FLUKE ®

MET/CAL®

Metrology Software

Reference

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Metrology Software

Conventions

The MET/CAL Reference Manual uses the following special symbols and conventions:

numeric

The following are examples of valid *numeric* entries:

123
+123
-12345

12.3
+1.234
-0.12345

1.23E+5
+123.4E-56
-12345.678E+90

integer

The following is an example of *integer* numbers with an implied decimal point.

123
+123
-12345

[ ]

Unbold square brackets indicate that data within them are optional.

[ ]

Bold square brackets indicate that data within them are literals (not optional).

filename

File names that are literal (not optional) are lowercase, bold.

blank

This indicates that a field is blank or empty.

NA

This indicates Not Applicable.

Fields of MET/CAL instrument FSC statements:

References to the fields of a MET/CAL instrument Function Selection Code (FSC) are upper-case, i.e., RANGE, NOMINAL, and TOLERANCE.

General Rules of Function Selection Codes

The following pages describe the general rules of how the Function Selection Codes (FSCs) control the MET/CAL system. The topics covered in this discusion are:

- What is a Function Selection Code?
- Common FSC Properties
- Rules for FSCs
- Results Reporting
- Special Constructions

What is a Function Selection Code?

A Function Selection Code (FSC) instructs the system to perform a task that is requested in a procedure. For example, the 5700 FSC instructs the system to provide a stimulus output from the Fluke 5700A Calibrator, while the DISP FSC directs the system to display a message to the operator during the execution of a calibration procedure.

Detailed Description of a Procedure

The following example shows you what a procedure looks like. The descriptions of a procedure on the following pages relate back to this example.

Fluke Corporation MET/CAL Procedure

==

INSTRUMENT:	Fluke 87: (1 year) CAL VER /5500 (Example)
DATE:	27-Oct-95
AUTHOR:	Fluke Corporation
REVISION:	1.0
ADJUSTMENT THRESHOLD:	70%
NUMBER OF TESTS:	7
NUMBER OF LINES:	46
CONFIGURATION LINES:	Fluke 5500A

==

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
# Source: Fluke 80 Series Service Manual (PN 834168 April 1989).									
# The 90 day specifications of the 5500A are used in TUR computations.									
1.001	ASK-	R	N	P		F			W
1.002	ASK+		K						
1.003	HEAD		PRELIMINARY INSTRUCTIONS						
1.004	DISP		[32] WARNING						
1.004	DISP		HIGH VOLTAGE is used or exposed during the performance						
1.004	DISP		of this calibration. DEATH ON CONTACT may result if						
1.004	DISP		personnel fail to observe safety precautions.						
1.005	RSLT		=DISPLAY TEST						
1.006	PICE		87_dsp						
2.001	DISP		No warm-up time requirement.						
2.001	DISP		Ambient temperature: 18C - 28C.						
2.001	DISP		Relative humidity: less than 90%.						
2.002	HEAD		{ROTARY SWITCH TESTS}						
2.003	DISP		Hold down the RANGE button while turning the UUT rotary						
2.003	DISP		function switch from OFF to VDC. Release the RANGE						
2.003	DISP		button and turn the switch to {VAC}.						
2.004	EVAL	Does the UUT Indicate between -0012 and 0012?							
3.001	DISP		Rotate the rotary switch to OFF.						
3.002	HEAD		{AC VOLTAGE TESTS}						
3.003	DISP		Rotate the UUT function switch to VAC.						
3.004	PIC		55_87_2w						
3.005	HEAD		AC VOLTAGE TESTS: {400mV Range}						
3.006	5500	400	350.0mV	-2.9U +2.9U	60H	SI			2W
4.001	5500	400	350.0mV	7.4U	5kH	SI			2W
5.001	HEAD		{FREQUENCY TESTS}						
5.002	DISP		Select the 400mV Range on the UUT.						
5.002	DISP		Press the Hz button to select the Frequency Counter.						
5.003	HEAD		FREQUENCY TESTS: {19.999kHz Range}						
5.004	5500	20	19.000kH	0.002U	150mV	SI			2W
6.001	HEAD		{FREQUENCY SENSITIVITY AND TRIGGER LEVEL TESTS}						
6.002	DISP		Press the Range button to select the 4V range.						

6.003	5500	1000.0H	0.2U	300mV	SI	2W
7.001	END					

This example procedure performs a partial calibration verification of a Fluke 87 Digital Multimeter. The Fluke 5500A is used as a calibration source.

MET/CAL Procedure Headers

The procedure is prefaced by a procedure header. The procedure header is described as follows:

Title Line

The **`Title`** line typically contains the name of your organization that is specified during the configuration of your calibration system.

Instrument

The **`Instrument`** line specifies the name of the procedure. In the example procedure, the name is **`Fluke 87: (1 year) CAL VER /5500 (Example)`**. Use names that uniquely identify the UUT for which you wrote the procedure. The name is used by an operator to select a procedure.

The name can be up to 55 characters long. Spaces are significant, but case (upper or lower) is not.

A procedure may have up to six distinct names and each name is specified on a separate Instrument line.

Date

The **`Date`** line shows the date on which the procedure was written or last edited. The system enters this information automatically. In the example procedure, the date is **`20-May-94`**.

Author

The **`Author`** line may contain the name of the person who wrote the procedure. The **`Author`** line is an optional entry. In the example procedure, the author is **`Fluke Corporation`**.

Revision

The **`Revision`** line shows the current revision of the procedure. This is incremented exclusively by the procedure writer.

Adjustment Threshold

The **`Adjustment Threshold`** line is used to specify the point above which a PASS condition is considered marginal.

Note

Percent of tolerance (% TOL) is rounded off to the nearest 1%. Therefore, you see PASS 100% (if the result is between 99.5% and 100%) and FAIL 100% (if the result is greater than 100% and less than 100.5%).

In the example procedure, the default adjustment threshold value is 70%.

Number of Tests

This line indicates how many tests the procedure contains. A test is defined as a portion of the procedure that produces a result. In a procedure, a test is identified by the integer portion of the STEP number (described later). MET/CAL automatically computes and enters this number. The example procedure contains seven tests.

Number of Lines

This line indicates how many lines the procedure contains. The procedure header is included in this count. MET/CAL automatically calculates this number.

Configuration

The **`Configuration`** line specifies the instruments required by the procedure. In the example, the Fluke 5500A is the only required instrument.

Standard

The STD FSC causes MET/CAL to perform a traceability check for a manually controlled external standard used by the procedure. The MET/CAL procedure compiler (editor) generates a "STANDARD" statement in the header of a compiled procedure for each distinct instrument specified in an STD statement.

Column Headers

The Column Headers line identifies the fields of a MET/CAL procedure statement.

Naming a Procedure

To create a name for a procedure, press Ctrl I on a blank line. The Instrument: line appears. Type in the name and press ↵ Enter to compile the line.

Calibration procedures can be designed to calibrate different instruments with similar calibration or verification requirements. For example, the procedures for the Fluke 73, 75, and 77 are similar, but there are slight differences. Instead of creating a different calibration procedure for each model, it is possible to create one procedure in which the execution of the procedure is controlled by the name selected. This single procedure would have three names, shown as follows in the header of the procedure:

INSTRUMENT:	Fluke 73
INSTRUMENT:	Fluke 75
INSTRUMENT:	Fluke 77

The action of the Name Procedure command depends on the contents of the line, status of the line, and the type of line the cursor is on. The following explains what may occur in certain situations when a procedure is named:

If the line is blank, Name Procedure causes INSTRUMENT: to appear. Type in the name you want the procedure called and press [↵ Enter]. The procedure compiles and the procedure name appears in the instrument line.

If the line is not blank but compiled, either the procedure name appears in the title bar or the line was not an INSTRUMENT: line and the following status message displays: **Not an Instrument Line**.

If the line is not blank and not compiled, the current line may be an INSTRUMENT: line and the selected procedure name is entered into the title bar of the active window. If the line is not an Instrument line or is deleted, the previously selected procedure name is re-selected and its name remains in the title bar of the active window.

Observe the following rules for naming procedures:

- A procedure must have at least one name and may have up to six names. These names are displayed individually in the MET/CAL Procedure Directory after the procedure is stored.
- The JMPT and JMPF Function Selection Codes may be used to jump in a procedure in a manner dependent on the name selected.
- If the procedure to be edited is loaded from the Procedure Directory, the selected name of the procedure is set to the name by which it was chosen. This name is shown in the header of the Procedure Editor.
- If the procedure is created from scratch, no name is assigned until [Ctrl] I is used to create an instrument line. If you do not use the Name Procedure command, the selected procedure, after compilation, is the name in the first INSTRUMENT: line. The selected name can be assigned or changed by the Name Procedure command.

MET/CAL Procedure Body Statements

The remainder of the procedure is called the procedure body. The procedure body consists of executable procedure lines that follow the header. All procedure lines in the procedure body begin with a Step Number followed by a Function Selection Code (FSC).

In the previous section, an FSC was defined as a code that informs the system of a task to be performed. All FSC statements have the following common properties:

Test Number

The **Test Number** is the integer portion of the number in the STEP field. A test is one or more statements with the same test number. Test numbers identify tests. A test is defined as a portion of a procedure that generates a test result.

Step Number

The **Step Number** is the entire number in the "STEP" field. The step number associated with each procedure test can be between <step #> .001 and <step#> .999. The step numbers are automatically assigned by the procedure compiler, although you can influence the numbering of lines in certain situations.

FSC Identifier

The **FSC** identifies the statement. It is the field following the "STEP" field. For example, DISP identifies a display statement, 5100 identifies a statement used to control the Fluke 5100B calibrator, and so on.

Function Selection Code Types

MET/CAL has seven FSC types; the FSC categories are as follows:

- Instrument
- Display Control
- Evaluation
- Interface Control
- Memory Register Operation
- Procedure Control
- Miscellaneous

Each FSC type performs a different function in the MET/CAL system. The following describes the function of each FSC type and, where appropriate, describes specific information required in the Range, Nominal, Tolerance, MOD1, MOD2, MOD3, MOD4, and CON fields. The use of these fields varies with the type of FSC. The requirements of the remaining fields are discussed in detail in the respective FSC sections of this manual.

Table 1 contains a list of all the FSCs in MET/CAL. The table shows the type of each FSC and the task each FSC performs.

Table 1. Function Selection Code Types

Display Control FSCs	
CON	Displays a connection message.
DISP	Displays messages to the operator.
DRAW	Sets up a UUT outline and image for display by EVAL, DISP,OPBR, or SET.
HEAD	Display a header message.
MESS	Stores a message to be displayed with a stimulus instrument evaluation, measurement instrument setup, or an EVAL statement
PIC	Displays a picture. (Also refer to PICE under Evaluation FSC.)
SET	Displays a list of settings for complex UUT setups.
RNG	Displays a range message.
Evaluation FSCs	
DOSE	Set PASS or FAIL via a DOS program.
EVAL	Set PASS or FAIL based on operator response to a YES/NO prompt
MEMC	Set PASS or FAIL based on numeric evaluation. MEM = System Actual value MEM1 = UUT Indicated value
MEMCX	Sets PASS or FAIL based on numeric evaluation. MEM1 = System Actual MEM = UUT Indicate
PICE	Set PASS or FAIL based on operator response to a YES/NO prompt displayed over picture.
Instrument FSCs	
Calibrators	
4000, M4000	Datron 4000 Autocal Standard
4000A, M4000A	Datron 4000A Autocal Standard
4200, M4200	Datron 4200 Autocal AC Standard
4200A, M4200A	Datron 4200A Autocal AC Standard
4700, M4700	Datron 4700 Multifunction Calibrator
4705, M4705	Datron 4705 Multifunction Calibrator
4707, M4707	Datron 4707 Multifunction Calibrator
4708, M4708	Datron 4708 Multifunction Calibrator
4800, M4800	Wavetek/Datron 4800 Multifunction Calibrator
4800A, M4800A	Wavetek/Datron 4800A Multifunction Calibrator
4805, M4805	Wavetek/Datron 4805 Multifunction Calibrator
4808, M4808	Wavetek/Datron 4808 Multifunction Calibrator

Table 1. Function Selection Code Types (cont.)

Instrument FSCs	
Calibrators	
5001, MCAL	Tektronix CG 5001 Calibration Generator
5011, M511	Tegam/Tektronix CG 5011 Calibration Generator
5100	Fluke 5100B Calibrator, DC and AC Voltage and Current
5130	Fluke 5130A Calibrator, DC and AC Voltage and Current
RESF	Fluke 5100B or 5130A Calibrator, Resistance
WIDE	Fluke 5100B Calibrator, Wideband AC Voltage
5200	Fluke 5200A AC Calibrator
5205	Fluke 5205A and 5215A Power Amplifier controlled by a 5100B or 5130A
5220	Fluke 5220A Transconductance Amplifier controlled by a 5100B or 5130A
5320	Fluke 5320A Electrical Safety Tester Calibrator
5440	Fluke 5440B DC Calibrator
5450	Fluke 5450A Resistance Calibrator
5500, M550	Fluke 5500A Multiproduct Calibrator
5520, M5520	Fluke 5520A Multiproduct Calibrator
5700, MMFC	Fluke 5700A Multifunction Calibrator
5720, M5720	Fluke 5720A Multifunction Calibrator
5800, M5800	Fluke 5800A Oscilloscope Calibrator
5820, M5820	Fluke 5820A Oscilloscope Calibrator
P525	Pressure Calibration using Fluke 525A
P700	Pressure Calibration using Fluke 525A or 5520A
9000, M9000	Wavetek/Datron 9000 Meter Calibration System
9100, M9100	Wavetek/Datron 9100 Calibration System
9500, M9500	Wavetek/Datron 9500 and Fluke 9500B Oscilloscope Calibrators
Transfer Standards	
4950, M4950	Wavetek/Datron 4950 Multifunction Transfer Standard
5790, ACMC	Fluke 5790 AC Measurement Standard

Table 1. Function Selection Code Types (cont.)

Instrument FSCs	
Counters\ Timers	
53131, M53131	Agilent/Hewlett-Packard 53131A Universal Counter
53132, M53132	Agilent/Hewlett-Packard 53132A Universal Counter
53181, M53181	Agilent/Hewlett-Packard 53181A Frequency Counter
5335, M5335	Hewlett-Packard 5335A Universal Counter
6666, M666	Philips PM 6666 Timer/Counter
6680, M680	Fluke/Philips PM 6680 / PM 6680B or Wavetek 900 Timer/Counter
6681, M681	Fluke/Philips PM 6681 or Wavetek 901 Timer/Counter
6685, M685	Fluke/Philips PM 6685 or Wavetek 905 Timer/Counter
Electrial Power Standards	
6100	Fluke 6100A Electrical Power Standard
Loads	
HP60	Agilent/Hewlett-Packard 6060B DC Electronic Load
HP63	Agilent/Hewlett-Packard 6063B DC Electronic Load
Phase Meters	
6000	Clarke-Hess 6000 Phase Meter
Multimeters	
1271, M1271	Wavetek/Datron 1271 Multimeter
1281, M1281	Wavetek/Datron 1281 Multimeter
2000	Keithley 2000 Multimeter
2001	Keithley 2001 Multimeter
2002	Keithley 2002 Multimeter
34401	Agilent/Hewlett-Packard 34401 Multimeter
34420	Agilent/Hewlett-Packard 34420 Multimeter
3458, M3458	Agilent/Hewlett-Packard 3458A Digital Multimeter
45, M45	Fluke 45 Dual Display Multimeter
8505	Fluke 8505A Digital Multimeter
8506	Fluke 8506A Thermal RMS Digital Multimeter
8508, M8508	Fluke 8508A Reference Multimeter
8842	Fluke 8842A Digital Multimeters
8845, M8845	Fluke 8845A 5-1/2 Digit Precision Multimeter
8846, M8846	Fluke 8846A 6-1/2 Digit Precision Multimeter
8920	Fluke 8920A True RMS Voltmeter

Table 1. Function Selection Code Types (cont.)

Signal Generators	
2024, M2024	Marconi 2023, 2024, and IFR 2023A, 2024A AM/FM Signal Generators
5030	Tegam/Tektronix SG 5030 Leveled Sine Wave Generator
5050	Tegam SG 5050 Leveled Sine Wave Generator
6060, M606	Fluke 6060A, 6060B, 6061A, 6062A, 6080A, and 6082A RF Signal Generators
8648, M8648	Hewlett-Packard 8648A, 8648B, 8648C, and 8648D RF Signal Generators
SMY02, MSMY02	Rohde & Schwarz SMY01, SMY02, and SMY43 RF Signal Generators
Function Generators	
195, M195	Wavetek 195 Universal Waveform Generator
3325, M3325	Hewlett-Packard 3325A and 3325B Function Generators
33120, M33120	Agilent 33120A Function Generator
33250, M33250	Agilent 33250A Function Generator
39A, M39A	Wavetek 39A Universal Waveform Generator
5191	Philips PM 5191 Function Generator
5192	Philips PM 5192 Function Generator
5193	Philips PM 5193 Function Generator
Power Meters	
437, M437	Hewlett- Packard 437B Power Meter and EPM-441A or E4418A in 437B emulation mode
4418, M4418	Agilent E4418B Power Meter and Agilent/HP E4418A formally EPM-441A Power Meter
4419, M4419	Agilent E4419B Power Meter and Agilent/HP E4419A formally EPM-442A Power Meter
RCL Meters	
6304, M6304	Fluke/Philips PM 6304 Programmable Automatic RCL Meter
6304C, M6304C	Fluke/Philips PM 6304C Programmable Automatic RCL Meter
6306, M6306	Fluke/Philips PM 6306 Programmable Automatic RCL Meter
RF Analyzers	
8901, M8901	Hewlett-Packard 8901A and 8901B Modulation Analyzer
8902, M8902	Hewlett-Packard 8902A Measuring Receiver and 8902S Microwave Measurement System
8903, M8903	Hewlett-Packard 8903B Audio Analyzer and 8903E Distortion Analyzer
N5531	Agilent N5531S Measuring Receiver
RF Reference Standard	
9640	Fluke 9640A Reference Standard
Spectrum Analyzers	
8560, M8560	Hewlett-Packard 8560A, 8561A/B, 8562A/B, 8563A and 8560 E-Series Spectrum Analyzers
8566, M8566	Hewlett-Packard 8566B Spectrum Analyzer
8568, M8568	Hewlett-Packard 8568B Spectrum Analyzer
8590, M8590	Hewlett-Packard 8590L, 8591E, 8592L, 8593E, 8594E, 8595E, and 8596E Spectrum Analyzers
PSA	Agilent E4440A, E4443A, E4445A, E4446A, E4447A, E4448A PSA Series Spectrum Analyzers

Table 1. Function Selection Code Types (cont.)

Interface Control FSCs	
IEEE	Direct control of a device on an IEEE-488 interface.
IEEE2	Direct control of an IEEE-488.2 compliant device with built-in synchronization using Message Available (MAV) and Operation Complete (OPC) and error handling using Query Error (QYE), Device Dependent Error (DDE), Execution Error (EXE), and Command Error (CME).
PORT	Direct control of a device on a serial interface.
SCPI	Direct control of an SCPI compliant device with built-in synchronization using Message Available (MAV) and Operation Complete (OPC) and error handling using System Error Query (SYST:ERR?).
Memory Register Operations FSCs	
MATH	Performs arithmetic & string operations using memory register.
MEM2	Manipulates the contents of the memory register MEM2.
MEME	Exchanges the values of memory registers MEM and MEM1.
MEMI	Displays a prompt for a number to be placed in memory register MEM.
MEM+	Add MEM1 or the specified value to memory register MEM.
MEM-	Subtract MEM1 or the specified value to memory register MEM.
MEM*	Multiply MEM1 or the specified value to memory register MEM.
MEM/	Divide MEM1 or the specified value to memory register MEM.
Procedure Control FSCs	
ASK+	Set system flags.
ASK-	Unset system flags.
CALL	Call one procedure from another.
DO, UNTIL	Conditional looping over procedure statements.
DOS	Call a DOS program. Also see DOSE under Evaluation FSCs.
IF, ELSEIF, ELSE, ENDIF	Conditional execution of procedure statements.
JMP	Branch to a specified procedure step.
JMPF	Branch to a specified procedure step if MEM1 is less than zero.
JMPL	Branch to specified LABEL.
JMPT	Branch to a specified procedure step if MEM1 is greater than zero.
JMPZ	Branch to a specified procedure step if MEM1 is equal to zero.
LABEL	Establishes target for JMPL.
OPBR	Presents a message that requests a response.
RPT	Repeats a test.
TARGET	Specifies jump destination for post test “Repeat” and “Cancel” options.
WAIT	Specifies a delay between procedure statements with optional popup message and countdown timer.
WHILE, ENDW	Conditional looping over procedure statements.

Table 1. Function Selection Code Types (cont.)

Miscellaneous FSCs	
ACC	Specifies the system accuracy for a MEMC FSC.
ACCF	Specifies an alternate accuracy file.
RESET	Specifies reset commands for user-configured instruments or the UUT.
RSLT	Adds text to result files with or without an operator prompt.
STD	Includes traceability information for manual instrument.
TOL	Specifies tolerance for multiple evaluations.
TSET	Assigns values to system parameters for the current test only.
VSET	Assigns values to system parameters for all tests.

Instrument FSCs

Instrument FSCs control system calibration instruments. An Instrument FSC is used to apply a stimulus to, or take a measurement from, the UUT. The FSC may also generate automatic messages describing the signal connection between the calibration instrument and the UUT, and the UUT range required for the test. In addition, an instrument FSC may perform an evaluation that results in a PASS or FAIL condition.

When you enter information for a given FSC, you must enter the step number first, the FSC second. If no step number is entered, it is automatically inserted by the procedure compiler. Following the FSC code, other information for the FSC may be entered in an arbitrary order. When the statement is compiled, the compiler sorts the entries into the appropriate fields.

In some situations, the order in which entries are made is significant. For example, in the 6060 FSC, if you enter the amplitude information before the frequency information, amplitude is stored in the NOMINAL field and frequency in the MOD1 field and an evaluation, if any, is based on the amplitude.

If you enter the frequency first and then amplitude, the frequency value is stored in the NOMINAL field and the amplitude information in the MOD1 field and an evaluation, if performed, is based on the frequency. The compiler sorting routine displays error messages if it cannot sort the line. The following rules apply to all Instrument FSCs after a line is sorted.

RANGE Field

The RANGE field is a five-character field that specifies the Unit Under Test (UUT) range in units of the NOMINAL value. The format of the RANGE field is one of the following:

- number
- "A"
- *blank*

The RANGE field causes an automatic range message to be generated when the procedure statement is executed. If the RANGE field is "A", "Autorange" is specified. Refer to the section, *Automatic Messages* later in this manual for more information. Note that the ASK "R" flag can be used to disable automatic range messages, and the ASK "D" flag can be used modify the range message. Refer to *ASK+, ASK- FSC* sections of this manual.

A numeric RANGE field may be used for the following:

- Calculating test tolerance. For more information, refer to the section *TOLERANCE Field Rules*.
- Generating automatic slew message for certain FSCs, i.e., the FSCs affected by the ASK 'D' flag.
- Calculating the compile-time T.U.R. when the procedure statement does not specify a numeric NOMINAL value.
- Controlling the formatting of certain results variables. For more information, refer to the section, *Results Formatting*.

Other rules:

- To be compatible with earlier versions of MET/CAL, any RANGE field specification may include an appended "R". If the appended "R" is present, the procedure compiler removes the "R" when the procedure statement is formatted. The "R" does not affect the interpretation of the RANGE field.
- No RANGE field entry is allowed in an instrument setup statement. An instrument setup statement is an instrument statement that contains an 'S' in the MOD4 field.
- No RANGE field entry is allowed in a statement that appears in an adjustment block. Statements in an adjustment block are indented so that the FSC appears in the RANGE field.

NOMINAL Field

The NOMINAL field specifies the nominal value of the stimulus for a calibration instrument source function (e.g. AC Voltage) or the anticipated measurement value of a calibration instrument measurement function (e.g. Ohms). The NOMINAL field can be up to 14 characters long. The following example shows how the nominal value is entered:

```
[numeric][prefix]units
```

Table 2 lists the recognized units and Table 3 lists the recognized prefixes.

Table 2. Recognized Units

Quantity	Units	Symbols
Amplitude	Decibels	D
Capacitance	Farads	F
Current, RMS or DC	Amps	A
Current peak	Amps peak	Ap
Current peak-to-peak	Amps peak-to-peak	App
Conductance	Siemens	Y
Duty Factor [1]	None	DF
Energy	Joules	J
Event Count	Cycles	c
Frequency	Hertz	H
Frequency Ratio [1]	None	H/H
Inductance	Henry	Hy
Percent [1]	na	pct
Phase	Degrees	deg
Power, RMS or DC	Watts	W
Power Ratio	Decibels	dB
Pressure	Pascals	Pa
Pressure	Bars	bar
Pressure	Centimeters of water	cmH2O
Pressure	Feet or water	ftH20
Pressure	Grams per sq. cm.	g/cm2
Pressure	Inches of Mercury	inHg
Pressure	Inches of water	inH20
Pressure	Meters of Mercury	mHg
Pressure	Meters of water	mH20
Pressure	Pounds per sq. inch	psi
Quality Factor [1]	None	QF
Reactive Power	Volt-Amps Reactive	VAR
Resistance	Ohms	Z
Resistance Ratio [1]	None	Z/Z
Temperature	Degrees Celsius	degC
Temperature	Degrees Fahrenheit	degF
Temperature	Kelvins	K
Time or period	Seconds	T
Video Amplitude	IRE	IRE
Video Line Marker [1]	None	LM
Voltage, RMS or DC	Volts	V
Voltage offset	Volts	Voff
Voltage peak	Volts peak	Vp
Volts per Amp	Volts per Amp	V/A
Voltage peak-to-peak	Volts peak-to-peak	Vpp
Voltage Ratio [1]	None	V/V

[1] MET/CAL requires a units symbol to identify the quantity, even if the quantity is dimensionless (duty factor, frequency ratio, quality factor, resistance ratio, video line marker, and voltage ratio). Similarly, even though percent is not a unit, the symbol "pct" is used to satisfy MET/CAL'S requirement for a symbol.
The actual units allowed are dependent on the FSC. Refer to the FSC sections for the allowed units for a particular FSC.

Table 3. Recognized Prefixes

Prefix	Symbol	Multiple
pico	p	1E-12
nano	n	1E-9
micro	u	1E-6
milli	m	1E-3
kilo	k	1E+3
mega	M	1E+6
giga	G	1E+9

With the exception of 'm' and 'M', case is not significant. For example, a procedure statement could specify 'NV' instead of 'nV' to indicate nanovolts. If a non-standard case is used to enter a prefix symbol (for example, 'N' for nano), the Procedure Compiler converts the symbol to the standard case.

For units of hertz or ohms, 'm' and 'M' are case significant. 'M' represents mega and 'm' represents milli.

When just units and an optional prefix (e.g., mV) are entered in the NOMINAL field, the value is taken from memory register MEM when the statement is executed.

If the NOMINAL field contains a single asterisk (*), the calibration instrument is set to a reset condition. Since this implies a Setup test, S is automatically inserted in the MOD4 field. Refer to the *MOD4 Field Rules* section later in this manual for more information.

When an instrument FSC is entered with all other fields blank, an asterisk is inserted automatically in the NOMINAL field and an 'S' is automatically inserted in the MOD4 field.

When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value and vice versa.

TOLERANCE Field

The TOLERANCE field specifies the tolerance to which the UUT indicated value is evaluated. This field can be up to 13 characters long including spaces. Any combination of up to three of the following entries described in Table 3 can be used.

Table 4. Tolerance Field

Entry	Tolerance Specification
⟨% of nominal⟩ %	This tolerance is the percent of the nominal value.
⟨% of range⟩ /	This tolerance is the percent of range as entered in the RANGE field. A numeric entry (not `A`) in the RANGE field is required with this expression. See "Other Rules" below for information about autoranging.)
⟨ppm of nominal⟩ P%	This tolerance is in ppm of the nominal value.
⟨ppm of range⟩ P/	This tolerance is in ppm of range as entered in the RANGE field. There must be a numeric entry in the RANGE field (not `A`) in order to use this expression.
⟨absolute units⟩ U	Units are the same as used in the NOMINAL field; this includes the prefix.

- If the tolerance is unsigned, a ± tolerance is implied. For example, "1%" is equivalent to "+1% -1%".
- If the tolerance is prefaced by **+**, the tolerance is specified in the positive direction from the nominal value; if prefaced by **-**, the tolerance is specified as negative from the nominal value.
- A tolerance specification is not allowed with a setup (MOD4 = 'S") test or in an indented adjustment procedure step.
- % of range (/) or ppm of range (P/) are not allowed when the RANGE field is blank or autorange.
- If UUT tolerance is specified in an evaluation or comparison test, TOL is entered and the tolerance specified in the last executed TOL FSC applies. If no TOL FSC is present, the tolerance applied is zero units. Refer to the description of the TOL FSC in the *TOL* section of this manual.
- The tolerance value may be a literal numeric value or may refer to a numeric register. Valid numeric register specifications are M1, M2, ..., M255. If the value is not specified, the value is taken from MEM at runtime.

MOD1 Field

The MOD1 field specifies the frequency, period, or amplitude of a periodic signal, or the field is left blank.

If the MOD1 field contains the frequency or period, the NOMINAL field contains the amplitude and vice versa.

When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value and vice versa.

The modifier value is entered as follows:

[*numeric*] [*prefix*] *units*

As in the case of the nominal value, the *units* and allowed *numeric value* for the MOD1 field depend on the particular FSC. Refer to the FSC sections of this manual for detailed information on specific FSCs.

Recognized prefixes are the same as discussed under the NOMINAL field rules.

MOD2 Field

One or two characters can be in the MOD2 field. Refer to the FSC sections of this manual for detailed descriptions of each FSC.

MOD3 Field

One or two characters can be in the MOD3 field. Refer to the FSC sections of this manual for detailed descriptions of each FSC.

MOD4 Field

The MOD4 field specifies the type of test being performed and can contain only a single character. The following four types of tests are defined in the MET/CAL procedure language:

- Evaluation Test (MOD4 field is blank).

  For a stimulus function, a calibration applies a known value to the UUT and MET/CAL checks that the UUT reading is within the specified tolerance. For a measurement function, MET/CAL checks that a UUT output is within the specified tolerance.

- Setup Test (MOD4 is S).

  For a stimulus function, a Setup Test applies the nominal value to the UUT. For a measurement function, a Setup Test continually monitors a UUT output so that it may be adjusted to the specified nominal value.

- Nominal Setup Test (MOD4 is N).

The Nominal Setup test does not perform an evaluation. The Nominal Setup test allows the output of a stimulus calibration function to be adjusted so that the UUT reads a nominal value. For a measurement calibration function, a single reading is taken. This value may be used later in a Comparison Test.

- Comparison Test (MOD4 is C).

  The Comparison Test is used in conjunction with the Nominal Setup test. The Comparison Test operates like an evaluation test, except that the value established by the Nominal Test is used as a reference for the evaluation, instead of the value specified in the NOMINAL field.

  These tests are explained in greater detail later in this manual.

CON Field

The CON field is a two-character field. The entries depend on the particular instrument FSC. Refer to the FSC sections of this manual for more information on individual FSCs.

Evaluation Test

An Evaluation test may perform one of two types of evaluation: a stimulus or a measurement evaluation.

For a stimulus evaluation, a calibrator applies a known value to the UUT and checks the UUT reading to determine if it is within the specified tolerance.

A measurement evaluation checks that a UUT output is within the specified tolerance.

The effects of the type of calibration instrument function, type of test, and method of UUT reading entry on UUT Indicated, System Actual, and the contents of MEM and MEM1 are described below.

Stimulus Function

An example of this type of evaluation test is as follows:

```
STEP   FSC    RANGE   NOMINAL TOLERANCE   MOD1    MOD2    3   4   CON
2.001  5500   400     350mV   0.1% 0.1/   60H     SI                2W
```

There are three ways to evaluate UUT performance when using stimulus-type calibration instruments:

- Slew the output until the UUT reads the nominal value, or slew the reading on the display to match the UUT reading. The latter method is used when the calibration instrument supplies only discrete values of resistance. This method provides detailed performance information and is least prone to operator error. The Slew method is used when any of the defaults ASK- B, ASK- G, or ASK-

K is in effect. Refer to the description of these flags in the ASK FSC description in the *ASK FSC* section of this manual.

- Enter the UUT reading from the keyboard. The keyboard method is selected with ASK+ K. When ASK+ B is set, the operator has the option to select Keyboard entry.
- Select Yes if the UUT reading is within the range displayed on the screen; if not, select No. This method, called Go/No-Go testing, does not provide detailed performance information on the UUT but does minimize procedure execution time. The Go/No-Go method is selected when ASK+ G is in effect. When ASK+ B is set the operator has the option to select Go/No-Go.

If the UUT reading can be obtained under remote control via the IEEE-488 or RS-232C interface, a closed-loop verification is possible. Setup tests are used to apply the required stimuli. The PASS/FAIL evaluations of the readings are done with the MEMC FSC. Refer to the descriptions of the IEEE, PORT, and MEMC FSCs in the respective FSC sections of this manual for detailed information. Each method is explained in more detail below:

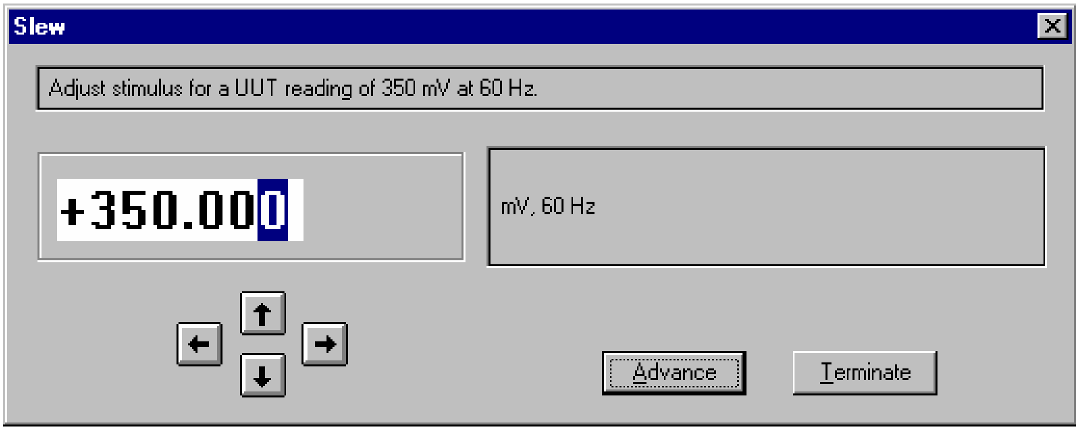
Note

Remote control of a UUT does not guarantee the reading can be obtained remotely. This is especially true for scopes.

- Slew Evaluation (Except Discrete Resistance)

  (ASK- B, ASK- G, ASK- K or optionally with ASK+ B)

  Use the Tab key or the mouse to select the desired button, then use either the mouse or Enter key to slew the output of the calibration instrument. Refer to Figure 1. When the stimulus is adjusted sufficiently for the UUT to read the nominal value, select **Advance** to proceed to the next procedure step. The error is computed, and a PASS or FAIL condition is established for the test. Refer to Figure 4 to see the test result.



fs1s.bmp

Figure 1. Slew Dialog Box (Except Discrete Resistance)

The following UUT Indicated and System Actual are reported in the Post-Test Summary and may be included in the results file depending on the results template used at the time the procedure is executed:

UUT Indicated	The value shown in the NOMINAL field or the value of memory register MEM if only units were specified in the NOMINAL field.
System Actual	The calibration instrument output when **Advance** is selected.

Values of memory registers MEM and MEM1:

MEM	Not affected by the slew evaluation.
MEM1	System Actual

- Slew Evaluation (Discrete Resistance)

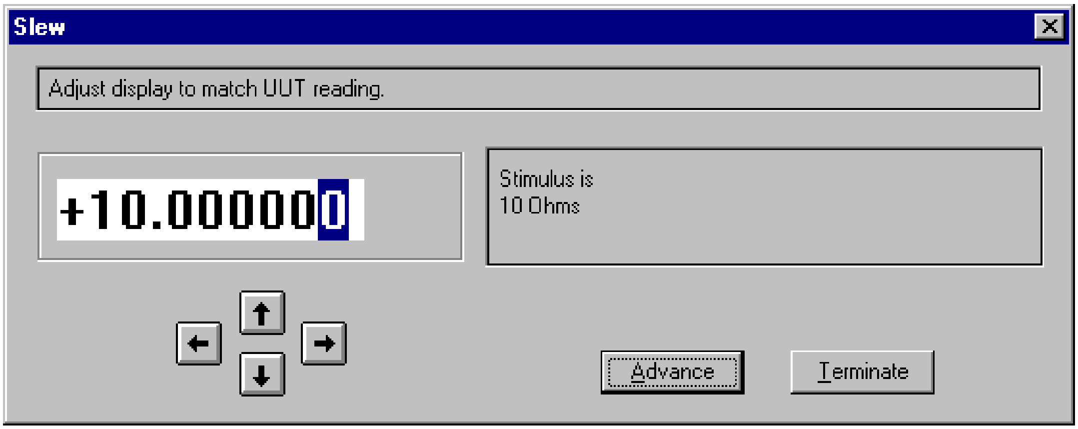
  (ASK- B, ASK- G, ASK- K or optionally with ASK+ B)

  When only discrete resistance values are available from calibration stimulus instruments, resistance cannot be slewed. When the slew method is used for discrete resistance, the value on the display is adjusted to exactly match the UUT. This includes the 4000, 4000A, 4700, 4705, 4707, 4708, 4800, 4800A, 4805, 4808, 5450, 5700, 5720, and RESF FSCs.

  An example of this type of evaluation test is as follows:

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
2.001	5700	10	10Z	0.1% 0.1/					2W

Use the mouse or the Enter key to slew the displayed reading as described before. When the value on the display matches the UUT reading, select **Advance** to go to the next procedure step. The error is computed and compared to the specified value in the procedure line.



fs2s.bmp

Figure 2. Slew Dialog (Discrete Resistance)

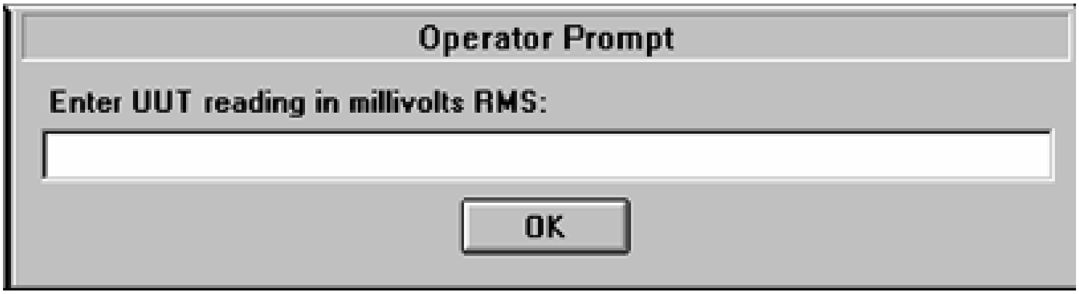
The following UUT Indicated and System Actual are reported in the Post-Test Summary and may be included in the results file depending on the results template used at the time the procedure is executed:

UUT Indicated	This value on the display when **Advance** is selected.
System Actual	The actual calibration value of resistance for the 5450A, 5700A, and 5720A. The actual value is reported instead of the value in the NOMINAL field (e.g., 10.000012 instead of 10 Ω). The 4000, 4000A, 4700, 4705, 4707, 4708, 4800, 4800A, 4805, 4808, 5450, 5700, 5720, 5100B and 5130A do not support the ability to query the actual resistance; therefore, the NOMINAL value is used.

Values of memory registers MEM and MEM1:

MEM	Not affected by the slew evaluation.
MEM1	UUT Indicated.

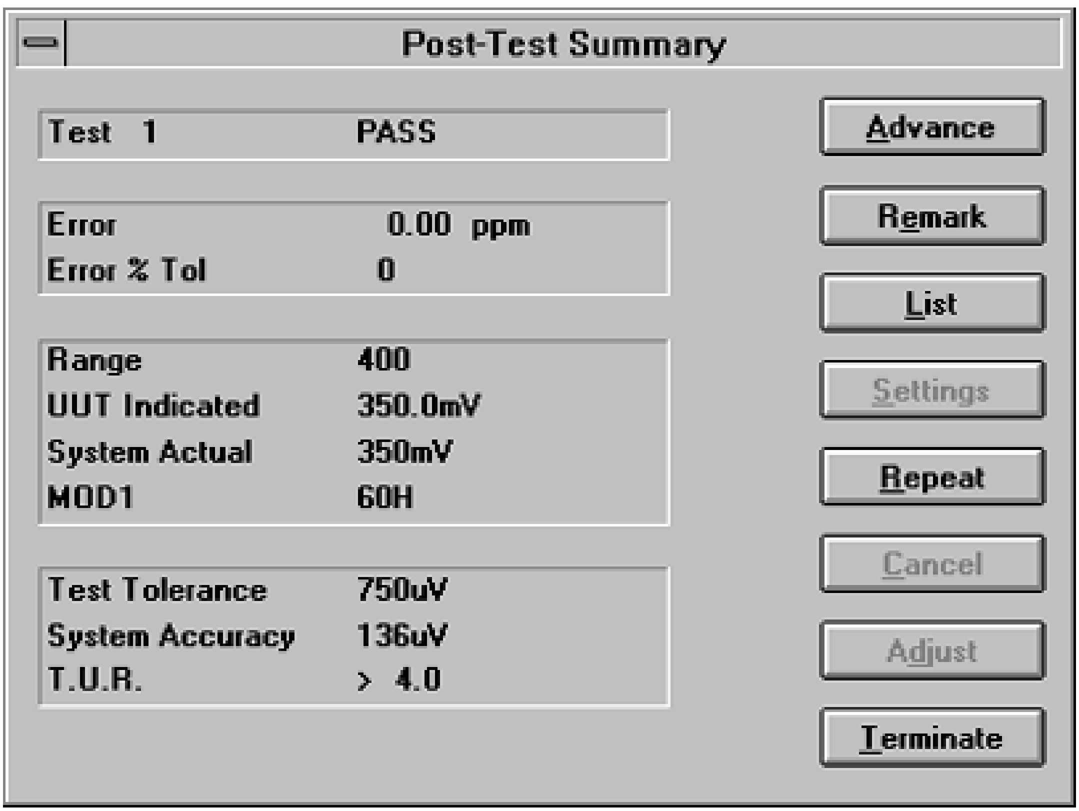
- Keyboard Evaluation (ASK+ K or optionally with ASK+ B)
- When the keyboard method is used, you are prompted to enter the UUT reading. Refer to Figure 3.



fs3s.bmp

Figure 3. Keyboard Entry Operator Prompt

After the UUT reading is entered, the error is computed. The test result appears as shown in Figure 4.



fs4s.bmp

Figure 4. Post-Test Summary of a Slew or Keyboard Entry Instrument Evaluation

The following UUT Indicated and System Actual are reported in the Post-Test Summary and may be included in the results file depending on the results template used at the time the procedure was executed:

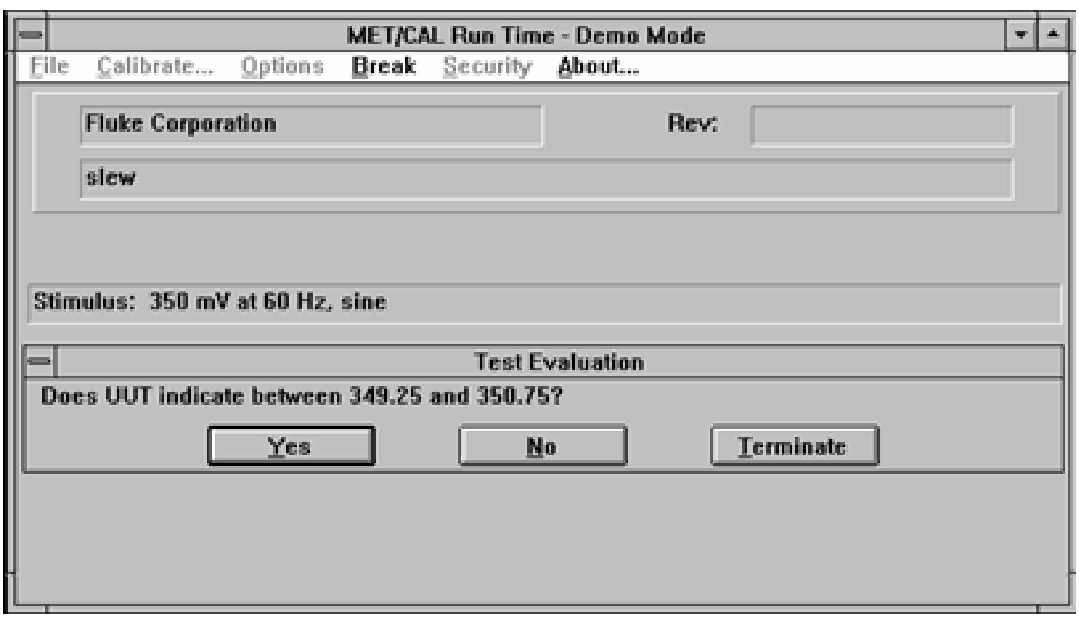
UUT Indicated	The value entered from the keyboard.
System Actual	The value shown in the NOMINAL field or the value of memory register MEM if only units were specified in the NOMINAL field.

Values of memory registers MEM and MEM1:

MEM	Not affected by keyboard entry evaluation.
MEM1	UUT Indicated.

- Go/No-Go Evaluation (ASK+ G or optionally with ASK+ B)

  When the Go/No-Go method is used, you are prompted to respond Yes or No based on whether the UUT reading is between the limits displayed in the dialog. Refer to Figure 5.



fs5s.bmp

Figure 5. Go/No-Go Evaluation Test

These limits are determined from the tolerance information and depend on the adjustment threshold value if an adjustment procedure follows the evaluation step. For example, if no adjustment step follows, the limits are as follows:

```
349.25 mV and 350.75 mV
```

The exact UUT error cannot be computed, only a PASS/FAIL condition is determined, based on operator's response. The test result appears as shown in Figure 6.

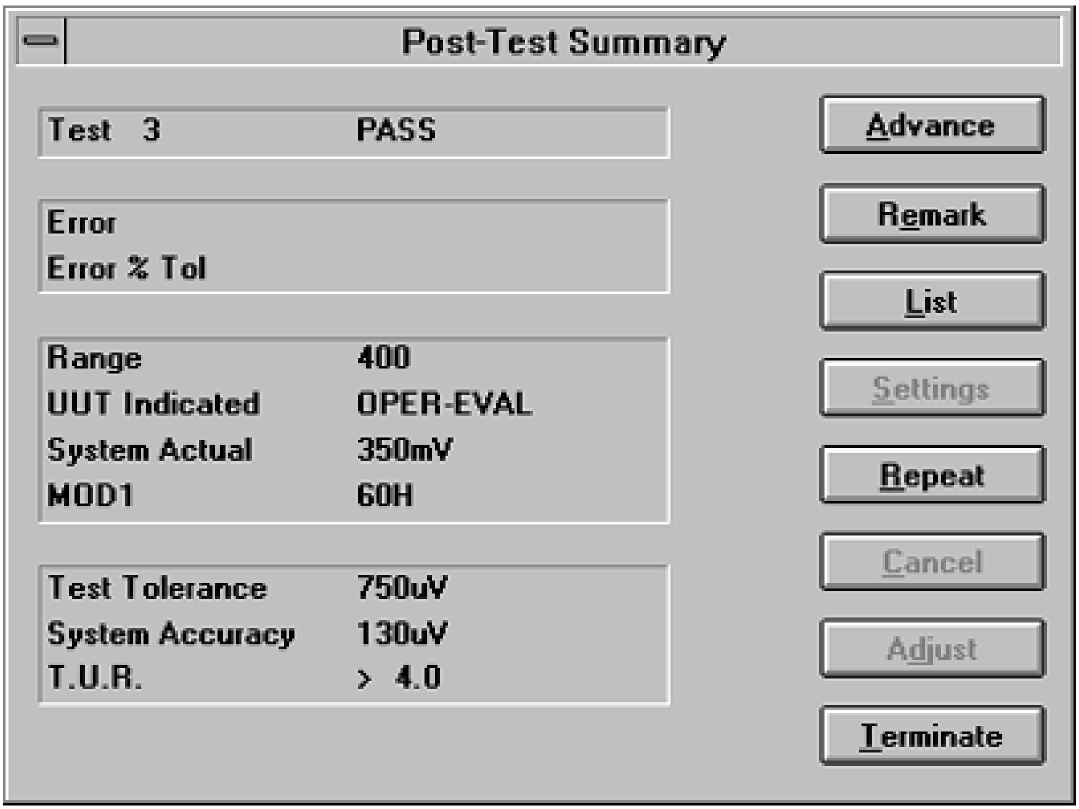


Figure 6. Post-Test Summary of a Go/No-Go Instrument Evaluation

The following UUT Indicated and System Actual are reported in the Post-Test summary and may be included in the results file depending on the results template used at the time the procedure was executed:

UUT Indicated	**`OPER-EVAL`**.
System Actual	The value shown in the NOMINAL field or the value of memory register MEM if only units were specified in the NOMINAL field.

MEM and MEM1 updates:

MEM	Not affected by the Go/No-Go evaluation.
MEM1	+1 indicating a PASS condition if YES was selected. -1 indicating a FAIL condition if NO was selected.

Measurement Function

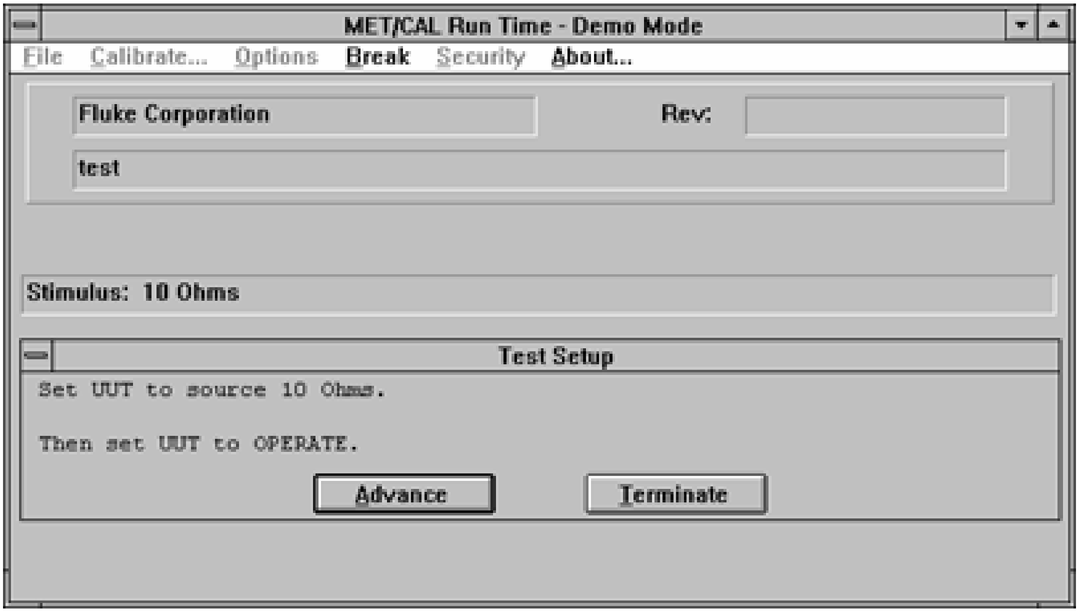
An example of this type of evaluation test is as follows:

```
STEP   FSC    RANGE   NOMINAL    TOLERANCE  MOD1    MOD2    3   4   CON
2.001  8842   10      10Z        0.1% 0.1/                          2W
```

This example programs the 8842A to measure volts.

The operator is asked to set the UUT output to the NOMINAL value and place it in operate unless this automatic message is disabled by ASK- N (Figure 7).

When **Advance** is selected, the measurement is made and the operator is asked to put the UUT in standby unless this automatic message is disabled by ASK- N (Figure 10).



fs11s.bmp

Figure 7. Test Setup Prompt

The error is computed and a PASS or FAIL condition is established for the test. The ASK B, G, and K-flags have no influence on this type of evaluation.

The following UUT Indicated and System Actual are reported in the Post-Test Summary and may be included in the results file depending on the results template used at the time the procedure is executed:

UUT Indicated	The value shown in the NOMINAL field or the value of memory register MEM if only units were specified in the NOMINAL field.
System Actual	The actual UUT output as measured by the calibration instrument.

Values of memory registers MEM and MEM1:

MEM	Not affected by the evaluation.
MEM1	System Actual.

Setup Test

For a stimulus function, a Setup Test applies the nominal value to the UUT. For a measurement function, a Setup Test continually monitors a UUT output as the UUT is adjusted to the specified nominal value.

Stimulus Function

The calibration instrument is set up to output the nominal value. The upper part of the display indicates the stimulus. No evaluations or results are generated, and procedure execution continues immediately with the next procedure statement.

The stimulus is removed when a reset statement for the same FSC is executed, e.g., "*" is in the nominal field, or when an evaluation FSC is completed and the step number increments, unless ASK- D is in effect.

Values of memory registers MEM and MEM1:

MEM	Not affected by the setup test.
MEM1	The applied stimulus. This is the value specified in the NOMINAL field except for resistance from the 5700A and 5450A. For these cases, MET/CAL queries the calibrator to determine the actual resistance which is then used instead of the value in the NOMINAL field (e.g., 10.000012 instead of 10Ω).

The following is an example of a stimulus Setup Test used during closed-loop verification of a UUT.

```
STEP   FSC        RANGE   NOMINAL   TOLERANCE MOD1    MOD2    3    4    CON
2.001  IEEE               F1R3
2.002  5700               10V                                 S    2W
2.003  IEEE               ?[I]
2.004  MEMCX       20      10.0000V .005% .0003U
```

Explanation:

1. The UUT is programmed to the desired function and range in step 2.001. Refer to the IEEE FSC section for more detailed information on its operation.
2. Step 2.002 causes the 5700A to apply 10V. After this step, MEM1 contains the value 10.
3. In step 2.003, the system acquires the reading from the UUT and stores the result in register MEM.
4. In step 2.004, the values stored in MEM and MEM1 are used to determine the UUT error and a PASS or FAIL condition is established for the test. Refer to the MEMCX FSC section for more detailed information on its operation.

Measurement Function

The operator is prompted to adjust the UUT to the NOMINAL value, unless the message has been disabled with ASK- N (Figure 7).

The system displays any pending MESS lines (refer to the description of the MESS FSC section for more information), and then displays the present measurement, which is continually updated. After the operator selects **Advance**, the next procedure line is executed (Figure 10).

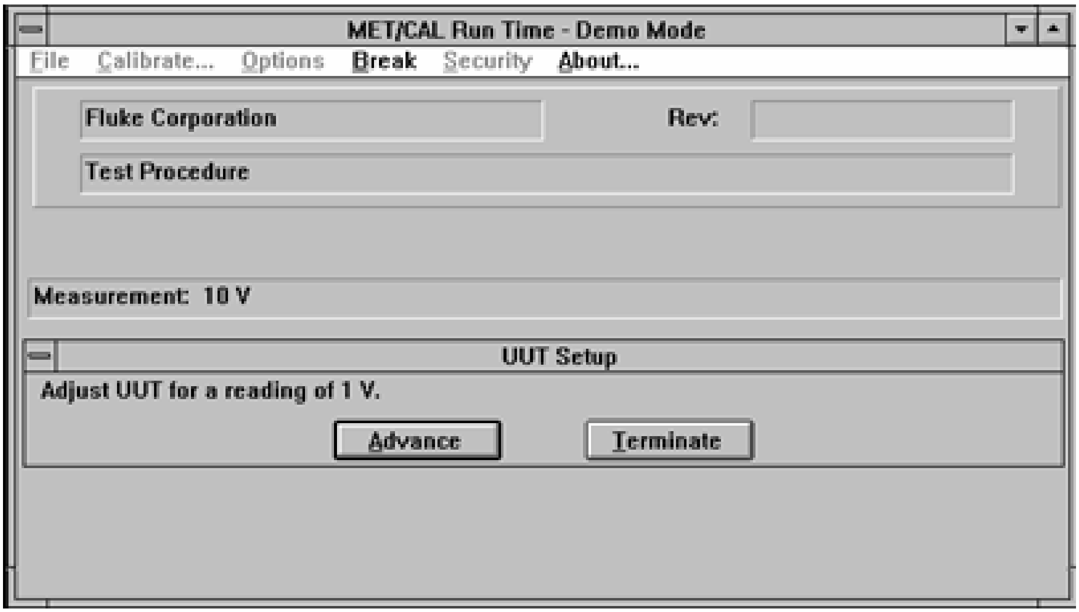


Figure 8. UUT Setup Dialog

Values of memory registers MEM and MEM1:

MEM	Not affected by the setup test.
MEM1	The UUT output as measured just prior to selecting **Advance**.

The operator is asked to set the UUT output to the NOMINAL value and place it in operate unless this automatic message is disabled by ASK- N (Figure 7).

When **Advance** is selected, the measurement is made and the operator is asked to put the UUT in standby unless this automatic message is disabled by ASK- N (Figure 10).

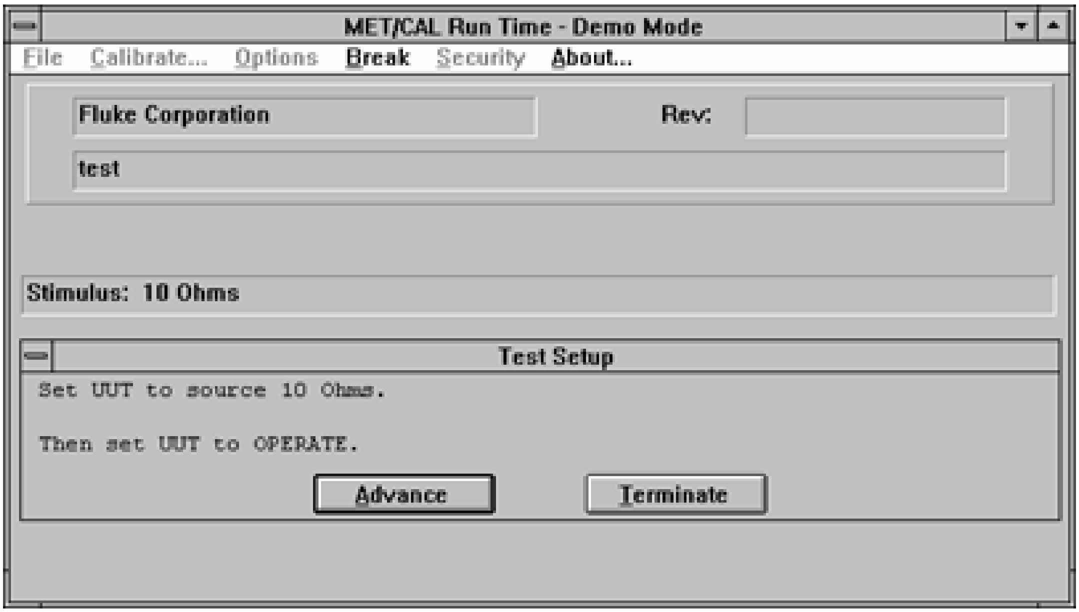
Nominal Setup Test

The Nominal Setup test allows the output of a stimulus calibration function to be adjusted until the UUT reads a nominal value; it does not perform an evaluation. For a measurement calibration function, a single reading is taken. This value may be used later in a Comparison Test.

Stimulus Function

The ASK B, G, and K flags have no influence on the NOMINAL Setup test. You slew the system stimulus until the UUT reads the nominal value, as is done for the Slew evaluation test. However, no evaluation takes place and no results are generated. The following is an example of a stimulus Nominal Setup Test.

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
2.001	5700	10	10V					N	2W



fs10s.bmp

Figure 9. Stimulus Nominal Setup Dialog

Values of memory registers MEM and MEM1:

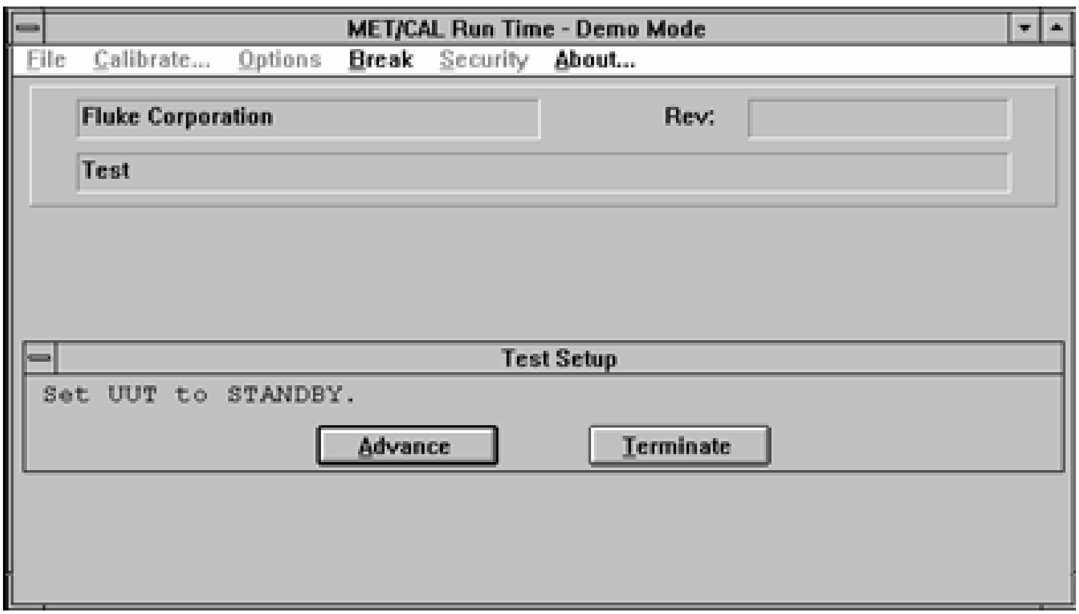
MEM	The calibration instrument output on selecting **Advance**.
MEM1	Not affected by the test.

Measurement Function

An example of this type of test is as follows:

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
3.001	8842	10	10Z					N	2W

The calibration measurement instrument expects to measure the nominal value. You are asked to set the UUT output to the NOMINAL value and place it in Operate. When you select **Advance**, the measurement is taken and you are asked to put the UUT in standby. No evaluation takes place and no results are generated. The next procedure line is executed immediately afterwards.



fs7s.bmp

Figure 10. Automatic Completion Message

This test can be used for frequency response testing initialization in conjunction with Comparison Tests.
Values of memory registers MEM and MEM1:

MEM The measured value.

MEM1 Not affected by the test.

Comparison Tests

The Comparison Test is used in conjunction with the Nominal Setup Test. The Comparison Test operates like an evaluation test, except that the value established by the Nominal Setup Test is used as the reference for the evaluation, rather than the value specified in the NOMINAL field.

Stimulus Function

An example of this type of test is as follows:

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	5500	400	350.0mV		60H	SI		N	2W
1.002	5500	400	350.0mV	0.1% 0.1/	1kH	SI		C	2W
2.001	5500	400	350.0mV	0.1% 0.1/	100kH	SI		C	2W

Only the Slew method is used; ASK K, G, and B flags are ignored. See Slew Evaluation under Evaluation Tests - Stimulus Function described earlier in this section.

Measurement Function

An example of this type of test is as follows:

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	8842	2	1.900V		60H			N	2W
1.002	8842	2	1.900V	0.1% 0.1/	1kH			C	2W
3.001	8842	2	1.900V	0.1% 0.1/	10kH			C	2W

The operator is asked to set the UUT output to the NOMINAL value and place it in Operate (Figure 7).When **Advance** is selected, the measurement is taken and the operator is asked to put the UUT in standby (Figure 10). These automatic messages may be disabled using ASK- N. If ASK- R and ASK- W are in effect, the automatic connection and range messages are also disabled. The UUT error is computed using the measurement and the reference value stored in MEM. A PASS or FAIL condition is then established for the test based on the limits specified in the tolerance field.

IEEE-488 Service Request (SRQ) Processing

The calibration system maintains a list of valid instruments and their IEEE-488 addresses. IEEE-488 SRQs are processed as follows:

1. The SRQ is detected.
2. MET/CAL checks to see if the SRQ was expected as a result of the IEEE FSC. If so, the serial poll is performed and the SRQ interrupt is cleared.

If the SRQ was not expected as a result of the IEEE FSC, continue with step 3.

3. The calibration instrument whose FSC is being executed is serial polled if it is on the IEEE-488 bus. If an error is reported, the Post Test screen comes up, indicates the error and asks you to do one of the following:

    - Repeat
    - Advance
    - Terminate

    If the calibration instrument whose FSC is being executed did not issue an SRQ, continue with step 4.

4. The UUT is serial polled if the UUT is on the IEEE-488 bus. If the SRQ originated from the UUT, MET/CAL reports:

Unexpected SRQ From UUT: address, SPL = *value*, *value*

You have the same choices: repeat or skip the test, or terminate the procedure.

If the UUT did not create the SRQ, continue with step 5.

5. Perform a serial poll of the configured calibration instruments. If the SRQ was from one of these instruments, report the error. You have the choice to repeat the test, skip it, or terminate the procedure.

    If the SRQ did not come from one of these configured instruments, test to see if the SRQ is still present. If the SRQ line is no longer asserted, continue with MET/CAL procedure execution. Otherwise, the procedure is aborted.

Instrument Resets

MET/CAL Run Time resets the calibration instruments under the following circumstances:

- When MET/CAL is started, the following sequence is carried out:

    1. An IEEE-488 Interface Clear command is sent.
    2. Each system instrument required by the procedure receives a reset command.
    3. Any error that occurs as a result of a calibration instrument not responding is reported.

    If an error occurs, the following selections are available:

    a. Correct the hardware error and retry. (Turn the power on.)

    b. Abort the calibration procedure.

    c. Ignore the error and proceed without the instrument that reported the error. MET/CAL removes this instrument from the list of configured instruments. If the instrument is needed to perform a calibration step in the procedure, another error is reported and the operator can choose to go to the next calibration test or terminate the procedure.

- At the completion or abnormal termination of every test in the calibration procedure (an evaluation), the following occurs:
  1. Stimulus calibration instruments are placed in Standby mode.
  2. Stimulus calibration instruments are reprogrammed to a safe voltage if necessary.
- After termination of the procedure, the following occurs:
  1. An IEEE-488 Interface Clear command is sent.
  2. Each system instrument required by the procedure receives a reset command

Display Control FSCs

Display Control FSCs are used to present calibration instructions (e.g., Set Switch S1 to ON) or other information to the operator. This information is displayed on the screen of the Calibration System during execution of the calibration procedure. The following is a list of the display control FSCs for MET/CAL Calibration Software.

CON: Specify a connection from a calibration system instrument to the UUT.

DISP: Display a message.

DRAW: Define a stick figure representation of the UUT.

HEAD: Display a Header message during calibration procedure execution.

MESS: Define a message for EVAL, Measurement or Stimulus Setup test or Slew.

PIC: Display a Picture.

RNG: Specify a UUT Range message.

SET: Generate a list of UUT settings (usually used with oscilloscopes).

In addition to the general rules applicable to all FSCs (step numbers and adjustment procedure steps) that are discussed earlier in this section, the following general rules apply to Display Control FSCs.

- RANGE, NOMINAL, TOLERANCE, MOD1, MOD2, MOD3, MOD4, and CON fields are not separate. Instead, the FSC-dependent information starts with the NOMINAL field column, and the rest of the line is a single undivided record.

- Messages with up to eight lines can be created for the DISP, MESS, and SET FSCs. Each line of a multiline message is assigned identical step numbers.
- The message length in any line is limited to 56 characters.
- Certain special constructions can be used in some of these display-control FSCs. The description of the individual display control FSC contains information on which Special Constructions are allowed for that FSC. For general information about the special constructions, refer to *Special Constructions* discussed later in this manual.

Evaluation FSCs

Evaluation FSCs are non-instrument procedure statements that perform evaluations. These are used when a simple instrument evaluation statement is not adequate for the test. For example, if UUT units are not directly supported by an instrument FSC.

The following is a list of evaluation FSCs:

- DOSE: Sets PASS or FAIL via a user program.
- EVAL: Sets PASS or FAIL based on operator response to a YES/NO prompt.
- MEMC: Sets PASS or FAIL based on numeric comparison.
- MEMCX: Sets PASS or FAIL based on numeric comparison.
- PICE: Sets PASS or FAIL based on operator response to a YES/NO prompt displayed over a picture.

In addition to the general rules applicable to all FSCs (step numbers and adjustment procedure steps) that are discussed, the following information applies to Evaluation FSCs.

Certain special constructions can be used in some of these FSCs. The description of the individual procedure control FSC contains information on which Special Constructions are allowed with that FSC. For general information about the special constructions, refer to *Special Constructions* discussed later in this manual.

Interface Control FSCs

The Interface Control FSCs provide direct control of a UUT using an IEEE-488 or serial interface. IEEE-488 or serial system calibration instruments may also be controlled when no FSC exists or the FSC does not support the desired instrument function.

- IEEE: Direct control of a device on an IEEE-488 interface.
- IEEE2: Direct control of a device on an IEEE-488 interface that is IEEE-488.2 compliant.

- PORT: Direct control of a device on a serial interface.
- SCPI: Direct control of a device on a IEEE-488 interface that is SCPI compliant.

In addition to the general rules applicable to all FSCs discussed earlier in this manual, the following information applies to the Interface Control FSCs.

Certain special constructions can be used with some of these FSCs. The descriptions of individual FSCs contain information on which special constructions are allowed with that FSC. For general information, refer to *Special Constructions* discussed later in this manual.

Memory Register Operation FSCs

The Memory Register Operation FSCs store, retrieve, and maintain data stored in the data registers. The following FSCs are used in memory register operations:

- MATH: performs arithmetic operations using memory registers.
- MEM2: Manipulates the contents of the memory register MEM2.
- MEME: Exchanges the values of memory registers MEM and MEM1.
- MEMI: Displays a prompt for a number to be placed in memory register MEM.
- MEM+: Adds MEM1 or the specified value to memory register MEM.
- MEM-: Subtracts MEM1 or the specified value from memory register MEM.
- MEM*: Multiplies MEM by a the specified value or MEM1.
- MEM/: Divides MEM by a specified value or MEM1.

Procedure Control FSCs

The Procedure Control FSCs control the flow of the procedure. These are transparent to the operator and do not perform tests or produce results. OPBR is the only exception; this FSC displays a prompt that requires a response. Refer to the OPBR FSC section in this manual for more information on OPBR.

The following FSCs control procedures:

- ASK+: Sets one or more of the system flags.
- ASK-: Unsets one or more of the system flags.
- CALL: Calls one procedure from another.
- DO, UNTIL: Conditional looping over procedure statements.
- DOS: Calls a user program (also see DOSE under Evaluation FSCs).
- IF, ELSEIF, ELSE, ENDIF: Conditional execution of procedure statements.

- JMP: Jumps to a specified procedure step.
- JMPF: Jumps to a specified procedure step if MEM1 is less than zero.
- JMPT: Jumps to a specified procedure step if MEM1 is greater than zero.
- JMPL: Branch to specified LABEL.
- JMPZ: Jumps to a specified procedure step if MEM1 is equal to zero.
- LABEL: Establishes target for JMPL.
- OPBR: Presents a message that requests a response.
- RPT: Repeats a test.
- TARGET: Specifies jump destinction for post test "Repeat" and "Cancel" options.
- WAIT: Specifies a delay between procedure statements with an optional popup message and countdown timer.
- WHILE, ENDW: Conditional looping over procedure statements.

In addition to the general rules applicable to all FSCs (step numbers and adjustment procedure steps), the following information applies to Procedure Control FSCs.

Certain special constructions can be used in some of these FSCs. The descriptions of the individual procedure control FSCs contain information on which Special Constructions are allowed. For general information about the special constructions, refer to *Special Constructions* discussed later in this manual.

Miscellaneous FSCs

The following list contains various FSCs that have specific functions but do not belong to any other category:

- ACC This specifies the system accuracy for a MEMC FSC.
- RESET: Specifies reset commands for user-configured instruments or the UUT.
- RSLT: Adds text to result files, with or without an operator prompt.
- STD: Includes traceability information for manual instrument.
- TOL: Specifies tolerance.
- TSET: Assigns values for system parameters for current test only.
- VSET: Assigns values for system parameters for all tests.

Use of Standard Memory Registers

The following tables show how the standard memory locations, MEM, MEM1, UUT Indicated, and System Actual, are used.

Table 5. Evaluation Tests

Function	MEM	MEM1	UUT Indicated	System Actual
Stimulus, SLEW (Except Discrete Ohms)	No Change	Slew Value	Nominal Value	Slew Value
Stimulus, SLEW (4000, 4000A, 4700, 4705, 4707, 4708, 4800, 4800A, 4805, 4808, 5100B & 5130A Ohms)	No Change	Slew Value	Slew Value	Nominal Value
Stimulus, SLEW (5450A, 5700A, & 5720A Ohms)	No Change	Slew Value	Slew Value	Actual Resistance
Stimulus, Keyboard Entry	No Change	Entered Value	Entered Value	Nominal Value
Stimulus, Go/No-Go	No Change	+1 (PASS) -1 (FAIL)	OPER-EVAL	Nominal Value
Measurement	No Change	Measured Value	Nominal Value	Measured Value

Table 6. Setup Tests

Function	MEM	MEM1	UUT Indicated	System Actual
Stimulus (Except 5700A & 5450A Ohms)	No Change	Nominal Value	na	na
Stimulus (5700A & 5450A Ohms)	No Change	Real Value	na	na
Measurement	No Change	Measured Value when advance is selected	na	na

Table 7. Nominal Setup Tests

Function	MEM	MEM1	UUT Indicated	System Actual
Stimulus, SLEW	Slew Value	No Change	na	na
Measurement	Measured Value	No Change	na	na

Table 8. Comparison Tests

Function	MEM	MEM1	UUT Indicated	System Actual
Stimulus, SLEW (Except Discrete Ohms)	No Change	Slew Value	MEM	Slew Value
Stimulus, SLEW (Discrete Ohms)	No Change	Slew Value	Slew Value	MEM
Measurement	No Change	Measured Value	Nominal Value	Measured Value

Adjustment Statements

If the instrument's actual performance is below the adjustment threshold, a normal PASS condition is recorded, and any adjustment statement immediately following are skipped. The value of the adjustment threshold (shown in the procedure header) is normally set to 70%.

If the instrument's actual performance is between the adjustment threshold and the full specified tolerance, a MARGINAL PASS condition is recorded, and any immediately following adjustment procedure lines are executed. This condition indicates that although the UUT is within specification, it is advisable to adjust the UUT so it is well within specification.

If the instrument's performance is out of tolerance, a FAIL condition is recorded and any immediately following adjustment procedure lines are executed. The adjustment may resolve the FAIL condition, so the UUT can PASS the calibration procedure. The following example illustrates how the adjustment portion of a procedure might appear:

```
STEP   FSC     RANGE   NOMINAL TOLERANCE MOD1 MOD2   3   4   CON
2.001  5700    10      10V     0.1% 0.1/                     2W
2.001          5700    10V                               S   2W
2.003          DISP    Adjust R1 for a 10V Reading
```

Because the FSC is in the RANGE field, no UUT range information is allowed in an adjustment procedure step. To adjust a step, select Adjust while entering the line. After successfully compiling the line, the FSC is shown under the RANGE header. When you press Enter, the next line is an adjustment procedure line.

To change an adjustment procedure step back to a regular procedure step, select adjust anywhere in the line and recompile that line. The spaces are deleted in the line and the FSC is positioned in the FSC field.

Continuation Statements

Continue allows you to mark the current line as a continuation of the previous line. This is useful for certain FSCs which allow multiline statements.

To create a multiline statement, type in the first line of the statement and press Enter. On the second line of the statement, press F6 to link the lines together. The FSC is automatically inserted if the following conditions occur:

- The FSC field of the current line is empty.
- The previous line was successfully compiled.
- The FSC of the previous line can be part if a multiline message.

In some cases, there are FSC-specific limits on the number of continuation lines per statement. An attempt to exceed these limits causes the compiler to display an appropriate error message.

Automatic Messages

The following messages are automatically displayed by MET/CAL unless defeated using an associated ASK flag. Refer to Chapter 2, *FSC Reference* for a general description of the ASK+ and ASK- FSCs.

- Connection Message

  An automatic connection message is generated by an instrument FSC or the CON FSC. If the required connection from the UUT to the calibration system changes, the operator is asked to make the required disconnections and connections before proceeding. The automatic connection message may be disabled using ASK- V or ASK- W.

- UUT Range Message

  An automatic range message is generated by an instrument FSC for an evaluation test, nominal setup test, or comparison test (with a non-blank RANGE field) or the RNG FSC. If the UUT function or range has changed, you are asked to set the UUT to the new function and range. The automatic range message for a numeric value in the RANGE field is of the form:

  Set UUT <MEM2> to the *range* value nominal prefix + units [AC|DC] range.

  The automatic range message for autorange is of the form:

  Set UUT <MEM2> to autorange *function* (based on nominal units).

  If the D-flag is in effect the automatic range message is of the form:

  Set UUT <MEM2> to *range* value nominal prefix + units/div.

  The automatic range message may be disabled using ASK- R.

- Slew Message

  An automatic slew message is generated by an instrument FSC specifying a calibration instrument stimulus function in the following cases:

1. An evaluation test is specified and any of the defaults ASK- B, ask- G, or ASK- K are in effect.
2. A nominal setup test is specified.

   For discrete resistance specified using 4000, 4000A, 4700, 4705, 4707, 4708, 4800, 4800A, 4805, 4808, 5450,5700, 5720, and RESF FSCs, the automatic slew message is:

   Adjust display to match UUT reading.

   For all other cases, the automatic slew message is of the form:

   Adjust stimulus for a UUT reading of *nominal* value+prefix+units.

   If the D-flag is in effect and the RANGE field specifies a numeric value, the automatic slew message is one of the following:
3. Adjust stimulus for a UUT horizontal reading of *nominal/range* divisions (when the NOMINAL field specifies amplitude).

   Adjust stimulus for a UUT vertical reading of *nominal/range* markers/div (when the NOMINAL field specifies frequency or period).

   The automatic slew message may be disabled using ASK- N.

   - UUT Setup Message

     An automatic UUT setup message is generated by an instrument FSC specifying a calibration instrument measurement function for an evaluation test, nominal setup test, or comparison test. The UUT setup message may be disabled using ASK- N.

   - UUT Adjustment Message

An automatic UUT adjustment message is generated by an instrument FSC specifying a setup test for a calibration instrument measurement function. The UUT adjustment message may be disabled using ASK- N.

Special Constructions

A number of special constructions are used in Procedure Control FSCs, Display Control FSCs, PORT, IEEE, IEEE2, SCPI, and EVAL FSCs. Table 9 shows what the various special constructions are, how they are written, and what FSCs they are used with.

Table 9. Special Constructions

IEEE-488	address @pri addr:sec addr	IEEE, IEEE2, SCPI
delay	Dnumber	DISP, EVAL, HEAD, IEEE, MEMI, OPBR, PORT, RSLT, SET
draw	Drawx,y, view	DISP, EVAL, OPVR, SET
input	[I$] > file name or [I] > file name	IEEE, IEEE2, PORT, SCPI
memory register	MEM, MEM1 or MEM2	DISP, EVAL, HEAD, IEEE, IEEE2, SCPI, MEMI, MEM2, MESS, OPBR, PORT, RSLT
integer	positive integer	DISP, EVAL, HEAD, IEEE, MEMI, MEM2, MESS, OPBR, PORT, RSLT
port configuration	[baud],[par],[ndata], [nstop], [hndshk]	PORT only
timout	Ttimeout	IEEE, IEEE2, SCPI,PORT
wait for srq	SRQ(delay, mask) |ON|OFF	IEEE only
serial poll	SPLmask	IEEE only
negate response	N	EVAL only
selected device clear	SDC	IEEE, IEEE2, SCPI
remote enable	REN	IEEE, IEEE2, SCPI
goto local	GTL	IEEE, IEEE2, SCPI
local lockout	LLO	IEEE, IEEE2, SCPI
group execute trigger	TRIG	IEEE, IEEE2, SCPI
end of information	EOI ON|OFF	IEEE only
input terminator	TERM number, TERM 'char', TERM CR or TERM LF	IEEE, PORT
output terminator	OTERM number, OTERM ‘char’, OTERM CR, OTERM LF, OTERM CRLF, OTERM NONE, OTERM OFF	PORT only
interface clear	IFC port number	IEEE, IEEE2, SCPI
inter-byte delay	S inter-byte delay	IEEE, IEEE2, SCPI
variable	V variable name	DISP, HEAD, IEEE, IEEE2, SCPI, MEMI, MEM2, MESS, OPBR, PORT, RSLT, SET
output to file	O < file name	IEEE, IEEE2, SCPI, PORT
flush receive buffer	CLR, CLR ON or CLR OFF	PORT only
serial address	@port designator	PORT only
default button	NO	OPBR only

Delay Construction

The special construct D[*n*] causes a delay of the message line by *integer* milliseconds. The available range is 0 to 32767 milliseconds. The delay occurs at the position of the construct. For example, the following procedure line first causes the word **`This`** to be displayed. Ten seconds later, the word **`message`** is added, followed five seconds later by **`is delayed`**.

Draw Construction

A drawing is defined by a "DRAW" statement together with a [DRAW*x*, *y*, *view*] construction. The drawing does not appear until a statement containing a [DRAW*x*, *y*, *view*] construction is executed.

The DRAW FSC allows you to display two rectangles, one within the other. These rectangles are intended to show the outline of the UUT and the location of an item of interest (such as an adjustment potentiometer.) For detailed information on the DRAW FSC, refer to its description in Chapter 2.

The DRAW construct positions a annunciator within a simple drawing of the UUT, as created by the DRAW FSC, to show the location of a control or an adjustment. The drawing can indicate the view (from the front, from the back, etc.)The drawing appears on the right side of the computer screen.

The DRAW construct includes three modifiers (par1, par2, and par3), and is entered as follows:

```
[DRAWpar1,par2,par3]
```

The three modifiers are optional; however, the commas must still be entered. The modifiers are used for the following purposes:

- *par1* specifies the Y coordinate of the annunciator. This modifier is specified as a percentage of the height of the UUT box, measured up from the bottom edge.

  Allowable range: 0 - 100, inclusive.

- *par2* specifies the X coordinate of the annunciator. This modifier is specified as a percentage of the width of the UUT box, measured right from the left edge.

  Allowable range: 0 - 100, inclusive.

- *par3* indicates the desired view from the UUT: front (F), back (B), left side (L), right side ®, top (T), or bottom/underside (U).

  Specifying 0 (zero) for *par1* and *par2* causes the UUT drawing to be displayed without an annunciator.

Memory Registers

MET/CAL provides a number of registers that can be used to store and retrieve values. The registers that are directly accessible are:

[MEM]	MEM is a global numeric memory register that stores a floating-point value. This construction causes the current value of memory register MEM to be inserted in the text in place of the construction.
[MEM1]	MEM1 is a global numeric memory register that stores a floating-point value. This construction causes the current value of memory register MEM1 to be inserted in the text in place of the construction.
[MEM2]	MEM2 is a global 4096-character string register. This construction causes the current value of memory register MEM2 to be inserted in the text in place of the construction.
[M1], [M2], [M3], …, [M255]	M[n] are global numeric memory registers that store a floating-point value. These constructions cause the value of the respective memory register M[n] to be inserted in the text in place of the construction.
[L1], [L2], [L3], …, [L32]	L[n] are local numeric memory registers that store a floating-point value. These constructions cause the value of the respective memory register L[n] to be inserted in the text in place of the construction.
[S1], [S2], [S3], …, [S32]	S[n] are global string registers (max 32767). These constructions cause the current value of memory register S[n] to be inserted in the text in place of the construction.
[SREG1], [SREG2], …, [SREG32]	Alternate form for S[1] through S[32]. This from is required when used in the IEEE, IEEE2, RESET, and SCPI FSC's.

When included in a procedure statement, the value contained in the identified memory location replaces the related special construction during procedure execution. For example:

```
STEP   FSC     RANGE    NOMINAL    TOLERANCE  MOD1     MOD2     3    4    CON
1.010  DISP             [MEM] Volts are stored
```

Assuming that memory location MEM contains the value 2, the following is displayed during program execution:

```
2 Volts are Stored
```

Numeric Literals

Numeric literals print ASCII characters during procedure execution. The syntax that provides this capability is **[*n*]**. The square brackets are included. This construction causes the ASCII character corresponding to the numeric to be printed or used. For example:

```
STEP   FSC     RANGE   NOMINAL     TOLERANCE   MOD1     MOD2     3    4    CON
1.011  DISP            [7]Safety Notice Follows
```

This construction causes the computer to beep when the message is displayed because 7 is the ASCII character for bell (BEL).

Since braces and square brackets are reserved for special constructions, they cannot be used literally in a procedure line. The following special constructions must be used to print braces or square brackets:

Construct	Prints
[91]	[(left square bracket)
[93]	] (right square bracket)
[123]	{ (left brace)
[125]	} (right brace)

Variables

The Variable construction evaluates to the value of the named variable. The syntax for the variable construction is [V*variable name*]. The variable must, at run time, be present in the MET/CAL Variable File. The default name is VARIABLE.DAT. The following is an example:

```
DISP Current date is [V DATE$].
```

Function Selection Code Reference

Chapter 2 provides specific information about the various FSCs. The information there must be used in conjunction with material provided in this section, where the general features and restrictions of the FSCs are discussed.

The FSCs are arranged in alphanumerical order except in the case of auxiliary instrument FSCs. For example the 5520A auxiliary FSC *M5520* follows the 5520A main FSC *5520*.. The page header for the FSC contains:

- FSC name (e.g., 5700)
- FSC type (e.g., Instrument or Message)

The description of each FSC includes:

- A general description.
- The values each parameter field in the FSC can assume.
- Use of the standard memory registers MEM, MEM1, and MEM2.
- Miscellaneous information on the FSC.
- One or more examples.

FSC Sections

The following sections describe each FSC in detail. The FSCs are presented in a logical but non-sequential order. Use the bookmarks in the pdf file to access a specific FSC.

Note

Flexible Standards is a MET/CAL technique that allows the operator to interchange any reference instrument with another, specially configured instrument, of the same functional class without necessitating procedure modification. This technique is best suited to those categories of remotely controllable standards that include many different models with essentially the same functionality. These are the types of instruments that have similar functional capabilities but likely have different range points, different specifications and different control commands. See the Flexible Standards application note included in MET/CAL's documentation directory.

195

195 Instrument FSC

Description

The 195 FSC programs the Wavetek 195 Universal Waveform Generator to output DC voltage, or sine, square, triangle, positive ramp, negative ramp, and pulse waveforms.

Note

If the 195 is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 195. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements. Use the Windows Control Panel to set the port configuration as follows:

Baud Rate:	9600
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	Xon/Xoff

Press the Utility button on the 195 front panel. Press the right arrow below the knob until "Remote" can be selected using one of the softkeys on the left side of the display. Select the following settings:

interface: RS232

baud rate: 9600

Functional Capability

Waveform	Frequency
Sine	0.1 mHz to 16 MHz
Square	0.1 mHz to 16 MHz
Triangle	0.1 mHz to 100 kHz
Positive Ramp	0.1 mHz to 100 kHz
Negative Ramp	0.1 mHz to 100 kHz
Pulse	
Period	100 ns to 100 s
Width	25 ns to 99.99 s
Output Level	
2.5 mV to 10 Vpp into 50 Ω	
5.0 mV to 20 Vpp open circuit	

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak) entered as: [*numeric*][*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H
- Period entered as: [*numeric*][*prefix*]T

Rules:

- The NOMINAL field may specify Decibels only when the MOD2 field specifies SI.
- The NOMINAL field may specify Voltage peak-to-peak, Frequency, or Period only when the MOD2 field specifies SI, SQ, TI, +R, -R, or PU (i.e. MOD2 is not blank).
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak) entered as: [*numeric*][*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- *blank* DC

Rules:

- The MOD1 field may specify Decibels only when the MOD2 field specifies SI.
- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage or decibels only when the NOMINAL field specifies frequency or period.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies the function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- +R Positive Ramp
- -R Negative Ramp
- PU Pulse

Rules:

- When the MOD2 field is PU, the M195 RANGE field must specify PER or PULSE.
- SI is inserted automatically in the MOD2 field when the MOD1 field is not blank and no MOD2 code is entered.
- The MOD2 field must be blank when the MOD1 field is blank (i.e. DC Voltage is specified).

MOD3

This field is not used.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- L 50 Ω termination
- *blank* 1 MΩ Input Impedance

Rules:

- When the CON field specifies "L" the output is expected to be terminated with 50 Ω. This can be accomplished by using a 50 Ω terminator at the UUT or setting the UUT input impedance to 50 Ω.

- If ASK- W or ASK- V is in effect, the procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP    FSC    RANGE NOMINAL      TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  195         *                                              S
# ----- DC Voltage -----
  1.002  195         1.00V                                          S  L
# ----- Sine Wave -----
  1.003  195    400   2.5Vp          -2.8U +2.9U   60H         SI        L
  2.001  195    400   3.500Vp        7.4U          20kH        SI        L
  3.001  195          -37.78D                      100H        SI    S  L
# ----- Square Wave w/DC offset -----
  3.002  M195                                      0.5Voff             CH1
  3.003  195          1Vp                          1kH         SQ    S  L
# ----- Triangle Wave -----
  3.004  M195         *
  3.005  195          13mVp                        10kH        TI    S  L
# ----- Positive Ramp -----
  3.006  195          1.0Vp                        100kH       +R    S  L
# ----- Negative Ramp -----
  3.007  195          1.0Vp                        20kH        -R    S  L
# ----- Pulse -----
  3.008  M195   PER   1uT                                              CH1
  3.009  195          100nT                        1Vp         PU    S  L
  3.010  M195         *
# ----- Frequency -----
  3.011  195          800.0H                       300mV       SI    S  L
# ----- Simultaneous Output -----
  3.012  M195                                                          CH1
  3.013  195          1Vpp                         1kH         SI    S  L
  3.014  M195                                                          CH2
  3.015  195          1Vpp                         2kH         SQ    S  L
  3.016  M195                                                          CH3
  3.017  195          1Vpp                         4kH         TI    S  L
  3.018  M195                                                          CH4
  3.019  195          1Vpp                         8kH         +R    S  L
# ----- Phase-setting Between Channels -----
  3.020  M195                                                     MS   CH3
  3.021  195          3Vpp                         1kH         SI    S  L
  3.022  M195                        30deg                        SL   CH4
  3.023  195          3Vpp                         1kH            SI S  L
  3.024  END
```

M195

Auxiliary Instrument Setup FSC

Description

The M195 FSC is used to specify pulse period, pulse width, and DC offset, channel mode (master/slave), and output channel.

Functional Capability

Pulse Period	100 ns to 100 s
Pulse Width	25 ns to 99.99 s
DC Offset:	0 V to 5 V into 50 Ω
	0 V to 10 V open circuit
	restricted by:
	|Voff| + |Vp| <= Vmax

Parameters

Range

This field specifies one of the following:

- PULSE — Pulse Width
- PER — Pulse Period
- *blank* — field not applicable

Nominal

This field specifies one of the following:

- Pulse Width entered as: [*numeric*][*prefix*]T
- Pulse Period entered as: [*numeric*][*prefix*]T
- "*" reset to default values

- *blank* not applicable

Rules:

- The NOMINAL field must specify the pulse width when the RANGE field is PULSE.
- The NOMINAL field must specify the pulse period when the RANGE field is PER.
- If the Nominal field does not contain a value the value is taken from memory register MEM.

Tolerance

The Tolerance field specifies the phase of the specified channel relative to the master channel.

- Phase entered as: [*numeric*][*prefix*]deg
- *blank* mode in independent or this is the master channel

Rules:

- The Tolerance field may specify the phase only when the MOD3 field is "SL" (Slave).
- When the MOD3 is field is SL and no phase is specified, 0 deg is automatically insert in the tolerance field.

MOD1

The MOD1 field specifies the following:

- DC Offset entered as: [*numeric*][*prefix*]Voff
- *blank* no offset

Rules:

- If the MOD1 field does not contain a value the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

The MOD3 field specifies the channel mode:

- MS Master
- SL Slave
- *blank* Independent

Rules:

- If the MOD3 field must be blank when the RANGE field is PULSE or PER.

MOD4

This field is not used.

CON

This field specifies the output channel.

- CH1
- CH2
- CH3
- CH4

Rules:

- If no valid CON field code is entered, CH1 is automatically inserted in the CON field.

Examples

See 195 FSC.

1271

Instrument FSC

Description

The 1271 FSC programs the Datron 1271 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance and frequency.

Note

The 1271 must have firmware version 2.03 or later.

Functional Capability

Function	Nominal	MOD1	MOD2	MOD3
DC Voltage	-1100 V to 1100 V			
AC Voltage [1,5]	2 mV to 199.9999 mV	1 Hz to 100 kHz		
	200 mV to 199.9999 V	1 Hz to 1 MHz		
	200 V to 1100 V	1 Hz to 100 kHz		
	-40.969 dBm to -0.969 dBm	1 Hz to 100 kHz		5Z
	-0.969 dBm to +59.031 dBm	1 Hz to 1 MHz		5Z
	+59.031 dBm to +73.838 dBm	1 Hz to 100 kHz		5Z
	-42.730 dBm to -2.730 dBm	1 Hz to 100 kHz		7Z
	2.730 dBm to +57.270 dBm	1 Hz to 1 MHz		7Z
	+57.270 dBm to +72.077 dBm	1 Hz to 100 kHz		7Z
	-51.761 dBm to -11.761 dBm	1 Hz to 100 kHz		6Z
	-11.761 dBm to +48.239 dBm	1 Hz to 1 MHz		6Z
	+48.239 dBm to +63.046 dBm	1 Hz to 100 kHz		6Z
Resistance [2]				
True Ohms	0 Ω to 199.999999 kΩ		OC	
Normal Ohms	0 Ω to 1.99999999 MΩ			
Hi Ohms	2 MΩ to 1.99999999 GΩ			
DC Current [4]	-1.5 A to 1.5 A			
AC Current [5]	2 µA to 1.5 A	10 Hz to 5 kHz		
Frequency [1,5, 6]	10 Hz to 100 kHz	2 mV to 1000 V		
	10 Hz to 1 MHz	200 mV to 199.9999 V		
	10 Hz to 5 kHz	2 µA to 1.5 A		

1. Requires Option 10 or 12.
2. Requires Option 20.
3. Requires Options 20 and 30.
4. Requires Options 10, 20, and 30 or Options 12, 20, and 30.
5. Option 10 is limited to a minimum of 10 Hz for all AC voltage.
6. Lower bound is 200 Hz when MOD3 = FE (Fast Gate)

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V.
- dBm entered as [*numeric*][*prefix*]D.
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- The NOMINAL field may specify frequency only when the MOD1 field specifies voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency or amplitude for AC voltage or AC current measurements.

- Frequency entered as *numeric*[*prefix*]H.
- Voltage entered as *numeric*[*prefix*]V.
- Current entered as *numeric*[*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.

- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance.

Option 10

The AC filter is selected as follows:

Frequency	Filter
>= 1 kHz	1 kHz High Pass Filter
< 1 kHz and >= 360 Hz	360 Hz High Pass Filter
< 360 Hz and >= 40 Hz	40 Hz High Pass Filter
< 40 Hz	10 Hz High Pass Filter

Option 12

The AC filter is selected as follows:

Frequency	Filter
>= 100 Hz	100 Hz High Pass Filter
< 100 Hz and >= 40 Hz	40 Hz High Pass Filter
< 40 Hz and >= 10 Hz	10 Hz High Pass Filter
< 10 Hz	1 Hz High Pass Filter

MOD2

This field specifies one of the following:

1. The load impedance that the AC voltage is referenced to, or
2. Offset compensated resistance "TRUE OHMS" function.

- 5Z 50 Ω
- 7Z 75 Ω
- 6Z 600 Ω
- OC Enable offset compensated resistance "True OHMS".
- *blank* (see below)

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- The MOD2 field may specify "OC" only when the NOMINAL field specifies a resistance less than 200 kΩ.
- The MOD2 must be blank for any of the following conditions:
  1. DC Voltage: The NOMINAL specifies voltage and the MOD1 field is blank.
  2. DC Current: The NOMINAL specifies current
  3. AC Current: The NOMINAL or MOD1 field specifies current

MOD3

Specifies the measurement mode. The measurement mode determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement. The effect of the measurement mode on the programmed function is shown in the following table:

Function	F	*blank*	E	FE
DC Volts:				
resolution	6.5 digits	6.5 digits	8.5 digits	8.5 digits
fast	on	off	off	on
reading rate	50/s	10/s	10/s	1/6s
Readings:				
thrown away[1]	1	1	1	1
averaged[1]	5	1	1	1
AC Volts:				
resolution	5.5 digits	5.5 digits	6.5 digits	5.5 digits
TFER (Option 12)	off	on	on	on
coupling:				
< 40 Hz	DC	DC	DC	DC
>= 40 Hz	AC	AC	AC	AC
gate fast	on	on	on	on
reading rate:				
Option 10:				
>= 1kHz	20/s	20/s	20/s	20/s
360 to 1 kHz	8/s	8/s	8/s	8/s
40 to 360 Hz	1/s	1/s	1/s	1/s
10 to 40 Hz	1/5s	1/5s	1/5s	1/5s
Option 12:				
>= 100 Hz	2/s	2/s	2/s	2/s
40 to 100 Hz	1/2s	1/2s	1/2s	1/2s
10 to 40 Hz	1/2.5s	1/2.5s	1/2.5s	1/2.5s

1 to 10 Hz	1/25s	1/25s	1/25s	1/25s
Readings:				
thrown away[1]	1	1	1	1
averaged[1]	1	3	3	1
Frequency Measurement				
gate fast	n/a	off	n/a	on
DC Current:				
resolution	6.5 digits	5.5 digits	6.5 digits	5.5 digits
fast	on	off	off	On
reading rate	50/s	50/s	10/s	50/s
Readings:				
thrown away[1]	1	1	2	1
averaged[1]	1	3	5	1
AC Current:				
resolution	5.5 digits	5.5 digits	5.5 digits	5.5 digits
coupling:				
< 40 Hz	DC	DC	DC	DC
>= 40 Hz	AC	AC	AC	AC
reading rate:				
Option 10:				
>= 1 kHz	20/s	20/s	20/s	20/s
360 to 1 kHz	8/s	8/s	8/s	8/s
40 to 360 Hz	1/s	1/s	1/s	1/s
10 to 40 Hz	1/5s	1/5s	1/5s	1/5s
Option 12:				
>= 100 Hz	4/s	4/s	4/s	4/s
40 to 100 Hz	1/s	1/s	1/s	1/s
10 to 40 Hz	1/5s	1/5s	1/5s	1/5s
Readings:				

thrown away[1]	1	1	2	1
averaged[1]	1	3	5	1
Frequency Measurement				
gate fast	n/a	off	n/a	on
Resistance:				
resolution:				
True Ω (4-Wire only)				
>= 0 Ω to < 200 kΩ	6.5 digits	6.5 digits	7.5 digits	6.5 digits
Normal Ω				
>= 20 Ω to < 2 MΩ	6.5 digits	6.5 digits	7.5 digits	6.5 digits
HI Ω				
>= 2 MΩ	5.5 digits	5.5 digits	6.5 digits	5.5 digits
reading rate				
< 2 MΩ	50/s	10/s	1/2s	50/s
>= 2 MΩ	1000/s	50/s	10/s	1000/s
fast	on	off	off	on
<= 20 kΩ:				
Readings:				
thrown away [1]	1	2	2	1
averaged[1]	3	4	4	1
>20 kΩ to <= 200 kΩ:				
Readings:				
thrown away [1]	1	2	5	1
averaged[1]	3	4	4	1
>200 kΩ:				
Readings:				
thrown away [1]	1	2	7	1
averaged[1]	3	4	5	1

1. With measurement uncertainty disabled. Use VSET to set number of readings to throw away and the number of readings to average when measurement certainty is enabled.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance.
- The CON field must specify a 4W when the MOD2 field specifies Offset Compensated Resistance "OC" (True OHMS Function).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  1271         *                                                 S
# ----- DC Voltage -----
  1.002  M1271  RNGLK 1V
  1.003  1271         10mV                                              N  2W
  1.004  M1271        *
  1.005  1271   A     -1000V         1% 0.1U                               2W
# ----- AC Voltage -----
  2.001  1271   200   100V           1% 2/         10kH                    2W
# ---- dBm, 50 Ohms ----
  3.001  1271         0.00D          0.1U          1kH            5Z       2W
# ----- DC Current -----
  4.001  1271   10    1.00A          1000P%                                2W
# ----- AC Current -----
  5.001  1271   2     mA             1%            1kH                     2W
# ----- Resistance -----
  6.001  1271   100   256kZ          1%                                    4W
# ----- Frequency  -----
  7.001  1271   1     10.0kH         1% 2/         1V                      2W
  8.001  1271   10    1.00kH         1% 2/         10mA                    2W
```

M1271

Auxiliary Instrument Setup FSC

Description

The M1271 FSC provides additional functions for the Datron 1271 Multimeter that are not addressed in the 1271 FSC. These functions include range locking, DC and Ohms filter, and guard.

Parameters

When a blank M1271 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* field not applicable

Rules:

- When the RANGE field specifies RNGLK, the NOMINAL field must specify the range selection value.

NOMINAL

This field specifies the locked range or reset.

- Voltage range selection value entered as: *numeric*[*prefix*]V
- Current range selection value entered as: *numeric*[*prefix*]A
- Resistance range selection value entered as: *numeric*[*prefix*]Z
- "*" reset to default values

Rules:

- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Selection Value	Locked Range
0 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µA to 100 µA	100 µA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1 A	1 A
0 Ω to 10 Ω	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ
> 10 MΩ to 100 MΩ	100 MΩ
> 100 MΩ to 1 GΩ	1 GΩ

- A M1271 range lock specification only applies when a subsequent 1271 FSC specifies an applicable measurement function (see EXAMPLES below).
- When a M1271 range lock is specified for the 10 Ohm range any subsequent 1271 FSC's, that specify resistance measurement (1271 Nominal units are Ω "Z"), must also specify MOD2 = "OC" Offset Compensated Resistance (TRUE OHMS).
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field is enables and disables the filter for DC voltage, DC current, and resistance measurements.

- FL enable filter
- *blank* disable filter

Rules:

- The MOD2 field is ignored when the 1271 FSC specifies AC Voltage or AC Current measurement.

MOD3

This field is not used.

MOD4

This field is used to specify the guard connection:

- G remote guard
- *blank* local guard

CON

This field is not used.

Examples

```
  STEP    FSC     RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
#
  1.001   M1271   RNGLK 100mV
#
#  100mV range is locked
#
  1.002   1271          100mV          1%                                       2W
#
#  10mV range is locked
#
  2.001   1271          10mV           1%            1kH                        2W
  3.001   1271          1kH            1%            10mV                       2W
#
#  Autorange is selected (M1271 FSC not applicable).
```

```
#
  4.001  1271         1uA           1%                                     2W
  5.001  1271         100uA         1%            1kH                      2W
  6.001  1271         1kH           1%            100uA                    2W
  7.001  1271         10Z           1%                                     2W
#
  8.001  M1271  RNGLK 100uA
#
#  Autorange is selected (M1271 FSC not applicable).
#
  8.002  1271         100mV         1%                                  N  2W
  9.001  1271         10mV          1%            1kH                   N  2W
 10.001  1271         1kH           1%            10mV                     2W
#
#  100uA range is locked
#
 11.001  1271         100uA         1%                                  N  2W
#
#  100uA range is locked
#
 12.001  1271         100uA         1%            1kH                   N  2W
 13.001  1271         1kH           1%            100uA                    2W
#
# Autorange is selected (M1271 FSC not applicable).
#
 14.001  1271         10Z           1%                                  N  2W
#
 15.001  M1271  RNGLK 10Z
#
#  Autorange is selected (M1271 FSC not applicable).
#
 15.002  1271         100mV         1%                                  N  2W
 16.001  1271         10mV          1%            1kH                   N  2W
 17.001  1271         1uA           1%                                  N  2W
 18.001  1271         100uA         1%            1kH                   N  2W
#
#  10 Ohm range is locked.
#
 19.001  1271         10Z           1%                            OC    N  4W
#
#  Autorange is selected for all subsequent 1271 FSCs.
#
 20.001  M1271        *
```

1281

Instrument FSC

Description

The 1281 FSC programs the Datron 1281 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance and frequency.

Note

The 1281 must have firmware version 3.06 or later.

Functional Capability

Function	Nominal	MOD1	MOD2	MOD3
DC Voltage	-1100 V to 1100 V			
AC Voltage[1]	2 mV to 199.9999 mV	1 Hz to 100 kHz		
	200 mV to 199.9999 V	1 Hz to 1 MHz		
	200 V to 1100 V	1 Hz to 100 kHz		
	-40.969 dBm to -0.969 dBm	1 Hz to 100 kHz	5 Z	
	-0.969 dBm to +59.031 dBm	1 Hz to 1 MHz	5 Z	
	+59.031 dBm to +73.838 dBm	1 Hz to 100 kHz	5 Z	
	-42.730 dBm to -2.730 dBm	1 Hz to 100 kHz	7 Z	
	-2.730 dBm to +57.270 dBm	1 Hz to 1 MHz	7 Z	
	+57.270 dBm to +72.077 dBm	1 Hz to 100 kHz	7 Z	
	-51.761 dBm to -11.761 dBm	1 Hz to 100 kHz	6 Z	
	-11.761 dBm to +48.239 dBm	1 Hz to 1 MHz	6 Z	
	+48.239 dBm to +63.046 dBm	1 Hz to 100 kHz	6 Z	
Resistance[2]				
True Ohms	0 Ω to 199.999999 kΩ	OC		
Normal Ohms	0 Ω to 1.99999999 MΩ			
Hi Ohms	2 MΩ to 1.99999999 GΩ			
DC Current[3]	-1.5 A to 1.5 A			
AC Current[4]	2 µA to 1.5 A	10 Hz to 5 kHz		

Function	Nominal	MOD1	MOD2	MOD3
Frequency[1,5]	10 Hz to 100 kHz[1]	2 mV to 1000 V		
	10 Hz to 1 MHz[1]	200 mV to 199.9999 V		
	10 Hz to 5 kHz[4]	2 µA to 1.5 A		

1. Requires Option 10.
2. Requires Option 20.
3. Requires Options 20 and 30.
4. Requires Options 10, 20, and 30.
5. Lower bound is 200 Hz when MOD3 = FE (Fast Gate)

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V.
- dBm entered as [*numeric*][*prefix*]D.
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- The NOMINAL field may specify frequency only when the MOD1 field specifies voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency or amplitude for AC voltage or AC current measurements.

- Frequency entered as *numeric*[*prefix*]H.
- Voltage entered as *numeric*[*prefix*]V.
- Current entered as *numeric*[*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance.

The AC filter is selected as follows:

Frequency	Filter
>= 100 Hz	100 Hz High Pass Filter
< 100 Hz and >= 40 Hz	40 Hz High Pass Filter
< 40 Hz and >= 10 Hz	10 Hz High Pass Filter
< 10 Hz	10 Hz High Pass Filter

MOD2

This field specifies one of the following:

1. The load impedance that the AC voltage is referenced to, or
2. Offset compensated resistance "TRUE OHMS" function.

- 5Z 50 Ω
- 7Z 75 Ω
- 6Z 600 Ω
- OC Enable offset compensated resistance "True OHMS".
- *blank* (see below)

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- The MOD2 field may specify "OC" only when the NOMINAL field specifies a resistance less than 200 kΩ.
- The MOD2 must be blank for any of the following conditions:
  1. DC Voltage: The NOMINAL specifies voltage and the MOD1 field is blank.
  2. DC Current: The NOMINAL specifies current
  3. AC Current: The NOMINAL or MOD1 field specifies current

MOD3

Specifies the measurement mode. The measurement mode determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement. The effect of the measurement mode on the programmed function is shown in the following table:

Function	F	*blank*	E	FE
DC Volts:				
resolution	6.5 digits	6.5 digits	8.5 digits	8.5 digits
fast	on	off	off	on
reading rate	35/s	2/s	1/25s	1/6s
Readings:				
thrown away[1]	1	1	1	1
averaged[1]	5	1	1	1
AC Volts:				
resolution	5.5 digits	5.5 digits	6.5 digits	5.5 digits
TFER	off	on	on	on
Coupling:				
< 40 Hz	DC	DC	DC	DC
>= 40 Hz	AC	AC	AC	AC
reading rate:				
>= 100 Hz	4/s	2/s	2/s	2/s

Function	F	blank	E	FE
40 to 100 Hz	1/s	1/2s	1/2s	1/2s
10 to 40 Hz	1/2.5s	1/5s	1/5s	1/5s
1 to 10 Hz	1/25s	1/50s	1/50s	1/50s
Readings:				
thrown away[1]	1	1	1	1
averaged[1]	1	3	3	1
Frequency Measurement				
gate fast	n/a	off	n/a	on
DC Current:				
resolution	6.5 digits	5.5 digits	6.5 digits	5.5 digits
fast	on	off	off	on
reading rate	35/s	35/s	2/s	35/s
Readings:				
thrown away[1]	1	1	2	1
averaged[1]	1	3	5	1
Frequency Measurement				
gate fast	n/a	off	n/a	on
AC Current:				
resolution	4.5 digits	4.5 digits	5.5 digits	4.5 digits
coupling:				
< 40 Hz	DC	DC	DC	DC
>= 40 Hz	AC	AC	AC	AC
reading rate:				
>= 100 Hz	4/s	4/s	2/s	4/s
40 to 100 Hz	1/s	1/s	1/2s	1/s
10 to 40 Hz	1/2.5s	1/2.5s	1/5s	1/2.5s
Readings:				

Function	F	blank	E	FE
thrown away[1]	1	1	2	1
averaged[1]	1	3	5	1
Resistance:				
resolution				
True Ω (4-Wire only)				
>= 0 Ω to < 200 kΩ	6.5 digits	6.5 digits	7.5 digits	6.5 digits
Normal Ω				
>= 20 Ω to < 20 MΩ	6.5 digits	6.5 digits	7.5 digits	6.5 digits
HI Ω				
>= 20 MΩ	5.5 digits	5.5 digits	6.5 digits	5.5 digits
reading rate:				
< 20 Ω	35/s	1/6s	1/6s	1/6s
>= 20 Ω to < 20 MΩ	35/s	2/s	1/6s	2/s
>= 20 MΩ	35/s	2/s	1/2s	2/s
fast	on	off	off	on
<= 20 kΩ:				
Readings:				
thrown away[1]	1	2	2	1
averaged[1]	3	4	4	1
20 kΩ to <= 200 kΩ:				
Readings:				
thrown away[1]	1	2	5	1
averaged[1]	3	4	4	1
200 kΩ:				
Readings:				
thrown away[1]	1	2	7	1

Function	F	blank	E	FE
averaged[1]	3	4	5	
1. With measurement uncertainty disabled. Use VSET to set number of readings to throw away and the number of readings to average when measure uncertainty is enabled.				

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W   2-wire
- 4W   4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance.
- The CON field must specify a 4W when the MOD2 field specifies Offset Compensated Resistance "OC" (True OHMS Function).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP     FSC     RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
# ----- Reset -----
  1.001  1281         *                                                   S
# ----- DC Voltage -----
  1.002  M1281  RNGLK 1V
  1.003  1281         10mV                                                N   2W
  1.004  M1281        *
  1.005  1281   A     -1000V          1% 0.1U                                 2W
# ----- AC Voltage -----
  2.001  1281   200   100V            1% 2/         10kH                      2W
# ---- dBm, 50 Ohms ----
  3.001  1281         0.00D           0.1U          1kH             5Z        2W
# ----- DC Current -----
  4.001  1281   10    1.00A           1000P%                                  2W
# ----- AC Current -----
  5.001  1281   2     mA              1%            1kH                       2W
# ----- Resistance -----
  6.001  1281   100   256kZ           1%                                      4W
# ----- Frequency  -----
  7.001  1281   1     10.0kH          1% 2/         1V                        2W
  8.001  1281   10    1.00kH          1% 2/         10mA                      2W
```

M1281

Auxiliary Instrument Setup FSC

Description

The M1281 FSC provides additional functions for the Datron 1281 Multimeter that are not addressed in the 1281 FSC. These functions include range locking, DC and Ohms filter, and guard.

Parameters

When a blank M1281 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

RANGE

This field specifies one of the following:

- RNGLK	Range Lock
- *blank*	field not applicable

Rules:

- When the RANGE field specifies RNGLK, the NOMINAL field must specify the range selection value.

NOMINAL

This field specifies the locked range or reset.

- Voltage range selection value entered as: *numeric*[*prefix*]V
- Current range selection value entered as: *numeric*[*prefix*]A
- Resistance range selection value entered as: *numeric*[*prefix*]Z
- "*"	reset to default values

Rules:

- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

	Selection Value	Locked Range
	0 mV to 100 mV	100 mV
>	100 mV to 1 V	1 V
>	1 V to 10 V	10 V
>	10 V to 100 V	100 V
>	100 V to 1000 V	1000 V
	0 µA to 100 µA	100 µA
>	100 µA to 1 mA	1 mA
>	1 mA to 10 mA	10 mA
>	10 mA to 100 mA	100 mA
>	100 mA to 1 A	1 A
	0 Ω to 10 Ω	10 Ω
>	10 Ω to 100 Ω	100 Ω
>	100 Ω to 1 kΩ	1 kΩ
>	1 kΩ to 10 kΩ	10 kΩ
>	10 kΩ to 100 kΩ	100 kΩ
>	100 kΩ to 1 MΩ	1 MΩ
>	1 MΩ to 10 MΩ	10 MΩ
>	10 MΩ to 100 MΩ	100 MΩ
>	100 MΩ to 1 GΩ	1 GΩ

- A M1281 range lock specification only applies when a subsequent 1281 FSC specifies an applicable measurement function (see EXAMPLES below).
- When a M1281 range lock is specified for the 10 Ohm range any subsequent 1281 FSC's, that specify resistance measurement (1281 Nominal units are Ohms "Z"), must also specify MOD2 = "OC" Offset Compensated Resistance (TRUE OHMS).
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field is enables and disables the filter for DC voltage, DC current, and resistance measurements.

- FL enable filter
- *blank* disable filter

Rules:

- The MOD2 field is ignored when the 1281 FSC specifies AC Voltage or AC Current measurement.

MOD3

This field is not used.

MOD4

This field is used to specify the guard connection:

- G remote guard
- *blank* local guard

CON

This field is not used.

EXAMPLES

```
 STEP    FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2  3  4 CON
#
  1.001  M1281  RNGLK 100mV
#
#  100mV range is locked
#
  1.002  1281         100mV         1%                                   2W
#
#  10mV range is locked
#
  2.001  1281         10mV          1%            1kH                    2W
  3.001  1281         1kH           1%            10mV                   2W
#
```

```
#  Autorange is selected (M1281 FSC not applicable).
#
  4.001  1281         1uA           1%                                 2W
  5.001  1281         100uA         1%            1kH                  2W
  6.001  1281         1kH           1%            100uA                2W
  7.001  1281         10Z           1%                                 2W
#
  8.001  M1281  RNGLK 100uA
#
#  Autorange is selected (M1281 FSC not applicable).
#
  8.002  1281         100mV         1%                              N  2W
  9.001  1281         10mV          1%            1kH               N  2W
 10.001  1281         1kH           1%            10mV                 2W
#
#  100uA range is locked
#
 11.001  1281         100uA         1%                              N  2W
#
#  100uA range is locked
#
 12.001  1281         100uA         1%            1kH               N  2W
 13.001  1281         1kH           1%            100uA                2W
#
# Autorange is selected (M1281 FSC not applicable).
#
 14.001  1281         10Z           1%                              N  2W
#
 15.001  M1281  RNGLK 10Z
#
#  Autorange is selected (M1281 FSC not applicable).
#
 15.002  1281         100mV         1%                              N  2W
 16.001  1281         10mV          1%            1kH               N  2W
 17.001  1281         1uA           1%                              N  2W
 18.001  1281         100uA         1%            1kH               N  2W
#
#  10 Ohm range is locked.
#
 19.001  1281         10Z           1%                        OC    N  4W
#
#  Autorange is selected for all subsequent 1281 FSCs.
#
 20.001  M1281        *
```

2000

Instrument FSC

Description

The 2000 FSC programs the Keithley 2000 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, conductance, frequency, and period.

Note

If the 2000 is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600, N,...], to set the baud rate, parity, etc. of the port used to control the 2000. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 2000 must be set correctly before a procedure is executed. If the 2000 is connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. If the 2000 is connected to the 5500A, 5520A, or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Function	Nominal	MOD1	MOD2
DC Voltage	-1100 V to 1100 V		
AC Voltage[1]	0.1 mV to 750 V	3 Hz to 300 kHz	
DC Current	-3 A to 3 A		
AC Current	1 µA to 3 A	3 Hz to 5 kHz	
Resistance	0 Ω to 119.9999 MΩ		
Conductance	>8.4 nS		
Frequency	3 Hz to 300 kHz	100 mV to 750 V	
Period	3.3 µs to 0.33 s	100 mV to 750 V	
dBm[1]	-66.98 dBm to 70.51 dBm	3 Hz to 300 kHz	5Z
dBm[1]	-68.75 dBm to 68.75 dBm	3 Hz to 300 kHz	7Z
dBm[1]	-74.77 dBm to 62.73 dBm	3 Hz to 300 kHz	3Z
dBm[1]	-77.78 dBm to 59.71 dBm	3 Hz to 300 kHz	6Z
1. Volt-Hertz product not to exceed $8x10^7$.			

Parameters

RANGE

This field specifies the UUT range as described in “General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V.
- dBm entered as: [*numeric*][*prefix*]D.
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency or period measurements.

- Frequency entered as [*numeric*][*prefix*]H.
- Voltage entered as [*numeric*][*prefix*]V.
- *blank* not applicable.

Rules:

- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.
- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage when the NOMINAL field specifies frequency or period.

MOD2

This field specifies the load impedance that the AC voltage is referenced to.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.

MOD3

Not used.

MOD4

This field specifies the type of test being performed as described in “General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2 W 2-wire
- 4 W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance or conductance.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  2000        *                                                 S
# ----- DC Voltage -----
  1.002  2000   10    10V            1% 0.01U                              2W
# ----- AC Voltage -----
  5.001  2000   1000  650V           5%            30kH                    2W
  6.001  2000   1     1V             1% 0.01U      10kH                    2W
# ----- Decibels -----
  7.001  2000   A     60.0D          0.1U          1kH            5Z       2W
# ----- DC Current -----
  9.001  2000   4000  350mA          9U                                    2W
# ----- AC Current -----
 10.001  2000   2     1A             3%            60H                     2W
# ----- Resistance -----
 11.001  2000   100   10MZ           1%                                    2W
# ----- Conductance -----
 12.001  2000   100   100nY          5%                                    2W
# ----- Setup Test -----
 13.001  2000         1V                           10kH                 S  2W
# ----- Nominal Setup Test -----
 13.002  2000   1     1V                           10kH                 N  2W
# ----- Comparison Test -----
 13.003  2000   1     1V             1% 0.1U       20kH                 C  2W
```

2001

Instrument FSC

Description

The 2001 FSC programs the Keithley 2001 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, conductance, frequency, and temperature.

Functional Capability

Function	Nominal	MOD1	MOD2
DC Voltage	-1100 V to 1100 V		
AC Voltage[1]	100 nV to 775 V	1 Hz to 2 MHz	
AC Coupling	> 200 Hz		
AC+DC Coupling	≤ 200 Hz		
DC Current	-2.1 A to 2.1 A		
AC Current	100 pA to 2.1 A	1 Hz to 100 kHz	
Resistance	0 Ω to 1.05 GΩ		
Conductance	>0.9524 nS		
Frequency[1]	1 Hz to 5 MHz 5 MHz to 15 MHz 1 Hz to 5 MHz	60 mV to 775 V 350 mV to 775 V 150 µA to 2.1 A	
Decibels[1]	-126.9 dBm to 70.79 dBm	1 Hz to 2 MHz	5Z
Decibels[1]	-128.7 dBm to 69.03 dBm	1 Hz to 2 MHz	7Z
Decibels[1]	-134.7 dBm to 63.01 dBm	1 Hz to 2 MHz	3Z
Decibels[1]	-137.7 dBm to 60.00 dBm	1 Hz to 2 MHz	6Z
Temperature[2]			
D100 RTD	-200 °C to 630 °C	RD	
F100 RTD	-200 °C to 630 °C	R0	
Pt100 RTD	-200 °C to 630 °C	RP	
Pt385 RTD	-200 °C to 630 °C	R1	
Pt3916 RTD	-200 °C to 630 °C	R7	
SPRT	-200 °C to 630 °C	RR	
Type J TC	-200 °C to 760 °C	_J	
Type K TC	-200 °C to 1372 °C	_K	
Type T TC	-200 °C to 400 °C	_T	
Type E TC	-200 °C to 10000 °C	_E	
Type R TC	0 °C to 1768 °C	_R	
Type S TC	0 °C to 1768 °C	_S	
Type B TC	+350 °C to 1820 °C	_B	

1. Volt-Hertz product not to exceed 2^7.
2. Temperature measurement using a thermocouple requires an external thermocouple card.

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Decibels entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A
- Resistance entered as [*numeric*][*prefix*]Z
- Conductance entered as [*numeric*][*prefix*]Y
- Frequency entered as [*numeric*][*prefix*]H
- Temperature entered as: [*numeric*][*prefix*]degC or degF
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.
- The NOMINAL field must specify a resistance, or equivalent conductance, less than or equal to 21 kΩ when the MOD2 field specifies offset compensation override "O".

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency or period measurements.

- Frequency entered as *numeric*[*prefix*]H
- Voltage entered as *numeric*[*prefix*]V
- Current entered as *numeric*[*prefix*]A
- *blank* not applicable

Rules:

- The MOD1 field must be blank when the NOMINAL field specifies resistance, conductance, or temperature.
- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.

MOD2

This field specifies the load impedance that the AC voltage is referenced to for decibels or the RTD or thermocouple type for temperature measurement.

- O Override offset compensation for ohms
- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- R0 F100 RTD
- R1 100 Ω Pt 385 RTD
- R7 100 Ω Pt 385 RTD
- RD D100 RTD
- RP Pt100 RTD
- RR SPRT
- _J Type J thermocouple
- _K Type K thermocouple
- _T Type T thermocouple
- _E Type E thermocouple
- _R Type R thermocouple
- _S Type S thermocouple
- _B Type B thermocouple
- *blank* field not applicable

Rules:

- The MOD2 field may specify offset compensation override "O" only when the NOMINAL field specifies resistance or conductance.
- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- The MOD2 field may specify a thermocouple, RTD, or SPRT only when the NOMINAL field specifies temperature.

MOD3

This field specifies the measurement mode. The measurement mode determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement. The effect of the measurement mode on the programmed function is shown in the following table:

	F	***blank***	**E**
DC Volts			
Number of powerline cycles	1	10	10
Resolution	6.5 digits	6.5 digits	7.5 digits
Readings			
thrown away	1	1	1
averaged	1	3	5
Autozero	On	On	On
DC Current			
Number of powerline cycles	1	10	10
Resolution	6.5 digits	6.5 digits	7.5 digits
Readings			
thrown away	1	1	2
averaged	1	3	5
Autozero	On	On	On
Ohms (2-Wire and 4-Wire)			
Number of powerline cycles	1	10	10
Resolution	6.5 digits	6.5 digits	7.5 digits
Readings			
thrown away	1	2	2
averaged	3	4	5
Autozero	On	On	On
Offset Compensation			
≤21 kΩ	On	On	On
>21 kΩ	Off	Off	Off

AC Volts			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	3	3
Resolution	N/A	5.5 digits	6.5 digits
Autozero	On	On	On
AC Current			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	3	3
Resolution	N/A	5.5 digits	6.5 digits
Autozero	On	On	On
Frequency			
Readings			
thrown away	N/A	1	N/A
averaged	N/A	1	N/A
Resolution	N/A	5 digits	N/A
Autozero	Off	Off	Off
Temperature			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	3	3
Resolution			
D100 RTD	N/A	0.001 °C	0.001 °C
F100 RTD	N/A	0.001 °C	0.001 °C
Pt100 RTD	N/A	0.001 °C	0.001 °C
Pt385 RTD	N/A	0.001 °C	0.001 °C
Pt3916 RTD	N/A	0.001 °C	0.001 °C
SPRT	N/A	0.001 °C	0.001 °C
Type J TC	N/A	0.1 °C	0.1 °C
Type K TC	N/A	0.1 °C	0.1 °C
Type T TC	N/A	0.1 °C	0.1 °C
Type E TC	N/A	0.1 °C	0.1 °C
Type R TC	N/A	1 °C	1 °C
Type S TC	N/A	1 °C	1 °C
Type B TC	N/A	1 °C	1 °C
Autozero	On	On	On

Rules:

- The MOD3 field may specify "E" only when the NOMINAL field specifies voltage, decibels, current, resistance, conductance, or temperature.
- The MOD3 field may specify "F" only when the MOD1 field is blank (DC) and the NOMINAL field specifies voltage, current, resistance, or conductance.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 3W 3-wire
- 4W 4-wire

Rules:

- The CON field may specify a 3W only when the MOD2 field specifies a RTD type.
- The CON field may specify a 4W only when the NOMINAL field specifies resistance or conductance and the resistance is ≤ 2.1 MΩ.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2   3  4 CON
# ----- Reset -----
  1.001  2001        *                                                   S
# ----- DC Voltage -----
  1.002  2001   10    10V            1% 0.01U                                 2W
# ----- AC Voltage -----
  5.001  2001   1000  650V           5%            30kH                       2W
  6.001  2001   1     1V             1% 0.01U      10kH                       2W
# ----- Decibels -----
  7.001  2001   A     60.0D          0.1U          1kH            5Z          2W
# ----- DC Current -----
  9.001  2001   4000  350mA          9U                                       2W
# ----- AC Current -----
 10.001  2001   2     1A             3%            60H                        2W
# ----- Resistance -----
 11.001  2001   100   10MZ           1%                                       2W
```

```
# ----- Conductance -----
 12.001  2001   100   100nY          5%                                   2W
# ----- Setup Test -----
 13.001  2001         1V                           10kH                S  2W
# ----- Nominal Setup Test -----
 13.002  2001   1     1V                           10kH                N  2W
# ----- Comparison Test -----
 13.003  2001   1     1V             1% 0.1U       20kH                C  2
```

2002

Instrument FSC

Description

The 2002 FSC programs the Keithley 2002 Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, conductance, frequency, or temperature.

Functional Capability

Function	Nominal	MOD1	MOD2
DC Voltage	-1100 V to 1100 V		
AC Voltage[1] AC Coupling AC+DC Coupling	100 nV to 775 V > 200 Hz ≤ 200 Hz	1 Hz to 2 MHz	
DC Current	-2.1 A to 2.1 A		
AC Current	100 pA to 2.1 A	1 Hz to 100 kHz	
Resistance	0 Ω to 1.05 GΩ		
Conductance	>0.9524 nS		
Frequency[1]	1 Hz to 5 MHz 5 MHz to 15 MHz 1 Hz to 5 MHz	60 mV to 775 V 350 mV to 775 V 150 µA to 2.1 A	
dBm[1]	-126.9 dBm to 70.79 dBm	1 Hz to 2 MHz	5Z
dBm[1]	-128.7 dBm to 69.03 dBm	1 Hz to 2 MHz	7Z
dBm[1]	-134.7 dBm to 63.01 dBm	1 Hz to 2 MHz	3Z
dBm[1]	-137.7 dBm to 60.00 dBm	1 Hz to 2 MHz	6Z
Temperature[2] D100 RTD F100 RTD Pt100 RTD Pt385 RTD Pt3916 RTD SPRT Type J TC Type K TC Type T TC Type E TC Type R TC Type S TC Type B TC	 -200 °C to 630 °C -200 °C to 630 °C -200 °C to 630 °C -200 °C to 630 °C -200 °C to 630 °C -200 °C to 630 °C -200 °C to 760 °C -200 °C to 1372 °C -200 °C to 400 °C -200 °C to 10000 °C 0 °C to 1768 °C 0 °C to 1768 °C +350 °C to 1820 °C	 RD R0 RP R1 R7 RR _J _K _T _E _R _S _B	

1. Volt-Hertz product not to exceed 2^7.
2. Temperature measurement using a thermocouple requires an external thermocouple card.

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A
- Resistance entered as [*numeric*][*prefix*]Z
- Conductance entered as [*numeric*][*prefix*]Y
- Frequency entered as [*numeric*][*prefix*]H
- Temperature entered as: [*numeric*][*prefix*]degC or degF
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.
- The NOMINAL field may specify temperature only when the MOD2 field specifies a RTD or thermocouple type.
- The NOMINAL field must specify a resistance, or equivalent conductance, less than or equal to 21 kΩ when the MOD2 field specifies offset compensation override "O".

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency or period measurements.

- Frequency entered as *numeric*[*prefix*]H.
- Voltage entered as *numeric*[*prefix*]V.
- Current entered as *numeric*[*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field must be blank when the NOMINAL field specifies resistance, conductance, or temperature.
- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.

MOD2

This field specifies the load impedance that the AC voltage is referenced to for decibels or the RTD or thermocouple type for temperature measurement.

- O Override offset compensation for ohms
- 5Z 50Ω
- 7Z 75Ω
- 3Z 300Ω
- 6Z 600Ω
- R0 F100 RTD
- R1 100Ω Pt 385 RTD
- R7 100Ω Pt 3916 RTD
- RD D100 RTD
- RP Pt100 RTD
- RR SPRT
- _J Type J thermocouple
- _K Type K thermocouple
- _T Type T thermocouple
- _E Type E thermocouple
- _R Type R thermocouple
- _S Type S thermocouple
- _B Type B thermocouple
- *blank* field not applicable

Rules:

- The MOD2 field may specify offset compensation override "O" only when the NOMINAL field specifies resistance or conductance.
- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- The MOD2 field may specify a thermocouple, RTD, or SPRT only when the NOMINAL field specifies temperature.

MOD3

This field specifies the measurement mode. The measurement mode determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement. The effect of the measurement mode on the programmed function is shown in the following table:

	F	*blank*	E
DC Volts			
Number of powerline cycles	1	1	10
Resolution	7.5 digits	7.5 digits	8.5 digits
Readings thrown away	1	1	1
Readings averaged	1	10	10
Autozero	Synchronous	Synchronous	Synchronous
DC Current			
Number of powerline cycles	1	1	10
Resolution	6.5 digits	6.5 digits	7.5 digits
Readings thrown away	1	1	1
Readings averaged	1	10	10
Autozero	Normal	Normal	Normal
Ohms (2-Wire and 4-Wire)			
Number of powerline cycles	1	1	10
Resolution	7.5 digits	7.5 digits	8.5 digits
Readings thrown away	1	1	1
averaged	1	10	10
Autozero	Normal	Normal	Synchronous

	F	*blank*	E
Offset Compensation			
≤21 kΩ	On	On	On
>21 kΩ	Off	Off	Off
AC Volts			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	1	1
Resolution	N/A	5.5 digits	6.5 digits
Autozero	Normal	Normal	Normal
AC Current			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	1	1
Resolution	N/A	5.5 digits	6.5 digits
Autozero	Normal	Normal	Normal
Frequency			
Readings			
thrown away	N/A	1	N/A
averaged	N/A	1	N/A
Resolution	N/A	5 digits	N/A
Autozero	Off	Off	Off
Temperature			
Number of powerline cycles	N/A	1	10
Readings			
thrown away	N/A	1	1
averaged	N/A	1	1
Resolution			
D100 RTD	N/A	0.001 °C	0.001 °C
F100 RTD	N/A	0.001 °C	0.001 °C
Pt100 RTD	N/A	0.001 °C	0.001 °C
Pt385 RTD	N/A	0.001 °C	0.001 °C
Pt3916 RTD	N/A	0.001 °C	0.001 °C
SPRT	N/A	0.001 °C	0.001 °C
Type J TC	N/A	0.1 °C	0.1 °C
Type K TC	N/A	0.1 °C	0.1 °C
Type T TC	N/A	0.1 °C	0.1 °C
Type E TC	N/A	0.1 °C	0.1 °C
Type R TC	N/A	1 °C	1 °C
Type S TC	N/A	1 °C	1 °C
Type B TC	N/A	1 °C	1 °C
Autozero	Normal	Normal	Normal

Rules:

- The MOD3 field may specify "E" only when the NOMINAL field specifies voltage, decibels, current, resistance, conductance, or temperature.
- The MOD3 field may specify "F" only when the MOD1 field is blank (DC) and the NOMINAL field specifies voltage, current, resistance, or conductance,

MOD4

This field specifies the type of test being performed as described in “General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 3W 3-wire
- 4W 4-wire

Rules:

- The CON field may specify a 3W only when the MOD2 field specifies a RTD type.
- The CON field may specify a 4W only when the NOMINAL field specifies resistance or conductance and the resistance is ≤. 2.1 MΩ.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  2002        *                                                 S
# ----- DC Voltage -----
  1.002  2002   10    10V            1% 0.01U                              2W
# ----- AC Voltage -----
  5.001  2002   1000  650V           5%            30kH                    2W
  6.001  2002   1     1V             1% 0.01U      10kH                    2W
# ----- Decibels -----
  7.001  2002   A     60.0D          0.1U          1kH            5Z       2W
# ----- DC Current -----
  9.001  2002   4000  350mA          9U                                    2W
# ----- AC Current -----
 10.001  2002   2     1A             3%            60H                     2W
# ----- Resistance -----
 11.001  2002   100   10MZ           1%                                    2W
# ----- Conductance -----
 12.001  2002   100   100nY          5%                                    2W
# ----- Setup Test -----
 13.001  2002         1V                           10kH                 S  2W
# ----- Nominal Setup Test -----
 13.002  2002   1     1V                           10kH                 N  2W
# ----- Comparison Test -----
  13.003  2002   1     1V             1% 0.1U       20kH                 C  2W
```

2024

Instrument FSC

Description

The 2024 FSC programs amplitude and frequency of the Marconi 2023, 2024, IFR 2023A and 2024A AM/FM Signal Generators.

Note on serial control

If the 202x is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 202x. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements. Therefore the settings of the port used to control the 202x must be set correctly before a procedure is executed. If the 202x is connected to a standard serial port (COM1, COM2, ..., COM16), use the "Ports" application in the Windows Control Panel to choose the proper settings. If the 202x is connected to the 5500A, 5520A, 5800A, or 5820A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Model	Frequency	Amplitude
2023	9 kHz to 1.2 GHz	-137 dBm to +13 dBm (+25 dBm Option 3)
2024	9 kHz to 2.4 GHz	-137 dBm to +13 dBm (+25 dBm Option 3)

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

- Amplitude entered as: [*numeric*][*prefix*]D, V, or Vpp.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.
- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Amplitude entered as: [*numeric*][*prefix*]D, V, or Vpp.

Rules:

- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *Blank* 202x RF Output

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 58xxA is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 58xxA is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  2024         *                                                 S
  1.002  2024   A     -42.95D        1U            100kH          -D
  2.001  2024         100mV                        550MH          -D    S
  2.002  2024   0.5   28mVpp         5U            100kH          -D
  3.001  2024   A     D              1U            100kH          -D
  4.001  2024         V              1%            100kH          -D
  5.001  2024   50    10uT           1% 1/ 1U      -35D
  6.001  2024   200   100nT          1% 1/ 1U      1Vpp
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                     F        W
  7.002  ASK+     D
  7.003  DISP         Connect the 5800A to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  2024   20    120mVpp                      100kH                N  CH1
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  2024         5MH            -100%         mVpp           -D       CH1
  8.001  MESS
  8.002  ASK+         N
```

M2024

Auxiliary Instrument Setup FSC

Description

The M2024 FSC provides the additional program functions for the Marconi 2023, 2024, IFR 2023A and 2024A AM/FM Signal Generators which are not addressed by the 2024 FSC. These functions are: Modulation Frequency, AM Depth, FM Deviation, and Phase Deviation.

Parameters

RANGE

Not used.

NOMINAL

The NOMINAL field specifies the modulation frequency or a reset.

Modulation Frequency:

When the NOMINAL field is used to specify the modulation frequency, the format is [*numeric*][*prefix*]H. Allowed values are 10 Hz to 20 kHz.

If just units are entered, the value is taken from memory register MEM at run time.

Reset:

To specify a reset, enter an asterisk (*) in the NOMINAL field. This resets all previous settings created with the M2024 FSC.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies the AM depth, FM deviation, or phase deviation. The MOD1 field cannot be blank in an 2024 statement.

- AM Depth:

  AM depth is entered as *numeric*[*prefix*]pct. AM depth limits are 0 to 99.9%.

- FM Deviation:

  FM deviation is entered as *numeric*[*prefix*]H. FM deviation limits are 0 to 100 kHz.

- Phase Deviation:

  Phase deviation is entered as *numeric*[*prefix*]rad. Phase deviation limits are 0 to 10 radians.

MOD2

Not used.

MOD3

Not used.

MOD4

Not used.

CON

Not used.

Examples

```
 STEP    FSC     RANGE NOMINAL         TOLERANCE     MOD1          MOD2   3   4  CON
# AM Modulation
  1.001  M2024         *
  1.002  M2024         400H                          0pct
  1.003  2024    10    0D              1U            10MH
  2.001  M2024         1000H                         90pct
  2.002  2024    10    0D              1U            10MH
# FM Modulation
  3.001  M2024         400H                          100H
  3.002  2024    10    0D              0.11U         200kH
  4.001  M2024         1000H                         99.9kH
  4.002  2024    10    0D              0.1U          1000MH
# Phase Modulation
  5.001  M2024         400H                          2rad
  5.002  2024    10    0D              0.11U         200kH
  6.001  M2024         1000H                         10rad
  6.002  2024    10    0D              0.1U          1000MH
```

2620T

Instrument FSC

Description

The 2620T FSC programs the Fluke 2620T Recording Thermometer.

Functional Capability

-196 °C to 400 °C (-320.8 °F to 752 °F)

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Temperature entered as: [*numeric*][*prefix*]degC or degF
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This is not used and must be blank.

MOD2

This is not used and must be blank.

MOD3

This is not used and must be blank.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This is not used and must be blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
  STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3   4  CON
 # ----- Reset -----
   1.001  2620T       *                                                  S
 # ----- Evaluation Test -----
   7.001  2620T        23.0degC       0.1U
 # ----- Setup Test -----
   9.001  2620T        100.0degC                                         S
 # ----- Nominal Setup Test -----
   9.002  2620T  1     212.0degF                                         N
 # ----- Comparison Test -----
   9.003  2620T  1     212.0degF      1% 0.1U                            C
```

2635T

Instrument FSC

Description

The 2635T FSC programs the Fluke 2635T Recording Thermometer.

Functional Capability

-196degC to 400degC (-320.8degF to 752degF)

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Temperature entered as: [*numeric*][*prefix*]degC or degF
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This is not used and must be blank.

MOD2

This is not used and must be blank.

MOD3

This is not used and must be blank.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This is not used and must be blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP     FSC     RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
# ----- Reset -----
  1.001  2635T       *                                                       S
# ----- Evaluation Test -----
  7.001  2635T        23.0degC      0.1U
# ----- Setup Test -----
  9.001  2635T        100.0degC                                              S
# ----- Nominal Setup Test -----
  9.002  2635T  1     212.0degF                                              N
# ----- Comparison Test -----
  9.003  2635T  1     212.0degF     1% 0.1U                                  C
```

33120

Instrument FSC

Description

The 33120 FSC programs the Hewlett-Packard 33120A Function Generator to output sine, square, triangle, positive ramp, and negative ramp waveforms.

Note

If the 33120A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600, N,…], to set the baud rate, parity, etc. of the port used to control the 33120A. MET/CAL executes a “Test” function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 33120A must be set correctly before a procedure is executed. The 33120A does not support standard hardware flow control using the RS-232C request-to-send (RTS) and clear-to-send (CTS) lines.

If the 33120A is connected to a standard serial port (COM1, COM2,..., COM16), select the “Ports” application in the Windows control panel to choose the proper settings. Select “Flow Control = None”. Selecting “Hardware” sets RTS/CTS flow control. The 33120A uses DTR/DSR hardware flow control. The MET/CAL 33120A driver will automatically set DTR/DSR flow control (i.e. DTR/DSR is supported at a lower level even though the Control Panel does not support direct selection of DTR/DSR flow control).

The 33120A cannot be connected to the 5500A, 5520A, 5800A, or 5820A UUT “Pass-Through” Serial port. These calibrators do not support the DTR/DSR hardware flow control required for communication with the 33120A.

Functional Capability

Waveform	Frequency
Sine	100 µHz to 15 MHz
Square	100 µHz to 15 MHz
Triangle	100 µHz to 100 kHz
Positive Ramp	100 µHz to 100 kHz
Negative Ramp	100 µHz to 100 kHz
Exponential Rise	100 µHz to 5 MHz
Exponential Fall	100 µHz to 5 MHz
Sync	100 µHz to 5 MHz
Cardiac	100 µHz to 5 MHz

Output Termination	Amplitude
50 Ω	+/-5V (DC), 50 mVpp to 10 Vpp (AC)
Open Circuit	+/-10V (DC), 100 mVpp to 20 Vpp (AC)

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H
- Period entered as: [*numeric*][*prefix*]T

Rules:

- The NOMINAL field may specify Decibels only when the MOD2 field specifies SI.
- The NOMINAL field may specify Voltage peak-to-peak, Frequency, or Period only when the MOD2 field specifies SI, SQ, TI, +R, -R, +X, -X, SY, CD, or OI (i.e. MOD2 is not blank).
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H
- Period entered as [*numeric*][*prefix*]T
- *blank* DC or Noise

Rules:

- The MOD1 field may specify Decibels only when the MOD2 field specifies SI.
- The MOD1 field must be blank when the MOD2 field specifies OI (Noise).
- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage or decibels only when the NOMINAL field specifies frequency or period.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies the function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- +R Positive Ramp
- -R Negative Ramp
- +X Exponential Rise
- -X Exponential Fall
- SY Sync Signal
- CD Cardiac Signal
- OI Noise

Rules:

- SI is inserted automatically in the MOD2 field when the MOD1 field is not blank and no MOD2 code is entered.
- The MOD2 field must be blank or OI when the MOD1 field is blank (i.e. DC Voltage or Noise is specified).

MOD3

This field is not used.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- *blank* Unterminated
- L 50 Ω termination

Rules:

- When the CON field is L the output is expected to be terminated with 50 Ω. This can be accomplished by using a 50 Ω terminator at the UUT or setting the UUT input impedance to 50 Ω.
- L is automatically inserted the CON field when the amplitude in the Nominal or MOD1 field is expressed in dBm.
- If ASK-W or ASK-V is in effect, the procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP     FSC     RANGE  NOMINAL        TOLERANCE     MOD1          MOD2   3   4  CON
# ----- Reset -----
  1.001  33120         *                                                   S
# ----- DC Voltage -----
  1.002  33120   2     1.9V           2% 0.4U                                 L
# ----- Sine Wave -----
  2.001  33120   400   3.500V         7.4U          20kH            SI        L
  3.001  33120         -10D           1U            100H            SI        L
# ----- Square Wave w/DC offset -----
  4.001  M33120        0.5Voff
  4.002  33120         1Vpp                         1kH             SQ     S  L
# ----- Triangle Wave -----
  4.003  M33120        *
  4.004  33120         75mVpp                       10kH            TI     S  L
# ----- Positive Ramp -----
  4.005  33120         1.0Vpp                       100kH           +R     S  L
# ----- Negative Ramp -----
  4.006  33120         1.0Vpp                       5MH             -R     S
# ----- Frequency -----
  4.007  33120   1000  800.0H         0.1% 0.1U     300mV           SI
```

M33120

Auxiliary Instrument Setup FSC

Description

The M33120 FSC is used to specify modulation, modulation frequency, AM depth, FM deviation, duty cycle, and DC offset. The M33120 FSC is ignored when the 33120 FSC specifies DC voltage.

Functional Capability

Modulation Frequency	10 MHz to 20 kHz (AM), 10 kHz (FM)
AM Depth	0% to 120%
FM Deviation	10 MHz to 7.5 MHz
Duty cycle	20% to 80% <= 5 MHz, 40% to 60% > 5 MHz.
DC Offset	0 V to 5 V (50 Ω), 0 V to 10 V (open circuit) restricted by: |Voff|+ (Vpp / 2) <= Vmax and |Voff| <= 2 x Vpp

Parameters

RANGE

This field specifies one of the following:

- INT Internal modulation source
- EXT External modulation source
- *blank* no modulation

Rules:

- The Range field must "INT" or "EXT" when the Nominal field specifies modulation frequency.

NOMINAL

This field specifies one of the following:

- Modulation Frequency is entered as [*numeric*][*prefix*]H.
- DC Offset entered as: [*numeric*][*prefix*]Voff

- "*" reset to default values
- *blank* no modulation and no DC offset

Rules:

- The Nominal field must specify the modulation frequency when the Range field specifies "INT" or "EXT".
- If the Nominal field does not contain a value the value is taken from memory register MEM.

TOLERANCE

This field is not used.

MOD1

The MOD1 field specifies the following:

- AM Depth entered as: [*numeric*][*prefix*]pct.
- FM Deviation entered as: [*numeric*][*prefix*]H.
- Duty Cycle entered as: [*numeric*][*prefix*]pct.
- *blank* no modulation and 50% Duty Cycle (square wave only)

Rules:

- The MOD1 field must specify AM depth when the Range field specifies an external modulation source.
- The MOD1 field must specify AM depth or FM deviation when the Range field specifies an internal modulation source.
- When two frequency values are entered for a M33120 FSC, the first is taken to be the Modulation Frequency and the second is taken to be the FM deviation.
- When the MOD1 field specifies FM deviation, the deviation must be less than or equal to the frequency specified in the 33120 FSC Nominal or MOD1 field.
- When a frequency value and a percent value are entered for a M33120 FSC, the frequency is taken to be the Modulation Frequency and the percent is taken to be the AM depth.
- When a percent value is entered without also entering a frequency value, the percent is taken to be duty cycle.

- The M33120 MOD1 field may specify duty cycle only when the 33120 FSC MOD2 field is "SQ" (square wave).
- If the MOD1 field does not contain a value the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 33120 FSC.

3325

Instrument FSC

Description

The 3325 FSC programs the Hewlett-Packard 3325B and 3325A Function Generators to output sine, square, triangle, positive ramp, and negative ramp waveforms.

Note on 3325B serial control

If the 3325B is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 3325B. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 3325B must be set correctly before a procedure is executed. If the 3325B connected to a standard serial port (COM1, COM2, ..., COM16), use the "Ports" application in the Windows Control Panel to choose the proper settings. If the 3325B is connected to the 5500A, 5520A, or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Function	Amplitude (1)	Frequency (2)
DC Voltage	-5 V to 5 V	
Sine	1 mVpp to 10 Vpp, 0.354 mV to 3.536 V, -56.02 dBm to +23.98 dBm	1 μHz to 20.999999999 MHz
Square	1 mVpp to 10 Vpp, 0.5 mV to 5 V	1 μHz to 10.999999999 MHz
Triangle	1 mVpp to 10 Vpp, 0.289 mV to 2.887 V	1 μHz to 10.999999999 kHz
Positive Ramp	1 mVpp to 10 Vpp, 0.289 mV to 2.887 V	1 μHz to 10.999999999 kHz
Negative Ramp	-1 mVpp to -10 Vpp, -0.289 mV to -2.887 V	1 μHz to 10.999999999 kHz
(1) Amplitude limits are increased by 4x when high voltage (opt 002) is enabled. (2) Frequency is limited to 1 MHz for sin and square when the high voltage (opt 002) is enabled.		

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H
- Period entered as: [*numeric*][*prefix*]T

Rules:

- The NOMINAL field may specify Decibels only when the MOD2 field specifies SI.
- The NOMINAL field may specify Voltage peak-to-peak, Frequency, or Period only when the MOD2 field specifies SI, SQ, TI, +R or -R.
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- *blank* DC

Rules:

- The MOD1 field may specify Decibels only when the MOD2 field specifies SI.
- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage or decibels only when the NOMINAL field specifies frequency or period.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies the function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- +R Positive Ramp
- -R Negative Ramp

Rules:

- SI is inserted automatically in the MOD2 field when the MOD1 field is not blank and no MOD2 code is entered.

MOD3

This field is used to set the high voltage option.

- HV Enabled
- *blank* Disabled

Rules:

- The MOD3 field may specify HV only when the NOMINAL or MOD1 field specifies voltage (i.e. decibels are not allowed with HV).

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- *blank* Unterminated
- L 50 Ω termination

Rules:

- The CON field must be blank when the MOD3 field is HV.
- The CON field must be L when the MOD3 field is blank.

- L is automatically inserted in the CON field when the MOD3 field is blank.
- When the CON field is L the output is expected to be terminated with 50 Ω. This can be accomplished by using a 50 Ω terminator at the UUT or setting the UUT input impedance to 50 Ω.
- If ASK- W or ASK- V is in effect, the procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  3325         *                                                 S
# ----- DC Voltage -----
  1.002  3325   20     19.99mV        2% 0.04U                              L
  2.001  3325   400    350.0mV        1.9% 0.4U                             L
# ----- Sine Wave -----
  3.001  3325   400    350.0mV        -2.8U +2.9U   60H            SI       L
  4.001  3325   400    3.500V         7.4U          20kH           SI       L
  5.001  3325          -37.78D        0.01U         100H           SI       L
# ----- Square Wave w/DC offset -----
  6.001  M3325                                      0.5Voff
  6.002  3325          1Vpp                         1kH            SQ    S  L
# ----- Triangle Wave -----
  6.003  M3325                                      0Voff
  6.004  3325          13mVpp                       10kH           TI    S  L
# ----- Positive Ramp -----
  6.005  3325          1.0Vpp                       5kH            +R    S  L
# ----- Negative Ramp -----
  6.005  3325          1.0Vpp                       5kH            -R    S  L
# ----- Frequency -----
  6.006  3325   1000   800.0H         0.1% 0.1U     300mV          SI    S  L
# ----- High Voltage -----
  7.001  3325          40.00Vpp                     2kH            SQ HV S
```

M3325

Auxiliary Instrument Setup FSC

Description

The M3325 FSC is used to specify DC Offset for AC waveforms of the 3325B or 3325A.

Parameters

RANGE

This field is not used.

NOMINAL

This field is not used.

TOLERANCE

This field is not used.

MOD1

This field specifies the DC Offset entered as: [*numeric*][*prefix*]Voff

Rules:

- A DC offset specification is ignored when the 3325 FSC specifies DC Voltage.
- Specify 0.0Voff to turn off a DC offset.
- If the MOD1 field does not contain a value the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

EXAMPLES

See 3325 FSC.

33250

Instrument FSC

Description

The 33250 FSC programs the Agilent 33250A Function Generator to output DC volts and sine, square, ramp, pulse, noise, exponential rise, exponential fall, sync, and cardiac waveforms.

Note

If the 33250A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 33250A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 33250A must be set correctly before a procedure is executed.

Functional Capability

Waveform	Characteristics
Sine	
Frequency	1 µHz to 80 MHz
Square	
Frequency	1 µHz to 80 MHz
Ramp	
Frequency	1 µHz to 1 MHz
Duty Cycle	0% to 100%
	50%: triangle
	0%: negative ramp
	100%: positive ramp
Pulse	
Period	20 ns to 2000 s, 500 µHz to 50 MHz
Width	8 ns to 1999.9 s
Edge Time	5 ns to 1 ms
Exponential Rise	1 µHz to 25 MHz
Exponential Fall	1 µHz to 25 MHz
Sync	1 µHz to 25 MHz
Cardiac	1 µHz to 25 MHz
Noise	50 MHz bandwidth
Amplitude: +/-5 V (DC) 10 mVpp to 10 Vpp (AC, 50 Ohm) 20 mVpp to 20 Vpp (AC, open circuit)	

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H
- Period entered as: [*numeric*][*prefix*]T
- Pulse Width entered as: [*numeric*][*prefix*]T or H

Rules:

- The NOMINAL field may specify Voltage peak-to-peak, Frequency, or Period only when the MOD2 field specifies SI, SQ, LR, TI, +R, -R, +X, -X, SY, CD, or OI (i.e MOD2 is not blank).
- The NOMINAL field may specify Decibels only when the MOD2 field specifies SI.
- The NOMINAL field may specify Pulse Width only when the MOD2 field specifies PU.
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.

- Period entered as [*numeric*][*prefix*]T.
- *blank* DC or Noise

Rules:

- The MOD1 field may specify Decibels only when the MOD2 field specifies SI.
- The MOD1 field must be blank when the MOD2 field specifies OI (Noise).
- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage or decibels only when the NOMINAL field specifies frequency, period, or pulse width.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies the function (waveform type).

- SI Sine
- SQ Square
- LR Ramp (general)
- TI Triangle (same as LR with 50% duty cycle)
- +R Positive Ramp (same as LR with 100% duty cycle)
- -R Negative Ramp (same as LR with 0% duty cycle)
- PU Pulse
- OI Noise
- +X Exponential Rise
- -X Exponential Fall
- SY Sync Signal
- CD Cardiac Signal
- *blank* DC Volts

Rules:

- SI is inserted automatically in the MOD2 field when the MOD1 field is not blank and no MOD2 code is entered.
- The MOD2 field must be blank or OI when the MOD1 field is blank (i.e. DC Voltage or Noise is specified).

MOD3

This field specifies the waveform polarity.

- PI Polarity Inverted
- *blank* Polarity Normal

Rules:

- The MOD3 field must be blank when the MOD2 field is blank (DCV).

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- L Terminated (see M33250 CON field description)
- *blank* Unterminated (open circuit)

Rules:

- When the CON field is L the output is expected to be terminated. This can be accomplished by using a terminator at the UUT or setting the UUT input impedance. The default termination is 50 Ω. 75 Ω, 300 Ω, or 600 Ω termination may be selected using the M33250 FSC.
- L is automatically inserted the CON field when the amplitude in the Nominal or MOD1 field is expressed in dBm.
- If ASK- W or ASK- V is in effect, the procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  33250        *                                               S
# ----- DC Voltage -----
  1.002  33250  2     1.9V           2% 0.4U                             L
# ----- Sine Wave -----
  2.001  33250  400   3.500V         7.4U          20kH           SI     L
  3.001  33250        -10D           1U            100H           SI     L
# ----- Square Wave w/DC offset -----
  4.001  M33250                                    0.5Voff
  4.002  33250        1Vpp                         1kH            SQ   S L
# ----- Ramp Wave -----
  4.003  33250        75mVpp                       10kH           LR   S L
# ----- Triangle Wave -----
  4.004  M33250       *
  4.005  33250        75mVpp                       10kH           TI   S L
# ----- Positive Ramp -----
  4.006  33250        1.0Vpp                       100kH          +R   S L
# ----- Negative Ramp -----
  4.007  33250        1.0Vpp                       5MH            -R   S L
# ----- Frequency -----
  4.008  33250  1000  800.0H         0.1% 0.1U     300mV          SI     L
```

M33250

Auxiliary Instrument Setup FSC

Description

The M33250 FSC is used to specify parameters not otherwise specified in the 33250 FSC.

Functional Capability

Pulse Width	8 ns to 1999.9 s
Pulse Period	20 ns to 2000 s
PRF	500 µHz to 50 MHz
Modulation Source	internal or external
Moduation Frequency	2 mHz to 20 kHz
AM Depth	0% to 120%
FM Deviation	5 Hz to 40305 MHz
FSK "hop" Frequency	1 µHz to 80 MHz
FSK Rate	2 mHz to 100 kHz (internal) 2 mHz to 1 MHz (external)
Duty cycle	
Square	20% to 80% <= 25 MHz 40% to 60% > 25 MHz & <=50 MHz 50% > 50 MHz
Ramp	0% to 100%
DC Offset	-5 V to 5 V restricted by: |Voff| + (Vpp / 2) <= Vmax and |Voff| <= 2 x Vpp
Frequency Reference	internal or external
Output Termination	50 Ω, 75 Ω, 300 Ω, or 600 Ω

Parameters

Units Symbols

Units Symbol	Name	Quantity
H	Hertz	frequency, PRF, 1 / pulse width, modulation frequency, FM deviation, FSK rate, or FSK "hop" frequency
T	Time	period, pulse width, or edge time
pct	percent	duty cycle or AM depth
Voff	Volts offset	DC offset

Modulated Waveforms
M33250 FSC Range, Nominal, Tolerance, and Mod1 Rules

Modulation	M33250 Range	M33250 Nominal	M33250 Tolerance	M33250 MOD2
AM Modulation	INT|EXT	H	pct	
FM Modulation	INT|EXT	H	H	
FSK Modulation	INT|EXT	H	H	F
Note, blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.				

Unmodulated Waveforms
M33250 FSC Range, Nominal, Tolerance, and MOD1 Rules

Waveform	33250 MOD2	M33250 Range	M33250 Nominal	M33250 Tolerance	M33250 MOD1
Square	SQ			[pct]	[Voff]
Linear Ramp Triangle Positive Ramp Negative Ramp	LR TI -R R			[pct]	[Voff] [Voff] [Voff] [Voff]
Pulse	PU	PER|PULSE	T|H	T	[Voff]
Noise OI					
Exp Rise	+X				[Voff]
Exp Fall	-X				[Voff]
Cardiac	CD				[Voff]
Note: blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.					

RANGE

This field specifies one of the following:

- EXT External modulation source
- INT Internal modulation source
- PER Pulse period or Pulse Repetition Frequency
- PULSE Pulse width
- *blank* not applicable

NOMINAL

This field specifies one of the following:

- Pulse Width entered as [*numeric*][*prefix*]T or H.
- Pulse Period entered as [*numeric*][*prefix*]T.

- Pulse Repetition Frequency (PRF) entered as [*numeric*][*prefix*]H.
- Modulation Frequency entered as [*numeric*][*prefix*]H.
- FSK Rate entered as [*numeric*][*prefix*]H.
- "*" reset to default values
- *blank* not applicable

Rules:

- If the Nominal field does not contain a value the value is taken from memory register MEM.

TOLERANCE

This field specifies one of the following:

- Duty Cycle or Ramp Symmetry entered as: [*numeric*][*prefix*]pct.
- Edge Time entered as: [*numeric*][*prefix*]T.
- AM Depth entered as: [*numeric*][*prefix*]pct.
- FM Deviation entered as: [*numeric*][*prefix*]H.
- FSK "hop" frequency entered as: [*numeric*][*prefix*]H.
- *blank* 50% Square Duty Cycle, 100% Ramp Symmetry, no modulation

Rules:

- If the Tolerance field does not contain a value the value is taken from memory register MEM.
- If the Range field is PER or PULSE and the no edge time is entered 5nT is automatically entered in the Tolerance field.
- A percentage entered in the tolerance field is interpreted as follows:

Waveform	33250 MOD2	M33250 Range	M33250 Tolerance (pct)
Square	SQ		duty cycle
Linear Ramp	LR		symmetry
(na)	(na)	INT|EXT	AM Depth

MOD1

The MOD1 field specifies the following:

- DC Offset entered as: [*numeric*][*prefix*]Voff
- *blank* no DC offset, or not applicable

Rules:

- If the MOD1 field does not contain a value the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is used to specify Frequency-Shift Keying (FSK) modulation.

- F Enable FSK modulation
- *blank* FM modulation or not applicable

Rules:

- If the MOD3 field may specify FSK ("F") only when the Tolerance field specifies a "hop" frequency.

MOD4

This is not used.

CON

The CON field is used to specify the output termination:

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* see rules below

Rules:

- The M33250 CON field must be blank when the 33250 FSC CON field is blank.

- When the M33250 CON field is blank and the 33250 FSC CON field is "L", the output termination is 50 Ω.

Examples

See 33250 FSC.

34401

Instrument FSC

Description

The 34401 FSC programs the HP 34401A Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, conductance, frequency, and period.

Note

The 34401A remote language must be set to SCPI when the 34401A is to be controlled using the 34401 FSC.

To set or verify that the 34401A language is set to SCPI, perform the following steps via the 34401A front panel:

1. Press **Shift** then **MENU On/Off**.
2. Press → until **E: I/O MENU** is displayed.
3. Press ↓ to enter I/O MENU.
4. Press → until **5: LANGUAGE** is displayed.
5. Press ↓ to enter LANGUAGE.
6. Press → until **SCPI** is displayed.

Note

If the 34401A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600, N,...], to set the baud rate, parity, etc. of the port used to control the 34401A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 34401A must be set correctly before a procedure is executed.

The 34401A does not support standard hardware flow control using the RS-232C request-to-send (RTS) and clear-to-send (CTS) lines.

If the 34401A is connected to a standard serial port (COM1, COM2,..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. Select "Flow Control = None". Selecting "Hardware" sets RTS/CTS flow control. The 34401A uses DTR/DSR hardware flow control. The MET/CAL 34401A driver will automatically set DTR/DSR flow control (i.e. DTR/DSR is supported at a lower level even though the Control Panel does not support direct selection of DTR/DSR flow control).

The 34401A cannot be connected to the 5500A, 5520A, 5800A, or 5820A UUT "Pass-Through" Serial port. These calibrators do not support the DTR/DSR hardware flow control required for communication with the 34401A.

Functional Capability

Function	Nominal	MOD1	MOD2
DC Voltage	-1000 V to 1000 V		
AC Voltage[1]	0.1 mV to 750 V	3 Hz to 300 kHz	
DC Current	-3 A to 3 A		
AC Current	1 µA to 3 A	3 Hz to 5 kHz	
Resistance	0 Ω to 119.9999 MΩ		
Conductance	>8.4 nS		
Frequency[1]	3 Hz to 300 kHz	100 mV to 750 V	
Period[1]	3.3 µs to 0.33 s	100 mV to 750 V	
dBm[1]	-66.98 dBm to 70.51 dBm	3 Hz to 300 kHz	5Z
dBm[1]	-68.75 dBm to 68.75 dBm	3 Hz to 300 kHz	7Z
dBm[1]	-74.77 dBm to 62.73 dBm	3 Hz to 300 kHz	3Z
dBm[1]	-77.78 dBm to 59.71 dBm	3 Hz to 300 kHz	6Z
1. Volt-Hertz product not to exceed $8x10^7$.			

Parameters

RANGE

This field specifies the UUT range as described in “General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V.
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.

- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency or period measurements.

- Frequency entered as [*numeric*][*prefix*]H.
- Voltage entered as [*numeric*][*prefix*]V.
- *blank* not applicable.

Rules:

- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.
- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage when the NOMINAL field specifies frequency or period.

MOD2

This field specifies the load impedance that the AC voltage is referenced to.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.

MOD3

Not used.

MOD4

This field specifies the type of test being performed as described in “General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance or conductance.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Example

```
  STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2   3   4 CON
# ----- Reset -----
   1.001  34401        *                                                   S
# ----- DC Voltage -----
   1.002  34401  10     10V           1% 0.01U                                2W
# ----- AC Voltage -----
   5.001  34401  1000   650V          5%            30kH                      2W
   6.001  34401  1      1V            1% 0.01U      10kH                      2W
# ----- Decibels -----
   7.001  34401  A      60.0D         0.1U          1kH            5Z         2W
# ----- DC Current -----
   9.001  34401  4000   350mA         9U                                      2W
# ----- AC Current -----
  10.001  34401  2      1A            3%            60H                       2W
# ----- Resistance -----
  11.001  34401  100    10MZ          1%                                      2W
# ----- Conductance -----
  12.001  34401  100    100nY         5%                                      2W
# ----- Setup Test -----
  13.001  34401         1V                          10kH                   S  2W
# ----- Nominal Setup Test -----
  13.002  34401  1      1V                          10kH                   N  2W
# ----- Comparison Test -----
  13.003  34401  1      1V            1% 0.1U       20kH                   C  2W
```

34420

Instrument FSC

Description

The 34420 FSC programs the Hewlett-Packard 34420A Multimeter measure DC voltage, DC voltage ratio, DC voltage difference, Resistance, and temperature. The 34420 FSC is also used to program the 34420/SPRT and 34420/PRT to measure temperature.

Note

If the 34420A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600, N,...], to set the baud rate, parity, etc. of the port used to control the 34420A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 34420A must be set correctly before a procedure is executed.

The 34420A does not support standard hardware flow control using the RS-232C request-to-send (RTS) and clear-to-send (CTS) lines.

If the 34420A connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. Select "Flow Control = None". Selecting "Hardware" sets RTS/CTS flow control. The 34420A uses DTR/DSR hardware flow control. The MET/CAL 34420A driver will automatically set DTR/DSR flow control (i.e. DTR/DSR is supported at a lower level even though the Control Panel does not support direct selection of DTR/DSR flow control).

The 34420A cannot be connected to the 5500A, 5520A, 5800A, or 5820A UUT "Pass-Through" Serial port. These calibrators do not support the DTR/DSR hardware flow control required for communication with the 34420A.

Functional Capability

FUNCTION	NOMINAL	MOD2
DC Voltage	-119.99999 V to 119.99999 V	
DC Voltage Ratio (Ch1/Ch2)	-11999999 to 11999999	
DC Voltage Difference (Ch1-Ch2)	-119.99999 V to 119.99999 V	VD
Resistance	0 Ω to 1.1999999 MΩ	
Low Power Resistance	0 Ω to 1.1999999 MΩ	LP
Voltage Limited Resistance	0 Ω to 119.99999 Ω	VL
Temperature		
100 Ω Pt 385 RTD	-200 °C to 630 °C	R1
200 Ω Pt 385 RTD	-200 °C to 630 °C	R4
500 Ω Pt 385 RTD	-200 °C to 630 °C	R5
1 kΩ Pt 385 RTD	-200 °C to 630 °C	R6
100 Ω Pt 3916 RTD	-200 °C to 630 °C	R7
Rosemount 162CE SPRT(1)	-200 °C to 661 °C	RR
Hart Scientific 5628 PRT(2)	-200 °C to 660 °C	RH
Type B TC	+350 °C to 1820 °C	_B
Type E TC	-200 °C to 10000 °C	_E
Type J TC	-200 °C to 760 °C	_J
Type K TC	-200 °C to 1372 °C	_K
Type N TC	-200 °C to 1300 °C	_N
Type R TC	0 °C to 1767 °C	_R
Type S TC	0 °C to 1767 °C	_S
Type T TC	-250 °C to 400 °C	_T
1. 34420/SPRT only.		
2. 34420/PRT only.		

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage entered as: [*numeric*][*prefix*]V
- Voltage Ratio entered as: [*numeric*][*prefix*]V/V
- Voltage Difference entered as: [*numeric*][*prefix*]V
- Resistance entered as [*numeric*][*prefix*]Z
- Temperature entered as: [*numeric*][*prefix*]deg C or deg F
- Reset entered as *.

Rules:

- The NOMINAL field may specify temperature only when the MOD2 field specifies a RTD or thermocouple type.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This is not used and must be blank.

MOD2

This field is used to override offset compensation for ohms, to select Low Power or Voltage Limited Resistance, or to specify the RTD or thermocouple type for temperature measurement.

- O Override offset compensation for ohms
- LP Low Power Resistance
- VL Voltage Limited Resistance

- VD Voltage Difference
- R1 100 Ω Pt 385 RTD
- R4 200 Ω Pt 385 RTD
- R5 500 Ω Pt 385 RTD
- R6 1 kΩ Pt 385 RTD
- R7 100 Ω Pt 3916 RTD
- RR Rosemount 162CE Standard Platinum Resistance Thermometer
- RH Hart Scientific 5628 Platinum Resistance Thermometer
- _B Type B thermocouple
- _E Type E thermocouple
- _J Type J thermocouple
- _K Type K thermocouple
- _N Type N thermocouple
- _R Type R thermocouple
- _S Type S thermocouple
- _T Type T thermocouple
- *blank* field not applicable

Rules:

- The MOD2 field may specify offset compensation override "O" only when the NOMINAL field specifies resistance.
- The MOD2 field may specify LP or VL only when the NOMINAL field specifies resistance.
- The MOD2 field may specify VD when the NOMINAL field specifies voltage.
- The MOD2 field may specify a RTD or thermocouple type only when the NOMINAL field specifies temperature.

MOD3

This field specifies the measurement mode. The measurement model determines certain function settings, as well as the number of readings that are discarded and the number of readings that are averaged to obtain a measurement.

The effect of the measurement mode on the programmed function is shown in the following table:

	F	blank	E	FE
DC Volts:				
number of powerline cycles	10	100	200	100
Readings:				
thrown away	1	1	1	1
averaged	1	3	5	1
Ohms (2-Wire and 4-Wire):				
number of powerline cycles	10	100	200	100
<= 19 kΩ				
Readings:				
thrown away	1	2	2	1
averaged	3	4	4	1
>19 kΩ to <= 190 kΩ				
Readings:				
thrown away	1	2	5	1
averaged	3	4	4	1
>190 kΩ				
Readings:				
thrown away	1	2	7	1
averaged	3	4	5	1
Temperature (Thermocouples) number of powerline cycles	10	100	200	100
Readings:				
thrown away	1	1	1	1
averaged	1	3	5	1
Temperature (RTD's, SPRT, and PRT)number of powerline cycles	10	100	200	100
Readings:				
thrown away	1	2	2	1
averaged	3	4	4	1

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance or the MOD2 field specifies a RTD type.
- The CON field must specify 4W when the MOD2 field specifies Lower Power resistance (LP), Voltage Limitedresistance (VL) or an RTD type.
- 4W is inserted automatically in the CON field when theMOD2 field specifies LP, VL, or an RTD type and no CON field code is entered.

Use of Standard Memory Locations And Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for InstrumentEvaluation FSCs" in the on-line Reference Manual.

Examples

```
  STEP    FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2  3   4 CON
 # ----- Reset -----
   1.001  34420       *                                                 S
 # ----- DC Voltage -----
   1.002  34420  10    10V           1% 0.01U                              2W
 # ----- DC Voltage Ratio -----
   2.001  34420        0.1V/V        0.01U                                 2W
 # ----- DC Voltage Difference -----
   3.001  34420        10uV          1U                          VD        2W
 # ----- Resistance -----
   4.001  34420  100   100kZ         1%                                    2W
 # ----- Low Power Resistance -----
   5.001  34420  10    10Z           0.1U                        LP        4W
 # ----- Low Power Resistance -----
   6.001  34420  10    10Z           0.1U                        VL        4W
```

```
# ----- Temperature RTD -----
  7.001  34420        23.0degC       0.1U                           R1       4W
# ----- Temperature TC -----
  8.001  34420        23.0degC       0.1U                           _K       2W
# ----- Setup Test -----
  9.001  34420        1V                                                  S  2W
# ----- Nominal Setup Test -----
  9.002  34420  1     1V                                                  N  2W
# ----- Comparison Test -----
  9.003  34420  1     1V             1% 0.1U                              C  2W
```

3458

Instrument FSC

Description

The 3458 FSC programs the Hewlett-Packard 3458A Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, frequency, period, or decibels.

Functional Capability

Function	Nominal	MOD1	MOD2	MOD3
DC Voltage	-1050 V to 1050 V			[F|E|FE]
AC Voltage	500 µV to 742 V 500 µV to 742 V 1 mV to 742 V		10 Hz to 2 MHz 20 Hz to 10 MHz 1 Hz to 2 MHz	[FE] F E
DC Current	-1.2 A to 1.2 A			[F|E|FE]
AC Current	5 µA to 1.2 A		10 Hz to 100 kHz	[F|E|FE]
Resistance	0 Ω to 1.2 GΩ		[O]	[F|E|FE]
Frequency	1 Hz to 10 mHz		1 mV to 742 V	[FE]
Period	100 ns to 1 s		1 mV to 742 V	[FE]
dBm	-53.01 dBm to 70.41 dBm -53.01 dBm to 70.41 dBm -46.99 dBm to 70.41 dBm -54.77 dBm to 68.65 dBm -54.77 dBm to 68.65 dBm -48.75 dBm to 68.65 dBm -60.79 dBm to 62.63 dBm -60.79 dBm to 62.63 dBm -54.77 dBm to 62.63 dBm -63.80 dBm to 59.92 dBm -63.80 dBm to 59.92 dBm -57.78 dBm to 59.92 dBm	10 Hz to 2 mHz 20 Hz to 10 mHz 1 Hz to 2 mHz 10 Hz to 2 mHz 20 Hz to 10 mHz 1 Hz to 2 mHz 10 Hz to 2 mHz 20 Hz to 10 mHz 1 Hz to 2 mHz 10 Hz to 2 mHz 20 Hz to 10 mHz 1 Hz to 2 mHz	5Z 5Z 5Z 7Z 7Z 7Z 3Z 3Z 3Z 6Z 6Z 6Z	[FE] F E [FE] F E [FE] F E [FE] F E
The AC Voltage input range is extended to 1500 Vp if the kilovolt option is installed.				

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix]D*
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency and period measurements.

- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Voltage entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance.

MOD2

This field specifies one of the following:

- The load impedance that the AC voltage is referenced to or
- A code which overrides the automatic enabling of the offset compensated ohms function.

5Z	50 Ω
7Z	75 Ω
3Z	300 Ω
6Z	600 Ω
O	Override (disable) offset compensated ohms
blank	field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- The MOD2 field may specify override only when the NOMINAL field specifies resistance.

MOD3

	F	Blank	E	FE
DC Volts				
number of powerline cycles	10	100	100	100
Readings				
thrown away	1	1	1	1
averaged	1	3	5	1
Autozero	On	On	On	On
DC Current				
number of powerline cycles	10	100	100	100
Readings				
thrown away	1	1	2	1
averaged	1	3	5	1
Autozero	On	On	On	On
Ohms (2-Wire and 4-Wire)				
Number of powerline cycles	10	100	100	100
≤19 kΩ Readings				
thrown away	1	2	2	1
averaged	3	4	4	1
>19 kΩ to ≤190 kΩ Readings				
thrown away	1	2	5	1
averaged	3	4	4	1
>190 kΩ Readings				
thrown away	1	2	7	1
averaged	3	4	5	1
Autozero	On	On	On	On
Offset Compensation				
<12 kΩ	On	On	On	On
≥12 kΩ	Off	Off	Off	Off

	F	Blank	E	FE
AC Volts				
Conversion	Random Samp.	Analog RMS	Synchronous	Analog RMS
Bandwidth	20 Hz to 10 MHz	10 Hz to 2 MHz	1 Hz to 2 MHz	10 Hz to 2 MHz
Reading Thrown away averaged	 1 1	 1 3	 1 3	 1 1
Resolution	Default	Default	0.001	Default
Level Filter, AC Volts only	Default	Default	On < 75 kHz Off ≥ 75 kHz	Default
Sync. Source	NA	NA	Level, Hold	NA
AC Current				
number of powerline cycles	10	100	100	100
Reading Thrown away averaged	 1 1	 1 3	 2 5	 1 1
Frequency				
Reading Thrown away averaged	 NA NA	 1 3	 NA NA	 1 1
Level Filter, AC Volts only	Default	On < 75 kHZ Off ≥ 75 kHz	Default	On < 75 kHZ Off ≥ 75 kHz
Period				
Reading Thrown away averaged	 NA NA	 1 3	 NA NA	 1 1
AC Volts only Level Filter	Default	On > 13.3 µs Off ≤ 13.3 µs	Default	On > 13.3 µs Off ≤ 13.3 µs

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  3458         *                                                 S
# ----- DC Voltage -----
  1.002  3458   A     -1000V         1% 0.1U                               2W
# ----- AC Voltage -----
  2.001  3458   200   100V           1% 2/         10kH                    2W
# ----- Decibels -----
  3.001  3458   100   56.62D         2% 0.1U       1kH               6Z    2W
# ----- DC Current -----
  4.001  3458   10    1.00A          1000P%                                2W
# ----- AC Current -----
  5.001  3458   2     mA             1%            1kH                     2W
# ----- Resistance -----
  6.001  3458   100   256kZ          1%                                    2W
# ----- Frequency -----
  7.001  3458         800.0H         0.1% 0.1U     300mV                   2W
```

M3458

M3458 Auxiliary Instrument Setup FSC

Description

The M3458 FSC provides range locking for the Hewlett-Packard 3458A Multimeter.

Parameters

When a blank M3458 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* field not applicable

Rules:

- When the RANGE field specifies RNGLK, the NOMINAL field must specify the range selection value.

NOMINAL

This field specifies one of the following:

- Voltage range selection value entered as: *numeric*[*prefix*]V
- Current range selection value entered as: *numeric*[*prefix*]A
- Resistance range selection value entered as: *numeric*[*prefix*]Z
- "*" reset to default values

Rules:

- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Selection Value	Locked Range
-12 mV to 12 mV	100 mV DC, 10 mV AC
-120 mV to < -12 mV	100 mV
> 12 mV to 120 mV	100 mV

Selection Value	Locked Range
-1.2 V to < -120 mV	1 V
> 120 mV to 1.2 V	1 V
-12 V to < -1.2 V	10 V
> 1.2 V to 12 V	10 V
-120 V to < -12 V	100 V
> 12 V to 120 V	100 V
-1050 V to < -120 V	1000 V
> 120 V to 1050 V	1000 V
-0.12 μA to 0.12 μA	0.1 μA DC, 100μA AC
-1.2 μA to < -0.12 μA	1 μA DC, 100μA AC
> 0.12 μA to 1.2 μA	1 uA DC, 100μA AC
-12 μA to < -1.2 μA	10 μA DC, 100μA AC
> 1.2 μA to 12 μA	10 μA DC, 100μA AC
-120 μA to < -12 μA	100 μA
>12 μA to 120 μA	100 μA
-1.2 mA to < -120 μA	1 mA
> 120 μA to 1.2 mA	1 mA
-12 mA to < -1.2 mA	10 mA
> 1.2 mA to 12 mA	10 mA
-120 mA to < -12 mA	100 mA
> 12 mA to 120 mA	100 mA
-1.2 A to < -120 mA	1 A
> 120 mA to 1.2 A	1 A
0 Ω to 12 Ω	10 Ω
> 12 Ω to 120 Ω	100 Ω
> 120 Ω to 1.2 kΩ	1 kΩ
> 1.2 kΩ to 12 kΩ	10 kΩ

Selection Value	Locked Range
> 12 kΩ to120 kΩ	100 kΩ
> 120 kΩ to 1.2 MΩ	1 MΩ
> 1.2 MΩ to 12 MΩ	10 MΩ
> 12 MΩ to 120 MΩ	100 MΩ
> 120 MΩ to 1.2 GΩ	1 GΩ

- A M3458 range lock specification only applies when a subsequent FSC specifies an applicable measurement function (see EXAMPLES below).
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

```
STEP     FSC     RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
#
  1.001  M3458   RNGLK 10mV
#
#  100mV range is locked
#
  1.002  3458          100mV          1%                                      2W
#
#  10mV range is locked
#
  2.001  3458          10mV           1%            1kH                       2W
  3.001  3458          1kH            1%            10mV                      2W
#
#  Autorange is selected (M3458 FSC not applicable).
#
  4.001  3458          1uA            1%                                      2W
  5.001  3458          100uA          1%            1kH                       2W
  6.001  3458          1kH            1%            100uA                     2W
  7.001  3458          10Z            1%                                      2W
#
  8.001  M3458   RNGLK 1uA
#
#  Autorange is selected (M3458 FSC not applicable).
#
  8.002  3458          100mV          1%                                   N  2W
  9.001  3458          10mV           1%            1kH                    N  2W
 10.001  3458          1kH            1%            10mV                      2W
#
#  1uA range is locked
#
 11.001  3458          1uA            1%                                   N  2W
#
#  100uA range is locked
#
 12.001  3458          100uA          1%            1kH                    N  2W
 13.001  3458          1kH            1%            100uA                     2W
#
# Autorange is selected (M3458 FSC not applicable).
#
 14.001  3458          10Z            1%                                   N  2W
#
 15.001  M3458   RNGLK 10Z
```

```
#
#  Autorange is selected (M3458 FSC not applicable).
#
 15.002  3458         100mV          1%                                N  2W
 16.001  3458         10mV           1%            1kH                 N  2W
 17.001  3458         1uA            1%                                N  2W
 18.001  3458         100uA          1%            1kH                 N  2W
#
#  10 Ohm range is locked.
#
 19.001  3458         10Z            1%                                N  2W
#
#  Autorange is selected for all subsequent 3458 FSCs.
#
20.001  M3458        *
```

39A

Instrument FSC

Description

The 39A FSC programs the Wavetek 39A Universal Waveform Generator to output DC voltage, or sine, square, triangle, positive ramp, negative ramp, and pulse waveforms. The 39A FSC can also program Channel 1 of the Wavetek 195 Universal Waveform Generator.

Note

If the 39A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 39A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements. Use the Windows Control Panel to set the port configuration as follows:

Baud Rate:	9600
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	Xon/Xoff

Press the Utility button on the 39A front panel. Press the right arrow below the knob until "Remote" can be selected using one of the softkeys on the left side of the display. Select the following settings:

interface: RS232

baud rate: 9600

Functional Capability

Waveform	Frequency
Sine	0.1 mHz to 16 MHz
Square	0.1 mHz to 16 MHz
Triangle	0.1 mHz to 100 kHz
Positive Ramp	0.1 mHz to 100 kHz
Negative Ramp	0.1 mHz to 100 kHz
Pulse	
Period	100 ns to 100 s
Width	25 ns to 99.99 s
Output Level	
2.5 mV to 10 Vpp into 50 Ω	
5.0 mV to 20 Vpp open circuit	

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak) entered as: [*numeric*][*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H
- Period entered as: [*numeric*][*prefix*]T

Rules:

- The NOMINAL field may specify Decibels only when the MOD2 field specifies SI.
- The NOMINAL field may specify Voltage peak-to-peak, Frequency, or Period only when the MOD2 field specifies SI, SQ, TI, +R, -R, or PU (i.e. MOD2 is not blank).
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak) entered as: [*numeric*][*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- *blank* DC

Rules:

- The MOD1 field may specify Decibels only when the MOD2 field specifies SI.
- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage or decibels only when the NOMINAL field specifies frequency or period.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies the function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- +R Positive Ramp
- -R Negative Ramp
- PU Pulse

Rules:

- When the MOD2 field is PU, the M39A RANGE field must specify PER or PULSE.
- SI is inserted automatically in the MOD2 field when the MOD1 field is not blank and no MOD2 code is entered.
- The MOD2 field must be blank when the MOD1 field is blank (i.e. DC Voltage is specified).

MOD3

This field is not used.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- L 50 Ω termination
- *blank* 1 MΩ Input Impedance

Rules:

- When the CON field specifies "L" the output is expected to be terminated with 50 Ω. This can be accomplished by using a 50 Ω terminator at the UUT or setting the UUT input impedance to 50 Ω.

- If ASK- W or ASK- V is in effect, the procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1     MOD2  3   4  CON
# ----- Reset -----
  1.001  39A          *                                              S
# ----- DC Voltage -----
  1.002  39A          1.00V                                          S   L
# ----- Sine Wave -----
  1.003  39A    400   2.5Vp          -2.8U +2.9U   60H           SI        L
  2.001  39A    400   3.500Vp        7.4U          20kH          SI        L
  3.001  39A          -37.78D                      100H          SI     S  L
# ----- Square Wave w/DC offset -----
  3.002  M39A                                      0.5Voff
  3.003  39A          1Vp                          1kH           SQ     S  L
# ----- Triangle Wave -----
  3.004  M39A         *
  3.005  39A          13mVp                        10kH          TI     S  L
# ----- Positive Ramp -----
  3.006  39A          1.0Vp                        100kH         +R     S  L
# ----- Negative Ramp -----
  3.007  39A          1.0Vp                        20kH          -R     S  L
# ----- Pulse -----
  3.008  M39A   PER   1uT
  3.009  39A          100nT                        1Vp           PU     S  L
  3.010  M39A         *
# ----- Frequency -----
  3.011  39A          800.0H                       300mV         SI     S  L
```

M39A

Auxiliary Instrument Setup FSC

Description

The M39A FSC is used to specify pulse period, pulse width, and DC offset. The M39A FSC is ignored when the 39A FSC specifies DC voltage.

Functional Capability

Pulse Period	100 ns to 100 s
Pulse Width	25 ns to 99.99 s
DC Offset:	0 V to 5 V into 50 Ω
	0 V to 10 V open circuit
	restricted by:

```
|Voff| + |Vp| <= Vmax
```

Parameters

Range

This field specifies one of the following:

- PULSE   Pulse Width
- PER   Pulse Period
- *blank*   field not applicable

Nominal

This field specifies one of the following:

- Pulse Width entered as: [*numeric*][*prefix*]T
- Pulse Period entered as: [*numeric*][*prefix*]T
- "*"   reset to default values
- *blank* not applicable

Rules:

- The NOMINAL field must specify the pulse width when the RANGE field is PULSE.
- The NOMINAL field must specify the pulse period when the RANGE field is PER.
- If the Nominal field does not contain a value the value is taken from memory register MEM.

Tolerance

This field is not used.

MOD1

The MOD1 field specifies the following:

- DC Offset entered as: [*numeric*][*prefix*]Voff
- *blank* no offset

Rules:

- If the MOD1 field does not contain a value the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 39A FSC.

395

Instrument FSC

Description

The 395 FSC programs the Wavetek 395 Arbitrary Waveform Generator to output DC voltage, periodic random noise, or sine, square, triangle, positive ramp, and negative ramp waveforms.

Note

If the 395 is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 395. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements. Use the Windows Control Panel to set the port configuration as follows:

Baud Rate:	*9600*
Data Bits:	*8*
Parity:	*None*
Stop Bits:	*1*
Flow Control:	*Hardware*

Press the REMOTE button on the 395 front panel.

Press F3 "RS-232".

Press F7 "setup" and select the following settings:

echo:	*off*
handshake:	*on*
timeout:	*2.0 sec*
baud:	*9600*

Functional Capability

Waveform	Frequency
Sine	1 µHz to 40 MHz
Square	1 µHz to 50 MHz
Triangle	1 µHz to 10 MHz
Positive Ramp	1 µHz to 2 MHz
Negative Ramp	1 µHz to 2 MHz

Output Termination	Amplitude
50 Ω	±5 V (DC), -5 Vp to 5 Vp (AC)

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak) entered as: [*numeric*][*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H
- Period entered as: [*numeric*][*prefix*]T

Rules:

- The NOMINAL field may specify Decibels only when the MOD2 field specifies SI.
- The NOMINAL field may specify Voltage peak-to-peak, Frequency, or Period only when the MOD2 field specifies SI, SQ, TI, +R, -R, or OI (i.e MOD2 is not blank).
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak) entered as: [*numeric*][*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- *blank* DC or Noise

Rules:

- The MOD1 field may specify Decibels only when the MOD2 field specifies SI.
- The MOD1 field must be blank when the MOD2 field specifies OI (Noise).
- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage or decibels only when the NOMINAL field specifies frequency or period.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies the function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- +R Positive Ramp
- -R Negative Ramp
- PU Pulse
- OI Periodic Random Noise

Rules:

- When the MOD2 field is PU, the M395 RANGE field must specify PER or PULSE.
- SI is inserted automatically in the MOD2 field when the MOD1 field is not blank and no MOD2 code is entered.
- The MOD2 field must be blank or OI when the MOD1 field is blank (i.e. DC Voltage or Noise is specified).

MOD3

This field is not used.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- L 50 Ω termination

Rules:

- L is automatically inserted the CON field when no CON field code in entered.
- The output is expected to be terminated with 50 Ω. This can be accomplished by using a 50 Ω terminator at the UUT or setting the UUT input impedance to 50 Ω.
- If ASK- W or ASK- V is in effect, the procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  395          *                                                 S
# ----- DC Voltage -----
  1.002  395          1.00V                                             S  L
# ----- Sine Wave -----
  1.003  395    400   2.5Vp          -2.8U +2.9U   60H            SI       L
  2.001  395    400   3.500Vp        7.4U          20kH           SI       L
  3.001  395          -37.78D                      100H           SI    S  L
# ----- Square Wave w/DC offset -----
  3.002  M395                                      0.5Voff
  3.003  395          1Vp                          1kH            SQ    S  L
# ----- Triangle Wave -----
  3.004  M395         *
  3.005  395          13mVp                        10kH           TI    S  L
# ----- Positive Ramp -----
  3.006  395          1.0Vp                        100kH          +R    S  L
# ----- Negative Ramp -----
  3.007  395          1.0Vp                        20kH           -R    S  L
# ----- Pulse -----
  3.008  M395   PER   1uT
  3.009  395          10nT                         1Vp            PU    S  L
  3.010  M395         *
# ----- Frequency -----
  3.011  395          800.0H                       300mV          SI    S  L
# ----- AM Modulation -----
  3.012  M395         1kH                          10pct
  3.013  395          950kH                        1Vp            SI    S  L
# ----- FM Modulation -----
  3.014  M395         1kH                          10kH
  3.015  395          1MH                          1Vp            SI    S  L
```

M395

Auxiliary Instrument Setup FSC

Description

The M395 FSC is used to specify modulation, modulation frequency, AM depth, FM deviation, and DC offset. The M395 FSC is ignored when the 395 FSC specifies DC voltage.

Functional Capability

Pulse Period	100 ns to 10 s
Pulse Width	10 ns to 9.99 s
Modulation Frequency	1 Hz to 40 MHz
AM Depth	0 % to 200 %
FM Deviation	1 Hz to 40 MHz
DC Offset	0 V to 5 V into 50 Ohms restricted by: |Voff| + |Vp| <= Vmax

Parameters

RANGE

This field specifies one of the following:

- PULSE Pulse Width
- PER Pulse Period
- *blank* field not applicable

NOMINAL

This field specifies one of the following:

- Pulse Width entered as: [*numeric*][*prefix*]T
- Pulse Period entered as: [*numeric*][*prefix*]T
- Modulation Frequency is entered as [*numeric*][*prefix*]H.
- "*" Reset to default values
- *blank* Not applicable

Rules:

- The NOMINAL field must specify the pulse width when the RANGE field is PULSE.
- The NOMINAL field must specify the pulse period when the RANGE field is PER.
- If the Nominal field does not contain a value the value is taken from memory register MEM.

TOLERANCE

This field is not used.

MOD1

The MOD1 field specifies the following:

- DC Offset entered as: [*numeric*][*prefix*]Voff
- AM Depth entered as: [*numeric*][*prefix*]pct.
- FM Deviation entered as: [*numeric*][*prefix*]H.
- *blank* No modulation

Rules:

- The MOD1 field must specify AM depth or FM deviation when the Nominal field specifies a modulation frequency.
- When two frequency values are entered for a M395 FSC, the first is taken to be the Modulation Frequency and the second is taken to be the FM deviation.
- When the MOD1 field specifies FM deviation, the deviation must be less than or equal to the frequency specified in the 395 FSC Nominal or MOD1 field.
- When a frequency value and a percent value are entered for a M395 FSC, the frequency is taken to be the Modulation Frequency and the percent is taken to be the AM depth.
- If the MOD1 field does not contain a value the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 395 FSC.

4000, 4000A

Instrument FSC

Description

The 4000 FSC controls Datron 4000 Autocal Standard. The 4000A FSC controls Datron 4000A Autocal Standard. The functions are supported:

- DC Voltage
- DC Current and Resistance with Option 20 installed

The M4000 and M4000A FSCs are used for control the folling:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Note

The 4000 FSC can be used to control a 4000A. In this case the 4000A accuracy file will be used at run time.

Functional Capability

Function	Nominal
DC Voltage	-1200 V to 1200 V
DC Current [1]	-1.999999 A to 1.999999 A
Resistance [1] Conductance [1]	0 Ω (Short), 1 Ω to 10 MΩ, 1 S to 100 nS (in decade steps)
1. With Option 20 installed.	

PARAMETERS

Range

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

Nominal

This field specifies one of the following.

- Voltage entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Reset entered as *.

Tolerance

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used and must be blank.

MOD2

This field allows you to specify negative zero or the divider override feature of the calibration system.

- -Z Negative Zero
- O Divider Override

The internal divider allows a user to achieve higher levels of calibration accuracy in most circumstances; therefore the use of the divider is always automatically selected, where it is applicable.

The following table is shows effect of the MOD2 field

Function	Nominal	MOD2	Effect
DC Volts	≥20 V	*blank*	Low output impedance
DC Volts	< 20 V	*blank*	50 Ω output impedance
DC Volts	< 20 V	0	Locked in 10 V range, low output impedance
DC Volts	0.0	-Z	Negative Zero output
DC Amps	0.0	-Z	Negative Zero output

Rules:

- The MOD2 field may specify Z only for DC Voltage or DC Current when the Nominal value is zero.

MOD3

This field is not used and must be blank.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance, and DC Voltage ≥ 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
STEP     FSC     RANGE  NOMINAL         TOLERANCE      MOD1         MOD2   3   4  CON
 1.001   4000           *                                                      S
 1.002   4000    1000   1200V           1U 1/                                     2W
 2.001   4000    10     0V              1U                                        2W
 3.001   4000A   100    -22uA           10%                                       2W
 4.001   4000    10     20mV                                                   N  2W
 4.002   4000    A      1Z              5%                                        4W
```

M4000, M4000A

Auxiliary Instrument Setup FSC's

Description

The M4000 and M4000A FSCs are used to for controlling range locking, safety delay override, and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* Field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V, A or Z
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4000 statement is entered.
- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 µV to 100 uV	100 µV
> 100 µV to 1 mV	1 mV
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000V
0 µA to 100 µA	100 µA
> 100 uA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1 A	1 A

0 Ω to 1 Ω	1 Ω
> 1 Ω to 10 Ω	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay
- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4000 to standby for each 4000 statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS.
- MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performance by implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4000 FSC Execution Sequence
blank	Set the Safety Delay Override to Off (safety delay active). Set the 4000 to standby. Setup the 4000 to the desired state; function, range, etc. Set the 4000 to operate and wait for the Output On SRQ. Wait an additional 1 second.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4000 to the desired state; function, range, etc. Set the 4000 to operate. If DCV > 110V wait 3 seconds. Wait an additional 1 second.
D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4000 to the desired state; function, range, etc. Set the 4000 to operate. Wait an additional 1 second.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4000 to the desired state; function, range, etc. Set the 4000 to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4000 FSC.

4200, 4200A

Instrument FSC

Description

The 4200 FSC controls Datron 4200 Autocal AC Standard.

The 4200A FSC controls Datron 4200A Autocal AC Standard.

The following functions are supported:

- AC Voltage
- AC Current with Option 30 installed

The M4200 and M4200A FSCs are used to control the following:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Note

The 4200 FSC can be used to control a 4200A. In this case the 4000A accuracy file will be used at run time.

Functional Capability

Function	Amplitude	Frequency
AC Voltage	100 µV to 19.99999 V	10 Hz to 1 MHz
	20 V to 100 V	10 Hz to200 kHz
	100 V to 199.9999 V	10 Hz to 100 kHz[1]
	200 V to 1100 V	45 Hz to 33 kHz
AC Current[2]	100 µA to 1.999999 A	10 Hz to 5 kHz
1. V x Hz product not to exceed 20e+6 2. Requires Option 30		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following:

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.
- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.

MOD2

This field is not used and must be blank.

MOD3

This field is not used and must be blank.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for AC Voltage ≥ 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4200		*					S	
1.002	4200	200	220mV	10%	50H				2W
2.001	4200	1000	1000V	1U	1kH				4W
3.001	4200	2	1.999A	1% 1/	1kH				2W
4.001	4200	A	mV	0.1U	50H				2W
5.001	4200	A	A	5%	1kH				2W
6.001	4200		1.999A		1kH			S	2W
6.002	4200	10	20mV	0.5%	1kH			C	2W

M4200, M4200A

Auxiliary Instrument Setup FSC's

Description

The M4200 and M4200A FSCs are used for controlling range locking, safety delay override and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* Field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V or A
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4200 statement is entered.
- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 mV to 1 mV	1 mV
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µ A to 100 µA	100 uA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1 A	1 A

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay
- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4200 to standby for each 4200 statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS.
- MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performance by implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4200 FSC Execution Sequence
blank	Set the Safety Delay Override to Off (safety delay active). Set the 4200 to standby. Setup the 4200 to the desired state; function, range, etc. Set the 4200 to operate and wait for the Output On SRQ. Wait an additional delay as defined below.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4200 to the desired state; function, range, etc. Set the 4200 to operate. If ACV > 110V wait 3 seconds. Wait an additional delay as defined below.

D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4200 to the desired state; function, range, etc. Set the 4200 to operate. Wait an additional delay as defined below.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4200 to the desired state; function, range, etc. Set the 4200 to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

Additional Settling Delay
MOD2 *blank*, D0, & D1

frequency <= 33Hz	**wait 10 seconds**
frequency <= 330Hz	**wait 3 seconds**
otherwise	**wait 1 second**

MOD

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4200 FSC.

437

Instrument FSC

Description

The 437 FSC programs the Hewlett-Packard 437B Power Meter. The 437 FSC can also program the Hewlett-Packard E4418A (previously EPM-441A) Power Meter when it is in 437B language emulation mode. The driver automatically sets the E4418A to 437B language emulation mode.

Functional Capability

Function	437 MOD3	437 Nominal	437 MOD1	M437 Nominal
RF Power[1]	RF RF	-70 dBm to +44 dBm 100 pW to 25 W	100 kHz to 110 GHz 100 kHz to 110 GHz	
Zero Sensor	ZR	0 W	100 kHz to 110 GHz	
Zero and Cal Sensor	CP	1 µW to 1 mW	50 MHz	0 to 100%
1. NOMINAL (Power) and MOD1 (frequency) ranges depend upon the power sensor model used (see M437 MOD1 field).				

Model	Power Range	Frequency Range
25 W Sensors		
8481B	0 to +44 dBm (1 mW to 25 W)	10 MHz to 18.0 GHz
8482B	0 to +44 dBm (1 mW to 25 W)	100 kHz to 4.2 GHz
3 W Sensors		
8481H	-10 to +35 dBm (100 µW to 3 W)	10 MHz to 18.0 GHz
8482H	-10 to +35 dBm (100 µW to 3 W)	100 kHz to 4.2 GHz
100 mW Sensors		
8481A	-30 to +20 dBm (1 µW to 100 mW)	10 MHz to 18.0 GHz
8482A	-30 to +20 dBm (1 µW to 100 mW)	100 kHz to 4.2 GHz
8483A	-30 to +20 dBm (1 µW to 100 mW)	100 kHz to 2.0 GHz
8485A	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 26.5 GHz
R8486A	-30 to +20 dBm (1 µW to 100 mW)	26.5 MHz to 40 GHz
Q8486A	-30 to +20 dBm (1 µW to 100 mW)	33 MHz to 50 GHz
W8486A	-30 to +20 dBm (1 µW to 100 mW)	75 MHz to 110 GHz
8487A	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 50 GHz
Model	**Power Range**	**Frequency Range**
High Sensitivity Sensors		
8481D	-70 to -20 dBm (100 pW to 10 µW)	10 MHz to 18.0 GHz

8484A	-70 to -20 dBm (100 pW to 10 µW)	10 MHz to 18.0 GHz
8485D	-70 to -20 dBm (100 pW to 10 µW)	50 MHz to 26.5 GHz
R8486D	-70 to -20 dBm (100 pW to 10 µW)	26.5 MHz to 40 GHz
Q8486D	-70 to -20 dBm (100 pW to 10 uW)	33 MHz to 50 GHz
8487D	-70 to -20 dBm (100 pW to 10 uW)	50 MHz to 50 GHz

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- RF Power entered as [*numeric*][*prefix*]W or D.
- Reset entered as *.

Rules:

- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency.

- Frequency entered as [*numeric*][*prefix*]H.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is not used.

MOD3

This field specifies the measurement type:

- RF RF Power
- ZR Zero sensor
- CP Zero and Calibrate sensor

Rules:

- See Functional Capability table.
- RF is inserted in the MOD3 field when no legal MOD3 field code is entered.
- The MOD3 field may specify ZR and CP only for a Nominal Setup Test
- (MOD4 = N). However MEM is not update when MOD3 is ZR or CP.
- When the MOD3 field specifies CP the M437 NOMINAL field must specify the reference calibration factor.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1          MOD2  3  4  CON
# ----- Reset -----
  1.002  M437          *
  1.002  437           *                                                   S
# ----- Specify table for Power Sensor Data -----
# ----- Assume factory default table (#5) for 8482A ----
  1.002  M437                                      HP8482A       T5
# ----- Zero and Calibrate sensor -----
  1.004  DISP          Connect the HP 8482A Power Sensor to the 437B.
  1.005  MEMI          Enter sensor's reference calibration factor in percent.
  1.006  M437          pct                         HP8482A       T5
  1.007  DISP          Connect the sensor to the 1mW/50MHz POWER REF Output.
  1.008  437           1mW                         50MH             CP N
# ----- Power Measurement (Decibels) -----
  1.010  M437                        F4            HP8482A       T5
  1.011  DISP          Connect the 437B Power Sensor to Sig. Gen. RF Output.
  1.013  437           -30.00D       3.00U         100MH            RF
  2.002  437           -20.00D       1.00U         100MH            RF
  3.002  437           -10.00D       1.00U         100MH            RF
  4.002  437           0.00D         1.00U         100MH            RF
  5.002  437           10.00D        1.00U         100MH            RF
# ----- Power Measurement (Watts) -----
  6.003  437           1.00uW        20%           100MH            RF
  7.002  437           10.00uW       5%            100MH            RF
  8.002  437           100.0uW       5%            100MH            RF
  9.002  437           1.000mW       5%            100MH            RF
 10.002  437           10.00mW       5%            100MH            RF
# ----- Low Resolution -----
 11.004  M437   LOW                  F128          HP8482A
 11.005  437           0.0D                        300MH            RF S
# ----- Mid Resolution -----
 11.009  M437   MID                  F128          HP8482A
 11.010  437           0.00D                       300MH            RF S
# ----- High Resolution -----
 11.014  M437   HIGH                 F128          HP8482A
 11.015  437           0.000D                      300MH            RF S
# ----- Filter -----
 11.018  M437                        F1            HP8482A
 11.019  437           -1.00D                      150MH            RF N
 11.022  M437   HIGH                 F512          HP8482A
 11.023  437           -2.000D                     150MH            RF N
```

M437

Auxiliary Instrument Setup FSC

Description

The M437 FSC provides the additional program functions for Hewlett-Packard 437B which are not addressed by the 437 FSC.These functions include resolution, calibration factor, filter, and calibration factor table number.

Parameters

RANGE

This field specifies the resolution.

- LOW 0.1 dB (log), 1% full scale (linear)
- MID 0.01 dB (log), 0.1% full scale (linear)
- HIGH 0.001 dB (log), 0.01% full scale (linear)
- *blank* Default

Rules:

- When the Range field is blank the power-on default resolution is used, which is "MID".

NOMINAL

This field specifies the reference calibration factor or a reset.

- Reference Calibration Factor entered as: [*numeric*][*prefix*]pct.
- "*" Reset
- *blank* Not applicable

Rules:

- Legal values for reference calibration factor are 0 to 100%.
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- When the NOMINAL field specifies a reset the following default values are selected:

  Resolution: MID

Filter: Auto

Cal. Factor Table: 0

TOLERANCE

This field specifies the filter.

- Number of readings to average entered as: F *average*.
- *blank* Default

Rules:

- Legal values for *average* are: 1, 2, 4, 8,... 512.
- When the TOLERANCE field is blank auto filter mode is selected.

MOD1

This field specifies the power sensor used entered as:

[HP] *model number*. Legal entries are:

HP8481A

HP8481B

HP8481D

HP8481H

HP8482A

HP8482B

HP8482H

HP8483A

HP8484A

HP8485A

HP8485D

HP8487A

HP8487D

HPQ8486A

HPQ8486D

HPR8486A

HPR8486D

HPW8486A

Rules:

- The MOD1 field must specify the power sensor model number except when the NOMINAL field specifies a reset '*'.

MOD2

This field specifies the power sensor calibration factor table to be used.

Cal factor table entered as: T [*table number*]

blank Default

Rules:

- Legal values for table number are: 0-9
- When the MOD1 field does not specify a value, the value is taken from memory register MEM2 as an ASCII integer.
- When the MOD1 field is blank table 0 is selected.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

```
Refer to 437 FSC.
```

4418

Instrument FSC

Description

The 4418 FSC programs the Agilent E4418B and Agilent/HP E4418A (formally EPM-441A) Power Meters.

Note

Procedures written using the 4418/M4418 FSCs will also execute when an Agilent E4419B or Agilent/HP E4419A (formally EPM-442A) is used. In this case channel A is used.

A single procedure may use up to 8 different power sensors during the course of procedure execution. If channel A of the dual channel power is used, the limit is 4 different sensors.

When the power meter contains firmware with major revision 3 or later, the instrument driver uses the SERV:SENS:TYPE? Command to determine if the power sensor specified in the most recently executed M4418 FSC is in fact connected to the power meter. For E-Series power sensors, the command returns the actual power sensor model connected to the power meter. For 8480-Series power sensors only the suffix A, B, D, or H is returned so the check can only detect a sensor with an incorrect power range.

When ASK+ W or ASK+ V is specified, automatic connection messages for calibrating the power sensor include any required attenuators and adapters to properly connect the power sensor to the power meter POWER REF output.

If the E4418B is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the E4418B. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the E4418B must be set correctly before a procedure is executed.

If the E4418B is connected to a standard serial port (COM1, COM2, ..., COM16), use the "Ports" application in the Windows Control Panel to choose the proper settings. If the E4418B is connected to the 5500A, 5520A, or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Function	4418 MOD3	4418 Nominal	4418 MOD1
RF Power (1)	RF	-70 dBm to +44 dBm	100 kHz to 110 GHz
	RF	100 pW to 25 W	100 kHz to 110 GHz
Zero sensor	ZR	0 W	100 kHz to 110 GHz
Zero and Cal. sensor	CP	1 µW to 1 mW	50 MHz
(1) Nominal (Power) and MOD1 (frequency) ranges depend upon the power sensor model used (see M4418 MOD1 field):			

Model	Power Range	Frequency
E-Series E441XA CW Power Sensors		
E4412A	-70 to +20 dBm (100 pW to 100 mW)	10 MHz to 18.0 GHz
E4413A	-70 to +20 dBm (100 pW to 100 mW)	50 MHz to 26.5 GHz
E-Series E9300 Average Power Sensors		
E9300A	-60 to +20 dBm (1 nW to 100 mW)	10 MHz to 18.0 GHz
E9301A	-60 to +20 dBm (1 nW to 100 mW)	10 MHz to 6.0 GHz
E9304A	-60 to +20 dBm (1 nW to 100 mW)	9 kHz to 6.0 GHz
E9300B	-30 to +44 dBm (1 µW to 25 W)	10 MHz to 18.0 GHz
E9301B	-30 to +44 dBm (1 µW to 25 W)	10 MHz to 6.0 GHz
E9300H	-50 to +30 dBm (10 nW to 1 W)	10 MHz to 18.0 GHz
E9301H	-50 to +30 dBm (10 nW to 1 W)	10 MHz to 6.0 GHz
8480-Series Power Sensors		
25 W Sensors		
8481B	0 to +44 dBm (1 mW to 25 W)	10 MHz to 18.0 GHz
8482B	0 to +44 dBm (1 mW to 25 W)	100 kHz to 4.2 GHz
3 W Sensors		
8481H	-10 to +35 dBm (100 µW to 3 W)	10 MHz to 18.0 GHz
8482H	-10 to +35 dBm (100 µW to 3 W)	100 kHz to 4.2 GHz

Model	Power Range	Frequency
100 mW Sensors		
8481A	-30 to +20 dBm (1 µW to 100 mW)	10 MHz to 18.0 GHz
8482A	-30 to +20 dBm (1 µW to 100 mW)	100 kHz to 4.2 GHz
8483A	-30 to +20 dBm (1 µW to 100 mW)	100 kHz to 2.0 GHz
8485A	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 26.5 GHz
Opt 033	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 33 GHz
R8486A	-30 to +20 dBm (1 µW to 100 mW)	26.5 MHz to 40 GHz
Q8486A	-30 to +20 dBm (1 µW to 100 mW)	33 MHz to 50 GHz
V8486A	-30 to +20 dBm (1 µW to 100 mW)	50 GHz to 75 GHz
W8486A	-30 to +20 dBm (1 µW to 100 mW)	75 MHz to 110 GHz
8487A	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 50 GHz
10 µW High Sensitivity Sensors		
8481D	-70 to -20 dBm (100 pW to 10 µW)	10 MHz to 18.0 GHz
8484A	-70 to -20 dBm (100 pW to 10 µW)	10 MHz to 18.0 GHz
8485D	-70 to -20 dBm (100 pW to 10 µW)	50 MHz to 26.5 GHz
Opt 033	-70 to -20 dBm (100 pW to 10 µW)	50 MHz to 33 GHz
R8486D	-70 to -20 dBm (100 pW to 10 µW)	26.5 MHz to 40 GHz
Q8486D	-70 to -20 dBm (100 pW to 10 µW)	33 MHz to 50 GHz
8487D	-70 to -20 dBm (100 pW to 10 µW)	50 MHz to 50 GHz

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- RF Power entered as [*numeric*][*prefix*]W or D.

- Relative Power entered as [*numeric*][*prefix*]pct or dB.
- Reset entered as *.

Rules:

- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency.

- Frequency entered as [*numeric*][*prefix*]H.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is not used.

MOD3

This field specifies the measurement type:

- ZR Zero sensor
- CP Zero and Calibrate sensor
- RS Set reference
- RL Relative
- RF RF Power

Rules:

- The MOD3 field may specify ZR or CP only for a Nominal Setup Test (MOD4 = N). However MEM is not updated when MOD3 is ZR or CP.
- When the MOD3 field is ZR, CP, RS, or RF, the Nominal field units must be watts "W" or dBm "D".
- When the MOD3 field is RL, Nominal field units must be percent "pct" or ratio "dB".
- When the Nominal field units are watts "W" or dBm "D" and no MOD3 field code is entered, RF is inserted automatically in the MOD3 field.
- When the Nominal field units are percent "pct" or ratio "dB" and no MOD3 field code is entered, RL is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies the input channel.

- CH1 Channel A

Rules:

- If no CON field code is specified, CH1 is automatically entered in the CON field.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
  STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
   1.001  ASK-   R     N              P     U                      F
 # Use MET/CAL's automatic connection message for connection to Power ref.
   1.002  ASK+                                                            V
 # Zero and Calibrate
   1.003  DISP         Connect the HP 8481A Power Sensor to the E4418B.
   1.004  MEMI         Enter sensor's reference calibration factor in percent.
   1.005  M4418        8481A          pct
   1.006  4418         1mW                          50MH              CP N
 # Turn off automatic connection messages
   1.007  ASK-   R   Q N              P     U                      F        V
 # Absolute Power Measurement: dBm
 # Assume factory default table for HP 8481A Power Sensor Data.
   1.008  M4418  F4    8481A
   1.009  DISP         Connect the 8481A to the 6060 RF Output.
   1.010  IEEE         [@6060]AP-30DB,FR100E6HZ
   1.011  4418         -30.00D        3.00U         100MH             RF
   2.001  IEEE         [@6060]AP10DB,FR100E6HZ
   2.002  4418         10.00D         1.00U         100MH             RF
 # Relative Power Measurement: dB
   3.001  IEEE         [@6060]AP10DB,FR100E6HZ
   3.002  4418         10.00D                       100MH             RS N
   3.003  IEEE         [@6060]AP0DB
   3.004  4418         -9.00dB        2.00U         100MH             RL
 # Absolute Power Measurement: Watts
   4.001  IEEE         [@6060]AP-30DB,FR100E6HZ[D2000]
   4.002  4418         1.00uW         25%           100MH             RF
   5.001  IEEE         [@6060]AP10DB,FR100E6HZ
   5.002  4418         10.00mW        5%            100MH             RF
 # Relative Power Measurement: %
   6.001  IEEE         [@6060]AP10DB,FR100E6HZ
   6.002  4418         10.00mW                      100MH             RS N
   6.003  IEEE         [@6060]AP0DB,FR100E6HZ
   6.004  4418         10.00pct       5%            100MH             RL
 # Filter: Off
   7.001  M4418        8481A
   7.002  IEEE         [@6060]AP-1DB,FR150E6HZ
   7.003  4418         -1.00D                       150MH             RF N
 # Filter: 1
   7.004  M4418  F1    8481A
   7.005  IEEE         [@6060]AP-1DB,FR150E6HZ
   7.006  4418         -1.00D                       150MH             RF N
```

```
# Filter: 1024
  7.007  M4418  F1024 8481A
  7.008  IEEE         [@6060]AP-2DB,FR150E6HZ
  7.009  4418         -2.000D                      150MH            RF N
```

 MET/CAL Procedure

```
=============================================================================
INSTRUMENT:            Agilent E441xA/B: Store 8480 Series Cal Factors IEEE
INSTRUMENT:            HP EPM-441A/442A: Store 8480 Series Cal Factors IEEE
DATE:                  2002-01-14
AUTHOR:                Fluke
REVISION:              $Revision: 1.13 $
ADJUSTMENT THRESHOLD:  70%
NUMBER OF TESTS:       1
NUMBER OF LINES:       120
CONFIGURATION:         Agilent E4419B
=============================================================================
#
# This procedure is used to store cal factors for an 8480 series power sensor
# in a E4418B, E4419B, E4418A (EPM-441A), or E4419A (EPM-442A) power meter.
#
# Source:
#   HP EPM-441A/442A Power Meters Programming Guide
#   HP Part No. E4418-90025, March 1998
#
# Compatibility:
#   MET/CAL 7.1 or later
#
# Subprocedure: None
#
# Registers Used:
#
#   M[1]
#     Number of cal factors to be entered (excluding ref cal factor).
#
#   MEM1
#     Cal factor counter
#
#   S[1]
#     Frequencies associated with cal factors.
#
#   S[2]
#     Ref Cal Factor and Cal Factors
#
```

```
#
# The cal factor table has the following format:
#
#   Frequency S[1]   Cal Factors S[2]
#   --------------   ----------------
#         --          ref cal factor
#    frequency 1       cal factor 1
#    frequency 2       cal factor 2
#    frequency 3       cal factor 3
#        .                  .
#        .                  .
#    frequency n       cal factor n
#
# The following rules apply:
#
#   The number of frequency points must be one less than the number of cal
#   points.  This is verified when the sensor calibration table is selected.
#
#   The frequencies must be in ascending order.
#
#   All frequencis are truncated to a multiple of 1 kHz.
#
#   Maximum of 81 cal points are allowed.
#
# Note, this procedure has no explict error checking of 441x remote commands.
# When used with MET/CAL 7.1 or later, configuring a E4418B or E4419B
# establishes the alias 441x.  If a command in an IEEE FSC in this procedure
# causes an error, it is caught by the SRQ handler in the MET/CAL 441x driver.
#
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON

  1.001  LABEL        ENTER_CAL_FACTOR_TABLE_NAME
  1.002  HEAD         ENTER CAL FACTOR TABLE NAME
  1.003  MEM2         Enter cal factor table name:
  1.004  IEEE         [@441x]MEM:TABLE:SELECT "[MEM2]"

  1.005  HEAD         ENTER REFERENCE CAL FACTOR
  1.006  MEMI         Enter reference cal factor in percent:
  1.007  MATH         S[2] = "MEM:TABLE:GAIN " & MEM & ","

  1.008  LABEL        ENTER_NUMBER_CAL_FACTORS
  1.009  HEAD         ENTER NUMBER CAL FACTORS
  1.010  MEMI         Enter number of cal factors:
  1.011  JMPL         CONTINUE_NUM_CAL_FACTORS      MEM <= 80
```

```
1.012  DISP       Number of cal factors must <= 80.
1.013  JMPL       ENTER_CAL_FACTOR

1.014  LABEL      CONTINUE_NUM_CAL_FACTORS
1.015  MATH       M[1] = MEM
1.016  MATH       M[2] = 0
1.017  MATH       S[1] = "MEM:TABLE:FREQ "
1.018  MATH       MEM1 = 1

1.019  LABEL      ENTER_CAL_FACTOR
1.020  MEMI       Enter frequency #[MEM1] in hertz:
1.021  JMPL       CONTINUE_CAL_FACTOR          MEM > M[2]
1.022  DISP       Frequencies must be entered in ascending order.
1.023  JMPL       ENTER_CAL_FACTOR

1.024  LABEL      CONTINUE_CAL_FACTOR
1.025  MATH       M[2] = MEM
1.026  MATH       S[1] = S[1] & MEM
1.027  MEMI       Enter cal factor #[MEM1] in percent:
1.028  MATH       S[2] = S[2] & MEM
1.029  MATH       MEM1 = MEM1 + 1
1.030  JMPL       STORE_CAL_FACTORS            MEM1 > M[1]
1.031  MATH       S[1] = S[1] & ","
1.032  MATH       S[2] = S[2] & ","
1.033  JMPL       ENTER_CAL_FACTOR

1.034  LABEL      STORE_CAL_FACTORS
1.035  IEEE       [@441x][SREG1]
1.035  IEEE       [@441x][SREG2]
1.036  DISP       Cal factors successfully stored.
1.037  JMPL       END

1.038  LABEL      ERROR
1.039  DISP       [MEM2]

1.040  LABEL      END
1.041  END
```

M4418

Auxiliary Instrument Setup FSC

Description

The M4418 FSC provides the additional program functions for Agilent E4418B and Agilent/HP E4418A (formally EPM-441A) which are not addressed by the 4418 FSC.

RANGE

This field specifies the filter.

- Number of readings to average entered as: F*average*.
- *blank* Filter Off

Rules:

- Legal values for *average* are: 1, 2, 4, 8,... 1024.
- When the RANGE field is blank filter is turned off.
- When the RANGE field specifies a filter, trigger delay is set to on. When the RANGE field is blank, trigger delay is set to off.

NOMINAL

This field specifies the power sensor model number.

Rules:

- Supported model numbers are:

  E4412A (formally ECP-E18A)
  E4413A (formally ECP-E26A)
  E9300A
  E9300B
  E9300H
  E9301A
  E9301B
  E9301H
  E9304A
  8481A
  8481B
  8481D
  8481H
  8482A

8482B
8482H
8483A
8484A
8485A
8485D
Q8486A
Q8486D
R8486A
R8486D
V8486A
W8486A
8487A
8487D

TOLERANCE

This field specifies the calibration factor or sensor calibration table name when the Nominal field specifies an 8480 series power sensor.

- Calibration Factor entered as: [*numeric*][*prefix*]pct.
- Sensor Calibration Table name: entered as: "*table name*"
- *blank* Nominal field specifies a E-series power sensor

Rules:

- The Tolerance field must be blank when the Nominal field specifies an E-series power sensor.
- Legal values for calibration factor are 0 to 100%.
- When the Tolerance field specifies only % ("pct"), no value, the cal factor is taken from memory register MEM.
- When Nominal field specifies an 8040 series power sensor and no cal. factor or sensor cal. table name is specified, the default table for the sensor is used (see E4418B Programming Manual).

MOD1

This field is not used.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

```
STEP    FSC    RANGE NOMINAL       TOLERANCE     MOD1         MOD2  3  4 CON
# ----- E-series power sensors -----
  1.001  M4418  F128  E4412A
# ----- 8480 series power sensors -----
  1.002  M4418  F512  8481A          99.72pct
# ----- 8480 series power sensors -----
  1.003  M4418  F512  8481A          "TBL_2"
```

Also see 4418 FSC.

4419

Instrument FSC

Description

The 4419 FSC programs the Agilent E4419B and Agilent/HP E4419A (formally EPM-442A) Power Meters.

Note

A single procedure may use up to 4 different power sensors on each channel during the course of procedure execution. A power sensor may not be swapped from channel A to channel B during procedure execution. Channel A and channel B can use the same model power sensor, however they must be physically unique assets.

When the power meter contains firmware with major revision 3 or later, the instrument driver uses the SERV:SENS[1|2]:TYPE? command to determine if the power sensor(s) specified in the most recently executed M4419 FSC is in fact connected to the power meter.

For E-Series power sensors, the command returns the actual power sensor model connected to the power meter. For 8480-Series power sensors only the suffix A, B, D, or H is returned so the check can only detect a sensor with an incorrect power range.

When ASK+ W or ASK+ V is specified, automatic connection messages for calibrating the power sensor include any required attenuators and adapters to properly connect the power sensor to the power meter POWER REF output.

If the E4419B is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the E4419B. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the E4419B must be set correctly before a procedure is executed. If the E4419B is connected to a standard serial port (COM1, COM2, ..., COM16), use the "Ports" application in the Windows Control Panel to choose the proper settings. If the E4419B is connected to the 5500A, 5520A, or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Function	4419 MOD3	4419 Nominal	4419 MOD1
RF Power (1)	RF	-70 dBm to +44 dBm	100 kHz to 110 GHz
	RF	100 pW to 25 W	100 kHz to 110 GHz
Zero sensor	ZR	0 W	100 kHz to 110 GHz
Zero and Cal. sensor	CP	1 μW to 1 mW	50 MHz
(1) Nominal (Power) and MOD1 (frequency) ranges depend upon the power sensor model used (see M4419 Nominal and MOD1 fields):			

Model	Power Range	Frequency Range
E-Series E441XA CW Power Sensors		
E4412A	-70 to +20 dBm (100 pW to 100 mW)	1 0 MHz to 18.0 GHz
E4413A	-70 to +20 dBm (100 pW to 100 mW)	50 MHz to 26.5 GHz
E-Series E9300 Average Power Sensors		
E9300A	-60 to +20 dBm (1 nW to 100 mW)	10 MHz to 18.0 GHz
E9301A	-60 to +20 dBm (1 nW to 100 mW)	10 MHz to 6.0 GHz
E9304A	-60 to +20 dBm (1 nW to 100 mW)	9 kHz to 6.0 GHz
E9300B	-30 to +44 dBm (1 μW to 25 W)	10 MHz to 18.0 GHz
E9301B	-30 to 44 dBm (1 μW to 25 W)	10 MHz to 6.0 GHz
E9300H	-50 to +30 dBm (10 nW to 1 W)	10 MHz to 18.0 GHz
E9301H	-50 to +30 dBm (10 nW to 1 W)	10 MHz to 6.0 GHz
8480-Series Power Sensors		
25 W Sensors		
8481B	0 to +44 dBm (1 mW to 25 W)	10 MHz to 18.0 GHz
8482B	0 to +44 dBm (1 mW to 25 W)	100 kHz to 4.2 GHz
3 W Sensors		
8481H	-10 to +35 dBm (100 μW to 3 W)	10MHz to 18.0 GHz
8482H	-10 to +35 dBm (100μW to 3 W)	100kHz to 4.2 GHz

Model	Power Range	Frequency Range
100 mW Sensors		
8481A	-30 to +20 dBm (1 µW to 100 mW)	10 MHz to 18.0 GHz
8482A	-30 to +20 dBm (1 µW to 100 mW)	100 kHz to 4.2 GHz
8483A	-30 to +20 dBm (1 µW to 100 mW)	100 kHz to 2.0 GHz
8485A	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 26.5 GHz
Opt 033	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 33 GHz
R8486A	-30 to +20 dBm (1 µW to 100 mW)	26.5 MHz to 40 GHz
Q8486A	-30 to +20 dBm (1µW to 100 mW)	33 MHz to 50 GHz
V8486A	-30 to +20 dBm (1µW to 100 mW)	50 GHz to 75 GHz
W8486A	-30 to +20 dBm (1 µW to 100 mW)	75 MHz to 110 GHz
8487A	-30 to +20 dBm (1 µW to 100 mW)	50 MHz to 50 GHz
10 µW High Sensitivity Sensors		
8481D	-70 to -20 dBm (100 pW to 10 µW)	10 MHz to 18.0 GHz
8484A	-70 to -20 dBm (100 pW to 10 µW)	10 MHz to 18.0 GHz
8485D	-70 to -20 dBm (100 pW to 10 µW)	50 MHz to 26.5 GHz
Opt 033	-70 to -20 dBm (100 pW to 10 µW)	50 MHz to 33 GHz
R8486D	-70 to -20 dBm (100 pW to 10 µW)	26.5 MHz to 40 GHz
Q8486D	-70 to -20 dBm (100 pW to 10 µW)	33 MHz to 50 GHz
8487D	-70 to -20 dBm (100 pW to 10 µW)	50 MHz to 50 GHz

Parameters

4419 FSC Nominal, MOD2, MOD3, CON Rules

Measurement	Nominal	MOD2	MOD3	CON
Zero A	W		ZR	CH1
Zero B	W		ZR	CH2
Zero & Cal A	W		CP	CH1
Zero & Cal B	W		CP	CH2
Power A (set ref)	W | D		RS	CH1
Power B (set ref)	W | D		RS	CH2
Power A (relative)	W | D		RL	CH1
Power B (relative)	W | D		RL	CH2
Power A (absolute)	W | D		RF	CH1
Power B (absolute)	W | D		RF	CH2
Difference A-B (set ref)	W | D	-D	RS	CH1
Difference B-A (set ref)	W | D	-D	RS	CH2
Difference A-B (relative)	W | D	-D	RL	CH1
Difference B-A (relative)	W | D	-D	RL	CH2
Difference A-B (absolute)	W | D	-D	RF	CH1
Difference B-A (absolute)	W | D	-D	RF	CH2
Ratio A/B (set ref)	dB | pct	RT	RS	CH1
Ratio B/A (set ref)	dB | pct	RT	RS	CH2
Ratio A/B (relative)	dB | pct	RT	RL	CH1
Ratio B/A (relative)	dB | pct	RT	RL	CH2
Ratio A/B (absolute)	dB | pct	RT	RF	CH1
Ratio B/A (absolute)	dB | pct	RT	RF	CH2
Note: Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.				

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- RF Power entered as [*numeric*][*prefix*]W or D.
- RF Power Difference entered as [*numeric*][*prefix*]W or D.
- RF Power Ratio entered as [*numeric*][*prefix*]pct or dB.
- Relative Power entered as [*numeric*][*prefix*]pct or dB.
- Relative Difference entered as [*numeric*][*prefix*]pct or dB.
- Relative Ratio entered as [*numeric*][*prefix*]pct or dB.
- RF Power entered as [*numeric*][*prefix*]W or D.
- Reset entered as *.

Rules:

- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency.

- Frequency entered as [*numeric*][*prefix*]H.
- *blank* not applicable

Rules:

- For difference and ratio measurements, the frequency of the channel A and channel B signals is presumed to be the same.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is used to specify a difference or ratio measurement.

- -D Difference A-B or B-A
- RT Ratio A/B or B/A
- *blank* not applicable

Rules:

- The MOD2 field must be blank except for difference and ratio measurements.
- If no MOD2 field code is specified and the Nominal field units are dB or pct, RT is automatically entered in the MOD2 field.

MOD3

This field specifies the measurement type:

- ZR Zero sensor
- CP Zero and Calibrate sensor
- RS Set reference
- R Relative
- RF Absolute

Rules:

- The MOD3 field may specify ZR or CP only for a Nominal Setup
- Test (MOD4 = N). However MEM is not updated when MOD3 is ZR or CP.
- When the MOD3 field is ZR, CP, RS, or RF, the Nominal field units must be watts "W" or dBm "D".
- When the MOD2 field is blank or -D and the MOD3 field is ZR, CP, RS, or RF, the Nominal field units must be watts "W" or dBm "D".
- When the MOD2 field is RT, Nominal field units must be percent "pct" or ratio "dB".
- When the MOD3 field is RL, Nominal field units must be percent "pct" or ratio "dB".
- When the Nominal field units are watts "W" or dBm "D" and no MOD3 field code is entered, RF is inserted automatically in the MOD3 field.
- When the Nominal field units are percent "pct" or ratio "dB" and no MOD3 field code is entered, RL is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies the input channel(s).

- CH1 Channel A
- CH2 Channel B

Rules:

- If no CON field code is specified, CH1 is automatically entered in the CON field.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  ASK-   R     N              P     U                     F
# Use MET/CAL's automatic connection message for connection to Power ref.
  1.002  ASK+                                                             V
# Zero and Calibrate (Ch A)
  1.003  DISP         Connect the HP 8481A Power Sensor to the E4419B Ch A.
  1.004  MEMI         Enter sensor's reference calibration factor in percent.
  1.005  M4419        8481A          pct
  1.006  4419         1mW                          50MH              CP N  CH1
# Turn off automatic connection messages
  1.007  ASK-   R   Q N              P     U                     F        V
# Absolute Power Measurement (Ch A): dBm
# Assume factory default table for HP 8481A Power Sensor Data.
  1.008  M4419  F4    8481A
  1.009  DISP         Connect the Ch A 8481A to the 6060 RF Output.
  1.010  IEEE         [@6060]AP-30DB,FR100E6HZ
  1.011  4419         -30.00D        3.00U         100MH             RF    CH1
  2.001  IEEE         [@6060]AP10DB,FR100E6HZ
  2.002  4419         10.00D         1.00U         100MH             RF    CH1
```

```
# Relative Power Measurement (Ch A): dB
  3.001  IEEE         [@6060]AP10DB,FR100E6HZ
  3.002  4419         10.00D                      100MH            RS N  CH1
  3.003  IEEE         [@6060]AP0DB
  3.004  4419         -9.00dB        2.00U        100MH            RL    CH1
# Absolute Power Measurement (Ch A): Watts
  4.001  IEEE         [@6060]AP-30DB,FR100E6HZ[D2000]
  4.002  4419         1.00uW         25%          100MH            RF    CH1
  5.001  IEEE         [@6060]AP10DB,FR100E6HZ
  5.002  4419         10.00mW        5%           100MH            RF    CH1
# Relative Power Measurement (Ch A): %
  6.001  IEEE         [@6060]AP10DB,FR100E6HZ
  6.002  4419         10.00mW                     100MH            RS N  CH1
  6.003  IEEE         [@6060]AP0DB,FR100E6HZ
  6.004  4419         10.00pct       5%           100MH            RL    CH1
# Filter (Ch A): Off
  7.001  M4419        8481A
  7.002  IEEE         [@6060]AP-1DB,FR150E6HZ
  7.003  4419         -1.00D                      150MH            RF N  CH1
# Filter (Ch A): 1
  7.004  M4419  F1    8481A
  7.005  IEEE         [@6060]AP-1DB,FR150E6HZ
  7.006  4419         -1.00D                      150MH            RF N  CH1
# Filter (Ch A): 1024
  7.007  M4419  F1024 8481A
  7.008  IEEE         [@6060]AP-2DB,FR150E6HZ
  7.009  4419         -2.000D                     150MH            RF N  CH1
# Use MET/CAL's automatic connection message for connection to Power ref.
  7.010  ASK+                                                            V
# Zero and Calibrate (Ch B)
  7.011  DISP         Connect the HP 8481A Power Sensor to the E4419B Ch B.
# Zero and Calibrate sensor
  7.012  MEMI         Enter sensor's reference calibration factor in percent.
  7.013  M4419        8481A          pct          8481A         pct
  7.014  4419         1mW                         50MH             CP N  CH2
# Turn off automatic connection messages
  7.015  ASK-   R   Q N              P     U                    F        V
# Absolute Power Measurement (Ch B): dBm
# Assume factory default table for HP 8481A Power Sensor Data.
  7.016  M4419  F4    8481A                       8481A
  7.017  DISP         Connect the Ch A 8481A to the 6060 RF Output.
  7.018  IEEE         [@6060]AP-20DB,FR100E6HZ
  7.019  4419         -20.00D        1.00U        100MH            RF    CH2
  8.001  IEEE         [@6060]AP0DB,FR100E6HZ
```

```
  8.002  4419         0.00D          1.00U         100MH              RF    CH2
# Relative Power Measurement (Ch B): dB
  9.001  IEEE         [@6060]AP10DB,FR100E6HZ
  9.002  4419         10.00D                       100MH              RS N  CH2
  9.003  IEEE         [@6060]AP0DB,FR100E6HZ
  9.004  4419         -9.00dB        2.00U         100MH              RL    CH2
# Absolute Power Measurement (Ch B): Watts
 10.001  IEEE         [@6060]AP-10DB,FR100E6HZ
 10.002  4419         100.0uW        5%            100MH              RF    CH2
 11.001  IEEE         [@6060]AP10DB,FR100E6HZ
 11.002  4419         10.00mW        5%            100MH              RF    CH2
# Relative Power Measurement (Ch B): %
 12.001  IEEE         [@6060]AP10DB,FR100E6HZ
 12.002  4419         10.00mW                      100MH              RS N  CH2
 12.003  IEEE         [@6060]AP0DB,FR100E6HZ
 12.004  4419         10.00pct       5%            100MH              RL    CH2
# Use MET/CAL's automatic connection message for connection to power ref.
 13.001  ASK+                                                               V
# Zero and Calibrate (Ch A)
 13.002  MEMI         Enter 8485A reference calibRation factor in percent.
 13.003  M4419        8485A          pct
 13.004  4419         1mW                          50MH               CP N  CH1
# Zero and Calibrate (Ch B)
 13.005  MEMI         Enter 8481A reference calibRation factor in percent.
 13.006  M4419        8485A          pct           8481A          pct
 13.007  4419         1mW                          50MH               CP N  CH2
# Turn off automatic connection messages
 13.008  ASK-   R   Q N              P     U                     F        V
 13.009  DISP         Connect Ch A 8485A to 9500 Ch1 Active Head.
 13.009  DISP         Connect Ch B 8481A to the 6060 RF Output.
# Assume factory default table for 8485A and 8481A Power Sensor Data.
 13.010  M4419  F4    8485A                        8481A
# Absolute Power Difference (Ch A - Ch B): dBm
 13.011  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 13.011  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 13.012  IEEE         [@6060]AP2DB,FR50E6HZ
 13.013  4419         9.25D          0.20U         50MH            -D RF    CH1
# Relative Power Difference (Ch A - Ch B): dB
 14.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 14.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 14.002  IEEE         [@6060]AP2DB,FR50E6HZ
 14.003  4419         9.54D                        50MH            -D RS N  CH1
 14.004  IEEE         [@6060]AP-10DB
 14.005  4419         0.71dB         0.20U         50MH            -D RL    CH1
```

```
# Absolute Power Difference (Ch B - Ch A): dBm
 15.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 15.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 15.002  IEEE         [@6060]AP12DB,FR50E6HZ
 15.003  4419         7.65D         0.20U         50MH          -D RF    CH2
# Relative Power Difference (Ch B - Ch A): dB
 16.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 16.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 16.002  IEEE         [@6060]AP12DB,FR50E6HZ
 16.003  4419         7.65D                       50MH          -D RS N  CH2
 16.004  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 16.004  IEEE         [@9500]VOLT 1;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 16.005  IEEE         [@6060]AP10DB
 16.006  4419         1.07dB        0.20U         50MH          -D RL    CH2
# Absolute Power Difference (Ch A - Ch B): Watts
 17.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 17.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 17.002  IEEE         [@6060]AP10DB,FR50E6HZ
 17.003  4419         0.00mW        0.20U         50MH          -D RF    CH1
# Relative Power Difference (Ch A - Ch B): %
 18.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 18.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 18.002  IEEE         [@6060]AP2DB,FR50E6HZ
 18.003  4419         8.41mW                      50MH          -D RS N  CH1
 18.004  IEEE         [@6060]AP-10DB
 18.005  4419         118pct        2%            50MH          -D RL    CH1
# Absolute Power Difference (Ch B - Ch A): Watts
 19.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 19.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 19.002  IEEE         [@6060]AP10DB,FR50E6HZ
 19.003  4419         0.00mW        0.20U         50MH          -D RF    CH2
# Relative Power Difference (Ch B - Ch A): Watts
 20.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 20.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 20.002  IEEE         [@6060]AP2DB,FR50E6HZ
 20.003  4419         -8.41mW                     50MH          -D RS N  CH2
 20.004  IEEE         [@6060]AP-10DB
 20.005  4419         118pct        2%            50MH          -D RL    CH2
# Absolute Power Ratio (Ch A / Ch B): dB
 21.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 21.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 21.002  IEEE         [@6060]AP2DB,FR50E6HZ
 21.003  4419         8.00dB        0.20U         50MH          RT RF    CH1
# Relative Power Ratio (Ch A / Ch B): dB
```

```
 22.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 22.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 22.002  IEEE         [@6060]AP2DB,FR50E6HZ
 22.003  4419         8.00dB                       50MH           RT RS N  CH1
 22.004  IEEE         [@6060]AP1DB
 22.005  4419         1.00dB        0.20U          50MH           RT RL    CH1
# Absolute Power Ratio (Ch B / Ch A): dB
 23.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 23.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 23.002  IEEE         [@6060]AP2DB,FR50E6HZ
 23.003  4419         -8.00dB       0.20U          50MH           RT RF    CH2
# Relative Power Ratio (Ch B / Ch A): dB
 24.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 24.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 24.002  IEEE         [@6060]AP2DB,FR50E6HZ
 24.003  4419         -8.00dB                      50MH           RT RS N  CH2
 24.004  IEEE         [@6060]AP1DB
 24.005  4419         -1.00dB       0.20U          50MH           RT RL    CH2
# Absolute Power Ratio (Ch A / Ch B): %
 25.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 25.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 25.002  IEEE         [@6060]AP7DB,FR50E6HZ
 25.003  4419         200pct        3%             50MH           RT RF    CH1
# Relative Power Ratio (Ch A / Ch B): %
 26.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 26.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 26.002  IEEE         [@6060]AP10DB,FR50E6HZ
 26.003  4419         100pct                       50MH           RT RS N  CH1
 26.004  IEEE         [@6060]AP7DB
 26.005  4419         200pct        3%             50MH           RT RL    CH1
# Absolute Power Ratio (Ch B / Ch A): %
 27.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 27.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 27.002  IEEE         [@6060]AP7DB,FR50E6HZ
 27.003  4419         49.8pct       3%             50MH           RT RF    CH2
# Relative Power Ratio (Ch B / Ch A): %
 28.001  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
 28.001  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
 28.002  IEEE         [@6060]AP10DB,FR50E6HZ
 28.003  4419         100pct                       50MH           RT RS N  CH2
 28.004  IEEE         [@6060]AP7DB
 28.005  4419         49.8pct       3%             50MH           RT RL    CH2

#
```

```
# This procedure shows how the ACCV2 and RSS2 MATH FSC functions can be used
# in conjunction with the ACC FSC to establish the system accuracy for a
# E4419B power ratio measurement.
#
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  ASK-         N              P                            F

  1.002  HEAD         ABSOLUTE POWER RATIO (Ch A / Ch B): %

# Select filter 16, Ch A E4412A, Ch B 8481A
  1.003  M4419  F16   E4412A                       8481A

  1.004  DISP         Connect E4412A power sensor to E4419B Channel A.
  1.004  DISP         Connect 8481A power sensor to E4419B Channel B.

# Zero and calibrate power sensors.
  1.005  4419         1mW                          50MH             CP N  CH1
  1.006  4419         1mW                          50MH             CP N  CH2

  1.007  ASK-                                                             V
  1.008  DISP         Connect Ch A 8485A to 9500 Ch1 Active Head.
  1.009  DISP         onnect Ch B 8481A to the 6060 RF Output.

# Set 9500B to 10mW
  1.010  IEEE         [@9500]FUNC SIN;:ROUT:SIGN:PATH CH1;IMP 50
  1.010  IEEE         [@9500]VOLT 2;:FREQ 50e6;:OUTP:STAT ON;*OPC?[I!]
# Set 6060B to 5mW
  1.011  IEEE         [@6060]AP7DB,FR50E6HZ

# Get E4419B power ratio measurement in percent.
  1.012  4419         200pct                       50MH          RT RF N  CH1

# Get E4419B spec for E4412A measuring 10mW, 50MHz with filter 16.
  1.013  MATH         S[1] = "Agilent E4419B"
  1.014  MATH         S[2] = "Watts E441XA F16"
  1.015  MATH         M[1] = ACCV2(S[1], S[2], 10e-3, 50e6)

# Convert to percent.
  1.016  MATH         M[1] = M[1] / 10e-3 * 100

# Get E4419B spec for 8481A measuring 5mW, 50MHz with filter 16.
  1.017  MATH         S[2] = "Watts 100mW F16"
  1.018  MATH         M[2] = ACCV2(S[1], S[2], 5e-3, 50e6)
```

```
# Convert to percent.
  1.019  MATH         M[2] = M[2] / 5e-3 * 100

# Compute E4419B ratio accuracy in percent.
  1.020  MATH         M[3] = RSS2(M[1], M[2])

  1.021  ACC          200pct         M3%
  1.022  MEMC         200pct         10%           50MH

#
# This procedure is used to store cal factors for an 8480 series power sensor
# in a E4418B, E4419B, E4418A (EPM-441A), or E4419A (EPM-442A) power meter.
#
# Source:
#   HP EPM-441A/442A Power Meters Programming Guide
#   HP Part No. E4418-90025, March 1998
#
# Compatibility:
#   MET/CAL 7.1 or later
#
# Subprocedure: None
#
# Registers Used:
#
#   M[1]
#     Number of cal factors to be entered (excluding ref cal factor).
#
#   MEM1
#     Cal factor counter
#
#   S[1]
#     Frequencies associated with cal factors.
#
#   S[2]
#     Ref Cal Factor and Cal Factors
#
#
# The cal factor table has the following format:
#
#   Frequency S[1]   Cal Factors S[2]
#   --------------   ----------------
#         --          ref cal factor
#    frequency 1       cal factor 1
#    frequency 2       cal factor 2
```

```
#    frequency 3       cal factor 3
#        .                  .
#        .                  .
#    frequency n       cal factor n
#
# The following rules apply:
#
#   The number of frequency points must be one less than the number of cal
#   points.  This is verified when the sensor calibration table is selected.
#
#   The frequencies must be in ascending order.
#
#   All frequencis are truncated to a multiple of 1 kHz.
#
#   Maximum of 81 cal points are allowed.
#
# Note, this procedure has no explict error checking of 441x remote commands.
# When used with MET/CAL 7.1 or later, configuring a E4418B or E4419B
# establishes the alias 441x.  If a command in an IEEE FSC in this procedure
# causes an error, it is caught by the SRQ handler in the MET/CAL 441x driver.
#
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON

  1.001  LABEL        ENTER_CAL_FACTOR_TABLE_NAME
  1.002  HEAD         ENTER CAL FACTOR TABLE NAME
  1.003  MEM2         Enter cal factor table name:
  1.004  IEEE         [@441x]MEM:TABLE:SELECT "[MEM2]"

  1.005  HEAD         ENTER REFERENCE CAL FACTOR
  1.006  MEMI         Enter reference cal factor in percent:
  1.007  MATH         S[2] = "MEM:TABLE:GAIN " & MEM & ","

  1.008  LABEL        ENTER_NUMBER_CAL_FACTORS
  1.009  HEAD         ENTER NUMBER CAL FACTORS
  1.010  MEMI         Enter number of cal factors:
  1.011  JMPL         CONTINUE_NUM_CAL_FACTORS      MEM <= 80
  1.012  DISP         Number of cal factors must <= 80.
  1.013  JMPL         ENTER_CAL_FACTOR

  1.014  LABEL        CONTINUE_NUM_CAL_FACTORS
  1.015  MATH         M[1] = MEM
  1.016  MATH         M[2] = 0
  1.017  MATH         S[1] = "MEM:TABLE:FREQ "
  1.018  MATH         MEM1 = 1
```

```
1.019  LABEL        ENTER_CAL_FACTOR
1.020  MEMI         Enter frequency #[MEM1] in hertz:
1.021  JMPL         CONTINUE_CAL_FACTOR          MEM > M[2]
1.022  DISP         Frequencies must be entered in ascending order.
1.023  JMPL         ENTER_CAL_FACTOR

1.024  LABEL        CONTINUE_CAL_FACTOR
1.025  MATH         M[2] = MEM
1.026  MATH         S[1] = S[1] & MEM
1.027  MEMI         Enter cal factor #[MEM1] in percent:
1.028  MATH         S[2] = S[2] & MEM
1.029  MATH         MEM1 = MEM1 + 1
1.030  JMPL         STORE_CAL_FACTORS            MEM1 > M[1]
1.031  MATH         S[1] = S[1] & ","
1.032  MATH         S[2] = S[2] & ","
1.033  JMPL         ENTER_CAL_FACTOR

1.034  LABEL        STORE_CAL_FACTORS
1.035  IEEE         [@441x][SREG1]
1.035  IEEE         [@441x][SREG2]
1.036  DISP         Cal factors successfully stored.
1.037  JMPL         END

1.038  LABEL        ERROR
1.039  DISP         [MEM2]

1.040  LABEL        END
1.041  END
```

M4419

Auxiliary Instrument Setup FSC

Description

The M4419 FSC provides the additional program functions for Agilent E4419B and Agilent/HP E4419A (formally EPM-442A) which are not addressed by the 4419 FSC.

RANGE

This field specifies the filter.

- Number of readings to average entered as: F*average*.
- *blank* Filter Off

Rules:

- Legal values for *average* are: 1, 2, 4, 8,... 1024.
- When the RANGE field is blank filter is turned off.
- When the RANGE field specifies a filter, trigger delay is set to on. When the RANGE field is blank, trigger delay is set to off.

NOMINAL

The Nominal field specifies the channel A power sensor model number.

Rules:

- Supported model numbers are:

  E4412A (formally ECP-E18A)
  E4413A (formally ECP-E26A)
  E9300A
  E9300B
  E9300H
  E9301A
  E9301B
  E9301H
  E9304A
  8481A
  8481B
  8481D
  8481H
  8482A

8482B
8482H
8483A
8484A
8485A
8485D
Q8486A
Q8486D
R8486A
R8486D
V8486A
W8486A
8487A
8487D

TOLERANCE

The Tolerance field specifies the channel A calibration factor or sensor calibration table name when the Nominal field specifies an 8480 series power

- Channel A Cal. Factor entered as: [*numeric*][*prefix*]pct.
- Channel A Sensor Cal. Table Name: entered as: "*table name*"
- *blank* Nominal field specifies a E-series power sensor

Rules:

- The Tolerance field must be blank when the Nominal field specifies an E-series power sensor.
- Legal values for calibration factor are 0 to 100%.
- When the Tolerance field specifies only % ("pct"), no value, the cal factor is taken from memory register MEM.
- When Nominal field specifies an 8040 series power sensor and the Tolerance field does not specify a cal. factor or sensor cal. factor name, the default table for the sensor is used (see E4419B Programming Manual).

MOD1

The MOD1 field specifies the channel B power sensor model number.

Rules:

- See Nominal field rules.

MOD2, MOD3, MOD4, & CON

The MOD2 through CON fields are combined and used to specify the channel B calibration factor or sensor calibration table name when the MOD1 field specifies an 8480 series power

- Channel B Cal. Factor entered as: [*numeric*][*prefix*]pct.
- Channel B Sensor Cal. Table Name: entered as: "*table name*"
- *blank* Nominal field specifies a E-series power sensor

Rules:

- The MOD2 through CON fields must be blank when the MOD1 field specifies an E-series power sensor.
- Legal values for calibration factor are 0 to 100%.
- When the MOD2 through CON fields specify only % ("pct"), no value, the cal factor is taken from memory register MEM.
- When MOD1 field specifies an 8040 series power sensor and the MOD2 through CON fields do not specify a cal. factor or sensor cal. factor name, the default table for the sensor is used (see E4418B Programming Manual).

Examples

```
 STEP    FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2  3  4 CON
# ----- E-series power sensors -----
  1.001  M4419  F128  E4412A                      E4413A
# ----- 8480 series power sensors -----
  1.002  M4419  F512  8481A         99.72pct      8485A          99.83pct
# ----- 8480 series power sensors -----
  1.002  M4419  F512  8481A         "TBL_2"       8485A          "TBL_3"
```

Also see 4419 FSC.

45

Instrument FSC

Description

The 45 FSC programs the Fluke 45 Dual Display Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, frequency, audio power, or decibels.

Note

If the 45 is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 45. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 45 must be set correctly before a procedure is executed. If the 45 is connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. If the 45 is connected to the 5500A, 5520A, or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

The 45 setting "Echo Off" must be used for serial control by MET/CAL.

Functional Capability

Function	45 Nominal	45 MOD1	45 MOD3	M45 Nominal
DC Voltage	-999.99 V to 999.99 V			
DC Voltage w/6 kV Probe	-6 kV to 6 kV		F	
DC Voltage w/40 kV Probe	+/-(1 kV to 40 kV)		G	
AC Voltage[1]	15 mV to 200 V 15 mV to 400 V 15 mV to 750 V	10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		
DC Current (100 mA Input)	-99.999 mA to 99.999 mA			
DC Current (10 A Input)	-9.9999 A to 9.9999 A		E	
AC Current (100 mA Input)	1.5 mA to 99.999 mA	20 Hz to 20 kHz		
AC Current (10 A Input)	0.5 A to 9.9999 A	20 Hz to 2 kHz	E	
Resistance	0 Ω to 98 M Ω			
Frequency	5 Hz to 20 kHz 5 Hz to 50 kHz 5 Hz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 mHz	30 mV to 750 V 30 mV to 400 V 30 mV to 200 V 100 mV to[1] 1 V to[1]		
Audio Power	10 mW to 999.99 W 10 mΩ to 999.99 Ω	*blank* (DC), 10 Hz to 100 kHz		2,4,8, or 16
dBm	-77.45 dBm to 86.99 dBm -9.49 dBm to 73.01 dBm -9.49 dBm to 79.03 dBm -9.49 dBm to 84.49 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		2 Ω 2 Ω 2 Ω 2 Ω
dBm	-80.46 dBm to 83.98 dBm -12.50 dBm to 70.00 dBm -12.50 dBm to 76.02 dBm -12.50 dBm to 81.48 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		4 Ω 4 Ω 4 Ω 4 Ω

Function	45 Nominal	45 MOD1	45 MOD3	M45 Nominal
dBm	-83.47 dBm to 80.97 dBm -15.51 dBm to 66.99 dBm -15.51 dBm to 73.01 dBm -15.51 dBm to 78.47 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		8 Ω 8 Ω 8 Ω 8 Ω
dBm	-86.48 dBm to 77.96 dBm -18.52 dBm to 63.98 dBm -18.52 dBm to 70.00 dBm -18.52 dBm to 75.46 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		16 Ω 16 Ω 16 Ω 16 Ω
dBm	-91.43 dBm to 73.01 dBm -23.47 dBm to 59.03 dBm -23.47 dBm to 65.05 dBm -23.47 dBm to 70.51 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		50 Ω 50 Ω 50 Ω 50 Ω
dBm	-93.19 dBm to 71.25 dBm -25.23 dBm to 57.27 dBm -25.23 dBm to 63.29 dBm -25.23 dBm to 68.75 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		75 Ω 75 Ω 75 Ω 75 Ω
dBm	-94.12 dBm to 70.32 dBm -26.16 dBm to 56.34 dBm -26.16 dBm to 62.36 dbm -26.16 dBm to 67.82 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 50 kHz		93 Ω 93 Ω 93 Ω 93 Ω
dBm	-94.85 dBm to 69.59 dbm -26.89 dBm to 55.61 dBm -26.89 dBm to 61.63 dBm -26.89 dBm to 67.09 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		110 Ω 110 Ω 110 Ω 110 Ω
dBm	-95.37 dBm to 69.07 dBm -27.41 dBm to 55.09 dBm -27.41 dBm to 61.11 dBm -27.41 dBm to 66.57 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		124 Ω 124 Ω 124 Ω 124 Ω
dBm	-95.41 dBm to 69.03 dBm -27.45 dBm to 55.05 dBm -27.45 dBm to 61.07 dBm -27.45 dBm to 66.53 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		125 Ω 125 Ω 125 Ω 125 Ω
dBm	-95.74 dBm to 68.70 dBm -27.78 dBm to 54.72 dBm -27.78 dBm to 60.74 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz		135 Ω 135 Ω 135 Ω

Function	45 Nominal	45 MOD1	45 MOD3	M45 Nominal
dBm	-27.78 dBm to 66.20 dBm	10 Hz to 20 kHz		135 Ω
	-96.20 dBm to 68.24 dBm	*blank* (DC)		150 Ω
	-28.24 dBm to 54.26 dBm	10 Hz to 100 kHz		150 Ω
	-28.24 dBm to 60.28 dBm	10 Hz to 50 kHz		150 Ω
	-28.24 dBm to 65.74 dBm	10 Hz to 20 kHz		150 Ω
dBm	-98.42 dBm to 66.02 dBm	*blank* (DC)		250 Ω
	-30.46 dBm to 52.04 dBm	10 Hz to 100 kHz		250 Ω
	-30.46 dBm to 58.06 dBm	10 Hz to 50 kHz		250 Ω
	-30.46 dBm to 63.52 dBm	10 Hz to 20 kHz		250 Ω
dBm	-99.21 dBm to 65.23 dBm	*blank* (DC)		300 Ω
	-31.25 dBm to 51.25 dBm	10 Hz to 100 kHz		300 Ω
	-31.25 dBm to 57.27 dBm	10 Hz to 50 kHz		300 Ω
	-31.25 dBm to 62.73 dBm	10 Hz to 20 kHz		300 Ω
dBm	-101.43 dBm to 63.01 dBm	*blank* (DC)		500 Ω
	-33.47 dBm to 49.03 dBm	10 Hz to 100 kHz		500 Ω
	-33.47 dBm to 55.05 dBm	10 Hz to 50 kHz		500 Ω
	-33.47 dBm to 60.51 dBm	10 Hz to 20 kHz		500 Ω
dBm	-102.22 dBm to 62.22 dBm	*blank* (DC)		600 Ω
	-34.26 dBm to 48.24 dBm	10 Hz to 100 kHz		600 Ω
	-34.26 dBm to 54.26 dBm	10 Hz to 50 kHz		600 Ω
	-34.26 dBm to 59.72 dBm	10 Hz to 20 kHz		600 Ω
dBm	-103.47 dBm to 60.97 dBm	*blank* (DC)		800 Ω
	-35.51 dBm to 46.99 dBm	10 Hz to 100 kHz		800 Ω
	-35.51 dBm to 53.01 dBm	10 Hz to 50 kHz		800 Ω
	-35.51 dBm to 58.47 dBm	10 Hz to 20 kHz		800 Ω
dBm	-103.98 dBm to 60.46 dBm	*blank* (DC)		900 Ω
	-36.02 dBm to 46.48 dBm	10 Hz to 100 kHz		900 Ω
	-36.02 dBm to 52.50 dBm	10 Hz to 50 kHz		900 Ω
	-36.02 dBm to 57.96 dBm	10 Hz to 20 kHz		900 Ω
dBm	-104.44 dBm to 60.00 dBm	*blank* (DC)		1 kΩ
	-36.48 dBm to 46.02 dBm	10 Hz to 100 kHz		1 kΩ
	-36.48 dBm to 52.04 dBm	10 Hz to 50 kHz		1 kΩ
	-36.48 dBm to 57.50 dBm	10 Hz to 20 kHz		1 kΩ
dBm	-105.23 dBm to 59.21 dBm	*blank* (DC)		1.2 kΩ
	-37.27 dBm to 45.23 dBm	10 Hz to 100 kHz		1.2 kΩ
	-37.27 dBm to 51.25 dBm	10 Hz to 50 kHz		1.2 kΩ
	-37.27 dBm to 56.71 dBm	10 Hz to 20 kHz		1.2 kΩ

Function	45 Nominal	45 MOD1	45 MOD3	M45 Nominal
dBm	-113.47 dBm to 50.97 dBm -45.51 dBm to 36.99 dBm -45.51 dBm to 43.01 dBm -45.51 dBm to 48.4 7 dBm	*blank* (DC) 10 Hz to 100 kHz 10 Hz to 50 kHz 10 Hz to 20 kHz		8 kΩ 8 kΩ 8 kΩ 8 kΩ
1. Volt-Hertz product not to exceed 1e6.				

Parameters

RANGE

This field specifies the UUT range as described in “General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Audio Power entered as: [*numeric*][*prefix*]W
- Current entered as [*numeric*][*prefix*]A
- Resistance entered as [*numeric*][*prefix*]Z
- Frequency entered as [*numeric*][*prefix*]H
- Reset entered as *

Rules:

- The NOMINAL field may specify audio power only when the M45 FSC specifies the reference impedance as 2, 4, 8, or 16 Ω.
- The NOMINAL field may specify decibels only when the M45 FSC specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency measurements. See the NOMINAL field specification for allowed values and units.

- Frequency entered as: *numeric*[*prefix*]H
- Voltage entered as: *numeric*[*prefix*]V
- *blank* not applicable

Rules:

- The MOD1 field may specify voltage only when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or the MOD3 field specifies "F" or "G".

MOD2

This field is not used.

MOD3

This field specifies one of the following:

- E Current measurement using the 10 A input
- F DC Voltage measurement using 6 kV probe
- G DC Voltage measurement using 40 kV probe
- *blank* field not applicable

Rules:

The MOD3 field may specify E only when the NOMINAL field specifies current.

- E is automatically inserted in the MOD3 field when current is specified in the NOMINAL field with a value greater than or equal to 100 mA.
- E may be specified for current lower than 100 mA to avoid connection changes.
- The MOD3 field may specify F or G only when the NOMINAL field specifies voltage.
- F is automatically inserted in the MOD3 field when DC Voltage is specified and the NOMINAL field value is greater than 1000 V and less than or equal to 6000 V.
- G is automatically inserted in the MOD3 field when DC Voltage is specified and the NOMINAL field value is greater than 6000 V.
- F or G may be specified at lower voltages to avoid connection changes.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection and is always 2-wire (2W). 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

T.U.R. Calculation

Calculation of the Test Uncertainty Ratio (T.U.R.) for a "45" statement which specifies decibels ("D") in the NOMINAL fields requires that the impedance from the "M45" statement be known. Because of this requirement, the compile time T.U.R. calculation in this case is not done until the "last pass" of the compiler runs. In other words, if you enter, using the MET/CAL editor, a "45" statement in which NOMINAL units are decibels and press Enter (or F8), no T.U.R. calculation will be done at that time. When you press F9 ("Next Error" function) to compile the entire procedure, the T.U.R. calculation will be done and a warning message, if appropriate, will be displayed.

Examples

```
  STEP   FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2  3   4 CON
# ----- Reset -----
  1.001  45           *                                                S
# ----- DC Voltage -----
  1.002  45     20    19.99mV       2% 0.04U                              2W
# ----- AC Voltage -----
  2.001  45     400   350.0mV       -2.8U +2.9U   60H                     2W
# ----- Decibels -----
  3.001  M45          50Z

  3.002  45           10D                         100H                 N  2W
# ----- Audio Power -----
  3.003  M45          8Z
  3.004  45           15W                         1kH                  N  2W
```

```
# ----- DC Current -----
  3.005  45     4000  3500mA         9U                            E     2W
# ----- AC Current -----
  4.001  45           35.00mA        0.37U         60H                   2W
# ----- Frequency -----
  5.001  45     1000  800.0H         0.1% 0.1U     300mV                 2W
# ----- Resistance -----
  6.001  45           390.0Z                                          S  2W
```

M45

Auxiliary Instrument Setup FSC

Description

The M45 FSC allows selection of the reference impedances supported by the Fluke 45 which cannot be specified in the 45 FSC MOD3 field.

Parameters

RANGE

This field is not used.

NOMINAL

This field specifies the reference impedance entered as: *numeric*[*prefix*]Z.

Allowed values are:

`2Ω, 4Ω, 8Ω, 16Ω, 93Ω, 110Ω, 124Ω, 125Ω, 135Ω, 150Ω, 250Ω, 500Ω, 800Ω, 900Ω, 1 kΩ, 1.2 kΩ, and 8 kΩ.`

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

4700

Instrument FSC

Description

The 4700 FSC controls the following functions of the Datron 4700 Multifunction Calibrator:

- DC Voltage
- AC Voltage
- DC Current with Option 20
- AC Current with Option 20
- Resistance with Option 20
- DC Current from the 4600 Transconductance Amplifier
- AC Current from the 4600 Transconductance Amplifier

The M4700 FSC is used for controlling the following:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Note

The 4700 FSC can also be used to control a 4800, 4800A 4707, 4708, or 4808. The accuracy file corresponding to the instrument that is actually configured is used at run time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.9999 V to 199.99999 V -1100 V to 1100 V[1]		
AC Voltage	90 µV to 19.99999 V 90 µV to 199.9999 V 90 µV to 1100 V[1]	10 Hz to 1 MHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
DC Current	-1.999999 A to 1.999999 A[2] -11 A to 11 A[3,2]		BC
AC Current	9 µA to 1.999999 A[2] 100 mA to 11 A[3,2]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance [2]	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		

1. Requires Option 10, 1000 V Ranges (DCV & ACV)
2. Requires Option 20, DC Current, AC Current, and Resistance Functions
3. Requires Option 60, 4600 Transconductance Amplifier

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as:
- [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.
- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify negative zero for DC Voltage or DC Current.

- -Z Negative Zero
- *blank* All other amplitudes

Rules:

- The MOD2 field may specify Z only for DC Voltage or DC Current when the Nominal value is zero.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- *blank* No boost or not applicable

Rules:

If the current can be created only by the Boost Amplifier, BC is inserted automatically.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance, and DC Voltage and AC Voltage >= 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4700		*					S	
1.002	4700	1000	1100V	1U 1/					2W
2.001	4700	10	0V	1U					2W
3.001	4700	200	220mV	10%	50H				2W
4.001	4700	1000	1100V	1U	1kH				4W
5.001	4700	100	-22uA	10%					2W
6.001	4700	2	1.999A	1% 1/	1kH				2W
7.001	4700	A	mV	0.1U	50H				2W
8.001	4700	A	A	5%	1kH				2W
9.001	4700		1.999A		1kH			S	2W
9.002	4700	10	20mV		500H			N	2W
9.003	4700	10	20mV	0.5%	1kH			C	2W
10.001	4700	A	10Z	5%					4W

M4700

Auxiliary Instrument Setup FSC

Description

The M4700 FSC is used for controlling range locking, safety delay override, and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V, A, or Z
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4000 statement is entered.

- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 µV to 100 µV	100 µV DC, 1 mV AC
> 100 µV to 1 mV	1 mV
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µA to 100 µA	100 µA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1A	1 A
0 Ωs to 10 Ωs	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ
> 10 MΩ to 100 MΩ	100 MΩ

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.his field is not used.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay
- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4700 to standby for each 4700 statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS.
- MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performance by implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4700 FSC Execution Sequence
blank	Set the Safety Delay Override to Off (safety delay active). Set the 4700 to standby. Setup the 4700 to the desired state; function, range, etc. Set the 4700 to operate and wait for the Output On SRQ. Wait an additional delay as defined below.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4700 to the desired state; function, range, etc. Set the 4700 to operate. If DCV or ACV > 110V wait 3 seconds. Wait an additional delay as defined below.
D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4700 to the desired state; function, range, etc. Set the 4700 to operate. Wait an additional delay as defined below.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4700 to the desired state; function, range, etc. Set the 4700 to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

Additional Settling Delay
MOD2 *blank*, D0, & D1

DC Voltage, DC Current, & Resistance	**wait 1 second**
AC Voltage & AC Current:	
frequency <= 33Hz	**wait 10 seconds**
frequency <= 330Hz	**wait 3 seconds**
otherwise	**wait 1 second**

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4000 FSC.

4705

Instrument FSC

Description

The 4705 FSC controls the following functions of the Datron 4705 Multifunction Calibrator:

- DC Voltage
- AC Voltage
- DC Current
- AC Current
- Resistance
- DC Current from the 4600 Transconductance Amplifier
- AC Current from the 4600 Transconductance Amplifier

The M4705 FSC is used for controlling the following:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Note

The 4705 FSC can also be used to control 4700, 4800, 4800A, 4707, 4708, or 4808. The accuracy file corresponding to the instrument that is actually configured is used at run time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-1100 V to 1100 V		
AC Voltage	90 µV to 199.9999 V 90 µV to 1100 V	10 Hz to 100 kHz 45 Hz to 33 kHz	
DC Current	-1.99999 A to 1.99999 A -11 A to 11 A[1]		BC
AC Current	9 µA to 1.99999 A 100 mA to 11 A[1]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		
1. Requires 4600 Transconductance Amplifier.			

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.
- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify negative zero for DC Voltage or DC Current.

- -Z Negative Zero
- *blank* All other amplitudes

Rules:

- The MOD2 field may specify Z only for DC Voltage or DC Current when the Nominal value is zero.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- *blank* No boost or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance, and DC Voltage and AC Voltage >= 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of the this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4705		*					S	
1.002	4705	1000	1100V	1U 1/					2W
2.001	4705	10	0V	1U					2W
3.001	4705	200	220mV	10%	50H				2W
4.001	4705	1000	1100V	2U	1kH				4W
5.001	4705	100	-22uA	10%					2W
6.001	4705	2	1.999A	1% 1/	1kH				2W
7.001	4705	A	mV	0.1U	50H				2W
8.001	4705	A	A	5%	1kH				2W
9.001	4705		1.999A		1kH			S	2W
9.002	4705	10	20mV		500H			N	2W
9.003	4705	10	20mV	1%	1kH			C	2W
10.001	4705	A	10Z	5%					4W

M4705

Auxiliary Instrument Setup FSC

Description

The M4705 FSC is used for controlling range locking, safety delay override, and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* Field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V, A, or Z
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4000 statement is entered.
- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 µV to 100 µV	100 µV DC, 1 mV AC
> 100 µV to 1 mV	1 mV
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µA to 100 µA	100 µA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1A	1 A
0 Ω to 10 Ω	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ
> 10 MΩ to 100 MΩ	100 MΩ

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay
- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4705 to standby for each 4705 statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS.
- MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performance by implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4705 FSC Execution Sequence
blank	Set the Safety Delay Override to Off (safety delay active). Set the 4705 to standby. Setup the 4705 to the desired state; function, range, etc. Set the 4705 to operate and wait for the Output On SRQ. Wait an additional delay as defined below.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4705 to the desired state; function, range, etc. Set the 4705 to operate. If DCV or ACV > 110V wait 3 seconds. Wait an additional delay as defined below.
D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4705 to the desired state; function, range, etc. Set the 4705 to operate. Wait an additional delay as defined below.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4705 to the desired state; function, range, etc. Set the 4705 to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

Additional Settling Delay
MOD2 *blank*, D0, & D1

DC Voltage, DC Current, & Resistance	**wait 1 second**
AC Voltage & AC Current:	
frequency <= 33Hz	**wait 10 seconds**
frequency <= 330Hz	**wait 3 seconds**
otherwise	**wait 1 second**

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4000 FSC.

4707

Instrument FSC

Description

The 4707 FSC controls the following functions of the Datron 4707 Multifunction Calibrator:

- DC Voltage
- AC Voltage
- DC Current with Option 27
- AC Current with Option 27
- Resistance with Option 27
- DC Current from the 4600 Transconductance Amplifier
- AC Current from the 4600 Transconductance Amplifier

The M4707 FSC is used for controlling the following:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Note

The 4707 FSC can also be used to control a 4708 or 4808. The accuracy file corresponding to the instrument that is actually configured is used at run time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.9999 V to 199.99999 V -1100 V to 1100 V [1]		
AC Voltage	90 µV to 19.99999 V 90 µV to 199.9999 V 90 µV to 1100 V [1]	10 Hz to 1 MHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
DC Current	-1.999999 A to 1.999999 A [2] -11 A to 11 A [2,3]		BC
AC Current	9 µA to 1.999999 A [2] 100 mA to 11 A [2,3]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance [2]	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		

1. Requires Option 17, 1000 V Ranges (DCV & ACV).
2. Requires Option 27, DC Current, AC Current, and Resistance Functions.
3. Requires Option 60, 4600 Transconductance Amplifier.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as:
  [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals:

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.
- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify negative zero for DC Voltage or DC Current.

- -Z Negative Zero
- *blank* All other amplitudes

Rules:

- The MOD2 field may specify Z only for DC Voltage or DC Current when the Nominal value is zero.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- *blank* No boost or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance, and DC Voltage and AC Voltage >= 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4700		*					S	
1.002	4700	1000	1100V	1U 1/					2W
2.001	4700	10	0V	1U					2W
3.001	4700	200	220mV	10%	50H				2W
4.001	4700	1000	1100V	2U	1kH				4W
5.001	4700	100	-22uA	10%					2W
6.001	4700	2	1.999A	1% 1/	1kH				2W
7.001	4700	A	mV	0.1U	50H				2W
8.001	4700	A	A	5%	1kH				2W
9.001	4700		1.999A		1kH			S	2W
9.002	4700	10	20mV		500H			N	2W
9.003	4700	10	20mV	1%	1kH			C	2W
10.001	4700	A	10Z	5%					4W

M4707

Auxiliary Instrument Setup FSC

Description

The M4707 FSC is used for controlling range locking, safety delay override, and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK   Range Lock
- *blank*   Field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V, A, or Z
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4000 statement is entered.
- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 µV to 100 µV	100 µV DC, 1 mV AC
> 100 µV to 1 mV	1 mV
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µA to 100 µA	100 µA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1A	1 A
0 Ω to 10 Ω	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ
> 10 MΩ to 100 MΩ	100 MΩ

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay

- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4707 to standby for each 4707 statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS.
- MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performanceby implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4707 FSC Execution Sequence
<blank>	Set the Safety Delay Override to Off (safety delay active). Set the 4707 to standby. Setup the 4707 to the desired state; function, range, etc. Set the 4707 to operate and wait for the Output On SRQ. Wait an additional delay as defined below.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4707 to the desired state; function, range, etc. Set the 4707 to operate. If DCV or ACV > 110V wait 3 seconds. Wait an additional delay as defined below.
D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4707 to the desired state; function, range, etc. Set the 4707 to operate. Wait an additional delay as defined below.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4707 to the desired state; function, range, etc. Set the 4707 to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

Additional Settling Delay
MOD2 <blank>, D0, & D1

DC Voltage, DC Current, & Resistance	**wait 1 second**
AC Voltage & AC Current:	
frequency <= 33Hz	**wait 10 seconds**
frequency <= 330Hz	**wait 3 seconds**
otherwise	**wait 1 second**

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4000 FSC.

4708

Instrument FSC

Description

The 4708 FSC controls the following functions of the Datron 4708 Multifunction Calibrator:

- DC Voltage with Option 10 installed
- AC Voltage with Option 20 installed
- DC Current with Option 30 and Option 10 installed
- AC Current with Option 30 and Option 20 installed
- Resistance with Option 30 and Option 10 or 20 installed
- DC Current from the 4600 Transconductance Amplifier
- AC Current from the 4600 Transconductance Amplifier

The M4708 FSC is used for controlling the following:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Note

The 4708 FSC can also be used to control a 4808. The accuracy file corresponding to the instrument that is actually configured is used at run time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage [1]	-1100 V to 1100 V		
AC Voltage [2]	90 µV to 19.99999 V 90 µV to 100.0000 V 90 µV to 750 V 90 µV to 1100 V	10 Hz to 1 MHz 10 Hz to 200 kHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
DC Current	-1.99999 A to 1.99999 A [1,3] -11 A to 11 A [1,3,4]		 BC
AC Current	9 µA to 1.99999 A [2,3] 100 mA to 11 A [2,3,4]	10 Hz to 5 kHz 10 Hz to 20 kHz	 BC
Resistance or Conductance [3]	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		

1. Requires Option 10, DC Voltage
2. Requires Option 20, AC Voltage
3. Requires Option 30, Ohms and Current
4. Requires 4600 Transconductance Amplifier

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage or current.
- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify negative zero for DC Voltage or DC Current.

- -Z Negative Zero
- *blank* All other amplitudes

Rules:

- The MOD2 field may specify Z only for DC Voltage or DC Current when the Nominal value is zero.

MOD3

This field specifies one of the following:

- BC   use 4600 for current boost
- *blank*   no boost or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W   2-wire
- 4W   4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may specify 4W only for resistance, conductance, and DC Voltage and AC Voltage >= 200 mV.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4708		*					S	
1.002	4708	1000	1100V	1U 1/					2W
2.001	4708	10	0V	1U					2W
3.001	4708	200	220mV	10%	50H				2W
4.001	4708	1000	1100V	1U	1kH				4W
5.001	4708	100	-22uA	10%					2W
6.001	4708	2	1.999A	1% 1/	1kH				2W
7.001	4708	A	mV	0.1U	50H				2W
8.001	4708	A	A	5%	1kH				2W
9.001	4708		1.999A		1kH			S	2W
9.002	4708	10	20mV		500H			N	2W
9.003	4708	10	20mV	0.5%	1kH			C	2W
10.001	4708	A	10Z	5%					4W

M4708

Auxiliary Instrument Setup FSC

Description

The M4708 FSC is used for range locking, safety delay override, and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* Field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V, A, or Z
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4000 statement is entered.
- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 µV to 100 µV	100 µV DC, 1 mV AC
> 100 µV to 1 mV	1 mV
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µA to 100 µA	100 µA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1A	1 A
0 Ω to 10 Ω	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ
> 10 MΩ to 100 MΩ	100 MΩ

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay
- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4708 to standby for each 4708 statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS.
- MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performance by implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4708 FSC Execution Sequence
blank	Set the Safety Delay Override to Off (safety delay active). Set the 4708 to standby. Setup the 4708 to the desired state; function, range, etc. Set the 4708 to operate and wait for the Output On SRQ. Wait an additional delay as defined below.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4708 to the desired state; function, range, etc. Set the 4708 to operate. If DCV or ACV > 110V wait 3 seconds. Wait an additional delay as defined below.
D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4708 to the desired state; function, range, etc. Set the 4708 to operate. Wait an additional delay as defined below.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4708 to the desired state; function, range, etc. Set the 4708 to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

Additional Settling Delay
MOD2 *blank*, D0, & D1

DC Voltage, DC Current, & Resistance wait 1 second

AC Voltage & AC Current:

frequency <= 33Hz	**wait 10 seconds**
frequency <= 330Hz	**wait 3 seconds**
otherwise	**wait 1 second**

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4000 FSC.

4800

Instrument FSC

Description

The 4800 FSC controls the following functions of the Datron 4800 Multifunction Calibrator:

- DC Voltage with Option 10 installed
- AC Voltage with Option 20 installed
- DC Current with Option 40 and Option 10 installed
- AC Current with Option 40 and Option 20 installed
- Resistance with Option 50 and Option 10 or 20 installed
- DC Current from the 4600 Transconductance Amplifier (Option 60 with Option 40 and Option 10 installed in 4800)
- AC Current from the 4600 Transconductance Amplifier (Option 60 with Option 40 and Option 20 installed in 4800)
- Wideband AC Voltage with Option 70 installed

Note

The 4800 FSC can also be used to control a 4800A, 4707, 4708, or 4808. The accuracy file corresponding to the instrument that is actually configured is used at run time.

The M4800 FSC is used for controlling the following:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.99999 V to 199.99999 V [1] -1100 V to 1100 V [1,3]		
AC Voltage	90 µV to 19.99999 V[2] 90uV to 199.9999V[2] 100 µV to 1100 V[2,3]	10 Hz to 1 MHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
Note *The maximum voltage increases linearly from 199.9999 V at 10 Hz to 1100 V at 40 Hz.*			
DC Current	-1.99999 A to 1.99999 A [1,4] -11 A to 11 A [1,4,6]		BC
AC Current	9 µA to 1.99999 A [2,4] 100 mA to 11 A[2,4,6]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance [5 & 1 or 2]	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		
Wideband ACV [7]	300 µV to 3.5 V	10 Hz to 30 MHz	W

1. Requires Option 10, DC Voltage
2. Requires Option 20, AC Voltage
3. Requires Option 30, 1000V Range
4. Requires Option 40, Current
5. Requires Option 50, Resistance
6. Requires Option 60, 4600 Transconductance Amplifier
7. Requires Option 70, Wideband ACV

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify negative zero for DC Voltage or DC Current.

- -Z Negative Zero
- *blank* All other amplitudes

Rules:

- The MOD2 field may specify Z only for DC Voltage or DC Current when the Nominal value is zero.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- W use Option 70, Wideband output for AC Voltage
- *blank* No boost, wideband, or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.
- If the amplitude and frequency combination can only be created using Option 70, Wideband AC Voltage, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may not specify 4W when any of the following conditions exist:

1. DC Current
2. AC Current
3. AC or DC Voltage less than 200 mV

Use of Standard Memory Locations And Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4800		*					S	
1.002	4800	1000	1100V	1U 1/					2W
2.001	4800	10	0V	1U					2W
3.001	4800	200	220mV	10%	50H				2W
4.001	4800	1000	1100V	1U	1kH				4W
5.001	4800	100	-22uA	10%					2W
6.001	4800	2	1.999A	1% 1/	1kH				2W
7.001	4800	A	mV	0.1U	50H				2W
8.001	4800	A	A	5%	1kH				2W
9.001	4800		1.999A		1kH			S	2W
9.002	4800	10	20mV		500H			N	2W
9.003	4800	10	20mV	0.5%	1kH			C	2W
10.001	4800	A	10Z	5%					4W

M4800

Auxiliary Instrument Setup FSC

Description

The M4800 FSC is used for control range locking, safety delay override, and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* Field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V, A, or Z
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4000 statement is entered.
- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 µV to 100 µV	100 µV DC, 1 mV AC
> 100 µV to 1 mV	1 mV
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µA to 100 µA	100 µA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1A	1 A
0 Ω to 10 Ω	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ
> 10 MΩ to 100 MΩ	100 MΩ

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay
- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4800 to standby for each 4800 statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS.
- MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performance by implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4800 FSC Execution Sequence
<blank>	Set the Safety Delay Override to Off (safety delay active). Set the 4800 to standby Setup the 4800 to the desired state; function, range, etc. Set the 4800 to operate and wait for the Output On SRQ. Wait an additional delay as defined below.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4800 to the desired state; function, range, etc. Set the 4800 to operate. If DCV or ACV > 110V wait 3 seconds. Wait an additional delay as defined below.
D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4800 to the desired state; function, range, etc. Set the 4800 to operate. Wait an additional delay as defined below.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4800 to the desired state; function, range, etc. Set the 4800 to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

Additional Settling Delay
MOD2 <blank>, D0, & D1

DC Voltage, DC Current, & Resistance: wait 1 second

AC Voltage & AC Current

frequency <= 33Hz:	**wait 10 seconds**
frequency <= 330Hz:	**wait 3 seconds**
otherwise:	**wait 1 second**

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4000 FSC.

4800A

Instrument FSC

Description

The 4800A FSC controls the following functions of the Datron 4800A MultifunctionCalibrator:

- DC Voltage
    - AC Voltage
    - DC Current
    - AC Current
    - Resistance
    - DC Current from the 4600 Transconductance Amplifier (Option 60)
    - AC Current from the 4600 Transconductance Amplifier (Option 60)
    - Wideband AC Voltage with Option 70 installed

The M4800A FSC is used for controlling the following:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Note

The 4800A FSC can also be used to control a 4707, 4708, or 4808. The accuracy file corresponding to the instrument that is actually configured is used at run time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.99999 V to 199.99999 V -1100 V to 1100 V		
AC Voltage[3]	90 µV to 19.99999 V 90 µV to 199.9999 V 100 µV to 1100 V	10 Hz to 1 MHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
DC Current	-1.99999 A to 1.99999 A -11 A to 11 A[1]		 BC
AC Current	9 µA to 1.99999 A 100 mA to 11 A[1]	10 Hz to 5 kHz 10 Hz to 20 kHz	 BC
Resistance or Conductance	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		
Wideband ACV	300 µV to 3.5 V[2]	10 Hz to 30 MHz	W

1. Requires Option 60, 4600 Transconductance Amplifier
2. Requires Option 70, Wideband ACV
3. The maximum voltage increases linearly from 199.9999 V at 10 Hz to 1100 V at 40 Hz.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as:[*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*] V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify negative zero for DC Voltage or DC Current.

- -Z Negative Zero
- *blank* All other amplitudes

Rules:

- The MOD2 field may specify Z only for DC Voltage or DC Current when the Nominal value is zero.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- W use Option 70, Wideband output for AC Voltage
- *blank* No boost, wideband, or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.
- If the amplitude and frequency combination can only be created using Option 70, Wideband AC Voltage, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2W 2-wire

4W 4-wire

Rules:

2W is automatically entered in the CON field when no CON field code is entered.

The CON field may not specify 4W when any of the following conditions exist:

1. DC Current
2. AC Current
3. AC or DC Voltage less than 200 mV

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of the MET/CAL Reference Manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4800A		*					S	
1.002	4800A	1000	1100V	1U 1/					2W
2.001	4800A	10	0V	1U					2W
3.001	4800A	200	220mV	10%	50H				2W
4.001	4800A	1000	1100V	1U	1kH				4W
5.001	4800A	100	-22uA	10%					2W
6.001	4800A	2	1.999A	1% 1/	1kH				2W
7.001	4800A	A	mV	0.1U	50H				2W
8.001	4800A	A	A	5%	1kH				2W
9.001	4800A		1.999A		1kH			S	2W
9.002	4800A	10	20mV		500H			N	2W
9.003	4800A	10	20mV	0.5%	1kH			C	2W
10.001	4800A	A	100Z	5%					4W
11.001	END								

M4800A

Auxiliary Instrument Setup FSC

Description

The M4800A FSC is used for controlling range locking, safety delay override, and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* Field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V, A, or Z
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4000 statement is entered.
- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 µV to 100 µV	100 µV DC, 1 mV AC
> 100 µV to 1 mV	1 mV
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µA to 100 µA	100 µA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1A	1 A
0 Ω to 10 Ω	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ
> 10 MΩ to 100 MΩ	100 MΩ

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay

- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4800A to standby for each 4800A statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS.
- MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performance by implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4800A FSC Execution Sequence
blank	Set the Safety Delay Override to Off (safety delay active). Set the 4800A to standby. Setup the 4800A to the desired state; function, range, etc. Set the 4800A to operate and wait for the Output On SRQ. Wait an additional delay as defined below.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4800A to the desired state; function, range, etc. Set the 4800A to operate. If DCV or ACV > 110V wait 3 seconds. Wait an additional delay as defined below.
D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4800A to the desired state; function, range, etc. Set the 4800A to operate. Wait an additional delay as defined below.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4800A to the desired state; function, range, etc. Set the 4800A to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

Additional Settling Delay
MOD2 *blank*, D0, & D1

DC Voltage, DC Current, & Resistance: wait 1 second

AC Voltage & AC Current

frequency <= 33Hz:	**wait 10 seconds**
frequency <= 330Hz:	**wait 3 seconds**
otherwise:	**wait 1 second**

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4000 FSC.

4805

Instrument FSC

Description

The 4805 FSC controls the following functions of the Datron 4805 Multifunction Calibrator:

- DC Voltage
- AC Voltage
- DC Current
- AC Current
- Resistance
- DC Current from the 4600 Transconductance Amplifier (Option 60)
- AC Current from the 4600 Transconductance Amplifier (Option 60)
- Wideband AC Voltage with Option 70 installed

The M4805 FSC is used for controlling the following:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Note

The 4805 FSC can be used to control any 4700 series or 4800 series calibrator. The accuracy file corresponding to the instrument that is actually configured is used at the time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-1100 V to 1100 V		
AC Voltage	90 µV to 199.9999 V 90 µV to 1100 V	10 Hz to 100 kHz 10 Hz to 33 kHz	
Note *The maximum voltage increases linearly from 199.9999 V at 10 Hz to 1100 V at 40 Hz.*			
DC Current	-1.99999 A to 1.99999 A -11 A to 11 A[1]		BC
AC Current	9 µA to 1.99999 A 900 mA to 11 A[1]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps)		
Wideband ACV [2]	300 µV to 3.5 V	10 Hz to 30 MHz	W
1. Requires Option 60, 4600 Transconductance Amplifier 2. Requires Option 70, Wideband ACV 3. Maximum voltage = 30 x freq - 100			

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify negative zero for DC Voltage or DC Current.

- -Z Negative Zero
- *blank* All other amplitudes

Rules:

- The MOD2 field may specify Z only for DC Voltage or DC Current when the Nominal value is zero.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- W use Option 70, Wideband output for AC Voltage
- *blank* No boost, wideband, or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.
- If the amplitude and frequency combination can only be created using Option 70, Wideband AC Voltage, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may not specify 4W when any of the following conditions exist:
  1. DC Current
  2. AC Current
  3. AC or DC Voltage less than 200 mV

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4805		*					S	
1.002	4805	1000	1100V	1U 1/					2W
2.001	4805	10	0V	1U					2W
3.001	4805	200	220mV	10%	50H				2W
4.001	4805	1000	1100V	3U	1kH				4W
5.001	4805	100	-22uA	10%					2W
6.001	4805	2	1.999A	1% 1/	1kH				2W
7.001	4805	A	mV	0.1U	50H				2W
8.001	4805	A	A	5%	1kH				2W
9.001	4805		1.999A		1kH			S	2W
9.002	4805	10	20mV		500H			N	2W
9.003	4805	10	20mV	1%	1kH			C	2W
10.001	4805	A	1kZ	5%					4W

M4805

Auxiliary Instrument Setup FSC

Description

The M4805 FSC is used for controlling range locking, safety delay override, and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* Field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V, A, or Z
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4000 statement is entered.
- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 µV to 100 µV	100 µV DC, 1 mV AC
> 100 µV to 1 mV	1 mV
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µA to 100 µA	100 µA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA

> 100 mA to 1A	1 A
0 Ω to 10 Ω	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ
> 10 MΩ to 100 MΩ	100 MΩ

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay
- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4805 to standby for each 4805 statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS.
- MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performance by implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4805 FSC Execution Sequence
blank	Set the Safety Delay Override to Off (safety delay active). Set the 4805 to standby.

	Setup the 4805 to the desired state; function, range, etc. Set the 4805 to operate and wait for the Output On SRQ. Wait an additional delay as defined below.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4805 to the desired state; function, range, etc. Set the 4805 to operate. If DCV or ACV > 110V wait 3 seconds. Wait an additional delay as defined below.
D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4805 to the desired state; function, range, etc. Set the 4805 to operate. Wait an additional delay as defined below.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4805 to the desired state; function, range, etc. Set the 4805 to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

Additional Settling Delay
MOD2 *blank*, D0, & D1

DC Voltage, DC Current, & Resistance:	**wait 1 second**
AC Voltage & AC Current	
frequency <= 33Hz:	**wait 10 seconds**
frequency <= 330Hz:	**wait 3 seconds**
otherwise:	**wait 1 second**

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4000 FSC.

4808

Instrument FSC

Description

The 4808 FSC controls the following functions of the Datron 4808 Multifunction Calibrator:

- DC Voltage with Option 10 installed
- AC Voltage with Option 20 installed
- DC Current with Option 40 and Option 10 installed
- AC Current with Option 40 and Option 20 installed
- Resistance with Option 50 and Option 10 or 20 installed
- DC Current from the 4600 Transconductance Amplifier (Option 60 with Option 40 and Option 10 installed in 4808)
- AC Current from the 4600 Transconductance Amplifier (Option 60 with Option 40 and Option 20 installed in 4808)
- Wideband AC Voltage with Option 70 installed

The M4808 FSC is used for controlling the following:

- Range Locking
- Safety Delay Override
- Driver Settling Delay

Note

The 4808 FSC can also be used to control a 4708. The accuracy file corresponding to the instrument that is actually configured is used at run time.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-199.99999 V to 199.99999 V [1] -1100 V to 1100 V [1,3]		
AC Voltage	90 µV to 19.99999 V 90 µV to 199.9999 V 90 µV to 750 V 90 uV to 1100 V	10 Hz to 1 MHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 33 kHz	
Note *The maximum voltage increases linearly from 199.9999 V at 10 Hz to 1100 V at 40 Hz. The maximum voltage decreases linearly from 199.999 9 V at 100 kHz to 19.9999 9 V at 1 MHz.*			
DC Current	-1.99999 A to 1.99999 A [1,4] -11 A to 11 A [1,4,6]		BC
AC Current	9 µA to 1.99999 A[2,4] 100 mA to 11 A[2,4,6]	10 Hz to 5 kHz 10 Hz to 20 kHz	BC
Resistance or Conductance	10 Ω to 100 MΩ, 100 mS to 10 nS (in decade steps) [5 & 1 or 2]		
Wideband ACV	300 µV to 3.5 V[7]	10 Hz to 30 MHz	W

1. Requires Option 10, DC Voltage
2. Requires Option 20, AC Voltage
3. Requires Option 30, 1000 V Range
4. Requires Option 40, Current
5. Requires Option 50, Resistance
6. Requires Option 60, 4600 Transconductance Amplifier
7. Requires Option 70, Wideband ACV

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

- Nominal

This field specifies one of the following:

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency or period, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency or period only when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify negative zero for DC Voltage or DC Current.

- -Z Negative Zero
- *blank* All other amplitudes

Rules:

- The MOD2 field may specify Z only for DC Voltage or DC Current when the Nominal value is zero.

MOD3

This field specifies one of the following:

- BC use 4600 for current boost
- W use Option 70, Wideband output for AC Voltage
- *blank* No boost, wideband, or not applicable

Rules:

- If the current can be created only by the Boost Amplifier, BC is inserted automatically.
- If the amplitude and frequency combination can only be created using Option 70, Wideband AC Voltage, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may not specify 4W when any of the following conditions exist:
  1. DC Current
  2. AC Current
  3. AC or DC Voltage less than 200 mV

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	4808		*					S	
1.002	4808	1000	1100V	1U 1/					2W
2.001	4808	10	0V	1U					2W
3.001	4808	200	220mV	10%	50H				2W
4.001	4808	1000	1100V	1U	1kH				4W
5.001	4808	100	-22uA	10%					2W
6.001	4808	2	1.999A	1% 1/	1kH				2W
7.001	4808	A	mV	0.1U	50H				2W
8.001	4808	A	A	5%	1kH				2W
9.001	4808		1.999A		1kH			S	2W
9.002	4808	10	20mV		500H			N	2W
9.003	4808	10	20mV	0.5%	1kH			C	2W
10.001	4808	A	10kZ	5%					4W

M4808

Auxiliary Instrument Setup FSC

Description

The M4808 FSC is used for range locking, safety delay override, and driver settling delay.

Parameters

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- *blank* Field not applicable

NOMINAL

This field specifies the range selection value or a reset to autorange.

- Range selection value entered as *numeric*[*prefix*]V, A, or Z
- Reset (autorange) entered as "*"

Rules:

- "*" is automatically inserted in the NOMINAL field when a blank M4000 statement is entered.
- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Range Selection Value	Locked Range
0 µV to 100 µV	100 µV DC, 1 mV AC, 10 mV WB
> 100 µV to 1 mV	1 mV, 10 mV WB
> 1 mV to 10 mV	10 mV
> 10 mV to 100 mV	100 mV
> 100 mV to 1 V	1 V
> 1 V to 10 V	10 V
> 10 V to 100 V	100 V
> 100 V to 1000 V	1000 V
0 µA to 100 µA	100 µA
> 100 µA to 1 mA	1 mA
> 1 mA to 10 mA	10 mA
> 10 mA to 100 mA	100 mA
> 100 mA to 1A	1 A
0 Ω to 10 Ω	10 Ω
> 10 Ω to 100 Ω	100 Ω
> 100 Ω to 1 kΩ	1 kΩ
> 1 kΩ to 10 kΩ	10 kΩ
> 10 kΩ to 100 kΩ	100 kΩ
> 100 kΩ to 1 MΩ	1 MΩ
> 1 MΩ to 10 MΩ	10 MΩ
> 10 MΩ to 100 MΩ	100 MΩ

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field controls the safety delay override and settling delay.

- *blank* Safety Delay Override off / wait for Output On SRQ
- D0 Safety Delay Override off / driver settling delay
- D1 Safety Delay Override on / driver settling delay
- DX Safety Delay Override on / no driver settling delay

Rules:

- MOD2 blank is for compatibility with MET/CAL 6.10, 6.11, and 6.11A. These versions of MET/CAL used the Output On SRQ to determine when the output was present. This required first setting the 4808 to standby for each 4808 statement.
- MOD2 D0 is the recommended mode for procedures used to calibrate manual DMMS. MOD2 D1 is the recommended mode for procedures used to calibrate remote controlled DMMs (i.e. closed-loop procedures).
- MOD2 DX is for procedure writers who wish to optimize performance by implementing their own settling delay using the IEEE or PORT FSC.

MOD2	4808 FSC Execution Sequence
blank	Set the Safety Delay Override to Off (safety delay active). Set the 4808 to standby. Setup the 4808 to the desired state; function, range, etc. Set the 4808 to operate and wait for the Output On SRQ. Wait an additional delay as defined below.
D0	Set the Safety Delay Override to Off (safety delay active). Setup the 4808 to the desired state; function, range, etc. Set the 4808 to operate. If DCV or ACV > 110V wait 3 seconds. Wait an additional delay as defined below.
D1	Set the Safety Delay Override to On (safety delay inactive). Setup the 4808 to the desired state; function, range, etc. Set the 4808 to operate. Wait an additional delay as defined below.
DX	Set the Safety Delay Override to On (safety delay inactive). Setup the 4808 to the desired state; function, range, etc. Set the 4808 to operate.

Caution

When MOD2 is set to DX, the FSC does not perform ANY settling delay. Therefore when MOD2 DX is used in a closed-loop procedure, the procedure writer is responsible for implementing any required settling delay using the IEEE or PORT FSC.

Additional Settling Delay
MOD2 *blank*, D0, & D1

DC Voltage, DC Current, & Resistance:	**wait 1 second**
AC Voltage & AC Current	
frequency <= 33Hz:	**wait 10 seconds**
frequency <= 330Hz:	**wait 3 seconds**
otherwise:	**wait 1 second**

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 4808 FSC.

4950

Instrument FSC

Description

The 4950 FSC programs the Datron 4950 Multifunction Transfer Standard to measure DC voltage, AC voltage, DC current, AC current, resistance and frequency.

Functional Capability

BANDS ON (MOD2 = *blank*)

Function	Range	Band	Amplitude	Frequency
DC Voltage	100 mV	0%	-15 mV to +15 mV	
	100 mV	100%	+85 mV to +115 mV	
	100 mV	100%	-115 mV to -85 mV	
	1 V	0%	-0.1 V to +0.1 V	
	1 V	100%	+0.9 V to +1.1 V	
	1 V	100%	-1.1 V to -0.9 V	
	10 V	0%	-1 V to +1 V	
	10 V	100%	+9 V to +11 V	
	10 V	190%	-11 V to -9 V	
	100 V	0%	-10 V to +10 V	
	100 V	100%	+90 V to +110 V	
	100 V	100%	-110 V to -90 V	
	1000 V	0%	-100 V to +100 V	
	1000 V	100%	+900 V to +1100 V	
	1000 V	100%	-1100 V to -900 V	

AC Voltage	1 mV	100%	0.85 mV to 1.15 mV	9 Hz to 11 Hz
	1 mV	100%	0.85 mV to 1.15 mV	18 Hz to 22 Hz
	1 mV	100%	0.85 mV to 1.15 mV	27 Hz to 33 Hz
	1 mV	100%	0.85 mV to 1.15 mV	36 Hz to 44 Hz
	1 mV	100%	0.85 mV to 1.15 mV	46.25 Hz to 63.75 Hz
	1 mV	100%	0.85 mV to 1.15 mV	270 Hz to 440 Hz
	1 mV	100%	0.85 mV to 1.15 mV	0.9 kHz to 1.1 kHz
	1 mV	100%	0.85 mV to 1.15 mV	18 kHz to 22 kHz
	1 mV	100%	0.85 mV to 1.15 mV	27 kHz to 33 kHz
	1 mV	100%	0.85 mV to 1.15 mV	45 kHz to 55 kHz
	1 mV	100%	0.85 mV to 1.15 mV	90 kHz to 110 kHz
	1 mV	100%	0.85 mV to 1.15 mV	270 kHz to 330 kHz
	1 mV	100%	0.85 mV to 1.15 mV	450 kHz to 550 kHz
	1 mV	100%	0.85 mV to 1.15 mV	0.9 MHz to 1.1 MHz
	10 mV	100%	8.5 mV to 11.5 mV	9 Hz to 11 Hz
	10 mV	100%	8.5 mV to 11.5 mV	18 Hz to 22 Hz
	10 mV	100%	8.5 mV to 11.5 mV	27 Hz to 33 Hz
	10 mV	100%	8.5 mV to 11.5 mV	36 Hz to 44 Hz
	10 mV	100%	8.5 mV to 11.5 mV	46.25 Hz to 63.75 Hz
	10 mV	100%	8.5 mV to 11.5 mV	270 Hz to 440 Hz
	10 mV	100%	8.5 mV to 11.5 mV	0.9 kHz to 1.1 kHz
	10 mV	100%	8.5 mV to 11.5 mV	18 kHz to 22 kHz
	10 mV	100%	8.5 mV to 11.5 mV	27 kHz to 33 kHz
	10 mV	100%	8.5 mV to 11.5 mV	45 kHz to 55 kHz
	10 mV	100%	8.5 mV to 11.5 mV	90 kHz to 110 kHz
	10 mV	100%	8.5 mV to 11.5 mV	270 kHz to 330 kHz
	10 mV	100%	8.5 mV to 11.5 mV	450 kHz to 550 kHz
	10 mV	100%	8.5 mV to 11.5 mV	0.9 MHz to 1.1 MHz

	100 mV	100%	85 mV to 115 mV	9 Hz to 11 Hz
	100 mV	100%	85 mV to 115 mV	18 Hz to 22 Hz
	100 mV	100%	85 mV to 115 mV	27 Hz to 33 Hz
	100 mV	100%	85 mV to 115 mV	36 Hz to 44 Hz
	100 mV	100%	85 mV to 115 mV	46.25 Hz to 63.75 Hz
	100 mV	100%	85 mV to 115 mV	270 Hz to 440 Hz
	100 mV	100%	85 mV to 115 mV	0.9 kHz to 1.1 kHz
	100 mV	100%	85 mV to 115 mV	18 kHz to 22 kHz
	100 mV	100%	85 mV to 115 mV	27 kHz to 33 kHz
	100 mV	100%	85 mV to 115 mV	45 kHz to 55 kHz
	100 mV	100%	85 mV to 115 mV	90 kHz to 110 kHz
	100 mV	100%	85 mV to 115 mV	270 kHz to 330 kHz
	100 mV	100%	85 mV to 115 mV	450 kHz to 550 kHz
	100 mV	100%	85 mV to 115 mV	0.9 MHz to 1.1 MHz
	1 V	100%	0.9 V to 1.1 mV	9 Hz to 11 Hz
	1 V	100%	0.9 V to 1.1 mV	18 Hz to 22 Hz
	1 V	100%	0.9 V to 1.1 mV	27 Hz to 33 Hz
	1 V	100%	0.9 V to 1.1 mV	36 Hz to 44 Hz
	1 V	100%	0.9 V to 1.1 mV	46.25 Hz to 63.75 Hz
	1 V	100%	0.9 V to 1.1 mV	270 Hz to 440 Hz
	1 V	100%	0.9 V to 1.1 mV	0.9 kHz to 1.1 kHz
	1 V	100%	0.9 V to 1.1 mV	18 kHz to 22 kHz
	1 V	100%	0.9 V to 1.1 mV	27 kHz to 33 kHz
	1 V	100%	0.9 V to 1.1 mV	45 kHz to 55 kHz
	1 V	100%	0.9 V to 1.1 mV	90 kHz to 110 kHz
	1 V	100%	0.9 V to 1.1 mV	270 kHz to 330 kHz
	1 V	100%	0.9 V to 1.1 mV	450 kHz to 550 kHz
	1 V	100%	9 V to 11 V	0.9 MHz to 1.1 MHz

	10 V	100%	9 V to 11 V	9 Hz to 11 Hz
	10 V	100%	9 V to 11 V	18 Hz to 22 Hz
	10 V	100%	9 V to 11 V	27 Hz to 33 Hz
	10 V	100%	9 V to 11 V	36 Hz to 44 Hz
	10 V	100%	9 V to 11 V	46.25 Hz to 63.75 Hz
	10 V	100%	9 V to 11 V	270 Hz to 440 Hz
	10 V	100%	9 V to 11 V	0.9 kHz to 1.1 kHz
	10 V	100%	9 V to 11 V	18 kHz to 22 kHz
	10 V	100%	9 V to 11 V	27 kHz to 33 kHz
	10 V	100%	9 V to 11 V	45 kHz to 55 kHz
	10 V	100%	9 V to 11 V	90 kHz to 110 kHz
	10 V	100%	9 V to 11 V	270 kHz to 330 kHz
	10 V	100%	9 V to 11 V	450 kHz to 550 kHz
	10 V	100%	9 V to 11 V	0.9 MHz to 1.1 MHz
	10 V	190%	18 V to 19.5 V	0.9 kHz to 1.1 kHz
	100 V	100%	90 V to 110 V	9 Hz to 11 Hz
	100 V	100%	90 V to 110 V	18 Hz to 22 Hz
	100 V	100%	90 V to 110 V	27 Hz to 33 Hz
	100 V	100%	90 V to 110 V	36 Hz to 44 Hz
	100 V	100%	90 V to 110 V	46.25 Hz to 63.75 Hz
	100 V	100%	90 V to 110 V	270 Hz to 440 Hz
	100 V	100%	90 V to 110 V	0.9 kHz to 1.1 kHz
	100 V	100%	90 V to 110 V	18 kHz to 22 kHz
	100 V	100%	90 V to 110 V	27 kHz to 33 kHz
	100 V	100%	90 V to 110 V	45 kHz to 55 kHz
	100 V	100%	90 V to 110 V	90 kHz to 110 kHz
	100 V	100%	90 V to 110 V	180 kHz to 220 kHz

	1000 V	70%	600 V to 800 V	45 kHz to 55 kHz
	1000 V	70%	600 V to 800 V	90 kHz to 110 kHz
	1000 V	100%	900 V to 1100 V	9 Hz to 11 Hz
	1000 V	100%	900 V to 1100 V	18 Hz to 22 Hz
	1000 V	100%	900 V to 1100 V	27 Hz to 33 Hz
	1000 V	100%	900 V to 1100 V	36 Hz to 44 Hz
	1000 V	100%	900 V to 1100 V	46.25 Hz to 63.75 Hz
	1000 V	100%	900 V to 1100 V	270 Hz to 440 Hz
	1000 V	100%	900 V to 1100 V	0.9 kHz to 1.1 kHz
	1000 V	100%	900 V to 1100 V	18 kHz to 22 kHz
	1000 V	100%	900 V to 1100 V	27 kHz to 33 kHz
DC Current	100 µa	0%	-10.µA to +10 µA	
	100 µA	100%	+90 µA to +110 µA	
	100 µA	100%	-110 µA to -90 µA	
	1 mA	0%	-0.1 mA to +0.1 mA	
	1 mA	100%	+0.9 mA to +1.1 mA	
	1 mA	100%	-1.1 mA to -0.9 mA	
	10 mA	0%	-1 mA to +1 mA	
	10 mA	100%	+9 mA to +11 mA	
	10 mA	100%	-11 mA to -9 mA	
	100 mA	0%	-10 mA to +10 mA	
	100 mA	100%	+90 mA to +110 mA	
	100 mA	100%	-110 mA to -90 mA	
	1 A	0%	-0.1 A to +0.1 A	
	1 A	100%	+0.9 A to +1.1 A	

	1 A	100%	-1.1 A to -0.9 A	
	10 A[1]	0%	-1 A to +1 A	
	10 A[1]	100%	+9 A to +11 A	
	10 A[1]	100%	-11 A to -9 A	
AC Current	100 µA	100%	90 µA to 110 µA	9 Hz to 11 Hz
	100 µA	100%	90 µA to 110 µA	18 Hz to 22 Hz
	100 µA	100%	90 µA to 110 µA	27 Hz to 33 Hz
	100 µA	100%	90 µA to 110 µA	36 Hz to 44 Hz
	100 µA	100%	90 µA to 110 µA	46.25 Hz to 63.75 Hz
	100 µA	100%	90 µA to 110 µA	270 Hz to 440 Hz
	100 µA	100%	90 µA to 110 µA	0.9 kHz to 1.1 kHz
	100 µA	100%	90 µA to 110 µA	4.5 kHz to 5.5 kHz
	100 µA	100%	90 µA to 110 µA	9 kHz to 11 kHz
	100 µA	100%	90 µA to 110 µA	18 kHz to 22 kHz
	100 µA	100%	90 µA to 110 µA	27 kHz to 33 kHz
	1 mA	100%	0.9 mA to 1.1 mA	9 Hz to 11 Hz
	1 mA	100%	0.9 mA to 1.1 mA	18 Hz to 22 Hz
	1 mA	100%	0.9 mA to 1.1 mA	27 Hz to 33 Hz
	1 mA	100%	0.9 mA to 1.1 mA	36 Hz to 44 Hz
	1 mA	100%	0.9 mA to 1.1 mA	46.25 Hz to 63.75 Hz
	1 mA	100%	0.9 mA to 1.1 mA	270 Hz to 440 Hz
	1 mA	100%	0.9 mA to 1.1 mA	0.9 kHz to 1.1 kHz
	1 mA	100%	0.9 mA to 1.1 mA	4.5 kHz to 5.5 kHz
	1 mA	100%	0.9 mA to 1.1 mA	9 kHz to 11 kHz
	1 mA	100%	0.9 mA to 1.1 mA	18 kHz to 22 kHz
	1 mA	100%	0.9 mA to 1.1 mA	27 kHz to 33 kHz

	10 mA	100%	9 mA to 11 mA	9 Hz to 11 Hz
	10 mA	100%	9 mA to 11 mA	18 Hz to 22 Hz
	10 mA	100%	9 mA to 11 mA	27 Hz to 33 Hz
	10 mA	100%	9 mA to 11 mA	36 Hz to 44 Hz
	10 mA	100%	9 mA to 11 mA	46.25 Hz to 63.75 Hz
	10 mA	100%	9 mA to 11 mA	270 Hz to 440 Hz
	10 mA	100%	9 mA to 11 mA	0.9 kHz to 1.1 kHz
	10 mA	100%	9 mA to 11 mA	4.5 kHz to 5.5 kHz
	10 mA	100%	9 mA to 11 mA	9 kHz to 11 kHz
	10 mA	100%	9 mA to 11 mA	18 kHz to 22 kHz
	10 mA	100%	9 mA to 11 mA	27 kHz to 33 kHz
	100 mA	100%	90 mA to 110 mA	9 Hz to 11 Hz
	100 mA	100%	90 mA to 110 mA	18 Hz to 22 Hz
	100 mA	100%	90 mA to 110 mA	27 Hz to 33 Hz
	100 mA	100%	90 mA to 110 mA	36 Hz to 44 Hz
	100 mA	100%	90 mA to 110 mA	46.25 Hz to 63.75 Hz
	100 mA	100%	90 mA to 110 mA	270 Hz to 440 Hz
	100 mA	100%	90 mA to 110 mA	0.9 kHz to 1.1 kHz
	100 mA	100%	90 mA to 110 mA	4.5 kHz to 5.5 kHz
	100 mA	100%	90 mA to 110 mA	9 kHz to 11 kHz
	100 mA	100%	90 mA to 110 mA	18 kHz to 22 kHz
	100 mA	100%	90 mA to 110 mA	27 kHz to 33 kHz
	1 A	100%	0.9 A to 1.1 A	9 Hz to 11 Hz
	1 A	100%	0.9 A to 1.1 A	18 Hz to 22 Hz
	1 A	100%	0.9 A to 1.1 A	27 Hz to 33 Hz
	1 A	100%	0.9 A to 1.1 A	36 Hz to 44 Hz
	1 A	100%	0.9 A to 1.1 A	46.25 Hz to 63.75 Hz
	1 A	100%	0.9 A to 1.1 A	270 Hz to 440 Hz

	1 A	100%	0.9 A to 1.1 A	0.9 kHz to 1.1 kHz
	1 A	100%	0.9 A to 1.1 A	4.5 kHz to 5.5 kHz
	1 A	100%	0.9 A to 1.1 A	9 kHz to 11 kHz
	1 A	100%	0.9 A to 1.1 A	18 kHz to 22 kHz
	1 A	100%	0.9 A to 1.1 A	27 kHz to 33 kHz
	10 A[1]	100%	9 A to 11 A	9 Hz to 11 Hz
	10 A[1]	100%	9 A to 11 A	18 Hz to 22 Hz
	10 A[1]	100%	9 A to 11 A	27 Hz to 33 Hz
	10 A[1]	100%	9 A to 11 A	36 Hz to 44 Hz
	10 A[1]	100%	9 A to 11 A	46.25 Hz to 63.75 Hz
	10 A[1]	100%	9 A to 11 A	270 Hz to 440 Hz
	10 A[1]	100%	9 A to 11 A	0.9 kHz to 1.1 kHz
	10 A[1]	100%	9 A to 11 A	4.5 kHz to 5.5 kHz
	10 A[1]	100%	9 A to 11 A	9 kHz to 11 kHz
	10 A[1]	100%	9 A to 11 A	18 kHz to 22 kHz
Resistance	10 Ω	0%	0 Ω to 1 Ω	
	10 Ω	10%	0 Ω to 2 Ω	
	10 Ω	30%	2 Ω to 4 Ω	
	10 Ω	100%	9 Ω to 11 Ω	
	10 Ω	190%	18 Ω to 19.5 Ω	
	100 Ω	0%	0 Ω to 10 Ω	
	100 Ω	30%	20 Ω to 40 Ω	
	100 Ω	100%	90 Ω to 110 Ω	
	100 Ω	190%	180 Ω to 195 Ω	
	1 kΩ	0%	0 k Ω to 0.1 kΩ	
	1 kΩ	30%	0.2 k Ω to 0.4 k Ω	

	1 kΩ	100%	0.9 kΩ to 1.1 kΩ
	1 kΩ	190%	1.8 kΩ to 1.95 kΩ
	10 kΩ	0%	0 kΩ to 1 kΩ
	10 kΩ	30%	2 kΩ to 4 kΩ
	10 kΩ	100%	9 k Ω to 11 kΩ
	10 kΩ	190%	18 kΩ to 19.5 kΩ
	100 kΩ	0%	0 kΩ to 10 kΩ
	100 kΩ	30%	20 kΩ to 40 k Ω
	100 kΩ	100%	90 kΩ to 110 kΩ
	100 kΩ	190%	180 kΩ to 195 kΩ
	1 MΩ	0%	0 MΩ to 0.1 MΩ
	1 MΩ	30%	0.2 MΩ to 0.4 MΩ
	1 MΩ	100%	0.9 MΩ to 1.1 MΩ
	1 MΩ	190%	1.8 MΩ to 1.95 MΩ
	10 MΩ	0%	0 MΩ to 1 MΩ
	10 MΩ	30%	2 MΩ to 4 MΩ
	10 MΩ	100%	9 MΩ to 11 MΩ
	10 MΩ	190%	18 MΩ to 19.5 MΩ
	100 MΩ	0%	0 MΩ to 10 MΩ
	100 MΩ	30%	20 MΩ to 40 MΩ
	100 MΩ	100%	90 MΩ to 110 MΩ

BANDS OFF (MOD2 = "O")

Function	Amplitude	Frequency
DC Voltage	-1100 V to 1100 V	
AC Voltage	0.85 mV to 19.99999 V	9 Hz to 1.1 MHz
	20 V to 199.9999 V	9 Hz to 220 kHz
	200 V to 800 V	9 Hz to 110 kHz
	>800 V to 1100 V	9 Hz to 33 kHz
Resistance	0 Ω to 199.999999 MΩ	
DC Current	-1.999999 A to 1.999999 A	
	-19.99999 A to 19.99999 A[1]	
AC Current	90 µA to 1.999999 A	10 Hz to 33 kHz
	2 A to 19.99999 A[1]	10 Hz to 22 kHz
Frequency	9 Hz to 1.1 MHz	0.85 mV to 19.99999 V
	9 Hz to 220 kHz	20 V to 199.9999 V
	9 Hz to 110 kHz	200 V to 800 V
	9 Hz to 33 kHz	>800 V to 1100 V
	10 Hz to 33 kHz	90 µA to 1.999999 A
	10 Hz to 22 kHz[1]	2 A to 11 A
1. Requires 4953 AC/DC Shunt		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V.
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.

- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- The NOMINAL field may specify frequency only when the MOD1 field specifies voltage or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency or amplitude for AC voltage or AC current measurements.

- Frequency entered as[*numeric*][*prefix*]H.
- Voltage entered as [*numeric*][*prefix*]V.
- Current entered as [*numeric*][*prefix*]A.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance.

MOD2

This field specifies one the band limits mode:

- *blank* Bands On
- O Override (Bands Off)

MOD3

This field specifies the accuracy mode for the instrument.

- *blank* High accuracy
- F Low accuracy
- ZR Perform input zero

Note

MOD3 does not effect the measurement accuracy of a frequency measurement. Therefore, if MOD3 is left blank for frequency, measurement execution time will be increased with no increase in accuracy.

Rules:

- The MOD3 field may specify ZR only under the following conditions:
  1. The Nominal value is zero or MEM is zero when the Nominal field does not contain a value,

     and

  2. The MOD1 field is blank (DC volts, DC amps, or ohms).

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON may specify 2W only for either for the following conditions:
  1. DC Voltage, DC Current, AC Current, and Resistance measurement,

     or

  2. AC voltage and Frequency measurement when
     a) the M4950 Nominal field locks the 1 V or 10 V range and
     b) the M4950 MOD1 field is 300 kHz, 500 kHz, or 1 MHz.
- The CON may specify 4W only for AC Voltage, Frequency, or Resistance measurement.

Using the Datron 4950

In most respects the Datron 4950 functions like any other supported system instrument. However, since the 4950 is designed to internally take a sequence of measurements and return to the user the mean of the measurements and the standard error, MET/CAL handles the 4950 as a special case. When the number of measurements (NMEAS) is set to 1, and when the 4950 is in a mode in which the sample size is greater than 1, MET/CAL uses the standard error calculated by the 4950 as the basis for the determination of the standard deviation.

The calculation is:

Standard Deviation = Standard Error * (N ^ 0.5)

where N is the sample size.

Note that this operation is different from the normal operation when NMEAS is 1. Normally, when NMEAS is 1, no standard deviation is determined, which causes S1 to be zero, which in turn causes U2 to be based only on the UUT's resolution.

It remains possible, even with the Datron 4950, for the procedure writer to override the default calculation. For example, if the procedure includes a VSET statement which directly specifies the value of S1, MET/CAL will no longer use the Standard Error calculated by the 4950, even if NMEAS is set to 1 and the 4950 sample size is greater than 1.

Setting NMEAS to any value greater than 1 disables the built-in use of the standard error calculated by the 4950. For example, suppose NMEAS is 5 and the 4950 is in high accuracy DCI mode. The sample size is 32, and the 4950 calculates the standard error, but MET/CAL will make no use of the calculated standard error in the measurement uncertainty calculation. Rather, in this case, MET/CAL will simply calculate the standard deviation of 5 readings (each of which is really based on 32 internal readings).

If the 4950 is used in a mode in which the sample size is 1 (for example, low accuracy ACV), the procedure writer should set the number of measurements to a value greater than 1 in order to include in the measurement uncertainty calculation the standard deviation of a sequence of measurements.

For additional information refer to the "Sample Size and Resolution" table on page 6-17 of the "Wavetek Model 4950 Multifunction Transfer Standard Instrument User's Handbook" (December 1998).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in this manual.

Examples

```
STEP     FSC     RANGE NOMINAL        TOLERANCE      MOD1         MOD2   3   4  CON
  1.001  ASK-                                                                    V

# -----  Number of Measurement to average in MET/CAL is set to one because
# -----  the 4950 internal number of samples and standard error are used
# -----  for the measurement uncertainty calculation.
  1.002  VSET         NMEAS = 1

# -----  Establish reset command for UUT.
  1.003  RESET        *CLS;*RST;*OPC?[I!]

# -----  Perform Input Zero
  1.004  M4950  RNGLK 100mV          0%
  1.005  4950         0mV                                               ZR N   2W
  1.006  ASK-         N
  1.007  M4950  RNGLK 1V             0%
  1.008  4950         0V                                                ZR N   2W
  1.009  M4950  RNGLK 10V            0%
  1.010  4950         0V                                                ZR N   2W
  1.011  M4950  RNGLK 100V           0%
  1.012  4950         0V                                                ZR N   2W
  1.013  M4950  RNGLK 1000V          0%
  1.014  4950         0V                                                ZR N   2W
  1.015  ASK+         N
  1.016  M4950  RNGLK 100uA          0%
  1.017  4950         0uA                                               ZR N   2W
  1.018  ASK-         N
  1.019  M4950  RNGLK 1mA            0%
  1.020  4950         0mA                                               ZR N   2W
  1.021  M4950  RNGLK 10mA           0%
  1.022  4950         0mA                                               ZR N   2W
  1.023  M4950  RNGLK 100mA          0%
  1.024  4950         0mA                                               ZR N   2W
  1.025  M4950  RNGLK 1A             0%
  1.026  4950         0A                                                ZR N   2W
  1.027  M4950  RNGLK 10A            0%
  1.028  4950         0A                                                ZR N   2W
  1.029  ASK+         N
  1.030  M4950  RNGLK 10Z            0%
  1.031  4950         0Z                                                ZR N   2W
  1.032  ASK-         N
  1.033  M4950  RNGLK 100Z           0%
```

```
  1.034  4950         0Z                                                 ZR N  4W
  1.035  M4950  RNGLK 1kZ           0%
  1.036  4950         0kZ                                                ZR N  4W
  1.037  M4950  RNGLK 10kZ          0%
  1.038  4950         0kZ                                                ZR N  4W
  1.039  M4950  RNGLK 100kZ         0%
  1.040  4950         0kZ                                                ZR N  4W
  1.041  M4950  RNGLK 1MZ           0%
  1.042  4950         0MZ                                                ZR N  4W
  1.043  M4950  RNGLK 10MZ          0%
  1.044  4950         0MZ                                                ZR N  4W
  1.045  M4950  RNGLK 100MZ         0%
  1.046  4950         0MZ                                                ZR N  4W
  1.047  ASK-   R   Q               P                             F        V

# -----  DC Voltage
  1.048  DISP         Connect the 4950 Input Cable to the 5700A as follows:
  1.048  DISP         [32] 4950 Hi Lead to 5700A OUTPUT HI
  1.048  DISP         [32] 4950 Lo Lead to 5700A OUTPUT LO
  1.048  DISP         [32] 4950 I+ Lead to 5700A SENSE HI
  1.048  DISP         [32] 4950 I- Lead to 5700A SENSE LO
  1.049  IEEE         OUT 0V;OPER;*OPC?[I!]
  1.050  M4950  RNGLK 100mV         0%
  1.051  4950   220   0.00000mV     7P% 0.00075U                           2W
  2.001  IEEE         OUT 100mV;OPER;*OPC?[I!]
  2.002  M4950  RNGLK 100mV         100%
  2.003  4950   220   100.00000mV   7P% 0.00075U                           2W
  3.001  IEEE         *CLS;*RST;*OPC?[I!]

# -----  AC Voltage
  3.002  IEEE         OUT 1V,10Hz;OPER;*OPC?[I!]
  3.003  M4950  RNGLK 1V            100%          10H
  3.004  4950   2.2   1.000000V     550P% 100e-6U 10H                      4W
  4.001  IEEE         OUT 1V,10kHz;OPER;*OPC?[I!]
  4.002  M4950  RNGLK 1V            100%          10kH
  4.003  4950   2.2   1.000000V     75P% 7e-6U    10kH                     4W
  5.001  IEEE         *CLS;*RST;*OPC?[I!]

# -----  Resistance
  5.002  IEEE         OUT 0Ohm;EXTSENSE ON;OPER;*OPC?[I!]
  5.003  M4950  RNGLK 10Z           0%
  5.004  4950   0     0.0000000Z    0.0000500U                             4W
  6.001  IEEE         OUT 10Ohm;EXTSENSE ON;OPER;*OPC?[I!]OUT?[I]
  6.002  M4950  RNGLK 10Z           100%
```

```
  6.003  4950   10    Z              0.000028U                             4W
  7.001  IEEE         OUT 19Ohm;EXTSENSE ON;OPER;*OPC?[I!]OUT?[I]
  7.002  M4950  RNGLK 10Z            190%
  7.003  4950   19    Z              0.000026U                             4W
  8.001  IEEE         *CLS;*RST;*OPC?[I!]

# -----  DC Current
  8.002  DISP         Connect the 4950 Input cable to the 5700A as follows.
  8.002  DISP         [32] 4950 I+ Lead to 5700A OUTPUT HI
  8.002  DISP         [32] 4950 I- Lead to 5700A OUTPUT LO
  8.003  M4950  RNGLK 1mA            0%
  8.004  4950         0.000mA                                        F  N  2W
  8.005  IEEE         OUT 0mA;OPER;*OPC?[I!]
  8.006  4950   2.2   0.000mA        50P% 0.010U                             2W
  9.001  M4950  RNGLK 1mA            100%
  9.002  4950         1.000mA                                        F  N  2W
  9.003  IEEE         OUT 1mA;OPER;*OPC?[I!]
  9.004  4950   2.2   1.000mA        50P% 0.010U                             2W
 10.001  IEEE         *CLS;*RST;*OPC?[I!]

# -----  AC Current
 10.002  M4950  RNGLK 100mA          100%          10H
 10.003  4950         100.000mA                    10H               F  N  2W
 10.004  IEEE         OUT 100mA,10Hz;OPER;*OPC?[I!]
 10.005  4950   220   100.000mA      700P% 5e-6U   10H                       2W
 11.001  M4950  RNGLK 100mA          100%          1kH
 11.002  4950         100.000mA                    1kH               F  N  2W
 11.003  IEEE         OUT 100mA,1kHz;OPER;*OPC?[I!]
 11.004  4950   220   100.000mA      150P% 4e-6U   1kH                       2W
 12.001  IEEE         *CLS;*RST;*OPC?[I!]

# -----  4953 10A Current Shunt
 12.002  DISP         Connect the 4950 Input cable to 4953 Shunt as follows:
 12.002  DISP         [32] 4950 Hi Lead to 4953 Hi
 12.002  DISP         [32] 4950 Lo Lead to 4953 Lo
 12.002  DISP
 12.002  DISP         Connect the 5725A to the 4953 Shunt as follows:
 12.002  DISP         [32] 5725A CURRENT OUTPUT HI to 4953 I+
 12.002  DISP         [32] 5725A CURRENT OUTPUT LO to 4953 I-
 12.003  M4950  RNGLK 10A            100%
 12.004  4950         10.00000A                                      F  N  2W
 12.005  IEEE         OUT 10A;OPER;*OPC?[I!]
 12.006  4950   11    10.00000A      340P% 480e-9U                           2W
 13.001  M4950  RNGLK 10A            100%          40H
```

13.002	4950		10.0000A		40H	F	N	2W
13.003	IEEE		OUT 10A,40Hz;OPER;*OPC?[I!]					
13.004	4950	11	10.0000A	400P% 170e-9U	40H			2W
14.001	M4950	RNGLK	10A	100%	5kH			
14.002	4950		10.0000A		5kH	F	N	2W
14.003	IEEE		OUT 10A,5kHz;OPER;*OPC?[I!]					
14.004	4950	11	10.0000A	850P% 380e-9U	5kH			2W

M4950

Instrument FSC

Description

The M4950 FSC provides additional functions for the Datron 4950 Multimeter that are not addressed in the 4950 FSC. These functions include measurement range, percentage band, and guard.

Parameters

RANGE

This field must be "RNGLK".

Rules:

- "RNGLK" is inserted automatically if no range field code is entered.

NOMINAL

This field specifies the locked range.

- Voltage range selection value entered as: *numeric*[*prefix*]V
- Current range selection value entered as: *numeric*[*prefix*]A
- Resistance range selection value entered as: *numeric*[*prefix*]Z

Rules:

Function	M4950 Nominal	Locked Range
DC Voltage	10 mV to 100 mV	100 mV
	>100 mV to 1 V	1 V
	>1 V to 10 V	10 V
	>10 V to 100 V	100 V
	>100 V to 1000 V	1000 V
AC Voltage	0 mV to 1 mV	1 mV
	>1 mV to 10 mV	10 mV
	>10 mV to 100 mV	100 mV
	>100 mV to 1V	1 V

Function	M4950 Nominal	Locked Range
	>1 V to 10 V	10 V
	>10 V to 100 V	100 V
	>100 to 1000 V	1000 V
DC Current	0 μA to 100 μA	100 μA
	>100 μA to 1 mA	1 mA
	>1 mA to 10 mA	10 mA
	>10 mA to 100 mA	100 mA
	>100 mA to 1 A	1 A
	>1 A to 10 A	10 A
AC Current	0 μA to 100 μA	100 μA
	>100 μA to 1 mA	1 mA
	>1 mA to 10 mA	10 mA
	>10 mA to 100 mA	100 mA
	>100 mA to 1 A	1 A
	>1 A to 10 A	10 A
Resistance	0 Ω to 10 Ω	10 Ω
	>10 Ω to 100 Ω	100 Ω
	>100 Ω to 1 kΩ	1 kΩ
	>1 kΩ to 10 kΩ	10 kΩ
	>10 kΩ to 100 kΩ	100 kΩ
	>100 kΩ to 1 MΩ	1 MΩ
	>1 MΩ to 10 MΩ	10 MΩ
	>10 MΩ to 100 MΩ	100 MΩ

TOLERANCE

This field specifies the band selection value entered as: 0 %, 10 %, 30 %, 70 %, 100 %, or 190 %. The Tolerance field must be 0 % when the 4950 FSC MOD3 field is ZR.

Rules:

See MOD1 field.

MOD1

This field specifies the frequency band center:

- Band selection value entered as: *numeric* [*prefix*]H

Rules:

Function	Locked Range	M4950 Tolerance	M4950 MOD1
DC Voltage	100 mV	0%, 100%	
	1 V	0%, 100%	
	10 V	0%, 100%, 190%	
	100 V	0%, 100%	
	1000 V	0%, 100%	
AC Voltage	1 mV	100%	10, 20, 30, 40, 55, 300 Hz 1, 10, 20, 30, 50, 100, 300, 500 kHz, 1 MHz
	10 mV	100%	10, 20, 30, 40, 55, 300 Hz 1, 10, 20, 30, 50, 100, 300, 500 kHz, 1 MHz
	100 mV	100%	10, 20, 30, 40, 55, 300 Hz, 1, 10, 20, 30, 50, 100, 300, 500 kHz, 1 MHz
	1 V	100%	10, 20, 30, 40, 55, 300 Hz 1, 10, 20, 30, 50, 100, 300, 500 kHz, 1 MHz
	10 V	100%	10, 20, 30, 40, 55, 300 Hz, 1, 10, 20, 30, 50, 100, 300, 500 kHz 1 MHz
	10 V	190%	1 kHz
	100 V	100%	10, 20, 30, 40, 55, 300 Hz, 1, 10, 20, 30, 50, 100, 200 kHz
	1000 V	70%	50, 100 kHz
	1000 V	100%	10, 20, 30, 40, 55, 300 Hz 1, 10, 20, 30 kHz
DC Current	100 µA	0%, 100%	
	1 mA	0%, 100%	

Function	Locked Range	M4950 Tolerance	M4950 MOD1
	10 mA	0%, 100%	
	100 mA	0%, 100%	
	1 A	0%, 100%	
	10 A	0%, 100%	
AC Current	100 μA	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	1 mA	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	10 mA	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	100 mA	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	1 A	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20, 30 kHz
	10 A	100%	10, 20, 30, 40, 55, 300 Hz 1, 5, 10, 20 kHz
Resistance	10 Ω	0%, 10%, 30%, 100%, 190%	
	100 Ω	0%, 30%, 100%, 190%	
	1 kΩ	0%, 30%, 100%, 190%	
	10 kΩ	0%, 30%, 100%, 190%	
	100 kΩ	0%, 30%, 100%, 190%	
	1 MΩ	0%, 30%, 100%, 190%	
	10 MΩ	0%, 30%, 100%, 190%	
	100 MΩ	0%, 30%, 100%	

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is used to specify the guard connection:

G	remote guard
blank	local guard

CON

This field is not used.

Examples

See 4950 FSC.

5001

Instrument FSC

Description

The 5001 FSC programs the Tektronix CG 5001 or CG 551AP Calibration Generator, respectively, to provide the following:

- Voltage to check vertical and horizontal gain.
- Current to check current probes and amplifiers.
- Edges to check the transient response of amplifiers and attenuator networks.
- Markers & Slewed Edge to check the timing accuracy of horizontal sweep rates.
- Comparator Test to check the accuracy of calibrator outputs.

Functional Capability

Function	Nominal	MOD1
Amplitude Mode: Voltage	40 mVpp to 80 mVpp [3] 100 mVpp to 5 Vpp [3] 6 Vpp to 10 Vpp [2] 12 Vpp to 200 Vpp [2]	10 Hz, 100 Hz, 1 kHz, 10 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz
Amplitude Mode: Current	1 mApp to 100 mApp	DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz
Amplitude Mode: Edge	20 mVpp to 1 Vpp [1] 1.2 Vpp to 100 Vpp [2]	10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz
Amplitude Mode: Fast Edge	1.1 Vpp [1]	100 Hz, 1 kHz, 10 kHz, 100 kHz
Amplitude Mode: Comparator	100 mVpp to 100 Vpp	DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz
Timing Mode: Slewed Edge	0.4 ns & 0.5 ns - 10 ns, 2.5 GHz to 100 MHz [1]	
Timing Mode: Markers	10 ns to 5 s, 100 MHz to 0.2 Hz [1]	

1. 50 Ω Load
2. ≥1 MΩ Load
3. 50 Ω or ≥1 MΩ Load

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the voltage or current for Amplitude Mode or the period or frequency for Timing Mode.

- Voltage entered as: [*numeric*][*prefix*]Vpp
- Current entered as [*numeric*][*prefix*]A.
- Period entered as [*numeric*][*prefix*]T.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- Amplitude Mode cardinal values are within the specified range and a decade value of one of the following factors: 1, 1.2, 1.5, 1.6, 2, 2.5, 3, 4, 5, 6, 7, or 8.
- The Timing Mode cardinal values are within the specified range and a decade value of one of 1, 2, or 5.
- The NOMINAL field entries must be within 9.9% of these cardinal values.
- For Edge (MOD3 = E) and Fast Edge (MOD3 = FE) modes, the edge polarity is selected as follows:

  NOMINAL > 0   Positive Edge

  NOMINAL < 0   Negative Edge

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency for Amplitude Mode.

- Frequency entered as: *numeric*[*prefix*]H.
- *blank* not applicable

Rules:

The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies the function when Amplitude Mode is specified and the NOMINAL field units are volts:

- *blank* Voltage or not applicable
- E Edge
- FE Fast Edge
- CO Comparator

Rules:

- The MOD2 field must be blank when the NOMINAL field units are not volts.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the input impedance that should be present at the Unit Under Test (UUT).

- blank   1 MΩ or greater
- L   50 Ω

Rules:

- The CON field must be blank for:
  1. Voltage > 5 Vpp
  2. Current
  3. Edge > 1.1 Vpp
  4. Slewed Edge (5001 only)
  5. Markers
- The CON field may be either L or blank for comparator tests with voltage < 5 Vpp.
- When the CON field is L, the procedure writer must instruct the operator to select the 50 Ω input impedance on the UUT or instruct the operator to use a 50 Ω termination at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5001         *                                                 S
  1.002  5001         *                                                 S
# ----- Amplitude Mode: Current -----
  1.003  5001         100mA          0.1%          100kH          -D
# ----- Amplitude Mode: Voltage -----
  2.001  5001   5     40uVpp         1%            10H            -D
# ----- Amplitude: Edge -----
  3.001  5001   100   20mVpp         1%            1kH            -D E     L
# ----- Amplitude Mode: Fast Edge -----
  4.001  5001         1.1Vpp                       10kH           -D FE S  L
# ----- Timing Mode: Slewed Edge -----
  4.002  5001    5    2.5GH          1%
# ----- Timing Mode: Markers -----
  5.001  5001   10    10 nT          1%
# ----- Amplitude Mode: Comparator Function -----
  6.001  5001   10    100mVpp        1%            1kH               CO
```

5011

Instrument FSC

Description

The 5011 FSC programs the Tegam and Tektronix CG 5011 Calibration Generator, respectively, to provide the following:

- Voltage to check vertical and horizontal gain.
- Current to check current probes and amplifiers.
- Edges to check the transient response of amplifiers and attenuator networks.
- Markers to check the timing accuracy of horizontal sweep rates.
- Comparator Test to check the accuracy of calibrator outputs.

Functional Capability

Function	Nominal	MOD1
Amplitude Mode: Voltage	40 mVpp to 80 mVpp [3] 100 mVpp to 5 Vpp [3] 6 Vpp to 10 Vpp [2] 12 Vpp to 200 Vpp [2]	10 Hz, 100 Hz, 1 kHz, 10 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz
Amplitude Mode: Current	1 mApp to 100 mApp	DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz
Amplitude Mode: Edge	20 mVpp to 1 Vpp [1] 1.2 Vpp to 100 Vpp [2]	10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz
Amplitude Mode: Fast Edge	1.1 Vpp [1]	100 Hz, 1 kHz, 10 kHz, 100 kHz
Amplitude Mode: Comparator: Timing Mode: Markers	100 mVpp to 100 Vpp 0.5 ns to 5 s, 2 GHz to 0.2 Hz [1]	DC, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz

1. 50 Ω Load
2. ≥1 MΩ Load
3. 50 Ω or ≥1 MΩ Load

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the voltage or current for Amplitude Mode or the period or frequency for Timing

MODE

This field specifies the UUT range as described in the section ‘‘General Rules for Instrument Evaluation FSCs’’.

- Voltage entered as: [*numeric*][*prefix*]Vpp
- Current entered as [*numeric*][*prefix*]A.
- Period entered as [*numeric*][*prefix*]T.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- Amplitude Mode cardinal values are within the specified range and a decade value of one of the following factors: 1, 1.2, 1.5, 1.6, 2, 2.5, 3, 4, 5, 6, 7, or 8.
- The Timing Mode cardinal values are within the specified range and a decade value of one of 1, 2, or 5.
- The NOMINAL field entries must be within 9.9% of these cardinal values.
- For Edge (MOD3 = E) and Fast Edge (MOD3 = FE) modes, the edge polarity is selected as follows:

  NOMINAL >0   Positive Edge

  NOMINAL < 0   Negative Edge

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency for Amplitude Mode.

- Frequency entered as: *numeric*[*prefix*]H.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- blank "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies the function when Amplitude Mode is specified and the NOMINAL field units are volts:

- *blank* Voltage or not applicable
- E Edge
- FE Fast Edge
- CO Comparator

Rules:

- The MOD2 field must be blank when the NOMINAL field units are not volts.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the input impedance that should be present at the Unit Under Test (UUT).

- *blank* 1 MΩ or greater
- L 50 Ω

Rules:

- The CON field must be blank for:
- Voltage > 5 V pp
- Current
- Edge > 1.1 V pp
- Markers
- The CON field may be either L or blank for comparator tests with voltage < 5 V pp.
- When the CON field is L, the procedure writer must instruct the operator to select the 50 Ω input impedance on the UUT or instruct the operator to use a 50 Ω termination at the UUT.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
# ----- Reset -----
  1.001  5011         *                                                    S
  1.002  5011         *                                                    S
# ----- Amplitude Mode: Current -----
  1.003  5001         100mA          0.1%          100kH           -D
# ----- Amplitude Mode: Voltage -----
  2.001  5011   5     40uVpp         1%            10H             -D
# ----- Amplitude: Edge -----
  3.001  5011   100   20mVpp         1%            1kH             -D  E      L
# ----- Amplitude Mode: Fast Edge -----
  4.001  5011         1.1Vpp                       10kH            -D  FE  S  L
# ----- Timing Mode: Markers -----
  5.001  5011   10    0.5nT          1%
# ----- Amplitude Mode: Comparator Function -----
  6.001  5011   10    100mVpp        1%            1kH                 CO
```

MCAL

Instrument FSC

Description

The MCAL FSC provides additional program functions for the Tektronix CG 5001 and CG 551AP Calibration Generator, not addressed in the 5001 FSC.

The special functions specified by the MCAL FSC will become effective in the first 5001 FSC that follows the MCAL FSC and remain in effect until they are disabled or changed by another MCAL FSC.

To return back to the original settings, use:

```
STEP  FSC RANGE NOMINAL TOLERANCE  MOD1 MOD2  3  4  CON
2.001 MCAL      10P                15,0E              1T
```

Parameters

RANGE

Not used.

NOMINAL

The Nominal field specifies the minimum repetition rate that the CG5001 is allowed to use for the Markers mode before switching to the Slewed Edge mode.

This value is entered by: *repetition rate*P

The allowed values are expressed in nanoseconds and must be one of 10, 20, 50, 100, or 200.

If no value is entered, the default value of 10P (for 10 ns) is automatically entered.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies the number of edges and how far the first edge is shifted from the trigger pulse for the Slewed Edge mode. These values are entered in the following format:

The allowed values for the number of edges are integers ranging from 1 to 15.

The allowed values for the number shifts are integers ranging from -99 to +99.

If no value is entered for the first parameter (no comma is entered), then a default value of 15, *number of shifts* E is entered.

If no value is entered for the second parameter, than a default value of *number of edges* ,0E is entered.

If no value is entered at all, then a default value of 15,0E is entered.

MOD2

The MOD2 specifies that every tenth pulse of the Marker mode is to be accentuated.

This function is entered by entering the character 'M' in the MOD2 field.

If nothing is entered then the Magnifier is disabled.

M may be used with 5001 nominal values greater than 1 µs or less than 1 MHz.

MOD3

The MOD3 field specifies whether narrow markers should be used for slow marker repetition rates.

The narrow markers functions are selected by entering the character 'N' in this field.

If nothing is entered, the markers are returned to their normal widths.

N may be used with nominal values between 10 µs to 5 s.

MOD4

The MOD4 field specifies a 100 ns delay between the trigger and the fast-edge pulse. This delay is useful for oscilloscopes that have no internal delay between the trigger and vertical amplifier inputs.

This delay is programmed by entering a 'D' in this field.

If nothing is entered, the 100 ns delay is disabled.

CON

The CON field specifies the Trigger Rate for all functions except the Slewed Edge function. Allowed entries are:

CON entry	Effect
0T	Turn off the trigger
1T	Turn on trigger in Normal Mode
2T	Turn on trigger at x .1 of output rate
3T	Turn on trigger at x .01 of output rate

The default value entered is '1T'.

Miscellaneous

The interrelationships between the MCAL and 5001 FSCs are not verified when the procedure is compiled. Errors reported during procedure execution may occur as a result of improper parameter combinations.

Use of Standard Memory Locations

The content of standard memory registers is not affected by the MCAL FSC.

Automatic Messages

There are no automatic messages created with the MCAL FSC.

Examples

```
STEP     FSC     RANGE  NOMINAL        TOLERANCE      MOD1           MOD2   3   4  CON
2.001    MCAL           10P                           15,0E                         1T
3.002    MCAL           10P                           15,0E             M   N   D   1T
```

M511

Auxiliary Instrument Setup FSC

Description

The M511 FSC provides additional program functions for the Tegam and Tektronix CG5011 Programmable Calibration Generator, not addressed in the 5011 FSC.

The special functions specified by the M511 FSC will become effective in the first 5011 FSC that follows the M511 FSC and remain in effect until they are disabled or changed by another M511 FSC.

To return back to the original settings, use:

```
STEP   FSC RANGE NOMINAL TOLERANCE  MOD1 MOD2  3   4   CON
2.001 M511                                              1T
```

Parameters

RANGE

Not used.

NOMINAL

Not used.

TOLERANCE

Not used.

MOD1

Not used.

MOD2

The MOD2 specifies that every tenth pulse of the Marker mode is to be accentuated.

This function is entered by entering the character 'M' in the MOD2 field.

If nothing is entered then the Magnifier is disabled.

M may be used with 5011 nominal values greater than 1 us or less than 1 MHz.

MOD3

The MOD3 field specifies whether narrow markers should be used for

slow marker repetition rates.

The narrow markers functions are selected by entering the character 'N' in this field.

If nothing is entered, the markers are returned to their normal widths.

N may be used with nominal values between 10 µs to 5s.

MOD4

The MOD4 field specifies a 100 ns delay between the trigger and the fast-edge pulse. This delay is useful for oscilloscopes that have no internal delay between the trigger and vertical amplifier inputs.

This delay is programmed by entering a 'D' in this field.

If nothing is entered, the 100 ns delay is disabled.

CON

The CON field specifies the Trigger Rate for all functions. Allowed entries are:

CON entry	Effect
0T	Turn off the trigger
1T	Turn on trigger in Normal Mode
2T	Turn on trigger at x .1 of output rate
3T	Turn on trigger at x .01 of output rate

The default value entered is '1T'.

Miscellaneous

The interrelationships between the M511 and 5011 FSCs are not verified when the procedure is compiled. Errors reported during procedure execution may occur as a result of improper parameter combinations.

Use of Standard Memory Locations

The content of standard memory registers is not affected by the M511 FSC.

Automatic Messages

There are no automatic messages created with the M511 FSC.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
2.001	M511								1T
3.002	M511					M	N	D	1T

5030

Instrument FSC

Description

The 5030 FSC programs the Tegam and Tektronix SG 5030 Leveled Sine Wave Generators.

Functional Capability

- Amplitude values of 1.59 V to 1.94 V, 4.5 mVpp to 5.5 Vpp, -49.95 dBm to +18.75 dBm.
- Frequency or Period 0.1 Hz to 550 MHz, 1.8182 ns to 10 s.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.
- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

- Frequency entered as: [*numeric*][*prefix*]H.
- Period entered as: [*numeric*][*prefix*]T.
- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: [*numeric*][*prefix*]D

Rules:

- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *blank* 5030 Leveling Head

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 58XXA is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 58XXA is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5030         *                                                 S
  1.003  5030   A     -42.95D        1U            100kH          -D
  2.001  5030   1     100mV                        550MH          -D    S
  2.002  5030   0.5   28mVpp         5U            100kH          -D
  3.001  5030   A     D              1U            100kH          -D
  4.001  5030         V              1%            100kH          -D
  5.001  5030   50    10uT           1% 1/ 1U      -35D
  6.001  5030   200   100nT          1% 1/ 1U      1Vpp
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                     F        W
  7.002  ASK+     D
  7.003  DISP         Connect the SG 5030 to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  5030   20    120mVpp                      100kH                N
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  5030         5MH            -100%         mVpp           -D
  8.001  MESS
  8.002  ASK+         N
  8.003  END
```

5050

Instrument FSC

Description

The 5050 FSC programs the Tegam SG 5050 Leveled Sine Wave Generator.

Functional Capability

- Amplitude
- 1.59 V to 1.94 V, 4.5 mVpp to 5.5 Vpp, -49.95 dBm to +18.75 dBm
- Frequency or Period
- Hz to 2.5 GHz, 0.4 ns to 10 s

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.
- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: [*numeric*][*prefix*]D

Rules:

- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *blank* 5050 Leveling Head

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 58xxA is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 58xxA is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5050         *                                                 S
  1.003  5050   A     -42.95D        1U            100kH          -D
  2.001  5050   1     100mV                        550MH          -D    S
  2.002  5050   0.5   28mVpp         5U            100kH          -D
  3.001  5050   A     D              1U            100kH          -D
  4.001  5050         V              1%            100kH          -D
  5.001  5050   50    10uT           1% 1/ 1U      -35D
  6.001  5050   200   100nT          1% 1/ 1U      1Vpp
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                     F        W
  7.002  ASK+     D
  7.003  DISP         Connect the SG 5050 to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  5050   20    120mVpp                      100kH                N
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  5050         5MH            -100%         mVpp           -D
  8.001  MESS
  8.002  ASK+         N
  8.003  END
```

5100

Instrument FSC

Description

The 5100 FSC programs the Fluke 5100B Calibrator to output DC voltage, AC voltage, DC current, and AC current. 5100B resistance is programmed using the RESF FSC. 5100B wideband AC voltage is programmed using the WIDE FSC.

Functional Capability

Function	Nominal	MOD1
DC Voltage	-1100 V to 1100 V	
AC Voltage	1 µV to 19.9999 V (-117 dBm to 28.239 dBm)[2] 1 µV to 110 V (-117 dBm to 43.046 dBm)[2] 1 µV to 1100 V (-117 dBm to 63.046 dBm)[2]	50 Hz to 50 kHz[1] 50 Hz to 20 kHz[1] 50 Hz to 1 kHz[1]
DC Current	±(9 µA to 1.99999 A)	
AC Current	9 µA to 1.99999 A (accuracy specification up to 1 kHz only)	50 Hz to 5 kHz[1]
1. The value of frequency must have single-digit resolution. For example, 50 Hz or 60 Hz is allowed, but 55 Hz is not. 2. All dBm values are into 600 Ω.		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current.

- Frequency entered as: *numeric*[*prefix*]H.
- *blank* DC

MOD2

This field allows you to specify the divider override feature of the calibration system. Divider Override is specified by entering the character 'O' for this field.

The use of internal and external divider allows a user to achieve higher levels of calibration accuracy in most circumstances; therefore the use of the divider is always automatically selected, where it is applicable.

There are two reasons to override the use of the divider:

The high burden property of the UUT requires divider override to maintain calibration accuracy.

Fewer operator interactions will be necessary and the feature of the (external) divider is not necessary, resulting in shorter calibration times.

The following table shows effect of the MOD2 field

Function	Nominal	MOD2	Effect
DC Volts	≥ 20 V		Low output impedance
DC Volts	< 20 V		50 Ω output impedance
DC Volts	< 20 V	O	Locked in 20 V range, low output impedance
AC Volts	≥ 2 V		Low output impedance
AC Volts	≥ 20 mV & < 200 mV		50 Ω output impedance
AC Volts	< 20 mV		External 1000:1 50 Ω divider. Reduced system noise levels.
AC Volts	< 20 mV	O	Internal divider

An external 1000:1 divider is supplied with every calibration system, which uses the 5100B as a calibration source. This external divider is used to reduce the impact of system noise on the response of the UUT. If the bandwidth of the AC voltmeter function of the UUT is below 1 MHz, the external divider is typically not necessary, however to calibrate wideband voltmeters, this external divider should be used.

MOD3

This field is used to specify accuracy enhancement. Accuracy enhancement in this case means that the output of the 5100B is measured by the typically higher accuracy voltmeter in the calibration system.

The value measured by the voltmeter is then used as a further reference to execute the procedure step. The exact operation depends on the type of test; refer to the information under MOD4 for more information on the type of tests. A regular and fast mode of accuracy enhancement can be selected.

In the DC Voltage function, accuracy enhancement applies to almost the full range of allowed values (exception: 128V to 200V).

In the AC Voltage mode, accuracy enhancement can only be used between 12.5 mV and 600V, assuming the external divider is not used. If the external divider is used for nominal values below 20 mV, accuracy enhancement can be selected to improve the accuracy at the input of the external divider.

During Setup procedure steps only, another mode of accuracy enhancement is possible with the 8506A DMM. The output of the 5100B can be changed depending on the reading of the 8506A. Refer to the following accuracy enhancement information.

MOD3	MOD4	Effect
(blank)	(any)	No accuracy enhancement specified
-E	(any)	Prevent automatic accuracy enhancement
E or EF	(blank)	Apply stimulus from 5100B, nominal value. Adjust manually the stimulus so that the UUT reads nominal. Read adjusted output with the voltmeter, compare the result to the UUT nominal value, and generate the result.
E	S	Apply the stimulus Adjust the stimulus to the nominal based on a reading by the voltmeter.
EF	S	Apply the stimulus The voltmeter measures the stimulus of the 5100B, and stores the reading in MEM1.

Automatic Selection of Accuracy Enhancement

Accuracy enhancement is specified automatically where the accuracy of the UUT requires the highest accuracy from the calibration system. Automatic accuracy enhancement selection is dependent on the mode (DC or AC Voltage), the Nominal Voltage (in NOMINAL field), and the specified Tolerance (in TOLERANCE field). The following information shows the conditions for automatic accuracy enhancement selection:

Function	Nominal	UUT Tolerance
Volts DC	≥0.02 V	< 0.02 %
Volts AC	≥0.2 V	< 0.2 %

Prevention of Automatic Accuracy Enhancement Selection

Automatic insertion of accuracy enhancement is prevented by entering -E during entry of the calibration step. This entry remains and is shown in the procedure listing.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5100         *                                                 S
# ----- DC Voltage -----
  1.002  5100   1000  1000mV         0.05% 1U                                  2W
  2.001  5100   2     -1.999V        1000P/                           O        2W
  3.001  5100   20    20mV           6%                               O  -E    2W
  4.001  5100   200   -20mV          0.019%                              E     2W
# ----- AC Voltage -----
  5.001  5100   10    1mV            +1U -2U       50H                         2W
  6.001  5100   1000  1100V          +2U -4U       1kH                         2W
  7.001  5100   A     mV             100P%         50H                         2W
  8.001  5100   20    12.6mV         2%            1kH            O  E     2W
# ----- Decibels -----
  9.001  5100   10    10D            0.1U          50kH                        2W
# ----- DC Current -----
 10.001  5100   2     1.999A         1%                                        2W
# ----- AC Current -----
 11.001  5100         100uA          1% 1/         1kH                         2W
 12.001  5100         10uA                         50H                  S  2W
 12.002  5100   A     1.999A         -1U +0.1%     1kH
```

RESF

Instrument FSC

Description

The RESF FSC provides fixed resistance or conductance from the Fluke 5100B Calibrator.

Functional Capability

1 Ω to 10 MΩ (1 s to 100 nS) in decade steps

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the resistance, conductance, or specifies a reset.

Resistance entered as: [*numeric*][prefix]V

Current entered as: [*numeric*][prefix]A

Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used.

MOD2

This selection is used to compensate for lead resistance in the two-wire ohms mode. If the character O (for Offset) is entered in this field, the contents of memory location MEM are used instead of the value in the NOMINAL field for comparison against the expected nominal value.

To take advantage of this feature, use another DMM, e.g., 8506A, to measure the total of the lead resistance and the value of resistance being measured. Then store this measurement in MEM, and evaluate the UUT with the nominal value of resistance (with the O selection specified.)

The following example tests the accuracy of a UUT at 100 Ω in two-wire mode:

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.004	ASK-	R							
1.005	HEAD		LOW RESISTANCE/HIGH CONDUCTANCE TEST						
1.006	RESF		100.0Z					S	2W
1.007	DISP		Configure the 8506A as follows:						
1.007	DISP		8506A: Input-Hi to 8506A: Source-Hi						
1.007	DISP		8506A: Input-Lo to 8506A: SOurce-Lo						
1.007	DISP		Press the 4T Ω button in to enable 4-wire ohms.						
1.008	IEEE		[@8506]G3?[I]						
1.009	MEME								
1.010	JMPT		1.013						
1.011	DISP		Press the FRONT/REAR select switch.						
1.012	JMP		1.008						
1.013	DISP		Connect the 5100B and the 8506A as follows:						
1.013	DISP		5100B: Output-Hi to 8506A: Input-Hi						
1.013	DISP		5100B: Output-Lo to 8506A: Input-Lo						
1.014	8506		100Z					N	4W
1.015	MEME								
1.016	DISP		Disconnect the 8506A from the 5100B.						
1.016	DISP		Connect the 5100B and the UUT as follows:						
1.016	DISP		5100B: Output-Hi to UUT V/ Ω						
1.016	DISP		5100B: Output-Lo to UUT COMMON						
1.017	RESF		100Z	0.7% 0.2U		O			2W

The explanation is as follows:

Step 1.004 disables the regular range and function messages.

Step 1.006 applies 100 Ω from the 5100B in the two-wire mode.

Step 1.007 wires the 8506A up in the four-wire mode, directly on its front panel input terminals.

Step 1.008 checks that the FRONT/REAR selection switch of the 8506A is in the FRONT position. If it is not, the operator is prompted as defined in step 1.011.

The output of the 5100B is now connected and then measured with the leads up to the front panel of the 8506A in steps 1.013 and 1.014. The result is stored in MEM1, then it is moved over to MEM in step 1.015.

The test leads are now moved over from the 8506A input to the UUT input in step 1.016.

The performance of the UUT is now evaluated against the value in MEM in step 1.017 (note the ○ selection).

MOD3

This field specifies the guard connection.

G	External guard connection is active
blank	Guard is internally shorted to low.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

2W	2-wire
4W	4-wire

Rules:

2W is automatically inserted in the CON field when no CON field parameter is entered.

4W does not apply for 5100B resistance values over 10 kΩ.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  RESF         *                                                 S
  1.002  RESF   100   100kZ          5.0%                                  2W
  2.001  RESF   10    10Z            500P%                                 4W
  3.001  RESF   10    10MZ           10000P/                               2W
  4.001  RESF   200   100Z           5.0%                                  4W
  5.001  RESF   10    Z              5.0U                                  4W
  6.001  RESF   10    1mY            4000P/                                4W
  6.002  RESF   1     0.1Y           5.0%                                  4W
  7.001  RESF   1     1Z             5%                                    4W
  8.001  RESF         1Z                                                S  4W
```

WIDE

Instrument FSC

Description

The WIDE FSC provides voltage from the 5100B-03 Wideband AC option installed in a 5100B Calibrator.

Functional Capability

Nominal	MOD1
270 µV to 3.1623 V, -58.362 dBm to +23 dBm	10 Hz to 10 MHz

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or reset.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency entered as [*numeric*][*prefix*]H.

Rules:

- The value of frequency must have single-digit resolution. For example, 50H or 60H are allowed, but 55H is not.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection. A 50 Ω load is required. If the UUT does not have an internal 50 Ω input impedance or termination, the procedure must inform the operator to connect such a device to the end of the BNC cable near the input of the UUT. The procedure writer can use the DISP FSC to create such a message.

2W 2-wire

Rules:

- 2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3   4  CON
# ----- Reset -----
  1.001  WIDE         *                                                  S
  1.003  WIDE   10    3.1623V        1% 0.1U       10MH                     2W
  2.001  WIDE   A      -57.5D        2%            10H                      2W
  3.001  WIDE   A     V              1%            10kH                     2W
  4.001  WIDE   A     D              0.1U          20kH                     2W
  5.001  WIDE   1     1V             5%            10kH                     2W
# ----- Setup Test ----
  6.001  WIDE         1V                           10kH                  S  2W
  6.002  WIDE   1     1V                           10kH                  N  2W
  6.003  WIDE   1     1V             5%            20kH                  C
```

5205

Instrument FSC

Description

The 5205 FSC programs the Fluke 5205A or 5215A Power Amplifier via the 5100B or 5130A Calibrator. To use the 5205A with Fluke 5200A AC Calibrator, use the 5200 FSC. To use the 5205A with the Fluke 5700A Multi-function Calibrator, use the 5700 FSC.

Functional Capability

Function	Nominal	MOD1
DC Voltage	-1100 V to 1100 V[1]	
AC Voltage	20 V to 1100 V, 28.24 dBm to +63.046 dBm[2]	50 Hz to 50 kHz[3]

1. 5205A only.
2. All values in dBm are into 600 Ω.
3. The value of frequency must have single-digit resolution. For example, 50 Hz or 60 Hz is allowed, but 55 Hz is not.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Reset entered as: *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency for AC Voltage.

- Frequency entered as: [*numeric*][*prefix*]H.
- *blank* DC

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire

Rules:

- 2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP    FSC   RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001   5205        *                                                 S
  1.002   5205  1000  1100V          -5% 5000P/                            2W
  2.001   5205  60    63.046D        0.1U          50kH                    2W
  3.001   5205  A     1100V          5%            50kH                    2W
  4.001   5205  1000  1100V          5%            50kH                    2W
  5.001   5205        1100V                        50kH                 S  2W
```

5200

Instrument FSC

Description

The 5200 FSC programs the Fluke 5200A AC Calibrator.

Functional Capability

Nominal	MOD1
100 mV to 119.9999 V, -77.78 dBm to +43.8 dBm[1]	10 Hz to 1.199 MHz
120 V to 1100 V, 43.803 dBm to 63 dBm[2]	10 Hz to 100 kHz
1. Product of voltage and frequency not to exceed 10^7 when frequency > 100 kHz. 2. With 5205A or 5215A Power Amplifier.	

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or reset.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Reset entered as: *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency entered as [*numeric*][*prefix*]H.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically inserted in the CON field when no CON field parameter is entered.
- The CON field may specify 4W only when the amplitude is 0.12 V to 119.9999 V (-16.19 dBm to +43.8 dBm).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP    FSC     RANGE NOMINAL        TOLERANCE      MOD1         MOD2   3   4  CON
# ----- Reset -----
  1.001   5200          *                                                     S
  1.003   5200    1     0.1mV          1U 1%          10H                          2W
  2.001   5200    100   10V            0.05U 1%       1MH                          2W
  2.002   5200    1000  1000V          1U 1% 1/       100kH                        2W
  3.001   5200    50    -77.78D        5U             10H                          2W
  4.001   5200    50    43.9D          0.1U           100H                         2W
  5.001   5200    50    D              1U             100kH                        2W
  6.001   5200    1     0.12V          +0.1U          10H                          2W
```

5220

Instrument FSC

Description

The 5220 FSC programs the Fluke 5220A Transconductance Amplifier via the 5100B or 5130A Calibrator. To use the 5220A with Fluke 5440B DC Calibrator, use the 5440 FSC. To use the 5220A with the Fluke 5700A Multi-function Calibrator, use the 5700 FSC.

Functional Capability

Function	Nominal	MOD1
DC Current	-19.9999 A to 19.9999 A	
AC Current	1 A to 19.9999 A	50 Hz to 5 kHz[1]
1. The value of frequency must have single-digit resolution. For example, 50 Hz or 60 Hz is allowed, but 55 Hz is not.		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the current or reset.

- Current (DC or RMS) entered as: [*numeric*][*prefix*]A
- Reset entered as: *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency for AC Current.

- Frequency entered as: [*numeric*][*prefix*]H.
- *blank* DC

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire

Rules:

- 2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
# ----- Reset -----
  1.001  5220         *                                                    S
  1.002  5220   20    -19A           -5% 4000P%                               2W
  2.001  5220   A     19A            5000P%        50H                        2W
  3.001  5220   10    2A             -5%           1kH                        2W
  4.001  5220   20    10A            5%            1kH                        2W
  5.001  5220         10A                          1kH                     S  2W
  6.001  5220         10A            5%            500H                    N  2W
```

5130

Instrument FSC

Description

The 5130 FSC instructs the system to request a voltage or current stimulus from the Fluke 5130A Calibrator. Ω stimulus from the 5130A is obtained using the RESF FSC.

RANGE

- Specifies the UUT range in units of the Nominal Value or Autorange.
- Allowed entries: numeric, numericR A, AR.

NOMINAL

Starting Nominal value of the 5130A output or reset: ('*').

Allowed values:

Volts, DC		
-1100 V to +1100 V		(V)
Volts, AC		
1 µV to 19.9999 V	50 Hz to 50 kHz	(V)
20 V to 110 V	50 Hz to 20 kHz	(V)
110 V to 1100 V	50 Hz to 1 kHz	(V)
(All values of dBm are into 600 Ω)		
-117 dBm to 28.239 dBm	50 Hz to 50 kHz	(D)
-117 dBm to 43.046 dBm	50 Hz to 20 kHz	(D)
-117 dBm to 63.046 dBm	50 Hz to 1 kHz	(D)
Amps, DC		
9 µA to 1.99999 A		(A)
-1.99999 A to -9 µA		(A)
Amps, AC		
9 µA to 1.99999 A	50 Hz to 5 kHz	(A)
Note: Accuracy specification up to 1 kHz only		

TOLERANCE

Specifies the tolerances that UUT results are evaluated against. The tolerances should reflect the instrument specifications of the UUT at the Nominal value. Entries (3 max) used:

numeric% (% of reading)	numeric/ (% of range)
numericP% (PPM of reading)	numericP/ (PPM of range)
numericU (Units of nominal) TOL	(from last TOL FSC)

MOD1

Frequency of the Nominal value for AC Volts and Current. See also under Nominal. Allowed values and units:

MOD1 Values	MOD1 Units	Nominal Values
50 Hz to 1 kHz	(H)	1 µV to 1100 V
50 Hz to 20 kHz	(H)	1 µV to 110 V
50 Hz to 50 kHz	(H)	1 µV to 19.9999 V
50 Hz to 5 kHz	(H)	9 µA to 1.99999 A

Additional Note

The value of frequency must have single-digit resolution. For example 50H or 60H are allowed, but 55H is not.

MOD2

The MOD2 field allows you to specify the divider override feature of the calibration system. Divider Override is specified by entering the character 'O' for this field.

The use of internal and external divider allows a user to achieve higher levels of calibration accuracy in most circumstances; therefore the use of the divider is always automatically selected, where it is applicable.

There are two sets of reasons to override the use of the divider.

The high burden property of the UUT requires divider override to maintain calibration accuracy.

Fewer operator interactions will be necessary and the feature of the (external) divider is not necessary, resulting in shorter calibration times.

In the following table is shown the entry in the MOD2 field, the mode of the 5130A, the Nominal value and the effect.

Entry	Mode	Nominal	Effect
(blank)	Volts DC	< 20 V	50 Ω output impedance from 5130A
(blank)	Volts DC	≥20 V	Low output impedance from 5130A
(blank)	Volts AC	<20 mV	External 1000:1 50 Ω divider used reduced system noise levels
(blank)	Volts AC	≥20 mV	50 Ω output <200 mV impedance from 5130A
(blank)	Volts AC	≥2 V	Low output impedance from 5130A
O	Volts DC	< 20 V	5130A fixed in 20 V range
O	Volts DC	≥20 V	Not applicable
O	Volts AC	<20 mV	5130A fixed in 2 V range, external divider not used
O	Volts AC	≥20 mV	Not applicable

An external 1000:1 divider is supplied with every calibration system, which uses the 5130A as a calibration source. This external divider is used to reduce the impact of system noise on the response of the UUT. If the bandwidth of the AC voltmeter function of the UUT is below 1 MHz, the external divider is typically not necessary, however to calibrate wideband voltmeters, this external divider should be used.

MOD3

Not used.

MOD4

Specifies the type of test being performed:

- blank Evaluation test
- S Setup test
- N Nominal Set test
- C Comparison test

CON

The CON field specifies the UUT connection. Possible entries are:

- 2W for a 2-wire connection to the UUT.
- 4W for a 4-wire connection to the UUT.
- If nothing is entered, the system will automatically insert 2W.

In the case of the Volts AC mode and the external 1000:1 divider is specified, and Nominal value is less than 20 mV, divider override (0) is not specified in the MOD2 field the calibration system will solicit a connection to the terminals using the external AC Divider.

Four-wire (4W) stimulus is not applicable in some situations:

- Volts DC, Nominal < 2V unless MOD2 is O
- Volts AC, Nominal < 200 mV
- Current DC and AC

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.003	5130		*					S	
1.005	5130	1000	1000mV	0.05% 1U					2W
9.002	5130	10	1mV	+1U -2U	50H				2W
4.001	5130	1000	1100V	+2U -4U	1kH				2W
6.001	5130	10	10D	0.1U	50kH				2W
2.003	5130	2	1.999A	1%					2W
4.002	5130	20	10uA	1% 1/	50H				2W
4.003		5130	10uA		50H			S	2W
6.003	5130	A	mV	100P%	50H				2W
3.002	5130	A	1.999A	-1U +0.1%	1kH				2W
3.001	5130	2	-1.999V	1000P/		O			2W

5191

Instrument FSC

Description

The 5191 FSC programs the Fluke/Philips PM 5191 Function Generator to output sine, square, triangle, and sawtooth waveforms.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-10 V to 10 V		
Sine	0 Vpp to 30 Vpp 0 V to 10.6 V -45 dBm to +27 dBm	0.1 mHz to 2.147 MHz 0.1 mHz to 2.147 MHz 0.1 mHz to 2.147 MHz	SI SI SI
Square	0 Vpp to 30 Vpp 0 V to 15 V -45 dBm to +30 dBm	0.1 mHz to 2.147 MHz 0.1 mHz to 2.147 MHz 0.1 mHz to 2.147 MHz	SQ SQ SQ
Triangle	0 Vpp to 30 Vpp 0 V to 8.6 V -45 dBm to +25 dBm	0.1 mHz to 200 kHz 0.1 mHz to 200 kHz 0.1 mHz to 200 kHz	TI TI TI
Positive Sawtooth	0 Vpp to 15 Vpp 0 V to 4.3 V -45 dBm to +19 dBm	0.1 mHz to 20 kHz 0.1 mHz to 20 kHz 0.1 mHz to 20 kHz	ST ST ST
Negative Sawtooth	<0 Vpp to –15 Vpp <0 V to -4.3 V dBm not available	0.1 mHz to 20 kHz 0.1 mHz to 20 kHz 0.1 mHz to 20 kHz	ST ST ST

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or frequency or period.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V

- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H.
- Period entered as: [*numeric*][*prefix*]T.
- Reset entered as: *.

Rules:

- A DC voltage offset can be programmed by specifying a Setup test. The MOD1 field must be *blank*. A DC voltage offset turns the AC voltage off. The DC voltage offset remains in effect until a reset (*) or the end of a test. Any AC voltage function must be reprogrammed after the DC voltage statement in the procedure.
- When the NOMINAL field specifies frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H.
- Period entered as: [*numeric*][*prefix*]T.
- *blank* DC

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage only when the NOMINAL field specifies frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- ST Sawtooth

Rules:

- The MOD3 field must be *blank* when the MOD1 field is *blank*.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- *blank* Open circuit
- L 50 Ω

Rules:

- If the amplitude is expressed in dBm, the output is expected to be terminated and L is automatically inserted in the CON field. The procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.

- Termination affects the range of possible output signal values. The programmed voltage is corrected to obtain the nominal value across the 50 Ω terminating resistor.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3   4  CON
# ----- Reset -----
  1.001  5191         *                                                  S
# ----- DC Voltage -----
  1.002  5191         1V                                                 S
# ----- Sine w/1V DC offset -----
  2.001  5191   A     5V             1U            100kH          -D SI
# ----- Square -----
  3.001  5191   1     10Vpp          10%           10kH           -D SQ
# ----- Triangle -----
  4.001  5191   0.5   0.28Vpp        8/            100kH          -D TI
# ----- Sine (decibels) -----
  5.001  5191   A     D              1U            100kH          -D SI     L
# ----- Period -----
  6.001  5191   0.2   1T             1% 1/ 1U      1Vpp           -D SI
```

5192

Instrument FSC

Description

The 5192 FSC programs the Fluke/Philips PM 5192 Function Generator to output sine, square, triangle, and sawtooth waveforms.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-10 V to 10 V		
Sine	0 Vpp to 20 Vpp 0 V to 7 V -45 dBm to +24 dBm	0.1 mHz to 20 MHz 0.1 mHz to 20 MHz 0.1 mHz to 20 MHz	SI SI SI
Square	0 Vpp to 20 Vpp 0 V to 10 V -13 dBm to +27 dBm	0.1 mHz to 20 MHz 0.1 mHz to 20 MHz 0.1 mHz to 20 MHz	SQ SQ SQ
Triangle	0 Vpp to 20 Vpp 0 V to 5.7 V -45 dBm to +22 dBm	0.1 mHz to 200 kHz 0.1 mHz to 200 kHz 0.1 mHz to 200 kHz	TI TI TI
Positive Sawtooth	0 Vpp to 10 Vpp 0 V to 2.8 V -48 dBm to +16 dBm	0.1 mHz to 20 kHz 0.1 mHz to 20 kHz 0.1 mHz to 20 kHz	ST ST ST
Negative Sawtooth	<0 Vpp to -10 Vpp <0 V to -2.8 V dBm not available	0.1 mHz to 20 kHz 0.1 mHz to 20 kHz 0.1 mHz to 20 kHz	ST ST ST

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or frequency or period.

- Voltage (DC or RMS) entered as: [numeric][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H.
- Period entered as: [*numeric*][*prefix*]T.
- Reset entered as: *.

Rules:

- A DC voltage offset can be programmed by specifying a Setup test. The MOD1 field must be *blank*. A DC voltage offset turns the AC voltage off. The DC voltage offset remains in effect until a reset (*) or the end of a test. Any AC voltage function must be reprogrammed after the DC voltage statement in the procedure.
- When the NOMINAL field specifies frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H.
- Period entered as: [*numeric*][*prefix*]T.
- *blank* DC

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.

- The MOD1 field may specify voltage only when the NOMINAL field specifies frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- ST Sawtooth

Rules:

The MOD3 field must be *blank* when the MOD1 field is *blank*.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- *blank* Open circuit
- L 50 Ω

Rules:

- If the amplitude is expressed in dBm, the output is expected to be terminated and L is automatically inserted in the CON field. The procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.
- Termination affects the range of possible output signal values. The programmed voltage is corrected to obtain the nominal value across the 50 Ω terminating resistor.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2  3  4  CON
# ----- Reset -----
  1.001  5192         *                                                  S
# ----- DC Voltage -----
  1.002  5192         1V                                                 S
# ----- Sine w/1V DC offset -----
  2.001  5192   A     5V             1U            100kH           -D SI
# ----- Square -----
  3.001  5192   1     10Vpp          10%           10kH            -D SQ
# ----- Triangle -----
  4.001  5192   0.5   0.28Vpp        8/            100kH           -D TI
# ----- Sine (decibels) -----
  5.001  5192   A     D              1U            100kH           -D SI    L
# ----- Period -----
  6.001  5192   0.2   1T             1% 1/ 1U      1Vpp            -D SI
```

5193

Instrument FSC

Description

The 5193 FSC programs the Fluke/Philips PM 5193 Function Generator to output sine, square, triangle, and sawtooth waveforms.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-10 V to 10 V		
Sine	0 Vpp to 20 Vpp, 0 V to 7 V, -45 dBm to +24 dBm	0.1 mHz to 50 MHz	SI
Square	0 Vpp to 20 Vpp, 0 V to 10 V, -13 dBm to +27 dBm	0.1 mHz to 20 MHz	SQ
Triangle	0 Vpp to 20 Vpp, 0V to 5.7 V, -45 dBm to +22 dBm	0.1 mHz to 200 kHz	TI
Positive Sawtooth	0 Vpp to 10 Vpp, 0 V to 2.8 V, -48 dBm to +16 dBm	0.1 mHz to 20 kHz	ST
Negative Sawtooth	<0 Vpp to -10 Vpp, <0 V to -2.8 V, dBm not available	0.1 mHz to 20 kHz	ST

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or frequency or period.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H.
- Period entered as: [*numeric*][*prefix*]T.
- Reset entered as: *.

Rules:

- A DC voltage offset can be programmed by specifying a Setup test. The MOD1 field must be *blank*. A DC voltage offset turns the AC voltage off. The DC voltage offset remains in effect until a reset (*) or the end of a test. Any AC voltage function must be reprogrammed after the DC voltage statement in the procedure.
- When the NOMINAL field specifies frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies amplitude or frequency or period for AC functions.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H.
- Period entered as: [*numeric*][*prefix*]T.
- *blank* DC

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field may specify voltage only when the NOMINAL field specifies frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field specifies function (waveform type).

- *blank* DC Volts
- SI Sine
- SQ Square
- TI Triangle
- ST Sawtooth

Rules:

- The MOD3 field must be *blank* when the MOD1 field is *blank*.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- *blank* Open circuit
- L 50 Ω

Rules:

- If the amplitude is expressed in dBm, the output is expected to be terminated and L is automatically inserted in the CON field. The procedure writer must use a DISP FSC to prompt the operator to terminate the output signal at the UUT.
- Termination affects the range of possible output signal values. The programmed voltage is corrected to obtain the nominal value across the 50 Ω terminating resistor.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP    FSC     RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
# ----- Reset -----
  1.001  5193         *                                                       S
# ----- DC Voltage -----
  1.002  5193         1V                                                      S
# ----- Sine w/1V DC offset -----
  2.001  5193    A      5V             1U            100kH           -D SI
# ----- Square -----
  3.001  5193    1      10Vpp          10%           10kH            -D SQ
# ----- Triangle -----
  4.001  5193    0.5    0.28Vpp        8/            100kH           -D TI
# ----- Sine (decibels) -----
  5.001  5193    A      D              1U            100kH           -D SI    L
# ----- Period -----
  6.001  5193    0.2    1T             1% 1/ 1U      1Vpp            -D SI
```

5200

Instrument FSC

Description

The 5200 FSC programs the Fluke 5200A AC Calibrator.

Functional Capability

Nominal	MOD1
100 mV to 119.9999 V, -77.78 dBm to +43.8 dBm[1]	10 Hz to 1.199 MHz
120 V to 1100 V, 43.803 dBm to 63 dBm[2]	10 Hz to 100 kHz
1. Product of voltage and frequency not to exceed 10^7 when frequency > 100 kHz. 2. With 5205A or 5215A Power Amplifier.	

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude or reset.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Reset entered as: *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency entered as [*numeric*][*prefix*]H.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W   2-wire
- 4W   4-wire

Rules:

- 2W is automatically inserted in the CON field when no CON field parameter is entered.
- The CON field may specify 4W only when the amplitude is 0.12 V to 119.9999 V (-16.19 dBm to +43.8 dBm).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  5200         *                                                 S
  1.003  5200   1     0.1mV          1U 1%         10H                     2W
  2.001  5200   100   10V            0.05U 1%      1MH                     2W
  2.002  5200   1000  1000V          1U 1% 1/      100kH                   2W
  3.001  5200   50    -77.78D        5U            10H                     2W
  4.001  5200   50    43.9D          0.1U          100H                    2W
  5.001  5200   50    D              1U            100kH                   2W
  6.001  5200   1     0.12V          +0.1U         10H                     2W
```

525

Instrument FSC

Description

The 525 FSC provides the means to control the following functions of the Fluke 525A Temperature / Pressure Calibrator:

- DC Voltage Source
- DC Current Source
- Resistance Source and Measurement
- RTD Source and Measurement
- Thermocouple Source and Measurement

For pressure measurement, use P700 FSC (Fluke 700 Series pressure modules) or P525 FSC (Fluke 525-Pxx Series pressure modules).

The M525 FSC may be used to range lock DCV Source and Resistance Measurement functions.

MET/CAL can control the 525A using any of the following modes:

- Serial control of the 525A via its RS-232 port.

  For this mode, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 525A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 525A must be set correctly before a procedure is executed. Select the "Ports" application in the Windows control panel to choose the proper settings for port to which the 525A is connected.

- IEEE-488 control of the 525A via its RS-232 port and an IEEE-488 to RS-232 translator (MET/CAL 6.11A and later).

  MET/CAL 6.11A

  No modifications are necessary. 525A IEEE-488 termination defaults to carriage return (CR).

  MET/CAL 7.1 and later

  The following line must be added to the [startup] section of the MET/CAL initialization file (metcal.ini):

  525A_488_iterm = CR

- IEEE-488 control of the 525A via its IEEE-488 interface (MET/CAL 6.11A and later).

  MET/CAL 6.11A

  The following line must be added to the [startup] section of the MET/CAL initialization file (metcal.ini):

  525A_488_iterm = EOI

  MET/CAL 7.1 and later

  No modifications are necessary. 525A IEEE-488 termination defaults to End-Or-Identify (EOI).

Functional Capability

DC Voltage Source	0 V to 100 V
DC Current Source	0 mA to 100 mA
Resistance Source	5 Ω to 4000 Ω
Resistance Measurement	5 Ω to 4000 Ω
RTD Source and Measurement:	
100 Ohm Pt 385	-200 °C to 800 °C (-328 °F to 1472 °F)
100 Ohm Pt 3926	-200 °C to 630 °C (-328 °F to 1166 °F)
100 Ohm Pt JIS 3916	-200 °C to 630 °C (-328 °F to 1166 °F)
200 Ohm Pt 385	-200 °C to 630 °C (-328 °F to 1166 °F)
500 Ohm Pt 385	-200 °C to 630 °C (-328 °F to 1166 °F)
1000 Ohm Pt 385	-200 °C to 630 °C (-328 °F to 1166 °F)
120 Ohm Ni	-80 °C to 260 °C (-112 °F to 500 °F)
10 Ohm Cu	-100 °C to 260 °C (-148 °F to 500 °F)
YSI400	15 °C to 50 °C (59 °F to 122 °F)
PRT Source and Measurement	-500 °C to 1000 °C [1]
SPRT Measurement	-200 °C to 660 °C [2]
Thermocouple Source and Measurement:	
Type B	600 °C to 1820 °C (1112 °F to 3308.0 °F)
Type C	0 °C to 2316 °C (32 °F to 4200.8 °F)
Type E	-250 °C to 1000 °C (-418 °F to 1832.0 °F)
Type J	-210 °C to 1200 °C (-346 °F to 2192.0 °F)
Type K	-200 °C to 1372 °C (-328 °F to 2501.5 °F)
Type L	-200 °C to 900 °C (-328 °F to 1652.0 °F)
Type N	-200 °C to 1300 °C (-328 °F to 2372.0 °F)
Type R	0 °C to 1767 °C (32 °F to 3212.5 °F)
Type S	0 °C to 1767 °C (32 °F to 3212.5 °F)
Type T	-250 °C to 400 °C (-418 °F to 752.0 °F)
Type U	-200 °C to 600 °C (-328 °F to 1112.0 °F)
mV / °C	-10 mV to 75 mV

1. Actual range depends upon coefficients entered.
2. Actual range depends upon temperature probe used.

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the voltage, current, temperature, or reset.

- Current entered as: [*numeric*][*prefix*]A
- Resistance entered as: [*numeric*][*prefix*]Z
- Temperature entered as: [*numeric*][*prefix*]degC , degF, or K
- Reset entered as *.

Rules:

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field units are ohms, the M525 RANGE and NOMINAL fields must specify the range to be used.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used.

MOD2

This field specifies the temperature measurement or source type.

- *blank* DC Voltage, DC Current, or Resistance
- _B Type B thermocouple
- _C Type C thermocouple
- _E Type E thermocouple
- _J Type J thermocouple
- _K Type K thermocouple
- _L Type L thermocouple
- _N Type N thermocouple
- _R Type R thermocouple
- _S Type S thermocouple
- _T Type T thermocouple
- _U Type U thermocouple
- R1 100 Ω Pt 385 RTD
- R2 100 Ω Pt 3926 RTD
- R3 120 Ω Ni RTD
- R4 200 Ω Pt 385 RTD
- R5 500 Ω Pt 385 RTD
- R6 1 kΩ Pt 385 RTD
- R7 100 Ω Pt JIS 3916 RTD
- R8 10 Ω Cu RTD
- P1 PRT, constants table 1
- P2 PRT, constants table 2
- P3 PRT, constants table 3
- P4 PRT, constants table 4
- P5 PRT, constants table 5
- RR SPRT
- Y4 YSI400 thermistor

Rules:

- _K is inserted automatically in the MOD2 field for TC Calibration when no MOD2 code is entered.
- R1 is inserted automatically in the MOD2 field for RTD Calibration when no MOD2 code is entered.
- The MOD2 field must be blank when the Nominal field specifies voltage, current, or resistance.
- The MOD2 field may not be blank when the Nominal field specifies temperature.

MOD3

This field is used to specify source vs measure for resistance, RTD, and thermocouple modes.

- TM Thermocouple Measurement
- TC Thermocouple Source
- ZM Resistance or RTD Measurement
- *blank* DC Voltage, DC Current, Resistance, or Temperature source.

Rules:

- The MOD3 field may specify ZM only when the Nominal field specifies resistance or the MOD3 field specifies a RTD type, PRT, or SPRT.
- The MOD3 field may specify TM or TC only when the MOD2 field specifies a thermocouple type.
- The MOD3 must be blank when the Nominal field specifies current.
- TM is automatically inserted in the MOD3 field when the MOD2
- field specifies a thermocouple type and no MOD3 code is entered.
- ZM is automatically inserted in the MOD3 field when the MOD2 field is RR and no MOD3 code is entered.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

525A Mode	CON
Voltage Source	2W
mA Source	2W
RTD / Ohms Source	2W
RTD / Ohms Measure	4W
TC Source / Measure	2W

- 2W is inserted automatically in the CON field when no CON field code is entered, and the MOD3 field is TM or TC, or the MOD3 field is blank and the Nominal field specifies voltage, current, resistance, or temperature.
- 4W is inserted automatically in the CON field when no CON field code is entered, and the MOD3 field specifies ZM.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.002  525          *                                                 S
# ----- DC Voltage -----
  1.003  525   2      1.999V         2% 0.04U                              2W
# ----- DC Voltage w/Range Lock -----
  2.001  M525   RNGLK 1V
  2.002  525   400    350.0mV        1.9% 0.4U                             2W
  3.001  M525         *
# ----- DC Voltage, TC Terminals -----
  3.002  525          35mV                                           TC S  2W
# ----- DC Current -----
  7.004  525   1      1.00mA         1%                                    2W
  8.001  525   20     19.00mA        0.07U                                 2W
# ----- Temperature Measurement -----
 21.002  525          1200.0degF                                  _J TM N  2W
# ----- Temperature Source -----
 21.004  525          50degC         1%                           _K TC    2W
 22.002  525          45degC                                      R1    S  4W
```

M525

Auxiliary Instrument Setup FSC

Description

The M525 FSC allows the specification of external thermocouple reference or range locking for Volts Source or Ohms Source or Measurement.

Parameters

RANGE

This field specifies one of the following:

- TCREF External Thermocouple Reference
- RNGLK Range Lock
- *blank* Field not applicable

Rules:

- The Range field may specify RNGLK only under the following conditions:
  1. Volts Source - the 525 FSC Nominal field units are volts "V" and the 525 FSC MOD2 field is blank.

     OR
  2. Ohms Source or Measurement - the 525 FSC Nominal field units are ohms "Z".
- The Range field must specify RNGLK for Ohms Source and Measurement (no autorange is supported).

NOMINAL

This field specifies a range lock selection value:

- External thermocouple reference value (0 °C / 32 °F)
- Range lock selection value

  -- Voltage entered as *numeric*[*prefix*]V or

  -- Resistance entered as *numeric*[*prefix*]Z
- "*" Reset to defaults (autorange/internal TC ref)

Rules:

- The NOMINAL field may specify a voltage or resistance only when the RANGE field specifies RNGLK.

Voltage	Locked Range
0 mV to 100 mV	100 mV DC
> 100 mV to 1V	1V DC
> 1 V to 10 V	10 mV
> 10 V to 100 V	100 V

Resistance	Locked Range
0 Ω to 400 Ω	400 Ω
400 Ω to 4000 Ω	4000 Ω

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

See 525 FSC.

53131, 53132

Instrument FSC

Description

The 53131 and 53132 FSCs program the Agilent or Hewlett-Packard 53131A and 53132A Universal Counters to measure frequency, frequency ratio, period, time interval, phase, pulse width, duty cycle, rise and fall time, and maximum, minimum, and peak-to-peak voltage. All 5313xA capabilities are not supported. To program unsupported functions, use the IEEE or SCPI FSC.

Note

The 53131 FSC may also be used to control a 53132A. This capability allows a 53131A based procedure to be executed without modification when a 53132A is configured. If channel 3 is used, the pre-scaler model must be the same.

Parameters

The following table shows the relationship between the supported 5313xA measurement functions and the FSC fields listed.

Function	MOD3	Nominal	MOD1
Frequency Ch 1	FA	0.1 Hz to 100 MHz 100 MHz to 200 MHz 200 MHz to 22 5 MHz	20 mV rms to 5 V rms[1] 30 mV rms to 5 V rms[1] 40 mV rms to 5 V rms[1]
Frequency Ch 3 (Opt. 030)	FC	100 MHz to 2.7 GHz >2.7 GHz to 3 GHz	-27 dBm to +19 dBm -21 dBm to +13 dBm
Frequency Ch 3 (Opt. 050)	FC	200 MHz to 5 GHz	-23 dBm to +13 dBm
Frequency Ch 3 (Opt. 124)	FC	200 MHz to 12.4 GHz	-23 dBm to +13 dBm
Ratio Ch 1/2	FR	10^{-10} to 10^{11}	[2]
Period Ch 1	PA	4.44 ns to 10 s	[2]
Time Interval 1-2	TI	1 ns to 10^{5}	[2]
Phase Ch 1-2	PR	-180 ° to +360 °	0.1 Hz to 225 MHz
Pulse Width Ch 1	WA	5 ns to 10^{5} s	[2]
Duty Factor Ch 1	DA	0 to 1	0.1 Hz to 225 MHz
Rise/Fall Time Ch 1	RF	5 ns to 10^{5} s	[2]
Voltage Max Ch 1	MX	-5.1 V to 5.1 V[1] -5.1 Vp to 5.1 Vp[1]	*blank* (DC) 100 Hz to 30 MHz
Voltage Min Ch 1	MN	-5.1 V to 5.1 V[1] -5.1 Vp to 5.1 Vp[1]	*blank* (DC) 100 Hz to 30 MHz
Voltage Peak-to-Peak Ch 1	PP	0 Vpp to 10.2 Vpp[1]	100 Hz to 30 MHz

1. Values shown are for X1 attenuator setting. Multiply all values by 10 when using the X10 attenuator setting.
2. Same amplitude restrictions as frequency measurement.

Range

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

Nominal

This field specifies the expected measured value or a reset.

- Frequency entered as [*numeric*] [*prefix*]H.
- Frequency Ratio entered as [*numeric*] [*prefix*]H/H.
- Period entered as [*numeric*] [*prefix*]T.
- Time Interval entered as [*numeric*] [*prefix*]T.
- Phase entered as [*numeric*] [*prefix*]deg.
- Pulse Width entered as [*numeric*] [*prefix*]T.
- Duty Cycle entered as [*numeric*] [*prefix*]df.
- Rise or Fall Time entered as [*numeric*] [*prefix*]T.
- Voltage max. or min. entered as [*numeric*] [*prefix*] V or Vp.
- Voltage peak-to-peak entered as [*numeric*] [*prefix*] Vpp.
- Reset entered as *.

Rules:

- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.
- When the NOMINAL field contains only units, the value is obtained from memory register MEM.

Tolerance

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For measurements of frequency, frequency ratio, period, time interval, pulse width and rise/ fall time, this field specifies the expected amplitude. For measurements of phase, duty cycle, and peak voltage of AC, this field specifies the expected frequency. For measurements of DC peak voltage, this field should be blank.

- Voltage (RMS) entered as: *numeric*[*prefix*]V
- Voltage (Peak) entered as: *numeric*[*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: *numeric*[*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: *numeric*[*prefix*]D
- Frequency entered as *numeric*[*prefix*]H
- *blank*

Rules:

- For Ratio Channel 1/2 (FR) measurements, the MOD1 field specifies the expected amplitude on channel 1, not channel 2.
- For Pulse Width Channel 1 (WA) measurements, the MOD1 field must be voltage peak or voltage peak-to-peak.

MOD2

This field specifies the trigger slope as follows:

- +A Positive slope triggering, AC coupled
- -A Negative slope triggering, AC coupled
- +D Positive slope triggering, DC coupled
- -D Negative slope triggering, DC coupled
- *blank*

Rules:

When the MOD2 field is blank, the trigger slope and coupling for channel 1 and 2 default to values determined by the measurement function unless otherwise specified using the M5313x FSC.

- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency Ch 3 (FC).

MOD3

This field specifies the measurement function:

- FA Frequency Channel 1
- FC Frequency Channel 3
- PA Period Channel 1
- FR Ratio Channel 1/2
- TI Time Interval Channel 1 to Channel 2
- WA Pulse Width Channel 1
- RF Rise or Fall Time Channel 1
- PR Phase Channel 1 Relative to Channel 2
- DA Duty Factor Channel 1
- MX Maximum Voltage Channel 1
- MN Minimum Voltage Channel 1
- PP Volts Peak-to-Peak Voltage Channel 1

Rules:

- When MOD3 is "RF" and channel 1 trigger slope is positive, a rise time measurement is performed. When channel 1 trigger slope is negative a fall time measurement is performed.
- The MOD3 field may specify Frequency Channel 3 (FC) only when option 030, 050, or 124 is installed.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The Connection field specifies the UUT connection.

- L 50 Ω Input Impedance
- *blank* 1 MΩ Input Impedance

Rules:

- L is inserted automatically in the CON field when the MOD3 field specifies Frequency Channel 3 (FC).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1     MOD2  3  4 CON
# ----- Reset -----
  1.001  M53132       *
  1.002  53132        *                                                   S
# ----- Frequency Channel 1 -----
  1.003  M53132 ChA                                 100kH
  1.004  53132        10.000kH       1%             1Vpp        +A FA
# ----- Frequency Channel 3 -----
  2.001  53132       1GH  100MH          0.1%           -1D     +A FC       L
# ----- Period Channel 1 -----
  3.001  M53132       *
  3.002  53132        1.000mT        0.003U         5V          +A PA
# ----- Ratio Channel 1/2 -----
  4.001  M53132 ChA                                             AC
  4.002  M53132 ChB                                             DC
  4.003  53132        10H/H          1%             1Vpp           FR
# ----- Time Interval Channel 1 to 2 -----
  5.001  M53132 COM   20T            0.2V           0.8V        DC ++   X1
  5.002  53132        10.00T         0.02U          1Vpp           TI
# ----- Pulse Width Channel 1 -----
  6.001  M53132       *
  6.002  53132        300uT          5%             5Vp         -A WA
# ----- Rise Time Channel 1 -----
  7.001002  53132        100nT          5%             1Vpp           RF
# ----- Phase Channel 1 relative to Channel 2 -----
  8.001  M53132       *
  8.002  53132        30deg          1U             10kH           PR    L
# ----- Duty Cycle Channel 1 -----
  9.001  53132        0.3DF           2%             100H           DA
```

M53131, M53132

Auxiliary Instrument Setup FSCs

Description

The M53131 and M53132 FSCs provide the additional program functions for Channel 1 and 2 of the Agilent/Hewlett-Packard 53131A and 53132A Universal Counters which are not addressed by the 53131 and 53132 FSCs. These functions include Common 2 via 1, Gate Time, Trigger Level, Trigger Sensitivity, Trigger Slope, Input Coupling, Input Impedance, and Input Attenuation.

Range

This field specifies the Channel.

- ChA Channel 1
- ChB Channel 2
- COM Common 2 via 1
- *blank*

Rules:

- The M5313x statement is ignored under the following conditions:

1. The RANGE field specifies channel 2 and the 5313x FSC specifies Frequency Ch 1, Period Ch 1, Pulse Width Ch 1, or Peak Voltage Ch 1, (5313x MOD3 field is FA, PA, WA, or MX respectively).
2. The RANGE field specifies Common 2 via 1 and the 5313x FSC specifies a measurement function other than Time Interval 1-2 (5313x MOD3 field is not TI).
3. The 5313x FSC specifies Frequency Ch 3 (53131 MOD3 field is FC).

Nominal

This field specifies one the following:

- Gate Time entered as: *numeric*[*prefix*]T.

  Allowed values are: 1 ms to 1000 s.
- "*"   Reset to Auto Mode
- *blank*

Rules:

- Gate Time is not channel specific. It may be specified in a separate M5313x statement or in conjunction with a channel 1 or channel 2 specification. Either way, the last Gate Time specification prior to a 5313x statement is used.

Tolerance

This field specifies one of the following:

- The Channel 1 or 2 Trigger Level entered as [*numeric*][*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

CON Field	Allowed values TOLERANCE field	Resolution
X1	-5.125 V to +5.125 V	0.005 V
X10	-51.25 V to +51.25 V	0.05 V

- The TOLERANCE field specifies the channel 1 trigger level when the RANGE field specifies Channel 1 or Common Ch 2 via 1.
- The TOLERANCE field specifies the channel 2 trigger level when the RANGE field specifies Channel 2.
- The TOLERANCE field must be blank when the RANGE field is blank.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel 1 or Common Ch 2 via 1.
- Auto Level causes the attenuation, and trigger level to be automatically controlled for both channel 1 and 2.
- The TOLERANCE field specification is ignored when the 5313x FSC specifies Auto Level (5313x MOD2 field is not blank).

- If the TOLERANCE field does not contain a value, the value is taken form memory register MEM.

MOD1

This field specifies one of the following:

- The Channel 1 Low-Pass Filter entered as: *numeric* [*prefix*]H.
- The Channel 2 Trigger Level entered as [*numeric*][*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

CON Field	Allowed values TOLERANCE field	Allowed values MOD1 field	Resolution
X1	-5.125 V to +5.125 V	-5.125 V to +5.125 V	0.005 V
X10	-51.25 V to +51.25 V	-51.25 V to +51.25 V	0.05 V

- The MOD1 field may specify the channel 1 low-pass filter only when the RANGE field specifies channel 1.
- When the MOD1 field specifies the channel 1 low-pass filter, the value must be 100kHz.
- The MOD1 field may specify the channel 2 trigger level only when the RANGE specifies Common channel 2 via 1.
- The MOD1 field must be blank when the RANGE field is blank or Auto Level is specified by the 5313x FSC (5313x MOD2 field is not blank).
- The MOD1 field specification is ignored when the MOD1 field specifies the channel 2 trigger level and the 5313x FSC specifiesAuto Level (53131 MOD2 field is not blank).
- If the MOD1 field does not contain a value, the value is taken form memory register MEM.

MOD2

This field specifies the input coupling and sensitivity:

- AL AC Coupling, Low Sensitivity
- AC AC Coupling, Medium Sensitivity
- AH AC Coupling, High Sensitivity

- DL   DC Coupling, Low Sensitivity
- DC   DC Coupling, Medium Sensitivity
- DH   DC Coupling, High Sensitivity
- *blank*   Default Coupling, Medium Sensitivity

5313x MOD3 Field	53131 MOD1 Field	Coupling
FA (Frequency Ch 1)	NA	AC
FC (Frequency Ch 3)	NA	NA
PA (Period Ch 1)	NA	AC
FR (Ratio Ch 1/2)	NA	AC
WA (Pulse Width Ch 1)	NA	DC
TI (Time Interval Ch 1-2)	NA	DC
PR (Phase Ch 1-2)	NA	AC
DA (Duty Cycle Ch 1)	NA	DC
RF (Rise Time Ch 1)	NA	DC
MX (Peak Voltage Ch 1)	<100Hz >=100Hz	DC AC

Rules:

- Default values are used when the 5313x FSC does not specify the input coupling (5313x MOD2 field is blank) and one of the following conditions exists:
  1. No M5313x statement has been executed.
  2. The last M5313x statement executed was a M53131 Reset.
  3. The M5313x MOD2 field is blank and the M53131 RANGE field specifies Channel 1, Channel 2, or Common Ch 2 via 1.
- The MOD2 field must be blank when the RANGE field is blank.
- The MOD2 field must specify AC when TOLERANCE field specifies the trigger sensitivity.
- The MOD2 field must specify DC when TOLERANCE field specifies the trigger level.
- The MOD2 field specification is ignored when the 5313x FSC specifies the input coupling (5313x MOD2 field is not blank).

MOD3

This field specifies the trigger slope:

- \+ Positive, Channel 1 or 2
- \- Negative, Channel 1 or 2
- ++ Positive, Channel 1 and 2
- +- Positive, Channel 1, Negative Channel 2
- -+ Negative, Channel 1, Positive Channel 2
- -- Negative, Channel 1 and 2
- *blank*

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel 1 (CHA) or Channel 2 (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common Ch 2 via 1 (COM).
- The MOD3 field specification is ignored when the 5313x FSC specifies the trigger slope (5313x MOD2 field is not blank).

MOD4

This field specifies that an external reference oscillator is to be used:

- X External Reference Oscillator
- *blank*

Rules:

A M5313x reset statement, NOMINAL field is an "*", must be used to re-select the internal reference once the external reference is selected.

CON

This field specifies the Attenuation. Legal entries are:

- X1 (default)
- X10
- *blank*

Rules:

- The CON field must be blank when the RANGE is blank.
- The CON field must not be blank when the TOLERANCE field specifies the trigger sensitivity or level.
- The CON field specification is ignored when the 5313x FSC specifies Auto Level (5313x MOD2 field is not blank).

Examples

Refer to 53131 or 53132 FSC.

53181

Instrument FSC

Description

The 53181 FSC programs the Agilent/Hewlett-Packard 53181A RF Counter to measure frequency, frequency ratio, period, and maximum, minimum, and peak-to-peak voltage.

Parameters

The following table shows the relationship between the supported 53181A measurement functions and the FSC fields listed.

Function	MOD3	Nominal	MOD1
Frequency Ch 1	FA	0.1 Hz to 100 MHz 100 MHz to 200 MHz 200 MHz to 22 5MHz	20 mV rms to 5 V rms[1] 30 mV rms to 5 V rms[1] 40 mV rms to 5 V rms[1]
Frequency Ch 2 (Opt. 015)	FC	100 MHz to 1.5 GHz	-27 dBm to +19 dBm
Frequency Ch 2 (Opt. 030)	FC	100 MHz to 2.7 GHz >2.7 GHz to 3 GHz	-27 dBm to +19 dBm -21 dBm to +13 dBm
Frequency Ch 2 (Opt. 050)	FC	200 MHz to 5 GHz	-23 dBm to +13 dBm
Frequency Ch 2 (Opt. 124)	FC	200 MHz to 12.4 GHz	-23 dBm to +13 dBm
Ratio Ch 2/1	FR	10^{-10} to 10^{11}	[2]
Period Ch 1	PA	4.44 ns to 10 s	[2]
Voltage Max Ch 1	MX	-5.1 V to 5.1 V [1] -5.1 Vp to 5.1 Vp [1]	*blank* (DC) 100 Hz to 30 MHz
Voltage Min Ch 1	MN	-5.1 V to 5.1 V [1] -5.1 Vp to 5.1 Vp [1]	*blank* (DC) 100 Hz to 30 MHz
Voltage Peak-to-Peak Ch 1	PP	0 Vpp to10.2 Vpp [1]	100 Hz to 30 MHz

1. Values shown are for X1 attenuator setting. Multiply all values by 10 when using the X10 attenuator setting.
2. Same amplitude restrictions as frequency measurement.

Range

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

Nominal

This field specifies the expected measured value or a reset.

- Frequency entered as [*numeric*] [*prefix*]H.
- Frequency Ratio entered as [*numeric*] [*prefix*]H/H.
- Period entered as [*numeric*] [*prefix*]T.
- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage max. or min. entered as [*numeric*] [*prefix*] V or Vp.
- Voltage peak-to-peak entered as [*numeric*] [*prefix*] Vpp.
- Reset entered as *.

Rules:

- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.
- When the NOMINAL field contans only units, the value is obtained from memory register MEM.

Tolerance

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For all measurements except peak voltage, this field specifies the amplitude. For peak voltage, this field specifies the frequency of an AC signal.

- Voltage (RMS) entered as: *numeric*[*prefix*]V
- Voltage (Peak) entered as: *numeric*[*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: *numeric*[*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: *numeric*[*prefix*]D
- Frequency entered as *numeric*[*prefix*]H.

- *blank*

Rules:

- For Ratio Channel C/A (FR) measurements, the MOD1 field specifies the expected amplitude on channel 1, not channel 2.

MOD2

This field specifies the trigger slope as follows:

- +A Positive
- -A Negative
- *blank*

Rules:

When the MOD2 field is blank, the trigger slope defaults to positive unless specified otherwise using the M53181 FSC.

- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency Ch 2 (FC).

MOD3

This field specifies the measurement function:

- FA Frequency Channel 1
- FC Frequency Channel 2
- PA Period Channel 1
- FR Ratio Channel 2/1
- MX Maximum Voltage Channel 1
- MN Minimum Voltage Channel 1
- PP Volts Peak-to-Peak Voltage Channel 1

Rules:

- The MOD3 field may specify Frequency Channel 2 (FC) and Ratio 2/1 (FR) only when a High Frequency Input, 53181A option 015, 030, 050, or 124 is installed.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The Connection field specifies the UUT connection.

- L 50 Ω Input Impedance
- *blank* 1 MΩ Input Impedance

Rules:

- For Ratio 2/1 (FR) measurements, the CON field specifies the impedance of the channel 1 input, not the channel 2 input.
- L is inserted automatically in the CON field when the MOD3 field specifies Frequency Ch 2 (FC).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1      MOD2   3   4  CON
# ----- Reset -----
  1.001  M53181       *
  1.002  53181        *
# ----- Frequency Ch 1 -----
  1.002  M53181                      100mV         100kH
  1.003  53181        10kH           1%            1Vpp             FA
# ----- Frequency Ch 2 -----
  2.001  53181        10MH           0.1%          +2D          +A  FC     L
# ----- Period Ch 1 -----
  3.001  M53181       *
  2.002  53181        1.000mT        0.003U        5V               PA
# ----- Ratio Ch 2/1 -----
  3.003  53181        10H/H          1%            1Vpp             FR
```

M53181

Auxiliary Instrument Setup FSC

Description

The M53181 FSC provides the additional program functions for Channel 1 of the Agilent/Hewlett-Packard 53181A RF Counter which are not addressed by the 53181 FSC. These functions include Gate Time, and Channel 1 Trigger Level, Trigger Sensitivity, and Low-pass Filter.

Range

This field specifies the Channel.

- ChA   Channel 1
- *blank*

Rules:

- Ch1 is inserted automatically when the RANGE field is left blank and the TOLERANCE field specifies the channel 1 trigger sensitivity or the MOD1 field specifies the channel 1 low-pass filter.
- M53181 specifications other than gate time are ignored when the 53181 FSC specifies Frequency Ch 2 (53181 MOD3 field is FC).

Nominal

This field specifies one of the following:

- Gate Time entered as *numeric*[<*prefix*>]T.

  Allowed values are 1 ms to 1000 s
- "*"   Reset to defaults
- *blank*

Tolerance

This field specifies one of the following:

- The Trigger Level entered as *numeric*[*prefix*]V.

- *blank* Auto Level (default)

Rules:

CON Field	Allowed values TOLERANCE Field	Resolution
X1	-5.125 V to +5.125 V	0.005 V
X10	-51.25 V to +51.25 V	0.05 V

- The TOLERANCE field specification is ignored when the 53181 FSC specifies Auto Level (53181 MOD2 field is not blank).

MOD1

This field specifies one of the following:

- Channel 1 low-pass filter entered as: *numeric*[*prefix*]H.
- *blank*

Rules:

- When the MOD1 field specifies the Channel 1 low-pass filter, the value must be 100 kH.
- A M53181 reset statement, NOMINAL field is an "*", must be used to disable the Channel 1 low-pass filter once it is enabled.

MOD2

This field specifies the input coupling and sensitivity:

- AL AC Coupling, Low Sensitivity
- AC AC Coupling, Medium Sensitivity
- AH AC Coupling, High Sensitivity
- DL DC Coupling, Low Sensitivity
- DC DC Coupling, Medium Sensitivity
- DH DC Coupling, High Sensitivity
- *blank* Default Coupling, Medium Sensitivity

MOD3

This field specifies the trigger slope:

- \+ Positive (default)
- \- Negative
- *blank*

Rules:

- The MOD3 field specification is ignored when the 53181 FSC specifies the trigger slope (53181 MOD2 field is not blank).

MOD4

This field specifies that an external reference oscillator is to be

used:

- X External Reference Oscillator
- *blank*

Rules:

- A M53181 reset statement, NOMINAL field is an "*", must be used to re-select the internal reference once the external reference is selected.

CON

This field is not used.

Examples

See 53181 FSC.

5320

Instrument FSC

Description

The 5320 FSC controls the Fluke 5320A Electrical Test Equipment Calibrator.

Parameters

A 5320 statement consists of one or more parameters. A parameter consists of a name and a value. Each parameter must be separated by a semicolon and/or one or more spaces. A single 5320 statement can encompass more than one physical line as long as the line numbers are the same. However each parameter name and its value must occur on one line. A single line can accommodate 56 characters, not including the statement number and FSC.

Syntax

5320 *parameter[separater parameter]*

parameter = [prefix]parameter name[sp]=[sp]parameter value

separater = ;[sp] | sp

prefix = + | @

sp = one or more spaces

parameter name = see Parameters Names section below

parameter value = see Parameters Names section below

| Denotes "or" (i.e. A | B is A or B).

[ ] Denotes an optional syntax element, except in examples. In examples [ ] enclose a special construction.

\+ Designates the parameter as the Evaluation Quantity.

@ Designates the parameter as the MOD1 value.

Examples

The following 5320 statement are identical with respect to the 5320A:

Statement #1

5320 Mode = Volt; +Volt = 240 V; @Freq = 50 Hz

Statement #2

5320 Mode = Volt +Voltage = 240.0 V @Frequency = 50 Hz

Statement #3

5320 Apply
5320 Mode = VoltageCalibrator
5320 +Voltage = 240 V
5320 @Freq = 50 Hz

Rules:

- One and only one parameter must be designated as the Evaluation Quantity in a 5320 Apply, Measure, Setup, or Slew statement.
- At most one parameter may be designated as the Modifier Quantity in a 5320 Apply, Measure, Setup, or Slew statement.
- Parameter values may be taken from a MET/CAL memory register using a special construction.
- When a 5320 Apply statement is executed, the value of the Evaluation Quantity is copied to memory register MEM1 in base units.

  Example:

  5320 Mode = Volt; +Volt = 240 V; @Freq = 50 Hz; Apply

  After the 5320 statement is executed the value of MEM1 is 120.

- When a 5320 Operate statement is executed, the value of the Evaluation Quantity designated in the previous Setup or Apply statement is copied to memory register MEM1 in base units.

  Example:

  5320 Mode = Volt; +Volt = 240 V; @Freq = 50 Hz; Setup

  5320 Mode = Volt; +Volt = 240 V; @Freq = 50 Hz; Operate

  After the 5320 Operate statement is executed the value of MEM1 is 240.

- When a 5320 Slew statement is executed, the Evaluation Quantity designates the slew quantity.

- When a 5320 Slew statement is executed, the final slew value is copied to memory register MEM in base units.

  Example:

  5320 Mode = Volt; +Volt = 240 V; @Freq = 50 Hz; Slew

  Operator slews the 5320A output to 241.5 V.

  After the 5320 Slew statement is executed the value of MEM is 241.5.

- When a 5320 Slew statement is executed, the Modifier Quantity is concatenated to the Evaluation Quantity in the automatic slew message. Note, the automatic slew message is not displayed when ASK- N is in effect.

  Examples:

  ASK+ N

  5320 Mode = Volt; +Volt = 120 V; @Freq = 60 Hz; Slew

  "Adjust stimulus for a UUT reading of 120 V at 60 Hz."

  No Modifier Quantity designated.

  5320 Mode = Volt; +Volt = 120 V; Freq = 60 Hz; Slew

  "Adjust stimulus for a UUT reading of 120 V."

  Automatic slew message inhibited.

  ASK- N

  5320 Mode = Volt; +Volt = 120 V; Freq = 60 Hz; Slew

  No automatic slew message generated, use MESS FSC.

- When a 5320 Measure statement is executed, the 5320A measurement is copied to memory register MEM in units of the Evaluation Quantity.

  Example:

  5320 Mode = Meter; +Voltage = 240 V; @Freq = 50 Hz; Measure

  After the 5320 statement is executed, if the 5320A measurement was 239.5 V, MEM would be 239.5.

- When a 5320 Read statement is executed, the 5320A measurement is copied to memory register MEM in units of the Evaluation Quantity designated in the previous Setup or Measure statement.

  Example:

  5320 Mode = Meter; +Current = 20 A; @Freq = 50 Hz; Setup

  5320 Mode = Meter; +Current = 20 A; @Freq = 50 Hz; Read

  After the 5320 READ statement is executed, if the 5320A measurement was 239.5 V, MEM would be 239.5.

Parameter Names

Parameter names consist of single words or compound words. Each word in a parameter name can be entered in long form (as shown below), or in short form. The short form is the first 4 characters of the long form, unless the last character or the word is a vowel. In this case the short form is three characters.

Compound parameter names can be entered in any combination of long and short forms. Example, ExternalReference can be entered using any of the following forms:

LeakageCurrent

LeakageCurr

LeakCurrent

LeakCurr

Action Parameters

Apply

Measure

Operate

Query

Read

Reset

Setup

Standby

General Parameters

Current

Frequency

LeakageCurrent

LineVoltage

Low

Mode

Open

PFC (Perspective Fault Current)

Power

Probe

ResidualImpedance

ResidualImpedanceCorrection

Resistance

ResistanceMultiplierOn

Sense

Short

TestCurrent

TestVoltage

TouchVoltage

TripCurrent

TripCurrentMultiplier

TripCurrentRecognitionLevel

TripTime

UUTCurrent

UUTOutputResistance

Voltage

Mode/Parameter Rules

If a parameter is not listed for a mode, it is not allowed.

Mode = GBR | GroundBondResistance

Evaluation Quantity: Resistance

Required Parameters:

+Resistance

Optional Parameters	Default
TestCurrent	na
TestVoltage	na
Apply | Setup | Operate | Query	Apply

Evaluation Quantity: TestCurrent

Required Parameters:

+TestCurrent

Resistance

Setup, Operate, and Read

Optional Parameters	Default
TestVoltage	na

Evaluation Quantity: TestVoltage

Required Parameters:

+TestVoltage

Open

Operate | Read | Setup

Mode = HR | HighResistance

Evaluation Quantity: Resistance

Required Parameters:

+Resistance

TestVoltage

Optional Parameters	Default
Setup | Operate | Apply | Slew	Apply
Low	Ground
ResistanceMultiplierOn	Off

Evaluation Quantity: Resistance (0 Ohms)

Required Parameters:

+Resistance = 0 Ohms

Short

TestVoltage

Optional Parameters	Default
Setup | Operate | Apply	Apply
Low	Ground

Evaluation Quantity: TestCurrent

Required Parameters:

+TestCurrent

Short

Setup | Operate | Read

Optional Parameters	Default
Low	Ground
Resistance = 0 Ohms	na

Evaluation Quantity: TestVoltage

Required Parameters:

+TestVoltage

Resistance

Setup | Operate | Read

Optional Parameters	Default
Low	Ground
ResistanceMultiplierOn	Off

Mode = HRF | HighResistanceFixed

Evaluation Quantity: Resistance (100 GOhm)

Required Parameters:

+Resistance = 100 GOhm

TestVoltage

Optional Parameters	Default
Low	Ground
Setup | Operate | Apply	Apply

Evaluation Quantity: TestVoltage

Required Parameters:

+TestVoltage

Resistance

Setup | Operate | Read

Optional Parameters	Default
Low	Ground

Mode = LR | LowResistance

Evaluation Quantity: Resistance

Required Parameters:

+Resistance

TestCurrent

Optional Parameters	Default
Low	Ground
Sense	2-Wire
Short	na
Setup | Operate | Apply | Slew(1)	Apply

1. Slew is not allowed when short is specified.

Evaluation Quantity: TestCurrent

Required Parameters:

+TestCurrent

Resistance

Setup | Operate | Read

Optional Parameters	Default
Low	Ground
Sense	2-Wire

Evaluation Quantity: TestVoltage

Required Parameters:

+TestVoltage

Open

Setup | Operate | Read

Optional Parameters	Default
Low	Ground

Mode = IDA | LeakageCurrentActive (Requires 5320A/VLC)

Required Parameters:

+LeakageCurrent

Optional Parameters	Default
Setup | Operate | Apply	Apply

Mode = IDS | LeakageCurrentSubstitute

Required Parameters:

+LeakageCurrent

UUTOutputResistance

Optional Parameters	Default
Setup | Operate | Apply	Apply

Mode = IDP | LeakageCurrentPassive | IDD | LeakageCurrentDifferential

Required Parameters:

+LeakageCurrent

Setup | Operate | Read

Mode = RCDT | RCDTripTime

Required Parameters:

+TripTime (1)

+TripCurrent (1)

Setup | Operate | Query (2) | Read (3)

Optional Parameters	Default
TripCurrentMultiplier	1
TripCurrentRecognitionLevel	90 %

1. Only one evaluation quantity may be specified.
2. Only allowed when evaluation quantity is TripTime.
3. Only allowed when evaluation quantity is TripCurrent.

Mode = RCDC | RCDTripCurrent

Required Parameters:

+TripCurrent

Setup | Operate | Read

Mode = Line | LineImpedance | Loop | LoopImpedance

Evaluation Quantity: Resistance

Required Parameters:

+Resistance

ResidualImpedance (1)

Optional Parameters	Default
ResidualImpedanceCorrection	Off
TestCurrent	na
Apply | Setup | Operate | Query	Apply

1. ResidualImpedance is only required, and can only be specified, when ResidualImpedanceCorrection is Manual.

Evaluation Quantity: TestCurrent or PFC

Required Parameters:

+TestCurrent (1)

+PFC (1)

Resistance

ResidualImpedance (2)

Setup | Operate | Read

Optional Parameters	Default
ResidualImpedanceCorrection	Off
TestVoltage	na

1. Only one of Current or PFC may be specified.
2. ResidualImpedance is only required, and can only be specified, when ResidualImpedanceCorrection is Manual.

Mode = Volt | VoltageCalibrator (Requires 5320A/VLC)

Required Parameters:

+Voltage

Optional Parameters	Default
Frequency	
Low	
Setup | Operate | Apply | Slew	Apply

Mode = Meter | Multimeter

Required Parameters:

+Current (1)

+Voltage (1)

+Power (1)

Measure | Read | Setup

Optional Parameters	Default
Frequency	na
Probe	na

1. Only one of Current, Voltage, or Power may be specified.

Parameter Definitions and Values

Apply

This action sets up the instrument and enables the output.

Syntax

Apply

Rules:

- When Apply is specified, no other action may be specified.

Examples

Apply

Current

This parameter specifies one of the following:

1. Expected current flowing through the selected resistance, when Resistance is the specified evaluation quantity for GBR, LR, HR, HRF, Line, or Loop mode.
2. Measured current flowing through the selected resistance, when Current is the specified evaluation quantity for GBR, LR, Line, or Loop mode.
3. Measured value of current for Multimeter mode.

Syntax

[+]Current[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]A

Rules:

Mode: GBR, LR, HR, HRF, Line, and Loop

- Range of legal values is based on the selected resistance.

Mode: Multimeter

- Legal values are: 0 to 30 A
- When this parameter is specified, it must be designated as the Evaluation Quantity.

Examples

Current = 2.5 A

Frequency

This parameter specifies the following:

Mode: VoltageCalibrator

Output frequency

Mode: Multimeter

Input signal frequency

Syntax

[@]Frequency[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]Hz

Rules:

When this parameter is specified, AC mode is enabled.

Mode: VoltageCalibrator

- Legal values are: 40 to 400 Hz

Mode: Multimeter

- Legal values are: 0 to 2 kHz

Examples

@Freq = 50 Hz

LeakageCurrent

This parameter specifies the nominal value of leakage current.

Syntax

Mode: IDA & IDS

+LeakageCurrent[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]A

Mode: IDP & IDD

LeakageCurrent[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]A

Rules:

- Legal values are: 0.1 to 30 mA

Mode: IDA & IDS

- When this parameter is specified, it must be designated as the Evaluation Quantity.

Examples

LeakageCurrent = 10 mA

Low

This parameter connects or disconnects the Low terminal to/from GND terminal.

Syntax

Low[<sp>]=[<sp>]<value>

<value> = Float | Ground

Examples

Low = Float

Measure

This action sets up multimeter mode and returns the measurement designated by the Evaluation Quantity.

Syntax

Measure

Rules:

- When Measure is specified, no other action may be specified.

Examples

Measure

Mode

This parameter selects the instrument mode.

Syntax

Mode[<sp>]=[<sp>]<value>

<value> =	GBR	GroundBondResistance
	LR	LowResistance
	HR	HighResistance
	HRF	HighResistanceFixed
	IDA	LeakageCurrentActive
	IDS	LeakageCurrentSubstitute
	IDP	LeakageCurrentPassive
	RCDT	RCDTripTime
	RCDC	RCDTripCurrent
	Line	LineImpedance
	Loop	LoopImpedance
	Volt	VoltageCalibrator
	Meter	Multimeter

Examples

Mode = GBR

Open

This parameter selects the GBR or Low Resistance Open.

Syntax

Open

Examples

Open

Operate

This parameter turns the output on.

Syntax

Operate

Rules:

- When Operate is specified, no other parameters are allowed.

Examples

Operate

PFC

This parameter specifies the expected Perspective Fault Current.

Syntax

+PFC[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]A

Rules:

- Legal values are: tbd
- When this parameter is specified, it must be designated as the Evaluation Quantity.

Examples

+PFC = 100 mA

Power

This parameter specifies the expected Phantom Power.

Syntax

+Power[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]VA

Rules:

- Legal values are: 0 to 33 kVA
- When this parameter is specified, it must be designated as the Evaluation Quantity.

Examples

+Power = 10 kVA

Probe

This parameter selects the 10 kV or 80 K-40 40 kV high voltage probe.

Syntax

Probe[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]V

Rules:

- Legal values are 10 kV and 40 kV.

Examples

Probe = 10 kV

Query

This returns the "true" value designated by the Evaluation Quantity.

Syntax

Query

Rules:

- When Query is specified, no other parameters are allowed.

Examples

Query

Read

This returns the measurement designated by the Evaluation Quantity.

Syntax

Read

Rules:

- When Read is specified, no other parameters are allowed.

Examples

Read

Reset

This parameter resets the instrument.

Syntax

Reset

Rules:

- When Reset is specified, no other parameters are allowed.

Examples

Reset

ResidualImpedance

This parameter specifies the manually entered value of residual impedance for line and loop impedance modes.

Syntax

ResidualImpedance[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]Ohms

Rules:

- Legal values are: <tbd>
- ResidualImpedance is only allowed when ResidualImpedanceCorrection = Man or Manual.

Examples

ResidualImpedance = 0.87 Ohm

ResidualImpedanceCorrection

This parameter specifies the type of residual impedance correction for Line Impedance mode.

Syntax

ResidualImpedanceCorrection[<sp>]=[<sp>]<value>

<value> =	Man	Manual
	Scan	Scanned (Requires 5320A/VLC)
	Comp	Compensated

Rules:

- When ResidualImpedanceCorrection is not specified, correction is turned off.
- ResidualImpedanceCorrection = Compensated requires 5320A/VLC.

Examples

ResidualImpedanceCorrection = Manual

Resistance

This parameter specifies the nominal resistance value.

Syntax

Resistance[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]Ohms

Rules:

- Legal values depend on the operating mode (see 5320A specifications).

Examples

Resistance = 100 mOhm

ResistanceMultiplierOn

This parameter turns on the 1:1000 resistance multiplier.

Syntax

ResistanceMultiplierOn

Examples

ResistanceMultiplierOn

Sense

This parameter selects 4-wire High Resistance

Syntax

Sense[<sp>]=[<sp>]<value>

<value> = 2W | 4W | 2-Wire | 4-Wire

Examples

Sense = 4-Wire

Setup

This action causes the instrument to be setup only.

Mode: Multimeter

No reading is returned.

Mode: All other modes

The instrument remains in standby.

Syntax

Setup

Rules:

- When Setup is specified, no other action may be specified.

Examples

Setup

Short

This action selects the High or Low Resistance short.

Syntax

Short

Examples

Short

Slew

This action sets up the instrument and enables the output. Slewing is then enabled for the parameter designated as the Evaluation Quantity (i.e. + prefix).

Syntax

Slew

Rules:

- When Slew is specified, no other action may be specified.

Examples

Slew

Standby

This action selects standby (output disabled).

Syntax

Standby

Rules:

- When Standby is specified, no other parameters are allowed.

Examples

Standby

TestVoltage

This parameter specifies one of the following:

1. Expected test voltage, when Resistance is the specified evaluation quantity for HR or HRF mode.
2. Measured test voltage, when TestVoltage is the specified evaluation quantity for HR or HRF mode.

Syntax

[+]TestVoltage[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]V

Rules:

- Range of legal values is based on the selected resistance.

Examples

TestVoltage = 240 V

TripCurrent

This parameter specifies the nominal trip current.

Syntax

+TripCurrent[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]A

Rules:

- When this parameter is specified, it must be designated as the Evaluation Quantity (i.e. +TripCurrent).

  Mode: RCD Trip Current

- Legal values are 10, 20, 30, 50, 100, 200, 300, 500 ms, 1, 2, and 3 A.

  Mode: RCD Trip Time

- Legal values are 10 mA to 3 A.

Examples

+TripCurrent = 100 mA

TripCurrentMultiplier

This parameter specifies the multiplier of nominal trip current terminal.

Syntax

TripCurrentMultiplier[<sp>]=[<sp>]<value>

<value> = 0.5 | 1 | 1.4 | 2 | 5

Rules:

- If this parameter is not specified, the default is 1.

Examples

Multiplier = 2

TripCurrentRecognitionLevel

This parameter specifies the percentage level of recognition that trip current has reached nominal trip current level.

Syntax

TripCurrentRecognitionLevel[<sp>]=[<sp>]<value>[<sp>]%

<value> = 5 | 30 | 60 | 75 | 90 | 100 | 120

Rules:

- If this parameter is not specified, the default is 90 %.

Examples

TripCurrRecLevel = 75 %

TripTime

This parameter specifies the trip time for RCD Trip Time mode.

Syntax

TripTime[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]s

Rules:

- Legal values are: 10, 20, 30, 50, 100, 200, 300, 500 ms, 1, 2, 3, and 5 s.

Examples

TripTime = 50 ms

UUTCurrent

This parameter returns the resulting measured value of UUT current for Leakage Current Passive and Differential modes.

Syntax

+UUTCurrent[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]A

Rules:

- Legal values are: 0.1 to 30 mA
- When this parameter is specified, it must be designated as the Evaluation Quantity.

Examples

+UUTCurrent = 10 mA

UUTOutputResistance

This parameter specifies the UUT output resistance for Leakage Current Substitute mode.

Syntax

UUTOutputResistance[<sp>]=[<sp>]<numeric value>[<prefix>]Ohm

Rules:

- Legal values are: tbd

Examples

UUTOutputRes = 2 kOhm

Voltage

This parameter specifies the following:

Mode: GBR, HR, HRF, Line, and Loop

Expected voltage applied to the selected resistance.

Mode: VoltageCalibrator

Output voltage

Mode: Multimeter

Expected voltage reading

Syntax

Mode: GBR, LR, HR, HRF, Line, and Loop

Voltage[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]V

Mode: VoltageCalibrator and Multimeter

+Voltage[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]V

Rules:

Mode: GBR, HR, HRF, Line, and Loop

- Maximum voltage is based on selected resistance.

Mode: VoltageCalibrator

- Legal values are: 3 to 600 V
- When this parameter is specified, it must be designated as the Evaluation Quantity (i.e. +Voltage).

Mode: Multimeter

- Legal values are: 0 to 1100 V
- When this parameter is specified, it must be designated as the Evaluation Quantity (i.e. +Voltage).

Examples

+Voltage = 240 V

Voltage

This parameter specifies one of the following:

1. Expected current flowing through the selected resistance, when Resistance is the specified evaluation quantity for GBR, LR, HR, HRF, Line, or Loop mode.
2. Measured current flowing through the selected resistance, when Current is the specified evaluation quantity for GBR, LR, Line, or Loop mode.
3. Measured value of current for Multimeter mode.

Syntax

[+]Current[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]A

Rules:

Mode: GBR, LR, HR, HRF, Line, and Loop

- Range of legal values is based on the selected resistance.

Mode: Multimeter

- Legal values are: 0 to 30 A
- When this parameter is specified, it must be designated as the Evaluation Quantity.

Examples

Current = 2.5 A

Examples

```
 STEP    FSC     RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON

# -----  Reset -----
  1.001  5320         Reset

# -----  Standby  -----
  1.002  5320         Standby

# -----  GBR (Ground Bond Resistance) -----
  1.003  5320         Mode = GBR; +Resistance = 0.10 Ohm
  1.004  TARGET       -m
  1.005  DISP         Press BOND 200 mA.
  1.006  WAIT         -t 5 Waiting for measurement to complete...
  1.007  MEMI         Enter UUT reading in ohms:
  1.008  MEMCX        Z              2.5% 0.04U

# -----  High Resistance  -----
  2.001  5320         Mode = HR; +Resistance = 2.50 MOhm
  2.002  TARGET       -m
  2.003  DISP         Press and hold the UUT TEST button.
  2.003  DISP
  2.003  DISP         UUT will initially beep.  Release TEST button after
  2.003  DISP         UUT beeps a second time.
  2.004  MEMI         Enter UUT reading in megohms:
  2.005  MEMCX  50    MZ             3% 0.03U

# -----  Low Resistance  -----
  3.001  5320         Mode = LR; +Resistance = 18.00 Ohms
  3.002  TARGET       -m
  3.003  DISP         Press and hold TEST button until reading updates.
  3.004  MEMI         Enter UUT reading in ohms:
  3.005  MEMCX  20    Z              1.5% 0.03U

# -----  Leakage Current Substitute  -----
  4.001  5320         Mode = IDS; +LeakageCurrent = 0.25 mA
  4.001  5320         UUTOutputResistance = 2000 Ohms
  4.002  TARGET       -m
  4.003  DISP         Press I SUB.
  4.004  WAIT         -t 7 Waiting for UUT measurement to complete...
  4.005  MEMI         Enter UUT reading in milliamps:
  4.006  MEMCX        0.25mA         2.5% 0.03U
```

```
# -----  Leakage Current Passive  -----
  5.001  TSET          NMEAS = 1
  5.002  TARGET        -p
  5.003  5320          Mode = IDP; +LeakageCurrent = 1.50 mA; Setup
  5.004  5320          Mode = IDP; +LeakageCurrent = 1.50 mA; Operate
  5.005  TARGET        -m
  5.006  DISP          Press I TOUCH and release (two fast beeps).
  5.006  DISP
  5.006  DISP          Press and hold I TOUCH, release after two beeps.
  5.006  DISP
  5.006  DISP          Release I TOUCH immediately after the second beep.
  5.007  WAIT          -t 5 Waiting for readings...
  5.008  5320          Mode = IDP; +LeakageCurrent = 1.50 mA; Read
  5.009  MATH          MEM1 = MEM
  5.010  MEMI          Enter UUT reading in milliamps:
  5.011  MEMCX         mA             4% 0.04U

# -----  Leakage Current Differential  -----
  6.001  TSET          NMEAS = 1
  6.002  TARGET        -p
  6.003  5320          Mode = IDD; +LeakageCurrent = 0.25 mA; Setup
  6.004  5320          Mode = IDD; +LeakageCurrent = 0.25 mA; Operate
  6.005  TARGET        -m
  6.006  DISP          Press LOAD/LEAK and release (two fast beeps).
  6.006  DISP
  6.006  DISP          Press LOAD/LEAK again and hold for two beeps.
  6.006  DISP
  6.006  DISP          Select Advance now!
  6.007  WAIT          -t 5 Waiting for readings...
  6.008  5320          Mode = IDD; +LeakageCurrent = 0.25 mA; Read
  6.009  MATH          MEM1 = MEM
  6.010  MEMI          Enter UUT reading in milliamps:
  6.011  MEMCX         mA             4% 0.04U

# -----  RCDT (Trip Current)  -----
  7.001  TSET          MEAS = SA; TDESC = 10mA x½ ~
# Get 5320A RCD current accuracy at 10 mA, x½ multiplier.
  7.002  MATH          RefAccAmps = ACCV2(Name, Mode, 10E-3, 0.5)
# Convert to percent.
  7.003  MATH          L[1] = (RefAccAmps / 10E-3) * 100
  7.004  TARGET        -p
  7.005  DISP          Turn UUT rotary function switch to RCD TIME (delta T).
  7.006  5320          Mode = RCDT; +TripCurrent = 10 mA; TripTime = 300 ms
  7.006  5320          TripCurrentMultiplier = 0.5; Setup
```

```
  7.007  DISP         Press F1 until 10 mA is displayed in the upper
  7.007  DISP         left-hand corner of the display.
  7.007  DISP
  7.007  DISP         Press F2 until x1/2 is displayed.
  7.007  DISP
  7.007  DISP         Press F3 until sinusoidal symbol is displayed.
  7.007  DISP
  7.007  DISP         Press F4 until 0° is displayed in the lower
  7.007  DISP         left-hand corner of the display.
  7.008  TARGET       -m
  7.009  5320         Mode = RCDT; +TripCurrent = 10 mA; TripTime = 300 ms
  7.009  5320         TripCurrentMultiplier = 0.5; Operate
  7.010  DISP         Press and release the TEST button.
  7.010  DISP
  7.010  DISP         Select Advance when TEST annunciator is no longer
  7.011  5320         Mode = RCDT; +TripCurrent = 10 mA; TripTime = 300 ms
  7.011  5320         TripCurrentMultiplier = 0.5; Read
  7.012  ACC    5.00  mA             L1%
  7.013  MEMC   1000  5.00mA         +10%

  8.001  TSET         MEAS = SA; TDESC = 30mA x1 ~
  8.002  TARGET       -p
  8.003  5320         Mode = RCDT; +TripCurrent = 30 mA; TripTime = 300 ms
  8.003  5320         TripCurrentMultiplier = 1; Setup
  8.004  DISP         Press F1 until 30 mA is displayed in the upper
  8.004  DISP         left-hand corner of the display.
  8.004  DISP
  8.004  DISP         Press F2 until x1 is displayed.
# Multiplier is x1.  No ACC statement necessary.
  8.005  TARGET       -m
  8.006  5320         Mode = RCDT; +TripCurrent = 30 mA; TripTime = 300 ms
  8.006  5320         TripCurrentMultiplier = 1; Operate
  8.007  DISP         Press and release the TEST button.
  8.007  DISP
  8.007  DISP         Select Advance when TEST annunciator is no longer
  8.008  5320         Mode = RCDT; +TripCurrent = 30 mA; TripTime = 300 ms
  8.008  5320         TripCurrentMultiplier = 1; Read
  8.009  MEMC   1000  30.0mA         -10%

# -----  RCDT (Trip Time)  -----
  9.001  5320         Mode = RCDT; TripCurrent = 30 mA; +TripTime = 30.0 ms
  9.001  5320         TripCurrentMultiplier = 1; Setup
  9.002  DISP         Press F1 until 30 mA is displayed in the upper
  9.002  DISP         left-hand corner of the display.
```

```
  9.003  TARGET       -m
  9.004  5320         Mode = RCDT; TripCurrent = 30 mA; +TripTime = 30.0 ms
  9.004  5320         TripCurrentMultiplier = 1; Operate
  9.005  DISP         Press and release the TEST button.
  9.006  5320         Standby
  9.007  MEMI         Enter UUT reading in milliseconds:
  9.008  MEMCX  100   30.0ms         1% 1.0U

# -----  Loop Impedance  -----
 10.001  5320         Mode = Loop; +Resistance = 1.80 Ohms
 10.001  5320         ResidualImpedanceCorrection = Compensated
 10.002  TARGET       -m
 10.003  DISP         Press and release the TEST button.
 10.003  DISP
 10.003  DISP         Wait until the TEST annunciator is no longer displayed.
 10.004  MEMI         Enter UUT reading in ohms:
 10.005  MEMCX  20    Z              3% 0.10U

# -----  Voltage Calibrator  -----
 11.001  5320         +Voltage = 25.0 V; Freq = 50 Hz
 11.002  TARGET       -m
 11.003  MEMI         Enter UUT reading in volts:
 11.004  MEMCX  500   25.0V          0.8% 0.3U     50Hz

# -----  Multimeter (Current Measurement)  -----
 12.001  STD          750 Ohm/100 W Power Resistor
 12.002  TSET         NMEAS = 1
 12.003  TARGET       -p
 12.004  5320         Mode = Meter; +Current = 0.3 A; Setup
 12.005  TARGET       -m
 12.006  DISP         Press LOAD/LEAK key for 3 s to initiate continuous mode.
 12.007  WAIT         -t 5 Waiting for power resistor to warmup...
 12.008  5320         Mode = Meter; +Current = 0.3 A; Read
 12.009  MATH         MEM1 = MEM
 12.010  DISP         Press STOP.
 12.011  MEMI         Enter UUT reading in amps:
 12.012  MEMCX        A              4% 0.2U
```

5335

Instrument FSC

Description

The 5335 FSC programs the Hewlett-Packard 5335A Universal Counter to measure frequency, frequency ratio, period, time interval, phase, pulse width, duty factor, rise and fall time, and DC voltage. Not all 5335A capabilities are supported. To program unsupported functions, use the IEEE FSC.

Parameters

The following table shows the relationship between the supported 5335A measurement functions and the FSC fields listed.

Function	MOD3	Nominal	MOD1
Frequency A	FA	0 Hz to 200 MHz	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Frequency C[1]	FC	150 MHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm
Ratio A|B	FR	10^{-8} to 10^{16}	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Period A	PA	10 ns to 10^{7} s	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Time Interval A-B	TI	0 ns to 10^{7} s	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Phase A-B	PR	-180 ° to + 360 °	0.01 Hz to 160 MHz
Pulse Width A	WA	5 ns to 10^{7} s	75 mVpp to 50 Vpp 37.5 mVp to 25 Vp 26.5 mV rms to 17.7 V rms
Duty Cycle A	DA	1% to 99%	0 Hz to 100 MHz
Rise|Fall Time A	RF	20 ns to 10 ms	500 mVpp to 50 Vpp 177 mV rms to 17.7 V rms
DC Voltmeter [2]		-1000 V to 1000 V	*blank*

1. Requires Option 030:1.3 GHz C Channel.
2. Requires Option 020:DC Digital Voltmeter.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as [*numeric*][*prefix*]H.
- Frequency Ratio entered as [*numeric*[*prefix*]H/H.
- Period entered as [*numeric*][*prefix*]T.
- Time Interval entered as [*numeric*][*prefix*]T.
- Phase entered as [*numeric*][*prefix*]deg.
- Pulse Width entered as [*numeric*][*prefix*]T.
- Duty Cycle entered as [*numeric*][*prefix*]pct.
- Rise or Fall Time entered as [*numeric*][*prefix*]T.
- Voltage entered as [*numeric*][*prefix*]V.
- Reset entered as *.

Rules:

- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For measurements of frequency, frequency ratio, period, time interval, pulse width and rise/ fall time, this field specifies the expected amplitude. For measurements of phase, duty factor, voltage min/max of AC and voltage peak-to-peak, this field specifies the expected frequency. For measurements of voltage min/max of DC, this field should be blank.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (Peak) entered as: [*numeric*][*prefix*]Vp

- Voltage (Peak-to-Peak) entered as: [*numeric*][*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: [*numeric*][*prefix*]D
- Frequency entered as [*numeric*][*prefix*]H.
- *blank*

Rules:

- For Ratio A/B (FR) measurements, the MOD1 field specifies the expected amplitude on channel A, not channel B.

MOD2

This field is not used.

MOD3

This field specifies the measurement function:

- FA Frequency A
- FC Frequency C
- PA Period A
- FR Ratio A/B
- TI Time Interval A to B
- WA Pulse Width A
- RF Rise or Fall Time A
- PR Phase A Relative to B
- DA Duty Cycle A
- *blank* DC Voltage

Rules:

- The MOD3 field may specify Frequency C (FC) only when the Option 030: 1.3 GHz C Channel C is installed.
- FA is automatically inserted in the MOD3 field when the nominal field units are Hertz and no legal MOD3 code is entered.
- FR is automatically inserted in the MOD3 field when the nominal field units are Hertz/Hertz and no legal MOD3 code is entered.

- PA is automatically inserted in the MOD3 field when the nominal field units are seconds and no legal MOD3 code is entered.
- PR is automatically inserted in the MOD3 field when the nominal field units are degrees and no legal MOD3 code is entered.
- DA is automatically inserted in the MOD3 field when the nominal field units are percent and no legal MOD3 code is entered.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Input Impedance
- L 50 Ω Input Impedance
- 2W 2-Wire

Rules:

MOD3	CON
blank	2W
not blank	L or *blank*

- The CON field may specify L for MOD3 = FA, PA, FR, TI, WA, RF, PR, or DA, only when Option 040 "Programmable Input Amplifiers"is not installed.
- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC) and no legal CON field code is entered.
- 2W is inserted automatically in the CON field when the MOD3 field is blank and no legal CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M5335        *
  1.002  5335         *
# ----- Frequency A -----
  1.003  M5335  ChA                                100kH
  1.004  5335         10.000kH       1%            1Vpp              FA
# ----- Frequency C -----
  2.001  5335         100MH          0.1%          -1D               FC    L
# ----- Period A -----
  3.001  M5335        *
  3.002  5335         1.000mT        0.003U        5V                PA
# ----- Ratio A/B -----
  4.001  M5335  ChA                                               AC
  4.002  M5335  ChB                                               DC
  4.003  5335         10H/H          1%            1Vpp                FR
# ----- Time Interval A to B -----
  5.001  M5335  COM   20T            0.2V          0.8V           DC ++    X1
  5.002  5335         10.00T         0.02U         1Vpp              TI
# ----- Pulse Width A -----
  6.001  M5335        *
  6.002  5335         300uT          5%            5Vp               WA
# ----- Rise Time A -----
  7.002  5335         100nT          5%            1Vpp              RF
# ----- Phase A relative to B -----
  8.001  M5335        *
  8.002  5335         30deg          1U            10kH              PR    L
# ----- Duty Cycle A -----
  9.001  5335         30.0pct        2%            100H              DA
```

M5335

Auxiliary Instrument Setup FSC

Description

The M5335 FSC provides the additional program functions for Channel A and Channel B of the Hewlett-Packard 5335A Universal Counter, which are not addressed by the 5335 FSC. These functions include Common B via A, gate time, and trigger slope. Input coupling, attenuation, and impedance along with the trigger level and channel A low-pass filter may also be specified if Option 040 "Programmable Input Amplifiers" is installed in the counter.

Parameters

Option 040 not installed

Range	Nominal	TOL	MOD1	MOD2	MOD3	CON
	*					
	gate time					
ChA	[gate time]				[slope]	
ChA	[gate time]				[slope]	
COM	[gate time]				[slope]	

Option 040 installed

Range	Nominal	TOL	MOD1	MOD2	MOD3	CON
	*					
	gate time					
ChA	[gate time]	[level]	[LP filter]	[coupling]	[slope]	[attn]
ChA	[gate time]	[level]		[coupling]	[slope]	[attn]
COM	[gate time]	[level]	[level]	[coupling]	[slope]	[attn]

Note

Blank entries in the above table are significant and must be blank. [] denotes optionality. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Channel specific parameters are not "sticky". For example, if a M5335 FSC specifies channel A trigger level and then a subsequent M5335 FSC specifies channel slope and attenuation, the trigger level field will be viewed and *blank* and auto level will be selected.

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	M5335	ChA		1.0V					
1.002	M5335	ChA				+			X10
1.003	M5335	ChA		1.0V		+			X10

Statements 1.001 and 1.002 should be combined as statement 1.003 to preserve the trigger level specification.

RANGE

This field specifies the Channel.

- ChA Channel A
- ChB Channel B
- COM Common B via A
- *blank*

Rules:

- M5335 FSC parameters, other than gate time are ignored under the following conditions:

1. The RANGE field specifies Channel B and the 5335 FSC specifies Frequency A, Period A, Pulse Width A, or DC Voltmeter (5335 MOD3 field is FA, PA, WA, or blank respectively).
2. The RANGE field specifies Common B via A and the 5335 FSC specifies a measurement function other than Time Interval A-B (5335 MOD3 field is not TI).
3. The 5335 FSC specifies Frequency C (MOD3 field is FC).

NOMINAL

This field specifies one the following:

- Gate Time entered as: *numeric*[*prefix*]T.
- Allowed values are: 100 ns to 10^7 s.
- "*" Reset to defaults
- *blank*

Rules:

- This field is ignored and GATE MODE MIN is selected when the 5335 MOD3 field is any of the following:

  TI Time Interval A to B

  WA Pulse Width A

  RF Rise or Fall Time A

  PR Phase A Relative to B
- This field is ignored when the 5335 MOD3 field is blank.
- Gate Time is not channel specific. It may be specified in a separate M5335 statement or in conjunction with a channel A or channel B specification. Either way, the last Gate Time specification prior to a 5335 statement is used.

Gate Time	Gate Mode
100 µs to 20 ms	Fast
20 ms to 30 s	Normal

TOLERANCE

This field specifies one of the following:

- The Channel A or B Trigger Level entered as *numeric*[*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

- Allowed values for trigger level are –5 V to +5 V.
- The TOLERANCE field specifies the channel A trigger level when the RANGE field specifies Channel A or Common B via A.

- The TOLERANCE field specifies the channel B trigger level when the RANGE field specifies Channel B.
- The TOLERANCE field must be blank when the RANGE field is blank or Option 040, "Programmable Input Amplifiers", is not installed.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel A or Common B via A.

MOD1

This field specifies one of the following:

- The Channel A Low-Pass Filter entered as: *numeric*[*prefix*]H.
- The Channel B Trigger Level entered as *numeric*[*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

- Allowed values for trigger level are –5 V to +5 V.
- Allowed value for channel A low-pass filter is 150 kHz.
- The MOD1 field may specify the channel A low-pass filter only when the RANGE field specifies channel A.
- When the MOD1 field specifies the channel A low-pass filter, the value must be 150 kHz.
- The MOD1 field may specify the channel B trigger level only when the RANGE specifies Common B via A.
- The MOD1 field must be blank when the RANGE field is blank or Option 040, "Programmable Input Amplifiers" is not installed.

MOD2

This field specifies the input coupling:

- AC
- DC
- *blank* Default

5335 MOD3	Description	Default Coupling
FA	Frequency A	AC
FC	Frequency C	na
PA	Period A	AC
FR	Ratio A|B	AC
WA	Pulse Width A	DC
TI	Time Interval A-B	AC
PR	Phase A-B	AC
DA	Duty Cycle A	DC
RF	Rise Time A	DC
blank	DC Volts	na

Rules:

- The MOD2 field must be blank if Option 040 "Programmable Input Amplifiers" is not installed.
- Default values are used when one of the following conditions exists:

1. No M3535 statement has been executed.
2. The last M3535 statement executed was a M3535 Reset.
3. The M3535 MOD2 field is blank and the M3535 RANGE field specifies Channel A, Channel B, or Common B via A.

- The MOD2 field must be blank when the RANGE field is blank.

MOD3

This field specifies the trigger slope:

- + Positive, Channel A or B
- - Negative, Channel A or B
- ++ Positive Channel A and B
- +- Positive Channel A, Negative Channel B

- -+ Negative Channel A, Positive Channel B
- -- Negative Channel A and B
- *blank*

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel A (CHA) or Channel B (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common B via A (COM).
- When the MOD3 field is blank and the RANGE is ChA, ChB, or COM,

the trigger level is the last programmed value or the front panel setting.

MOD4

This field is not used.

CON

This field specifies the Attenuation. Legal entries are:

- X1 (default)
- X10
- *blank*

Rules:

- The CON field must be blank when Option 040 "Programmable Input Amplifiers" is not installed.
- The CON field must be blank when the RANGE is blank.
- When the CON field is blank and the RANGE is ChA, ChB, or COM, the attenuation is the last programmed value or the front panel setting.

Examples

Refer to 5335 FSC..

5350, 5351, and 5352

Instrument FSCs

Description

The 5350, 5351, and 5352 FSCs programs the Hewlett-Packard 5350A/B/M, 5351A/B/M, and 5352A/B/M Microwave Frequency Counters, respectively.

Note

The 5350 FSC may also be used to control a 5351A/B/M or 5352A/B/M. This capability allows a 5350 based procedure to be executed without modification when a 5351B or 5352B is configured.

Similarly, a 5351 FSC may be used to control a 5352A/B/M. This capability allows a 5351 based procedure to be executed without modification when a 5352B is configured.

An exception to the above occurs when a 5350 or 5351 statement Input 1 amplitude exceeds +7 dBm. In this case Option 006 "Limiter" is required. Since Option 006 is not available for the 5352A/B/M, a procedure which requires Option 006 will not execute with a 5352B configured.

Parameters

The following table shows the relationship between the supported 5350 series measurement functions and the FSC fields listed.

Input 1 (MOD2 = "I1")

Frequency (Nominal)	Amplitude (MOD1)
5350A, 5350B, and 5350M	
500.0 MHz to 12.4 GHz	-32 dBm to +7.0 dBm
500.0 MHz to 20.0 GHz	-27 dBm to +7.0 dBm
Option 006 "Limiter" (M5350 MOD3 = "LM") (1)	
500.0 MHz to 6.0 GHz	+3 dBm to +39.0 dBm
6.0 GHz to 12.4 GHz	+3 dBm to +36.0 dBm
12.4 GHz to 18.0 GHz	+4 dBm to +36.0 dBm
18.0 GHz to 20.0 GHz	+4 dBm to +34.8 dBm

Frequency (Nominal)	Amplitude (MOD1)
5351A, 5351B, and 5351M	
500.0 MHz to 12.4 GHz	-32 dBm to +7.0 dBm
500.0 MHz to 20.0 GHz	-27 dBm to +7.0 dBm
500.0 MHz to 26.5 GHz	-16 dBm to +7.0 dBm
Option 006 "Limiter" (M5351 MOD3 = "LM") (1)	
500.0 MHz to 6.0 GHz	+3 dBm to +39.0 dBm
6.0 GHz to 12.4 GHz	+3 dBm to +36.0 dBm
12.4 GHz to 18.0 GHz	+4 dBm to +36.0 dBm
18.0 GHz to 20.0 GHz	+4 dBm to +34.8 dBm
20.0 GHz to 26.5 GHz	+5 dBm to +34.8 dBm
5352A, 5352B, and 5352M	
500.0 MHz to 46.0 GHz	-25 dBm to +7.0 dBm

1. Applying in excess of +7 dBm to units not equipped with Option 006 will cause extensive ($$$) damage.

Input 2 (MOD2 = "I2")

Frequency (Nominal)	Amplitude (MOD1)
10.0 Hz to 80.0 MHz	25 mVrms to 1 Vrms (1 MOhm)
10.0 MHz to 525.0 MHz	-20 dBm to +10 dBm (50 Ohm)

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as *[<numeric>][<prefix>]H*
- Reset entered as *

Rules:

- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the expected amplitude of the frequency to be measured.

- Voltage (RMS) entered as: *[<numeric>][<prefix>]V*
- Voltage (into 50 Ohms, dBm) entered as: *[<numeric>][<prefix>]D*

Rules:

- For Input 1 measurements, the MOD1 field must be in dBm.
- For Input 2 measurements, the MOD1 field may be in Volts or dBm.

MOD2

This field specifies the input channel:

- I1 Input 1
- I2 Input 2

Rules:

- I1 is inserted automatically in MOD3 when the Nominal field is >525 MHz.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The Connection field specifies the UUT connection.

- L 50 Ohm Input Impedance
- <*blank*> 1 MOhm Input Impedance

Rules:

- L is inserted automatically in the CON field when the MOD2 field is I1.
- CON may be <*blank*> only when the MOD2 field is I2 and the Nominal field is between 10 Hz and 80 MHz.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the online Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M5350        *
  1.002  5350         *
# ----- Frequency Input 1, Automatic Measurement Mode -----
  2.001  5350         10GH           0.1%          +2D         I1         L
# ----- Frequency Input 1, Manual Measurement Mode -----
  3.001  M5350                                                            MAN
  3.002  5350         10GH           0.1%          +2D         I1         L
# ----- Frequency Input 1, 1 MHz resolution -----
  4.001  M5350        1MH
  4.002  5350         10.000GH       0.1%          +2D         I1         L
# ----- Frequency Input 1, FM Rate, Low -----
  5.001  M5350                                                            LOW
  5.002  5350         10GH           0.1%          +2D         I1         L
# ----- Frequency Input 2, 1 MOhm input impedance -----
  6.001  5350         10kH           1%            1V          I2
# ----- Frequency Input 2, High Resolution -----
  7.001  M5350                                                    HI
  7.002  5350         100.000H       1%            1V          I2
```

M5350, M5351, and M5352

Auxiliary Instrument Setup FSCs

Description

The M5350, M5351, and M5352 FSCs provide the additional program functions for the Hewlett-Packard 5350A/B/M, 5351A/B/M, and 5352A/B/M Microwave Counters which are not addressed by the 5350, 5351, and 5352 FSCs. These functions include resolution, Input 2 high resolution, smoothing, Input 1 FM rate tolerance low, and Input 1 manual measurement mode.

RANGE

This field is not used.

NOMINAL

This field specifies one of the following:

- Resolution entered as: *<numeric>[<prefix>]H.*
- "*" Reset to defaults
- *<blank>* Fast Sample Rate (default)

Rules:

- Allowed values for resolution are 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, and 1 MHz.
- If a blank M5350 statement is entered a "*" is automatically entered in the Nominal field

TOLERANCE

This field is not used.

MOD1

This field is not used.

MOD2

This field is used to select Input 2 High Resolution.

- HI Input 2 High Resolution
- <*blank*> Normal (default)

Rules:

- The MOD2 field may specify high resolution only when the Nominal field does not specify the resolution.

MOD3

This field is not used.

MOD4

This field enables/disables smoothing.

- S Enable smoothing
- <*blank*> Disable smoothing (default)

Rules:

- MOD4 must be blank for either of the following:
  1. Nominal specifies resolution.
  2. MOD2 specifies Input 2 High Resolution.

CON

This field is used to select the following Input 1 parameters:

- LOW FM Rate Tolerance Low
- MAN Manual Measurement mode
- TRK Track mode
- <*blank*> default

Rules:

CON	FM Rate Tolerance	Measurement Mode
LOW	Low	Auto
MAN	Normal	Manual
TRK	Track	Auto
<blank>	Normal	Auto

1. When the CON field specifies the manual measurement mode and 535x FSC MOD3 field is I1, the 535x FSC Nominal value must be within 20 MHz of actual from 1 GHz to maximum allowable frequency input and 3 MHz of actual from 500 MHz to 1 GHz. If not, erroneous readings will result.

Examples

See 5350/5351/5352 FSC.

5440

Instrument FSC

Description

The 5440 FSC programs the Fluke 5440B or 5442A DC Calibrator to output DC Voltage or DC Current from a Fluke 5220A Transconductance Amplifier controlled by a 5440B or 5442A.

Functional Capability

Function	Nominal
DC Voltage	-1100 V to 1100 V
DC Current	+/-(0.1 mA to 20 A) with 5220A

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the voltage, current, or reset.

- Voltage entered as: [*numeric*][*prefix*]V
- Current entered as: [*numeric*][*prefix*]A
- Reset entered as: *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used.

MOD2

This field allows you to specify the divider override feature of the calibration system. This selection is specified by entering the character "O". This selection is only available when the divider output can be active (between -2.2 V and +2.2 V.)

The internal divider allows the user to achieve higher levels of calibration accuracy in most circumstances; therefore, the use of the divider is always automatically selected, where it is applicable. Reasons to override the use of the divider is the following:

The high burden property of the UUT requires divider override to maintain calibration accuracy. The output impedance of the 5440B is 50Ω for programmed voltages below 2.2V. Substantial errors could be introduced in the calibration of high burden meters as a result of this output impedance.

The resolution and accuracy of the 2.2V range is adequate for the requirement. Operator time may be saved by not having to change connections from the normal output of the calibrator to the divided output (and back again at some later time).

MOD3

This field specifies the guard connection.

- G External guard connection is active
- *blank* Guard is internally shorted to low.

The guard active mode is appropriate for low level voltages where noise could affect the response of the unit under test.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- 2W is automatically inserted in the CON field when no CON field parameter is entered.

- 4W is not applicable in the following situations:
- -2.2 V to 2.2 V unless divider override is specified (MOD2 is O).
- Current output from the 5220A.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
# ----- Reset -----									
1.001	5440		*					S	
1.002	5440	1000	1100V	+500P/ 4/					2W
2.001	5440		10mV	0.05U					2W
3.001	5440	10	-2.2V	1%		O			2W
4.001	5440	10	10V	5%			G		2W
5.001	5440	10	10V	5%					2W
6.001	5440		10V					S	2W
6.002	5440		10V	5%				N	2W
7.001	5440	10	10A	0.1U					2W
8.001	5440	A	A	0.01U					2W

5450

Instrument FSC

Description

The 5450 FSC programs the Fluke 5450A Resistance Calibrator.

Functional Capability

- 0 Ω (short)
- 1 Ω to 100 MΩ, 1 S to 10 nS in decade steps
- 1.9 Ω to 19 MΩ, 0.52631 S to 52.631 nS in decade steps

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the resistance, conductance, or reset.

- Resistance entered as: [*numeric*][*prefix*]Z
- Conductance entered as: [*numeric*][*prefix*]Y
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used.

MOD2

This selection is used to compensate for lead resistance in the two-wire ohms mode. If the character "O" (for Offset) is entered in this field, the contents of memory location MEM are used (instead of the value in the NOMINAL field) for comparison against the expected nominal value.

To take advantage of this feature, you need to measure the total of the lead resistance and the value of resistance, using another DMM, for example an 8506A. Then you store the measured value in MEM and evaluate the UUT with the nominal value of resistance ("O" selected.)

Example

Test the accuracy of a UUT at 100 ohms, two-wire mode.

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.004	ASK-	R							
1.005	HEAD		LOW RESISTANCE/HIGH CONDUCTANCE TEST						
1.006	5450		100.0Z					S	2W
1.007	DISP		Configure the 8506A as follows:						
1.007	DISP		8506A: Input-Hi to 8506A: Source-Hi						
1.007	DISP		8506A: Input-Lo to 8506A: SOurce-Lo						
1.007	DISP		Press the 4T Ohms button in to enable 4-wire ohms.						
1.008	IEEE		[@8506]G3?[I]						
1.009	MEME								
1.010	JMPT		1.013						
1.011	DISP		Press the FRONT/REAR select switch.						
1.012	JMP		1.008						
1.013	DISP		Connect the 5450A and the 8506A as follows:						
1.013	DISP		5450A: Output-Hi to 8506A: Input-Hi						
1.013	DISP		5450A: Output-Lo to 8506A: Input-Lo						
1.014	8506		100Z					N	4W
1.015	MEME								
1.016	DISP		Disconnect the 8506A from the 5450A.						
1.016	DISP		Connect the 5450A and the UUT as follows:						
1.016	DISP		5450A: Output-Hi to UUT V/Ohms						
1.016	DISP		5450A: Output-Lo to UUT COMMON						
1.017	5450		100Z	0.7% 0.2U		O			2W

- Step 1.004 disables the regular range and function messages.
- Step 1.006 applies 100 ohms from the 5450A in the two-wire mode.

- Step 1.007 wires the 8506A up in the two-wire mode, directly on its front panel input terminals.
- Step 1.008 checks if the FRONT/REAR selection switch of the 8506A is in the FRONT position. Otherwise, the operator is prompted as defined in step 1.011.
- The output of the 5450A is now connected and then measured with the leads up to the front panel of the 8506A in steps 1.013 and 1.014. The result is stored in MEM1 and then moved over to MEM in step 1.015.
- The test leads are now moved over from the 8506A input to the UUT input in step 1.016. The performance of the UUT is now evaluated against the value in MEM in step 1.017 (note the <cb>O<rv> selection).

MOD3

This field specifies the guard connection.

- G — External guard connection is active
- *blank* — Guard is internally shorted to low.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W — 2-wire
- 4W — 4-wire
- RW — 2-wire with 2-wire compensation turned on

Rules:

- 2W is automatically inserted in the CON field when no CON field parameter is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP     FSC     RANGE NOMINAL         TOLERANCE     MOD1          MOD2   3   4  CON
# ----- Reset -----
  1.001  5450         *                                                        S
  1.002  5450    100   100kZ            5.0%                                      2W
  2.001  5450    10    10Z              500P%                                     4W
  3.001  5450    100   100MZ            1000P/                                    2W
  4.001  5450    200   190Z             5.0%                                      RW
  5.001  5450    10    Z                5.0U                                      RW
  6.001  5450    10    1mY              4000P/                                    4W
  6.002  5450    1     .52631Y          5.0%                                      4W
  7.001  5450    1     1Z               5%                                        4W
  8.001  5450          1Z                                                      S  4W
```

5500

Instrument FSC

Description

The 5500 FSC provides the means to control the following functions of the Fluke 5500A Calibrator:

- DC Voltage and DC Current
- AC Voltage and AC Current (Sine, Square, Triangle, and Truncated Sine waveforms)
- Synthesized Resistance and Capacitance
- RTD and Thermocouple Calibration stimulus
- Thermocouple measurement
- Boosted AC Voltage using the 5725A Boost Amplifier.
- Boosted DC and AC Current using the 5725A Boost Amplifier.

The 5725A must be connected to the 5500A in order to be controlled through the 5500 FSC.

When the M550 FSC is used in conjunction with the 5500 FSC the following additional 5500A functions may be controlled:

- Dual DC and Dual AC Voltage
- DC and AC Power stimulus (simultaneous voltage and current output)
- DC Voltage and DC Current range locking
- DC Offset for AC Voltage
- Duty Cycle for square waves
- Phase for Dual Voltage and Power stimulus
- Displacement Power Factor for Power stimulus
- External Reference Temperature for Thermocouple Calibration and Measurement

The following functions are available with 5500A-SC300 Scope Option:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Scope Square, Edge, Time Mark, and ScopeMeter waveforms)
- Trigger Signal

The following functions are available with 5500A-SC600 Scope Option:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Positive and Negative Scope Square, Edge, Time Mark, Pulse and Video waveforms)
- Oscilloscope Input Impedance Measurement
- Oscilloscope 50 Ω Impedance Overload Protection Measurement
- Trigger Signal

Note

If the 5500A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 5500A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 5500A must be set correctly before a procedure is executed. If the 5500A is connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. If the 5500A is connected to the 5520A or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Function	Amplitude	Frequency/Period	Misc.
DC Voltage:			
Normal Output	-1000 V to 1000 V		
TC Output	-329.9999 mV to 329.9999		
AC Voltage:			
Normal Output			
Sine			
Boost Off	1 mV to 33 mV	0.01 Hz to 9.99 Hz	Vp + |Voff| ≤ 80 mVp
	34 mV to 330 mV	0.01 Hz to 9.99 Hz	Vp + |Voff| ≤ 800 mVp
	0.4 V to 3.3 V	0.01 Hz to 9.99 Hz	Vp + |Voff| ≤ 8 Vp
	4 V to 33 V	0.01 Hz to 9.99 Hz	Vp + |Voff| ≤ 50 Vp
	1 mV to 32.999 mV	10 Hz to 500 kHz	Vp + |Voff| ≤ 80 mVp

<table>
<tr><th>Function</th><th>Amplitude</th><th>Frequency/Period</th><th>Misc.</th></tr>
<tr><td></td><td>33 mV to 329.999 mV</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>0.33 V to 3.29999 V</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>3.3 V to 32.9999 V</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td></td><td>33 V to 329.999 V</td><td>45 Hz to 20 kHz</td><td></td></tr>
<tr><td></td><td>330 V to 1000 V</td><td>45 Hz to 10 kHz</td><td></td></tr>
<tr><td></td><td>0.3 V to 3.3 V</td><td>1 MHz, 2 MHz</td><td></td></tr>
<tr><td>Boost Off</td><td>-63.80 dBm to -7.29 dBm</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td></td><td>-27.28 dBm to -7.40 dBm</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>-7.3 dBm to 12.7 dBm</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>13 dBm to 32 dBm</td><td>0.01 Hz to 9.99 Hz</td><td>+ |Voff| ≤ 50 Vp</td></tr>
<tr><td></td><td>-57.78 dBm to -27.41 dBm</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td></td><td>-27.41 dBm to -7.41 dBm</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>-7.41 dBm to 12.58 dBm</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>12.59 dBm to 32.58 dBm</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td></td><td>32.59 dBm to 52.58 dBm</td><td>45 Hz to 20 kHz</td><td></td></tr>
<tr><td></td><td>52.59 dBm to 62.21 dBm</td><td>45 Hz to 10 kHz</td><td></td></tr>
<tr><td></td><td>-8 dBm to 12.7 dBm</td><td>1 MHz, 2 MHz</td><td></td></tr>
<tr><td>Boost On</td><td>100 V to 750 V</td><td>45 Hz to 100 kHz</td><td></td></tr>
<tr><td></td><td>750 V to 1000 V</td><td>45 Hz to 30 kHz</td><td></td></tr>
<tr><td>Boost On</td><td>42.22 dBm to 59.71 dBm</td><td>45 Hz to 100 kHz</td><td></td></tr>
<tr><td></td><td>59.72 dBm to 62.21 dBm</td><td>45 Hz to 30 kHz</td><td></td></tr>
<tr><td>Square[1]</td><td>3 mVpp to 66 mVpp</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td></td><td>67 mVpp to 660 mVpp</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>0.7 Vpp to 6.6 Vpp</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 8 V</td></tr>
<tr><td></td><td>7 Vpp to 66 Vpp</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td></td><td>2.9 mVpp to 65.999 mVpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff≤80 mVp</td></tr>
<tr><td></td><td>66 mVpp to 659.999 mVpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>0.66 Vpp to 6.59999 Vpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>6.6 Vpp to 66 Vpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td>Triangle &</td><td>2.9 mVpp to 92.999</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td>Truncated Sine</td><td>93 mVpp to 929.999 mVpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>0.93 Vpp to 9.29999 Vpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>9.3 Vpp to 93 Vpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td>DC Current:</td><td></td><td></td><td></td></tr>
<tr><td>Aux. Output</td><td>-11 A to 11 A</td><td></td><td></td></tr>
<tr><td>5725A Output</td><td></td><td></td><td></td></tr>
<tr><td>Boost Off</td><td>-2.19999 A to 2.19999 A</td><td></td><td></td></tr>
<tr><td>Boost On</td><td>-11 A to 11 A</td><td></td><td></td></tr>
<tr><td>AC Current:
Aux Output,
Sine</td><td></td><td></td><td></td></tr>
</table>

Function	Amplitude	Frequency/Period	Misc.
no toroid	29 µA to 330 mA 29 µA to 329.999 mA 0.33 A to 2.19999 A 2.2 A to 11 A	0.01 Hz to 9.99 Hz 10 Hz to 10 kHz 10 Hz to 5 kHz	
10-turn toroid	0.29 mA to 3.29999 A 3.3 A to 21.9999 A 22 A to 110 A	10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz	
30-turn toroid	0.87 mA to 8.9997 A 9.9 A to 65.9997 A 66 A to 330 A	10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz	
50-turn toroid	1.45 mA to 16.49995 A 16.5 A to 109.9995 A 110 A to 550 A	10 Hz to 10 kHz 10 Hz to 5 45 Hz to 1 kHz	
Square	47 µApp to 660 mApp 47 µApp to 659.999 mApp 0.66 App to 4.39999 App 4.4 App to 22 App	0.01 Hz to 9.99 Hz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz	
Triangle & Truncated Sine	47 µApp to 930 mApp 47 µApp to 929.999 mApp 0.93 App to 6.19999 mApp 6.2 App to 31 App	0.01 Hz to 9.99 Hz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz	
AC Current: 5725A Output Sine no toroid			
Boost Off	0.33 mA to 329.999 mA 0.33 A to 2.19999 A	10 Hz to 10 kHz 10 Hz to 5 kHz	
Boost On	1.5 A to 11 A	45 Hz to 10 kHz	
10-turn toroid			
Boost Off	3.3 mA to 3.29999 A 3.3 A to 21.9999 A	10 Hz to 10 kHz 10 Hz to 5 kHz	
Boost On	15 A to 110 A	45 Hz to 10 kHz	
30-turn toroid			
Boost Off	9.9 mA to 8.9997 A 9.9 A to 65.9997 A	10 Hz to 10 kHz 10 Hz to 5 kHz	
Boost On	45 A to 330 A	45 Hz to 10 kHz	

Function	Amplitude	Frequency/Period	Misc.
50-turn toroid			
Boost Off	16.5 mA to 16.49995 A	10 Hz to 10 kHz	
	16.5 A to 109.9995 A	10 Hz to 5 k	
Boost On	75 A to 550 A	45 Hz to 10 kHz	
Square			
Boost Off	0.47 mApp to 659.999 mApp	10 Hz to 10 kHz	
	0.66 App to 4.39999 App	10 Hz to 5 kHz	
Boost On	4.4 App to 22 App	45 Hz to 10 kHz	
Triangle &			
Truncated Sine			
Boost Off	0.47 mApp to 929.999 mApp	10 Hz to 10 kHz	
	0.93 App to 6.19999 App	10 Hz to 5 kHz	
Boost On	6.2 App to 31 App	45 Hz to 10 kHz	
Synthesized Res.			
4-wire & 2-wire comp.	0Ω to 109.999 kΩ		
2-wire	110 kΩ to 330 MΩ		
Synthesized Cap.			
4-wire & 2-wire	330 pF to 1100 μF		
4-wire & 2-wire comp.	110 nF to 1100 μF		
RTD Calibration			
100Ω Pt 385	-200 °C to 800 °C, -328 °F to 1472 °F		
200Ω Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
500Ω Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
1 kΩ Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
100Ω Pt 3916	-200 °C to 630 °C, -328 °F to 1166 °F		
100Ω Pt 3926	-200 °C to 630 °C, -328 °F to 1166 °F		
120Ω Ni 391	-80 °C to 260 °C, -112 °F to 500 °F		
10Ω Cu	-100 °C to 260 °C, -148 °F to 500 °F		
Thermocouple Calibration & Measurement			
Type B	600 °C to 1820 °C, 32 °F to 3308 °F		
Type C	0 °C to 2316°C, 32 °F to 4201 °F		
Type E	-250 °C to 1000 °C, -418 °F to 1832 °F		

Function	Amplitude	Frequency/Period	Misc.
Type J	-210 °C to 1200 °C, -410 °F to 2192 °F		
Type K	-200 °C to 1372 °C, -328 °F to 2502 °F		
Type L	-200 °C to 900 °C, -328 °F to 2502 °F		
Type N	-200 °C to 1300 °C, -328 °F to 2372 °F		
Type R	0 °C to 1767 °C, 32 °F to 3213 °F		
Type S	0 °C to 1767 °C, 32 °F to 3213 °F		
Type T	-250 °C to 400 °C, -418 °F to 752 °F		
Type U	-200 °C to 600 °C, -328 °F to 1103 °F		
Dual DC Voltage:			
Normal Output	-1100 V to 1100 V		
Aux Output	-3.3 V to 3.3 V		
Dual AC Voltage:			Phase:
Normal Output [4]			-180 ° to +180 °
Sine [2]			
Boost Off	1 mV to 1000 V	10 Hz to 10 kHz	
Boost Off	-57.78 dBm to 62.21 dBm	10 Hz to 10 kHz	
Boost On	150 V to 1000 V	40 Hz to 10 kHz	
Boost On	45.74 dBm to 62.21 dBm	40 Hz to 10 kHz	
Square	2.9 mVpp to 66 Vpp	10 Hz to 10 kHz	
Triangle &	2.9 mVpp to 93 Vpp	10 Hz to 10 kHz	
Truncated Sine			
Aux Output			
Sine [2]	10 mV to 330 mV	0.01 Hz to 9.99 Hz	
	-27.28 dBm to -7.40 dBm	0.01 Hz to 9.99 Hz	
	0.4 V to 3.3 V	0.01 Hz to 9.99 Hz	
	-7.3 dBm to 12.7 dBm	0.01 Hz to 9.99 Hz	
	10 mV to 3.3V	10 Hz to 10 kHz	
	-37.78 dBm to 12.58 dBm	10 Hz to 10 kHz	
Square	29 mVpp to 6.6 Vpp	0.01 Hz to 10 kHz	
Triangle &			
Truncated Sine	29 mVpp to 9.3 Vpp	0.01 Hz to 10 kHz	
DC Power:			
Normal Output	-1100 V to 1100 V		
Aux Output	-11 A to 11 A		
5725A Output			
Boost Off	-2.19999 A to 2.19999 A		

Function	Amplitude	Frequency/Period	Misc.
Boost On	-11 A to 11 A		
AC Power: Normal Output [4] Sine[2] Boost Off Boost Off Boost On Boost On Square Triangle & Truncated Sine[2]	 1 mV to 1000 V -57.78 dBm to 62.21 dBm 150 V to 1000 V 45.74 dBm to 62.21 dBm 2.9 mVpp to 65.9999 Vpp 2.9 mVpp to 93 Vpp	 [3] [3] [3] [3] [3] [3]	Phase: -180° to + 180°
Aux Output [2] no toroid 10-turn toroid 30-turn toroid 50-turn toroid Square Triangle & Truncated Sine	 0.33 mA to 330 mA 0.33 mA to 329.999 mA 0.33 A to 2.19999 A 2.2 A to 11 A 0.29 mA to 3.29999 A 3.3 A to 21.9999 A 22 A to 110 A 0.87 mA to 9.89997 A 9.9 A to 65.9997 A 66 A to 330 A 1.45 mA to 16.49995 A 16.5 A to 109.9995 A 110 A to 550 A 47 mApp to 659.999 mApp 0.66 App to 4.39999 App 4.4 App to 22 App 47 mApp to 929.999 mApp 0.93 App to 6.19999 mApp 6.2 App to 31 App	 0.01 Hz to 9.99 Hz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz 10 Hz to 10 kHz 10 Hz to 5 kHz 45 Hz to 1 kHz	
AC Power: 5725A Output[4] Sine[2] Boost Off	 0.33 mA to 329.999 mA 0.33 A to 2.19999 A	 10 Hz to 10 kHz 10 Hz to 5 kHz	Phase: -180 ° to +180 °

Function	Amplitude	Frequency/Period	Misc.
Boost On	1.5 A to 11 A	45 Hz to 10 kHz	
Square			
Boost Off	0.47 mA to 659.999 mApp	10 Hz to 10 kHz	
	0.66 App to 4.39999 App	10 Hz to 5 kHz	
Boost On	4.4 App to 22 App	45 Hz to 10 kHz	
Triangle & Truncated Sine			
Boost Off	0.47 mA to 929.999 mApp	10 Hz to 10 kHz	
	0.93 App to 6.19999 App	10 Hz to 5 kHz	
Boost On	6.2 App to 31 App	45 Hz to 10 kHz	

1. A duty cycle of 1% to 99% may be specified for square waves. The default is 50%.
2. When both waveforms are sine, either the Normal or Aux output may be specified to be a harmonic from 1 to 31.
3. The frequency is the same for the voltage and the current, therefore the limits of the AC Voltage frequency are the same as those specified for the AC Current range selected.
4. The phase between the two output signals may be specified from -180 degrees to +180 degrees.

Functional Capability (5500A SCOPE Output with Option 5500A-SC300 Installed)

Function	Amplitude	Frequency	Misc.
DC voltage			
50 Ω term.	-2.2 V to 2.2 V		
1 MΩ term.	-33 V to 33 V		
AC Voltage Scope Square Wave (zero based)			
50 Ω term.	1.8 mVpp to 2.2 Vpp	10 Hz to 10 kHz	
1 MΩ term.	1.8 mVpp to 55 Vpp	10 Hz to 10 kHz	
Scopemeter Square Wave			
1 MΩ term.	95 Vpp to 105 Vpp	10 Hz to 10 kHz	
Edge			
50 Ω term.	5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/-10%	1 kHz to 1 MHz	
Leveled Sine			
50 Ω term.	5m Vpp to 5.5 Vpp	50 kHz to 350 MHz	
Time Markers			Period
50 Ω term.			1.8 ns to 2.2 ns 4.5 ns to 11 ns 18 ns to 22 ns 45 ns to 110 ns 180 ns to 1.1 µs 1.8 µs to 60 µs 90 µs to 12 ms 18 ms to 5.5 s

Functional Capability (5500A SCOPE Output with Option 5500A-SC300 Installed)(cont)

Function	Amplitude	Frequency	Misc.
Wavegen Sine, Square, and Triangle Waveforms (zero centered)			
50 Ω term.	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤3.1 Vp
1 MΩ term.	1.8 mVpp to 21.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤26 mVp
	22 mVpp to 89.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤100 mVp
	90 mVpp to 219 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤260 mVp
	220 mVpp to 899 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤1000 mVp
	0.9 Vpp to 6.59 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤6.6 Vp
	6.6 Vpp to 55 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤50 Vp

Functional Capability (5500A SCOPE Output with Option 5500A-SC600 Installed)

Function	Amplitude	Frequency	Misc.
DC Voltage			
50 Ω term.	-6.599 V to 6.599 V		
1 MΩ term.	-130 V to 130 V		
AC Voltage Scope Square Wave (zero based positive and negative)			
50 Ω term.	1.0 mVpp to 6.599 Vpp	10 Hz to 10 kHz	
1 MΩ term.	1.0 mVpp to 130 Vpp	10 Hz to 10 kHz	
Edge			
50 Ω term.	5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/- 10 %	900 Hz to 11 MHz	
w/ Tunnel Diode Pulser Drive Signal	11 Vpp to 2.5 Vpp	900 Hz to 11 MHz	
Leveled Sine			
50 Ω term.	5 mVpp to 5.5 Vpp	50 kHz to 600 MHz	
Time Markers			
50 Ω term			Period
Spike			18 ns to 5.5 s
Square			7.5 ns to 5.5 s
20 % Duty Square			75 ns to 34.99 ms
sine			1.8 ns to 17.9 ns

Functional Capability (5500A SCOPE Output with Option 5500A-SC600 Installed)(cont)

Function	Amplitude	Frequency	Misc.
Wavegen			Max AC + DC Offset
Sine, Square, and Triangle Waveforms (zero centered)			
50 Ω term	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤3.1 Vp
1 MΩ term	1.8 mVpp to 21.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤26 mVp
	22 mVpp to 89.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤100 mVp
	90 mVpp to 219 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤260 mVp
	220 mVpp to 899 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤1000 mVp
	0.9 Vpp to 6.59 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤6.6 Vp
	6.6 Vpp to 55 Vpp	10 Hz to 100 kHz Video	Vp + |Voff|≤50 Vp
Video			Line Marker
NTSC	-150 % to 150 % -1.5 Vp to 1.5 Vp -140 IRE to 140 IRE		1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 262 Odd or Even
PAL	-150 % to 150 %		1 to 622
	-1.5 Vp to 1.5 Vp		1 to 622
PAL-M	-150 % to 150 %		1 to 262 Odd or Even
	-1.5 Vp to 1.5 Vp		1 to 262 Odd or Even
	-140 IRE to 140 IRE		1 to 262 Odd or Even
SECAM			
	-150 % to 150%		1 to 262
	-1.5 Vp to 1.5 Vp		1 to 262
Pulse		Period	Pulse Width
50 Ω term	10 mVpp, 25 mVpp, 100 mVpp, 250 mVpp, 1 Vpp, and 2.5 Vpp	200 ns to 22 ms	2 ns to 500 ns
UUT Input Impedance Measurement (MEAS Z):			

Functional Capability (5500A SCOPE Output with Option 5500A-SC600 Installed)(cont)

Function	Amplitude	Frequency	Misc.
50 Ω			40 Ω to 60 Ω
1 MΩ			500 kΩ to 1.5 MΩ
Capacitance			5 pF to 50 pF
UUT 50 Ω Input Impedance Overload Protection Measurement (OVERLD)			
DC	5 V to 9 V		
AC	5 V to 9 V	1 kHz	

Parameters

The following table describes the basic operating modes of the 5500A Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 5500 FSC.

5500A Operating Modes

<table>
<tr><th>5500A Mode</th><th>5500 Nominal</th><th>5500 MOD1</th><th>5500 MOD3[1]</th><th>M550 Range</th><th>M550 Nominal</th><th>M550 MOD1</th></tr>
<tr><td>DC Voltage</td><td>voltage</td><td></td><td>[TC|SC|S6|E]</td><td>[RNGLK</td><td>voltage]</td><td></td></tr>
<tr><td>AC Voltage</td><td>voltage</td><td>freq|period</td><td>[BV|SC|S6|E]</td><td></td><td></td><td>[DC offset]</td></tr>
<tr><td>AC Voltage</td><td>freq|period</td><td>voltage</td><td>[BV]</td><td></td><td></td><td>[DC offset]</td></tr>
<tr><td>AC Voltage
(pulse)</td><td>p-width
period[2]</td><td>voltage
voltage</td><td>S6
S6</td><td>Per
Pulse</td><td>period
p-width[2]</td><td></td></tr>
<tr><td>AC Voltage</td><td>duty cycle</td><td>freq|period</td><td></td><td></td><td>voltage</td><td>[DC offset]</td></tr>
<tr><td>AC Voltage
(time marks)</td><td>freq|period</td><td></td><td>SC|S6</td><td></td><td></td><td></td></tr>
<tr><td>DC Current</td><td>current</td><td></td><td>[BC|BP|E]</td><td>[RNGLK</td><td>current]</td><td></td></tr>
<tr><td>AC Current</td><td>current</td><td>freq|period</td><td>[BC|BP|E]</td><td></td><td></td><td></td></tr>
<tr><td>AC Current</td><td>freq|period</td><td>current</td><td>[BC|BP]</td><td></td><td></td><td></td></tr>
<tr><td>Resistance</td><td>resistance</td><td></td><td>[E]</td><td></td><td></td><td></td></tr>
</table>

5500A Operating Modes (cont)

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD3[1]	M550 Range	M550 Nominal	M550 MOD1
Resistance	conductance		[**E**]			
Capacitance	capacitance					
RTD Cal	temperature					
TC Cal	temperature		**TC**	[**TCREF**	temp.]	
TC Meas	temperature		**TM**|**TN**	[**TCREF**	temp.]	
Dual DC Voltage	voltage		[**AX**]		voltage	
Dual AC Voltage	voltage	freq|period	[**BV**|**AX**]	[**H***n*|**HX***n*]	voltage	
Dual AC voltage	freq|period	voltage	[**BV**]	[**HX***n*]	voltage	
Dual AC voltage	freq|period	voltage	**AX**	[**H***n*]	voltage	
Dual AC Voltage	phase	freq|period	[**BV**|**AX**]	[**H***n*|**HX***n*]	voltage	voltage
DC Power	power		[**BC**|**BP**]		voltage	
DC Power	power				current	
DC Power	voltage				current	
DC Power	current		[**BC**|**BP**]		voltage	
AC Power	power	freq|period	[**BC**|**BP**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	voltage	
AC Power	power	freq|period	[**BV**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	current	
AC Power	current	freq|period	[**BC**|**BP**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	voltage	
AC Power	voltage	freq|period	[**BV**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	current	

5500A Operating Modes (cont)

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD3[1]	M550 Range	M550 Nominal	M550 MOD1
AC Power	freq|period	current	[**BC**|**BP**]	[**H***n*| **LEAD**|**LAG**]	voltage	
AC Power	freq|period	voltage	[**BV**]	[**HX***n*| **LEAD**|**LAG**]	current	
AC Power	phase	freq|period	[**BC**|**BP**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	voltage	current
AC Power	phase	freq|period	[**BV**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	current	voltage
Video	Percent| Voltage|IRE	line marker	**S6**	**ODD|EVEN**		
Impedance Meas.	resistance| capacitance		**ZM**			
Overload Meas.	voltage	[freq]	**OM**	Limit	time	

1. See MOD3 parameter for description of these specification codes and rules.
2. Period and pulse width (p-width) may be entered as a frequency in Hertz.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Units Symbols

Units	Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
D	dBm	decibels
F	Farads	capacitance
H	Hertz	frequency
IRE	IRE	video amplitude
LM	Line Marker	video line marker position
T	Time	period or pulse width
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
W	Watts	power
Y	Siemens	conductance
Z	Ohms	resistance
deg	degrees	phase
degC	degrees Celsius	temperature
degF	degrees Fahrenheit	temperature
pct	percent	duty cycle or video amplitude

5500 FSC Nominal, MOD 1, MOD2 and MOD3 Rules

<table>
<tr><th>5500A Mode</th><th>5500 Nominal</th><th>5500 MOD1</th><th>5500 MOD2 [1]</th><th>5500 MOD3 [2]</th></tr>
<tr><td>DC Voltage</td><td>V</td><td></td><td></td><td>[TC|E]</td></tr>
<tr><td>AC Voltage</td><td>V|Vpp|D
V|Vpp
Vp
H|T
H|T
pct</td><td>H|T
H|T
H|T
V|Vpp|D
V|Vpp
H|T</td><td>SI
SQ|TI|TS
SI
SI
SQ|TI|TS
SI|SQ|TI|TS</td><td>[BV|E]
[BV]
[BV]
[BV]
[BV]</td></tr>
<tr><td>DC Current</td><td>A</td><td></td><td></td><td>[BC|BP|E]</td></tr>
<tr><td>AC Current</td><td>A|App
A|App
Ap
H|T</td><td>H|T
H|T
H|T
A|App</td><td>SI
SI|SQ|TI|TS
SI|SQ|TI|TS
SI|SQ|TI|TS</td><td>[BC|BP|E]
[BC|BP]
[BC|BP]
[BC|BP]</td></tr>
<tr><td>Resistance</td><td>Z|Y</td><td></td><td></td><td>[E]</td></tr>
<tr><td>Capacitance</td><td>F</td><td></td><td></td><td></td></tr>
<tr><td>RTD Cal</td><td>degC|degF</td><td></td><td>R1|R2|R3|R4|R5|R6|
R7|R8</td><td></td></tr>
<tr><td>TC Cal</td><td>degC|degF</td><td></td><td>_B|_C|_E|_J|_K|_L|_
N|_R|_S|_T|_U</td><td>TC</td></tr>
<tr><td>TC Meas</td><td>degC|degF</td><td></td><td>_B|_C|_E|_J|_K|_L|_
N|_R|_S|_T|_U</td><td>TM/TN</td></tr>
<tr><td>Dual DC Voltage</td><td>V</td><td></td><td></td><td>[AX]</td></tr>
<tr><td>Dual AC Voltage</td><td>V|Vp|Vpp|D
V|Vp|Vpp
H|T
H|T</td><td>H|T
H|T
V|Vpp|D
V|Vpp</td><td>SI
SQ|TI|TS
SI
SQ|TI|TS</td><td>[AX|BV]
[AX]
[AX|BV]
[AX]</td></tr>
<tr><td>DC Power</td><td>W|A
V</td><td></td><td></td><td>[BC|BP]</td></tr>
<tr><td>AC Power</td><td>W
V|Vp|Vpp|D
V|Vp|Vpp
A|Ap|App
H|T
H|T
H|T</td><td>H|T
H|T
H|T
H|T
V|Vpp|D
V|Vpp
A|App</td><td>SI
SI
SQ|TI|TS
SI|SQ|TI|TS
SI
SQ|TI|TS
SI|SQ|TI|TS</td><td>[BV|BC|BP]
[BV]

[BC|BP]
[BV]

[BC|BP]</td></tr>
<tr><td colspan="5">1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.</td></tr>
</table>

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5500 FSC Nominal, MOD1, MOD2, and MOD3 Rules for 5500A-SC300

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD2 [1]	5500 MOD3 [2]
DC Voltage (VOLT)	**V**			**SC**
AC Voltage (VOLT)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**ZQ|SM** **ZQ|SM**	**SC** **SC**
AC Voltage (Edge)	**V|Vp|Vpp**	**H|T**	**MK**	**SC**
AC Voltage (LEVSINE)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vp|Vpp**	**LS** **LS**	**SC** **SC**
AC Voltage (MARKER)	**H|T**		**MK**	**SC**
AC Voltage (WAVEGEN)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vp|Vpp**	**SI|SQ|TI** **SI|SQ|TI**	**SC**

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5500 FSC Nominal, MOD1, MOD2, and MOD3 Rules for 5500A-SC600

5500A Mode	5500 Nominal	5500 MOD1	5500 MOD2[1]	5500 MOD3[2]
DC Voltage (VOLT)	**V**			**S6**
AC Voltage (VOLT)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**ZQ|SN** **ZQ|SN**	**S6** **S6**
AC Voltage (EDGE)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**ED** **ED**	**S6**
AC Voltage (LEVSINE)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**LS** **LS**	**S6** **S6**
AC Voltage (MARKER)	**H|T**		**M1|M2|M3|M4**	**S6**
AC Voltage (WAVEGEN)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vp|Vpp**	**SI|SQ|TI** **SI|SQ|TI**	**S6**
AC Voltage (PULSE)	**H|T**	**Vpp**	**PU**	**S6**
Video (VIDEO)	**pct|Vp|IRE** **pct|Vp**	**LM** **LM**	**F1|F3** **F2|F4**	**S6** **S6**
Impedance Meas (MEAS Z)	**Z** **F**			**ZM** **ZM**
Overload Meas (OVERLD)	**V** **Vpp**	 **H**		**OM** **OM**

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies the UUT range as described in “General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*]*units symbol*

or "*" to specify a reset.

Rules:

- The NOMINAL field may not specify frequency or period when any of the following sets of conditions exist:

  1. Dual AC Voltage is specified and either

     a. the M550 RANGE field specifies H and the M550 MOD3 field specifies AX or

     b. the M550 RANGE field specifies HX and the 5500 MOD3 field specifies AX.

  2. AC Power is specified and either

     a. the M550 RANGE field specifies H and the M550 NOMINAL field specifies current or

     b. the M550 RANGE field specifies HX and the M550 NOMINAL field specifies voltage.

  3. The MOD3 field specifies E.

- When the NOMINAL field specifies frequency or period and the M550 RANGE field specifies a harmonic (H or HX), the Keyboard Entry (ASK+ K) or Go/No-Go (ASK+ G) evaluation mode must be specified, Slew is not allowed.

A duty cycle other than 50 % may only be specified for square waveforms (MOD2 is SQ). Therefore keyboard entry and go-nogo evaluations may be performed at 50 % duty cycle for non-square waveforms, but slew mode is not allowed. In addition the duty cycle is restricted to 50 %, regardless of the type of waveform, when the DC offset is not zero.

- When the NOMINAL field specifies power and the value is slewed, if the M550 NOMINAL field specifies voltage, the voltage is held constant and a new value of current is computed by the 5500A.
- If the M550 NOMINAL field specifies current, the current is held constant and a new value of voltage is computed by the 5500A.
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.

- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage, or current for AC Voltage, AC Current, Dual AC Voltage, or AC Power modes entered as:

[*numeric*][*prefix*] *units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

- The waveform type for the voltage or current specified in the NOMINAL or MOD1 field for AC Voltage or AC Current.
- The waveform type for the voltage or current not specified in the M550 FSC NOMINAL field for AC Power or Dual AC Voltage.
- The thermocouple or RTD type for TC Measurement, TC Calibration, or RTD Calibration.

blank	DC or not applicable
SI	Sine wave (WaveGen)
SQ	Square wave (WaveGen)
TI	Triangle wave (WaveGen)
TS	Truncated sine wave
LS	Leveled sine wave
ZQ	Scope square wave (DC offset is 1/2 peak-to-peak voltage)
SM	ScopeMeter wave (See 5500A manual for description)
ED	Edge signal

MK	Marker signal
_B	Type B thermocouple
_C	Type C thermocouple
_E	Type E thermocouple
_J	Type J thermocouple
_K	Type K thermocouple
_L	Type L thermocouple
_N	Type N thermocouple
_R	Type R thermocouple
_S	Type S thermocouple
_T	Type T thermocouple
_U	Type U thermocouple
R1	100 Ω Pt 385 RTD
R2	100 Ω Pt 3926 RTD
R3	120 Ω Ni RTD
R4	200 Ω Pt 385 RTD
R5	500 Ω Pt 385 RTD
R6	1 kΩ Pt 385 RTD
R7	100 Ω Pt 3916 RTD
R8	10 Ω Cu RTD
ZQ	Positive square wave (5500A-SC300 and 5500A-SC600 AC Voltage)
ZN	Negative square wave (5500A-SC600 AC Voltage)
SM	ScopeMeter wave (5500A-SC300 AC Voltage)
ED	Edge signal (5500A-SC300 and 5500A-SC600)
LS	Leveled sine wave (5500A-SC300 and 5500A-SC600)
MK	Marker signal (5500A-SC300)
M1	Spike Marker signal (5500A-SC600)
M2	Square Marker signal (5500A-SC600)
M3	20% Duty Cycle Square Marker signal (5500A-SC600)

M4 Sinusoid Marker signal (5500A-SC600)

PU Pulse wave (5500A-SC600)

F1 NTSC video signal (5500A-SC600)

F2 PAL video signal (5500A-SC600)

F3 PAL-M video signal (5500A-SC600)

F4 SECAM video signal (5500A-SC600)

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage, AC Current, Dual AC Voltage, or AC Power (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- _K is inserted automatically in the MOD2 field for TC Measurement or TC Calibration if no MOD2 code is entered.
- R1 is inserted automatically in the MOD2 field for RTD Calibration if no MOD2 code is entered.
- The M550 RANGE and NOMINAL field must specify the pulse wave period or frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M550 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse wave period or frequency.
- The M550 RANGE field must specify ODD or EVEN frame when the MOD2 field specifies F1 (NTSC video) or F3 (PAL-M video).

MOD3

This field specifies the calibrator output mode:

blank Default for mode specified

AX Auxiliary Voltage

BV Boost Voltage

BC Boost Current

BP Boost Port (Use Boost Amplifier port for non-boosted current)

SC Scope

TM Thermocouple Measurement (open TC detection on)

TN Thermocouple Measurement (open TC detection off)

TC	Thermocouple Cal
E	Extended Performance
SC	5500A-SC300 Scope Option
S6	5500A-SC600 Scope Option
ZM	5500A-SC600 UUT Input Impedance Measurement
OM	5500A-SC600 UUT 50 Ω Input Overload Protection Measurement

Rules:

- The MOD3 field must specify AX when Dual DC Voltage or Dual AC Voltage is specified and the M550 FSC MOD3 field does not specify AX.
- The MOD3 field may specify BV only when the following conditions exist:
  1. AC Voltage, Dual AC Voltage, or AC Power is specified.
  2. The MOD2 field specifies SI.
  3. Voltage is specified in the NOMINAL or MOD1 field or the M550 MOD1 field or power is specified in the NOMINAL field and current is specified in the M550 NOMINAL field.
  4. The voltage specified in the NOMINAL field, the MOD1 field, the M550 MOD1 field, computed from the power specified in the NOMINAL field, or the current specified in the M550 NOMINAL field, and any phase or power factor specified in the M550 TOLERANCE field, is within the range of the 5725A Boost Amplifier.
  5. The M550 FSC MOD3 field does not specify BV, BC, or BP.
- The MOD3 field may specify BC only when the following conditions exist:
  1. DC Current, AC Current, DC Power, or AC Power is specified.
  2. Current is specified in the NOMINAL or MOD1 field or the M550 MOD1 field or power is specified in the NOMINAL field and voltage is specified in the M550 NOMINAL field.
  3. The current specified or computed from the power specified in the NOMINAL field, the voltage specified in the M550 NOMINAL field, and any phase or power factor specified in the M550 TOLERANCE field, is within the range of the 5725A Boost Amplifier with boost on.
  4. The M550 FSC MOD3 field does not specify BC, BV, or BP.

- The MOD3 field may specify BP only when the following conditions exist:
  1. DC Current, AC Current, DC Power, or AC Power is specified.
  2. Current is specified in the NOMINAL or MOD1 field or the M550 MOD1 field or power is specified in the NOMINAL field and voltage is specified in the M550 NOMINAL field.
  3. The current specified or computed from the power specified in the NOMINAL field, the voltage specified in the M550 NOMINAL field, and any phase or power factor specified in the M550 TOLERANCE field, is within the range of the 5725A Boost Amplifier with boost off.
  4. The M550 FSC MOD3 field does not specify BC, BV, or BP.
- The MOD3 field may specify SC only when the 5500A-SC300 Scope option is configured.
- SC is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, SM, MK, ED, LS or MK, and the 5500A-SC300 Scope option is configured, and no MOD3 code is entered.
- S6 is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, ZN, ED, LS, PU, M1, M2, M3, M4, F1, F2, F3, or F4, and the 5500A-SC600 Scope Option is configured, and no MOD3 code is entered.
- The MOD3 field may specify E only when the 5500A/EP option is configured. For a full description of the 5500A/EP, see the on-line help for the 5500A when "Edit Configuration" (F12) is selected from within the MET/CAL Editor.
- The M550 FSC RANGE and NOMINAL fields must specify the time limit when the MOD3 field specifies OM.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify N (Nominal Setup Test) when the MOD3 field specifies OM (Overload Measurement).
- N is inserted automatically in the MOD4 field when the MOD3 field specifies OM and no MOD3 code is entered.

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- 3W 3-wire
- 4W 4-wire
- CW 2-wire Ω compensated at the UUT terminals
- DV 2-wire using the external AC Divider
- TD Tunnel Diode Pulser Drive signal enabled
- T1 10-turn Toroid Coil
- T3 30-turn Toroid Coil
- T5 50-turn Toroid Coil
- FT 5500A/COIL and Toroidal UUT
- FX 5500A/COIL and Non-toroidal UUT
- L 50 Ω Termination
- *blank* 1 MΩ Termination

Rules:

- 2W is inserted automatically in the CON field when the MOD3 field does not specify SC or S6 and no CON field code is entered.
- The CON field may specify 3W only when the RTD Cal mode is specified.
- The CON field may specify CW or 4W only when RTD Cal, Resistance, or Capacitance mode is specified.
- The CON field may specify DV only when AC Voltage mode is specified, the MOD2 field specifies SI, the MOD3 field specifies a voltage of 22 mV or less.
- The CON field may specify T1, T3, T5, FT, or FX only when the MOD3 field does not specify E and DC Current or DC Power mode is specified or AC Current mode is specified and the MOD2 field specifies SI or AC Power mode is specified and either:

1. the M550 NOMINAL field specifies voltage and the 5500 MOD2 field specifies SI

   or

2. The M550 NOMINAL field specifies current and the M550 MOD2 fields specifies SI. Refer to the Fluke 31/33 Instruction Manual for directions for constructing a suitable toroid coil.

- The CON field may specify L only when the MOD3 field specifies SC or S6 and the MOD3 field specifies SC.
- The CON field must specify L when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4 and the MOD3 field specifies S6.
- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or MK, the MOD3 field specifies SC and no CON field code is entered.
- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, the MOD3 field specifies S6 and no CON field code is entered.
- The CON field must specify 2W when the MOD3 field specifies ZM or OM.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M550         *
  1.002  5500         *                                                 S
# ----- DC Voltage -----
  1.003  M550                                                              FL
  1.004  5500   20    19.99mV        2% 0.04U                              2W
# ----- DC Voltage w/Range Lock -----
  2.001  M550   RNGLK 3V
  2.002  5500   400   350.0mV        1.9% 0.4U                             2W
  3.001  M550         *
# ----- DC Voltage, TC Terminals -----
  3.002  5500         35mV                                           TC S  2W
# ----- AC Voltage -----
```

```
  3.003  5500   400   350.0mV        -2.8U +2.9U   60H            SI        2W
# ----- AC Voltage w/5725A Boost -----
  4.001  5500   400   350.0V         7.4U          20kH           SI BV     2W
# ----- AC Voltage w/External AC Divider -----
  5.001  5500         -37.78D        0.1U          100H           SI        DV
# ----- AC Voltage (Frequency Test) -----
  6.001  5500   1000  800.0H         0.1% 0.1U     300mV          SI        2W
# ----- Square Wave w/DC Offset -----
  7.001  M550                                      0.5Voff
  7.002  5500         1Vpp                         1kH            SQ     S  2W
# ----- Square Wave w/Duty Cycle Specified -----
  7.003  M550                        35pct
  7.004  5500         1Vpp                         1kH            SQ     S  2W
# ----- Square Wave (Duty Cycle Test) ------
  7.005  M550         1Vpp
  7.006  5500         30pct          2U            500H           SQ        2W
  8.001  M550         *
# ----- Triangle Wave -----
  8.002  5500         13mVpp                       10kH           TI     S  2W
# ----- Truncated Sine Wave -----
  8.003  5500         2.5mApp                      5kH            TS     S  2W
# ----- DC Current -----
  8.004  5500   4000  3500mA         9U                                     2W
# ----- AC Current at 5725A Output, Boost Off -----
  9.001  5500         35.00mA        0.37U         60H            SI BP     2W
# ----- AC Current at 5725A Output, Boost On -----
 10.001  5500   10    10A            0.12U         1kH            SI BC     2W
# ----- Dual DC Voltage -----
 11.001  M550         10mV
 11.002  5500         100mV          3%                              AX     2W
# ----- Dual AC Voltage w/5725A Boost -----
 12.001  M550         1V                                          SI AX
 12.002  5500         350Vp                        10kH           SI BV S   2W
# ----- Dual AC Voltage (Phase Test) ------
 12.003  M550         1Vpp                         1Vpp           SQ AX
 12.004  5500         30deg          1U            60H            SQ        2W
# ----- Dual AC Voltage (Harmonics) ------
 13.001  M550   H2    100V                                        SI BV
 13.002  5500         0D             1U            60H            SI AX     2W
 14.001  M550   HX3   1Vpp                                        SI AX
 14.002  5500         1Vpp           1U            60H            SI        2W
 15.001  M550         *
# ----- DC Power (Volts and Amps) -----
 15.002  M550         1mV                                                O  FL
```

```
 15.003  5500         1mA            1%                                    2W
# ----- AC Power (Volts and Amps) -----
 16.001  M550         1mA            60deg                        SI
 16.002  5500         1V                           400H           SI    S  2W
# ----- AC Power (Watts and Volts) w/Displacement Power Factor -----
 16.003  M550   LEAD  1V             0.998                        SI
 16.004  5500   20    19mW           1%            60H            SI       2W
# ----- AC Power (Watts and Vpp) w/Phase Specified -----
 17.001  M550         1Vpp           -45deg                       SI
 17.002  5500   20    1mW            1U            400H           SI       2W
# ----- AC Power (Harmonics) ------
 18.001  M550   H2    45D                                         SI BV
 18.002  5500         100W           1U            60H            SI       2W
 19.001  M550   HX3   1mApp                                       SI
 19.002  5500         1Vpp           1U            60H            SI       2W
 20.001  M550         *
# ----- Resistance -----
 20.002  5500   400   390.0Z         0.4% 0.1U                             CW
 21.001  5500   4     3.900MZ        0.05U                                 2W
# ----- Capacitance ----
 22.001  5500   10    1.100uF        2% 0.002U                             2W
# ----- Temperature Measurement -----
 23.001  5500         1200.0degF                                  _J TM N  2W
# ----- Temperature Stimulus -----
 23.002  M550   TCREF 0degC
 23.003  5500         50degC         1%                           _K TC    2W
 24.001  M550         *
 24.002  5500         45degC                                      R1    S  3W
```

5500A-SC300 Scope Option

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- DC Voltage -----
  1.001  5500   20    19.99mV        4%                              SC
# ----- AC Voltage (Scope Square Wave) -----
  2.001  5500   400   350.0mV        50U           60H            ZQ SC
# ----- AC Voltage (ScopeMeter Wave) -----
  3.001  5500         100Vpp                       1kH            SM SC S
# ----- AC Voltage (Frequency Test) -----
  3.002  5500   1000  800.0H         0.1% 0.1U     300mV          ZQ SC
# ----- Edge Signal (Scope Output) -----
  4.001  5500         0.5Vpp                       1MH            ED SC S  L
# ----- Leveled Sine Wave -----
  4.002  5500         200mVpp                      50kH           LS SC S  L
```

```
# ----- Marker Signal -----
  4.003  M550                                                              2T
  4.004  5500         1uT                                         MK SC S  L
# ----- Wavegen -----
  4.005  5500         5V                           1kH            SI SC S
# ----- Wavegen w/DC Offset -----
  4.006  M550                                      0.5Voff
  4.007  5500         1Vpp                         1kH            TI SC S
# ----- Wavegen w/Duty Cycle Specified -----
  4.008  M550                       35pct
  4.009  5500         1Vpp                         1kH            SQ SC S
  4.010  M550         *

5500A-SC600 Scope Option

 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- DC Voltage -----
  1.001  5500   20    19.99mV        4%                              S6
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  5500   400   350.0mV        50U           60H            ZQ S6
# ----- AC Voltage (Negative Scope Square Wave) -----
  3.001  5500         100Vpp                       1kH            ZN S6 S
# ----- AC Voltage (Frequency Test) -----
  3.002  5500   1000  800.0H         0.1% 0.1U     300mV          ZQ S6
# ----- Edge Signal (Scope Output) -----
  4.001  5500         0.5Vpp                       1MH            ED S6 S  L
# ----- Leveled Sine Wave -----

g4.002  5500         200mVpp                      50kH            LS S6 S  L
# ----- Spike Marker Signal -----
  4.003  M550                                                              2T
  4.004  5500         1uT                                         M1 S6 S  L
  4.005  M550         *
# ----- Square Marker Signal -----
  4.006  5500         1mT                                         M2 S6 S  L
# ----- 20% Duty Cycle Square Marker Signal -----
  4.007  5500         5uT                                         M3 S6 S  L
# ----- Sinusoid Marker Signal -----
  4.008  5500         2nT                                         M4 S6 S  L
# ----- Wavegen -----
  4.009  5500         5V                           1kH            SI S6 S
# ----- Wavegen w/DC Offset -----
  4.010  M550                                      0.5Voff
```

```
  4.011  5500         1Vpp                         1kH            TI S6 S
# ----- NTSC Video -----
  4.012  M550   ODD
  4.013  5500         1Vp                          262LM          F1 S6 S  L
  4.014  M550         *
# ----- PAL Video -----
  4.015  5500         50pct                        400LM          F2 S6 S  L
# ----- PAL-M Video -----
  4.016  M550   EVEN
  4.017  5500         -140IRE                      1LM            F3 S6 S  L
  4.018  M550         *
# ----- SECAM Video -----
  4.019  5500         -100pct                      622LM          F4 S6 S  L
# ----- Pulse Wave (Slew Pulse Width) -----
  4.020  M550   PER   200nT
  4.021  5500         5.0nT                        2.5Vpp         PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M550   PULSE 10nT
  4.023  5500         1.00kH                       2.5Vpp         PU S6 N  L
  4.024  M550         *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5500         50Z           1U                               ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  5500         1.000MZ       1U                               ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5500         10pF                                           ZM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.002  M550   LIMIT 10T
  6.003  5500         5V                                             OM N  2W
  6.004  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M550   LIMIT 10T
  7.002  5500         7V                                             OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

```
# ----- Pulse Wave (Slew Pulse Width) -----
  4.020  M550   PER   200nT
  4.021  5500         5.0nT                       2.5Vpp         PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M550   PULSE 10nT
  4.023  5500         1.00kH                      2.5Vpp         PU S6 N  L
  4.024  M550         *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5500         50Z            1U                             ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  5500         1.000MZ        1U                             ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5500         10pF                                          ZM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.002  M550   LIMIT 10T
  6.003  5500         5V                                            OM N  2W
  6.004  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M550   LIMIT 10T
  7.002  5500         7V                                            OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

M550

Auxiliary Instrument Setup FSC

Description

The M550 FSC provides the additional program functions for the Fluke 5500A Calibrator which are not addressed by the 5500 FSC. These functions include Range Locking, DC Offset, Thermocouple External Temperature Reference, Phase, Power Factor, Duty Cycle, voltage and/or current for power stimulus, and voltage of the second signal for dual voltage output.

The following functions are available with 5500A-SC600 Scope Option:

- Time limit for UUT 50 Ω input overload protection measurement.
- Odd frame for NTSC or PAL-M video signals.
- Trigger output

Parameters

For a description of the 5500A Calibrator operating modes referenced in this section, see Table 1 in the 5500 Instrument FSC description.

When a blank M550 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
D	dBm	decibels
H	Hertz	frequency
T	Time	period, pulse width, or time limit
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Voff	Volts offset	DC offset
deg	degrees	phase
degC	degrees Celsius	temperature
degF	degrees Fahrenheit	temperature
pct	percent	duty cycle or video amplitude

M550 FSC RANGE, NOMINAL, MOD1, MOD2, and MOD3 Rules

5500A Mode	M550 Range	M550 Nominal	M550 TOL.	M550 MOD1	M550 MOD2 [1]	M550 MOD3 [2]
DC Voltage	[RNGLK	V]				
AC Voltage		[V/Vp/Vpp] [V/Vpp]	 [pct]	Voff [Voff]		
DC Current	[RNGLK	A]				
Dual DC Voltage	V					[AX]
Dual AC Voltage	[H*n*] [HX*n*] [H*n*] [HX*n*]	V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp V/Vp/Vpp	[deg] [deg] [deg]	 [V/Vp/Vp p/D] V/Vp/Vpp /D] V/Vp/Vpp	SI SI SI SI SQ/TI/TS SQ/TI/TS	[AX/BV [AX/BV] [AX/BV] [AX/BV] [AX] [AX]
DC Power	V A					[BC/BP]
AC Power	[LEAD/LAG] [LEAD/LAG] [H*n*] [HX*n*] [H*n*] [HX*n*] [H*n*] [HX*n*] [H*n*] [HX*n*]	V/Vp/Vpp/D A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D	[*dpf*] [*dpf*] [deg] [deg] [deg] [deg] [deg]	 A/Ap/App A/Ap/App V/Vp/Vpp /D V/Vp/Vpp /D A/Ap/App	SI SI SI SI SI SI SI SI SI SI SQ/TI/TS SQ/TI/TS	[BV] [BC/BP] [BV] [BV] [BC/BP] [BC/BP] [BV] [BV] [BC/BP] [BC/BP] [BC/BP]

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5500 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules for SC600

M550 RANGE, NOMINAL, TOLERANCE, MOD1, MOD2, and MOD3 fields are not used for 5500A-SC300.

5500 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules for 5500A-SC600

5500A Mode	M550 Range	M550 Nominal	M550 Tolerance	M550 MOD1	M550 MOD2 [1]	M550 MOD3 [2]
AC Voltage (WAVEGEN)				[OFFSET]		
AC Voltage (PULSE)	PER/PULSE	H/T				
Video (VIDEO)	[ODD/EVEN]					
Overload Meas (OVERLD)	LIMIT	T				
1. See MOD2 parameter for description of these specification codes and rules. 2. See MOD3 parameter for description of these specification codes and rules.						

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter m550 Range, nominal, tolerance, MOD1, MOD2, and MOD3 fields are not used for 5500A-SC600 operating modes listed.

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- TCREF Thermocouple Reference
- LEAD Leading
- LAG Lagging
- H*n* Primary output is a harmonic, 1 to 51
- HX*n* Secondary output is a harmonic, 1 to 51
- PULSE Pulse Width
- PER Pulse Period

- LIMIT Time Limit (Overload Measurement)
- ODD Odd Frame (NTSC or PAL-M video)
- EVEN Even Frame (NTSC or PAL-M video)
- *blank* field not applicable

Rules:

- When the RANGE field specifies LEAD or LAG, the TOLERANCE field must specify the Displacement Power Factor.
- The primary output is always the Normal output. The secondary output is typically the Aux output, but may be the 5725A current output is the case of AC Power with boosted current.
- The RANGE field may specify PULSE or PER only when the 5500 FSC MOD2 field specifies PU.
- The RANGE field must specify PULSE or PER when the 5500 FSC MOD2 field specifies PU.
- The RANGE field may specify ODD or EVEN only when the 5500 FSC MOD2 field specifies F1 or F3.
- The RANGE field must specify ODD or EVEN when the 5500 FSC MOD2 field specifies F1 or F3.
- The RANGE field may not specify RNGLK when the 5500 MOD3 field specifies TC, SC, or S6.

NOMINAL

This field specifies one of the following:

- Range lock selection value when RANGE field is RNGLK
- Thermocouple Reference when RANGE field is TCREF
- Pulse Period or Pulse Repetition Frequency when RANGE field is PER
- Pulse Width when RANGE field is PULSE
- Signal amplitude for AC Voltage, Dual DC Voltage, Dual AC Voltage, DC Power, or AC Power
- "*" reset to default values
- *blank* field not applicable

Rules:

- The NOMINAL field may specify a Voltage or Current range selection value only when the RANGE field specifies RNGLK.

Voltage Range Selection Value	Locked Range
0 mV to 33 mV	33 mV DC
> 33 mV to 330 mV	330 mV DC
> 330 mV to 3.3 V	3.3 V DC
> 3.3 V to 33 V	33 V DC
> 33 V to 330 V	330 V DC
> 330 V to 1020 V	1000 V DC
Current Range Selection Value	**Locked Range**
0 mA to 3.3 mA	3.3 mA DC
> 3.3 mA to 33 mA	33 mA DC
> 33 mA to 330 mA	330 mA DC
> 330 mA to 2.2 A	2.2 A DC
> 2.2 A to 11 A	11 A DC[1]
1. The 11 A range may be locked only when the 5500 FSC MOD3 field does not specify BP (Boost Port).	

- When the NOMINAL field specifies voltage and Dual DC Voltage or Dual AC Voltage mode is specified, either the MOD3 field must specify AX or the 5500 FSC MOD3 field must specify AX.
- The NOMINAL field may specify Thermocouple Reference only when the RANGE field specifies TCREF. In this case, the UUT is compensating for its thermocouple junction temperature and Thermocouple Reference should be set to the temperature of the UUT's junction. Thermocouple Reference must be in the same units as the temperature specified in the 5500 FSC NOMINAL field.
- When the NOMINAL field does not specify Thermocouple Reference, the 550A internal reference is used and the UUT is not compensating for it's thermocouple junction temperature.
- When the NOMINAL field contains only units, the value is taken from MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field specifies phase or duty cycle entered as [*numeric*] [*prefix*] *units symbol* or displacement power factor entered as *numeric*.

Rules:

- The TOLERANCE field may specify Displacement Power Factor only when the RANGE field specifies LEAD or LAG.
- The TOLERANCE field may specify Duty Cycle only when AC Voltage mode is specified and the 5500FSC MOD2 field specifies SQ.

MOD1

This field specifies DC offset for AC Voltage or one amplitude for AC Power or Dual AC Voltage entered as:

[*numeric*][*prefix*]*units symbol*

Rules:

- The MOD1 field may specify voltage or current only when the 5500 NOMINAL field specifies phase.
- When the MOD1 field specifies voltage with units of "D", the 5500 FSC MOD2 field must specify SI.
- When the MOD1 field specifies voltage with units of "Vp" or "Vpp" or current with units of "Ap" or "App", the 5500 FSC MOD2 field must specify SI, SQ, TI, or TS.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- The MOD1 field may specify DC offset only when AC Voltage mode is specified, the 5500 FSC MOD3 field does not specify E, the 5500 NOMINAL field units are not decibels.
- When the MOD1 field specifies DC Offset, either the voltage specified in the 5500 NOMINAL or MOD1 field must be less than 33 V or the DC Offset value must be zero.
- When the MOD1 field specified DC Offset and the 5500 FSC NOMINAL field specifies duty cycle, the specified DC Offset must be zero.
- When the MOD1 field specifies DC Offset other than 0 V, and the TOLERANCE field specifies duty cycle, the duty must be 50%.
- When the MOD1 field specifies DC Offset and the 5500 FSC NOMINAL field specifies duty cycle, the specified DC Offset must be zero.

MOD2

This field specifies the waveform for the output specified in the NOMINAL field.

- SI Sine wave
- SQ Square wave
- TI Triangle wave
- TS Truncated sine wave
- *blank* DC or field not applicable

MOD3

This field specifies the calibrator output mode:

- AX Auxiliary Voltage
- BV Boost Voltage
- BC Boost Current
- BP Boost Port (Use Boost Amplifier port for non- boosted current)
- *blank* no boost, default port, or field not applicable

Rules:

- The MOD3 field must specify AX when Dual DC Voltage or Dual AC Voltage mode is specified and the 5500 FSC MOD3 field does not specify AX.
- The MOD3 field may specify BV only when the following conditions exist:
  1. AC Power or Dual AC Voltage mode is specified.
  2. The MOD2 field specifies "SI".
  3. Voltage is specified in the NOMINAL field.
  4. The voltage specified in the NOMINAL field is within the range of the 5725A Boost Amplifier.
  5. The 5500 FSC MOD3 field does not specify BV, BC, or BP.
- The MOD3 field may specify BC only when the following conditions exist:
  1. DC Power or AC Power mode is specified.
  2. The current is specified in the NOMINAL field.
  3. The specified current is within the range of the 5725A Boost Amplifier with boost on (see Table 1).
  4. The 5500 FSC MOD3 field does not specify BC, BV, or BP.
- The MOD3 field may specify BP only when the following conditions exist:

1. DC Power or AC Power mode is specified.
2. The current is specified in the NOMINAL field.
3. The specified current is with the range of the 5725A Boost Amplifier with boost off (see Table 1).
4. The 5500 FSC MOD3 field does not specify BC, BV, or BP.

MOD4

This field controls whether or not the NORMAL and AUX "LO" terminals are tied together for DC Power, AC Power, Dual DC Voltage, and Dual AC Voltage modes.

- *blank* Lows Shorted or field not applicable
- O Lows Open

Rules:

- The MOD4 field may specify "0" only when the mode is DC Power, AC Power, Dual DC Voltage, or Dual DC Voltage, and the M550 CON specifies "EL" or "FL".

CON

This field controls whether or not the NORMAL and AUX "LO" terminals are tied to Earth and the trigger output.

- *blank* default or field not applicable
- EL Low tied to Earth
- FL Floating Low
- 1T Trigger Output on, Normal mode
- 2T Trigger Output on, 1/10 of output rate
- 3T Trigger Output on, 1/100 of output rate

Rules:

- The CON field specification is ignored, and a floating low is used, when any of the following conditions exist:
  1. Resistance, Capacitance, RTD Calibration, or Thermocouple Measurement mode is specified.
  2. AC Current or AC Power mode is specified with a current less than 330 µA.

- A CON field specification of 1T, 2T, or 3T is only applicable (is ignored otherwise) when the 5500 MOD2 field specifies ZQ, ZN, ED, MK, M1, M2, M3, and M4.
- When the CON field is blank, a floating low is used.

Examples

See 5500 FSC.

5520

Instrument FSC

Description

The 5520 FSC provides the means to control the following functions of the Fluke 5520A Calibrator:

- DC Voltage and DC Current
- AC Voltage and AC Current (Sine, Square, Triangle, and Truncated Sine waveforms)
- Synthesized Resistance and Capacitance
- RTD and Thermocouple Calibration stimulus
- Thermocouple measurement
- Humidity measurement

When the M5520 FSC is used in conjunction with the 5520 FSC the following additional 5520A functions may be controlled:

- Dual DC and Dual AC Voltage
- DC and AC Power stimulus (simultaneous voltage and current output)
- DC Voltage and DC Current range locking
- DC Offset for AC Voltage
- Duty Cycle for square waves
- Phase for Dual Voltage and Power stimulus
- Displacement Power Factor for Power stimulus
- External Reference Temperature for Thermocouple Calibration and Measurement

The following functions are available with SC300 Scope Option:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Scope Square, Edge, Time Mark, and ScopeMeter waveforms)
- Trigger Signal

The following functions are available with SC600 Scope Option:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Positive and Negative Scope Square, Edge, Time Mark, Pulse and Video waveforms)
- Oscilloscope Input Impedance Measurement
- Oscilloscope 50 Ω Impedance Overload Protection Measurement
- Trigger Signal

Note

If the 5520A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 5520A .MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 5520A must be set correctly before a procedure is executed. If the 5520A is connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. If the 5520A is connected to the 5500A or 5800A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Functional Capability (5520A NORMAL, AUX, and 20A Outputs)

Function	Amplitude	Frequency/Period	Misc.
DC Voltage: Normal Output TC Output	 -1020 V to 1020 V -329.9999 mV to 329.9999 mV		
AC Voltage: Normal Output Sine			
	1 mV to 33 mV	0.01 Hz to 9.99 Hz	Vp + |Voff| ≤ 80 mVp
	34 mV to 330 mV	0.01 Hz to 9.99 Hz	Vp + |Voff| ≤ 800 mVp
	0.4 V to 3.3 V	0.01 Hz to 9.99 Hz	Vp + |Voff| ≤ 8 Vp
	4 V to 33 V	0.01 Hz to 9.99 Hz	Vp + |Voff| ≤ 50 Vp

<table>
<tr><th>Function</th><th>Amplitude</th><th>Frequency/Period</th><th>Misc.</th></tr>
<tr><td></td><td>1 mV to 32.999 mV</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td></td><td>33 mV to 329.999 mV</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>0.33 V to 3.29999 V</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>3.3 V to 32.9999 V</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td></td><td>33 V to 329.999 V</td><td>45 Hz to 100 kHz</td><td></td></tr>
<tr><td></td><td>330 V to 1020 V</td><td>45 Hz to 10 kHz</td><td></td></tr>
<tr><td></td><td>0.3 V to 3.3 V</td><td>1 MHz, 2 MHz</td><td></td></tr>
<tr><td></td><td>-63.80 dBm to -7.29 dBm</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td></td><td>-27.28 dBm to -7.40 dBm</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>-7.3 dBm to 12.7 dBm</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>13 dBm to 32 dBm</td><td>0.01 Hz to 9.99 Hz</td><td>+ |Voff| ≤ 50 Vp</td></tr>
<tr><td></td><td>-57.78 dBm to -27.41 dBm</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td></td><td>-27.41 dBm to -7.41 dBm</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>-7.41 dBm to 12.58 dBm</td><td>10 Hz to 500 kHz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>12.59 dBm to 32.58 dBm</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td></td><td>32.59 dBm to 52.58 dBm</td><td>45 Hz to 20 kHz</td><td></td></tr>
<tr><td></td><td>52.59 dBm to 62.39 dBm</td><td>45 Hz to 10 kHz</td><td></td></tr>
<tr><td></td><td>-8 dBm to 12.7 dBm</td><td>1 MHz, 2 MHz</td><td></td></tr>
<tr><td>Square[1]</td><td>3 mVpp to 66 mVpp</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td></td><td>67 mVpp to 660 mVpp</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>0.7 Vpp to 6.6 Vpp</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 8 V</td></tr>
<tr><td></td><td>7 Vpp to 66 Vpp</td><td>0.01 Hz to 9.99 Hz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td></td><td>2.9 mVpp to 65.999 mVpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td></td><td>66 mVpp to 659.999 mVpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>0.66 Vpp to 6.59999 Vpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>6.6 Vpp to 66 Vpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td>Triangle &</td><td>2.9 mVpp to 92.999</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 80 mVp</td></tr>
<tr><td>Truncated Sine</td><td>93 mVpp to 929.999 mVpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 800 mVp</td></tr>
<tr><td></td><td>0.93 Vpp to 9.29999Vpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 8 Vp</td></tr>
<tr><td></td><td>9.3 Vpp to 93Vpp</td><td>10 Hz to 100 kHz</td><td>Vp + |Voff| ≤ 55 Vp</td></tr>
<tr><td>DC Current:</td><td></td><td></td><td></td></tr>
<tr><td>Aux. Output</td><td>-2.99999 A to 2.99999 A</td><td></td><td></td></tr>
<tr><td>20 A Output</td><td>-20.5 A to -3 A, 3 A to 20.5 A</td><td></td><td></td></tr>
<tr><td>w/range lock</td><td>-20.5 A to 20.5 A</td><td></td><td></td></tr>
</table>

Function	Amplitude	Frequency/Period	Misc.
AC Current:			
Aux Output			
LCOMP OFF			
Sine			
no toroid	29 uA to 330 mA	0.01 Hz to 9.99 Hz	
	29 uA to 329.999 mA	10 Hz to 30 kHz	
	0.33 A to 2.99999 A	10 Hz to 10 kHz	
10-turn toroid	0.29 mA to 3.29999 A	10 Hz to 30 kHz	
	3.3 A to 29.9999 A	10 Hz to 10 kHz	
30-turn toroid	0.87 mA to 8.9997 A	10 Hz to 30 kHz	
	9.9 A to 65.9997A	10 Hz to 10 kHz	
50-turn toroid	1.45 mA to 16.49995 A	10 Hz to 30 kHz	
	16.5 A to 109.9995 A	10 Hz to 10kHz	
Square	47 uApp to 660 mApp	0.01 Hz to 9.99 Hz	
	47 uApp to 5.99999 mApp	10 Hz to 10 kHz	
Triangle &	47 uApp to 930 mApp	0.01 Hz to 9.99 Hz	
Truncated Sine	47 uApp to 8.49999 mApp	10 Hz to 10 kHz	
20 A Output			
Sine			
no toroid	3 A to 20.5 A	45 Hz to 5 kHz	
10-turn toroid	30 A to 205 A	45 Hz to 5 kHz	
30-turn toroid	90 A to 615 A	45 Hz to 5 kHz	
50-turn toroid	150 A to 1025 A	45 Hz to 5 kHz	
Square	6 App to 41 App	45 Hz to 1 kHz	
Triangle &			
Truncated Sine	8.5 App to 57 App	45 Hz to 1 kHz	
LCOMP ON			
Sine	29 uA to 329.999 mA	10 Hz to 1 kHz	
no toroid	0.33 A to 2.99999 A	10 Hz to 440 Hz	
	0.29 mA to 3.29999 A	10 Hz to 1 kHz	
10- turn toroid	3.3 A to 29.9999 A	10 Hz to 440 Hz	
	0.87 mA to 8.9997 A	10 Hz to 1 kHz	
30-turn toroid	9.9 A to 65.9997 A	10 Hz to 440 Hz	
	1.45 mA to 16.49995 A	10 Hz to 1 kHz	
50- turn toroid	16.5 A to 109.9995 A	10 Hz to 440 Hz	
Square	47 uApp to 659.999 mApp	10 Hz to 1 kHz	
	0.66 App to 5.99999 App	10 Hz to 440 Hz	
Triangle &			
Truncated SIne	47 uA pp to 929.999 mApp	10 Hz to 1 kHz	
	0.93 App to 8.49999 App	10 Hz to 440 Hz	

Function	Amplitude	Frequency/Period	Misc.
20A Output			
Sine			
No toroid	3 A to 20.5 A	45 Hz to 440 Hz	
10-turn toroid	30 A to 205 A	45 Hz to 440 Hz	
30- turn toroid	90 A to 615 A	45 Hz to 440 Hz	
50 turn toroid	150 A to 1025 A	45 Hz to 440 Hz	
Square	6 App to 41 App	45 Hz to 440 Hz	
Triangle & Truncated Sine	8.5 App to 57 App	45 Hz to 440 Hz	
Synthesized Resistance: 4-wire & 2-wire comp.	0 Ω to 109.999 kΩ		
2-wire	110 kΩ to 1100 MΩ		
Synthesized Capacitance			
2-wire	330 pF to 110.00 mF 110 nF to 110.00 mF		
2-wire comp.	110 nF to 110.00 mF		
RTD Calibration			
100Ω Pt 385	-200 °C to 800 °C, -328 °F to 1472 °F		
200Ω Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
500Ω Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
1 kΩ Pt 385	-200 °C to 630 °C, -328 °F to 1166 °F		
100Ω Pt 3916	-200 °C to 630 °C, -328 °F to 1166 °F		
100Ω Pt 3926	-200 °C to 630 °C, -328 °F to 1166 °F		
120Ω Ni 391	-80 °C to 260 °C, -112 °F to 500 °F		
10Ω Cu	-100 °C to 260 °C, -148 °F to 500 °F		
Thermocouple Calibration & Measurement			
Type B	600 °C to 1820 °C, 32 °F to 3308 °F		
Type C	0 °C to 2316 °C, 32 °F to 4201 °F		
Type E	-250 °C to 1000 °C, -418 °F to 1832 °F		
Type J	-210 °C to 1200 °C, -410 °F to 2192 °F		
Type K	-200 °C to 1372 °C, -328 °F to 2502 °F		
Type L	-200 °C to 900 °C, -328 °F to 2502 °F		
Type N	-200 °C to 1300 °C, -328 °F to 2372 °F		
Type R	0 °C to 1767 °C, 32 °F to 3213 °F		
Type S	0 °C to 1767 °C, 32 °F to 3213 °F		
Type T	-250 °C to 400 °C, -418 °F to 752 °F		
Type U	-200 °C to 600°C, -328 °F to 1103 °F		

Function	Amplitude	Frequency/Period	Misc.
Dual DC Voltage:			
Normal Output	-1020 V to 1020V		
Aux Output	-7 V to 7 V		
Dual AC Voltage:			
Normal Output[4],			
Sine[2]	1 mV to 1020 V	10 Hz to 10 kHz	
Square	2.9 mVpp to 66 Vpp	10 Hz to 10 kHz	
Triangle &	2.9 mVpp to 93 Vpp	10 Hz to 10 kHz	
Truncated Sine			
Aux Output			
Sine[2]	10 mV to 330 mV	0.01 Hz to 9.99 Hz	
	0.4 V to 3.3V	0.01 Hz to 9.99 Hz	
	10 mV to 3.29999 V	10 Hz to 30 kHz	
	3.3 V to 5 V	10 Hz to 10 kHz	
Square	29 mVpp to 6. 59999 Vpp	0.01 Hz to 10 kHz	
Triangle &	29 mVpp to 9.29999 Vpp	0.01 Hz to 10 kHz	
Truncated Sine	9.3 Vpp to 14 Vpp	0.01Hz to 1kHz	
DC Power:			
Normal Output	-1020 V to 1020 V		
Aux Output	-2.99999 A to 2.99999 A		
20A Output	-20.5 A to 20.5 A		
AC Power:			
Normal Output[4]			
Sine[2]	1 mV to 1020 V	[3]	
	-57.78 dBm to 62.39 dBm	[3]	
Square	2.9 mVpp to 65.9999 Vpp	[3]	
Triangle &	2.9 mVpp to 93 Vpp	[3]	
Truncated Sine			
Aux Output:			
LCOMP OFF			
Sine			
no toroid	29 µA to 330 mA	0.01 Hz to 9.99 Hz	
Sine	29 µA to 329.999 mA	10 Hz to 30 kHz	
	0.33 A to 2.99999 A	10 Hz to 10 kHz	
10-turn toroid	0.29 mA to 3.29999 A	10 Hz to 30 kHz	
	3.3 A to 29.999 A	10 Hz to 10 kHz	
30-turn toroid	0.87 mA to 8.9997 A	10 Hz to 30 kHz	
	9.9 A to 65.9997 A	10 Hz to 10 kHz	
50-turn toroid	1.45 mA to 16.49995 A	10 Hz to 30 kHz	
	16.5 A to 109.9995 A	10 Hz to 10 kHz	
Square	47 µApp to 660 mApp	0.01Hz to 9.99 Hz	
	47 uApp to 5.99999 App	10 Hz to 10 kHz	
Triangle &	47 µApp to 930 mApp	0.01 Hz to 9.99 Hz	
Truncated Sine	47 µApp to 8.49999 App	10 Hz to 10 kHz	

Function	Amplitude	Frequency/Period	Misc.
20 A Ouput: Sine no toroid 10-turn toroid 30-turn toroid 50-turn toroid Square Triangle & Truncated Sine	 3 A to 20.5 A 30 A to 205 A 90 A to 615 A 150 A to 1025 A 6 App to 41 App 8.5 A to 57 App	 45 Hz to 5 kHz 45 Hz to 5 kHz 45 Hz to 5 kHz 45 Hz to 5 kHz 45 Hz to 1 kHz 45 Hz to 1 kHz	
Humidity Meas.			

1. A duty cycle of 1% to 99% may be specified for square waves. The default is 50%.
2. When both waveforms are sine, either the Normal or Aux output may be specified to be a harmonic from 1 to 31.
3. The frequency is the same for the voltage and the current, therefore the limits of the AC Voltage frequency are the same as those specified for the AC Current range selected.
4. The phase between the two output signals may be specified from -180 degrees to +180 degrees.

Functional Capability (5520A SCOPE Output with Option SC300 Installed)

Function	Amplitude	Frequency	Misc.
DC Voltage: 50 Ω term. 1 MΩ term.	 -2.2 V to 2.2 V -33 V to 33 V		
AC Voltage: Scope Square Wave (zero based) 50 Ω term. 1 MΩ term. ScopeMeter Square Wave 1 MΩ term. Edge 50 Ω term. Leveled Sine 50 Ω term. Time Markers 50 Ω term.	 1.8 mVpp to 2.2 Vpp 1.8 mVpp to 55 Vpp 95 Vpp to 105 Vpp 5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence ±10 % 5 mVpp to 5.5 Vpp	 10 Hz to 10 kHz 10 Hz to 10 kHz 10 Hz to 10 kHz 1 kHz to 1 MHz 50 kHz to 350 MHz	Period 1.8 ns to 2.2 ns 4.5 ns to 11 ns 18 ns to 22 ns 45 ns to 110 ns 180 ns to 1.1 µs 1.8 µs to 60 µs 90 µs to 12 ms 18 ms to 5.5 s

Functional Capability (5520A SCOPE Output with Option SC300 Installed)(cont)

Function	Amplitude	Frequency	Misc.
Wavegen Sine, Square, and Triangle Waveforms (zero centered)			
50 Ω term.	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤3.1 Vp
1 MΩ term.	1.8 mVpp to 21.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤26 mVp
	22 mVpp to 89.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤100 mVp
	90 mVpp to 219 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤260 mVp
	220 mVpp to 899 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤1000 mVp
	0.9 Vpp to 6.59 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤6.6 Vp
	6.6 Vpp to 55 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤50 Vp

Functional Capability (5520 SCOPE Output with Option SC600 Installed)

Function	Amplitude	Frequency	Misc.
DC Voltage:			
50 Ω term.	-6.599 V to 6.599 V		
1 MΩ term.	-130 V to 130 V		
AC Voltage: Scope Square Wave (zero based positive and negative)			
50 Ω term.	1.0 mVpp to 6.599 Vpp	10 Hz to 10 kHz	
1 MΩ term.	1.0 mVpp to 130 Vpp	10 Hz to 10 kHz	
Edge			
50 Ω term.	5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence ±10%	900 Hz to 11 MHz	
w/ Tunnel Diode Pulser Drive Signal	11 Vpp to 2.5 Vpp	900 Hz to 11 MHz	
Leveled Sine			
50 Ω term.	5 mVpp to 5.5 Vpp	50 kHz to 600 MHz	
Time Markers			
50 Ω term			Period
Spike			18 ns to 5.5 s
Square			7.5 ns to 5.5 s
20 % Duty Square			75 ns to 34.99 ms
Square			1.8 ns to 17.9 ns
Sine			
Wavegen Sine, Square, and Triangle Waveforms (zero centered)			Max AC + DC Offset
50 Ω term	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤3.1 Vp
1 MΩ term	1.8 mVpp to 21.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤26 mVp
	22 mVpp to 89.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤100 mVp
	90 mVpp to 219 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤260 mVp
	220 mVpp to 899 mVpp	10 Hz to 100 kHz	Vp + |Voff|≤1000 mVp
	0.9 Vpp to 6.59 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤6.6 Vp
	6.6 Vpp to 55 Vpp	10 Hz to 100 kHz	Vp + |Voff|≤50 Vp
		Video	

Functional Capability (5520 SCOPE Output with Option SC600 Installed)(cont)

Function	Amplitude	Frequency	Misc.
Video			Line Marker
NTSC	-150% to 150% -1.5 Vp to 1.5 Vp -140 IRE to 140 IRE		1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 262 Odd or Even
PAL	-150% to 150% -1.5 Vp to 1.5 Vp		1 to 622 1 to 622
PAL-M	-150% to 150% -1.5 Vp to 1.5 Vp -140 IRE to 140 IRE		1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 262 Odd or Even
SECAM	-150% to 150% -1.5 Vp to 1.5 Vp		1 to 262 1 to 262
Pulse		Period	Pulse Width
50 Ω term	10 mVpp, 25 mVpp, 100 mVpp, 250 mVpp, 1 Vpp, and 2.5 Vpp	200 ns to 22 ms	2 ns to 500 ns
UUT Input Impedance Measurement (MEAS Z):			
50 Ω			40 Ω to 60 Ω
1 MΩ			500 kΩ to 1.5 MΩ
Capacitance			5 pF to 50 pF
UUT 50 Ω Input Impedance Overload Protection Measurement (OVERLD)			
DC	5 V to 9 V		
AC	5 V to 9 V	1 kHz	

Parameters

The following table describes the basic operating modes of the 5520A Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 5520FSC.

5520 Operating Modes

5520 Mode	5520 Nominal	5520 MOD1	5520 MOD3[1]	M5520 Range	M5520 Nominal	M5520 MOD1
DC Voltage	voltage		[**TC**|**SC**|**S6**]	[**RNGLK**	voltage]	
AC Voltage	voltage	freq|period	[**SC**|**S6**]			[DC offset]
AC Voltage	freq|period	voltage				[DC offset]
AC Voltage (pulse)	p-width period[2]	voltage voltage	**S6** **S6**	Per Pulse	period p-width[2]	
AC Voltage	duty cycle	freq|period			voltage	[DC offset]
AC Voltage (time marks)	freq|period		**SC**|**S6**			
DC Current	current			[**RNGLK**	current]	
AC Current	current	freq|period				
AC Current	freq|period	current				
Resistance	resistance					
Resistance	conductance					
Capacitance	capacitance					
RTD Cal	temperature					
TC Cal	temperature		**TC**	[**TCREF**	temp.]	
TC Meas	temperature		**TM**|**TN**	[**TCREF**	temp.]	
Dual DC Voltage	voltage		[**AX**]		voltage	
Dual AC Voltage	voltage	freq|period	[**BV**|**AX**]	[**H***n*|**HX***n*]	voltage	
Dual AC voltage	freq|period	voltage	[**BV**]	[**HX***n*]	voltage	
Dual AC voltage	freq|period	voltage	**AX**	[**H***n*]	voltage	
Dual AC Voltage	phase	freq|period	[**BV**|**AX**]	[**H***n*|**HX***n*]	voltage	voltage
DC Power	power		[**BC**|**BP**]		voltage	

5520 Operating Modes (cont)

5520 Mode	5520 Nominal	5520 MOD1	5520 MOD3[1]	M5520 Range	M5520 Nominal	M5520 MOD1
DC Power	voltage				current	
DC Power	current		[**BC**|**BP**]		voltage	
AC Power	power	freq|period	[**BC**|**BP**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	voltage	
AC Power	power	freq|period	[**BV**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	current	
AC Power	current	freq|period	[**BC**|**BP**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	voltage	
AC Power	voltage	freq|period	[**BV**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	current	
AC Power	freq|period	current	[**BC**|**BP**]	[**H***n*| **LEAD**|**LAG**]	voltage	
AC Power	freq|period	voltage	[**BV**]	[**HX***n*| **LEAD**|**LAG**]	current	
AC Power	phase	freq|period	[**BC**|**BP**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	voltage	current
AC Power	phase	freq|period	[**BV**]	[**H***n*|**HX***n*| **LEAD**|**LAG**]	current	voltage
Video	Percent| Voltage|IRE	line marker	**S6**	**ODD**|**EVEN**		
Impedance Meas.	resistance| capacitance		**ZM**			
Overload Meas.	voltage	[freq]	**OM**	Limit	time	

5520 Operating Modes (cont)

5520 Mode	5520 Nominal	5520 MOD1	5520 MOD3[1]	M5520 Range	M5520 Nominal	M5520 MOD1
Humidity Meas	percent		**HM**			
Impedance Meas	Resistance | Capacitance		**ZM**			
Overload Meas	voltage	[freq]	**OM**	LIMIT	time	
Dual DC Voltage	voltage		[**AX**]		voltage	
Dual AC Voltage	voltage	freq|period	[**AX**]	[**H***n*|**HX***n*]	voltage	
Dual AC voltage	freq|period	voltage		[**HX***n*]	voltage	
Dual AC voltage	freq|period	voltage	**AX**	[**H***n*]	voltage	
Dual AC Voltage	phase	freq|period	[**AX**]	[**H***n*|**HX***n*]	voltage	voltage
DC Power	power				voltage	
DC Power	power				current	
DC Power	voltage				current	
DC Power	current				voltage	
AC Power	power	freq|period		[**H***n*|**HX***n*|**LEAD**|**LAG**]	voltage	
AC Power	power	freq|period		[**H***n*|**HX***n*|**LEAD**|**LAG**]	current	
AC Power	current	freq|period		[**H***n*|**HX***n*|**LEAD**|**LAG**]	voltage	
AC Power	voltage	freq|period		[**H***n*|**HX***n*|**LEAD**|**LAG**]	current	

5520 Operating Modes (cont)

5520 Mode	5520 Nominal	5520 MOD1	5520 MOD3[1]	M5520 Range	M5520 Nominal	M5520 MOD1
AC Power	freq|period	current		[**H***n*| **LEAD**|**LAG**]	voltage	
AC Power	freq|period	voltage		[**HX***n*| **LEAD**|**LAG**]	current	
AC Power	phase	freq|period		[**H***n*|**HX***n*| **LEAD**|**LAG**]	voltage	current
AC Power	phase	freq|period		[**H***n*|**HX***n*| **LEAD**|**LAG**]	current	voltage
Video	Percent| Voltage|IRE	line marker	**S6**	**ODD**|**EVEN**		

1. See MOD3 parameter for description of these specification codes and rules.
2. Period and pulse width (p-width) may be entered as a frequency in Hertz.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Units Symbols

Units	Symbol Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
D	dBm	decibels
F	Farads	capacitance
H	Hertz	frequency
IRE	IRE	video amplitude
LM	Line Marker	video line marker position
T	Time	period or pulse width
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
W	Watts	power
Y	Siemens	conductance
Z	Ohms	resistance
deg	degrees	phase
degC	degrees Celsius	temperature
degF	degrees Fahrenheit	temperature
pct	percent	duty cycle, video amplitude, or humidity

5520 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules

5520A Mode	5520 Nominal	5520 MOD1	5520 MOD2 [1]	5520 MOD3 [2]
DC Voltage	V			[TC]
AC Voltage	V|Vpp|D V|Vpp Vp Vp H|T H|T pct	HT H|T H|T H|T V|Vpp|D V|Vpp H|T	SI SQ|TI|TS SI SQ|TI|TS SI SQ|TI|TS SI|SQ|TI|TS	
DC Current	A			
AC Current	A|App A|App Ap H|T	H|T H|T H|T A|App	SI SI|SQ|TI|TS SI|SQ|TI|TS SI|SQ|TI|TS	
Resistance	Z|Y			
Capacitance	F			
RTD Cal	degC|degF		R1|R2|R3|R4|R5|R6|R7|R8	
TC Cal	degC|degF		_B|_C|_E|_J|_K|_L|_N|_R|_S|_T|_U	TC
TC Meas	degC|degF		_B|_C|_E|_J|_K|_L|_N|_R|_S|_T|_U	TM|TN
Humidity Meas	pct		PB	HM
Dual DC Voltage	V			[AX]
Dual AC Voltage	V|Vp|Vpp|D V|Vp|Vpp H|T H|T	H|T H|T V|Vpp|D V|Vpp	SI SQ|TI|TS SI SQ|TI|TS	[AX] [AX] [AX] [AX]
DC Power	W|A|V			

5520 FSC Nominal, MOD1, MOD2, and MOD3 Rules (cont)

5520A Mode	5520 Nominal	5520 MOD1	5520 MOD2 [1]	5520 MOD3 [2]
AC Power	**W** **V|Vp|Vpp|D** **V|Vp|Vpp** **A|Ap|App** **H|T** **H|T** **H|T**	**H|T** **H|T** **H|T** **H|T** **V|Vpp|D** **V|Vpp** **A|App**	**SI** **SI** **SQ|TI|TS** **SI|SQ|TI|TS** **SI** **SQ|TI|TS** **SI|SQ|TI|TS**	
1. See MOD2 parameter for description of these specification codes and rules. 2. See MOD3 parameter for description of these specification codes and rules.				

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5520 FSC Nominal, MOD1, MOD2, and MOD3 Rules for SC300

5520A Mode	5520 Nominal	5520 MOD1	5520 MOD2[1]	5520 MOD3[2]
DC Voltage (VOLT)	**V**			**SC**
AC Voltage (VOLT)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**ZQ|SM** **ZQ|SM**	**SC** **SC**
AC Voltage (Edge)	**V|Vp|Vpp**	**H|T**	**ED**	**SC**
AC Voltage (LEVSINE)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vp|Vpp**	**LS** **LS**	**SC** **SC**
AC Voltage (MARKER)	**H|T**		**MK**	**SC**
AC Voltage (WAVEGEN)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vp|Vpp**	**SI|SQ|TI** **SI|SQ|TI**	**SC**
1. See MOD2 parameter for description of these specification codes and rules. 2. See MOD3 parameter for description of these specification codes and rules.				

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

5520 FSC Nominal, MOD1, MOD2, and MOD3 Rules for SC600

5520A Mode	5520 Nominal	5520 MOD1	5500 MOD2 [1]	5500 MOD3 [2]
DC Voltage (VOLT)	**V**			**S6**
AC Voltage (VOLT)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**ZQ|SN** **ZQ|SN**	**S6** **S6**
AC Voltage (EDGE)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**ED** **ED**	**S6**
AC Voltage (LEVSINE)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**LS** **LS**	**S6** **S6**
AC Voltage (MARKER)	**H|T**		**M1|M2|M3|M4**	**S6**
AC Voltage (WAVEGEN)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vp|Vpp**	**SI|SQ|TI** **SI|SQ|TI**	**S6**
AC Voltage (PULSE)	**H|T**	**Vpp**	**PU**	**S6**
Video (VIDEO)	**pct|Vp|IRE** **pct|Vp**	**LM** **LM**	**F1|F3** **F2|F4**	**S6** **S6**
Impedance Meas (MEAS Z)	**Z** **F**			**ZM** **ZM**
Overload Meas (OVERLD)	**V** **Vpp**	 **H**		**OM** **OM**

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*]*units symbol*

or "*" to specify a reset.

Rules:

- The NOMINAL field may not specify frequency or period when any of the following sets of conditions exist:
  1. Dual AC Voltage is specified and either
     a. the M5520 RANGE field specifies H and the M5520 MOD3 field specifies AX

        or

     b. the M5520 RANGE field specifies HX and the 5520 MOD3 field specifies AX.
  2. AC Power is specified and either
     a. the M5520 RANGE field specifies H and the M5520 NOMINAL field specifies current

        or

     b. the M5520 RANGE field specifies HX and the M5520 NOMINAL field specifies voltage.
  3. The MOD3 field specifies E.
- When the NOMINAL field specifies frequency or period and the M5520 RANGE field specifies a harmonic (H or HX), the Keyboard Entry (ASK+ K) or Go/No-Go (ASK+ G) evaluation mode must be specified, Slew is not allowed.

  A duty cycle other than 50% may only be specified for square waveforms (MOD2 is SQ). Therefore keyboard entry and go-nogo evaluations may be performed at 50% duty cycle for non-square waveforms, but slew mode is not allowed. In addition the duty cycle is restricted to 50%, regardless of the type of waveform, when the DC offset is not zero.

- When the NOMINAL field specifies power and the value is slewed, if the M5520 NOMINAL field specifies voltage, the voltage is held constant and a new value of current is computed by the 5520A.

  If the M5520 NOMINAL field specifies current, the current is held constant and a new value of voltage is computed by the 5520A.

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described In “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage, or current for AC Voltage, AC Current, Dual AC Voltage, or AC Power modes entered as:

[*numeric*][*prefix*]*units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

1. The waveform type for the voltage or current specified in the NOMINAL or MOD1 field for AC Voltage or AC Current.
2. The waveform type for the voltage or current not specified in the M5520 NOMINAL field for AC Power or Dual AC Voltage.
3. The thermocouple or RTD type for TC Measurement, TC Calibration, or RTD Calibration.

• *blank*	DC or not applicable
• SI	Sine wave (5520A, SC300 and SC600 Wavegen)
• SQ	Square wave (5520A, SC300 and SC600 Wavegen)
• TI	Triangle wave (5520A, SC300 and SC600 Wavegen)
• TS	Truncated sine wave
• PB	Temperature/Humidity Probe
• _B	Type B thermocouple
• _C	Type C thermocouple
• _E	Type E thermocouple
• _J	Type J thermocouple
• K	Type K thermocouple
• _L	Type L thermocouple
• _N	Type N thermocouple
• _R	Type R thermocouple
• _S	Type S thermocouple
• _T	Type T thermocouple
• _U	Type U thermocouple
• R1	100 Ω Pt 385 RTD
• R2	100 Ω Pt 3926 RTD
• R3	120 Ni RTD
• R4	200 Ω Pt 385 RTD
• R5	500 Ω Pt 385 RTD
• R6	1 kPt 385 RTD
• R7	100 Ω Pt 3916 RTD
• R8	10 Ω Cu RTD
• ZQ	Positive square wave (SC300 and SC600 AC Voltage)
• ZN	Negative square wave (SC600 AC Voltage)
• SM	ScopeMeter wave (SC300 AC Voltage)
• ED	Edge signal (SC300 and SC600)
• LS	Leveled sine wave (SC300 and SC600)
• MK	Marker signal (SC300)
• M1	Spike Marker signal (SC600)
• M2	Square Marker signal (SC600)
• M3	20 % Duty Cycle Square Marker signal (SC600)
• M4	Sinusoid Marker signal (SC600)
• PU	Pulse wave (SC600)
• F1	NTSC video signal (SC600)
• F2	PAL video signal (SC600)
• F3	PAL-M video signal (SC600)
• F4	SECAM video signal (SC600)

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage, AC Current, Dual AC Voltage, or AC Power (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- _K is inserted automatically in the MOD2 field for TC Measurement or TC Calibration if no MOD2 code is entered.

R1 is inserted automatically in the MOD2 field for RTD Calibration if no MOD2 code is entered.

- The M5520 RANGE and NOMINAL field must specify the pulse wave period or frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M5520 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse wave period or frequency.
- The M5520 RANGE field must specify ODD or EVEN frame when the MOD2 field specifies F1 (NTSC video) or F3 (PAL-M video).

MOD3

This field specifies the calibrator output mode:

- *blank* Default for mode specified
- AX Auxiliary Voltage
- TC Thermocouple Cal
- TM Thermocouple Measurement (open to TC detection on)
- TN Thermocouple Measurement (open to TC detection off)
- HM Humidity Measurement
- SC SC300 Scope Option
- S6 SC600 Scope Option
- ZM SC600 UUT Input Impedance Measurement
- OM SC600 UUT 50 Ω Input Overload Protection Measurement

Rules:

- The MOD3 field must specify AX when Dual DC Voltage or Dual AC Voltage is specified and the M5520 MOD3 field does not specify AX.
- The MOD3 field may specify SC only when the SC300 Scope option is configured.
- The MOD3 field may specify S6 only when the SC600 Scope option is configured.
- SC is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, SM, ED, LS, or MK, and the SC300 Scope Option is configured, and no MOD3 code is entered.
- S6 is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, ZN, ED, LS, PU, M1, M2, M3, M4, F1, F2, F3, or F4, and the SC600 Scope Option is configured, and no MOD3 code is entered.
- The M5520 RANGE and NOMINAL fields must specify the time limit when the MOD3 field specifies OM.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify N (Nominal Setup Test) when the MOD3 field specifies OM (Overload Measurement).
- N is inserted automatically in the MOD4 field when the MOD3 field specifies OM and no MOD3 code is entered.

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- L2W 2-wire w/load compensation enabled
- 3W 3-wire
- 4W 4-wire
- CW 2-wire ohms compensated at the UUT terminals
- DV 2-wire using the external AC Divider

- TD Tunnel Diode Pulser Drive signal enabled
- T1 10-turn Toroid Coil
- LT1 10-turn Toroid Coil w/load compensation enabled
- T3 30-turn Toroid Coil
- LT3 30-turn Toroid Coil w/load compensation enabled
- T5 50-turn Toroid Coil
- LT5 50-turn Toroid Coil w/load compensation enabled
- FT 5500A/COIL and Toroidal UUT
- LFT 5500A/COIL and Toroidal UUT w/load compensation enabled
- FX 5500A/COIL and Non-toroidal UUT
- LFX 5500A/COIL and Non-toroidal UUT w/load compensation enabled
- L 50 Ω Termination
- *blank* 1 MΩ Termination

Rules:

- 2W is inserted automatically in the CON field when the MOD3 field does not specify SC or S6 and no CON field code is entered.
- The CON field may specify 3W only when the RTD Cal mode is specified.
- The CON field may specify CW only when RTD Cal, Resistance, or Capacitance mode is specified.
- The CON field may specify 4W only when RTD Cal, Resistance, or Capacitance mode is specified.
- The CON field may specify DV only when AC Voltage mode is specified, the MOD2 field specifies SI, the MOD3 field does not specify E and the NOMINAL or MOD1 field specifies a voltage of 22 mV or less.
- The CON field may specify T1, T3, or T5 only when the MOD3 field does not specify E and DC Current or DC Power mode is specified or AC Current mode is specified and the MOD2 field specifies SI or AC Power mode is specified and either

1. the M5520 NOMINAL field specifies voltage and the 5520 MOD2 field specifies SI

   or

2. the M5520 NOMINAL field specifies current and the M5520 MOD2 field specifies SI.

- The CON field may specify L2W, LT1, LT3, LT5, LFT, or LFX only when the mode is AC Current or AC Power.
- The CON field may specify L only when the MOD3 field specifies SC or S6 and the MOD2 field does not specify SM.
- The CON field must specify L when the MOD2 field specifies LS, ED, or MK, and the MOD3 field specifies SC.
- The CON field must specify L when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, and the MOD3 field specifies S6.
- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or MK, the MOD3 field specifies SC and no CON field code is entered.
- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, the MOD3 field specifies S6 and no CON field code is entered.
- CON field must specify 2W when the MOD3 field specifies ZM, HM, or OM.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M5520        *
  1.002  5520         *                                                S
# ----- DC Voltage -----
  1.003  5520   20    19.99mV        2% 0.04U                              2W
# ----- DC Voltage w/Range Lock -----
  2.001  M5520  RNGLK 3V
  2.002  5520   400   350.0mV        1.9% 0.4U                             2W
  3.001  M5520        *
# ----- DC Voltage, TC Terminals -----
```

```
  3.002  5520         35mV                                        TC S  2W
# ----- AC Voltage -----
  3.003  5520   400   350.0mV        -2.8U +2.9U   60H           SI       2W
# ----- AC Voltage w/External AC Divider -----
  4.001  5520         -37.78D        0.1U          100H          SI       DV
# ----- AC Voltage (Frequency Test) -----
  5.001  5520   1000  800.0H         0.1% 0.1U     300mV         SI       2W
# ----- Square Wave w/DC Offset -----
  6.001  M5520                                     0.5Voff
  6.002  5520         1Vpp                         1kH           SQ    S  2W
# ----- Square Wave w/Duty Cycle Specified -----
  6.003  M5520                       35pct
  6.004  5520         1Vpp                         1kH           SQ    S  2W
# ----- Square Wave (Duty Cycle Test) ------
  6.005  M5520        1Vpp
  6.006  5520         30pct          2U            500H          SQ       2W
  7.001  M5520        *
# ----- Triangle Wave -----

 7.002  5520         13mVpp                       10kH          TI    S  2W
# ----- Truncated Sine Wave -----
  7.003  5520         2.5mApp                      5kH           TS    S  2W
# ----- DC Current -----
  7.004  5520   1     1.00A          1%                                   2W
  8.001  5520   20    19.00A         0.07U                          HC    2W
# ----- Dual DC Voltage -----
  9.001  M5520        10mV
  9.002  5520         100mV          3%                             AX    2W
# ----- Dual AC Voltage -----
 10.001  M5520        1V                                         SI AX
 10.002  5520         141Vp                        10kH          SI    S  2W
# ----- Dual AC Voltage (Phase Test) ------
 10.003  M5520        1Vpp                         1Vpp          SQ AX
 10.004  5520         30deg          1U            60H           SQ       2W
# ----- Dual AC Voltage (Harmonics) ------
 11.001  M5520  H2    100V                                       SI
 11.002  5520         750mV          1U            60H           SI AX    2W
 12.001  M5520  HX3   1Vpp                                       SI AX
 12.002  5520         1Vpp           1U            60H           SI       2W
 13.001  M5520        *
# ----- DC Power (Volts and Amps) -----
 13.002  M5520        1mV                                              O  EL
 13.003  5520         1mA            1%                                   2W
# ----- AC Power (Volts and Amps) -----
```

```
 14.001  M5520        1mA            60deg                         SI
 14.002  5520         1V                           400H            SI    S  2W
# ----- AC Power (Watts and Volts) w/Displacement Power Factor -----
 14.003  M5520  LEAD  1V             0.998                         SI
 14.004  5520   20    19mW           1%            60H             SI       2W
# ----- AC Power (Watts and Vpp) w/Phase Specified -----
 15.001  M5520        1Vpp           -45deg                        SI
 15.002  5520   20    1mW            1U            400H            SI       2W
# ----- AC Power (Harmonics) ------
 16.001  M5520  H2    45V                                          SI
 16.002  5520         100W           1U            60H             SI       2W
 17.001  M5520  HX3   1mApp                                        SI
 17.002  5520         1Vpp           1U            60H             SI       2W
 18.001  M5520        *
# ----- Resistance -----
 18.002  5520   400   390.0Z         0.4% 0.1U                              CW
 19.001  5520   4     3.900MZ        0.05U                                  2W
# ----- Capacitance ----
 20.001  5520   10    1.100uF        2% 0.002U                              2W
# ----- Humidity Measurement -----
 21.001  5520         50.0pct                                      PB HM N  2W
# ----- Temperature Measurement -----
 21.002  5520         1200.0degF                                   _J TM N  2W
# ----- Temperature Stimulus -----
 21.003  M5520  TCREF 0degC
 21.004  5520         50degC         1%                            _K TC    2W
 22.001  M5520        *
 22.002  5520         45degC                                       R1    S  3W

SC300 Scope Option

 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- DC Voltage -----
  1.001  5520   20    19.99mV        4%                               SC
# ----- AC Voltage (Scope Square Wave) -----
  2.001  5520   400   350.0mV        50U           60H             ZQ SC
# ----- AC Voltage (ScopeMeter Wave) -----
  3.001  5520         100Vpp                       1kH             SM SC S
# ----- AC Voltage (Frequency Test) -----
  3.002  5520   1000  800.0H         0.1% 0.1U     300mV           ZQ SC
# ----- Edge Signal (Scope Output) -----
  4.001  5520         0.5Vpp                       1MH             ED SC S  L
# ----- Leveled Sine Wave -----
  4.002  5520         200mVpp                      50kH            LS SC S  L
```

```
# ----- Marker Signal -----
  4.003  M5520                                                          2T
  4.004  5520         1uT                                      MK SC S  L
# ----- Wavegen -----
  4.005  5520         5V                       1kH             SI SC S
# ----- Wavegen w/DC Offset -----
  4.006  M5520                                 0.5Voff
  4.007  5520         1Vpp                     1kH             TI SC S
# ----- Wavegen w/Duty Cycle Specified -----
  4.008  M5520                    35pct
  4.009  5520         1Vpp                     1kH             SQ SC S
  4.010  M5520        *

SC600 Scope Option

 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- DC Voltage -----
  1.001  5520   20    19.99mV        4%                                 S6
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  5520   400   350.0mV        50U           60H             ZQ S6
# ----- AC Voltage (Negative Scope Square Wave) -----
  3.001  5520         100Vpp                       1kH             ZN S6 S
# ----- AC Voltage (Frequency Test) -----
  3.002  5520   1000  800.0H         0.1% 0.1U     300mV           ZQ S6
# ----- Edge Signal (Scope Output) -----
  4.001  5520         0.5Vpp                       1MH             ED S6 S  L
# ----- Leveled Sine Wave -----
  4.002  5520         200mVpp                      50kH            LS S6 S  L
# ----- Spike Marker Signal -----
  4.003  M5520                                                          2T
  4.004  5520         1uT                                          M1 S6 S  L
  4.005  M5520        *
# ----- Square Marker Signal -----
  4.006  5520         1mT                                          M2 S6 S  L
# ----- 20% Duty Cycle Square Marker Signal -----
  4.007  5520         5uT                                          M3 S6 S  L
# ----- Sinusoid Marker Signal -----
  4.008  5520         2nT                                          M4 S6 S  L
# ----- Wavegen -----
  4.009  5520         5V                           1kH             SI S6 S
# ----- Wavegen w/DC Offset -----
  4.010  M5520                                     0.5Voff
  4.011  5520         1Vpp                         1kH             TI S6 S
# ----- NTSC Video -----
```

```
  4.012  M5520  ODD
  4.013  5520         1Vp                          262LM          F1 S6 S  L
  4.014  M5520        *
# ----- PAL Video -----
  4.015  5520         50pct                        400LM          F2 S6 S  L
# ----- PAL-M Video -----
  4.016  M5520  EVEN
  4.017  5520         -140IRE                      1LM            F3 S6 S  L
  4.018  M5520        *
# ----- SECAM Video -----
  4.019  5520         -100pct                      622LM          F4 S6 S  L
# ----- Pulse Wave (Slew Pulse Width) -----
  4.020  M5520  PER   200nT
  4.021  5520         5.0nT                        2.5Vpp         PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M5520  PULSE 10nT
  4.023  5520         1.00kH                       2.5Vpp         PU S6 N  L
  4.024  M5520        *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5520         50Z            1U                              ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  5520         1.000MZ        1U                              ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5520         10pF                                           ZM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.002  M5520  LIMIT 10T
  6.003  5520         5V                                             OM N  2W
  6.004  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M5520  LIMIT 10T
  7.002  5520         7V                                             OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

M5520

Auxiliary Instrument Setup FSC

Description

The M5520 FSC provides the additional program functions for the Fluke 5520A Calibrator which are not addressed by the 5520 FSC. These functions include Range Locking, DC Offset, Thermocouple External Temperature Reference, Phase, Power Factor, Duty Cycle, voltage and/or current for power stimulus, and voltage of the second signal for dual voltage output.

The following functions are available with SC600 Scope Option:

- Time limit for UUT 50 Ω input overload protection measurement.
- Odd frame for NTSC or PAL-M video signals.
- Trigger output

Parameters

For a description of the 5520A Calibrator operating modes referenced in this section, see Table 1 in the 5520 Instrument FSC description.

When a blank M5520 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

Units Symbols

Units	Symbol Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
D	dBm	decibels
H	Hertz	frequency
T	Time	period or pulse width
V	Volts	voltage or video amplitude
V0ff	Volts offset	DC Offset
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Z	Ohms	resistance
deg	degrees	phase
degC	degrees Celsius	temperature
degF	degrees Fahrenheit	temperature
pct	percent	duty cycle

M5520 FSC Range, Nominal, MOD1, MOD2, and MOD3 Rules

5520A Mode	M5520 Range	M5520 Nominal	M5520 TOL.	M5520 MOD1	M5520 MOD2 [1]	M5520 MOD3 [2]
DC Voltage	[RNGLK	V]				
AC Voltage	 [IMPED	[V/Vp/Vpp] [V/Vpp] ohms]	 [pct]	Voff [Voff]		
DC Current	[RNGLK	A]				
TC Cal	[TCREF	degC/degF]				
TC Meas	[TCREF	degC/degF]				
Dual DC Voltage	V					[AX]
Dual AC Voltage	[H*n*] [HX*n*] [H*n*] [HX*n*]	V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp/D V/Vp/Vpp V/Vp/Vpp	[deg] [deg] [deg]	 [V/Vp/Vpp/ D] V/Vp/Vpp/ D] V/Vp/Vpp	SI SI SI SI SQ/TI/TS SQ/TI/TS	[AX] [AX] [AX] [AX] [AX] [AX]
DC Power	V/A					
AC Power	[LEAD/LA G] [LEAD/LA G] [H*n*] [HX*n*] [H*n*] [HX*n*] [H*n*] [HX*n*] [H*n*] [HX*n*]	V/Vp/Vpp/D A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App A/Ap/App V/Vp/Vpp/D V/Vp/Vpp/D A/Ap/App A/Ap/App V/Vp/Vpp V/Vp/Vpp	[*dpf*] [*dpf*] [deg] [deg] [deg] [deg] [deg]	 A/Ap/App A/Ap/App V/Vp/Vpp/ D V/Vp/Vpp/ D A/Ap/App	SI SI SI SI SI SI SI SI SI SI SQ/TI/TS SQ/TI/TS	[HC] [HC] [HC] [HC] [HC]

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

M5520 NOMINAL, MOD1, MOD2, and MOD3 Rules for SC600

M5520 RANGE, NOMINAL, TOLERANCE, MOD1, MOD2, and MOD3 fields are not used for SC300.

M5520 FSC Nominal, MOD1, MOD2, and MOD3 Rules for SC600

5500A Mode	M550 Range	M550 Nominal	M550 Tolerance	M550 MOD1	M550 MOD2	M550 MOD3
AC Voltage (WAVEGEN)				[OFFSET]		
AC Voltage (PULSE)	PER/PULSE	H/T				
Video (VIDEO)	[ODD/EVEN]					
Overload Meas (OVERLD)	LIMIT	T				

Note

blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter. M5520 RANGE, NOMINAL, TOLERANCE, MOD1, MOD2, and MOD3 fields are not used for SC600 operating modes not listed.

RANGE

This field specifies one of the following:

- RNGLK Range Lock
- IMPED Output Impedance
- TCREF Thermocouple Reference
- LEAD Leading
- LAG Lagging
- H*n* Primary output is a harmonic, 1 to 51
- HX*n* Secondary output is a harmonic, 1 to 51
- PULSE Pulse Width
- PER Pulse Period

- LIMIT Time Limit (Overload Measurement)
- ODD Odd Frame (NTSC or PAL-M video)
- EVEN Even Frame (NTSC or PAL-M video)
- *blank* field not applicable

Rules:

- The RANGE field may not specify RNGLK when the 5520 MOD3 field specifies TC, SC, or S6.
- The RANGE field may specify IMPED only for AC Voltage mode when the amplitude is expressed in decibels.
- When the RANGE field specifies LEAD or LAG, the TOLERANCE field must specify the Displacement Power Factor.
- The primary output is always the Normal output. The secondary output is the Aux or 20A output.
- The RANGE field may specify PULSE or PER only when the 5520 MOD2 field specifies PU.
- The RANGE field must specify PULSE or PER when the 5520 MOD2 field specifies PU.
- The RANGE field may specify ODD or EVEN only when the 5520 MOD2 field specifies F1 or F3.
- The RANGE field must specify ODD or EVEN when the 5520 MOD2 field specifies F1 or F3.

NOMINAL

This field specifies one of the following entered as:

[*numeric*][*prefix*]*units symbol*

- Range lock selection value in Volts or Amps
- Output Impedance in Ohms
- Thermocouple Reference
- Pulse Period or Pulse Repetition Frequency
- Pulse Width
- Signal amplitude for AC Voltage, Dual DC Voltage, Dual AC Voltage, DC Power, or AC Power
- "*" reset to default values

- *blank* field not applicable

Rules:

- The NOMINAL field may specify a Voltage or Current range selection value only when the RANGE field specifies RNGLK.

Voltage Range Selection Value	Locked Range
0 mV to 33 mV	33 mV DC
> 33 mV to 330 mV	330 mV DC
> 330 mV to 3.3 V	3.3 V DC
> 3.3 V to 33 V	33 V DC
> 33 V to 330 V	330 V DC
> 330 V to 1020 V	1000 V DC
Current Range Selection Value	**Locked Range**
0 mA to 3.3 mA	3.3 mA DC
> 3.3 mA to 33 mA	33 mA DC
> 33 mA to 330 mA	330 mA DC
> 330 mA to 3 A	3 A DC
> 3 A to 20 A	20 A DC[1]

1. The 11 A range may be locked only when the 5500 FSC MOD3 field does not specify BP (Boost Port).

The NOMINAL field must specify the pulse period or pulse repetition frequency when the M5520 RANGE field is PER.

- The NOMINAL field must specify the pulse width when the M5520 RANGE field is PULSE.
- When the NOMINAL field specifies voltage and Dual DC Voltage or Dual AC Voltage mode is specified, either the MOD3 field must specify AX or the 5520 MOD3 field must specify AX.
- The NOMINAL field may specify Thermocouple Reference only when the RANGE field specifies TCREF. In this case, the UUT is compensating for its thermocouple junction temperature and Thermocouple Reference should be set to the temperature of the UUT's junction. Thermocouple Reference must be in the same units as the temperature specified in the 5520 NOMINAL field.
- When the NOMINAL field does not specify Thermocouple Reference, the 5520A internal reference is used and the UUT is not compensating for its thermocouple junction temperature.
- When the NOMINAL field contains only units, the value is taken from MEM.

- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field specifies phase or duty cycle entered as

numeric[*prefix*]*units symbol* or displacement power factor entered as *numeric*.

Rules:

- The TOLERANCE field may specify Displacement Power Factor only when the RANGE field specifies LEAD or LAG.
- The TOLERANCE field may specify Duty Cycle only when AC Voltage mode is specified and the 5520 MOD2 field specifies SQ.

MOD1

This field specifies DC offset for AC Voltage or one amplitude for AC Power or Dual AC Voltage entered as:

[*numeric*][*prefix*]*units symbol*

Rules:

- The MOD1 field may specify voltage or current only when the 5520 NOMINAL field specifies phase.
- When the MOD1 field specifies voltage with units of "D", the 5520 MOD2 field must specify SI.
- When the MOD1 field specifies voltage with units of "Vp" or "Vpp" or current with units of "Ap" or "App", the 5520 MOD2 field must specify SI, SQ, TI, or TS.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- The MOD1 field may specify DC offset only when AC Voltage mode is specified and the 5520 NOMINAL field units are not decibels.
- When the MOD1 field specifies DC Offset, either the voltage specified in the 5520 NOMINAL or MOD1 field must be less than 33V or the DC Offset value must be zero.

- When the MOD1 field specified DC Offset and the 5520 NOMINAL field specifies duty cycle, the specified DC Offset must be zero.
- When the MOD1 field specifies DC Offset other than 0V, and the TOLERANCE field specifies duty cycle, the duty must be 50%.
- When the MOD1 field specifies DC Offset and the 5520 NOMINAL field specifies duty cycle, the specified DC Offset must be zero.

MOD2

This field specifies the waveform for the output specified in the NOMINAL field.

- SI Sine wave
- SQ Square wave
- TI Triangle wave
- TS Truncated sine wave
- *blank* DC or field not applicable

MOD3

This field specifies the calibrator output mode:

- AX Auxiliary Voltage
- HC 20 A Output
- *blank* default port, or field not applicable

Rules:

The MOD3 field must specify AX when Dual DC Voltage or Dual AC Voltage mode is specified and the 5520 MOD3 field does not specify AX.

MOD4

This field controls the external guard and whether or not the NORMAL and AUX "LO" terminals are tied together for DC Power, AC Power, Dual DC Voltage, and Dual AC Voltage modes.

MOD4	Lows	External Guard
blank	Shorted	Off
O	Open	Off
G	Shorted	On

OG Open On

Rules:

- The MOD4 field may specify "O" or "OG" only when the CON specifies "EL" or "FL".

CON

This field controls whether or not the NORMAL and AUX "LO" terminals are tied to Earth and the trigger output.

- *blank* default or field not applicable
- EL Low tied to Earth
- FL Floating Low
- 1T Trigger Output on, Normal mode
- 2T Trigger Output on, 1/10 of output rate
- 3T Trigger Output on, 1/100 of output rate

Rules:

- The CON field specification is ignored, and a floating low is used when Resistance, Capacitance, RTD Calibration, or Thermocouple Measurement mode is specified.
- A CON field specification of 1T, 2T, or 3T is only applicable (is ignored otherwise) when the 5520 MOD2 field specifies ZQ, ZN, ED, MK, M1, M2, M3, and M4.
- When the CON is field is blank, a floating low is used.

Examples

See 5520 FSC.

5700

Instrument FSC

Description

The 5700 FSC controls the following functions of the Fluke 5700A Multi-function Calibrator:

- Voltage, current, or resistance stimulus
- HF Voltage using the 5700A-03 Wideband AC Option
- Voltage or current from the 5725A Precision Power Amplifier
- Voltage from the 5205A or 5215A Power Amplifier
- Current from the 5220A Transconductance Amplifier The 5725A, 5205A, 5215A, or 5220A must be connected to the 5700A in order to be controlled via the 5700 FSC.

Note

The 5700 FSC may also be used to control a 5700A/EP or 5720A. This capability allows 5700A based to procedures to be executed without modificaiton when a 5700A/EP or 5720A is configured.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-1100 V to 1100 V		
DC Voltage w/5205A Boost	+/-(100 V to 1100 V)		B2
AC Voltage	220 µV to 219.9999 V, -70.99307 dBm to 49.06693 dBm 220 V to 1100 V 49.06694 dBm to 63.04634 dBm	10 Hz to 1.1999 MHz 50 Hz to 1 kHz	
AC Voltage w/5725A Boost	220 V to 1100 V 49.06694 dBm to 59.71971 dBm 220 V to 750 V 49.06694 dBm to 63.04634 dBm	40 Hz to 100 kHz 40 Hz to 30 kHz	B1 B1
AC Voltage w/5205A Boost	220 V to 1100 V 49.06694 dBm to 63.04634 dBm	10 Hz to 100 kHz	B2
AC Voltage w/5215A Boost	220 V to 1100 V 49.06694 dBm to 63.04634 dBm	10 Hz to 100 kHz	B3
AC Voltage w/5700A-03 Opt	300 µV to 3.5 V -57.44741 dBm to 23.89167 dBm	10 Hz to 30 MHz	W
DC Current	-2.199999 A to 2.199999 A		
DC Current w/5725A Boost	-11 A to 11 A	B1	
DC Current w/5220A Boost	-20 A to 20 A	B4	
AC Current	9 µA to 219.999 mA 220 mA to 2.199999 A 220 mA to 2.199999 A	10 Hz to 10 kHz 40 Hz to 10 kHz Series I 10 Hz to 10 kHz Series II (1)	
AC Current w/5725A Boost	1 A to 11 A	40 Hz to 10 kHz	B1
AC Current w/5220A Boost	1 A to 20 A	40 Hz to 5 kHz	B4
Resistance	0 Ω, 1 Ω to 100 MΩ (in decade steps) 1.9 Ω to 19 MΩ (in decade steps)		
Conductance	1 S to 10 nS (in decade steps) 0.52631 S to 52.631 nS (in decade steps)		
1. No accuracy specification below 20 Hz) 5700A Series II only.			

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify the divider override feature of the calibration system. Divider Override is specified by entering the character "O" for this field. The use of the internal and external divider allows a user to achieve higher levels of calibration accuracy in most circumstances. Therefore, the use of the divider is always automatically selected, where it is applicable.

There are two reasons to override the use of the divider:

- The high burden property of the UUT requires divider override to maintain calibration accuracy in the DC Volts mode.
- Fewer operator interactions are necessary and the feature of the internal and external divider is not necessary, resulting in shorter calibration times.

The following information shows the entries in the MOD2 field, the mode of the 5700A, the Nominal value, and the effect.

Entry	Mode	Nominal	Effect
(blank)	Volts DC	< 220 mV	50 Ω output impedance from 5700A
(blank)	Volts DC	≥220 mV	Low output impedance from 5700A
(blank)	Volts AC	<22 mV	50 Ω divider used. Reduced system noise levels, less accuracy
(blank)	Volts AC	≥22 mV	Low output impedance from 5700A
O	Volts DC	<220 mV	5700A fixed in 2.2 V range
O	Volts DC	≥220 mV	Not applicable
O	Volts AC	<22 mV	used, more wideband noise.
O	Volts AC	≥22 mV	Not applicable

Use of Divider Override in DC Voltage Mode

The output impedance of the 5700A is 50 Ω for programmed voltages below 220 mV in the DC Voltage mode. Substantial errors could be introduced in the calibration of high burden meters as a result of this output impedance.

In the DC Voltage mode, the internal divider of the 5700A can be overridden and fixed in the 2.2 V range to calibrate these high burden meters. If the input impedance of the UUT has no impact on the accuracy of calibration, the divider override in DC Voltage should not be specified, since the calibration system uncertainty is less.

Use Of Divider Override In AC Voltage Mode

The output impedance of the 5700A is low in any of the ranges. An external 1000:1 divider is supplied with every calibration system, that uses the 5700A as a calibration source. This external divider is used to reduce the impact of system noise on the response of the UUT. If the bandwidth of the AC voltmeter function of the UUT is below 1 MHz, the external divider is generally not necessary; however, to calibrate wideband voltmeters, this external divider should be used.

If the bandwidth of the AC function of the UUT is below 1 MHz, the external divider should be disabled by using the "O" selection in the MOD2 field. The calibration system uncertainty is less in this case.

MOD3

This field specifies one of the following:

- B1 use 5725A for voltage or current boost
- B2 use 5205A for voltage boost
- B3 use 5215A for voltage boost
- B4 use 5220A for current boost
- W use 5700A-03 Wideband output for AC Voltage
- *blank* No Boost, wideband, or not applicable

Rules:

- If the amplitude and frequency combination can be created only by the Boost Amplifier, B1, B2, B3, or B4 is inserted automatically. If there are two voltage boost amplifiers (e.g., 5725A and 5205A) configured in the system and both can provide the desired voltage/current combination, the 5725A has precedence and B1 is automatically inserted in the MOD3 field. If there are two current boost amplifiers (e.g., 5725A and 5220A) configured in the system and both can provide the desired current, the 5725A again has precedence and B1 is automatically inserted in the MOD3 field.
- If the amplitude and frequency combination can be created only the 5700A-03 Wideband AC option, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire
- CW 2-wire Ohms compensated at the UUT terminals
- RW 2-wire Ohms compensated at the 5700A terminals

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may not specify 4W when any of the following conditions exist:

  DC Voltage < 22 mV (unless MOD2 is O)

  AC Voltage < 220 mV

  DC Current

  AC Current

  100 MΩ Resistance
- The CON field may specify CW or RW only for resistance less than or equal to 19 kΩ.
- MET/CAL displays an automatic connection message to use the external 1000:1 divider when the following conditions exist:
  1. AC Voltage mode is specified and the amplitude is less than 22 mV
  2. The MOD2 does not specify divider override (O)
  3. The automatic message has not been disabled using ASK- V.

⚠ Warning

If ASK- V is in effect and conditions 1 and 2 exist it is of paramount importance that the procedure write explicitly generate a connection message for the external divider using the DISP FSC. Failure to do so could result in damage to the UUT and possible bodily injury.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	5700		*					S	
1.002	5700	1000	1100V	1U 1/					2W
2.001	5700	10	0V	1U					2W
3.001	5700	200	220mV	10%	50H				2W
4.001	5700	1000	1100V	1U	1kH				4W
5.001	5700	1	-47.12D	0.1U	50H				2W
6.001	5700	100	63.045D	0.5U	1kH				2W
7.001	5700	100	-22µA	10%					2W
8.001	5700	2	1.999A	1% 1/	1kH				2W
9.001	5700	A	mV	0.1U	50H				2W
10.001	5700	A	A	5%	1kH				2W
11.001	5700		1.999A		1kH			S	2W
11.002	5700	10	20mV	500H				N	2W
11.003	5700	10	20mV	0.5%	1kH			C	2W
12.001	5700	A	1Z	5%					CW

MMFC

Auxiliary Instrument Setup FSC

Description

The MMFC FSC programs the 5700A Multifunction Calibrator for special functions. All special functions are reset when another MMFC FSC is used. The new set-up defined by the MMFC FSC becomes effective with the next occurrence of the 5700 FSC.

Parameters

RANGE

Not used.

NOMINAL

Specifies the Phase in degrees from the Variable Phase Reference Output of the 5700A, relative to the normal output, or a reset of the MMFC FSC to the default parameters. The phase is entered as:

sign phase o

A reset of the MMFC parameters is accomplished by entering an asterisk ('*').

Allowed values	Units:
-180° to +180°	(o)

- If the Nominal field is blank, the variable phase is OFF.
- The sign may be +, -, or blank.

TOLERANCE

Not used.

MOD1

Specifies the 5700A range that the nominal values will use in all succeeding 5700 FSCs using the Range Lock capability of the 5700A.

- The range used will be the one that provides the highest resolution of the value entered in the range field of the MMFC FSC. Note that the value indicated by the range name cannot be generated by that range. For example, the maximum value in the 2.2 V range is 2.1999999 V, not 2.2 V.

- Only DC voltage and DC current can be range locked.
- FSC statements which don't specify Nominal values in DC voltage or current will ignore this field.
- DC voltage outputs may have either positive or negative polarity, so the true range of possible outputs is –1100 V to +1100 V. The same is true for current, so the range of possible outputs is -2.2 A to +2.2 A
- The range to be range locked is entered as:

  `nominal_value_in_range` *`prefix`* `units`

  The prefix can be the same as specified for the NOMINAL and MOD1 field of any instrument FSC.
- Function, allowed values for nominal_value_in_range and units:

Volts, DC	-1100 V to + 1100 V	(V)
Amps, DC	-2.2 A to + 2.2 A	(A)

- The following 5700A ranges allow range locking:

	MMFC MOD1 Value	Range Locked
DC Voltage	-219.99999 mV to -219.99999 mV	220 mV
	-2.1999999 V to -220.00000 mV	2.2 V
	2.1999999 V	2.2 V
	-10.999999 V to -2.2000000 V	11 V
	10.999999 V	11 V
	-21.999999 V to -11.000000 V	22 V
	21.999999 V	22 V
	-219.99999 V to -22.000000 V	220 V
	219.99999 V	220 V
	-1100.0000 V to -220.00000 V	1100 V
	1100.0000 V	1100 V
	219.99999 µA	220 µA
DC Current	-2.1999999 mA to -220.00000 µA	2.2 mA
	2.1999999 mA	2.2 mA
	-21.999999 mA to -2.200000 0 mA	22 mA
	21.999999 mA	22 mA
	-219.99999 mA to -22.000000 mA	220 mA
	219.99999 mA	220 mA
	220.00000 mA	2.2 A
	2.2000000 A	2.2 A

MOD2

Allows specification of the guard connection. If 'G' is specified, the external guard connection becomes active. If nothing is entered the guard is internally shorted to low. The guard active mode is appropriate for low level voltages where noise could affect the response of the unit under test.

MOD3

Specifies Phase Lock. Enter 'PL' when AC voltage or current are to use external phase lock.

MOD4

Not used.

CON

Specifies which output terminals are to be used in the Current Mode of operation. The following entries should be used as a function of the terminals to be used:

CON entry	Output terminals
C1	Normal output terminals
C2	AUX output terminals
C3	5725A output terminals

- Current greater than 2.2A will always come out of the appropriate Boost terminals.
- If the field is left blank, the default will be the value of the CON field in the previous MMFC FSC and if there is none, the default 'C1' is assumed.

Miscellaneous

- No memory location is affected by the MMFC FSC.
- There are no automatic messages associated with the MMFC FSC.
- Certain combinations of entries in MMFC FSC and 5700 FSCs that follow, are inappropriate. The interrelationships of the 5700 and MMFC FSCs are NOT verified during backup or compilation of the procedure. Incorrect combinations may result in error messages during procedure execution.

Examples

```
STEP    FSC     RANGE  NOMINAL         TOLERANCE      MOD1          MOD2   3   4  CON

2.001   MMFC           180o                                                PL     C1

6.002   MMFC           -180o                                               PL     C2
```

5720

Instrument FSC

Description

The 5720 FSC controls the following functions of the Fluke 5720A Multi-function Calibrator:

- Voltage, current, or resistance stimulus
- HF Voltage using the 5700A-03 Wideband AC Option
- Voltage or current from the 5725A Precision Power Amplifier
- Voltage from the 5205A or 5215A Power Amplifier
- Current from the 5220A Transconductance Amplifier

The 5725A, 5205A, 5215A, or 5220A must be connected to the 5720A in order to be controlled via the 5720 FSC.

Functional Capability

Function	Amplitude	Frequency	MOD3
DC Voltage	-1100 V to 1100 V		
DC Voltage w/5205A Boost	+/- (100 V to 1100 V)		B2
AC Voltage	220 µV to 219.9999 V, -70.99307 dBm to 49.06693 dBm 220 V to 250 V, 49.06694 dBm to 50.17729 dBm 250.001 V to 1100 V, 50.17732 dBm to 63.04634 dBm	10 Hz to 1.1999 MHz 15 Hz to 1 kHz 50 Hz to 1 kHz	
AC Voltage w/5725A Boost	220 V to 1100 V, 49.06694 dBm to 59.71971 dBm 220 V to 750 V, 49.06694 dBm to 63.04634 dBm	40 Hz to 100 kHz 40 Hz to 30 kHz	B1 B1
AC Voltage w/5205A Boost	220 V to 1100 V, 49.06694 dBm to 63.04634 dBm	10 Hz to 100 kHz	B2

Function	Amplitude	Frequency	MOD3
AC Voltage w/5215A Boost	220 V to 1100 V, 49.06694 dBm to 63.04634 dBm	10 Hz to 100 kHz	B3
AC Voltage w/5700A-03 Opt	300 μV to 3.5 V, -57.44741 dBm to 23.89167 dBm	10 Hz to 30 MHz	W
DC Current	-2.199999 A to 2.199999 A		
DC Current w/5725A Boost	-11 A to 11 A		B1
DC Current w/5220A Boost	-20 A to 20 A		B4
AC Current	9 μA to 219.999 mA 220 mA to 2.199999 A 220 mA to 2.199999 A	10 Hz to 10 kHz 40 Hz to 10 kHz Series I 10 Hz to 10 kHz Series II (1)	
AC Current w/5725A Boost	1 A to 11 A	40 Hz to 10 kHz	B1
AC Current w/5220A Boost	1 A to 20 A	40 Hz to 5 kHz	B4
Resistance or Conductance	0 Ω (short) 1 Ω to 100 MΩ, 1 S to 10 nS (in decade steps) 1.9 Ω to 19 MΩ, 0.52631 S to 52.631 nS (in decade steps)		

1. No accuracy specification below 20 Hz.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies one of the following.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency, the MOD1 field must specify voltage, decibels, or current.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- *blank* DC or not applicable

Rules:

- The MOD1 field may specify frequency when the NOMINAL field specifies voltage, decibels, or current.
- The MOD1 field may specify voltage, decibels, or current only when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field allows you to specify the divider override feature of the calibration system. Divider Override is specified by entering the character "O" for this field. The use of the internal and external divider allows a user to achieve higher levels of calibration accuracy in most circumstances. Therefore, the use of the divider is always automatically selected, where it is applicable.

There are two reasons to override the use of the divider:

- The high burden property of the UUT requires divider override to maintain calibration accuracy in the DC Volts mode.
- Fewer operator interactions are necessary and the feature of the internal and external divider is not necessary, resulting in shorter calibration times.

The following information shows the entries in the MOD2 field, the mode of the 5720A, the Nominal value, and the effect.

Entry	Mode	Nominal	Effect
(blank)	Volts DC	< 220 mV	50 Ω output impedance from 5720A
(blank)	Volts DC	≥220 mV	Low output impedance from 5720A
(blank)	Volts AC	<22 mV	External 1000:150 Ω divider used. Reduced system noise levels, less accuracy
(blank)	Volts AC	≥22 mV	Low output impedance from 5720A
O	Volts DC	<220 mV	5700A fixed in 2.2 V range
O	Volts DC	≥220 mV	Not applicable
O	Volts AC	<22 mV	External divider not used, more wideband noise.
O	Volts AC	≥22 mV	Not applicable

Use of Divider Override in DC Voltage Mode

The output impedance of the 5720A is 50 Ω for programmed voltages below 20 mV in the DC Voltage mode. Substantial errors could be introduced in the calibration of high burden meters as a result of this output impedance.

In the DC Voltage mode, the internal divider of the 5720A can be overridden and fixed in the 2.2V range to calibrate these high burden meters. If the input impedance of the UUT has no impact on the accuracy of calibration, the divider override in DC Voltage should not be specified, since the calibration system uncertainty is less.

Use of Divider Override in AC Voltage Mode

The output impedance of the 5720A is low in any of the ranges. An external 1000:1 divider is supplied with every calibration system, that uses the 5720A as a calibration source. This external divider is used to reduce the impact of system noise on the response of the UUT. If the bandwidth of the AC voltmeter function of the UUT is below 1 MHz, the external divider is generally not necessary; however, to calibrate wideband voltmeters, this external divider should be used.

If the bandwidth of the AC function of the UUT is below 1 MHz, the external divider should be disabled by using the "O" selection in the MOD2 field. The calibration system uncertainty is less in this case.

MOD3

This field specifies one of the following:

- B1 use 5725A for voltage or current boost
- B2 use 5205A for voltage boost
- B3 use 5215A for voltage boost
- B4 use 5220A for current boost
- W use 5700A-03 Wideband output for AC Voltage
- *blank* No Boost, wideband, or not applicable

Rules:

- If the amplitude and frequency combination can be created only by the Boost Amplifier, B1, B2, B3, or B4 is inserted automatically. If there are two configured in the system and both can provide the desired voltage/current combination, the 5725A has precedence and B1 is automatically inserted in the MOD3 field. If there are two current boost amplifiers (e.g., 5725A and 5220A) configured in the system and both can provide the desired current, the 5725A again has precedence and B1 is automatically inserted in the MOD3 field.
- If the amplitude and frequency combination can be created only the 5700A-03 Wideband AC option, W is inserted automatically in the MOD3 field.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire
- CW 2-wire Ω compensated at the UUT terminals
- RW 2-wire Ω compensated at the 5720A terminals

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The CON field may not specify 4W when any of the following conditions exist:
  1. DC Voltage < 22 mV (unless MOD2 is O)
  2. AC Voltage < 220 mV
  3. DC Current
  4. AC Current
  5. MΩ Resistance
- The CON field may specify CW or RW only for resistance less than or equal to 19 kΩ.
- MET/CAL displays an automatic connection message to use the external 1000:1 divider when the following conditions exist:
  1. AC Voltage mode is specified and the amplitude is less than 22 mV
  2. The MOD2 does not specify divider override (O)
  3. The automatic message has not been disabled using ASK- V.

⚠Warning

If ASK- V is in effect and conditions 1 and 2 exist, it is of paramount importance that the procedure writer explicitly generate a connection message for the external divider using the DISP FSC. Failure to do so could result in damage to the UUT and possible bodily injury.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	5720		*					S	
1.002	5720	1000	1100V	1U 1/					2W
2.001	5720	10	0V	1U					2W
3.001	5720	200	220mV	10%	50H				2W
4.001	5720	1000	1100V	1U	1kH				4W
5.001	5720	1	-47.12D	0.1U	50H				2W
6.001	5720	100	63.045D	0.5U	1kH				2W
7.001	5720	100	-22uA	10%					2W
8.001	5720	2	1.999A	1% 1/	1kH				2W
9.001	5720	A	mV	0.1U	50H				2W
10.001	5720	A	A	5%	1kH				2W
11.001	5720		1.999A		1kH			S	2W
11.002	5720	10	20mV		500H			N	2W
11.003	5720	10	20mV	0.5%	1kH			C	2W
12.001	5720	A	1Z	5%					CW

- Only DC voltage and DC current can be range locked.
- 5720 FSC statements which don't specify Nominal values in DC voltage or current will ignore this field.
- DC voltage outputs may have either positive or negative polarity, so the true range of possible outputs is –1100 V to +1100 V. The same is true for current, so the range of possible outputs is -2.2 A to +2.2 A.
- The range to be range locked is entered as:

  `nominal_value_in_range` *`prefix`* `units`

  The prefix can be the same as specified for the NOMINAL and MOD1 field of any instrument FSC.
- Function, allowed values for nominal_value_in_range and units:

Volts, DC	-1100 V to + 1100 V	(V)
Amps, DC	-2.2 A to + 2.2 A	(A)

- The following 5720A ranges allow range locking:

	M5720 MOD1 Value	Range Locked
DC Voltage	-219.99999 mV to -219.99999 mV	220 mV
	-2.1999999 V to -220.00000 mV	2.2 V
	220.00000 mV to 2.1999999 V	2.2 V
	-10.999999 V to -2.2000000 V	11 V
	2.2000000 V to 10.999999 V	11 V
	-21.999999 V to -11.000000 V	22 V
	11.000000 V to 21.999999 V	22 V
	-219.99999 V to -22.000000 V	220 V
	22.000000 V to 219.99999 V	220 V
	-1100.0000 V to -220.00000 V	1100 V
	220.00000 V to 1100.0000 V	1100 V
DC Current	-219.99999 µA to 219.99999 µA	220 µA
	-2.1999999 mA to -220.00000 µA	2.2 mA
	220.00000 µA to 2.1999999 mA	2.2 mA
	-21.999999 mA to -2.2000000 mA	22 mA
	2.2000000 mA to 21.999999 mA	22 mA
	-219.99999 mA to -22.000000 mA	220 mA
	22.000000 mA to 219.99999 mA	220 mA
	-2.2000000 A to 220.00000 mA	2.2 A
	220.00000 mA to 2.2000000 A	2.2 A

MOD2

Allows specification of the guard connection. If 'G' is specified, the external guard connection becomes active. If nothing is entered the guard is internally shorted to low. The guard active mode is appropriate for low level voltages where noise could affect the response of the unit under test.

MOD3

Specifies Phase Lock. Enter 'PL' when AC voltage or current are to use external phase lock.

MOD4

Not used.

CON

Specifies which output terminals are to be used in the Current Mode of operation. The following entries should be used as a function of the terminals to be used:

CON entry	Output terminals
C1	Normal output terminals
C2	AUX output terminals
C3	5725A output terminals

- Current greater than 2.2 A will always come out of the appropriate Boost terminals.
- If the field is left blank, the default will be the value of the CON field in the previous M5720 FSC and if there is none, the default 'C1' is assumed.

Miscellaneous

- No memory location is affected by the M5720 FSC.
- There are no automatic messages associated with the M5720 FSC.
- Certain combinations of entries in M5720 FSC and 5720 FSCs that follow, are inappropriate. The interrelationships of the 5720 and M5720 FSCs are NOT verified during backup or compilation of the procedure. Incorrect combinations may result in error messages during procedure execution.

Examples

```
  STEP    FSC     RANGE NOMINAL        TOLERANCE      MOD1         MOD2   3   4  CON
  2.001  M5720          180o                                                PL    C1
 6.002  M5720          -180o                                               PL    C2
Instrument
```

5790

Instrument FSC

Description

The 5790 FSC programs the Fluke 5790A AC Measurement Standard perform the following measurements:

- AC Voltage from Input 1 or Input 2
- AC/DC and AC/AC Voltage transfer measurement
- HF AC Voltage using the Wideband option
- AC/DC Current transfer measurement on Input 1 using one of the A40 current shunts and the 792A-7004 adapter or one of the A40A current shunts and the 792A-7004 adapter and A45-4004 adapter cable.
- AC/DC Current transfer measurements on the Shunt Input using one of the A40 current shunts, a Pomona Model 1829 banana plug splice, and a Pomona cable model 1368-A-18 or one of the A40A current shunts and a Pomona cable model 5268-C-12.

Functional Capability

Mode	Amplitude	Frequency	MOD2
DC Voltage	+|-(700 µV to 1000 V)		I1
DC Voltage	+|-(700 µV to 1000 V)		I2
AC Voltage	700 µV to 1000 V	10 Hz to 1 MHz	I1
AC Voltage	700 µV to 1000 V	10 Hz to 1 MHz	I2
AC Voltage w|5790A-03 Opt	700 µV to 1 V	10 Hz to 30 MHz	W
DC Current	-20 A to 20 A[1]		I1
AC Current	0 A to 20 A[1]	10 Hz to 100 kHz	I1
1. Actual range depends on the actual A40 or A40A current shunt used.			

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies frequency, the MOD1 field must specify voltage or current.
- When the NOMINAL field specifies current, only a Setup or Nominal Setup Test is allowed. You cannot perform an Evaluation Test in this mode, only AC/DC current transfer measurements.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies one of the following for AC signals.

- Frequency entered as [*numeric*][*prefix*]H.
- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- *blank* DC

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field may specify voltage or current only when the NOMINAL field specifies frequency.

MOD2

The MOD2 field specifies the input to be used.

I1	Input 1
I2	Input 2
SH	Shunt
W	Wideband

Rules:

- The MOD2 field value must be explicitly entered. No default value is automatically inserted in the MOD2 field and the field may not be blank.

MOD3

The MOD3 field controls the digital filter of the 5790A.

- -F OFF -> 1 sample/reading
- F FAST -> 4 samples/reading
- *blank* MEDIUM -> 16 samples/reading
- E SLOW -> 32 samples/reading

Rules:

- The 5790A has different modes of operation, which allow higher levels of accuracy at longer measurement times. Refer to the 5790A Operator Manual for detailed information on the different types of measurements and their properties.
- Readings on the 700 mV range and above have an extra digit of resolution in modes E and "blank." However, the digital filter restart does not use this extra digit when evaluating the sample window. For more information about the digital filter restart, refer to the help file for the ACMS FSC and the 5790A Operator Manual.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the type of test to be performed.

- 2W Standard measurement
- XF Transfer measurement

Rules:

- 2W is automatically entered in the CON field when no CON field code is entered.
- The AC/DC or AC/AC transfer measurement capability (AC Voltage connected to Input 1 and DC Reference Voltage connected to Input 2) is supported in a single 5790 FSC statement when the CON field specifies XF. However, it may be desirable to implement the transfer function using multiple FSC statements.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Transfer Measurements

In the following example. A Fluke 5440A is used to supply the DC reference voltage at Input 2 and the UUT on Input 1. The AC output of the UUT is measured and verified to be within 25 ppm.

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	ASK-	R	N						W
1.002	DISP		Connect the 5440B Output to the 5790A Input 2.						
1.002	DISP								
1.002	DISP		Connect the UUT Output to the 5790A Input 1.						
1.003	DISP		Setup the UUT to 1V @ 1kHz and Operate.						
1.005	5440		1.000000V					S	2W
1.006	5790		1.000000V			I2	E	N	2W
1.007	MATH		M[1] = MEM						
1.008	5440		-1.000000V					S	2W
1.009	5790		-1.000000V			I2	E	N	2W
1.010	MATH		M[3] = (M[1] - MEM) / 2						
1.011	5790		1.000000V		1kH	I1	E	N	2W
1.012	MATH		MEM1 = M[3]						
1.013	MEME								
1.014	5440		*					S	
1.015	DISP		Set the UUT to Standby.						
1.016	MEMC		V	0.000025U	1kH				

If so desired, lines 1.001 through 1.014 could be included in a subprocedure to function as a pseudo 5790A transfer function as shown below. The main procedure now becomes:

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
1.001	ASK-	R	N						W
1.003	DISP		Connect the 5440B Output to the 5790A Input 2.						
1.003	DISP								
1.003	DISP		Connect the 5700A Output to the 5790A Input 1.						
1.005	MATH		M[1] = 1						
1.006	MEM2		=1kHz						
1.007	CALL		Sub 5790A Voltage Transfer Measurement						
1.008	MEMC		V	0.000025U	1kH				

The subprocedure is coded as follows:

```
          .
INSTRUMENT:            Sub 5790A Voltage Transfer Measurement
          .
          .
# It is assumed that the amplitude is stored in M[1] and the frequency
# designation string is stored in MEM2 before this subprocedure is called.
# This subprocedure will overwrite any value stored in M[10] by the
# calling procedure.
# Note, the frequency value in MOD1 on line 1.011 is not a concern in this
# procedure since it is neither measured or evaluated.

  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4  CON
  1.001  ASK-   R     N                                                    W
  1.002  MATH         MEM = M[1]
  1.003  DISP         Set the UUT to [MEM]V @ [MEM2] and Operate.
  1.003  5440         V                                                 S  2W
  1.004  5790         V                                        I2 E  N  2W
  1.005  MATH         M[10] = MEM
  1.006  MATH         MEM = -1 * M[1]
  1.007  5440         V                                                 S  2W
  1.008  5790         V                                        I2 E  N  2W
  1.009  MATH         M[10] = (M[10] - MEM) / 2
  1.010  MATH         MEM = M[1]
  1.011  5790         V                            1kH         I1 E  N  2W
  1.012  MATH         MEM1 = M[10]
  1.013  MEME
  1.014  5440         *                                                 S
  1.015  DISP         Set the UUT to Standby.
  1.016  END
```

The original main procedure above could be coded as follows using the built in 5790 AC/ DC transfer function:

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4  CON
  1.001  ASK-   R     N                                                    W
  1.002  DISP         Connect the 5440B Output to the 5790A Input 2.
  1.002  DISP
  1.002  DISP         Connect the UUT Output to the 5790A Input 1.
  1.003  DISP         Setup the UUT to 1V @ 1kHz and Operate.
  1.005  5440         1.000000V                                         S  2W
  1.006  5790         1.000000V                    1kH         I1 E  N  XF
  1.007  MATH         M[1] = MEM
  1.008  5440         -1.000000V                                        S  2W
  1.009  5790         1.000000V                    1kH         I1 E  N  XF
  1.010  MATH         MEM = (M[1] + MEM) / 2
  1.014  5440         *                                                 S
  1.015  DISP         Set the UUT to Standby.
  1.016  MEMC         1.000000V      0.000025U     1kH
```

Current Measurements

Current measurement is accomplished using an A40 or A40A and measuring the voltage drop across the shunt. AC currents are determined through comparison with a known DC or AC current.

If automatic connection messages are enabled, MET/CAL prompts you for the appropriate A40 current shunt. The shunt value is selected based on the nominal field value. You can override this feature by using the ACMS FSC to manually select a different shunt value (See ACMS FSC).

In the following example, the AC current function of a Fluke 5700A is tested using the DC current of the same 5700A. It is assumed that the DC current is in calibration and meets the manufacturer's specification.

Example

```
STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
1.001  ASK-   R     N                                                        W
1.002  ACMS         F
1.003  HEAD         AC CURRENT: {22mA Range}
1.004  DISP         Connect the 5700A Output terminals to the 5790A
1.004  DISP         Input 1 using a Pomona cable #1368-A-18, an A40-20mA
1.004  DISP         current shunt, and a 792A-7004 current shunt adapter.
1.005  MEMI         Enter the AC-DC difference of the shunt at 100Hz.
1.006  MATH         M[20] = MEM
1.007  5790         20.00000mA                                 I1  E   N   2W
1.008  IEEE         OUT 20mA;OPER
1.009  5790         20.00000mA                                 I1  E   N   2W
1.010  MATH         M[1] = MEM + M[20]
1.011  5700         OUT -20mA;OPER
1.012  5790         -20.00000mA                                I1  E   N   2W
1.013  MATH         M[3] = (M[1] - (MEM + M[20])) / 2
1.014  IEEE         OUT 20mA,100Hz;OPER
1.015  5790         20.00000mA                   100H          I1  E   N   2W
1.016  MATH         MEM1 = 200E-6 - (200E-6 * (1 - ((MEM + M[20])/ M[1])))
1.017  IEEE         STBY
1.018  MEMC         20.00000mA     140P% 0.0004U 100H
```

ACMS

Instrument Setup FSC

Refer to ACMS earlier in this chapter.

5800

Instrument FSC

Description

The 5800 FSC provides the means to control the following functions of the Fluke 5800A Oscilloscope Calibrator:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Positive and Negative Scope Square, Edge, Time Mark, Pulse and Video waveforms)
- Oscilloscope Input Impedance Measurement
- Oscilloscope 50 Ohm Impedance Overload Protection Measurement
- Trigger Signal

Note

The 5800 FSC may also be used to control a 5820A. This capability allows a 5800A based procedure to be executed without modification when a 5820A is configured.

If the 5800A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600, N,...], to set the baud rate, parity, etc. of the port used to control the 5800A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements. Therefore, the settings of the port used to controlling the 5800A must be set correctly before a procedure is executed. If the 5800A is connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. If the 5800A is connected to the 5800A or 5520A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Function	Amplitude	Frequency	Misc.
DC Voltage 50 Ω term. 1 MΩ term.	 -6.599 V to 6.599 V -130 V to 130 V		
AC Voltage Scope Square Wave (zero based positive and negative) 50 Ω term. 1 MΩ term.	 1.0 mVpp to 6.599 Vpp 1.0 mVpp to 130 Vpp	 10 Hz to 10 kHz 10 Hz to 10 kHz	
DC Current [2]	100 µA to 100 mA		
AC Current [2]	100 µA to 100 mA	10 Hz to 100 kHz	
Edge 50 Ω term. w/ Tunnel Diode Pulser Drive Signal	 5m Vpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/-10% 11 Vpp to 2.5 Vpp	 900 Hz to 11 MHz 900 Hz to 11 MHz	
Leveled Sine 50 Ω term.	 5 mVpp to 5.5 Vpp 5 mVpp to 3.5 Vpp	 50 kHz to 600 MHz 50 kHz to 2.4 GHz [1]	
Time Markers 50 Ω term Spike Square 20 % Duty Square Sine			 Period 18 ns to 5.5 s 7.5 ns to 5.5 s 75 ns to 34.99 ms 1.8 ns to 17.9 ns 450 ps to 17.9 ns [1]
Wavegen Sine, Square, and Triangle Waveforms (zero centered) 50 Ω term	 1.8 mVpp to 10.9 mVpp 11 mVpp to 44.9 mVpp 45 mVpp to 109 mVpp 110 mVpp to 449 mVpp 0.45 Vpp to 1.09 Vpp 1.1 Vpp to 2.2 Vpp	 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz	Max AC + DC Offset Vp + |Voff|<=12.5 mVp Vp + |Voff|<=50.5 mVp Vp + |Voff|<=125 mVp Vp + |Voff|<=225 mVp Vp + |Voff|<=1.25 Vp Vp + |Voff|<=3.1 Vp

Function	Amplitude	Frequency	Misc.
1 MΩ term	1.8 mVpp to 21.9 mVpp 22 mVpp to 89.9 mVpp 90 mVpp to 219 mVpp 220 mV pp to 899 mVpp 0.9 Vpp to 6.59 Vpp 6.6 Vpp to 55 Vpp	10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz 10 Hz to 100 kHz	Vp + |Voff|<=26 mVp Vp + |Voff|<=100 mVp Vp + |Voff|<=260 mVp Vp + |Voff|<=1000 mVp Vp + |Voff|<=6.6 Vp Vp + |Voff|<=50 Vp
Video NTSC PAL PAL-M SECAM	 -150 % to 150 % -1.5 Vp to 1.5 Vp -140 IRE to 140 IRE -150 % to 150 % -1.5 Vp to 1.5 Vp -150 % to 150 % -1.5 Vp to 1.5 Vp -140 IRE to 140 IRE -150 % to 150 % -1.5 Vp to 1.5 Vp		Line Marker 1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 622 1 to 622 1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 262 Odd or Even 1 to 622 1 to 622
Pulse: Old Pulse Board 50 Ω term New Pulse Board 50 Ω term	 10 mVpp, 25 mVpp, 100 mVpp, 250 mVpp, 1 Vpp, and 2.5 Vpp 15 mVpp, 60 mVpp, 150 mVpp, 600 mVpp, and 1.5 Vpp -10 ns to +30 ns skew variation[1]	Period 200 ns to 22 ms 200 ns to 22 ms	Pulse Width 2 ns to 500 ns 400 ps to 500 ns
UUT Input Impedance Measurement (MEAS Z): 50 Ω 1 MΩ Capacitance			 40 Ω to 60 Ω 500 kΩ to 1.5 MΩ 5 pF to 50 pF
UUT 50 Ω Input Impedance Overload Protection Measurement (OVERLD) DC AC	 5 V to 9 V 5 V to 9 V	 1 kHz	
1. 5800A/BW and 5800A-GHz only 2. 5800A/BW only			

Parameters

The following table describes the basic operating modes of the 5800A Oscilloscope Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 5800 FSC.

5800A Mode	5800 Nominal	5800 MOD1	5800 MOD3[1]	M5800 Range	M5800 Nominal	M5800 MOD1	M5800 MOD3
DC Voltage (volt mode)	voltage		**S6**		voltage]		
AC Voltage (volt mode)	voltage	freq|period	**S6**				
AC Voltage (pulse) [4]	p-width	voltage	**S6**	**PER**	period		
	p-width [3]	voltage	**S6**	**PER**	period	[skew	**SK]**
	p-width [3]	voltage	**S6**	**SKEW**	skew	period	**PR**
	period	voltage	**S6**	**PULSE**	p-width		
	period [3]	voltage	**S6**	**PULSE**	p-width	[skew	**SK]**
	period [3]	voltage	**S6**	**SKEW**	skew	p-width	**PL**
	skew [3]	voltage	**S6**	**PER**	period	p-width	**PL**
	skew [3]	voltage	**S6**	**PULSE**	p-width	period	**PR**
AC Voltage (wavegen)	voltage	freq|period	**S6**			[offset]	
AC Voltage (wavegen)	freq|period	voltage	**S6**			[offset]	
AC Voltage (time marks)	freq|period		**S6**				
DC Current [2]	current		**S6**				
AC Current [2]	current freq|per	freq|per current	**S6** **S6**				
Video	percent| voltage|IRE	line marker	**S6**	**[ODD|EVEN]**			
Impedance Meas	resistance| capacitance		**ZM**				
Overload Meas	voltage	[freq]	**OM**	**LIMIT**	time		

1. See MOD3 parameter for description of these specification codes and rules.
2. 5800A|BW only.
3. 5800A/B and 5800A-GHz only.
4. Period and pulse width (p-width) may be entered as a frequency in Hertz.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
AP	Amps peak	current
APP	Amps peak to peak	current
D	dBm	decibels
F	Farads	capacitance
H	Hertz	frequency
IRE	IRE	video amplitude
LM	Line Marker	video line marker position
T	Time	period, pulse, width, or skew
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Z	Ohms	resistance
pct	percent	video amplitude

5800 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules

5800A Mode	5800 Nominal	5800 MOD1	5800 MOD2[1]	5800 MOD3[2]
DC Voltage (VOLT)	**V**			**S6**
AC Voltage (VOLT)	**V/Vp/Vpp** **H/T**	**H/T** **V/Vpp**	**ZQ/ZN** **ZQ/ZN**	**S6** **S6**
AC Voltage (Edge)	**V/Vp/Vpp** **H/T**	**H/T** **V/VPP**	**ED** **ED**	**S6** **S6**
AC Voltage (LEVSINE)	**V/Vp/Vpp** **H/T**	**H/T** **V/Vpp**	**LS** **LS**	**S6** **S6**
AC Voltage (MARKER)	**H/T**		**M1/M2/M3/M4**	**S6**
AC Voltage (WAVEGEN)	**V/VP/VPP** **H/T**	**H/T** **V/VP/VPP**	**SI/SQ/TI** **SI/SQ/TI**	**S6**
AC Voltage (PULSE)	**H/T**	**Vpp**	**PU**	**S6**
DC Current[3] (CURR)	**A**			**S6**
Video (VIDEO)	**pct/Vp/IRE** **pct/Vp**	**LM** **LM**	**F1/F3** **F2/F4**	**S6** **S6**
Impedance Meas (MEAS Z)	**Z** **F**			**ZM** **ZM**
Overload Meas (OVERLD)	**V** **Vpp**	 **H**		**OM** **OM**

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.
3. 5800A/BW only.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*]*units symbol*

or "*" to specify a reset.

Rules:

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in “General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage entered as:

[*numeric*][*prefix*] *units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

1. The waveform type for the voltage or current specified in the NOMINAL or MOD1 field for AC Voltage.

- *blank* DC or not applicable
- SI Sine wave (Wavegen)
- SQ Square wave (Wavegen)
- TI Triangle wave (Wavegen)
- ZQ Positive square wave (AC Voltage)
- ZN Negative square wave (AC Voltage)
- ED Edge signal
- LS Leveled sine wave
- M1 Spike Marker signal
- M2 Square Marker signal
- M3 20 % Duty Cycle Square Marker signal
- M4 Sinusoid Marker signal
- PU Pulse wave
- F1 NTSC video signal
- F2 PAL video signal
- F3 PAL-M video signal
- F4 SECAM video signal

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- ZQ is inserted automatically in the MOD2 field for AC Current (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- The M5800 RANGE and NOMINAL field must specify the pulse wave period or frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M5800 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse wave period or frequency.

- The M5800 RANGE field must specify ODD or EVEN frame when the MOD2 field specifies F1 (NTSC video) or F3 (PAL-M video).

MOD3

This field specifies the calibrator output mode:

- S6 5800A-SC600 Scope Option
- ZM UUT Input Impedance Measurement
- OM UUT 50 Input Overload Protection Measurement
- *blank* NA

Rules:

- S6 is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, ZN, ED, LS, PU, M1, M2, M3, M4, F1, F2, F3, or F4, and no MOD3 code is entered.
- The M5800 FSC RANGE and NOMINAL fields must specify the time limit when the MOD3 field specifies OM.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify N (Nominal Setup Test) when the MOD3 field specifies OM (Overload Measurement).
- N is inserted automatically in the MOD4 field when the MOD3 field specifies OM and no MOD3 code is entered.

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- TD Tunnel Diode Pulser Drive signal enabled
- L 50 Ohm Termination
- *blank* 1 MOhm Termination

Rules:

- 2W is inserted automatically in the CON field when the MOD3 field does not specify S6 and no CON field code is entered.
- The CON field may specify TD only when the MOD2 field specifies ED.
- The CON field may specify L only when the MOD3 field specifies S6.
- The CON field must specify L when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, and the MOD3 field specifies S6.
- L is inserted automatically in the CON field when the MOD2 field specifies LS, ED, or M1, M2, M3, M4, F1, F2, F3, or F4, and no CON field code is entered.
- The CON field must specify 2W when the MOD3 field specifies ZM or OM.
- The CON field must be blank when the NOMINAL or MOD1 field specifies current.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M5800        *
  1.002  5800         *                                                 S
# ----- DC Voltage -----
  1.003  5800   20    19.99mV        4%                              S6
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  5800   400   350.0mV        50U           60H            ZQ S6
# ----- AC Voltage (Negative Scope Square Wave) -----
  3.001  5800         100Vpp                       1kH            ZN S6 S
# ----- AC Voltage (Frequency Test) -----
  3.002  5800   1000  800.0H         0.1% 0.1U     300mV          ZQ S6
# ----- Edge Signal (Scope Output) -----
  4.001  5800         0.5Vpp                       1MH            ED S6 S  L
# ----- Leveled Sine Wave -----
  4.002  5800         200mVpp                      50kH           LS S6 S  L
# ----- Spike Marker Signal -----
  4.003  M5800                                                         2T
  4.004  5800         1uT                                         M1 S6 S  L
```

```
  4.005  M5800        *
# ----- Square Marker Signal -----
  4.006  5800         1mT                                         M2 S6 S  L
# ----- 20% Duty Cycle Square Marker Signal -----
  4.007  5800         5uT                                         M3 S6 S  L
# ----- Sinusoid Marker Signal -----
  4.008  5800         2nT                                         M4 S6 S  L
# ----- Wavegen -----
  4.009  5800         5V                          1kH             SI S6 S
# ----- Wavegen w/DC Offset -----
  4.010  M5800                                    0.5Voff
  4.011  5800         1Vpp                        1kH             TI S6 S
# ----- NTSC Video -----
  4.012  M5800  ODD
  4.013  5800         1Vp                         262LM           F1 S6 S  L
  4.014  M5800        *
# ----- PAL Video -----
  4.015  5800         50pct                       400LM           F2 S6 S  L
# ----- PAL-M Video -----
  4.016  M5800  EVEN
  4.017  5800         -140IRE                     1LM             F3 S6 S  L
  4.018  M5800        *
# ----- SECAM Video -----
  4.019  5800         -100pct                     622LM           F4 S6 S  L
# ----- Pulse Wave (Slew Pulse Width) -----
  4.020  M5800  PER   200nT
  4.021  5800         5.0nT                       1Vpp            PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M5800  PULSE 10nT
  4.023  5800         1.00kH                      1Vpp            PU S6 N  L
  4.024  M5800        *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5800         50Z            1U                              ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  5800         1.000MZ        1U                              ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5800         10pF                                           ZM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.002  M5800  LIMIT 10T
  6.003  5800         5V                                             OM N  2W
  6.004  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M5800  LIMIT 10T
  7.002  5800         7V                                             OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

```
  4.019  5800         -100pct                       622LM          F4 S6 S  L
# ----- Pulse Wave (Slew Pulse Width) -----
  4.020  M5800  PER   200nT
  4.021  5800         5.0nT                         1Vpp           PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M5800  PULSE 10nT
  4.023  5800         1.00kH                        1Vpp           PU S6 N  L
  4.024  M5800        *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5800         50Z           1U                                ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  5800         1.000MZ       1U                                ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5800         10pF                                            ZM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.002  M5800  LIMIT 10T
  6.003  5800         5V                                              OM N  2W
  6.004  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M5800  LIMIT 10T
  7.002  5800         7V                                              OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

M5800

Auxiliary Instrument Setup FSC

Description

The M5800 FSC provides the additional program functions for the Fluke 5800A Oscilloscope Calibrator, which are not addressed by the 5800 FSC.

- Time limit for UUT 50 Ω input overload protection measurement.
- Odd frame for NTSC or PAL-M video signals.
- Channel selection for 5800A-5 Five Channel Output Option
- Trigger output and rate

Parameters

5800/M5800 Rules for 5800A Pulse Mode:

5800 Nominal	M5800 Range	M5800 Nominal	M5800 MOD1	M5800 MOD3
pulse period	PULSE	pulse width		
pulse width	PER	pulse period		

5800/M5800 Rules for 5800A/BW Pulse Mode:

5800 Nominal	M5800 Range	M5800 Nominal	M5800 MOD1	M5800 MOD3
pulse period	PULSE	pulse width	[trigger skew	SK]
pulse period	SKEW	trigger skew	pulse width	PL
pulse width	PER	pulse period	[trigger skew	SK]
pulse width	SKEW	trigger skew	pulse period	PR
trigger skew	PER	pulse period	pulse width	PL
trigger skew	PULSE	pulse width	pulse period	PR

Range

This field specifies one of the following:

- PULSE Pulse Width
- PER Pulse Period

- SKEW Trigger Skew
- LIMIT Time Limit (Overload Measurement)
- ODD Odd Frame (NTSC or PAL-M video)
- EVEN Even Frame (NTSC or PAL-M video)
- *blank* field not applicable

Rules:

- The RANGE field may specify ODD or EVEN only when the 5800 FSC MOD2 field specifies F1 or F3.
- The RANGE field must specify ODD or EVEN when the 5800 FSC MOD2 field specifies F1 or F3.
- See table in "PARAMETERS" section for pulse mode rules.

NOMINAL

This field specifies one of the following:

- Pulse Width entered as: [*numeric*][*prefix*]T or H
- Pulse Period entered as: [*numeric*][*prefix*]T
- Pulse Repetition Frequency entered as: [*numeric*][*prefix*]H
- Trigger Skew entered as: [*numeric*][*prefix*]T or H
- Time Limit entered as: [*numeric*][*prefix*]T
- "*" reset to default values
- *blank* field not applicable

Rules:

- The NOMINAL field must specify the time limit when the RANGE field is LIMIT.
- The NOMINAL field must be blank when the RANGE field is ODD or EVEN.
- When the NOMINAL field contains only units, the value is taken from MEM.
- When the NOMINAL field specifies reset *, all other fields must be blank.
- See table in "PARAMETERS" section for pulse mode rules.

TOLERANCE

This field is not used.

MOD1

This field specifies one of the following:

- DC Offset entered as: [*numeric*][*prefix*]Voff
- Pulse Width entered as: [*numeric*][*prefix*]T or H
- Pulse Period entered as: [*numeric*][*prefix*]T
- Pulse Repetition Frequency entered as: [*numeric*][*prefix*]H
- Trigger Skew entered as: [*numeric*][*prefix*]T or H
- *blank* field not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- The MOD1 field may specify DC offset only when AC Voltage mode is specified and the 5800 FSC MOD2 field specifies SI, SQ or TI.
- The MOD1 field must specify the pulse width when the MOD3 field specifies PL.
- The MOD1 field must be blank when the RANGE field specifies ODD, EVEN, or LIMIT.
- See table in "PARAMETERS" section for pulse mode rules.

MOD2

This field selects the signal output channel when the 5800A-5 Five channel output option is installed.

- C1 Channel 1
- C2 Channel 2
- C3 Channel 3
- C4 Channel 4
- C5 Channel 5
- *blank*

MOD3

This field specifies one of the following:

- PL Pulse Width
- PR Pulse Period
- SK Trigger Skew
- *blank*

Rules:

See table in "PARAMETERS" section.

MOD4

This field is not used.

CON

This field controls the trigger output.

- *blank* Trigger Output off
- 1T Trigger Output on, Normal mode
- 2T Trigger Output on, 1/10 of output rate
- 3T Trigger Output on, 1/100 of output rate

The following codes require the 5800A-5 Five Channel Output Option:

- 1T1 Trigger Output on Channel 1, Normal mode
- 2T1 Trigger Output on Channel 1, 1/10 of output rate
- 3T1 Trigger Output on Channel 1, 1/100 of output rate
- 1T5 Trigger Output on Channel 5, Normal mode
- 2T5 Trigger Output on Channel 5, 1/10 of output rate
- 3T5 Trigger Output on Channel 5, 1/100 of output rate

Rules:

M5800 FSC MOD2 and CON Field Rules

MOD2	CON
blank	*blank* | 1T | 2T | 3T
C1	*blank* | 1T5 | 2T5 | 3T5
C2 | C3 | C4	*blank* | 1T1 | 2T1 | 3T1 | 1T5 | 2T5 | 3T5
C5	*blank* | 1T1 | 2T1 | 3T1

- If MOD1 is not blank (i.e. skew is specified), the CON field must not be blank.
- A CON field specification of 1T, 2T, 3T, 1T1, 2T1, 3T1, 1T5, 2T5, and 3T5 is only applicable (is ignored otherwise) when the 5800
- MOD2 field specifies ZQ, ZN, ED, MK, M1, M2, M3, and M4.

EXAMPLES

`See 5800 FSC.`

5820

Instrument FSC

Description

The 5820 FSC provides the means to control the following functions of the Fluke 5820A Oscilloscope Calibrator:

- DC Voltage
- AC Voltage (Sine, Square, Triangle, Leveled Sine, Positive and Negative Scope Square, Edge, Time Mark, Pulse and Video waveforms)
- Oscilloscope Input Impedance Measurement
- Oscilloscope 50 Ohm Impedance Overload Protection Measurement
- DC Voltage Measurement
- Trigger Signal

Note

If the 5820A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 5820A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements. Therefore, the settings of the port used to controlling the 5820A must be set correctly before a procedure is executed. If the 5820A is connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. If the 5820A is connected to the 5500A or 5520A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Function	Amplitude	Frequency	Misc.
DC Voltage 50 Ω term. 1 MΩ term.	 -6.599 V to 6.599 V -130 V to 130 V		
AC Voltage Scope Square Wave (zero based positive and negative) 50 Ω term. 1 MΩ term.	 1.0 mVpp to 6.599 Vpp 1.0 mVpp to 130 Vpp	 10 Hz to 10 kHz 10 Hz to 10 kHz	
DC Current	100 µA to 100 mA		
AC Current	100 µA to 100 mA	10 Hz to 100 kHz	
Edge 50 Ω term. w/ Tunnel Diode Pulser Drive Signal	 5 mVpp to 2.5 Vpp in a 1-(2.5)-5 sequence +/-10% 11 Vpp to 2.5 Vpp	 900 Hz to 11 MHz 900 Hz to 11 MHz	
Leveled Sine 50 Ω term.	 5 mVpp to 5.5 Vpp 5 mVpp to 3.5 Vpp	 50 kHz to 600 MHz 50 kHz to 2.4 GHz [1]	
Fast Edge 50 Ω term	 250 mVpp fixed	 900 Hz to 11 MHz	
Leveled Sine 50 Ω term	 5 mVpp to 5.5Vpp 5 mVpp to 3.5Vpp	 50 kHz to 600 MHz 50 kHz to 2.4 GHz [1]	
Time Markers 50 Ω term Spike Square 20 % Duty Square Sine			 Period 18 ns to 5.5 s 7.5 ns to 5.5 s 75 ns to 34.99 ms 1.8 ns to 17.9 ns 450 ps to 17.9 ns [1]

Function	Amplitude	Frequency	Misc.
Wavegen Sine, Square, and Triangle Waveforms (zero centered)			Max AC + DC Offset
50 Ω term	1.8 mVpp to 10.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=12.5 mVp
	11 mVpp to 44.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=50.5 mVp
	45 mVpp to 109 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=125 mVp
	110 mVpp to 449 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=225 mVp
	0.45 Vpp to 1.09 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=1.25 Vp
	1.1 Vpp to 2.2 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=3.1 Vp
1 MΩ term	1.8 mVpp to 21.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=26 mVp
	22 mVpp to 89.9 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=100 mVp
	90 mVpp to 219 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=260 mVp
	220 mVpp to 899 mVpp	10 Hz to 100 kHz	Vp + |Voff|<=1000 mVp
	0.9 Vpp to 6.59 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=6.6 Vp
	6.6 Vpp to 55 Vpp	10 Hz to 100 kHz	Vp + |Voff|<=50 Vp
Video			Line Marker
NTSC	-150 % to 150 %		1 to 262 Odd or Even
	-1.5 Vp to 1.5 Vp		1 to 262 Odd or Even
	-140IRE to 140IRE		1 to 262 Odd or Even
PAL	-150 % to 150 %		1 to 622
	-1.5 Vp to 1.5 Vp		1 to 622
PAL-M	-150 % to 150 %		1 to 262 Odd or Even
	-1.5 Vp to 1.5 Vp		1 to 262 Odd or Even
	-140 IRE to 140 IRE		1 to 262 Odd or Even
SECAM	-150 % to 150 %		1 to 622
	-1.5 Vp to 1.5 Vp		1 to 622
Pulse 50 Ω term	15 mVpp, 60 mVpp, 150 mVpp, 600 mVpp, and 1.5 Vpp	Period 200 ns to 22 ms	Pulse Width 400 ps to 500 ns -10 ns to +30 ns skew variation [1]
UUT Input Impedance Meas. (MEAS Z)			
50 Ω			40 Ω to 60 Ω
1 MΩ			500 kΩ to 1.5 MΩ
Capacitance			5 pF to 50 pF

Function	Amplitude	Frequency	Misc.
UUT Voltage Measurement (MEAS V) 1 MΩ	 -10 V to +10 V DC		
UUT 50 Ω Input Impedance Overload Protection Measurement (OVERLD) DC AC	 5 V to 9 V 5 V to 9 V	 1 kHz	
1. With 5800A-GHz option.			

Parameters

The following table describes the basic operating modes of the 5820A Oscilloscope Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 5820 FSC.

5820A Mode	5820 Nominal	5820 MOD1	5820 MOD3[1]	M5820 Range	M5820 Nominal	M5820 MOD1	M5820 MOD3
DC Voltage (volt mode)	voltage		**S6**				
AC Voltage (volt mode)	voltage	freq|period	**S6**				
AC Voltage (pulse)	p-width	voltage	**S6**	**PER**	period		
	p-width [2]	voltage	**S6**	**PER**	period	[skew	**SK]**
	p-width [2]	voltage	**S6**	**SKEW**	skew	period	**PR**
	period	voltage	**S6**	**PULSE**	p-width		
	period [2]	voltage	**S6**	**PULSE**	p-width	[skew	**SK]**
	period [2]	voltage	**S6**	**SKEW**	skew	p-width	**PL**
	skew [2]	voltage	**S6**	**PER**	period	p-width	**PL**
	skew [2]	voltage	**S6**	**PULSE**	p-width	period	**PR**
AC Voltage (wavegen)	voltage	freq|period	**S6**			[offset]	
	freq|period	voltage	**S6**			[offset]	
AC Voltage (time marks)	freq|period		**S6**				
DC Current	current		**S6**				
AC Current	current	freq|per	**S6**				
	freq|per	current	**S6**				
Video	percent|voltage|IRE	line marker	**S6**	**[ODD|EVEN]**			
Impedance Meas	resistance|capacitance		**ZM**				
Voltage Meas	voltage		**VM**				
Overload Meas	voltage	[freq]	**OM**	**LIMIT**	time		

1. See MOD3 parameter for description of these specification codes and rules.
2. Period and pulse width (p-width) may be entered as a frequency in Hertz.

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
AP	Amps peak	current
APP	Amps peak to peak	current
D	dBm	decibels
F	Farads	capacitance
H	Hertz	frequency
IRE	IRE	video amplitude
LM	Line Marker	video line marker position
T	Time	period, pulse, width, or skew
V	Volts	voltage or video amplitude
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Z	Ohms	resistance
Pct	percent	video amplitude

5820 FSC NOMINAL, MOD1, MOD2, and MOD3 Rules

5820A Mode	5820 Nominal	5820 MOD1	5820 MOD2[1]	5820 MOD3[2]
DC Voltage (VOLT)	**V**			**S6**
AC Voltage (VOLT)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**ZQ|ZN** **ZQ|ZN**	**S6** **S6**
AC Voltage (EDGE)	**V|Vp|Vpp** **H|T**	**H|T** **V|VPP**	**ED** **ED**	**S6** **S6**
AC Voltage (FAST EDGE)	**V|Vp|Vpp** **H|T**	**H|T** **V|VPP**	**FE** **FE**	**S6** **S6**
AC Voltage (LEVSINE)	**V|Vp|Vpp** **H|T**	**H|T** **V|Vpp**	**LS** **LS**	**S6** **S6**
AC Voltage (MARKER)	**H|T**		**M1|M2|M3|M4**	**S6**
AC Voltage (WAVEGEN)	**V|VP|VPP** **H|T**	**H|T** **V|VP|VPP**	**SI|SQ|TI** **SI|SQ|TI**	**S6**
AC Voltage (PULSE)	**H|T**	**Vpp**	**PU**	**S6**
DC Current (CURR)	**A**			**S6**
Video (VIDEO)	**pct|Vp|IRE** **pct|Vp**	**LM** **LM**	**F1|F3** **F2|F4**	**S6** **S6**
Impedance Meas (MEAS Z)	**Z** **F**			**ZM** **ZM**
Voltage Meas (MEAS V)	**V**			**VM**
Overload Meas (OVERLD)	**V** **Vpp**	 **H**		**OM** **OM**

1. See MOD2 parameter for description of these specification codes and rules.
2. See MOD3 parameter for description of these specification codes and rules.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*]*units symbol*

or "*" to specify a reset.

Rules:

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency, period, or voltage entered as:

[*numeric*][*prefix*]*units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

1. The waveform type for the voltage or specified in the NOMINAL or MOD1 field for AC Voltage.

- *blank* DC or not applicable
- SI Sine wave (Wavegen)
- SQ Square wave (Wavegen)
- TI Triangle wave (Wavegen)
- ZQ Positive square wave (AC Voltage)
- ZN Negative square wave (AC Voltage)
- ED Edge signal
- LS Leveled sine wave
- M1 Spike Marker signal
- M2 Square Marker signal
- M3 20 % Duty Cycle Square Marker signal

- M4 Sinusoid Marker signal
- PU Pulse wave
- F1 NTSC video signal
- F2 PAL video signal
- F3 PAL-M video signal
- F4 SECAM video signal

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- ZQ is inserted automatically in the MOD2 field for AC Current (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- The M5820 RANGE and NOMINAL field must specify the pulse wave period or frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M5820 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse wave period or frequency.
- The M5820 RANGE field must specify ODD or EVEN frame when the MOD2 field specifies F1 (NTSC video) or F3 (PAL-M video).

MOD3

This field specifies the calibrator output mode:

- S6 Default
- OM UUT 50 Input Overload Protection Measurement
- ZM UUT Input Impedance Measurement
- VM UUT Voltage Measurement
- *blank* NA

Rules:

- S6 is inserted automatically in the MOD3 field when the MOD2 field specifies ZQ, ZN, ED, FE, LS, PU, M1, M2, M3, M4, F1, F2, F3, or F4, and no MOD3 code is entered.
- The M5820 FSC RANGE and NOMINAL fields must specify the time limit when the MOD3 field specifies OM.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify N (Nominal Setup Test) when the MOD3 field specifies OM (Overload Measurement).
- N is inserted automatically in the MOD4 field when the MOD3 field specifies OM and no MOD3 code is entered.

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- TD Tunnel Diode Pulser Drive signal enabled
- L 50 Ω Termination
- *blank* 1 MΩ Termination

Rules:

- 2W is inserted automatically in the CON field when the MOD3 field does not specify SC or S6 and no CON field code is entered.
- The CON field may specify TD only when the MOD2 field specifies ED.
- The CON field may specify L only when the MOD3 field specifies S6.
- The CON field must specify L when the MOD2 field specifies LS, M1, M2, M3, M4, F1, F2, F3, or F4.
- The CON field must specify L or TD when the MOD2 field specifies ED.
- L is inserted automatically in the CON field when the MOD2 field
- Specifies LS, ED, FE, M1, M2, M3, M4, F1, F2, F3, or F4, and no CON field code is entered.
- The CON field must specify 2W when the MOD3 field specifies ZM or OM.
- The CON field must be blank when the NOMINAL or MOD1 field specifies current.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M5820        *
  1.002  5820         *                                                 S
# ----- DC Voltage -----
  1.003  5820   20    19.99mV        4%                                S6
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  5820   400   350.0mV        50U           60H            ZQ S6
# ----- AC Voltage (Negative Scope Square Wave) -----
  3.001  5820         100Vpp                       1kH            ZN S6 S
# ----- AC Voltage (Frequency Test) -----
  3.002  5820   1000  800.0H         0.1% 0.1U     300mV          ZQ S6
# ----- Edge Signal (Scope Output) -----
  4.001  5820         0.5Vpp                       1MH            ED S6 S  L
# ----- Leveled Sine Wave -----
  4.002  5820         200mVpp                      50kH           LS S6 S  L
# ----- Spike Marker Signal -----
  4.003  M5820                                                             2T
  4.004  5820         1uT                                         M1 S6 S  L
  4.005  M5820        *
# ----- Square Marker Signal -----
  4.006  5820         1mT                                         M2 S6 S  L
# ----- 20% Duty Cycle Square Marker Signal -----
  4.007  5820         5uT                                         M3 S6 S  L
# ----- Sinusoid Marker Signal -----
  4.008  5820         2nT                                         M4 S6 S  L
# ----- Wavegen -----
  4.009  5820         5V                           1kH            SI S6 S
# ----- Wavegen w/DC Offset -----
  4.010  M5820                                     0.5Voff
  4.011  5820         1Vpp                         1kH            TI S6 S
# ----- NTSC Video -----
  4.012  M5820  ODD
  4.013  5820         1Vp                          262LM          F1 S6 S  L
  4.014  M5820        *
# ----- PAL Video -----
```

```
  4.015  5820         50pct                        400LM          F2 S6 S  L
# ----- PAL-M Video -----
  4.016  M5820  EVEN
  4.017  5820         -140IRE                      1LM            F3 S6 S  L
  4.018  M5820        *
# ----- SECAM Video -----
  4.019  5820         -100pct                      622LM          F4 S6 S  L
# ----- Pulse Wave (Slew Pulse Width) -----
  4.020  M5820  PER   200nT
  4.021  5820         5.0nT                        1Vpp           PU S6 N  L
# ----- Pulse Wave (Slew Pulse Repetition Frequency) -----
  4.022  M5820  PULSE 10nT
  4.023  5820         1.00kH                       1Vpp           PU S6 N  L
  4.024  M5820        *
# ----- Impedance Measurement (50 Ohm) -----
  4.025  5820         50Z           1U                               ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  5820         1.000MZ       1U                               ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  5820         10pF                                           ZM N  2W
# ----- Voltage Measurement -----
  6.002  5820         2.5V          0.1U                             VM N  2W
# ----- 50 Ohm Input Impedance Overload -----
  6.003  M5820  LIMIT 10T
  6.004  5820         5V                                             OM N  2W
  6.005  EVAL   -e MEM == 0 : 50 Ohm overload protection trip not expected
  7.001  M5820  LIMIT 10T
  7.002  5820         7V                                             OM N  2W
  7.003  EVAL   -e MEM : 50 Ohm overload protection trip expected
```

M5820

Auxiliary Instrument Setup FSC

Description

The M5820 FSC provides the additional program functions for the Fluke 5820A Oscilloscope Calibrator which are not addressed by the 5820 FSC.

- Time limit for UUT 50 Ω input overload protection measurement.
- Odd frame for NTSC or PAL-M video signals.
- Channel selection for 5800A-5 Five Channel Output Option
- Trigger output and rate

Parameters

5820/M5820 Rules for 5820A Pulse Mode

5820 Nominal	**M5820 Range**	**M5820 Nominal**	**M5820 MOD1**	**M5820 MOD3**
pulse period	PULSE	*pulse width*	[*trigger skew*	SK]
pulse period	SKEW	*trigger skew*	*pulse width*	PL
pulse width	PER	*pulse period*	[*trigger skew*	SK]
pulse width	SKEW	*trigger skew*	*pulse period*	PR
trigger skew	PER	*pulse period*	*pulse width*	PL
trigger skew	PULSE	*pulse width*	*pulse period*	PR

RANGE

This field specifies one of the following:

- PULSE Pulse Width
- PER Pulse Period
- SKEW Trigger Skew
- LIMIT Time Limit (Overload Measurement)
- ODD Odd Frame (NTSC or PAL-M video)
- EVEN Even Frame (NTSC or PAL-M video)
- *blank* field not applicable

Rules:

- The RANGE field may specify ODD or EVEN only when the 5820 FSC MOD2 field specifies F1 or F3.
- The RANGE field must specify ODD or EVEN when the 5820 FSC MOD2 field specifies F1 or F3.
- See table in "PARAMETERS" section for pulse mode rules.

NOMINAL

This field specifies one of the following:

- Pulse Width entered as: [*numeric*][*prefix*]T or H
- Pulse Period entered as: [*numeric*][*prefix*]T
- Pulse Repetition Frequency entered as: [*numeric*][*prefix*]H
- Trigger Skew entered as: [*numeric*][*prefix*]T or H
- Time Limit entered as: [*numeric*][*prefix*]T
- "*" reset to default values
- *blank* field not applicable

Rules:

- The NOMINAL field must specify the time limit when the RANGE field is LIMIT.
- The NOMINAL field must be blank when the RANGE field is ODD or EVEN.
- When the NOMINAL field contains only units, the value is taken from MEM.
- When the NOMINAL field specifies reset *, all other fields must be blank.
- See table in "PARAMETERS" section for pulse mode rules.

TOLERANCE

This field is not used.

MOD1

This field specifies one of the following:

- DC Offset entered as: [*numeric*] [*prefix*] Voff
- Pulse Width entered as: [*numeric*] [*prefix*] T or H
- Pulse Period entered as: [*numeric*] [*prefix*] T
- Pulse Repetition Frequency entered as: [*numeric*] [*prefix*] H
- Trigger Skew entered as: [*numeric*] [*prefix*] T or H
- *blank* field not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- The MOD1 field may specify DC offset only when AC Voltage mode is specified and the 5820 FSC MOD2 field specifies SI, SQ or TI.
- The MOD1 field must specify the pulse width when the MOD3 field specifies PL.
- The MOD1 field must be blank when the RANGE field specifies ODD, EVEN, or LIMIT.
- See table in "PARAMETERS" section for pulse mode rules.

MOD2

This field selects the signal output channel when the 5800A-5 Five channel output option is installed.

- C1 Channel 1
- C2 Channel 2
- C3 Channel 3
- C4 Channel 4
- C5 Channel 5
- *blank*

MOD3

This field specifies one of the following:

- PL Pulse Width
- PR Pulse Period
- SK Trigger Skew
- *blank*

Rules:

- See table in "PARAMETERS" section.

MOD4

This field is not used.

CON

This field controls the trigger output.

- *blank* Trigger Output off
- 1T Trigger Output on, Normal mode
- 2T Trigger Output on, 1/10 of output rate
- 3T Trigger Output on, 1/100 of output rate

The following codes require the 5800A-5 Five Channel Output Option:

- 1T1Trigger Output on Channel 1, Normal mode
- 2T1Trigger Output on Channel 1, 1/10 of output rate
- 3T1Trigger Output on Channel 1, 1/100 of output rate
- 1T5Trigger Output on Channel 5, Normal mode
- 2T5Trigger Output on Channel 5, 1/10 of output rate
- 3T5Trigger Output on Channel 5, 1/100 of output rate

Rules:

M5820 FSC MOD2 and CON Field Rules

MOD2	CON
Blank	*blank* | 1T | 2T | 3T
C1	*blank* | 1T5 | 2T5 | 3T5
C2 | C3 | C4	*blank* | 1T1 | 2T1 | 3T1 | 1T5 | 2T5 | 3T5
C5	*blank* | 1T1 | 2T1 | 3T1

- If MOD1 is not blank (i.e. skew is specified), the CON field must not be blank.
- A CON field specification of 1T, 2T, 3T, 1T1, 2T1, 3T1, 1T5, 2T5, and 3T5 is only applicable (is ignored otherwise) when the 5820 MOD2 field specifies ZQ, ZN, ED, MK, M1, M2, M3, and M4.

Examples

See 5820 FSC.

6000

Instrument FSC

Description

The 6000 FSC programs the Clarke-Hess 6000 Phase Meter.

Functional Capability

Phase

-180.00 ° to 180.00 °

0 ° to 360.00 °

Frequency

5 Hz to 500 kHz

Amplitude

10 mV to 350 V RMS

Parameters

Range

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

Nominal

This field specifies the expected measured value or a reset. A reset causes the 6000 to perform an A/D cal.

- Phase entered as [*numeric*][*prefix*]deg.
- Reset entered as *.

Rules:

- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

Tolerance

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency.

- Frequency entered as [*numeric*][*prefix*]H.

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field specifies the measurement range and input waveform:

- *blank* 0 to 360 °, sine
- SI -180 to 180 °, sine
- ZQ 0 to 360 °, square
- SQ -180 to 180 °, square

MOD3

This field is used to enable and disable the internal filter banks.

- -F disable filters
- *blank* enable filters

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2 wire

Rules:

- If no CON field code is entered, 2W is automatically inserted in the CON field.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP     FSC     RANGE NOMINAL          TOLERANCE      MOD1     MOD2   3   4  CON
```

6100

Instrument FSC

Description

The 6100 FSC controls the Fluke 6100A Electrical Power Standard Master unit and up to three Fluke 6101A Electrical Power Standard Auxiliary Units.

Editor Learn Mode

Because of the inherent complexity of the 6100A and, consequently, of the 6100 FSC, the MET/CAL Editor allows a 6100 statement to be automatically generated based on the current 6100A instrument settings.

This facility is called "learn mode".

To use learn mode:

1. Setup the 6100A to the desired state.

- Enable only the channels to be included in the 6100 statement.
- Do not put the 6100A in operate (see safety note below)

2. Type "6100" on a blank line in the edit window.
3. Press F7.

A new MET/CAL 6100 procedure statement will be automatically generated.

The generated statement will, when executed, cause the 6100A to be placed in the state it was in at the time F7 was entered. In addition, to the 6100A will be placed in operate.

In order to use learn mode the 6100A, and any attached 6101As, must be correctly configured using the MET/CAL Configuration Editor (F12).

Important Safety Note

Unlike the MET/CAL Run Time and MET/CAL Test Run procedure execution environments, the MET/CAL Editor does not display a dangerous voltage warning symbol in learn mode when the 6100A is in operate and a dangerous voltage is present.

It is not necessary to place the 6100A in "operate" to use learn mode. Therefore, do not place the 6100A in operate when using learn mode.

If the instrument is in operate when learn mode is used, the MET/CAL software should not be depended on to indicate that an unsafe voltage is present at the 6100A's output terminals.

Learn mode does not generate a complete evaluation step. A MEMCX statement must be added after the generated 6100 statement to complete the evaluation step. It is also necessary to add additional statements, between the 6100 statement and the MEMCX statement, to obtain the UUT reading. See examples at the end of this document.

Learn mode functions correctly even if the Run Time and/or Test Run applications are currently configured to execute in "demo mode".

Parameters

A 6100 statement consists of one or more parameters. A parameter consists of a name and a value. Each parameter must be separated by a semicolon and/or one or more spaces. A single 6100 statement can encompass more than one physical line as long as the line numbers are the same. However each parameter name and its value must occur on one line. A single line can accommodate 56 characters, not including the statement number and FSC.

Syntax

6100 *parameter* [*separator parameter*]

parameter = [*prefix*]*parameter name*[*sp*]=[*sp*]*parameter value*

separator = ;[*sp*] | *sp*

prefix = + | @

sp = one or more spaces

parameter name = see PARAMETERS NAMES section below

parameter value = see PARAMETERS NAMES section below

| Denotes "or" (i.e. A | B is A or B)

[ ] Denotes an optional syntax element, except in examples.

In examples [ ] enclose a special construction.

\+ Designates the parameter as the Evaluation Quantity

@ Designates the parameter as the Modifier Quantity

Rules:

- One and only one parameter must be designated as the Evaluation Quantity in a 6100 Setup (default) statement.
- When a 6100 statement is executed, the value of the Evaluation Quantity is copied to memory register MEM1 in base units.

  Example:

  6100 +L1IAC = 100 mA; L1IRange = 250 mA

  After the 6100 statement is executed the value of MEM1 is 100.
- At most one parameter may be designated as the Modifier Quantity in a 6100 Setup (default) statement.
- Parameter values may be taken from a MET/CAL memory register using a special construction.

Example: Setup 6100A 'V' channel to 100 V, 'I' channel to 5 A

```
6100    L1VRange = 168 V; L1IRange = 5 A
6100    L1VAC = 100 V; L1IAC = 5 A
6100    +L1Power = 500 V; Freq = 60 Hz
or
6100    L1VAC    = 100 V  L1IAC = 5 A
6100    +L1Power = 500 V  Freq  = 60 Hz
or
6100    Freq      = 60 Hz
6100    L1VRange  = 168 V
6100    L1VAC     = 100 V
6100    L1IRange  = 5 A
6100    L1IAC     = 5 A
6100    +L1Power  = 500 W
```

Parameter Names

Parameter names consist of single words or compound words. Each word in a parameter name can be entered in long form (as shown below), or in short form. The short form is the first 4 characters of the long form, unless the last character or the word is a vowel. In this case the short form is three characters. Compound parameter names can be entered in any combination of long and short forms.

The following abbreviations are used in the parameter names and definitions below.

Ph (phase)	L1 | L2 | L3 | N
Ch (channel)	V | I

System Global Parameters

Action

Frequency

OutputROscillator

OutputSense

Phase Specific / Channel Global Parameters

ph Power

ph PowerFactor

DC Mode Parameters

ph ch Range

ph ch DC

ph ch FluctuateDC

ph ICoil

ph IUUTCurrentClamp

ph IUUTInputCouping

AC Mode Parameters

ph ch Range

ph ch AC

ph ch Phase

ph ch Offset

ph IBandwidth

ph ICoil

ph IUUTCurrentClamp

ph IUUTInputCouping

Flicker

- *ph ch* FlickerDepth
- *ph ch* FlickerFrequency
- *ph ch* FlickerShape
- *ph ch* FlickerDuty
- *ph ch* FlickerPst

Dips and Swells

- *ph ch* DipChangeTo
- *ph ch* DipRampIn
- *ph ch* DipPeriod
- *ph ch* DipRampOut
- *ph ch* DipEndDelay
- *ph ch* DipTriggerInput
- *ph ch* DipTriggerHoldOff
- *ph ch* DipTriggerODelay

Harmonic Mode Parameters

VoltageHarmonicUnits

CurrentHarmonicUnits

ph ch Range

ph ch RMSAmplitude

ph ch AmplitudeHarmonic n, n = 1 to 100

ph ch PhaseHarmonic n, n = 1 to 100

ph ch Offset

ph IBandwidth

ph ICoil

ph IUUTCurrentClamp

ph IUUTInputCouping

Fluctuating harmonics

- *ph ch* FluctuateHarmonic *n* , n = 1 to 100
- *ph ch* FluctuationDepth
- *ph ch* FluctuationFrequency
- *ph ch* FluctuationShape
- *ph ch* FluctuationDuty

Interharmonics

- *ph ch* IHarmonicAmplitudeA
- *ph ch* IHarmonicFrequencyA
- *ph ch* IHarmonicAmplitudeB
- *ph ch* IHarmonicFrequencyB

Flicker

- *ph ch* FlickerDepth
- *ph ch* FlickerFrequency
- *ph ch* FlickerShape
- *ph ch* FlickerDuty
- *ph ch* FlickerPst

Dips and Swells

- *ph ch* DipChangeTo
- *ph ch* DipRampIn
- *ph ch* DipPeriod
- *ph ch* DipRampOut
- *ph ch* DipEndDelay
- *ph ch* DipTriggerInput
- *ph ch* DipTriggerHoldOff
- *ph ch* DipTriggerODelay

Parameter Definitions and Values

ph ch AC

This parameter specifies an AC signal. This is accomplished by setting the RMS value to the value specified and turning and harmonics 2 through 100 off.

Syntax

ph ch AC[*sp*]=[*sp*]*value*

ph	=	L1 | L2 | L3 | N
ch	=	V | I
value	=	*numeric value* [*sp*][*prefix*] *units*
units	=	V | A

Alternate Forms

None

Rules:

- When *ph* VAC is specified the voltage channels are set to "Absolute RMS"
- When *ph* IAC is specified the current channels are set to "Absolute RMS"
- See "AC Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VAC = 110 V

L3IAC = [M5] mA

ph ch AmplitudeHarmonic n

This parameter specifies the amplitude of a harmonic.

Syntax

ph ch AmplitudeHarmonic *n* [*sp*]=[*sp*] *dim quan* *dim quan = value [sp][prefix] units*

ph	=	L1 | L2 | L3 | N
ch	=	V | I
n	=	1 100
Value	=	*numeric value* [*sp*][*prefix*] *units*
Units	=	V | A | % | dB

Alternate Forms

ph ch AmplitudeHarm *n* | AmplHarmonic *n* | AmplHarm *n*

Rules:

- When units are dB or %, *prefix* is not allowed.
- *Ph* VAmplitudeHarmonic *n*, 2 - 100 and offset for all phases must have the same units.
- *Ph* IAmplitudeHarmonic *n*, 2 - 100 and offset for all phases must have the same units.

Voltage Channel			
VoltHarmUnit	***ph* VRMSAmpl**	***ph* VAmplHarm1**	***ph* VAmplHarm 2-100 & *ph* VOffset**
ABS	not allowed	volts (V)	volts (V)
PRMS	volts (V)	not allowed	percent (%)
PFund	not allowed	volts (V)	percent (%)
dBDown	not allowed	volts (V)	decibels (dB)

Current Channel (current)			
CurrHarmUnit	***ph* VRMSAmpl**	***ph* VAmplHarm1**	***ph* VAmplHarm 2-100 & *ph* VOffset**
ABS	not allowed	amps (A)	amps (A)
PRMS	amps (A)	not allowed	percent (%)
PFund	not allowed	amps (A)	percent (%)
dBDown	not allowed	amps (A)	decibels (dB)

Current Channel (voltage)			
CurrHarmUnit	***ph* VRMSAmpl**	***ph* VAmplHarm1**	***ph* VAmplHarm 2-100 & *ph* VOffset**
ABS	not allowed	volts (V)	volts (V)
PRMS	volts (V)	not allowed	percent (%)
PFund	not allowed	volts (V)	percent (%)
dBDown	not allowed	volts (V)	decibels (dB)

- See "Harmoincs Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

ph ICoil

This parameter specifies a current coil connected to the current output terminals.

Syntax

ph ICoil[*sp*]=[*sp*]*value*

ph = L1 | L2 | L3 | N

value = 5500A/Coil | 5500ACoil | 9100/Coil_X10 | 9100Coil_X10 | 9100/Coil_X50 | 9100Coil_X50

Alternate Forms

None

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1ICoil = 5500A/Coil

ph ch DC

This parameter sets the specified phase and channel to output a DC signal. This accomplished as follows:

1. Clear all harmonics on the specified phase and channel.
2. Set harmonic 1 (fundamental) amplitude to zero.
3. Set harmonic 0 (DC Offset) to the specified value.

Syntax

ph ch DC[*sp*]=[*sp*] *dim quan*

dim quan = value [sp][prefix] units

ph	=	L1 | L2 | L3 | N
ch	=	V | I
value	=	*reguster reference* [*sp*][*prefix*] *units*
units	=	V | A

Alternate Forms

None

Rules:

- When *ph* VDC is specified the voltage channels are set to "Absolute RMS"
- When *ph* IDC is specified the current channels are set to "Absolute RMS"
- See "DC Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VDC = 10 V

NIDC = [MEM] mA

ph ch DipChangeTo

This parameter sets the Dips and Swells "Change To" value.

Syntax

ph ch DipChangeTo[*sp*]=[*sp*] percent quan

percent quan = *value [sp]* [prefix] %

ph = L1 | L2 | L3 | N

ch = V | I

value = *numeric value* [*sp*]%

Alternate Forms

ph ch DipChanTo

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VDipChangeTo = 10 %

ph ch DipEndDelay
ph ch DipPeriod
ph ch DipRampIn
ph ch DipRampOut

These parameters set the Dips and Swells End Delay, Period, Ramp In, and Ramp Out values.

Syntax

ph ch DipEndDelay[*sp*]=[*sp*] *dim quan*

ph ch DipPeriod[*sp*]=[*sp*] *dim quan*

ph ch DipRampIn[*sp*]=[*sp*] *dim quan*

ph ch DipRampOut[*sp*]=[*sp*] *dim quan*

dim quan = value [sp] [prefix] units

ph = L1 | L2 | L3 | N

ch	=	V | I
value	=	*numeric value* | *register reference*
units	=	s | c (cycles)

Alternate Forms

ph ch DipEndDel

ph ch DipPer

Rules:

- When *units* = c, *prefix* is not allowed.
- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VDipEndDelay = 10 ms

L1VDipEndDelay = 3 c

L1VDipPeriod = 10 ms

L1VDipPeriod = 3 c

L1VDipRampIn = 10 ms

L1VDipRampIn = 3 c

L1VDipRampOut = 10 ms

L1VDipRampOut = 3 c

ph ch DipTriggerHoldOff

This parameter sets the Dips and Swells "Start (Trig Input)" value.

Syntax

ph ch DipTriggerHoldOff[*sp*]=[*sp*] *dim quan*

dim quan = value [sp] [prefix] units

ph	=	L1 | L2 | L3 | N

ch = V | I

value = *numeric value* | *register reference*

units = deg | s | c (cycles)

Alternate Forms

ph ch DipTrigHoldOff

Rules:

- When *units* = c, *prefix* is not allowed.
- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VDipTriggerHoldOff = 10 ms

L1VDipTriggerHoldOff = 3 c

L1VDipTriggerHoldOff = 10 deg

ph ch DipTriggerInput

This parameter sets the trigger used to determine the event that starts the dip or swell.

Syntax

ph ch DipTriggerInput[*sp*]=[*sp*] *value*

ph = L1 | L2 | L3 | N

ch = V | I

value = Free | EOne | ERepeat

Free	Free running dips/swells
EOne	One dip/swell trigger from an external source
ERepeat	Continuous dips/swells trigger from an external source.

Alternate Forms

ph ch DipTriggerInp | *ph ch* DipTrigInput | *ph ch* DipTrigInp

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VDipTriggerInput = ERep

ph ch DipTriggerODelay

This parameter sets the delay before the output trigger is generated, following the completion of a dip or swell.

Syntax

ph ch DipTriggerODelay[*sp*]=[*sp*] *value*

dim quan = value [sp] [prefix] units

ph	=	L1 | L2 | L3 | N
ch	=	V | I
value	=	*numeric value* | *register reference*
units	=	s | c (cycles)

Alternate Forms

ph ch DipTriggerODel | *ph ch* DipTrigODelay |

ph ch DipTrigODel

Rules:

- When *units* = c, *prefix* is not allowed.
- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VDipTriggerODelay = 10 ms

L1VDipTriggerODelay = 3 c

ph ch FlickerDepth

This parameter sets the flicker modulation depth expressed as a percentage of the voltage waveform RMS amplitude.

Syntax

ph ch FlickerDepth[*sp*]=[*sp*] *percent quan*

percent quan = value [sp] prefix] %

ph	=	L1 | L2 | L3 | N
ch	=	V | I
value	=	*numeric value* | *register reference*

Alternate Forms

ph ch FlickerDept | *ph ch* FlicDepth | *ph ch* FlicDept

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VFlickerDepth = 10 %

ph ch FlickerDuty

This parameter sets the flicker duty cycle for rectangular modulation.

Syntax

ph ch FlickerDuty[*sp*]=[*sp*] *percent quan*

percent quan = value [sp] [prefix] units

ph = L1 | L2 | L3 | N

ch = V | I

value = *numeric value* | *register reference*

Alternate Forms

ph ch FlicDuty

Rules:

- "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VFlickerDuty = 10 %

ph ch FlickerFrequency

This parameter sets the flicker modulation frequency.

Syntax

ph ch FlickerFrequency[*sp*]=[*sp*] *dim quan*

dim quan = *value [sp] [prefix] Hz*

ph = L1 | L2 | L3 | N

ch = V | I

value = *numeric value* | *register reference*

Alternate Forms

ph ch FlickerFreq | *ph ch* FlicFrequency | *ph ch* FlicFreq

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VFlickerFrequency = 1 kHz

ph ch FlickerPst

This parameter is used to query the flicker perception level, short term, computed by the 6100A.

Syntax

ph ch FlickerPst[*sp*]=[*sp*] *value*

ph = L1 | L2 | L3 | N

ch = V | I

value = *numeric value* | *register reference*

Alternate Forms

ph ch FlicPst

Rules:

- Since Pst is a "query only" parameter, specifying this parameter is only useful when it is designated as the Evaluation Quantity Nominal value.
- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

+L1VFlickerPst = 1.00

ph ch FlickerShape

This parameter sets the flicker modulation shape.

Syntax

ph ch FlickerShape[*sp*]=[*sp*]*value*

ph = L1 | L2 | L3 | N

ch = V | I

value = Rect | Rectangle | Rectangular |
Sin | Sine | Sinusoid | Sinusodial |
Squ | Square

Rect Sets the modulation waveform to be rectangular.

Sin Sets the modulation waveform to be sinusoidal.

Squ Sets the modulation waveform to be square.

Alternate Forms

ph ch FlickerShap | *ph ch* FlicShape | *ph ch* FlicShap

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VFlickerShape = Square

ph ch FluctuateDC

This parameter turns on/off DC fluctuation.

Syntax

ph ch FluctuateDC[*sp*]=[*sp*]*value*

ph = L1 | L2 | L3 | N

ch = V | I

value = On | Off

Alternate Forms

ph ch FlucDC

Examples

L1VFluctuateDC = On

ph ch FluctuateHarmonic n

This parameter turns on/off the fluctuation of harmonic *n* oscillator signal.

Syntax

ph ch FluctuateHarmonic *n* [*sp*]=[*sp*]*value*

ph	=	L1 | L2 | L3 | N
ch	=	V | I
n	=	1 100
value	=	On | Off

Alternate Forms

ph ch FluctuateHarm *n* | *ph ch* FlucHarmonic *n* |

ph ch FlucHarm *n*

Examples

L1VFluctuateHarmonic9 = On

ph ch FluctuationDepth

This parameter sets the fluctuating harmonics modulation depth expressed as a percentage of the voltage waveform RMS amplitude.

Syntax

ph ch FluctuationDepth[*sp*]=[*sp*] *percent quan*

percent quan = *value* [*sp*][*prefix*] %

ph	=	L1 | L2 | L3 | N
ch	=	V | I

value = *numeric value* | *register reference*

Alternate Forms

ph ch FluctuationDept | *ph ch* FlucDepth | *ph ch* FlucDept

Rules:

- "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VFluctuationDepth = 10 %

ph ch FluctuationFrequency

This parameter sets the fluctuating harmonics modulation frequency.

Syntax

ph ch FluctuationFrequency[*sp*]=[*sp*]*value*

dim quan = *value [sp] [prefix] Hz*

ph = L1 | L2 | L3 | N

ch = V | I

value = *numeric value* | *register reference*

Alternate Forms

ph ch FluctuationFreq | *ph ch* FlucFrequency | *ph ch* FlucFreq

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VFluctuationFrequency = 1 kHz

ph ch FluctuationShape

This parameter sets the fluctuating harmonics modulation shape.

Syntax

ph ch FluctuationShape[*sp*]=[*sp*]*value*

ph	=	L1 | L2 | L3 | N
ch	=	V | I
value	=	Rect | Rectangle | Rectangular |
		Sin | Sine | Sinusoid | Sinusodial |
		Squ | Square

Rect	Sets the modulation waveform to be rectangular.
Sin	Sets the modulation waveform to be sinusoidal.
Squ	Sets the modulation waveform to be square.

Alternate Forms

ph ch FluctuationShap | *ph ch* FlucShape | *ph ch* FlucShap

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VFluctuationShape = Square

ph ch IharmonicAmplitudeA
ph ch IharmonicAmplitudeB

These parameters sets the interharmonic A and B amplitudes.

Syntax

ph ch IharmonicAmplitudeA[*sp*]=[*sp*]*dim quan*

ph ch IharmonicAmplitudeB[*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix] units

ph	=	L1 | L2 | L3 | N
ch	=	V | I
value	=	*numeric value* | *register reference*
units	=	V | A

Alternate Forms

ph ch IharmonicAmplA | *ph ch* IharAmplitudeA |

ph ch IharAmplA

ph ch IharmonicAmplB | *ph ch* IharAmplitudeB |

ph ch IharAmplB

Rules:

- When *ch* = V, *units* must be V.
- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VIHarmonicAmplitudeA = 1 V

L1IHarmonicAmplitudeB = 100 mA

ph ch IharmonicFrequencyA
ph ch IharmonicFrequencyB

These parameters sets the interharmonic A and B frequencies.

Syntax

ph ch IharmonicFrequencyA[*sp*]=[*sp*]*dim quan* *ph ch* IharmonicFrequencyB[*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix] Hz

ph	=	L1 | L2 | L3 | N
ch	=	V | I
value	=	*numeric value* | *register reference*

Alternate Forms

ph ch IharmonicFreqA | *ph ch* IharFrequencyA |

ph ch IharFreqA

ph ch IharmonicFreqB | *ph ch* IharFrequencyB |

ph ch IharFreqB

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1IIHarmonicFrequencyB = 375 Hz

ph ch Offset

This parameter sets the DC Offset.

Syntax

ph ch Offset[*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix]units

ph	=	L1 | L2 | L3 | N
ch	=	V | I

value = *numeric value* | *register reference*

units = V | A

Alternate Forms

ph ch Offs

Rules:

- When *ch* = V, *units* must be V.
- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VOffset = 10 mV

NIOffset = [M20] mV

ph ch PhaseHarmonic *n*

This parameter specifies the phase of a harmonic.

Syntax

ph ch PhaseHarmonic *n* [*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix] units

ph = L1 | L2 | L3 | N

ch = V | I

n = 1..100

value = *numeric value* | *register reference*

units = deg | rad

Alternate Forms

ph ch PhaseHarm *n* | *ph ch* PhasHarmonic *n* |

ph ch PhasHarm *n*

Rules:

- L1VPhaseHarmonic1 is not allowed. It is always 0 deg.
- n = 1

  same as *ph ch* Phase.
- n = 2 through 100

  ch = V: Phase of specified voltage harmonic relative to the voltage fundamental on the same phase.

  ch = I: Phase of specified current harmonic relative to the current fundamental on the same phase.
- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

ph ch Phase

This parameter specifies the phase of the fundamental.

Syntax

ph ch Phase[*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix] units

ph	=	L1 | L2 | L3 | N
ch	=	V | I
value	=	*numeric value*| *register reference*
units	=	deg | rad

Alternate Forms

ph ch Phas

Rules:

- L1VPhase is not allowed. It is always 0 deg.
- ch = V: Phase of voltage channel relative to L1 voltage fundamental.

- ch = I: Phase of current channel relative to voltage fundaments on the same phase.
- See "AC Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

ph ch Range

This parameter specifies the output range.

Syntax

ph ch Range[*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix] units

ph = L1 | L2 | L3 | N

ch = V | I

value = *numeric value_| register reference*

units = V | A

Values are:

16, 33, 78, 168, 336, & 1008 V voltage channel (*ch* = 'V')

0.25, 0.5, 1, 2, 5, 10, 20, 80 A, or

0.25, 1.5, 10 V current channel (*ch* = 'I')

Alternate Forms

ph ch Rang

Rules:

- If *ph ch* Range is not specified, the range for phase and channel is selected based on the following parameters, in the order shown:

  ph ch AC | *ph ch* DC

  ph ch RMS

  ph ch AmplitudeHarmonic1

Examples

NVRange = 168 V

L1IRange = 500 mA

L3IRange = 5 A

ph ch RMSAmplitude

This parameter specifies the RMS amplitude.

Syntax

ph ch RMSAmplitude[*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix] units

ph	=	L1 | L2 | L3 | N
ch	=	V | I
value	=	*numeric value*| *register reference*
units	=	V | A

Alternate Forms

RMSAmpl

Rules:

Voltage Channel			
VoltHarmUnit	***ph* VRMSAmpl**	***ph* VAmplHarm1**	***ph* VAmplHarm 2-100 & *ph* VOffset**
ABS	not allowed	volts (V)	volts (V)
PRMS	volts (V)	not allowed	percent (%)
PFund	not allowed	volts (V)	percent (%)
dBDown	not allowed	volts (V)	decibels (dB)

Current Channel (current)			
CurrHarmUnit	***ph* VRMSAmpl**	***ph* VAmplHarm1**	***ph* VAmplHarm 2-100 & *ph* VOffset**
ABS	not allowed	amps (A)	amps (A)
PRMS	amps (A)	not allowed	percent (%)
PFund	not allowed	amps (A)	percent (%)
dBDown	not allowed	amps (A)	decibels (dB)

Current Channel (voltage)			
CurrHarmUnit	***ph* VRMSAmpl**	***ph* VAmplHarm1**	***ph* VAmplHarm 2-100 & *ph* VOffset**
ABS	not allowed	volts (V)	volts (V)
PRMS	volts (V)	not allowed	percent (%)
PFund	not allowed	volts (V)	percent (%)
dBDown	not allowed	volts (V)	decibels (dB)

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1VRMSAmpl = 110 V

ph IBandwidth

This parameter specifies the current bandwidth.

Syntax

ph IBandwidth[*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix] units

ph = L1 | L2 | L3 | N

value = numeric value | *register reference*

Alternate Forms

Ph IBand

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

L1IBandwidth = 1.5 kHz

ph Power

This parameter is used to specify a phase's power.

Syntax

ph Power[*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix] units

ph = L1 | L2 | L3 | N

value = *numeric value*| *register reference*

units = W | VA

Alternate Forms

ph Pow

Rules:

- Since power is a "query only" parameter, specifying this parameter is only useful when it is designated as the Evaluation Quantity.
- If voltage and current are specified for the phase and channel this parameter will return the power as computed by the 6100A.

ph PowerFactor

This parameter is used to specify a phase's power factor.

Syntax

ph PowerFactor[*sp*]=[*sp*]*value*

ph	=	L1 | L2 | L3 | N
value	=	*numeric value* | *register reference*

Alternate Forms

ph PowerFact | *ph* PowFactor | *ph* PowFact

Rules:

- Since power factory is a "query only" parameter, specifying this parameter is only useful when it is designated as the Evaluation Quantity.
- If voltage and current are specified for the phase and channel this parameter will return the power factor as computed by the 6100A.

Action

This parameter specifies the operation to be performed.

Syntax

Action[*sp*]=[*sp*]*value*

Value	=	Setup | Reset

Alternate Forms

Act

Rules:

- If not specified, the default is setup.

CurrentHarmonicUnits VoltageHarmonicUnits

This parameter sets the units for all current harmonic amplitudes.

Syntax

VoltageHarmonicUnits[*sp*]=[*sp*]*value*

CurrentHarmonicUnits[*sp*]=[*sp*]*value*

Value = Abs | Absolute |
PRMS |
PFund | PFundamental |
dBDown | dBFund | dbFundamental

Alternate Forms

VoltageHarmonicUnit | VoltageHarmUnits | VoltageHarmUnit |

VoltHarmonicUnit | VoltHarmonicUnits | VoltHarmUnit

CurrentHarmonicUnit | CurrentHarmUnits | CurrentHarmUnit |

CurrHarmonicUnit | CurrHarmonicUnits | CurrHarmUnit

Rules:

- If not specified, the default is absolute.

Frequency

This parameter specifies the fundamental frequency.

Syntax

Frequency[*sp*]=[*sp*]*dim quan*

dim quan = value [sp] [prefix] Hz

Value = *numeric value*[*sp*][*prefix*]Hz

Alternate Forms

Freq

Rules:

- When the frequency is greater than 850 Hz, no channel may specify Harmonics mode.

OutputROscillator

This parameter specifies the state of the instrument's reference oscillator signal.

Syntax

OutputROscillator[*sp*]=[*sp*]*value*

Value = On | Off

Alternate Forms

OutputROsc | OutpROscillator | OutpROsc

Rules:

- If not specified, the default is off.

OutputSense

This parameter specifies the state of the instrument's sense capability for all voltage channels.

Syntax

OutputSense[*sp*]=[*sp*]*value*

Value	=	On (4-wire) | Off (2-wire)

Alternate Forms

OutputSens | OutpSense | OutpSens

Rules:

- If not specified, the default is on.

ph IUUTCurrentClamp

This parameter specifies the type of UUT current clamp.

Syntax

ph IUUTCurrentClamp[*sp*]=[*sp*]*value*

ph	=	L1 | L2 | L3 | N
value	=	Toroidal | Non-toroidal

Alternate Forms

ph IUUTCurrentClam | *ph* IUUTCurrClamp | *ph* IUUTCurrClam

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples

6100	L1ICoil	=	5500A/COIL
6100	L1IUUTCurrClamp	=	Toroidal
6100	L1IRange	=	10A
6100	+L1IAC	=	500.0A

ph ch InputCoupling

This parameter specifies the type of UUT input coupling.

Syntax

ph ch UUTInputCoupling[*sp*]=[*sp*]*value*

ph = L1 | L2 | L3 | N

value = DC | AC (default)

Alternate Forms

ph ch UUTInputCoup | *ph ch* UUTInpCoupling | *ph ch* UUTInpCoup

Rules:

- See "Harmonics Mode Parameters" above for a list of other parameters that are allowed for the phase and channel specified.

Examples:

L1VUUTInputCoupling = DC

```
  STEP     FSC    RANGE  NOMINAL         TOLERANCE       MOD1        MOD2   3   4    CON
#
# -----    DC Voltage (Voltage Channel) -----
#
  1.001    RSLT          =
  1.002    HEAD          DC VOLTAGE:{ 20 V Range}
  1.003    TARGET
  1.004    6100          +L1VDC = 5.0V
  1.005    MEMI          Enter UUT reading in volts DC:
  1.006    MEMCX  20     5.0V            2% 0.5U
#
# -----    DC Current (Current Channel) -----
#
  2.001    HEAD          DC CURRENT:{ 5 A Range}
  2.002    TARGET        -p
  2.003    IEEE2         CURR:MODE:ELEM1 DC
  2.004    IEEE2         CURR:RANGE:ELEM1 5
  2.005    6100          +L1IDC = 5.0000A
  2.006    WAIT          [D1000]
  2.007    TARGET        -m
  2.008    IEEE2         [D500]MEAS:VAL?[I$]
  2.009    MATH          MEM = FLD(MEM2, 2, ",")
  2.010    MEMCX  5      5.0000A         0.04% 0.08/
#
# -----    DC Voltage (Current Channel), UUT input is 1 mV/A  -----
#
  3.001    RSLT          =
  3.002    HEAD          DC CURRENT:{ 2000 A Range}
```

```
# Get 6100A current channel accuracy and convert to ppm.
  3.003    MATH         S[1] = "Fluke 6100A"
  3.004    MATH         L[1] = ACCV(S[1], "DC 10V AUX", 1) * 1e6
  3.005    TARGET
  3.006    6100         +L1IDC = 1000mV
  3.007    ACC          1000A           L1P%
  3.008    MEMI         Enter UUT reading in amps DC.
  3.009    MEMCX  2000  1000A           2% 4U
#
# -----    AC Voltage (Voltage Channel) -----
#
  4.001    RSLT         =
  4.002    HEAD         AC VOLTAGE:{ 200 V Range}
  4.003    TARGET
  4.004    6100         +L1VAC = 130.0V; Freq = 60Hz
  4.005    MEMI         Enter UUT reading in volts RMS:
  4.006    MEMCX  200   130.0V          0.5% 0.2U       60H
#
# -----    AC Current (Current Channel) -----
#
  5.001    HEAD         AC CURRENT:{ 10 A Range}
  5.002    TARGET       -p
  5.003    IEEE2        CURR:MODE:ELEM1 RMS
  5.004    IEEE2        CURR:RANGE:ELEM1 10
  5.005    6100         +L1IAC = 10.000A@Freq = 50Hz
  5.006    WAIT         [D1000]
  5.007    TARGET       -m
  5.008    IEEE2        [D500]MEAS:VAL?[I$]
  5.009    MATH         MEM = FLD(MEM2, 2, ",")
  5.010    MEMCX  10    10.000A         0.03% 0.05/     50H
#
# -----    AC Voltage (Current Channel), UUT input is 1 mV/A  -----
#
  6.001    RSLT         =
  6.002    HEAD         AC CURRENT:{ 1000 A Range}
# Get 6100A current channel accuracy and convert to ppm.
  6.003    MATH         L[1] = ACCV2(S[1], "Sine 1.5V AUX", 670e-3, 60)
  6.004    MATH         M[1] = (M[1] / 670e-3) * 1e6
  6.005    TARGET
  6.006    6100         +L1IAC = 670mV; Freq = 60Hz
  6.007    ACC          670A            M1P%
  6.008    MEMI         Enter UUT reading in amps RMS.
  6.009    MEMCX  1000  670A            0.5% 3U         60H
#
# -----    DC Power (Current Channel Current)
#
  7.001    RSLT         =
  7.002    HEAD         DC POWER:{ 60 V, 1 A}
  7.003    TARGET       -p
  7.004    IEEE2        VOLT:RANGE:ELEM[M14] 60
  7.005    IEEE2        VOLT:MODE:ELEM[M14] DC
  7.006    IEEE2        CURR:RANGE:ELEM[M14] 1
```

```
  7.007    IEEE2        CURR:MODE:ELEM[M14] DC
  7.008    6100         L1VDC           = 60V  L1IDC = 1A
  7.008    6100         +L1Power = 60.00W
  7.009    TARGET       -m
  7.010    IEEE2        [D500]MEAS:VAL?[I$]
  7.011    MATH         MEM = FLD(MEM2, 3, ",")
  7.012    MEMCX  60    W               0.08% 0.12/
#
# -----    AC Power (Current Channel Current)
#
  8.001    MEM2         =
  8.002    HEAD         AC POWER:{ PF -0.5}
  8.003    TARGET
  8.004    6100         L1VAC           = 100V          L1IAC = 5A
  8.004    6100         +L1Power = 250.00W  Freq  = [M15]Hz  L1IPhase = 120deg
  8.005    MEMI         Enter UUT reading in watts.
  8.006    MEMCX  250   W               0.04% 0.04/
#
  9.001    MEM2         =100 V, 2 A @ 400 Hz, Phase 45 deg
  9.002    HEAD         AC POWER:{ 100 V, 2 A @ 400 Hz, Phase 45 deg}
  9.003    TARGET       -p
  9.004    6100         CurrHarmUnits = PRMS
  9.004    6100         Freq            = 400Hz
  9.004    6100         L1VRMSAmpl      = 100V
  9.004    6100         L1IRMSAmpl      = 2A
  9.004    6100         L1IPhase        = 45deg
  9.004    6100         L1IAmplHarm3    = 20%
  9.004    6100         L1IAmplHarm15   = 5%
  9.004    6100         +L1Power        = 138.376W
  9.005    TARGET       -m
  9.006    IEEE2        [D500]MEAS:VAL?[I$]
  9.007    MATH         MEM = FLD(MEM2, 3, ",")
  9.008    MEMCX  138.4 W               0.169U          400H
#
# -----    AC Power (Current Channel Voltage), UUT input is 1 mV/A
#
  10.001   RSLT         =
  10.002   RSLT         =100 V, 150 A @ 60 Hz
# Get 6100A voltage channel accuracy and convert to ppm.
  10.003   MATH         L[1] = ACCV2(S[1], "Sine 168V", 100, 60)
  10.004   MATH         M[1] = (L[1] / 100) * 1e6
# Get 6100A current channel accuracy and convert to ppm.
  10.005   MATH         L[2] = ACCV2(S[1], "Sine 0.25V AUX", 150e-3, 60)
  10.006   MATH         M[2] = (M[2] / 150e-3) * 1e6
# Convert phase to radians.
  10.007   MATH   L[4] = RAD(157)
# Get 6100A current to voltage channel phase accuracy and convert to ppm.
  10.008   MATH         L[5] = ACCV2(S[1], "Phase I-V 0.25V V>40%", 150e-3, 60)
# Convert to ppm.
  10.009  MATH          L[3] = (1 - COS(L[4] + RAD(L[5])) / COS(L[4])) * 1e6
# Calculate RSS of voltage channel, current channel, and phase accuracies.
  10.010   MATH         M[1] = RSS3(L[1], L[2], L[3])
```

```
  10.011   TARGET
  10.012   6100         L1VAC = 100V; L1IAC = 150mV; Freq = 60Hz
  10.012   6100         +L1Power = -13.8kW; L1IPhase = 157deg
  10.013   ACC          -13.8kW         M1P%
  10.014   MEMI         Enter UUT reading in kilowatts.
  10.015   MEMCX        -13.8kW         1% 0.4U         60H

  11.001   6100         L1VAC = 100V; L1IAC = 150mV; Freq = 60Hz
  11.001   6100         +L1Power = 15.0kVA; L1IPhase = 157deg
  11.002   ACC          15.0kVA         M1P%
  11.003   MEMI         Enter UUT reading in kilovolt-amps.
  11.004   MEMCX        15.0kVA         1% 0.4U         60H

  12.001   6100         L1VAC = 100V; L1IAC = 150mV; Freq = 60Hz
  12.001   6100         +L1Power = 5.9kVAR; L1IPhase = 157deg
  12.002   ACC          5.9k'VAR'       M1P%
  12.003   MEMI         Enter UUT reading in units of kVAR.
  12.004   MEMCX        5.9k'VAR'       1% 0.4U         60H
#
# -----    Harmonic Amplitude -----
#
  13.001   RSLT   =
  13.002   HEAD   HARMONICS:{ 10.000 V @ 100 Hz, Harmonic 25}
  13.003   TARGET       -p
  13.004   6100         L1VRange        = 168V          L1IRange    = 20A
  13.004   6100         L1VAmplHarm1    = 100V          L1IRMSAmpl  = 10A
  13.004   6100         +L1VAmplHarm25  = 10.000V       Freq        = 100Hz
  13.005   TARGET       -m
  13.006   IEEE2        [D500]MEAS:VAL?[I$]
  13.007   MATH         MEM = FLD(MEM2, 26, ",")
  13.008   MEMCX  168   10.000V         2.0% 0.05/      2.5kH
#
# -----    Flicker Analysis -----
#
  14.001   RSLT         =
  14.002   HEAD         {FLICKER ANALYSIS}
  14.003   TSET         TDESC = [MEM2]
  14.004   6100         L1VAC           = 230V
  14.004   6100         Frequency       = 50Hz
  14.004   6100         L1VFlickerShape = Square
  14.004   6100         L1VFlickerFreq  = 58.3mHz
  14.004   6100         L1VFlickerDepth = 1.459%
  14.004   6100         +L1VFlickerPST  = 1
  14.005   IEEE2        FLICKER:INIT
  14.006   WAIT         -t 30 Waiting for UUT...
  14.007   IEEE2        FLICKER:START
  14.008   WAIT         -t 10:10 Waiting for UUT...
  14.009   TARGET       -m
  14.010   IEEE2        [D500]MEAS:VAL?[I$]
  14.011   MATH         MEM = FLD(MEM2, 9, ",")
  14.012   MEMCX  1     ''              0.05U           58.3mH
```

```
15.001   END
```

6060

Instrument FSC

Description

The 6060 FSC programs the frequency and amplitude of the Fluke or Gigatronics 6060A, 6060B, 6061A, 6062A, 6080A(1), or 6082A(1) RF Signal Generators. The M606 FSC may be used to program the modulation frequency and AM depth or FM deviation.

(1) The 6080A and 6082A must be in 6060 emulation mode in order to be programmed using the 6060 FSC.

Parameters

Note

The 6060 FSC programs the 6060A, 6060B, 6061A, 6062A, 6080A, and 6082A which all have different frequency ranges. You have to verify the capability of the instrument, which is actually in the system against the value specified. If you violate the limitations of the generator, you will get an error message while executing the procedure.

FREQUENCY

6060A: 100 kHz to 1050 MHz, 952.3809 ps to 10 µs

6060B: 10 kHz to 1050 MHz, 952.3809 ps to 100 µs

6061A: 10 kHz to 1050 MHz, 952.3809 ps to 100 µs

6062A: 100 kHz to 2100 MHz, 476.1905 ps to 10 µs

6080A: 10 kHz to 1056 MHz, 946.9697 ps to 100 µs

6081A: 100 kHz to 2100 MHz(1), 476.1905 ps(1) to 10 µs

(1) Maximum frequency of the 6082A is limited to that of the 6062A.

AMPLITUDE

0.1 µV to 1 V

0.283 µVpp to 2.82 Vpp

-127 dBm to +13 dBm

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the frequency, period, or amplitude of the output signal, or a reset. The 6060 FSC can contain frequency or period information in the NOMINAL field and amplitude information in the MOD1 field or vice-versa. The order in which this information is provided determines which information is contained in either field.

- Frequency entered as: [*numeric*][*prefix*]H
- Period entered as: [*numeric*][*prefix*]T
- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.
- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency of period.
- When the NOMINAL field contains only units the value is taken from MEM.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

- Voltage (RMS) entered as: [*numeric*][*prefix*]V
- Voltage (peak-to-peak) entered as: [*numeric*][*prefix*]Vpp
- dBm entered as: [*numeric*][*prefix*]D
- Frequency entered as: [*numeric*][*prefix*]H

- Period entered as: [*numeric*][*prefix*]T

Rules:

- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency of period.
- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field contains only units the value is taken from MEM.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is not used. The signal generator always expects a 50 Ohm termination.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
  STEP    FSC     RANGE NOMINAL        TOLERANCE      MOD1         MOD2   3   4  CON
   1.001  ASK-                                                                    W
   1.002  ASK+      D
   # ----- Reset -----
   1.003  6060          *                                                      S
   1.004  6060    A     -127D          1U             100kH           -D
   2.001  6060    1     0.1uV          1%             1050MH          -D
   2.002  6060    0.5   0.28uVpp       1/             100kH
   3.001  6060    A     D              1U             100kH           -D
   4.001  6060          uV             1%             100kH           -D
   5.001  6060    50    10uT           1% 1/ 1U       -127D
   6.001  6060    0.2   1nT            1% 1/ 1U       1Vpp
   # ----- Oscilloscope Bandwidth Testing -----
 #
 # Line 7.001 enables the automatic range and adjustment messages with the
 # "/div" modifier.
 # Line 7.002 instructs the operator to perform the proper connection.
 # Line 7.003 generates the following range message:
 #     Set UUT to 10us/div.
 # Line 7.004 sets the MEM2 string register to "Channel 1".
 # Line 7.005 generates the following automatic range and adjustment messages:
 #     Set UUT Channel 1 to 20mV/div.
 #     Adjust stimulus for a UUT reading of 6 divisions.
 # Line 7.006 disables automatic adjustment messages.
 # Line 7.007 specifies a message to be displayed upon execution of line 7.008.
 # Line 7.008 sets the generator to the final amplitude from line 7.005 and a
 # starting frequency of 5 MHz. The message specified on line 7.007 is then
 # displayed which instructs the operator to slew the frequency until the
 # amplitude displayed on the UUT is 3dB (4.2 div.) down from the original
 # peak-to-peak amplitude of 6 divisions. Note the tolerance is negative to
 # reflect that the bandwidth should be more than the nominal value (creating
 # a negative error).
 #
   7.001  ASK+    R D   N
   7.002  DISP          Connect the 6060B to the UUT Channel1
   7.003  RNG           1uT
   7.004  MEM2          =Channel 1
   7.005  6060    20    120mVpp                       100kH                    N
   7.006  ASK-          N
   7.007  MESS          Adjust stimulus for a UUT reading of 4.2 divisions.
   7.008  6060          5MH            -50%           mVpp
   7.009  MESS
```

M606

Auxiliary Instrument Setup FSC

Description

The M606 FSC provides the additional program functions for the Fluke 6060A, 6060B, 6061A or 6062A Synthesized Signal Generators, which are not addressed by the 6060 FSC. This functions include AM and FM modulation.

The special functions specified by the M606 FSC will become effective in the first 6060 FSC that follows this M606 FSC.

RANGE

Not used.

NOMINAL

The Nominal field specifies the Modulation Frequency or a reset.

- Modulation Frequency entered as [*numeric*][*prefix*]H or T.
- Reset entered as *.

Rules:

- Allowed values are 400 Hz or 1000 Hz.
- If just nominal units are entered, the nominal value will be that of the content of memory register MEM plus the units specified.
- An asterisk ('*') in the Nominal field resets all previous settings created with the M606 FSC.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies the AM Depth or FM Deviation.

- AM Depth entered as *numeric*%.
- FM Deviation entered as *numeric*[*prefix*]H or T.

Rules:

- AM Depth limits are 0 to 90%.

- FM Deviation limits depend upon the carrier and modulation frequency as shown in the table below:

Carrier Frequency	FM Deviation (lesser of)
10 kHz to 0.4 MHz	100 Hz to 99.9 kHz and (1000 x fo^1 - 100) / 3
0.4 MHz to 245 MHz	100 Hz to 99.9 kHz and (2 x fm^2 x (fo^1 + 800))
245 MHz to 1050 MHz	100 Hz to 99.9 kHz and (2 x fm^2 x $fo^{1)}$
fo = Carrier Frequency fm = Modulation Frequency	

MOD2

Not used

MOD3

Not used.

MOD4

Not used.

CON

Not used.

Miscellaneous

- The Procedure Editor cannot always check the correctness of the M606 entry with the 6060 FSC entries that follow. If the combination of parameters is not valid, an error message will occur when the procedure is executed. Procedures using the M606 FSC should be carefully tested.
- The Pulse Modulation capability of the 6062A is not supported in MET/CAL calibration software.

Example

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# AM Modulation
  4.003  M606         *
  4.004  M606         400H                         0%
  4.005  6060   10    0D             1U            10MH
  5.001  M606         *
  5.002  M606         1000H                        90%
  5.003  6060   10    0D             1U            10MH
# FM Modulation
  6.005  M606         *
  6.006  M606         400H                         100H
  6.007  6060   10    0D             0.11U         200kH
  7.001  M606         *
  7.002  M606         1000H                        99.9kH
  7.003  6060   10    0D             0.1U          1000MH
```

6304, 6304C

Instrument FSC

Description

The 6304 and 6304C FSCs program the Fluke PM 6304 and PM 6304C Programmable Automatic RCL Meter to resistance, capacitance, inductance, impedance, quality factor, dissipation factor, phase angle, voltage, or current.

Note

If the PM 6304 is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600, N,...], to set the baud rate, parity, etc. of the port used to control the PM 6304. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the PM 6304 must be set correctly before a procedure is executed. If the PM 6304 is connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. If the PM 6304 is connected to the 5500A, 5520A, 5800A, 5820A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Use the following for serial flow control:

PC COMM Port via Windows Control Panel

Flow Control: Hardware

Fluke 55xxA UUT Setup

STALL

cts/rts

Functional Capability

Impedance/Resistance	0 Ω to 200 MΩ (AC), 50 MΩ (DC, PM 6304)
Capacitance	0 pF to 31.8 F
Inductance	0 µH to 637 µH
Quality Factor	0 to 1000
Dissipation Factor	0 to 1000
Phase Angle	-179 deg to 180 deg

Voltage	0.1 µV to 2 V
Current	0.005 µA to 10 mA

If the instrument indicates an underrange or overrange condition MET/CAL sets the measurement value returned as follows:

underrange: -200e+33

overrange: +200e+33

Parameters

Range

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

Nominal

This field specifies the expected measured value or a reset.

- Impedance/Resistance entered as [*numeric*][*prefix*]Z.
- Capacitance entered as [*numeric*][*prefix*]F.
- Inductance entered as [*numeric*][*prefix*]Hy.
- Quality Factor entered as [*numeric*][*prefix*]QF.
- Dissipation Factor entered as [*numeric*][*prefix*]df.
- Phase Angle entered as [*numeric*][*prefix*]deg.
- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Reset entered as *.

Tolerance

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the test signal frequency.

- Frequency entered as: [*numeric*][*prefix*]H
- *blank* DC (PM 6304 only)

Rules:

- Allowed values are:

    50, 60, 100, and 120 Hz

    200 Hz to 20 kHz in 100 Hz steps

    100 kHz
- 1 kHz is automatically inserted in the 6404C MOD1 if test frequency is entered.

MOD2

This field is not used.

MOD3

This field specifies Zero Trim.

- ZR Zero Trim
- *blank* field not applicable

Rules:

- The MOD3 field may specify ZR only when the MOD4 field specifies "N" (Nominal Setup test).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection and is always 4-wire (4W). 4W is inserted automatically in the CON field when no CON field code is entered.

6306

Instrument FSC

Description

The 6306 FSC programs the Fluke PM 6306 Programmable Automatic RCL Meter to resistance, capacitance, inductance, impedance, quality factor, dissipation factor, phase angle, voltage, or current.

Note

If the PM 6306 is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600, N,...], to set the baud rate, parity, etc. of the port used to control the PM 6306. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the PM 6306 must be set correctly before a procedure is executed. If the PM 6306 connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. If the PM 6306 is connected to the 5500A, 5520A, 5800A, 5820A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Use the following for serial flow control:

PC COMM Port via Windows Control Panel

Flow Control: Hardware

Fluke 55xxA UUT Setup

STALL cts/rts

Functional Capability

Impedance/Resistance	0 Ohms to 200 MOhms (AC), 50 MOhms (DC)
Capacitance	0 pF to 31.8 F
Inductance	0 µH to 637 µH
Quality Factor	0 to 1000
Dissipation Factor	0 to 1000
Phase Angle	-179 deg to 180 deg
Voltage	0.1 µV to 2 V
Current	0.005 µA to 10 mA

If the instrument indicates an underrange or overrange condition MET/CAL sets the measurement value returned as follows:

underrange: -200e+33

overrange: +200e+33

Parameters

Range

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

Nominal

- This field specifies the expected measured value or a reset.
- Impedance/Resistance entered as [*numeric*>][*prefix*]Z.
- Capacitance entered as [*numeric*][*prefix*]F.
- Inductance entered as [*numeric*][*prefix*]Hy.
- Quality Factor entered as [*numeric*][*prefix*]QF.
- Dissipation Factor entered as [*numeric*][*prefix*]df.
- Phase Angle entered as [*numeric*][*prefix*]deg.
- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Reset entered as *.

Tolerance

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the test signal frequency.

- Frequency entered as: [*numeric*][*prefix*]H
- *blank* DC

Rules:

- Allowed values are:

  50, 60, 100, and 120 Hz

  200 Hz to 100 kHz in 100 Hz steps

  100 kHz to 1 MHz in 1 kHz steps

MOD2

This field is not used.

MOD3

This field specifies Zero Trim.

- ZR Zero Trim
- *blank* field not applicable

Rules:

- The MOD3 field may specify ZR only when the MOD4 field specifies "N" (Nominal Setup test).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection and is always 4-wire (4W). 4W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1    MOD2  3  4 CON
# ----- Reset -----
  1.001  6306         *                                          S
# ----- Test Signal Amplitude -----
  1.002  M6306        1V
# ----- Zero Trim (Open Circuit) -----
  1.003  DISP         SEPARATE the LCR meter test cables
  1.003  DISP         for the "Open Circuit" TRIM.
  1.003  DISP
  1.003  DISP         Press "Advance" ready.
  1.004  6306         350.0pF                      1kH           ZR N  4W
# ----- Zero Trim (Short Circuit) -----
  1.005  DISP         SHORT the LCR Meter test cables (using a COPPER
short)
  1.005  DISP         for the "Short Circuit" TRIM.
  1.005  DISP
  1.005  DISP         Press "Advance" when ready.
  1.006  6306         300.00nF                     1kH            ZR N  4W
# ----- Capacitance -----
  1.007  IEEE         OUT 350pF;OPER;*OPC?[I!]
  1.008  6306         350.0pF        0.38% 10U     1kH                  4W
  2.001  RSLT         =
# ----- Impedance / Resistance AC -----
  2.002  M6306        1V
  2.003  6306         0.000Z         0.010U        50H                  4W
  3.001  6306         100.00kZ       5%            50H                  4W
# ----- Quality Factor -----
  4.001  6306         0.008QF        0.005U        50H                  4W
  5.001  6306         124QF          5U            1kH
4W
# ----- Dissipation Factor -----
  6.001  6306         0.008DF        0.005U        1kH                  4W
  7.001  6306         131DF          5U            50H                  4W
# ----- Phase Angle -----
  8.001  6306         -90.0deg       1.0U          1kH                  4W
# ----- Voltage -----
  9.001  6306         0.91V          0.01U         1kH                  4W
 10.001  6306         0.843V         0.01U         1kH
4W
# ----- Current -----
 11.001  6306         0.90mA         0.01U         1kH
4W
 12.001  6306         5.30mA         0.1U          1kH                  4W
# ----- Inductance -----
 13.001  6306         25.00uHy       5%            1kH                  4W
 14.001  6306         230.00uHy      5%            1kH                  4W
# ----- Range Hold -----
 15.001  M6306  HOLD  1V
 15.002  6306         1.0000uF                     100H                 4W
# ----- AC Test Signal Amplitude -----
 15.003  M6306        50mV
 15.004  6306         1.0000uF                     100H              N  4W
 15.005  M6306        2V
```

```
 15.006  6306         1.0000uF                     100H              N  4W
 15.007  M6306        1V
 15.008  6306         1.0000uF                     100H              N  4W
# ----- Internal Bias Voltage -----
 15.009  M6306        1V                           2V                  INT
 15.010  6306         1.0000uF                     100H              N  4W
# ----- External Bias Voltage -----
 15.011  M6306        1V                           1V                  EXT
 15.012  6306         1.0000uF                     100H              N  4W
# ----- Fast Mode -----
 15.013  M6306        1V                                             FS
 15.014  6306         1.0000uF                     1kH               N  4W
# ----- Serial Measurement Mode -----
 15.015  M6306        1V                                             S
 15.016  6306         1.0000uF                     100H              N  4W
# ----- Parallel Measurement Mode -----
 15.017  M6306        1V                                             P
 15.018  6306         1.0000uF                     100H              N  4W
# ----- Auto Measurement Mode -----
 15.019  M6306        1V
 15.020  6306         1.0000uF                     100H              N  4W
```

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1    MOD2  3   4 CON
# ----- Reset -----
  1.001  6304C        *         S
# ----- Test Signal Amplitude -----
  1.002  M6304C       1V
# ----- Zero Trim (Open Circuit) -----
  1.003  DISP         SEPARATE the LCR meter test cables
  1.003  DISP         for the "Open Circuit" TRIM.
  1.003  DISP
  1.003  DISP         Press "Advance" ready.
  1.004  6304C        350.0pF                      1kH          ZR N  4W
# ----- Zero Trim (Short Circuit) -----
  1.005  DISP         SHORT the LCR Meter test cables (using a COPPER
short)
  1.005  DISP         for the "Short Circuit" TRIM.
  1.005  DISP
  1.005  DISP         Press "Advance" when ready.
  1.006  6304C        300.00nF                     1kH          ZR N  4W
# ----- Capacitance -----
  1.007  IEEE         OUT 350pF;OPER;*OPC?[I!]
  1.008  6304C        350.0pF        0.38% 10U     1kH                4W
  2.001  RSLT         =
# ----- Impedance / Resistance AC -----
  2.002  M6304        1V
  2.003  6304         0.000Z         0.010U        50H                4W
  3.001  6304         100.00kZ       5%            50H                4W
# ----- Quality Factor -----
  4.001  6304         0.008QF        0.005U        50H                4W
  5.001  6304         124QF          5U            1kH                4W
# ----- Dissipation Factor -----
  6.001  6304         0.008DF        0.005U        1kH                4W
  7.001  6304         131DF          5U            50H                4W
# ----- Phase Angle -----
  8.001  6304         -90.0deg       1.0U          1kH                4W
# ----- Voltage -----
  9.001  6304         0.91V          0.01U         1kH                4W
 10.001  6304         0.843V         0.01U         1kH                4W
# ----- Current -----
 11.001  6304         0.90mA         0.01U         1kH                4W
 12.001  6304         5.30mA         0.1U          1kH                4W
# ----- Inductance -----
 13.001  6304         25.00uHy       5%            1kH                4W
 14.001  6304         230.00uHy      5%            1kH                4W
# ----- Range Hold -----
 15.001  M6304  HOLD  1V
```

```
 15.002  6304          1.0000uF                    100H            N  4W
# ----- AC Test Signal Amplitude -----
 15.003  M6304         50mV
 15.004  6304          1.0000uF                    100H            N  4W
 15.005  M6304         2V
 15.006  6304          1.0000uF                    100H            N  4W
 15.007  M6304         1V
 15.008  6304          1.0000uF                    100H            N  4W
# ----- Internal Bias Voltage -----
 15.009  M6304         1V        2V  INT
 15.010  6304          1.0000uF                    100H            N  4W
# ----- External Bias Voltage -----
 15.011  M6304         1V        1V  EXT
 15.012  6304          1.0000uF                    100H            N  4W
# ----- Fast Mode -----
 15.013  M6304         1V      FS
 15.014  6304          1.0000uF                    1kH             N  4W
# ----- Serial Measurement Mode -----
 15.015  M6304         1V         S
 15.016  6304          1.0000uF                    100H            N  4W
# ----- Parallel Measurement Mode -----
 15.017  M6304         1V         P
 15.018  6304          1.0000uF                    100H            N  4W
# ----- Auto Measurement Mode -----
 15.019  M6304         1V
 15.020  6304          1.0000uF                    100H            N  4W
```

M6304, M6304C

Auxiliary Instrument Setup FSC

Description

The M6304 and M6304C FSCs are used to specify the following:

Range Hold On/Off

Test Signal Level

DC Bias

Fast Mode On/Off

DC Bias Source Int/Ext

Note

The PM 6304 AVERAGE command is not supported. The PM 630x driver uses SINGLE mode, however the AVERAGE command is only allowed in CONTINUOUS mode. To control the number of readings which are averaged, set NMEAS using the VSET or TSET FSC.

Parameters

Range

This field specifies whether RANGE HOLD is on or off.

- HOLD Turn RANGE HOLD on
- *blank* Turn RANGE HOLD off

Nominal

This field specifies the test signal level.

- Voltage entered as: [*numeric*][*prefix*]V

Rules:

- Allowed values are:

LEVEL	AC	DC (PM 6304 only)
LO	50 mV	300 mV
NORMAL	1 V	1 V
HI	2 V	2 V

- 1 V is automatically inserted in the NOMINAL field if no test signal level is entered.
- If the NOMINAL field does not contain a value, the value is taken from memory register MEM.

Tolerance

This field is not used.

MOD1

This field optionally specifies a DC bias for an AC test signal.

- Voltage entered as: [*numeric*][*prefix*]V
- *blank* DC bias off

Rules:

- The MOD1 field may specify voltage only when the 6304 FSC MOD1 field specifies frequency.
- If the MOD1 field does not contain a value, the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field specifies whether FAST MODE is on or off.

- FS Turn FAST MODE on
- *blank* Turn FAST MODE off

MOD4

This field specifies the measurement mode.

- S Serial
- P Parallel
- *blank* Auto

CON

This field specifies whether the MOD1 DC bias is an internal or external.

- INT Internal DC Bias
- EXT External DC Bias
- *blank* no DC bias

Rules:

6304 CON	6304 MOD1
INT	0 V or 2 V
EXT	0 V to 40 V

- The CON field may specify INT or EXT only when the M6304 FSC MOD1 field specifies a DC bias.

6306

Instrument FSC

Description

The 6306 FSC programs the Fluke PM 6306 Programmable Automatic RCL Meter to resistance, capacitance, inductance, impedance, quality factor, dissipation factor, phase angle, voltage, or current.

Note

If the PM 6306 is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600, N,...], to set the baud rate, parity, etc. of the port used to control the PM 6306. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the PM 6306 must be set correctly before a procedure is executed. If the PM 6306 connected to a standard serial port (COM1, COM2, ..., COM16), select the "Ports" application in the Windows control panel to choose the proper settings. If the PM 6306 is connected to the 5500A, 5520A, 5800A, 5820A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Use the following for serial flow control:

PC COMM Port via Windows Control Panel

Flow Control: Hardware

Fluke 55xxA UUT Setup

STALL cts/rts

Functional Capability

Impedance/Resistance 0 Ohms to 200 MOhms (AC), 50 MOhms (DC)

Capacitance	0 pF to 31.8 F
Inductance	0 µH to 637 µH
Quality Factor	0 to 1000
Dissipation Factor	0 to 1000
Phase Angle	-179 deg to 180 deg
Voltage	0.1 µV to 2 V
Current	0.005 µA to 10 mA

If the instrument indicates an underrange or overrange condition MET/CAL sets the measurement value returned as follows:

underrange: -200e+33

overrange: +200e+33

Parameters

Range

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

Nominal

- This field specifies the expected measured value or a reset.
- Impedance/Resistance entered as [*numeric*>][*prefix*]Z.
- Capacitance entered as [*numeric*][*prefix*]F.
- Inductance entered as [*numeric*][*prefix*]Hy.
- Quality Factor entered as [*numeric*][*prefix*]QF.
- Dissipation Factor entered as [*numeric*][*prefix*]df.
- Phase Angle entered as [*numeric*][*prefix*]deg.
- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- Current entered as [*numeric*][*prefix*]A.
- Reset entered as *.

Tolerance

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the test signal frequency.

- Frequency entered as: [*numeric*][*prefix*]H
- *blank* DC

Rules:

- Allowed values are:

  50, 60, 100, and 120 Hz

  200 Hz to 100 kHz in 100 Hz steps

  100 kHz to 1 MHz in 1 kHz steps

MOD2

This field is not used.

MOD3

This field specifies Zero Trim.

- ZR Zero Trim
- *blank* field not applicable

Rules:

- The MOD3 field may specify ZR only when the MOD4 field specifies "N" (Nominal Setup test).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection and is always 4-wire (4W). 4W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
  STEP     FSC     RANGE  NOMINAL           TOLERANCE      MOD1     MOD2   3   4  CON
# ----- Reset -----
   1.001  6306            *                                                    S
# ----- Test Signal Amplitude -----
   1.002  M6306           1V
# ----- Zero Trim (Open Circuit) -----
   1.003  DISP            SEPARATE the LCR meter test cables
   1.003  DISP            for the "Open Circuit" TRIM.
   1.003  DISP
   1.003  DISP            Press "Advance" ready.
   1.004  6306            350.0pF                          1kH              ZR  N   4W
# ----- Zero Trim (Short Circuit) -----
   1.005  DISP            SHORT the LCR Meter test cables (using a COPPER
short)
   1.005  DISP            for the "Short Circuit" TRIM.
   1.005  DISP
   1.005  DISP            Press "Advance" when ready.
   1.006  6306            300.00nF                         1kH               ZR N   4W
# ----- Capacitance -----
   1.007  IEEE            OUT 350pF;OPER;*OPC?[I!]
   1.008  6306            350.0pF          0.38% 10U       1kH                      4W
   2.001  RSLT            =
# ----- Impedance / Resistance AC -----
   2.002  M6306           1V
   2.003  6306            0.000Z           0.010U          50H                      4W
   3.001  6306            100.00kZ         5%              50H                      4W
# ----- Quality Factor -----
   4.001  6306            0.008QF          0.005U          50H                      4W
   5.001  6306            124QF            5U              1kH
4W
# ----- Dissipation Factor -----
   6.001  6306            0.008DF          0.005U          1kH                      4W
   7.001  6306            131DF            5U              50H                      4W
# ----- Phase Angle -----
   8.001  6306            -90.0deg         1.0U            1kH                      4W
# ----- Voltage -----
   9.001  6306            0.91V            0.01U           1kH                      4W
  10.001  6306            0.843V           0.01U           1kH
4W
# ----- Current -----
  11.001  6306            0.90mA           0.01U           1kH
4W
  12.001  6306            5.30mA           0.1U            1kH                      4W
# ----- Inductance -----
  13.001  6306            25.00uHy         5%              1kH                      4W
  14.001  6306            230.00uHy        5%              1kH                      4W
# ----- Range Hold -----
  15.001  M6306   HOLD    1V
  15.002  6306            1.0000uF                         100H                     4W
# ----- AC Test Signal Amplitude -----
  15.003  M6306           50mV
  15.004  6306            1.0000uF                         100H                 N   4W
  15.005  M6306           2V
```

```
 15.006  6306         1.0000uF                     100H                  N  4W
 15.007  M6306        1V
 15.008  6306         1.0000uF                     100H                  N  4W
# ----- Internal Bias Voltage -----
 15.009  M6306        1V                           2V                      INT
 15.010  6306         1.0000uF                     100H                  N  4W
# ----- External Bias Voltage -----
 15.011  M6306        1V                           1V                      EXT
 15.012  6306         1.0000uF                     100H                  N  4W
# ----- Fast Mode -----
 15.013  M6306        1V                                                 FS
 15.014  6306         1.0000uF                     1kH                   N  4W
# ----- Serial Measurement Mode -----
 15.015  M6306        1V                                                 S
 15.016  6306         1.0000uF                     100H                  N  4W
# ----- Parallel Measurement Mode -----
 15.017  M6306        1V                                                 P
 15.018  6306         1.0000uF                     100H                  N  4W
# ----- Auto Measurement Mode -----
 15.019  M6306        1V
 15.020  6306         1.0000uF                     100H                  N  4W
```

M6306

Auxiliary Instrument Setup FSC

Description

The M6306 FSC is used to specify the following:

Range Hold On/Off

Test Signal Level

Test Fixture Capacitance

DC Bias

Fast Mode On/Off

DC Bias Source Int/Ext

Note

The PM 6306 AVERAGE command is not supported. The PM 630x driver uses SINGLE mode, however the AVERAGE command is only allowed in CONTINUOUS mode. To control the number of readings which are averaged, set NMEAS using the VSET or TSET FSC.

Parameters

Range

This field specifies whether RANGE HOLD is on or off.

- HOLD Turn RANGE HOLD on
- *Blank* Turn RANGE HOLD off

Nominal

This field specifies the test signal level.

- Voltage entered as: [*numeric*][*prefix*]V

Rules:

- Allowed values are: 0.05 V to 2.00 V with a resolution of 0.01 V.
- 1 V is automatically inserted in the NOMINAL field if no test signal level is entered.

- If the NOMINAL field does not contain a value, the value is taken from memory register MEM.

Tolerance

This field specifies the test fixture capacitance.

- Capacitance entered as: [*numeric*][*prefix*]F
- *blank* fixture capacitance not programmed

Rules:

- Allowed values are: 50 pF to 1050 pF.
- If the TOLERANCE field does not contain a value, the value is taken from memory register MEM.

MOD1

This field optionally specifies a DC bias for an AC test signal.

- Voltage entered as: [*numeric*][*prefix*]V
- *blank* DC bias off

Rules:

- The MOD1 field may specify voltage only when the 6306 FSC MOD1 field specifies frequency.
- If the MOD1 field does not contain a value, the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field specifies whether FAST MODE is on or off.

- FS Turn FAST MODE on
- *blank* Turn FAST MODE off

MOD4

This field specifies the measurement mode.

- S Serial
- P Parallel

- *blank* Auto

CON

This field specifies whether the MOD1 DC bias is an internal or external.

- INT Internal DC Bias
- EXT External DC Bias
- *blank* no DC bias

Rules:

6306 CON	6306 MOD1
INT	0.1 V or 10 V
EXT	0.1 V to 40 V

- The CON field may specify INT or EXT only when the M6306 FSC MOD1 field specifies a DC bias.

6520

Instrument FSC

Description

The 6520 FSC programs the Guildline 6520 Teraohmmeter to measure resistance or current.

Note

MET/CAL requires 6520 firmware revision G or later.

See M6520 FSC for additional 6520 settings.

⚠ Caution

Dangerous voltages can be present at the source connector.

IEEE-488 Control

To configure the 6520 for IEEE-488 control using the factory default address, perform the following steps from 6520 front panel top level menu.

1. Select "Measure" softkey.
2. Select "Ohms" or "Current" softkey.
3. Select "Setup" softkey.
4. Select "Profiles" softkey.
5. Press the up or down arrow key, as necessary, until the "GPIB" is highlighted.
6. Select "Select" softkey.

RS-232 Control

To configure the 6520 for RS-232 control using the factory default settings, perform the following steps from 6520 front panel top level menu.

1. Select "Measure" softkey.
2. Select "Ohms" or "Current" softkey.
3. Select "Setup" softkey.
4. Select "Profiles" softkey.
5. Press the up or down arrow key, as necessary, until the "RS232" is highlighted.
6. Select "Select" softkey.

Note

Do not use the PORT FSC port configuration special construction, [P960, N, 8, 1, X], to set the baud rate, parity, data bits, stop bits, and flow control. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 6520 must be set correctly before a procedure is executed. If the 6520 is connected to a standard serial port (COM1, COM2, ..., COM16), COM3, or COM4, use the Windows control panel to choose the proper settings. If the 6520 is connected to the 5500A, 5520A, 5800A, or 5820A UUT port, select the proper settings for the UUT Serial Port from the front panel of the calibrator.

Functional Capability

Resistance	100 kOhms to 100,000 TOhms
Current	± (10 fA to 10 mA)

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Resistance entered as *[<numeric>][<prefix>]Z.*
- Current entered as *[<numeric>][<prefix>]A.*
- Reset entered as *.

Rules:

- When the NOMINAL field units are amps, the M6520 FSC MOD4 field must specify positive or negative polarity (+ or -).
- When the NOMINAL field specifies positive amps, the M6520 FSC MOD4 field must specify positive polarity ('+').
- When the NOMINAL field specifies negative amps, the M6520 FSC MOD4 field must specify negative polarity ('-').
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field is not used.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 3W 3-wire

Rules:

- 3W is automatically inserted in the CON field if no valid CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the online Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  ASK-   R     N             P                            F        V
# ----- Reset -----
  1.002  M6520        *
  1.003  6520         *                                                S
# ----- Ohms Measurement -----
  1.004  DISP         Connect the 6520 SOURCE and INPUT leads to the Decade
  1.004  DISP         Resistor Hi and Lo terminals, respectively. Connect the
  1.004  DISP         shield of both leads to the Decade Resistor ground
  1.004  DISP         terminal.
  1.004  DISP
  1.004  DISP         The gound and Lo terminal of the Decade Resistor must
  1.004  DISP         NOT be strapped together.

  1.005  DISP         Set the Decade Resistor to 100 kOhms.
# ----- Autoange -----
  1.006  M6520  MAX   10V
  1.007  6520   100   100.000kZ                                        N  3W
# ----- Manual Ranging -----
  1.008  M6520  TEST  10V                                        C3 T3
  1.009  6520   100   100.000kZ                                        N  3W
# ----- Positive Polarity -----
  1.010  M6520                                                         +
  1.011  6520   100   100.000kZ                                        N  3W
# ----- Negative Polarity -----
  1.012  M6520                                                         -
```

```
  1.013  6520   100   100.000kZ                                    N  3W
# ----- Evalutation Tests -----
  1.014  6520   100   100.000kZ      0.1%                             3W
  2.001  DISP         Set the Decade Resistor to 1 MOhm.
  2.002  6520   1     1.00000MZ      0.1%                             3W
  3.001  DISP         Set the Decade Resistor to 10 MOhms.
  3.002  6520   10    10.0000MZ      0.1%                             3W
  4.001  6520         *                                            S

  4.002  DISP         Disconnect the 6520 from the Decade Resistor.
  4.003  DISP         Connect the 6520 SOURCE and INPUT leads to a 1000 MOhm
  4.003  DISP         Test Resistor Hi and Lo terminals, respectively. Connect
  4.003  DISP         the shield of both leads to the Test Resistor ground
  4.003  DISP         terminal.
  4.003  DISP
  4.003  DISP         The gound and Lo terminal of the Test Resistor must
  4.003  DISP         NOT be strapped together.

  4.004  MEMI         Enter certified value of the Test Resistor (in MOhms):
  4.005  M6520        *
  4.006  6520   1000  MZ             0.1% 0.00U                       3W
# ----- Current Measurement -----
  5.001  DISP         Connect the 6520 INPUT lead to the current source.
# Set the 6520 to amps to prevent an overcompliance error from current source.
  5.002  IEEE         [@6520]MEAS:UNIT AMPS
# ----- Autoange -----
  5.003  DISP         Set the current source to 10 uA DC.
  5.004  M6520                                                     +
  5.005  6520   10    10.0000uA      1%                               3W
  6.001  DISP         Set the current source to -10 uA DC.
  6.002  M6520                                                     -
  6.003  6520   10    -10.0000uA     1%                               3W
# ----- Manual Ranging -----
  7.001  DISP         Set the current source to 100 uA DC.
  7.002  M6520                                               C3 T3 +  ON
  7.003  6520   100   100.000uA      1%                               3W
  8.001  DISP         Set the current source to -100 uA DC.
  8.002  M6520                                               C3 T3 -  ON
  8.003  6520   100   -100.000uA     1%                               3W
  9.001  DISP         Set the current source to 1 mA DC.
  9.002  M6520                                               C3 T3 +  ON
  9.003  6520   1     1.00000mA      1%                               3W
 10.001  DISP         Set the current source to -1 mA DC.
 10.002  M6520                                               C3 T3 -  ON
```

```
10.003  6520   1     -1.00000mA     1%                                    3W
11.001  DISP         Set the current source to 10 mA DC.
11.002  M6520                                                    C3 T3 +  ON
11.003  6520   10    10.0000mA      1%                                    3W
12.001  DISP         Set the current source to -10 mA DC.
12.002  M6520                                                    C3 T3 -  ON
12.003  6520   10    -10.0000mA     1%                                    3W
```

6666

Instrument FSC

Description

The 6666 FSC programs the Philips PM 6666 Timer/Counter to measure frequency, frequency ratio, period, time interval and voltage max and min.

Perameters

The following table shows the relationship between the supported PM 6666 measurement functions and the FSC fields listed.

Function	MOD3	Nominal Value	MOD1 Value
Frequency A	FA	0.1 Hz to 120 MHz	[1]
Frequency C (Opt PM 9608)	FC	70 MHz to 900 MHz 70 MHz to 900 MHz 900 MHz to 1.1 GHz 900 MHz to 1.1 GHz 1.1 GHz to 1.3 GHz 1.1 GHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm 15 mV to 12 V -24 dBm to +35 dBm 40 mV to 12 V -15 dBm to +35 dBm
Ratio A/B	FR	$1x10^{-7}$ to 2×10^{9}	[1]
Period A	PA	8 ns to 2×10^{8}s	[1]
Time Interval A-B	TI	100 ns to 2×10^{8}s	[1]
Voltage Max A	MX	-51 V to 51 V –51 V to 51 V	*blank* (DC) or 100 Hz to 50 MHz
Voltage Min A	MN	-51 V to 51 V –51 V to 51 V	*blank* (DC) or 100 Hz to 50 MHz

1. The allowed voltage is based upon the input frequency:

0.1 Hz to 440 Hz	20 mV rms to 350 Vp
440 Hz to 1 MHz	20 mV rms to [2]
1 MHz to 30 MHz	20 mV rms to 8 V rms
30 MHz to 120 MHz	40 mV rms to 8 V rms

2. The voltage upper bound is determined by the line defined by {(440 Hz, 350 Vp), (1 MHz, 8 Vrms)}. Range This field specifies the UUT range as described "General Rules for Instrument Evaluation FSCs".

RANGE

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as [*numeric*][*prefix*]H.
- Frequency Ratio entered as [*numeric*][*prefix*]H/H.
- Period entered as [*numeric*][*prefix*]T.
- Time Interval entered as [*numeric*][*prefix*]T.
- Voltage entered as [*numeric*][*prefix*]V.
- Reset entered as *.

Rules:

- The NOMINAL field may specify the units symbol "H" only when the MOD3 field specifies Frequency A (FA) or Frequency C (FC).
- The NOMINAL field may specify the units symbol "H/H" only when the MOD3 field specifies Ratio A/B (FR).
- The NOMINAL field may specify the units symbol "T" only when the MOD3 field specifies Period A (PA) or Time Interval A-B (TI).
- The NOMINAL field may specify the units symbol "V" only when the MOD3 specifies Voltage Max A (MX) or Voltage Min A (MN).
- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the expected amplitude.

- Voltage (RMS) entered as: *numeric*[*prefix*]V
- Voltage (Peak) entered as: *numeric*[*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: *numeric*[*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: *numeric*[*prefix*]D
- Frequency entered as *numeric*[*prefix*]H.
- *blank*

Rules:

- The MOD1 field may specify the units symbol "V" only when the MOD3 field does not specify Voltage Max A (MX) or Voltage Min A (MN).
- The input signal is assumed to be sinusoid when the MOD1 field specifies the units symbol "V".
- The MOD1 field may specify the units symbol "Vp" only when the MOD3 field specifies Frequency A (FA), Period A (PA), Frequency A/B (FR), or Time Interval A-B (TI).
- The MOD1 field may specify the units symbol "Vpp" only when the MOD3 field specifies Frequency A (FA), Period A (PA), Frequency A/B (FR), or Time Interval A-B (TI).
- The MOD1 field may specify the units symbol "D" only when the MOD3 field specifies Frequency C (FC).
- The MOD1 field may be blank or specify the units symbol "H" only when the MOD3 field specifies Voltage Max A (MX) or Voltage Min A (MN).

MOD2

This field specifies the trigger slope as follows:

- +A Positive slope triggering, AC coupled
- -A Negative slope triggering, AC coupled
- +D Positive slope triggering, DC coupled
- -D Negative slope triggering, DC coupled
- *blank*

Rules:

- When the MOD2 field is blank, the trigger slope and coupling for channel A and B default to values determined by the measurement function unless specified otherwise using the M666 FSC.
- The MOD2 field must specify +A when the MOD3 field specifies Frequency C (FC).
- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency C (FC).

MOD3

This field specifies the measurement function:

FA	Frequency A
FC	Frequency C
PA	Period A
FR	Ratio A/B
TI	Time Interval A to B
MX	Voltage Max A
MN	Voltage Min A

Rules:

- The MOD3 field may specify Frequency C (FC) only when the High Frequency Input, option PM 9608 is installed. This is indicated in the CONFIG.DAT file as 6666(HF).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Input Impedance
- L 50 Ω Input Impedance
- 2W 2-Wire

Rules:

- The CON field may only specify "L" when the MOD3 field specifies Frequency C (FC).
- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC).
- 2W is allowed for compatibility with previous versions of MET/CAL.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2  3  4  CON
# ----- Reset -----
  1.001  M666         *
  1.002  6666         *
# ----- Frequency A -----
  1.003  6666         10.000kH       1%            1Vpp +          +A FA
# ----- Frequency C -----
  2.001  6666         100MH          0.1%          1V              +A FC    L
# ----- Period A -----
  3.001  6666         1.000mT        0.003U        5V              +A PA
# ----- Ratio A/B -----
  4.001  M666   ChA                                                AC
  4.002  M666   ChB                                                DC
  4.003  6666         10H/H          1%            1Vpp               FR
# ----- Time Interval A to B (Rise Time) -----
  5.001  M666   COM   10T            0.1V          0.9V            DC ++    X1
  5.002  6666         1.00uT         0.02U         1Vpp               TI
# ----- Time Interval A to B (Pulse Width) -----
  6.001  M666   COM   10T            100mV         100mV           DC +-    X1
  6.002  6666         1.00uT         0.02U         1Vpp               TI
```

M666

Auxiliary Instrument Setup FSC

Description

The M666 FSC provides the additional program functions for Channel A and Channel B of the Philips PM 6666 Timer/Counter which are not addressed by the 6666 FSC. These functions include Common B via A, Measuring Time, Trigger Level (DC coupling), Trigger Sensitivity (AC coupling), Input Coupling, Trigger Slope, and Input Attenuation.

RANGE

This field specifies the Channel.

- ChA Channel A
- ChB Channel B
- COM Common B via A
- *blank*

Rules:

- The M666 statement is ignored under the following conditions:
- The RANGE field specifies Channel B and the 6666 FSC specifies Frequency A, Period A, Voltage Max A, or Voltage Min A (6666 MOD3 field is FA, PA, MX, or MN respectively).
- The RANGE field specifies Common B via A and the 6666 FSC specifies a measurement function other than Time Interval A-B (6666 MOD3 field is not TI).
- The 6666 FSC specifies Frequency C (6666 MOD3 field is FC).

NOMINAL

This field specifies one the following:

- Measuring Time entered as: *numeric*[*prefix*]T. Allowed values are: 0 or 10 ms to 10s with a resolution of 10 ms. 0 selects SINGLE-measuring mode.
- "*" Reset to defaults
- *blank*

Rules:

- Measuring Time is not channel specific. It may be specified in a separate M666 statement or in conjunction with a channel A, channel B, or Common B via A specification. Either way, the last Measuring Time specification prior to a 6666 statement is used.
- The PM 6666 truncates all values to the nearest 10 ms. For example specifying 7.34567T is the same as specifying 7.34T.

TOLERANCE

This field specifies one of the following:

- The Channel A or B Trigger Sensitivity or Level entered as *numeric*[*prefix*]V.
- *blank*Auto Level (default) or not applicable.

Rules:

MOD2 Field	CON Field	Allowed values TOLERANCE	Resolution field
AC	X1	20 mV, 50 mV, 100 mV	NA
AC	X10	0.2 V, 0.5V, 1.0 V	NA
DC	X1	-5.10 V to +5.10 V	0.02 V
DC	X10	-51.0 V to +51.0 V	0.2 V

- The TOLERANCE field specifies the channel A trigger sensitivity or level when the RANGE field specifies Channel A or Common B via A.
- The TOLERANCE field specifies the channel B trigger sensitivity or level when the RANGE field specifies Channel B.
- The TOLERANCE field must be blank when the RANGE field is blank.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel A or Common B via A.
- Auto Level causes the attenuation, and trigger sensitivity or level to be automatically controlled for both Input A and Input B.
- The TOLERANCE field specification is ignored when the 6666 FSC specifies Auto Level (6666 MOD2 field is not blank).

MOD1

This field specifies one of the following:

- The Channel B Trigger Sensitivity or Level entered as *numeric*[*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

MOD2	CON	Allowed values TOLERANCE field	Allowed values MOD1	Resolution field
AC	X1	20 mV, 50 mV, 100 mV	20 mV, 50 mV, 100 mV	NA
AC	X10	0.2 V, 0.5 V, 1.0 V	0.2 V, 0.5 V, 1.0 V	NA
DC	X1	-5.10 V to +5.10 V	-5.10 V to +5.10 V	0.02 V
DC	X10	-51.0 V to +51.0 V	-51.0 V to +51.0 V	0.2 V

- The MOD1 field may specify the channel B trigger level or sensitivity only when the RANGE field specifies Common B via A (COM).
- The MOD1 field must be blank when the RANGE field is blank or Auto Level is specified (TOLERANCE field is blank).
- The MOD1 field specification is ignored when the 6666 FSC specifies Auto Level (6666 MOD2 field is not blank).

MOD2

This field specifies the input coupling:

- AC
- DC
- *blank*

Default Coupling

6666 MOD3 Field	6666 MOD1 Field	Coupling
FA (Frequency A)	NA	AC
FC (Frequency C)	NA	NA
PA (Period A)	NA	AC
FR (Ratio A/B)	NA	AC
TI (Time Interval A-B)	NA	DC
MX (Voltage Max A)	<100 Hz ≥100 Hz	DC
MN (Voltage Min A)	<100 Hz ≥100 Hz	DC

Rules:

- Default values are used when the 6666 FSC does not specify the input coupling (6666 MOD2 field is blank) and one of the following conditions exists:
  1. No M666 statement has been executed.
  2. The last M666 statement executed was a M666 Reset.
  3. The M666 MOD2 field is blank and the M666 RANGE field specifies Channel A, Channel B, or Common B via A.
- The MOD2 field must be blank when the RANGE field is blank.
- The MOD2 field must specify AC when the TOLERANCE field specifies the trigger sensitivity.
- The MOD2 field must specify DC when the TOLERANCE field specifies the trigger level.
- The MOD2 field specification is ignored when the 6666 FSC specifies the input coupling (6666 MOD2 field is not blank).

MOD3

This field specifies the trigger slope:

- + Positive, Channel A or B
- \- Negative, Channel A or B
- ++ Positive Channel A and B
- +- Positive Channel A, Negative Channel B
- -+ Negative Channel A, Positive Channel B
- -- Negative Channel A and B
- *blank*

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel A (CHA) or Channel B (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common B via A (COM).
- The MOD3 field specification is ignored when the 6666 FSC specifies the trigger slope (6666 MOD2 field is not blank).

MOD4

This field is not used.

CON

This field specifies the Attenuation. Legal entries are:

- X1 (default)
- X10
- *blank*

Rules:

- The leading "X" is optional.
- The CON field must be blank when the RANGE is blank.
- The CON field must not be blank when the TOLERANCE field specifies the trigger sensitivity or level.
- The CON field specification is ignored when the 6666 FSC specifies Auto Level (6666 MOD2 field is not blank).

Example

Refer to 6666 FSC.

6680

Instrument FSC

Description

The 6680 FSC programs the Philips PM 6680 Timer/Counter to measure frequency, frequency ratio, period, time interval, phase, pulse width, duty factor, rise and fall time, voltage min and max, and voltage peak-to- peak. Not all PM 6680 capabilities are supported. To program unsupported functions, use the IEEE FSC.

Note

The 6680 FSC may also be used to control a PM 6681. This capability allows a PM 6680 based procedure to be executed without modification when a PM 6681 is configured. If the C channel is used, the pre-scaler model must be the same.Parameters

The following table shows the relationship between the supported PM 6680 measurement functions and the FSC fields listed.

Function	MOD3	Nominal	MOD1
Frequency A	FA	10^{-10} Hz to 225 MHz	60 mV pp to 100 Vpp 30 mV p to 50 Vp 22 mV rms to 35 V rms
Frequency C (Opt PM 9621)	FC	70 MHz to 900 MHz >900 MHz to 1.1 GHz >1.1 GHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm 15 mV to 12 V -24 dBm to +35 dBm 40 mV to 12 V -15 dBm to +35 dBm
Frequency C (Opt PM 9624)	FC	100 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 2.7 GHz	20 mV to 12 V -21 dBm to +35 dBm 10 mV to 12 V -27 dBm to +35 dBm 20 mV to 12 V -21 dBm to +35 dBm
Frequency C (Opt PM 9625)	FC	150 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 3.7 GHz >3.7 GHz to 4.2 GHz >4.2 GHz to 4.5 GHz	20 mV to 1 V -21 dBm to +13 dBm 10 mV to 1 V -27 dBm to +13 dBm 15 mV to 1 V -24 dBm to +13 dBm 25 mV to 1 V -19 dBm to +13 dBm 50 mV to 1 V -13 dBm to +13 dBm

Function	MOD3	Nominal	MOD1
Ratio A/B	FR	10^{-9} to 10^{-5}	60 mVpp to 100 Vpp 30 mVp to 50 Vp 2 2 mV rms to 35 V rms
Period A	PA	6 ns to 10^{10} s	60 mV pp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Time Interval A-B	TI	0 ns to 10^{10} s	60 mVpp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Phase A-B	PR	-180° to +360°	0.01 Hz to 160 MHz
Pulse Width A	WA	3 ns to 5 ns >5 ns to 10^{10} s	90 mVpp to 100 Vpp 45 mVp to 50 Vp 60 mV pp to 100 Vpp 30 mV p to 50 Vp
Duty Factor A	DA	0 to 1	0.01 Hz to 160 MHz
Rise/Fall Time A	RF	3 ns to 10^{10} s	500 mVpp to 100 Vpp 250 mVp to 50 Vp
Voltage Max A	MX	-51 V to 51 V -51 Vp to 51 Vp	*blank* (DC) 100 Hz to 120 MHz
Voltage Min A	MN	-51 V to 51 V -51 Vp to 51 Vp	*blank* (DC) 100 Hz to 120 MHz
Voltage Peak-to-Peak A	PP	0 Vpp to 102 Vpp	100 Hz to 120 MHz

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as [*numeric*][*prefix*]H.
- Frequency Ratio entered as [*numeric*][*prefix*]H/H.
- Period entered as [*numeric*][*prefix*]T.
- Time Interval entered as [*numeric*][*prefix*]T.
- Phase entered as [*numeric*][*prefix*]deg.
- Pulse Width entered as [*numeric*][*prefix*]T.

- Duty Factor entered as [*numeric*][*prefix*]DF.
- Rise or Fall Time entered as [*numeric*][*prefix*]T.
- Voltage max or min entered as [*numeric*][*prefix*]V or Vp.
- Voltage peak-to-peak entered as [*numeric*][*prefix*]Vpp.
- Reset entered as *.

Rules:

- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For measurements of frequency, frequency ratio, period, time interval, pulse width and rise/ fall time, this field specifies the expected amplitude. For measurements of phase, duty factor, voltage min/max of AC and voltage peak-to-peak, this field specifies the expected frequency. For measurements of voltage min/max of DC, this field should be blank.

- Voltage (RMS) entered as: *numeric*[*prefix*]V
- Voltage (Peak) entered as: *numeric*[*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: *numeric*[*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: *numeric*[*prefix*]D
- Frequency entered as *numeric*[*prefix*]H.
- *blank*

Rules:

For Ratio A/B (FR) measurements, the MOD1 field specifies the expected amplitude on channel A, not channel B.

MOD2

This field specifies the trigger slope as follows:

- +A Positive slope triggering, AC coupled
- -A Negative slope triggering, AC coupled
- +D Positive slope triggering, DC coupled
- -D Negative slope triggering, DC coupled
- *blank*

Rules:

- When the MOD2 field is blank, the trigger slope and coupling for channel A and B default to values determined by the measurement function unless otherwise specified using the M680 FSC.
- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency C (FC).

MOD3

This field specifies the measurement function:

- FA Frequency A
- FC Frequency C
- PA Period A
- FR Ratio A/B
- TI Time Interval A to B
- WA Pulse Width A
- RF Rise or Fall Time A
- PR Phase A Relative to B
- DA Duty Factor A
- MX Voltage Max A
- MN Voltage Min A
- PP Voltage Peak-to-Peak A

Rules:

- When MOD 3 is “RF” and channel A trigger slope is positive, a rise time measurement is performed. When channel A trigger slope is negative a fall time measurement is performed.
- The MOD3 field may specify Frequency C (FC) only when a High Frequency Input, option PM 9621, PM 9624, or PM 9625 is installed. This is indicated in the CONFIG.DAT file as 6680(21), 6680(24), or 6680(25) respectively.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Input Impedance
- L 50 Ω Input Impedance
- 2W 2-Wire

Rules:

- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC).
- 2W is allowed for compatibility with previous versions of MET/CAL.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE    MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M680         *
  1.002  6680         *
# ----- Frequency A -----
  1.003  M680   ChA                                100kH
  1.004  6680         10.000kH       1%            1Vpp           +A FA
# ----- Frequency C -----
  2.001  6680         100MH          0.1%          -1D            +A FC    L
# ----- Period A -----
  3.001  M680         *
  3.002  6680         1.000mT        0.003U        5V             +A PA
# ----- Ratio A/B -----
  4.001  M680   ChA                                               AC
  4.002  M680   ChB                                               DC
  4.003  6680         10H/H          1%            1Vpp                FR
# ----- Time Interval A to B -----
  5.001  M680   COM   20T            0.2V          0.8V           DC ++    X1
  5.002  6680         10.00T         0.02U         1Vpp              TI
# ----- Pulse Width A -----
  6.001  M680         *
  6.002  6680         300uT          5%            5Vp            -A WA
# ----- Rise Time A -----
  7.002  6680         100nT          5%            1Vpp              RF
# ----- Phase A relative to B -----
  8.001  M680         *
  8.002  6680         30deg          1U            10kH              PR    L
# ----- Duty Factor A -----
  9.001  6680         0.30df         2%            100H              DA
```

M680

Auxiliary Instrument Setup FSC

Description

The M680 FSC provides the additional program functions for Channel A and Channel B of the Fluke/Philips PM 6680 Timer/Counter which are not addressed by the 6680 FSC. These functions include Common B via A, Measuring Time, Trigger Level, Trigger Slope, Input Coupling, Input Impedance, and Input Attenuation.

RANGE

This field specifies the Channel.

- ChA Channel A
- ChB Channel B
- COM Common B via A
- *blank*

Rules:

The M680 statement is ignored under the following conditions:

- The RANGE field specifies Channel B and the 6680 FSC specifies Frequency A, Period A, Pulse Width A, Voltage Max A, or Voltage Min A (6680 MOD3 field is FA, PA, WA, MX, or MN respectively).
- The RANGE field specifies Common B via A and the 6680 FSC specifies a measurement function other than Time Interval A-B (6680 MOD3 field is not TI).
- The 6680 FSC specifies Frequency C (6680 MOD3 field is FC).

NOMINAL

This field specifies one the following:

- Measuring Time entered as: *numeric*[*prefix*]T.
- "*" Reset to defaults
- *blank*

Rules:

- Allowed values for measuring time are: 0.8, 1.6, 3.2, 6.4, 12.8 and 50 µs to 400s.
- Measuring Time is not channel specific. It may be specified in a separate M680 statement or in conjunction with a channel A or channel B specification. Either way, the last Measuring Time specification prior to a 6680 statement is used.

TOLERANCE

This field specifies one of the following:

- The Channel A or B Trigger Level entered as [*numeric*][*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

CON Field	Allowed values TOLERANCE	Resolution field
X1	-5.10 V to +5.10 V	0.02 V
X10	-51.0 V to +51.0 V	0.2 V

- The TOLERANCE field specifies the channel A trigger level when the RANGE field specifies Channel A or Common B via A.
- The TOLERANCE field specifies the channel B trigger level when the RANGE field specifies Channel B.
- The TOLERANCE field must be blank when the RANGE field is blank.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel A or Common B via A.
- Auto Level causes the attenuation, and trigger level to be automatically controlled for both Input A and Input B.
- The TOLERANCE field specification is ignored when the 6680 FSC specifies Auto Level (6680 MOD2 field is not blank).
- If the TOLERANCE field does not contain a value, the value is taken from memory register MEM.

MOD1

This field specifies one of the following:

- The Channel A Low-Pass Filter entered as: *numeric*[*prefix*]H.
- The Channel B Trigger Level entered as [*numeric*][*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

CON Field	Allowed values TOLERANCE	Allowed values MOD1 field	Resolution MOD1 field
X1	-5.10 V to +5.10 V	-5.10 V to +5.10 V	0.02 V
X10	-51.0 V to +51.0 V	-51.0 V to +51.0 V	0.2 V

- The MOD1 field may specify the channel A low-pass filter only when the RANGE field specifies channel A.
- When the MOD1 field specifies the channel A low-pass filter, the value must be 100 kHz.
- The MOD1 field may specify the channel B trigger level only when the RANGE specifies Common B via A.
- The MOD1 field must be blank when the RANGE field is blank.
- The MOD1 field specification is ignored when the MOD1 field specifies the channel B trigger level and the 6680 FSC specifies Auto Level (6680 MOD2 field is not blank).
- If the MOD1 field does not contain a value, the value is taken from memory register MEM.

MOD2

This field specifies the input coupling:

- AC
- DC
- *blank*

Default Coupling

6680 MOD3 Field	6680 MOD1 Field	Coupling
FA (Frequency A)	NA	AC
FC (Frequency C)	NA	NA
PA (Period A)	NA	AC
FR (Ratio A/B)	NA	AC
WA (Pulse Width A)	NA	DC
TI (Time Interval A-B)	NA	DC
PR (Phase A-B)	NA	AC
DA (Duty Factor A)	NA	DC
RF (Rise Time A)	NA	DC
MX (Voltage Max A)	<100 Hz ≥100 Hz	DC AC
MN (Voltage Min A)	<100 Hz ≥100 Hz	DC AC

Rules:

- Default values are used when the 6680 FSC does not specify the input coupling (6680 MOD2 field is blank) and one of the following conditions exists:
  1. No M680 statement has been executed.
  2. The last M680 statement executed was a M680 Reset.
  3. The M680 MOD2 field is blank and the M680 RANGE field specifies Channel A, Channel B, or Common B via A.
- The MOD2 field must be blank when the RANGE field is blank.
- The MOD2 field must specify AC or DC when TOLERANCE field specifies the trigger level.
- The MOD2 field specification is ignored when the 6680 FSC specifies the input coupling (6680 MOD2 field is not blank).

MOD3

This field specifies the trigger slope:

+	Positive, Channel A or B
-	Negative, Channel A or B
++	Positive Channel A and B
+-	Positive Channel A, Negative Channel B
-+	Negative Channel A, Positive Channel B
--	Negative Channel A and B
blank	

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel A (CHA) or Channel B (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common B via A (COM).
- The MOD3 field specification is ignored when the 6680 FSC specifies the trigger slope (6680 MOD2 field is not blank).

MOD4

This field specifies that an external reference oscillator is to be used:

- X External Reference Oscillator
- *blank*

Rules:

A M680 reset statement, NOMINAL field is an "*", must be used to re-select the internal reference once the external reference is selected.

CON

This field specifies the Attenuation. Legal entries are:

- X1 (default)
- X10
- *blank*

Rules:

- The leading "X" is optional.
- The CON field must be blank when the RANGE is blank. The CON field must not be blank when the TOLERANCE field specifies the trigger level.
- The CON field specification is ignored when the 6680 FSC specifies Auto Level (6680 MOD2 field is not blank).

Example

Refer to 6680 FSC.

6681

Instrument FSC

Description

The 6681 FSC programs the Philips PM 6681 Timer/Counter to measure frequency, frequency ratio, period, time interval, phase, pulse width, duty factor, rise and fall time, voltage min and max, and voltage peak-to-peak. All PM 6681 capabilities are not supported. To program unsupported functions, use the IEEE FSC.

Parameters

The following table shows the relationship between the supported PM 6681 measurement functions and the FSC fields listed.

Function	MOD3	Nominal	MOD1
Frequency A	FA	10^{-10} Hz to 300 MHz	60 mV pp to 100 Vpp 30 mV p to 50 Vp 22 mV rms to 35 rms
Frequency C (PM 6681 Opt PM 9621)	FC	70 MHz to 900 MHz >900 MHz to 1.1 GHz >1.1 GHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm 15 mV to 12 V -24 dBm to +35 dBm 40 mV to 12 V -15 dBm to +35 dBm
Frequency C (PM 6681 Opt PM 9624)	FC	100 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 2.7 GHz	20 mV to 12 V -21 dBm to +35 dBm 10 mV to 12 V -27 dBm to +35 dBm 20 mV to 12 V -21 dBm to +35 dBm
Frequency C (PM 6681 Opt PM 9625)	FC	150 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 3.7 GHz >3.7 GHz to 4.2 GHz >4.2 GHz to 4.5 GHz	20 mV to 1 V -21 dBm to +13 dBm 10 mV to 1 V -27 dBm to +13 dBm 15 mV to 1 V -24 dBm to +13 dBm 25 mV to 1 V -19 dBm to +13 dBm 50 mV to 1 V -13 dBm to +13 dBm

Function	MOD3	Nominal	MOD1
Frequency C (PM 6681 Opt PM 9638)	FC	300 MHz to <500 MHz 500 MHz to 3.0 GHz >3.0 GHz to 4.5 GHz >4.5 GHz to 6.0 GHz >6.0 GHz to 8.0 GHz	20 mV to 7 V -21 dBm to +30 dBm 10 mV to 7 V -27 dBm to +30 dBm 20 mV to 7 V -21 dBm to +30 dBm 40 mV to 7 V -15 dBm to +30 dBm 80 mV to 7 V -9 dBm to +30 dBm
Ratio A/B	FR	10^{-9} to 10^{-15}	60 mVpp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Period A	PA	6 ns to 10^{-10}s	60 mVpp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Time Interval A-B	TI	0 ns to 10^{-10}s	60 mVpp to 100 Vpp 30 mVp to 50 Vp 22 mV rms to 35 V rms
Phase A-B	PR	-180° to +360°	0.01 Hz to 160 MHz
Pulse Width A	WA	3 ns to 5 ns >5 ns to 10^{-10}s	90 mVpp to 100 Vpp 45 mVp to 50 Vp- 60 mVpp to 100 Vpp 30 mVp to 50 Vp
Duty Factor A	DA	0 to 1	0.01 Hz to 160 MHz
Rise/Fall Time A	RF	y	250 mVpp to 100 Vpp 125 mVp to 50 Vp
Voltage Max A	MX	-51 V to 51 V	*blank* (DC) 1 Hz to 120 MHz
Voltage Min A	MN	-51 V to 51 V	*blank* (DC) 1 Hz to 120 MHz
Voltage Peak-to-Peak A	PP	0 Vpp to 102 Vpp	1 Hz to 120 MHz

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as [*numeric*][*prefix*]H.
- Frequency Ratio entered as [*numeric*][*prefix*]H/H.

- Period entered as [*numeric*][*prefix*]T.
- Time Interval entered as [*numeric*][*prefix*]T.
- Phase entered as [*numeric*][*prefix*]deg.
- Pulse Width entered as [*numeric*][*prefix*]T.
- Duty Factor entered as [*numeric*][*prefix*]DF.
- Rise or Fall Time entered as [*numeric*][*prefix*]T.
- Voltage max or min entered as [*numeric*][*prefix*]V or Vp.
- Voltage peak-to-peak entered as [*numeric*][*prefix*]Vpp.
- Reset entered as *.

Rules:

If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For measurements of frequency, frequency ratio, period, time interval, pulse width and rise/ fall time, this field specifies the expected amplitude. For measurements of phase, duty factor, voltage min/max of AC and voltage peak-to-peak, this field specifies the expected frequency. For measurements of voltage min/max of DC, this field should be blank.

- Voltage (RMS) entered as: *numeric*[*prefix*]V
- Voltage (Peak) entered as: *numeric*[*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: *numeric*[*prefix*]Vpp
- Voltage (into 50Ω, dBm) entered as: *numeric*[*prefix*]D
- Frequency entered as *numeric*[*prefix*]H.
- *blank*

Rules:

- For Ratio A/B (FR) measurements, the MOD1 field specifies the expected amplitude on channel A, not channel B.

MOD2

This field specifies the trigger slope as follows:

- +A Positive slope triggering, AC coupled
- -A Negative slope triggering, AC coupled
- +D Positive slope triggering, DC coupled
- -D Negative slope triggering, DC coupled
- *blank*

Rules:

- When the MOD2 field is blank, the trigger slope and coupling for channel A and B default to values determined by the measurement function unless otherwise specified using the M681 FSC.
- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency C (FC).

MOD3

This field specifies the measurement function:

FA	Frequency A
FC	Frequency C
PA	Period A
FR	Ratio A/B
TI	Time Interval A to B
WA	Pulse Width A
RF	Rise or Fall Time A
PR	Phase A Relative to B
DA	Duty Factor A
MX	Voltage Max A
MN	Voltage Min A
PP	Voltage Peak-to-Peak A

Rules:

- When MOD3 is “RF” and channel A trigger slope is positive, a rise time measurement is performed. When channel A trigger slope is negative a fall time measurement is performed.
- The MOD3 field may specify Frequency C (FC) only when a High Frequency Input, option PM 9621, PM 9624, or PM 9625, or PM 9638 Option 201, is installed. This is indicated in the CONFIG.DAT file as 6681(21), 6681(24), or 6681(25) respectively.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Input Impedance
- L 50 Ω Input Impedance
- 2W 2-Wire

Rules:

- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC).
- 2W is allowed for compatibility with previous versions of MET/CAL.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M681         *
  1.002  6681         *
# ----- Frequency A -----
  1.003  M681   ChA                                100kH
  1.004  6681         10.000kH       1%            1Vpp           +A FA
# ----- Frequency C -----
  2.001  6681         100MH          0.1%          -1D            +A FC    L
# ----- Period A -----
  3.001  M681         *
  3.002  6681         1.000mT        0.003U        5V             +A PA
# ----- Ratio A/B -----
  4.001  M681   ChA                                               AC
  4.002  M681   ChB                                               DC
  4.003  6681         10H/H          1%            1Vpp              FR
# ----- Time Interval A to B -----
  5.001  M681   COM   20T            0.2V          0.8V           DC ++    X1
  5.002  6681         10.00T         0.02U         1Vpp              TI
# ----- Pulse Width A -----
  6.001  M681         *
  6.002  6681         300uT          5%            5Vp            -A WA
# ----- Rise Time A -----
  7.002  6681         100nT          5%            1Vpp              RF
# ----- Phase A relative to B -----
  8.001  M681         *
  8.002  6681         30deg          1U            10kH              PR    L
# ----- Duty Factor A -----
  9.001  6681         0.30df         2%            100H              DA
```

M681

Auxiliary Instrument Setup FSC

Description

The M681 FSC provides the additional program functions for Channel A and Channel B of the Fluke/Philips PM 6681 Timer/Counter which are not addressed by the 6681 FSC. These functions include Common B via A, Measuring Time, Trigger Level, Trigger Slope, Input Coupling, Input Impedance, and Input Attenuation.

RANGE

This field specifies the Channel.

- ChA Channel A
- ChB Channel B
- COM Common B via A
- *blank*

Rules:

- The M681 statement is ignored under the following conditions:
  1. The RANGE field specifies Channel B and the 6681 FSC specifies Frequency A, Period A, Pulse Width A, Voltage Max A, or Voltage Min A (6681 MOD3 field is FA, PA, WA, MX, or MN respectively).
  2. The RANGE field specifies Common B via A and the 6681 FSC specifies a measurement function other than Time Interval A-B (6681 MOD3 field is not TI).
  3. The 6681 FSC specifies Frequency C (6681 MOD3 field is FC).

NOMINAL

This field specifies one the following:

- Measuring Time entered as: *numeric*[*prefix*]T.
- "*" Reset to defaults
- *blank*

Rules:

- Allowed values for measuring time are: 0.8, 1.6, 3.2, 6.4, and 12.8 µs and 50 µs to 400s.
- Measuring Time is not channel specific. It may be specified in a separate M681 statement or in conjunction with a channel A or channel B specification. Either way, the last Measuring Time specification prior to a 6681 statement is used.

TOLERANCE

This field specifies one of the following:

- The Channel A or B Trigger Level entered as [*numeric*][*prefix*]V.
- *Blank* Auto Level (default) or not applicable.

Rules:

CON Field	Tolerance Allowed values	Resolution field
X1	-5.10 V to +5.10 V	0.02 V
X10	-51.0 V to +51.0 V	0.2 V

- The TOLERANCE field specifies the channel A trigger level when the RANGE field specifies Channel A or Common B via A.
- The TOLERANCE field specifies the channel B trigger level when the RANGE field specifies Channel B.
- The TOLERANCE field must be blank when the RANGE field is blank.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel A or Common B via A.
- Auto Level causes the attenuation and trigger level to be automatically controlled for both Input A and Input B.
- The TOLERANCE field specification is ignored when the 6681 FSC specifies Auto Level (6681 MOD2 field is not blank).
- If the TOLERANCE field does not contain a value, the value is taken from memory register MEM.

MOD1

This field specifies one of the following:

- The Channel A Low-Pass Filter entered as: *numeric*[*prefix*]H.
- The Channel B Trigger Level entered as [*numeric*][*prefix*]V.
- *blank* Auto Level (default) or not applicable.

Rules:

CON Field	Allowed values Tolerance field	Allowed values MOD1	Resolution field
X1	-5.10 V to +5.10 V	-5.10 V to +5.10 V	0.02 V
X10	-51.0 V to +51.0 V	-51.0 V to +51.0 V	0.2 V

- The MOD1 field may specify the channel A low-pass filter only when the RANGE field specifies channel A.
- When the MOD1 field specifies the channel A low-pass filter, the value must be 100 kHz.
- The MOD1 field may specify the channel B trigger level only when the RANGE specifies Common B via A.
- The MOD1 field must be blank when the RANGE field is blank or Auto Level is specified by the 6681 FSC
- MOD2 field is not blank). The MOD1 field specification is ignored when the MOD1 field specifies the channel B trigger sensitivity or level and the 6681 FSC specifies Auto Level (6681 MOD2 field is not blank).
- If the MOD1 field does not contain a value, the value is taken from memory register MEM.

MOD2

This field specifies the input coupling:

- AC
- DC
- *blank*

Rules:

- Default Coupling

6681 MOD3 Field	6681 MOD1 Field	Coupling
FA (Frequency A)	NA	AC
FC (Frequency C)	NA	NA
PA (Period A)	NA	AC
FR (Ratio A/B)	NA	AC
WA (Pulse Width A)	NA	DC
TI (Time Interval A-B)	NA	DC
PR (Phase A-B)	NA	AC
DA (Duty Factor A)	NA	DC
RF (Rise Time A)	NA	DC
MX (Voltage Max A)	<100 Hz	DC
	≥100 Hz	AC
MN (Voltage Min A)	<100 Hz	DC
	≥1 00 Hz	AC

Rules:

- Default values are used when the 6681 FSC does not specify the input coupling (6681 MOD2 field is blank) and one of the following conditions exists:
  1. No M681 statement has been executed.
  2. The last M681 statement executed was a M681 Reset.
  3. The M681 MOD2 field is blank and the M6816681 RANGE field specifies Channel A, Channel B, or Common B via A.
- The MOD2 field must be blank when the RANGE field is blank.
- The MOD2 field must specify AC or DC when TOLERANCE field specifies the trigger level.
- The MOD2 field specification is ignored when the 6681 FSC specifies the input coupling (6681 MOD2 field is not blank).

MOD3

This field specifies the trigger slope:

- + Positive, Channel A or B
- - Negative, Channel A or B
- ++ Positive Channel A and B
- +- Positive Channel A, Negative Channel B
- -+ Negative Channel A, Positive Channel B
- -- Negative Channel A and B
- *blank*

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel A (CHA) or Channel B (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common B via A (COM).
- The MOD3 field specification is ignored when the 6681 FSC specifies the trigger slope (6681 MOD2 field is not blank).

MOD4

This field specifies that an external reference oscillator is to be used:

- X External Reference Oscillator
- *blank*

Rules:

- A M681 reset statement, NOMINAL field is an "*", must be used to re-select the internal reference once the external reference is selected.

CON

This field specifies the Attenuation. Legal entries are:

- X1(default)
- X10
- *blank*

Rules:

- The leading "X" is optional.
- The CON field must be blank when the RANGE is blank. The CON field must not be blank when the TOLERANCE field specifies the trigger level.
- The CON field specification is ignored when the 6681 FSC specifies Auto Level (6681 MOD2 field is not blank).

Example

Refer to 6681 FSC.

6685

Instrument FSC

Description

The 6685 FSC programs the Philips PM 6685 Timer/Counter to measure frequency, frequency ratio, period, pulse width, and duty factor.

Parameters

The following table shows the relationship between the supported PM 6685 measurement functions and the FSC fields listed.

Function	MOD3	Nominal Value	MOD1 Value
Frequency A	FA	10 Hz to 300 MHz	30 mVpp to 70 Vpp 15 mVp to 35 Vp 10 mV rms to 25 V rms
Frequency C (PM 6685 Opt PM 9621)	FC	70 MHz to 900 MHz >900 MHz to 1.1 GHz >1.1 GHz to 1.3 GHz	10 mV to 12 V -27 dBm to +35 dBm 15 mV to 12 V -24 dBm to +35 dBm 40 mV to 12 V -15 dBm to +35 dBm
Frequency C (PM 6685 Opt PM 9624) (905 Option 10)	FC	100 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 2.7 GHz	20 mV to 12 V -21 dBm to +35 dBm 10 mV to 12 V -27 dBm to +35 dBm 20 mV to 12 V -21 dBm to +35 dBm
Frequency C (PM 6685 Opt PM 9625)	FC	150 MHz to <300 MHz 300 MHz to 2.5 GHz >2.5 GHz to 3.7 GHz	20 mV to 1 V -21 dBm to +13 dBm 10 mV to 1 V -27 dBm to +13 dBm 15 mV to 1 V -24 dBm to +13 dBm

Function	MOD3	Nominal Value	MOD1 Value
		>3.7 GHz to 4.2 GHz >4.2 GHz to 4.5 GHz	25 mV to 1 V -19 dBm to +13 dBm 50 mV to 1 V -13 dBm to +13 dBm
Frequency C (PM 6681 Opt PM 9638)	FC	300 MHz to <500 MHz 500 MHz to 3.0 GHz >3.0 GHz to 4.5 GHz >4.5 GHz to 6.0 GHz >6.0 GHz to 8.0 GHz	20 mV to 7 V -21 dBm to +30 dBm 10 mV to 7 V -27 dBm to +30 dBm 20 mV to 7 V -21 dBm to +30 dBm 40 mV to 7 V -15 dBm to +30 dBm 80 mV to 7 V -9 dBm to +30 dBm
Ratio C/A	FR	10^{-7} to 10^{-10}	30 mVpp to 70 Vpp 15 mVp to 35 Vp 10 mV rms to 25 V rms
Period A	PA	6 ns to 100 ms	30 mVpp to 70 Vpp 15 mVp to 35 Vp 10 V rms to 25 V rms
Pulse Width A	WA	3 ns to 10 ms	100 mVpp to 70 Vpp 50 mVp to 35 Vp
Duty Factor A	DA	0 to 1	50 Hz to 160 MHz

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as [*numeric*][*prefix*]H.
- Frequency Ratio entered as [*numeric*][*prefix*]H/H.
- Period entered as [*numeric*][*prefix*]T.
- Pulse Width entered as [*numeric*][*prefix*]T.
- Duty Factor entered as [*numeric*][*prefix*]df.
- Reset entered as *.

Rules:

- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For all measurements except duty factor, this field specifies the expected amplitude. For measurements of duty factor, this field specifies the expected frequency.

- Voltage (RMS) entered as: *numeric*[*prefix*]V
- Voltage (Peak) entered as: *numeric*[*prefix*]Vp
- Voltage (Peak-to-Peak) entered as: *numeric*[*prefix*]Vpp
- Voltage (into 50 Ω, dBm) entered as: *numeric*[*prefix*]D
- Frequency entered as *numeric*[*prefix*]H.

Rules:

- For Ratio C/A (FR) measurements, the MOD1 field specifies the expected amplitude on channel A, not channel C.

MOD2

This field specifies the trigger slope as follows:

- +A Positive
- -A Negative
- *blank*

Rules:

- When the MOD2 field is blank, the trigger slope defaults to positive unless specified otherwise Pulse Width A using the M685 FSC.
- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency C (FC).

MOD3

This field specifies the measurement function:

FA	Frequency A (default)
FC	Frequency C
FR	Ratio C/B
PA	Period A
WA	Pulse Width A
DA	Duty Factor A

Rules:

The MOD3 field may specify Frequency C (FC) and Ratio C/A (FR) only when a High Frequency Input, option PM 9621, PM 9624, or PM 9625, or PM 9638 or 905 is installed. This is indicated in the CONFIG.DAT file as 6685(21), 6685(24), or 6685(25) respectively.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection:

- *blank* 1 MΩ Input Impedance
- L 50Ω Input Impedance
- 2W 2-Wire

Rules:

- For Ratio C/A (FR) measurements, the CON field specifies the impedance of the channel A input, not the channel C input.
- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC).
- 2W is allowed for compatibility with previous versions of MET/CAL.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Example

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M685         *
  1.002  6685         *
# ----- Frequency A -----
  1.002  M685                        100mV         100kH
  1.003  6685         10kH           1%            1Vpp              FA
# ----- Frequency C -----
  2.001  6685         10MH           0.1%          +2D            +A FC    L
# ----- Period A -----
  3.001  M685         *
  2.002  6685         1.000mT        0.003U        5V                PA
# ----- Ratio C/A -----
  3.003  6685         10H/H          1%            1Vpp              FR
# ----- Pulse Width A -----
  5.002  6685         300uT          5%            5Vp            -S WA
# ----- Duty Factor A -----
  6.003  6685         0.30df         2%            100H              DA
```

M685

Auxiliary Instrument Setup FSC

Description

The M685 FSC provides the additional program functions for Channel A of the Fluke/Philips PM 6685 Timer/Counter which are not addressed by the 6685 FSC. These functions include Measuring Time, and Channel A Trigger Sensitivity and Low-pass Filter.

RANGE

This field specifies the Channel.

- ChA   Channel A
- *blank*

Rules:

- ChA is inserted automatically when the RANGE field is left blank and the TOLERANCE field specifies the channel A trigger sensitivity or the MOD1 field specifies the channel A low-pass filter.
- The M685 statement is ignored when the 6685 FSC specifies Frequency C (6685 MOD3 field is FC).

NOMINAL

This field specifies one of the following:

- Measuring Time entered as *numeric*[*prefix*]T. Allowed values are 800 ns, 1.6 µs, 3.2 µs, 6.4 µs, 12.8 µs, and 50 µs to 400s.
- "*"   Reset to defaults
- *blank*

TOLERANCE

This field specifies one of the following:

- Channel A Trigger Sensitivity entered as [*numeric*][*prefix*]V.
- *blank*   Auto Level (default)

Rules:

- Allowed values for trigger sensitivity are 27.12 mV to 75.4 V.
- The TOLERANCE field specification is ignored when the 6685 FSC specifies Auto Level (6685 MOD2 field is not blank).

MOD1

This field specifies one of the following:

- Channel A low-pass filter entered as: *numeric*[*prefix*]H.
- *blank*

Rules:

- When the MOD1 field specifies the Channel A low-pass filter, the value must be 100 kHz.
- A M685 reset statement, NOMINAL field is an "*", must be used to disable the Channel A low-pass filter once it is enabled.

MOD2

This field is not used.

MOD3

This field specifies the Channel A trigger slope:

- \+ Positive (default)
- \- Negative
- *blank*

Rules:

- The MOD3 field specification is ignored when the 6685 FSC specifies the trigger slope (6685 MOD2 field is not blank).

MOD4

This field specifies that an external reference oscillator is to be used:

- X External Reference Oscillator
- *blank*

Rules:

- A M685 reset statement, NOMINAL field is an "*", must be used to re-select the internal reference once the external reference is selected.

CON

This field is not used.

Example

See 6685 FSC.

6690

Instrument FSC

Description

The 6690 FSC programs the Fluke PM 6690 Timer/Counter to measure frequency, frequency ratio, period, time interval, phase, pulse width, duty factor, rise and fall time, voltage min and max, and voltage peak-to-peak.

All PM 6690 capabilities are not supported. To program unsupported functions, use the SCPI or IEEE FSC.

Parameters

The following table shows the relationship between the supported PM 6690 measurement functions and the FSC fields listed.

Function	MOD3	NOMINAL	MOD1
Frequency A	FA	0.001 Hz to 300 MHz	30 mVpp to 10 Vpp (1)
Frequency C (PM 6690/6xx)	FC	100 MHz to 300 MHz 300 MHz to 2.5 GHz 2.5 GHz to 2.7 GHz 2.7 GHz to 3.0 GHz	20 mV to 12 V 10 mV to 12 V 20 mV to 12 V 40 mV to 12 V
Frequency C (PM 6690/7xx)	FC	0.2 GHz to 0.5 GHz 0.5 GHz to 3.0 GHz 3.0 GHz to 4.5 GHz 4.5 GHz to 6.0 GHz 6.0 GHz to 8.0 GHz	20 mV to 7 V 10 mV to 7 V 20 mV to 7 V 40 mV to 7 V 80 mV to 7 V
Frequency C (PM 6690/9xx)	FC	0.2 GHz to 0.5 GHz 0.5 GHz to 3.0 GHz 3.0 GHz to 4.5 GHz 4.5 GHz to 6.0 GHz 6.0 GHz to 8.0 GHz 8.0 GHz to 14.0 GHz	20 mV to 7 V 10 mV to 7 V 20 mV to 7 V 40 mV to 7 V 80 mV to 7 V ?? mV to 7 V
Period A	PA	3.3 ns to 1000 s	30 mVpp to 10 Vpp (1)
Ratio A/B	FR	1E-9 to 1E+11	30 mVpp to 10 Vpp (1)
Time Interval A-B	TI	0 ns to 1E+6 s	30 mVpp to 10 Vpp (1)

Function	MOD3	NOMINAL	MOD1
Pulse Width A	WA	1.6 ns to 1E+6 s	30 mVpp to 10 Vpp (1)
Rise/Fall Time A	RF	700 ps to 1000 s	30 mVpp to 10 Vpp (1)
Phase A-B	PR	-180 deg to +360 deg	0.01 Hz to 160 MHz
Duty Factor A	DA	0.000001 to 0.999999	0.1 Hz to 300 MHz
Voltage Max A	MX	-5 V to 5 V (1) -5 Vp to 5 Vp (1)	<blank> (DC) 1 Hz to 300 MHz
Voltage Min A	MN	-5 V to 5 V (1) -5 Vp to 5 Vp (1)	<blank> (DC) 1 Hz to 300 MHz
Vpp A	PP	0 Vpp to 10 Vpp (1)	1 Hz to 300 MHz

1. X1 attenuation. Multiply limits by 10 for X10 attenuation.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Frequency entered as *[<numeric>][<prefix>]H*.
- Frequency Ratio entered as *[<numeric>][<prefix>]H/H*.
- Period entered as *[<numeric>][<prefix>]T*.
- Time Interval entered as *[<numeric>][<prefix>]T*.
- Phase entered as *[<numeric>][<prefix>]deg*.
- Pulse Width entered as *[<numeric>][<prefix>]T*.
- Duty Factor entered as *[<numeric>][<prefix>]df*.
- Rise or Fall Time entered as *[<numeric>][<prefix>]T*.
- Voltage max or min entered as *[<numeric>][<prefix>]V* or *Vp*.
- Voltage peak-to-peak entered as *[<numeric>][<prefix>]Vpp*.
- Reset entered as *.

Rules:

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- If no NOMINAL field value is entered and all other fields are blank, an * is automatically inserted.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

For measurements of frequency, frequency ratio, period, time interval, pulse width and rise/fall time, this field specifies the expected amplitude. For measurements of phase, duty factor, voltage min/max of AC and voltage peak-to-peak, this field specifies the expected frequency. For measurements of voltage min/max of DC, this field should be blank.

- Voltage (RMS) entered as: *<numeric>[<prefix>]V*
- Voltage (Peak) entered as: *<numeric>[<prefix>]Vp*
- Voltage (Peak-to-Peak) entered as: *<numeric>[<prefix>]Vpp*
- Voltage (into 50 Ohms, dBm) entered as: *<numeric>[<prefix>]D*
- Frequency entered as *<numeric>[<prefix>]H*
- *<blank>*

Rules:

- For Ratio A/B (FR) measurements, the MOD1 field specifies the expected amplitude on channel A, not channel B.

MOD2

This field specifies the trigger slope as follows:

- +A Positive slope triggering, AC coupled
- -A Negative slope triggering, AC coupled
- +D Positive slope triggering, DC coupled
- -D Negative slope triggering, DC coupled
- *<blank>*

Rules:

- When the MOD2 field is blank, the trigger slope and coupling for channel A and B default to values determined by the measurement function unless otherwise specified using the M6690FSC.
- +A is inserted automatically in the MOD2 field when the MOD3 field specifies Frequency C (FC).

MOD3

This field specifies the measurement function:

- FA Frequency A
- FC Frequency C
- PA Period A
- FR Ratio A/B
- TI Time Interval A to B
- WA Pulse Width A
- RF Rise or Fall Time A
- PR Phase A Relative to B
- DA Duty Factor A
- MX Voltage Max A
- MN Voltage Min A
- PP Voltage Peak-to-Peak A

Rules:

- When MOD3 is "RF" and channel A trigger slope is positive, a rise time measurement is performed. When channel A trigger slope is negative a fall time measurement is performed.
- The MOD3 field may specify Frequency C (FC) only when a High Frequency Input, PM6690/6xx, PM6690/7xx, or PM6690/9xx is installed.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- *<blank>* 1 MOhm Input Impedance
- L 50 Ohm Input Impedance

Rules:

- L is inserted automatically in the CON field when the MOD3 field specifies Frequency C (FC).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2  3  4 CON
# ----- Reset -----
  1.001  M6690        *
  1.002  6690         *
# ----- Frequency A -----
  1.003  M6690  ChA                              100kH
  1.004  6690         10.000kH       1%          1Vpp            +A FA
# ----- Frequency C -----
  2.001  6690         100MH          0.1%        -1D             +A FC    L
# ----- Period A -----
  3.001  M6690        *
```

```
  3.002  6690         1.000mT        0.003U        5V             +A PA
# ----- Ratio A/B -----
  4.001  M6690  ChA                                               AC
  4.002  M6690  ChB                                               DC
  4.003  6690         10H/H          1%            1Vpp              FR
# ----- Time Interval A to B -----
  5.001  M6690  COM   20T            0.2V          0.8V           DC ++    X1
  5.002  6690         10.00T         0.02U         1Vpp              TI
# ----- Pulse Width A -----
  6.001  M6690        *
  6.002  6690         300uT          5%            5Vp            -A WA
# ----- Rise Time A -----
  7.002  6690         100nT          5%            1Vpp              RF
# ----- Phase A relative to B -----
  8.001  M6690        *
  8.002  6690         30deg          1U            10kH              PR    L
# ----- Duty Factor A -----
  9.001  6690         0.30df         2%            100H              DA
```

M6690

Auxiliary Instrument FSC

Description

The M6690 FSC provides the additional program functions for Channel A and Channel B of the Fluke Frequency Counter/Timer/Analyzer which are not addressed by the 6690 FSC. These functions include Common B via A, Measuring Time, Trigger Level, Trigger Slope, Input Coupling, Input Impedance, and Input Attenuation.

RANGE

This field specifies the Channel.

- ChA Channel A
- ChB Channel B
- COM Common B via A
- *<blank>*

Rules:

- The M6690 statement is ignored under the following conditions:
  1. The RANGE field specifies Channel B and the 6690 FSC specifies Frequency A, Period A, Pulse Width A, Voltage Max A, or Voltage Min A (6690 MOD3 field is FA, PA, WA, MX, or MN respectively).
  2. The RANGE field specifies Common B via A and the 6690 FSC specifies a measurement function other than Time Interval A-B (6690 MOD3 field is not TI).
  3. The 6690 FSC specifies Frequency C (6690 MOD3 field is FC).

NOMINAL

This field specifies one of the following:

- Measuring Time entered as: *<numeric>[<prefix>]T*.
- Allowed 20 ns to 1000 s
- "*" Reset to defaults
- *<blank>*

Rules:

- Measuring Time is not channel specific. It may be specified in a separate M6690 statement or in conjunction with a channel A or channel B specification. Either way, the last Measuring Time specification prior to a 6690 statement is used.

TOLERANCE

This field specifies one of the following:

- The Channel A or B Trigger Level entered as *[<numeric>][<prefix>]V*.
- *<blank>* Auto Level (default) or not applicable.

Rules:

CON Field	Allowed values TOLERANCE field	Resolution
X1	-5.000 V to +5.000 V	1 mV
X10	-50.00 V to +50.00 V	10 mV

- The TOLERANCE field specifies the channel A trigger level when the RANGE field specifies Channel A or Common B via A.
- The TOLERANCE field specifies the channel B trigger level when the RANGE field specifies Channel B.
- The TOLERANCE field must be blank when the RANGE field is blank.
- Auto Level is specified when the TOLERANCE field is blank and the RANGE field specifies Channel A or Common B via A.

- Auto Level causes the attenuation and trigger level to be automatically controlled for both Input A and Input B.
- The TOLERANCE field specification is ignored when the 6690 FSC specifies Auto Level (6690 MOD2 field is not blank).
- If the TOLERANCE field does not contain a value the value is taken from memory register MEM.

MOD1

This field specifies one of the following:

- The Channel A Low-Pass Filter entered as: *<numeric>[<prefix>]H*.
- The Channel B Trigger Level entered as *[<numeric>][<prefix>]V*.
- *<blank>*Auto Level (default) or not applicable.

Rules:

CON Field	Allowed values TOLERANCE field	Allowed values MOD1 field	Resolution
X1	-5.000 V to +5.000 V	-5.000 V to +5.000 V	1 mV
X10	-50.00 V to +50.00 V	-50.00 V to +50.00 V	10 mV

- The MOD1 field may specify the channel A low-pass filter only when the RANGE field specifies channel A.
- When the MOD1 field specifies the channel A low-pass filter, the value must be 100 kHz.
- The MOD1 field may specify the channel B trigger level only when the RANGE specifies Common B via A.
- The MOD1 field must be blank when the RANGE field is blank or Auto Level is specified by the 6690 FSC (6690 MOD2 field is not blank).
- The MOD1 field specification is ignored when the MOD1 field specifies the channel B trigger level and the 6690 FSC specifies Auto Level (6690 MOD2 field is not blank).
- If the MOD1 field does not contain a value the value is taken from memory register MEM.

MOD2

This field specifies the input coupling:

- AC
- DC
- *<blank>*

Table 3: Default Coupling

6690 MOD3 Field	6690 MOD1 Field	Coupling
FA (Frequency A)	NA	AC
FC (Frequency C)	NA	NA
PA (Period A)	NA	AC
FR (Ratio A/B)	NA	AC
WA (Pulse Width A)	NA	DC
TI (Time Interval A-B)	NA	DC
PR (Phase A-B)	NA	AC
DA (Duty Factor A)	NA	DC
RF (Rise Time A)	NA	DC
MX (Voltage Max A)	<100 Hz >=100 Hz	DC AC
MN (Voltage Min A)	<100 Hz >=100 Hz	DC AC

Rules:

- Default values are used when the 6690 FSC does not specify the input coupling (6690 MOD2 field is blank) and one of the following conditions exists:
  1. No M6690 statement has been executed.
  2. The last M6690 statement executed was a M6690 Reset.
  3. The M6690 MOD2 field is blank and the M66906690 RANGE field specifies Channel A, Channel B, or Common B via A.

- The MOD2 field must be blank when the RANGE field is blank.
- The MOD2 field must specify AC or DC when TOLERANCE field specifies the trigger level.
- The MOD2 field specification is ignored when the 6690 FSC specifies the input coupling (6690 MOD2 field is not blank).

MOD3

This field specifies the trigger slope:

- + Positive, Channel A or B
- - Negative, Channel A or B
- ++ Positive Channel A and B
- +- Positive Channel A, Negative Channel B
- -+ Negative Channel A, Positive Channel B
- -- Negative Channel A and B
- *<blank>*

Rules:

- The MOD3 field must be blank when the RANGE field is blank.
- The MOD3 field may specify "+" or "-" only when the RANGE field specifies Channel A (CHA) or Channel B (CHB).
- The MOD3 field may specify "++", "+-", "-+", or "--" only when the RANGE field specifies Common B via A (COM).
- The MOD3 field specification is ignored when the 6690 FSC specifies the trigger slope (6690 MOD2 field is not blank).

MOD4

This field specifies that an external reference oscillator is to be used:

- X External Reference Oscillator
- *<blank>*

Rules:

- A M6690 reset statement, NOMINAL field is an "*", must be used to re-select the internal reference once the external reference is selected.

CON

This field specifies the Attenuation. Legal entries are:

- X1 (default)
- X10
- *<blank>*

Rules:

- The CON field must be blank when the RANGE is blank.
- The CON field must not be blank when the TOLERANCE field specifies the trigger level.
- The CON field specification is ignored when the 6690 FSC specifies Auto Level (6690 MOD2 field is not blank).

Examples

Refer to 6690 FSC.

8505

Instrument FSC

Description

The 8505 FSC programs the Fluke 8505A or 8502A Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, or conductance.

Functional Capability

Caution

Do not use the 8505 FSC when measuring current on closed loop procedures or when ASK- N is true. Using this FSC could cause damage to the Fluke 8505A. Use the IEEE FSC (as shown below) to program the 8505A setup prior to outputting any current from the UUT.

```
  STEP    FSC     RANGE NOMINAL        TOLERANCE     MOD1        MOD2   3   4  CON
  1.001   IEEE          [@8505]I
# The following IEEE FSC programs the UUT to source 50 mA.
  1.002   IEEE          50mA;OPER
  1.003   IEEE          [@8505]?[I]
# Convert to milliamps
  1.004   MATH          MEM = MEM * 1000
  1.005   MEMC          50mA           1%
```

Function	Nominal	MOD1	MOD2
DC Voltage	-1200 V to 1200 V		
AC Voltage	1 mV to 1000 V	10 Hz to 1 MHz	
DC Current	-1.28 A to 1.28 A		
AC Current	0 A to 1.28 A	10 Hz to 1 MHz	
Resistance	0 Ω to 265 MΩ		
Conductance	>3.8 nS		
dBm	-46.99 dBm to 73.01 dBm	10 Hz to 1 MHz	5Z
dBm	-48.75 dBm to 71.24 dBm	10 Hz to 1 MHz	7Z
dBm	-54.77 dBm to 65.22 dBm	10 Hz to 1 MHz	3Z
dBm	-57.78 dBm to 62.21 dBm	10 Hz to 1 MHz	6Z

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency and period measurements.

- Frequency entered as *numeric*[*prefix*]H.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.
- The product of the voltage and frequency must be less than $2x10^7$.

MOD2

This field specifies the load impedance that the AC voltage is referenced to when expressed in dBm.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- 6Z is inserted automatically in the MOD2 field when the NOMINAL field specifies decibels and no MOD2 code is entered.

MOD3

This field specifies the coupling mode of the 8502A or 8505A.

- *blank* DC coupled AC mode
- F AC coupled
- FE AC coupled, 1024 samples/reading, slow filter

Note

MET/CAL was designed to use the RMS AC converter (option -09). If the Averaging AC converter (option - 01) is used, F must be selected; otherwise, and error will occur when executing the procedure.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance less than 256 kΩ.
- 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3   4  CON
# ----- Reset -----
  1.001  8505         *                                                  S
# ----- DC Voltage -----
  1.002  8505   A     -1100V         1% 0.1U                                2W
# ----- AC Voltage -----
  2.001  8505   A     1000V          1%            10kH                     2W
# ----- Decibels -----
  3.001  8505   100   10D            2% 0.1U       1kH               6Z     2W
# ----- Conductance -----
  4.001  8505   20    10nY           -1% +5%                                2W
  5.001  8505   20    10uY           1%                                     2W
# ----- Resistance -----
  6.001  8505   100   256kZ          1%                                     2W
# ----- Setup Test -----
  7.001  8505         1V                           10kH                  S  2W
# ----- Nominal Setup Test ----
  7.002  8505   2     1V                           10kH                  N  2W
# ----- Comparison Test -----
  7.003  8505   2     1V             1% 0.1U       20kH                  C  2W
```

8506

Instrument FSC

Description

The 8506 FSC programs the Fluke 8506A True RMS Digital Multimeter to measure DC voltage, AC voltage, DC current, resistance, or conductance.

Functional Capability

Caution

Do not use the 8506 FSC when measuring current on closed loop procedures or when ASK- N is true. Using this FSC could cause damage to the Fluke 8506A. Use the IEEE FSC (as shown below) to program the 8506A setup prior to outputting any current from the UUT.

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  IEEE         [@8506]I
# The following IEEE FSC programs the UUT to source 50 mA.
  1.002  IEEE         50mA;OPER
  1.003  IEEE         [@8506]?[I]
# Convert to milliamps
  1.004  MATH         MEM = MEM * 1000
  1.005  MEMC         50mA           1%
```

Function	Nominal	MOD1	MOD2
DC Voltage	-1200 V to 1200 V		
AC Voltage	1 mV to 600 V (1010 V)[1]	10 Hz to 1 MHz	
DC Current	-1.28 A to 1.28 A		
Resistance	0 Ω to 265		
Conductance	>3.8 nS		
dBm	-46.99 dBm to 68.57 dBm (73.09 dBm)[1]	10 Hz to 1 MHz	5Z
dBm	-48.75 dBm to 66.81 dBm (71.33 dBm)[1]	10 Hz to 1 MHz	7Z
dBm	-54.77 dBm to 60.79 dBm (65.31 dBm)[1]	0 Hz to 1 MHz	3Z
dBm	-57.78 dBm to 57.78 dBm (62.30 dBm)[1]	10 Hz to 1 MHz	6Z
1. (kV) specified in the CONFIG.DAT file.			

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency and period measurements.

- Frequency entered as *numeric*[*prefix*]H.
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or decibels.
- The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.
- The product of the voltage and frequency must be less than 10^7.

MOD2

This field specifies the load impedance that the AC voltage is referenced to when expressed in dBm.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- 6Z is inserted automatically in the MOD2 field when the NOMINAL field specifies decibels and no MOD2 code is entered.

MOD3

This field specifies DC and AC operating modes which allow higher levels of accuracy at longer measurement times. Refer to the 8506A Instruction Manual for detailed information on the different types of measurements and their properties.

Function	MOD3	Operating	Samples/ Reading	Filter	Coupling
DC Voltage		normal	128	Fast	na
DC Voltage	E [1]	AVG	1024	Slow	na
AC Voltage		ENH'D	~2	na	DC
AC Voltage	F	ENH'D	~2	na	AC
AC Voltage	E	HI ACCUR	na	na	DC
AC Voltage	FE	HI ACCUR	na	na	AC
AC Voltage	G	NORMAL	~2	na	AC

1. This mode of operation will result in an improved noise floor and specification.

2. In this mode of operation the 8506A takes a single reading in the "HI ACCUR" mode and stores a correction factor (requires approximately 6 seconds). After the initial reading, the 8506A operates at approximately 2 readings/second applying the correction factor to each reading. In a stable environment, this results in the 8506A making measurements to the same accuracy as the "HI ACCUR" mode for a period of 5 minutes. If the input changes by more then +/-1%, the measurement process begins again with a single "HI ACCUR" measurement.

3. The advantage of this mode is that every measurement involves a correction factor, and therefore, the best possible specifications are maintained regardless of time, environment, and level. A full measurement cycle takes 6 seconds.

4. In this mode accuracy is limited to approximately 0.5%.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance less than 256 kΩ.
- 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  8506         *                                                 S
# ----- DC Voltage -----
  1.002  8506   A     -1100V         1% 0.1U                               2W
# ----- AC Voltage -----
  2.001  8506   A     600V           1%            10kH                    2W
  3.001  8506   1     1V             1% 0.01U      10kH                    2W
  4.001  8506   10    10V            1% 1/ 1P%     1kH               E     2W
  5.001  8506   10    10D            0.1U          1kH            6Z FE    2W
  6.001  8506   10    10V            1/ 1P%        1kH               E     2W
  7.001  8506   10    10D            0.1U          1kH            6Z F     2W
  8.001  8506   10    10D            0.2U          1kH            6Z E     2W
# ----- Decibels -----
  9.001  8506   A     0D             0.1U          1kH            5Z       2W
 10.001  8506   A     -25D           0.1U          10kH           7Z       2W
 11.001  8506   -30   -26D           0.1U          100kH          3Z       2W
 12.001  8506   A     60.791D        0.1U          10kH           3Z       2W
 13.001  8506   A     0D             0.1U          1kH            6Z       2W
# ----- Conductance -----
 14.001  8506   10    3.82nY         1%                                    2W
# ----- Resistance -----
 15.001  8506   100   256kZ          2%                                    4W
# ----- Setup Test -----
 16.001  8506         1V                           10kH                 S  2W
# ----- Nominal Setup Test ----
 16.002  8506   2     1V                           10kH                 N  2W
# ----- Comparison Test -----
16.003  8506   2     1V             1% 0.1U       20kH                 C  2W
```

8508

Instrument FSC

Description

The 8508 FSC programs the Fluke 8508A Reference Multimeter to measure DC voltage, AC voltage, DC current, AC current, resistance, and temperature. Measurements can be made using the front or rear terminals. Difference, ratio, and deviation measurements can also be performed using the front and rear terminals.

The following auxiliary functions are provided by the M8508 FSC:

- Range Locking
- Rolling Average
- Block Average
- Settling Delay
- Filter for DC Voltage, DC Current, and Resistance
- Fast Mode for DC Voltage, DC Current, and Resistance
- DC Coupling for AC Voltage and AC Current
- External Guard
- Transfer Mode Off for AC Voltage
- Low Current Resistance for Normal and True Ohms

Functional Capability

FUNCTION	NOMINAL	MOD1	MO
DC Voltage	-1050 V to 1050 V		
AC Voltage	2 mV to 199.9999 V	1 Hz to 1 MHz	
	200 V to 1050 V	1 Hz to 100 kHz	
	-40.969 dBm to +59.031 dBm	1 Hz to 1 MHz	5Z
	+59.031 dBm to +73.434 dBm	1 Hz to 100 kHz	5Z
	-42.730 dBm to +57.270 dBm	1 Hz to 1 MHz	7Z
	+57.270 dBm to +71.673 dBm	1 Hz to 100 kHz	7Z
	-51.761 dBm to +48.239 dBm	1 Hz to 1 MHz	6Z
	+48.239 dBm to +62.642 dBm	1 Hz to 100 kHz	6Z
Resistance			
True Ohms	0 Ω to 19.9999999 kΩ		OC
Normal	0 Ωto 1.99999999 GΩ		NO
HV Ohms	2 MΩ to 19.99999 GΩ		HI
DC Current	-19.999999 A to 19.999999 A[1]		
AC Current	2 µA to 19.99999 mA	1 Hz to 100 kHz	
	20 mA to 1.999999 A	1 Hz to 30 kHz	
	2 A to 19.99999 A[2]	1 Hz to 10 kHz	
Frequency			
ACV	10 Hz[3] to 100 kHz	7 mV to 1050 V	
	10 Hz[3] to 1 MHz	7 mV to 199.9999 V	
ACI	10 Hz[3] to 100 kHz	2 µA to 19.99999 mA	
	10 Hz[3] to 30 kHz	2 µA to 1.999999 A	
	10 Hz[3] to 10 kHz	2 µA to 19.99999 A[2]	
PRT	-200 deg C to 1000 deg C[4]		

1. Rear inputs are limited to ±1.9999999 A.
2. Rear inputs are limited to 1.999999 A.
3. Lower bound is 200 Hz when MOD3 = D4 or FE (Fast Gate).
4. Compiler limits only. Physical limits depend upon actual PRT.

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V
- Voltage Difference entered as [*numeric*][*prefix*]V
- Voltage Ratio entered as [*numeric*][*prefix*]V/V or pct
- Voltage Deviation entered as [*numeric*][*prefix*]pct
- dBm entered as [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A
- Resistance entered as [*numeric*][*prefix*]Z
- Resistance Difference entered as [*numeric*][*prefix*]Z
- Resistance Ratio entered as [*numeric*][*prefix*]Z/Z or pct
- Resistance Deviation entered as [*numeric*][*prefix*]pct
- Frequency entered as [*numeric*][*prefix*]H
- Period entered as [*numeric*][*prefix*]T
- Temperature entered as [*numeric*][*prefix*]degC, degF, or K
- Reset entered as *

Rules:

- The NOMINAL field may specify frequency only when the MOD1 field specifies voltage or current.

  When the NOMINAL field specifies frequency or period, the AC filter is selected as follows:

Frequency (1/period)	Filter
≥ 110 Hz	100 Hz High Pass Filter
< 110 Hz and ≥ 41 Hz	40 Hz High Pass Filter
< 41 Hz and ≥ 11 Hz	10 Hz High Pass Filter
< 11 Hz	1 Hz High Pass Filter

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency or amplitude for AC voltage or AC current measurements.

- Frequency entered as *numeric*[*prefix*]H
- Voltage entered as *numeric*[*prefix*]V
- Current entered as *numeric*[*prefix*]A
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage or current.
- The MOD1 field must specify voltage or current when the NOMINAL field specifies frequency.
- The MOD1 field must be blank when the NOMINAL field specifies resistance.

  When the MOD1 field specifies frequency, the AC filter is selected as follows:

Frequency	Filter
≥ 100 Hz	100 Hz High Pass Filter
< 100 Hz and ≥ 40 Hz	40 Hz High Pass Filter
< 40 Hz and ≥ 10 Hz	10 Hz High Pass Filter
< 10 Hz	1 Hz High Pass Filter

Note

For best accuracy DC coupling should be used for frequencies of 100 Hz and below (See 8508 MOD3 and M8508 FSC MOD3 field descriptions).

MOD2

This field specifies one of the following:

1. The load impedance that the AC voltage is referenced to, or
2. Resistance measurement type: HV Ohms, Normal Ohms, or True Ohms.
3. PRT accuracy data to use in the 8508A accuracy file.

- 5Z 50 Ω
- 6Z 600 Ω
- 7Z 75 Ω
- HI HV Ohms
- NO Normal Ohms
- OC True Ohms
- P1 PRT 1, User Defined (default: Fluke 8508A-PRT or Hart 5626)
- P2 PRT 2, User Defined (default: Fluke 8508A-SPRT or Hart 5699)
- P3 PRT 3, User Defined
- P4 PRT 4, User Defined
- P5 PRT 5, User Defined
- P6 PRT 6, User Defined
- P7 PRT 7, User Defined
- P8 PRT 8, User Defined
- P9 PRT 9, User Defined
- *blank* (see below)

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- The MOD2 field may specify a PRT only when the NOMINAL field specifies temperature.
- When MOD2 field specifies HI (HVOhms), the M8508 FSC must lock the 20 MΩ, 200 MΩ, 2 GΩ, or 20 GΩ range.
- When MOD2 field specifies NO (Normal Ohms), the Nominal field is ≥ 20 MΩ, and the M8508 FSC CON field specifies LOI (low current), the M8508 FSC must lock the 200 MΩ or 2 GΩ range.
- The MOD2 must be blank for any of the following conditions:
  1. DC Voltage: The NOMINAL specifies voltage and the MOD1 field is blank.
  2. DC Current: The NOMINAL specifies current.
  3. AC Current: The NOMINAL or MOD1 field specifies current.

- If the NOMINAL field specifies resistance and no MOD2 code is entered, NO is automatically entered in the MOD2 field.
- If the NOMINAL field specifies temperature and no MOD2 code is entered, P1 is automatically entered in the MOD2 field.

MOD3

The MOD3 field Specifies the measurement resolution or input zero.

- D4 4.5 digit resolution
- D5 5.5 digit resolution
- D6 6.5 digit resolution
- D7 7.5 digit resolution
- D8 8.5 digit resolution
- ZR Perform input zero

Rules:

Function	D4	D5	D6	D7	D8
DC Voltage		x	x	x	x
AC Voltage		x	x		
DC Current		x	x	x	
AC Current		x	x		
Normal Ohms		x	x	x	x
True Ohms		x	x	x	x
HV Ohms		x	x	x	x
Temperature		x	x	x	x
Frequency	x		x		

- When the MOD3 field specifies D*n*, the M8508 FSC must be used to specify fast on, ACV transfer mode off, DC coupling, and low current resistance.
- When the 8508A is range locked (see M8508 FSC) and MOD3 specifies ZR, a range zero is performed otherwise a function zero is performed.
- When the MOD3 field specifies ZR and the MOD1 field is not blank (ACV or ACI), the M8508 MOD3 field must be DC (DC Coupling).

The following MOD3 codes are for compatibility with the 1271/1281 and other DMM FSCs. These MOD3 codes should not be used when measurement uncertainty is enabled, or when direct control of measurement resolution, fast mode, or coupling is required.

- *blank* Default measurement mode
- E Enhanced measurement mode
- F Fast measurement mode
- FE Fast Enhanced measurement mode

Rules:

	F	*blank*	E	FE
DC Volts				
resolution	6.5 digits	6.5 digits	8.5 digits	8.5 digits
fast	on	off	off	on
Readings				
thrown away[1]	1	1	1	1
averaged[1]	5	1	1	1
AC Volts				
resolution	5.5 digits	5.5 digits	6.5 digits	5.5 digits
TFER	on	on	on	on
coupling				
< 40 Hz	DC	DC	DC	DC
≥ 40 Hz	AC	AC	AC	AC
gate fast	on	on	on	on
Readings				
thrown away[1]	1	1	1	1
averaged[1]	1	3	3	1
DC Current				
resolution	6.5 digits	5.5 digits	6.5 digits	5.5 digits
fast	on	off	off	on
Readings				
thrown away[1]	1	1	2	1
averaged[1]	1	3	5	1
AC Current				
resolution	5.5 digits	5.5 digits	5.5 digits	5.5 digits
coupling				
< 40 Hz	DC	DC	DC	DC
≥ 40 Hz	AC	AC	AC	AC
Readings				
thrown away[1]	1	1	2	1
averaged[1]	1	3	5	1

	F	*blank*	E	FE
Resistance				
resolution	6.5 digits	6.5 digits	7.5 digits	6.5 digits
fast	on	off	off	on
≤ 20 kΩ				
Readings				
thrown away[1]	1	2	2	1
averaged[1]	3	4	4	1
>20 kΩ to ≤ 200 kΩ				
Readings				
thrown away[1]	1	2	5	1
averaged[1]	3	4	4	1
>200 kΩ				
Readings				
thrown away[1]	1	2	7	1
averaged[1]	3	4	5	1
Frequency				
gate fast	n/a	off	n/a	on
resolution	n/a	6.5 digits	n/a	4.5 digits
coupling				
< 40 Hz	n/a	DC	n/a	DC
≥ 40 Hz	n/a	AC	n/a	AC
Readings				
thrown away[1]	n/a	1	n/a	1
averaged[1]	n/a	3	n/a	1

1. With measurement uncertainty disabled. When measurement uncertainty is enabled, use VSET FSC to set number of readings to throw away and average.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W Selects 2-wire, front inputs
- 3W Selects 3-wire, front inputs
- 4W Selects 4-wire, front inputs
- 2WR Selects 2-wire, rear inputs
- 3WR Selects 3-wire, rear inputs
- 4WR Selects 4-wire, rear inputs
- DIV Selects ratio (front / rear), 2-wire
- DI4 Selects ratio (front / rear), 4-wire
- SUB Selects difference (front - rear), 2-wire
- SU4 Selects difference (front - rear), 4-wire
- DEV Selects deviation |(front - rear) / rear|, 2-wire
- DE4 Selects deviation |(front - rear) / rear|, 4-wire

Rules:

Function	Nominal	MOD1	CON
DC Voltage	V		2W| 3W 4W 2WR
DC Voltage Ratio	V/V|pct		3WR 4WR DIV| DI4*
DC Voltage Difference	V		SUB| SU4*
DC Voltage Deviation	pct		DEV| DE4*
AC Voltage	V|D	H	2W| 4W| 2WRx
AC Voltage Ratio	V/V|pct	H	DIV| DI4*
AC Voltage Difference	V	H	SUB| SU4*
AC Voltage Deviation	pct	H	DEV| DE4*
Frequency	H	V	2W| 4W| 2WR
Frequency	H	A	2W| 2WR

Function	Nominal	MOD1	CON
Period	T	V	2W| 4W| 2WR
Period	T	A	2W| 2WR
Normal Ohms	Z		2W| 4W| 2WR| 4WR
Normal Ohms Ratio	Z/Z|pct		DIV| DI4*
Normal Ohms Difference	Z		SUB| SU4*
Normal Ohms Deviation	pct		DEV| DE4*
HV Ohms	Z		2W| 4W| 2WR| 4WR
HV Ohms Ratio	Z/Z|pct		DIV| DI4*
HV Ohms Difference	Z		SUB| SU4*
HV Ohms Deviation	pct		DEV| DE4*
True Ohms	Z		4W| 4WRx
True Ohms ratio	Z/Z|pct		DI4*
True Ohms Difference	Z		SU4*
True Ohms Deviation	pct		DE4*
DC Current	A		2W| 2WRx
AC Current	A	H	2W| 2WRx
Temperature	degC|degF|K		2W|3W|4W|2WR|3WR|4WRx
* 4-wire front, 2-wire rear			

- If the NOMINAL field specifies temperature and no CON field code is entered, 4W is automatically entered in the CON field. Otherwise, if the NOMINAL field is not temperature and no CON field code is entered, 2W is automatically entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

The following procedure may be used to load PRT identity and coefficients into the 8508A:

```
#
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  LABEL        START
  1.002  OPBR         Do you wish to delete a PRT identity?
  1.003  JMPL         ENTER_PRT_IDENTITY           MEM1 < 0

  1.004  LABEL        DELETE_PRT_IDENTITY
  1.005  MEM2         Enter PRT identity to delete:
  1.006  IEEE         [@8508]PRT_DEL "[MEM2]"
  1.007  JMPL         START

  1.008  LABEL        ENTER_PRT_IDENTITY
  1.009  MEM2         Enter new PRT identity (max 16 characters):
  1.010  JMPL         ENTER_PRT_IDENTITY           LEN(MEM2) > 16

  1.011  LABEL        ENTER_STD
  1.012  MEMI         Enter Std, (1) ITS 90 (2) CVD Alpha (3) CVD DIN (4) CVD:
  1.013  JMPL         STD_PRT                      MEM == 1
  1.014  JMPL         CVD_ALPHA                    MEM == 2
  1.015  JMPL         CVD_DIN                      MEM == 3
  1.016  JMPL         CVD                          MEM == 4
  1.017  JMPL         ENTER_STD

  1.018  LABEL        STD_PRT
  1.019  MATH         S[2] = "STD_PRT"
  1.020  JMPL         ENTER_CONNECTION

  1.021  LABEL        CVD_ALPHA
  1.022  MATH         S[2] = "CVD_ALPHA"
  1.023  JMPL         ENTER_CONNECTION

  1.024  LABEL        CVD_DIN
  1.025  MATH         S[2] = "CVD_DIN"
  1.026  JMPL         ENTER_CONNECTION

  1.027  LABEL        CVD
  1.028  MATH         S[2] = "CVD"

  1.029  LABEL        ENTER_CONNECTION
```

```
  1.030  MEMI         Enter Connection (2, 3, or 4) Wire:
  1.031  JMPL         TWO_WIRE                     MEM == 2
  1.032  JMPL         THREE_WIRE                   MEM == 3
  1.033  JMPL         FOUR_WIRE                    MEM == 4
  1.034  JMPL         ENTER_CONNECTION

  1.035  LABEL        TWO_WIRE
  1.036  MATH         S[3] = "TWO_WR"
  1.037  JMPL         CREATE_PRT_IDENTITY

  1.038  LABEL        THREE_WIRE
  1.039  MATH         S[3] = "THREE_WR"
  1.040  JMPL         CREATE_PRT_IDENTITY

  1.041  LABEL        FOUR_WIRE
  1.042  MATH         S[3] = "FOUR_WR"

  1.043  LABEL        CREATE_PRT_IDENTITY
  1.044  IEEE         [@8508]PRT_CHR "[MEM2]",[SREG2],[SREG3]

# Enter PRT Coefficients

# 1st: TPW
  1.045  MEMI         Enter triple point of water:
  1.046  MATH         M[1] = MEM
  1.047  JMPL         PROGRAM_CVD_COEF                ZCMP(S[2], "CVD")
  1.048  JMPL         PROGRAM_CVD_ALPHA_CVD_DIN_COEF  ZCMP(S[2], "CVD_ALPHA")
  1.049  JMPL         PROGRAM_CVD_ALPHA_CVD_DIN_COEF  ZCMP(S[2], "CVD_DIN")

  1.050  LABEL        PROGRAM_STD_PRT_COEF
# 2nd: a7
  1.051  MEMI         Enter a7:
  1.052  MATH         M[2] = MEM
# 3rd: b7
  1.053  MEMI         Enter b7:
  1.054  MATH         M[3] = MEM
# 4th: c7
  1.055  MEMI         Enter c7:
  1.056  MATH         M[4] = MEM
# 5th: a4
  1.057  MEMI         Enter a4:
  1.058  MATH         M[5] = MEM
# 6th: b4
  1.059  MEMI         Enter b4:
```

```
  1.060  MATH        M[6] = MEM
  1.061  IEEE        [@8508]PRT_COEF "[MEM2]",[M1],[M2],[M3],[M4],[M5],[M6]
  1.062  JMPL        GET_PRT_DATA

  1.063  LABEL       PROGRAM_CVD_ALPHA_CVD_DIN_COEF
# 2nd: alpha
  1.064  MEMI        Enter alpha:
  1.065  MATH        M[2] = MEM
# 3rd: beta
  1.066  MEMI        Enter beta:
  1.067  MATH        M[3] = MEM
# 4th: delta
  1.068  MEMI        Enter delta:
  1.069  MATH        M[4] = MEM
  1.070  IEEE        [@8508]PRT_COEF "[MEM2]",[M1],[M2],[M3],[M4]
  1.071  JMPL        GET_PRT_DATA

  1.072  LABEL       PROGRAM_CVD_COEF
  1.073  IEEE        [@8508]PRT_COEF "[MEM2]",[M1]

  1.074  LABEL       GET_PRT_DATA
  1.075  IEEE        [@8508][D1000]PRT_DATA? "[MEM2]"[I$]
  1.076  MATH        S[1] = FLD(MEM2, 1, ",")
  1.077  MATH        S[2] = FLD(MEM2, 2, ",")
  1.078  MATH        S[3] = FLD(MEM2, 3, ",")
  1.079  MATH        S[4] = FLD(MEM2, 4, ",")
  1.080  DISP        PRT Identity: [S1]
  1.080  DISP        [32] Standard:   [S2]
  1.080  DISP        [32] Connection: [S3]
  1.081  JMPL        DISPLAY_CVD_COEF                ZCMP(S[2], "CVD")

  1.082  MATH        S[5] = FLD(MEM2, 5, ",")
  1.083  MATH        S[6] = FLD(MEM2, 6, ",")
  1.084  MATH        S[7] = FLD(MEM2, 7, ",")
  1.085  JMPL        DISPLAY_CVD_ALPHA_CVD_DIN_COEF  ZCMP(S[2], "CVD_ALPHA")
  1.086  JMPL        DISPLAY_CVD_ALPHA_CVD_DIN_COEF  ZCMP(S[2], "CVD_DIN")
  1.087  MATH        S[8] = FLD(MEM2, 8, ",")
  1.088  MATH        S[9] = FLD(MEM2, 9, ",")

  1.089  LABEL       DISPLAY_STD_PRT_COEF
  1.090  DISP        TPW:        [S4]
  1.090  DISP        a7:         [S5]
  1.090  DISP        b7:         [S6]
  1.090  DISP        c7:         [S7]
```

```
1.090  DISP         a4:          [S8]
1.090  DISP         b4:          [S9]
1.091  JMPL         END

1.092  LABEL        DISPLAY_CVD_ALPHA_CVD_DIN_COEF
1.093  DISP         TPW:         [S4]
1.093  DISP         alpha:       [S5]
1.093  DISP         beta:        [S6]
1.093  DISP         delta:       [S7]
1.094  JMPL         END

1.095  LABEL        DISPLAY_CVD_COEF
1.096  DISP         TPW:         [S4]

1.097  LABEL        END
1.098  END
```

M8508

Auxiliary Instrument Setup FSC

Description

The M8508 FSC provides the following functions for the Fluke 8508A Reference Multimeter that are not addressed in the 8508 FSC:

- Range Locking
- Rolling Average
- Block Average
- Settling Delay
- Filter for DC Voltage, DC Current, and Resistance
- Fast Mode for DC Voltage, DC Current, and Resistance
- DC Coupling for AC Voltage and AC Current
- External Guard
- Disable Transfer Mode for AC Voltage
- Low Current Resistance for Normal and True Ohms

Parameters

When a blank M8508 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

RANGE

This field specifies one of the following:

- PRT PRT Identity
- RNGLK Range Lock
- *blank* field not applicable

Rules:

- When the RANGE field specifies PRT, the PRT identity is taken memory register MEM2.
- When the RANGE field specifies RNGLK, the NOMINAL field must specify the range selection value.
- The RANGE field must RNGLK, when the 8508 FSC MOD2 specifies HI (HV Ohms).

NOMINAL

This field specifies the locked range or reset.

- Voltage range selection value entered as: *numeric*[*prefix*]V
- Current range selection value entered as: *numeric*[*prefix*]A
- Resistance range selection value entered as: *numeric*[*prefix*]Z
- "*" reset to default values

Rules:

- The NOMINAL field may specify a range selection value only when the RANGE field specifies RNGLK.

Selection Value	Locked Range
0 mV to 200 mV	200 mV
> 200 mV to 2 V	2 V
> 2 V to 20 V	20 V
> 20 V to 200 V	200 V
> 200 V to 1050 V	1050 V
0 µA to 200 µA	200 µA
> 200 µA to 2 mA	2 mA
> 2 mA to 20 mA	20 mA
> 20 mA to 200 mA	200 mA
> 200 mA to 2 A	2 A
> 2 A to 20 A	20 A (front inputs only)
0 Ω to 2 Ω	2 Ω
> 2 Ω to 20 Ω	20 Ω
> 20 Ω to 200 Ω	200 Ω
> 200 Ω to 2 kΩ	2 kΩ
> 2 kΩ to 20 kΩ	20 kΩ
> 20 kΩ to 200 kΩ	200 kΩ

> 200 kΩ to 2 MΩ	2 MΩ
> 2 MΩ to 20 MΩ	20 MΩ
> 20 MΩ to 200 MΩ	200 MΩ
> 200 MΩ to 2 GΩ	2G Ω
> 2 GΩ to 20 GΩ	20 GΩ

- A M8508 range lock specification only applies when a subsequent 8508 FSC specifies an applicable measurement function (see EXAMPLES below).
- The NOMINAL field must be greater then 2 MΩ when the 8508 FSC MOD2 field is HI (HV Ohms).
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field enables and disables averaging.

- *m*avg m reading rolling average
- *n*blk n reading block average

Rules:

- Allowed values for *m* are 4, 8, 16, 32, and 64
- Allowed values for *n* are 1 to 9999.

MOD1

This field specifies the settling delay.

- Settling delay entered as [*numeric*][*prefix*]T.
- *blank* Default for function and range

Rules:

- Allowed values for delay are 0s to 65,000 s.

MOD2

This field enables and disables the filter for DC voltage, DC current, and resistance measurements.

- FL Enable filter
- *blank* Disable filter

Rules:

- The MOD2 field must be blank when the 8508 FSC MOD2 field specifies Offset Compensated True Ohms "OC".
- The MOD2 field is ignored when the 8508 FSC specifies AC Voltage or AC Current measurement.

MOD3

This field enables and disables fast mode or DC coupling.

- FS Fast on, AC coupling
- DC Fast off, DC coupling
- *blank* Fast off, AC coupling

Rules:

- The MOD3 field must be blank when the 8508 FSC MOD3 field is blank, E, F, or FE.

MOD4

This field is used to specify the guard connection:

- G Enable remote guard
- *blank* Disable local guard

CON

This field enables and disables ACV transfer mode or low current resistance mode.

- NOT Disable ACV transfer mode, normal current resistance
- LOI ACV transfer mode, low current resistance
- *blank* ACV transfer mode, normal current resistance

Rules:

- The CON field must be blank when the 8508 FSC specifies AC Voltage and the 8508 FSC MOD3 field is blank, E, F, or FE (see 8508 FSC MOD3 description).
- The CON field must be blank when the 8508 FSC MOD2 field is HI (HV Ohms).
- The CON field is ignored when the 8508 FSC specifies DC Voltage, DC Current, or AC Current.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2   3  4 CON
#
  1.001  M8508  RNGLK 200mV
#
#  200mV range is locked
#
  1.002  8508         100mV          1%                                    2W
#
#  200mV range is locked
#
  2.001  8508         10mV           1%            1kH                     2W
  3.001  8508         1kH            1%            10mV                    2W
#
#  Autorange is selected (M8508 FSC not applicable).
#
  4.001  8508         1uA            1%                                    2W
  5.001  8508         100uA          1%            1kH                     2W
  6.001  8508         1kH            1%            100uA                   2W
  7.001  8508         10Z            1%                            OC      2W
#
  8.001  M8508  RNGLK 200uA
#
#  Autorange is selected (M8508 FSC not applicable).
#
  8.002  8508         100mV          1%                                 N  2W
  8.003  8508         10mV           1%            1kH                  N  2W
  8.004  8508         1kH            1%            10mV                    2W
#
#  200uA range is locked
#
```

```
  9.001  8508         100uA          1%                                 N  2W
#
#  200uA range is locked
#
  9.002  8508         100uA          1%            1kH                  N  2W
  9.003  8508         1kH            1%            100uA                   2W
#
# Autorange is selected (M8508 FSC not applicable).
#
 10.001  8508         10Z            1%                           OC    N  2W
#
 10.002  M8508  RNGLK 20Z
#
#  Autorange is selected (M8508 FSC not applicable).
#
 10.003  8508         100mV          1%                                 N  2W
 10.004  8508         10mV           1%            1kH                  N  2W
 10.005  8508         1uA            1%                                 N  2W
 10.006  8508         100uA          1%            1kH                  N  2W
#
#  20 Ohm range is locked.
#
 10.007  8508         10Z            1%                           OC    N  4W
#
#  Autorange is selected for all subsequent 8508 FSCs.
#
 10.008  M8508        *
```

8560

Instrument FSC

Description

The 8560 FSC supports the Hewlett-Packard 8560A, 8562A, 8563A, 8561B, 8562B, and 8560 E-Series Spectrum Analyzers.

The parameters associated with the frequency domain may be specified in two different ways, in conjunction with the M8560 FSC:

1. Center Frequency and Frequency Span
2. Start and Stop Frequency

In both modes, the amplitude or frequency obtained from a peak search is returned.

Optionally, the peak search operation may be disabled, allowing amplitude measurement at a specified frequency (see MOD3 below).

Functional Capability

Function	8560 Nominal	8560 MOD1
8560A/E		
Peak Amplitude	-134 dBm to +30 dBm	30 Hz to 2.9 GHz
Peak Frequency	30 Hz to 2.9 GHz	-134 dBm to +30 dBm [1]
8561A/B/E		
Peak Amplitude	-134 dBm to +30 dBm	30 Hz to 6.5 GHz
Peak Frequency	30 Hz to 6.5 GHz	-134 dBm to +30 dBm [1]
8562E		
Peak Amplitude	-134 dBm to +30 dBm	30 Hz to 13.2 GHz
Peak Frequency	30 Hz to 13.2 GHz	-134 dBm to +30 dBm [1]
8562A/B, 8563E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 26.5 GHz
	-134 dBm to +30 dBm	30 Hz to 26.5 GHz [1]
Peak Frequency	9 kHz to 26.5 GHz	-134 dBm to +30 dBm
	30 Hz to 26.5 GHz	-134 dBm to +30 dBm [1]
1. Requires Option 006		

Function	8560 Nominal	8560 MOD1
8564E		
Peak Amplitude	-134 dBM to +30 dBm	9 kHz to 40 GHz
	-134 dBm to +30 dBm	30 Hz to 40 GHz [1]
Peak Frequency	9 kHz to 40 GHz	-134 dBm to +30 dBm
	30 Hz to 40 GHz	-134 dBm to +30 dBm [1]
8565E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 50 GHz
	-134 dBm to +30 dBm	30 Hz to 50 GHz [1]
Peak Frequency	9 kHz to 50 GHz	-134 dBm to +30 dBm
	30 Hz to 50 GHz	-134 dBm to +30 dBm [1]
1. Requires Option 006		

Parameters

Range

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Amplitude entered as [*numeric*][*prefix*]D.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When Nominal units are **D** (dBm), MOD1 units must be **H** (hertz).
- When Nominal units are **H** (hertz), MOD1 units must be **D** (dBm).
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.
- In addition to specifying the expected measured value, when the Nominal field specifies amplitude, the value is used to set the reference level.
- Likewise, when the Nominal field specifies frequency, the value is used to initially set the center frequency.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude or frequency.

- Frequency entered as [*numeric*][*prefix*]H.
- Amplitude entered as [*numeric*][*prefix*]D.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.
- When the MOD1 field specifies a frequency AND the M8560 FSC DOES NOT specify START, the value is used to initially set the center frequency.
- When the MOD1 field specifies a frequency AND the M8560 FSC DOES specify START, the value is used to set the marker frequency at which to take an amplitude measuement.
- When the MOD1 field specifies amplitude, the value is used to set the reference level.

MOD2

This field enables/disables the marker peak search function.

- AF Returns amplitude at specified MOD1 frequency
- <blank> Peak search enabled

Rules:

- When the MOD3 field specifies AF, an associated M8560 FSC MUST specify the start and stop frequencies. SPAN is NOT legal with AF.
- When the MOD3 field specifies AF, the Nominal field units must be dBm (**D**).

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8560        *
  1.002  8560         *                                                 S
# ----- Peak Search: Marker Amplitude -----
  1.003  M8560  SPAN  1MH
  1.004  M8560  VIDBW 1kH
  1.005  8560         -30.00D        120U          50MH
  2.001  8560         -30.00D        120U          100MH
  3.001  8560         -30.00D        120U          150MH
  4.001  8560         -30.00D        120U          200MH
# ----- Peak Search: Marker Amplitude, Start & Stop specified -----
  5.001  M8560  START 40MH                 60MH
  5.002  8560         -30.00D        120U          50MH
  6.001  M8560  START 90MH                 100MH
  6.002  8560         -30.00D        120U          100MH
  7.001  M8560  START 140MH                160MH
  7.002  8560         -30.00D        120U          150MH
  8.001  M8560  START 190MH                210MH
  8.002  8560         -30.00D        120U          200MH
# ----- Marker Amplitude: Start, Stop and Marker Frequency specified -----
  9.001  M8560  START 40MH                 60MH
  9.002  8560         -30.00D        120U          50MH        AF
```

M8560

Auxiliary Instrument Setup FSC

Description

The M8560 FSC is used to specify the resolution bandwidth, RF attenuation, start frequency, stop frequency, sweep time, reference level, video bandwidth and external reference oscillator.

RANGE

This field identifies the value in the Nominal field.

Rules:

Range	Nominal	MOD1
	Reset "*"	
	Sweep Time	[Reference Level]
ATTEN	RF Attenuation	[Reference Level]
RESBW	Resolution Bandwidth	[Reference Level]
SPAN	Frequency Span	[Reference Level]
START	Start Frequency	Stop Frequency
VIDBW	Video Bandwidth	[Reference Level]

NOMINAL

This field specifies one of the following:

- Frequency Span entered as [*numeric*][*prefix*]H.
- RF Attenuation entered as [*numeric*][*prefix*]dB.
- Resolution Bandwidth entered as [*numeric*][*prefix*]H.
- Start Frequency entered as [*numeric*][*prefix*]H.
- Sweep Time entered as [*numeric*][*prefix*]T.
- Video Bandwidth entered as [*numeric*][*prefix*]H.
- "*" Reset

Rules:

- See above table under Range field.
- Legal values for frequency span are 30 Hz to 50 GHz [1].
- Legal values for RF attenuation are:

  0 dB, 10 dB, 20 dB, 30 dB, 40 dB, 50 dB, 60 dB, and 70 dB.
- Legal values for resolution bandwidth are:

  10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- Legal values for start frequency are 30 Hz to 50 GHz [1].
- Legal values for sweep time are 50 ms to 100 ks.
- Legal values for video bandwidth are:

  1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100k Hz, 300 kHz, 1 MHz, and 3 MHz.
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- Consecutive M8560 FSC's may be used to specify a combination of these parameters for a single 8560 measurement.
- Parameter values stay in effect until a M8560 reset is executed or a new value for the parameter is specified.
- When the NOMINAL field specifies a reset the following default values are selected:

Frequency Span:	Maximum
Reference Level:	0 dBm
Resolution Bandwidth:	Coupled
RF Attenuation:	Coupled
Sweep Time:	Coupled
Video Bandwidth:	Coupled
Start Frequency:	na
Stop Frequency:	na

1. Actual limit is based on model used.

TOLERANCE

This field is not used.

MOD1

This field specifies the reference level.

- Reference Level entered as [*numeric*] [*prefix*]D.
- Stop Frequency entered as [*numeric*] [*prefix*]H.

Rules:

- Note, reference level is not "sticky". When the MOD1 field is blank the reference level is "unset".
- Legal values for reference level are –120 dBm to 30 dBm.
- Legal values for stop frequency are 30 Hz to 50 GHz [1].
- The stop frequency must be greater than or equal to the start frequency.
- When the MOD1 field does not specify a value, the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies that an external reference oscillator is to be used:

X	External Frequency Reference Oscillator
blank	Internal Frequency Reference Oscillator

Rules:

An M8560 reset statement, NOMINAL field is an "*", must be used to re-select the internal frequency reference once the external frequency reference is selected.

CON

This field is not used.

Examples

Refer to 8560 FSC.

8566

Instrument FSC

Description

The 8566 FSC supports the Hewlett-Packard 8566B Spectrum Analyzer.

The parameters associated with the frequency domain may be specified in two different ways, in conjunction with the M8566 FSC:

1. Center Frequency and Frequency Span
2. Start and Stop Frequency

In both modes, the amplitude or frequency obtained from a peak search is returned.

Optionally, the peak search operation may be disabled, allowing amplitude measurement at a specified frequency (see MOD3 below).

The 8566 FSC does not support the 8566A because the 8566A does not support SRQ on completion of peak search. Peak search is the primary function supported in the MET/CAL spectrum analyzer FSCs.

Functional Capability

Function	Nominal	MOD1
Peak Amplitude	-134 dBm to +30 dBm	100 Hz to 1.0 MHz
	-134 dBm to +30 dBm	1.0 MHz to 2.5 GHz
	-132 dBm to +30 dBm	2.0 GHz to 5.8 GHz
	-125 dBm to +30 dBm	5.8 GHz to 12.5 GHz
	-119 dBm to +30 dBm	12.5 GHz to 18.6 GHz
	-114 dBm to +30 dBm	18.6 GHz to 22.0 GHz
Peak Frequency	100 Hz to 1.0 MHz	-134 dBm to +30 dBm
	1.0 MHz to 2.5 GHz	-134 dBm to +30 dBm
	2.0 GHz to 5.8 GHz	-132 dBm to +30 dBm
	5.8 GHz to 12.5 GHz	-125 dBm to +30 dBm
	12.5 GHz to 18.6 GHz	-119 dBm to +30 dBm
	18.6 GHz to 22.0 GHz	-114 dBm to +30 dBm

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Amplitude entered as [*numeric*][*prefix*]D.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When Nominal units are **D** (dBm), MOD1 units must be **H** (hertz).
- When Nominal units are **H** (hertz), MOD1 units must be **D** (dBm).
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.
- In addition to specifying the expected measured value, when the Nominal field specifies amplitude, the value is used to set the reference level.
- Likewise, when the Nominal field specifies frequency, the value is used to set the center frequency.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude or frequency.

- Frequency entered as [*numeric*][*prefix*]H.
- Amplitude entered as [*numeric*][*prefix*]D.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.
- When the MOD1 field specifies a frequency AND the M8566 FSC DOES NOT specify START, the value is used to initially set the center frequency.
- When the MOD1 field specifies a frequency AND the M8566 FSC DOES specify START, the value is used to set the marker frequency at which to take an amplitude measurement.
- When the MOD1 field specifies amplitude, the value is used to set the reference level.

MOD2

This field is not used.

MOD3

This field enables/disables the marker peak search function.

- AF Returns amplitude at specified MOD1 frequency
- <blank> Peak search enabled

Rules:

- When the MOD3 field specifies AF, an associated M8566 FSC MUST specify the start and stop frequencies. SPAN is NOT legal with AF.
- When the MOD3 field specifies AF, the Nominal field units must be dBm (**D**).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8566         *
  1.002  8566          *                                                 S
# ----- Peak Search: Marker Amplitude -----
  1.003  M8566  SPAN  1MH                          30D
  1.004  M8566  VIDBW 1kH
  1.005  8566          -30.00D        120U          50MH
  2.001  8566          -30.00D        120U          100MH
  3.001  8566          -30.00D        120U          150MH
  4.001  8566          -30.00D        120U          200MH
# ----- Peak Search: Marker Amplitude, Start & Stop specified -----
  5.001  M8566  START 40MH                 60MH
  5.002  8566          -30.00D        120U          50MH
  6.001  M8566  START 90MH                 100MH
  6.002  8566          -30.00D        120U          100MH
  7.001  M8566  START 140MH                160MH
  7.002  8566          -30.00D        120U          150MH
  8.001  M8566  START 190MH                210MH
  8.002  8566          -30.00D        120U          200MH
# ----- Marker Amplitude: Start, Stop and Marker Frequency specified -----
  9.001  M8566  START 40MH                 60MH
  9.002  8566          -30.00D        120U          50MH        AF
```

M8566

Auxiliary Instrument Setup FSC

Description

The M8566 FSC is used to specify the frequency span, resolution bandwidth, RF attenuation, start frequency, stop freqency, sweep time, reference level, and video bandwidth.

RANGE

This field identifies the value in the Nominal field.

Rules:

Range	Nominal	MOD1
ATTEN	RF Attenuation	[Reference Level]
SPAN	Frequency Span	[Reference Level]
RESBW	Resolution Bandwidth	[Reference Level]
VIDBW	Video Bandwidth	[Reference Level]
START	Start Frequency	Stop Frequency
blank	Sweep Time	[Reference Level]
blank	Reset "*"	

NOMINAL

This field specifies one of the following:

- Frequency Span entered as [*numeric*] [*prefix*]H.
- RF Attenuation entered as [*numeric*] [*prefix*]dB.
- Resolution Bandwidth entered as [*numeric*][*prefix*]H.
- Start Freqency entered as [*numeric*][*prefix*]H.
- Sweep Time entered as [*numeric*] [*prefix*]T.
- Video Bandwidth entered as [*numeric*] [*prefix*]H.
- "*" Reset

Rules:

- See above table under Range field.
- Legal values for frequency span are 100 Hz to 22 GHz.
- Legal values for RF attenuation are:

  0 dB, 10 dB, 20 dB, 30 dB, 40 dB, 50 dB, 60 dB, and 70 dB.
- Legal values for resolution bandwidth are:

  10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- Legal values for start frequency are 100 Hz to 22 GHz.
- Legal values for sweep time are 50ms to 1.5ks.
- Legal values for video bandwidth are:

  1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- Consecutive M8566 FSC's may be used to specify a combination of these parameters for a single 8566B measurement.
- Parameter values stay in effect until a M8566 reset is executed or a new value for the parameter is specified.
- When the NOMINAL field specifies a reset the following default values are selected:

Frequency Span:	2.9 GHz
Reference Level:	0.0 dBm
Resolution Bandwidth:	Coupled
RF Attenuation:	Coupled
Sweep Time:	Coupled
Video Bandwidth:	Coupled
Start Frequency:	na
Stop Frequency:	na

TOLERANCE

This field is not used.

MOD1

This field specifies the reference level.

- Reference Level entered as [*numeric*] [*prefix*]D.
- Stop Frequency entered as [*numeric*] [*prefix*]H.

Rules:

- Note, reference level is not "sticky". When the MOD1 field is blank the reference level is "unset".
- Legal values for reference level are -89.9 dBm to +30.0 dBm.
- Legal values for stop frequency are 100 Hz to 22 GHz.
- The stop frequency must be greater than or equal to the start frequency.
- When the MOD1 field does not specify a value, the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

Refer to 8566 FSC.

8568

Instrument FSC

Description

The 8568 FSC supports the Hewlett-Packard 8568B Spectrum Analyzer.

The parameters associated with the frequency domain may be specified in two different ways, in conjunction with the M8568 FSC:

1. Center Frequency and Frequency Span
2. Start and Stop Frequency

In both modes, the amplitude or frequency obtained from a peak search is returned.

Optionally, the peak search operation may be disabled, allowing amplitude measurement at a specified frequency (see MOD3 below).

The 8568 FSC does not support the 8568A because the 8568A does not support SRQ on completion of peak search. Peak search is the primary function supported in the MET/CAL spectrum analyzer FSCs.

Functional Capability

Function	Nominal	MOD1
Peak Amplitude	-135 dBm to 30 dBm	100 Hz to 1.5 GHz
Peak Frequency	100 Hz to 1.5 GHz	-135 dBm to 30 dBm

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Amplitude entered as [*numeric*][*prefix*]D.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When Nominal units are **D** (dBm), MOD1 units must be **H** (hertz).
- When Nominal units are **H** (hertz), MOD1 units must be **D** (dBm).
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.
- In addition to specifying the expected measured value, when the Nominal field specifies amplitude, the value is used to set the reference level.
- Likewise, when the Nominal field specifies frequency, the value is used to set the center frequency.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude or frequency.

- Frequency entered as [*numeric*][*prefix*]H.
- Amplitude entered as [*numeric*][*prefix*]D.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.
- When the MOD1 field specifies frequency AND the M8568 FSC DOES NOT specify START, the value is used to initially set the center frequency.
- When the MOD1 field specifies frequency AND the M8568 FSC DOS specify START, the value is used to set the marker frequency at which to take an amplitude measurement.
- When the MOD1 field specifies amplitude, the value is used to set the reference level.

MOD2

This field specifies the input to be used.

- I1 Input 1

- I2 Input 2

Rules:

- When no valid MOD1 code is entered, I2 is automatically inserted in the MOD2 field.

MOD3

This field enables/disables the marker peak search function.

- AF Returns amplitude at specified MOD1 frequency
- <blank> Peak search enabled

Rules:

- When the MOD3 field specifies AF, an associated M8590 FSC MUST specify the start and stop frequencies. SPAN is NOT legal with AF.
- When the MOD3 field specifies AF, the Nominal field units must be dBm **D**.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Rusults Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8560        *
  1.002  8560         *                                                 S
# ----- Peak Search: Marker Amplitude, Span & Center Freq specified -----
  1.003  M8560  SPAN  1MH
  1.004  M8560  VIDBW 1kH
  1.005  8560         -30.00D        120U          50MH
  2.001  8560         -30.00D        120U          100MH
  3.001  8560         -30.00D        120U          150MH
  4.001  8560         -30.00D        120U          200MH
# ----- Peak Search: Marker Amplitude, Start & Stop specified -----
  5.001  M8568  START 40MH                 60MH
  5.002  8568         -30.00D        120U          50MH
  6.001  M8568  START 90MH                 100MH
  6.002  8568         -30.00D        120U          100MH
  7.001  M8568  START 140MH                160MH
  7.002  8568         -30.00D        120U          150MH
  8.001  M8568  START 190MH                210MH
  8.002  8568         -30.00D        120U          200MH
# ----- Marker Amplitude: Start, Stop and Marker Frequency specified -----
  9.001  M8568  START 40MH                 60MH
  9.002  8568         -30.00D        120U          50MH        AF
```

M8568

Auxiliary Instrument Setup FSC

Description

The M8568 FSC is used to specify the frequency span, resolution bandwidth, RF attenuation, start frequency, stop frequency, sweep time, reference level, and video bandwidth.

RANGE

This field identifies the value in the Nominal field.

Rules:

Range	Nominal	MOD1
ATTEN	RF Attenuation	[Reference Level]
RESBW	Resolution Bandwidth	[Reference Level]
SPAN	Frequency Span	[Reference Level]
Start	Start Frequency	Stop Frequency
VIDBW	Video Bandwidth	[Reference Level]
blank	Sweep Time	[Reference Level]
blank	Reset "*"	

NOMINAL

This field specifies one of the following:

- Frequency Span entered as [*numeric*][*prefix*]H.
- RF Attenuation entered as [*numeric*][*prefix*]dB.
- Resolution Bandwidth entered as [*numeric*][*prefix*]H.
- Start Frequency entered as [*numeric*][*prefix*]H.
- Sweep Time entered as [*numeric*][*prefix*]T.
- Video Bandwidth entered as [*numeric*][*prefix*]H.
- "*" Reset

Rules:

- See above table under Range field.
- Legal values for frequency span are 100 Hz to 1.5 GHz.
- Legal values for RF attenuation are:

  0 dB, 10 dB, 20 dB, 30 dB, 40 dB, 50 dB, 60 dB, and 70 dB.
- Legal values for resolution bandwidth are:

  10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- Legal values for start frequency are 100 Hz to 1.5 GHz.
- Legal values for sweep time are 20 ms to 1.5 ks.
- Legal values for video bandwidth are:

  1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz,

  100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- Consecutive M8568 FSC's may be used to specify a combination of these parameters for a single 8568B measurement.
- Parameter values stay in effect until in effect until a M8568 reset is executed or a new value for the parameter is specified.
- When the NOMINAL field specifies a reset the following default values are selected:

Frequency Span:	1.5 GHz
Reference Level:	0.0 dBm
Resolution Bandwidth:	Coupled
RF Attenuation:	Coupled
Sweep Time:	Coupled
Video Bandwidth:	Coupled
Sweep Time:	Coupled
Start Frequency:	na
Stop Frequency:	na

TOLERANCE

This field is not used.

MOD1

This field specifies the reference level.

- Reference Level entered as [*numeric*][*prefix*]D.
- Stop Frequency entered as [*numeric*][*prefix*]H.

Rules:

- Note, reference level is not "sticky". When the MOD1 field is blank the reference level is "unset".
- Legal values for reference level are -89.9 dBm to +30.0 dBm.
- Legal values for stop frequency are 100 Hz to 1.5 GHz.
- The stop frequency must be greater than or equal to the start frequency.
- When the MOD1 field does not specify a value, the value is taken from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

Refer to 8568 FSC.

8590

Instrument FSC

Description

The 8590 FSC supports the Hewlett-Packard 8590 Series Spectrum Analyzers.

The parameters associated with the frequency domain may be specified in two different ways, in conjunction with the M8590 FSC:

1. Center Frequency and Frequency Span
2. Start and Stop Frequency

In both modes, the amplitude or frequency obtained from a peak search is returned.

Optionally, the peak search operation may be disabled, allowing amplitude measurement at a specified frequency (see MOD3 below).

Functional Capability

Function	8590 Nominal	8590 MOD1
8590L, 8591E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 1.8 GHz
Peak Frequency	9 kHz to 1.8 GHz	-134 dBm to +30 dBm
8592L, 8593E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 22.0 GHz
	-134 dBm to +30 dBm	9 kHz to 26.5 GHz [1]
Peak Frequency	9 kHz to 22.0 GHz	-134 dBm to +30 dBm
	9 kHz to 26.5 GHz	-134 dBm to +30 dBm [1]
8594E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 2.9 GHz
Peak Frequency	9 kHz to 2.9 GHz	-134 dBm to +30 dBm
8595E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 6.5 GHz
Peak Frequency	9 kHz to 6.5 GHz	-134 dBm to +30 dBm
8596E		
Peak Amplitude	-134 dBm to +30 dBm	9 kHz to 6.5 GHz
Peak Frequency	9 kHz to 6.5 GHz	-134 dBm to +30 dBm
1. Requires Option 026/027		

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Amplitude entered as [*numeric*][*prefix*]D.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- When Nominal units are **D** (dBm), MOD1 units must be **H** (hertz).
- When Nominal units are **H** (hertz), MOD1 units must be **D** (dBm).
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.
- In addition to specifying the expected measured value, when the

  Nominal field specifies amplitude, the value is used to set the reference level.
- Likewise, when the Nominal field specifies frequency, the value is used to set the center frequency.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude or frequency.

- Frequency entered as [*numeric*][*prefix*]H.
- Amplitude entered as [*numeric*][*prefix*]D.
- *blank* not applicable

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.
- When the MOD1 field specifies frequency AND the M8590 FSC DOES NOT specify START, the value is used to initially set the center frequency.
- When the MOD1 field specifies frequency AND the M8590 FSC DOES specify START, the value is used to set the marker frequency at which to take an amplitude measurement.
- When the MOD1 field specifies amplitude, the value is used to set the reference level.

MOD2

This field is not used.

MOD3

This field enables/disables the marker peak search function.

- AF Returns amplitude at specified MOD1 frequency
- <blank> Peak search enabled

Rules:

- When the MOD3 field specifies AF, an associated M8590 FSC MUST specify the start and stop frequencies. SPAN is NOT legal with AF.
- When the MOD3 field specifies AF, the Nominal field units must be dBm (**D**).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M8590        *
  1.002  8590         *                                                 S
# ----- Peak Search: Marker Amplitude, Span & Center Freq Specified -----
  1.003  M8590  SPAN  1MH
  1.004  M8590  VIDBW 1kH                            30D
  1.005  8590         -30.00D        120U          50MH           I2
  2.001  8590         -30.00D        120U          100MH          I2
  3.001  8590         -30.00D        120U          150MH          I2
  4.001  8590         -30.00D        120U          200MH          I2
# ----- Peak Search: Marker Amplitude, Start & Stop specified -----
  5.001  M8590  START 40MH                 60MH
  5.002  8590         -30.00D        120U          50MH
  6.001  M8590  START 90MH                 100MH
  6.002  8590         -30.00D        120U          100MH
  7.001  M8590  START 140MH                160MH
  7.002  8590         -30.00D        120U          150MH
  8.001  M8590  START 190MH                210MH
  8.002  8590         -30.00D        120U          200MH
# ----- Marker Amplitude: Start, Stop and Marker Frequency specified -----
  9.001  M8590  START 40MH                 60MH
  9.002  8590         -30.00D        120U          50MH        AF
```

M8590

Auxiliary Instrument Setup FSC

Description

The M8590 FSC is used to specify the frequency span, resolution bandwidth, RF attenuation, start frequency, stop frequency, sweep time, reference level, and video bandwidth.

Parameters

RANGE

This field identifies the value in the Nominal field.

Rules:

Range	**Nominal**	**MOD1**
ATTEN	RF Attenuation	[Reference Level]
RESBW	Resolution Bandwidth	[Reference Level]
SPAN	Frequency Span	[Reference Level]
START	Start Frequency	Stop Frequency
VIDBW	Video Bandwidth	[Reference Level]
blank	Sweep Time	[Reference Level]
blank	Reset "*"	

NOMINAL

This field specifies one of the following:

- Frequency Span entered as [*numeric*][*prefix*]H.
- RF Attenuation entered as [*numeric*][*prefix*]dB.
- Resolution Bandwidth entered as [*numeric*][*prefix*]H.
- Start Frequency entered as [*numeric*][*prefix*]H.
- Sweep Time entered as [*numeric*][*prefix*]T.
- Video Bandwidth entered as [*numeric*][*prefix*]H.
- "*" Reset

Rules:

- See above table under Range field.
- Legal values for frequency span are 9 kHz to 26.5 GHz [1].
- Legal values for RF attenuation are:

  0 dB, 10 dB, 20 dB, 30 dB, 40 dB, 50 dB, and 60 dB.
- Legal values for resolution bandwidth are:

  1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, and 3 MHz.
- Legal values for start frequency are 9 kHz to 26.5 GHz [1].
- Legal values for sweep time are 20 ms to 100 s
- Legal values for video bandwidth are:

  30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, and 1 MHz
- When the NOMINAL field does not specify a value, the value is taken from memory register MEM.
- Consecutive M8590 FSC's may be used to specify a combination of these parameters for a single 8590 measurement.
- Parameter values stay in effect until a M8590 reset is executed or a new value for the parameter is specified.
- When the NOMINAL field specifies a reset the following default values are selected:

Frequency Span:	Maximum
Reference Leve[l]:	0 dBm
Resolution Bandwidth:	Coupled
RF Attenuation:	Coupled
Sweep Time:	Coupled
Video Bandwidth:	Coupled
Start Frequency:	na
Stop Frequency:	na[1]. Upper bound depends upon actual spectrum analyzer used (see 8590 FSC).

TOLERANCE

This field is not used.

MOD1

This field specifies the reference level or the stop frequency.

- Reference Level entered as [*numeric*][*prefix*]D.
- Stop Frequency entered as [*numeric*][*prefix*]H.

Rules:

- Note, reference level is not "sticky". When the MOD1 field is blank the reference level is "unset".
- Legal values for reference level are -134 dBm to 30 dBm.
- Legal values for stop frequency are 9 kHz to 26.5 GHz [1].
- The stop frequency must be greater than or equal to the start frequency.
- When the MOD1 field does not specify a value, the value is taken from memory register MEM.

[1] Upper bound depends upon actual spectrum analyzer used (see 8590 FSC).

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field is not used.

Examples

Refer to 8590 FSC.

8648

Instrument FSC

Description

The 8648 FSC programs amplitude and frequency of the Hewlett-Packard 8648A/B/C/D Signal Generators.

Functional Capability

Model	Frequency	Std	Amplitude [1]	
			Opt 1EA[2]	Opt 1EA & 1E6[3]
8648A	100 kHz to 1000 MHz	+10 dBm	NA	NA
8648B	9 kHz to < 100 kHz	+13 dBm	+17 dBm	+13 dBm
	>= 100 kHz to < 100 MHz	+13 dBm	+20 dBm	+13 dBm
	>= 100 MHz to <= 1000 MHz	+13 dBm	+20 dBm	+18 dBm
	> 1000 MHz to <= 1500 MHz	+13 dBm	+19 dBm	+17 dBm
	> 1500 MHz to 2000 MHz	+13 dBm	+17 dBm	+15 dBm
8648C	9 kHz to < 100 kHz	+13 dBm	+17 dBm	+13 dBm
	>= 100 kHz to < 100 MHz	+13 dBm	+20 dBm	+13 dBm
	>= 100 MHz to <= 1000 MHz	+13 dBm	+20 dBm	+18 dBm
	> 1000 MHz to <= 1500 MHz	+13 dBm	+19 dBm	+17 dBm
	> 1500 MHz to <= 2100 MHz	+13 dBm	+17 dBm	+15 dBm
	> 2100 MHz to <= 2500 MHz	+13 dBm	+15 dBm	+13 dBm
	> 2500 MHz to <= 3200 MHz	+10 dBm	+13 dBm	+11 dBm
8648D	9 kHz to < 100 kHz	+13 dBm	+17 dBm	+13 dBm
	>= 100 kHz to < 100 MHz	+13 dBm	+20 dBm	+13 dBm
	>= 100 MHz to <= 1000 MHz	+13 dBm	+20 dBm	+18 dBm
	> 1000 MHz to <= 1500 MHz	+13 dBm	+19 dBm	+17 dBm
	> 1500 MHz to <= 2100 MHz	+13 dBm	+17 dBm	+15 dBm
	> 2100 MHz to <= 2500 MHz	+13 dBm	+15 dBm	+13 dBm
	> 2500 MHz to <= 4000 MHz	+10 dBm	+13 dBm	+11 dBm

1. Minimum amplitude is -136dBm for all models and all option configurations.
2. Option 1EA - High power (HP 8648B/C/D only)
3. Option 1E6 - Pulse modulation (HP 8648B/C/D only)

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

- Amplitude entered as: [*numeric*][*prefix*]D, V, or Vpp.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.
- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Amplitude entered as: [*numeric*][*prefix*]D, V, or Vpp.

Rules:

- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *blank* 8648A/B/C/D RF Output

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 5800A or 5820Aor 5820A is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 5800A is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
# ----- Reset -----
  1.002  8648         *                                                    S
  1.003  8648   A     -42.95D        1U            100MH
  2.001  8648         100mV                        550MH            -D     S
  2.002  8648   0.5   28mV           5U            100MH
  3.001  8648   A     D              1U            100MH
  4.001  8648         V              1%            100MH
  5.001  8648   50    10uT           1% 1/ 1U      -35D
  6.001  8648   200   100nT          1% 1/ 1U      100mV
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                       F         W
  7.002  ASK+     D
  7.003  DISP         Connect the 8648 to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  8648   20    120mVpp                      100kH                   N  CH1
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  8648         5MH            -100%         mVpp                       CH1
  8.001  MESS
  8.002  ASK+         N
END
```

M8648

Auxiliary Instrument Setup FSC

Description

The M8648 FSC provides the additional program functions for the Hewlett-Packard 8648A/B/C/D RF Signal Generators which are not addressed by the 8648 FSC. These functions are: Modulation Frequency, AM Depth, FM Deviation, and Phase Deviation.

RANGE

Not used.

NOMINAL

The NOMINAL field specifies the modulation frequency or a reset.

- Modulation Frequency:

  When the NOMINAL field is used to specify the modulation frequency, the format is [*numeric*][*prefix*]H. Allowed values are 400 Hz or 1000 Hz, or 10 Hz to 20 kHz with Option 1E2.

  If just units are entered, the value is taken from memory register MEM at run time.

- Reset:

  To specify a reset, enter an asterisk (*) in the NOMINAL field. This resets all previous settings created with the M8648 FSC.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies the AM depth, FM deviation, or phase deviation The MOD1 field cannot be blank in an 8648 statement.

- AM Depth:

  AM depth is entered as *numeric*%. AM depth limits are 0 to 100%; output <= 4 dBm.

- FM Deviation:

FM deviation is entered as *numeric*[*prefix*]H.

FM deviation depends upon the carrier and modulation frequencies as shown in the table below:

Modulation Frequency > 25 Hz

Carrier Frequency	FM Deviation
< 249 MHz	0 to 200 kHz
< 501 MHz	0 to 100 kHz
< 1001 MHz	0 to 200 kHz
< 2001 MHz	0 to 400 kHz
<= 4000 MHz	0 to 800 kHz

- Phase Deviation:

  Phase deviation is entered as *numeric*[*prefix*]rad.

  Phase deviation depends upon the carrier and modulation frequencies as shown in the table below:

Modulation Frequency > 20 Hz

Carrier Frequency	Phase Deviation
< 249 MHz	0 to 10 radians
< 501 MHz	0 to 5 radians
< 1001 MHz	0 to 10 radians
< 2001 MHz	0 to 20 radians
<= 4000 MHz	0 to 40 radians

MOD2

Not used.

MOD3

Not used.

MOD4

Not used.

CON

Not used.

Examples

```
STEP     FSC     RANGE NOMINAL        TOLERANCE      MOD1         MOD2   3   4  CON
# AM Modulation
  1.001  M8648         *
  1.002  M8648         400H                           0pct
  1.003  8648    10    0D              1U             10MH
  2.001  M8648         *
  2.002  M8648         1000H                          90pct
  2.003  8648    10    0D              1U             10MH
# FM Modulation
  3.001  M8648         *
  3.002  M8648         400H                           100H
  3.003  8648    10    0D              0.11U          200kH
  4.001  M8648         *
  4.002  M8648         1000H                          99.9kH
  4.003  8648    10    0D              0.1U           1000MH
```

8842

Instrument FSC

Description

The 8842 FSC programs the Fluke 8842A and 8840A Digital Multimeters to measure DC voltage, AC voltage, DC current, AC current, resistance, and conductance. High voltage probes extend the DC voltage range to 40 kV.

Note

The 8842 FSC will not work with 8840A's or 8842A's with firmware version 3.0. Firmware version 3.0 does not set the Data Available bit in the status byte, which is required by MET/CAL.

Functional Capability

Function	Nominal	MOD1	MOD2	MOD3
DC Voltage	-1000 V to 1000 V			
DC Voltage w/6 kV Probe	-6 kV to 6 kV			F
DC Voltage w/40 kV Probe	±(1 kV to 40 kV)			G
AC Voltage[1]	1 mV to 700 V	20 Hz to 100 kHz		
DC Current	-1.99999 mA to 1.99999 mA			
AC Current	100 mA to 1.99999 A	20 Hz to 5 kHz		
Resistance	0 Ω to 19.9999 MΩ			
Conductance	>50 nS			
dBm[1]	-46.99 dBm to 69.91 dBm	20 Hz to 100 kHz	5Z	
dBm[1]	-48.75 dBm to 68.15 dBm	20 Hz to 100 kHz	7Z	
dBm[1]	-54.77 dBm to 62.13 dBm	20 Hz to 100 kHz	3Z	
dBm[1]	-57.78 dBm to 59.12 dBm	20 Hz to 100 kHz	6Z	
1. Volt-Hertz product not to exceed 2 x 10^7.				

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Current entered as [*numeric*][*prefix*]A.
- Resistance entered as [*numeric*][*prefix*]Z.
- Conductance entered as [*numeric*][*prefix*]Y.
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage and AC current measurements or voltage for frequency measurements. See the NOMINAL field specification for allowed values and units.

- Frequency entered as *numeric*[*prefix*]H.
- *blank* not applicable

Rules:

The MOD1 field must be blank when the NOMINAL field specifies resistance or conductance.

MOD2

This field specifies the load impedance that the AC voltage is referenced to.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.

MOD3

This field specifies one of the following:

- F DC Voltage measurement using 6 kV probe
- G DC Voltage measurement using 40 kV probe
- *blank* field not applicable

Rules:

- The MOD3 field may specify F or G only when the NOMINAL field specifies voltage.
- F is automatically inserted in the MOD3 field when DC Voltage is specified and the NOMINAL field value is greater than 1000 V and less than or equal to 6000 V.
- G is automatically inserted in the MOD3 field when DC Voltage is specified and the NOMINAL field value is greater than 6000 V.
- F or G may be specified at lower voltages to avoid connection changes.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance.
- If 2 W is specified for a nominal value below 20 Ω, the measurement is taken on the 200 Ω range. 4W must be specified if the 20 Ω range is to be used.

Use of Standard Memory Locations and Results Reporting

- System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  8842         *                                                 S
# ----- DC Voltage -----
  1.002  8842   10     10V            1% 0.01U                              2W
  2.001  8842   2      1 kV            5%                              F      2W
  3.001  8842   10     6 kV            1%                              F      2W
  4.001  8842   100    40kV           20%                             G     2W
# ----- AC Voltage -----
  5.001  8842   1000   650V           5%            30kH                    2W
  6.001  8842   1      1V             1% 0.01U      10kH                    2W
# ----- Decibels -----
  7.001  8842   A      69.268D        0.1U          1kH            5Z       2W
# ----- DC Current -----
  9.001  8842   4000   350mA          9U                              E     2W
# ----- AC Current -----
 10.001  8842   2      1A             3%            60H                     2W
# ----- Resistance -----
 11.001  8842   100    10MZ           1%                                    2W
# ----- Conductance -----
 12.001  8842   100    100nY          5%                                    2W
# ----- Setup Test -----
 13.001  8842         1V                            10kH                 S  2W
# ----- Nominal Setup Test -----
 13.002  8842   1      1V                           10kH                 N  2W
# ----- Comparison Test -----
 13.003  8842   1      1V             1% 0.1U       20kH                 C  2W
        .
```

8845, 8846

Instrument FSCs

Description

The 8845 and 8846 FSCs program the Fluke 8845A and 8846A Multimeters to measure DC voltage, AC voltage, dBm, decibels, DC current, AC current, resistance, frequency, period, capacitance (8846A only), and temperature (8846A only).

The following auxiliary functions are provided by the M8845 and M8846 FSCs:

Range Locking

Reference Impedance (also see 8845/8846 FSC MOD2)

dB Reference

Note

If the 8845A/46A is to be controlled via its serial port, do not use the PORT FSC port configuration special construction, [P9600,N,...], to set the baud rate, parity, etc. of the port used to control the 8845A/46A. MET/CAL executes a "Test" function for each System Instrument prior to executing any procedure statements, therefore the settings of the port used to controlling the 8845A/46A must be set correctly before a procedure is executed. If the 8845A/46A is connected to a standard serial port (COM1, COM2, ..., COM16), select "Ports" application in the Windows control panel to choose the proper settings. If the 8845A/46A is connected to the 5500A, 5520A, 5800A, or 5820A UUT port, select the proper settings for the UUT Port from the front panel of the calibrator.

Functional Capability

Function	Nominal	MOD1
DC Voltage	-1000 V to 1000 V	
AC Voltage	0.1 mV to 750 V (8845A)	3 Hz to 300 kHz [1]
	0.1 mV to 1000 V (8846A)	3 Hz to 300 kHz [1]
dBm Ref. Impedance (see MOD2 & M884x FSC)	Limits are based ACV range and reference impedance specified: 2, 4, 8, 16, 50, 75, 93, 110, 124, 125, 135, 150, 250, 300, 500, 600, 800, 900 Ohms,1, 1.2, & 8 kOhm	
dB	Limits are based ACV limits	
Resistance	0 Ohms to 199.99999 MOhm (8845A)	
	0 Ohms to 1.9999999 GOhm (8846A)	
DC Current	10 A to 10 A	
DC Current	10 A to 10 A	
AC Current	1 µA to 10 A	3 Hz to 10 kHz
Frequency	3 Hz to 300 kHz	100 mV to 750 V (8845A,1)
	3 Hz to 1 MHz	100 mV to 750 V (8846A,1)
Period	1 µs to 330 ms	100 mV to 750 V [1]
Capacitance(8846A)	100 pF to 199.9 mF	
Temperature(8846A)	-200 degC to 600 degC	
1. V-Hz product not to exceed 8E+7		

Parameters

Range

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

Nominal

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as [*numeric*][*prefix*]V

- Voltage Ratio entered as [*numeric*][*prefix*]V/V or pct
- dBm entered as [*numeric*][*prefix*]D
- Decibels entered as [*numeric*][*prefix*]dB
- Resistance entered as [<numeric>][<prefix>]Z
- Current entered as [*numeric*][*prefix*]A
- Frequency entered as [*numeric*][*prefix*]H
- Period entered [*numeric*][*prefix*]T
- Capacitance entered [*numeric*][*prefix*]F (8846 FSC only)
- Temperature entered as [*numeric*][*prefix*]degC, degF, or K (8846)
- Reset entered as *

Rules:

- When the NOMINAL field units are dBm the 8845/8846 MOD2 field or the M8845/M8846 NOMINAL field must specify the reference impedance.
- When the NOMINAL field units are decibels the M8845/M8846 NOMINAL field must specify the reference value.
- When the NOMINAL field units are degC, degF, or Kelvin, the MOD2 field must specify the RTD type.
- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.

Tolerance

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency or amplitude for AC voltage, dBm, decibels, or AC current measurements.

- Frequency entered as [*numeric*][*prefix*]H
- Voltage entered as [*numeric*][*prefix*]V
- *blank* not applicable

Rules:

- The MOD1 field may specify frequency only when the NOMINAL field specifies voltage, dBm, or decibels, or current.
- The MOD1 field must specify voltage when the NOMINAL field frequency or period.
- The MOD1 field must be blank when the NOMINAL field specifies resistance, capacitance, or temperature.

MOD2

This field specifies the reference impedance* that the AC voltage is reference to for dBm or decibels, or the RTD type for temperature measurement.

- 3Z 300 Ohm
- 5Z 50 Ohm
- 6Z 600 Ohm
- 7Z 75 Ohm
- R1 100 Ohm Pt 385 RTD (8846 FSC only)
- *blank* Not applicable

*Additional reference impedance values may be specified using the M8845/46 FSC.

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies dBm.
- The MOD2 field must specify a reference impedance only when the NOMINAL field specifies dBm and the MOD3 field specifies the voltage measurement resolution.
- The MOD2 field may specify a RTD type only when the NOMINAL field specifies degC, degF, or K.

MOD3

This field specifies the resolution.

- D4 4.5 digits
- D5 5.5 digits
- D6 6.5 digits

- RS Reference Set
- RL Relative
- *blank* Not applicable

Rules:

- The MOD3 field must be blank when the Nominal field units are farads.
- The MOD3 field may specify a Reference Set only when the NOMINAL field specifies capacitance.
- The MOD3 field may specify a Relative only when the NOMINAL field specifies capacitance.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the UUT connection.

- 2W Selects 2-wire
- 4W Selects 4-wire

Rules:

- The CON field may specify a 4W only when the NOMINAL field specifies resistance or temperature.
- 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
  STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2  3  4 CON

#  -----  Reset -----
```

```
  1.002  M8846        *
  1.003  8846         *                                                  S

# -----  DC Voltage  -----
  1.004  8846         1.000V        0.001U                                  2W
  2.001  M8846  RNGLK 10V
  2.002  8846         1.00V         0.01U                                   2W
  3.001  M8846        *

# -----  AC Voltage  -----
  3.002  8846         100.0mV       0.1U          1kH                       2W

# -----  2-Wire Resistance  -----
  4.001  8846         1.0000MZ      0.0010U                                 2W

# -----  4-Wire Resistance  -----
  5.001  8846         100.00Z       1.00U                                   4W

# -----  DC Current  -----
  6.001  8846         1.0000mA      0.0100U                                 2W
  7.001  8846         10.000A       0.100U                                  2W

# -----  AC Current  -----
  8.001  8846         10.000mA      0.100U        10kH                      2W
  9.001  8846         10.000A       0.100U        1kH                       2W

# -----  Frequency  -----
 10.001  8846         100.00kH      1%            100mV                     2W

# -----  Period  -----
 11.001  8846         10.000mT      0.001U        1V                        2W

# -----  dBm  -----
 12.001  8846         -7.00D        1.00U         1kH            5Z         2W
 13.001  M8846  IMPED 50Z
 13.002  8846         -7.00D        1.00U         1kH                       2W
 14.001  M8846        *

# -----  dB  -----
# Get reference value.
 14.002  M8846  IMPED 50Z
 14.003  8846         -10.00D       1.00U         1kH                       2W
# Put reference value in MEM for M8846 statement.
 15.001  MATH         MEM = MEM1
```

```
 15.002  M8846  DBREF D
 15.003  8846         10.00dB       1.00U         1kH                     2W

# -----  Capacitance  -----
# Set reference value.
 16.001  8846         0nF                                           RS N  2W
# Take relative measurement.
 16.002  8846         1.000nF       0.100U                          RL    2W

# -----  Temperature (100 Ohm Pt 385)  -----
 17.001  8846         -190.0degC    1.0U                         R1       4W
```

M8846

Auxiliary Instrument Setup FSC

Description

The M8845 and M8846 FSC provides the following functions for the Fluke 8845A/46A Multimeters:

- dB Reference
- dBm Reference Impedance
- Range Lock
- NPLC
- AC Detector Band (Filter)
- External Trigger

Parameters

When a blank M8845/M8846 statement is entered, a "*" is inserted automatically in the NOMINAL field. See NOMINAL field parameter for a description of "*".

Range

This field specifies one of the following:

- DBREF dB Reference
- IMPED dBm Reference Impedance
- RNGLK Range Lock
- *blank* Not applicable

Rules:

- When the RANGE field specifies IMPED, the NOMINAL field must specify the reference impedance in ohms.
- When the RANGE field specifies RNGLK, the NOMINAL field must specify the range selection value.

Nominal

This field specifies the dB reference, dBm reference impedance, range lock selection value, or reset.

- dB Reference entered as: *numeric*[*prefix*]D
- dBm Reference Impedance entered as: *numeric*[*prefix*]Z
- Voltage range entered as: *numeric*[*prefix*]V
- Current range entered as: *numeric*[*prefix*]A
- Resistance range entered as: *numeric*[*prefix*]Z
- Capacitance range entered as: *numeric*[*prefix*]F
- "*" Reset to default values

Rules:

- The NOMINAL field may specify a dB reference value only when the RANGE field is "DBREF".
- The NOMINAL field must specify a dB reference value when the 8845/8846 FSC Nominal field specifies dB.
- The NOMINAL field may specify a dBm reference impedance only when the RANGE field is "IMPED".
- The NOMINAL field must specify a dBm reference impedance when the 8845/8846 FSC Nominal field specifies dBm and the 8845/8846 FSC MOD2 field is not 3Z, 5Z, 6Z, or 7Z.
- Allowed values for dBm reference impedance are: 2 Ohm, 4 Ohm, 8 Ohm, 16 Ohm, 50 Ohm, 75 Ohm, 93 Ohm, 100 Ohm, 110 Ohm, 124 Ohm, 125 Ohm, 135 Ohm, 150 Ohm, 250 Ohm, 300 Ohm, 500 Ohm, 600 Ohm, 800 Ohm, 900 Ohm, 1 kOhm, 1.2 kOhm, and 8 kOhm.
- The NOMINAL field may specify a range only when the RANGE field specifies RNGLK.

Legal Ranges:

100 mV	100 µA	10 Ohm[3]	1 nF[3]
1 V	1 mA	100 Ohm	10 nF[3]
10 V	10 mA	1 kOhm	100 nF[3]
100 V	100 mA	10 kOhm	1 µF[3]
750 V[1]	1 A	100 kOhm	10 µF[3]
1000 V[2]	3 A	1 MOhm	100 µF[3]
	10 A	10 MOhm	1 mF[3]
		100 MOhm	10 mF[3]
		1 GOhm[3]	100 mF[3]

1. 8845A ACV
2. 8845A DCV, 8846A DCV & ACV
3. 8846A only

- A M8845/M8846 range lock specification only applies when a subsequent 8845/8846 FSC specifies an applicable measurement function.

Tolerance

This field specifies the number of power line cycles for DC measurements.

- NPLC entered as: *numeric*[*prefix*]NPLC
- *blank* Reset to default values (10 NPLC)

Rules:

- Allowed values for NPLC are: 0.02, 0.2, 1, 10, 100.

MOD1

This field specifies the Detector band (filter) for AC measurements.

- Detector band entered as *numeric*[*prefix*]H
- *blank* Reset to default value or not applicable

Rules:

- Allowed values are 3 Hz, 20 Hz, and 200 Hz.

- When the detector band is not specified, the default is 20 Hz.
- When the MOD1 field contains only units, the value is obtained from the memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies external trigger.

- "X" External trigger
- *blank* Bus trigger

CON

This field is not used.

8901

Instrument FSC

Description

The 8901 FSC programs the Hewlett-Packard 8901A and 8901B Modulation Analyzers to measure AM, FM, and Phase Modulation, Carrier Frequency, RF Level, and Tuned RF Level.

Functional Capability

Function	8901 MOD3	8901 Nominal	8901 MOD1	M8901 Nominal
AM	AM	0 to 99%	150 kHz to 10 MHz	20 Hz to 10 kHz
	AM	0 to 99%	10 MHz to 1300 MHz	20 Hz to 100 kHz
FM	FM	0 Hz to 40 kHz	150 kHz to 10 MHz	20 Hz to 10 kHz
	FM	0 Hz to 400 kHz	10 MHz to 1300 MHz	20 Hz to 200 kHz
PM[1]	PM	0 rad to 400 rad	10 MHz to 1300 MHz	200 Hz to 20 kHz
Frequency	FA	150 kHz to 650 MHz	-25 dBm to 30 dBm	(12 mV to 7 V)
	FA	>650 MHz to 1300 MHz	-20 dBm to 30 dBm	(22 mV to 7 V)
RF Level[2]	RF	1 mW to 1 W	150 kHz to 1300 MHz	
RF Power[3]	RF	10 uW to 1 W	100 kHz to 2.6 GHz	
	RF	-20 dBm to +30 dBm	100 kHz to 2.6 GHz	
Tuned RF Level[2]	TL	1 mW to 1 W	150 kHz to 1300 MHz	
Tuned RF Level[3]	TL	10 uW to 1 W	100 kHz to 1300 MHz	
	TL	-20 dBm to +30 dBm	100 kHz to 1300 MHz	
AM Calibration	CA	100.00%		
FM Calibration	CF	100.00%		

Function	8901 MOD3	8901 Nominal	8901 MOD1	M8901 Nominal
Power Zero[3]	ZR	0.0 W	100 kHz to 2.6 GHz	
Power Zero and Calibrate[3]	CP	1.00 mW	50 MHz	

1. Actual allowed Phase Modulation is dependent upon modulation frequency according to the graph in the 8901A Operating Manual.
2. 8901A
3. 8901B

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- AM Depth entered as: [*numeric*][*prefix*]pct.
- FM Deviation entered as: [*numeric*][*prefix*]H.
- Phase Deviation entered as [*numeric*][*prefix*]rad.
- RF Level or Tuned RF Level entered as [*numeric*][*prefix*]W.
- RF Power entered as [*numeric*][*prefix*]W or D.
- Frequency entered as [*numeric*][*prefix*]H.
- Reset entered as *.

Rules:

- See Functional Capability table.
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies carrier frequency or amplitude.

- Carrier Frequency entered as [*numeric*][*prefix*]H.
- Amplitude entered as [*numeric*][*prefix*]D or V.
- *blank* not applicable

Rules:

- See Functional Capability table.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is used to specifying tuning.

- TU Tune frequency
- *blank* Do not tune or not applicable

Rules:

- When the MOD2 field specifies TU, the MOD1 field is used as the tune frequency.
- The MOD2 field my specify TU only for modulation measurements, RF power measurements, and tuned RF level measurements (MOD3 = AM, FM, PM, RF, or TL).

MOD3

This field specifies the measurement type:

- AM AM Measurement
- FM FM Measurement
- PM Phase Measurement
- FA Frequency Measurement
- RF RF Level

- TL Tuned RF Level
- CA Calibrate AM (8901A Requires Opt 010)
- CF Calibrate FM (8901A Requires Opt 010)
- ZR Zero (8901B only)
- CP Zero and Calibrate RF Power (8901B only)

Rules:

- See Functional Capability table.
- The MOD3 field may specify CA, CF, ZR, and CP only for a Nominal Setup Test (MOD4 = N).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2  3   4  CON
# ----- Reset -----
  1.001  8901         *                                                 S
# ----- AM -----
  1.002  M8901        400Hz
  1.003  8901         20pct         5U            750kH             AM
# ----- FM -----
  2.001  M8901        1kH                                           L2     P+
  2.002  8901         35.0H         +100%         5MH               FM
# ----- Phase -----
  3.001  8901         15.0rad       1.0U          5MH               PM
# ----- RF Level -----
  4.001  M8901        *
  4.002  8901         50.0mW        0.2U          102.5MH           RF
# ----- Frequency -----
  5.001  8901         102.5MH       0.1U          10D               FA
```

M8901

Auxiliary Instrument Setup FSC

Description

The M8901 FSC provides the additional program functions for Hewlett-Packard 8901A/B which are not addressed by the 8901 FSC. These functions include modulation frequency, special functions, FM de-emphasis, high-pass filter, low-pass filter, and detector.

Parameters

RANGE

This field is used not used.

NOMINAL

This field specifies the Modulation Frequency or a reset.

- Modulation Frequency entered as: *numeric*[*prefix*]H.
- "*"   Reset
- *blank*

Rules:

- When the M8901 FSC Nominal field specifies a reset thefollowing parameter values are set:
- High-Pass Filter   All Off
- Low-Pass Filter   All Off
- Special Functions Off or Zero Suffix setting, which ever applies

TOLERANCE

This field is used to specify special functions.

- Special function entered as: *numeric*SP.
- *blank*   not applicable

Rules:

- Special Function codes supported:

Tolerance Field	Special Function
1.0SP to 1.6SP	Input Attenuation
2.0SP to 2.3SP	Modulation Range
3.0SP to 3.4SP	IF Frequency and Input High-Pass Filter
4.0SP to 4.2SP	Tune Mode
5.0SP to 5.1SP	Audio Peak Detector Time Constant
6.0SP to 6.2SP	AM ALC Response Time
7.0SP to 7.2SP	Frequency Resolution
8.0SP to 8.8SP	Error Disable
15.0SP	Display E12 if Oven Cold
16.0SP to 16.1SP	AM Calibration
17.0SP to 17.1SP	FM Calibration

- See the 8901B Operator's Manual for a description of individual Special Function codes.
- Multiple M8901 statements may be used to specify more than one special function for a measurement. A special function specification is retained until a M8901 reset is executed.
- However the actual special function settings of the 8901 are only updated when a 8901 statement is executed.
- MET/CAL does not check to make sure that a special function specified is compatible with other 8901 settings specified in the 8901 and M8901 FSCs.

MOD1

This field specifies FM De-Emphasis.

- FM De-Emphasis entered as: [*numeric*][*prefix*]T.
- *blank* Pre-Display and FM De-Emphasis off

Rules:

- Allowed values are: 25µs, 50 µs, 75 µs, and 750 µs.
- Pre-Display is turned on whenever De-Emphasis is specified.

- The M8901 MOD1 field may only specify FM De-Emphasis when the 8901 MOD3 field specifies FM.

MOD2

This field specifies the High-Pass Filter:

- H0 All Off
- H1 50 Hz
- H2 300 Hz

Rules:

- H0 is automatically inserted in the MOD2 field if no MOD2 field code is entered.

MOD3

This field specifies the Low-Pass Filter:

- L0 All Off
- L1 3 kHz
- L2 15 kHz
- L3 >20 kHz

Rules:

- L0 is automatically inserted in the MOD3 field if no MOD3 field code is entered.

MOD4

This field is not used.

CON

This field specifies the Detector:

- P+ Peak +
- P- Peak -
- P+- Peak +-/2 (8901B only)
- HLD Peak Hold

- AVG Average (RMS Calibrated)
- *blank* Not applicable

Rules:

8901 MOD3	M8901 Nominal	M8901 CON
AM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
FM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
PM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
FA	*blank*	*blank*
RF	*blank*	*blank*
TL	*blank*	*blank*
CA	mod-freq	*blank*
CF	mod-freq	*blank*
CP	*blank*	*blank*

Examples

```
Refer to 8901 FSC.
```

8902

Instrument FSC

Description

The 8902 FSC programs the Hewlett-Packard 8902A Measuring Receiver and 8902S Microwave Measurement System to measure AM, FM, and Phase Modulation, Carrier Frequency, RF Power, Tuned RF Level, and Audio Distortion, Frequency, and Level.

The 8902S is a 8902A, with a 11792A Sensor Module, and a 11793A Microwave Converter.

Functional Capability

Function	8902 MOD3	8902 Nominal	8902 MOD1	M8902 Nominal
AM	AM	0 to 99%	150 kHz to <10 MHz	20 Hz to 10 kHz
	AM	0 to 99%	10 MHz to 1300 MHz [3]	20 Hz to 100 kHz
FM	FM	0 Hz to 40 kHz	150 kHz to <10 MHz	20 Hz to 10 kHz
	FM	0 Hz to 400 kHz	10 MHz to 1300 MHz [3]	20 Hz to 200 kHz
PM [1]	PM	0 rad to 400 rad	150 kHz to <10 MHz	200 Hz to 10 kHz
	PM	0 rad to 400 rad	10 MHz to 1300 MHz [3]	200 Hz to 20 kHz
Frequency	FA	150 kHz to 650 MHz	-25 dBm to 30 dBm	(12 mV to 7 V)
	FA	>650 MHz to 1300 MHz [3]	-20 dBm to 30 dBm	(22 mV to 7 V)
RF Power [2]	RF	10 uW to 1 W	100 kHz to 2.6 GHz [3]	
	RF	-20 dBm to +30 dBm	100 kHz to 2.6 GHz [3]	
Tuned RF Level	TL	10 uW to 1 mW	2.5 MHz to 1300 MHz [3]	
	TL	-127 dBm to 0 dBm	2.5 MHz to 1300 MHz [3]	
Audio Dist	AD	0.01% to 100%	380 Hz to 420 Hz	
	AD	-80 dB to 0 dB	380 Hz to 420 Hz	
	AD	0.01% to 100%	0.95 kHz to 1.05 kHz	
	AD	-80 dB to 0 dB	0.95 kHz to 1.05 kHz	
Audio Freq	AF	20 Hz to 600 kHz	-20 dBm to 12.04 dBm	
	AF	20 Hz to 600 kHz	100 mV to 4 V	
Audio Level	AL	100 mV to 4 V	50 Hz to 40 kHz	
	AL	-20 dBm to 12.04 dBm	50 Hz to 40 kHz	

Function	8902 MOD3	8902 Nominal	8902 MOD1	M8902 Nominal
AM Calibration	CA	100.00%		
FM Calibration	CF	100.00%		
Power Zero only	ZR	0.0 W	100 kHz to 2.6 GHz [3]	
Power Zero and Calibrate	CP	1.00 mW	50 MHz	

1. Actual allowed Phase Modulation is dependent upon modulation frequency according to the the graph in the 8902A Operating Manual.
2. With HP 11711A Sensor Module
3. 8902S: 1300 MHz to 26.5 GHz

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- AM Depth entered as: [*numeric*][*prefix*]pct.
- FM Deviation entered as: [*numeric*][*prefix*]H.
- Phase Deviation entered as [*numeric*][*prefix*]rad.
- Frequency entered as [*numeric*][*prefix*]H.
- RF Power entered as [*numeric*][*prefix*]W or D.
- Tuned RF Level entered as [*numeric*][*prefix*]W or D.
- Relative Tuned RF Level entered as [*numeric*][*prefix*]dB.
- Audio Distortion entered as [*numeric*][*prefix*]pct or dB.
- Audio Frequency entered as: [*numeric*][*prefix*]H.

- Audio Level entered as: [*numeric*][*prefix*]V or D.
- Reset entered as *.

Rules:

- See Functional Capability table.
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the carrier frequency or amplitude.

- Carrier Frequency entered as [*numeric*][*prefix*]H.
- Amplitude entered as [*numeric*][*prefix*]D or V.
- *blank* not applicable

Rules:

- See Functional Capability table.
- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is used to specifying tuning.

- TU Tune frequency
- *blank* Do not tune or not applicable

Rules:

- When the MOD2 field specifies TU, the MOD1 field is used as the tune frequency.
- The MOD2 field my specify TU only for modulation measurements, RF power measurements, and tuned RF level measurements (MOD3 = AM, FM, PM, RF, or TL).

MOD3

This field specifies the measurement type:

- AMAM Measurement
- FM FM Measurement
- PM Phase Measurement
- RF RF Power
- TL Tuned RF Level
- RS Tuned RF Level (set reference)
- FA Frequency Measurement
- AD Audio Distortion Measurement
- AF Audio Frequency Measurement
- AL Audio Level Measurement
- CA Calibrate AM
- CF Calibrate FM
- ZR Zero
- CP Zero and Calibrate RF Power

Rules:

- See Functional Capability table.
- The MOD3 field may specify CA, CF, ZR, and CP only for a Nominal Setup Test (MOD4 = N).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field is always blank.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
# ----- Reset -----									
1.001	M8902		*						
1.002	8902		*					S	
# ----- AM Calibration -----									
1.003	8902		100.00pct				CA	N	
# ----- FM Calibration -----									
1.004	8902		100.00pct				CF	N	
# ----- RF Power Calibration -----									
1.008	HEAD		HP 8902A ZERO/CAL operations completed.						
1.009	DISP		Remove the HP 11722A Sensor Module from the HP 8902A						
1.009	DISP		CALIBRATION RF POWER OUTPUT and connect it to the UUT.						
1.007	8902		1mW		50MH		CP	N	
1.008	HEAD		HP 8902A ZERO/CAL operations completed.						
1.009	DISP		Remove the HP 11722A Sensor Module from the HP 8902A						
1.009	DISP		CALIBRATION RF POWER OUTPUT and connect it to the UUT.						
# ----- Frequency Measurement -----									
1.010	8902		120MH		11D		FA	N	
# ----- RF Power Zero -----									
1.007	8902		0mW				ZR	N	
# ----- RF Power Measurement -----									
1.011	8902	130	11.0D	1.0U	MH	TU	RF		
# ----- Tuned RF Level Measurement -----									
2.001	8902		120MH		-13D		FA	N	
2.002	8902	130	-13.0D	1.0U	MH	TU	TL		
# ----- AM Measurement -----									
3.001	M8902		400H			H0	L0		P+-
3.002	8902		30.0pct	3.2U	0.4MH		AM		
4.001	M8902		*						
# ----- FM Measurement -----									
4.002	M8902		1kH			H1	L2		P+-
4.003	8902		100.0kH	7U	245MH		FM		
# ----- PM Measurement -----									
5.001	8902		50.0rad	10U	50MH		PM		
# ----- Relative Tuned RF Level -----									
6.001	HEAD		0 dBm REFERENCE: 10 MHz						

```
  6.002  DISP         Set UUT to 0 dB.
  6.003  6060         0D                           10MH           -D    S   L
# Disable relative mode.
  6.004  M8902                       26.0SP                       H0 L0
  6.005  8902         0D                           10MH           TU RS N
  6.006  HEAD         10 dB @ 10 MHz
  6.007  DISP         Set UUT to 10 dB.
  6.008  6060         0D                           10MH           -D    S   L
# Enable relative mode.
  6.009  M8902                       26.1SP                       H0 L0
  6.010  8902         10.0dB                       10MH              TL N
  6.011  MATH         MEM = ABS(MEM)
  6.012  ACC    10    dB             0.02U
  6.013  MATH         MEM = MEM1
  6.014  MEMC         10.0dB         0.1U          10MH
  7.001  END


# ----- Relative Tuned RF Level: > 1.3 GHz -----
# Clear all calibration factors.
  7.002  IEEE         [@8902]39.9SP
  7.003  HEAD         SET 0 dB REFERENCE @ 1500 MHz
  7.004  DISP         Set the UUT to 10 dB.
  7.005  8648         1500MH                       5D             -D    S
  7.006  IEEE         [@8340]CW1620.53MZPL8DBRF1
  7.007  M8902                       26.0SP                       H0 L0
# Set IF Freq: 455 kHz, Wide IF Filter: 200 kHz, Narrow IF & RF High-Pass in.
  7.008  M8902                       3.7SP                        H0 L0
# Set input attenuation to 10 dB.
  7.009  M8902                       1.9SP                        H0 L0
# Specify LO frequency.
  7.010  M8902        1620.53MH      27.3SP                       H0 L0
  7.011  8902         1500MH                       5D                FA N
# Re-tune the 8902A and set the 0 dB reference.
  7.012  8902         0.00D                        MH             TU RS N

  7.013  HEAD         ATTENUATION: 10 dB @ 1500 MHz
  7.014  DISP         Set the UUT to 10 dB.
  7.015  8648         1500MH                       5D             -D    S
  7.016  IEEE         [@8340]CW1620.53MZPL8DBRF1
  7.017  M8902                       26.1SP                       H0 L0
  7.018  TARGET       -m
  7.019  8902         -10.00dB       0.2U          1500MH            TL
```

8.001	HEAD	ATTENUATION: 20 dB @ 1500 MHz					
8.002	DISP	Set the UUT to 20 dB.					
8.003	8648	1500MH		5D		-D	S
8.004	IEEE	[@8340]CW1620.53MZPL8DBRF1					
8.005	TARGET	-m					
8.006	8902	-20.00dB	0.4U	1500MH	TL		
9.001	HEAD	ATTENUATION: 30 dB @ 1500 MHz					
9.002	DISP	Set the UUT to 30 dB.					
9.003	8648	1500MH		5D		-D	S
9.004	IEEE	[@8340]CW1620.53MZPL8DBRF1					
9.005	TARGET	-m					
9.006	8902	-30.00dB	0.5U	1500MH	TL		
10.001	HEAD	ATTENUATION: 40 dB @ 1500 MHz					
10.002	DISP	Set the UUT to 40 dB.					
10.003	8648	1500MH		5D		-D	S
10.004	IEEE	[@8340]CW1620.53MZPL8DBRF1					
10.005	TARGET	-m					
10.006	8902	-40.00dB	0.7U	1500MH	TL		
11.001	HEAD	ATTENUATION: 50 dB @ 1500 MHz					
11.002	DISP	Set the UUT to 50 dB.					
11.003	8648	1500MH		5D		-D	S
11.004	IEEE	[@8340]CW1620.53MZPL8DBRF1					
11.005	TARGET	-m					
11.006	8902	-50.00dB	0.8U	1500MH	TL		

M8902

Auxiliary Instrument Setup FSC

Description

The M8902 FSC provides the additional program functions for Hewlett-Packard 8902A which are not addressed by the 8902 FSC. These functions include modulation frequency, 8902S Local Oscillator (LO) frequency, special functions, FM de-emphasis, modulation output/audio input, high-pass filter, low-pass filter, and detector.

Parameters

RANGE

This field is used not used.

NOMINAL

This field specifies the Modulation Frequency or a reset.

- Modulation Frequency entered as: *numeric*[*prefix*]H.
- Local Oscillator Frequency enter as: [*numeric*][*prefix*]H.
- "*"   Reset
- *blank*

Rules:

- When a frequency is entered in the Nominal field, it is interpreted as follows: If the M8902 Tolerance field is 27.3SP the Nominal field value is assumed to be the LO frequency applied to the 11793A Microwave Converter. In all other cases, the Nominal value is assumed to be the modulation frequency.
- Allowed values for LO Frequency are 0 Hz to 40.7 GHz.
- When the M8902 FSC Nominal field specifies a reset the following parameter values are set:

High-Pass Filter	All Off
Low-Pass Filter	All Off
Special Functions	Off or Zero Suffix setting, which ever applies

TOLERANCE

This field is used to specify special functions.

- Special function entered as: *numeric*SP.
- *blank* not applicable

Rules:

- Special Function codes supported:

Tolerance Field	Special Function
1.0SP to 1.9SP	Input Attenuation & Gain
2.0SP to 2.4SP	Audio Range Selection
3.0SP to 3.8SP	RF and IF Filters
4.0SP to 4.7SP	Tune RF Level Sync., Average Detector, & Display Averaging
5.0SP to 5.1SP	Audio Detector Response
6.0SP to 6.2SP	Automatic Level Control
7.0SP to 7.4SP	RF Frequency Resolution
8.0SP to 8.8SP	Error Message Disable Control
9.0SP to 9.7SP	IF Gain
10.0SP to 10.5SP	RF Power Range
15.0SP	Display E12 if Oven Cold
16.0SP to 16.1SP	AM Calibration
17.0SP to 17.1SP	FM Calibration
23.0SP to 23.1SP	External LO (Option 030 only)
26.0SP to 26.1SP	Relative Tuned RF Level Measurement
27.0SP to 27.3SP	Frequency Offset Mode (8902S only)
32.0SP to 32.2SP	Increased Resolution (Option 050 only)

- See the 8902A Operator's Manual for a description of individual Special Function codes.
- Multiple M8902 statements may be used to specify more than one special function for a measurement. A special function specification is retained until a

M8902 reset is executed. However the actual special function settings of the 8902 are only updated when a 8902 statement is executed.

- In general, MET/CAL does not check to make sure that a special function specified is compatible with other 8902 settings specified in the 8902 and M8902 FSCs. The exception is special function 27.3, which is used to enter and enable the 8902S frequency offset mode. When the Tolerance field specifies 27.3SP, the M8902 Nominal field must specify the frequency of the local oscillator applied to the 11793A Microwave Converter.

MOD1

This field specifies FM De-Emphasis.

- FM De-Emphasis entered as: [*numeric*][*prefix*]T.
- *blank* NA or Pre-Display and FM De-Emphasis off

Rules:

- Allowed values of FM De-Emphasis are: 25 µs, 50 µs, 75 µs, and 750 µs.
- Pre-Display is turned on whenever De-Emphasis is specified.
- The M8902 MOD1 field may only specify FM De-Emphasis when the 8902 MOD3 field specifies FM.

MOD2

This field specifies the High-Pass Filter:

- H0 All Off
- H1 50 Hz
- H2 300 Hz

Rules:

- H0 is automatically inserted in the MOD2 field if no MOD2 field code is entered.

MOD3

This field specifies the Low-Pass Filter:

- L0 All Off
- L1 3 kHz
- L2 15 kHz
- L3 >20 kHz

Rules:

- L0 is automatically inserted in the MOD3 field if no MOD3 field code is entered.

MOD4

This field specifies the state of the MODULATION OUTPUT/AUDIO INPUT front panel BNC connection.

- X Audio Input
- *blank* Modulation Output

Rules:

- When using the AUDIO INPUT, the allowable frequency range (by function) is as follows:

  Audio Frequency: 20 Hz to 250 kHz

  Audio RMS Level: 50 Hz to 40 kHz

  Audio Distortion: 400 Hz or 1 kHz, ±5%

  The maximum safe input to the AUDIO INPUT is 4 Vrms.

CON

This field specifies the Detector:

- P+ Peak +
- Peak -
- P+- Peak +-/2
- HLD Peak Hold
- AVG Average (RMS Calibrated)
- RMS RMS
- D5 1 kHz DISTN
- D6 400 Hz DISTN
- *blank* Not applicable

Rules:

8902 MOD3	M8902 NOMINAL	M8902 CON
AM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
FM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
PM	mod-freq	P+, P-, P+-, HLD, AVG, RMS
FA	*blank*	*blank*
RF	*blank*	*bank*
TL	*blank*	*blank*
AF	*blank*	*blank*
AD	*blank*	RMS, D5, D6
CA	mod-freq	*blank*
CF	mod-freq	*blank*
CP	*blank*	*blank*

Examples

Refer to 8902 FSC.

8903

8903 Instrument FSC

Description

The 8903 FSC programs the Hewlett-Packard 8903A or 8903B Audio Analyzer to measure AC Level, DC Level, Distortion, and Signal-to-Noise Ratio and the Hewlett-Packard 8903E Distortion Analyzer to measure AC Level, DC Level, and Distortion.

Note

If the 8903 FSC is to be used to control an 8903A or 8903E, the parameter hp8903 must be added to the ***[startup]*** *section of the MET/CAL initialization file. Legal entries are as follows:*

Parameter	Model
hp8903=A	8903A
hp8903=B	8903B
hp8903=E	8903E
omitted	8903B

Functional Capability

Funtion	MOD3	Nominal	MOD1
AC Level	AL	0.0001 mV to 300 V	20 Hz to 150 kHz
	AL	-160 dBm to +30 dBm	20 Hz to 150 kHz
DC Level	DL	0 V to 300 V	
Frequency	AF	20 Hz to 150 kHz	5 mV to 300 V
	AF	20 Hz to 150 kHz	-46.02 dBm to +49.54 dBm
Distortion	AD	0% to 100%	20 Hz to 100 kHz
	AD	-99.99 dB to 0 dB	20 Hz to 100 kHz
Source [1]		0.6 mV to 6 V	20 Hz to 100 kHz
		-62.21 dBm to 17.78 dBm	20 Hz to 100 kHz

1. 8903B only. To use the source and a measurement function simultaneously, simply apply the source with a 8903 Setup statement (MOD4 = S) followed by a 8903 statement specifying the measurement function desired. The source will be turned off when an evaluation occurs except when ASK- Q is in effect.

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- AC Level entered as: [*numeric*][*prefix*]V or D.
- DC Level entered as: [*numeric*][*prefix*]V.
- Frequency entered as: [*numeric*][*prefix*]H.
- Distortion entered as: [*numeric*][*prefix*]pct or dB.
- Source Amplitude entered as: [*numeric*][*prefix*]V or D.

Rules:

- See Functional Capability table.
- When the Nominal field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency.

- Frequency entered as [*numeric*][*prefix*]H.
-
- Source Frequency entered as: [*numeric*][*prefix*]H.
- *blank* not applicable

Rules:

- See Functional Capability table.

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the Nominal field MUST contain a value.

MOD2

This field is not used.

MOD3

This field specifies the measurement type:

- AD Distortion
- AF Frequency
- AL AC Level
- DL DC Level
- *blank* Source

Rules:

- See Functional Capability table.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

This field specifies the source output impedance.

- L 50 Ω
- *blank* 600 Ω or not applicable

Rules:

- The CON must be blank when the MOD3 field is not blank (analyzer).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2   3  4 CON
# ----- Reset -----
  1.001  M8903        *
  1.002  8903         *                                                 S
  1.003  DISP         Connect 8902A MODULATION OUTPUT to the 8903B INPUT HIGH.
  1.003  DISP
  1.003  DISP         Connect 8903B OUTPUT HIGH to the UUT MOD INPUT.
  1.003  DISP
  1.003  DISP         Ensure that both the HP 8903B INPUT and OUTPUT "FLOAT"
  1.003  DISP         switches are set for 'grounded' operation.
  1.004  M8902        1kH                                        H0 L0    P+-
  1.005  M8903                                                   H0 L2    RMS
# ----- Source -----
  1.006  8903         1.4142V                      1kH                  S
  1.007  8902         30.0pct                      0.4MH             AM N
# ----- Distortion -----
  1.008  8903         0.000pct       1.5U          1kH               AD
  2.001  M8903        *
# ----- AC Level -----
  2.002  8903         10.0mV         0.2U          400H              AL
  3.001  8903         -10D                         400H              AL N
# ----- DC Level -----
  3.002  8903         35.0V          +100%                           DL
```

M8903

Auxiliary Instrument Setup FSC

Description

The M8903 FSC provides the additional program functions for Hewlett-Packard 8903B and 8903E which are not addressed by the 8903 FSC. These functions include special functions, plug-in and low-pass filters, and detector.

Parameters

RANGE

This field is used not used.

NOMINAL

This field specifies a reset.

- "*" Reset
- *blank* Not applicable

Rules:

- When the M8903 FSC Nominal field specifies a reset the following parameter values are set:

Source	Off
Plug-in Filters	Off
Low-Pass Filter	All Off
Detector	RMS
Special Functions	Off or Zero Suffix setting, which ever applies

TOLERANCE

This field is used to specify special functions.

- Special Function entered as: *numeric*SP.
- *blank* not applicable

Rules:

- Special Function codes supported:

Tolerance Field	Special Function
1.0SP to 1.19SP	Input Level Range (except DC Level)
2.0SP to 2.4SP	Input Level Range (DC Level only)
3.0SP to 3.4SP	Post Notch Gain
5.0SP to 5.7SP	Post Notch Detector Response
6.0SP to 6.1SP	Notch Tuning
8.0SP to 8.3SP	Error Disable
12.0SP to 12.9SP	Signal-to-Noise Measurements Delay
14.0SP to 14.1SP	Time Between Measurements
16.0SP to 16.1SP	Signal-to-Noise Display Resolution
19.0SP to 19.NNNSP	Display Level in Watts

- See the 8903B Operator's Manual for a description of individual Special Function codes.
- Multiple M8903 statements may be used to specify more than one special function for a measurement. A special function specification is retained until a M8903 reset is executed. However the actual special function settings of the 8903 are only updated when a 8903 statement is executed.
- MET/CAL does not check to make sure that a special function specified is compatible with other 8903 settings specified in the 8903 and M8903 FSCs.

MOD1

This field is not used.

MOD2

This field specifies the Plug-in HP/BP Filters:

- H0 All Off
- H1 Left Plug-in Filter on
- H2 Right Plug-in Filter on

Rules:

- H0 is automatically inserted in the MOD2 field if no MOD2 field code is entered.

MOD3

This field specifies the Low-Pass Filter:

- L0 All Off
- L1 30 kHz
- L2 80 kHz

Rules:

- L0 is automatically inserted in the MOD3 field if no MOD3 field code is entered.

MOD4

This field is not used.

CON

This field specifies the Detector:

- RMS RMS
- AVG Average

Rules:

- RMS is automatically inserted in the CON field if no CON field code is entered.

Examples

Refer to 8903 FSC.

8920

Instrument FSC

Description

The 8920 FSC programs the Fluke 8920A True RMS Voltmeter using the Fluke 1120A IEEE-488 translator and the -520 IEEE-488 Interface. Normally a MET/CAL instrument FSC will program the required instrument setup for a measurement. However, because the 8920A is a talk only device (cannot be programmed), a reading is taken to determine the current measurement units.

If the current units do not agree with the units in the NOMINAL field (Volts or dBm), an automatic message is generated to prompt the operator to select the correct display mode on the 8920A front panel. In addition, if the NOMINAL field units are dBm, and the current 8920A dBm reference value does not agree with the reference specified by the MOD2 field, an automatic message is also generated to prompt the operator to select the correct reference value.

Note

It is not possible for MET/CAL to determine the current 8920A range and function (AC or AC+DC and filter on or off). The DISP FSC must be used to prompt the operator to perform any changes to the function and range settings.

Functional Capability

MEAS. MODE	Nominal	MOD 1	MOD2	Function
DC Voltage	180 µV to 700 V			AC+DC
AC Voltage	180 µV to 700 V	2 Hz to 30 MHz		AC or AC+DC
dBm	-61.88 dBm to 69.91 dBm	2 Hz to 30 MHz	5Z	AC or AC+DC
dBm	-63.65 dBm to 68.15 dBm	2 Hz to 30 MHz	7Z	AC or AC+DC
dBm	-69.67 dBm to 62.13 dBm	2 Hz to 30 MHz	3Z	AC or AC+DC
dBm	-72.68 dBm to 62.13 dBm	2 Hz to 30 MHz	6Z	AC or AC+DC

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Voltage (DC or RMS) entered as: [*numeric*][*prefix*]V
- dBm entered as: [*numeric*][*prefix*]D
- Reset entered as *.

Rules:

- The NOMINAL field may specify decibels only when the MOD2 field specifies the reference impedance.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency for AC voltage.

- Frequency entered as *numeric*[*prefix*]H.
- *blank* DC

MOD2

This field specifies the load impedance that the AC voltage is referenced to.

- 5Z 50 Ω
- 7Z 75 Ω
- 3Z 300 Ω
- 6Z 600 Ω
- *blank* field not applicable

Rules:

- The MOD2 field may specify a reference impedance only when the NOMINAL field specifies decibels.
- 6Z is automatically inserted in the MOD2 field if no MOD2 field impedance code is entered.

MOD3

This field specifies the coupling for AC Voltage.

- F AC
- *blank* AC+DC

AC accuracy is better when using the AC mode (MOD3 = F).

Rules:

The MOD3 field may specify F (AC) only when the MOD1 field specifies a frequency (AC Voltage).

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection and is always 2-wire (2W). 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" .

Examples

```
  STEP   FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2  3  4  CON
# ----- Reset -----
  1.001  8920         *                                                S
# ----- DC Voltage -----
  1.002  DISP         Set the 8920A FUNCTION to AC+DC.
  1.003  8920   1000  650V           10%                                  2W
# ----- AC Voltage -----
  2.001  DISP         Set the 8920A FUNCTION to AC.
  2.002  8920   10    10V            1% 0.1U       100kH              F   2W
  3.001  8920   1     1V             1% 0.1U       10kH                   2W
# ----- Decibels -----
  4.001  8920   A     50D            1U            1kH             6Z F   2W
# ----- Setup Test -----
  5.001  8920         1V                           10kH               F  S  2W
# ----- Nominal Setup Test -----
  5.002  8920   1     1V                           10kH                  N  2W
# ----- Comparison Test -----
  5.003  8920   1     1V             1% 1U         20MH                  C  2W
```

9000

Instrument FSC

Description

The 9000 FSC provides the means to control the following functions of the Datron 9000 Calibrator:

- DC Voltage
- AC Voltage (sine)
- DC Current
- AC Current (sine)
- Resistance (resistance or conductance)
- Frequency
- Mark/Period (pulse)
- Capacitance
- Thermocouple Temperature
- RTD Temperature

Functional Capability

DC Voltage	-1050 V to 1050 V	
AC Voltage (Sine)	0.000 V to 105 V	10 Hz to 100 kHz
	105.001 V to 350 V	40 Hz to 30 kHz
	320.01 V to 1050 V	40Hz to 30 kHz*
DC Current	-20 A to 20 A	
AC Current (Sine)	0.00000 mA to 320 mA	10 Hz to 30 kHz
	0.32001 A to 20 A	10 Hz to 10 kHz
Resistance	0 Ω to 400 MΩ	
	2.5 nS to 2.49999 mS	
Frequency	0.5 Hz to 10 MHz	+/-(0.01Vp to 30Vp)* *|Vp| + |offset| < 30Vp
Mark/Period:	0.6 µs to 2000.00 ms	+/-(0.01Vp to 30Vp)*
Pulse Width	0.3 µs to 1999.99 ms	*|Vp| + |offset| < 30Vp
Mark/Period:	0.6 µs to 2000.00 ms	+/-(0.01Vp to 30Vp)*
Pulse Width	0.3 µs to 1999.99 ms	*|Vp| + |offset| < 30Vp
% Duty:	0.05 % to 99.95 %	+/-(0.01Vp to 30Vp)*
Period:	0.6 µs to 2000.00 ms	*|Vp| + |offset| < 30Vp
Capacitance	0.5 nF to 40 mF	
RTD Temperature:		
Pt 385	-200 °C to 850 °C	100 Ω (fixed)
	-328 °F to 1562 °F	100 Ω (fixed)
	7301 K to 1123.15 K	100 Ω (fixed)
TC Temperature:		
Type K	-250 °C to 1350 °C	100 Ω (fixed)
	-418 °F to 1832 °F	100 Ω (fixed)
	23.1 K to 1273.2 K	100 Ω (fixed)
*ramped to 10 kHz		

Parameters

The following table describes the basic operating modes of the 9000 Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 9000 FSC.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
App	Amps peak to peak	current
F	Farads	capacitance
H	Hertz	frequency
T	Time	period or pulse width
V	Volts	voltage
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Y	Siemens	conductance
Z	Ohms	resistance
degC	degrees Celcius	temperature
degF	degrees Fahrenheit	temperature
K	Kelvins	temperature

9000 FSC Nominal, MOD1, MOD2, and CON Rules

9000 Mode (function)	9000 Nominal	9000 MOD1	9000 MOD2[1]	9000 CON[2]
DC Voltage	V			2W
AC Voltage	V|Vpp	H|T	SI	2W
	H|T	V|Vpp	SI	2W
DC Current	A			2W
AC Current	A|App	H|T	SI	2W
	H|T	A|App	SI	2W
Resistance	Z|Y			2W|4W
Frequency	H|T	Vp	ZQ	2W
	Vp	H|T	ZQ	2W
Mark/Period:	H|T	Vp	PU	2W
Pulse	Vp	H|T	PU	2W
% Duty (pulse)	pct	Vp	PU	2W
Capacitance	F			2W|4W
TC Temperature	degC|degF|K		_K	2W
RTD Temperature	degC|degF|K	Z	R1	2W|4W

Notes:
Blank entries are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

1. See MOD2 parameter for description of these specification codes.
2. See CON parameter for description of these specification codes.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*] *units symbol*

or "*" to specify a reset.

Rules:

- When the NOMINAL field contains only units, the value is obtained from memory register MEM. In this case the MOD1 field MUST contain a value if it is not blank.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage, or current for AC Voltage or AC Current modes or the nominal resistance for RTD Temperature mode entered as:

[*numeric*][*prefix*] *units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.
- For RTD Temperature, only a nominal resistance of 100 Ohms is allowed.

MOD2

This field specifies the waveform, thermocouple, or RTD type.

- *blank* not applicable
- SI AC Voltage or AC Current (Sine)
- _K TC Temperature Mode (Type K)
- R1 RTD Temperature Mode (Pt 385)
- PU Pulse Mode (Mark/Period or % Duty)

- ZQ	Frequency Mode (Hz)

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage, or AC Current (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- _K is inserted automatically in the MOD2 field for TC Temperature if no MOD2 code is entered.
- R1 is inserted automatically in the MOD2 field for RTD Temperature if no MOD2 code is entered.
- The M9000 RANGE and NOMINAL field must specify the pulse period or pulse repetition frequency when the MOD2 field specifies PU and the NOMINAL field specifies the pulse width.
- The M9000 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse period or pulse repetition frequency.

MOD3

This field is used simply to make it easier to convert 55xxA based procedures to 9000 based procedures.

- TC	Thermocouple simulation
- *blank*	not applicable

Rules:

- TC is inserted automatically in the MOD3 field for TC Temperature if not MOD3 code is entered.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- 2W	2-wire
- 4W	4-wire

Rules:

- The CON field may specify 4W only for resistance, capacitance, and RTD temperature modes.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
STEP    FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2   3   4  CON
# ----- Reset -----
  1.001  M9000        *
  1.002  9000         *                                              S
# ----- DC Voltage -----
  1.003  9000   20    19.99mV       2% 0.04U                            2W
# ----- AC Voltage -----
  2.001  9000   400   350.0mV       -2.8U +2.9U   60H          SI         2W
# ----- DC Current -----
  3.001  9000   400   350mA         9U                                  2W
# ----- AC Current -----
  4.001  9000         350.0mA                     60H          SI    S  2W
# ----- Resistance -----
  4.002  9000   400   390.0Z        0.4% 0.1U                           4W
  5.001  9000   4     3.900MZ       0.05U                               2W
# ----- Conductance -----
  6.001  9000         2.50uY                                         N  2W
# ----- Capacitance ----
  6.002  9000   10    1.100uF       2% 0.002U                           2W
# ----- Frequency Function -----
  7.001  9000         1kH                         1Vp          ZQ    S  2W
  7.002  M9000                                    1Voff
  7.003  9000         -1.00Vp                     1kH          ZQ    N  2W
# ----- Marker/Period (pulse) Function -----
  7.004  M9000  PULSE 10uT
  7.005  9000         1mT                         1Vp          PU    S  2W
  7.006  M9000  PER   200mT
  7.007  9000         1mT                         1Vp          PU    S  2W
  7.008  M9000  PULSE 10uT                        -10Voff
  7.009  9000         -5.00Vp                     1kH          PU    N  2W
  7.010  M9000        *
# ----- % Duty (pulse) Function -----
  7.011  M9000  PER   200mT
  7.012  9000         0.5pct                      1Vp          PU    S  2W
# ----- TC Temperature -----
```

```
  7.013  9000         50degC         1U                          _K       2W
# ----- RTD Temperature -----
  8.001  9000         45degC                       100Z          R1    S  4W
```

M9000

Auxiliary Instrument Setup FSC

Description

The M9000 FSC provides the additional program functions for the Datron 9000 Calibrator which are not addressed by the 9000 FSC.

Parameters

For a description of the 9000 Calibrator operating modes referenced in this section, see Table 1 in the 9000 Instrument FSC description.

RANGE

This field specifies the pulse width, pulse period, or pulse repetition frequency for Mark/Period mode or the temperature scale for RTD or TC Temperature mode.

- PULSE Pulse Width
- PER Pulse Period
- *blank* default or field not applicable

NOMINAL

This field specifies a reset or the pulse period or pulse width entered as:

[*numeric*][*prefix*]H or T

- Pulse Period or Pulse Repetition Frequency
- Pulse Width
- "*" reset to default values
- *blank* field not applicable

Rules:

- The NOMINAL field must specify the pulse period or pulse repetition frequency when the M9000 RANGE field is PER.
- The NOMIMAL field must specify the pulse width when the M9000 RANGE field is PULSE.
- When the NOMINAL field contains only units, the value is obtained from memory register MEM.
- When the NOMINAL field specifies reset "*", all other fields mustbe blank.

TOLERANCE

This field is not used.

MOD1

This field specifies DC offset for Frequency or Mark/Period (pulse) mode

[*numeric*][*prefix*]Voff

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field is not used.

CON

This field specifies the 9005 Work Mat connection for current or the UUT source current for Resistance and RTD Temperature modes.

Temperature modes.

- C1 9005 Work Mat yellow lead (I+20A)
- C2 9005 Work Mat white lead (I+mA)
- LO Low UUT source current
- HI High UUT source current
- *blank* Applicable default (C1 or LO)

Rules:

Mode (function)	M9100 CON	Connection
DC Current	[C1]	9005 Work Mat Yel & Blk
	C2	9005 Work Mat Wht & Blk
AC Current	[C1]	9005 Work Mat Yel & Blk
	C2	9005 Work Mat Wht & Blk
Mode	9000 Nominal	
Resistance	< 40,001 Ω	[LO]
	> = 40,001 Ω	[LO][HI]
	Siemens (all)	[LO][HI]
RTD Temperature	< -149.29 degC	[LO]
	> = -149.30 degC	[LO][HI]
	< - -236.73 degF.	[LO]
	> = -236.73 degF	[LO][HI]
	< 128.86 K	[LO]
	> = 128.86 K	[LO][HI]

Examples

9100

Instrument FSC

Description

The 9100 FSC provides the means to control the following functions of the Datron 9100 Calibrator:

- DC Voltage
- AC Voltage (sine, square, pulse, triangle, trapezoid, impulse)
- DC Current
- AC Current (sine, square, pulse, triangle, trapezoid, impulse)
- Resistance (resistance or conductance)
- Frequency
- Mark/Period (pulse)
- % Duty (pulse)
- Capacitance
- Thermocouple Temperature
- RTD Temperature

9100 with Option 135 (High Voltage Resistance)

- Insulation
- Continuity

9100 with Option 250 or Option 600 (250 MHz or 600 MHz Scope Module):

- Square
- DC Voltage
- Leveled Sine
- Edge Signal
- Marker Signal

9100 with Option PWR (Power Module):

- DC Power (voltage & current or dual voltage)
- AC Power (voltage & current or dual voltage)
- AC Harmonics

Functional Capability

DC Voltage	-1050 V to 1050 V	
AC Voltage:		
Sine	0 V to 105 V	10 Hz to 100 kHz
	105.001 V to 320 V	40 Hz to 30 kHz
	320.01 V to 800 V	40 Hz to 30 kHz
	800.01 V to 1050 V	40 Hz to 20 kHz
Square	0 V to 147.9 V	10 Hz to 1 kHz
	147.9 V to 500 V	45 Hz to 65 Hz
Impulse	0 V to 78.05 V	10 Hz to 1 kHz
	78.05 V to 500 V	45 Hz to 65 Hz
Triangle	0 V to 85.7 V	10 Hz to 1 kHz
	85.7 V to 500 V	45 Hz to 65 Hz
Trapezoid	0 V to 131.9 V	10 Hz to 1 kHz
	131.9 V to 500 V	45 Hz to 65 Hz
DC Current	-20 A to 20 A	
	+/-(3.2001 A to 200 A) [1]	
	+/-(16.001 A to 1000 A)[2]	
AC Current:		
Sine	0 mA to 320 mA	10 Hz to 30 kHz
	0.32001 A to 20 A	10 Hz to 10 kHz
	3.2001 A to 200 A	10 Hz to 440 Hz[1]
	16.001 A to 1000 A	10 Hz to 100 Hz[2]
Square	0 mA to 450.8 mA	10 Hz to 1 kHz
	0.4508 A to 18 A	10 Hz to 100 Hz
	4.508 A to 180 A	10 Hz to 65 Hz[1]
	22.45 A to 900 A	10 Hz to 65 Hz[2]
Impulse	0 mA to 237.9 mA	10 Hz to 1 kHz
	0.2379 A to 15 A	10 Hz to 100 Hz
	2.379 A to 150 A	10 Hz to 65 Hz[1]
	11.9 A to 750 A	10 Hz to 65 Hz[2]
Triangle	0 mA to 261.2 mA	10 Hz to 1 kHz
	0.2612 A to 16.3 A	10 Hz to 100 Hz
	2.612 A to 163 A	10 Hz to 65 Hz[1]
	13.06 A to 815 A	10 Hz to 65 Hz[2]

Trapezoid	0 mA to 399.1 mA	10 Hz to 1 kHz
	0.3991 A to 19.2 A	10 Hz to 100 Hz
	3.991 A to 192 A	10 Hz to 65 Hz[1]
	19.95 A to 960 A	10 Hz to 65 Hz[2]
Resistance	0 Ω to 400 MΩ	
	2.5 nS to 2.5 mS	
Frequency	0.5 Hz to 10 MHz	+/-(0.01 Vp to 30 Vp)*
		*|Vp| + |offset| < 30 Vp
Mark/Period:	0.6 µs to 2000.00 ms	+/-(0.01 Vp to 30 Vp)*
Pulse Width	0.3 µs to 1999.99 ms	*|Vp| + |offset| < 30 Vp
% Duty:	0.05% to 99.95%	±(0.01 Vp to 30 Vp)
Period	0.6 µs to 2000.00 ms	*|Vp| + | offset| < 30 Vp
Capacitance	0.5 nF to 40 mF	
RTD Temperature:		
Pt 385	-200 degC to 850 degC	10 Ω to 2 kΩ
Pt 392	-200 degC to 850 degC	10 Ω to 2 kΩ
TC Temperature:		
Type B	0 degC to 1820 degC	
Type C	0 degC to 2320 degC	
Type E	-250 degC to 1000 degC	
Type J	-210 degC to 1200 degC	
Type K	-250 degC to 1372 degC	
Type L	-200 degC to 900 degC	
Type N	-200 degC to 1300 degC	
Type R	0 degC to 1767 degC	
Type S	0 degC to 1767 degC	
Type T	-250 degC to 400 degC	

1. Requires Option 200 (10-Turn Current Coil)
2. Requires Option 200 (50-Turn Current Coil)

Option 135 (High Voltage Resistance)

Insulation:	100 kΩ to 2 GΩ
	0 V to 1350 V
	1 µA to 2.3 mA
Continuity:	0 Ω to 4 kΩ
	100 µA to 350 mA

Option PWR (Power Module)

DC Power:		
Primary Output	-1050 V to 1050 V	
Aux Output:		
Voltage	0 V to 7.5 V[1,5]	
Current	-20 A to 20 A	
	+/-(3.2001 A to 200 A)[2]	
	+/-(16.001 A to 1000 A)[3]	
AC Power:		
Primary Output:		
Sine	0 V to 105 V	10 Hz to 3 kHz[4]
	105.001 V to 1050 V	40 Hz to 3 kHz[4]
Square	0 V to 147.9 V	10 Hz to 1 kHz[4]
	147.9 V to 500 V	45 Hz to 65 H[4]
Impulse	0 V to 78.05 V	10 Hz to 1 kHz[4]
	78.05 V to 500 V	45 Hz to 65 H[4]
Triangle	0 V to 85.7 V	10 Hz to 1 kHz[4]
	85.7 V to 500 V	45 Hz to 65 Hz[4]
Trapezoid	0 V to 131.9 V	10 Hz to 1 kHz[4]
	131.9 V to 500 V	45 Hz to 65 Hz[4]

Aux Output:		
Sine		
Voltage	0.32 mV to 7.5 V	10 Hz to 3 kHz[1,4,5]
Current	0 A to 20 A	10 Hz to 3k Hz[4]
	3.2001 A to 200 A	10 Hz to 440 Hz[2,4]
	16.001 A to 1000 A	10 Hz to 100 Hz[3,4]
Square		
Voltage	0 V to 4.5 V	10 Hz to 1 kHz[1,4,5]
Current	0 mA to 450.8 mA	10 Hz to 1 kHz[4]
	0.4508 A to 18 A	10 Hz to 100 Hz[4]
	4.508 A to 180 A	10 Hz to 65 Hz[2,4]
	22.45 A to 900 A	10 Hz to 65 Hz[3,4]
Impulse		
Voltage	0 V to 2.38 V	10 Hz to 1 kHz[1,4,5]
Current	0 mA to 237.9 mA	10 Hz to 1 kHz[4]
	0.2379 A to 15 A	10 Hz to 100 Hz[4]
	2.379A to 150A	10 Hz to 65 Hz[2,4]
	11.9A to 750A	10 Hz to 65 Hz[3,4]
Triangle		
Voltage	0 V to 2.61 V	10 Hz to 1 kHz[1,4,5]
Current	0 mA to 261.2 mA	10 Hz to 1 kHz[4]
	0.2612 A to 16.3 A	10 Hz to 100 Hz[4]
	2.612 A to 163 A	10 Hz to 65 Hz[2,4]
	13.06 A to 815 A	10 Hz to 65 Hz[3,4]

Trapezoid		
Voltage	0 V to 4.02 V	10 Hz to 1 kHz[1,4,5]
Current	0 mA to 399.10 mA	10 Hz to 1 kHz[4]
	0.3991 A to 19.2 A	10 Hz to 100 Hz[4]
	3.991 A to 192 A	10 Hz to 65 Hz[2,4]
	19.95 A to 960 A	10 Hz to 65 Hz[3,4]
Phase	-180deg to 180deg	
AC Harmonic:		
Primary Output:		
Sine	0 V to 1050 V	50, 60, or 400 Hz[4]
Aux Output:		
Sine		
Voltage	0.32 mV to 7.5 V	50, 60, or 400 Hz[4]
Current	0 A to 20 A	50, 60, or 400 Hz[4]
	3.2001 A to 200 A	50, 60, or 400 Hz[2,4]
	16.001 A to 1000 A	50 or 60 Hz [3,4]
Phase	-180° to 180°	
Harmonic	1 to 40	

1. Using appropriate V/A scale factor.
2. Requires Option 200 (10-Turn Current Coil)
3. Requires Option 200 (50-Turn Current Coil)
4. Actual maximum frequency is the lower of the maximum frequency for the primary channel signal and the maximum frequency for the auxiliary channel signal.
5. Actual maximum frequency is the lower of the maximum frequency for the primary channel signal and the maximum frequency for the auxiliary channel signal.

Option 250 and Option 600 (Scope Calibrators)

Square:		
50 Ω term.	4.44 mVpp to 3.336 Vpp	1 kHz/1 ms
1 MΩ term.	4.44 mVpp to 133.44 Vpp	1 kHz/1 ms
DC Voltage:		
50 Ω term.	+/-(4.44 mV to 2.78 V)	
1 MΩ term.	+/-(4.44 mV to 133.44 V)	
Leveled Sine:		
50 Ω term.	4.44 mVpp to 5.56 Vpp	10 Hz to 250 MHz [1]
	4.44 mVpp to 5.56 Vpp	1.6666 ns to 100 ms[1]
50 Ω term.	4.44 mVpp to 5.56 Vpp	10 Hz to 600 MHz[2]
	4.44 mVpp to 5.56 Vpp	4.0000 ns to 100 ms[2]
1 MΩ term.	4.44 mVpp to 133.44 Vpp	10 Hz to 49.999 kHz
	4.44 mVpp to 133.44 Vpp	20.001 µs to 100 ms
Edge:		
50 Ω term.	88.8 mVpp to 1.112 Vpp	100 Hz to 10 MHz or 0.1 µs to 10 ms[3]
1 MΩ term.	88.8 mVpp to 55.6 Vpp	100 Hz to 100 kHz or 10 µs to 10 ms[3]
Marker (50 Ω only):		
	4.0000 ns to 5.5005 s[1]	0.1, 0.2, 0.5 & 1 Vpp
	0.1818 Hz to 250 MHz [1]	0.1, 0.2, 0.5 & 1 Vpp
	1.6666 ns to 5.5005 s[2]	0.1, 0.2, 0.5 & 1 Vpp
	0.1818 Hz to 600 HHz[2]	0.1, 0.2, 0.5 & 1 Vpp
1. Option 250 2. Option 600 3. In a 1-2-5 sequence.		

Parameters

The following table describes the basic operating modes of the 9100 Calibrator in terms of the FSC fields listed. Only the combinations of field quantities listed below are allowed. These mode names are also used in other places in this section to clarify the rules for each parameter of the 9100 FSC.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
App	Amps peak to peak	current
F	Farads	capacitance
H	Hertz	frequency
K	Kelvins	temperature
T	Time	period or pulse width
V	Volts	voltage
VA	Volt-Amps	power
VAR	Volt-Amps reactive	power
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
W	Watts	power
Y	Siemens	conductance
Z	Ohms	resistance
deg	degrees	phase
degC	degrees Celcius	temperature
degF	degrees Fahrenheit	temperature
%	duty cycle	percent

9100 FSC Nominal, MOD1, MOD2, MOD3, and CON Rules

9100 Mode (function)	9100 Nominal	9100 MOD1	9100 MOD2 [1]	9100 MOD3 [2]	9100 CON [3]
DC Voltage	V				2W
AC Voltage	V|Vpp	H|T	SI|SQ|IP|TI|TZ	2W	
	H|T	V|Vpp	SI|SQ|IP|TI|TZ	2W	
DC Current	A				2W|T1|T5
AC Current	A|App	H|T	SI|SQ|IP|TI|TZ		2W|T1|T5
	H|T	A|App	SI|SQ|IP|TI|TZ		2W|T1|T5
Resistance	Z|Y				2W|4W
Frequency	H|T	Vp	ZQ		2W
	Vp	H|T	ZQ		2W
Mark/Period (pulse)	H|T	Vp	PU		2W
	Vp	H|T	PU		2W
% Duty (pulse)	pct	Vp	PU		2W
Capacitance	F				2W|4W
TC Temperature	degC|degF|K		_B|_C|_E|_J|_K| _L|_N|_R|_S|_T	TC	2W
RTD Temperature	degC|degF|K	Z	R1|R9		2W|4W
DC Power	W|V			PR	2W|T1|T5
	A			AX	2W|T1|T5
AC Power	W|VA|VAR	H|T	SI	PR	2W|T1|T5
	V|Vpp	H|T	SI|SQ|IP|TI|TZ	PR	2W|T1|T5
	A|App	H|T	SI|SQ|IP|TI|TZ	AX	2W|T1|T5
	H|T	V|Vpp	SI|SQ|IP|TI|TZ	PR	2W|T1|T5
	deg	H|T	SI|SQ|IP|TI|TZ	PR	2W|T1|T5

AC Harmonic	V|Vpp	H	SI	MN|MX	2W|T1|T5
	A|App	H	SI	MX	2W|T1|T5
	H	V|Vpp	SI	MN	2W|T1|T5
	deg	H	SI	MN	2W|T1|T5
Scope (Square)	V|Vpp	H|T	ZQ	SC	[L]
	H|T	V|Vpp	ZQ	SC	[L]
Scope (DCV)	V			SC	[L]
Scope (Leveled Sine)	V|Vpp	H|T	LS	SC	[L]
	H|T	V|Vpp	LS	SC	[L]
Scope (Edge)	V|Vpp	H|T	ED	SC	[L]
	H|T	V|Vpp	ED	SC	[L]
Scope (Marker)	H|T	Vpp	MK	SC	L
Insulation	Z		[SE]	HV	2W
	V|A	Z	SE	HV	2W
Continuity	Z		[SE]	CO	4W
	A	Z	SE	CO	4W

Notes:

Blank entries are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

1. See MOD2 parameter for description of these specification codes.
2. See MOD3 parameter for description of these specification codes.
3. See CON parameter for description of these specification codes.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*]*units symbol*

or "*" to specify a reset.

Rules:

- When the NOMINAL field units are "W" (Watts), the M9100 NOMINAL field must specify the auxiliary channel current.
- When the NOMINAL field units are "deg" (phase), the M9100 MOD1 field must specify the primary channel voltage.
- When the NOMINAL field contains only units, the value is obtained from memory register MEM.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the frequency, period, voltage, or current for AC Voltage, AC Current, Dual AC Voltage, or AC Power modes entered as:

[*numeric*][*prefix*]*units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM.

MOD2

This field specifies the waveform, thermocouple, or RTD type or source vs. sense (read) for High Voltage Resistance mode.

- *blank* not applicable
- SI AC Voltage, Current, or Power Modes (Sine)
- SQ AC Voltage, Current, or Power Modes (Square)
- IP AC Voltage, Current, or Power Modes (Impulse)

- TI AC Voltage, Current, or Power Modes (Triangle)
- TZ AC Voltage, Current, or Power Modes (Trapezoid)
- _B TC Temperature Mode (Type B)
- _C TC Temperature Mode (Type C)
- _E TC Temperature Mode (Type E)
- _J TC Temperature Mode (Type J)
- _K TC Temperature Mode (Type K)
- _L TC Temperature Mode (Type L)
- _N TC Temperature Mode (Type N)
- _R TC Temperature Mode (Type R)
- _S TC Temperature Mode (Type S)
- _T TC Temperature Mode (Type T)
- R1 RTD Temperature Mode (Pt 385)
- R9 RTD Temperature Mode (Pt 392)
- PU Pulse Mode (Mark/Period or % Duty)
- ZQ Frequency Mode (Hz) or Scope Mode (Square)
- LS Scope Mode (Leveled Sine)
- ED Scope Mode (Edge signal)
- MKScope Mode (Marker signal)
- SE Insulation or Continuity Mode (Sense "Read" Nominal value)

Rules:

- SI is inserted automatically in the MOD2 field for AC Voltage, AC Current, or AC Power mode (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- _K is inserted automatically in the MOD2 field for TC Temperature if no MOD2 code is entered.
- R1 is inserted automatically in the MOD2 field for RTD Temperature if no MOD2 code is entered.
- The M9100 RANGE and NOMINAL field must specify the pulse period or pulse repetition frequency when the MOD2 field specifies PU and the NOMINAL or MOD1 field specifies the pulse period or pulse repetition frequency.
- The M9100 RANGE and NOMINAL field must specify the pulse width when the MOD2 field specifies PU and the NOMINAL field specifies the pulse period or pulse repetition frequency.

MOD3

This field specifies the calibrator option required or TC. In addition, for Power mode, the channel associated with the MOD2 field and the amplitude specified in the 9100 NOMINAL or M9100 MOD1 field. TC is supported simply to make it easier to convert 55xxA based procedures to 9100 based procedures.

- PR Option PWR (Power Module) Power mode Primary channel
- AX Option PWR (Power Module) Power mode Auxiliary channel
- MN Option PWR (Power Module) Harmonic mode Primary channel
- MXOption PWR (Power Module) Harmoinc mode Auxiliary channel
- SC Option 250 or Option 600 (Scope Calibrator)
- HV Option 135 (High Voltage Resistance) Insulation mode
- CO Option 135 (High Voltage Resistance) Continuity mode
- TC Thermocouple simulation
- *blank* No option required

Rules:

9100 & M9100 NOMINAL, MOD1, and MOD3 Rules

	9100			M9100		
Mode (function)	NOMINAL	MOD1	MOD3	NOMINAL	MOD1	MOD3
DC Power	V		PR	A		AX
	A		AX	V		PR
AC Power	W|V|Vpp	H|T	PR	A|App	[deg]	AX
	A|App	H|T	AX	V|Vpp	[deg]	PR
	H|T	V|Vpp	PR	A|App	[deg]	AX
	deg	H|T	PR	A|App	V|Vpp	AX
AC Harmonic	V|Vpp	H|T	MN	A|App|V|Vpp	[deg]	MX
	A|App|V|Vpp	H|T	MX	V|Vpp	[deg]	MN
	H|T	V|Vpp	MN	A|App|V|Vp	[deg]	MX
	deg	H|T	MN	A|App|V|Vpp	V|Vpp	MX
Insulation	Z		HV			
	A	Z	HV			
	V	Z	HV			
Continuity	Z		CO			
	A	Z	CO			
TC Temperature	DegC|degF		TC			
Note: Blank entries are significant and must be blank.						

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection.

- 2W 2-wire
- 4W 4-wire
- T1 Option 200 10-turn Toroid Coil
- T5 Option 200 50-turn Toroid Coil
- L 50-Ω Termination (scope modes only)
- *blank* 1-MΩ Termination (scope modes only)

Rules:

- The CON field may specify 4W only for Resistance, Capacitance, RTD Temperature, or High Voltage Resistance mode.
- The CON field may specify T1 or T5 only when the Nominal or MOD1 field specifies current or for DC or AC Power mode and the M9100 Tolerance field does not specify a V/A scale factor.
- The CON field may specify L or be blank only for scope modes.
- The CON field must be L for Scope Marker mode.
- L is inserted automatically in the CON field for Scope Marker mode if no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in this manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
# ----- Reset -----
  1.001  M9100        *
  1.002  9100         *                                                 S
# ----- DC Voltage -----
  1.003  9100   20     19.99mV        2% 0.04U                              2W
# ----- AC Voltage (sine) -----
  2.001  9100   400    350.0mV        -2.8U +2.9U   60H            SI       2W
# ----- AC Voltage (square) -----
  3.001  9100         1V                            1kH            SQ    S  2W
# ----- AC Voltage (impulse) -----
  3.002  9100         1V                            1kH            IP    S  2W
# ----- AC Voltage (triangle) -----
  3.003  9100         13mVpp                        100H           TI    S  2W
# ----- AC Voltage (trapezoid) -----
  3.004  9100         1V                            1kH            TZ    S  2W
# ----- DC Current -----
  3.005  9100   400    350mA          9U                                    2W
# ----- AC Current (sine) -----
  4.001  9100         350.0mA                       60H            SI    S  2W
# ----- AC Current (square) -----
  4.002  9100         1mA                           1kH            SQ    S  2W
# ----- AC Current (impulse) -----
  4.003  9100         100mA                         1kH            IP    S  2W
# ----- AC Current (triangle) -----
  4.004  9100         13mApp                        440H           TI    S  2W
# ----- AC Current (trapezoid) -----
  4.005  9100         1mA                           1kH            TZ    S  2W
# ----- Resistance -----
  4.006  9100   400    390.0Z         0.4% 0.1U                             4W
  5.001  9100   4      3.900MZ        0.05U                                 2W
# ----- Conductance -----
  6.001  9100         2.50uY                                             N  2W
# ----- Capacitance ----
  6.002  9100   10     1.100uF        2% 0.002U                             2W
# ----- Frequency Function -----
  7.001  9100         1kH                           1Vp            ZQ    S  2W
  7.002  M9100                                      1Voff
  7.003  9100         -1.00Vp                       1kH            ZQ    N  2W
# ----- Marker/Period (pulse) Function -----
  7.004  M9100  PULSE 10uT
  7.005  9100         1mT                           1Vp            PU    S  2W
```

```
  7.006  M9100  PER   200mT
  7.007  9100         1mT                           1Vp            PU    S  2W
  7.008  M9100  PULSE 10uT                          -10Voff
  7.009  9100         -5.00Vp                       1kH            PU    N  2W
# ----- % Duty (pulse) Function -----
  7.006  M9100  PER   200mT
  7.007  9100         0.5pct                        1Vp            PU    S  2W
# ----- TC Temperature -----
  7.010  M9100  TS68
  7.011  9100         50degC        1U                             _K TC    2W
# ----- RTD Temperature -----
  8.001  9100         45degC                        100Z           R1    S  4W

# ============================== Option 135 ==================================


  8.002  DISP         Set UUT to MOhm, 250V.
  8.003  M9100                                                              HI
  8.004  9100         1.0mA                         250kZ          SE HV N  2W
  8.005  EVAL   -e MEM > 1.0 : Current [MEM]mA
  9.001  9100         250.0V        20%             250kZ          SE HV    2W
 10.001  DISP         Set UUT to MOhm, 500V
 10.002  M9100                                                              SP
 10.003  9100         1.0mA                         500kZ          SE HV N  2W
 10.004  EVAL   -e MEM > 1.0 : Current [MEM]mA
 11.001  9100         500.0V        20%             500kZ          SE HV    2W
 12.001  DISP         Set UUT to MOhm, 1000V
 12.002  M9100                                                              SP
 12.003  9100         1.0mA                         1MZ            SE HV N  2W
 12.004  EVAL   -e MEM > 1.0 : Current [MEM]mA
 13.001  9100         1000V         20%             1MZ            SE HV    2W
 14.001  DISP         Set UUT to LO Ohm.
 14.002  M9100                                                              HI
 14.003  9100         1.000mA                       1kZ            SE CO N  4W
 14.004  EVAL   -e MEM > 1.0 : Current [MEM]mA
 15.001  M9100        *

# ========================== Option 250 & 600 ================================

# ----- DC Voltage -----
 15.002  9100   20    19.99mV       4%                                SC
# ----- Square Voltage -----
 16.001  9100   400   350.0mV       50U             1kH            ZQ SC
# ----- Edge Signal -----
 17.001  9100         0.5Vpp                        1MH            ED SC S  L
```

```
# ----- Leveled Sine Wave -----
 17.002  9100         200mVpp                      50kH          LS SC S  L
 17.003  9100         1.00MH        1%             100mVpp       LS SC    L
# ----- Marker Signal -----
 18.001  9100         1uT                          0.2Vpp        MK SC S  L

# ============================== Option PWR ================================

# ----- DC Power -----
 18.002  M9100        1V                                            PR
 18.003  9100         1.000A                                        AX S  2W
 18.004  M9100        10A           45uV/A                          AX
 18.005  9100         1W                                            PR S  2W
 18.006  M9100        10A                                           AX
 18.007  9100         1.000kW                                       PR S  2W
# ----- DC Power w/Option 200 10-turn coil -----
 18.008  M9100        100A                                          AX
 18.009  9100         10.00kW                                       PR S  T1
# ----- DC Power w/Option 200 50-turn coil -----
 18.010  M9100        500A                                          AX
 18.011  9100         -100.0kW                                      PR S  T5

# ----- AC Power (Watts) -----
 18.012  M9100        10A                          0deg          SI AX
 18.013  9100         1W                           1kH           SI PR S  2W

# ----- AC Power (Watts), UUT with 1mV/A Current Clamp input -----
 18.014  RSLT         =
 18.015  RSLT         =100 V, 150 A @ 60 Hz
 18.016  MATH         L[1] = ACCV2("Datron 9100", S[1], 150, 60)
 18.017  MATH         L[1] = (L[1] / 150) * 100
 18.018  MATH         L[2] = ACCV2("Datron 9100", "Volts SI", 100, 60)
 18.019  MATH         L[2] = (L[2] / 100) * 100
# Compute phase accuracy in percent.
 18.020  MATH         L[4] = ACCV2("Datron 9100", "Phase SI V", 100, 60)
 18.021  MATH         L[5] = ACCV2("Datron 9100", "Phase SI V AUX", 0.15, 60)
 18.022  MATH         L[3] = L[4] + L[5]
 18.023  MATH         L[3] = (L[3] / 157) * 100
# ACC tolerance is RSS of the NORMAL & AUX voltage accuracies + phase adder.
 18.024  MATH         M[1] = RSS3(L[1], L[2], L[3])
 18.025  M9100        150A          1mV/A          157.0deg      SI AX
 18.026  TARGET
 18.027  9100         100V                         60H           SI PR S  2W
 18.028  ACC          -13.8kW       M1%
```

```
 18.029  MEMI         Enter UUT reading in kilowatts.
 18.030  MEMCX        -13.8kW        1% 0.4U

# ----- AC Power (VA), UUT with 1mV/A Current Clamp input -----
 19.001  9100         100V                         60H            SI PR S  2W
 19.002  ACC          15.0kVA        M1%
 19.003  MEMI         Enter UUT reading in kilovolt-amps.
 19.004  MEMCX        15.0kVA        1% 0.4U

# ----- AC Power (VAR), UUT with 1mV/A Current Clamp input -----
 20.001  9100         100V                         60H            SI PR S  2W
 20.002  ACC          5.9k'VAR'      M1%
 20.003  MEMI         Enter UUT reading in units of kVAR.
 20.004  MEMCX        5.9k'VAR'      1% 0.4U

# ----- AC Power (Phase), UUT with 1mV/A Current Clamp input -----
 21.001  MATH         L[1] = ACCV2("Datron 9100", "Phase SI V", 100, 60)
 21.002  MATH         L[2] = ACCV2("Datron 9100", "Phase SI V AUX", 0.15, 60)
 21.003  MATH         M[1] = L[1] + L[2]
 21.004  M9100        150A           1mV/A         100V           SI AX
 21.005  TARGET
 21.006  9100         157deg                       60H            SI PR S  2W
 21.007  ACC          157deg         M1U
 21.008  MEMI         Enter UUT reading in degrees.
 21.009  MEMCX        157deg         2U

# ----- AC Harmonic -----
 22.001  RSLT         =
 22.002  HEAD         { 9th HARMONIC}: Amps
 22.003  TARGET
 22.004  M9100  HX9   7V                           30deg          SI MN
 22.005  9100         20mV                         60H            SI MX S  2W
 20.003  M9100  HX1   1V                           0deg           SI MN
 20.004  9100         1.000mA        0.010U        60H            SI MX    2W
 21.001  M9100  HX39  1V                           0deg           SI MN
 21.002  9100         10mV                         60H            SI MX S  2W
```

M9100

Auxiliary Instrument Setup FSC

Description

The M9100 FSC provides the additional program functions for the Datron 9100 Calibrator which are not addressed by the 9100 FSC.

Parameters

For a description of the 9100 Calibrator operating modes referenced in this section, see the 9100 Instrument FSC description.

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
App	Amps peak to peak	current
H	Hertz	frequency
T	Time	period or pulse width
V	Volts	voltage
Voff	Volts offset	DC offset
Vpp	Volts peak to peak	voltage
V/A	Volts per Amp	scale factor (see Tolerance field)
deg	degrees	phase

M9100 FSC Range, Nominal, Tolerance, MOD1, MOD2, and MOD3 Rules

Mode (function)	Range	Nominal	TOL	MOD1	MOD2	MOD3
Frequency				[Voff]		
Mark/Period (pulse)	PER|PULSE	T|H		[Voff]		
% Duty (pulse)	PER	T|H		[Voff]		
RTD Temperature	[TS68|TS90]					
TC Temperature	[TS68|TS90]					
DC Power		V	[V/A]			PR
		A	[V/A]			AX
AC Power		V|Vpp	[V/A]	[deg]	SI|SQ|IP|TI|TZ	PR
		A|App	[V/A]	[deg]	SI|SQ|IP|TI|TZ	AX
		A|App	[V/A]	[V|Vpp]	SI|SQ|IP|TI|TZ	AX
AC Harmonic	HX*n*	V|Vpp		[deg]	SI|SQ|IP|TI|TZ	MN
	HX*n*	A|App|V|Vpp		[deg]	SI|SQ|IP|TI|TZ	MX
	HX*n*	A|App|V|Vpp		[V|Vpp]	SI|SQ|IP|TI|TZ	MX
Scope Edge	RISE|FALL					
Blank entries are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.						

RANGE

This field specifies one of the following:

- HX*n* Selects harmonic on auxiliary channel, 1 to 40
- PULSE Pulse Width
- PER Pulse Period
- RISE Polarity (Edge)
- FALL Polarity (Edge)
- TS68 TS68 temperature scale
- TS90 TS90 temperature scale
- *blank* default or field not applicable

Rules:

- For RTD and TC Temperature modes, if the RANGE field does not specify the temperature scale, the default is TS90.
- For Scope Edge mode, if the RANGE field does not specify RISE or FALL, the default is RISE.
- The RANGE field may only specify FALL for Edge mode when the 9100 FSC CON field specifies 50-Ω output impedance "L".
- The RANGE field must specify PULSE or PER when the 9100 MOD2 field is PU.

NOMINAL

This field specifies one of the following entered as:

[*numeric*][*prefix*]*units symbol*

- Pulse Period or Pulse Repetition Frequency
- Pulse Width
- Signal amplitude for the power or harmonic mode channel specified by the MOD3 field.
- "*" reset to default values
- *blank* field not applicable

Rules:

- The NOMINAL field must specify the pulse period or pulse repetition frequency when the M9100 RANGE field is PER.
- The NOMIMAL field must specify the pulse width when the M9100 RANGE field is PULSE.
- When the NOMINAL field contains only units, the value is obtained from memory register MEM.
- When the NOMINAL field specifies reset "*", all other fields must be blank.

TOLERANCE

This field is used to specify the scale factor applied to the auxiliary channel, when in 'auxiliary voltage' power mode, to calculate the effective voltage on the auxiliary channel. This field is entered as:

[*numeric*][*pref*ix]V/A

Rules:

- When the TOLERANCE field contains only units, the value is obtained from memory register MEM.

MOD1

This field specifies one of the following:

1. DC offset for Frequency or Mark/Period (pulse) mode and % Duty (pulse) modes, or
2. The phase for AC Power or AC Harmonic mode, or
3. The primary voltage for AC Power or AC Harmonic mode when the 9100 NOMINAL field specifies phase.

Values are entered as:

[*numeric*][*prefix*] units symbol

Rules:

- The MOD1 field may specify voltage or current only when the 9100 NOMINAL field specifies phase.
- The MOD1 field may specify DC offset only for Frequency and Mark/Period (pulse), and % Duty (pulse) modes.
- When the MOD1 field is blank the DC offset is set to zero.
- When the MOD1 field contains only units, the value is obtained from memory register MEM.

MOD2

This field specifies the waveform for the power mode channel specified by the MOD3 field.

- *blank* DC
- SI Sine
- SQ Square
- IP Impulse
- TI Triangle
- TZ Trapezoid

MOD3

This field specifies the channel associated with the Power mode parameters specified in the NOMINAL and MOD2 fields.

- PR Power mode Primary channel
- AX Power mode Auxiliary channel
- MN Harmonic mode Primary channel
- MX Harmoinc mode Auxiliary channel
- *blank* not applicable

Rules:

See 9100 MOD3 field rules.

MOD4

This field is not used.

CON

This field specifies the 9105 Work Mat connection for current or the UUT source current for Resistance, Capacitance, and RTD Temperature modes.

- C1 9105 Work Mat yellow lead (I+20A)
- C2 9105 Work Mat white lead (I+mA)
- LO Low UUT source current
- HI High UUT source current
- SP Super High UUT source current
- *blank* Applicable default (C1 or LO)

Rules:

Mode (function)	9100 CON	M9100 CON	Connection
DC Current	2W	[C1]	9105 Work Mat Yel & Blk
	2W	C2	9105 Work Mat Wht & Blk
	T1|T5	[C1]	9100 I+ & I-
AC Current	2W	[C1]	9105 Work Mat Yel & Blk
	2W	C2	9105 Work Mat Wht & Blk
	T1|T5	[C1]	9100 I+ & I-
Resistance	2W|4W	[LO|HI|SP]	9105 Work Mat Red & Blk
Capacitance	2W|4W	[LO|SP]	9105 Work Mat Red & Blk
RTD Temperature	2W|4W	[LO|HI|SP]	9105 Work Mat Red & Blk
Continuity	4W	[HI|SP]	9100 HI and LO Terminals 9100 1 + and 1 – as sense
Insulation	2W	[HI|SP]	9100 HI and LO Terminals

Examples

See 9100 FSC.

9500

Instrument FSC

Description

The 9500 FSC provides the means to control the following functions of the Datron 9500 and Fluke 9500B Oscilloscope Calibrator:

- DC Voltage
- Square Voltage
- Leveled Sine
- Edge
- Fast Edge
- Time Markers
- DC Current
- Square Current
- Composite Video
- Linear Ramp
- Zero Skew
- Oscilloscope 50 Ohm Input Impedance Overload Pulse
- Oscilloscope Input Impedance Measurement
- Trigger Signal
- Pulse (9500B only)

Functional Capability

9500 Model	Maximum Frequency	Minimum Period
9500/400	400 MHz	2.5 ns
9500(B)/600*	600 MHz	1.6666 ns
9500(B)/1100*	1100 MHz	909.09 ps
9500(B)/3200*	3200 MHz	312.50 ps
w/9560 Head	6.4 GHz	156.25 ps
* (B) denotes 9500 and 9500B		

Active Head	Maximum Frequency	Minimum Period
9510	1.1 GHz	909.09 ps
9520	1.1 GHz	909.09 ps
9530	3.2 Hz	312.50 ps
9550	(see Fast Edge)	
9560	6.4 GHz	256.25 ps

DC Voltage	Amplitude
Single Channel	
50 Ω term.	0 V (Gnd) and +/-(888 µV to 5.56 V)
1 MΩ term.	0 V (Gnd) and +/-(888 µV to 222.4 V)
Multi-Channel (9500B only)	
1 MΩ term.	0V (Gnd) and +/-(888 µV to 222.4V)

Square Voltage	Amplitude	Frequency
Single Channel		
50 Ω term.	35.521 µVpp to 5.56 Vpp	10 Hz to 100 kHz
1 MΩ term.	35.521 µVpp to 222.4 Vpp	10 Hz to 100 kHz
Multi-Channel (9500B only)	35.521 µVpp to 222.4 Vpp	10 Hz to 100 kHz

Leveled Sine	Frequency	Amplitude
Single Channel:		
50 Ω & 1 MΩ	100 mHz to 550 MHz	4.4401 mVpp to 5.560 Vpp
	>550 MHz to 1.1 GHz	4.4401 mVpp to 3.336 Vpp
50 Ω	>1.1 GHz to 2.5 GHz	4.4401 mVpp to 3.336 Vpp
	>2.5 GHz to 3.2 GHz	4.4401 mVpp to 2.224 Vpp
	>3.2 GHz to 6.4 GHz	22.241 mVpp to 2.224 Vpp (9560 only)
Dual Channel:		
50 Ω & 1 MΩ	100 mHz to 550 MHz	4.4401 mVpp to 2.780 Vpp
	>550 MHz to 1.1 GHz	4.4401 mVpp to 1.668 Vpp
50 Ω	>1.1 GHz to 3.2 GHz	4.4401 mVpp to 1.668 Vpp (9560 only)

Low Edge	Amplitude	Frequency	Rise Time
50 Ω & 1 MΩ	4.44 mVpp to 3.1 Vpp	10 Hz to 2 MHz	<=500 ps

High Edge	Amplitude	Frequency	Rise Time
50 Ω	888 mVpp to 5.56 Vpp	10 Hz to 100 kHz	<=150 ns
1 MΩ	888 mVpp to <100 Vpp	10 Hz to 100 kHz	<=150 ns
1 MΩ	100 Vpp to 222.4 Vpp	10 Hz to 100 kHz	<=200 ns

Fast Edge (50 Ω only)	Amplitude	Frequency	Rise Time
9510	not supported		
9520 and 9530:	4.44 mVpp to 3.1 Vpp	10 Hz to 2 MHz	<=150 ps
9550	425 mVpp to 575 mVpp	10 Hz to 1 MHz	<=25 ps
9560	22.241 mVpp to 2.224 Vpp	10 Hz to 1 MHz	<=70 ps

Time Markers (50 Ω)	Period	Amplitude
Sine	181.19 ps to 909.09 ps	100 mVpp, 250 mVpp, 500 mVpp (9560 only)
Sine	450.46 ps to 909.09 ps	100 mVpp, 250 mVpp, 500 mVpp
Sine	909.10 ps to 9 ns	909.10 ps to 9 ns
Square	9.0001 ns to 55.002 s	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp
Pulse	901.00 ns to 55.002 s	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp
Triangle	901.00 ns to 55.002 s	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp

Time Markers (1 MΩ)	Period	Amplitude
Sine	450.46 ps to 909.09 ps	100 mVpp, 250 mVpp, 500 mVpp
Sine	909.10 ps to 9 ns	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp
Square	9.0001 ns to 55.002 s	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp
Pulse	901.00 ns to 55.002 s	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp
Triangle	901.00 ns to 55.002 s	100 mVpp, 250 mVpp, 500 mVpp, 1 Vpp

Function	Amplitude
DC Current	+/-(88.8 µA to 111.2 mA)

Function	Amplitude	Frequency
Square Current	88.8 µApp to 111.2 mApp	10 Hz to 100 kHz

Video	Amplitude	Video
NTSC	0.3 Vpp	Black
	0.7 Vpp	Mid-Grey
	1.0 Vpp	White
PAL/SECAM	0.3 Vpp	Black
	0.7 Vpp	Mid-Grey
	1.0 Vpp	White

Function	Period	Amplitude
Linear Ramp	3 s, 300 ms, 30 ms, 3 ms	1 Vpp

Function	Frequency	Amplitude
Zero Skew	10 Hz to 100 MHz	1 Vpp

Function	Amplitude	Energy
Overload Pulse	+/-(5 V to 20 V)	1.6 J to 50.0 J

Function	UUT Input Impedance Measurement
Resistance	10 Ω to 150 Ω and 50 kΩ to 12 M Ω
Capacitance	1 p F to 95 pF

Parameters

Units Symbols

Units Symbol	Name	Quantity
A	Amps	current
Ap	Amps peak	current
App	Amps peak to peak	current
F	Farads	capacitance
H	Hertz	frequency
J	Joule	energy
T	Time	period
V	Volts	voltage
Vp	Volts peak	voltage
Vpp	Volts peak to peak	voltage
Z	Ohms	resistance

9500 FSC Nominal, MOD1, MOD2, and MOD3 Rules

9500 Mode	9500 Nominal	9500 MOD1	9500 MOD2[1]	9500 MOD3
DC Voltage	V			
Square Voltage	V|Vp|Vpp	H|T	SQ|ZQ|ZN	
	H|T	V|Vpp	SQ|ZQ|ZN	
Low Edge	V|Vp|Vpp	H|T	ED	
	H|T	V|Vpp	ED	
High Edge	V|Vp|Vpp	H|T	HE	
	H|T	V|Vpp	HE	
Fast Edge	V|Vp|Vpp	H|T	FE	[EF]
	H|T	V|Vpp	FE	[EF]
Leveled Sine	V|Vp|Vpp	H|T	LS	
	H|T	V|Vpp	LS	
Linear Ramp	Vpp	T	LR	
	T	Vpp	LR	
Time Marker	T|H	Vpp	M1|M2|M3|M4	
DC Current	A			
Square Current	A|Ap|App	H|T	SQ	
	H|T	A|App	SQ	
Video	Vpp		F1|F2	
Overload Pulse	V	J	OP	
Zero Skew	H|T	Vpp	ZK	[PR]
Impedance Meas	Z|F			ZM

1. See MOD2 parameter for description of these specification codes and rules.

Blank entries are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the starting Nominal value of the stimulus output or expected UUT reading for the test entered as:

[*numeric*][*prefix*] *units symbol*

or "*" to specify a reset.

Rules:

- When the NOMINAL field contains only units, the value is obtained from the memory register MEM.
- When the NOMINAL field contains only units and the MOD1 field is not blank, the MOD1 field must specify a value.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies frequency, period, voltage, or energy entered as:

[*numeric*][*prefix*] *units symbol*

Rules:

- When the MOD1 field contains only units, the value is obtained from memory register MEM. In this case the NOMINAL field MUST contain a value.

MOD2

This field specifies one of the following:

1. The waveform type for the voltage or specified in the NOMINAL or MOD1 field for AC Voltage.

- *blank* DC or not applicable
- SQ Squarewave (symmetrical)
- ZQ Squarewave (positive)
- ZN Squarewave (negative)
- ED Low-Edge signal
- HE High-Edge signal

- FE Fast-Edge signal
- M1 Triangle Marker signal
- M2 Square Marker signal
- M3 Pulse Marker signal
- M4 Sine Marker signal
- LS Leveled sine wave
- F1 NTSC composite video signal
- F2 PAL/SECAM composite video signal
- LR Linear Ramp
- OP Overload Pulse
- ZK Zero Skew
- PU Pulse (9500B only)

Rules:

- ZQ is inserted automatically in the MOD2 field for AC Voltage (i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- SQ is inserted automatically in the MOD2 field for AC Current.(i.e. the MOD1 field is not blank) if no MOD2 code is entered.
- The MOD2 field may specify fast edge "FE", only when a 9520, 9530, or 9550 Active Head is configured on the signal channel specified in the M9500 FSC MOD2 field.
- When the MOD2 field specifies "ZK" (Zero Skew) the M9500 Tolerance field must specify two, three, four, or five signal channels.

MOD3

This field specifies the calibrator mode:

- *blank* Not applicable
- ZM Input (UUT Impedance Measurement)
- +V Positive Video Polarity
- -V Negative Video Polarity
- EF Use 9550 Active Head for Fast Edge
- 7E Use 9560 Active Head for Fast Edge
- PR Use zero skew precision adjustments already performed and stored manually.

Rules:

- ZM is inserted automatically in the MOD3 field when the Nominal field units are Ohms or Farads.
- The MOD3 field must specify +V or -V when the MOD2 field is F1 or F2.
- The MOD3 field may specify EF only when the MOD2 field specifies FE.
- The MOD3 field may specify PR only when the MOD2 field specifies ZK.
- The MOD3 field may specify 7E only when the MOD2 field specifies FE.

MOD4

This field specifies the type of test being as described in "General Rules for Instrument Evaluation FSCs".

Additional Rules:

- The MOD4 field must specify S (Setup Test) when the MOD2 field specifies OP (Overload Pulse).

CON

The CONnection field specifies the UUT connection.

- *blank* 1 MΩ Termination
- L 50 Ω Termination
- 2W 2-Wire

Rules:

- 2W is inserted automatically in the CON field when the MOD3 is ZM.
- The CON field must specify 2W when the MOD3 field specifies ZM.
- The CON field must be blank (1 MΩ for multi-channel DC Voltage (i.e. the M9500 TOLERANC field specifies two or more signal channels).
- The CON field must be L for any of the following conditions:
    1. Nominal field specifies current.
    2. MOD1 field specifies current.
    3. The MOD2 field specifies fast edge (FE).
    4. The MOD2 field specifies overload pulse (OP).
    5. The MOD2 field specifies zero skew (ZK).

- L is inserted automatically in the CON field for any of the following conditions if no CON field code is entered:
  1. Nominal field specifies current.
  2. MOD1 field specifies current.
  3. The MOD2 field specifies fast edge (FE).
  4. The MOD2 field specifies overload pulse (OP).
  5. The MOD2 field specifies zero skew (ZK).
- L is inserted automatically in the CON field for any of the following conditions if no CON field code is entered:
  6. Nominal field specifies current.
  7. MOD1 field specifies current.
  8. The MOD2 field specifies fast edge (FE).
  9. The MOD2 field specifies overload pulse (OP).
  10. The MOD2 field specifies zero skew (ZK).

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in this manual.

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2   3  4 CON
# ----- Reset -----
  1.001  M9500        *              CH1
  1.002  9500         *                                                 S
# ----- DC Voltage -----
  1.003  9500   20    19.99mV        4%
# ----- AC Voltage (Positive Scope Square Wave) -----
  2.001  9500   400   350.0mV        50U            60H            ZQ
# ----- AC Voltage (Negative Scope Square Wave) -----
  3.001  9500         100Vpp                        1kH            ZN    S
# ----- AC Voltage (Frequency Test) -----
  3.002  9500   1000  800.0H         0.1% 0.1U      300mV          ZQ
# ----- Low-Edge Signal (Scope Output) -----
  4.001  9500         0.5Vpp                        500kH          ED    S  L
# ----- High-Edge Signal (Scope Output) -----
  4.002  9500         100Vpp                        100kH          HE    S
# ----- Fast-Edge Signal (Scope Output) -----
  4.003  9500         100Vpp                        100kH          HE    S
  4.004  M9500                       CH12
  4.005  9500         10mVpp                        1MH            FE    S  L
# ----- Triangle Marker Signal -----
  4.006  M9500                       CH1
  4.007  9500         1uT                           1Vpp           M1    S  L
  4.008  M9500        *              CH1
# ----- Square Marker Signal -----
  4.009  9500         1mT                           1Vpp           M2    S  L
# ----- Pulse Marker Signal -----
  4.010  9500         5uT                           1Vpp           M3    S  L
# ----- Sinusoid Marker Signal -----
  4.011  9500         2nT                           1Vpp           M4    S  L
# ----- NTSC Video -----
  4.012  9500         1Vpp                                         F1 +V S  L
  4.013  M9500        *              CH1
# ----- PAL Video -----
  4.014  9500         0.7Vpp                                       F2 -V S  L
# ----- Linear Ramp Signal -----
  4.015  9500         300mT                         1Vpp           LR    S  L
# ----- Zero Skew Function -----
  4.016  M9500                       CH1234
  4.017  9500         500kH                         1Vpp           ZK    S  L
# ----- Impedance Measurement (50 Ohm) -----
  4.018  M9500        *              CH1
```

```
  4.019  9500         50Z            1U                               ZM    2W
# ----- Impedance Measurement (1 MOhm) -----
  5.001  9500         1.000MZ        1U                               ZM    2W
# ----- Impedance Measurement (Capacitance) -----
  6.001  9500         10pF                                            ZM N  2W
# ----- Overload Pulse -----
  6.002  HEAD         {CH 1 50 Ohm OVERLOAD PROTECTION}
  6.003  DISP         Connect 9500 CH 1 Active Head to UUT CH 1.
  6.004  SET          VERTICAL MODE CH 1: ON
  6.004  SET          VERTICAL MODE CH 2: OFF
  6.004  SET          VERTICAL MODE CH 3: OFF
  6.004  SET          VERTICAL MODE CH 4: OFF
  6.004  SET          COUPLING CH 1 : 50 Ohm
  6.004  SET          VOLTS/DIV CH 1 : 1V
  6.004  SET          TRIGGER SOURCE : CH 1
  6.005  HEAD         CH 1 50 Ohm OVERLOAD PROTECTION: 5V test ~60s
# 5V at 30J = 60s duration.
  6.006  9500         5V                          30J            OP    S
  6.007  MATH         MEM2 = "No overload at 5V"
  6.008  EVAL   -s MEM2 : [N]Does the UUT display show "50 Ohm OVERLOAD"?
  7.001  SET          VOLTS/DIV CH 1 : 5V
  7.002  HEAD         CH 1 50 Ohm OVERLOAD PROTECTION: 20V test ~12.5s
# 20V at 50J = 6.25s. Spec is 10s so two setup statements are needed.
  7.003  9500         20V                         50J            OP    S
  7.004  9500         20V                         50J            OP    S
  7.005  MATH         MEM2 = "50 Ohm Overload at 20V"
  7.006  EVAL   -s MEM2 : Does the UUT display show "50 Ohm OVERLOAD"?
```

M9500

Instrument FSC

Description

The M9500 FSC provides the additional program functions for the Datron 9500 and Fluke 9500B Oscilloscope Calibrators which are not addressed by the 9500 FSC.for the Datron 9500 Oscilloscope Calibrator which are not addressed by the 9500 FSC.

- Overload Pulse Time Limit
- Video Trigger
- Edge Polarity
- Signal Channel
- Trigger Output Impedance
- Trigger Channel
- Pulse Width (9500B only)
- Pulse Repetition Frequency (9500B only)
- Pulse Period (9500B only)

Parameters

9500 NOMINAL, MOD1, MOD2, MOD3 and M9500 RANGE and NOMINAL Rules

9500 Mode	9500 NOMINAL	9500 MOD1	9500 MOD2	9500 MOD3	M9500 RANGE	M9500 NOMINAL
Video	<amplitude>		F1|F2	+V|-V	[COMP|FRAME]	
Low Edge	<amplitude>	<freq|per>	ED		[RISE|FALL]	
Low Edge	<freq|per>	<amplitude>	ED		[RISE|FALL]	
High Edge	<amplitude>	<freq|per>	HE		[RISE|FALL]	
High Edge	<freq|per>	<amplitude>	HE		[RISE|FALL]	
Fast Edge	<amplitude>	<freq|per>	FE	[EF]	[RISE|FALL]	
Fast Edge	<freq|per>	<amplitude>	FE	[EF]	[RISE|FALL]	
Fast Edge	<amplitude>	<freq|per>	FE	7E	[RISE]	
Fast Edge	<freq|per>	<amplitude>	FE	7E	[RISE]	
Pulse	<width>	1Vpp	PU		PER	<freq|per>
Pulse	<freq|per>	1Vpp	PU		PULSE	<width>

Note

Blank entries in the above table are significant and must be blank. FSC field interdependencies not expressed in this table are listed under "Rules" for the appropriate parameter.

RANGE

This field specifies one of the following:

- COMP Trigger Composite (Video)
- FRAME Trigger Frame (Video)
- RISE Polarity (Edge)
- FALL Polarity (Edge)
- PULSE Pulse Width (9500B only)
- PER Pulse Period (9500B only)
- *blank* field not applicable

NOMINAL

This field specifies one of the following:

- Pulse Width entered as: [*numeric*][*prefix*]T or H
- Pulse Period entered as: [*numeric*][*prefix*]T
- Pulse Repetition Frequency entered as: [*numeric*][*prefix*]H
- "*" reset to default values
- *blank* field not applicable

TOLERANCE

This field selects the signal channel(s).

- *blank* CH 1
- CH1 CH 1
- CH2 CH 2
- CH3 CH 3
- CH4 CH 4
- CH5 CH 5
- CH12 CH 1 & CH 2
- CH13 CH 1 & CH 3
- CH14 CH 1 & CH 4
- CH15 CH 1 & CH 5
- CH23 CH 2 & CH 3
- CH24 CH 2 & CH 4
- CH25 CH 2 & CH 5
- CH34 CH 3 & CH 4
- CH35 CH 3 & CH 5
- CH45 CH 4 & CH 5

• CH123	CH 1, CH 2, & CH 3
• CH124	CH 1, CH 2, & CH 4
• CH125	CH 1, CH 2, & CH 5
• CH134	CH 1, CH 3, & CH 4
• CH135	CH 1, CH 3, & CH 5
• CH145	CH 1, CH 4, & CH 5
• CH234	CH 2, CH 3, & CH 4
• CH235	CH 2, CH 3, & CH 5
• CH245	CH 2, CH 4, & CH 5
• CH345	CH 3, CH 4, & CH 5
• CH1234	CH 1, CH 2, CH 3, & CH 4
• CH1235	CH 1, CH 2, CH 3, & CH 5
• CH1245	CH 1, CH 2, CH 4, & CH 5
• CH1345	CH 1, CH 3, CH 4, & CH 5
• CH2345	CH 2, CH 3, CH 4, & CH 5
• CH12345	CH 1, CH 2, CH 3, CH 4, & CH 5

Rules:

9500	M9500
	MOD2 TOLERANCE

- When the mode is Leveled Sine (9500 MOD2 is "LS") the M9500 Tolerance field may specify one or two signal channels.
- When the mode is Zero Skew (9500 MOD2 is "ZK") the Tolerance field must specify two, three, four, or five signal channels.
- When the mode is 1 MOhm DC Voltage (9500 NOMINAL units are V and 9500 MOD1, MOD2, and CON are blank) the Tolerance field may specify two, three, four, or five signal channels.
- For all other modes and 50 Ohm DC Voltage) the TOLERANCE field may specify only one signal channel.
- When the mode is Leveled Sine or DC Voltage with multi-channel output, if any channel uses the 9560 Active Head, all other channels selected must also use a 9560 Active Head.

MOD1

This field is not used.

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the trigger output impedance.

- *blank* 1 MΩ Termination
- L 50 Ω Termination

CON

This field specifies the trigger channel and rate. The following codes require Option 5, 5 Five Channel Output:

- *blank* Trigger Output off
- 1T1 Trigger Output on Channel 1, Normal mode
- 2T1 Trigger Output on Channel 1, 1/10 of output rate
- 3T1 Trigger Output on Channel 1, 1/100 of output rate
- 1T2 Trigger Output on Channel 2, Normal mode
- 2T2 Trigger Output on Channel 2, 1/10 of output rate
- 3T2 Trigger Output on Channel 2, 1/100 of output rate
- 1T3 Trigger Output on Channel 3, Normal mode
- 2T3 Trigger Output on Channel 3, 1/10 of output rate
- 3T3 Trigger Output on Channel 3, 1/100 of output rate
- 1T4 Trigger Output on Channel 4, Normal mode
- 2T4 Trigger Output on Channel 4, 1/10 of output rate
- 3T4 Trigger Output on Channel 4, 1/100 of output rate
- 1T5 Trigger Output on Channel 5, Normal mode
- 2T5 Trigger Output on Channel 5, 1/10 of output rate
- 3T5 Trigger Output on Channel 5, 1/100 of output rate

Rules:

- The CON field must be blank for any of the following conditions:
  1. The M9500 Tolerance field is blank.
  2. The M9500 Tolerance field specifies three or more output channels (zero skew).
  3. The 9500 MOD2 field specifies zero skew "ZK".
  4. The 9500 MOD3 field specifies impedance measurment "ZM".
- When a trigger output channel is specified the trigger channel number cannot be the same as a signal output channel specified in the Tolerance field.

Examples

See 9500 FSC.

9640

Instrument FSC

Description

The 9640 FSC controls the Fluke 9640A RF Reference Source.

Editor Learn Mode

The MET/CAL Editor allows a 9640 statement to be automatically generated based on the current 9640A instrument settings.

This facility is called "learn mode".

To use learn mode:

1. Setup the 9640A to the desired state. Note it is not necessary to turn the output on.
2. Type "9640" on a blank line in the edit window.
3. Press F7.

A new MET/CAL 9640 procedure statement will be automatically generated.

The generated statement will, when executed, cause the 9640 to be placed in the state it was in at the time F7 was entered. In addition the 9640 output will be turned on.

In order to use learn mode the 9640A, must be correctly configured using the MET/CAL Configuration Editor (F12).

Learn mode does not generate a complete evaluation step. A MEMCX statement must be added after the generated 9640 statement to complete the evaluation step. It is also necessary to add additional statements, between the 9640 statement and the MEMCX statement, to obtain the UUT reading. See examples at the end of this document.

Learn mode functions correctly even if the Run Time and/or Test Run applications are currently configured to execute in "demo mode".

Not all instrument parameter values cause Learn Mode to generate an entry in the 9640 statement. Specifically, some parameters are not included in the 9640 statement generated when F7 is pressed and the state of the parameter is the (*RST) default. These parameters are listed below:

Instrument State when F7 is Pressed	9640 Statement
External Coupling	
AC (default)	<no entry generated>
DC	ExternalCoupling = DC
Modulation Waveform	
Sine (default)	<no entry generated>
Triangle	ModulationWaveform = Triangle
External	ModulationWaveform = External
Reference Frequency	
Internal (default)	<no entry generated>
External	ExternalReferenceFrequency = 1 MHz
Remote Leveling	
Off (default)	<no entry generated>
On	RemoteLevelingOn
Sweep Mode	
Continuous (Default)	<no entry generated>
Single	SweepMode = Single
Sweep Type	
Linear (default)	<no entry generated>
Logarithmic	SweepType = Log
Sweep Trigger Source	
Internal (default)	<no entry generated>
External	TriggerSource = Ext
Sweep Trigger Slope	
Positive (default)	<no entry generated>
Negative	TriggerSlope = Neg

Parameters

A 9640 statement consists of one or more parameters. A parameter consists of a name and a value. Each parameter must be separated by a semicolon and/or one or more spaces. A single 9640 statement can encompass more than one physical line as long as the line numbers are the same. However each parameter name and its value must occur on one line. A single line can accommodate 56 characters, not including the statement number and FSC.

Syntax

9640 *<parameter>[<separator><parameter>]*

<parameter> = *[<prefix>]<parameter name>[<sp>]=[<sp>]<parameter value>*

<separator> = *;[<sp>]* | *<sp>*

<prefix> = + | @

<sp> = one or more spaces

<parameter name> = see Parameters Names section below

<parameter value> = see Parameters Names section below

| Denotes "or" (i.e. A | B is A or B)

[ ] Denotes an optional syntax element, except in examples. In examples

[ ] Enclose a special construction.

\+ Designates the parameter as the Evaluation Quantity

@ Designates the parameter as the Modifier Quantity

Examples

The following 9640 statement are identical with respect to the 9640A:

```
9640    +Level = 3 dBm; @Freq = 500 MHz; OutputImp = 50 Ohm
MATH    L[1] = 500
9640    +Level = 3 dBm @Freq = [L1] MHz; OutputImp = 50 Ohm
MATH    M[1] = 3
9640    Apply
```

9640 +Level = [M1] dBm

9640 @Freq = 500 MHz

9640 OutputImp = 50 Ohm

Rules:

- One and only one parameter must be designated as the Evaluation Quantity in a 9640 Apply (default), Setup, or Slew statement.
- When a 9640 Apply (default) statement is executed, the value of the Evaluation Quantity is copied to memory register MEM1 in base units.

  Example:

  9640 +Freq = 500 MHz; Level = 3 dBm; OutputImp = 50 Ohm

  or

  9640 Apply; +Freq = 500 MHz; Level = 3 dBm; OutputImp = 50 Ohm

  After the 9640 statement is executed the value of MEM1 is 500.
- When a 9640 Operate statement is executed, the value of the Evaluation Quantity designated in the previous Setup or Apply statement is copied to memory register MEM1 in base units.

  Example:

  9640 Setup; +Freq = 500 MHz; Level = 3 dBm; OutpImp = 50 Ohm

  9640 Operate

  After the 9640 Operate statement is executed the value of MEM1 is 500.
- When a 9640 Slew statement is executed, the Evaluation Quantity designates the slew quantity.
- When a 9640 Slew statement is executed, the final slew value is copied to memory register MEM in base units.

  Example:

  9640 Slew; +Freq = 500 MHz; Level = 3 dBm; OutpImp = 50 Ohm

  Operator slews the 9640A output to 501.23 MHz.

  After the 9640 Slew statement is executed the value of MEM is 501.23.
- At most one parameter may be designated as the Modifier Quantity in a 9640 Apply (default), Setup, or Slew statement.

- When a 9640 Slew statement is executed, the Modifier Quantity is concatenated to the Evaluation Quantity in the automatic slew message. Note, the automatic slew message is not displayed when ASK- N is in effect.

  Examples:

  ASK+ N

  9640 Slew; +Freq = 500 MHz; @Level = 3 dBm; OutpImp = 50 Ohm

  "Adjust stimulus for a UUT reading of 500 MHz at 3 dBm."

  No Modifier Quantity designated.

  9640 Slew; +Freq = 500 MHz; Level = 3 dBm; OutpImp = 50 Ohm

  "Adjust stimulus for a UUT reading of 500 MHz."

  Automatic slew message inhibited.

  ASK- N

  9640 Slew; +Freq = 500 MHz; @Level = 3 dBm; OutpImp = 50 Ohm

  No automatic slew message generated, use MESS FSC.

- Parameter values may be taken from a MET/CAL memory register using a special construction.

Parameter Names

Parameter names consist of single words or compound words. Each word in a parameter name can be entered in long form (as shown below), or in short form. The short form is the first 4 characters of the long form, unless the last character or the word is a vowel. In this case the short form is three characters.

Compound parameter names can be entered in any combination of long and short forms. Example, ExternalReferenceFrequency can be entered using any of the following forms:

ExtRefFreq

ExtRefFrequency

ExtReferenceFreq

ExtReferenceFrequency

ExternalRefFreq

ExternalRefFrequency

ExternalReferenceFreq

ExternalReferenceFrequency

Action Parameters

Apply

Operate

Setup

Slew

Standby

Trigger

General Parameters

ExternalReferenceFrequency

Level (1, 2)

Mode

OutputImpedance (2)

ReferenceFrequencyOutput

TimebaseAccuracyOff

Sine Parameters

Frequency (1, 2)

RemoteLevelingOn

Modulation Parameters

AMDepth (1, 2)

ExternalCoupling

FMDeviation (1, 2)

Frequency (1, 2)

ModulationFrequency (1, 2)

ModulationWaveform

PMDeviation (1, 2)

Sweep Parameters

CenterFrequency

FrequencySpan

StartFrequency

StopFrequency

SweepDwellTime

SweepMode

SweepSquelchOn

SweepStep

SweepType

TriggerSlope

TriggerSource

TriggerOutputOn

1. May be designated as the Evaluation Quantity.
2. May be designated as the Modifier Quantity.

Instrument Mode

MET/CAL determines the 9640A operating mode based on occurance of the following parameters in a 9640 statement:

AMDepth

FMDeviation

CenterFrequency

FrequencySpan

StartFrequency

StopFrequency

Rules:

- If AMDepth occurs sequentially in a 9640 statement before any of the other parameters listed above, the mode is AM.
- If FMDeviation occurs sequentially in a 9640 statement before any of the other parameters listed above, the mode is FM.
- If CenterFrequency, FrequencySpan, StartFrequency, or StopFrequency occurs sequentially in a 9640 statement before any of the other parameters listed above, the mode is Sweep.
- If none of the parameters listed above occur in the 9640 statement, the mode is Sine.

Mode/Parameter Rules

If a parameter is not listed for a mode, it is not allowed.

Sine

Required Parameters:

Frequency

Level

OutputImpedance

Optional Parameters	Default
Apply | Operate | Setup | Slew	Apply
ExternalReferenceFrequency	Internal
Low	Ground
Mode	Sine
ReferenceFrequencyOutput	Off
RemoteLevelingOn	Off
ResistanceMultiplierOn	Off
TimebaseAccuracyOff	na

Amplitude Modulation

Required Parameters:

AMDepth

Frequency

Level

Mode

ModulationFrequency

OutputImpedance

Optional Parameters	Default
Apply | Setup | Slew	Apply
ExternalCoupling	AC
ExternalReferenceFrequency	Internal
ModulationWaveform	Sine
ReferenceFrequencyOutput	Off
TimebaseAccuracyOff	na

Frequency Modulation

Required Parameters:

FMDeviation

Frequency

Level

Mode

ModulationFrequency

OutputImpedance

Optional Parameters	Default
Apply | Setup | Slew	Apply
ExternalReferenceFrequency	Internal
ExternalCoupling	AC
ModulationWaveform	Sine
ReferenceFrequencyOutput	Off
TimebaseAccuracyOff	na

Phase Modulation

Required Parameters:

PMDeviation

Frequency

Level

Mode

ModulationFrequency

Optional Parameters	Default
Apply | Setup | Slew	Apply
ExternalReferenceFrequency	Internal
ModulationWaveform	Sine
ReferenceFrequencyOutput	Off
TimebaseAccuracyOff	na

Sweep

Required Parameters:

CenterFrequency (1)

FrequencySpan (1)

Level

Mode

OutputImpedance

StartFrequency (1)

StopFrequency (1)

SweepStep

1. Either CenterFrequency and FrequencySpan or StartFrequency and StopFrequency is required, but only either is allowed, not both.

Optional Parameters	Default
Apply | Setup	Apply(1)
ExternalReferenceFrequency	Internal
ReferenceFrequencyOutput	Off
SweepDwellTime	100 ms
SweepMode	Continuous
SweepSquelchOn	Off
SweepType	Linear
TriggerOutputOn	Off

Optional Parameters	Default
TriggerSlope	Positive
TriggerSource	Internal
TimebaseAccuracyOff	na

Parameter Definitions and Values

AMDepth

This parameter sets the output mode to AM and selects sets the AM depth.

Syntax

[<prefix>]AMDepth[<sp>]=[<sp>]<percent quan>

<percent quan> = *<value>[<sp>][<prefix>]%*

<value> = <numeric value> | <register reference>

Rules:

- Legal values are: 0.1 % to 99 %.

Examples

+AMDepth = 30.0 %

+AMDepth = [L1] %

Apply

This parameter causes the instrument to be setup to the state specified by the remaining parameters listed. The output is also turned on.

Syntax

Apply

Rules:

- When Apply is specified, Setup and Slew must not be specified.

Examples

Apply

CenterFrequency

This parameter sets the output mode to sweep and sets the center frequency for the sweep.

Syntax

CenterFrequency[<sp>]=[<sp>]<value> = <numeric value>[<sp>][<prefix>]Hz

Rules:

- Legal values are: 9 Hz to 4.024 GHz.

Examples

CenterFreq = 100 MHz

ExternalReferenceFrequency

This parameter sets the reference oscillator source to external and reference oscillator external frequency to the value specified. If this parameter is not specified, the reference oscillator source is set to internal.

Syntax

ExternalReferenceFrequency[<sp>] = [<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]Hz

Rules:

- Legal values are: 1 MHz to 20 MHz in 1 MHz steps.

Examples

ExtRefFreq = 10 MHz

FMDeviation

This parameter sets the output mode to FM and selects sets the FM deviation.

Syntax

[<prefix>]FMDeviation[<sp>] = [<sp>]<numeric value>[<sp>][<prefix>]Hz

Rules:

- Legal values are: 9 MHz to 4.024 GHz.

Examples

+FMDev = 5.00 kHz

Frequency

This parameter establishes the expected frequency of the input signal.

Syntax

[<prefix>]Frequency[<sp>] = [<sp>]<numeric value>[<sp>][<prefix>]Hz

Rules:

- Legal values are: 9 Hz to 4.024 GHz.

Examples

+Freq = 1 MHz

FrequencySpan

This parameter sets the output mode to sweep and sets the frequency span for sweep.

Syntax

FrequencySpan[<sp>] = [<sp>]<numeric value>[<sp>][<prefix>]Hz

Rules:

- Legal values are: 100 kHz to 4.024 GHz.

Examples

FreqSpan = 9 MHz

ExternalCoupling

This parameter sets the external modulation coupling.

Syntax

ExternalCoupling[<sp>] = [<sp>]<value>

<value> = AC | DC

Examples

ExtCoup = DC

Level

This parameter sets the power level of the output.

Syntax

[<prefix>]Level[<sp>] = [<sp>]<dim quan>

<dim quan> = <value>[<sp>][<prefix>]<units>

<value> = <numeric value> | <register reference>

<units> = dBm | dBuV | V | Vpp | W

Rules:

- Legal values are:

Impedance	Level
50 Ohms	-130 dBm to 24 dBm(1)
75 Ohms	-130 dBm to 18 dBm(1)
1. Sine and sweep modes. See 9640A specifications for modulation mode limits and amplitude vs. frequency restrictions.	

Examples

@Level = -2.00 dBm

Mode

This parameter selects the operating mode.

Syntax

Mode[<sp>] = [<sp>]<value>

<*value*> = Sine | AM | FM | PM | Sweep

Rules:

- When this parameter is not specified, the default is Sine.

Examples

Mode = Sweep

ModulationFrequency

This parameter sets the modulation frequency of the AM or FM.

Syntax

[<prefix>]ModulationFrequency[<sp>] = [<sp>]<value>

<*value*> = [<sp>]<numeric value>[<sp>][<prefix>]Hz

Rules:

- Legal values are:

Type	Waveform	ModFreq
AM	Sine	20 Hz to 220 kHz
AM	Triangle	20 Hz to 10 kHz
FM	Sine	20 Hz to 300 kHz
PM	Sine	20 Hz to 300 kHz

Examples

&ModFreq = 1 kHz

ModulationWaveform

This parameter sets the shape of the modulation of the AM or FM.

Syntax

ModulationWaveform[<sp>] = [<sp>]<value>

<value> = Sine | Triangle | External

Rules:

- Triangle is only allowed for AM.

Examples

ModWav = Sine

Operate

This parameter turns the output on.

Syntax

Operate

Rules:

- When Operate is specified, no other parameters are allowed.

Examples

Operate

OutputImpedance

This parameter specifies the output impedance. The specified output impedance is used to determine whether a 9640A-50 Ohm or 9640A-75 Ohm head is required.

Syntax

OutputImpedance[<sp>] = [<sp>]<dim quan>

<dim quan> = <value>[<sp>][<prefix>]Ohm

<value> = <numeric value> | <register reference>

Rules:

- Legal values are: 50 and 75 Ohms.

Examples

OutputImpedance = 50 Ohm

ReferenceFrequencyOutput

This parameter enables the reference frequency output and sets the frequency to the value specified. If this parameter is not specified, the reference frequency output is disabled.

Syntax

ReferenceFrequencyOutput[<sp>] = [<sp>]<dim quan>

<dim quan> = <value>[<sp>][<prefix>]Hz

<value> = <numeric value> | <register reference>

Rules:

- Legal values are: 1 MHz and 10 MHz.

Examples

ReferenceFrequencyOutput = 10 MHz

RemoteLevelingOn

This parameter enables remote leveling for sine mode.

Syntax

RemoteLeveling

Rules:

- When RemoteLevelingOn is specified, remote leveling is enabled.
- When RemoteLevelingOn is not specified, remote leveling is disabled.

Examples

RemLevOn

Reset

This parameter resets the instrument.

Syntax

Reset

Rules:

- When Reset is specified, no other parameters are allowed.

Examples

Reset

Setup

This parameter causes the instrument to be setup to the state specified by the remaining parameters listed. The output IS NOT turned on.

Syntax

Setup

Rules:

- When Setup is specified, Apply or Slew must not be specified.

Examples

Setup

Slew

This parameter causes the instrument to be setup to the state specified by the remaining parameters listed. The output is turned on, and slewing is enabled for the parameter designated as the Evaluation Quantity (+) prefix.

Syntax

Slew

Rules:

- When Slew is specified, Apply or Setup must not be specified.

Examples

Slew

Standby

This parameter turns the output off.

Syntax

Standby

Rules:

- When Standby is specified, no other parameters are allowed.

Examples

Standby

StartFrequency

This parameter sets the sweep start frequency.

Syntax

StartFrequency[<sp>] = [<sp>]<numeric value>[<sp>][<prefix>]Hz

Rules:

- Legal values are: 9 Hz to 4.024 GHz.

Examples

StartFreq = 1 MHz

StopFrequency

This parameter sets the sweep stop frequency.

Syntax

StopFrequency[<sp>] = [<sp>]<numeric value>[<sp>][<prefix>]Hz

Rules:

- Legal values are: 9 Hz to 4.024 GHz.

Examples

StopFreq = 10 MHz

SweepDwellTime

This parameter sets the amount of time spent at each point during a sweep.

Syntax

SweepDwellTime[<sp>] = [<sp>]<numeric value>[<sp>][<prefix>]s

Rules:

- Legal values are: 20 ms to 10 s.

Examples

SweepDwellTime = 100 ms

SweepMode

This parameter sets the sweep mode.

Syntax

SweepMode[<sp>] = [<sp>]<value>

<value> = Continuous | Single

Examples

SweepMode = Cont

SweepSquelchOn

This parameter enables sweep squelch.

Syntax

SweepSquelch

Rules:

- When SweepSquelchOn is specified, sweep squelch is enabled.
- When SweepSquelchOn is not specified, sweep squelch is disabled.

Examples

SweSquOn

SweepStep

This parameter sets the sweep step.

Syntax

SweepStep[<sp>] = [<sp>]<numeric value>[<sp>][<prefix>]<units>

<units> = Hz | ppd | ppm | pts |%

Rules:

- Legal values are: 0.1 Hz to 4 GHz.
- If SweepType is Linear, SweepStep units must be hertz ("Hz"), parts per million ("ppm"), points per step ("pts") or percent ("%").
- If SweepType is Logarithmic, SweepStep units must be points per decade ("ppd") or points per step ("pts").

Examples

SweepStep = 10 ppd

SweepType

This parameter sets the sweep type.

Syntax

SweepType[<sp>] = [<sp>]<value>

<value> = Linear | Logarithmic

Examples

SweepType = Log

TimebaseAccuracyOff

This parameter...

Syntax

TimebaseAccuracyOff[<sp>] = [<sp>]<value>

Examples

TimebaseAccuracyOff

Trigger

This parameter initiates a single sweep.

Syntax

Trigger

Rules:

- When Trigger is specified, no other parameters are allowed.
- Trigger must only follow 9640 single sweep setup and operate statements.

Examples

Trigger

TriggerOutputOn

This parameter enables the trigger output signal.

Syntax

TriggerOutputOn

Rules:

- TriggerOutputOn may only be specified when TriggerSource is internal (default).
- When TriggerOutputOn is specified, the trigger output is enabled.
- When TriggerOutputOn is not specified, the trigger output is disabled.

Examples

TrigOutpOn

TriggerSlope

This parameter sets the sweep trigger slope.

Syntax

TriggerSlope[<sp>] = [<sp>]<value>

<*value*> = Positive | Negative

Examples

TrigSlope = Pos

TriggerSource

This parameter sets the sweep trigger source.

Syntax

TriggerSource[<sp>] = [<sp>]<value>

<*value*> = Internal | External

Examples

TrigSource = Int

Examples

```
STEP     FSC     RANGE  NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON

# Sine Mode, evaluation quantity, frequency, 50 Ohm Leveling Head.
  1.001  9640         +Freq = 1 GHz; Level = -10 dBm; OutputImp = 50 Ohms

# Sine Mode, evaluation quantity, frequency, 75 Ohm Leveling Head.
# 1.002  9640         +Freq = 2 GHz; Level = -10 dBm; OutputImp = 75 Ohms

# Sine Mode, evaluation quantity, level.
  1.002  9640         +Level = -10 dBm; Freq = 50 MHz; OutputImp = 50 Ohms
```

```
# Sine Mode, evaluation quantity, frequency, 10 MHz External Reference used
# for Timebase accuracy.
# 1.004  9640         +Freq = 1.5 GHz; Level = -10 dBm; OutputImp = 50 Ohms
# 1.004  9640         ExtRefFreq = 10 MHz

# Sine Mode, evaluation quantity, frequency, 10 MHz External Reference used
# for synchronizing purposes only.
  1.003  9640         +Freq = 1.5 GHz; Level = -10 dBm; OutputImp = 50 Ohms
  1.003  9640         ExtRefFreq = 10 MHz; TimebaseAccOff

# AM Mode, Modulation Frequency evaluation quantity, Triangle Modulation.
  1.004  9640         Freq = 500 MHz; Level = -10 dBm; Mode = AM
  1.004  9640         +ModFreq = 10 kHz; ModWav = Triangle; AMDepth = 90 %
  1.004  9640         OutputImp = 50 Ohms

# AM Mode, Modulation Frequency evaluation quantity, Triangle Modulation,
# Slewing enabled.
  1.005  9640         Freq = 500 MHz; Level = -10 dBm; Mode = AM
  1.005  9640         +ModFreq = 10 kHz; ModWav = Triangle; AMDepth = 90 %
  1.005  9640         OutputImp = 50 Ohms; Slew

# FM Mode, FM Deviation evaluation quantity, 10 Hz Sine Modulation.
  1.006  9640         Frequency = 10 MHz; Level = -10 dBm; OutputImp = 50 Ohms
  1.006  9640         +FMDeviation = 10 Hz; Mode = FM; ModFreq = 1 kHz

  1.007  ASK-                             U
  1.008  9640         Mode = Sweep; StartFreq = 10 MHz; StopFreq = 3 GHz
  1.008  9640         SweepStep = 10 MHz; SweepDwellTime  =  100 ms
  1.008  9640         SweepSquelchOn
  1.008  9640         +Level = -10 dBm; OutputImpedance = 50 Ohms

  1.009  9640         Mode            =   Sweep
  1.009  9640         +Level          = -10 dBm
  1.009  9640         StartFrequency  =  10 MHz
  1.009  9640         StopFrequency   =   3 GHz
  1.009  9640         SweepStep       =  10 MHz
  1.009  9640         SweepDwellTime  =  100 ms
  1.009  9640         SweepSquelchOn
  1.009  9640         OutputImpedance = 50 Ohms
```

ACC

Miscellaneous FSC

Description

The ACC FSC enables MET/CAL to calculate a Test Uncertainty Ratio for a user-configured system instrument by allowing the procedure writer to specify the system accuracy. The ACC FSC must be used in conjunction with an associated MEMC or MEMCX statement.

Format

ACC *range nominal tolerance*

Rules

RANGE

The RANGE field in the ACC FSC has two uses. First, it can be referred to by the TOLERANCE field. For example, a TOLERANCE specification of "1/" indicates 1% of the RANGE value. The second use is as a stand-in for the ACC NOMINAL value at compile time. If the ACC FSC does not directly specify a NOMINAL value, but does specify a RANGE value, the compile-time T.U.R. calculation uses the RANGE value in place of the NOMINAL value. The RANGE field is optional. For compatibility with other FSCs, the RANGE field may contain a number or an 'A' (for AUTORANGE), however an 'A' in the ACC RANGE field has no effect.

The ACC RANGE field is compatible with the RANGE field in an instrument FSC. Refer to the RANGE field rules section under "Instrument FSCs" in Chapter 1 of the MET/CAL Procedure Language Reference Manual.

NOMINAL

The NOMINAL field specifies the value at which the system accuracy is to be determined. If the ACC NOMINAL does not specify a numeric value, the NOMINAL value is taken from memory register MEM at run-time. Like MEMC and MEMCX, the ACC fsc allows an arbitrary units string to be specified in the NOMINAL field. When an ACC fsc is paired with a MEMC or MEMCX statement, the units string in the ACC NOMINAL field documents the procedure and is used when the System Actual, UUT Indicated, System Tolerance, and Test Tolerance are printed in the Post Test summary and results. As with MEMC and MEMCX, MET/CAL does not evaluate any units prefix specified in the ACC

NOMINAL field. The NOMINAL values in the ACC and MEMC statements are presumed to be in the same units.

The general format for the NOMINAL field of the ACC FSC is:

[*value*]*string*

The following rules apply to the ACC NOMINAL field:

1. *string* need not be present if there is a numerical *value*.
2. *string* may be any text string, with two restrictions:

   (a) The string cannot contain blanks.

   (b) The last character in the string cannot be a 'R', '/', '%' or 'U'.
3. *string* does not affect the NOMINAL value used to calculate the system accuracy. The procedure writer must ensure that the NOMINAL values given in the ACC and associated MEMC or MEMCX statements are in commensurate units. Otherwise, the T.U.R. calculation will be incorrect.
4. A maximum of 14 characters is allowed in the NOMINAL field.
5. The *value* is specified in floating-point format (NR3). It may contain a sign, a decimal point, and may be expressed in scientific notation (E-format).

TOLERANCE

The TOLERANCE field specifies the tolerance used to calculate the system accuracy. The tolerances may be specified with respect to the ACC NOMINAL value, with respect to the ACC RANGE value, in absolute units, or in some combinations of these three ways. The tolerances should reflect the instrument specifications of the user-configured system instrument at the specified NOMINAL value.

An asymmetrical tolerance specification has no purpose when used in an ACC statement. The maximum deviation from the ACC NOMINAL will be taken to be the system accuracy when an asymmetrical specification is given. For example,

```
ACC 10V +1% -2%
```

specifies an asymmetrical tolerance in which the upper deviation is 0.1 V and the lower deviation is 0.2 V. The system accuracy is the maximum of the two deviations, which is 0.2 V.

The TOLERANCE field is limited to 14 characters and may contain up to 3 subfields. Allowed formats for the subfields are:

[*val*]%	% of NOMINAL
[*val*]/	% of RANGE
[val]*P*%	PPM of NOMINAL
[*val*]P/	PPM of RANGE
[*val*]U	Units of NOMINAL
TOL	use TOLERANCE spec in last "TOL" FSC

val, if specified, may be a literal numeric value or may specify a numeric register in the form M *i* where *i* is the register index (1 to 255). If *val* is not specified, the tolerance value is taken from numeric register MEM.

Examples:

```
ACC 10V M23%
```

In this example the tolerance is specified as a percentage of the NOMINAL (10 V) and the tolerance value is taken from numeric register M[23] at run time.

```
ACC 10V U
```

In this example the tolerance is specified in absolute units (in this case volts) and the tolerance value is taken from numeric register MEM at run time.

- Memory Registers

Execution of an ACC statement causes the ACC NOMINAL value to be copied into memory register MEM1. The ACC NOMINAL value is the numeric value specified in the ACC NOMINAL field. If no numeric value is specified in the ACC NOMINAL field, the value is taken from memory register MEM. The ACC FSC does not change the value of the other MET/CAL memory registers (MEM, MEM2, M[1], ..., M[255]).

Note than the ACC FSC functions in the same manner as an Instrument SETUP statement with regard to its effect on MEM1.

Example

```
STEP    FSC    RANGE NOMINAL       TOLERANCE            MOD1 MOD2  3   4   CON
# Reference is a source (System Instrument)
  1.001  5700         2V                             60H                 S   2W
  1.002  MATH         MEM = MEM1 * 1.414
# Get 5700A accuracy at 2V, 60Hz and convert to volts peak.
  1.003  MATH         M[1] = ACCV2("Fluke 5700A", "Volts", 2.0, 60.0)
  1.004  MATH         M[1] = M[1] * 1.414
  1.005  ACC          Vp             M1U
  1.006  DISP         Press the MIN MAX button.
  1.006  DISP         Press the BEEPER button to display maximum values.
  1.007  MEMI         Enter UUT reading in volts peak:
  1.008  MEMCX        Vp             0.045U

# Reference is a sensor (User-configured Instrument)
  2.001  IEEE         [@DMM]DCV 10;ARANGE ON;NPLC 10;MATH OFF;AZERO ON
  2.001  IEEE         [@DMM]FIXEDZ OFF;MEM OFF;DELAY -1;NDIG 6;NRDGS 1,AUTO
  2.001  IEEE         [@DMM]TARM AUTO;TRIG HOLD
  2.002  IEEE         OUT 10V;OPER;*OPC?[I!]
  2.003  IEEE         [@DMM]TRIG SGL[I!]TRIG SGL[I]
  2.004  ACC          V              2.6P% 2e-6U
  2.005  MATH         MEM = MEM1
  2.006  MEMC         10.00V         0.01U
```

Note

The linkage between an ACC statement and an associated MEMC or MEMCX statement is disabled when ASK- U is in effect. (This works in the same manner as the association between an instrument SETUP statement and a MEMC or MEMCX statement.) When ASK- U is set, ACC statements have no effect.

An ACC statement which is not paired with a MEMC or MEMCX statement the same test has no effect.

If an ACC FSC is paired with a MEMC or MEMC statement, and an instrument Setup statement (MOD4 = 'S') or Nominal Setup statement (MOD4 = 'N') appears in the test as well, the ACC statement has priority over the instrument Setup or Nominal Setup statement in specifying the system accuracy.

For example,

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
  1.001  ACC          8.000V        0.0025U
  1.002  5700         8.000V                                  S  2W
  1.003  IEEE         [@UUT]?[I]
  1.004  MEMCX        8.000V        0.01%
```

In this example, the system accuracy is .0025. It is not based on looking up the accuracy of the 5700A at 8V in the appropriate MET/CAL accuracy file, as it would be if the ACC statement were not there.

Results may be unpredictable if a MEMC or MEMCX test includes 2 or more ACC or Instrument Setup or Nominal Setup statements and the state of the ASK 'U' flag is changed between those statements.

ACCF

Miscellaneous FSC

Description

The ACCF FSC allows an alternate accuracy file to be specified for a particular instrument FSC.

Caution #1 – Compile Time TURs vs. Run Time TURs

Procedure writers should carefully read the NOTES section below before using the ACCF FSC. Unless procedures are written to follow the guidelines indicated below, compile time and run time test uncertainty ratio (T.U.R.) calculations may not agree.

Caution #2 – Measurement Uncertainty

When ACCF is used MET/CAL does not read the accuracy file header (if any). Specifically, this means that when MET/CAL normalizes the reference accuracy to 1 sigma, it uses a default confidence value (2 sigma), rather than the confidence specified in the accuracy file. If measurement uncertainty is enabled, then when any accuracy file containing specifications with a confidence other than 2 sigma is used, the procedure writer must also include in the procedure a VSET statement to directly specify the confidence. For example:

VSET CONF = 2.58

Should be used if the confidence is 99%.

Format

ACCF *FSC Accuracy File*

Rules

- \+ *FSC* Field

The *FSC* field specifies the name of the instrument FSC to which the alternate accuracy file applies.

- \+ *Accuracy File*

The *Accuracy File* field specifies the name of the alternate accuracy file.

If the name is a path specification, MET/CAL uses the name exactly as specified. (A path specification is one which contains one or more forward or backward slashes used to separate path components.)

If the name is not a path specification, MET/CAL expects the alternate accuracy file to be located in the MET/CAL accuracy directory. This is the directory specified as the value of the "accdir" parameter in the MET/CAL initialization file ("metcal.ini" in the Windows directory).

If the *Accuracy File* field specifies "*" it indicates that an ACCF reset for the specified FSC is to be done. Execution of an ACCF reset statement restores the use of the default accuracy file for the specified FSC.

- + Field Order

  The order of the fields is important. The *FSC* field must precede the *Accuracy File* field.

Notes

+ Important Note on Compile Time Assumptions

The compile time system assumes that ACCF statements, if any, for a particular instrument FSC exist in the same procedure as the instrument FSC statement, and precede the instrument statement in the procedure.

Procedure writers are strongly encouraged to write procedures which conform to these assumptions. Otherwise, T.U.R.s calculated at compile time will not agree with T.U.R.s calculated at run time.

("Compile time" includes both compiling procedures (F8, F9), and generating T.U.R. reports.)

Specifically, procedure writers should adhere to the following rules:

1. Do not write procedures in which an ACCF statement is intended to apply to an instrument FSC in another procedure (either the calling procedure or a called subprocedure).

For example, do not write a procedure like this:

Main #1

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 ACCF 5700  5700_95.90D
1.002 CALL       Sub #1
```

Sub #1

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700      1V .001%                            2W
```

At run time, the ACCF-specified accuracy file will be used when the T.U.R. calculation for the 5700 statement in the subprocedure is done, because the run time is based on execution order. But at compile time, when the system searches back from the 5700 statement in the subprocedure for ACCF statements, none will be found and the default accuracy file will therefore be used.

For example, do not write a procedure like this:

Main #2

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
    1.001 CALL      Sub #2
    1.002 5700      1V      .001%                       2W
```

Sub #2

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
    1.001 ACCF 5700  5700_95.90D
```

As in the preceding example, the run time and compile time systems will not do the same T.U.R. calculation. At compile time, when the 5700 statement in the main procedure is compiled, the system will use the default accuracy file, since it has no way of knowing that the subprocedure contains an ACCF statement. (Remember that when the main procedure is compiled the subprocedure need not exist.) But at run time the system will call the subprocedure first, execute the ACCF statement, and then, when the 5700 statement in the main procedure is executed, use the alternate accuracy file to do the T.U.R. calculation.

2. Do not write procedures in which jump statements are used to jump to an ACCF statement, which is then followed by a jump back to an instrument statement.

For example, the following procedure could produce different compile time and run time T.U.R. calculations:

```
    STEP   FSC  RANGE   NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001  JMP          2.002
1.002  5700         1V       0.001%                      2W
2.001  JMP          2.004
2.002  ACCF 5700    5700_95.90D
2.003  JMP          1.002
2.004  END
```

At compile time MET/CAL will search back from the 5700 statement and, not finding any ACCF statements, use the default accuracy file. At run time MET/CAL will execute the indicated JMP statements, execute the ACCF statement before the 5700 statement, and therefore use the alternate accuracy file to do the run time T.U.R. calculation.

Examples

Example 1

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 ACCF 5700  5700_95.90D
1.002 5700       1V      0.001%                      2W
```

In this example an alternate accuracy file for the Fluke 5700A is specified. The accuracy file name is "5700_95.90D". Since the name is not a path specification, MET/CAL expects to find the file in the MET/CAL accuracy directory (specified by "accdir" in "metcal.ini").

When MET/CAL calculates the test uncertainty ratio (T.U.R.) for the 5700 statement, the system uncertainty will be determined by looking in "5700_95.90D" instead of the default accuracy file ("5700.ACC").

Example 2

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 ACCF 5700  C:\ACC\5700.ACC
1.002 5700       1V      0.001%                      2W
```

This is the same as the first example except that the ACCF statement specifies a full path name for the alternate accuracy file. MET/CAL will use the accuracy file name exactly as specified. It will not look in the MET/CAL accuracy directory.

Example 3

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700       1V      .001%                      2W
2.001 ACCF 5700  5700_95.90D
2.002 5700       1V      .001%                      2W
3.001 ACCF 5700  *
3.002 5700       1V      .001%                      2W
```

When the first 5700 statement is executed, the default accuracy file will be used, because, at that point, no ACCF statement has been executed. When the second 5700 statement is executed, the alternate accuracy file ("5700_95.90D") specified in the ACCF statement will be used. When the third 5700 statement is executed, MET/CAL will use the default accuracy file. This is because an ACCF reset statement for the 5700 has been executed.

ASK+, ASK-

Procedure Control FSCs

Description

The ASK+ and ASK- FSCs enable and disable the MET/CAL system control flags. The effect of each system flag is summarized below.

⚠Warning

The procedure writer must make certain that safety is not compromised!

Automatic Messages

The following flags control the display of messages during procedure execution.

Flag	Controls display of automatic...	Default setting
W	Connection messages, excl. divider	ASK+ W
V	Connection messages	ASK+ V
R	UUT range message	ASK+ R
S	SET FSC messages	ASK+ S
N	Instructions to perform test	ASK+ N
M	MOD1 value with test instructions	ASK+ M
D	Meter or Oscilloscope message format	*

* The default value of the D-flag depends on the type of calibration system. The default is:

```
ASK- D for a meter calibration system and
ASK+ D for a scope calibration system.
```

Refer to section 6 of the Users Manual for a Description of how to configure the calibration system type.

Stimulus Evaluation Statement Options

The following flags are used to select the method by which an operator enters a UUT Indicated value during procedure execution.

Flag	Controls evaluation mode	Default setting
G	Go/No-Go	ASK- G
B	Go/No-Go with Slew and Kybd Options	ASK- B
K	Keyboard entry	ASK- K

The G, B, and K flags are mutually exclusive. When the G, B, and K flags are all disabled, slew mode is used.

Post Test Options

The following flags determine which options in the Post Test dialog are enabled.

Flag	Enable / Disable	Default setting
A,F	display of Post Test dialog	ASK+ A
L	List option	ASK+ L
P	Repeat current step option	ASK+ P
X	Cancel option	configurable
J	Adjust option	ASK+ J
T	Terminate option	ASK+ T

Miscellaneous

Flag	Enable / Disable	Default setting
C	Use correction file (if it exists)	configurable
Q	Reset after completion of test	ASK+ Q
U	TUR checking	ASK+ U

General Characteristics

- Entering a blank ASK+ statement results in the following:

  ASK+ R D Q N B P J S U M C X A L T W

- Entering a blank ASK- statement results in the following:

  ASK- R D N B P J S U M C X A L T W

  The Q-flag is not affected by ASK- *blank*.

- Only the state of the flags specified in an ASK+ or ASK- statement is affected unless there is a relationship between the state of a specified flag and one or more unspecified flags.

Relationships between flags are explained in detail in the paragraphs below.

- The D, R, and Q flags are not allowed in an ASK+ or ASK- FSC in an adjustment block.
- The state of the flags is preserved from procedure to subprocedure and vice versa.

A-FLAG

The A and F flags control whether or not the Post Test dialog is displayed upon completion of an evaluation step.

- ASK+ A causes the Post Test dialog to be displayed after an evaluation.
- ASK- A prevents the display of the Post Test dialog after an evaluation.
- ASK- F prevents the display of the Post Test dialog upon a PASS condition.

  The Post Test dialog will be displayed if the test fails.
- The ASK+ A and ASK+ F statements have the same effect.
- The default is: ASK+ A

The table below shows the combined effect of the A, F, and J flags.

Note

In a PASS condition, the J-flag has no effect. In a FAIL condition, the J-flag has an effect only when there is an adjustment block following the evaluation statement.

	ASK+ J	ASK- J
ASK+ A, ASK+ F, or ASK- F	Adjust option enabled in Post Test dialog for a FAIL condition.	Adjust option disabled in Post Test dialog. Adjustment block automatically executed for FAIL condition upon selecting Advance.
ASK- A	No Post Test dialog. Adjustment block can never be executed!	Adjustment block automatically executed upon FAIL condition.

B-FLAG

The B-flag controls the Go/No-Go with Slew and Keyboard Entry options for a stimulus function instrument evaluation or comparison test.

- ASK+ B enables Go/No-Go with Slew and Keyboard Entry options.
- ASK- B disables the B, G, and K flags, resulting in a slew test.
- The default is: ASK- B

C-FLAG

The C-flag is used to enable or disable the MET/CAL correction mechanism.

- ASK+ C enables corrections
- ASK- C disables corrections
- The default state of the C-flag is configurable using the "ask_c_default" parameter in the MET/CAL initialization file ("metcal.ini"). If

"ask_c_default" is set to "yes" (or "+"), the C-flag defaults to ASK+ C. If "ask_c_default" is set to "no" (or "-"), the C-flag defaults to ASK- C. For compatibility with earlier versions of MET/CAL which did not support the "ask_c_default" initialization file parameter, if "ask_c_default" is omitted from the initialization file, the C-flag defaults to ASK+ C. The "ask_c_default" parameter, if specified, should be in the "[startup]" section of the initialization file.

In order for a correction to be performed the following conditions must apply:

- The C-Flag must be enabled.
- A correction file must exist.
- The System Actual value to be corrected must match a range specified in the correction file.

Refer to Vol. 1, Chap. 7 of the MET/CAL manual for more information. During procedure execution, The Test Results dialog indicates whether a correction was performed for each test listed.

D-FLAG

The D-flag controls whether or not automatic range messages use the scope "units/division" format.

- ASK+ D enables scope format for automatic range messages.
- ASK- D disables scope format for automatic range messages.
- The default value of the D-flag depends on the type of calibration system: ASK- D for a meter calibration system and ASK+ D for a scope calibration system.

The calibration system type is determined by the "systype" parameter inthe MET/CAL initialization file ("metcal.ini").

In the "[Startup]" section of the MET/CAL initialization file, set

systype = meter

to configure the system for meter calibration.

Set

systype = oscilloscope

to configure the system for oscilloscope calibration.

The default setting of "systype" for new MET/CAL installations is

systype = meter

The "systype" initialization file parameter has no effect other than to determine the default state of the ASK 'D' flag.

Example:

The following example shows the effect of the ASK 'D' flag on automatic range messages generated for four "6060" statements. The first two "6060" statements (1.002 and 1.003) are executed with ASK- D in effect. The second two "6060" statements (1.005 and 1.006) are executed with ASK+ D in effect. The automatic range message associate with each "6060" statement is shown immediately after the procedure line. Notice that the automatic range messages for the second two "6060" statements are appropriate for scope calibration (because ASK+ D is in effect).

```
STEP     FSC     RANGE NOMINAL        TOLERANCE      MOD1         MOD2   3   4  CON
 1.001  ASK-       D
 1.002  6060    2     0.8V                           1MH                     N
Range Message:  Set UUT to the 2 V AC range.
 1.003  6060    10    10nT                           0.8V                    N
Range Message:  Set UUT to the 10 ns range.
 1.004  ASK+       D
 1.005  6060    2     0.8V                           1MH                     N
Range Message:  Set UUT to 2 V/div.
 1.006  6060    10    10nT                           0.8V                    N
Range Message:  Set UUT to 10 ns/div.
```

- Some FSCs allow "-D" to be specified in the MOD2 field. When specified, "-D" in the MOD2 field overrides the ASK 'D' flag.
- For MET/CAL versions 6.10 and earlier, the effect of the ASK 'D' flag on automatic slew messages varies for different FSCs. Most instrument FSCs do not take the ASK 'D' flag into account when constructing automatic slew messages.

For additional information, refer to Volume 1, Chapter 7.

F-FLAG

The A-flag and F-flag control whether or not the Post Test dialog is displayed upon completion of an evaluation step.

- ASK+ A causes the Post Test dialog to be displayed unconditionally after an evaluation.
- ASK- A prevents the Post Test dialog from being displayed after an evaluation.
- ASK- F prevents the display of the Post Test dialog upon a PASS condition. The Post Test dialog will be displayed upon a FAIL condition.

- The ASK+ A and ASK+ F commands have the same effect.
- The default is: ASK+ A

The table below shows the combined effect of the A, F, and J flags.

Notes

In a PASS condition, the J flag has no effect. In a FAIL condition, the J flag has an effect only when there is an adjustment block following the evaluation statement.

	ASK+ J	ASK- J
ASK+ A, ASK+ F, or ASK- F	Adjust option enabled in Post Test dialog for a FAIL condition.	Adjust option disabled in Post Test dialog. Adjustment block automatically executed for FAIL condition upon selecting Advance.
ASK- A	No Post Test dialog. Adjustment block can never be executed!	Adjustment block automatically executed upon FAIL condition.

G-FLAG

The G-flag controls the use of Go/No-Go for a stimulus function instrument evaluation or comparison test.

- ASK+ G enables Go/No-Go.
- ASK- G disables the B, G, and K flags, resulting in a slew test.
- The default is: ASK- G

J-FLAG

The J-flag controls the appearance of the Adjust option in the Post Test dialog. Refer to the description of Post Test options in the User's Manual for more information. Note that the J-flag has no effect unless (1) the test result is FAIL, and (2) an adjustment block follows the evaluation statement.

- ASK+ J enables the Adjust option in the Post Test dialog.
- ASK- J disables the Adjust option in the Post Test dialog.
- The default is: ASK+ J

The table below shows the combined effect of the A, F, and J flags.

	ASK+ J	ASK- J
ASK+ A, ASK+ F, or ASK- F	Adjust option enabled in Post Test dialog for a FAIL condition.	Adjust option disabled in Post Test dialog. Adjustment block automatically executed for FAIL condition upon selecting Advance.
ASK- A	No Post Test dialog. Adjustment block can never be executed!	Adjustment block automatically executed upon FAIL condition.

K-FLAG

The K-flag controls the use of Keyboard Entry for a stimulus function instrument evaluation or comparison test.

- ASK+ K enables Keyboard Entry.
- ASK- K disables the B, G, and K flags, resulting in a slew test.
- The default is: ASK- K

L-FLAG

The L-flag enables or disables the List option in the Post Test dialog. Refer to the description of Post Test options in the User's Manual for more information.

- ASK+ L enables the List option in the Post Test dialog.
- ASK- L disables the List option in the Post Test dialog.
- The default is: ASK+ L

M-FLAG

The M-flag controls the appearance of the MOD1 field information in the automatic messages which describe to the operator how to perform the test. Refer to the section describing Automatic Messages in the MET/CAL Procedure Language Reference Manual for more information.

- ASK+ M enables inclusion of MOD1 information in messages.
- ASK- N disables inclusion of MOD1 information in messages.
- The default is: ASK+ M

N-FLAG

The N-flag controls the appearance of automatic messages which describe to the operator how to perform the test. Refer to the section describing Automatic Messages in the MET/CAL Procedure Language Reference Manual for more information.

- ASK+ N enables automatic messages which instruct the operator how to perform a test.
- ASK- N disables automatic messages which instruct the operator how to perform a test.
- The default is: ASK+ N

P-FLAG

The P-flag determines the statement at which a test is re-started after the operator selects "Repeat" in the Post Test dialog.

- ASK+ P causes the procedure to be re-started at the current procedure line when the operator selects the Post Test "Repeat" option.
- ASK- P causes the procedure to be re-started at the first statement of the current test when the operator selects the Post Test "Repeat" option.

(The step number of the first statement of the test has the form XX.001.)

- The default is: ASK+ P

Q-FLAG

The Q-flag controls the reset of calibration instruments after a test.

- ASK+ Q enables the reset of calibration instruments after a test. ASK+ Q is forced if any of ASK+ R, ASK+ N, ASK+ W, or ASK+ V are active.
- ASK- Q disables the reset of calibration instruments after a test. ASK- Q takes effect only if ASK- R, ASK- N, ASK- W or ASK- R, ASK- N, and ASK- V are in effect.
- The default is: ASK+ Q

⚠Warning

The procedure writer should carefully evaluate every procedure using ASK- Q for safety, potential overload conditions and potential for damaging calibration instruments and the UUT. Problems may occur when setting up a new function or range in the UUT while the stimulus of the previous test is still applied.

R-FLAG

The R-flag controls the appearance of automatic UUT range messages generated by instrument FSCs and the RNG (Range) FSC. Refer to the section describing Automatic Messages in the MET/CAL Reference Manual for more information.

- ASK+ R enables automatic UUT range messages.
- ASK- R disables automatic UUT range messages.
- The default is: ASK+ R

S-FLAG

The S-flag controls the appearance of all automatic messages defined by the SET FSC. Refer to the SET FSC in the FSC Reference for more information.

- ASK+ S enables all automatic messages defined by the SET FSC.
- ASK- S disables all automatic messages defined by the SET FSC.
- The default is: ASK+ S

T-FLAG

The T-flag controls the appearance of the Terminate option in the Post Test dialog. Refer to the description of Post Test options in the User's Manual for more information.

- ASK+ T enables the Terminate option in the Post Test dialog.
- ASK- T disables the Terminate option in the Post Test dialog.
- The default is: ASK+ T

Caution

The procedure writer is advised not to specify ASK- T before a procedure has been thoroughly tested. When ASK-T is in effect, it may be difficult to terminate a procedure.

U-FLAG

The T-flag controls Test Uncertainty Ratio (TUR) checking. Refer to the description of the TUR calculation in the User's Manual for more information.

- ASK+ U enables TUR checking.
- ASK- U disables TUR checking.
- The default is: ASK+ U

In order for TUR checking to be performed the "tur_limit", specified in the MET/CAL initialization file ("metcal.ini"), must not equal zero.

V-FLAG

The V-flag controls the appearance of automatic connection messages.

- ASK+ V enables all automatic connection messages, including those related to the External AC Divider and High Voltage Probes. ASK+ V and ASK+ W have the same effect.
- ASK- V disables all automatic connection messages, including those related to the External AC Divider and High Voltage Probes.
- The default is: ASK+ V

⚠Warning

The automatic connection and disconnection messages for the External AC Divider and High Voltage Probes are disabled when ASK- V is active. If no alternate messages are created by the procedure writer, the operator may damage the UUT or calibration equipment.

Note

The procedure writer must make absolutely sure that no safety or fire hazard is present during the execution of the procedure; when ASK- V is active, the system will assume that a connection was made to the port that was active at the time that the signal is applied.

W-FLAG

The W-flag controls the appearance of automatic connection messages.

- ASK+ W enables all automatic connection messages, including those related to the External AC Divider and High Voltage Probes. ASK+ W and ASK+ V have the same effect.
- ASK- W disables all automatic connection messages, except those related to the External AC Divider and High Voltage Probes.
- The default is: ASK+ W

Note

The procedure writer must make absolutely sure that no safety or fire hazard is present during the execution of the procedure; when ASK- W is active, the system will assume that a connection was made to the port that was active at the time that the signal is applied.

X-FLAG

The X-flag controls the appearance of the Cancel option in the Post Test dialog. Refer to the description of Post Test options in the User's Manual for more information.

- ASK+ X enables the Cancel option in the Post Test dialog.
- ASK- X disables the Cancel option in the Post Test dialog.

The default state of the X-flag is configurable using the "ask_x_default" parameter in the MET/CAL initialization file ("metcal.ini"). If "ask_x_default" is set to "yes" (or "+"), the X-flag defaults to ASK+ X. If "ask_x_default" is set to "no" (or "-"), the X-flag defaults to ASK- X. For compatibility with earlier versions of MET/CAL which did not support the "ask_x_default" initialization file parameter, if "ask_x_default" is omitted from the initialization file, the X-flag defaults to ASK- X. The "ask_x_default" parameter, if specified, should be in the "[startup]" section of the initialization file. If the procedure step terminates abnormally, the Post Test Cancel option is always disabled, regardless of the state of the X-flag. This applies both to termination due to an error and termination by the operator. In these cases no test result was generated, so there's nothing to be cancelled. If desired, use the Post Test Repeat option to retry the test.

Example

```
STEP  FSC   RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 ASK+ R D    N G     P J S     M    A     L  T   W
1.001 ASK+ R        G                    A
```

Additional Information

The information below may help procedure writers in interpreting the Test Run "ASK" dialog.

Internally, each ASK flag is a single bit which is either set (1) or clear (0). The Test Run "ASK" dialog displays a vertical list of flags in which a check box is used to show the state of each flag. If a box is checked, this indicates that the corresponding ASK flag is set. If a box is not checked, this indicates that the corresponding ASK flag is clear.

In all cases except as noted in rules (1) to (7) below "ASK+ *flag*" sets *flag* and does nothing else, and "ASK- *flag*" clears *flag* and does nothing else. For example, "ASK+ X" sets the 'X' flag and has no side-effects involving other flags, and "ASK- X" clears the 'X' flag and has no side-effects involving other flags.

The following rules explain the cases in which setting or clearing an ASK flag has side-effects involving other ASK flags:

1. "ASK- A"
   This statement clears A and clears F.

   "ASK- F"
   This statement clears A and sets F.

   A and F cannot both be specified in a single ASK-statement.

2. "ASK- B"
   This statement clears B, clears G, and clears K.

   "ASK- G"
   This statement clears B, clears G, and clears K.

   "ASK- K"
   This statement clears B, clears G, and clears K.

   At most one of B, G, and K can be specified in a single ASK- statement.

3. "ASK- W"
   This statement clears W and sets V.

   "ASK- V"
   This statement clears V and clears W.

   W and V cannot both be specified in a single ASK-statement.

4. "ASK+ A"
   This statement sets A and clears F.

   "ASK+ F"
   This statement sets A and clears F.

   A and F cannot both be specified in a single ASK-statement.

5. "ASK+ B"
   This statement sets B, clears G, clears K.

   "ASK+ G"
   This statement sets G, clears B, clears K.

   "ASK+ K"
   This statement sets K, clears B, clears G.

   At most one of B, G, and K can be specified in a single ASK+ statement.

6. "ASK+ W"
   This statement sets W and sets V.

   "ASK+ V"
   This statement sets W and sets V.

   W and V cannot both be specified in a single ASK+statement.

7. "ASK+ R"
   This statement sets R and sets Q.

   "ASK+ N"
   This statement sets N and sets Q.

   "ASK+ W"
   This statement sets W and sets Q.

   "ASK+ A"
   This statement sets A and sets Q.

   In other words, setting R, N, W, or A automatically sets Q. This means that a statement like "ASK+ R" will cancel a preceding "ASK- Q" statement. It is still the case, however, that:

   ASK+ R

   ASK- Q

   leaves Q unset.

CALL

Procedure Control FSC

Description

The CALL FSC allows a procedure to call a subprocedure. The called sub procedure terminates when the end of the subprocedure is reached. At that point, execution of the calling procedure resumes at the first statement after the CALL statement.

Format

CALL *procedure name*

Rules

- A maximum of 55 characters is allowed in the *procedure name* field.
- Blank spaces preceding or following the procedure name are ignored.
- The comparison between the name of the called subprocedure and names in the MET/CAL Procedure directory is case-insensitive.
- Most internal data values maintained by MET/CAL are global. This applies to memory registers (MEM, MEM1, MEM2, M[1], M[2], ...), ASK flags, SET FSC messages, and DRAW parameters. These data values are available on entry into a called procedure, and, on exit from the subprocedure, retain their most recently assigned values, whether or not the assignment occurred in the called procedure.

Example:

```
INSTRUMENT:    main
MATH     MEM = 29
CALL     sub
DISP     MEM = [MEM]

INSTRUMENT:    sub
DISP     sub:  MEM = [MEM]
MATH     MEM = 11
```

In the example above, the main procedure sets MEM to 29. It then calls the procedure "sub". "sub" displays the value of MEM, which is still 29, and then sets MEM to 11 before it returns. When the main procedure resumes, it displays the updated value of MEM (now 11).

- Each called subprocedure must exist as a separate, compiled MET/CAL procedure file. There is no actual distinction between main procedures and subprocedures. Any procedure can call any other procedure. A procedure should not call itself, directly or indirectly, unless the procedure writer ensures that procedure termination is handled properly.
- The maximum procedure call nesting depth is 8.

Examples

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
3.007 CALL       Fluke 8050A AC Gain Adjustment
6.007 CALL       Fluke 8050A AC Zero Adjustment
```

CON

Display Control Help

Description

The CON FSC invokes a standard connection message to prompt the operator to make a change to the UUT's connections. There are two reasons why, in some cases, an automatic connection message might be used in preference to a message generated using a DISP statement:

- The message format is identical to the format of automatic connection messages generated by MET/CAL instrument drivers.
- When automatic connection messages are used, MET/CAL remembers the list of current connections. This allows the automatic generation of disconnection messages when new connections are made, and also precludes the generation of redundant connection messages.

However, because automatic connection messages are worded in a general way (that is, they are not specific to a particular UUT), most procedure writers use the DISP FSC to construct messages which refer directly to the particular UUT being calibrated.

The CON FSC refers to connection messages by number. Each connection message has a number. Connection messages (and the associated numbers) are shown in the "Connection Messages Section."

⚠Warning

When the CON FSC is used to generate connection and disconnection messages, MET/CAL cannot verify that instruments to which connections are to be made are in a safe state. The procedure writer must ensure that instruments are in STANDBY or are not generating unsafe voltages before prompting the operator to make connections or disconnection’s.

Format

CON *connection code message list*

CON 0

Rules

- The *connection code* field may be '=', '+', or '-'. It determines the interpretation of the following *message list* as shown in the table below:

  '=' - *message list* specifies connections to be made

  '+' - *message list* specifies connections to be added

  '-' - *message list* specifies connections to be removed

  The difference between making a connection ('=') and adding a connection ('+') is that '=' first causes a disconnection message for all present connections, followed by a connection message for the new connections. '+', on the other hand, presumes that present connections are to remain, and simply generates a prompt to add the new connections.

  When the *connection code* is '+' or '-', the *message list* must be non-empty. When the *connection_code* is '=', the *message list* may be empty. In this case, an empty *message list* causes a prompt to disconnect all present connections.

- The *message list* is a list of 1 or more connection message numbers, separated by commas.

- The statement "CON 0" may be used to generate a disconnection message for all connections. This statement is equivalent to "CON =".

  Example:

  ```
  CON     =47
  CON     =48
  CON     +49
  CON     -48, 49
  ```

  The first CON statement prompts the operator to make the connection indicated by connection message number 47. The second CON statement first causes a prompt to disconnect 47, followed by a prompt to connect 48. The third CON statement causes a prompt to connect 49. Note that, since the *connection code* is '+', it does not first trigger a disconnection message for 48. The fourth CON statement generates a disconnection message for 48 and 49.

Compatibility

For compatibility with previous versions of MET/CAL, the list of connection message numbers may be specified in binary-coded decimal format. Using this method, 53 is the maximum number which can be specified. Refer to 7411B or 7411C manuals for further information.

See Also

The ASK- W and V flags may be used to disable automatic connection messages. This applies to messages specified in CON statements, as well as to messages generated by MET/CAL instrument drivers. Refer to the ASK+ and ASK- FSC Reference for more information.

Examples

Additional CON FSC examples are shown below.

Example 1:

```
CON        =9,10
```

Disconnect any other connection, then prompt to connect the UUT to 5100B Output and 5100B Sense (if they are not already connected).

Example 2:

```
CON        +21
```

Adds a connection from the UUT to the 5450 Sense.

Example 3:

```
CON        -21
```

Disconnect the UUT from the 5450 Sense.

Example 4:

```
CON        =
CON        0
```

Remove all connections (both forms allowed).

Example 5:

```
CON        1024
```

Connect the UUT to 5100B Wideband (old BCD format).

Connection Messages

Message 5
English: UUT to CG 5001 Output using Comparator Head
Español: UBP a la salida del CG 5001 usando Cabeza Comparadora
Message 6
English: UUT to CG 5001 Output using Pulse Head
Español: UBP a la salida del CG 5001 usando Cabeza de pulso
Message 7
English: UUT to CG 5001 TRIGGER Output
Español: UBP a la salida de TRIGGER del CG 5001
Message 8
English: UUT to 5100B Output Terminals using external AC Divider
Español: UBP a los terminales de salida del 5100B usando divisor externo AC
Message 9
English: UUT to 5100B Output Terminals
Español: UBP a los terminales de salida del 5100B
Message 10
English: UUT to 5100B Sense Terminals
Español: UBP a los terminales del sense del 5100B
Message 11
English: UUT to 5100B Wideband Output
Español: UBP a la salida de Ancho de Banda del 5100B
Message 12
English: UUT to 5220A Current Output Terminals
Español: UBP a los terminales de salida de intensidad del 5220A
Message 13
English: 5205A Output Cable to UUT
Español: Cable de salida del 5205A a UBP
Message 14
English: UUT to 5200A Output Terminals
Español: UBP a los terminales de salida del 5200A
Message 15
English: UUT to 5200A Sense Terminals
Español: UBP a los terminales de sense del 5200A
Message 16
English: 5215A Output Cable to UUT
Español: Cable de salida del 5215A a UBP
Message 17
English: UUT to 5440B Divider Terminals
Español: UBP a los terminales del divisor del 5440B

Message 18

English: UUT to 5440B Guard Terminal
Español: UBP a los terminales de guarda del 5440B

Message 19

English: UUT to 5440B Output Terminals
Español: UBP a los terminales de salida del 5440B

Message 20

English: UUT to 5440B Sense Terminals
Español: UBP a los terminales de sense del 5440B

Message 21

English: UUT to 5450A Sense Terminals
Español: UBP a los terminales de sense del 5450A

Message 22

English: UUT to 5450A Output Terminals
Español: UBP a los terminales de salida del 5450A

Message 23

English: UUT to 5450A Guard Terminal
Español: UBP al terminal de guarda del 5450A

Message 25

English: UUT to 6060 RF Output
Español: UBP a la salida RF del 6060

Message 29

English: UUT to 8502/5 Ohms Sense Terminals
Español: UBP a los terminales sense de Ohmios del 8202/5

Message 30

English: UUT to 8502/5 Ohms Source Terminals
Español: UBP a los terminales fuente de Ohmios del 8205/5

Message 32

English: UUT to 8506A Volts Input Terminals
Español: UBP a los terminales de entrada Voltios del 8506A

Message 33

English: UUT to 8506A Amps Input Terminals
Español: UBP a los terminales de entrada Amperios del 8506A

Message 44

English: UUT to IEEE-488 Port 1
Español: UBP al puerto IEEE-488 1

Message 45

English: UUT to COM1
Español: UBP al COM1

Message 46

English: UUT to 5220A Current Output Terminals
Español: UBP a los terminales de salida de intensidad del 5220A

Message 47

English: UUT to 5700A Output Terminals
Español: UBP a los terminales de salida del 5700A

Message 48

English: UUT to 5700A Sense Terminals
Español: UBP a los terminales sense del 5700A

Message 49

English: UUT to 5700A Aux Current Output
Español: UBP al terminal auxiliar de intensidad del 5700A

Message 50

English: UUT to 5700A Wideband Output
Español: UBP a la salida de ancho de banda del 5700A

Message 51

English: UUT to 5700A Guard Terminal
Español: UBP al terminal de guarda del 5700A

Message 52

English: UUT to 5700A Output Terminals using external AC Divider
Español: UBP a los terminales de salida del 5700A usando divisor externo AC

Message 53

English: UUT to 5725A Current Output Terminals
Español: UBP a los terminales de salida de intensidad del 5725A

Message 54

English: UUT to 5220A Current Output Terminals
Español: UBP a los terminales de salida de intensidad del 5220A

Message 55

English: 5205A Output Cable to UUT
Español: Cable de salida del 5205A a UBP

Message 56

English: 5215A Output Cable to UUT
Español: Cable de salida del 5215A a UBP

Message 57

English: 5215A Output Cable to UUT
Español: Cable de salida del 5215A a UBP

Message 58

English: UUT to 8502/5 Volts Input Terminals
Español: UBP a los terminales de entrada de Voltios del 8502/5

Message 59

English: UUT to 8502/5 Amps Input Terminals
Español: UBP a los terminales de entrada de Amperios del 8502/5

Message 60

English: UUT to 8506A Ohms Sense Terminals
Español: UBP a los terminales Sense de Ohmios del 8506A

Message 61

English: UUT to 8506A Ohms Source Terminals

Español: UBP a los terminales fuente de Ohmios del 8506A

Message 62

English: UUT to 8842A Input Terminals using 40 kV Probe

Español: UBP a los terminales de entrada del 8842A usando sonda de 40 kV

Message 63

English: UUT to 8842A Input Terminals using 6 kV Probe

Español: UBP a los terminales de entrada del 8842A usando sonda de 6 kV

Message 64

English: UUT to 8842A Input Terminals

Español: UBP a los terminales de entrada del 8842A

Message 65

English: UUT to 8842A Sense Terminals

Español: UBP a los terminales Sense del 8842A

Message 66

English: UUT to 8842A 2A and LO Input Terminals

Español: UBP a los terminales de entrada 2A y LO del 8842A

Message 67

English: UUT to 3458A Input Terminals

Español: UBP a los terminales de entrada del 3458A

Message 68

English: UUT to 3458A Sense Terminals

Español: UBP a los terminales sense del 3458A

Message 69

English: UUT to 3458A 1A and LO Input Terminals

Español: UBP a los terminales de entrada 1A y LO del 3458A

Message 70

English: UUT to CG 5011 Output using Comparator Head

Español: UBP a la salida del CG 5011 usando la Cabeza Comparadora

Message 71

English: UUT to CG 5011 Output using Pulse Head

Español: UBP a la salida del CG 5011 usando la Cabeza de Pulso

Message 72

English: UUT to CG 5011 TRIGGER Output

Español: UBP a la salida de TRIGGER del CG 5011

Message 73

English: UUT to PM 5191 Output

Español: UBP a la entrada del PM 5191

Message 74

English: UUT to 8920A Input

Español: UBP a la entrada del 8920A

Message 75

English: UUT to PM 6666 Input A

Español: UBP a la entrada A del PM 6666

Message 76

English: UUT to PM 6666 Input C

Español: UBP a la entrada C del PM 6666

Message 77

English: UUT to PM 6666 Input A (for Ratio A/B measurement)

Español: UBP a la entrada A del PM 6666 (para medida de relación A/B)

Message 78

English: UUT to PM 6666 Input B (for Ratio A/B measurement)

Español: UBP a la entrada B del PM 6666 (para medida de relación A/B)

Message 79

English: UUT to PM 6666 Input A (for Time Interval A-B measurement)

Español: UBP a la entrada A del PM 6666 (para medida del intervalo de tiempo A-B)

Message 80

English: UUT to PM 6666 Input B (for Time Interval A-B measurement)

Español: UBP a la entrada B del PM 6666 (para medida del intervalo de tiempo A-B)

Message 81

English: UUT to SG 5030 OUTPUT using Leveling Head

Español: UBP al SG 5030 OUTPUT usando Cabeza Niveladora

Message 82

English: UUT to 5790A Input 1, reference voltage to 5790A Input 2

Español: UBP a la entrada 1 del 5790A, referencia de tensión a entrada 2 del 5790A

Message 83

English: UUT to 5790A Input 2, reference voltage to 5790A Input 1

Español: UBP a la entrada 2 del 5790A, referencia de tensióna entrada 1 del 5790A

Message 84

English: UUT to 5790A Input 1

Español: UBP a la entrada 1 del 5790A

Message 85

English: UUT to 5790A Input 2

Español: UBP a la entrada 2 del 5790A

Message 86

English: UUT to 5790A WIDEBAND Input

Español: UBP a la entrada 5790A WIDEBAND

Message 87

English: UUT to 5790A Shunt Input using A40-10mA shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-10mA y adaptador 5790A-7001

Message 88

English: UUT to 5790A Shunt Input using A40-20mA shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-20mA y adaptador 5790A-7001

Message 89

English: UUT to 5790A Shunt Input using A40-30mA shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-30mA y adaptador 5790A-7001

Message 90

English: UUT to 5790A Shunt Input using A40-50mA shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-50mA y adaptador 5790A-7001

Message 91

English: UUT to 5790A Shunt Input using A40-100mA shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-100mA y adaptador 5790A-7001

Message 92

English: UUT to 5790A Shunt Input using A40-200mA shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-200mA y adaptador 5790A-7001

Message 93

English: UUT to 5790A Shunt Input using A40-300mA shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-300mA y adaptador 5790A-7001

Message 94

English: UUT to 5790A Shunt Input using A40-500mA shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-500mA y adaptador 5790A-7001

Message 95

English: UUT to 5790A Shunt Input using A40-1A shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-1A y adaptador 5790A-7001

Message 96

English: UUT to 5790A Shunt Input using A40-2A shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-2A y adaptador 5790A-7001

Message 97

English: UUT to 5790A Shunt Input using A40-3A shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-3A y adaptador 5790A-7001

Message 98

English: UUT to 5790A Shunt Input using A40-5A shunt & 5790A-7001adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-5A y adaptador 5790A-7001

Message 99

English: UUT to 5790A Shunt Input using A40A-10A shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-10A y adaptador 5790A-7001

Message 100

English: UUT to 5790A Shunt Input using A40A-20A shunt & 5790A-7001 adapter

Español: UBP a la entrada Shunt 5790A usando shunt A40-20A y adaptador 5790A-7001

Message 101

English: UUT to PM 6680 Input A

Español: UBP a la entrada A del PM 6680

Message 102

English: UUT to PM 6680 Input C

Español: UBP a la entrada C del PM 6680

Message 103

English: UUT to PM 6680 Input A (for Ratio A/B measurement)

Español: UBP a la entrada A del PM 6680 (para medida de relación A/B)

Message 104

English: UUT to PM 6680 Input B (for Ratio A/B measurement)

Español: UBP a la entrada B del PM 6680 (para medida de relación A/B)

Message 105

English: UUT to PM 6680 Input A (for Time Interval A-B measurement)

Español: UBP a la entrada A del PM 6680 (para medida de intervalo de tiempo A-B)

Message 106

English: UUT to PM 6680 Input B (for Time Interval A-B measurement)

Español: UBP a la entrada B del PM 6680 (para medida de intervalo de tiempo A-B)

Message 107

English: UUT to 5790A SHUNT Input

Español: UBP a la entrada SHUNT del 5790A

Message 108

English: UUT to 5790A Input 1 using 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el adaptador 792A-7004

Message 109

English: UUT to 5790A Input 1 using A40-10mA shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-10mA y adaptador 792A-7004

Message 110

English: UUT to 5790A Input 1 using A40-20mA shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-20mA y adaptador 792A-7004

Message 111

English: UUT to 5790A Input 1 using A40-30mA shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-30mA y adaptador 792A-7004

Message 112

English: UUT to 5790A Input 1 using A40-50mA shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-50mA y adaptador 792A-7004

Message 113

English: UUT to 5790A Input 1 using A40-100mA shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-100mA y adaptador 792A-7004

Message 114

English: UUT to 5790A Input 1 using A40-200mA shunt & 792A-7004adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-200mA y adaptador 792A-7004

Message 115

English: UUT to 5790A Input 1 using A40-300mA shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-300mA y adaptador 792A-7004

Message 116

English: UUT to 5790A Input 1 using A40-500mA shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-500mA y adaptador 792A-7004

Message 117

English: UUT to 5790A Input 1 using A40-1A shunt & 792A-7004 adapter Español: UBP a la entrada 1 del 5790A usando el shunt A40-1A y adaptador 792A-7004

Message 118

English: UUT to 5790A Input 1 using A40-2A shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-2A y adaptador 792A-7004

Message 119

English: UUT to 5790A Input 1 using A40-3A shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-3A y adaptador 792A-7004

Message 120

English: UUT to 5790A Input 1 using A40-5A shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-5A y adaptador
792A-7004

Message 121

English: UUT to 5790A Input 1 using A40A-10A shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-10A y adaptador 792A-7004

Message 122

English: UUT to 5790A Input 1 using A40A-20A shunt & 792A-7004 adapter

Español: UBP a la entrada 1 del 5790A usando el shunt A40-20A y adaptador 792A-7004

Message 123

English: UUT to 5790A GUARD Terminal

Español: UBP al terminal de guarda del 5790A

Message 124

English: UUT to Fluke 45 Volt-Ohm-Diode and COM Input Terminals

Español: UBP a los terminales de entrada Volt-Ohm-Diode y COM del Fluke 45

Message 125

English: UUT to Fluke 45 100mA and COM Input Terminals

Español: UBP a los terminales de entrada 100mA y COM del Fluke 45

Message 126

English: UUT to Fluke 45 10A and COM Input Terminals

Español: UBP a los terminales de entrada 10A y COM del Fluke 45

Message 127

English: UUT to Fluke 45 Volt and COM Terminals using 6 kV Probe
Español: UBP a los terminales Volt y COM del Fluke 45 usando la sonda de 6 kV

Message 128

English: UUT to Fluke 45 Volt and COM Terminals using 40 kV Probe
Español: UBP a los terminales Volt y COM del Fluke 45 usando la sonda de 40 kV

Message 129

English: 5205A Output Cable to UUT
Español: Cable de salida del 5205 a la UBP

Message 130

English: UUT to 5500A NORMAL Output Terminals using external AC Divider
Español: UBP a los terminales de salida NORMAL del 5500A usando divisor externo AC

Message 131

English: UUT to 5500A NORMAL Output Terminals
Español: UBP a los terminales de salida NORMAL del 5500A

Message 132

English: UUT to 5500A AUX Output Terminals
Español: UBP a los terminales de salida AUX del 5500A

Message 133

English: UUT to 5500A SCOPE Output
Español: UBP a la salida SCOPE del 5500A

Message 134

English: UUT to 5500A TRIG OUT
Español: UBP al terminal TRIG OUT del 5500A

Message 135

English: UUT to 5500A GUARD Terminal
Español: UBP al terminal de guarda del 5500A

Message 136

English: UUT to 5500A TC Terminals
Español: UBP a los terminales TC del 5500A

Message 137

English: UUT to 5500A TC Terminals using copper wire
Español: UBP a los terminales TC del 5500A usando hilo de cobre

Message 138

English: UUT to 5500A TC Terminals using type B thermocouple wire
Español: UBP a los terminales TC del 5500A usando termopar tipo B

Message 139

English: UUT to 5500A TC Terminals using type C thermocouple wire
Español: UBP a los terminales TC del 5500A usando termopar tipo C

Message 140

English: UUT to 5500A TC Terminals using type E thermocouple wire
Español: UBP a los terminales TC del 5500A usando termopar tipo E

Message 141

English: UUT to 5500A TC Terminals using type J thermocouple wire
Español: UBP a los terminales TC del 5500A usando termopar tipo J

Message 142

English: UUT to 5500A TC Terminals using type K thermocouple wire
Español: UBP a los terminales TC del 5500A usando termopar tipo K

Message 143

English: UUT to 5500A TC Terminals using type N thermocouple wire
Español: UBP a los terminales TC del 5500A usando termopar tipo N

Message 144

English: UUT to 5500A TC Terminals using type R thermocouple wire
Español: UBP a los terminales TC del 5500A usando termopar tipo R

Message 145

English: UUT to 5500A TC Terminals using type S thermocouple wire
Español: UBP a los terminales TC del 5500A usando termopar tipo S

Message 146

English: UUT to 5500A TC Terminals using type T thermocouple wire
Español: UBP a los terminales TC del 5500A usando termopar tipo T

Message 147

English: Type B Thermocouple Standard to 5500A TC Terminals
Español: Termopar estándar tipo B a los terminales TC del 5500A

Message 148

English: Type C Thermocouple Standard to 5500A TC Terminals
Español: Termopar estándar tipo C a los terminales TC del 5500A

Message 149

English: Type E Thermocouple Standard to 5500A TC Terminals
Español: Termopar estándar tipo E a los terminales TC del 5500A

Message 150

English: Type J Thermocouple Standard to 5500A TC Terminals
Español: Termopar estándar tipo J a los terminales TC del 5500A

Message 151

English: Type K Thermocouple Standard to 5500A TC Terminals
Español: Termopar estándar tipo K a los terminales TC del 5500A

Message 152

English: Type N Thermocouple Standard to 5500A TC Terminals
Español: Termopar estándar tipo N a los terminales TC del 5500A

Message 153

English: Type R Thermocouple Standard to 5500A TC Terminals
Español: Termopar estándar tipo R a los terminales TC del 5500A

Message 154

English: Type S Thermocouple Standard to 5500A TC Terminals
Español: Termopar estándar tipo S a los terminales TC del 5500A

Message 155

English: Type T Thermocouple Standard to 5500A TC Terminals
Español: Termopar estándar tipo T a los terminales TC del 5500A

Message 156

English: UUT to 5500A NORMAL and AUX Terminals (3-wire configuration)
Español: UBP a los terminales AUX y NORMAL del 5500A (configuración 3-hilos)

Message 157

English: UUT to 5725A Current Output Terminals
Español: UBP a los terminales de salida de intensidad del 5725A

Message 158

English: UUT to PM 6681 Input A
Español: UBP a la entrada A del PM 6681

Message 159

English: UUT to PM 6681 Input C
Español: UBP a la entrada C del PM 6681

Message 160

English: UUT to PM 6681 Input A (for Ratio A/B measurement)
Español: UBP a la entrada A del PM 6681 (para medida de relación A/B)

Message 161

English: UUT to PM 6681 Input B (for Ratio A/B measurement)
Español: UBP a la entrada B del PM 6681 (para medida de relación A/B)

Message 162

English: UUT to PM 6681 Input A (for Time Interval A-B measurement)
Español: UBP a la entrada A del PM 6681 (para medida de intervalo de tiempo A-B)

Message 163

English: UUT to PM 6681 Input B (for Time Interval A-B measurement)
Español: UBP a la entrada B del PM 6681 (para medida de intervalo de tiempo A-B)

Message 164

English: UUT to PM 6685 Input A
Español: UBP a la entrada A del PM 6685

Message 165

English: UUT to PM 6685 Input C
Español: UBP a la entrada C del PM 6685

Message 166

English: UUT to PM 6685 Input C (for Ratio C/A measurement)
Español: UBP a la entrada C del PM 6685 (para medida de relación C/A)

Message 167

English: UUT to PM 6685 Input A (for Ratio C/A measurement)
Español: UBP a la entrada A del PM 6685 (para medida de relación C/A)

Message 168

English: UUT to HP 6060B Input Terminals
Español: UBP a los terminales de entrada del HP 6060B

Message 169

English: UUT to HP 6063B Input Terminals

Español: UBP a los terminales de entrada del HP 6063B

Message 170

English: UUT to PM 5192 Output

Español: UBP a la salida del PM 5192

Message 171

English: UUT to PM 5193 Output

Español: UBP a la salida del PM 5193

Message 172

English: UUT to COM2

Español: UBP al COM2

Message 173

English: UUT to COM3

Español: UBP al COM3

Message 174

English: UUT to COM4

Español: UBP al COM4

Message 175

English: UUT to 5500A UUT serial port

Español: UBP al puerto serie del 5500A (UUT serial port)

Message 176

English: UUT to 5130A Output Terminals using external AC Divider

Español: UBP a los terminales de salida del 5130A usando divisor externo AC

Message 177

English: UUT to 5130A Output Terminals

Español: UBP a los terminales de salida del 5130A

Message 178

English: UUT to 5130A Sense Terminals

Español: UBP a los terminales Sense del 5130A

Message 179

English: UUT to 5220A Current Output Terminals

Español: UBP a los terminales de intensidad del 5220A

Message 180

English: 5205A Output Cable to UUT

Español: El cable de salida del 5205A a UBP

Message 181

English: 5215A Output Cable to UUT

Español: El cable de salida del 5215A a la UBP

Message 182

English: UUT to 5720A Output Terminals

Español: UBP a los terminales de salida del 5720A

Message 183

English: UUT to 5720A Sense Terminals

Español: UBP a los terminales Sense del 5720A

Message 184

English: UUT to 5720A Aux Current Output

Español: UBP al terminal de salida de intensidad Aux del 5720A

Message 185

English: UUT to 5720A Wideband Output

Español: UBP a la salida de ancho de banda del 5720A

Message 186

English: UUT to 5720A Guard Terminal

Español: UBP al terminal de guarda del 5720A

Message 187

English: UUT to 5720A Output Terminals using external AC Divider

Español: UBP a los terminales de salida del 5720A usando divisor externo AC

Message 188

English: UUT to 5500A TC Terminals using type L thermocouple wire

Español: UBP a los terminales TC del 5500A usando termopar tipo L

Message 189

English: UUT to 5500A TC Terminals using type U thermocouple wire

Español: UBP a los terminales TC del 5500A usando termopar tipo U

Message 190

English: Type L Thermocouple Standard to 5500A TC Terminals

Español: Termopar estándar tipo L a los terminales TC del 5500A

Message 191

English: Type U Thermocouple Standard to 5500A TC Terminals

Español: Termopar estándar tipo U a los terminales TC del 5500A

Message 192

English: UUT to 34401A Input Terminals

Español: UBP a los terminales de entrada del 34401A

Message 193

English: UUT to 34401A Sense Terminals

Español: UBP a los terminales Sense del 34401A

Message 194

English: UUT to 34401A 3A and LO Input Terminals

Español: UBP a los terminales de entrada 3A y LO del 34401A

Message 195

English: UUT to 2000 Input Terminals

Español: UBP a los terminales de entrada del 2000

Message 196

English: UUT to 2000 Sense Terminals

Español: UBP a los terminales de Sense del 2000

Message 197

English: UUT to 2000 3A and LO Input Terminals
Español: UBP a los terminales de entrada 3A y LO del 2000

Message 198

English: UUT to 2001 Input Terminals
Español: UBP a los terminales de entrada del 2001

Message 199

English: UUT to 2001 Sense Terminals
Español: UBP a los terminales Sense del 2001

Message 200

English: UUT to 2001 2A and LO Input Terminals
Español: UBP a los terminales de entrada 2A y LO del 2001

Message 201

English: UUT to 2002 Input Terminals
Español: UBP a los terminales de entrada del 2002

Message 202

English: UUT to 2002 Sense Terminals
Español: UBP a los terminales Sense del 2002

Message 203

English: UUT to 2002 2A and LO Input Terminals
Español: UBP a los terminales de entrada 2A y LO del 2002

Message 204

English: UUT to 2001 Input and Sense Terminals (3-wire configuration)
Español: UBP a los terminales entrada y Sense del 2001 (configuración 3-hilos)

Message 205

English: UUT to 2002 Input and Sense Terminals (3-wire configuration)
Español: UBP a los terminales entrada y Sense del 2002 (configuración 3-hilos)

Message 206

English: UUT to 34420A Channel 1 using Low Thermal Input Cable
Español: UBP al canal 1 del 34420A usando cable Low Thermal

Message 207

English: UUT to 34420A Channel 2 using Low Thermal Input Cable
Español: UBP al canal 2 del 34420A usando cable Low Thermal

Message 208

English: UUT to 5500A SCOPE Output using Tunnel Diode Pulser
Español: UBP a la salida SCOPE del 5500A usando Diodo Túnel

Message 209

English: UUT to SG 5050 OUTPUT using Leveling Head
Español: UBP a la salida del SG 5050 usando Cabeza Niveladora

Message 210

English: UUT to 3325B Output
Español: UBP a la salida del 3325B

Message 211

English: UUT to 3325B Output with 50 Ohm termination
Español: UBP a la salida del 3325B con carga de 50 Ohmios

Message 212

English: UUT to 5520A NORMAL Output Terminals using external AC Divider
Español: UBP a los terminales NORMAL del 5520A usando divisor externo AC

Message 213

English: UUT to 5520A NORMAL Output Terminals
Español: UBP a los terminales de salida NORMAL del 5520A

Message 214

English: UUT to 5520A AUX Output Terminals
Español: UBP a los terminales de salida AUX del 5520A

Message 215

English: UUT to 5520A SCOPE Output
Español: UBP a la salida SCOPE del 5520A

Message 216

English: UUT to 5520A TRIG OUT
Español: UBP a la salida TRIG OUT del 5520A

Message 217

English: UUT to 5520A GUARD Terminal
Español: UBP al terminal GUARD del 5520A

Message 218

English: UUT to 5520A TC Terminals
Español: UBP a los terminales TC del 5520A

Message 219

English: UUT to 5520A TC Terminals using copper wire
Español: UBP a los terminales TC del 5520A usando hilo de cobre

Message 220

English: UUT to 5520A TC Terminals using type B thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar B

Message 221

English: UUT to 5520A TC Terminals using type C thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar C

Message 222

English: UUT to 5520A TC Terminals using type E thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar E

Message 223

English: UUT to 5520A TC Terminals using type J thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar J

Message 224

English: UUT to 5520A TC Terminals using type K thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar K

Message 225

English: UUT to 5520A TC Terminals using type L thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar L

Message 226

English: UUT to 5520A TC Terminals using type N thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar N

Message 227

English: UUT to 5520A TC Terminals using type R thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar R

Message 228

English: UUT to 5520A TC Terminals using type S thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar S

Message 229

English: UUT to 5520A TC Terminals using type T thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar T

Message 230

English: UUT to 5520A TC Terminals using type U thermocouple wire
Español: UBP a los terminales TC del 5520A usando cable termopar U

Message 231

English: Type B Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo B a los terminales TC del 5520A

Message 232

English: Type C Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo C a los terminales TC del 5520A

Message 233

English: Type E Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo E a los terminales TC del 5520A

Message 234

English: Type J Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo J a los terminales TC del 5520A

Message 235

English: Type K Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo K a los terminales TC del 5520A

Message 236

English: Type L Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo L a los terminales TC del 5520A

Message 237

English: Type N Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo N a los terminales TC del 5520A

Message 238

English: Type R Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo R a los terminales TC del 5520A

Message 239

English: Type S Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo S a los terminales TC del 5520A

Message 240

English: Type T Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo T a los terminales TC del 5520A

Message 241

English: Type U Thermocouple Standard to 5520A TC Terminals
Español: Termopar estándar tipo U a los terminales TC del 5520A

Message 242

English: UUT to 5520A NORMAL and AUX Terminals (3-wire configuration)
Español: UBP a los terminales NORMAL y AUX del 5520A (configuración 3-hilos)

Message 243

English: UUT to 5520A UUT serial port
Español: UBP al puerto serie UBP del 5520A (UUT serial port)

Message 244

English: UUT to 5520A SCOPE Output using Tunnel Diode Pulser
Español: UBP a la salida SCOPE del 5520A usando el Diodo Túnel

Message 245

English: UUT to 5520A 20A Current Terminals
Español: UBP a los terminales de intensidad de 20A del 5520A

Message 246

English: 1mV/deg C Temperature Probe to 5520A TC Terminals
Español: Sonda de temperatura 1mV/ºC a los terminales TC del 5520A

Message 247

English: 1mV/deg F Temperature Probe to 5520A TC Terminals
Español: Sonda de temperatura 1mV/ºF a los terminales TC del 5520A

Message 248

English: 1mV/%%rh Humidity Probe to 5520A TC Terminals
Español: Sonda de humedad 1mV/%%rh a los terminales TC del 5520A

Message 249

English: UUT to 5800A Channel 1
Español: UBP al canal 1 del 5800A

Message 250

English: UUT to 5800A Channel 2
Español: UBP al canal 2 del 5800A

Message 251

English: UUT to 5800A Channel 3
Español: UBP al canal 3 del 5800A

Message 252

English: UUT to 5800A Channel 4
Español: UBP al canal 4 del 5800A

Message 253
English: UUT to 5800A Channel 5
Español: UBP al canal 5 del 5800A

Message 255
English: UUT to 5800A Channel 1 using Tunnel Diode Pulser
Español: UBP al canal 1 del 5800A usando el Diodo Túnel

Message 256
English: UUT to 5800A Channel 2 using Tunnel Diode Pulser
Español: UBP al canal 2 del 5800A usando el Diodo Túnel

Message 257
English: UUT to 5800A Channel 3 using Tunnel Diode Pulser
Español: UBP al canal 3 del 5800A usando el Diodo Túnel

Message 258
English: UUT to 5800A Channel 4 using Tunnel Diode Pulser
Español: UBP al canal 4 del 5800A usando el Diodo Túnel

Message 259
English: UUT to 5800A Channel 5 using Tunnel Diode Pulser
Español: UBP al canal 5 del 5800A usando el Diodo Túnel

Message 260
English: UUT to 5800A Channel 1 as trigger output
Español: UBP al canal 1 del 5800A como salida del trigger

Message 261
English: UUT to 5800A Channel 5 as trigger output
Español: UBP al canal 5 del 5800A como salida del trigger

Message 262
English: UUT to 700P01 Differential Pressure Module
Español: UBP al Módulo de Presión Diferencial 700P01

Message 263
English: UUT to 700P02 Differential Pressure Module
Español: UBP al Módulo de Presión Diferencial 700P02

Message 264
English: UUT to 700P22 Differential Pressure Module
Español: UBP al Módulo de Presión Diferencial 700P22

Message 265
English: UUT to 700P03 Differential Pressure Module
Español: UBP al Módulo de Presión Diferencial 700P03

Message 266
English: UUT to 700P23 Differential Pressure Module
Español: UBP al Módulo de Presión Diferencial 700P23

Message 267
English: UUT to 700P04 Differential Pressure Module
Español: UBP al Módulo de Presión Diferencial 700P04

Message 268

English: UUT to 700P24 Differential Pressure Module
Español: UBP al Módulo de Presión Diferencial 700P24

Message 269

English: UUT to 700P05 Gage Pressure Module
Español: UBP al Módulo indicador de Presión 700P05

Message 270

English: UUT to 700P06 Gage Pressure Module
Español: UBP al Módulo indicador de Presión 700P06

Message 271

English: UUT to 700P07 Gage Pressure Module
Español: UBP al Módulo indicador de Presión 700P07

Message 272

English: UUT to 700P08 Gage Pressure Module
Español: UBP al Módulo indicador de Presión 700P08

Message 273

English: UUT to 700P09 Gage Pressure Module
Español: UBP al Módulo indicador de Presión 700P09

Message 274

English: UUT to 700PA3 Absolute Pressure Module
Español: UBP al Módulo de Presión Absoluta 700PA3

Message 275

English: UUT to 700PA4 Absolute Pressure Module
Español: UBP al Módulo de Presión Absoluta 700PA4

Message 276

English: UUT to 700PA5 Absolute Pressure Module
Español: UBP al Módulo de Presión Absoluta 700PA5

Message 277

English: UUT to 700PA6 Absolute Pressure Module
Español: UBP al Módulo de Presión Absoluta 700PA6

Message 278

English: UUT to 700PV3 Vacuum Module
Español: UBP al Módulo de vació 700PV3

Message 279

English: UUT to 700PV4 Vacuum Module
Español: UBP al Módulo de vacío 700PV4

Message 280

English: UUT to 700PD2 Dual Pressure Module
Español: UBP al Módulo de Presión Dual 700PD2

Message 281

English: UUT to 700PD3 Dual Pressure Module
Español: UBP al Módulo de Presión Dual 700PD3

Message 282

English: UUT to 700PD4 Dual Pressure Module
Español: UBP al Módulo de Presión Dual 700PD4

Message 283

English: UUT to 700PD5 Dual Pressure Module
Español: UBP al Módulo de Presión Dual 700PD5

Message 284

English: UUT to 700PD6 Dual Pressure Module
Español: UBP al Módulo de Presión Dual 700PD6

Message 285

English: UUT to 700PD7 Dual Pressure Module
Español: UBP al Módulo de Presión Dual 700PD7

Message 286

English: UUT to 700P29 High Pressure Module
Español: UBP al Módulo de Presión Dual 700P29

Message 287

English: UUT to 700P30 High Pressure Module
Español: UBP al Módulo de Presión Dual 700P30

Message 288

English: UUT to 700P31 High Pressure Module
Español: UBP al Módulo de Presión Dual 700P31

Message 289

English: 700P01 Differential Pressure Module for zero measurement
Español: 700P01 Módulo de Presión Diferencial para medida de cero

Message 290

English: 700P02 Differential Pressure Module for zero measurement
Español: 700P02 Módulo de Presión Diferencial para medida de cero

Message 291

English: 700P22 Differential Pressure Module for zero measurement
Español: 700P22 Módulo de Presión Diferencial para medida de cero

Message 292

English: 700P03 Differential Pressure Module for zero measurement
Español: 700P03 Módulo de Presión Diferencial para medida de cero

Message 293

English: 700P23 Differential Pressure Module for zero measurement
Español: 700P23 Módulo de Presión Diferencial para medida de cero

Message 294

English: 700P04 Differential Pressure Module for zero measurement
Español: 700P04 Módulo de Presión Diferencial para medida de cero

Message 295

English: 700P24 Differential Pressure Module for zero measurement
Español: 700P24 Módulo de Presión Diferencial para medida de cero

Message 296

English: 700P05 Gage Pressure Module for zero measurement
Español: 700P05 Módulo Indicador de Presión para medida de cero

Message 297

English: 700P06 Gage Pressure Module for zero measurement
Español: 700P06 Módulo Indicador de Presión para medida de cero

Message 298

English: 700P07 Gage Pressure Module for zero measurement
Español: 700P07 Módulo Indicador de Presión para medida de cero

Message 299

English: 700P08 Gage Pressure Module for zero measurement
Español: 700P08 Módulo Indicador de Presión para medida de cero

Message 300

English: 700P09 Gage Pressure Module for zero measurement
Español: 700P09 Módulo Indicador de Presión para medida de cero

Message 301

English: 700PA3 Absolute Pressure Module for zero measurement
Español: 700PA3 Módulo Indicador de Presión para medida de cero

Message 302

English: 700PA4 Absolute Pressure Module for zero measurement
Español: 700PA4 Módulo Indicador de Presión para medida de cero

Message 303

English: 700PA5 Absolute Pressure Module for zero measurement
Español: 700PA5 Módulo Indicador de Presión para medida de cero

Message 304

English: 700PA6 Absolute Pressure Module for zero measurement
Español: 700PA6 Módulo Indicador de Presión para medida de cero

Message 305

English: 700PV3 Vacuum Module for zero measurement
Español: 700PV3 Módulo de Vacío para medida de cero

Message 306

English: 700PV4 Vacuum Module for zero measurement
Español: 700PV4 Módulo de Vacío para medida de cero

Message 307

English: 700PD2 Dual Pressure Module for zero measurement
Español: 700PD2 Módulo de Presión Dual para medida de cero

Message 308

English: 700PD3 Dual Pressure Module for zero measurement
Español: 700PD3 Módulo de Presión Dual para medida de cero

Message 309

English: 700PD4 Dual Pressure Module for zero measurement
Español: 700PD4 Módulo de Presión Dual para medida de cero

Message 310

English: 700PD5 Dual Pressure Module for zero measurement
Español: 700PD5 Módulo de Presión Dual para medida de cero

Message 311

English: 700PD6 Dual Pressure Module for zero measurement
Español: 700PD6 Módulo de Presión Dual para medida de cero

Message 312

English: 700PD7 Dual Pressure Module for zero measurement
Español: 700PD7 Módulo de Presión Dual para medida de cero

Message 313

English: 700P29 High Pressure Module for zero measurement
Español: 700P29 Módulo de Alta Presión para medida de cero

Message 314

English: 700P30 High Pressure Module for zero measurement
Español: 700P30 Módulo de Alta Presión para medida de cero

Message 315

English: 700P31 High Pressure Module for zero measurement
Español: 700P31 Módulo de Alta Presión para medida de cero

Message 316

English: UUT to 8901A Input
Español: UBP a Entrada del 8901A

Message 317

English: 8901A Input to 8901A Calibration Output
Español: Entrada 8901A a Salida Calibración 8901A

Message 318

English: 11722A Sensor Module to UUT Español: Módulo Sensor del 11722A a la UBP

Message 319

English: 11722A Sensor Module to 8901B AM/FM Calibration Output
Español: Módulo Sensor 11722A a Salida Calibración 8901B AM/FM

Message 320

English: 11722A Sensor Module to 8902A AM/FM Calibration Output
Español: Módulo Sensor 11722A a Salida Calibración 8902A AM/FM

Message 321

English: 11722A Sensor Module to 8901B RF Power Calibration Output
Español: Módulo Sensor 11722A a Salida Calibración 8901B RF Power

Message 322

English: 11722A Sensor Module to 8902A RF Power Calibration Output
Español: Módulo Sensor 11722A a Salida Calibración 8902A RF Power

Message 323

English: UUT to 8903B Input High
Español: UBP a la entrada HIGH del 8903B

Message 324

English: UUT to 8903E Input High

Español: UBP a la entrada HIGH del 8903E

Message 325

English: UUT to 8903B Output High

Español: UBP a la salida HIGH del 8903B

Message 326

English: UUT to 4000 Hi and Lo Output Terminals

Español: UBP a los Terminales Output Hi y Lo del 4000

Message 327

English: UUT to 4000 I+ and I- Output Terminals

Español: UBP a los Terminales Output I+ e I- del 4000

Message 328

English: UUT to 4000 I+ and I- as Sense Terminals

Español: UBP a los Terminales Sense I+ e I- del 4000

Message 329

English: UUT to 4200 Hi and Lo Output Terminals

Español: UBP a los Terminales Output Hi y Lo del 4200

Message 330

English: UUT to 4200 I+ and I- Output Terminals

Español: UBP a los Terminales Output I+ e I- del 4200

Message 331

English: UUT to 4200 I+ and I- as Sense Terminals

Español: UBP a los Terminales Sense I+ e I- del 4200

Message 332

English: UUT to 4600 I+ and I- Output Terminals

Español: UBP a los Terminales Output I+ e I- del 4600

Message 333

English: UUT to 4700 Hi and Lo Output Terminals

Español: UBP a los Terminales Output Hi y Lo del 4700

Message 334

English: UUT to 4700 I+ and I- Output Terminals

Español: UBP a los Terminales Output I+ e I- del 4700

Message 335

English: UUT to 4700 I+ and I- as Sense Terminals

Español: UBP a los Terminales Sense I+ e I- del 4700

Message 336

English: UUT to 4708 Hi and Lo Output Terminals

Español: UBP a los Terminales Output Hi y Lo del 4708

Message 337

English: UUT to 4708 I+ and I- Output Terminals

Español: UBP a los Terminales Output I+ e I- del 4708

Message 338

English: UUT to 4708 I+ and I- as Sense Terminals
Español: UBP a los Terminales Sense I+ e I- del 4708

Message 339

English: UUT to 8648 RF Output
Español: UBP a la salida RF Output del 8648

Message 340

English: UUT to 2023 RF Output
Español: UBP a la salida RF Output del 2023

Message 341

English: UUT to 2024 RF Output
Español: UBP a la salida RF Output del 2024

Message 342

English: UUT to SYM01 RF Output
Español: UBP a la salida RF Output del SMY01

Message 343

English: UUT to SYM02 RF Output
Español: UBP a la salida RF Output del SMY02

Message 344

English: 8481B Power Sensor to UUT
Español: Sensor de Potencia 8481B a la UBP

Message 345

English: 8482B Power Sensor to UUT
Español: Sensor de Potencia 8482B a la UBP

Message 346

English: 8481B Power Sensor to Power Ref Output
Español: Sensor de Potencia 8481B a Power Ref Output

Message 347

English: 8482B Power Sensor to Power Ref Output
Español: Sensor de Potencia 8482B a Power Ref Output

Message 348

English: 8481H Power Sensor to UUT
Español: Sensor de Potencia 8481H a la UBP

Message 349

English: 8482H Power Sensor to UUT
Español: Sensor de Potencia 8482H a la UBP

Message 350

English: 8481H Power Sensor to Power Ref Output
Español: Sensor de Potencia 8481H a Power Ref Output

Message 351

English: 8482H Power Sensor to Power Ref Output
Español: Sensor de Potencia 8482H a Power Ref Output

Message 352

English: 8481A Power Sensor to UUT
Español: Sensor de Potencia 8481A a la UBP

Message 353

English: 8482A Power Sensor to UUT
Español: Sensor de Potencia 8482A a la UBP

Message 354

English: 8483A Power Sensor to UUT
Español: Sensor de Potencia 8483A a la UBP

Message 355

English: 8485A Power Sensor to UUT
Español: Sensor de Potencia 8485A a la UBP

Message 356

English: 8487A Power Sensor to UUT
Español: Sensor de Potencia 8487A a la UBP

Message 357

English: Q8486A Power Sensor to UUT
Español: Sensor de Potencia Q8486A a la UBP

Message 358

English: R8486A Power Sensor to UUT
Español: Sensor de Potencia R8486A a la UBP

Message 359

English: W8486A Power Sensor to UUT
Español: Sensor de Potencia W8486A a la UBP

Message 360

English: 8481A Power Sensor to Power Ref Output
Español: Sensor de Potencia 8481A a Power Ref Output

Message 361

English: 8482A Power Sensor to Power Ref Output
Español: Sensor de Potencia 8482A a Power Ref Output

Message 362

English: 8483A Power Sensor to Power Ref Output
Español: Sensor de Potencia 8483A a Power Ref Output

Message 363

English: 8485A Power Sensor to Power Ref Output
Español: Sensor de Potencia 8485A a Power Ref Output

Message 364

English: 8487A Power Sensor to Power Ref Output
Español: Sensor de Potencia 8487A a Power Ref Output

Message 365

English: Q8486A Power Sensor to Power Ref Output
Español: Sensor de Potencia Q8486A a Power Ref Output

Message 366
English: R8486A Power Sensor to Power Ref Output
Español: Sensor de Potencia R8486A a Power Ref Output

Message 367
English: W8486A Power Sensor to Power Ref Output
Español: Sensor de Potencia W8486A a Power Ref Output

Message 368
English: 8481D Power Sensor to UUT
Español: Sensor de Potencia 8481D a la UBP

Message 369
English: 8484A Power Sensor to UUT
Español: Sensor de Potencia 8484A a la UBP

Message 370
English: 8485D Power Sensor to UUT
Español: Sensor de Potencia 8485D a la UBP

Message 371
English: 8487D Power Sensor to UUT
Español: Sensor de Potencia 8487D a la UBP

Message 372
English: Q8486D Power Sensor to UUT
Español: Sensor de Potencia Q8486D a la UBP

Message 373
English: R8486D Power Sensor to UUT
Español: Sensor de Potencia R8486D a la UBP

Message 374
English: 8481D Power Sensor to Power Ref Output using 30dB attenuator
Español: Sensor pot. 8481D al Power Ref Output usando atenuador 30dB

Message 375
English: 8484A Power Sensor to Power Ref Output using 30dB attenuator
Español: Sensor pot. 8484A al Power Ref Output usando atenuador 30dB

Message 376
English: 8485D Power Sensor to Power Ref Output using 30dB attenuator
Español: Sensor pot. 8485D al Power Ref Output usando atenuador 30dB

Message 377
English: 8487D Power Sensor to Power Ref Output using 30dB attenuator
Español: Sensor pot. 8487D al Power Ref Output usando atenuador 30dB

Message 378
English: Q8486D Power Sensor to Power Ref Output using 30dB attenuator
Español: Sensor pot. Q8486D al Power Ref Output usando atenuador 30dB

Message 379
English: R8486D Power Sensor to Power Ref Output using 30dB attenuator
Español: Sensor pot. R8486D al Power Ref Output usando atenuador 30dB

Message 380

English: UUT to 5335A Input A

Español: UBP a la entrada A del 5335A

Message 381

English: UUT to 5335A Input C

Español: UBP a la entrada C del 5335A

Message 382

English: UUT to 5335A Input A (for Ratio A/B measurement)

Español: UBP a la entrada A del 5335A (para medida de relación A/B)

Message 383

English: UUT to 5335A Input B (for Ratio A/B measurement)

Español: UBP a la entrada B del 5335A (para medida de relación A/B)

Message 384

English: UUT to 5335A Input A (for Time Interval A-B measurement)

Español: UBP a la entrada A del 5335A (para medida Intervalo de tiempo A-B)

Message 385

English: UUT to 5335A Input B (for Time Interval A-B measurement)

Español: UBP a la entrada B del 5335A (para medida Intervalo de tiempo A-B)

Message 386

English: UUT to 5335A DCV and COM Input Terminals

Español: UBP a las entradas DCV y COM del 5335A

Message 387

English: UUT to 856X Input

Español: UBP a la Entrada 856X

Message 388

English: UUT to 8566B RF Input

Español: UBP a la Entrada RF del 8566B

Message 389

English: UUT to 8568B Signal Input 1

Español: UBP a la Señal de Entrada 1 del 8568B

Message 390

English: UUT to 8568B Signal Input 2

Español: UBP a la Señal de Entrada 2 del 8568B

Message 391

English: UUT to 859X Input

Español: UBP a la entradaa del 859X

Message 392

English: UUT to 5820A Channel 1

Español: UBP al Canal 1 del 5820A

Message 393

English: UUT to 5820A Channel 2

Español: UBP al Canal 2 del 5820A

Message 394

English: UUT to 5820A Channel 3
Español: UBP al Canal 3 del 5820A

Message 395

English: UUT to 5820A Channel 4
Español: UBP al Canal 4 del 5820A

Message 396

English: UUT to 5820A Channel 5
Español: UBP al Canal 5 del 5820A

Message 397

English: UUT to 5820A Channel 1 using Tunnel Diode Pulser
Español: UBP al Canal 1 del 5820A usando el Diodo Túnel

Message 398

English: UUT to 5820A Channel 2 using Tunnel Diode Pulser
Español: UBP al Canal 2 del 5820A usando el Diodo Túnel

Message 399

English: UUT to 5820A Channel 3 using Tunnel Diode Pulser
Español: UBP al Canal 3 del 5820A usando el Diodo Túnel

Message 400

English: UUT to 5820A Channel 4 using Tunnel Diode Pulser
Español: UBP al Canal 4 del 5820A usando el Diodo Túnel

Message 401

English: UUT to 5820A Channel 5 using Tunnel Diode Pulser
Español: UBP al Canal 5 del 5820A usando el Diodo Túnel

Message 402

English: UUT to 5820A Channel 1 as trigger output
Español: UBP al Canal 1 del 5820A como salida trigger

Message 403

English: UUT to 5820A Channel 5 as trigger outpu
Español: UBP al Canal 5 del 5820A como salida trigger

Message 404

English: Insert 2620T Temperature Probe
Español: Inserte la sonda de temperatura en el 2620T

Message 405

English: Insert 2635T Temperature Probe
Español: Inserte la sonda de temperatura en el 2635T

Message 406

English: UUT to 33120A Output
Español: UBP a la salida del 33120A

Message 407

English: UUT to 33120A Output with 50 Ohm termination
Español: UBP a la salida del 33120A con terminación de 50 Ohmios

Message 408

English: Insert Rosemount 162CE SPRT Probe
Español: Inserte la sonda SPRT Rosemount 162CE

Message 409

English: Insert Hart Scientific 5628 PRT Probe
Español: Inserte la sonda PRT Hart Scientific 5628

Message 410

English: UUT to 9500 Channel 1 Active Head

Message 411

English: UUT to 9500 Channel 2 Active Head

Message 412

English: UUT to 9500 Channel 3 Active Head

Message 413

English: UUT to 9500 Channel 4 Active Head

Message 414

English: UUT to 9500 Channel 5 Active Head

Message 415

English: UUT to 9500 Channel 1 Trigger Cable

Message 416

English: UUT to 9500 Channel 2 Trigger Cable

Message 417

English: UUT to 9500 Channel 3 Trigger Cable

Message 418

English: UUT to 9500 Channel 4 Trigger Cable

Message 419

English: UUT to 9500 Channel 5 Trigger Cable

Message 420

English: UUT Probe to 9500 Channel 1 Active Head using Current Loop Assembly

Message 421

English: UUT Probe to 9500 Channel 2 Active Head using Current Loop Assembly

Message 422

English: UUT Probe to 9500 Channel 3 Active Head using Current Loop Assembly

Message 423

English: UUT Probe to 9500 Channel 4 Active Head using Current Loop Assembly

Message 424

English: UUT Probe to 9500 Channel 5 Active Head using Current Loop Assembly

Message 425

English: UUT to 4800 Hi and Lo Output Terminals

Message 426

English: UUT to 4800 I+ and I- Output Terminals

Message 427

English: UUT to 4800 I+ and I- as Sense Terminals

Message 428

English: UUT to 4805 Hi and Lo Output Terminals

Message 429

English: UUT to 4805 I+ and I- Output Terminals

Message 430

English: UUT to 4805 I+ and I- as Sense Terminals

Message 431

English: UUT to 4808 Hi and Lo Output Terminals

Message 432

English: UUT to 4808 I+ and I- Output Terminals

Message 433

English: UUT to 4808 I+ and I- as Sense Terminals

Message 434

English: UUT to 4705 Hi and Lo Output Terminals

Message 435

English: UUT to 4705 I+ and I- Output Terminals

Message 436

English: UUT to 4705 I+ and I- as Sense Terminals

Message 437

English: UUT to 4707 Hi and Lo Output Terminals

Message 438

English: UUT to 4707 I+ and I- Output Terminals

Message 439

English: UUT to 4707 I+ and I- as Sense Terminals

Message 440

English: UUT to 1271 Hi and Lo Input Terminals

Message 441

English: UUT to 1271 I+ and I- as Sense Terminals

Message 442

English: UUT to 1271 I+ and I- Input Terminals

Message 443

English: UUT to 1281 Hi and Lo Input Terminals

Message 444

English: UUT to 1281 I+ and I- as Sense Terminals

Message 445

English: UUT to 1281 I+ and I- Input Terminals

Message 446

English: UUT to 4950 Hi and Lo Input Terminals

Message 447

English: UUT to 4950 I+ and I- as Sense Terminals

Message 448

English: UUT to 4950 I+ and I- Input Terminals

Message 449

English: 4953 AC/DC Shunt Hi and Lo Terminals to 4950 Hi and Lo Terminals

Message 450

English: UUT to 4953 I+ and I- Input Terminals

Message 451

English: UUT to 9005 Red Lead (Hi and sH)

Message 452

English: UUT to 9005 Black Lead (sH and LI-)

Message 453

English: UUT to 9005 Yellow Lead (I+20A)

Message 454

English: UUT to 9005 White Lead (I+mA)

Message 455

English: UUT to 9005 TC Terminals

Message 456

English: UUT to 9105 Red Lead (Hi and sH)

Message 457

English: UUT to 9105 Black Lead (sH and LI-)

Message 458

English: UUT to 9105 Yellow Lead (I+20A)

Message 459

English: UUT to 9105 White Lead (I+mA)

Message 460

English: UUT to 9105 Thermocouple Adapter

Message 461

English: UUT to 9100 Hi and Lo Output Terminals

Message 462

English: UUT to 9100 I+ and I- Output Terminals

Message 463

English: Option 200 10-Turn coil to 9100 I+ and I- Output Terminals. Clamp UUT around the center of the coil.

Message 464

English: Option 200 50-Turn coil to 9100 I+ and I- Output Terminals. Clamp UUT around the center of the coil.

Message 465

English: UUT to 9100 SIG OUT (on rear).

Message 466

English: UUT to 525A Hi and Lo Volts Source Terminals

Message 467

English: UUT to 525A Hi and Lo mA Source Terminals

Message 468

English: UUT to 525A Hi and Lo RTD/Ohms Source Terminals

Message 469
English: UUT to 525A Hi and Lo RTD/Ohms Measure Terminals
Message 470
English: UUT to 525A Hi and Lo RTD/Ohms Sense Terminals
Message 471
English: UUT to 525A TC Terminal
Message 472
English: UUT to 525A TC Terminals using copper wire
Message 473
English: UUT to 525A TC Terminals using type B thermocouple wire
Message 474
English: UUT to 525A TC Terminals using type C thermocouple wire
Message 475
English: UUT to 525A TC Terminals using type E thermocouple wire
Message 476
English: UUT to 525A TC Terminals using type J thermocouple wire
Message 477
English: UUT to 525A TC Terminals using type K thermocouple wire
Message 478
English: UUT to 525A TC Terminals using type L thermocouple wire
Message 479
English: UUT to 525A TC Terminals using type N thermocouple wire
Message 480
English: UUT to 525A TC Terminals using type R thermocouple wire
Message 481
English: UUT to 525A TC Terminals using type S thermocouple wire
Message 482
English: UUT to 525A TC Terminals using type T thermocouple wire
Message 483
English: UUT to 525A TC Terminals using type U thermocouple wire
Message 484
English: Type B Thermocouple Standard to 525A TC Terminals
Message 485
English: Type C Thermocouple Standard to 525A TC Terminals
Message 486
English: Type E Thermocouple Standard to 525A TC Terminals
Message 487
English: Type J Thermocouple Standard to 525A TC Terminals
Message 488
English: Type K Thermocouple Standard to 525A TC Terminals
Message 489
English: Type L Thermocouple Standard to 525A TC Terminals

Message 490
English: Type N Thermocouple Standard to 525A TC Terminals
Message 491
English: Type R Thermocouple Standard to 525A TC Terminals
Message 492
English: Type S Thermocouple Standard to 525A TC Terminals
Message 493
English: Type T Thermocouple Standard to 525A TC Terminals
Message 494
English: Type U Thermocouple Standard to 525A TC Terminals
Message 495
English: 100 Ohm Pt 385 RTD Standard to 525A RTD Measure and Sense Terminals
Message 496
English: 100 Ohm Pt 3926 RTD Standard to 525A RTD Measure and Sense Terminals
Message 497
English: 120 Ohm Ni RTD Standard to 525A RTD Measure and Sense Terminals
Message 498
English: 200 Ohm Pt 385 RTD Standard to 525A RTD Measure and Sense Terminals
Message 499
English: 500 Ohm Pt 385 RTD Standard to 525A RTD Measure and Sense Terminals
Message 500
English: 1 kOhm Pt 385 RTD Standard to 525A RTD Measure and Sense Terminals
Message 501
English: 100 Ohm Pt 3916 RTD Standard to 525A RTD Measure and Sense Terminals
Message 502
English: 10 Ohm Cu Standard to 525A RTD Measure and Sense Terminals
Message 503
English: PRT Standard to 525A RTD Measure and Sense Terminals
Message 504
English: SPRT Standard to 525A RTD Measure and Sense Terminals
Message 505
English: UUT to 6000P04 Differential Pressure Module
Español: UBP al Módulo de Presión Diferencial 6000P04
Message 506
English: UUT to 6000P05 Gage Pressure Module
Español: UBP al Módulo indicador de Presión 6000P05
Message 507
English: UUT to 6000P06 Gage Pressure Module
Español: UBP al Módulo indicador de Presión 6000P06
Message 508
English: UUT to 6000P07 Gage Pressure Module
Español: UBP al Módulo indicador de Presión 6000P07

Message 509

English: UUT to 6000P08 Gage Pressure Module
Español: UBP al Módulo indicador de Presión 6000P08

Message 510

English: UUT to 6000PA4 Absolute Pressure Module
Español: UBP al Módulo de Presión Absoluta 6000PA4

Message 511

English: UUT to 6000PV4 Vacuum Module
Español: UBP al Módulo de vacío 6000PV4

Message 512

English: UUT to 6000P29 High Pressure Module
Español: UBP al Módulo de Presión Dual 6000P29

Message 513

English: 6000P04 Differential Pressure Module for zero measurement
Español: 6000P04 Módulo de Presión Diferencial para medida de cero

Message 514

English: 6000P05 Gage Pressure Module for zero measurement
Español: 6000P05 Módulo Indicador de Presión para medida de cero

Message 515

English: 6000P06 Gage Pressure Module for zero measurement
Español: 6000P06 Módulo Indicador de Presión para medida de cero

Message 516

English: 6000P07 Gage Pressure Module for zero measurement
Español: 6000P07 Módulo Indicador de Presión para medida de cero

Message 517

English: 6000P08 Gage Pressure Module for zero measurement
Español: 6000P08 Módulo Indicador de Presión para medida de cero

Message 518

English: 6000PA4 Absolute Pressure Module for zero measurement
Español: 6000PA4 Módulo Indicador de Presión para medida de cero

Message 519

English: 6000PV4 Vacuum Module for zero measurement
Español: 6000PV4 Módulo de Vacío para medida de cero

Message 520

English: 6000P29 High Pressure Module for zero measurement
Español: 6000P29 Módulo de Alta Presión para medida de cero

DISP

Display Control FSC

Description

The DISP FSC is used to display a message to the operator during procedure execution. When a DISP statement is executed, a dialog appears showing the specified message, and containing "**Advance**" and "**Terminate**" buttons.

If the operator chooses "**Advance**", execution continues with the next procedure statement.

If the operator chooses "**Terminate**", the current step is terminated, and the Post Test dialog appears.

Format

DISP *message*

Rules

- A single DISP statement may contain up to 32 lines.
- Each line of a DISP statement may contain up to 56 characters.
- The following special constructions may be used in a DISP statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [D*integer*]

  [DRAW*x*,*y*,*view*]

  [V*variable*]

  {*text*}

  [L1], [L2], …

  [M1], [M2], ...

  [S1], [S2], ...

  [SREG1], [SREG2], ...

Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (6).

The constructions [L1], [L2], … access the local numeric registers. The constructions [M1], [M2], ... access the global numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The constructions [S1], [S2], ... access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ... are identical to [S1], [S2], ..., and are included only for compatibility with the IEEE FSC.

Refer to "Special Constructions" in this manual for details.

Examples

```
1.011  DISP        Set the PM 3055 Ch.1 vertical attenuation to 1V/div.
1.011  DISP        Set the PM 3055 time base to 5ms/div.
1.011  DISP
1.011  DISP        Trigger Ch.1 on the inductive pickup waveform.
```

The example above shows a 4 line DISP statement. (The fact that all 4 lines have the same step number indicates that it is a single statement, rather than 4 separate DISP statements.)

```
1.001  DISP        [D1000] The value of MEM is [MEM].
```

This example illustrates the use of special constructions. The [D1000] construction causes a delay of 1 second (1000 milliseconds), and then displays the value of memory register MEM.

Note

[] special constructions may be enclosed in {}, but will not be evaluated and stored in the results. For example, the following DISP statements will cause "Ch[MEM] 20mV/div" to be stored in the results, not "Ch1 20mV/div".

```
12.001 MATH        MEM = 1

12.002 HEAD        Ch[MEM] Tests

12.003 DISP        Set attenuation:  {Ch[MEM] 20mV/div}
```

The RSLT FSC should be used to store text with embedded [] special constructions in the results as shown below:

```
12.001 MATH        MEM = 1

12.002 HEAD        Ch[MEM] Tests

12.003 DISP        Set attenuation:  Ch[MEM] 20mV/div

12.004 RSLT        =Ch[MEM] 20mV/div
```

DOS, DOSE

Procedure Control FSCs

Description

The DOS and DOSE FSCs run user-provided programs or batch files.

The programs may be MS-DOS executables, Windows executables, MS-DOS batch files, or Windows PIF files.

The difference between the DOS and DOSE FSCs is that DOSE is an evaluation FSC which generates a result.

Format

DOS [-*arg*] *program*

DOSE [-*arg*] *program*

Rules

- The *program* field, plus any arguments, may contain up to 56 characters.

  Example:

  ```
  1.001   DOS       USERPROG
  ```

- This statement will execute the user-provided program named "USERPROG.EXE".

  Example:

  ```
  2.003   DOS       USER.BAT
  ```

- This statement will execute the user-provided batch file named "USER.BAT".

  The program or batch file to be executed must be in the current directory or in one of the directories listed in the "PATH" environment variable.

Arguments

1. Valid arguments are:

   -n - write all numeric registers to data file

   -a - write all registers to data file

   -x - pay attention to user program's exit status

   -i - ignore user program's exit status

2. One or more arguments may be specified for a DOS or DOSE procedure statement. Arguments, if any, must follow the FSC ("DOS" or "DOSE") and precede the user program name.

   For example:

   ```
   DOS -n myprog.exe
   ```

   is valid, but

   ```
   DOS myprog.exe -n
   ```

   is not valid (unless "-n" is an argument you wish to pass to "myprog.exe").
3. Arguments are case-sensitive.
4. No argument may be specified more than once for the same statement.
5. "-a" and "-n" may not both be specified for the same statement.
6. "-x" and "-i" may not both be specified for the same statement.
7. Each argument must be preceded and followed by one or more spaces.
8. The "-b" argument is used if you want MET/CAL to retain leading and trailing spaces on string register values read from the data file ("dosdose.dat"). For example,if you specify a MEM2 value of "x", MET/CAL will normally strip off the leading and trailing spaces and the value of MEM2 will be "x". If "-b" is specified,however, MEM2 will have the value "x" after the DOS or DOSE statement completes.

More information on the "-n" and "-a" arguments is provided in the DATA FILE section below.

More information on the "-x" and "-i" arguments is available in the EXIT CODE section below.

The *program* specifier may include optional command-line arguments and/or I/O redirection where appropriate.

These arguments are not the same as the DOS/DOSE arguments described above. Program arguments appear after the user program name, and are simply passed to the user program.

Example:

```
4.001 DOS       USER1.EXE 1.9 15.4 > TMP.DAT
```

The user-provided program "USER1.EXE" will be executed with two command-line arguments (1.9 and 15.4). Output will be directed to the file "TMP.DAT".

The following special constructions may be used to specify arguments to the user program.

(1) [MEM], [MEM1], and [MEM2]
(2) [M1], [M2], ..., [M255]
(3) [S1], [S2], ..., [S32]
(4) [SREG1], [SREG2], ..., [SREG32]
(5) [V*variable*]
(6) {*text*}

This capability is new with V6.0.

The constructions [SREG1], [SREG2], [SREG32] are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

There is an optional initialization file parameter which can be used to disable the evaluation of special constructions in user program arguments, if necessary. It is probably unlikely, but if a user program has command line arguments which include literal bracket or brace characters ('[', ']', '{', or '}'), it will be necessary to disable special construction parsing for DOS and DOSE procedure statements. To do this, add the line:

dos_sc_eval = no

to the "[startup]" section of the MET/CAL initialization file.Specifying "dos_sc_eval = yes", or simply omitting any "dos_sc_eval" specification, enables special construction evaluation.

Example:

```
5.001 MATH      M[3] = 2.97 ; S[5] = "-x"
5.002 DOS       USER1 [S5] [M3]
```

The user-provided program "USER1.EXE" will be executed with two command-line arguments. The first argument will be "-x", which is the value of register S[5]. The second argument will be "2.97", which is the value of register M[3].

Data File

Parameters are passed between MET/CAL and the user-written program by way of an ASCII data file named "dosdose.dat". Before executing the *program* specified in the DOS or DOSE statement, MET/CAL writes the current values of the MET/CAL memory registers into this file.

A user-written program may alter the values in this file. When MET/CAL resumes, it reads back the data file, and starts up with the values present at that time in "dosdose.dat". The file is then removed.

Optional arguments allow the procedure writer to control which memory register values are written to the data file.

The "-n" argument causes all of the numeric registers to be written, instead of just the first 20.

The "-a" argument causes all of the numeric and all of the string registers to be written.

If neither "-n" nor "-a" are specified, the data file is compatible with MET/CAL 4.0 and previous.

The following table shows the affect of the "-n" and "-a" arguments on the data file:

Argument	MEM	MEM1	MEM2	M Registers	S Registers
none	yes	yes	yes	1 - 20	none
-n	yes	yes	yes	1 - 255	none
-a	yes	yes	yes	1 - 255	1 - 32

If neither "-n" nor "-a" are specified, the registers are written in the order MEM, MEM1, MEM2, M[1], M[2], ..., M[20]. Each memory register value is written on a separate line.

If the "-n" argument is specified, the registers are written in the order MEM, MEM1, MEM2, M[1], M[2], ..., M[255]. Each memory register value is written on a separate line.

If the "-a" argument is specified, the registers are written in the order MEM, MEM1, MEM2, M[1], M[2], ..., M[255], S[1], S[2], ..., S[32]. Up to M[255], each memory register value is written on a separate line. The S registers are written out using two lines for each register. The first line is an integer which specifies the length of the following string, and the second line is the string. An empty string is written as a single LINEFEED character, with the length set to 0.

Example:

Consider the procedure fragment:

```
MATH    s[1] = "abc"
MATH    S[3] = "defgh"
DOS     -a <program>
```

The beginning of the string register section of the DOS/DOSE data file will look like:

```
3
abc
0

5
defgh
.
.
.
```

The "3" indicates that the length of the following string ("abc") is 3. The 0 indicates that S[2] is empty, the 5 indicates that the length of the following string

("defgh") is 5, and so on.

When the DOSE FSC is used, the user-written program must append either 1 or 2 lines to "dosdose.dat". The first appended line is a result text string (not more than 64 characters). It is included in the Post Test Summary. The second appended line is optional. If present, it may be "PASS" to indicate a PASS condition, "FAIL" to indicate a FAIL condition, or a floating-point number to indicate the percent error for the test. This information determines the pass/fail status of the evaluation as displayed in the Post Test Summary and written to the results. If the second appended line is omitted, the evaluation is a default PASS.

Note that the DOSE mechanism described above (the requirement that the user program append 1 or 2 lines to the data file, and the fact that MET/CAL uses that information to generate a PASS/FAIL result) is the only difference between the DOS and DOSE FSCs.

Exit Code

The procedure writer may control whether MET/CAL uses the exit code of the user program to determine if the user program succeeded or failed.

Control is provided in two ways.

1. The "-i" and "-x" arguments may be used on individual DOS or DOSE statements to specify how the exit code is to be handled for that statement only. If "-i" is specified, MET/CAL ignores the exit code of the user program. This is compatible with MET/CAL 4.0 through 4.2 and, in fact, was the only option for those versions of the software. If "-x" is specified, MET/CAL uses the user program's exit code to determine whether or not the user program succeeded. If the user program returns zero, the execution is successful. Any non-zero return value is regarded as a failure of the user program.

   "Success" and "failure", as used here, do not refer to the PASS/FAIL status of the test. To control the PASS/FAIL status of an evaluation step involving a user program, you must use the DOSE FSC and write the appropriate test status into the "dosdose.dat" data file. This is discussed in more detail elsewhere in this help document.

2. The second way to control the handling of user program exit codes is to specify the optional initialization file parameter "uexit_code". If "uexit_code" is set to "yes", MET/CAL pays attention to the exit codes of all user programs invoked by DOS statements, unless overridden by "-I" arguments on individual DOS or DOSE statements. If "uexit_code" is set to "no", MET/CAL ignores the exit codes of all user programs invoked by DOS or DOSE statements, unless overridden by "-x" arguments on individual DOS or DOSE statements. If "uexit_code" is not specified in the initialization file ("metcal.ini", "STARTUP" section) it defaults to "no". Thus, the default behavior is to ignore all user program exit codes. This is compatible with versions 4.2 and previous of Windows MET/CAL. (Note, however, that DOS MET/CAL did pay attention to the user program's exit code. Compatibility with DOS MET/CAL can be achieved by setting "uexit_code" to "yes".)

If a user program fails (returns a non-zero value) and MET/CAL is configured to pay attention to the exit code (as discussed above), the behavior of the system is as follows:

1. An error message displaying the name of the user program and the non-zero exit code is displayed.
2. After the operator chooses "OK" to remove the error message, the Post Test dialog appears with a message indicating that the DOS or DOSE statement was terminated by the preceding error. At this point the operator may repeat the test, terminate the procedure, or use any of the other Post Test options.

With some versions of BASIC it may be difficult (or impossible) to control the exit code of the user program. If this problem arises, the simplest solution is to ignore the exit code. As described above, this is done either by specifying "uexit_code = no" in the initialization file and specifying neither "-i" nor "-x" on the DOS or DOSE statement, or by specifying "-i" on the DOS or DOSE statement, which overrides the initialization file setting.

If the exit code of the user program cannot be easily controlled, but there is a need to handle user program errors, this can be dealt with by ignoring the user program's exit code (using "-i" or "uexit_code = no", as discussed above), and using an available memory register as an error indicator. That is, the user program can write a known value into a predetermined register in the "dosdose.dat" file. The procedure can then be written to jump to an error handling section if the register contains the pre-defined error indication value after return from execution of the user program.

Additional Information

The following additional information is provided for procedure writers familiar with the MS-DOS and/or Windows programming environments.

- If the *program* given in the DOS or DOSE statement specifies a batch file, or includes input/output redirection symbols ('>', '<', or '|'), MET/CAL uses the standard MS-DOS command interpreter "COMMAND.COM" to execute the batch file or executable program.
- If the *program* specifies an executable program (with extension ".EXE" or ".COM"), and no input/output redirection is specified, MET/CAL executes the program directly. The program executes either as an MS-DOS program or as a Windows program, depending on how the executable was built.
- The file name extension of the user-written program to be executed must be ".EXE", ".COM", ".BAT", or ".PIF". The extension must be explicitly specified in the DOS or DOSE statement if it is ".COM", ".BAT", or ".PIF". The extension is optional if it is ".EXE".

- The DOS or DOSE FSCs cannot be used to directly execute commands which are built into the MS-DOS command interpreter ("command.com"). For example, the statement "DOS dir" will not work. However, "command.com" may be invoked to execute built in commands. For example, "DOS command.com /c dir" will invoke the MS-DOS command interpreter to execute the built in "dir" command.

If a user-written program displays information on the PC screen, the program should pause until the operator has had time to read the display. Otherwise, when MET/CAL resumes execution, information displayed by the user program may be destroyed or overwritten. If the user program is an MS-DOS batch file, the necessary pause can be accomplished by using a "pause" statement in the batch file.

Example:

Create a batch file called "xyz.bat" which contains:

```
DIR /W
PAUSE
```

Execute the following line in a MET/CAL procedure:

```
DOS     XYZ.BAT
```

When the DOS statement is executed, an MS-DOS window will be created. A directory listing will be shown in the window (the output of the "DIR /W" command). This will be followed by the prompt:

```
Press any key to continue . . .
```

in the MS-DOS window. When the operator presses a key, the MS-DOS window will be closed, and MET/CAL will resume execution with the statement after the DOS statement.

The procedure writer may wish to use the Windows "PIF" editor to create a ".PIF" file to control the invocation of a user-written DOS or DOSE program. This allows individual control over whether the user-written program runs full screen or in a window, the window title, and other parameters.

Example:

Suppose you have an MS-DOS batch file named "XYZ.BAT" which you wish to run in a window, with the window title "Enter Parameters". Start the Windows "PIF" editor. Set "Program Filename" to "COMMAND.COM", set "Window Title" to "Enter Parameters", set "Optional Parameters" to "/c XYZ.BAT", and under "Display Usage" choose "Windowed".

Choose "Save As..." in the "File" menu and save the file as "XYZ.PIF".

Then, in your MET/CAL procedure, enter the statement:

```
DOS      XYZ.PIF
```

Compatibility

- In general, memory limitations are less evident in Windows MET/CAL that in DOS MET/CAL. If the user's PC Windows environment is configured to use disk storage as virtual memory, then memory used by the MET/CAL program itself can become available to the user program invoked by the DOS FSC.

  (In Windows 3.1, virtual memory configuration is done under "Control Panel" : "386 Enhanced" : "Virtual Memory".)

- To retain compatibility with DOS MET/CAL, only the first 20 auxiliary memory registers (M[1], M[2], ..., M[20]) are written to "dosdose.dat" before execution of a DOS FSC unless the DOS or DOSE statement specifies one of the optional arguments "-n" or "-a".

  In Windows MET/CAL the file name extension of the user-program must be explicitly specified unless the extension is ".EXE". (In DOS MET/CAL ".BAT" and ".COM" files could be executed without specifying the file name extension.)

DRAW

Display Control FSC

Description

The DRAW FSC is used to set up a simple sketch of an instrument. Execution of a DRAW statement does not display the sketch, however. The sketch is displayed when a DRAW special construction in an EVAL, DISP, OPBR or SET statement is executed.

The sketch consists of an outer rectangle, an inner rectangle, and an annunciator. The outer rectangle represents the outline of an instrument (the UUT). The inner rectangle represents the UUT's front panel display. The annunciator identifies the location of an adjustment or connection.

Before the sketch can be displayed, the following information must be specified:

- The position (in the front view) of the upper right corner of the outer rectangle.
- The position (in the side view) of the upper right corner of the outer rectangle.
- The position of the upper left corner of the inner rectangle.
- The position of the lower right corner of the inner rectangle.
- The position of the annunciator.
- The view (front, back, left, right, top, and bottom).

Items 1, 2, 3, and 4 are specified in the DRAW statement, as described in the FORMAT and RULES sections below.

Items 5 and 6 are specified in the DRAW special construction. Refer to "Special Constructions" in Volume 2, Chapter 1 for details on the DRAW special construction.

The DRAW special construction allows any of 6 different views to be specified (front, back, left, right, top, and bottom). The inner rectangle and annunciator are not shown unless the front view is selected.

Format

DRAW *p1 p2 p3 p4 p5 p6 p7 p8*

where:

p1 = position of top edge of outer rectangle (front, back views)
p2 = position of right edge of outer rectangle (front, back views)
p3 = position of top edge of outer rectangle (side views)
p4 = position of right edge of outer rectangle (side views)
p5 = position of top edge of inner rectangle
p6 = position of left edge of inner rectangle
p7 = position of bottom edge of inner rectangle
p8 = position of right edge of inner rectangle

All parameters are integers.

Rules

- *p1* and *p2* specify the position of the upper-right corner of the outer rectangle, in the front and back views.

  p1 specifies the UUT front top row number. It must be between 2 and 11.
  p2 specifies the UUT front right column number. It must be between 58 and 78.
- *p3* and *p4* specify the position of the upper-right corner of the outer rectangle, in the left, right, top, and bottom views.

  p3 specifies the UUT side top row number. It must be between 2 and 11.
  p4 specifies the UUT side right column number. It must be between 58 and 78.
- *p5*, *p6*, *p7*, and *p8* specify the positions of the upper-left and lower-right corners of the inner rectangle.

  p5 specifies the position of the top edge of the inner rectangle, expressed as a percentage of the height of the outer rectangle, with respect to the bottom of the outer rectangle. *p5* must be between 0 and 100, and must be greater than *p7*.

  p6 specifies the position of the left edge of the inner rectangle, expressed as a percentage of the width of the outer rectangle, with respect to the left edge of the outer rectangle. *p6* must be between 0 and 100, and must be less than *p8*.

  p7 specifies the position of the bottom edge of the inner rectangle, expressed as a percentage of the height of the outer rectangle, with respect to the bottom of the outer rectangle. *p7* must be between 0 and 100, and must be less than *p5*.

  p8 specifies the position of the right edge of the inner rectangle, expressed as a percentage of the width of the outer rectangle, with respect to the left edge of the outer rectangle. *p8* must be between 0 and 100, and must be greater than *p6*.

- The bottom row and left column positions of the outer rectangle are fixed (in all views).

Compatibility

- The DRAW FSC is not recommended in MET/CAL 4.0. It is supported to provide compatibility with previous versions of MET/CAL.
- The display created using the DRAW FSC and DRAW special construction is very simple: two rectangles and a small circle, with no text annotation. Procedure writer's are advised to create pictures which more accurately depict the UUT. Pictures may be created using the Windows Paintbrush program. Picture may be displayed in MET/CAL using the PIC and PICE FSCs.
- Previous versions of the MET/CAL editor supported interactive entry of the parameters in a DRAW statement. The MET/CAL 4.0 editor does not support interactive parameter entry.

Examples

```
STEP  FSC   RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 DRAW          6 78  6 77        80  5 20 60
1.002 DISP        Local/Remote switch [DRAW10,20,F]
2.001 DRAW          6100  6 78        80 25 20 60
2.002 DISP        Adjustment R1 is here [DRAW34,24,L]
```

END

Procedure Control FSC

Description

The END FSC is used to terminate procedure execution. An END statement may occur at any point in a procedure. It has a step number, and may be the destination of a jump statement. No information is allowed after the FSC in an END statement. An END statement is not required in a procedure, since simply executing the last statement in a procedure has the effect of terminating execution (unless, of course, the last statement is a jump statement).

Format

END

Example

```
1.001 DISP  This is a test.
1.002 END
```

EVAL

Evaluation FSC

Description

The EVAL FSC allows evaluations based on prompting the operator or evaluating a numeric expression.

An operator-based EVAL presents a message to the operator and waits for a YES or NO response. The operator's response determines the result of the test (PASS or FAIL), and causes the value of MEM1 to be set to 1 or -1.

An expression-based EVAL evaluates a numeric expression and, depending on whether the result is zero or not, determines the result of the test (PASS or FAIL), and causes the value of MEM1 to be set to 1 or -1.

Format

Operator-based EVAL statements have the format:

EVAL *prompt*

or

EVAL -s *string expression* : *prompt*

Expression-based EVAL statements have the format:

EVAL -e *numeric expression* : *result text*

Rules

- At most 62 characters may appear after the FSC ("EVAL").
- Operator-Based EVAL Statements

If the form of the statement is:

EVAL -s *string expression* : *prompt*

the *string expression* is evaluated as a string-valued MATH expression, and the resulting string replaces the default result string associated with the evaluation. The default result string is "Result of Operator Evaluation".

Example 1:

MEM2 ="Test #1"

EVAL -s mem2 : Did test #1 pass or fail?

or

```
MATH s[1] = "Test #1"
EVAL -s s[1] : Did test #1 pass or fail?
```

Please remember that the rules for *string expression* are defined by the MATH FSC. Thus memory register MEM2 is referred to here as "MEM2", not as "[MEM2]" (which is the syntax used in FSCs which support MET/CAL special constructions).

Example 2:

```
MATH MEM2 ="Ch2"
EVAL -s MEM2 & " Test #1" : Did [MEM2] test #1 pass or fail?
```

Example 3:

```
EVAL -s mem2 & " " & s[1] : Did test #1 pass or fail?
```

In this example, the contents of S[1] are concatenated to the contents of MEM2, with a separating space character, and the resulting string will appear in the results instead of "Result of Operator Evaluation".

The "-s" is case-insensitive, so "-S" is also ok.

- Expression-Based EVAL Statements

Expression-based EVAL statements are suitable for use in closed-loop procedures.

The *numeric expression* may be any valid MATH expression.

Here are some examples of valid expressions:

```
mem
mem < 10
m[1]
(2 * (m[3] + mem1)) > 1
```

Refer to the documentation on the MATH FSC for a full description of valid expression syntax.

Although a string-valued expression may be used, EVAL evaluates all expressions as numeric, so a string-valued expression is coerced to a numeric value.

Compound expressions are not allowed. (In the MATH FSC you can write, for example, "MATH MEM = 3 ; MEM1 = 5, where the semicolon separates the parts of a compound assignment. This syntax is not supported in the EVAL statement.)

The "-e" is case-insensitive, so "-E" is also ok.

In an expression-based EVAL statement, the colon (':') which separates the *expression* from the *result text* is required. If you leave out the colon, the statement will be interpreted as an operator-based EVAL statement.

The *expression* may not be empty.

result text is a text string to be associated with the evaluation in the formatted results. That is, where it says "Result of Operator Evaluation" for an operator-based EVAL statement, it will say *result text* for an expression-based EVAL statement.

If *result text* is not specified, the associated result text will be "Result of Expression Evaluation".

Note that when *result text* is not specified, it is still necessary to specify a colon (':') after the *expression*.

Example:

The following example retrieves error information from an instrument. The instrument's response consists of an error number, followed by an error message, with a comma between the error number and the error message.

The evaluation is a "pass" if the error number is a zero (no error). Otherwise the evaluation is a "fail".

```
IEEE    SYST:ERR? [I$]
MATH    L[1] = FLD(MEM2, 1, ",")
MATH    S[1] = FLD(MEM2, 2, ",")
EVAL    -e L[1] == 0 : [S1]
```

One important point illustrated in the example is that the math expression (between the "-e" and the ":") is like a MATH FSC procedure statement. It must follow the syntax rules of the MATH FSC. Specifically, the square brackets used with 'M', 'L', and 'S' register references are an array-subscripting operator. This use of square brackets is different from the traditional MET/CAL "special construction" usage. In a special construction, the square brackets are used to delineate the construction, to distinguish it from the surrounding literal text (if any). Thus, in the example above, the "[S1]" (to the right of the ":") is a special construction, whereas the "L[1]" in the math expression is an array reference.

The following special constructions may be used in an EVAL statement:

- [N]
- [MEM], [MEM1], and [MEM2]
- [*numeric*]
- [D*numeric*]
- [DRAW*x*, *y*,*view*] (operator-based EVAL only)
- [V*variable*]
- {*text*}
- [M1], [M2], ...
- [L1], [L2], …
- [S1], [S2], ...
- [SREG1], [SREG2], ...

The [N] special construction is specific to the EVAL FSC, and is described in detail in the rules below. For information on special constructions (2) to (7) see "Special Constructions" in Chapter 1 of this manual.

The [DRAW *x*, *y*, *view*] is not allowed in an expression-based EVAL statement.

In an expression-based EVAL statement all special constructions (if any are used) must occur in the *result text* part of the statement.

The constructions [M1], [M2], ..., access the global numeric registers. The constructions [L1], [L2], …, access the local numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC help for additional information on the numeric registers.

The constructions [S1], [S2], ..., [S32] access the string registers. Refer to the MATH FSC help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., are identical to [S1], [S2], ..., [S32], and are included only for compatibility with the IEEE FSC.

Note that the EVAL statement limit of 62 characters applies to the original EVAL statement and also to the evaluated text which results from replacing special constructions with the corresponding register values.

In an operator-based EVAL, if the EVAL *message* does not contain an [N] special construction the operator's response is interpreted as follows:

If the operator chooses YES:

1. The test result is PASS.
2. The value of MEM1 is set to 1.

If the operator chooses NO:

1. The test result is FAIL.
2. The value of MEM1 is set to -1.

In an operator-based EVAL, the [N] special construction may be used to negate the interpretation of the operator's answer as follows:

If the operator chooses YES:

1. The test result is FAIL.
2. The value of MEM1 is set to -1.

If the operator chooses NO:

1. The test result is PASS.
2. The value of MEM1 is set to 1.

Example:

The following example shows a case where the question to the operator is formulated as a negative, and the [N] construction is used to invert the normal interpretation of the response to achieve the desired test result.

```
1.011  HEAD        {DISPLAY PIXELS}
1.012  MESS        Press and hold the ON button. The
1.012  MESS        UUT displays a uniform pixel
1.012  MESS        pattern. Visually check the pixel
1.012  MESS        pattern for missing pixels. When
1.012  MESS        done, release the ON button and the
1.012  MESS        UUT will start normal operation.
1.012  MESS
1.013  EVAL   Are there any missing pixels? [N]
```

If the operator answer YES to the question "Are there any missing pixels?", the test result is FAIL and MEM1 is set to -1. If the operator answers NO, the result is PASS and MEM1 is set to 1.

In an expression-based EVAL, if the EVAL *result text* does not contain an [N] special construction the numeric result is interpreted as follows:

If the result is not zero:

1. The test result is PASS.
2. The value of MEM1 is set to 1.

If the result is zero:

1. The test result is FAIL.
2. The value of MEM1 is set to -1.

Example:

The following example bases the evaluation result on the numeric value in register M[5].If the value of M[5] is non-zero, the result is PASS. If the value of M[5] is zero, the result is FAIL.

```
1.001  EVAL   -e M[5] : Evaluation based on M[5].
```

In an expression-based EVAL, the [N] special construction may be used to negate the interpretation of the numeric result as follows:

If the result is not zero:

1. The test result is FAIL.
2. The value of MEM1 is set to -1.

If the result is zero:

1. The test result is PASS.
2. The value of MEM1 is set to 1.

The EVAL FSC cannot occur in an adjustment block. (Evaluation statements are not allowed in adjustment blocks.)

HEAD

Display Control FSC

Description

The HEAD FSC is used to display a one-line message during procedure execution. The message appears just below the procedure name in the main run time window, and remains displayed until it is subsequently overwritten, or until the procedure terminates. A HEAD message is not an operator prompt -- no operator action is required in response to a HEAD message.

Format

HEAD *message*

Rules

- A maximum of 56 characters may be entered in a HEAD message.
- When a HEAD statement is executed, the HEAD message displayed by a previously executed HEAD statement, if any, is overwritten.
- A HEAD statement with a blank *message* causes the displayed HEAD message to be erased.
- The following special constructions may be used in a HEAD statement:

  1. [MEM], [MEM1], and [MEM2]
  2. [*integer*]
  3. [<D*integer*]
  4. [V*variable*]
  5. {*text*}
  6. [M1], [M2], ...
  7. [L1], [L2], …
  8. [S1], [S2], ...
  9. [SREG1], [SREG2], ...

  Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions 1 to 5.

  The constructions [M1], [M2], ..., access the global numeric registers. The constructions [L1], [L2], …, access the local numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC help for additional information on the numeric registers.

The constructions [S1], [S2], ..., access the string registers. Refer to the MATH FSC help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., are identical to [S1], [S2], ..., and are included only for compatibility with the IEEE, IEEE2, and SCPI FSCs.

Refer to "Special Constructions" in Chapter 1 of the MET/CAL Procedure Language Reference Manual for details.

Examples

```
STEP   FSC   RANGE NOMINAL TOLERANCE MOD1 MOD2   3   4   CON
1.001 HEAD        DC Voltage tests
5.001 HEAD        Test delay [D32767].
7.001 HEAD        Test {AC Voltage Tests}
9.001 HEAD         CH  [MEM] Attenuator Tests
```

Note

[] special constructions may be enclosed in {}, but will not be evaluated and stored in the results. For example, the following HEAD statements will cause "Ch[MEM] Tests" to be stored in the results, not "Ch1 Tests".

```
12.001 MATH        MEM = 1

12.002 HEAD        {Ch[MEM] Tests}
```

The RSLT FSC should be used to store text with embedded [] special constructions in the results as shown below:

```
12.001 MATH        MEM = 1

12.002 HEAD        Ch[MEM] Tests

12.003 RSLT        =Ch[MEM] Tests
```

HP60, HP63

Instrument FSC

Description

The HP60 and HP63 FSC's program the Hewlett-Packard 6060B and 6063B Electronic Loads, respectively, for constant current, constant voltage, and constant resistance modes of operation.

Functional Capability

FSC	Model	Current	Voltage	Resistance
HP60	6060B	0A to 60 A	3 V to 60 V	0.033 Ω to 10 kΩ
HP63	6063B	0A to 10 A	3 V to 240 V	0.20 Ω to 50 kΩ

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the reading that is expected from the measurement (or reset "*").

- Voltage entered as: [*numeric*][*prefix*]V
- Current entered as: [*numeric*][*prefix*]A
- * reset

Rules:

- The NOMINAL field may specify voltage only when the MOD1 field specifies Constant Current or Constant Resistance mode.
- The NOMINAL field may specify current only when the MOD1 field specifies Constant Voltage or Constant Resistance mode.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the operating mode of the device.

- Constant Current entered as: [*numeric*][*prefix*]A
- Constant Voltage entered as: [*numeric*][*prefix*]V
- Constant Resistance entered as: [*numeric*][*prefix*]Z

MOD2

This field is not used.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the UUT connection and is always 2-wire (2W). 2W is inserted automatically in the CON field when no CON field code is entered.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Example

```
  STEP    FSC     RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON
# ----- Reset -----
  1.001   HP60        *                                                      S
# ----- Voltage verification (UUT in CV mode, 6060B in CC mode) -----
# ------- no load -------
  1.002   HP60        3V               0.23U         0A                         2W
  2.001   HP60        30V              0.34U         0A                         2W
  3.001   HP60        58V              0.45U         0A                         2W
# ------- sink current (load regulation) -------
  4.001   HP60        3V               0.23U         1A                         2W
  5.001   HP60        30V              0.34U         1A                         2W
  6.001   HP60        58V              0.45U         1A                         2W
# ----- Current verification (UUT in CC mode, 6060B in CV mode) -----
# ------- short -------
  7.001   HP60        0.2A             0.85U         3V                         2W
  8.001   HP60        1A               1.5U          3V                         2W
  9.001   HP60        1.8A             0.45U         3V                         2W
# ------- regulated shunt -------
 10.001   HP60        0.2A             0.85U         10V                        2W
 11.001   HP60        1A               1.5U          10V                        2W
 12.001   HP60        1.8A             0.45U         10V
```

IEEE

Interface Control FSC

Description

The IEEE FSC is used to control IEEE-488 instruments. Both UUTs and system calibration instruments may be controlled. The IEEE FSC may be used to control system calibration instruments which are not directly supported by MET/CAL. It may also be used to control supported instruments in cases where the built-in MET/CAL driver does not provide the required function.

Format

IEEE *message*

Rules

- An IEEE statement may include multiple lines.
- A maximum of 56 characters is allowed in a single IEEE *message*.
- A MET/CAL system may include 0, 1, or 2 IEEE-488 interfaces. In a system with two IEEE-488 interfaces, board 0 is reserved for system calibration instruments, and board 1 is reserved for the UUT.

  In a system with one IEEE-488 interface, board 0 is used for both system calibration instruments and the UUT.
- Leading and trailing blanks in a *message* are ignored.
- When an IEEE statement is executed, characters in the *message* which are not part of a special construction (enclosed by square brackets) are written to the currently addressed device on the IEEE-488 bus.
- The following special constructions may be used in an IEEE statement:

[@*address***]**	select *address* as current address
[D*delay***]**	delay execution for *delay* milliseconds
[EOI ON|OFF]	enable/disable assertion of EOI on a write
[GTL]	puts an instrument into local control state
[IFC *port***]**	causes an Interface Clear on specified port
[I]	read number from current address, store in MEM
[I$]	read string from current address, store in MEM2

[I > *filename***]** — read from current address, write to file

[I >> *filename***]** — read from current address, append to file

[I!] — read from current address, discard data

[LLO] — disable instrument front panel controls

[MEM] — write value of register MEM to current address

[MEM1] — write value of register MEM1 to current address

[MEM2] — write contents of register MEM2 to current address

[*number***]** — write number (ASCII) to current address

[O < *filename***]** — read from file, write to current address

[REN] — sets the Remote Enable line on the IEEE-488 bus

[SDC] — sends a Selected Device Clear to current address

[S*inter-byte delay***]** — sets delay between transmitted characters

[SPL*mask***]** — serial polls current address

[SRQ *delay,mask***]** — wait for IEEE Service Request

[SRQ ON|OFF] — enable/disable UUT Service Request processing

[TERM *number***]** — sets terminator character to *number* (ASCII)

[TERM '*c***']** — sets terminator character to *c*

[TERM CR] — sets terminator character to Carriage Return

[TERM LF] — sets terminator character to Line Feed

[TERM NONE] — indicates there is no terminator character

[TERM OFF] — indicates there is no terminator character

[T*number***]** — sets bus timeout to *numeric* milliseconds

[TRIG] — triggers instrument at current address

[V *variable***]** — write value of *variable* to current address

{*text***}** — send braced *text* to result file as well

[M*nreg***]** — write value of global numeric register to current address

[L*nreg***]** — write value of local numeric register to current address

[SREG*sreg***]** — write value of string register to current address

Constructions **[D***delay***]**, **[MEM]**, **[MEM1]**, **[MEM2]**, **[***number***]**, **[V***variable***]**, and **{***text***}** are used by a number of FSCs and are described in "Special Constructions" in Chapter 1 of this manual. Except for **[M***nreg***]**, **[L***nreg***]**, and **[SREG***sreg***]**, the rest of the constructions in the list above are either specific to the IEEE FSC, or are used only by IEEE, IEEE2, SCPI, and PORT. Detailed descriptions of these constructions, including **[M***nreg***]**, **[L***nreg***]**, and **[SREG***sreg***]**, are provided in the sections below.

IEEE-488 Bus Addresses

- A special IEEE construct is used to identify the IEEE-488 bus address of the instrument to receive the IEEE command; actual IEEE-488 addresses can be used or symbolic IEEE-488 addresses. IEEE-488 bus addresses are specified as follows:

  [@*primary address:secondary address***]**

  1. If only a *primary address* is specified, secondary addressing will not be used.
  2. If IEEE-488 port 1 is used, add 100 to the instrument address. For example, if the instrument address is 1 and the instrument is connected to IEEE port 1, it is addressed in the IEEE FSC as [@101].
  3. Addresses 0 and 100 cannot be used.
  4. There is no preset default for IEEE addresses. Once an address is specified, it becomes the default address until another address is assigned.
  5. A procedure line can specify a change of address within a single IEEE FSC message line.
  6. If no default address is established in the first IEEE FSC which requires sending out a command string to an instrument or obtain a reading from an instrument, one of two things can happen:

     a. If a second IEEE-488 port is available, MET/CAL software will attempt to find the address automatically.

     b. The operator will be prompted for the IEEE-488 bus default address to be used.

Note

If a UUT with a remote IEEE-488 interface is connected with an IEEE-488 port of the calibration system, you have to make sure that its address does NOT conflict with any of the addresses used by the calibration instruments in the system.

Where possible you should have all your calibration instruments on one IEEE-488 port and leave the other solely for the use by a UUT, so address conflicts never occur.

Refer to the instructions in the Configuration Manual for information on IEEE-488 addresses used. Generally IEEE-488 address 10 is left unused by calibration instruments.

7. Under the following conditions, the MET/CAL software will automatically find the IEEE-488 address of a UUT:

   a. The IEEE-488 address was not specified in a previous IEEE FSC.

   b. The searching is done on an IEEE FSC that would normally prompt for the UUT address.

   c. The UUT is by itself on port 1 (the secondary port).

   The first device found on the second port is assumed to be the UUT. Searching starts at IEEE-488 address 1 and ends at address 30.

   Note

   Address 0 cannot be searched since this address is reserved for the IEEE-488 card of the Instrument Controller.

- Symbolic bus addresses are shown as [@*alias*]. Symbolic names enhance readability of the procedure.

IEEE-488 Bus Input Commands

- The following special constructs are available which perform an input from the specified address.

[I]

The special construct [I] performs an input from the current address. Data strings returned by a remotely controlled instrument normally contain just a numeric value. In a few cases units are also sent. The non-numeric characters are deleted from the string.

The numeric value is stored as the contents of memory register MEM. The current contents of MEM are overwritten.

[I$]

The special construct [I$] performs an input from the current address. The input is an alphanumeric string, and it is stored in memory register MEM2, overwriting the current contents of that memory register. The MEM2 register is 4096 characters long.

[I > *filename***]**

This special construct stores the returned information in a file with the name *filename*. Any existing file is overwritten. This construct should be used, if the returned string is expected to be longer than 4096 characters. The DOS FSC is used to call a program, which processes the string and returns relevant information in the MET/CAL memory registers.

[I >> *filename***]**

This special construct appends the returned information to a file with the name *filename*. If the file does not exist, then it will be created. This construct should be used, if the returned string is expected to be longer than 4096 characters. The DOS FSC is used to call a program which processes the string and returns relevant information in the MET/CAL memory registers.

[I$]

This construction is the same as [I$], except that the data message read from the instrument is not stored in MEM2, or any other MET/CAL register. [I!] is appropriate only when it is necessary to read and discard a data message.

- The TERM special construction is used to define the terminator character for IEEE-488 messages sent by an instrument to the controller. This construct does not affect messages written by the controller to an instrument.

  The specified terminator remains in effect for the duration of the procedure, unless it is explicitly changed under procedure control. The terminator applies to all subsequent IEEE, IEEE2, and SCPI statements. For a system with two IEEE-488 boards, the terminator applies whether or not the device from which the data message is read is addressed using address alias.

  The practical consequence of this design is that if a procedure uses IEEE, IEEE2, or SCPI statements to communicate with two or more instruments, and if those instruments do not all share the same terminator, the procedure writer must directly set the appropriate terminator prior to reading data from each instrument.

  Valid TERM special constructs are:

[TERM *number***]**

number is a decimal integer between 0 and 255, but not 64.

[TERM '*c***']**

c is any printable character other than **@**. There must be exactly one character between the quotes, i.e. one cannot say: [TERM ' x '] and expect the blanks to be ignored. The case of the character between quotes IS case sensitive (in general special constructs are case insensitive).

[TERM CR]

Specifies that the terminator character is Carriage Return. This is equivalent to [TERM 13].

[TERM LF]

Specifies that the terminator character is Line Feed. This is equivalent to [TERM 10].

[TERM NONE]

Specifies that there is no terminator character. In this case the instrument must assert EOI to indicate the end of the message.

[TERM OFF]

Specifies that there is no terminator character. In this case the instrument must assert EOI to indicate the end of the message. This is just an alternate form for [TERM NONE].

IEEE-488 Bus Output Commands

- Alphanumeric characters, not part of a special construct will be sent to the addressed instrument. The strings are always terminated by an EOI (no CR or LF). Each line of a multiple line message will be terminated this way.
- Braces (**{** and **}**) or square brackets (**[** and **]**) can not be entered literally, since they are used to define special constructs for the IEEE FSC (see the following paragraph).
- The EOI special construct is used to disable or enable the assertion of EOI to terminate an IEEE-488 data message written by the controller to an IEEE-488 instrument using the IEEE FSC. The EOI special construct has no affect on data messages read by the controller from an IEEE-488 instrument. Allowed EOI special constructs are:

  [EOI ON] and **[EOI OFF]**

- The "Slow" special construction specifies the inter-byte delay between characters sent from the controller to the instrument when the IEEE FSC is used. The format is:

  [S*inter-byte delay***]**

  where *inter-byte delay* is an integer between 0 and 65536.

  The inter-byte delay is the number of milliseconds to delay between bytes when a data message consisting of 2 or more bytes is written to an IEEE-488 instrument by a MET/CAL IEEE statement.

  The default is 0. The delay, if a non-zero value is specified, affects only the current IEEE statement. It is reset to the default at the beginning of each new IEEE statement.

  Note

  There is no delay before the first byte, or after the last byte, of the data message. If such a delay is required, the procedure writer should use the [Ddelay] construct.

  This construct is used to be able to support older non-compatible IEEE-488 interfaces (e.g. DATA PROOF scanners).

- Output from a file directly to the instrument:

  Special construct is **[O <** *filename***]** (**O** for Output).

  The contents of the file *filename* is sent over the IEEE-488 bus.

- The following other special constructs may be used:

  [MEM], **[MEM1]**, and **[MEM2]**

  The contents of memory register MEM, MEM1 or MEM2 will be included in the IEEE command string.

  [*number***]**

  The character with the ASCII value of *number* will be included in the IEEE command string.

  Note

  The [number] construct should be used to output braces and brackets.

  [D*delay***]**

  The **[D***delay***]** special construct will cause a delay of the message line by *delay* milliseconds (*delay* is between 0 and 3600000).

In MET/CAL V6.00 and earlier, the maximum delay is 32767 ms. V6.01 or later is required for delays from 32768 to 3600000 ms.

{*text***}**

Text in braces in addition to being used in the IEEE command string, is copied literally into the results file (without numerical substitutions for [MEM] for example).

[V *variable name***]**

This construct evaluates to the value of the named variable. The variable must, at run time, be present in the MET/CAL variable file (default name **VARIABLE.DAT**).

Example: `IEEE [V DATE$]?`

[M*nreg***]**

The value of the specified global numeric register is included in the IEEE command string.

The constructions [M1], [M2], ... refer to the global numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

[L*nreg***]**

The value of the specified local numeric register is included in the IEEE command string.

The constructions [L1], [L2], … refer to the local numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

[SREG*sreg***]**

The contents of the specified string register are included in the IEEE command string.

The constructions [SREG1], [SREG2], ... refer to the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

Note

*Other FSCs, like DISP, EVAL, OPBR, HEAD, and others, support the [S*sreg*] special construction. [S*sreg*] is identical to [SREG*sreg*], but could not be used in the IEEE FSC, because [Sinter-byte delay] had already been used to specify an inter-byte delay.*

IEEE-488 Bus Timeout, SRQ and Serial Polls

- A number of special constructs are available to specify IEEE-488 bus timeouts, timeouts, wait for SRQs and perform a Serial Poll on the IEEE-488 bus. These constructs are unique to the IEEE FSC.

  [T*timeout*]

  This construct sets the timeout of the IEEE-488 bus to the specifiednumber of milliseconds. If the timeout is set to zero, there is no timeout. The specified timeout must be between 0 and 1000000 ms. The default timeout is 15 seconds. The timeout specification affects only the current IEEE FSC statement.

  The National Instruments device driver for IEEE-488 interfaces does not support all discrete timeout values (with millisecond resolution). The following table shows the actual timeout which corresponds to each possible specified timeout value:

Specified Timeout				Actual Timeout	
		0	ms	none	
		1	ms	1	ms
2	to	3	ms	3	ms
4	to	10	ms	10	ms
11	to	30	ms	30	ms
31	to	100	ms	100	ms
101	to	300	ms	300	ms
301	to	1000	ms	1	s
1001	to	3000	ms	3	s
3001	to	10000	ms	10	s
10001	to	30000	ms	30	s
30001	to	100000	ms	100	s
100001	to	300000	ms	300	s
300001	to	1000000	ms	1000	s

  [SRQ *timeout,mask***]**

  This construct causes the calibration system to wait for an IEEE Service Request from the device at the default IEEE-488 address (on either IEEE port if both are installed and configured). The *timeout* entry specifies the maximum time to wait in milliseconds (range 0 to 86,400,000). The *mask* expression is ANDed to the serial poll status byte and the result is stored in memory register MEM.

If 0 or no *timeout* is specified, there is no timeout.

The *mask* entry is optional. If no mask is specified, a mask of 255 decimal is assumed. The serial poll status byte is always ANDed with the mask and the result stored in memory register MEM.

This construct disables any other SRQ interrupts.

If *timeout* is exceeded, then the following error message will be displayed:

Timed out waiting for SRQ from device at address ##

where ## will be replaced by the current IEEE FSC default address.

After an SRQ is detected MET/CAL determines whether or not the SRQ was generated by the device at the current IEEE-488 default address.

Note that when the SRQ was generated by the expected device the serial poll done by MET/CAL to determine that fact will clear the RQS status bit. If the SRQ did not come from the default address, the error message "Unexpected SRQ from device at address ##" will be displayed and the program will present the Post Test Summary dialog, just as if the operator had pressed Terminate.

To specify a *mask* without a *timeout* the syntax is either:

[SRQ 0, *mask***]**or
[SRQ , *mask***]**

Procedure writers should be cautious when specifying an infinite timeout. If the waited-for SRQ does not occur, you may, in effect, lock up the application.

[SRQ ON] and **[SRQ OFF]**

This special SRQ related construct allows you to deal with a power up SRQ by a UUT, before an IEEE statement has been performed and the UUT address determined. Rules:

[SRQ ON] and **[SRQ OFF]** are illegal unless the system has two (2) IEEE-488 ports or is in Demo Mode. These constructs do not work if the UUT and the calibration instruments share the same IEEE-488 port.

The current UUT address must not be a port 0 address. Example:

```
IEEE     abc
IEEE     [SRQ OFF]
IEEE     [@24] xyz
IEEE     [SRQ ON]
IEEE     [@115] def
```

generates a run time error when the fourth IEEE statement is executed. At that time when the [SRQ ON] statement is evaluated, the current UUT address is 24. The solution may be to specify [@115] before the [SRQ ON] and then write "def".

an automatic search and/or prompt for the UUT address. [SRQ OFF] does not have this effect.

[SPL *mask*]

This special construct does a Serial Poll on the most recently addressed instrument. The *integer* expression is a mask, which is ANDed to the serial poll status byte and the result is stored in memory register MEM. In addition:

The range of possible *mask* values is from 0 to 255.

If no mask numeric is specified, then a mask of 255 decimal is assumed. The serial poll status byte is always ANDed with the mask and the result stored in memory register MEM.

The SPL instruction may or may not clear the RQS bit. This is UUT dependent.

IEEE-488 Bus SDC, REN, GTL, LLO, TRIG and IFC Commands

- The following additional IEEE-488 bus functions can be controlled through the special constructs in the IEEE FSC:

[SDC]

This construct sends a Selected device clear to the last instrument addressed with the IEEE FSC. It sends the bus commands UNL, UNT, MLA(address), SDC.

[REN]

This construct sets the Remote Enable line on the IEEE-488 bus. It sends the commands REN, UNL, UNT, MLA(address).

[GTL]

This construct will set an instrument into the local control state. Typically this means that front panel controls are activated. It sends the commands UNL, UNT, MLA(address), GTL.

[LLO]

This construct typically disables front panel controls and any "Return To Local" function button that may be on an instrument. It sends the commands REN, LLO.

[TRIG]

This construct addresses and then triggers an instrument. It sends out the commands UNL, UNT, MLA(address), GET.

[IFC *port number***]**

The IFC special construct causes an IEEE-488 Interface Clear on a specified IEEE-488 port. In MET/CAL only port 1 (the UUT port) can use IFC. The only legal option therefore is [IFC 1].

[O < *filename***]**

The contents of the specified file are included in the IEEE command string.

Miscellaneous

During procedure execution, the MET/CAL calibration software depends heavily on the configuration table and the information about the IEEE-488 boards in the STARTUP file needs to be absolutely correct, and does no error checking on this input. If the information is wrong, unexpected errors may occur or the system may hang. This is especially important in cases where SRQs may occur.

If you are experiencing problems of this type, check first the following values in the Startup file (refer to the information on the Startup file in the Configuration Manual for appropriate values):

ib_nport =
ib_type =
ib_dmachan =
ib_ioaddr =

Also check the IEEE-488 addresses in the configuration file to make sure they are correct.

When the calibration system is in the Demo Mode, no actual interactions on the IEEE bus will take place. The effect of the IEEE FSC in this mode is as follows:

- If an IEEE input is expected, the user will be prompted to enter the expected reading.
- The SRQ and SPL constructs are ignored.

Examples

STEP	FSC	RANGE	NOMINAL	TOLERANCE	MOD1	MOD2	3	4	CON
2.005	IEEE		[@124]VR1?[I][D500]?[I]						
3.004	IEEE		{[@1][MEM][MEM1][MEM2]}						
4.002	IEEE		{[@1][MEM][MEM1][MEM2]}						
5.007	IEEE		{[@1][127][D32767][T32767]}						
6.008	IEEE		[SRQ 32767]						
7.001	IEEE		[SPL 255]						
8.002	IEEE		[I][I$]						

IEEE2, SCPI

Interface Control FSCs

Description

The IEEE2 FSC is used to control instruments which are IEEE 488.2 compliant.

The SCPI FSC is used to control instruments which are SCPI (Standard Commands for Programmable Instruments) and IEEE 488.2 compliant.

The IEEE2 and SCPI FSCs provide "built-in" sequence control and error handling that is not automatically provided by the IEEE FSC. The SCPI FSC is identical to the IEEE2 FSC with the exception of improved error reporting made possible by the SCPI error query (SYSTem:ERRor?).

Sequence and error handling is facilitated by utilization of the IEEE 488.1 Service Request (SRQ) and IEEE 488.2 standardization of certain bits in the IEEE 488.1 status byte (STB), sometimes referred to as the "serial poll byte". Specifically the IEEE2 and SCPI FSCs use the IEEE 488.2 Event Status Bit (ESB) and Message Available bit (MAV) in the STB to determine when events have completed, if an error has occurred, and/or data is available. A detailed description of the IEEE 488 sequences generated by the IEEE2 and SCPI FSCs is described below.

Both UUTs and system calibration instruments may be controlled.

The IEEE2 and SCPI FSCs may be used to control system calibration instruments which are not directly supported by MET/CAL. It may also be used to control supported instruments in cases where the built-in MET/CAL driver does not provide the required function.

Format

IEEE2 *message*

SCPI *message*

Rules

- A maximum of 56 characters is allowed in a single IEEE2/SCPI *message*.
- Leading and trailing blanks in a *message* are ignored.
- A *message* is composed of one of more program messages separated by a semicolon.
- A program message is viewed by MET/CAL as either a command or a query.

- A program message is query if a question mark “?” occurs anywhere is the program message.
- A query causes the instrument to put a response in its output buffer, a command does not.

Note

*The IEEE 488.2 Trigger Command ("*TRG") performs the same function as the IEEE 488.1 Group Execute Trigger command (GET).*

IEEE 488.1 GET causes all listening devices to perform a pre-defined action.

Therefore it is entirely possible that an instrument will perform an action that includes a query when it receives *TRG. However since *TRG does not contain a question mark MET/CAL will handle *TRG as a command, not as a query and a query error or bus timeout will occur.

If *TRG generates a response, you must do one of the following:

1. Use an alternate command sequence to trigger the response.

   1.001 SCPI   INIT;:FETCH?[I$]

2. Use the Group Execute Trigger special construction [TRIG] to trigger the response.

   1.001 SCPI   [GET][I$]

3. Use the IEEE FSC in lieu of the IEEE2 or SCPI FSCs.

   1.001 IEEE   *TRG[I$]

- The order of program messages must uphold the syntax and semantic rules of IEEE 488.2 (and SCPI for the SCPI FSC).
- The order of program messages must uphold and any device dependent rules imposed by the instrument.
- A command must not follow a query without first executing an input special construction ([I], [I!], or [I$]).

  Correct

  1.001 SCPI   *RST;*IDN?[I$]

  or

  1.001 SCPI   *IDN?[I$]*RST

  Incorrect (This sequence will cause a query error.)

  1.001 SCPI   *IDN?;*RST[I$]

- SCPI FSC only: At most one query may follow one or more commands prior to an input special construction ([I], [I!], or [I$]).

  Allowed

  1.001 SCPI VOLT:DC:RANG:AUTO ON;:VOLT:DC:RANG?[I$]

  or

  1.001 SCPI VOLT:DC:RANG:AUTO ON

  1.002 SCPI VOLT:DC:RANG?;RANG:AUTO?[I$]

  Not Allowed

  1.001 SCPI VOLT:DC:RANG:AUTO
  ON;:VOLT:DC:RANG?;RANG:AUTO?[I$]

- The following special constructions may be used in an IEEE2/SCPI statement as part, or all of a command or query. When the special construction is evaluated the result becomes part of the current IEEE 488.2 or SCPI command or query being assembled.

[MEM]	add value of register MEM
[MEM1]	add value of register MEM1
[MEM2]	add value of register MEM2
[M*nreg*]	add value of numeric register
[L*nreg*]	add value of local numeric register
[*number*]	add number (ASCII)
[SREG*nreg*]	add value of string register to command or query
[V *variable*]	add value of variable

- The following special constructions may be used in an IEEE2/SCPI statement. To perform the operation described. When any of these special constructions is encountered, any pending command or query being assembled is first sent to the instrument before the special construction is executed.

[@ *address*]	select *address* as current address
[SDC]	sends a Selected Device Clear to current address
[S *inter-byte delay*]	sets delay between transmitted characters
[D *delay*]	delay execution for *delay* milliseconds
[GTL]	puts an instrument into local control state
[IFC *port*]	causes an Interface Clear on specified port

[I]	read number from current address, store in MEM
[I!]	read from current address, discard data
[I$]	read string from current address, store in MEM2
[I > *filename*]	read from current address, write to file
[I >> *filename*]	read from current address, append to file
[LLO]	disable instrument front panel controls
[O < *file*]	read from file, write to current address
[REN]	sets the Remote Enable line on the IEEE 488 bus
[T *number*]	sets bus timeout to *number* milliseconds
[TRIG]	triggers instrument at current address

- The following special constructions which may be used in an IEEE statement, are not allowed in an IEEE2 or scpi statement:

[EOI ON|OFF]	enable/disable assertion of EOI on a write
[SPL *mask*]	serial polls current address
[SRQ *timeout*, *mask*]	wait for IEEE 488 Service Request
[SRQ ON|OFF]	enable/disable UUT Service Request processing
[TERM *number*]	sets terminator character to number (ASCII)
[TERM '*c*']	sets terminator character to *c* (character)
[TERM CR]	sets terminator character to Carriage Return
[TERM LF]	sets terminator character to Line Feed
[TERM NONE]	indicates there is no terminator character
[TERM OFF]	indicates there is no terminator character

- Curly braces.

{*text*}	send braced text to result file as well

Note

Special constructions should not be enclosed in { }. If a special construction [ ] is enclosed in { }, the unevaluated special construction will written directly to the results.

Example:

1.001 MATH M[1] = 2

1.002 SCPI {INP[M2]:SLOPE NEG}

The IEEE 488 bus command will be "INP2:SLOPE NEG", however the string written to the results will be "INP2[M2]:SLOPE NEG".

See IEEE FSC for a detailed description of special constructions.

Message Processing

Each *message* is processed from left to right. A string of characters is assembled either directly from the characters in the message or evaluated special constructions until one of the command or query terminating special constructions is encountered or the end of the statement is reached. The assembled string of characters is then divided into individual program messages. A program message is one or more characters separated by a semicolon as described in the IEEE 488.2 standard.

Each program message is evaluated to determine if it is a command or a query. A query is any program message that contains a question mark "?". All other program messages are assumed to be commands. Sequential commands and sequential queries are then re-assembled in to a separate command string and query string. Command strings and query strings are then sent to the instrument in separate End-Or-Identify (EOI) terminated write operations. The following examples show how the resulting command and query strings are executed by the IEEE2 and SCPI FSCs.

Definitions

The following IEEE 488.2 mnemonics are used in the examples in the next section.

SRQ	Service Request
SRE	Service Request Enable register
STB	Status Byte
RQS	bit 6 - Request Service
ESB	bit 5 - Event Status Bit
MAV	bit 4 - Message Available
ESE	Event Status Enable register
ESR	Event Status Register

CME	bit 5 - Command Error
EXE	bit 4 - Execution Error
DDE	bit 3 - Device Dependent Error
QYE	bit 2 - Query Error
OPC	bit 0 - Operation Complete

Examples

Simple Command (Fluke 55xxA and 57xxA Calibrators)

1.001 IEEE2 OUT 1V,1kHz;OPER

Processing:

1. Break message in to individual program messages.

   "OUT 1V,1kHz" "OPER"

2. Re-assemble individual command and query strings. In this case only commands are present.

   "OUT 1V,1kHz;OPER"

3. Assemble string to send to the instrument.

   "*CLS;*SRE 96;*ESE 61;OUT 1V,1kHz;OPER;*OPC"

   *CLS clears status registers and output buffer (see IEEE 488.2).

   *SRE 96 sets the SRE to RQS (64) and ESB (32).

   *ESE 61 sets the ESE to CME (32), EXE (16), DDE (8), QYE (4), and OPC

   *OPC sets OPC when all pending operations are complete.

4. Wait for an SRQ. The Fluke 55xxA and 57xxA calibrators will set OPC and assert a SRQ when their output is settled. If an SRQ does not occur within 15 seconds (default), display an error message.

5. If an SRQ occurred, serial poll the instrument to which the command was sent to determine if it was the one requesting service.

6. If the instrument was the device that asserted the SRQ check to see if the ESB is set in the STB. If not, display an error.

7. If ESB is set in the STB, send *ESR? to read the ESR.

8. If any of CME, EXE, DDE, or QYE is set, an error has occurred. If this is the IEEE2 FSC, display an appropriate error message. If this is the SCPI FSC, send SYST:ERR? and display the returned message until the instrument returns "0,"No error"".
9. If no error bits are set in the ESR, check to see if the OPC bit is set.
10. If OPC is not set display an error.
11. If OPC is set, proceed with execution of the next procedure statement.

Simple Query (IEEE 488.2 Identification Query)

1.001 IEEE2 *IDN?[I$]

or

1.001 SCPI *IDN?[I$]

Processing:

1. Break message in to individual program messages:

   "*IDN?"

2. Re-assemble individual command and query strings:

   "*IDN?"

3. Assemble string to send to the instrument:

   "*CLS;*SRE 112;*ESE 60;*IDN?"

   *CLS clears status registers and output buffer (see IEEE 488.2).

   *SRE 112 sets the SRE to RQS (64), ESB (32), and MAV (16).

   *ESE 60 sets the ESE to CME (32), EXE (16), DDE (8), and QYE (4).

4. Wait for an SRQ. If an SRQ does not occur within 15 seconds (default), display an error message.
5. If an SRQ occurred, serial poll the instrument to which the command was sent to determine if it was the one requesting service.
6. If the instrument was the device that asserted the check to see if the MAV is set in the STB.
7. If MAV is set in the STB, read contents of the output buffer.
8. If ESB is set in the STB, send *ESR? to read the ESR.

9. If any of CME, EXE, DDE, or QYE is set, an error has occurred. If this is the IEEE2 FSC, display an appropriate error message. If this is the SCPI FSC, send SYST:ERR? and display the returned message until the instrument returns "0,"No error"".
10. If the MAV bit is set in the STB, store the string read from the device in step 7 to memory register MEM2.If MAV is not set display an error.
11. Execute the [I$] special construction. If OPC is not set, display an error.
    a. If MAV is to read the STB, copy the string read from the device in step 7 to memory register MEM2.
    b. If MAV is not set, display an errorresponse.

Command and Query (IEEE 488.2 Reset and Self-Test Query)

1.001 MATH MEM = 1

1.002 IEEE2 *RST;*TST?[I]

1.003 EVAL -e MEM == 0 : Self Test

or

1.001 MATH MEM = 1

1.002 SCPI *RST;*TST?[I]

1.003 EVAL -e MEM == 0 : Self Test

Processing

1. Break message in to individual program messages.

   "*RST" "*TST?"
2. Re-assemble individual command and query strings. commands are present.

   "*RST" "*TST?"
3. Assemble string to send to the instrument (see "Simple Command" above).

   "*CLS;*SRE 96;*ESE 61;*RST;*OPC"
4. Wait for an SRQ. If an SRQ does not occur within 15 seconds (default), display an error message.
5. If an SRQ occurred, serial poll the instrument to which the command was sent to determine if it was the one requesting service.
6. If the instrument was the device that asserted the SRQ check to see if the ESB is set in the STB. If not, display an error.

7. If ESB is set in the STB, send *ESR? to read the ESR.
8. If any of CME, EXE, DDE, or QYE is set, an error has occurred. If this is the IEEE2 FSC, display an appropriate error message. If this is the SCPI FSC, send SYST:ERR? and display the returned message until the instrument returns "0,"No error"".
9. If no error bits are set in the ESR, check to see if the OPC bit is set.
10. If OPC is not set display an error.
11. If OPC is set, proceed with execution of the query.
12. Assemble string to send to the instrument (See "Simple Query" above):

    "*CLS;*SRE 112;*ESE 60;*TST?"
13. Wait for an SRQ. If an SRQ does not occur within 15 seconds (default), display an error message.
14. If an SRQ occurred, serial poll the instrument to which the command was sent to determine if it was the one requesting service.
15. If MAV is set in the STB, read the contents of the output buffer. If the instrument was the device that asserted the SRQ check to see if the ESB is set in the STB.
16. If ESB is set in the STB, send *ESR? to read the ESR.
17. If any of CME, EXE, DDE, or QYE is set, an error has occurred. If this is the IEEE2 FSC, display an appropriate error message. If this is the SCPI FSC, send SYST:ERR? and display the returned message until the instrument returns "0,"No error"".
18. If the MAV bit is set in the STB, store the string read from the device in step 7 to memory register MEM2.
19. If MAV is not set, display an error. Execute the [I] special construction.
    a. If MAV is set in the STB, search the string read from the device in step 15 for the first occurrence of a NR1, NR2, or NR3 number. Convert the NRx numeric string to a floating number and store in memory register MEM.
    b. If MAV is not set, display an error.

Considerations

In this example if self test fails, an Execution Error (EXE) or Device Dependent Error (DDE) will occur which results in an SRQ. The SRQ will cause an error message to be displayed as described in step 17 above. However the SRQ will also terminate execution of the statement and the input special construction [I] will not be executed and MEM will not be updated. This is why MEM is set to 1 prior to the IEEE2 or SCPI FSC. Therefore if the operator selects Advance in the post test dialog displayed after the error messages are displayed, the EVAL statement generates a FAIL result. If self test passes, the instrument returns a 0 and the EVAL statement generates a PASS result.

IF, ELSE, ELSEIF, ENDIF

Procedure Control FSCs

Description

The IF, ELSE, ELSEIF, and ENDIF FSCs are used to specify conditional execution of procedure sections.

These FSCs may be used to improve procedure readability and procedure maintainability.

Format

IF [*expression*]

ELSE [*comment*]

ELSEIF [*expression*]

ENDIF [*comment*]

Rules

- The expression in an IF or ELSEIF statement may be any valid math expression, as defined by the MATH FSC. Note that the expression cannot be an assignment. That is, IF and ELSEIF cannot be used to change the value of a register. The rule is that anything valid on the right-hand side of an assignment in a MATH statement is also valid as a expression (space permitting).
- An IF statement must always be paired with a following ELSE, ELSEIF, or ENDIF statement.
- An ELSE statement must always be paired with a following ENDIF statement.
- An ELSEIF statement must always be paired with a following ELSE or ENDIF statement.
- When an IF statement executes, if the expression evaluates to a non-zero value, control transfers to the following statement. If the expression evaluates to zero, control transfers to the associated ELSE, ELSEIF, or ENDIF statement.

- When an ELSE statement executes, control transfers to the following statement if the preceding associated IF or ELSEIF statement expression evaluated to zero. Otherwise, control transfers to the associated ENDIF statement.
- When an ELSEIF statement executes, if the preceding associated IF or ELSEIF statement expression evaluated to a non-zero value, control transfers immediately to the following associated ELSEIF or ENDIF statement. Otherwise, if the ELSEIF expression evaluates to a non-zero value, control transfers to the following statement. Otherwise, control transfers to the following associated ELSEIF or ENDIF statement.
- ELSE and ENDIF statements may be followed by optional comments on the same line. The comment must be preceded by a valid comment symbol ('#' or ';').
- The expression in a IF or ELSEIF statement is evaluated as a numeric expression. If the specified expression produces a string value, the string is converted to numeric form for purposes of the IF or ELSEIF statement. In general, this is not recommended, because it usually makes the procedure less readable.
- Proper program structure should be maintained. Jumping directly into or out of an IF ... ELSEIF ... ELSE ... ENDIF procedure block is not recommended. (It is not illegal to do so, however. If a procedures jumps into such a block, execution continues as if the preceding part of the block were not present.)

Example

Example 1:

```
1.001  MEMI        Enter an integer:
1.002  IF          (MEM > 5)
1.003  DISP        [MEM] is greater than 5
1.004  ELSE
1.005  DISP        [MEM] is less than or equal to 5
1.006  ENDIF
```

The first DISP statement (1.003) will be executed if an integer greater than 5 is entered.

The second DISP statement (1.005) will be executed if an integer less than or equal to 5 is entered.

Example 2:

```
1.001  MEMI          Enter an integer:
1.002  IF            (MEM == 1)
1.003  DISP          value is 1
1.004  ELSEIF        (MEM == 2)
1.005  DISP          value is 2
1.006  ELSEIF        (MEM == 3)
1.007  DISP          value is 3
1.008  ELSEIF        (MEM > 3)
1.009  DISP          value is greater than 3
1.010  ELSE
1.011  DISP          value is less than 1
1.012  ENDIF
```

JMP

Procedure Control FSC

Description

The JMP FSC is used to perform unconditional jumps in a MET/CAL procedure, or to perform conditional jumps based on the PASS/FAIL status of the most recent evaluation step.

For a conditional jump, the most recent evaluation may be an instrument evaluation, MEMC, EVAL, PICE, or DOSE statement.

Format

JMP *step number condition* where *condition* is one of:

- *blank*
- PASS
- FAIL

Rules

- If *condition* is *blank* the specified step is unconditionally executed next.

  Example:

  ```
  1.001 JMP       1.003
  1.002 DISP      This statement won't be executed.
  1.003 DISP      This statement will be executed.
  ```

  When statement 1.001 is executed, an unconditional jump to 1.003 occurs. 1.002 will not be executed.

- If *condition* is **PASS**, the specified step is executed next if the result of the most recent evaluation was PASS. If the result of the most recent evaluation was **FAIL**, execution continues with the procedure statement immediately following the JMP statement.

Example:

```
1.001 EVAL      YES or NO
2.001 JMP       2.004 PASS
2.002 DISP      Operator selected NO
2.003 JMP       2.005
2.004 DISP      Operator selected YES
2.005 END
```

In this example the first statement is an operator evaluation (EVAL statement).

If the operator chooses YES, the evaluation is a PASS. When statement 2.001 is executed, a jump to DISP statement 2.004 occurs, and a message is displayed indicating that the operator selected YES.

If the operator chooses NO, the evaluation is a FAIL. When statement 2.001 is executed, no jump occurs. Execution continues with 2.002 which displays a message indicating that that the operator selected NO. 2.003 is executed next, which causes an unconditional jump to the END statement.

- If *condition* is **FAIL**, the specified step is executed next if the result of the most recent evaluation was FAIL. If the result of the most recent evaluation was PASS, execution continues with the procedure statement immediately following the JMP statement.

Example:

```
1.001 EVAL      YES or NO
2.001 JMP       2.004 FAIL
2.002 DISP      Operator selected YES
2.003 JMP       2.005
2.004 DISP      Operator selected NO
2.005 END
```

In this example the first statement is an operator evaluation (EVAL statement).

If the operator chooses YES, the evaluation is a PASS. When statement 2.001 is executed, no jump occurs. Execution continues with 2.002 which displays a message indicating that the operator selected YES. 2.003 is executed next, which causes an unconditional jump to the END statement.

If the operator chooses NO, the evaluation is a FAIL. When statement 2.001 is executed, a jump to DISP statement 2.004 occurs, and a message is displayed indicating that the operator selected NO.

- If a conditional JMP statement is executed, and no preceding evaluations have been performed, the JMP statement is executed as if the most recent evaluation resulted in a PASS.

- If the jump destination (*step number*) is omitted from a JMP statement, the destination defaults to the end of the procedure. This terminates execution of the active procedure.
- Jump destination step numbers must be between 1.001 and 999.999.
- If the minor step number is omitted, the procedure compiler automatically inserts .001 as the minor step number.

JMPF

Procedure Control FSC

Description

The JMPF FSC is used to perform a conditional jump based on the value of MEM1 or based on the selected procedure name.

The selected procedure name is the name under which the currently executing procedure is running. If the executing procedure is the main procedure, the selected name is the name which was chosen in the procedure selection dialog. If the currently executing procedure is a subprocedure, the selected name is the name by which the subprocedure was called.

Format

JMPF [*step number*] [*procedure name*]

where *procedure name* may be blank or may specify a MET/CAL procedure name.

Rules

- If *procedure name* is blank, JMPF jumps if the value of MEM1 is less than zero. If the value of MEM1 is greater than or equal to zero, execution continues with the statement immediately following the JMPF statement.

  Example:

  ```
  1.001 OPBR      YES or NO
  1.002 JMPF      1.005
  1.003 DISP      Operator selected YES
  1.004 JMP       1.006
  1.005 DISP      Operator selected NO
  1.006 END
  ```

  When an operator branch (OPBR) statement is executed, MEM1 is set to 1 if the operator answers YES, and is set to -1 if the operator answers NO.

  In the example above, if the operator selects YES, MEM1 is set to 1. The JMPF statement therefore does not jump to 1.005. Instead, execution continues with the statement which immediately follows the JMPF statement. This is 1.003, a DISP statement which displays a message indicating that the operator selected YES. Next, when 1.004 is executed, the procedure jumps unconditionally to 1.006.

If the operator selects NO, MEM1 is set to -1. Since MEM1 is less than zero, the JMPF statement (1.002) causes a JUMP to 1.005 to occur. 1.005 is a DISP statement which displays a message indicating that the operator selected NO.

- If *procedure name* is not blank, JMPF jumps if the name of the active procedure does not match the name specified in the JMPF statement. If the selected procedure name matches the name specified in the JMPF statement, execution continues with the statement immediately following the JMPF statement.

  Example:

  Suppose the main procedure contains the following Call statement:

```
CALLSub A
```

Suppose the called subprocedure contains:

```
INSTRUMENT:     Sub A
INSTRUMENT:     Sub B
1.001 JMPF      1.004   Sub B
1.002 DISP      Selected Procedure Name is "Sub B"
1.003 JMP       1.005
1.004 DISP      Selected Procedure Name is not "Sub B".
1.005 END
```

The subprocedure has two names: "Sub A" and "Sub B". When the "CALL Sub A" statement is executed in the main procedure, subprocedure execution begins with "Sub A" as the selected name.

When the JMPF statement executes, the name of the selected procedure name ("Sub A") is compared to the procedure name specified in the JMPF statement ("Sub B"). Since the names do not match, a jump to 1.004 occurs. 1.004 is a DISP statement which displays a message indicating that the selected procedure name is not "Sub B".

If the main procedure had called the subprocedure using the name "Sub B" instead of "Sub A", the selected name would have matched the name in the JMPF statement, and the jump to 1.004 would not have occurred.

The mechanism illustrated in this example may be useful when a single procedure is used for a family of closely related UUTs. For example, a single procedure could be written for the Fluke 73, 75, and 77 DMMs. The procedure could be given 3 names, one for each model number. The JMPF (and JMPT) FSCs can then be used to do conditional jumps based on the model number.

If a jump destination (*step number*) is not specified, a jump to the end of the active procedure occurs. This terminates execution of the active procedure.

- Jump destination step numbers must be between 1.001 and 999.999.

- If the minor step number is omitted, the procedure compiler automatically inserts .001 as the minor step number.
- The procedure name field in a JMPF statement is limited to 41 characters. If a JMPF statement specifies a 41-character procedure name, and the name of the active procedure is longer than 41 characters, MET/CAL considers the names to be the same if the first 41 characters of the active procedure name match the name specified in the JMPF statement.

  Example:

```
INSTRUMENT:     This procedure name contains more than 41 characters.
STEP    FSC     RANGE   NOMINAL     TOLERANCE   MOD1    MOD2    3   3   CON
1.001   JMPF            1.004       This procedure name contains more than 41
1.002   DISP            Names match.
1.003   JMP             1.005
1.004   DISP            Names do not match.
```

  When the JMPF statement is executed, the name specified in the JMPF statement matches the name of the procedure, even though the full procedure name does not fit in the JMPF statement. Since the names match, the jump to 1.004 does not occur. 1.002 DISP is therefore executed, which displays a message indicating that the test names match.

JMPL

Procedure Control FSC

Description

The JMPL FSC is used to perform conditional jumps in a MET/CAL procedure.

Each JMPL statement specifies a jump destination label and an optional MATH expression. If there is an expression, and it evaluates to a non-zero value, a jump to the specified label is done when the JMPL statement executes. If there is an expression and it evaluates to zero, procedure execution continues with the statement following the JMPL statement. If there's no expression, an unconditional jump to the specified label is done when the JMPL statement executes.

JMPL must be used in conjunction with the LABEL FSC. Only the LABEL FSC can specify the JMPL destination.

JMPL has two advantages over other MET/CAL jump-type FSCs:

1. The jump destination is specified as a label rather than a step number. This means that when the procedure compiler compiles the procedure, the literal jump destination doesn't change, as it may with JMP, JMPF, JMPT, and JMPZ. This may assist procedure writing and procedure readability.
2. The expression which defines the jump condition may be any MATH expression. This may improve readability and flexibility in specifying the jump condition.

Format

JMPL *label* [*expression*]

Rules

- The label may contain any characters except blanks and nuls (zero).
- The label and the expression, taken together are limited to 56 characters. One or more spaces must separate the label from the expression.
- When the JMPL statement executes, the jump is done only if the expression evaluates to a non-zero value, or if there's no expression.
- The expression may be any valid math expression, as defined by the MATH FSC. Note that the expression in a JMPL statement cannot be an assignment. That is, JMPL cannot be used to change the value of a register. The rule is that

anything valid on the right-hand side of an assignment in a MATH statement is also valid as a JMPL expression (space permitting).

- Every JMPL statement must have exactly one jump destination. A procedure cannot be executable if the jump destination is missing, or if there are multiple jump destinations (that is, multiple LABEL statements which specify the same label).
- The expression in a JMPL statement is evaluated as a numeric expression. If the specified expression produces a string value, the string is converted to numeric form for purposes of the JMPL statement. In general, this is not recommended, because it usually makes the procedure less readable.

Examples

Example 1:

```
STEP  FSC   RANGE NOMINAL TOLERANCE MOD1 MOD2   3   4   CON
      JMPL        abc     m[4] < 12
      .
      .
      .
      LABEL       abc
```

In this example the procedure jumps to the LABEL statement if the value in the M[4] register is less than 12.

JMPT

Procedure Control FSC

Description

The JMPT FSC is used to perform a conditional jump based on the value of MEM1 or based on the selected procedure name.

The selected procedure name is the name under which the currently executing procedure is running. If the executing procedure is the main procedure, the selected name is the name which was chosen in the procedure selection dialog. If the currently executing procedure is a subprocedure, the selected name is the name by which the subprocedure was called.

Format

JMPT [*step number*] [*procedure name*] where *procedure name* may be blank or may specify a MET/CAL procedure name.

Rules

- If *procedure name* is blank, JMPT jumps if the value of MEM1 is greater than zero. If the value of MEM1 is less than or equal to zero, execution continues with the statement immediately following the JMPT statement.

  Example:

  ```
  1.001 OPBR      YES or NO
  1.002 JMPT      1.005
  1.003 DISP      Operator selected NO
  1.004 JMP       1.006
  1.005 DISP      Operator selected YES
  1.006 END
  ```

  When an operator branch (OPBR) statement is executed, MEM1 is set to 1 if the operator answers YES, and is set to -1 if the operator answers NO.

  If the operator selects YES, MEM1 is set to 1. Since MEM1 is greater than zero, the JMPT statement (1.002) causes a JUMP to 1.005 to occur. 1.005 is a DISP statement which displays a message indicating that the operator selected YES.

  If the operator selects NO, MEM1 is set to -1. Since MEM1 is less than or equal to zero, the JMPT statement does not jump to 1.005. Instead, execution continues with the statement which immediately follows the JMPT statement. This is 1.003, a DISP statement which displays a message indicating that the operator selected NO. Next, when 1.004 is executed, the procedure jumps unconditionally to 1.006.

- If *procedure name* is not blank, JMPT jumps if the name of the active procedure matches the name specified in the JMPT statement. If the selected procedure name does not match the name specified in the JMPT statement, execution continues with the statement immediately following the JMPT statement.

  Example:

  Suppose the main procedure contains the following CALL statement:

  ```
  CALL        Sub B
  ```

  Suppose the called subprocedure contains:

  ```
  INSTRUMENT:    Sub A
  INSTRUMENT:    Sub B
  1.001 JMPT     1.004   Sub B
  1.002 DISP     Selected Procedure Name is not "Sub B"
  1.003 JMP      1.005
  1.004 DISP     Selected Procedure Name is "Sub B".
  1.005 END
  ```

- The subprocedure has two names: "Sub A" and "Sub B". When the "CALL Sub B" statement is executed in the main procedure, subprocedure execution begins with "Sub B" as the selected name.

  When the JMPT statement executes, the name of the selected procedure name ("Sub B") is compared to the procedure name specified in the JMPT statement ("Sub B"). Since the names match, a jump to 1.004 occurs. 1.004 is a DISP statement which displays a message indicating that the selected procedure name is "Sub B".

  If the main procedure had called the subprocedure using the name "Sub A" instead of "Sub B", the selected name would not have matched the name in the JMPT statement, and the jump to 1.004 would not have occurred.

  The mechanism illustrated in this example may be useful when a single procedure is used for a family of closely related UUTs. For example, a single procedure could be written for the Fluke 73, 75, and 77 DMMs. The procedure could be given 3 names, one for each model number. The JMPT (and JMPF) FSCs can then be used to do conditional jumps based on the model number.

- If a jump destination (*step number*) is not specified, a jump to the end of the active procedure occurs. This terminates execution of the active procedure.
- Jump destination step numbers must be between 1.001 and 999.999.
- If the minor step number is omitted, the procedure compiler automatically inserts .001 as the minor step number.

- The procedure name field in a JMPT statement is limited to 41 characters. If a JMPT statement specifies a 41-character procedure name, and the name of the active procedure is longer than 41 characters, MET/CAL considers the names to be the same if the first 41 characters of the active procedure name match the name specified in the JMPT statement.

  Example:

  ```
  INSTRUMENT:    This procedure name contains more than 41 characters.
  1.001   JMPT   1.004      This procedure name contains more than 41
  1.002   DISP   Names do not match.
  1.003   JMP    1.005
  1.004   DISP   Names match.
  ```

  When the JMPT statement is executed, the name specified in the JMPT statement matches the name of the procedure, even though the full procedure name does not fit in the JMPT statement. Since the names match, the jump to 1.004 occurs. 1.004 DISP is therefore executed, which displays a message indicating that the names match.

JMPZ

Procedure Control FSC

Description

The JMPZ FSC is used to perform a conditional jump based on the value of MEM1. If the value of MEM1 is zero, JMPZ causes a jump to the specified jump destination (step number). An optional tolerance for the comparison may be specified.

Format

JMPZ *step number tolerance*

where *tolerance* may be blank, or may specify a numeric expression followed by the letter 'U'.

Rules

- If *tolerance* is blank, JMPZ jumps to the specified jump destination only if the value of MEM1 is exactly zero.
- If *tolerance* is not blank, JMPZ jumps to the specified destination if the value of MEM1 is within the specified tolerance of zero.

  Example:

  ```
  JMPZ    1.002   .0001U
  ```

  When this statement is executed, the jump to 1.002 will occur if the value of MEM1 is between -0.0001 and +0.0001.

  MEM1 is stored internally as a floating-point number. When a computer compares two floating-point numbers for exact equality, the comparison may be unreliable due to small round-off errors introduced in the process of performing calculations. Whether such round-off errors are present depends on the numbers, and the sequence of operations, involved. To eliminate the possibility of unexpected results using a JMPZ statement, procedure writers are advised to always specify a small tolerance.

- When a *tolerance* is specified, only the absolute value is significant.

  Example:

  ```
  JMPZ    1.002   +1E6
  JMPZ    1.002   -1E6
  ```

  The above two statements are equivalent. In both cases, the jump will be performed if the value of MEM1 is within $1E^6$ of zero.

The *tolerance,* if specified, may be a simple number or any numeric expression compatible with the MATH FSC. Refer to the on-line help for the MATH FSC for information about expression syntax. When the *tolerance* is specified as a numeric expression, the expression may not contain spaces. The length of the expression, not counting the trailing 'U', is limited to 41 characters.

Examples:

```
JMPZ 2.001 MEMU
```

In this example, the numeric expression is "MEM". The jump will be done if, at run time, the value of MEM1 is within +/-MEM of zero.

```
JMPZ 2.001 M[1]+.001U
```

In this example, the numeric expression is "M[1]+.001". The jump will be done if, at run time, the value of MEM is within +/-(M[1]+.001) of zero.

- The ability to specify *tolerance* as a numeric expression was added in MET/CAL V5.0. Prior to V5.0, the *tolerance* could be expressed only as a simple number.
- If a jump destination (*step number*) is not specified, a jump to the end of the procedure occurs. This terminates execution of the procedure.
- Jump destination step numbers must be between 1.001 and 999.999.
- If the minor step number is omitted, the procedure compiler automatically inserts .001 as the minor step number.

LABEL

Miscellanious FSC

Description

The LABEL FSC is used to specify a label which can serve as the jump destination for a JMPL statement.

Format

LABEL *label*

Rules

- Any string of characters, not including blanks and nuls (zero),may be used as a label.
- The LABEL FSC restricts labels to 56 characters. As a practical matter, however, the maximum label length is shorter than 56. This is because the label is only useful as a JMPL destination, and the JMPL statement usually specifies both a label and a MATH expression in 56 characters or less. Refer to the JMPL manual.
- Labels are case sensitive.

Examples

Example 1:

```
STEP  FSC   RANGE NOMINAL TOLERANCE MOD1 MOD2  3   4   CON
1.001 JMPL        abc     MEM < 10
1.002 DISP        no
1.003 END
1.004 LABEL       abc
1.005 DISP        yes
```

In this example the procedure jumps to 1.004 and then prints "yes" if MEM is less than 10. Otherwise the procedure prints "no". Note that the step number of the jump destination (1.004 in this example) makes no difference. The important point is that the body of the LABEL statement (here "abc") matches the destination specified in the JMPL statement.

MATH

Memory Register Operation FSC

Description

The MATH FSC evaluates arithmetic and string expressions and assigns the result to a specified memory register.

Format

MATH *memory register* = *expression*

Multiple assignments may be included in a single MATH statement, separated by semicolons.

Rules

Registers & Variables

The *memory register* must be one of:

MEM	-	global numeric register
MEM1	-	global numeric register
M[1], M[2],…	-	global numeric registers
L[1]. L[2], …	-	local numeric registers
MEM2	-	global string register
S[1], S[2], …	-	global string registers
<variable>		named variable

The index of a numeric register (M[*index*] or L[*index*]) or a string register (S[*index*]) must be a literal integer. It cannot be an expression. For example, "M[MEM + 3]" is not a legal construction in a MATH statement.

MEM, MEM1, M[1], M[2], …, M[255] are global numeric registers.

Local numeric registers (the 'L' registers) are local to each procedure call. L registers are set to zero on entry into a procedure. After the return from a subprocedure back to the calling procedure, the L registers return to the values they had in the calling procedure prior to the subprocedure call.

(The L registers do not exist in MET/CAL V7.00 and prior.)

MEM2, S[1], S[2], …, and S[32] are global string registers. MEM2 is limited to 4096 characters. The S registers cannot exceed 32767 characters each, subject to available memory.

Beginning with V7.20 the MATH FSC supports variables. See below for a detailed description.

Operators

The MATH FSC supports the following binary operators:

Operation	**Symbol**
addition	**+**
subtraction	**-**
multiplication	*****
division	**/**
exponentiation	**^**
string concatenation	**&**
less than	<
less than or equal to	**<=**
greater than	**>**
greater than or equal to	**>=**
not equal to	**!=**
logical AND	**&&**
logical OR	**||**

The relational operators (**<**, **<=**, **>**, **>=**, **==**, and **!=**) evaluate to 1 or 0, depending on whether the relation is true or false. For example, "MATH MEM1 = MEM < 10" sets MEM1 to 1 if the value of MEM is less than 10, and sets MEM1 to 0 if the value of MEM is greater than or equal to 10.

The logical operators (**&&**, **||**) expect numeric operands. Non-zero operand values have a truth value of TRUE. Zero operand values have a truth value of FALSE. The logical operators adhere to the standard definitions:

```
(TRUE  && TRUE)  is TRUE
(TRUE  && FALSE) is FALSE
(FALSE && TRUE)  is FALSE
```

```
(FALSE && FALSE) is FALSE

(TRUE  || TRUE)  is TRUE
(TRUE  || FALSE) is TRUE
(FALSE || TRUE)  is TRUE
(FALSE || FALSE) is FALSE
```

Procedures which make use of any of the operators **<=**, **>=**, **==**, and **!=** should be tested carefully. There is some risk of unexpected behavior due to internal floating-point rounding in numerical calculations. For example, the statement:

```
MATH mem = (13.7 * 16.6 == 227.42)
```

will set MEM to zero, even though 13.7 * 16.6 really is equal to 227.42.

Variables

In MET/CAL V7.20 and later the MATH FSC supports named variables.

1. Variable names have a maximum length of 32 characters.

   Examples:

   MATH abcdefghijklmnopqrstuvwxyzABCDEF = 5

   MATH abcdefghijklmnopqrstuvwxyzABCDEFG = 5

   The first statement is legal; the second is not.

   Procedure writers should choose names that are descriptive, but not so long that the procedure line length-limit prevents programming the desired expressions.

2. Variable names are alpha-numeric plus underscore. The first character of a name cannot be a digit.

   Examples:

   Legal statements:

   MATH a = 10

   MATH a_b = 11

   MATH a5 = 12

   Illegal statements:

   MATH a@ = 10

   MATH 3a = 12

3. Both global and local variables are supported. Globals are distinguished from locals by name. The rule is that any variable name that begins with an at sign (‘@’) is global. All other variables are local.

   Examples:

   MATH @voltage = 10.0

   MATH current = 2.0

   "@voltage" is global because it begins with an ‘@’.

   "current" is local because it does not begin with an ‘@’.

4. All named variables are string variables. However, they may be used in contexts where numeric values are expected, as long as the string value can be converted to numeric form. MET/CAL does the conversion automatically.

   Examples:

   The following statements are equivalent:

   MATH x = "10"

   MATH y = 10

   Both "x" and "y" may be used in contexts that expect a numeric value:

   MATH z = x + 3

   MATH q = y + 3

   However, it is not valid to use a non-numeric value in a context that expects a numeric value:

   MATH t5 = "xyz"

   MATH alpha = t5 + 9

   When the assignment "alpha = t5 + 9" is performed MET/CAL will generate a run-time error.

5. Variables names are case sensitive.

   Examples:

   MATH s = "abc"

   MATH S = "xyz"

   "s" and "S" are different variables.

6. Variable names do not have to be different from function names.

Example:

MATH cos = cos(1.2)

This statement is valid. MET/CAL distinguishes variable names from function names by context. However, it is probably best not to give variables names that are the same as function names, because it may interfere with the readability of the procedure.

7. Variables may be used in all contexts that accept MATH expressions. This includes MATH, EVAL, JMPL, IF, WHILE, and UNTIL procedure statements.

8. The [V …] construction is used to display or access the value of a named variable in contexts that accept "special constructions".

   Examples:

   MATH count = 10

   DISP The count is [V count]

   Name/value FSCs (VSET, TSET, 6100, 9640, …) may also use the [V …] construction to specify the value of a parameter.

9. For debugging purposes, the Test Run "S-Reg" window displays the values of variables.

   Globals variables follow the 'S' registers. The globals are shown in alphabetical order in the "S-Reg" window.

   Local variables follow the globals and are shown in alphabetical order.

   For local variables, the sub procedure nesting level is normally indicated by the "S-Reg" window. This display method is controlled by the "TestRunLVarDisplay" initialization file parameter.

   Legal values for "TestRunLVarDisplay" are:

   (a) Level

   (b) Tab

   (c) Left

   If "TestRunLVarDisplay" is set to "Level", the subprocedure nesting level is shown before the local variable name "Level" is the default. If you do not assign a value for "TestRunLVarDisplay" in your initialization file, MET/CAL uses this method.

   Example:

   MATH x = 5

If the assignment above occurs in the main procedure the Test Run, "S-Reg" window will show:

1 : x = 5

If the assignment occurs in the subprocedure called by the main procedure, the Test Run "S-Reg" window will show:

```
2 : x = 5
```

If "TestRunLVarDisplay" is set to "Tab”, the sub procedure nesting level is indicated by indentation.

Example:

If the Test Run "S-Reg" window shows:

```
x = 5
    xx = 10
        xxx = 15
```

it indicates that the first assignment is at level 1 (main procedure), the second assignment is at level 2 (subprocedure called by main), and the third assignment is at level 3 (subprocedure called by subprocedure called by main), and so on.

If "TestRunLVarDisplay" is set to "Left”, the sub procedure nesting level is not indicated in the Test Run S-Reg window.

Functions

In addition to the operators listed above, expressions may also make use of function calls.

Functions Overview

Accuracy File Functions

ACCV	read MET/CAL accuracy file DC specification
ACCV2	read MET/CAL accuracy file AC specification
CONF	return accuracy file-confidence value

Database Functions

CAL	return Calibration Table field value

INV	return Inventory Table field value
NCAL	return number of cal records for asset
SN	return serial number of specified asset

Date and Time Functions

CTIME	convert time formatted as HH:MM:SS to seconds
DATE	return current date in specified format
FTIME	convert seconds to formatted time (HH:MM:SS)
TIME	return current time as HH:MM:SS
UGDT	convert seconds since 1/1/1970 UTC to date/time
ULDT	convert seconds since 1/1/1970 UTC to date/time
UTIME	return current time in seconds since 1/1/1970 UTC

General File-Related Functions

EXISTS	determine if a specified file exists
FLEN	get length of specified file
ISDIR	determine if a specified file is a directory
ISORD	determine if a specified file is an ordinary file
MTIME	determine last modification time of file

General Numeric Functions

ABS	absolute value
AVG	average of global registers
AVG_L	average of local registers
BIT	test a specified bit
CEIL	smallest integer greater than or equal to value
EXP	e (base of natural logarithms) raised to power
FRND	round to specified number of significant digits
INT	largest integer less than or equal to argument
LN	natural logarithm

LOG	base 10 logarithm
MAX	maximum of global registers
MAX_L	maximum of local registers
MAX2	maximum of two values
MIN	minimum of global registers
MIN_L	minimum of local registers
MIN2	minimum of two values
NOT	Boolean inverse
POW	raise value to power (same as '^' operator)
RND	round number to nearest integer
RSS	root sum square of global registers
RSS_L	root sum square of local registers
RSS2	root sum square of two values
RSS3	root sum square of three values
SDEV	standard deviation of global registers
SDEV_L	standard deviation of local registers
SGN	arithmetic sign of number
SQRT	square root
SUM	sum of global registers
SUM_L	sum of local registers

Initialization File Functions

DFILE	return full path of MET/CAL DOS/DOSE data file
IFILE	return full path of MET/CAL ini file
INI	return value of MET/CAL ini file parameter
RIF	return value of specified ini file parameter
RINF	read instrument information file
RINFE	read instrument information file, w/ error msg
WIF	write value of specified ini file parameter

Numeric Conversion Functions

CTOI	ASCII character to decimal equivalent
DBMTOV	dBm to volts (RMS)
DBMTOW	dBm to watts
DBTOPCTV	dB to percentage (voltage ratio)
DBTOPCTW	dB to percentage (power ratio)
DEG	radians to degrees
DEGC	degrees F to degrees C
DEGF	degrees C to degrees F
PCTTODBV	percentage to dB (voltage ratio)
PCTTODBW	percentage to dB (power ratio)
RAD	degrees to radians
VTODBM	volts RMS to dBm
WTODBM	watts to dBm

Humidity / Temperature Sensor Functions

RHT_HUMIDITY	return last RHT relative humidity
RHT_TEMP	return last RHT temperature
RHT_TIME	return last RHT timestamp

String Functions

CMP	case-sensitive string comparison, returns -1 or 1
CMPI	case-insensitive version of CMP
DEL	delete named variable
EMPTY	determine if string variable is empty or null
FIND	index of n^{th} occurrence of specified substring
FINDI	case-insensitive version of FIND
FLD	extract specified field
FMT	format number
IS_NUM	determine if string is a single number

IS_NUM_LEAD	determine if string begins with a number
IS_NUM_SUB	determine if string contains embedded number
ISVAR	determine if named variable exists
ITOC	convert decimal integer to ASCII equivalent
LEN	return string length
NULL	determine if string variable is null
PAD	append spaces to make string specified length
PADB	pre-pend spaces to make string specified length
REPL	replace substring with specified string
SUB	substring of specified length starting at index
ZCMP	case-sensitive string comparison, returns 0 or 1
ZCMPI	case-insensitive version of ZCMP

Trig Functions

ACOS	arccosine
ASIN	arcsine
ATAN	arctangent
COS	cosine
COSH	hyperbolic cosine
SIN	sine
SINH	hyperbolic sine
TAN	tangent
TANH	hyperbolic tangent

Units Functions

BASE	convert dimensioned number to base units
IS_DIM	Is string valid dimensioned number?
IS_UNIT	Does dimensioned number string have specified valid units?
PSCALE	get prefix-based scalar from dimensioned number
UNIT	extract units symbol from dimensioned number

UPREFIX	extract units prefix from dimensioned number

Miscellaneous Functions

ADJTHR	return adjustment threshold
ASSET	return asset number of instrument
ASSETC	return asset number of instrument on a channel
CM	specify connection message substring
FAIL	returns 1 if last evaluation failed, otherwise 0
GET	get value from MET/CAL variable cache
GETV	get value from MET/CAL variable file
INSTR	return instrument name for specified alias
LGET	get value of specified local numeric register
LSET	assign value to specified local numeric register
MGET	get value of specified global numeric register
MSET	assign value to specified global numeric register
PASS	returns 1 if last evaluation passed, otherwise 0
PROC	return name of currently executing procedure
PSUB	Is string a substring of name of executing proc?
PSUBI	case-insensitive version of PSUB
PUT	store value in MET/CAL variable cache
PUTV	store value in MET/CAL variable file
SAFEON	specify potentially dangerous signal
SAFEOFF	clear potentially dangerous signal
SGET	get value of specified global string register
SSET	assign value to specified global string register
UNC	return uncertainty parameter from last evaluation
UNCV	return measurement from last evaluation
UUT	return asset number of UUT
VERS	return MET/CAL version string

Detailed Function Descriptions

ABS

Purpose: Computes the absolute value of its argument.

Result Type: *Numeric*

Argument Type: *Numeric*

Example: MATH L[1] = ABS(MEM)

ACCV

Purpose: ACCV reads a MET/CAL accuracy file to determine the system accuracy for the specified device, with the specified "mode", and the specified lookup value.

Result Type: *Numeric*
The return value is the system accuracy, in base units. The accuracy is calculated from the accuracy file values as:

acc = 0.01 * <tol> * |<val>| + <flr>

where <tol> is the accuracy file-tolerance value, <flr> is the accuracy file-floor value, and <val> is the specified lookup value (argument 3).

Error Handling: The following conditions prevent the execution of ACCV. An error message is generated in each case.

(a) Device not configured.

(b) Device asset not specified.

(c) Device not in database.

(d) No accuracy file for specified device, asset, and cal interval.

(e) Duplicate accuracy files for specified device, asset, and cal interval.

(f) Accuracy data not found in accuracy file.

(g) Accuracy data set to "NA".

(h) Syntax error in accuracy file.

(i) Initialization file parameter "acc_check" set to "no".

Argument Type: *String*, *String*, *Numeric*

The first argument is the device name. The device must be either a supported system instrument (like "Fluke 5700A") or a user-configured device.

The second argument is an accuracy file-mode string. This string selects the appropriate section of the accuracy file.

The third argument is the numeric value at which the system accuracy is to be determined.

Compatibility: Requires V6.11c or later.

See Also: ACCV2

Example: `MATH MEM = ACCV("Fluke 5700A", "Volts", 5.0)`

After execution of the ACCV call, MEM will contain the 5700 accuracy, in volts DC, at 5V.

Usage: ACCV may be used in conjunction with the ACC FSC to lookup a cal interval-dependent system accuracy value for use in the T.U.R. and measurement uncertainty calculations.

When used with a user-configured instrument, the user (or procedure writer) is responsible for providing the necessary accuracy files.

ACCV2

Purpose: ACCV2 reads a MET/CAL accuracy file to determine the system accuracy for the specified device, with the specified "mode", and the specified lookup values.

ACCV2 is like ACCV, except there are two numeric parameters that control the accuracy lookup.

Result Type: *Numeric*

The return value is the system accuracy, in base units. The accuracy is calculated from the accuracy file values as:

acc = 0.01 * <tol> * |<val>| + <flr>

where <tol> is the accuracy file-tolerance value, <flr> is the accuracy file-floor value, and <val> is the specified lookup value (argument 3).

Error Handling: The following conditions prevent the execution of ACCV2. An error message is generated in each case.

(a) Device not configured.

(b) Device asset not specified.

(c) Device not in database.

(d) No accuracy file for specified device, asset, and cal interval.

(e) Duplicate accuracy files for specified device, asset, and cal interval.

(f) Accuracy data not found in accuracy file.

(g) Accuracy data set to "NA".

(h) Syntax error in accuracy file.

(i) Initialization file parameter "acc_check" set to "no".

Argument Type: *String, String, Numeric, Numeric*

The first argument is the device name. The device must be either a supported system instrument (like "Fluke 5700A") or a user-configured device.

The second argument is an accuracy file-mode string. This string selects the appropriate section of the accuracy file.

The third argument is the numeric value at which the system accuracy is to be determined.

The fourth argument is an auxiliary numeric lookup control. This argument typically specifies the frequency when the accuracy is determined for an AC section of the accuracy file. However, for an instrument specified in terms of frequency, the fourth parameter may specify an amplitude.

Compatibility: Requires V6.11c or later.

See Also: ACCV

Example:

```
MATH MEM2 = "Fluke 5700A"
MATH MEM = ACCV2(MEM2, "Volts", 5., 1E3)
```

After execution of the ACCV2 call, MEM will contain the 5700 accuracy, in volts AC, at 5 V, 1 kHz.

Usage: ACCV2 may be used in conjunction with the ACC FSC to lookup a cal interval-dependent system accuracy value for use in the T.U.R. and measurement uncertainty calculations.

When used with a user-configured instrument, the user (or procedure writer) is responsible for providing the necessary accuracy files.

ACOS

Purpose: Computes the arccosine of its argument.

Result Type: Numeric (radians)

Argument Type: Numeric (radians)

Example: MATH M[2] = ACOS(M[1])

ADJTHR

Purpose: Returns the adjustment threshold value.

The value returned by "ADJTHR" is the value from the header of the main procedure. It may be different from the value specified in the header of a sub procedure.

Result Type: Numeric (percentage)

Argument Type: None

Example: MATH MEM = ADJTHR()

DISP Adjustment Threshold = [MEM]%

Compatibility: Requires V7.10 or later.

ASIN

Purpose: Computes the arcsine of its argument.

Result Type: Numeric (radians)

Argument Type: Numeric (radians)

Example: MATH M[2] = ASIN(M[1])

ASSET

Purpose: Returns the asset number of a specified instrument. If the instrument is not configured, or no asset number is specified in the System Configuration File, the return value is an empty string. In the special case of an instrument configured on a channel, use function "ASSETC" instead.

Result Type: String

Argument Type: String

Compatibility: Requires V6.01 or later.

See Also: ASSETC

Example: MATH S[1] = ASSET("Fluke 5700A")

ASSETC

Purpose: Returns the asset number of a specified instrument configured on a specified channel. If the instrument is not configured, or no asset number is specified in the System Configuration File, the return value is an empty string. For instruments not configured on a channel, set the channel (2nd argument) to zero, or use function "ASSET".

Result Type: String

Argument Type: String, Numeric

Compatibility: Requires V6.10 or later.

See Also: ASSET

Example: MATH S[1] = ASSETC("Fluke 9560", 2)

ATAN

Purpose: Computes the arctangent of its argument.

Result Type: Numeric (radians)

Argument Type: Numeric (radians)

Example: MATH M[2] = ATAN(M[1])

AVG

Purpose: Computes the average of a set of numbers. The function arguments specify the indices of a range of global numeric registers the values of which are to be averaged.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example: MATH M[5] = 25MATH M[6] = 45MATH M[7] = 20MATH MEM = AVG(5, 7)

After the last MATH statement executes the value of MEM will be 30.

AVG_L

Purpose: Computes the average of a set of numbers. The function arguments specify the indices of a range of local numeric registers the values of which are to be averaged.

Result Type: Numeric

Argument Type: Numeric, Numeric

Compatibility: Requires V7.00b or later.

Example: MATH L[5] = 25

MATH L[6] = 45

MATH L[7] = 20

MATH MEM = AVG_L(5, 7)

After the last MATH statement executes the value of MEM will be 30.

BASE

Purpose: Given a string that represents a dimensioned number, BASE converts the value to base units.

Result Type: Numeric

Argument Type: String

Compatibility: Requires V7.11 or later.

Example: MATH MEM = BASE("34.5 mV")

After the call to BASE the value of MEM will be 0.0345.

BIT

Purpose: Tests a specified bit in a specified value. Bits are numbered from the LSB (bit 0) to the MSB.

The first argument specified the bit number.

The second argument is the value to test.

Both arguments are converted to unsigned integers before the test. If the specified bit is set, the result value is 1. If the specified bit is not set, the result value is 0. The bit number must be in the range 0 to 31.

Result Type: Numeric

Argument Type: Numeric, Numeric

Compatibility: Requires V6.01 or later.

Example: IEEE2 *ESR?[I]

```
MATH L[1] = BIT(0, MEM)
```

The IEEE2 statement reads the Extended Status Register (ESR) of a IEEE-488.2 compatible device. The MATH statement checks the Operation Complete (OPC), bit 0 of the ESR. If OPC is true L[1] is set to 1. If OPC is false L[1] is set to 0.

CAL

Purpose: Returns the value of a specified Calibration Table field, for a specified cal record of a specified asset.

The first argument specifies the asset number (string) of the instrument for which the specified Calibration Table value is to be retrieved.

The second argument specifies the record number. Records are numbered from 1 to <NREC>, where record 1 is the oldest record and record <NREC> is the most recent.

It is possible to access the records in reverse order by specifying a negative record number:

(-1) refers to the most recent record.

(-2) refers to the 2nd most recent.

And so on.

The third argument specifies a Calibration Table field number.

An error message is generated if the specified field number is not a valid Calibration Table field.

Result Type: String

Argument Type: String, Numeric, Numeric

Compatibility: Requires V7.11p or later.

Example: MATH MEM2 = CAL("Sample-5700", 5, 2342)

This example assumes there is an asset with the asset number "Sample-5700" in the database.

The value of field 2342 in the 5th calibration record will be stored in MEM2 when the call to CAL completes.

See Also: NCAL and INV

CEIL

Purpose: Computes the smallest integer greater than or equal to its argument.

Result Type: Numeric

Argument Type: Numeric

Example: MATH L[2] = CEIL(MEM)

CM

Purpose: Specify a connection message substring.

A connection message substring is used to replace a corresponding descriptor in an automatic connection message.

Connection message substrings are used to convert generic automatic connection messages to UUT-specific automatic connection messages.

Quick Proto: CM (substr number, substr)

Result Type: String (or void)

If the connection-message substring number is between 1 and 8, the return value is the previous value of the connection message substring.

If the connection-message substring number is zero, the return value is an empty string.

To reset all CM substrings specify: MATH CM (0, "")

Argument Type: Numeric, String

The first argument is a connection-message substring number. The number must be between 0 and 8. Numbers between 1 and 8 refer to a single connection message substring. Zero is a special case that refers to all connection message substrings.

Compatibility: Requires V7.20 or later.

Example: Unless inhibited, a procedure statement like this:

5700 1.000V 1%

generates a pop-up connection message that says:

```
Connect:
UUT to 5700A Output Terminals
```

Internally, this message is stored as "UUT @1 to 5700A Output Terminals".

If the procedure includes a statement like this:

```
MATH CM(1, "Input HI")
```

The displayed connection message will appear as:

```
Connect:
UUT Input HI to 5700A Output Terminals
```

Notice that the descriptor "@1" has been replaced by the specified connection message substring "Input HI".

CMP

Purpose:	Case-sensitive string comparison. Returns 1 if strings are the same, -1 otherwise. May be used in conjunction with JMPF.
Result Type:	Numeric
Argument Type:	String, String
Example:	IEEE2 *TST?[I$]
	MATH MEM1 = CMP(MEM2, "0")

CMPI

Purpose:	Case-insensitive string comparison. Returns 1 if strings are the same, -1 otherwise. May be used in conjunction with JMPF.
Result Type:	Numeric
Argument Type:	String, String

CONF

Purpose:	CONF returns the confidence value from the header of the accuracy file associated with a specified device.

Result Type: Numeric
The return value is the confidence value from the accuracy file header. The confidence is expressed as a "sigma" value. For example, 2.58 means 2.58 sigma.

Error Handling: The following conditions prevent the execution of CONF. An error message is generated in each case.

Device not configured.

Device asset not specified.

Device not in database.

No accuracy file for specified device, asset, and cal interval.

Duplicate accuracy files for specified device, asset, and cal interval.

Initialization file parameter "acc_check" set to "no".

Argument Type: String

The first argument is the device name. The device must be either a supported system instrument (like "Fluke 5700A") or a user-configured device.

Compatibility: Requires V6.11f or later.

See Also: ACCV and ACCV2

Example: MATH MEM = CONF("Fluke 5700A")

After execution of the CONF call, MEM will contain the confidence value from the Fluke 5700A accuracy file.

Usage: When used with ACCV or ACCV2, CONF may be used to normalize the system accuracy to one-sigma for use in the measurement uncertainty calculation.

For example, a sequence of statements like:

```
MATH S[1] = "Agilent XYZ"
MATH S[2] = "Volts"
MATH M[1] = ACCV(S[1], S[2], 5.)
MATH M[2] = CONF(S[1])
MATH M[3] = M[1] / M[2]
VSET SYS_ACC = [M3]
```

may be used to look up the accuracy of the user-configured instrument "Agilent XYZ" at 5 VDC, determine the associated confidence of the spec, normalize to 1 sigma, and assign the normalized value to SYS_ACC for use in the measurement uncertainty calculation.

When used with a user-configured instrument, the user (or procedure writer) is responsible for providing the necessary accuracy files.

COS

Purpose:	Computes the cosine of its argument.
Result Type:	Numeric (radians)
Argument Type:	Numeric (radians)
Example:	MATH L[1] = COS(MEM)

COSH

Purpose:	Computes the hyperbolic cosine of its argument.
Result Type:	Numeric (radians)
Argument Type:	Numeric (radians)
Example:	MATH L[1] = COSH(MEM)

CTIME

Purpose: Converts a time string formatted as H:MM:SS to an equivalent number of seconds.

The format DD:HH:MM:SS is also supported, where DD is a number of days.

All components (days, hours, minutes, seconds) are optional, but colons

may be required to make the time string unambiguous. For example, "1:" means 1 minute. If you simply specify "1", it means 1 second.

Result Type:	Numeric
Argument Type:	String
Compatibility:	Requires V7.00d or later.

Example: MATH MEM = CTIME("1:10:15")

In this example the time string, representing 1 hour, 10 minutes, and 15 seconds will be converted to the equivalent number of seconds (4215).

The value 4215 will be stored in the register MEM.

See Also: FTIME and UTIME

CTOI

Purpose: Converts an ASCII character to its decimal equivalent.

Result Type: Numeric

Argument Type: String

If the string argument is a multi-character string, CTOI converts only the first character.

Compatibility: Requires V6.11b or later.

Example: MATH MEM = CTOI("x")

After the above assignment takes place, the value of MEM will be 120, because 120 is the decimal equivalent of the ASCII character lower-case 'x'.

DATE

Purpose: Returns the current date.

The argument is a string that controls the date format. The following format descriptors may be used:

DD	- day number
MM	- month number
MON	- 3-letter month name
MONTH	- full month name
YY	- 4-digit year number

No format descriptor may occur more than once in a format control string.

At most one of { MM, MON, MONTH } may occur in a format control string.

At most one of { YY, YYYY } may occur.

Characters that do not match a valid format descriptor are copied unchanged to the formatted date string.

Format descriptors are case-insensitive.

Result Type: String

Argument Type: String

Compatibility: Requires V6.0 or later.

Month names are English-only in V6.0.

Example 1: MATH S[5] = date("DD/MM/YY")

This produces a date string like "04/20/99" and stores it in string register S[5].

Example 2: MATH MEM2 = date("month dd, yyyy")

This produces a formatted date like "April 20, 1999" and stores it in string register MEM2.

DBMTOV

Purpose: Converts from dBm to volts (RMS).

Note

The conversion is correct for sine waves only.

Result Type: Numeric (Vrms)

Argument Type: Numeric (dBm), Numeric (ohms)

The first argument is the dBm value to be converted. The second argument is the reference impedance (ohms).

Compatibility: Requires V6.11i or later.

Example: MATH MEM = DBMTOV(10.0, 600.0)

In this example DBMTOV will return the Vrms equivalent to 10 dBm at 600 ohms.

DBMTOW

Purpose: Converts from dBm to watts.

Result Type: Numeric (W)

Argument Type: Numeric (dBm)

The argument is the dBm value to be converted

Compatibility:	Requires V7.01f or later.
Example:	MATH MEM = DBMTOW(0.1)
	In this example DBMTOW will return the watts equivalent to 0.1.

DBTOPCTV

Purpose:	Converts voltage ratio in dB to percentage.
Result Type:	Numeric (%)
Argument Type:	Numeric (dB)
	The argument is the dB value to be converted.
Compatibility:	Requires V7.11h or later.
Example:	MATH MEM = DBTOPCTV(-5)
	In this example DBTOPCTV will return the percentage equivalent to a -5 dB voltage ratio (approximately 56.2341 %).

DBTOPCTW

Purpose:	Converts power ratio in dB to percentage.
Result Type:	Numeric (%)
Argument Type:	Numeric (dB)
	The argument is the dB value to be converted.
Compatibility:	Requires V7.11h or later.
Example:	MATH MEM = DBTOPCTW(-5)
	In this example, DBTOPCTW will return the percentage equivalent to a -5 dB power ratio (approximately 31.6228 %).

DEG

Purpose:	Converts from radians to degrees.
Result Type:	Numeric (degrees)
Argument Type:	Numeric (radians)
Example:	MATH M[1] = DEG(MEM)

DEGC

Purpose:	Converts from degrees F to degrees C.
Result Type:	Numeric (degrees Celsius)
Argument Type:	Numeric (degrees Fahrenheit)
Example:	MATH M[1] = DEGC(MEM)

DEGF

Purpose:	Converts from degrees C to degrees F.
Result Type:	Numeric (degrees Fahrenheit)
Argument Type:	Numeric (degrees Celsius)
Example:	MATH M[1] = DEGF(MEM)

DEL

Purpose:	DEL deletes a named variable.
Result Type:	String (or void)
	DEL returns the value of the variable being deleted. In normal usage, however, the return value of DEL will be ignored (as illustrated in the examples below).
Argument Type:	String
	The argument is the name of the variable to be deleted. Usually the name should be specified as a literal string.
Compatibility:	Requires V7.20 or later.
Example 1:	MATH x = 5
MATH DEL("x")	
	The call to DEL remove the variable named "x".
Example 2:	MATH y = "x"
	MATH x = 5
	MATH DEL(y)
	The call to DEL in this example removes the variable named "x", just as in Example 1. This is because the value of the variable named "y" is "x". In order to remove "y" you would have to say: DEL("y")

Usage: DEL has limited utility. In general there is no need to delete named variables. Possible reasons for removing named variables are:

(a) To remove variables which are no longer used from the Test Run "S-Reg" window.

(b) To prevent subsequent access to a variable after it is no longer needed. For example:

MATH x = 5

MATH DEL("x")

MATH y = x + 10

In this example a run time error will occur when the 3rd MATH statement is executed. This is because the variable "x" no longer exists.

DEL may be used only with "named variables". You cannot use DEL to delete an 'S', 'M', or 'L' register. You also cannot use DEL to delete MEM, MEM1, MEM2, or a variable cache variable.

DFILE

Purpose: Returns the full path name of the MET/CAL DOS/DOSE datafile.

This function may be used to pass the DOS/DOSE data file name to a user program to be invoked with the DOS or DOSE FSC.

Result Type: String

Argument Type: None

Compatibility: Requires V6.0 or later.

Example: MATH S[5] = DFILE()

DOS USER1 [S5]

In this example the full path name of the DOS/DOSE data file is stored in string register S[5], and then passed as the first (and only) argument to the user program USER1.

EMPTY

Purpose: EMPTY tests a string variable to determine if the value is an empty string or null.

Result Type: Numeric

EMPTY returns 1 if the value of the specified string variable is empty or null.

Empty returns 0 if the value of the specified string variable is neither empty nor null.

Argument Type: String

The argument is a string variable, or string-valued expression.

Compatibility: Requires V7.20 or later.

See Also: NULL and ISVAR

Example: MATH abc = ""

IF (EMPTY(abc))

DISP "abc" is empty

ENDIF

In this example the DISP statement will execute and print:

```
"abc" is empty
```

because the assignment in the MATH statement explicitly assigns an empty string as the value of named variable "abc".

Usage: An empty string is a string that exists but has zero length. Null strings are not quite the same. Examples of null strings are:

(a) An 'S' register value before any assignment to the register has been made.

(b) The return value of certain string-based functions when an error or lookup failure occurs. (For example, if you call RIF and the parameter you are looking for does not exist in the fill, RIF returns a NULL string as its return value.)

In most cases procedure writers do not have to be concerned about the distinction between empty strings and null strings.

Function EMPTY hides the distinction between empty strings and null strings, because it returns 1 in either case.

EXISTS

Purpose:	Determines if a specified file exists.
	This function does not distinguish files based on the file type.
	For example, directories (i.e., "folders") exist just like ordinary files.
Result Type:	Numeric
	The return value is 1 if the specified file exists.
	The return value is 0 if the specified file does not exist.
Argument Type:	String
	The argument is the name of the file to be tested.
Compatibility:	Requires V7.11 or later.
See Also:	ISORD, ISDIR
Example:	MATH S[1] = "C:\\MyData\\abc.txt"
	IF (EXISTS(S[1]))
	DISP File "[S1]" Exists
	ELSE
	DISP File "[S1]" Does Not Exist
	ENDIF
	Running the above procedure fragment causes a message to be displayed indicating whether or not the file "C:\MyData\abc.txt" exists.

EXP

Purpose:	Computes the exponential function of its argument.
Result Type:	Numeric
Argument Type:	Numeric
Example:	MATH L[2] = EXP(L[1])

FAIL

Purpose:	Returns 1 if the most recent evaluation failed, otherwise 0.
	It is important to note that execution of an instrument setup statement (e.g., 5700 1V S) clears the internal result status bit. This means that if "FAIL" is used to determine the result of

the last evaluation, the determination must be made before the next instrument setup statement.

Result Type: Numeric

Argument Type: None

Compatibility: Requires V6.01d or later.

Example 1:
```
MATH L[1] = FAIL()
```

Example 2:
```
5700 1V 0.01%
IF            FAIL()
DISP          Fail
ELSE
DISP             Pass
ENDIF
```

FIND

Purpose: Returns the index of the n-th occurrence of a specified substring in a specified string. The first argument is the string to be searched. The second argument is the substring to search for. The third argument is the number of the desired occurrence.

This function is case-sensitive.

The return value is zero if the specified occurrence of the specified substring is not found.

If FIND is called with the occurrence number set to 0, the return value is the number of occurrences of the specified substring in the specified string.

Result Type: Numeric

Argument Type: String, String, Numeric

Example 1:
MATH S[5] = "abcABCabc"
MATH MEM = FIND(S[5], "abc", 2)

After the second math statement is executed the value of MEM will be 7, since 7 is the index of the beginning of the second occurrence of "abc".

Example 2: MATH MEM = FIND("abcdef", "z", 1)

Since "z" does not occur in "abcdef", MEM will be set to zero.

Example 3: MATH MEM = FIND("a,b,c,d", ",", 0)

Since the 3rd argument is zero, MEM will be set to 3, because there are 3 commas in "a,b,c,d".

FINDI

Purpose: FINDI is a case-insensitive version of FIND (described above).

Returns the index of the nth occurrence of a specified substring in a specified string. The first argument is the string to be searched. The second argument is the substring to search for. The third argument is the number of the desired occurrence.

This function is not case-sensitive.

The return value is zero if the specified occurrence of the specified substring is not found.

If FINDI is called with the occurrence number set to 0, the return value is the number of occurrences of the specified substring in the specified string.

Result Type: Numeric

Argument Type: String, String, Numeric

Compatibility: Requires V6.01 or later.

Example: MATH S[5] = "abcABCabc"

```
MATH MEM = FINDI(S[5], "ABC", 2)
```

After the second math statement is executed, the value of MEM will be 4, since 4 is the index of the beginning of the second occurrence of "ABC" (case-insensitive).

FLD

Purpose: Extracts a specified field from a string. The first argument is the string from which the field is to be extracted. The second argument specifies which field to extract. (The first field is number 1.) The third argument is a string that specifies the field separator.

Result Type: String

Argument Type: String, Numeric, String

Example 1: MATH S[1] = "FLUKE,5500A,6320007,NONE+1.2"
MATH MEM2 = FLD(S[1], 2, ",")

After this statement executes the value of MEM2 will be "5500A".

Example 2:

```
# Setup RS232-communication
1.001    PORT     [P1200,N,8,1,X]
# Enable the SERVICE-mode of the
# ScopeMeter test tool.
  1.002   PORT     EX110,0[13][I]
  1.003   PORT     FLUKPHIL[13][I]
# Query Scopemeter Cal Fields
# returns Total Cal Fields, # Free
  1.004   PORT     QN[13][I][I$]
  1.005   MATH     MEM = FLD(MEM2, 2, ",")
  1.006   DISP     Fields Available [MEM]
```

FLEN

Purpose: Determines the length of a specified file.

Result Type: Numeric

The return value is the length of the file. f the file does not exist the return value is (-1).

Argument Type: String

The argument specifies the name of the file.

Compatibility: Requires V7.11 or later.

Example: Suppose you have a file on the H: drive named:

H:\mydata\data.dat"

Running the statements that follow causes the length of the file, in bytes, to be stored in local register L[1].

MATH MEM2 = "H:\\mydata\\data.dat"

MATH L[1] = FLEN(MEM2)

FMT

Purpose: Formats a number. Format specifiers have the form:

%*width***.***precisioncode*

width is the minimum field width.

precision is the precision of the result.

code is **f**, **e**, or **g**.

f specifies fixed-point.

e specifies floating-format.

g uses **f** or **e**, whichever is more compact. The precision specifies the maximum number of significant digits.

Result Type: String

Argument Type: Numeric, String

Example: MATH MEM2 = FMT(1.234567, "%4.2f")

After this statement executes the value of MEM2 will be "1.23".

FRND

Purpose: Rounds a number to a specified number of significant digits.

FRND cannot be used to increase the number of significant digits in a number.

(Use function FMT to control the formatting of numbers for display.)

It is important to understand that FRND controls the number of significant digits in a number. This is not, in general, the same as controlling the number of digits to the right of the decimal point.

If the specified number of significant digits is less than 1, FRND uses 1 as the requested number of significant digits.

If the specified number of significant digits is greater than 16, FRND uses 16 as the requested number of significant digits.

Result Type: Numeric

Argument Type: Numeric, Numeric

Compatibility: Requires V7.01d or later.

Example 1: MATH MEM = FRND(1.234567, 4)

DISP [MEM]

The displayed value will be "123.4")

Example 2:	MATH MEM = FRND(123.4567, 4)
	DISP [MEM]
	The displayed value will be "123.4")

FTIME

Purpose:	Converts a specified number of seconds into a formatted time string with the form HH:MM:SS.
	Values representing a non-integer number of seconds are truncated to the next smallest whole number of seconds. For example, "FTIME(2.7)" is the same as "FTIME(2.0)". Both calls produce "00:00:02".
Result Type:	String
Argument Type:	Numeric
Compatibility:	Requires V6.11m or later.
Example:	MATH MEM2 = FTIME(14370)
	In this example the MEM2 string register will contain "03:59:30", representing 3 hours, 59 minutes, and 30 seconds.
See Also:	UTIME

GET

Purpose:	Get value from MET/CAL variable cache.
	If the name does not exist in the variable cache, or the value is empty, the return value is an empty string.
	Variable names are case sensitive.
	The variable cache is an internal cache that may be used to store and retrieve string and numeric values during procedure execution.
	The variable cache is never saved as a disk file, and there is no access to the variable cache outside of the "GET" and "PUT" MATH FSC functions.
	The variable cache is re-initialized at the start of each procedure execution. (The variable cache is not reinitialized when "Go" in the Editor Test Run menu is used.)
Result Type:	String
Argument Type:	String

See Also:	PUT
Compatibility:	Officially requires V7.10 or later.
	(GET is supported in Run Time and Editor versions built after 11/14/2003.)
Example:	MATH MEM = get("temperature")

GETV

Purpose:	Get value from MET/CAL variable file.
	If the name does not exist in the variable file, or the value is empty, the return value is an empty string.
	All variable names must end with '$'. However, if the '$' is omitted in a MATH statement, it is automatically added before the value is retrieved.
	Variable names are case-insensitive.
	The MET/CAL variable file is cached (in memory) during normal program operation. It is used by the pre- and post-prompt dialogs, and accessed by the [V...] special construction.
Result Type:	String
Argument Type:	String
See Also:	PUTV
Compatibility:	Requires V6.0 or later.
Example:	MATH MEM2 = GETV("PROC_NAME$")

IFILE

Purpose:	Returns the full path name of the MET/CAL initialization file.
	This function may be used to pass the initialization file name to a user program to be invoked with the DOS or DOSE FSC.
Result Type:	String
Argument Type:	None
Compatibility:	Requires V6.0 or later.
Example:	MATH S[5] = IFILE()

INI

Purpose:	Retrieves the value of a specified MET/CAL initialization file parameter.
	This function takes two arguments. The first argument specifies the initialization file section. The second argument specifies the initialization file parameter.
	The return value is an empty string if the specified parameter does not exist in the specified section, or if the parameter exists but has no value.
	The section name and parameter name arguments are case-insensitive.
	One use of this function is to pass values from the initialization file to user program invoked with the DOS (or DOSE) FSC.
Result Type:	String
Argument Type:	String, String
Compatibility:	Requires V6.0 or later.
Example:	MATH M[10] = INI("startup", "tur_lim")
	In this example, the value of the "tur_lim" parameter (usually 4.0) is stored in numeric register M[10]. "tur_lim" specifies the T.U.R. limit used by MET/CAL. Note also that "INI" has a string return value, but in this example the return value is assigned to a numeric register. The MATH FSC automatically converts the string value to a numeric value when necessary.

INT

Purpose:	Computes the largest integer less than or equal to its argument.
Result Type:	Numeric
Argument Type:	Numeric
Example:	MATH L[1] = INT(MEM)

INV

Purpose:	Returns the value of a specified Inventory Table field, for a specified asset.

The first argument specifies the asset number (string) of the instrument for which the specified Inventory Table value is to be retrieved.

The second argument specifies an Inventory Table field number.

An error message is generated if the specified field number is not a valid Inventory Table field. Valid field numbers are 4201 to 4263, excluding 4227. 4299 is also valid. Note also that function "INV" does not allow field 4260 to be retrieved.

Result Type: String

Argument Type: String, Numeric

Compatibility: Requires V7.00d or later.

Example: MATH MEM2 = INV("Sample-5700", 4206)

This examples assumes there's an asset with the asset number

"Sample-5700" in the database.

Inventory Table field 4202 is the manufacturer name field.

The value of MEM2 will be "Fluke" after the call to "INV" shown in this example has been executed.

INSTR

Purpose: Returns the device name of the configured instrument that has a specified alias. If no device has the specified alias INSTR returns an empty string. It is an error to specify a NULL or empty alias.

Result Type: String

Argument Type: String

Compatibility: Requires V7.10b or later.

Example: MATH S[1] = INSTR("5700")

Assuming there is a configured Fluke 5700A, with the alias "5700", the call to INSTR in this example will return "Fluke 5700A".

IS_DIM

Purpose: Determines if a string represents a valid dimensioned number.

The return value is 1 if the string is a valid dimensioned number. Otherwise the return value is 0.

Result Type: Numeric

Argument Type: String

Compatibility: Requires V7.11 or later.

Examples: The examples in the group below show strings that are valid dimensioned numbers (so IS_DIM will return 1).

Valid representation of # 1.2 femtovolts.

MATH MEM = IS_DIM("1.2 fV")

The examples in the group below show strings that are not valid dimensioned numbers (so IS_DIM will return 0).

Numeric part not valid.

MATH MEM = IS_DIM("1x2 mV")

Units prefix not valid.

MATH MEM = IS_DIM("1.2 qV")

Units symbol not valid.

MATH MEM = IS_DIM("1.2 mX")

ISDIR

Purpose: Determines if a specified file is a directory.

Result Type: Numeric

The return value is 1 if the specified file is a directory.

The return value is 0 if the specified file is not a directory.

Argument Type: String

The argument is the name of the file to be tested.

Compatibility: Requires V7.11 or later.

See Also: EXISTS, ISORD

Example:

```
MATH S[1] = "C:\\MyData"
IF (ISDIR(S[1]))
DISP File "[S1]" Is a Directory
ELSE
DISP File "[S1]" Is Not a Directory
```

ENDIF

Running the above procedure fragment causes a message to be displayed indicating whether or not the file "C:\MyData" is a directory.

ISORD

Purpose: Determines if a specified file is an ordinary file.

An ordinary file is, generally, any data file, program file, text file, etc., which is not a directory (folder).

Some file system support other file types like sockets and device special files. These are also not ordinary files.

Result Type: Numeric

The return value is 1 if the specified file is an ordinary file.

The return value is 0 if the specified file is not an ordinary file.

Argument Type: String

The argument is the name of the file to be tested.

Compatibility: Requires V7.11 or later.

See Also: EXISTS, ISDIR

Example: MATH S[1] = "C:\\MyData"

IF (ISORD(S[1]))

DISP File "[S1]" Is an Ordinary File

ELSE

DISP File "[S1]" Is Not an Ordinary File

ENDIF

Running the above procedure fragment causes a message to be displayed indicating whether or not the file "C:\MyData" is an ordinary file.

IS_NUM

Purpose: Determines if a string is entirely numeric.

The return value is 1 if the string is entirely numeric. Otherwise the return value is 0.

Result Type: Numeric

Argument Type: String

Compatibility: Requires V7.10b or later.

Examples: The examples in the group below show strings that are entirely numeric (so IS_NUM will return 1).

MATH L[1] = IS_NUM("3.2e+5")

MATH L[1] = IS_NUM("3.2")

MATH L[1] = IS_NUM(".2e+5")

MATH L[1] = IS_NUM("3")

The examples in the group below show strings that are not entirely numeric (so IS_NUM will return 0).

MATH L[1] = IS_NUM("3.2e+5x")

MATH L[1] = IS_NUM(" 5")

MATH L[1] = IS_NUM("3.2 ")

MATH L[1] = IS_NUM("a23")

MATH L[1] = IS_NUM("")

IS_NUM_LEAD

Purpose: Determines if a string begins with a number.

The return value is 1 if the string begins with a number. Otherwise the return value is 0.

Note

Leading spaces are non-numeric characters. A string that begins one or more spaces will cause IS_NUM_LEAD to return 0.

Result Type: Numeric

Argument Type: String

Compatibility: Requires V7.10b or later.

Examples: The examples in the group below show strings which begin with a number (so IS_NUM_LEAD will return 1).

MATH L[1] = IS_NUM_LEAD("3.2e+5 mV")

MATH L[1] = IS_NUM_LEAD("3.2x")

MATH L[1] = IS_NUM_LEAD(".2e+5,3.5e-4")

MATH L[1] = IS_NUM_LEAD("3")

The examples in the group below show strings which do not begin with a number (so IS_NUM_LEAD will return 0).

MATH L[1] = IS_NUM_LEAD(" 3.2e+5")

MATH L[1] = IS_NUM_LEAD("x5")

MATH L[1] = IS_NUM_LEAD("voltage=3.2 ")

MATH L[1] = IS_NUM_LEAD("a23.7")

MATH L[1] = IS_NUM_LEAD("")

IS_NUM_SUB

Purpose: Determines if a string contains an embedded number.

The return value is 1 if the string contains an embedded number. Otherwise the return value is 0. (Any string that includes at least one digit is considered to contain an embedded number.)

Result Type: Numeric

Argument Type: String

Compatibility: Requires V7.10b or later.

Examples: The examples in the group below show strings that contain an embedded number (so IS_NUM_SUB will return 1).

MATH L[1] = IS_NUM_SUB("3.2e+5 mV")

MATH L[1] = IS_NUM_SUB(":3.2xyz")

MATH L[1] = IS_NUM_SUB("Fluke 5700A")

MATH L[1] = IS_NUM_SUB("3,4,5,6")

The examples in the group below show strings that do not contain an embedded number (so IS_NUM_SUB will return 0).

MATH L[1] = IS_NUM_SUB(" ")

MATH L[1] = IS_NUM_SUB("Fluke")

MATH L[1] = IS_NUM_SUB("")

IS_UNIT

Purpose: Determines if a dimensioned number string contains a specified valid units symbol.

The return value is 1 if the units are valid and match the specified units symbol. Otherwise, the return value is 0.

IS_UNIT is designed to compare a specified valid units symbol with a valid dimensioned number. It is not designed to determine if a dimensioned number contains a valid units symbol.

A call to IS_UNIT with an invalid dimensioned number results in a run time error that terminates the procedure statement.

Result Type: Numeric

Argument Type: String, String

Quick Prototype: Boolean = IS_UNIT(dim num, units symbol)

Compatibility: Requires V7.11 or later.

Examples: MATH MEM = IS_UNIT("1.2 mV", "V")

In the example above the return value is 1 because "V" is a valid units symbol, and the units symbol in the dimensioned number (first argument) is the same as the specified units (second argument).

MATH MEM = IS_UNIT("1.2 mX", "V")

In the example above the return value is 0 because "X" is not a valid units symbol.

ISVAR

Purpose: ISVAR determines if a named variable exists.

Result Type: Numeric

ISVAR returns 1 if the specified variable exists.

ISVAR returns 0 if the specified variable does not exist.

Argument Type: String

The argument is a string variable, or string-valued expression.

In general, the argument passed to ISVAR should be a literal string.

Compatibility: Requires V7.20 or later.

See Also: EMPTY, NULL

Example: MATH x = 3

IF (ISVAR("x"))

DISP "x" exists

ENDIF

IF (ISVAR("y"))

DISP "y" exists

ENDIF

In this example the first DISP statement will execute and print:

```
"x" exists
```

since the variable "x" was created when the assignment "x = 3" was executed.

The second DISP statement will not execute because no assignment to "y" has been made, so "y" does not exist.

Usage 1: ISVAR is used only with "named variables". It is not used with any of the following:

'L' registers

'M' registers

'S' registers

MEM

MEM1

MEM2

variable cache variables

variable file variables

A named variable does not exist if:

(a) it has never been assigned to, or

(b) it has been assigned to but was subsequently removed using the DEL function.

Usage 2: It is important to remember that the argument passed to ISVAR is a variable name. ISVAR("x") is not the same as ISVAR(x). Consider what happens if you do this:

MATH x = "abc"

IF (ISVAR(x))

DISP Exists.

ELSE

DISP Does not exist.

ENDIF

When you run this procedure you will see:

```
Does not exist.
```

The reason is that the value of the variable "x" is "abc". Therefore, the call to ISVAR is testing to see if there is a variable named "abc". Since, in the example above, no assignment to "abc" has been made, "abc" does not exist.

ITOC

Purpose:	Converts a decimal integer to its ASCII character equivalent. ITOC returns an empty string if the specified decimal value is not between 0 and 255. If the specified decimal value is not an integer, ITOC truncates the non-integer portion of the value before performing the conversion.
Result Type:	*String*
Argument Type:	Numeric
Compatibility:	Requires V6.11b or later.
Example:	MATH MEM2 = ITOC(120) After the above assignment takes place, the value of MEM2 will be "x", because 120 is the decimal equivalent of the ASCII character lower-case 'x'.

LEN

Purpose:	Computes the length of a string.
Result Type:	*Numeric*
Argument Type:	String
Example:	MATH L[1] = LEN(MEM2)

LN

Purpose:	Computes the natural logarithm of its argument.

Result Type: *Numeric*

Argument Type: Numeric

Example: MATH L[1] = LN(MEM)

LOG

Purpose: Computes the base 10 logarithm of its argument.

Result Type: *Numeric*

Argument Type: Numeric

Example: MATH L[1] = LOG(MEM)

LSET

Purpose: Assigns a value to a specified local numeric register. For simple L-register assignment it is not necessary to use LSET.

For example, to store the value 15.3 into L[5] one can simply write:

```
MATH L[5] = 15.3
```

LSET is useful only when the index of the L register is itself stored in another register. If, for example, the index is in MEM, you cannot write:

```
MATH L[MEM] = 15.3
```

but you can write:

```
MATH LSET(MEM, 15.3)
```

Result Type: *Numeric* (or Void)

The return value is the previous value of the assigned-to L register.

However, the MATH FSC parser allows the LSET return value to be ignored.

Argument Type: Numeric, Numeric

The first argument specifies an L-register index.

The second argument specifies the value to be assigned to the specified L register.

Compatibility: Requires V7.11 or later.

See Also: LGET, MGET, MSET, SGET, SSET

Example: MATH MEM = 10

MATH LSET(MEM, 2.56)

After the MATH statements above execute the value of L[10] will be 2.56.

MAX

Purpose: Computes the maximum of a set of numbers. The function arguments specify the indices of a range of global numeric registers for which the maximum is to be determined.

Result Type: *Numeric*

Argument Type: Numeric, Numeric

Example: MATH M[5] = 25

```
MATH M[6] = 45
MATH M[7] = 20
MATH MEM = MAX(5, 7)
```

After the last MATH statement executes the value of MEM will be 45.

MAX_L

Purpose: Computes the maximum of a set of numbers. The function arguments specify the indices of a range of local numeric registers for which the maximum is to be determined.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example: MATH L[5] = 25

MATH L[6] = 45

MATH L[7] = 20

MATH MEM = MAX_L(5, 7)

After the last MATH statement executes the value of MEM will be 45.

MAX2

Purpose: Computes the maximum of two values.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example: MATH M[5] = 3.7

MATH M[6] = 4.1

MATH MEM = MAX2(M[5], M[6])

After the last MATH statement executes the value of MEM will be 4.1.

MGET

Purpose: Retrieves a value from a specified global numeric register.

For simple M-register access it is not necessary to use MGET. For example, to store the value of M[5] into MEM one can simply write:

```
MATH MEM = M[5]
```

MGET is useful only when the index of the M register is itself stored in another register.

If, for example, the index is in MEM, you cannot write:

```
MATH MEM = M[MEM]
```

but you can write:

```
MATH MEM = MGET(MEM)
```

Result Type: Numeric

Argument Type: Numeric

The argument specifies an M-register index.

Compatibility: Requires V7.11 or later.

See Also: LGET, LSET, MSET, SGET, SSET

Example: MATH M[2] = 4

MATH M[1] = 2

MATH M[3] = MGET(M[1])

After the MATH statements above execute the value of M[3] will be 4.

MSET

Purpose: Assigns a value to a specified global numeric register.

For simple M-register assignment it is not necessary to use MSET. For example, to store the value 15.3 into M[5] one can simply write:

```
MATH M[5] = 15.3
```

MSET is useful only when the index of the M register is itself stored in another register.

If, for example, the index is in MEM, you cannot write:

```
MATH M[MEM] = 15.3
```

but you can write:

```
MATH MSET(MEM, 15.3)
```

Result Type: Numeric (or Void)

The return value is the previous value of the assigned-to M register. However, the MATH FSC parser allows the MSET return value to be ignored.

Argument Type: Numeric, Numeric

The first argument specifies an M-register index.

The second argument specifies the value to be assigned to the specified M register.

Compatibility: Requires V7.11 or later.

See Also: LGET, LSET, MGET, SGET, SSET

Example: MATH MEM = 10

MATH MSET(MEM, 2.56)

After the MATH statements above execute the value of M[10] will be 2.56.

MIN

Purpose: Computes the minimum of a set of numbers. The function arguments specify the indices of a range of global numeric registers for which the minimum is to be determined.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example: MATH M[5] = 25

MATH M[6] = 45

MATH M[7] = 20

MATH MEM = MIN(5, 7)

After the last MATH statement executes the value of MEM will be 20.

MIN_L

Purpose: Computes the minimum of a set of numbers. The function arguments specify the indices of a range of local numeric registers for which the minimum is to be determined.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example: MATH L[5] = 25

MATH L[6] = 45

MATH L[7] = 20

MATH MEM = MIN(5, 7)

After the last MATH statement executes the value of MEM will be 20.

MIN2

Purpose: Computes the minimum of two values.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example: MATH M[5] = 3.7

MATH M[6] = 4.1

MATH MEM = MIN2(M[5], M[6])

After the last MATH statement executes the value of MEM will be 3.7.

MTIME

Purpose: Determines the modification time of a specified file.

Result Type: Numeric

The return value is the modification time of the file.

The return value is expressed in seconds elapsed since midnight Jan 01 1970 UTC.

	If the file does not exist the return value is zero.
Argument Type:	String
	The argument specifies the name of the file.
Compatibility:	Requires V7.11 or later.
See Also:	UGDT, ULDT
	Functions UGDT and ULDT may be used convert the MTIME return value into a printable date and time string if necessary.
Example:	Suppose you have a file on the H: drive named:
	H:\mydata\data.dat"
	Running the following statements stores the modification time of the file in local register L[1]:
	MATH MEM2 = "H:\\mydata\\data.dat"
	MATH L[1] = MTIME(MEM2)

NCAL

Purpose:	Returns the number of cal records for a specified asset.
	The first argument specifies the asset number (string) of the instrument for which the specified Calibration Table value is to be retrieved.
Result Type:	Numeric
Argument Type:	String
Compatibility:	Requires V7.11p or later.
Example:	MATH MEM = NCAL("Sample-5700")
	This example assumes there is an asset with the asset number "Sample-5700" in the database.
See Also:	MATH function "CAL" and "INV".

NOT

Purpose:	Performs a Boolean inversion of its argument.
	If the argument is zero, NOT returns 1.
	If the argument is non-zero, NOT returns 0.

Note

There are no cases where NOT must be used, but there are some situations where procedure readability may be improved by using NOT.

Result Type: Numeric

Argument Type: Numeric

Compatibility: Requires V7.11u or later.

Example: MATH MEM = NOT(ZCMP("A", "B"))

ZCMP returns 0 because "A" and "B" are not the same. Therefore the value assigned to MEM will be 1.

NULL

Purpose: NULL tests a string variable to determine if the value is a null string.

Result Type: Numeric

NULL returns 1 if the value of the specified string variable is null.

NULL returns 0 if the value of the specified string variable is non-NULL.

Argument Type: String

The argument is a string variable, or string-valued expression.

Compatibility: Requires V7.20 or later.

See Also: EMPTY, ISVAR

Example: IF (NULL(S[1]))

DISP S[91]1[93] is null

ENDIF

In this example the DISP statement will execute and print:

S[1] is null

because no value has been assigned to S[1].

Usage: An empty string is a string that exists but has zero length. Null strings are not quite the same. Examples of null strings are:

(a) An 'S' register value before any assignment to the register has been made.

(b) The return value of certain string-based functions when an error or lookup failure occurs. (For example, if you call RIF and the parameter you are looking for does not exist in the fill, RIF returns a NULL string as its return value.)

In most cases procedure writers do not have to be concerned about the distinction between empty strings and null strings.

Function EMPTY hides the distinction between empty strings and null strings, because it returns 1 in either case. In most cases procedure writers will find that EMPTY is a more useful function than NULL.

PAD

Purpose: Adds spaces to the end of a string to make the string a specified length.

The 1st argument is the input string.

The 2nd argument is the result string length. The length cannot be less than 1.

PAD will not shorten a string. Therefore, if the target length is less than or equal to the length of the initial string the return string will simply be a copy of the original string.

If the input string is NULL or empty PAD simply generates a string containing the specified number of spaces.

Quick Proto: string = PAD(string, length)

Result Type: String

Argument Type: String, Numeric

Compatibility: Requires V7.10b or later.

See Also: PADB

Example: MATH S[1] = PAD("abc", 5)

The value of S[1] will be "abc ".

PADB

Purpose: Adds spaces to the beginning of a string to make the string a specified length.

The 1st argument is the input string.

The 2nd argument is the result string length. The length cannot be less than 1; PADB will not shorten a string.

Therefore, if the target length is less than or equal to the length of the initial string the return string will simply be a copy of the original string.

If the input string is NULL or empty, PADB simply generates a string containing the specified number of spaces.

Quick Proto: string = PAD(string, length)

Result Type: String

Argument Type: String, Numeric

Compatibility: Requires V7.10b or later.

See Also: PAD

Example: MATH S[1] = PADB("abc", 5)

The value of S[1] will be " abc".

PASS

Purpose: Returns 1 if most recent evaluation passed, otherwise 0.

It is important to note that execution of an instrument setup statement (e.g., 5700 1 V S) clears the internal result status bit. This means that if "PASS" is used to determine the result of the last evaluation, the determination must be made before the next instrument setup statement.

When using function "PASS" it is important to be aware that since MET/CAL keeps track internally of failures, the absence of a failure defines a "pass". Therefore, "PASS" will return 1 if the previous evaluation was not a "fail". This means that "PASS" returns 1 when there has been no previous evaluation, or when a subsequent instrument setup has cleared the internal memory of the result of the last evaluation.

Result Type: Numeric

Argument Type: None

Compatibility: Requires V7.00k or later.

Example 1: MATH M[1] = PASS()

Example 2: 5700 1V 0.01%

	JMPL ON_PASS PASS()
	DISP FAIL
	END
	LABEL ON_PASS
	DISP PASS
	END
See Also:	FAIL. "PASS" is simply the opposite of "FAIL". In some cases using function "PASS", rather than "FAIL", may improve procedure readability.

PCTTODBV

Purpose:	Converts voltage ratio in % to dB.
Result Type:	Numeric (dB)
Argument Type:	Numeric (%)
	The argument is the percentage value to be converted.
Compatibility:	Requires V7.11h or later.
Example:	MATH MEM = PCTTODBV(56.2341)
	In this example, PCTTODBV will return the dB equivalent to a 56.2341% voltage ratio (approximately -5 dB).

PCTTODBW

Purpose:	Converts power ratio in % to dB.
Result Type:	Numeric (dB)
Argument Type:	Numeric (%)
	The argument is the percentage value to be converted.
Compatibility:	Requires V7.11h or later.
Example:	MATH MEM = PCTTODBW(31.6228)
	In this example, PCTTODBW will return the dB equivalent to a 31.6228% power ratio (approximately -5 dB).

PSCALE

Purpose: Given a string that represents a dimensioned number, PSCALE returns the numeric scalar that corresponds to the units prefix.

The return value is the value by which you would multiply the numeric part of the dimensioned number to convert the value to base units.

The following list shows the correspondence:

Prefix	Scalar
'Y' (yotta)	1.0E+24
'Z' (zetta)	1.0E+21
'E' (exa)	1.0E+18
'P' (peta)	1.0E+15
'T' (tera)	1.0E+12
'G' (giga)	1.0E+9
'M' (mega)	1.0E+6
'k' (kilo)	1.0E+3
'm' (milli)	1.0E-3
'u' (micro)	1.0E-6
'n' (nano)	1.0E-9
'p' (pico)	1.0E-12
'f' (femto)	1.0E-15
'a' (atto)	1.0E-18
'z' (zepto)	1.0E-21
'y' (yocto)	1.0E-24

Note on micro: The Windows character set character mu (decimal 181) is equivalent to 'u' for the purposes of function PSCALE.

Result Type: Numeric

Argument Type: String

Compatibility: Requires V7.11 or later.

Example: MATH MEM = PSCALE("34.5 mV")

After the call to PSCALE the value of MEM will be 1.0E-3.

POW

Purpose: Raises a specified value to a specified power. (The exponentiation operator, '^', may also be used to raise a value to a power. For example, pow(5,2) is equivalent to 52.)

Result Type: Numeric

Argument Type: Numeric, Numeric

Example: MATH MEM = POW(5, 2)

After this statement executes the value of MEM will be 25.

PROC

Purpose: Returns the name of the currently executing procedure. If the currently executing procedure is a subprocedure, the name of the subprocedure is returned.

Result Type: String

Argument Type: None

Compatibility: Requires V7.00 or later.

Example: MATH MEM2 = PROC()

PSUB

Purpose: Determines if a specified string is a substring of the name of the currently executing procedure. The comparison is case-sensitive. If the currently executing procedure is a subprocedure, the name of the subprocedure is used for the comparison.

In many cases, PSUB may be used to replace JMPT and JMPF procedure statements, which have the disadvantage of using procedure step numbers as jump destinations.

Result Type: Numeric

The return value is 1 if the specified argument is a substring of the current procedure name. If the argument is not a substring the return value is 0.

Argument Type: String

Compatibility: Requires V7.00 or later.

Example: `JMPL L1 PSUB("3458 Verification")`

PSUBI

Purpose: Determines if a specified string is a substring of the name of the currently executing procedure. The comparison is case-insensitive.

If the currently executing procedure is a subprocedure, the name of the subprocedure is used for the comparison.

In many cases, PSUBI may be used to replace JMPT and JMPF procedure statements, which have the disadvantage of using procedure step numbers as jump destinations.

Result Type: Numeric

The return value is 1 if the specified argument is a case-insensitive substring of the current procedure name. If the argument is not a substring the return value is 0.

Argument Type: String

Compatibility: Requires V7.00 or later.

Example: `JMPL L1 PSUBI("3458 verification")`

PSCALE

Purpose: Given a string that represents a dimensioned number, PSCALE returns the numeric scalar that corresponds the units prefix.

The return value is the value by which you would multiply the numeric part of the dimensioned number to convert the value to base units.

The following list shows the correspondence:

Prefix	**Scalar**
'Y' (yotta)	1.0E+24
'Z' (zetta)	1.0E+21
'E' (exa)	1.0E+18
'P' (peta)	1.0E+15
'T' (tera)	1.0E+12
'G' (giga)	1.0E+9

'M' (mega)	1.0E+6
'k' (kilo)	1.0E+3
'm' (milli)	1.0E-3
'u' (micro)	1.0E-6
'n' (nano)	1.0E-9
'p' (pico)	1.0E-12
'f' (femto)	1.0E-15
'a' (atto)	1.0E-18
'z' (zepto)	1.0E-21
'y' (yocto)	1.0E-24

Note on micro: The Windows character set character mu (decimal 181) is equivalent to 'u' for the purposes of function PSCALE.

Result Type: Numeric

Argument Type: String

Compatibility: Requires V7.11 or later.

Example: MATH MEM = PSCALE("34.5 mV")

After the call to PSCALE the value ofMEM will be 1.0E-3.

PUTV

Purpose: Store value in MET/CAL variable file.

The first argument is the variable name.

The second argument is the variable value.

The return value is the previous value, if any, of the variable.

The variable name may refer to an existing variable, or may cause the creation of a new variable.

All variable names must end with '$'. However, if the '$' is omitted in a MATH statement, it is automatically added before the value is stored.

Variable names are case-insensitive.

The MET/CAL variable file is cached (in memory) during normal program operation. It is used by the pre-prompt and post-prompt dialogs, and accessed by the [V...] special construction.

The MET/CAL variable file contains lines which have a maximum of 511 characters. This includes the terminating linefeed character, as well as the equals sign ('=') used to separate the name from the value. The MATH FSC, therefore, does not allow the combined length of the name and value strings for a variable to exceed 509 characters.

Result Type: String

Argument Type: String, String

See Also: GETV

Compatibility: Requires V6.0 or later.

Example: MATH S[32] = PUTV("Humidity", S[30])

The above example assumes that string register S[30] contains the formatted relative humidity value.

Caution

Function PUTV must be used with caution. Modifying the value of a variable written automatically by the MET/CAL run system may cause unforeseen changes in the results.

RAD

Purpose: Converts from degrees to radians.

Result Type: Numeric (radians)

Argument Type: Numeric (degrees)

Example: MATH L[1] = RAD(MEM)

REPL

Purpose: Replaces a specified substring with a specified replacement string.

Argument 1 is the substring.

Argument 2 is the replacement string

Argument 3 is the original string.

REPL does not modify the original string. It makes a copy and performs the indicated replacement in the copy. (If you wish to modify the original string, assign the REPL return value back to the original string.)

If the substring is not found in the original string REPL simply returns the original

It is an error if any of the input arguments is NULL, however, empty strings are allowed.

Quick Proto: new str = REPL(sub, repl, orig str)

Argument Type: String, String, String

Result Type: String

Compatibility: V7.10c or later is required.

Example: MATH S[1] = "voltage = <v> mV"

MATH S[1] = REPL("<v>", "20.0", s[1])

The call above produces the string:

voltage = 20.0 mV

RHT_HUMIDITY

Purpose: Returns the most recent RHT relative humidity.

A run time error occurs if RHT use is not enabled on the workstation on which the procedure is being executed, or if RHT parameters in the MET/CAL initialization file are incorrect, or if RHT data values in the RHT data file are invalid or inaccessible.

Result Type: Numeric

Argument Type: None

Compatibility: Requires V6.11 or later.

Example: MATH M[1] = RHT_HUMIDITY()

RHT_TEMP

Purpose: Returns the most recent RHT temperature. Temperature units are either °C or °F, depending on the configuration of the RHT.

A run time error occurs if RHT use is not enabled on the workstation on which the procedure is being executed, or if RHT parameters in the MET/CAL initialization file are incorrect, or if RHT data values in the RHT data file are invalid or inaccessible.

Result Type: Numeric

Argument Type: None

Compatibility: Requires V6.11 or later.

Example: MATH M[1] = RHT_TEMP()

RHT_TIME

Purpose: Returns the most recent RHT timestamp in seconds since midnight Jan 01, 1970 UTC (coordinated universal time).

A run time error occurs if RHT use is not enabled on the workstation on which the procedure is being executed, or if RHT parameters in the MET/CAL initialization file are incorrect, or if RHT data values in the RHT data file are invalid or inaccessible.

Result Type: Numeric

Argument Type: None

Compatibility: Requires V6.11 or later.

Example: MATH M[1] = RHT_TIME()

RIF

Purpose: Reads the value of a specified initialization file parameter.

This function has three arguments. The first argument is the initialization file name. The second argument is the section name. The third argument is the parameter name.

The return value is an empty string if the file does not exist, or the specified parameter does not exist in the specified section, or if the parameter exists but has no value.

The file name is usually case-insensitive, but it depends on the file system. (For example, if you are reading a file on a Unix server, the file name will be case-sensitive.)

The section name and parameter name arguments are case-insensitive.

Result Type: String

Argument Type: String, String, String

Compatibility: Requires V7.01s or later.

Example: MATH S[10] = "c:\\metcal\\test.ini"

MATH MEM2 = RIF(S[10], "abc", "xyz")

In this example the value of parameter "xyz" in section "abc" of file "c:\metcal\test.ini" is retrieved. The file name is stored first in string register S[10] to save space on the line that calls "RIF". (This is optional. You only have to do this if the MATH statement gets too long.)

Note also that when a file name includes backslash characters, you must specify two backslashes to indicate a single literal backslash in a MET/CAL string register value.

Suppose the file "test.ini" looks like this:

```
[abc]
xyz = 23.6 mV
```

Then the value of MEM2 after the call to RIF will be "23.6 mV".

RINF

Purpose: Reads the value of a specified parameter in the instrument file.

This function has two arguments. The first argument is the section name. The second argument is the parameter name.

The return value is an empty string if the file does not exist, or the specified parameter does not exist in the specified section, or if the parameter exists. The section name and parameter name arguments are case-insensitive.

The name and location of the instrument information file are specified using the MET/CAL initialization file parameters "RinfDir" and "RinfBase".

RINF does not generate an error message if there is no value for the specified parameter in the specified section of the instrument information file.

Quick Proto: val = RINF(section, param)

Result Type: String

Argument Type: String, String

Compatibility: Requires V7.11 or later.

Example: MATH MEM2 = RINF("abc", "xyz")

In this example the value of parameter "xyz" in section "abc" of the instrument information file is retrieved.

Suppose the instrument information file contains:

[abc]

xyz = 23.6 mV

Then the value of MEM2 after the call to RINF will be "23.6 mV".

RINFE

Purpose: Reads the value of a specified parameter in the instrument information file.

This function has two arguments. The first argument is the section name. The second argument is the parameter name.

The return value is an empty string if the file does not exist, or the specified parameter does not exist in the specified section, or if the parameter exists but has no value.

The section name and parameter name arguments are case-insensitive.

The name and location of the instrument information file are specified using the MET/CAL initialization file parameters "RinfDir" and "RinfBase".

RINFE is the same as RINF, except that it generates an error message if the specified parameter value cannot be found.

Quick Proto: val = RINFE(section, param)

Result Type: String

Argument Type: String, String

Compatibility: Requires V7.11 or later.

Example: MATH MEM2 = RINFE("abc", "xyz")

In this example the value of parameter "xyz" in section "abc" of the instrument information file is retrieved.

Suppose the instrument information file contains:

[abc]

xyz = 23.6 mV

Then the value of MEM2 after the call to RINFE will be "23.6 mV".

RND

Purpose: Rounds a number to the nearest integer.

Result Type: Numeric

Argument Type: Numeric

Example: MATH L[1] = RND(MEM)

RSS

Purpose: Computes the RSS (square root of sum of squares) of a set of numbers. The function arguments specify the indices of a range of global numeric to be included in the RSS calculation.

Result Type: Numeric

Argument Type: Numeric, Numeric

The first argument is the starting index of the sequence of numeric registers.

The second argument is the ending index of the sequence of numeric registers.

Compatibility: Requires V6.11c or later.

Example:

```
MATH M[5]=5; M[6]=4;
MATH M[7]=2; M[8]=7; M[9]=12
MATH MEM = RSS(5, 9)
```

The call to RSS sets the value of MEM to 15.4272486205.

RSS_L

Purpose: Computes the RSS (square root of sum of squares) of a set of numbers. The function arguments specify the local numeric register indices of a range of numeric values to be included in the RSS calculation.

Result Type: Numeric

Argument Type: Numeric, Numeric

The first argument is the starting index of the sequence of local numeric registers.

The second argument is the ending index of the sequence of local numeric registers.

Compatibility: Requires V7.00b or later.

Example: MATH L[5]=5; L[6]=4;

MATH L[7]=2; L[8]=7; L[9]=12

MATH MEM = RSS_L(5, 9)

The call to RSS_L sets the value of MEM to 15.4272486205.

RSS2

Purpose: Calculates the RSS (square root of sum of the squares) of two specified numbers.

Result Type: Numeric

Argument Type: Numeric, Numeric

Compatibility: Requires V6.01 or later.

Example: MATH MEM = RSS2(3, 4)

Executing the MATH statement above results in MEM being set to 5, because the 32 + 42 is 25, and the square root of 25 is 5.

RSS3

Purpose: Calculates the RSS (square root of the sum of the squares) of three specified numbers.

Result Type: Numeric

Argument Type: Numeric, Numeric, Numeric

Compatibility: Requires V6.01 or later.

Example: MATH MEM = RSS3(2, 3, 6)

Executing the MATH statement above results in MEM being set to 7, because the 22 + 32 + 62 is 49, and the square root of 49 is 7.

SAFEOFF

Purpose: SAFEON is used to inform MET/CAL that a potentially dangerous voltage generated by the UUT or a user-configured reference is no longer present. If the "safety symbol" (OSHA lighting bolt warning graphic) has been displayed (based on a call to SAFEON) for a particular device, the graphic will be removed when SAFEOFF is called.

Quick Proto: SAFEOFF(device)

Result Type:	Numeric (or Void)
Argument Type:	String
	The argument specifies the instrument name. The name must be either "UUT" or the name of a configured instrument.
	(The INSTR function may be used to obtain a device name from an alias if necessary.)
Compatibility:	Requires V7.20 or later.
See Also:	SAFEON, INSTR

Example:

```
HEAD      DC VOLTAGE: 330 V Range
M8508     RNGLK 1000V           FS
TARGET    -p
MATH      SAFEON("UUT", "300 V", "")
IEEE2     OUT 300 V;OPER
TARGET    -m
TOL       0.0055% 500e-6U
8508   330   300.0000V   TOL D7 2W
MATH      SAFEOFF("UUT")
```

In this example, the UUT is generating an unsafe voltage (300 VDC). The lightning bolt graphic will appear when SAFEON is called. The graphic disappears when the call to SAFEOFF occurs.

SAFEON

Purpose:

SAFEON is used to inform MET/CAL that a potentially dangerous svoltage generated by the UUT or a user-configured reference is present.

The "safety symbol" (OSHA lighting bolt warning graphic) is displayed if the specified signal exceeds the danger threshold.

The SAFEON function interacts with the RESET FSC in the following manner:

When MET/CAL executes a reset command specified in a RESET statement, it is presumed that the instrument is being reset to a safe state. Therefore, if the lightning bolt graphic is displayed at the time that the reset command is executed, the graphic is removed. This means that if the procedure contains a RESET statement for a particular instrument it is not necessary to call the SafeOff function to remove a signal specified using SAFEON.

If multiple unsafe signals are present at the same time, multiple calls to SAFEON may be made. The lightning bolt graphic will not disappear until all unsafe signals have been removed.

Quick Proto: SAFEON(device, value, waveform)

Result Type: Numeric (or Void)

Argument Type: String, String, String

The first argument specifies the instrument name. The name must be either "UUT" or the name of a configured instrument. (The INSTR function may be used to obtain a device name from an alias if necessary.)

The second argument specifies a dimensioned value, including units prefix and units symbol. (The prefix is optional.)

The third argument specifies the waveform. For DC voltages specify an empty string ("") as the waveform.

Valid waveforms are:

- edge
- fast edge
- impulse
- leveled sine (or lev sine)
- linear ramp
- +ramp
- -ramp
- sawtooth
- scopemeter
- sine
- square (or sq)
- trapezoid
- triangle
- truncated sine (or trunc sine)

When the specified units are volts rms ("V") or volts peak-to-peak ("Vpp"), MET/CAL uses the specified waveform to convert to an equivalent peak AC voltage. By default, the maximum safe peak AC voltage is 42.4. Values greater than that threshold value will cause the lightning bolt graphic to appear during procedure execution. (The lightning bolt does not appear in demo mode.)

Compatibility: Requires V7.20 or later.

See Also: SAFEOFF, INSTR

Example:

```
RESET   STBY;*OPC?[I!]
HEAD          DC VOLTAGE: 330 V Range
M8508         RNGLK 1000V    FS
TARGET        -p
MATH          SAFEON("UUT", "300 V", "")
IEEE2         OUT 300 V;OPER
TARGET        -m
TOL           0.0055% 500e-6U
8508    330        300.0000V    TOL D7 2W
```

In this example, the UUT is generating an unsafe voltage (300 VDC).

The lightning bolt graphic will appear when SAFEON is called. The lightning bolt graphic disappears when the RESET-specific reset command is executed.

SDEV

Purpose: Computes the standard deviation of a set of numbers. The function arguments specify the indices of a range of global numeric registers the values of which are to be included in the calculation of the standard deviation.

Result Type: Numeric

Argument Type: Numeric, Numeric

Example:

```
MATH M[5] = 10
MATH M[6] = 11
MATH M[7] = 10
MATH M[8] = 11
```

MATH MEM = SDEV(5, 8)

After the last MATH statement executes the value of MEM will be .5774.

SDEV_L

Purpose: Computes the standard deviation of a set of numbers. The function arguments specify the indices of a range of local numeric registers the values of which are to be included in the calculation of the standard deviation.

Result Type: Numeric

Argument Type: Numeric, Numeric

Compatibility: Requires V7.00b or later.

Example: MATH L[5] = 10

MATH L[6] = 11

MATH L[7] = 10

MATH L[8] = 11

MATH MEM = SDEV_L(5, 8)

After the last MATH statement executes the value of MEM will be .5774.

SGET

Purpose: Retrieves the value of a specified string register.

For simple S-register access it is not necessary to use SGET. For example, to store the value of S[5] into MEM2 one can simply write:

```
MATH MEM2 = S[5]
```

SGET is useful only when the index of the S register is itself stored in another register.

If, for example, the index is in MEM, you cannot write:

```
MATH MEM2 = S[MEM]
```

but you can write:

```
MATH MEM2 = SGET(MEM)
```

Result Type: String

Argument Type: Numeric

The argument specifies an S-register index.

Compatibility: Requires V7.11 or later.

See Also: LGET, LSET, MGET, MSET, SSET

Example: MATH S[2] = "ABC"

MATH L[1] = 2

MATH S[3] = SGET(L[1])

After the MATH statements above execute the value of S[3] will be "ABC".

SSET

Purpose: Assigns a value to a specified global string register.

For simple S-register assignment it is not necessary to use SSET. For example, to store the value "abc" into S[5] one can simply write:

```
MATH S[5] = "abc"
```

SSET is useful only when the index of the S register is itself stored in another register.

If, for example, the index is in MEM, you cannot write:

```
MATH S[MEM] = "abc"
```

but you can write:

```
MATH SSET(MEM, "abc")
```

Result Type: String (or Void)

The return value is the previous value of the assigned-to S register.

However, the MATH FSC parser allows the SSET return value to be ignored.

Argument Type: Numeric, Numeric

The first argument specifies an SM-register index.

The second argument specifies the value to be assigned to the specified SM register.

Compatibility: Requires V7.11 or later.

See Also: LGET, LSET, MGET, MSETMGET, SGET

Example: MATH MEM = 10

MATH SSETMSET(MEM, "mV"2.56)

After the MATH statements above execute the value of SM[10] will be "mV"2.56.

SGN

Purpose: Determines the arithmetic sign of a number. Returns 1 for positive numbers, -1 for negative numbers, and 0 for zero.

Result Type: Numeric

Argument Type: Numeric

Example: MATH L[1] = SGN(MEM)

SIN

Purpose: Computes the sine of its argument.

Result Type: Numeric (radians)

Argument Type: (radians)

Example: MATH L[1] = SIN(MEM)

SINH

Purpose: Computes the hyperbolic sine of its argument.

Result Type: Numeric (radians)

Argument Type: Numeric (radians)

Example: MATH L[1] = SINH(MEM)

SN

Purpose: Returns the serial number of a specified asset.

The argument specifies the asset number (string) of the instrument for which the serial number is to be fetched from the database Inventory Table.

Result Type: String

Argument Type: String

Compatibility: Requires V7.00d or later.

Example: MATH MEM2 = SN("Sample-5700")

This example assumes there is an asset with the asset number "Sample-5700" in the database.)

SQRT

Purpose: Computes the square root of its argument.

Result Type: Numeric

Argument Type: Numeric

Example: MATH L[1] = SQRT(MEM)

SUB

Purpose: Extracts a substring of a specified length starting at a specified index. The first argument is the string from which the substring is to be extracted. The second argument is the starting index of the substring. The third argument is the length of the substring.

Quick Proto: SUB(string, index, substring length)

Result Type: String

Argument Type: String, Numeric, Numeric

Example: MATH MEM2 = SUB("abcdef", 2, 3)

After this statement executes the value of MEM2 will be "bcd".

SUM

Purpose: Computes the sum of a set of numbers. The function arguments specify the indices of a range of global numeric registers the values of which are to be added.

Quick Proto: SUM(starting M-Reg index, ending M-Reg index)

Result Type: Numeric

Argument Type: Numeric, Numeric

Compatibility: Requires V7.01s or later.

Example: MATH M[5] = 25

MATH M[6] = 45

MATH M[7] = 20

MATH MEM = SUM(5, 7)

After the last MATH statement executes the value of MEM will be 90.

SUM_L

Purpose: Computes the sum of a set of numbers. The function arguments specify the indices of a range of local numeric registers the values of which are to be added.

Quick Proto: SUM(starting L-Reg index, ending L-Reg index)

Result Type: Numeric

Argument Type: Numeric, Numeric

Compatibility: Requires V7.01s or later.

Example: MATH L[5] = 1.1

MATH L[6] = 2.2

MATH L[7] = 3.3

MATH MEM = SUM_L(5, 7)

After the last MATH statement executes the value of MEM will be 5.6.

TAN

Purpose: Computes the tangent of its argument.

Result Type: Numeric (radians)

Argument Type: Numeric (radians)

Example: MATH S[1] = TAN(MEM)

TANH

Purpose: Computes the hyperbolic tangent of its argument.

Result Type: Numeric (radians)

Argument Type: Numeric (radians)

Example: MATH S[1] = TANH(MEM)

TIME

Purpose: Returns the current time.

The format of the time string is HH:MM:SS.

The hour number (HH) is a number in the range 00 to 23.

The minute and second numbers (MM and SS) are numbers in the range 00 to 59.

Result Type: String

Argument Type: None

Compatibility: Requires V6.0 or later.

Example: MATH S[5] = TIME()

This produces a time string like "10:12:59" and stores it in string register S[5].

UGDT

Purpose: Converts a value representing seconds since Jan 01, 1970 UTC to a formatted date and time string.

The date format is controlled by the second argument. The time format is always HH:MM:SS.

The converted value represents Coordinated Universal Time (UTC), also known as Greenwich Mean Time (GMT).

The first argument is a numeric value interpreted as a number of seconds since Jan 01, 1970 UTC.

The second argument is a string that controls the date format. The following format descriptors may be used:

DD	- day number
MM	- month number
MON	- 3-letter month name
MONTH	- full month name
YY	- 2-digit year number (window 1970-2069)
YYYY	- 4-digit year number

No format descriptor may occur more than once in a format control string.

At most one of { MM, MON, MONTH } may occur in a format control string.

At most one of { YY, YYYY } may occur.

Characters that do not match a valid format descriptor are copied unchanged to the formatted date string.

Format descriptors are case-insensitive.

Result Type: String

Argument Type: Numeric, String

Compatibility: Requires V7.00g or later.

See Also: UTIME, ULDT, DATE

Example: MATH MEM2 = UGDT(1E+9, "month dd, yyyy")

MEM2 will contain the string "September 09, 2001 01:46:40", representing the date and time one billion seconds after midnight Jan 01, 1970 UTC.

ULDT

Purpose: Converts a value representing seconds since Jan 01, 1970 UTC to a formatted date and time string.

The date format is controlled by the second argument. The time format is always HH:MM:SS.

The converted value represents local time, as defined by the time zone settings on the workstation.

The first argument is a numeric value interpreted as a number of seconds since Jan 01, 1970 UTC.

The second argument is a string that controls the date format. The following format descriptors may be used:

DD	- day number
MM	- month number
MON	- 3-letter month name
MONTH	- full month name
YY	- 2-digit year number (window 1970 - 2069)
YYYY	- 4-digit year number

No format descriptor may occur more than once in a format control string.

At most one of { MM, MON, MONTH } may occur in a format control string.

At most one of { YY, YYYY } may occur.

Characters that do not match a valid format descriptor are copied unchanged to the formatted date string.

Format descriptors are case-insensitive.

Result Type: String

Argument Type: Numeric, String

Compatibility: Requires V7.00g or later.

See Also: UTIME, ULDT, DATE

Example: MATH MEM2 = ULDT(1E+9, "month dd, yyyy")

If the PC on which the ULDT function call above is executed is set to PST (Pacific Standard Time), MEM2 will contain the string "September 08, 2001 18:46:40", representing the PST date and time one billion seconds after midnight Jan 01, 1970 UTC.

UNC

Purpose: Retrieve specified uncertainty parameter value from most recent evaluation.

It is important to realize that values returned by UNC are always for the most recently completed evaluation step. You cannot query the system to determine values for the uncertainty calculation that is currently underway.

Result Type: Numeric

Argument Type: String

The following arguments are valid:

"CONF"
"COV_FAC"
"EXP_UNC"
"F"
"NMEAS"
"NTHROW"
"RSS"
"S1"
"S2"
"SDEV"
"STD_UNC"
"SYS_ACC"

"U1"
"U2"
"U3"
"U4"
"U5"
"U6"
"U7"
"U8"
"U9"
"U10"
"UUT_RES"

Refer to the VSET help file for an explanation of the parameters.

Compatibility: Requires V6.11d or later.

Error Handling: An attempt to access a parameter value when the measurement uncertainty calculation was disabled for the most recent evaluation results in a run time error.

Example:

```
ASK+ K
VSET   NMEAS = 5
5700   1.000V          S
TARGET -M
IEEE   <uut command>[I]
MEMCX  1.000V 0.01%
MATH   MEM = UNC("SDEV")
DISP   Standard Deviation = [MEM]
```

In this example the measurement in test #1 is repeated 5 times. After the MEMCX evaluation has completed, the "UNC" function is then used to retrieve the standard deviation ("SDEV") calculated as part of the measurement uncertainty calculation for test #1.

UNCV

Purpose: Retrieve specified measurement value from most recent evaluation.

It is important to realize that values returned by UNCV are always for the most recently completed evaluation step. You cannot query the system to determine values for the uncertainty calculation that is currently underway.

UNCV cannot be used if the measurement uncertainty calculation is not enabled.

Result Type: Numeric

Argument Type: Numeric

The argument specifies the index of the measurement. The index must be between 1 and NMEAS.

Compatibility: Requires V6.11d or later.

Error Handling: An attempt to access a measurement value when the measurement uncertainty calculation was disabled for the most recent evaluation results in a run time error.

Example:

```
1.001 ASK+ K
VSET    NMEAS = 3
5700    1.000V          S
TARGET     -M
IEEE    <uut command>[I]
MEMCX   1.000V       0.01%

MATH       M[1] = UNCV(1)
MATH  M[2] = UNCV(2)
MATH  M[3] = UNCV(3)
DISP  3 measurements are:
DISP  [M1], [M2], [M3]
MATH  MEM = UNCV(0)
DISP  Average measurement = [MEM]
```

In this example the measurement in test #1 is repeated 3 times. After the MEMCX evaluation has completed, the "UNCV" function is then used to retrieve the 3 measurements. (These are the measurements MET/CAL averages to determine the UUT Indicated value, and from which the standard deviation is determined as part of the measurement uncertainty calculation.)

UPREFIX

Purpose: Given a string that represents a dimensioned number, UPREFIX returns the units prefix symbol.

The UPREFIX supports the following

SI units prefixes:

Prefix

'Y' (yotta)

'Z' (zetta)

'E' (exa)

'P' (peta)

'T' (tera)

'G' (giga)

'M' (mega)

'k' (kilo)

'm' (milli)

[181] (micro)

'n' (nano)

'p' (pico)

'f' (femto)

'a' (atto)

'y' (yocto)

Note on micro: UPREFIX accepts as input a lowercase "u' to represent micro. However, the return value is a Greek mu characters (decimal 181 in the Windows characters set).

Units prefixes are case sensitive.

Result Type: String

The result value is a string that is equal to the units prefix in the provided dimensioned number.

Argument Type: String

The argument is a string that represents a dimensioned number.

The format of a dimensioned number is:

<n> <prefix><units>

where:

<n> = numeric value

<prefix> = SI units prefix

<units> = units symbol

Compatibility: Requires V7.11 or later.

See Also: UNIT

Example: MATH MEM2 = UPREFIX("34.5 mV")

After the call to UNIT the value of MEM2 will be "m".

UTIME

Purpose: Returns the current time in seconds since midnight Jan 01, 1970 UTC (coordinated universal time).

Result Type: Numeric

Argument Type: None

Compatibility: Requires V6.11 or later.

Example: MATH M[1] = UTIME()

UUT

Purpose: Returns the asset number of the UUT.

When running a procedure using the MET/CAL Editor's Test Run function the asset number of the UUT is unknown. In this case, the UUT function returns an empty string.

Result Type: String

Argument Type: None

Compatibility: Requires V7.11h or later.

See Also: ASSET and ASSETC

Example: MATH S[1] = UUT()

VERS

Purpose: Returns MET/CAL version string.

Result Type: String

Argument Type: None

Example 1: MATH MEM2 = VERS()

Example 2: MATH MEM = VERS()

In the second example, the version string is converted to numeric form. This allows the version number to be tested in a relational expression.

VTODBM

Purpose: Converts from volts RMS to dBm.

Note: The conversion is correct for sine waves only.

Result Type: Numeric (dBm)

Argument Type: Numeric (Vrms), Numeric (ohms)

The first argument is the RMS voltage value to be converted.

The second argument is the reference impedance (ohms).

Compatibility: Requires V6.11i or later.

Example: MATH MEM = VTODBM(100.0, 50.0)

In this example, VTODBM will return the dBm value equivalent to 100 V at 50 ohms.

WIF

Purpose: Writes the value of a specified initialization file parameter.

This function has four arguments.

The first argument is the initialization file name.

The second argument is the section name.

The third argument is the parameter name.

The fourth argument is the parameter value.

The return value is 0 if the call to WIF fails.

The return value is 1 if the call to WIF succeeds.

The file name is usually case-insensitive, but it depends on the file system. (For example, if you are writing to a file on a Unix server, the file name will be case-sensitive.)

The section name and parameter name arguments are case-insensitive.

Result Type: String

Argument Type: String, String, String, String

Compatibility: Requires V7.01s or later.

Example: MATH S[10] = "c:\\metcal\\test.ini"

MATH MEM2 = WIF(S[10], "abc", "x", "20")

In this example, the value of parameter "x" in section "abc" of file "c:\metcal\test.ini" is written. The file name is stored first in string register S[10] to save space on the line that calls "RIF". (This is optional. You only have to do this if the MATH statement gets too long.) Note also that when a file name includes backslash characters, you must specify two backslashes to indicate a single literal backslash in a MET/CAL string register value.

After the call to WIF, "test.ini" will contain:

```
[abc]
x = 20
```

WTODBM

Purpose: Converts from watts to dBm.

Result Type: Numeric (dBm)

Argument Type: Numeric (W)

The first argument is the power value, in watts, to be converted.

Compatibility: Requires V7.01f or later.

Example: MATH MEM = WTODBM(2.0)

In this example, WTODBM will return the dBm value equivalent to 2 W.

ZCMP

Purpose: Case-sensitive string comparison. Returns 1 if strings are the same, 0 otherwise. (Same as CMP, except returns 0 instead of -1 when strings are not the same.) Maybe used in conjunction with JMPZ.

Result Type: Numeric

Argument Type: String, String

Example: MATH S[1]="ABC"MATH S[2]="ABCD"
MATH MEM=ZCMP(S[1],S[2])

In this example, MEM will be set to zero, because the two strings being compared are not the same.

ZCMPI

Purpose: Case-insensitive string comparison. Returns 1 if strings are the same, 0 otherwise. (Same as CMPI except returns 0 instead of -1 when strings are not the same.) May be used in conjunction with JMPZ.

Result Type: Numeric

Argument Type: String, String

Example: MATH S[1]="abc"
MATH S[2]="ABC"
MATH MEM=ZCMPI(S[1],S[2])

In this example, MEM will be set to one, because the two strings being compared are not the same, except for case.

Literal Values

Literal values may be numeric or string values.

Numeric values may be integer, fixed-point or floating-point.

Examples:

integer	23
fixed-point	3.56
floating-point	2.4E3

String values must be enclosed in double quotes. String values may not contain embedded NUL characters (zero).

Literal strings may include the following backslash escape sequences:

r	carriage return
n	linefeed
\\	backslash
\"	double quote
\ddd	decimal integer (where ddd = 001 to 255)
xdd	hex integer (where xdd = x01 to xFF)

Value Conversion

Each operator has an expected type for its operands, each function has an expected type for its arguments, and each destination register has a type.

Implicit conversions from strings to integers, and vice versa, are done as needed during expression evaluation.

A string is converted to a numeric value by searching for the first numeric character (including '+', '-', and '.') and converting the number which begins at that point. A run time error results if the string does not contain a numeric value.

Example: MATH MEM = "abc1.4xyz"

After the statement is executed, the value of MEM will be 1.4.

When an implicit conversion from a numeric value to a string value is done, MET/CAL formats the numeric value to retain up to 6 significant digits.

If a procedure has a requirement for a conversion that results in a different number of significant digits, the FMT function should be used explicitly to specify the conversion.

Example:

```
MATH MEM = 13579.24
MATH MEM2 = MEM
DISP MEM2 = [MEM2]
```

The implicit conversion which occurs when the assignment MEM2 = MEM is done retains only 6 significant digits. If you display the value of MEM2 after this conversion you will see "13579.2". The 7th significant digit, '4', has been discarded.

To retain all significant digits in this example, use the FMT function:

```
MATH MEM = 13579.24
MATH MEM2 = FMT(MEM, "%.10g")
DISP MEM2 = [MEM2]
```

In the example above, the format descriptor "%.10g" causes up to 10 significant digits to be retained. When you display MEM2 you will now see "13579.24", which has 7 significant digits. The format descriptor should be chosen to retain at least as many as the required number of significant digits.

Operator Precedence

The following table shows operator precedence from highest to lowest. Operators at the same level have the same precedence and are evaluated left to right.

Level 1 (Highest)	**^**
Level 2	*****, **/**
Level 3	**+**, **-**, **&**
Level 4 (Lowest)	**<**, **<=**, **>**, **>=**, **==**, **!=**

The default precedence of an operator may be overridden by using parentheses to group sub-expressions.

Example:

MATH MEM = (M[1] + M[2]) * (M[3] - M[4])

This expression is evaluated as follows:

1. The sum of M[1] and M[2] is calculated.
2. The difference between M[3] and M[4] is calculated.
3. The result of step 1 is multiplied by the result of step 2.
4. The result of step 3 is stored in MEM.

Note

The expression in the example above would not be the same if the parentheses were removed.

Restrictions

1. Unary sign operators may not precede non-literal values.

   For example, "MATH MEM = 1 - -MEM1" is illegal.

   Instead, write: "MATH MEM = 1 - (-1 * MEM1)".

   Unary sign operators may precede literal values, however. For example, "MATH MEM = 1 - -3" is legal.

2. Array indices must be literal numeric values.

   For example, "MATH MEM = M[MEM1]" is illegal.

Error Handling

Division by zero is not allowed. A run-time error results if division by zero occurs.

Run-time errors occur if function parameters are out of range or otherwise illegal.

Relational Operators and Floating-Point Comparisons

Internally, MET/CAL uses double-precision floating-point values to represent numeric register values. Because binary floating-point numbers cannot exactly represent many real numbers, and because certain arithmetic operations and functions may not procedure exact results, there is a possibility that relational comparisons may produce unexpected results. Relational comparisons are comparisons which one of the relational operators: <, <=, >, >=, ==, !=.

To address this issue, the MATH FSC makes uses of an "epsilon factor". The default value of this factor is 10^{-13}. With the "==" operator, for example, using the default epsilon factor means that two numbers will be considered by MET/CAL to be equal if they are within one part in 10^{13} of one another.

Here is an example of a situation where the epsilon factor makes a difference. Consider the expression in the IF statement:

```
IF [(9.7 + 0.1 + 0.1 + 0.1) == 10.0]
```

In normal mathematics we would expect this expression to be true, because (9.7 + 0.1 + 0.1 + 0.1) is in fact equal to 10. However, on a typical binary computer (PC) which implements double-precision floating-point arithmetic, it happens that (9.7 + 0.1 + 0.1 + 0.1) evaluates to 9.999999999999998, not to 10. A system which implements exact floating-point comparisons will therefore evaluate the relational expression [(9.7 + 0.1 + 0.1 + 0.1) == 10.0] as false.

By applying the epsilon factor to the comparison, MET/CAL's MATH FSC will evaluate [(9.7 + 0.1 + 0.1 + 0.1) == 10.0] to true. This is because 10 and 9.999999999999998, although not identical, are within one part in 10^{13} of one another.

The VSET/TSET parameter, MATH_EPSILON, may be used to change the epsilon factor. Setting MATH_EPSILON to zero causes relational comparisons to be made without an epsilon factor. Otherwise, MATH_EPSILON values between 10^{-15} and 10^{-5} are valid.

Use of an epsilon factor in MATH relational comparisons is a V7.10 feature. V7.01 SP1 and prior do not implement this feature. (To be more precise, V7.01q or later of Run Time and Editor is required for this feature to be present.)

RIF/WIF Data Directory

Starting with MET/CAL V7.11 the directory used for data files accessed using the RIF and WIF MATH FSC functions may be specified using the optional initialization file parameter "RifWifDir".

The "RifWifDir" parameter should be placed in the [Startup] section of the initialization file ("metcal.ini").

In addition to directly specifying the directory to be used by RIF and WIF it's also legal to use "RifWifDir" to specify that one of the directories used for user programs in connection with the DOS and DOSE FSCs be used. The initialization file syntax for this is:

RifWifDir = @user_data_dir

RifWifDir = @user_prog_dir

RifWifDir = @user_cwd

The "RifWifDir" specification, if any, is not used in cases where the procedure directly specifies the full path name of the data file. Any file name that begins with a '/', a '\', or a single letter followed by a ':', is considered a full path name.

Here are some examples of full path names:

\metcal\rifdata.ini

/metcal/rifdata.ini

c:metcal\rifdata.ini

If the initialization file does not include a "RifWifDir" specification, and the procedure does not specify the full path name of the data file, the file must be placed in the Windows directory on the workstation.

Note

In general, however, one should avoid placing MET/CAL-specific data files in the Windows directory. Using the "RifWifDir" initialization file parameter is recommended.)

Examples

```
  1.001  MATH         MEM  = MEM + M[1] + M[20]
  1.002  MATH         M[3]  = 7
  1.003  MATH         MEM1  = M[2] / M[3]
  1.004  MATH         MEM  = MEM * MEM1 - 4.321

# Assign the string value "xyz" to string register
1.
  1.005  MATH         S[1] = "xyz"
```

```
# Assign the concatenation of the string in S[1]
with "abc" to MEM2.
  1.006  MATH         MEM2 = S[1] & "abc"


# Calculate the square root of 2.
  1.007  MATH         MEM = sqrt(2)


# Swap M[10] and M[11], using M[1] as a temporary
register.
  1.008  MATH         M[1] = M[10]; M[10] = M[11];
M[11] = M[1]
```

MEM* *(Not preferred)*

For compatibility only. Use MATH FSC

Memory Register Operation FSC

Description

The MEM* FSC multiplies MEM by a specified value. If the value is omitted, MEM is multiplied by MEM1. The result of the multiplication is stored back in MEM.

Format

MEM* *value* or MEM*

Rules

- If *value* is a numeric constant, MEM is multiplied by the specified value.

  Example:

  ```
  MATHMEM = 3
  MEM*2
  DISPMEM = [MEM]
  ```

  The MATH statement assigns the value 3 to MEM. The MEM* statement multiplies MEM by 2. The value of MEM is now 6. The DISP statement displays the updated value of MEM.
- If *value* is blank, MEM is multiplied by MEM1.

  Example:

  ```
  MATHMEM = 3.5
  MATHMEM1 = 6
  MEM*
  DISPMEM = [MEM]
  ```

  The MATH statements set MEM to 3.5 and MEM1 to 6. The MEM* statement multiplies the two values, storing the result in MEM. The value of MEM is now 21. The DISP statement displays the updated value of MEM.
- The MEM* statement is retained for compatibility with older versions of MET/CAL. Equivalent MATH statements are easier to read:

MEM* Statement	Equivalent MATH Statement
MEM* 5	MATH MEM = MEM * 5
MEM*	MATH MEM = MEM * MEM1

MEM+ *(Not preferred)*

For compatibility only. Use MATH FSC

Memory Register Operation FSC

Description

The MEM+ FSC adds a specified value to MEM. If the value is omitted, the value of MEM1 is added to MEM.

Format

MEM+ *value* or MEM+

Rules

- If *value* is a numeric constant, the specified value is added to MEM.

  Example:

```
MATHMEM = 3
MEM+1
DISPMEM = [MEM]
```

  The MATH statement assigns the value 3 to MEM. The MEM+ statement adds 1 to MEM. The value of MEM is now 4. The DISP statement displays the updated value of MEM.

- If *value* is blank, the value of MEM1 is added to MEM.

  Example:

```
MATHMEM = 3.5
MATHMEM1 = 4.2
MEM+
DISPMEM = [MEM]
```

  The MATH statements set MEM to 3.5 and MEM1 to 4.2. The MEM+ statement adds the two values, storing the result in MEM. The value of MEM is now 7.7. The DISP statement displays the updated value of MEM.

- The MEM+ statement is retained for compatibility with older versions of MET/CAL. Equivalent MATH statements are easier to read:

MEM+ Statement	Equivalent MATH Statement
MEM+ 5	MATH MEM = MEM + 5
MEM+	MATH MEM = MEM + MEM1

MEM- (Not preferred)

For compatibility only. Use MATH FSC

Memory Register Operation FSC

Description

The MEM- FSC subtracts a specified value from MEM. If the value is omitted, the value of MEM1 is subtracted from MEM.

Format

MEM- *value* or MEM-

Rules

- If *value* is a numeric constant, the specified value is subtracted from MEM.

  Example:

  ```
  MATHMEM = 3

  DISPMEM = [MEM]
  ```

  The MATH statement assigns the value 3 to MEM. The MEM- statement subtracts 1 from MEM. The value of MEM is now 2. The DISP statement displays the updated value of MEM.

- If *value* is blank, the value of MEM1 is subtracted from MEM.

  Example:

  ```
  MATHMEM = 9.5
  MATHMEM1 = 4.2
  MEM-
  DISPMEM = [MEM]
  ```

  The MATH statements set MEM to 9.5 and MEM1 to 4.2. The MEM- statement subtracts MEM1 from MEM, storing the result in MEM.

  The value of MEM is now 5.3. The DISP statement displays the updated value of MEM.

- The MEM- statement is retained for compatibility with older versions of MET/CAL. Equivalent MATH statements are easier to read:

MEM- Statement	Equivalent MATH Statement
MEM- 5	MATH MEM = MEM - 5
MEM-	MATH MEM = MEM - MEM1

MEM/ *(Not preferred)*

For compatibility only. Use MATH FSC

Memory Register Operation FSC

Description

The MEM/ FSC divides MEM by a specified value. If the value is omitted, MEM is divided by MEM1. The result of the division is stored back in MEM.

Format

MEM/ *value* or MEM/

Rules

- If *value* is a numeric constant, MEM is divvied by the specified value.

  Example:

  ```
  MATHMEM = 6
  MEM/2
  DISPMEM = [MEM]
  ```

  The MATH statement assigns the value 6 to MEM. The MEM/ statement multiplies MEM by 2. The value of MEM is now 3. The DISP statement displays the updated value of MEM.
- If *value* is blank, MEM is multiplied by MEM1.

  Example:

  ```
  MATHMEM = 8.4
  MATHMEM1 = 2
  MEM/
  DISPMEM = [MEM]
  ```

  The MATH statements set MEM to 8.4 and MEM1 to 2. The MEM/ statement divides MEM by MEM1, storing the result in MEM. The value of MEM is now 4.2. The DISP statement displays the updated value of MEM.
- If the divisor is zero, a run time error occurs, terminating execution of the MEM/ statement. The value of MEM is unchanged.
- The MEM/ statement is retained for compatibility with older versions of MET/CAL. Equivalent MATH statements are easier to read:

MEM/ Statement	Equivalent MATH Statement
MEM/ 5	MATH MEM = MEM / 5
MEM/	MATH MEM = MEM / MEM1

MEM2

Memory Register Operation FSC

Description

The MEM2 FSC assigns a value to memory register MEM2. MEM2 is a string register which may contain up to 4096 characters.

Format

MEM2 *string*

MEM2 = *string*

Rules

- If *string* is preceded by an equals sign ('=`), the string is copied directly into MEM2.

  The string, before any special constructions are evaluated, is limited to 55 characters. The evaluated string is limited by the length of MEM2 (4096 characters).

  Example:

  ```
  MEM2=ABC
  ```

  This statement causes the string "ABC" to be copied into MEM2.

- If *string* is not preceded by an equals sign ('='), the string is used as a prompt to the operator.

  The response entered by the operator is copied into MEM2. The unevaluated string entered in the MEM2 statement is limited to 56 characters. The evaluated string, used as an operator prompt, is limited to 72 characters. The operator's response is limited by the length of MEM2 (4096 characters).

  Example:

  ```
  MEM2    Enter the current temperature.
  DISP    Current temperature is [MEM2].
  ```

  Since the MEM2 string does not begin with an equals sign, the operator is prompted to "Enter the current temperature." The operator's response is stored (as a text string) in MEM2. The DISP statement then displays the response.

- The following special constructions may be used in a MEM2 statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [V*variable*]

  {*text*}

  [M1], [M2], ...

  [L1], [L2], …

  [S1], [S2], ...

  [SREG1], [SREG2], ...

  Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (4).

  The constructions [M1], [M2], ..., access the global numeric registers. The constructions [L1], [L2], …, access the local numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

  The constructions [S1], [S2], ..., access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

  The constructions [SREG1], [SREG2], ..., are identical to [S1], [S2], ..., and are included only for compatibility with the IEEE, IEEE2, and SCPI FSCs.

  Refer to "Special Constructions" in Chapter 1 of this manual for details.

MEMC, MEMCX

Evaluation FSCs

Description

The MEMC and MEMCX FSCs perform evaluations based on a comparison between the UUT Indicated value and the System Actual value.

For MEMC:

If the statement specifies a Nominal value, that value is used as the UUT Indicated value. If no value is specified in the NOMINAL field, the value of memory register MEM1 is used as theUUT Indicated value.

The value of memory register MEM is used as the System Actual value.

For MEMCX:

If the statement specifies a Nominal value, that value is used as the System Actual value. If no value is specified in the NOMINAL field, the value of memory register MEM1 is used as the System Actual value.

The value of memory register MEM is used as the UUT Indicated value.

Execution of a MEMC or MEMCX statement does not change the values of MEM or MEM1.

MEMCX is new with MET/CAL V6.1. With MEMCX it is no longer necessary to precede the evaluation with a MEME statement to swap the MEM and MEM1 registers. Depending on the type of test, it is always sufficient to use either a MEMC or MEMCX evaluation, without a preceding MEME statement. See the "Historical Note" in the EXAMPLE section (below) for more information.

Format

MEMC *range nominal tolerance mod1*

MEMCX *range nominal tolerance mod1*

Rules

- RANGE Field

  The RANGE field follows the same rules as an instrument FSC. Refer to "General Rules for Instrument FSCs" in this manual.

- NOMINAL Field

  The NOMINAL field is limited to 14 characters.

  The format of the NOMINAL field is:

  [*value*][*string*]

  value is an NR1, NR2, or NR3-format number.

  NR1-format is integer format (like "12").

  NR2-format is fixed point format (like "15.3").

  NR3-format is scientific notation (like "2.36E+3").

  In a MEMC statement, the value specifies the UUT Indicated value which will be compared to the value stored in MEM. If *value* is not specified, the value of MEM1 is used.

  In a MEMCX statement, the value specifies the System Actual value which will be compared to the value stored in MEM. If *value* is not specified, the value of MEM1 is used.

  Both *value* and *string* are optional. However, at least one of *value* and *string* must be specified.

  Note

  Although the MEMC and MEMCX FSCs are similar in appearance to instrument evaluation statements, they use the registers MEM and MEM1 differently. In an instrument FSC, if no numerical quantity is specified in the NOMINAL field, the value is taken from MEM. In the MEMC and MEMCX FSCs, the value is taken from MEM1.

  Additionally, *string* cannot include blanks and cannot end with 'R', ‘r’, '/', '%' or 'U', or ‘u’.

  The restriction on strings ending in 'R' or 'r' is a historical aspect of the MEMC/MEMCX parsing algorithm. All such strings are taken to be RANGE field values. To avoid the restriction, place the string value in double quotes. For example:

  MEMC 1.00"bar" 1%

Similarly, the restriction on strings ending in 'U' or 'u' may be overcome using double quotes:

MEMC 1.00"U" 1%

For purposes of the measurement uncertainty calculation, the test uncertainty ratio calculation, and the generation and formatting of the V7 Results table result quantities,the <string> portion of the NOMINAL field is interpretted as a units prefix and a units string. There are two ways to override the interpretation of the units prefix:

1. A leading underscore may be used to indicate that there is no units prefix. For example, to prevent `MEMC 1.00micron 1%,` from being interpretted as 1.00 milli-icron, write instead:

   `MEMC 1.00_ micron 1%`

2. The entire <string> may be enclosed in double quotes. For example,

   `MEMC 1.00" micronmeter" 1%`

The *string* does not affect the numerical value used for the comparison. For example, "10mV" causes the value 10 to be used for the comparison.

In a MEMC statement, procedure writer must ensure that the original UUT reading is in the same units as specified in the NOMINAL field of the MEMC FSC.

Similarly, in a MEMCX statement, procedure writer must ensure that the original System Actual value is in the same units as specified in the NOMINAL field of the MEMCX FSC.

If the MEMC or MEMCX NOMINAL field specifies a *value*, or ASK- U is specified for the test, the specified *string* is appended to the UUT Indicated and System Actual values in the results generated for the test. In other cases, the units written to the results for the test are based on the previous instrument setup or ACC statement.

Very often the *string* consists of a prefix followed by units. However, that is not a requirement of the MEMC and MEMCX FSCs.

- TOLERANCE Field

  The TOLERANCE field follows the same rules as an instrument FSC. Refer to "General Rules for Instrument FSCs" in this manual.

- MOD1 Field

  The MOD1 field is transferred directly to the results. Anything may be included in this field. Typically, the frequency parameter of the test is entered here.

  The length of the field cannot exceed 14 characters.

The field must not end with R, /, %, or U, and "TOL" is not allowed.

Example

```
STEP  FSC   RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700        19V                             S  2W
1.002 IEEE        ?[I]
1.003 MEMCX 20    19V     1% 1/
```

Explanation:

The 5700 statement sets up the stimulus for the desired Nominal value. This value, 10, is stored in MEM1 when the 5700 statement executes.

The IEEE statement takes a reading from an IEEE-488 controlled UUT. The numeric result of the reading is stored in MEM. It is presumed in this example that the UUT reading is reported in volts.

The MEMCX FSC compares the System Actual value specified in the MEMCX NOMINAL field (which is the same as the value of the 5700 stimulus specified in the 5700 setup) with the value in MEM (which is the UUT Indicated value).

Historical Note:

Prior to MET/CAL V6.1 the test in the above example would have been coded as follows:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700       19V                             S  2W
1.002 IEEE       ?[I]
1.003 MEME
1.004 MEMC 20    V         1% 1/
```

The reason for the difference is that the MEMCX statement did not exist in V6.01 and earlier.

One problem with the old way is that it required the presence of a MEME statement before the MEMC statement. By interchanging the values of MEM and MEM1, the MEME stored the values to be compared in the appropriate places before the MEMC statement was evaluated. Specifically, since the 5700 setup statement stores the System Actual value in MEM1, this value must be moved into MEM, which is where MEMC looks for the System Actual. And since the [I] construct in the IEEE statement stores the UUT Indicated value in MEM, this value must be moved into MEM1, which is where MEMC looks for the UUT Indicated value. The old method generally works, but is potentially incompatible with the measurement uncertainty calculation. The fundamental issue is that using MEME to swap the MEM and MEM1 registers also makes it absolutely necessary to repeat the 5700 setup each time through the measurement uncertainty loop. (When the number of measurements for the measurement uncertainty calculation is greater than 1 MET/CAL automatically repeats the steps of each test the specified number of times.)

Thus, if the procedure writer were to re-code the old-style test as:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700       19V                             S  2W
1.002 TARGET     -M
1.003 IEEE       ?[I]
1.004 MEME
1.005 MEMC 20    V        1% 1/
```

the test would now be incompatible with the measurement uncertainty calculation. The "optimization" of not repeating the 5700 setup each time through the uncertainty loop prevents the MET/CAL 5700 driver from re-establishing the System Actual value in MEM1, which leads to invalid values in MEM and MEM1 after the MEME. This in turn causes the calculated measurement uncertainty to be incorrect.

This potential problem with the measurement uncertainty calculation in MEMC-based tests provided the primary impetus for the creation of the MEMCX FSC. Since, for a test like the above example, it's no longer necessary to swap MEM and MEM1 before the MEMCX, the procedure writer is now free to skip the 5700 setup on the second and subsequent measurements:

```
STEP  FSC   RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 5700        19V                             S  2W
1.002 TARGET      -M
1.003 IEEE        ?[I]
1.004 MEMCX 20    19V     1% 1/
```

MEME

Memory Register Operation FSC

Description

The primary use of MEME FSC is used to exchange memory registers MEM and MEM1.

Format

MEME

Examples

```
MATHMEM = 7
MATHMEM1 = 9
MEME
DISPMEM = [MEM], MEM1 = [MEM1]
```

The MATH statements initialize MEM to 7 and MEM1 to 9. The MEME statement exchanges the values. MEM is now 9, and MEM1 is 7. The DISP statements displays the updated values of MEM and MEM1.

Non-Preferred Functionality

The MEME FSC may also be used to perform the following functions for compatibility only, the MATH FSC should be used instead.

+ Load a constant value into memory register MEM.

+ Copy MEM into one of the M[*index*] memory registers.

+ Copy an M[*index*] memory register into MEM.

Format	Action
MEME *numeric*	Assigns specified value to MEM.
MEME <*index*	Copies register M [*index*] into MEM.
MEME >*index*	Copies MEM into register M [*index*].

See Also

"Memory Registers" in Chapter 1 of the MET/CAL Procedure Language Reference Manual.

"Special Constructions" in Chapter 1 of the MET/CAL Procedure Language Reference Manual.

MEMI

Memory Register Operation FSC

Description

The MEMI FSC prompts the operator for a number. The number entered by the operator is stored in memory register MEM.

Format

MEMI *message*

Rules

- The MEMI *message* is displayed as a prompt to the operator.
- The *message* may be up to 56 characters.
- The operator must enter a numeric value in response to the MEMI prompt. If the operator's response is blank or includes non-numeric characters, the prompt dialog is redisplayed.
- After a valid response has been entered by the operator, the entered value is stored in memory register MEM.
- The following special constructions may be used in a MEMI statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [D*delay*]

  {*text*}

  [M1], [M2], ...

  [L1], [L2], …

  [S1], [S2], ...

  [SREG1], [SREG2], ...

  Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (4).

  The constructions [M1], [M2], ..., access the global numeric registers. The constructions [L1], [L2], …, access the local numeric registerUp to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The constructions [S1], [S2], ..., access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., are identical to [S1], [S2], ..., and are included only for compatibility with the IEEE, IEEE2, and SCPI FSCs.

Example

```
3.015   MEMI    Enter UUT reading in ohms:
```

MESS

Display Control FSC

Description

The MESS FSC is used to store messages for later display. There are 6 situations in which the stored messages are displayed:

- When an instrument FSC Evaluation Test is performed in slew mode.
- When an instrument FSC Evaluation Test is performed in go-nogo mode.
- When an instrument FSC Nominal Setup Test (stimulus only) is performed.
- When an instrument FSC Comparison Test (stimulus only) is performed.
- When an instrument FSC Setup Test (measurement only) is performed.
- When an EVAL FSC (without -e flag) is executed.

The MESS FSC is typically used to supplement or replace the default messages generated by these statements.

Format

MESS *message*

Rules

- A MESS *message* may contain a maximum of 56 characters.
- A MESS statement may contain up to 8 lines.
- The regular automatic message shown during slewing or go-nogo, or in a measurement Setup Test can be disabled using the ASK- N FSC command. In that case only the MESS messages are shown.

  Example:

  ```
  ASK-N
  MESSReplacement for slew message.
  57001v 1%
  ```

  When the 5700 statement is executed, the slew dialog will appear to allow the operator to slew the output of the 5700 calibrator. Since the ASK 'N' flag is disabled, the normal slew message ("Adjust stimulus for a UUT reading of 1 V.") will not appear. The specified MESS message will appear as a replacement (though not in the same place on the screen).

- A 1-line MESS statement with a blank *message* clears the existing MESS messages (if any) from internal storage.
- A blank MESS line which is part of a multi-line MESS statement does not clear MESS messages. It causes a blank line to appear when the MESS messages are displayed.
- Each MESS statement causes previous MESS messages to be overwritten.

  Example:

  ```
  1.001 MESS abc
  1.001 MESS def
  1.002 EVAL yes or no
  2.001 MESS xyz
  2.002 EVAL x or y
  ```

  The second MESS statement (2.001) overwrites the 2 MESS messages which were stored by the first MESS statement (1.001). Thus, when the second EVAL statement is executed, the displayed MESS messages will consist of the single line "xyz".
- The following special constructions may be used in a MESS statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [V *integer*]

  {*text*}

  [M1], [M2], ...

  [L1], [L2], …

  [S1], [S2], ...

  [SREG1], [SREG2], ...

  Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (4).

  The constructions [M1], [M2], ..., access the global numeric registers. The constructions [L1], [L2], …, access the local numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

  The constructions [S1], [S2], ..., access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., are identical to [S1], [S2], ..., and are included only for compatibility with the IEEE, IEEE2, and SCPI FSCs.

Note

[] special constructions may be enclosed in {}, but will not be evaluated and stored in the results. For example, the following MESS statement will cause "Ch[MEM] trigger slope positive" to be stored in the results, not "Ch1 trigger slope positive".

```
12.001 MATH      MEM = 1

12.002 HEAD      Ch[MEM] Tests

12.003 MESS      Set {Ch[MEM] trigger slope positive}

12.004 EVAL    Is Ch[MEM] triggered?
```

The RSLT FSC should be used to store text with embeded [] special constructions in the results as shown below:

```
12.001 MATH       MEM = 1

12.002 HEAD       Ch[MEM] Tests

12.003 RSLT       =Ch[MEM] trigger slope positive

12.004 MESS       Set Ch[MEM] trigger slope positive

12.005 EVAL     Is Ch[MEM] triggered?
```

N5531

Instrument FSC

Description

The N5531 FSC controls the Agilent PSA Option 233 "N5531S Measuring Receiver System". The N5531S Measuring Receiver System supports the following operating modes:

- Frequency Counter
- Tuned RF Level
- Absolute RF Power
- AM Depth
- FM Deviation
- PM Deviation
- Modulation Rate
- Modulation Distortion
- Modulation SINAD
- Audio Frequency (1)
- Audio AC Level (1)
- Audio Distortion (1)
- Audio SINAD (1)
- Calibrate Power Meter
- Zero Power Meter
- Zero and Calibrate Power Meter

Requires PSA Option 107 "Audio Input"

N5532A Sensor Modules

N5531 FSC statements which specify Absolute RF Power or Tuned RF Level measurement require a power meter and sensor module. Prior to either of these measurements, the following steps must be performed:

1. Connect the sensor module to the PSA.
2. Load the cal factors for the sensor module into the PSA.

3. Connect the sensor module to the power meter reference output.
4. Zero the power meter.
5. Cal the power meter.
6. Disconnect the sensor module from the power meter reference output.
7. Connect the sensor module to the UUT.

The following N5532A options are supported by the N5531 FSC:

<table>
<tr><th>100 kHz</th><th>10 MHz</th><th>30 MHz</th><th>50 MHz</th><th>4.2 GHz</th><th>18 GHz</th><th>26.5 GHz</th><th>50 GHz</th></tr>
<tr><td colspan="5">N5532A-504</td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="5">N5532A-518</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="5">N5532A-526</td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="5">N5532A-550</td></tr>
</table>

Therefore, depending upon the test frequencies required by the UUT, more than one sensor module may be required and the above steps will have to be performed more than once. The point at which the sensor module must be changed is dependent upon the actual sensor modules used.

Example: 20 MHz to 50 GHz Signal Generator

A single N5532A option is not available that covers all frequencies required. This frequency range requires either a N5532A-504 and N5532A-550 or a N5532A-518 and N5532-550. The sensor module can be changed anywhere from 50 MHz to 4.2 GHz for a N5532A-504 and N5532A-550, and 50 MHz to 18 GHz for a N5532A-518 and N5532A-550. The N5531 FSC is designed to allow N5531 RF Power and Tuned RF Level statements to be written without specifying a particular N5532A sensor module option. This feature allows a single procedure to be written that will execute with either a N5532A-504 and N5532A-550 configured or a N5532A-518 and N5532A-550 configured.

When the N5531 FSC determines that the sensor module must be changed, messages to the operator and commands to the PSA are automatically generated to perform the seven steps outlined above.

The N5531 FSC uses the following criteria to determine when the sensor module must be changed:

1. The specified frequency range of each sensor module option as shown above.
2. A custom frequency range for each sensor module option specified in the MET/CAL initialization file.*
3. A custom frequency range for each sensor module option specified in a VSET or TSET statement.*

* See the following parameters in VSET / TSET FSC help:

- N5532A-504
- N5532A-518
- N5532A-526
- N5532A-550
- SensorChange

The following procedure fragment uses the automatic sensor module selection feature of the N5531 FSC (1). Note that the procedure header configuration line does not specify a N5532A option. Instead, the configuration line specifies a range of frequencies that the sensor modules must cover.

```
CONFIGURATION:       Agilent PSA (50.0 GHz,233)

CONFIGURATION:       Agilent EPM

CONFIGURATION:       Agilent N5532A (10.0 MHz - 50.0 GHz)

============================================================
==================

 STEP   FSC   RANGE NOMINAL      TOLERANCE    MOD1      MOD2  3
4 CON

  1.001  ASK+                                    V

  1.002  IF       0

  1.003  N5531       Connect; Input = RF; Freq = 50 GHz

  1.003  N5531       SensorModule = N5532A

  1.004  ENDIF

  1.005  RSLT        =

  1.006  HEAD        RF LEVEL ACCURACY ({Carrier Frequency: 20 MHz})
```

```
  1.007  MATH        CM(1, "RF OUPUT")
  1.008  TARGET      -p
  1.009  N5531       Connect; Input = RF; Freq = 20 MHz
  1.009  N5531       SensorModule = N5532A
# First setup to 30 dB attenuation to prevent IF Overload.
  1.010  N5531       +Freq = 20 MHz; Power = 13 dBm; InputAtt = 30 dB; Setup
  1.011  SCPI        POW:AMPL 13DBM;:FREQ:CW 20MHZ;:OUTP:STAT ON
  1.012  N5531       +Freq = 20 MHz; Power = 13 dBm; InputAtt = 30 dB; Read
  1.013  MATH        FreqMHz = MEM
  1.014  TARGET      -m
  1.015  N5531       SensorModule = N5532A; InputAtt = 30 dB
  1.015  N5531       +Power = 13 dBm; Freq = [V FreqMHz] MHz
  1.016  MEMC   130   13.0dBm      1.0U
#         .
#         .
#         .
#         .
  2.001  RSLT        =
  2.002  HEAD        RF LEVEL ACCURACY ({Carrier Frequency: 50 MHz})
  2.003  TARGET      -p
  2.004  N5531       +Freq = 50 GHz; Power = 13 dBm; InputAtt = 30 dB; Setup
  2.005  SCPI        POW:AMPL 13DBM;:FREQ:CW 50GHZ;:OUTP:STAT ON
  2.006  N5531       +Freq = 50 GHz; Power = 13 dBm; InputAtt = 30 dB; Read
  2.007  MATH        FreqGHz = MEM
  2.008  TARGET      -m
  2.009  N5531       SensorModule = N5532A; InputAtt = 30 dB
  2.009  N5531       +Power = 13 dBm; Freq = [V FreqGHz] GHz
  2.010  MEMC   130   13.0dBm      1.0U
```

Explanation of Procedure Steps

Step 1.001

ASK+ V (or ASK+ W) enables the following:

1. Automatic N5532A sensor module connection messages.
2. Automatic messages to prompt operator to load sensor module cal factors.

Step 1.003

This statement forces the procedure header CONFIGURATION: line to include the maximum sensor module frequency required by the procedure.

Since N5531S RF Power measurement must be tuned, the Frequency parameter value must come from a register (steps 1.015 and 2.009). When a parameter value comes from a register, MET/CAL only knows the value when the statement is executed, not when it is compiled. Therefore, statement 2.009 will not, by itself, cause the necessary CONFIGURATION: line to be generate.

Step 1.007

The MATH FSC CM "Connection Message" function is used to annotate the automatic connection message, generated by the N5531 FSC, to connect the sensor module to the UUT. See MATH FSC help file for explanation of CM function.

Step 1.009

This statement forces automatic connection messages for the sensor module selected for 30 MHz RF Power or Tuned RF Level statements. The N5531S only requires a power meter and sensor module for absolute RF Power and Tuned RF Level measurements. However since RF Power and Tuned RF Level require a "tune" frequency, a N5531S frequency measurement must first be performed (steps 1.012 and 2.006). A N5531S frequency measurement generates an automatic connection message to connect the UUT to the PSA RF INPUT unless a sensor module is already connected. A N5531 Connect statement allows a procedure writer to force connection of sensor module before statements that actual require a sensor module.

Sensor Module Change

When the automatic sensor module selection feature of the N5531 FSC determines that a sensor module change is necessary, the following messages and actions are generated:

1. Prompt the operator to determine if the cal factors for the sensor module have been loaded.
   a. If the cal factors have not been loaded, prompt the operator for the path to the cal factors file (i.e. "A:\CFDATA.XML").
   b. If the cal factors path includes "A:", prompt the operator to insert the disk containing the file.
2. If there is an existing connection to the PSA RF INPUT, prompt the operator to remove the connection. This includes sensor modules or direct connections.
3. Prompt the operator to connect the sensor module to the PSA.
4. Prompt the operator to connect the sensor module to the power meter reference output.
5. Zero and cal the power meter.
6. Prompt the operator to disconnect the sensor module from the power meter reference output.
7. Prompt the operator to connect the sensor module to the UUT.

Parameters

An N5531 statement consists of one or more parameters. A parameter consists of a name and a value. Each parameter must be separated by a semicolon and/or one or more spaces. A single N5531 statement can encompass more than one physical line as long as the line numbers are the same. However each parameter name and its value must occur on one line.

A single line can accommodate 56 characters, not including the statement number and FSC.

Syntax

N5531 *<parameter>*[*<separator><parameter>*]

<parameter> = [<prefix>]<parameter name>[<sp>]=[<sp>]<parameter>value> <separator> = ;[*<sp>*] | *<sp>*

<prefix> = + | @

<sp> = one or more spaces

<parameter name> = see PARAMETERS NAMES section below

<parameter value> = see PARAMETERS NAMES section below

| Denotes "or" (i.e. A | B is A or B)

[ ] Denotes an optional syntax element, except in examples. In examples [ ] enclose a special construction.

\+ Designates the parameter as the Evaluation Quantity

@ Designates the parameter as the Modifier Quantity

Rules:

- One and only one parameter must be designated as the Evaluation Quantity in a N5531 Measure (default), Setup, or Read action.
- When a N5531 Measure (default) statement is executed, the N5531S measurement is copied to memory register MEM in units of the Evaluation Quantity.

Example

N5531 Freq = 100 MHz; Power = -10 dBm

N5531 +FMDev = 5 kHz; ModFreq = 1 kHz

or

N5531 Freq = 100 MHz; Power = -10 dBm

N5531 +FMDev = 5 kHz; ModFreq = 1 kHz; Measure

If the N5531S FM deviation measurement was 4.99 kHz, MEM would be 4.99.

When a N5531 Read statement is executed, the N5531S measurement is copied to memory register MEM in units of the Evaluation Quantity designated in the previous Setup or Measure statement.

Example

N5531 Freq = 100 MHz; Power = -10 dBm

N5531 +FMDev = 5 kHz; ModFreq = 1 kHz; Setup

N5531 Freq = 100 MHz; Power = -10 dBm

N5531 +FMDev = 5 kHz; ModFreq = 1 kHz; Read

- At most one parameter may be designated as the Modifier Quantity in a N5531 Measure or Setup.
- When a N5531 Measure is executed, the Modifier Quantity is concatenated to the Evaluation Quantity in the automatic message to setup the UUT. Note, the automatic message to setup the UUT is not displayed when ASK- N is in effect.

Examples

ASK+ N

N5531 Freq = 100 MHz; Power = -10 dBm

N5531 +AMDepth = 30 %; @ModFreq = 400 Hz

"Set UUT to source 30 % at 100 MHz."

No Modifier Quantity designated.

N5531 Freq = 100 MHz; Power = -10 dBm

N5531 +AMDepth = 30 %; ModFreq = 400 Hz

"Set UUT to source 30 %."

Automatic UUT setup message inhibited.

ASK- N

N5531 Freq = 100 MHz; Power = -10 dBm

N5531 +AMDepth = 30 %; ModFreq = 400 Hz

No automatic UUT setup generated.

Parameter values may be taken from a MET/CAL memory register using a special construction.

Parameter Names

Parameter names consist of single or compound words. Each word in a parameter name can be entered in long form (as shown below), or in short form. The short form is the first 4 characters of the long form, unless the last character or the word is a vowel. In this case the short form is three characters.

Compound parameter names can be entered in any combination of long and short forms. Example, ExternalReferenceFrequency can be entered using any of the following forms:

- ExtRefFreq
- ExtRefFrequency
- ExtReferenceFreq
- ExtReferenceFrequency
- ExternalRefFreq
- ExternalRefFrequency
- ExternalReferenceFreq
- ExternalReferenceFrequency

Action Parameters

Action parameters specify the operation to be performed:

- Calibrate
- Connect
- Local
- Measure
- Read
- Reset
- Setup
- Zero
- Zero_and_Cal

Rules:

Only one action parameter is allowed per N5531 statement (single or mult-line).

If an action is not specified, the default is Measure.

Primary Parameters

Primary parameters specify the measurement:

- AMDepth
- AMDepthRatio
- AudioACLevel
- AudioACLevelRatio
- AudioDistortion
- AudioDistortionRatio
- AudioFrequency
- AudioFrequencyRatio
- AudioSINAD
- AudioSINADRatio
- FMDeviation
- FMDeviationRatio
- Frequency
- FrequencyRatio
- Level
- LevelRatio
- ModulationDistortion
- ModulationDistortionRatio
- ModulationFrequency
- ModulationFrequencyRatio
- ModulationSINAD
- ModulationSINADRatio
- PMDeviation
- PMDeviationRatio
- Power
- PowerRatio
- RelativeLevel

- ResidualAM
- ResidualFM
- ResidualPM

Rules:

The primary parameter must be designated as the evaluation quantity.

Secondary Parameters

Secondary parameters are used for one or both of the following:

1. Clarify the action.
2. Configure the measurement specified by the primary parameter.
    - AudioRange
    - AutoTuneOff
    - AverageAccuracy
    - AverageCount
    - AverageType
    - BWMode
    - De-emphasis
    - Detector
    - ExternalReferenceFrequency
    - GateTime
    - HPF (High-pass Filter)
    - IFBW (IF Bandwidth)
    - Input
    - InputAttenuation
    - LPF (Low-pass Filter)
    - ModulationType
    - PeakHoldOn
    - PowerMeter
    - PreamplifierOn

- RBW (Resolution Bandwidth)
- RFInputRanging
- RangeHoldOn
- RatioReference
- ReferenceFrequencyOutput
- ReferenceLevel
- SensorModule
- SetReference
- uwPreselectorOff

Operating Mode

The following actions determine the operating mode directly.

Action Parameter	Operating Mode
Calibrate	Calibrate Power Meter
Connect	Determine automatic connection message
Reset	Reset PSA
Zero	Zero Power Meter
Zero_and_Cal	Zero and Calibrate Power Meter

For all other actions the operating mode is determined by the primary parameter as follows:

Primary Parameter	Operating Mode
AMDepth	AM Depth
AMDepthRatio	AM Depth
AudioACLevel	Audio AC Level
AudioACLevelRatio	Audio AC Level
AudioDistortion	Audio Distortion
AudioDistortionRatio	Audio Distortion
AudioFrequency	Audio Frequency
AudioFrequencyRatio	Audio Frequency

Primary Parameter	Operating Mode
AudioSINAD	Audio SINAD
AudioSINADRatio	Audio SINAD
FMDeviation	FM Deviation
FMDeviationRatio	FM Deviation
Frequency	Frequency Counter
FrequencyRatio	Frequency Counter
Level	Tuned RF Level
LevelRatio	Tuned RF Level
ModulationDistortion	Modulation Distortion
ModulationDistortionRatio	Modulation Distortion
ModulationFrequency	Modulation Frequency
ModulationFrequencyRatio	Modulation Frequency
ModulationSINAD	Modulation SINAD
ModulationSINADRatio	Modulation SINAD
PMDeviation	Phase Deviation
PMDeviationRatio	Phase Deviation
Power	Absolute RF Power
PowerRatio	Absolute RF Power
RelativeLevel	Tuned RF Level

Inter-Parameter Rules

If a parameter is not listed for a operating mode, it is not allowed.

Frequency Counter

Required Parameters:

- +Frequency (1)
- +FrequencyRatio (1, 2)

- RatioReference (3)
- Power

1. Either Frequency or FrequencyRatio is required, but not both.
2. FrequencyRatio is only allowed with the Read action and can only occur following a Frequency Measure statement.
3. RatioReference is only required if the FrequencyRatio is specified.

Optional Parameters	**Default**
AutoTuneOff	na (auto tuning on)
AverageCount	25
AverageType	Off
ExternalReferenceFrequency	Internal
GateTime	Auto
InputAttenuation	Depends upon input signal
ModulationFrequency	0 Hz
PeakHoldOn	Off
PreamplifierOn	Off
RBW	100 Hz
RFInputRanging	Auto
ReferenceFrequencyOutput	Off
SensorModule	No sensor module required
uwPreselectorOff	On

Tuned RF Level

Required Parameters:

- +Level (1)
- +LevelRatio (2)
- +RelativeLevel (3)
- Frequency
- RatioReference (4)
- SensorModule (5)

1. Either Level, LevelRatio, or RelativeLevel is required, but only one.
2. LevelRatio is only allowed with the Read action and can only occur following a Level Measure statement.
3. RelativeLevel is only allowed with the Read action and can only occur following a Level Measure statement with SetReference specified.
4. RatioReference is only required if the LevelRatio is specified.
5. SensorModule is only required for absolute measurement (Level or LevelRatio is specified, and SetReference is not specified).

Optional Parameters	**Default**
AverageAccuracy	Normal
AverageCount	25
ExternalReferenceFrequency	Internal
InputAttenuation	Depends upon input signal
PeakHoldOn	Off
IFBW	10 Hz
RFInputRanging	Auto
RangeHoldOn	Off
ReferenceLevel (1)	na
SensorModule	Automatic Selection
SetReference	na
uwPreselectorOn	Off
ReferenceFrequencyOutput	Off

Required for accuracy calculation on all TRFL read statements following the starting TRFL statement (see TRFL in Examples).

Absolute RF Power

Required Parameters:

- +Power (1)
- +PowerRatio (1, 2)

- RatioReference (3)
- SensorModule
- Frequency

1. Either Power or PowerRatio is required, but not both.
2. PowerRatio is only allowed with the Read action and can only occur following a Power Measure statement.
3. RatioReference is only required if the PowerRatio is specified.

Optional Parameters	**Default**
AverageCount	25
ExternalReferenceFrequency	Internal
InputAttenuation	Depends upon input signal
PeakHoldOn	Off
PreamplifierOn	Off
RFInputRanging	Auto
uwPreselectorOn	Off
ReferenceFrequencyOutput	Off

AM Depth

Required Parameters:

- +AMDepth (1)
- +AMDepthRatio (1, 2)
- +ResidualAM (1)
- Frequency
- ModulationFrequency
- Power
- RatioReference (3)

1. AMDepth, AMDepthRatio, or ResidualAM is required, but only one.
2. AMDepthRatio is only allowed with the Read action and can only occur following a AMDepth Measure statement.
3. RatioReference is only required if the AMDepthRatio is specified.

Optional Parameters	**Default**
AverageCount	25
AverageType	Off
BWMode	Auto
Detector	Peak+
ExternalReferenceFrequency	Internal
HPF	20 Hz
IFBW	Auto
InputAttenuation	Depends upon input signal
LPF	Off
PeakHoldOn	Off
PreamplifierOn	Off
RFInputRanging	Auto
ReferenceFrequencyOutput	Off
uwPreselectorOff	On

FM Deviation

Required Parameters:

- +FMDeviation (1)
- +FMDeviationRatio (1, 2)
- +ResidualFM (1)
- RatioReference (3)
- ModulationFrequency
- Frequency
- Power

1. FMDeviation, FMDeviationRatio, or ResidualFM is required, but only one.
2. FMDeviationRatio is only allowed with the Read action and can only occur following a FMDeviation Measure statement.
3. RatioReference is only required if the FMDeviationRatio is specified.

Optional Parameters	Default
AverageCount	25
AverageType	Off
BWMode	Auto
De-emphasis	Off
Detector	Peak+
ExternalReferenceFrequency	Internal
HPF	20 Hz
IFBW	Auto
InputAttenuation	Depends upon input signal
LPF	Off
PeakHoldOn	Off
PreamplifierOn	Off
RFInputRanging	Auto
uwPreselectorOff	On
ReferenceFrequencyOutput	Off

PM Deviation

Required Parameters:

- +PMDeviation (1)
- +PMDeviationRatio (1, 2)
- +ResidualPM (1)
- RatioReference (3)
- ModulationType
- ModulationFrequency
- Frequency
- Power

1. PMDeviation, PMDeviationRatio, or ResidualPM is required, but only one.
2. PMDeviationRatio is only allowed with the Read action and can only occur following a PMDeviation Measure statement.
3. RatioReference is only required if the PMDeviationRatio is specified.

Optional Parameters	Default
AverageCount	25
AverageType	Off
BWMode	Auto
De-emphasis	Off
Detector	Peak+
ExternalReferenceFrequency	Internal
HPF	20 Hz
IFBW	Auto
InputAttenuation	Depends upon input signal
LPF	Off
PeakHoldOn	Off
PreamplifierOn	Off
RFInputRanging	Auto
uwPreselectorOff	On
ReferenceFrequencyOutput	Off

Modulation Rate

Required Parameters:

- +ModulationFrequency (1)
- +ModulationFrequencyRatio (1, 2)
- RatioReference (3)
- ModulationType
- Frequency
- Power

1. Either ModulationFrequency or ModulationFrequencyRatio is required, but not both.
2. ModulationFrequencyRatio is only allowed with the Read action and can only occur following a ModulationFrequency Measure statement.
3. RatioReference is only required if the ModulationFrequencyRatio is specified.

Optional Parameters	Default
AverageCount	25
AverageType	Off
BWMode	Auto
De-emphasis	Off
Detector	Peak+
ExternalReferenceFrequency	Internal
HPF	20 Hz
IFBW	Auto
InputAttenuation	Depends upon input signal
LPF	Off
PeakHoldOn	Off
PreamplifierOn	Off
RFInputRanging	Auto
uwPreselectorOff	On
ReferenceFrequencyOutput	Off

Modulation SINAD

Required Parameters:

- +ModulationSINAD (1)
- +ModulationSINADRatio (1, 2)
- RatioReference (3)
- ModulationType

- ModulationFrequency
- Frequency
- Power

1. Either ModulationSINAD or ModulationSINADRatio is required, but not both.
2. ModulationSINADRatio is only allowed with the Read action and can only occur following a ModulationSINAD Measure statement.
3. RatioReference is only required if the ModulationSINADRatio is specified.

Optional Parameters	**Default**
AverageCount	25
AverageType	Off
BWMode	Auto
De-emphasis	Off
Detector	Peak+
ExternalReferenceFrequency	Internal
HPF	20 Hz
IFBW	Auto
InputAttenuation	Depends upon input signal
LPF	Off
PeakHoldOn	Off
PreamplifierOn	Off
RFInputRanging	Auto
uwPreselectorOff	On
ReferenceFrequencyOutput	Off

Audio Frequency

Required Parameters:

- +AudioFrequency (1)
- +AudioFrequencyRatio (1, 2)
- RatioReference (3)
- AudioACLevel

1. Either AudioFrequency or AudioFrequencyRatio is required, but not both.
2. AudioFrequencyRatio is only allowed with the Read action and can only occur following a AudioFrequency Measure statement.
3. RatioReference is only required if the AudioFrequencyRatio is specified.

Optional Parameters	**Default**
AudioRange	R4
AverageCount	25
AverageType	Off
ExternalReferenceFrequency	Internal
HPF	20 Hz
LPF	Off
ReferenceFrequencyOutput	Off

Audio AC Level

Required Parameters:

- +AudioACLevel (1)
- +AudioACLevelRatio (1, 2)
- RatioReference (3)
- AudioFrequency

1. Either AudioACLevel or AudioACLevelRatio is required, but not both.
2. AudioACLevelRatio is only allowed with the Read action and can only occur following a AudioACLevel Measure statement.
3. RatioReference is only required if the AudioACLevelRatio is specified.

Optional Parameters	**Default**
AudioRange	R4
AverageCount	25
AverageType	Off
ExternalReferenceFrequency	Internal
HPF	20 Hz
LPF	Off
ReferenceFrequencyOutput	Off

Audio Distortion

Required Parameters:

- +AudioDistortion (1)
- +AudioDistortionRatio (1, 2)
- RatioReference (3)
- AudioFrequency
- AudioACLevel

1. Either AudioDistortion or AudioDistortionRatio is required, but not both.
2. AudioDistortionRatio is only allowed with the Read action and can only occur following a AudioDistortion Measure statement.
3. RatioReference is only required if the AudioDistortionRatio is specified.

Optional Parameters	**Default**
AudioRange	R4
AverageCount	25
AverageType	Off
ExternalReferenceFrequency	Internal
HPF	20 Hz
LPF	Off
ReferenceFrequencyOutput	Off

Audio SINAD

Required Parameters:

- +AudioSINAD (1)
- +AudioSINADRatio (1, 2)
- RatioReference (3)
- AudioFrequency
- AudioACLevel

1. Either AudioSINAD or AudioSINADRatio is required, but not both.
2. AudioSINADRatio is only allowed with the Read action and can only occur following a AudioSINAD Measure statement.
3. RatioReference is only required if the AudioSINADRatio is specified.

Optional Parameters	**Default**
AudioRange	R4
AverageCount	25
AverageType	Off
ExternalReferenceFrequency	Internal
HPF	20 Hz
LPF	Off
ReferenceFrequencyOutput	Off

Modulation Distortion

Required Parameters:

- +ModulationDistortion (1)
- +ModulationDistortionRatio (1, 2)
- RatioReference (3)
- ModulationType
- ModulationFrequency
- Frequency
- Power

1. Either ModulationDistortion or ModulationDistortionRatio is required, but not both.
2. ModulationDistortionRatio is only allowed with the Read action and can only occur following a ModulationDistortion Measure statement.
3. RatioReference is only required if the ModulationDistortionRatio is specified.

Optional Parameters	**Default**
AverageCount	25
AverageType	Off
BWMode	Auto
De-emphasis	Off
Detector	Peak+
ExternalReferenceFrequency	Internal
HPF	20 Hz
IFBW	Auto
InputAttenuation	Depends upon input signal
LPF	Off
PeakHoldOn	Off
PreamplifierOn	Off
RFInputRanging	Auto
uwPreselectorOff	On
ReferenceFrequencyOutput	Off

Calibrate, Zero, Zero_and_Cal

Required Parameters:

PowerMeter

Connect

Required Parameters:

Input (1)

Optional Parameters	Default
SensorModule	na
Frequency	na

When Input = RF, Frequency is required.

Parameter Definitions and Values

AMDepth

This parameter specifies the expected AM modulation of the RF input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects AM Depth measurement mode.

Syntax

+AMDepth*[<sp>]=[<sp>]<value>*

<value> = *<numeric value>[<sp>]<units>*

<units> = <percent> | <decibels>

<percent> = %

<decibels> = *[<prefix>]*dB

Rules:

- When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +AMDepth).
- Legal values are:

Example

+AMDepth = 30.0 %

AMDepthRatio

This parameter specifies the expected AM modulation ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects AM Depth measurement mode.

Syntax

+AMDepthRatio*[<sp>]=[<sp>]<value>*

<value> = *<linear ratio>* | *<logarithmic ratio>*

<linear ratio> = *<numeric value>%*

<logarithmic ratio> = *<numeric value>[<sp>][<prefix>]*dB

Rules:

- When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +AMDepthRatio).
- When AMDepthRatio is specified in %, linear ratio mode is selected.
- When AMDepthRatio is specified in dB, log ratio mode is selected.
- Legal values are: *<tdb>*

Example

+AMDepthRatio = *<tbd>*

AudioACLevel

This parameter specifies the expected level of the audio input signal. When this parameter is designated as the Evaluation Quantity, Audio AC Level measurement mode is selected.

Syntax

[+|@]AudioACLevel*[<sp>]=[<sp>]<value>*

<value> = *<numeric value>[<sp>][<prefix>]*V

Rules:

- Audio AC Level measurement requires PSA Option 107 ("Audio Input").
- Legal values are: *<tbd>*

Example

+AudioACLevel = <*tbd*>

AudioACLevelRatio

This parameter specifies the expected audio AC level ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Audio AC Level measurement mode.

Syntax

+AudioACLevelRatio*[<sp>]=[<sp>]<value>*

<value> = *<linear ratio>* | *<logarithmic ratio>*

<linear ratio> = *<numeric value>%*

<logarithmic ratio> = *<numeric value>[<sp>][<prefix>]*dB

Rules:

- When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +AudioACLevelRatio).
- When AudioACLevelRatio is specified in %, linear ratio mode is selected.
- When AudioACLevelRatio is specified in dB, log ratio mode is selected.
- Legal values are: <*tdb*>

Example

+AudioACLevelRatio = <*tbd*>

AudioDistortion

This parameter specifies the expected distortion of the audio input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Audio Distortion measurement mode.

Syntax

+AudioDistortion*[<sp>]=[<sp>]<value>*

<value> = *<numeric value>[<sp>]<units>*

<units> = *<percent>* | *<decibels>*

<percent> = *%*

<decibels> = *[<prefix>]*dB

Rules:

- When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +AudioDist).
- Audio Distortion measurement requires PSA Option 107 ("Audio Input").
- Legal values are: *<tbd>*

Example

+AudioDist = *<tbd>*

AudioDistortionRatio

This parameter specifies the expected audio distortion ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Audio Distortion measurement mode.

Syntax

+AudioDistortionRatio*[<sp>]=[<sp>]<value>*

<value> = *<linear ratio>* | *<logarithmic ratio>*

<linear ratio> = *<numeric value>%*

<logarithmic ratio> = *<numeric value>[<sp>][<prefix>]*dB

Rules:

- When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +AudioDistortionRatio).
- When AudioDistortionRatio is specified in %, linear ratio mode is selected.

- When AudioDistortionRatio is specified in dB, log ratio mode is selected.
- Legal values are: *<tdb>*

Example

+AudioDistortionRatio = *<tbd>*

AudioFrequency

This parameter specifies the expected frequency of the audio input signal. When this parameter is designated as the Evaluation Quantity, Audio Frequency measurement is selected.

Syntax

[+|@]AudioFrequency*[<sp>]=[<sp>]<value>*

<value> = *<numeric value>[<sp>][<prefix>]*Hz

Rules:

- Audio Frequency measurement requires PSA Option 107 ("Audio Input").
- Legal values are: *<tbd>*

Example

+AudioFreq = *<tbd>*

AudioFrequencyRatio

This parameter specifies the expected audio frequency ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Audio Frequency measurement mode.

Syntax

+AudioFrequencyRatio*[<sp>]=[<sp>]<value>*

<value> = *<linear ratio>* | *<logarithmic ratio>*

<linear ratio> = *<numeric value>*%

<logarithmic ratio> = *<numeric value>[<sp>][<prefix>]*dB

Rules:

- When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +AudioFrequencyRatio).
- When AudioFrequencyRatio is specified in %, linear ratio mode is selected.
- When AudioFrequencyRatio is specified in dB, log ratio mode is selected.
- Legal values are: *<tdb>*

Example

+AudioFrequencyRatio = *<tbd>*

AudioRange

This parameter sets the measurement range of the Audion Input (Option 107).

Syntax

AudioRange*[<sp>]=[<sp>]<value>*

<value> = R0 | R1 | R2 | R3 | R4

Example

AudioRange = R3

AudioSINAD

This parameter specifies the expected SINAD of the Audio input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Audio SINAD measurement mode.

Syntax

+AudioSINAD*[<sp>]=[<sp>]<value>*

<value> = *<numeric value>[<sp>]<units>*

<units> = *<percent>* | *<decibels>*

<percent> = %

<decibels> = *[<prefix>]*dB

Rules:

- When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +AudioSINAD).
- Audio SINAD measurement requires PSA Option 107 ("Audio Input").
- Legal values are: <*tbd*>

Example

+AudioSINAD = <*tbd*>

AudioSINADRatio

This parameter specifies the expected audio SINAD ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Audio SINAD measurement mode.

Syntax

+AudioSINADRatio*[<sp>]=[<sp>]<value>*

<value> = *<linear ratio>* | *<logarithmic ratio>*

<linear ratio> = *<numeric value>%*

<logarithmic ratio> = *<numeric value>[<sp>][<prefix>]*dB

Rules:

- When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +AudioSINADRatio).
- When AudioSINADRatio is specified in %, linear ratio mode is selected.
- When AudioSINADRatio is specified in dB, log ratio mode is selected.
- Legal values are: <*tdb*>

Example

+AudioSINADRatio = <*tbd*>

AutoTuneOff

This parameter turns off auto tuning frequency counter mode.

Syntax

AutoTuneOff

Rules:

- When this is parameter is specified, the Frequency parameter value is used as the tune frequency.
- When this parameter is not specified, is auto tuning is used.

Examples

Auto Tuning

+Freq = 100 MHz

Manual Tuning

+Freq = 100 MHz; AutoTuneOff

AverageAccuracy

This parameter sets the average accuracy.

Syntax

AverageAccuracy*[<sp>]=[<sp>]<value>*

<value> = Normal | High

Rules:

If not specified, the default is Normal.

Example

AverageAcc = High

AverageCount

This parameter sets the average count.

Syntax

AverageCount*[<sp>]=[<sp>]<nr1>*

Rules:

- Legal values are: 1 to 8192
- If not specified, the default value is 25.

Example

AverageCount = 100

AverageType

This parameter sets the average type. When this parameter is not specified, the average type is set to off.

Syntax

AverageType*[<sp>]=[<sp>]<value>*

<value> = Off | Normal | Exponential | PeakHold

Example

AverageType = Norm

BWMode

This parameter sets the bandwidth mode. When this parameter is not specified, the bandwidth mode is set to auto.

Syntax

BWMode*[<sp>]=[<sp>]<value>*

Operating Mode	<value>
AM Depth	Auto | Manual | Minimal
FM Deviation	Auto | Manual
Modulation Distortion	Auto | Manual | Minimal
Modulation Frequency	Auto | Manual | Minimal
Modulation SINAD	Auto | Manual | Minimal
PM Deviation	Auto | Manual

Example

BWMode = Manual

Calibrate

This parameter causes a power meter calibration sequence to be performed.

Syntax

Calibrate

Rules:

When Calibrate is specified, PowerMeter must also be specified.

Examples

Calibrate PowerMeter

Connect

This parameter causes an automatic connection message to be generate when ASK+ W or ASK+ V is in effect. In addition, a connect statement will cause procedure header CONFIGURATION: lines to be generated, regardless of the state of the ASK W and ASK V flags.

Syntax

Connect

Rules:

- When Connect is specified, Input must also be specified.
- When SensorModule is specified, Frequency must also be specified.

Examples

Connect; Input = Audio

Connect; Input = RF; Freq = 10 MHz

Connect; Input = RF; Freq = 100 kHz; SensorModule = N5532A

Connect; Input = RF; Freq = 26.5 GHz; SensorModule = N5532A

Detector

This parameter sets the detector.

Syntax

Detector*[<sp>]=[<sp>]<value>*

<value> = Peak+ | Peak- | Peak+-/2 | RMS

Rules:

"Detector = RMS" is the only specification allowed for the following measurement modes:

- Audio AC Level
- Audio Distortion
- Audio Frequency
- Audio SINAD

Examples

Detector = Peak+-/2

De-emphasis

This parameter sets the FM De-Emphasis.

Syntax

De-emphasis*[<sp>]=[<sp>]<value>*

<value> = None | *<numeric value>[<sp>][<prefix>]*s

Rules:

- Legal values are: 25 us, 50 us, 75 us, and 750 us
- If not specified, the default value is off.

= ExternalReferenceFrequency
==

This parameter enables external reference lock and sets the external frequency reference frequency. If this parameter is not specified, external frequency lock is disabled.

Syntax:

ExternalReferenceFrequency[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]Hz

Rules:

o Legal values are: 1 MHz to 30 MHz

o If not specified, internal frequency reference is used.

Example:

ExtRefFreq = 10 MHz

= FMDeviation
==

This parameter specifies the expected FM modulation of the RF input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects FM Deviation measurement mode.

Syntax:

+FMDeviation[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]Hz

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +FMDeviation).

o Legal values are:

Example:

+FMDev = 5.00kHz

= FMDeviationRatio
==

This parameter specifies the expected FM deviation ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects FM Deviation measurement mode.

Syntax:

+FMDeviationRatio[<sp>]=[<sp>]<value>

<value> = <linear ratio> | <logarithmic ratio>

<linear ratio> = <numeric value>%

<logarithmic ratio> = <numeric value>[<sp>][<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +FMDeviationRatio).

o When FMDeviationRatio is specified in %, linear ratio mode is selected.

o When FMDeviationRatio is specified in dB, log ratio mode is selected.

o Legal values are: <tdb>

Example:

+FMDeviationRatio = <tbd>

= Frequency
===
=====

This parameter specifies the expected frequency of the RF input signal. When this parameter is designated as the Evaluation Quantity, Frequency Counter measurement mode is selected.

Syntax:

[+|@]Frequency[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]Hz

Rules:

o For Tuned RF Level and all modulation modes, the frequency value is used to set the center frequency.

o Legal values are based on the PSA model and sensor module used:

E4440A: 3 Hz to 26.5 GHz
E4443A: 3 Hz to 6.76 GHz
E4445A: 3 Hz to 13.2 GHz
E4446A: 3 Hz to 44.5 GHz
E4447A: 3 Hz to 42.98 GHz
E4448A: 3 Hz to 51.0 GHz

N5532A Option 504: 100 kHz to 4.2 GHz
N5532A Option 518: 10 MHz to 18.0 GHz
N5532A Option 526: 30 MHz to 26.5 GHz
N5532A Option 550: 50 MHz to 50.0 GHz

Example:

+Freq = 120.0000MHz

= FrequencyRatio
==

This parameter specifies the expected frequency ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Frequency Counter measurement mode.

Syntax:

+FrequencyRatio[<sp>]=[<sp>]<value>

<value> = <linear ratio> | <logarithmic ratio>

<linear ratio> = <numeric value>%

<logarithmic ratio> = <numeric value>[<sp>][<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +FrequencyRatio).

o When FrequencyRatio is specified in %, linear ratio mode is selected.

o When FrequencyRatio is specified in dB, log ratio mode is selected.

o Legal values are: <tdb>

Example:

+FrequencyRatio = <tbd>

= GateTime
==

This parameter disables auto gate time and sets the gate time over which frequency counter measures the signal. If this parameter is not specified , auto gate time is enabled.

Syntax:

GateTime[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]s

Rules:

o Legal values are:

= HPF (High-pass Filter)
==

This parameter sets the high-pass frequency filter.

Syntax:

HPF[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]Hz

Rules:

o Legal values are: 20 Hz, 50 Hz, & 300 Hz.

o If not specified, the default value is 20 Hz.

= IFBW (IF Bandwidth)
===

This parameter disables auto bandwidth mode and sets the IF bandwidth.

Syntax:

IFBW[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]Hz

Rules:

o Mode / Legal Values / Default

Mode	Legal Values	Default
AM Depth	10 Hz to 1 MHz	1 MHz
FM Deviation	10 Hz to 1 MHz	1 MHz
Modulation Distortion	10 Hz to 1 MHz	1 MHz
Modulation Rate	10 Hz to 1 MHz	1 MHz
Modulation SINAD	10 Hz to 1 MHz	1 MHz
PM Deviation	10 Hz to 1 MHz	1 MHz
Tuned RF Level	10 and 75 Hz	10 Hz

Example:

IFBW = 75 Hz

= Input
==

This parameter sets the input for a Connect statement.

Syntax:

  Input[<sp>]=[<sp>]<value>

  <value> = Audio | RF

Example:

  Input = RF

= InputAttenuation
==

This parameter sets the RF input attenuation.

Syntax:

  InputAttenuation[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]dB

Rules:

o   Legal values are: 0 dB to 70 dB in whole (integer) steps.

o   If not specified, the value depends upon the input signal.

Example:

  InputAttenuation = 30 dB

= LPF (Low-pass Filter)
==

This parameter sets the low-pass frequency filter.

Syntax:

LPF[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]Hz

Rules:

o Legal values are: 3 kHz, 15 kHz, 30 kHz, & 300 kHz.

= Level
===
=========

This parameter specifies the expected level of the RF input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Tuned RF Level measurement mode.

Syntax:

+Level[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]<units>

<units> = W | dBm | V

Rules:

- o When this parameter is specified, it must be specified as the Evaluation Quantity.

- o PSA Option 123 is required to perform Level measurements above 3 GHz.

- o Legal values are:

500 kHz to 3.05 GHz
-113 dBm to +30 dBm (without preamp, PSA Option 1DS)
-129 dBm to +16 dBm (with preamp, PSA Option 1DS)

3.05 GHz to 6.6 GHz
-113 dBm to +30 dBm

6.6 GHz to 13.2 GHz
-104 dBm to +30 dBm

13.2 GHz to 19.2 GHz
-93 dBm to +30 dBm

19.2 GHz to 26.5 GHz
-85 dBm to +30 dBm

Example:

+Level = -10.00dBm

= LevelRatio
===
====

This parameter specifies the expected level ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Tuned RF Level measurement mode.

Syntax:

+LevelRatio[<sp>]=[<sp>]<value>

<value> = <linear ratio> | <logarithmic ratio>

<linear ratio> = <numeric value>%

<logarithmic ratio> = <numeric value>[<sp>][<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +LevelRatio).

o When LevelRatio is specified in %, linear ratio mode is selected.

o When LevelRatio is specified in dB, log ratio mode is selected.

o Legal values are: <tdb>

Example:

+LevelRatio = <tbd>

= Local
===

This action puts the N5531S in local mode.

Syntax:

Local

Rules:

o When Local is specified, no other parameters may be specified.

Examples:

Local

= Measure
===

This "Action" parameter causes the following:

1. Setup the N5531S for measurement of the parameter designated as the Evaluation Quantity.

2. Initiate the measurement.

3. Return the reading in memory register MEM in units of the designated Nominal parameter value.

Syntax:

Measure

Rules:

- o When Measure is specified, Setup must not be specified.

- o When neither Measure or Setup is specified, Measure is assumed.

Examples:

N5531 +FMDev = 100 kHz

N5531 Measure +FMDev = 100 kHz

= ModulationDistortion
===

This parameter specifies the expected modulation distortion of the RF input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Modulation Distortion measurement mode.

Syntax:

+ModulationDistortion[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>]<units>

<units> = <percent> | <decibels>

<percent> = %

<decibels> = [<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +ModDist).

o Legal values are:

-80 to 0 dB
0.01% to 100%

Example:

+ModDist = 1.0%

= ModulationDistortionRatio
===

This parameter specifies the expected modulation distortion ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Modulation Distortion measurement mode.

Syntax:

+ModulationDistortionRatio[<sp>]=[<sp>]<value>

<value> = <linear ratio> | <logarithmic ratio>

<linear ratio> = <numeric value>%

<logarithmic ratio> = <numeric value>[<sp>][<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +ModulationDistortionRatio).

o When ModulationDistortionRatio is specified in %, linear ratio mode is selected.

- o When ModulationDistortionRatio is specified in dB, log ratio mode is selected.

- o Legal values are: <tdb>

Example:

+ModulationDistortionRatio = <tbd>

= ModulationSINAD
==

This parameter specifies the expected modulation SINAD of the RF input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Modulation SINAD measurement mode.

Syntax:

+ModulationSINAD[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>]<units>

<units> = <percent> | <decibels>

<percent> = %

<decibels> = [<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +ModSINAD).

o Legal values are: <tbd>

Example:

+ModSINAD = <tbd>

= ModulationSINADRatio
==

This parameter specifies the expected modulation SINAD ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Modulation SINAD measurement mode.

Syntax:

+ModulationSINADRatio[<sp>]=[<sp>]<value>

<value> = <linear ratio> | <logarithmic ratio>

<linear ratio> = <numeric value>%

<logarithmic ratio> = <numeric value>[<sp>][<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +ModulationSINADRatio).

o When ModulationSINADRatio is specified in %, linear ratio mode is selected.

o When ModulationSINADRatio is specified in dB, log ratio mode is selected.

o Legal values are: <tdb>

Example:

+ModulationSINADRatio = <tbd>

= ModulationFrequency
==

This parameter specifies the expected modulation frequency of the RF input signal. When this parameter is designated as the Evaluation Quantity, Modulation Rate measurement is selected.

Syntax:

[+|@]ModulationFrequency[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]Hz

Rules:

o Legal values are: 200 Hz to 300 kHz

Example:

+ModFreq = 400.0Hz

= ModulationFrequencyRatio
==

This parameter specifies the expected modulation frequency ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Modulation Frequency measurement mode.

Syntax:

+ModulationFrequencyRatio[<sp>]=[<sp>]<value>

<value> = <linear ratio> | <logarithmic ratio>

<linear ratio> = <numeric value>%

<logarithmic ratio> = <numeric value>[<sp>][<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the

Evaluation Quantity (i.e. +ModulationFrequencyRatio).

- o When ModulationFrequencyRatio is specified in %, linear ratio mode is selected.

- o When ModulationFrequencyRatio is specified in dB, log ratio mode is selected.

- o Legal values are: <tdb>

Example:

+ModulationFrequencyRatio = <tbd>

= ModulationType
===

This parameter sets the modulation type.

Syntax:

ModulationType[<sp>]=[<sp>]<value>

<value> = AM | FM | PM

Rules:

- o If not specified, the default value is AM.

Examples:

ModType = FM

= PMDeviation
==

This parameter specifies the expected phase modulation of the RF input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects PM Deviation measurement mode.

Syntax:

+PMDeviation[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]<units>

<units> = deg | rad

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +PMDev).

o Legal values are:

Example:

+PMDev = 5.00rad

= PMDeviationRatio
==

This parameter specifies the expected PM deviation ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects PM Deviation measurement mode.

Syntax:

+PMDeviationRatio[<sp>]=[<sp>]<value>

<value> = <linear ratio> | <logarithmic ratio>

<linear ratio> = <numeric value>%

<logarithmic ratio> = <numeric value>[<sp>][<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +PMDeviationRatio).

o When PMDeviationRatio is specified in %, linear ratio mode is selected.

o When PMDeviationRatio is specified in dB, log ratio mode is selected.

- o Legal values are: <tdb>

Example:

+PMDeviationRatio = <tbd>

= PeakHoldOn
==

This parameter turns the peak hold on.

Syntax:

PeakHoldOn

Rules:

- o PeakHoldOn is only allowed when Detector = Peak+ or Peak-.
- o When this parameter is not specified, the default is Off.

Example:

PeakHoldOn

= Power
==

This parameter specifies the expected power of the RF input signal.
When this parameter is designated as the Evaluation Quantity, Absolute RF Power measurement mode is selected.

Syntax:

[+|@]Power[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]<units>

<units> = dBm | W | V

Rules:

o The accompanying frequency or tuned frequency is dependent on the sensor module fitted as follows:

N5532A Option 504: 100 kHz to 4.2 GHz
N5532A Option 518: 10 MHz to 18.0 GHz
N5532A Option 526: 30 MHz to 26.5 GHz
N5532A Option 550: 50 MHz to 50.0 GHz

o Legal values are: -20 to +30 dBm

Examples:

+Power = -10.00 dBm

= PowerMeter
==

This parameter qualifies the Calibrate and Zero action parameters.

Syntax:

PowerMeter

Rules:

o When PowerMeter is specified, Calibrate or Zero must also be specified.

Examples:

Calibrate PowerMeter

-- or --

Zero PowerMeter

= PowerRatio
==

This parameter specifies the expected power ratio. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Absolute RF Power measurement mode.

Syntax:

+PowerRatio[<sp>]=[<sp>]<value>

<value> = <linear ratio> | <logarithmic ratio>

<linear ratio> = <numeric value>%

<logarithmic ratio> = <numeric value>[<sp>][<prefix>]dB

Rules:

- When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +PowerRatio).
- When PowerRatio is specified in %, linear ratio mode is selected.
- When PowerRatio is specified in dB, log ratio mode is selected.
- Legal values are: <tdb>

Example:

+PowerRatio = <tbd>

= PreamplifierOn
===

This parameter turns on the 100 kHz to 3 GHz internal preamplifier.

Syntax:

PreamplifierOn

Rules:

o When this parameter is not specified, the preamplifier is turned off.

Example:

PreamplifierOn

= RBW (Resolution Bandwidth)
==

This parameter sets the resolution bandwidth used for frequency and tuned RF level measurement.

Syntax:

RBW[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]Hz

Rules:

o Legal values are: 1 Hz to 80 MHz

o If not specified, the default value is 100 Hz.

= RFInputRanging
==

This parameter selects the RF input ranging.

Syntax:

RFInputRanging[<sp>]=[<sp>]<value>

<value> = Auto | Manual

Rules:

o If not specified, the default is RFInputRanging = Auto.

Example:

RFInputRanging = Manual

= RangeHold
===

This parameter enables/disables range hold.

Syntax:

RangeHold[<sp>]=[<sp>]<value>

<value> = Off | On

Rules:

o If not specified, the default is Off.

= RatioReference
===

This parameter sets the display mode to ratio and sets the ratio reference.

Syntax:

RatioReference[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]<units>

Rules:

o <units> must be same as the units of the evaluation quantity.

Example:

RatioReference = 1 GHz

= ReferenceLevel
==

This parameter establishes the reference level necessary to calculate absolute tuned RF level accuracy when the input power is between minimum and the residual noise threshold.

Syntax:

RatioReference[<sp>]=[<sp>]<numeric value>[<sp>][<prefix>]<units>

Rules:

o <units> must be same as the units of the evaluation quantity.

Example:

ReferenceLevel = [V RefLvl]

= Read
==

This "Action" parameter causes the following:

1. Initiate the measurement.

2. Return the reading in memory register MEM.

Syntax:

Read

Rules:

o A N5531 Measurement or Setup statement must precede a Read statement in the current test.

O The value in MEM is in units of the parameter designate as the Evaluation Quantity in the previous N5531 Measure or Setup statement.

o When Read is specified, no other parameters may be specified.

Examples:

N5531 Read

= ReferenceFrequencyOutput
==

This parameter enables the reference frequency output and sets the frequency to the value specified. If this parameter is not specified, the reference frequency output is disabled.

Syntax:

ReferenceFrequencyOutput[<sp>]=[<sp>]<dim quan>

<dim quan> = <value>[<sp>][<prefix>]Hz
<value> = <numeric value> | <register reference>

Rules:

o Legal values are: 10 MHz

Examples:

ReferenceFrequencyOutput = 10 MHz

= RelativeLevel
===
=

This parameter specifies the expected relative tuned RF level measurement. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects Tuned RF Level measurement mode.

Syntax:

+RelativeLevel[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]dB

Rules:

o SetReference must be specified in a previous Tuned RF Level statement to establish the reference level for the relative level.

o When this parameter is specified, it must be specified as the Evaluation Quantity.

o PSA Option 123 is required to perform Level measurements above 3 GHz.

o Legal values are: <tbd>

Example:

+RelativeLevel = -3 dB

= Reset
===

This parameter resets the instrument.

Syntax:

Reset

Rules:

o When Reset is specified, no other parameters are allowed.

Examples:

Reset

= ResidualAM
==

This parameter specifies the expected residual AM of the RF input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects AM Depth measurement mode.

Syntax:

+ResidualAM[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>]<units>

<units> = <percent> | <decibels>

<percent> = %

<decibels> = [<prefix>]dB

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +ResidualAM).

o Legal values are:

Example:

+ResidualAM = 0.0%

= ResidualFM
==

This parameter specifies the expected residual FM of the RF input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects FM Deviation measurement mode.

Syntax:

+ResidualFM[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>]Hz

Rules:

o When this parameter is specified, it must be specified as the

Evaluation Quantity (i.e. +ResidualFM).

o Legal values are:

Example:

+ResidualFM = 0.0 Hz

= ResidualPM
==

This parameter specifies the expected residual PM of the RF input signal. When this parameter is specified, it must be designated as the Evaluation Quantity. This automatically selects PM Deviation measurement mode.

Syntax:

+ResidualPM[<sp>]=[<sp>]<value>

<value> = <numeric value>[<sp>][<prefix>]<units>

<units> = deg | rad

Rules:

o When this parameter is specified, it must be specified as the Evaluation Quantity (i.e. +ResidualPM).

o Legal values are:

Example:

+ResidualPM = 0.0 rad

= SensorModule
==

This specifies the sensor module to be used for Absolute RF Power and Tuned RF Level measurement.

Syntax:

SensorModule[<sp>]=[<sp>]<value>

<value> = N5532A | N5532A-504 | N5532A-518 | N5532A-526 | N5532A-550

Rules:

o If not specified, the sensor module is based on required frequency and the sensor modules configured for the PSA.

o N5532A is only used for a Connect statements.

Example:

SensorModule = N5532A-526

= SetReference
==

This parameter causes the current measurement to be used as the ratio reference.

Syntax:

SetReference

Example:

SetRef

= Setup
===

This "Action" parameter sets up the N5531S for measurement of the parameter designated as the Evaluation Quantity.

Syntax:

Setup

Rules:

- o No measurement is performed.

- o A Read "Action" must be specified in a subsequent N5531 statement to cause a measurement to be performed and to obtain the reading.

- o When Setup is specified, Measure must not be specified.

Examples:

N5531 Setup +FMDev = 100 kHz

= uwPreselectorOff
==

This parameter turns the microwave preselector off.

Syntax:

uwPreselectorOn

Rules:

- o When this parameter is not specified the microwave preselector is turned on.

Example:

uwPreselectorOff

= Zero
==

This parameter causes a power meter zero sequence to be performed.

Syntax:

Zero

Rules:

o When Zero is specified, PowerMeter must also be specified.

Examples:

Zero PowerMeter

EXAMPLES

STEP FSC RANGE NOMINAL TOLERANCE MOD1 MOD2 3 4 CON

----- Reset -----

1.001 N5531 Reset

```
# -----  Automatic Connection Message  -----

  1.002  MATH         CM(1, "RF OUTPUT")
  1.003  N5531        Connect; Input = RF
  1.003  N5531        SensorModule = N5532A; Freq = 4000 MHz

# -----  Frequency Counter  -----

# The Frequency Counter is used to tune the N5531S in the following examples.

# -----  Absolute RF Power and Tuned RF Level  -----

# First setup to 30 dB attenuation to prevent IF Overload.
  1.004  N5531        ExtRefFreq = 10 MHz; TimebaseAccOff
  1.004  N5531        Power = 13 dBm; InputAtt = 30 dB
  1.004  N5531        +Freq = 4000 MHz; SensorModule = Same; Setup
  1.005  SCPI         POW:AMPL 13DBM;:FREQ:CW 4000MHZ;:OUTP:STAT
ON
  1.006  N5531        InputAtt = 30 dB; Power = 13 dBm
  1.006  N5531        ExtRefFreq = 10 MHz; TimebaseAccOff
  1.006  N5531        +Freq = 4000 MHz; SensorModule = Same; Read
  1.007  MATH         FreqMHz = MEM
  1.008  TARGET       -m
  1.009  N5531        ExtRefFreq = 10 MHz; TimebaseAccOff
  1.009  N5531        Freq = [V FreqMHz] MHz; SensorModule = Same
  1.009  N5531        +Power = 13 dBm; InputAtt = 30 dB
  1.010  MEMC   130   13.0dBm       1.0U

  2.001  SCPI         POW:AMPL 10DBM;:FREQ:CW 4000MHZ;:OUTP:STAT
ON
```

```
  2.002  TARGET      -m
  2.003  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
  2.003  N5531       Freq = [V FreqMHz] MHz; SensorModule = Same
  2.003  N5531       +Power = 10 dBm; InputAtt = 30 dB
  2.004  MEMC   130   10.0dBm       1.0U

  3.001  SCPI        POW:AMPL 4DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON
  3.002  TARGET      -m
  3.003  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
  3.003  N5531       Freq = [V FreqMHz] MHz; SensorModule = Same
  3.003  N5531       +Power = 4 dBm; InputAtt = 20 dB
  3.004  MEMC   130   4.0dBm        1.0U

  4.001  SCPI        POW:AMPL -5.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT
ON
  4.002  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
  4.002  N5531       Freq = [V FreqMHz] MHz; SensorModule = Same
  4.002  N5531       +Level = -5.9 dBm; Setup
  4.003  TARGET      -m
  4.004  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
  4.004  N5531       Freq = [V FreqMHz] MHz; SensorModule = Same
  4.004  N5531       +Level = -5.9 dBm; Read
  4.005  MEMC   130   -5.9dBm       1.0U

# Store reference level for accuracy calculation of the subsequent TRFL tests.
  5.001  MATH        RefLvl = MEM

  5.002  SCPI        POW:AMPL -15.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT
ON
  5.003  TARGET      -m
```

5.004 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

5.004 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same

5.004 N5531 +Level = -15.9 dBm; RefLevel = [V RefLvl] dBm; Read

5.005 MEMC 130 -15.9dBm 1.0U

6.001 SCPI POW:AMPL -25.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON

6.002 TARGET -m

6.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

6.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same

6.003 N5531 +Level = -25.9 dBm; RefLevel = [V RefLvl] dBm; Read

6.004 MEMC 130 -25.9dBm 1.0U

7.001 SCPI POW:AMPL -35.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON

7.002 TARGET -m

7.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

7.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same

7.003 N5531 +Level = -35.9 dBm; RefLevel = [V RefLvl] dBm; Read

7.004 MEMC 130 -35.9dBm 1.0U

8.001 SCPI POW:AMPL -45.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON

8.002 TARGET -m

8.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

8.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same

8.003 N5531 +Level = -45.9 dBm; RefLevel = [V RefLvl] dBm; Read

8.004 MEMC 130 -45.9dBm 1.0U

9.001 SCPI POW:AMPL -55.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON

9.002 TARGET -m
9.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff
9.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same
9.003 N5531 +Level = -55.9 dBm; RefLevel = [V RefLvl] dBm; Read
9.004 MEMC 130 -55.9dBm 1.0U

10.001 SCPI POW:AMPL -65.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON
10.002 TARGET -m
10.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff
10.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same
10.003 N5531 +Level = -65.9 dBm; RefLevel = [V RefLvl] dBm; Read
10.004 MEMC 130 -65.9dBm 1.0U

11.001 SCPI POW:AMPL -75.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON
11.002 TARGET -m
11.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff
11.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same
11.003 N5531 +Level = -75.9 dBm; RefLevel = [V RefLvl] dBm; Read
11.004 MEMC 130 -75.9dBm 1.0U

12.001 SCPI POW:AMPL -85.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON
12.002 TARGET -m
12.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff
12.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same
12.003 N5531 +Level = -85.9 dBm; RefLevel = [V RefLvl] dBm; Read
12.004 MEMC 130 -85.9dBm 1.0U

```
 13.001  SCPI        POW:AMPL -95.9DBM;:FREQ:CW 4000MHZ;:OUTP:STAT
ON
 13.002  TARGET      -m
 13.003  N5531        ExtRefFreq = 10 MHz; TimebaseAccOff
 13.003  N5531        Freq = [V FreqMHz] MHz; SensorModule = Same
 13.003  N5531        +Level = -95.9 dBm; RefLevel = [V RefLvl] dBm; Read
 13.004  MEMC   130   -95.9dBm       1.0U

 14.001  SCPI        POW:AMPL -96DBM;:FREQ:CW 4000MHZ;:OUTP:STAT
ON
 14.002  TARGET      -m
 14.003  N5531        ExtRefFreq = 10 MHz; TimebaseAccOff
 14.003  N5531        Freq = [V FreqMHz] MHz; SensorModule = Same
 14.003  N5531        +Level = -96 dBm; RefLevel = [V RefLvl] dBm; Read
 14.004  MEMC   130   -96.0dBm       1.0U

 15.001  SCPI        POW:AMPL -105.9DBM;:FREQ:CW 4000MHZ
 15.002  SCPI        OUTP:STAT ON
 15.003  TARGET      -m
 15.004  N5531        ExtRefFreq = 10 MHz; TimebaseAccOff
 15.004  N5531        Freq = [V FreqMHz] MHz; SensorModule = Same
 15.004  N5531        +Level = -105.9 dBm; RefLevel = [V RefLvl] dBm; Read
 15.005  MEMC   130   -105.9dBm      1.0U

 16.001  SCPI        POW:AMPL -106DBM;:FREQ:CW 4000MHZ;:OUTP:STAT
ON
 16.002  TARGET      -m
 16.003  N5531        ExtRefFreq = 10 MHz; TimebaseAccOff
 16.003  N5531        Freq = [V FreqMHz] MHz; SensorModule = Same
 16.003  N5531        +Level = -106 dBm; RefLevel = [V RefLvl] dBm; Read
```

16.004 MEMC 130 -106.0dBm 1.0U

17.001 SCPI POW:AMPL -115.9DBM;:FREQ:CW 4000MHZ

17.002 SCPI OUTP:STAT ON

17.003 TARGET -m

17.004 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

17.004 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same

17.004 N5531 +Level = -115.9 dBm; RefLevel = [V RefLvl] dBm; Read

17.005 MEMC 130 -115.9dBm 1.0U

18.001 SCPI POW:AMPL -116DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON

18.002 TARGET -m

18.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

18.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same

18.003 N5531 +Level = -116 dBm; RefLevel = [V RefLvl] dBm; Read

18.004 MEMC 130 -116.0dBm 1.0U

19.001 SCPI POW:AMPL -125.9DBM;:FREQ:CW 4000MHZ

19.002 SCPI OUTP:STAT ON

19.003 TARGET -m

19.004 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

19.004 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same

19.004 N5531 +Level = -125.9 dBm; RefLevel = [V RefLvl] dBm; Read

19.005 MEMC 130 -125.9dBm 1.0U

20.001 SCPI POW:AMPL -126DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON

20.002 TARGET -m

20.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

20.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same

20.003 N5531 +Level = -126 dBm; RefLevel = [V RefLvl] dBm; Read

20.004 MEMC 130 -126.0dBm 1.0U

21.001 SCPI POW:AMPL -127DBM;:FREQ:CW 4000MHZ;:OUTP:STAT ON

21.002 TARGET -m

21.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

21.003 N5531 Freq = [V FreqMHz] MHz; SensorModule = Same

21.003 N5531 +Level = -127 dBm; RefLevel = [V RefLvl] dBm; Read

21.004 MEMC 130 -127.0dBm 1.0U

----- AM Depth -----

22.001 TSET TDESC = AM Depth: 10%

22.002 TARGET -p

22.003 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

22.003 N5531 Power = -6 dBm; InputAtt = 10 dB

22.003 N5531 +Freq = 1000 MHz; Setup

22.004 SCPI FREQ:CW 1000MHZ;:AM:DEPT 10 PCT;:AM:SOUR INT

22.005 SCPI AM:INT:FREQ 1 KHZ;:AM:STAT ON

22.006 SCPI POW:AMPL -6DBM;:OUTP:STAT ON

22.007 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

22.007 N5531 Power = -6 dBm; InputAtt = 10 dB

22.007 N5531 +Freq = 1000 MHz; Read

22.008 MATH FreqMHz = MEM

22.009 TARGET -m

22.010 N5531 ExtRefFreq = 10 MHz; TimebaseAccOff

22.010 N5531 HPF = 300 Hz; LPF = 15 kHz; BWMode = Man; IFBW = 1 MHz

```
 22.010  N5531       Power = -6 dBm; InputAtt = 10 dB
 22.010  N5531       Freq = [V FreqMHz] MHz; ModFreq = 1 kHz
 22.010  N5531       +AMDepth = 10.0 %;
 22.011  MEMC          10.0pct        2.0U

# -----  FM Deviation  -----

 23.001  TSET        TDESC = FM Deviation: 5 kHz
 23.002  TARGET        -p
 23.003  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
 23.003  N5531       Power = 4 dBm; InputAtt = 20 dB
 23.003  N5531       +Freq = 1500 MHz; Setup
 23.004  SCPI        FREQ:CW 1500MHZ;:FM:DEV 5 KHZ;:FM:SOUR INT
 23.005  SCPI        FM:INT:FREQ 1 KHZ;:FM:STAT ON
 23.006  SCPI        POW:AMPL 4 DBM;:OUTP:STAT ON
 23.007  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
 23.007  N5531       Power = 4 dBm; InputAtt = 20 dB
 23.007  N5531       +Freq = 1500 MHz; Read
 23.008  MATH         FreqMHz = MEM
 23.009  TARGET        -m
 23.010  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
 23.010  N5531       HPF = 300 Hz; LPF = 15 kHz
 23.010  N5531       ModFreq = 1 kHz; Power = 4 dBm; InputAtt = 20 dB;
 23.010  N5531       +FMDev = 5.000 kHz; Freq = [V FreqMHz] MHz
 23.011  MEMC          5.000kH        0.210U

# -----  Modulation Distortion (AM)  -----

 24.001  TSET        TDESC = AM Depth: 30%
```

```
24.002  TARGET      -p
24.003  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
24.003  N5531       Power = +4 dBm; InputAtt = [V @AttndB] dB
24.003  N5531       +Freq = 400 MHz; Setup
24.004  SCPI        FREQ:CW 400MHZ;:AM:DEPT 30 PCT;:AM:SOUR INT
24.005  SCPI        AM:INT:FREQ 1 KHZ;:AM:STAT ON
24.006  SCPI        POW:AMPL +4DBM;:OUTP:STAT ON
24.007  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
24.007  N5531       Power = +4 dBm; InputAtt = [V @AttndB] dB
24.007  N5531       +Freq = 400 MHz; Read
24.008  MATH         FreqMHz = MEM
24.009  TARGET      -m
24.010  N5531       ExtRefFreq = 10 MHz; TimebaseAccOff
24.010  N5531       HPF = 300 Hz; LPF = 15 kHz
24.010  N5531       Power = -6 dBm; InputAtt = [V @AttndB] dB
24.010  N5531       Freq = [V FreqMHz] MHz; ModFreq = 1 kHz;
24.010  N5531       +ModDist = 0 %; AMDepth = 30 %
24.011  MEMC         0.00pct       -2.00U

# -----  Audio Frequency  -----

25.001  N5531       +AudioFreq = 400 Hz; AudioACLevel = 1 V; Setup
25.002  IEEE        [SDC]FR100KZAP+7DMAM50PCS2
25.003  TARGET      -m
25.004  N5531       +AudioFreq = 400 Hz; AudioACLevel = 1 V; Read
25.005  MEMC   1000  400H          2%

# -----  Power Ratio (%)  -----
```

```
26.001  SCPI      INST SINE;:POW -10;:FREQ 50E+6;:OUTP ON
# Get tune frequency for subsequent measurements at 50 MHz.
26.002  N5531      SensorModule = Same
26.002  N5531      +Freq = 50 MHz; Power = -10 dBm
26.003  MATH        Freq = MEM
26.004  N5531      SensorModule = Same
26.004  N5531      +Power = -10 dBm; Freq = [V Freq] MHz
26.005  MATH        Ref = MEM
26.006  SCPI      INST SINE;:POW -7;:FREQ 50E+6;:OUTP ON
26.007  N5531      Freq = [V Freq] MHz; SensorModule = Same
26.007  N5531      +PowerRatio = 199.5 %; RatioRef = [V Ref] dBm; Read
26.008  MEMC        199.5pct      3.0U

# -----  Power Ratio (dB)  -----

27.001  SCPI      INST SINE;:POW -10;:FREQ 50E+6;:OUTP ON
27.002  N5531      SensorModule = Same
27.002  N5531      +Power = -10 dBm; Freq = [V Freq] MHz
27.003  MATH        Ref = MEM
27.004  SCPI      INST SINE;:POW +10;:FREQ 50E+6;:OUTP ON
27.005  N5531      Freq = [V Freq] MHz; SensorModule = Same
27.005  N5531      +PowerRatio = 20.0 dB; RatioRef = [V Ref] dBm; Read
27.006  MEMC        20.0dB        0.1U

# -----  Tuned RF Level Ratio (dB)  -----

28.001  SCPI      INST SINE;:POW -5;:FREQ 50E+6;:OUTP ON
28.002  N5531      SensorModule = Same
28.002  N5531      +Level = -5 dBm; Freq = [V Freq] MHz
```

```
 28.003  MATH        Ref = MEM
 28.004  SCPI        INST SINE;:POW -40;:FREQ 50E+6;:OUTP ON
 28.005  N5531       Freq = [V Freq] MHz; SensorModule = Same
 28.005  N5531       +LevelRatio = -35.0 dB; RatioRef = [V Ref] dBm; Read
 28.006  MEMC        -35.0dB      0.1U

# -----  Frequency Ratio (%)  -----

 29.001  SCPI        INST SINE;:FREQ 100E+6;:POW -10;:OUTP ON
# Get tune frequency for subsequent measurements at 100 MHz.
 29.002  N5531       SensorModule = Same
 29.002  N5531       +Freq = 100 MHz; Power = -10 dBm
 29.003  MATH        Freq = MEM
 29.004  SCPI        INST SINE;:FREQ 10E+6;:POW -10;:OUTP ON
 29.005  N5531       Power = -10 dBm; SensorModule = Same
 29.005  N5531       +FreqRatio = 10.000 %; RatioRef = [V Freq] MHz; Read
 29.006  MEMC        10.000pct    0.001U

# -----  AM Depth Ratio (%)  -----

 30.001  SCPI        INST AM;:AM:INT:FREQ 400;:AM:DEPT 80;STAT ON
 30.002  SCPI        FREQ 100E+6;:POW -10;:OUTP ON
 30.003  N5531       Freq = [V Freq] MHz; Power = -10 dBm
 30.003  N5531       +AMDepth = 80 %; ModFreq = 400 Hz
 30.004  MATH        Ref = MEM
 30.005  SCPI        INST AM;:AM:INT:FREQ 400;:AM:DEPT 20;STAT ON
 30.006  SCPI        FREQ 100E+6;:POW -10;:OUTP ON
 30.007  N5531       Freq = [V Freq] MHz; Power = -10 dBm; ModFreq = 400 Hz
 30.007  N5531       +AMDepthRatio = 25.0 %; RatioRef = [V Ref] %; Read
```

```
 30.008  MEMC        25.0pct       0.1U

# -----  FM Deviation Ratio (%)  -----

 31.001  SCPI        INST FM;:FM:INT:FREQ 1E+3;:FM:DEV 40E+3;STAT ON
 31.002  SCPI        FREQ 100E+6;:POW -10;:OUTP ON
 31.003  N5531        Freq = [V Freq] MHz; Power = -10 dBm
 31.003  N5531        +FMDev = 40 kHz; ModFreq = 1 kHz
 31.004  MATH          Ref = MEM
 31.005  SCPI        INST FM;:FM:INT:FREQ 1E+3;:FM:DEV 8E+3;STAT ON
 31.006  SCPI        FREQ 100E+6;:POW -10;:OUTP ON
 31.007  N5531        Freq = [V Freq] MHz; Power = -10 dBm; ModFreq = 1 kHz
 31.007  N5531        +FMDevRatio = 20.0 %; RatioRef = [V Ref] kHz; Read
 31.008  MEMC        20.0pct       0.1U

# -----  PM Deviation Ratio (dB)  -----

 32.001  SCPI        INST PM;:PM:INT:FREQ 1E+3;:PM:DEV 10;STAT ON
 32.002  SCPI        FREQ 1E+9;:POW -10;:OUTP ON
# Get tune frequency for subsequent measurements at 1 GHz.
 32.003  N5531        +Freq = 1 GHz; Power = -10 dBm
 32.004  MATH          Freq = MEM
 32.005  N5531        Freq = [V Freq] GHz; Power = -10 dBm
 32.005  N5531        +PMDev = 10 rad; ModFreq = 1 kHz
 32.006  MATH          Ref = MEM
 32.007  SCPI        INST PM;:PM:INT:FREQ 1E+3;:PM:DEV 1000;STAT ON
 32.008  SCPI        FREQ 1E+9;:POW -10;:OUTP ON
 32.009  N5531        Freq = [V Freq] GHz; Power = -10 dBm; ModFreq = 400 Hz
 32.009  N5531        +PMDevRatio = 40.0 dB; RatioRef = [V Ref] rad; Read
```

```
 32.010  MEMC        40.0dB        0.1U

# -----  Modulation Frequency (Rate) Ratio (%)  -----

 33.001  SCPI        INST AM;:AM:INT:FREQ 400;:AM:DEPT 20;STAT ON
 33.002  SCPI        FREQ 100E+6;:POW -10;:OUTP ON
# Get tune frequency for subsequent measurements at 100 MHz.
 33.003  N5531        +Freq = 100 MHz; Power = -10 dBm
 33.004  MATH          Freq = MEM
 33.005  N5531        Freq = [V Freq] MHz; Power = -10 dBm
 33.005  N5531        +ModFreq = 400 Hz; AMDepth = 20 %
 33.006  MATH          Ref = MEM
 33.007  SCPI        INST AM;:AM:INT:FREQ 1E+3;:AM:DEPT 20;STAT ON
 33.008  SCPI        FREQ 100E+6;:POW -10;:OUTP ON
 33.009  N5531        Freq = [V Freq] MHz; Power = -10 dBm
 33.009  N5531        AMDepth = 20 %
 33.009  N5531        +ModFreqRatio = 250.000 %; RatioRef = [V Ref] Hz; Read
 33.010  MEMC          250.000pct     0.001U

# -----  Modulation Frequency (Rate) Ratio (dB)  -----

 34.001  SCPI        INST FM;:FM:INT:FREQ 400;:FM:DEV 10E+3;STAT ON
 34.002  SCPI        FREQ 100E+6;:POW -10;:OUTP ON
 34.003  N5531        Freq = [V Freq] MHz; Power = -10 dBm
 34.003  N5531        +ModFreq = 400 Hz; FMDev = 10 kHz
 34.004  MATH          Ref = MEM
 34.005  SCPI        INST FM;:FM:INT:FREQ 1000;:FM:DEV 10E+3;STAT ON
 34.006  SCPI        FREQ 100E+6;:POW -10;:OUTP ON
 34.007  N5531        Freq = [V Freq] MHz; Power = -10 dBm
```

```
34.007  N5531     FMDev = 10 kHz
34.007  N5531     +ModFreqRatio = 8.0 dB; RatioRef = [V Ref] Hz; Read
34.008  MEMC        8.0dB        0.1U

# -----  Modulation Distortion Ratio (%)  -----

35.001  SCPI     INST AM;:AM:INT:FREQ 400;:AM:DEPT 20;STAT ON
35.002  SCPI     FREQ 100E+6;:POW -10;:OUTP ON
35.003  N5531     Freq = [V Freq] MHz; Power = -10 dBm
35.003  N5531     +ModDist = 0 %; ModFreq = 400 Hz; AMDepth = 20 %
35.004  MATH        Ref = MEM
35.005  SCPI     INST AM;:AM:INT:FREQ 400;:AM:DEPT 20;STAT ON
35.006  SCPI     FREQ 1E+9;:POW -10;:OUTP ON
# Get tune frequency for distortion measurement at 1 GHz.
35.007  N5531     +Freq = 1 GHz; Power = -10 dBm
35.008  N5531     Freq = [MEM] GHz; Power = -10 dBm
35.008  N5531     ModFreq = 400 Hz; AMDepth = 20 %
35.008  N5531     +ModDistRatio = 75.0 %; RatioRef = [V Ref] %; Read
35.009  MEMC        80.0pct      10U

# -----  Modulation SINAD Ratio (dB)  -----

36.001  SCPI     INST AM;:AM:INT:FREQ 400;:AM:DEPT 20;STAT ON
36.002  SCPI     FREQ 100E+6;:POW -10;:OUTP ON
# Get tune frequency for SINAD measurement at 100 MHz.
36.003  N5531     +Freq = 10 MHz; Power = -10 dBm
36.004  N5531     Freq = [MEM] MHz; Power = -10 dBm
36.004  N5531     +ModSINAD = 0 dB; ModFreq = 400 Hz; AMDepth = 20 %
36.005  MATH        Ref = MEM
```

```
 36.006  SCPI        INST AM;:AM:INT:FREQ 400;:AM:DEPT 20;STAT ON
 36.007  SCPI        FREQ 1E+9;:POW -10;:OUTP ON
# Get tune frequency for SINAD measurement at 1 GHz.
 36.008  N5531        +Freq = 1 GHz; Power = -10 dBm
 36.009  N5531        Freq = [MEM] GHz; Power = -10 dBm
 36.009  N5531        ModFreq = 400 Hz; AMDepth = 20 %
 36.009  N5531        +ModSINADRatio = 0 dB; RatioRef = [V Ref] dB; Read
 36.010  MEMC          0dB          5U

# -----  Audio Frequency Ratio (%)  -----

 37.001  IEEE2       OUT 1V,400Hz;OPER
 37.002  N5531        +AudioFreq = 400 Hz; AudioACLevel = 1 V
 37.003  MATH          Ref = MEM
 37.004  IEEE2       OUT 1V,1kHz;OPER
 37.005  N5531        AudioACLevel = 1 V
 37.005  N5531        +AudioFreqRatio = 250.000 %; RatioRef = [V Ref] Hz; Read
 37.006  MEMC          250.000pct     0.001U

# -----  Audio AC Level Ratio (%)  -----

 38.001  IEEE2       OUT 1V,400Hz;OPER
 38.002  N5531        +AudioACLevel = 1 V; AudioFreq = 400 Hz
 38.003  MATH          Ref = MEM
 38.004  IEEE2       OUT 0.5V,400Hz;OPER
 38.005  N5531        AudioFreq = 400 Hz
 38.005  N5531        +AudioACLevelRatio = 50 %; RatioRef = [V Ref] V; Read
 38.006  MEMC          50.0pct       0.1U
```

----- Audio Distortion Ratio (dB) -----

39.001	IEEE2	OUT 1V,400Hz;OPER
39.002	N5531	AudioACLevel = 1 V; AudioFreq = 400 Hz
39.002	N5531	+AudioDistortion = 0.01 %
39.003	MATH	Ref = MEM
39.004	IEEE2	OUT 0.5V,1kHz;OPER
39.005	N5531	AudioACLevel = 1 V; AudioFreq = 1 kHz
39.005	N5531	+AudioDistortionRatio = 1 dB; RatioRef = [V Ref] %; Read
39.006	MEMC	2.5dB 1.0U

----- Audio SINAD Ratio (dB) -----

40.001	IEEE2	OUT 1V,1kHz;OPER
40.002	N5531	AudioACLevel = 1 V; AudioFreq = 1 kHz
40.002	N5531	+AudioSINAD = 0 dB
40.003	MATH	Ref = MEM
40.004	IEEE2	OUT 0.5V,400Hz;OPER
40.005	N5531	AudioACLevel = 1 V; AudioFreq = 400 Hz
40.005	N5531	+AudioSINADRatio = 1 dB; RatioRef = [V Ref] dB; Read
40.006	MEMC	-4.5dB 1.0U

OPBR

Procedure Control FSC

Description

The OPBR FSC presents a message to the operator. The operator must respond by choosing YES or NO. MEM1 is set to 1 if the operator chooses YES, and set to -1 if the operator chooses NO. The OPBR FSC is typically used in conjunction with a JMPF or JMPT statement to perform a jump based on the value of MEM1.

Format

OPBR [-z] *message*

Rules

- An OPBR *message* may contain up to 56 characters.
- An OPBR statement may contain up to 32 lines.
- The operator's response to the OPBR message determines the value of MEM1.

  If the “-z” argument *is not* specified:

Operator Response	**MEM1 Value**
YES	+1
NO	-1

  If the “z” argument *is* specified:

Operator Response	**MEM1 Value**
YES	+1
NO	0

  See the next paragraph for a description of the “-z” argument.

- The procedure writer may optionally specify the "-z" argument on the first line of an OPBR statement. Specifying "-z" causes MET/CAL to assign the value zero to MEM1 when the operator chooses "No" in response to the OPBR prompt.

  When "-z" is specified there must be a space after the 'z' unless the entire line is simply "OPBR -z".

  The "-z" argument is not supported in V7.11 or earlier versions of MET/CAL. The addition of support for the "-z" argument is not backwards compatible, but only existing OPBR statements which begin with "-z " on the first line are affected by the change.

- The following special constructions may be used in an OPBR statement:

  [MEM], [MEM1], and [MEM2]

  [*integer*]

  [D*delay*]

  [DRAW *x,y,view*]

  [V *variable*]

  {*text*}

  [M1], [M2], ...

  [L1], [L2], …

  [NO]

  [S1], [S2], ...

  [SREG1], [SREG2], ...

  Refer to "Special Constructions" in Chapter 1 of this manual for details on special constructions (1) to (6).

  The constructions [M1], [M2], ... access the global numeric registers. The constructions [L1], [L2], … access the local numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC help for additional information on the numeric registers.

  The [NO] construction changes the default button in the OPBR prompt dialog from "Yes" to "No". This can be useful when the expected response is "No" rather than "Yes", because it allows the operator to simply press the "Enter" button in order to choose "No". The [NO] construction affects only the OPBR statement in which it appears. The default button is "Yes" for any OPBR statement which does not contain a [NO] construction. (The [NO] construction is new with V6.0.)

  The constructions [S1], [S2], ..., [S32] access the string registers. Refer to the MATH FSC help for additional information on the string registers.

  The constructions [SREG1], [SREG2], ... are identical to [S1], [S2], ..., and are included only for compatibility with the IEEE, IEEE2, and SCPI FSCs.

Examples

Example 1

```
47.003      OPBR    This test requires the following equipment:
47.003      OPBR    Function Generator: Philips PM 5133/5134 or equiv.
47.003      OPBR    Oscilloscope: Philips PM 3055 or equivalent
47.003      OPBR
47.003      OPBR    Do you wish to perform the test?
47.004      JMPT    47.007
47.005      RSLT    = ****** NOT TESTED ******
47.006      JMP     47.008
47.007      CALL    Sub Fluke 86,88 Inductive Pickup (1 year) CAL VER
47.008      END
```

The example above illustrates a typical use of OPBR. The operator is presented with a list of required equipment for a test. If the equipment is available, the operator chooses YES, which causes MEM1 to be set to 1. The JMPT statement then causes a jump to 47.007, which calls a subprocedure to perform the desired test.

If the equipment is not available, the operator chooses NO, which causes MEM1 to be set to -1. The JMPT statement does not then jump to 47.007. Execution proceeds to 47.005, which writes "****** NOT TESTED ******" in the results, and then 47.006 which jumps around the CALL statement.

Note

[] special constructions may be enclosed in {}, but will not be evaluated and stored in the results. For example, the following OPBR statement will cause "Ch[MEM] triggered" to be stored in the results, not "Ch1 triggered".

```
12.001 MATH         MEM = 1
12.002 HEAD         Ch[MEM] Tests
12.003 OPBR         Is {Ch[MEM] triggered}?
```

The RSLT FSC should be used to store text with embedded [] special constructions in the results as shown below:

```
12.001 MATH         MEM = 1
12.002 HEAD         Ch[MEM] Tests
12.003 RSLT         =Ch[MEM] triggered
12.004 OPBR         Is Ch[MEM] triggered?
```

Example 2

```
1.014  OPBR        -z Do you wish to include the IR communication
1.014  OPBR        port test?
1.015  MATH        PUT("Test_IR_Port", MEM1)
```

In this example the "-z" argument is specified.

If the operator choose "No", MEM1 is set to 0, and 0 is saved as the value of the "Test_IR_Port" in the MET/CAL variable cache.

If the operator choose "Yes", MEM1 is set to 1, and 1 is saved as the value of the "Test_IR_Port" in the MET/CAL variable cache.

P525

Instrument FSC

Description

The P525 FSC programs the Fluke 525A Temperature/Pressure Calibrator to measure pressure using a Fluke 525A-Pxx Series Pressure Module.

Functional Capability

Model	Minimum	Maximum
525A-P01	0.0psi	0.3613psi
	0.0mmHg	18.680mmHg @ 0degC
	0.0inHg	0.7356inHg @ 32degF
	0.0inH2O	10.000inH2O @ 39.2degF
	0.0inH2O	10.018inH2O @ 68degF
	0.0ftH2O	0.83340ftH2O @ 39.2degF
	0.0ftH2O	0.83387ftH2O @ 68degF
	0.0mmH2O	254.02mmH2O @ 4degC
	0.0mmH2O	254.47mmH2O @ 20degC
	0.0cmH2O	25.402cmH2O @ 4degC
	0.0cmH2O	25.447cmH2O @ 20degC
	0.0mbar	24.910mbar
	0.0kPa	2.4910kPa
	0.0g/cm2	25.400g/cm2
525A-P02	0.0 psi	1.0000 psi
	0.0 mmHg	51.715 mmHg @ 0 °C
	0.0 inHg	1.0360 inHg @ 32 °F
	0.0 inH_2O	27.680 inH_2O @ 39.2 °F
	0.0 inH_2O	27.729 inH_2O @ 68 °F
	0.0 ftH_2O	2.3067 ftH_2O @ 39.2 °F
	0.0 ftH_2O	2.3107 ftH_2O @ 68 °F
	0.0 mmH_2O	703.07 mmH_2O @ 4 °C

Model	Minimum	Maximum
	0.0 mmH_2O	704.31 mmH_2O @ 20 °C
	0.0 cmH_2O	70.307 cmH_2O @ 4 °C
	0.0 cmH_2O	70.431 cmH_2O @ 20 °C
	0.0 mbar	68.948 mbar
	0.0 kPa	6.8948 kPa
	0.0 g/cm^2	70.307 g/cm^2
525A-P03	0.0psi	5.0000psi
	0.0mmHg	258.58mmHg @ 0degC
	0.0inHg	10.180inHg @ 32degF
	0.0inH2O	138.40inH2O @ 39.2degF
	0.0inH2O	138.64inH2O @ 68degF
	0.0ftH2O	11.533ftH2O @ 39.2degF
	0.0ftH2O	11.554ftH2O @ 68degF
	0.0cmH2O	351.53cmH2O @ 4degC
	0.0cmH2O	352.16cmH2O @ 20degC
	0.0mH2O	3.5153mH2O @ 4degC
	0.0mH2O	3.5216mH2O @ 20degC
	0.0mbar	344.73mbar
	0.0kPa	34.474kPa
	0.0g/cm2	351.53g/cm2
525A-P04/525A-PA4	0.0 psi	15.000 psi
	0.0 mmHg	775.73 mmHg @ 0 °C
	0.0 inHg	30.540 inHg @ 32 °F
	0.0 inH_2O	415.20 inH_2O @ 39.2 °F
	0.0 inH_2O	415.93 inH_2O @ 68 °F
	0.0 ftH_2O	34.600 ftH_2O @ 39.2 °F
	0.0 ftH_2O	34.661 ftH_2O @ 68 °F
	0.0 cmH_2O	1054.6 cmH_2O @ 4 °C
	0.0 cmH_2O	1056.5 cmH_2O @ 20 °C

Model	Minimum	Maximum
	0.0 mH_2O	10.546 mH_2O @ 4 °C
	0.0 mH_2O	10.565 mH_2O @ 20 °C
	0.0 bar	1.0342 bar
	0.0 kPa	103.42 kPa
	0.0 kg/cm^2	1.0546 kg/cm^2
525A-P05/	0.0 psi	30.000 psi
525A-PA5	0.0 mHg	1.5515 mHg
	0.0 inHg	61.081 inHg @ 32 °F
	0.0 inH_2O	830.40 inH_2O @ 39.2 °F
	0.0 inH_2O	831.87 inH_2O @ 68 °F
	0.0 ftH_2O	69.200 ftH_2O @ 39.2 °F
	0.0 ftH_2O	69.322 ftH_2O @ 68 °F
	0.0 cmH_2O	2109.2 cmH_2O @ 4 °C
	0.0 cmH_2O	2112.9 cmH_2O @ 20 °C
	0.0 mH_2O	21.092 mH_2O @ 4 °C
	0.0 mH_2O	21.129 mH_2O @ 20 °C
	0.0 bar	2.0684 bar
	0.0 kPa	206.84 kPa
	0.0 kg/cm^2	2.1092 kg/cm^2
525A-P06/	0.0 psi	100.00 psi
525A-PA6	0.0 mHg	5.1715 mHg
	0.0 inHg	203.60 inHg @ 32 °F
	0.0 inH_2O	2768.0 inH_2O @ 39.2 °F
	0.0 inH_2O	2772.9 inH_2O @ 68 °F
	0.0 ftH_2O	230.67 ftH_2O @ 39.2 °F
	0.0 ftH_2O	231.07 ftH_2O @ 68 °F
	0.0 cmH_2O	7030.7 cmH_2O @ 4 °C
	0.0 cmH_2O	7043.1 cmH_2O @ 20 °C
	0.0 mH_2O	70.307 mH_2O @ 4 °C

Model	Minimum	Maximum
	0.0 mH_2O	70.431 mH_2O @ 20 °C
	0.0 bar	6.8948 bar
	0.0 kPa	689.48 kPa
	0.0 kg/cm^2	7.0307 kg/cm^2
525A-P07/	0.0 psi	500.00 psi
525A-PA7	0.0 mHg	25.858 mHg
	0.0 inHg	1018.0 inHg @ 32 °F
	0.0 inH_2O	13840 inH_2O @ 39.2 °F
	0.0 inH_2O	13864 inH_2O @ 68 °F
	0.0 ftH_2O	1153.3 ftH_2O @ 39.2 °F
	0.0 ftH_2O	1155.4 ftH_2O @ 68 °F
	0.0 cmH_2O	35153 cmH_2O @ 4 °C
	0.0 cmH_2O	35216 cmH_2O @ 20 °C
	0.0 mH_2O	351.53 mH_2O @ 4 °C
	0.0 mH_2O	352.16 mH_2O @ 20 °C
	0.0 bar	34.474 bar
	0.0 MPa	3.4474 MPa
	0.0 kg/cm^2	35.153 kg/cm^2
525A-P08/	0.0 psi	1000.0 psi
525A-PA8	0.0 mHg	51.715 mHg
	0.0 inHg	2036.0 inHg @ 32 °F
	0.0 inH_2O	27680 inH_2O @ 39.2 °F
	0.0 inH_2O	27729 inH_2O @ 68 °F
	0.0 ftH_2O	2306.7 ftH_2O @ 39.2 °F
	0.0 ftH_2O	2310.7 ftH_2O @ 68 °F
	0.0 cmH_2O	70307 cmH_2O @ 4 °C
	0.0 cmH_2O	704 31 cmH_2O @ 20 °C
	0.0 mH_2O	703.07 mH_2O @ 4 °C
	0.0 mH_2O	704.31 mH_2O @ 20 °C

Model	Minimum	Maximum
	0.0 bar	68.948 bar
	0.0 MPa	6.8948 MPa
	0.0 kg/cm^2	70.307 kg/cm^2
525A-P29	0.0 psi	3000.0 psi
	0.0 mHg	155.15 mHg
	0.0 inHg	6108.1 inHg @ 32 °F
	0.0 inH_2O	83040 inH_2O @ 39.2 °F
	0.0 inH_2O	83187 inH_2O @ 68 °F
	0.0 ftH_2O	6920.0 ftH_2O @ 39.2 °F
	0.0 ftH_2O	6932.2 ftH_2O @ 68 °F
	0.0 cmH_2O	21092 cmH_2O @ 4 °C
	0.0 cmH_2O	21129 cmH_2O @ 20 °C
	0.0 kmH_2O	2.1092 kmH_2O @ 4 °C
	0.0 kmH_2O	2.1129 kmH_2O @ 20 °C
	0.0 bar	206.84 bar
	0.0 MPa	20.684 MPa
	0.0 kg/cm^2	210.92 kg/cm^2
525A-PV4	-15.000 psi	0.0 psi
	-775.73 mmHg	0.0 mmHg @ 0 °C
	-30.540 inHg	0.0 inHg @ 32 °F
	-415.20 inH_2O	0.0 inH_2O @ 39.2 °F
	-415.93 inH_2O	0.0 inH_2O @ 68 °F
	-34.600 ftH_2O	0.0 ftH_2O @ 39.2 °F
	-34.661 ftH_2O	0.0 ftH_2O @ 68 °F
	-1054.6 cmH_2O	0.0 cmH_2O @ 4 °C
	-1056.5 cmH_2O	0.0 cmH_2O @ 20 °C
	-10.546 mH_2O	0.0 mH_2O @ 4 °C
	-10.565 mH_2O	0.0 mH_2O @ 20 °C
	-1.0342 bar	0.0 bar

Model	Minimum	Maximum
	-103.42 kPa	0.0 kPa
	-1.0546 kg/cm^2	0.0 kg/cm^2

Units Symbols

Units Symbol	Name
bar	bar
cmH2O	centimeters of water
ftH2O	feet of water
g/cm2	grams per square centimeter
inH2O	inches of water
inHg	inches of mercury
mH2O	meters of water
mHg	meters of mercury
Pa	Pascal
psi	pounds per square inch

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value or a reset.

- Pressure entered as: [*numeric*][*prefix*]*units symbol*
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the temperature of the water.

- Temperature entered as *numeric*[*prefix*]degC or degF

Rules:

- The MOD1 field may specify temperature only when the NOMINAL field units are **inH2O**, **ftH2O**, **cmH2O**, or **mH2O**.
- Allowed values are 4 °C and 20 °C.

MOD2

This field is not used.

MOD3

This field is used to zero a pressure module.

- ZR zero pressure module
- *blank* not applicable

Rules:

- When the MOD3 field is **ZR** the MOD4 field must specify a Nominal Setup Test (**N**).
- When the MOD3 field is blank the outcome of executing the statement is determined by the type of test specified in the MOD4 field.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the model number of the 525A Series Pressure Module used.

CON	Model Number
P02	525A-P02
P04	525A-P04
P05	525A-P05
P06	525A-P06
P07	525A-P07
P08	525A-P08
P29	525A-P29
PA4	525A-PA4
PA6	525A-PA6
PV4	525A-PV4

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs" in the on-line Reference Manual.

Examples

```
  STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2  3   4 CON
# ----- Reset -----
  1.001  P525        *                                                S
# ----- Zero -----
  1.002  P525        0.00inH2O                    4 °C             ZR N  PA4
# ----- Evaluation (Relative to zero measurement) -----
  1.003  P525  10    5.00inH2O      0.15U         4 °C                   PA4
  2.001  P525        0.0inH2O                     60 °F            ZR N  P29
  2.002  P525        35.0inH2O      1.0U          60 °F                  P29
  3.001  P525        0.000psi                                       ZR N  P05
  3.002  P525        0.300psi        4%                                   P05
  4.001  MEMI         Enter zero value for 525PA5 absolute pressure module.
  4.002  P525        mmHg                                           ZR N  PA4
  4.003  P525  1000  754mmHg         2/                                   PA4
  5.001  P525        0kg/cm2                                        ZR N  PV4
# ----- Setup Test -----
  5.002  P525        -1.0kg/cm2                                       S   PV4
```

P700

Instrument FSC

Description

The P700 FSC programs the Fluke 525A Temperature/Pressure Calibrator or the Fluke 5520A Multi-Product Calibrator to measure pressure using a Fluke 700 Series Pressure Module.

Functional Capability

Model	Minimum	Maximum
700P01	0.0 psi	0.3613 psi
	0.0 mmHg	18.680 mmHg @ 0 °C
	0.0 inHg	0.7356 inHg @ 32 °F
	0.0 inH_2O	0.000 inH_2O @ 39.2 °F
	0.0 inH_2O	10.011 inH_2O @ 60 °F (5520A only)
	0.0 inH_2O	10.018 inH_2O @ 68 °F (525A only)
	0.0 ftH_2O	0.83340 ftH_2O @ 39.2 °F
	0.0 ftH_2O	0.83323 ftH_2O @ 60 °F (5520A only)
	0.0 ftH_2O	0.83387 ftH_2O @ 68 °F (525A only)
	0.0 mmH_2O	254.02 mmH_2O @ 4 °C
	0.0 mmH_2O	254.47 mmH_2O @ 20 °C (525A only)
	0.0 cmH_2O	25.402 cmH_2O @ 4 °C (525A only)
	0.0 cmH_2O	25.447 cmH_2O @ 20 °C (525A only)
	0.0 mbar	24.910 mbar
	0.0 kPa	2.4910 kPa
	0.0 g/cm2	25.400 g/cm2
700P02/700P22	0.0 psi	1.0000 psi
	0.0 mmHg	51.715 mmHg @ 0 °C
	0.0 inHg	2.0360 inHg @ 32degF
	0.0 inH_2O	27.680 inH_2O @ 39.2 °F
	0.0 inH_2O	27.707 inH_2O @ 60 °F (5520A only)

Model	Minimum	Maximum
	0.0 inH_2O	27.729 inH_2O @ 68 °F (525A only)
	0.0 ftH_2O	2.3067 ftH_2O @ 39.2 °F
	0.0 ftH_2O	2.3090 ftH_2O @ 60 °F (5520A only)
	0.0 ftH_2O	2.3107 ftH_2O @ 68 °F (525A only)
	0.0 mmH_2O	703.07 mmH_2O @ 4°C
	0.0 mmH_2O	704.31 mmH_2O @ 20°C (525A only)
	0.0 cmH_2O	70.307 cmH_2O @ 4°C (525A only)
	0.0 cmH_2O	70.431 cmH_2O @ 20°C (525A only)
	0.0 mbar	68.948 mbar
	0.0 kPa	6.8948 kPa
	0.0 g/cm2	70.307 g/cm2
700P03/700P23/700PA3	0.0 psi	5.0000 psi
	0.0 mmHg	258.58 mmHg @ 0 °C
	0.0inHg	10.180 inHg @ 32 °F
	0.0inH_2O	138.40 inH_2O @ 39.2 °F
	0.0inH_2O	138.54 inH_2O @ 60 °F (5520A only)
	0.0inH_2O	138.64 inH_2O @ 68 °F (525A only)
	0.0ftH_2O	11.533 ftH_2O @ 39.2 °F
	0.0ftH_2O	11.545 ftH_2O @ 60 °F (5520A only)
	0.0ftH_2O	11.554 ftH_2O @ 68 °F (525A only)
	0.0cmH_2O	351.53 cmH_2O @ 4 °C (525A only)
	0.0cmH_2O	352.16 cmH_2O @ 20 °C (525A only)
	0.0 mH_2O	3.5153 mH_2O @ 4 °C
	0.0 mH_2O	3.5216 mH_2O @ 20 °C (525A only)
	0.0 mbar	344.74 mbar
	0.0 kPa	34.474 kPa
	0.0 g/cm2	351.53 g/cm2

Model	Minimum	Maximum
700P04/700P24/700PA4	0.0 psi	15.000 psi
	0.0 mmHg	775.73 mmHg @ 0 °C
	0.0 inHg	30.540 inHg @ 32 °F
	0.0 inH_2O	415.20 inH_2O @ 39.2 °F
	0.0 inH_2O	415.61 inH_2O @ 60 °F (5520A only)
	0.0 inH_2O	415.93 inH_2O @ 68 °F (525A only)
	0.0 ftH_2O	34.600 ftH_2O @ 39.2 °F
	0.0 ftH_2O	34.634 ftH_2O @ 60 °F (5520A only)
	0.0 ftH_2O	34.661 ftH_2O @ 68 °F (525A only)
	0.0 cmH_2O	1054.6 cmH_2O @ 4 °C (525A only)
	0.0 cmH_2O	1056.5 cmH_2O @ 20 °C (525A only)
	0.0 mH_2O	10.546 mH_2O @ 4 °C
	0.0 mH_2O	10.565 mH_2O @ 20 °C (525A only)
	0.0 bar	1.0342 bar
	0.0 kPa	103.42 kPa
	0.0 kg/cm2	1.0546 kg/cm2
700P05/700PA5	0.0 psi	30.000 psi
	0.0 mHg	1.5515 mHg
	0.0 inHg	61.081 inHg @ 32 °F
	0.0 inH_2O	830.40 inH_2O @ 39.2 °F
	0.0 inH_2O	831.21 inH_2O @ 60 °F (5520A only)
	0.0 inH_2O	831.87 inH_2O @ 68 °F (525A only)
	0.0 ftH_2O	69.200 ftH_2O @ 39.2 °F
	0.0 ftH_2O	69.269 ftH_2O 60 °F (5520A only)
	0.0 ftH_2O	69.322 ftH_2O @ 68degF (525A only)
	0.0 cmH_2O	2109.2 cmH_2O @4 °C (525A only)
	0.0 cmH_2O	2112.9 cmH_2O @ 20 °C (525A only)
	0.0 mH_2O	21.092 mH_2O @ 4 °C

Model	Minimum	Maximum
	0.0 mH_2O	21.129 mH_2O @ 20 °C (525A only)
	0.0 bar	2.0684 bar
	0.0 kPa	206.84 kPa
	0.0 kg/cm2	2.1092 kg/cm2
700P06/700PA6	0.0 psi	100.00 psi
	0.0 mHg	5.1715 mHg
	0.0 inHg	203.60 inHg @ 32 °F
	0.0 inH_2O	2768.0 InH_2O @ 39.2 °F
	0.0 inH_2O	2770.7 inH_2O @ 60 °F (5520A only)
	0.0 inH_2O	2772.9 inH_2O @ 68 °F (525A only)
	0.0 ftH_2O	230.67 ftH_2O @ 39.2 °F
	0.0 ftH_2O	230.90 ftH_2O @ 60 °F (5520A only)
	0.0 ftH_2O	231.07 ftH_2O @ 68 °F (525A only)
	0.0 cmH_2O	7030.7 cmH_2O @ 4 °C 525A only)
	0.0 cmH_2O	7043.1 cmH_2O @ 20 °C (525A only)
	0.0 mH_2O	70.307 mH_2O @ 4 °C
	0.0 mH_2O	70.431 mH_2O @ 20 °C (525A only)
	0.0 bar	6.8948 bar
	0.0 kPa	689.48 kPa
	0.0 kg/cm2	7.0307 kg/cm2
700P07	0.0 psi	500.00 psi
	0.0 mHg	25.858 mHg
	0.0 inHg	1018.0 inHg @ 32 °F
	0.0 inH_2O	13840 inH_2O @ 39.2 °F
	0.0 inH_2O	13854 inH_2O @ 60 °F (5520A only)
	0.0 inH_2O	13864 inH_2O @ 68 °F (525A only)
	0.0 ftH_2O	1153.3 ftH_2O @ 39.2 °F
	0.0 ftH_2O	1154.5 ftH_2O @ 60 °F (5520A only)

Model	Minimum	Maximum
	0.0 ftH_2O	1155.4 ftH_2O @ 68 °F (525A only)
	0.0 cmH_2O	35153 cmH_2O @ 4 °C
	0.0 cmH_2O	352.16 cmH_2O @ 20 °C (525A only)
	0.0 mH_2O	351.53 mH_2O @ 4 °C
	0.0 mH_2O	352.16 mH_2O @ 20 °C (525A only)
	0.0 bar	34.474 bar
	0.0 Mpa	3.4474 MPa
	0.0 kg/cm2	35.153 kg/cm2
700P08	0.0 psi	1000.0 psi
	0.0 mHg	51.715 mHg
	0.0 inHg	2036.0 inHg @ 32°C
	0.0 inH_2O	27680 inH_2O @ 39.2°C
	0.0 inH_2O	27707 inH_2O @ 60°C (5520A only)
	0.0 inH_2O	27729 inH_2O @ 68°C (525A only)
	0.0 ftH_2O	2306.7 ftH_2O @ 39.2°C
	0.0 ftH_2O	2309.0 ftH_2O @ 60°C (5520A only)
	0.0 ftH_2O	2310.7 ftH_2O @ 68°C (525A only)
	0.0 cmH_2O	70307 cmH_2O @ 4°C
	0.0 cmH_2O	70431 cmH_2O @ 20°C (525A only)
	0.0 mH_2O	703.07 mH_2O @ 4 °C
	0.0 bar	68.948 bar
	0.0 MPa	6.8948 MPa
	0.0 kg/cm2	70.307 kg/cm2
700P09	0.0 psi	1500.0 psi
	0.0 mHg	77.573 mHg
	0.0 inHg	3054.0 inHg @ 32 °F
	0.0 inH_2O	41520 inH_2O @ 39.2 °F
	0.0 inH_2O	41561 inH_2O @ 60 °F (5520A only)

Model	Minimum	Maximum
	0.0 inH_2O	41593 inH_2O @ 68 °F (525A only)
	0.0 ftH_2O	3460.0 ftH_2O @ 39.2 °F
	0.0 ftH_2O	3463.4 ftH_2O @ 60 °F (5520A only)
	0.0 ftH_2O	3466.1 ftH_2O @ 68 °F (525A only)
	0.0 kmH_2O	1.0546 kmH_2O @ 4 °C (5520A only)
	0.0 bar	103.42 bar
	0.0 MPa	10.342 MPa
	0.0 kg/cm2	105.46 kg/cm2
700PV3	-5.0000 psi	0.0 psi
	-258.58 mmHg	0.0 mmHg @ 0 °C
	-10.180 inHg	0.0 inHg @32 °F
	-138.40 inH_2O	0.0 inH_2O @ 39.2 °F
	-138.54 inH_2O	0.0 inH_2O @ 60 °F (5520A only)
	-138.64 inH_2O	0.0 inH_2O @ 68 °F (525A only)
	-11.533 ftH_2O	0.0 ftH_2O @ 39.2 °F
	-11.545 ftH_2O	0.0 ftH_2O @ 60 °F (5520A only)
	-11.554 ftH_2O	0.0 ftH_2O @ 68 °F (525A only)
	-351.53 cmH_2O	0.0 cmH_2O @ 4 °C (525A only)
	-352.16 cmH_2O	0.0 cmH_2O @ 20 °C (525A only)
	-3.5153 mH_2O	0.0 mH_2O @ 4 °C
	-3.5216 mH_2O	0.0 mH_2O @ 20 °C (525A only)
	-344.74 mbar	0.0 mbar
	-34.474 kPa	0.0 kPa
	-351.53 g/cm2	0.0 g/ cm2
700PV4	-15.000 psi	0.0 psi
	-775.73 mmHg0	0 mmHg @ 0 °C
	-30.540 inHg0	0 inHg @ 32 °F
	-415.20 inH_2O	0.0 inH_2O @ 39.2 °F

Model	Minimum	Maximum
	-415.61 inH_2O	0.0 inH_2O @ 60 °F (5520A only)
	-415.93 inH_2O	0.0 inH_2O @ 68 °F (525A only)
	-34.600 ftH_2O	0.0 ftH_2O @ 39.2 °F
	-34.634 ftH_2O	0.0 ftH_2O @ 60 °F (5520A only)
	-34.661 ftH_2O	0.0 ftH_2O @ 68 °F (525A only)
	-1054.6 cmH_2O	0.0 cmH_2O @ 4 °C (525A only)
	-1056.5 cmH_2O	0.0 cmH_2O @ 20 °C (525A only)
	-10.546 mH_2O	0.0 mH_2O @ 4 °C
	-10.565 mH_2O	0.0 mH_2O @ 20 °C (525A only)
	-1.0342 bar	0.0 bar
	-103.42 kPa	0.0 kPa
	-1.0546 kg/cm2	0.0 kg/cm2
700PD2	-1.0000 psi	1.0000 psi
	-51.715 mmHg	51.715 mmHg @ 0°C
	-1.0360 inHg	1.0360 inHg @ 32°C
	-27.680 inH_2O	27.680 inH_2O @ 39.2°C
	-27.707 inH_2O	27.707 inH_2O @ 60°C (5520A only)
	-27.729 inH_2O	27.729 inH_2O @ 68°C (525A only)
	-2.3067 ftH_2O	2.3067 ftH_2O @ 39.2°C
	-2.3090 ftH_2O	2.3090 ftH_2O @ 60°C (5520A only)
	-2.3107 ftH_2O	2.3107 ftH_2O @ 68°C (525A only)
	-703.07 mmH_2O	703.07 mmH_2O @ 4 °C
	-704.31 mmH_2O	704.31 mmH_2O @ 20 °C (525A only)
	-70.307 cmH_2O	70.307 cmH_2O @ 4 °C (525A only)
	-70.431 cmH_2O	70.431 cmH_2O @ 20 °C (525A only)
	-68.948 mbar	68.948 mbar
	-6.8948 kPa	6.8948 kPa
	-70.307 g/cm2	70.307 g/cm2

Model	Minimum	Maximum
700PD3	-5.0000 psi	5.0000 psi
	-258.58 mmHg	258.58 mmHg @ 0 °C
	-10.180 inHg	10.180 inHg @ 32 °F
	-138.40 inH_2O	138.40 inH_2O @ 39.2 °F
	-138.54 inH_2O	138.54 inH_2O @ 60 °F (5520A only)
	-138.64 inH_2O	138.64 inH_2O @ 68 °F (525A only)
	-11.533 ftH_2O	11.533 ftH_2O @ 39.2 °F
	-11.545 ftH_2O	11.545 ftH_2O @ 60 °F (5520A only)
	-11.554 ftH_2O	11.554 ftH_2O @ 68 °F (525A only)
	-351.53 cmH_2O	351.53 cmH_2O @ 4 °C (525A only)
	-352.16 cmH_2O	3.5153 mH_2O @ 20 °C (525A only)
	-3.5153 mH_2O	3.5153 mH_2O @ 4 °C
	-3.5153 mH_2O	3.5153 mH_2O @ 20 °C (525A only)
	-344.74 mbar	344.74 mbar
	-34.474 kPa	34.474 kPa
	-351.53 g/cm2	351.53 g/cm2
700PD4	-15.000 psi	15.000 psi
	-775.73 mmHg	775.73 mmHg @ 0 °C
	-30.540 inHg	30.540 inHg @ 32 °F
	-415.20 inH_2O	415.20 inH_2O @ 39.2 °F
	-415.61 inH_2O	415.61 inH_2O @ 60 °F (5520A only)
	-415.93 inH_2O	415.93 inH_2O @ 68 °F (525A only)
	-34.600 ftH_2O	34.600 ftH_2O @ 39.2 °F
	-34.634 ftH_2O	34.634 ftH_2O @ 60 °F (5520A only)
	-34.661 ftH_2O	34.661 ftH_2O @ 68 °F (525A only)
	-1054.6 cmH_2O	1054.6 cmH_2O @ 4 °C (525A only)
	-1056.5 cmH_2O	1056.5 cmH_2O @ 20 °C (525A only)
	-10.546 mH_2O	10.546 mH_2O @ 4 °C

Model	Minimum	Maximum
	-10.565 mH_2O	10.565 mH_2O @ 20 °C (525A only)
	-1.0342 bar	1.0342 bar
	-103.42 kPa	103.42 kPa
	-1.0546 kg/cm2	1.0546 kg/cm2
700PD5	-15.000 psi	30.000 psi
	-775.73 mmHg	1.5515 mHg
	-30.540 inHg	61.081 inHg @ 32 °F
	-415.20 inH_2O	830.40 inH_2O @ 39.2 °F
	-415.61 inH_2O	831.21 inH_2O @ 60 °F (5520A only)
	-415.93 inH_2O	831.87 inH_2O @ 68 °F (525A only)
	-34.600 ftH_2O	69.200 ftH_2O @ 39.2°F
	-34.634 ftH_2O	69.269 ftH_2O @ 60 °F (5520A only)
	-34.661 ftH_2O	69.322 ftH_2O @ 68 °F (525A only)
	-1054.6 cmH_2O	2109.2 cmH_2O @ 4 °C (525A only)
	-1056.5 cmH_2O	2112.9 cmH_2O @ 20 °C (525A only)
	-10.546 mH_2O	21.092 mH_2O @ 4 °C
	-10.565 mH_2O	21.129 mH_2O @ 20°C (525A only)
	-1.0342 bar	2.0684 bar
	-103.42 kPa	206.84 kPa
	-1.0546 kg/cm2	2.1092 kg/cm2
700PD6	-15.00 psi	100.00 psi
	-775.73 mmHg	5.1715 mHg
	-30.540 inHg	203.60 inHg @ 32 °F
	-415.20 inH_2O	2768.0 inH_2O @ 39.2 °F
	-415.61 inH_2O	2770.7 inH_2O @ 60 °F (5520A only)
	-415.93 inH_2O	2772.9 inH_2O @ 68 °F (525A only)
	-34.600 ftH_2O	230.67 ftH_2O @ 39.2 °F
	-34.634 ftH_2O	230.90 ftH_2O @ 60 °F (5520A only)

Model	Minimum	Maximum
	-34.661 ftH_2O	231.07 ftH_2O @ 68 °F (525A only)
	-1054.6 cmH_2O	7030.7 cmH_2O @ 4 °C (525A only)
	-1056.5 cmH_2O	7043.1 cmH_2O @ 20 °C (525A only)
	-10.546 mH_2O	70.307 mH_2O @ 4 °C
	-10.565 mH_2O	70.431 mH_2O @ 20°C (525A only)
	-1.0342 bar	6.8948 bar
	-103.42 kPa	689.48 kPa
	-1.0546kg/cm2	7.0307 kg/cm2
700PD7	-15.00 psi	200.00 psi
	-775.73 mmHg	10.343 mHg
	-30.540 inHg	407.20 inHg @ 32 °F
	-415.20 inH_2O	5536.0 inH_2O @ 39.2 °F
	-415.61 inH_2O	5541.4 inH_2O @ 60 °F (5520A only)
	-415.93 inH_2O	5545.8 inH_2O @ 68 °F (525A only)
	-34.600 ftH_2O	461.33 ftH_2O @ 39.2 °F
	-34.634 ftH_2O	461.79 ftH_2O @ 60 °F (5520A only)
	-34.661 ftH_2O	462.15 ftH_2O @ 68 °F (525A only)
	-1054.6 cmH_2O	14061 cmH_2O @ 4 °C (525A only)
	-1056.5 cmH_2O	14086 cmH_2O @ 20 °C (525A only)
	-10.546 mH_2O	140.61 mH_2O @ 4 °C
	-10.565 mH_2O	140.86 mH_2O @ 20 °C (525A only)
	-1.0342 bar	13.790 bar
	-103.42 kPa	1.3790 MPa
	-1.0546 kg/cm2	14.061 kg/cm2
700P29	0.0 psi	3000.0 psi
	0.0 mHg	155.15 mHg (5520A only)
	0.0 inHg	6108.1 inHg @ 32 °F
	0.0 inH_2O	83040 inH_2O @ 39.2 °F

Model	Minimum	Maximum
	0.0 inH_2O	83121 inH_2O @ 60 °F (5520A only)
	0.0 inH_2O	83187 inH_2O @ 68 °F (525A only)
	0.0 ftH_2O	6920.0 ftH_2O 39.2 °F (5520A only)
	0.0 ftH_2O	6926.9 ftH_2O @ 60 °F (5520A only)
	0.0 ftH_2O	6932.2 ftH_2O @ 68 °F (525A only)
	0.0 kmH_2O	2.1092 kmH_2O @ 4 °C (5520A only)
	0.0 bar	206.84 bar
	0.0 MPa	20.684 MPa
	0.0 kg/cm2	210.92 kg/cm2
700P30	0.0 psi	5000.0 psi
	0.0 mHg	258.58 mHg (5520A only)
	0.0 inHg	10180 inHg @ 32 °F
	0.0 kinH_2O	138400 inH_2O @ 39.2 °F (5520A only)
	0.0 kinH_2O	138540 inH_2O @ 60 °F (5520A only)
	0.0 ftH_2O	11533 ftH_2O @ 39.2 °F (5520A only)
	0.0 ftH_2O	11545 ftH_2O @ 60 °F (5520A only)
	0.0 kmH_2O	3.5153 kmH_2O @ 4 °C (5520A only)
	0.0 bar	344.74 bar
	0.0 MPa	34.474 MPa
	0.0 kg/cm2	351.53 kg/cm2
700P31	0.0 psi	10000 psi
	0.0 mHg	517.15 mHg (5520A only)
	0.0 inHg	20360 inHg @ 32 °F
	0.0 kinH_2O	276800 inH_2O @ 39.2 °F (5520A only)
	0.0 kinH_2O	277070 inH_2O @ 60 °F (5520A only)
	0.0 ftH_2O	23067 ftH_2O @ 39.2 °F (5520A only)
	0.0 ftH_2O	23090 ftH_2O @ 60 °F (5520A only)
	0.0 kmH_2O	7.0307 kmH_2O @ 4 °C (5520A only)

Model	Minimum	Maximum
	0.0 bar	689.48 bar
	0.0 Mpa	68.948 MPa
	0.0 kg/cm2	703.07 kg/cm2

Units Symbols

Units	Symbol Name
bar	Bar
ftH2O	Feet of water
cmH20	Centimeters of water
g/cm2	Grams per square centimeter
inH2O	Inches of water
inHg	Inches of mercury
mH2O	meters of water
mHg	meters of mercury
Pa	Pascal
psi	Pounds per square inch

Parameters

RANGE

This field specifies the UUT range as described in "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the expected measured value, zero value, or a reset.

- Pressure entered as: [*numeric*][*prefix*]units symbol
- Reset entered as *.

TOLERANCE

This field specifies the UUT tolerance as described in "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the temperature of the water.

- Temperature entered as *numeric*[*prefix*]degC or degF

Rules:

The MOD1 field may specify temperature only when the NOMINAL field units are **mHg**, **inHg**, **inH2O**, **ftH2O**, **cmH2O**, or **mH2O**.

- Allowed values are as follows:

525A Temperature Calibrator

Nominal Units	MOD1
mHg	0degC
inHg	32degF
inH2O	39.2degF or 68degF
ftH2O	39.2degF or 68degF
cmH2O	4degC or 20degC
mH2O	4degC or 20degC

5520A Multi-Product Calibrator

Nominal Units	MOD1
mHg	0degC
inHg	32degF
inH2O	39.2degF or 60degF
ftH2O	39.2degF or 60degF
mH2O	4degC

MOD2

This field is enables and disables the filter.

- FL enable filter (5520A only)
- *blank* disable filter

MOD3

This field is used to zero a pressure module.

- ZR zero pressure module

- RL relative measurement to one taken with **ZR**
- *blank* 525: same as **RL**, 5520A: no zero offset

Rules:

- When the MOD3 field is **ZR** the MOD4 field must specify a Nominal
- When the MOD3 field is blank the outcome of executing the statement is determined by the type of test specified in the MOD4 field.

MOD4

This field specifies the type of test being performed as described in "General Rules for Instrument Evaluation FSCs".

CON

The CONnection field specifies the model number of the 700 Series Pressure Module used.

CON	Model Number
P01	FLUKE-700P01
P02	FLUKE-700P02
P03	FLUKE-700P03
P04	FLUKE-700P04
P05	FLUKE-700P05
P06	FLUKE-700P06
P07	FLUKE-700P07
P08	FLUKE-700P08
P09	FLUKE-700P09
P22	FLUKE-700P22
P23	FLUKE-700P23
P24	FLUKE-700P24
P29	FLUKE-700P29
P30	FLUKE-700P30
P31	FLUKE-700P31
PA3	FLUKE-700PA3
PA4	FLUKE-700PA4
PA5	FLUKE-700PA5
PA6	FLUKE-700PA6
PD2	FLUKE-700PD2
PD3	FLUKE-700PD3
PD4	FLUKE-700PD4
PD5	FLUKE-700PD5
PD6	FLUKE-700PD6
PD7	FLUKE-700PD7
PV3	FLUKE-700PV3
PV4	FLUKE-700PV4

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "General Rules for Instrument Evaluation FSCs".

Examples

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3   4  CON# -----
Reset -----
  1.001  P700         *                                                 S
# ----- Zero -----
  1.002  P700         0.00inH2O                   4degC               ZR N   P01
# ----- Evaluation (Relative to zero measurement) -----
  1.003  P700   10    5.00inH2O      0.15U        4degC               RL     P01
  2.001  P700         0.0inH2O                    60degF              ZR N   P23
  2.002  P700         35.0inH2O      1.0U         60degF              RL     P23
  3.001  P700         0.000psi                                     FL ZR N   P02
  3.002  P700         0.300psi       4%                            FL RL     P02
  4.001  MEMI         Enter zero value for 700PA5 absolute pressure module.
  4.002  P700         mmHg                                         FL ZR N   PA5
  4.003  P700   1000  754mmHg        2/                            FL RL     PA5
  5.001  P700         0kg/cm2                                         ZR N   PV4
# ----- Setup Test -----
  5.002  P700         -1.0kg/cm2                                      RL S   PV
```

PIC

Display Control FSC

Description

The PIC FSC displays a picture during procedure execution. Pictures, which may include text, are used to provide instructions to the operator. Pictures are used instead of text-only instructions to the operator in cases where a detailed description of a required connection, or adjustment is difficult to present in text-only form.

MET/CAL supports the following picture file types:

.bmp - Bitmap
.jpg - JPEG
.gif - Graphics Interchange Format
.emf - Enhanced Metafile
.wmf - Windows Metafile
.ico - Icon

The Windows "Paintbrush" application may be used to create bitmap-type (.bmp) pictures. Other tools are required to create, edit, and convert picture files of the other supported types.

Format

PIC [*picture file*] [*position/color*] [*text*]

Rules

- Text can be superimposed on the picture. Superimposed text can be located anywhere on the screen, with a number of foreground and background colors.
- A PIC statement consists of one or more PIC lines. The first PIC line must contain the name of the picture file. Subsequent lines, if any, are used to specify text to be overlaid on the picture.
- Each PIC line may specify at most 1 text string.
- A PIC line has the format:

PIC [*picture file*] [*position/color*] [*text*] (Square brackets indicate optional subfields.)

1. The *picture file, position/color,* and *text* subfields may be entered in any order.
2. Rules for the *picture file* subfield:

This subfield is a single word which specifies the file name of the picture file to be displayed. The length cannot exceed 32 characters. The name may not contain parentheses, double quotes, or blanks. The file name must be specified if the line is the first line of the PIC statement, and may not be specified if the line is not the first line of the PIC statement.

All picture files must reside in the MET/CAL picture directory. The picture directory is specified in the MET/CAL initialization file ("metcal.ini") as the value of the "picdir" parameter. For example, if "picdir = c:\metcal\pic" in "metcal.ini", all picture files should be placed in "c:\metcal\pic".

The picture file name may or may not include the file extension. If the extension is specified, a file with the specified name and extension must exist in the MET/CAL picture directory. If the extension is not specified, MET/CAL searches for a file with one of the supported extensions. The search order is: .bmp, .jpg, .gif, .emf, .wmf., ,ico.

A picture file name may contain certain embedded special constructions. By placing the file name in a string register the procedure writer may overcome the 32 character length limitation, as well as the restriction against embedded spaces. For example:

```
MATH S[1] = "Fluke 5700A Front Panel"
PIC [S1].jpg
```

will work as long as the MET/CAL picture directory contains a file named "Fluke 5700A Front Panel.jpg".

However, note that using special constructions in picture file names prevents the normal pre-run check which verifies that pictures required by the procedure about to be executed are present in the MET/CAL picture directory.

The following constructions are legal in picture file names:

(1) [L1], [L2], ...

(2) [M1], [M2], ...

(3) [MEM], [MEM1], and [MEM2]

(4) [S1], [S2], ...

(5) [SREG1], [SREG2], ...

(6) [V<variable>]

3. Rules for the *position/color* subfield:

   This subfield specifies the row and column at which to position the first character of the text string, as well as the foreground and background colors in which to display the text string.

   The subfield has the format:

   ([*row*],[*col*],[*color*])

   The enclosing parentheses must be included in the subfield.

   row specifies the row on which to display the text string. It is an integer between 0 and 23, or a '+' sign.

   col specifies the column at which to start the text string. It is an integer between 0 and 79, or a '+' sign.

   In MET/CAL 4.0, the row and column positions are scaled to fit the size of the displayed picture. Even if the picture is very small, it is still considered to consist of 24 rows X 80 columns for purposes of positioning text overlays. However, since the font used to display the text is not scaled with the picture, care must be taken to ensure that adjacent rows of text do not overlap.

   color has the format *fg*/*bg* where:

   fg has the format: ['L']|['l'] *color base*

   bg has the format: ['L']|['l'] *color base.*

   color base is one of the following:

   B - blue
   BL - black
   BR - brown
   C - cyan
   G - green
   M - magenta
   R - red
   W - white

   These codes indicate a high intensity color. To specify a low intensity, precede the color code with 'L' or 'l'.

   The entire subfield may be omitted, but, if it is not, the parentheses and all commas are required.

   The default: *row* = 0, *col* = 0, *color* is BL/W. The default is used when a specification is not included on the first line of a multiline PIC statement.

On a line other than the first line, a missing specification causes the current value for that statement to be used.

If *row* is '+', the current row for the PIC statement is incremented by 1. If the current row is already 23, *row* is set to 0. If *column* is '+', the current column for the PIC statement is set to the column following the end of the previously displayed text string. If this is 79, the current column is set to 0.

4. Rules for the *Text* subfield:

   The format is "*text*"

   Note that the double quotes must be included in the PIC statement. The length of the text string cannot exceed 54 (not counting the double quotes). In many cases however, the length is further limited by the fact that the PIC FSC is a display control-type FSC and the length of the body of a PIC line is limited to 56 characters.

   The text string can contain double quote """ characters. The last double quote on the line terminates the text string.

   Example:

   ```
   PIC (5,5,B/G) "Select "Volts""
   ```

   The text which will appear on the picture is: Select "Volts".

   The font used for text overlays is configurable. Choose "Picture Font" in the top-level "Configure" menu of the Editor or Run Time applications.

   Beginning with V7.00 the ampersand character ('&') is handled differently when included in overlaid text. A single ampersand which appears in text to be overlaid causes the following character to be underlined. Specify two ampersands ("&&") in the text in the procedure to generate a single ampersand in the overlaid text. For example, to cause "A & B" to appear on the picture, specify "A && B" in the *text* portion of the PIC statement.

5. Interfield Dependencies

   It is illegal to specify a text string, which, when displayed at the specified position, goes beyond column 79. In some cases this error is not detected until run time.

- Execution of a PIC Statement Execution of a multiline PIC statement occurs when the run time system reaches the last line of the statement. Execution proceeds as follows:

  1. MET/CAL determines the full path name of the picture file. The MET/CAL picture directory name, as specified in "metcal.ini", is prepended to the name specified in the PIC statement. If the PIC statement

name does not include an extension, the picture directory is searched to find a matching name with one of the supported extensions, and, if the search is successful, the extension is appended to the name.

2. All specified text strings are displayed. Execution of an empty PIC line has no effect.

3. "Advance" and "Terminate" buttons are shown in the window in which the picture is displayed.

- If the picture file is not found, or is corrupted, an error occurs and the user is presented with the Post Test dialog. If a required picture file is not present, the procedure will not start.
- If the picture to be displayed is larger than the available screen the picture is scaled as needed to fit the full screen.
- The picture may be resized as desired by the operator.

Compatibility

MET/CAL 4.0 and later does not support interactive entry of text data to be overlaid on a displayed picture. Procedure writers are encouraged to include text as an integral part of the picture itself. In other words, when a picture is created (using, for example, Windows Paintbrush) any needed text should be created as part of the picture, not subsequently overlaid on the picture by adding text to the PIC statement in a MET/CAL procedure. This approach allows flexible text positioning, color selection, and font selection.

For compatibility with previous versions of MET/CAL, overlaid text is supported when it is entered directly in a PIC statement. However, it may be difficult to determine the proper row and column position for the text overlay.

The relative position of overlaid text in a picture remains the same when the picture is scaled down or up.

If an existing picture is reduced in size, space available for each row of overlaid text is correspondingly reduced. This can result in a situation in which a displayed text row is partially overwritten by the next row.

MET/CAL V7.00 or later is required to display JPEG, GIF, EMF, WMF, and ICO pictures.

Examples

```
2.005 PIC       OnePict
3.005 PIC       psm-45 (1,47,LR/G) "Adjust R227 for a"
3.005 PIC       (2,47,LR/G) "UUT reading of 190.0mV."
12.005 PIC  psm-45 (3,6,LR/LG) "Adjust R 206 for a"
12.005 PIC  (4,6,LR/LG) "UUT reading of 0.00mV."
```

PICE

Evaluation FSC

Description

The PICE FSC displays a picture during procedure execution. The PICE FSC is similar to the PIC FSC. The difference is that PICE is an evaluation FSC. When a PICE statement is executed, the operator is presented with the choices: YES, NO, and TERMINATE.

The operator may choose YES to indicate PASS, NO to indicate FAIL, or TERMINATE to abort the PICE statement.

Pictures, which may include text, are used to provide instructions to the operator. Pictures are used instead of text-only instructions to the operator in cases where a detailed description of a required connection, or adjustment is difficult to present in text-only form.

MET/CAL supports the following picture file types:

.bmp - Bitmap
.jpg - JPEG
.gif - Graphics Interchange Format
.emf - Enhanced Metafile|
.wmf - Windows Metafile
.ico - Icon

The Windows "Paintbrush" application may be used to create bitmap-type (.bmp) pictures. Other tools are required to create, edit, and convert picture files of the other supported types.

Format

PICE [*picture file*] [*position/color*] [*text*]

Rules

- Text can be superimposed on the picture. Superimposed text can be located anywhere on the screen, with a number of foreground and background colors.
- A PICE statement consists of one or more PICE lines. The first PICE line must contain the name of the picture file. Subsequent lines, if any, are used to specify text to be overlaid on the picture.
- Each PICE line may specify at most 1 text string.

- A PICE line has the format:

  PICE [*picture file*] [*position/color*] [*text*]

  (Square brackets indicate optional subfields.)

  1. The *picture file, position/color*, and *text* subfields may be entered in any order.
  2. Rules for the *picture file* subfield:

     This subfield is a single word which specifies the file name of the picture file to be displayed. The length cannot exceed 32 characters. The name may not contain parentheses, double quotes, or blanks. The file name must be specified if the line is the first line of the PICE statement, and may not be specified if the line is not the first line of the PICE statement.

     All picture files must reside in the MET/CAL picture directory. The picture directory is specified in the MET/CAL initialization file ("metcal.ini") as the value of the "picdir" parameter. For example, if "picdir = c:\metcal\pic" in "metcal.ini", all picture files should be placed in "c:\metcal\pic".

     The picture file name may or may not include the file extension. If the extension is specified, a file with the specified name and extension must exist in the MET/CAL picture directory. If the extension is not specified, MET/CAL searches for a file with one of the supported extensions. The search order is: .bmp, .jpg, .gif, .emf, .wmf., ,ico.

     A picture file name may contain certain embedded special constructions. By placing the file name in a string register the procedure writer may overcome the 32 character length limitation, as well as the restriction against embedded spaces. For example:

     ```
     MATH S[1] = "Fluke 5700A Front Panel"
     PIC [S1].jpg
     ```

     will work as long as the MET/CAL picture directory contains a file named "Fluke 5700A Front Panel.jpg".

     However, note that using special constuctions in picture file names prevents the normal pre-run check which verifies that pictures required by the procedure about to be executed are present in the MET/CAL picture directory.

The following constructions are legal in picture file names:

(1) [L1], [L2], ...

(2) [M1], [M2], ...

(3) [MEM], [MEM1], and [MEM2]

(4) [S1], [S2], ...

(5) [SREG1], [SREG2], ...

(6) [V *variable*]

3. Rules for the *position/color* subfield:

   This subfield specifies the row and column at which to position the first character of the text string, as well as the foreground and background colors in which to display the text string.

   The subfield has the format:

   ([*row*],[*col*],[*color*])

   The enclosing parentheses must be included in the subfield.

   row specifies the row on which to display the text string. It is an integer between 0 and 23, or a '+' sign.

   col specifies the column at which to start the text string. It is an integer between 0 and 79, or a '+' sign.

   In MET/CAL 4.0, the row and column positions are scaled to fit the size of the displayed picture. Even if the picture is very small, it is still considered to consist of 24 rows X 80 columns for purposes of positioning text overlays. However, since the font used to display the text is not scaled with the picture, care must be taken to ensure that adjacent rows of text do not overlap.

   color has the format *fg*/*bg* where:

   fg has the format: ['L']|['l'] *color base bg* has the format: ['L']|['l'] *color base* *color base* is one of:

B - blue
BL - black
BR - brown
C - cyan
G - green
M - magenta
R - red
W - white

These codes indicate a high intensity color. To specify a low intensity, precede the color code with 'L' or 'l'.

The entire subfield may be omitted, but, if it is not, the parentheses and all commas are required.

The default: *row* = 0, *col* = 0, *color* is BL/W. The default is used when a specification is not included on the first line of a multiline PICE statement. On a line other than the first line, a missing specification causes the current value for that statement to be used.

If *row* is '+', the current row for the PICE statement is incremented by 1. If the current row is already 23, *row* is set to 0. If *column* is '+', the current column for the PICE statement is set to the column following the end of the previously displayed text string. If this is 79, the current column is set to 0.

4. Rules for the *Text* subfield:

   The format is "*text*"

   Note that the double quotes must be included in the PIC statement. The length of the text string cannot exceed 54 (not counting the double quotes). In many cases however, the length is further limited by the fact that the PICE FSC is a display control-type FSC and the length of the body of a PICE line is limited to 56 characters.

   The text string can contain double quote "" characters. The last double quote on the line terminates the text string.

   Example:

```
PICE (5,5,B/G) "Select "Volts""
```

   The text which will appear on the picture is: Select "Volts".

   The font used for text overlays is configurable. Choose "Picture Font" in the top-level "Configure" menu of the Editor or Run Time applications.

Beginning with V7.00 the ampersand character ('&') is handled differently when included in overlaid text. A single ampersand which appears in text to be overlaid causes the following character to be underlined. Specify two ampersands ("&&") in the text in the procedure to generate a single ampersand in the overlaid text. For example, to cause "A & B" to appear on the picture, specify "A && B" in the <text> portion of the PICE statement.

5. Interfield Dependencies

   It is illegal to specify a text string, which, when displayed at the specified position, goes beyond column 79. In some cases this error is not detected until run time.

- Execution of a PICE Statement

  Execution of a multiline PICE statement occurs when the run time system reaches the last line of the statement. Execution proceeds as follows:

  1. MET/CAL determines the full path name of the picture file. The MET/CAL picture directory name, as specified in "metcal.ini", is prepended to the name specified in the PICE statement. If the PICE statement name does not include an extension, the picture directory is searched to find a matching name with one of the supported extensions, and, if the search is successful, the extension is appended to the name.
  2. All specified text strings are displayed. Execution of an empty PICE line has no effect.
  3. "Yes", "No", and "Terminate" buttons are shown in the window in which the picture is displayed.

     If the operator chooses "Yes":

     - the test is a PASS
     - MEM1 is set to 1

     If the operator chooses "No":

     - the test is a FAIL
     - MEM1 is set to -1

     If the operator chooses "Terminate":

     - the PICE statement is aborted
     - the Post Test dialog appears

     Execution of a multiline PICE statement occurs when the run time system reaches the last line of the statement. Execution proceeds as follows:

Unlike the EVAL FSC, PICE does not support the [N] special construction. With PICE there is no way to invert the sense of the YES/NO question. YES always indicates PASS and NO always indicates FAIL.

Note that since PICE sets MEM1 to +1 or -1, a subsequent JMPT of JMPF statement may be used to jump to a desired procedure location based on whether the test was a PASS or a FAIL.

- If the picture file is not found, or is corrupted, an error occurs and the user is presented with the Post Test dialog. If a picture file is not present, the procedure will not start.
- If the picture to be displayed is larger than the available screen the picture is scaled as needed to fit the full screen.
- The picture may be resized as desired by the operator.

Compatibility

MET/CAL 4.0 and later does not support interactive entry of text data to be overlaid on a displayed picture. Procedure writers are encouraged to include text as an integral part of the picture itself. In other words, when a picture is created (using, for example, Windows Paintbrush) any needed text should be created as part of the picture, not subsequently overlaid on the picture by adding text to the PICE statement in a MET/CAL procedure. This approach allows flexible text positioning, color selection, and font selection.

For compatibility with previous versions of MET/CAL, overlaid text is supported when it is entered directly in a PICE statement. However, it may be difficult to determine the proper row and column position for the text overlay.

The relative position of overlaid text in a picture remains the same when the picture is scaled down or up.

If an existing picture is reduced in size, space available for each row of overlaid text is correspondingly reduced. This can result in a situation in which a displayed text row is partially overwritten by the next row.

MET/CAL V7.00 or later is required to display JPEG, GIF, EMF, WMF, and ICO pictures.

Examples

```
2.005      PICEOnePict
3.005      PICEpsm-45 (1,47,LR/G) "Adjust R227 for a"
3.005      PICE(2,47,LR/G) "UUT reading of 190.0mV."
```

```
12.005       PICEpsm-45 (3,6,LR/LG) "Adjust R 206 for a"
12.005       PICE(4,6,LR/LG) "UUT reading of 0.00mV."
```

PORT

Interface Control FSC

Description

The PORT FSC is used to transfer data through serial (RS232-C) ports.

Serial ports which may be used are COM1, COM2, COM3, COM4, ..., COM16, COM5500, COM5520, COM5800, and COM5820.
COM5500 designates the 5500A UUT port, and is available only if the system includes a Fluke 5500A.
COM5520 designates the 5520A UUT port, and is available only if the system includes a Fluke 5520A.
COM5800 designates the 5800A UUT port, and is available only if the system includes a Fluke 5800A.
COM5820 designates the 5820A UUT port, and is available only if the system includes a Fluke 5820A.

Availability of the other serial ports depends on the PC. Most PCs have COM1 and COM2. In some cases it may be possible to use a USB to serial converter to create virtual COM ports in addition to the built-in COM ports.

Format

PORT *message*

Rules

- Default Port

  The Default Port is set by selecting **Default Serial Port** under the **Configure** menu item in the Editor and Run Time applications. The Default Port may be COM1, COM2, COM3, COM4, …, COM16, COM5500, COM5520, COM5800, COM5820, or NONE. The default port is used by PORT statements in procedures which do not otherwise specify a serial port.

- Default Configuration

  Default configuration for all serial ports except COM5500, COM5520, COM5800, and COM5820 is maintained by Windows. This information may be accessed or modified by selecting **Ports** in the Windows Control Panel.

  If the default serial port is COM5500, COM5520, COM5800, or COM5820, there is no provision for specifying a default configuration. In other words, the default is the setting maintained by the corresponding Fluke calibrator (5500A, 5520A, 5800A, or 5820A).

When a MET/CAL procedure executes, each serial port required by the procedure is initially set to the specified default configuration.

- PORT Statement

  The *message* of each PORT statement specifies one or both of the following:

  1. Data to be written to the currently addressed serial port.
  2. Special constructions which control read from, configuring or addressing a serial port, or provide functions not related to the serial port. Special constructions are delimited by square brackets (**[** ... **]**).

  The body of each PORT line may contain up to 56 characters. A PORT statement may consist of multiple PORT lines.

  There are two ways to indicate that a line is a continuation line. The first way is to assign the same step number to consecutive PORT lines. The second way is to mark the line as a continuation line by using the Edit : Continue function (F6) in the MET/CAL editor. (The procedure compiler will then automatically assign identical step numbers to continuation lines.)

- Output Messages

  Alphanumeric characters which are not part of a special construction are written directly to the serial port.

  Example:

  ```
  PORT abc[13]
  ```

  causes the string "**abc**", followed by a Carriage Return terminator, to be written to the UUT.

- Message Termination

  1. Termination of Input Messages:

     By default, MET/CAL considers any character which precedes the space character (HEX 20) in the ASCII sequence to be a message terminator. The termination character is usually a CR (Carriage Return) or LF (Linefeed).

     By using the TERM special construction, described below, the procedure writer can specify a single character terminator. A terminator specified using the TERM special construction remains in effect until it is changed or reset, and affects all serial I/O controlled by PORT statements in the procedure, even if more than one serial port is used. It does not affect serial I/O done by MET/CAL's built-in device drivers, nor does it affect serial I/O specified in RESET statements.

  2. Termination of Output Messages:

Message termination depends on the requirements of the serial device. In general, the message must be terminated by a CR or LF, or both. This may be accomplished by including the necessary terminators in the output message using the special constructs:

```
[13] for CR
[10] for LF
```

Another way to specify the output terminator is to use the **OTERM** special construction. A terminator specified using the OTERM construction applies to all subsequent serial output using PORT statements with the executing procedure (including any called subprocedures), until the output terminator is changed or reset.

3. Braces and Brackets

   Braces (**{** and **}**) and square brackets (**[**and**]**) cannot be entered literally, since they are used to define special constructions for the PORT FSC (see below). Use the [*numeric*] special construction (described below) include braces and brackets in the output message.

4. Including Brace Data in Results

   Text in a PORT statement enclosed in braces is copied literally to the results file. Special constructions embedded in the brace data are not evaluated before the enclosed text is transferred to the results file.

   Example:

   ```
   PORT {abc[MEM]xyz}
   ```

   The literal string "**abc[MEM]xyz**" is written to the results file. [MEM] is not replaced with the value of MEM.

- Special Constructions

  The PORT FSC supports the following special constructions:

[@ *port*]	select port as current port
[CLR]	flush receive queue of current port
[CLR ON|OFF]	enable/disable auto flush of receive queue
[D*delay*]	delay execution for *delay* milliseconds
[I]	read number from current port, store in MEM

[I$]	read string from current port, store in MEM2
[I > *file*]	read from current port, write to file
[I >> *file*]	read from current port, append to file
[I!]	read from current port, discard data
[IB c*ount timeout*]]	binary read
[IB *count timeout* > *file*]]	binary read, write to file
[IB *count timeout* >> *file*]]	binary read, append to file
[MEM]	write value of register MEM to current port
[MEM1]	write value of register MEM1 to current port
[MEM2]	write value of register MEM2 to current port
[*numeric*]	write number (ASCII) to current port
[O < *file*]	read from file, write to current port
[P *params*]	configure port
[T*timeout*]	set timeout for current port
[V *variable*]	write value of *variable* to current port
[REOPEN]	close and re-open current port
[M*nreg*]	write value of global numeric register *nreg* to current port
[L*nreg*]	write value of local numeric register *nreg* to current port
[S*sreg*]	write value of string register *sreg* to current port
[SREG*sreg*]	write value of string register *sreg* to current port

[TERM *n*|'*c*'|CR|LF|NONE|OFF]	set input terminator
[OTERM *n*|'*c*'|CR|LF|CRLF|NONE|OFF]	set output terminator

Special Constructions

- Port Addressing

  The [@ *port*] special construction is used to select the current port.

  For example, the statement **PORT [@COM1]abc[@COM2]xyz** first writes "**abc**" to COM1, then write "**xyz**" to COM2.

  port may be COM1, COM2, COM3, COM4, …, COM16, COM5500, COM5520, COM5800, COM5820, or a valid device alias. Device aliases are specified in the System Configuration File (usually named "config.dat"). (Type F12 in the MET/CAL Editor to modify the system configuration.)

  Like the IEEE FSC, the PORT FSC distinguishes between the UUT port and the system port. If the [@ *port*] construction specifies a literal COM port name (e.g., COM1), the specified port becomes the UUT port and the system port. All subsequent serial I/O performed by PORT statements in the current procedure will use the specified port (until changed using a subsequent [@ *port*] special construction). On the other hand, if the [@ *port*] specifies a port by way of an alias, only the system port is changed. This address remains in effect only for the current PORT statement (which may be a multi-line statement). The following example clarifies the distinction:

```
1.001  PORT  [@COM1]aaa
1.002  PORT  [@45]bbb
1.002  PORT  ccc
1.003  PORT  ddd
```

  The procedure above causes the following sequence of events to occur:

  a. When the first line executes, "**aaa**" is written to COM1.

  b. When the second line executes, "**bbb**" is written to the device whose alias is **45**.

  c. When the third line executes, "**ccc**" is written to the device whose alias is **45**. Note that this line is a continuation line.

  d. When the last line executes, "**ddd**" is written to COM1. Since line 1.003 begins a new PORT statement, and does not specify a serial port address, the current address returns to the UUT port specified in 1.001.

When a procedure begins execution, the UUT port is the port designated by the Default Port setting. All serial I/O controlled by PORT statements refers to this default port, unless the procedure specifies otherwise.

Example:

```
1.001  PORT aaa
1.002  PORT [@45]bbb
1.003  PORT ccc
1.004  PORT [@COM1]ddd
1.005  PORT eee
```

Suppose the Default Port is COM2 The procedure above causes the following sequence of events to occur:

e. When 1.001 executes, "**aaa**" is written to COM2 (the default port).

f. When 1.002 executes, "**bbb**" is written to the device whose alias is "45".

g. When 1.003 executes, "**ccc**" is written to COM2 (the default port).

h. When 1.004 executes, "**ddd**" is written to COM1. COM1 becomes the current UUT port.

When 1.005 executes, "**eee**" is written to COM1, which is now the current UUT port (as a result of 1.004).

- Clearing the Input Buffer

  The [CLR] special construction causes the serial port input buffer for the current port to be immediately cleared. Any unread characters in the input buffer are simply discarded.

Note

Some UUTs may use a protocol designed for communication with a terminal, rather than under program control. Such UUTs may generate a "ready-for-command" prompt string. In such cases the [CLR] special construction can be used to flush the input buffer. An alternative to the [CLR] construction is to use [I!] to simply read (and discard) the prompt string. This method may be better than [CLR] in cases where timing is uncertain and it is necessary to wait for the prompt string to become available.

- Enabling / Disabling Automatic Input Buffer Clearing

  The [CLR OFF] special construction is used to disable automatic clearing of the input buffer after each terminated message is read.

[CLR OFF] is the default. That is, each procedure begins execution with automatic clearing disabled.

The [CLR ON] special construction is used to enable automatic clearing of the serial port input buffer after each terminated message is read.

A [CLR ON] or [CLR OFF] special construction remains in effect until procedure execution terminates, or a subsequent [CLR ON] or [CLR OFF] special construction is executed.

[CLR ON] is supported for compatibility with previous versions of MET/CAL. Procedure writers using the PORT FSC should be aware that it may be difficult to obtain reliable results when automatic buffer clearing is enabled. The difficulty is due to a lack of synchronization between clearing the input buffer and reading characters sent by the serial instrument. In other words, at the time the buffer is cleared, some or all of the characters may not yet have been read. Timing depends on the baud rate, the speed of the PC, and other hardware and software parameters.

The best way to deal with a serial instrument which sends messages containing embedded terminators is to leave automatic buffer clearing disabled ([CLR OFF]) and explicitly read each terminated data message.

Example:

Suppose the UUT response is:

```
90E-2CR><LF>=><CR><LF>
```

The Fluke 45 is an example of an instrument which sends such a response. From the Fluke 45's point of view the response contains two terminated messages. The terminator is CR LF. Notice, however, that the response is seen by MET/CAL as 4 distinct messages:

a. 90E-2 CR

b. LF

c. CR

d. LF

A MET/CAL procedure fragment which illustrates how to deal with this response:

```
STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  HEAD        {DIRECT VOLTAGE PERFORMANCE VERIFICATION}
  1.002  PORT        TRIGGER 3;VDC;RATE S;RANGE 1[10]
  1.003  DISP        [32] Connect 5500A and UUT as follows.
  1.003  DISP        [32]    5500A NORMAL HI to 45 V Ohm
```

```
1.003  DISP         [32]    5500A NORMAL LO to 45 COM
1.004  5500         0.000mV                                    S  2W
1.005  PORT         *TRG;VAL1?[10][I]
1.006  MATH         MEM = MEM * 1000

1.007  MEMCX  100   0.000mV       0.006U
2.001  5500         90.000mV                                   S  2W
2.002  PORT         [CLR]*TRG;VAL1?[10][I]
2.003  MATH         MEM = MEM * 1000

2.004  MEMCX  100   90.000mV      0.024U
```

In this example the UUT is a Fluke 45. The first PORT statement sets up the UUT. The seconds PORT statement (4.005) triggers a reading and reads the response. The second 5500 setup statement (5.001) provides a sufficient delay so that when the third PORT statement (5.002) executes the remaining characters sent by the Fluke 45 (LF=CR LF) are already in the input buffer. The third PORT statement then clears the input buffer (using the [CLR] construction), thus discarding the characters in the input buffer. At that point the third PORT statement triggers and reads a second reading.

In some procedures it may be necessary to use the delay construction in a procedure to ensure that sufficient time elapses before the [CLR] construction is executed. This depends on the baud rate, the length of the message being read from the serial instrument, and the inherent delay caused by the procedure statements between the reading of the response up to the first terminator and triggering the next response.

- Delay

The special construction [D*delay*] is used to specify a delay in milliseconds. The specified number of milliseconds must be between 0 and 32767. When MET/CAL evaluates a [D*delay*] special construction it simply pauses for the specified number of milliseconds before proceeding with any subsequent input or output specified in the PORT statement.

Example:

```
PORT CMD1[13][D1000][I]
```

In this example the string "**CMD1**", followed by a CR, is written to the current port. A one second delay then occurs, after which a value is read from the device attached to the current port.

- Numeric Input

  The [I] special construction is used to perform numeric input from the current serial port. When an [I] special construction is encountered in a PORT statement, MET/CAL reads a string from the serial device, strips leading non-numeric characters from the string, converts the numeric part of the string to a floating-point value, and stores the result in the global numeric register MEM. The prior value in MEM is overwritten. Non-numeric characters, if any, which follow the numeric portion of the string are ignored.

  See also the section on message termination.

- String Input

  The [I$] special construction is used to perform string input from the current serial port. When an [I$] special construction is encountered in a PORT statement, MET/CAL reads a string (up to 4096 characters) from the serial device, and stores the string in the global string register MEM2. The prior contents of MEM2 are overwritten. If the input string is too long for MEM2, an error message is generated.

  See also the section on message termination.

- Reading from a UUT and Writing to a File

  The [I > *filename*] special construction causes MET/CAL to read from the device connected to the current serial port, and write the characters read to the specified file. If the specified file already exists, it is overwritten. MET/CAL does

  not restrict the length of the input message when the [I > *filename*] special construction is used. For complex messages which exceed the length of MEM2, this special construction can be used in conjunction with a user-written program, called by a DOS or DOSE FSC, to parse and evaluate the input string.

  See also the section on message termination.

- Reading from a UUT and Appending to a File

  The [I >> *filename*] special construction causes MET/CAL to read from the device connected to the current serial port, and append the characters read to the specified file. If the specified file does not exist, it is created. MET/CAL does not restrict the length of the input message when the [I >> *filename*] special construction is used. For complex messages which exceed the length of MEM2, this special construction can be used in conjunction with a user-written program, called by a DOS or DOSE FSC, to parse and evaluate the input string.

  See also the section on message termination.

- Reading from a Serial Instrument and Discarding the Data

  The [I!] construction is the same as [I$], except that the data message read from the instrument is not stored in MEM2, or any other MET/CAL register. [I!] is appropriate only when it is necessary to read and discard a data message.

  Example:

  ```
  PORT [@DMM]REMS;FUNC1?[10][I$][I!]
  ```

  In this example, the serial instrument (a DMM with the address alias **DMM**) requires a linefeed terminator. This is why the command **REMS;FUNC1?** is followed by "[10]" -- 10 is the decimal representation of the ASCII linefeed character.

  The first part of the response is read into MEM2 using the [I$] construction. However, supposing the instrument terminates its message with CR (carriage return) and LF (linefeed), the LF is read and discarded using the [I!] construction.

- Including Memory Register MEM in Output Messages

  The special construction [MEM] causes the contents of the MEM register to be included in the output message. (The value of MEM is converted to ASCII form before being written to the serial device.)

- Including Memory Register MEM1 in Output Messages

  The special construction [MEM1] causes the contents of the MEM1 register to be included in the output message. (The value of MEM1 is converted to ASCII form before being written to the serial device.)

- Including Memory Register MEM2 in Output Messages

  The special construction [MEM2] causes the contents of the MEM2 string register to be included in the output message.

- Including Special or Non-Printable Characters in Output Messages

  The [*numeric*] special construction may be used to specify the decimal value of any ASCII character. This is useful for characters which have special significance to the PORT FSC (e.g., **{**, **}**, **[**,**]**), as well as for non-printable characters (e.g., CR, LF).

Examples:

```
PORT [13]  - write Carriage Return (CR)
PORT [10]  - write Linefeed (LF)
PORT [91]  - write Left Bracket ([)
PORT [93]  - write Right Bracket (])
PORT [123] - write Left Brace ({)
PORT [125] - write Right Brace (})
```

- Transferring Data from a File to the UUT

  The [O < *filename*] special construction causes MET/CAL to read data from the specified file, and write it to the current serial port. This special construction may be useful when the message to be sent to the UUT is too long for MEM2 (which has a maximum string length of 4096). *filename* in the above special construction is to be replaced with the actual name of an MS-DOS file containing the data to be written to the UUT.

- Port Configuration

  The special construction **[P**[*port*,]*baud rate*,*parity*,*data bits*,*stop b*its,*handshake***]** is used to configure a serial port. When MET/CAL evaluates a Port Configuration special construction, it overrides the default configuration parameters specified in the Windows Control Panel or, for COM5500, COM5520, COM5800, or COM5820, in the corresponding Fluke calibrator (5500A, 5520A, 5800A, or 5820A). The new configuration remains in effect until procedure termination, or until a subsequent Port Configuration special construction is executed.

  For COM5500 the new configuration remains in effect until changed using the front panel of the Fluke 5500A or until a subsequent Port Configuration special construction for COM5500 is executed.

  For COM5520 the new configuration remains in effect until subsequent Port Configuration special construction for COM5520 is executed.

  For COM5800 the new configuration remains in effect until changed using the front panel of the Fluke 5800A or until a subsequent Port Configuration special construction for COM5800 is executed. For COM5820 the new configuration remains in effect until changed using the front panel of the Fluke 5820A or until a subsequent Port Configuration special construction for COM5820 is executed.

The following table shows the allowed values for the 6 parameters:

PARAMETER	VALUES
port	**COM1**, **COM2**, **COM3**, **COM4**, **COM5,** **COM6,** **COM7,** **COM8,** **COM9,** **COM10,** **COM11,** **COM12,** **COM13,** **COM14,** **COM15,** **COM16,** **COM5500**, **COM5520**, **COM5800**, **COM5820**, or blank This parameter is optional. If omitted, the currently addressed port is configured. Specifying the port in this special construction does not select it as the current port. If *port* is not specified, the following comma must be omitted.
baud rate	**50**, **75**, **110**, **134**, **150**, **200**, **300**, **600**, **1200**, **1800**, **2000**, **2400**, **3600**, **4800**, **7200**, **9600**, **19200**, **38400**, **56000**, **128000**, **256000** The procedure writer must ensure that the specified baud rate is compatible with the serial instrument and the PC serial interface. If the serial port being configured is COM5500, COM5520, COM5800, or COM5820 the baud rate is further restricted to 300, 600, 1200, 2400, 4800 or 9600. Specifying a baud rate which would be legal for COM1, COM2, COM3, or COM4, …, COM16, but is illegal for

COM5500, COM5520, COM5800, or COM5820 results in a run time error when the PORT statement is executed.

parity — **N** (none),
E (even),
O (odd),
M (mark),
S (space)

data bits — **5**, **6**, **7**, **8**

stop bits — **1**, **2**

handshake — **X** (X-ON/X-OFF)
H (hardware - using RTS & CTS)
D (hardware - using DTR & DSR)
N (none)
R (X-ON/X-OFF - with RTS line high)
(Note: The 'R' handshake code requires MET/CAL V7.11p or later.)

Examples:

```
[P1200,N,8,1,N]
[PCOM2,9600,E,7,1,X]
```

If a parameter is omitted, the value is not changed. For example, "[P9600,,,,]" changes only the baud rate.

Except for the optional *port* designator (first parameter), the commas which separate the fields must always be specified.

- Time-Out

The [T*tomeout*] special construction is used to set the time-out for the current port, in milliseconds. The *timeout* must be an integer between 0 and 32767. A response from the UUT is expected within the specified time.

On output, a timeout will occur if the serial device being written to fails to accept a character within the specified time.

Setting the time-out to zero (**PORT [T0]**) disables the time-out, i.e., the PORT statement will never time-out. When a MET/CAL procedure starts, the time-out is initialized to zero (infinite). If it is then set by the procedure, it retains the new value until it is re-set or the procedure terminates.

For hardware handshaking, an infinite timeout on output is not supported. The receiving device must accept each character within 65535 milliseconds.

Note also that when a procedure is re-started from the editor (using Control-R), the PORT time-out is not re-initialized to zero.

- Including the Value of a MET/CAL Variable in the Output Message

  The special construction [V *variable name*] evaluates to the value of the specified variable. The variable must, at run time, be present in the MET/CAL variable file (default name "VARIABLE.DAT").

  Example:

  ```
  PORT [V DATE$]?
  ```

- Re-Open Current Port

  The special construction [REOPEN] causes the current serial port to be closed and re-opened. It is re-opened in a way which preserves the current configuration (baud rate, etc.). If the current port is not already open, or is COM5500, COM5520, COM5800, or COM5820, the [REOPEN] construction has no effect.

  This construction is supported in MET/CAL V5.0 and later.

  It may be useful as a way to clear pending error conditions on UUTs with unreliable serial interfaces.

  Example:

  ```
  PORT [REOPEN]
  ```

- Including a Numeric Register Value in Output Messages

  The special constructions [M1], [M2], ... cause the value of the specified global numeric register to be included in the output message. The special constructions [L1], [L2], …, cause the value of the specified local numeric register to be included in the output message. (The register value is converted to ASCII before being written to the serial device.) The numeric value may include up to 12 significant digits. See the MATH FSC on-line help for more information on the numeric registers.

  Example:

  ```
  PORT [M5]
  ```

- Including a String Register Value in Output Messages

  The special constructions [S1], [S2], ..., cause the contents of the specified string register to be included in the output message. See the MATH FSC on-line help for more information on the string registers.

  Example:

  ```
  PORT [S12]
  ```

- Including a String Register Value in Output Messages (SREG Form)

  The special constructions [SREG1], [SREG2], ..., cause the contents of the specified string register to be included in the output message. See the MATH FSC on-line help for more information on the string registers.

  The constructions [SREG1], [SREG2], ..., are identical to [S1], [S2], ..., and are included in the PORT FSC only for compatibility with the IEEE FSC.

  Example:

  ```
  PORT [SREG23]
  ```

- Specifying the Input Terminator

  The TERM special construction has a number of different forms:

[TERM *n*]	sets input terminator to number *n* (ASCII)
[TERM '*c*']	sets input terminator to *c* (character)
[TERM CR]	sets input terminator to Carriage Return
[TERM LF]	sets input terminator to Linefeed
[TERM NONE]	sets default input terminator (< HEX 20)
[TERM OFF]	sets default input terminator (< HEX 20)

  A procedure which does not specify the input terminator uses default input termination. The default is that any character less than 20 (hex) is considered an input message terminator. Thus, if a serial instrument always terminates its message with CR+LF, two input operations are required to fully read the response. The first input operation reads the response up to and including the CR (carriage return), and the second input operation reads the LF (linefeed).

  A procedure which specifies an input terminator in a PORT statement does not affect serial input done by MET/CAL's built-in device drivers.

  A specified input terminator does affect, however, all subsequent read operations initiated by PORT statements.

  The input terminator is not specific to a particular serial port.

For example:

```
PORT [TERM LF]
PORT [@COM1][I$]
PORT [@COM2][I$]
```

In the example above, the [TERM LF] applies to input from both COM1 and COM2.

There is no interaction between the input terminator specified in a PORT statement and the input terminator for read operations set up by RESET statements. A procedure writer who wishes to use the RESET FSC to reset a user-configured serial instrument should specify the input terminator in the RESET statement for the instrument, or rely on default input termination when the RESET command is executed.

The **@** character cannot be used as an input terminator.

- Specifying the Output Terminator

The OTERM special construction has a number of different forms:

[OTERM *n*]	sets output terminator to number *n* (ASCII)
[OTERM '*c*']	sets output terminator to *c* (character)
[OTERM CR]	sets output terminator to Carriage Return
[OTERM LF]	sets output terminator to Linefeed
[OTERM CRLF]	sets output terminator to CR + LF
[OTERM NONE]	disables the output terminator
[OTERM OFF]	disables the output terminator

A procedure which does not specify the output terminator must append the necessary terminator to each data message written to the serial device.

A procedure which specifies an output terminator in a PORT statement does not affect serial output done by MET/CAL's built-in device drivers, nor does it affect serial output done using the RESET FSC.

A specified terminator does affect, however, all subsequent write operations initiated by PORT statements.

The terminator is not specific to a particular serial port.

Example:

```
PORT [OTERM LF]
PORT [@COM1]ABC
PORT [@COM2]DEF
```

In the example above, the [OTERM LF] applies to output to both COM1 and COM2.

There is no interaction between the output terminator specified in a PORT statement and the output terminator set up by RESET statements. A procedure writer who wishes to use the RESET FSC to reset a user-configured serial instrument should specify the output terminator in the RESET statement for the instrument. This can be done by using the OTERM special construction, or by simply appending the required termination characters to the reset command.

- Binary Read

New in V7.20 the PORT FSC has a "binary read" capability.

Most serial instruments read and write ASCII messages, and properly terminate messages sent, usually with CR, LF, or CR-LF. For these instruments the binary read construction is not needed, and the [I] and [I$] constructions may be used.

Binary read is useful with serial instruments that:

(a) Communicate using binary data such as 16-bit integers, 32-bit integers, and 8-byte floating point values, or

(b) do not terminate messages, or

(c) use non-standard message termination.

The syntax of the binary read construction is:

[IB *count* [*timeout*] [>[>]*file name*]]

where:

count is a positive integer byte count or "*"

timeout is a positive integer interbyte timeout in milliseconds

file is a file name

Data read using the binary read construction are stored in an internal array which is accessible using MATH FSC functions.

The following MATH functions are available:

brb - convert 1 byte to 32-bit integer at specified byte offset

bri - convert 4 bytes to 32-bit integer starting at specified byte offset

brn - return current binary buffer byte count

brs - convert specified range of bytes to a string

brw - convert 2 bytes to 16-bit integer starting at specified byte offset

brx - convert specified range of bytes in binary buffer to printable hex

Refer to the MATH FSC help file for more information on these functions.

The *count* specific in a binary read ("IB") constructions is the number of bytes to read.

If the number of bytes to read is variable or unknown, the count can be specified as "*". In that case MET/CAL reads until a timeout occurs. The timeout which terminates the read operation is not regarded as an error condition by MET/CAL.

The binary read construction makes use of two separate timeouts.

The timeout which applies to the interval between the execution of the IB construction and the reading of the first byte from the instrument is set using the normal [T *timeout*] construction. The timeout which is, optionally, specified as the second parameter in an IB construction controls the interbyte timeout, i.e., the timeout between bytes read after the first byte has been read.

This difference in the two timeouts is important because having a longer timeout prior to reading the first byte allows the instrument to respond to the command which generates the instrument's response. A much shorter interbyte timeout is appropriate for subsequent bytes in the response message, however, because, once the instrument begins sending response bytes, the reading rate is controlled by the baud rate of the instrument.

Examples

```
STEP     FSC     RANGE NOMINAL        TOLERANCE      MOD1         MOD2   3   4 CON
 2.005   PORT          [P1200,N,8,1,N][T3000]V?[I]
 2.006   PORT          [D1000]Get[I]
```

PSA

Instrument FSC

Note

Refer to the online help for documentation on this FSC.

RESET

Interface Control FSC

Description

The RESET FSC is used to specify reset commands for user-configured instruments or for a UUT.

The RESET FSC may be used with both IEEE-488 and serial instruments.

The execution of a RESET statement saves the specified command in internal memory. The command is executed in the following situations:

1. After each evaluation step, unless system instrument reset is disabled using MET/CAL ASK flags.

   To disable instrument reset using ASK flags it's necessary place the following flags in the unset state:

   Q

   W or **V**

   R

   N

   For example, to set the W, R, N, and Q flags in the *unset* state use the following procedure statement:

   ASK- W R N Q

2. After an error during procedure execution.

3. After operator-termination of a procedure test.

   Operator-termination occurs when the operator chooses **Terminate** in a dialog, or choose the Run Time **Break** menu item, or chooses the **Stop** button in the Editor Test Run dialog.

4. When the Post Test dialog is displayed after an evaluation.

   The Post Test dialog is displayed after an evaluation if:

   a. ASK+ A is in effect, or

   b. ASK- F in in effect and the result of evaluation is FAIL.

5. After procedure termination.

Format

RESET [*address*] [*command*]

Rules

- Allowed Number of Lines Per Statement

  Each RESET statement is limited to a single line.

- Allowed Number of Commands Per Address

  For each address, at most one RESET command is active at a particular time.

- Allowed Number of Addresses Per Statement

  Unless the RESET statement applies to the UUT, each RESET statement must specify a single address, and the address must precede the RESET command.

  If the RESET statement applies to the UUT, the address may be omitted. MET/CAL will automatically send the specified reset command to the UUT when system instruments are reset.

- Resetting UUTs

  The RESET statement is designed to be used with user-configured instruments or with UUTs.

  One way to reset a UUT is to specify the UUT address in the RESET statement. This works, but makes the procedure less portable.

  A better way, not available until V6.1, is to omit the address from the RESET statement altogether. Omitting the address indicates that the reset command applies to the UUT, which may be either IEEE-488 or serial.

  There's an implicit assumption here that for a particular execution of a particular calibration procedure, there will not be multiple UUTs. MET/CAL does not enforce this assumption, however. If a procedure contains both PORT and IEEE statements which communicate with devices other than by way of an address alias, there will be, in effect, two UUTs. In this case the reset command will be sent to the serial device only.

  If there's no remotely-controlled UUT at all, a RESET statement in which the address is omitted is ignored. (However, the reset command may become active later in the procedure if a UUT has been established at that time.)

- Resetting System Instruments

  If a RESET command is specified for a system instrument (i.e., an instrument for which MET/CAL has a built-in driver), the command will be executed in addition to the built-in reset function. Thus, the built-in reset for a system instrument cannot be replaced by specifying a new reset command with the RESET FSC.

As a general rule, the RESET FSC should be used only with user-configured instruments, not with system instruments.

- Address Syntax

  The address syntax is the same as it is in IEEE and PORT statements. The format is [@*address*], where *address* is an IEEE-488 address, serial address, or alias string which refers to a configured instrument.

  Examples:

[@10]	specifies IEEE-488 address 10
[@COM1]	specifies the serial port COM1
[@xyz]	an alias for a configured IEEE-488 or serial instrument
[@10:5]	specifies primary IEEE-488 address 10, secondary address 5

- Clearing a Reset Command

  The command is optional. A reset statement which specifies an address, but no command, clears the previously specified RESET command, if any.

  It is important to be aware that clearing a reset command using a statement like:

  RESET [@10]

  is not the same as specifying "*" as the reset command:

  RESET [@10] *

  The second statement sends a "*" to the instrument at IEEE-488 address 10 after each evaluation. It does not remove the reset command from internal memory, as the first statement does.

  Note also that an empty RESET statement can be used to clear the UUT reset command.

- Maximum Command Length

  A maximum of 56 characters is allowed in a RESET statement for the *address* and *command*, taken together.

  If a reset command is too long for the space available, the procedure writer can use the MATH FSC and the built-in string registers (MEM2, S[1], S[2], ...) to construct a longer reset command, and then use the appropriate special construction in the RESET statement.

Example:

```
MATH        S[1] = "0123456789012345678901234567890123456789"

MATH        S[1] = S[1] & "0123456789012345678901234567890123456789"

RESET       [SREG1]
```

- The total string length of the reset command must not exceed 1023 characters.Handling of Spaces

  Leading and trailing blanks are ignored. Spaces between the *address* and the *command* are also ignored.

  Spaces embedded in the *command* are not ignored, however. For example:

  RESET [@10] a b

  When the RESET command is executed, "a b" will be sent to the IEEE-488 device at address 10.

- Command Syntax

  A RESET command consists of literal text and embedded special constructions. Special constructions are always delimited with brackets ('[' and ']'). When a RESET command is executed, characters in the command which are not part of a special construction are written to the specified device.

  In general, special constructions are evaluated as they are encountered. However, unlike IEEE and PORT statements, some special constructions are evaluated when the RESET statement is executed, while others are evaluated when the RESET command is executed.

  The special constructions which are evaluated when the RESET statement is executed are those constructions which refer to memory registers, plus the [V*variable*] construction.

  This is an important distinction which must be understood by procedure writers who make use of the RESET statements with embedded special constructions.

  Example:

  ```
  MATH MEM2 = "*RST"
  RESET [@10] [MEM2][SDC]
  MATH MEM2 = "ABC"
  5700 1V 1%
  ```

  The value of register MEM2 is inserted in the command when the RESET statement is executed. This value is "*RST". The RESET command is therefore "*RST[SDC]". This command will be sent to the device at IEEE-488 address 10 after each evaluation. When MEM2 is changed from "*RST" to

"ABC", after the RESET statement, this change does not affect the RESET command, which will be executed after the 5700 statement. The [SDC] construction (selected device clear) is evaluated each time the RESET command is executed.

- Command Termination

  In general, the same rules apply as for the IEEE and PORT FSCs.

  For IEEE-488 instruments, EOI termination is the default, and is sufficient for most instruments.

  For serial instruments there are two approaches.

  The first approach is to explicitly specify the terminator after the data message. Typically, serial instruments expect a linefeed ([10]), carriage return ([13]), or both as a terminator.

  The second approach is to use the **OTERM** special construction to specify the terminator. Note that if this approach is used, a separate OTERM construction must be specified in each RESET statement.

- Error Handling

  As with the built-in reset commands which MET/CAL automatically uses for system instruments (like the Fluke 5700A), reset commands specified using the RESET FSC cause the procedure to be aborted if an error occurs in executing the RESET command.

  Procedure writers who use the RESET FSC must therefore carefully test procedures to make sure that the RESET command is reliable.

- Special Constructions

  The RESET FSC supports most of the special constructions allowed by the IEEE and PORT FSCs.

  Constructions that are legal only for IEEE-488 instruments cannot be used with serial instruments.

  Constructions that are legal only for serial instruments cannot be used with IEEE-488 instruments.

  If the address is specified as a literal IEEE-488 or serial address (i.e., not as an alias), compile time checks prevent incorrect special construction specifications.

  If the address is an alias, some of the special construction error checks are deferred until run time.

  The following special constructions may be used in the command portion of a RESET statement:

1. Constructions Evaluated on RESET Statement Execution

[MEM]	write value of register MEM to specified address
[MEM1]	write value of register MEM1 to specified address
[MEM2]	write value of register MEM2 to specified address
[M*nreg*]	write value of global numeric register to specified address
[L*nreg*]	write value of local numeric register to specified address
[SREG*nreg*]	write value of string register to specified address
[V*variable*]	write value of *variable* to specified address
{*text*}	send text enclosed in braces to result file

2. Constructions Evaluated on RESET Command Execution

   a. Constructions Used with IEEE-488 and Serial Instruments

[D*delay*]	delay execution for *delay* milliseconds
[I!]	read number from specified address, discarding the data read
[*numeric*]	write number (ASCII) to specified address
[O < *file*]	read from file, write to specified address
[T*numeric*]	set timeout to *numeric* milliseconds
[TERM *number*]	set terminator character to number (ASCII)
[TERM '*c*']	set terminator character to *c* (character)
[TERM CR]	set terminator character to Carriage Return
[TERM LF]	set terminator character to Line Feed
[TERM NONE]	no terminator (IEEE-488) default termination (serial)

[TERM OFF]	same as [TERM NONE]
[OTERM *number*]	set output terminator character to number (ASCII)
[OTERM '*c*']	set output terminator character to *c* (character)
[OTERM CR]	set output terminator character to Carriage Return
[OTERM LF]	set output terminator character to Linefeed
[OTERM CRLF]	set output terminator character to Carriage Return + Linefeed
[OTERM NONE]	no output terminator
[OTERM OFF]	no output terminator

The [I!] construction was added for use with the RESET statement, because [I] and [I$] modify the memory registers (MEM and MEM2, respectively), and this side-effect is, in general, not acceptable in the context of a reset command which executes after each evaluation. The [I!] construction is also available for use in IEEE and PORT statements.

b. Constructions Used Only with IEEE-488 Instruments

[EOI ON|OFF]	enable/disable assertion of EOI on write
[GTL]	put instrument in local control state
[IFC *port*]	interface clear on specified port
[LLO]	disable instrument front panel controls
[REN]	assert Remote Enable line on the IEEE-488 bus
[SDC]	sends Selected Device Clear to specified address
[S*delay*]	set delay between transmitted characters
[SPL*mask*]	serial poll specified address
[SRQ*delay*,*mask*]	wait for IEEE Service Request
[SRQ ON|OFF]	enable/disable UUT Service Request processing
[TRIG]	trigger instrument at specified address

The SPL and SRQ constructions are allowed, but are not recommended for use in RESET statements, because they cause the value of memory register MEM to be modified when the RESET command is executed.

The timeout and terminator specifications, if any, are maintained independently of corresponding specifications in IEEE statements, if any.

c. Constructions Used Only with Serial Instruments

[CLR]	flush receive queue of specified port
[P*params*]	configure port
[REOPEN]	close and re-open the specified port

The "P" construction (port configuration) must be used with caution, because it interacts with the PORT statements in the procedure. In general, it's best to configure the port using either the Windows Control Panel, or a PORT statement at the beginning of the procedure.

The timeout specification, if any, is maintained independently of the corresponding specification in PORt statements, if any.

Refer to the IEEE FSC on-line help for additional details on special constructions used with IEEE-488 instruments.

Refer to the PORT FSC on-line help for additional details on special constructions used with serial instruments.

Examples

```
# Specify reset command for MFC.
  1.002  RESET        [@MFC]*RST;*OPC?[I!]

# Specify reset command for DMM.
  1.003  RESET        [@DMM]REMS;*RST[10][I!][I!][D1000]

# Clear reset commands for MFC and DMM.
  4.001  RESET        [@MFC]
  4.002  RESET        [@DMM]

# Re-establish reset commands for MFC and DMM.
  7.001  MATH         S[1] = "*RST;*OPC?[I!]"
  7.002  MATH         S[2] = "REMS;*RST[10][I!][I!][D1000]"
  7.003  RESET        [@MFC][SREG1]
  7.004  RESET        [@DMM][SREG2]
```

RNG

Display Control FSC

Description

The RNG FSC is used to generate a message which prompts the operator to set the UUT to a specified RANGE. The RNG FSC may be used in place of a DISP FSC for two reasons:

- Messages generated by the RNG FSC have the same format as automatic range messages.
- MET/CAL remembers the specified range. If a subsequent range message (whether automatic or generated by a RNG statement) is identical to the previous range message, the display of the message is inhibited.

Refer to "Automatic Messages" in Volume 2, Chapter 1 for a description of automatic range messages.

Format

RNG   *range* [AC] [-D]

Rules

- The *range* is specified as:

  [*range value*]*prefix units*

  range value is an NR3-format number.

  If *range value* is not specified, the message defaults to Autorange.

  prefix is a MET/CAL units prefix code:

  p - pico
  n - nano
  u - micro
  m - milli
  k - kilo
  M - mega
  g - giga

  Except for 'm' and 'M', prefix codes are case-insensitive.

  units is a MET/CAL units code:

  A - amps
  A/A - amps / amps (amps ratio)

Ap	-	amps peak
App	-	amps peak-to-peak
bar	-	bar
cmH2O	-	centimeters of water
D	-	dBm
dB	-	decibels
deg	-	degrees
degC	-	degrees Celsius
degF	-	degrees Fahrenheit
df	-	duty factor
F	-	farads
ftH2O	-	feet of water
g/cm2	-	grams per centimeter squared
H	-	hertz
H/H	-	hertz / hertz (frequency ratio)IRE - IRE
inH2O	-	inches of water
inHg	-	inches of mercury
K	-	Kelvin
LM	-	Line Marker
mH2O	-	meters of water
mHg	-	meters of mercury
Pa	-	Pascals
pct	-	percent
psi	-	pounds per square inch
rad	-	radians
T	-	seconds
V	-	volts
VA	-	volt-amps
VAR	-	volt-amps reactive
Voff	-	volts offset
Vp	-	volts peak
Vpp	-	volts peak-to-peak
V/A	-	volts / amps
V/V	-	volts / volts (volts ratio)
W	-	watts
Y	-	siemens
Z	-	ohms
Z/Z	-	ohms / ohms (ohms ratio)

- AC/DC Specification

  IF "AC" is specified, the range message will indicate that the signal is an AC signal.

It is illegal to specify "AC" unless the units are amps, amps peak, amps peak-to-peak, volts, volts peak, or volts peak-to-peak.

Example:

```
RNG        10V                        AC
```

The RNG statement above will cause the following automatic range message to be constructed:

"Set UUT to the 10V AC range."

If "AC" is not specified, DC is assumed.

- Per Division Specification

"-D" may be specified in a RNG statement to prevent inclusion of the 'per division' indicator in the range message.

Normally, when an automatic range message is constructed, the ASK 'D' flag determines whether a 'per division' indicator is added to the message. The 'per division' indicator is used in scope calibration. It is included in the range message when ASK+ D is specified. Adding "-D" to a RNG statement has no effect of the ASK 'D' flag is not set (i.e., if ASK- D is specified). Refer to the ASK FSC Reference for more information on the ASK 'D' flag.

Example:

```
ASK+     D
RNG          10V
RNG          5V -D
```

The first RNG statement generates the message:

"Set UUT to 10V/div."

"/div" is included in the messages because ASK+ D is in effect, and "-D" is not specified in the RNG statement.

The second RNG statement generates the message:

"Set UUT to the 5V DC range."

Although ASK+ D is still in effect, inclusion of "/div" in the message has been suppressed because "-D" is specified in the RNG statement.

- Inclusion of MEM2

If the MEM2 string register is non-empty, MEM2 is included in the range message. (This applies to automatic range messages as well as messages generated by the RNG FSC.)

Example:

```
ASK-     D
MEM2         = Fluke 77
RNG          20V
```

The RNG statement generates the range message:

"Set UUT Fluke 77 to the 20V DC range."

Notice that the value of MEM2 has been added to the message (after the word "UUT").

RPT

Procedure Control FSC

Description

The RPT FSC causes an unconditional jump to the first step of the current test.

Format

RPT

Rules

- RPT should be used only in an adjustment block.
- The RPT FSC causes the entire test to be repeated. Frequently, special set-up instructions are given using, for example, the DISP FSC. These set-up instructions precede the evaluation step. Since RPT jumps to the first step of the test (i.e., the statement with minor step number 001), the set-up instructions are also repeated. If this is undesirable, a JMP statement which jumps directly to the evaluation step may be used instead of a RPT statement.

RSLT

Miscellaneous FSC

Description

The RSLT FSC is used to enter information in the MET/CAL results file. The RSLT FSC has two modes of operation, depending on the first character of the text entry being the equals (=) sign.

- In the first mode of operation with the first character NOT being the equals (=) sign, the RSLT FSC displays the indicated message and then prompts the operator for a response. This allows the operator to make a detailed response to the RSLT message. The entire operator response is then placed in the results file.
- If the first character is the equals (=) sign, the RSLT information can be used to directly enter information into the results file. This mode is transparent to the operator.

Format

RSLT *prompt* or RSLT =*message*

Rules

- If the body of the RSLT statement begins with an equals sign (=), the text which follows the equals sign is entered in the results file.

  Example:

  ```
  1.012  RSLT         =Waveform Test <2V
  1.013  EVAL   Is the waveform less than 2V?
  ```

  When the above statements are executed, two individual rows are written to the results:

  Waveform Test <2V

  Result of Operator Evaluation PASS

  if the operator selects YES, or

  Waveform Test <2V

  Result of Operator Evaluation FAIL

  if the operator selects NO.

This can also be accomplished as follows:

```
1.012  MEM2         =Waveform Test <2V

1.013  EVAL   -s MEM2 : Is the waveform less than 2V?
```

In this case the single row:

Waveform Test <2V PASS

or

Waveform Test <2V FAIL

is written to the results.

- If the body of the RSLT statement does not begin with an equals sign (=), the body of the result statement is used as a prompt to the operator. The operator's response is entered into the results file.
- A maximum of 56 characters is allowed in the body of the RSLT statement.
- The following special constructions may be used in a RSLT statement:

[*numeric*]

[D*delay*]

[M1], [M2], ...

[L1], [L2], …

[MEM1]

[MEM2]

[MEM]

[S1], [S2], ...

[SREG1], [SREG2], ...

[V*variable*]

{*text*}

Refer to "Special Constructions" in Chapter 1 of this manual for details.

The constructions [M1], [M2], ... access the global numeric registers. The constructions [L1], [L2], …, access the local numeric registers. Up to 12 significant digits are included in the value. Refer to the MATH FSC help for additional information on the numeric registers.

The constructions [S1], [S2], ... access the string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ... are identical to [S1], [S2], ..., and are included only for compatibility with the IEEE, IEEE2, and SCPI FSCs.

- Special constructions which appear in a RSLT statement are evaluated before being written to the results file.

Examples

Example 1:

```
STEP  FSC RANGE NOMINAL   TOLERANCE     MOD1 MOD2  3  4 CON
1.001 ACMS                              3mV
1.002 5790      3.00000mV               1kH    W  F  N  2W
1.003 RSLT      =3mV @ 1kHz Reference reading = [MEM]mV
```

The result of the 5790 Nominal Setup test is stored in MEM. The RSLT statement then substitutes the value of MEM for the special construction [MEM], and writes the resulting text to the result file. If the value of MEM is 3.00002, the results file will contain: 3mV @ 1kHz Reference reading = 3.00002 mV

Example 2:

```
1.001 MATH        MEM = 4
1.002 RSLT        Enter {Reason Code for ERROR [MEM]:}
```

When the RSLT statement is executed, the operator will be prompted with:

```
Enter Reason Code for ERROR 4:
```

Suppose the operator responds by entering "Short R2". The results file will then contain:

```
Reason Code for Error 4: Short R2
```

SET

Display Control FSC

Description

The SET FSC generates a list of settings for complex UUT set-ups. When a SET statement is executed, a specified message is displayed, and also stored internally. Stored settings are recalled when the "Settings" option is chosen in the Post Test Summary.

The SET FSC may be used to specify a heading, a setting, or an automatic setting. These are described in detail below.

Format

SET *name*: *setting*

SET *name*:

SET *name*

SET

Rules

- The body of the SET statement is limited to 56 characters.
- If a SET statement has the form:

  SET *name*: *setting*

  The specified *name* and *setting* are stored in the internal settings table, according to the following rules:

  1. If the *name* matches a name already in the table, and the *settings* are different, the old *setting* in the table associated with that *name* is replaced by the new *setting*, and no new entry is created.

     After the table has been updated, the *name* and the new *setting* are displayed to the operator.

  2. If the *name* matches an existing name in the table, and the new setting is the same as the existing setting, no change is made to the table, and the setting is not displayed to the operator.

     The *setting* is limited to 32 characters (after embedded special constructions, if any, are evaluated).

Leading spaces in the specified *setting* are preserved. This allows settings to be lined up in the Post Test Summary "Settings" table.

Note that the space which immediately follows the colon is required. If a space is not present immediately after the colon, the colon is taken to be part of the *name*.

If the specified *setting* is '*', the setting is an automatic setting. In this case the following rules apply:

a. The current range is entered as the *setting* for that *name* in the settings table. (The current range is determined by the most-recently executed instrument FSC with a non-empty RANGE field, or the last-executed RNG statement.)

b. The *setting* is displayed to the operator only if the range is known. This applies both to the execution of the SET statement and to the Post Test Summary "Settings" display.

c. Whenever the current range changes, the value of the *setting* in the settings table is updated to match the current range.

- If a SET statement has the form:

  SET *name*:

  The entry for the specified *name* is deleted from the internal settings table.

  If the specified *name* does not match a name in the table, the statement is ignored.

- If the SET statement has the form:

  SET *name*

  In this case the *name* is considered to be a heading. Each time a SET statement specifies a heading, a new entry is made to the internal table.

  It is possible to have duplicate headings in the table. Headings cannot be deleted from the table, except by clearing the entire settings table, or when more than 18 entries are added to the table, causing early entries to be discarded. Headings are useful way to group related settings.

  Examples:

```
SET Vertical Mode Controls
SET Triggering Controls
```

- If the SET statement has the form:

  SET

An empty SET statement (or one which contains special constructions only) causes the internal settings table to be cleared. All existing entries are discarded.

- The internal settings table is large enough for 18 entries. If a new entry is added to a full table, the first (oldest) entry is deleted, and the new entry is added at the bottom of the table (it becomes the newest entry).
- The following special constructions may be used in a SET statement:

  [D *delay*]

  [DRAW *x*, *y*, *view*]

  [V*variable*]

  {*text*}

  Refer to "Special Constructions" in Chapter 1 of the MET/CAL Procedure Language Reference Manual for details.

  Example:

```
SET Setting: [V VAR$].
```

- If the ASK- S command is in effect, SET FSC messages are not displayed. However, the settings table is updated. The operator may view the settings table by choosing "Settings" in the Post Test Summary.

Examples

```
2.005 SET        Ch1 Volts/Div: 5mV[DRAW60,15,F]
3.007 SET        Vertical Deflection Tests [D10000]
4.008 SET        Sensitivity Volts/Div: *
```

SMY02

SMY02 Instrument FSC

Description

The SMY02 FSC programs amplitude and frequency of the Rohde & Schwarz SMY01, SMY02, SMY43 Signal Generators.

Functional Capability

Model	Frequency	Amplitude [1]
SMY01	9 kHz to 1040 MHz	-140 dBm to +13 dBm
SMY02	9 kHz to 2080 GHz	-140 dBm to +13 dBm
SMY43	9 kHz to 2080 GHz	-140 dBm to +13 dBm
1. +19 dBm with Option B43		

Parameters

RANGE

This field specifies the UUT range as described in the section "General Rules for Instrument Evaluation FSCs".

NOMINAL

This field specifies the amplitude, frequency, period, or reset.

- Amplitude entered as: [*numeric*][*prefix*]D, V, or Vpp.
- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T.
- Reset entered as *.

Rules:

- When the NOMINAL field specifies the amplitude, the MOD1 field must specify the frequency or period.
- When the NOMINAL field specifies the frequency or period, the MOD1 field must specify the amplitude.

TOLERANCE

This field specifies the UUT tolerance as described in the section "General Rules for Instrument Evaluation FSCs".

MOD1

This field specifies the amplitude, frequency, or period.

- Frequency entered as [*numeric*][*prefix*]H.
- Period entered as [*numeric*][*prefix*]T .
- Amplitude entered as: [*numeric*][*prefix*]D,V, or Vpp.

Rules:

- When the MOD1 field specifies the frequency or period, the NOMINAL field must specify the amplitude.
- When the MOD1 field specifies the amplitude, the NOMINAL field must specify the frequency or period.

MOD2

This field specifies whether "/div" is include in after the value in the automatic range message.

- -D "/div" is not included
- *blank* "/div" is included if ASK+ D is in effect

Rules:

- The MOD2 field is automatically set to -D for a Setup Test.

MOD3

This field is not used.

MOD4

This field specifies the type of test being performed as described in the section "General Rules for Instrument Evaluation FSCs".

CON

This field is specifies which output port is used for the signal.

- CH1 Fluke 58xxA Channel 1
- CH2 Fluke 58xxA Channel 2
- CH3 Fluke 58xxA Channel 3
- CH4 Fluke 58xxA Channel 4
- CH5 Fluke 58xxA Channel 5
- *blank* SMYxx RF Output

Rules:

- The CON field may specify CH1 or CH5 only when a Fluke 58xxA is configured.
- The CON field may specify CH2, CH3, or CH4 only when a Fluke 58xxA is configured with the 5800A-5 Five Channel option.

Use of Standard Memory Locations and Results Reporting

System memory locations MEM and MEM1 are used. For more information, refer to the "Syntax Rules for Instrument Evaluation FSCs" in Chapter 1 of this manual.

Examples

```
 STEP    FSC    RANGE NOMINAL        TOLERANCE     MOD1         MOD2   3  4 CON
# ----- Reset -----
  1.001  SMY02        *                                                   S
  1.002  SMY02  A     -42.95D        1U            100kH           -D
  2.001  SMY02        100mV                        550MH           -D     S
  2.002  SMY02  0.5   28mVpp         5U            100kH           -D
  3.001  SMY02  A     D              1U            100kH           -D
  4.001  SMY02        V              1%            100kH           -D
  5.001  SMY02  50    10uT           1% 1/ 1U      -35D
  6.001  SMY02  200   100nT          1% 1/ 1U      1Vpp
# ----- Oscilloscope bandwidth test -----
  7.001  ASK-                                                      F        W
  7.002  ASK+     D
  7.003  DISP         Connect the 5800A channel 1 to UUT channel 1.
  7.004  DISP         Set UUT to 20us/div.
  7.005  SMY02  20    120mVpp                      100kH                  N  CH1
  7.006  ASK-         N
  7.007  MESS         Adjust stimulus for a UUT vertical reading of 4.2 div.
  7.008  SMY02        5MH            -100%         mVpp            -D        CH1
  8.001  MESS
  8.002  ASK+         N
```

MSMY02

Auxiliary Instrument Setup FSC

Description

The MSMY02 FSC provides the additional program functions for the Rohde & Schwarz SMY01, SMY02, and SMY34 Signal Generators which are not addressed by the SMY02 FSC. These functions are: Modulation Frequency, AM Depth, FM Deviation, and Phase Deviation.

RANGE

Not used.

NOMINAL

The NOMINAL field specifies the modulation frequency or a reset.

Modulation Frequency:

When the NOMINAL field is used to specify the modulation frequency, the format is [*numeric*][*prefix*]H. Allowed values are 1 Hz to 500 kHz.

If just units are entered, the value is taken from memoryregister MEM at run time.

Reset:

To specify a reset, enter an asterisk (*) in the NOMINAL field. This resets all previous settings created with the MSMY02 FSC.

TOLERANCE

Not used.

MOD1

The MOD1 field specifies the AM depth, FM deviation, or phase deviation. The MOD1 field cannot be blank in an SMY02 statement.

AM Depth:

AM depth is entered as *numeric* [*prefix*] pct. AM depth limits are 0 to 100%.

FM Deviation:

FM deviation is entered as *numeric* [*prefix*] H

FM deviation depends upon the carrier frequency s shown in the table below:

Carrier Frequency	FM Deviation
< 65 MHz	0 to 10.0 MHz
< 130 MHz	0 to 1.25 MHz
< 260 MHz	0 to 2.50 MHz
< 520 MHz	0 to 5.00 MHz
< 1040 MHz	0 to 10.0 MHz
< 2080 MHz	0 to 20.0 MHz

Phase Deviation:

Phase deviation is entered as *numeric* [*prefix*] rad.

Phase deviation depends upon the carrier frequency as shown in the table below:

Carrier Frequency	Phase Deviation
< 65 MHz	0 to 200 rad
< 130 MHz	0 to 25 rad
< 260 MHz	0 to 50 rad
< 520 MHz	0 to 100 rad
< 1040 MHz	0 to 200 rad
< 2080 MHz	0 to 400 rad

MOD2

Not used.

MOD3

Not used.

MOD4

Not used.

CON

Not used.

Examples

```
 STEP     FSC     RANGE NOMINAL        TOLERANCE     MOD1        MOD2   3   4  CON
# AM Modulation
  1.001  MSMY02        *
  1.002  MSMY02        400H                          0pct
  1.003  SMY02   10    0D              1U            10MH
  2.001  MSMY02        1000H                         90pct
  2.002  SMY02   10    0D              1U            10MH
# FM Modulation
  3.001  MSMY02        400H                          100H
  3.002  SMY02   10    0D              0.11U         200kH
  4.001  MSMY02        1000H                         99.9kH
  4.002  SMY02   10    0D              0.1U          1000MH
# Phase Modulation
  5.001  MSMY02        400H                          2rad
  5.002  SMY02   10    0D              0.11U         200kH
  6.001  MSMY02        1000H                         10rad
  6.002  SMY02   10    0D              0.1U          1000MH
```

STD

Miscellaneous FSC

Description

The STD FSC is used by a procedure writer to indicate that a manual standard is a traceable reference.

Format

STD *standard*

Rules

- *standard* is the name of an instrument used as an external standard. A maximum of 29 characters is allowed.
- Leading and trailing spaces are ignored.
- The MET/CAL Editor generates a **STANDARD** statement in the header of a compiled procedure for each distinct instrument specified in an STD statement.
- Before starting execution of a procedure, MET/CAL retrieves the asset number associated with each standard from the MET/CAL Instrument Configuration. MET/CAL then queries the last calibration record for the asset in the database to determine if the standard is in cal or out of cal.

  If the standard is not configured, or an asset number is not associated with the standard, the MET/CAL Run Time cannot execute the procedure. The MET/CAL Editor Test Run does not require manual standards to be configured in order to execute a procedure.
- For each STD statement executed, the name of the standard (*standard*) is added to the list of standards used.

Examples

```
=============================================================================
INSTRUMENT:            STD FSC
DATE:                  2002-05-08
AUTHOR:                Fluke
REVISION:              1.0
ADJUSTMENT THRESHOLD:  70%
```

```
NUMBER OF TESTS:       1
NUMBER OF LINES:       22
STANDARD:              Fluke 792A
STANDARD:              Fluke 80K6 High Voltage Probe
=============================================================================
 STEP    FSC    RANGE NOMINAL       TOLERANCE     MOD1        MOD2  3  4 CON
  1.001  STD          Fluke 792A

  1.002  OPBR         Do you wish to perform the high voltage test?
  1.003  JMPL         END           MEM1 < 0

  1.004  STD          Fluke 80K6 High Voltage Probe

  1.005  LABEL        END
  1.006  END
```

When the above procedure is executed in the Run Time, both standards must be configured with an associated asset number. However, if the operator chooses not to perform the high voltage test, only the Fluke 792A will be included in the list of standards used.

TARGET

Miscellaneous FSC

Description

The TARGET FSC is used to specify a jump destination to be used in conjunction with the Post Test Repeat and Cancel options, and/or with Multiple Measurement mode.

Format

TARGET [-m] [-p]

Rules

The purpose of the TARGET FSC is to more conveniently allow a MET/CAL test to be written so that one or more initial statements of the test are executed only the first time the test is executed.

(Recall that a test in the MET/CAL procedure language is a group of one or more statements which all have the same major step number. Each test is terminated by an evaluation step.)

This facility may be useful in multiple measurement mode, if one or more connection messages, HEAD statements, RSLT statements, and so on, are appropriate only for the first execution of the test.

It also may be useful in conjunction with the Post Test "Repeat" and "Cancel" options.

+ TARGET -m

The "-m" option specifies the repeat target in multiple measurement mode.

+ TARGET -p

The "-p" option specifies the repeat target for the Post Test Repeat and Cancel options. The ASK 'P' flag affects the Repeat and Cancel options as follows:

> If the ASK 'P' flag is set (ASK+ P), no jump in performed when Repeat or Cancel are chosen. That is choosing Repeat or Cancel in the Post Test dialog causes the current statement to be re-executed.
>
> If the ASK 'P' flag is not set (ASK- P), choosing Repeat or Cancel in the Post Test dialog, causes execution to resume at the closest preceding TARGET statement in the same test which specifies the "-p" option. Note that an empty TARGET statement implicitly specifies "-p".

If the test does not include a TARGET statement which specifies "-p", or an empty TARGET statement, execution resumes at the first statement of the test.

+ Empty TARGET Statement

  An empty TARGET statement is equivalent to "TARGET -m -p". That is, it specifies a target used both for Post Test Repeat/Cancel and for Multiple Measurement mode.

Examples

Example 1:

```
STEP  FSC    RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 ASK-                 P
1.002 EVAL   Test #1

2.001 DISP         Message #1
2.002 TARGET
2.003 DISP         Message #2
2.004 EVAL   Test #2
```

If the user chooses "No" in response to the "Test #2" EVAL prompt, causing the test to fail, the Post Test dialog will be displayed. If the user then chooses "Repeat" or "Cancel" in the Post Test dialog, procedure execution will resume at line 2.002. (If the TARGET statement weren't there, execution would resue at 2.001.)

Note also that if the line 2.002 in the above example were changed to "TARGET -m", it would have no effect on the Post Test "Repeat" and "Cancel" options. It would be as if the TARGET statement weren't there, and execution would resume at 2.001.

TOL

Miscellaneous FSC

Description

The TOL FSC is used to specify a test tolerance which will be used in subsequent instrument, MEMC, MEMCX, or ACC statements.

When an instrument, MEMC, MEMCX, or ACC statement, which contains "TOL" in its TOLERANCE field is executed, the tolerance specified in the most recently executed TOL statement is used.

The specified tolerance should conform to the specifications of the UUT at the reference value. Tolerance specifications in a TOL statement follow the same conventions used in the TOLERANCE field of an instrument FSC.

The TOL FSC is useful when the instrument FSC TOLERANCE field is too narrow to hold the desired tolerance specification. The TOL FSC may also be used in cases where a single tolerance specification applies to more than one test.

Format

TOL *tol _spec tol _spec tol _spec ...*

Rules

- A TOL statement may contain 0 or more *tol _spec* subfields. Subfields are separated by 1 or more blanks. A maximum of 56 characters is allowed in the body of the TOL statement (including spaces used to separate subfields).
- Each *tol _spec* subfield must adhere to the format conventions which apply to the TOLERANCE field of an instrument FSC. Formats are shown in the following table:

Format	Meaning
[*val*]%	% of Nominal value
[*val*]/	% of Range value
[*val*]P%	PPM of Nominal value
[*val*]P/	PPM of Range value
[*val*]U	Units of Nominal

val, if specified, may be a literal numeric value (NR3) or may specify a global numeric register in the form M*i* where *i* is a register index, or a local numeric register in the form L*i*, where *i* is a register index. If *val* is not specified, the tolerance value is taken from numeric register MEM. (There is no way to use numeric register MEM1 to specify the tolerance value.)

Examples:

```
TOL M23%
```

In this example the tolerance is specified as a percentage of the NOMINAL and the tolerance value is taken from global numeric register M[23] at run time.

```
TOL U
```

In this example the tolerance is specified in absolute units and the tolerance value is taken from numeric register MEM at run time.

Refer to Volume 2, Chapter 1 for more information on the TOLERANCE field and the tolerance computations.

Examples

Example 1:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
2.005 TOL        0.001% 0.002/ 0.000001U
2.006 5700 10    10V     TOL                         2W
```

In this example, the desired tolerance specification is toolong to fit in the TOLERANCE field of the 5700 statement. A TOL FSC is therefore used before the 5700 statement to specify the tolerance. In the 5700 statement, "TOL" is entered in the TOLERANCE field. This indicates that the tolerance specified in the most recently executed TOL statement is to be used to calculate the test tolerance when the 5700 statement executes.

Example 2:

```
STEP  FSC  RANGE NOMINAL TOLERANCE MOD1 MOD2  3  4  CON
1.001 TOL        3%
1.002 5700 1     1V      TOL                         2W
2.001 5700 10    10V     TOL                         2W
3.001 5700 100   100V    TOL                         2W
```

This example illustrates a case in which a single tolerance specification applies to multiple tests. The 3 5700 statements all use the same tolerance specification (3%).

VSET, TSET

Miscellaneous FSCs

Description

The VSET and TSET FSCs are general purpose FSCs used to assign values to certain system parameters.

Assignments made in a VSET statement are global in the sense that they affect all subsequent steps in the execution of a procedure, whether those steps are in the main procedure or in a subprocedure, and remain in effect until overridden or reset by another VSET statement.

Assignments made in a TSET statement are valid only for the current test. After each evaluation all TSET-specified parameters are returned to their VSET-specified, default, or unset values, whichever applies.

Many VSET / TSET parameters are related to the measurement uncertainty calculation. This on-line help file contains general information about the measurement uncertainty calculation, which will be of interest even when the procedure does not include any VSET or TSET statements.

Notes

Initialization File

This document refers in numerous places to the "MET/CAL initialization file". The initialization file is normally named "metcal.ini" and is located in the Windows directory on your system. In the sample version of the product the initialization file is called "mcsample.ini".

The initialization file is not directly related to the VSET and TSET FSCs. However, many parameters that can be set using the VSET and TSET FSCs can also be set in the initialization file. Whenever a parameter is set both in the initialization file and in a VSET or TSET statement, the VSET or TSET specification always has precedence and overrides the initialization file specification.

It is important to understand that resetting a VSET parameter,by assigning the special value "" to the parameter in a VSET statement, causes the parameter value to revert to the initialization file-specified value (if there is one).*

Exponentiation

In this document the caret symbol ('^') is used to indicate exponentiation. For example, "3 ^ 0.5" means "3 to the ½ power", which is the square root of 3.

Units

Please refer to the UNITS section near the end of this help file for important information about using VSET to override values of physical quantities.

Measurement Uncertainty Hints

Refer to MEASUREMENT UNCERTAINTY HINTS near the end of this help file for general information about enabling and using the measurement uncertainty calculation.

Datron 4950

Refer to the section USING THE DATRON 4950 for a description of how to use the Datron 4950 in conjunction with the measurement uncertainty calculation.

Rules

1. The general form of a VSET statement is:

   VSET *name* = *value*

   The general form of a TSET statement is:

   TSET *name* = *value*

   where *name* is a recognized parameter name selected from the parameter list (see below), and value is a valid value for the specified parameter.

2. A VSET or TSET statement may contain multiple assignments on a single line:

   VSET *name1* = *value1* *name2* = *value2* ...

   The procedure line length limits the number of assignments, which may be made on a single line.

   A semi-colon (';') may be used to terminate the value specifier. Using semi-colons is optional and has no effect on the meaning of the procedure statement. In some cases using semi-colons may make the procedure statement easier to read.

3. All string comparisons are case-insensitive, and spaces before or after the equals sign in an assignment are not significant.

4. A VSET or TSET specification always overrides all other specifications. What the "other specifications" are depends on the particular parameter. Typically, the other specifications are by way of one or more of the following:

1. (a) Built-in calculation.
2. (b) Initialization file specification.
3. (c) Database specification.
4. (d) Default value.

5. A VSET specification of a parameter persists for the duration of a procedure's execution until it is either overridden or reset in a subsequent VSET or TSET statement.

   A TSET specification of a parameter persists only for the duration of the current test.

6. A VSET or TSET parameter specification can always be reset by assigning the special value "*".

   In the case of TSET, using "*" to reset the specification has limited usefulness, because the parameter will be reset automatically at the end of the current evaluation step.

   When a VSET-specified parameter is reset, it is as if the procedure had never had a specification for that parameter. In other words, the determination of the parameter value reverts to being based on one of the other specification methods for that parameter (see Rule 4, above).

   When a TSET-specified parameter is reset automatically after an evaluation step, the parameter value return to, in order of highest to lowest precedence:

   a) the last VSET-specified value, if any
   b) an initialization file-specified value, if any and if applicable,
   c) a database-specified value, if any and if applicable, or
   d) a built-in default value.

7. Special Constructions

   A VSET or TSET parameter *value* specification may include one or more MET/CAL special constructions. The following special constructions are supported:

   - [MEM], [MEM1], and [MEM2]
   - [M1], [M2], ...
   - [L1], [L2], …
   - [S1], [S2], ...
   - [SREG1], [SREG2], ...

- [V*variable*]
- [*numeric*]

Refer to "Special Constructions" in Chapter 1 of the MET/CAL Procedure Language Reference Manual for more information on special constructions.

The constructions [M1], [M2], ..., access the global numeric registers. The constructions [L1], [L2], …., access the local numeric register. Up to 12 significant digits are included in the value. Refer to the MATH FSC on-line help for additional information on the numeric registers.

The constructions [S1], [S2], ..., access the global string registers. Refer to the MATH FSC on-line help for additional information on the string registers.

The constructions [SREG1], [SREG2], ..., are identical to [S1], [S2], ..., and are included only for compatibility with the IEEE, IEEE2, and SCPI FSCs.

The two primary reasons for using a special construction in a VSET or TSET parameter value specification are:

- To allow the parameter value to be calculated using the MATH FSC.
- To allow the operator to be prompted for the parameter value.

  For example, to prompt the operator for the value of the VSET parameter "nmeas", include the procedure statements:

  ```
  MEMI Please enter the number of measurements:
  VSET nmeas = [mem]
  ```

When using special constructions in a VSET or TSET statement, it is important for the procedure writer to realize that doing so prevents the MET/CAL compile time system from checking the value to make sure it's valid. This means that an error in the value specification will result in a run time error. In some cases it may be difficult or impossible for the operator to correct such a mistake, and procedure execution may be terminated or the results may be invalidated.

Special constructions cannot be used in VSET or TSET parameter names, only in parameter values.

Parameter Summary

All supported VSET and TSET parameters are listed below. For full information on each parameter refer to the "Parameter List" section below.

VSET and TSET support exactly the same set of parameters.

In the remainder of this document, unless stated otherwise, all information about VSET parameters should be assumed to apply to TSET as well.

ACCRED	accreditation flag
ALL	special parameter used to reset all parameters
C1, ..., C10	sensitivity coefficients
CS1, CS2	sensitivity coefficients for S1 and S2
CONF	confidence value
CORREQ	configure correction requirement
COV_FAC	coverage factor
CPT	cardinal point
DF	effective degrees of freedom
DF1, ...,DF10	individual degrees of freedom values
DFS1, DFS2	degrees of freedom values for S1 and S2
EXP_UNC	expanded uncertainty
F	student's T factor
GB	guardband method
GBF	guardband factor
GB_INIT	guardband initialization file
GB_MODE	guardband table lookup mode
GB_OVERFLOW	guardband “overflow” control
GB_PTS	guardband Post Test Summary mode
GB_RESULT	guardband procedure result mode
GB_TABLE	guardband table
KCONF	specifies confidence for expanded uncertainty
MATH_EPSILON	specifies epsilon factor for MATH comparisons
MEAS	measurement quantity for MEMC or MEMCX w/o NOM
MEASURE_ONLY	flag to disable meter setup in meter drivers
MEMC_IRPT	control instrument statements in MEMC tests
MFILE	name of measurement uncertainty output file

MFILE_FORMAT	measurement uncertainty output file format
N5523A-504	set frequency range for N5532A-504 sensor module
N5523A-518	set frequency range for N5532A-518 sensor module
N5523A-526	set frequency range for N5532A-526 sensor module
N5523A-550	set frequency range for N5532A-550 sensor module
NMEAS	number of measurements
NSD	number of significant digits
NTHROW	number of measurements to discard
REMCON	control "Please Remove All Connections" message
RSM	controls result saving mode for repeated tests
S1	(SDEV / (N ^ 0.5)) * F
S2	(UUT_RES * 0.5) / (3 ^ 0.5)
SensorChange	control automatic sensor module change
SLEWSTART	specify starting slew digit for certain FSCs
SRQDELAY	wait-for-SRQ retry loop delay
SRQHOLDOFF	initial wait-for-SRQ delay
SRQRETRY	maximum number of wait-for-SRQ retries
STD_UNC	standard uncertainty
SYS_ACC	accuracy of system instrument
TDESC	test description
TOL_REF	UUT_INDICATED or NOMINAL
U1, ..., U10	uncertainty components
U2M	method for determining U2
USE_ST	enables use of Student's T to determine F
UUT_RES	absolute resolution of UUT
WS	Welch-Satterthwaite flag

Parameter List

ACCRED

ACCRED allows the procedure writer to designate one or more tests in a procedure as "accredited calibrations".

Legal values for ACCRED are "No", "Yes", "0", "1", or any integer between 2 and 32767."Yes" is equivalent to "1", and "No" is equivalent to "0".

ACCRED may be specified in the procedure only, not in the initialization file or database.

ACCRED provides a way to annotate individual test results in the V7 Results Table as "accredited" or "non-accredited". ACCRED has no effect on the measurement uncertainty calculation, or any other aspect of procedure execution. (ACCRED has no effect on, and is not recorded in, the "Cal Results" table, used in V6 Legacy Results.)

The intent of ACCRED is to allow procedure writers to comply with reporting requirements which mandate that accredited tests be distinguished from non-accredited tests.

Values other than 0 ("No") and 1 ("Yes") may be useful if it is necessary to distinguish between different types of accredited calibrations.

The default value of ACCRED is "No".

Example 1:

```
1.001   5700          1.00V          1%                               2W
2.001   TSET          ACCRED = Yes
2.002   5700          10.00V         1%                               2W
3.001   5700          100.00V        1%                               2W
```

The procedure fragment above shows 3 tests. The first and third are non-accredited. The second is accredited.

Example 2:

INSTRUMENT: Fluke 77 Verification

VSET ACCRED = Yes

In this example, a VSET statement which sets ACCRED to "Yes" is included at the top of the procedure. This causes all tests in the procedure to be designated as accredited.

ALL

"ALL" is a special parameter name used to refer to all VSET/TSET parameters.

The only legal value for the ALL parameter is "*".

The statement:

VSET ALL = *

resets all VSET / TSET parameters.

This statement must be used with caution because it resets all settings made up to the point of execution of the "VSET ALL = *" statement. The settings being reset include any settings made in the calling procedure, if any, as well as in the current procedure.

The statement:

TSET ALL = *

is allowed, but not very useful. It causes all current TSET settings to be reset. However, because TSET is defined to apply only to the current test, the TSET settings will be automatically reset when the test step terminates. (This is why the usefulness of "TSET ALL = *" is very limited.)

Compatibility:

ALL requires V7.11h or later.

C1, C2, ..., C10, CS1, CS2

C1, C2, ..., C10, CS1, CS2 specify sensitivity coefficients used in the measurement uncertainty calculation.

For all sensitivity coefficients the default value is 1.0.

By default, MET/CAL V7 calculates the standard uncertainty as:

Standard Uncertainty = RSS(C1*U1, C2*U2, ..., C10*U10)

If neither U2 nor C2 are directly specified in a VSET or TSET statement, C2 is calculated from CS1, S1, CS2, and S2.

If CS1 and CS2 are both allowed to default to 1, the calculated value of C2 will be 1 as well.

Thus, if the procedure writer does not specify values for any sensitivity coefficients, the calculation of standard uncertainty simplifies to the calculation used in MET/CAL V6:

Standard Uncertainty = RSS(U1, U2, ..., U10)

The sensitivity coefficients are partial derivatives, which appear in the standard formula for calculating standard uncertainty.

The partial derivatives describe how the output estimate varies with changes in the values of the input estimates.

The MET/CAL procedure interpreter does not have the information, which would be required to directly evaluate the partial derivatives. However, the metrologist may externally determine the partial derivatives and directly specify the resulting sensitivity coefficients.

Sensitivity coefficients are also used in Welch-Satterthwaite mode when the effective degrees of freedom is calculated.

CONF

The "CONF" parameter allows a Confidence to be specified for use in the measurement uncertainty calculation. The Confidence is a statistical measure of the confidence associated with the specifications given for a calibration standard.

The Confidence must be specified as a sigma value, not as a percentage. For example, if the specifications for a calibration standard are stated as having a 99% confidence, the Confidence should be set to 2.58, which is the equivalent sigma value.

In cases where the confidence associated with the specification of a calibration standard is unknown, you may wish to use 1.73 (that is, 3 ^ 0.5). This is a conservative choice based on the assumption of a rectangular distribution.

The Confidence is used to calculate Normalized System Accuracy.

Recall that:

Standard Uncertainty = RSS(U1, U2, ..., U10)

where U1 is the Normalized System Accuracy, calculated as:

System Accuracy / Confidence

The System Accuracy is the accuracy of the calibration standard, and is usually determined by looking up the value in a MET/CAL accuracy file.

There are 3 ways to specify the Confidence for a calibration standard:

1. Accuracy File Header

    The Confidence is a required part of the accuracy file header. When MET/CAL looks up the specifications of a supported system instrument in an accuracy file, it also reads the Confidence from the accuracy file header. Unless overridden in a VSET statement or in the initialization file, the value from the accuracy file is used in the measurement uncertainty calculation.

ACCF RESTRICTION:

When the ACCF FSC is used to specify an alternate accuracy file, the confidence value from the accuracy file header (if any) is not used to normalize the reference accuracy. Instead, the default confidence value (2 sigma) is used. Use VSET, as shown in (2) below, to directly specify the confidence if ACCF is used with an accuracy file for which the confidence is not 2 sigma.

2. VSET Statement

Syntax:

```
VSET conf = value
```

Example:

```
VSET conf = 2.58
```

Specifying the Confidence using a VSET statement in a procedure overrides the accuracy file specification and the initialization file specification, if any.

3. Initialization File

It is possible to specify the Confidence in the "[startup]" section of the MET/CAL initialization file.

In general, however, it is not advisable to specify the Confidence in the initialization file, because the specification overrides all confidence specifications in all accuracy file headers, and will be used globally in the measurement uncertainty calculation unless overridden at the procedure level using a VSET statement.

CORREQ

CORREQ allows the procedure writer to require that a correction be performed for designated tests.

Legal values for CORREQ are "Yes", "No", and "Exact".

CORREQ values are interpreted as follows:

Yes

If the ASK 'C' flag is set, terminate the step with an error if a correction was not performed.

No

If the ASK 'C' flag is set, but a correction was not performed, do not terminate the step. (This is the way MET/CAL worked unconditionally prior to V7.11 SP1.)

Exact

If the ASK 'C' flag is set, terminate the step with an error if an exact correction was not performed.

The default value, used when CORREQ is not specified, is "No".

CORREQ has no effect if the statement is not of the right type, regardless of the state of the ASK 'C' flag. For example, EVAL and Go / No Go tests cannot be corrected.

CORREQ cannot be specified in the MET/CAL initialization file.

Compatibility: Requires V7.20 or later.

COV_FAC

COV_FAC specifies the Coverage Factor used to calculate the

Expanded Uncertainty as:

Coverage Factor * Standard Uncertainty

By convention, the value typically used for the coverage factor is 2, and MET/CAL V6.0 is shipped with the coverage factor set to 2 in the database.

The are three ways to specify the coverage factor:

1. Database

   As shipped, the coverage factor is set to 2 in the V6.0 database. To change the database specification choose "Uncertainty..." in the "Configure" menu of the Metrology Database Customization and Configuration application. A dialog will appear which allows a different coverage factor to be specified. This value will apply to all workstations at your site, unless overridden at the workstation level by an initialization file specification or at the procedure level by a VSET specification.

2. Initialization File

   The coverage factor may be specified in the "[startup]" section of the MET/CAL initialization file. An initialization file specification applies to all uncertainty calculations on the workstation, and overrides the database specification.

3. VSET Statement

A VSET specification overrides the database and initialization file specifications, if any.

Example:

```
VSET cov_fac = 1.8
```

The default coverage factor value is 2. This is the value, which would be used if there were no database, initialization file, or procedure specification.

In V6.0, the coverage factor is one of three quantities, which can be written to the results. Use the MET/CAL variable MU_COV$ in the format file, usually "rslt_db.frm", to cause the coverage factor to be included in the result line for each test. (If the measurement uncertainty is not calculated for a particular test, MU_COV$ will be blank.)

There is no provision in V6.0 for automatically determining the coverage factor as a function of the number of degrees of freedom.

CPT

CPT is used to specify the cardinal point of a test.

The Cardinal Point of a test is normally determined automatically as follows:

If the test is an instrument FSC evaluation step, the Cardinal Point is the Nominal.

If the test is a MEMC or MEMCX evaluation:

If a literal numeric value is specified in the MEMC or MEMCX NOMINAL field, that value is the Cardinal Point. If no literal numeric value is specified in the MEMC or MEMCX NOMINAL field, and there's an ACC statement in the test, the Cardinal Point is the ACC Nominal value.

If no literal numeric value is specified in the MEMC or MEMCX NOMINAL field, and there's no ACC statement in the test, but there is an instrument FSC setup statement in the test, the Cardinal Point is the Nominal value of the instrument FSC setup statement. If no literal numeric value is specified in the MEMC or MEMCX NOMINAL field, and there's no ACC statement in the test, and no instrument FSC setup statement in the test, the Cardinal Point is the Fixed Quantity. (The Fixed Quantity is the test comparison value, which does not have the potential to vary.)

However, for some tests the automatic determination of the Cardinal Point, as described above, is not adequate and a direct specification of the Cardinal Point, using a VSET or TSET statement, is required.

Example:

Suppose the UUT is a decade resistance device. The Cardinal Point of a particular test may be 1 kΩ, but the characterized resistance at that cardinal point may be 1.00001 kΩ. The UUT Indicated value will therefore be 1.00001 kΩ, and the System Actual value will be the reading taken by the meter being used to verify the decade resistance device. Notice that neither the UUT Indicated nor the System Actual, which are the test comparison values, are the same as the 1 kΩ cardinal point. The procedure writer may therefore specify:

```
TSET CPT = 1.000 kOhm
```

Cardinal Point is written directly to the V7 Results Table. Cardinal Point is also used to construct the Test Description, unless overridden by a direct specification of Test Description. In some cases Fixed Quantity (another V7 result parameter) depends on Cardinal Point.

DF

DF specifies the effective degrees of freedom for the measurement uncertainty calculation.

DF is used only when the Welch-Satterthwaite mode is enabled. (Refer to the description of parameter WS.)

By default, DF is the estimated effective degrees of freedom based on the Welch-Satterthwaite approximation. The Welch-Satterthwaite formula makes use of the individual uncertainty components, the sensitivity coefficients, and the per-component degrees of freedom values.

However, the procedure writer may override the calculated DF value by directly specifying the effective degrees of freedom in a VSET or TSET statement.

DF cannot be specified in the MET/CAL initialization file.

Legal values for DF are any numeric value or the string "INF". "INF" designates infinity.

Procedure writers should take care not to specify an inappropriate value for the effective degrees of freedom.

DF1, DF2, ..., DF10, DFS1, DFS2

DF1, DF2, ..., DF10, DFS1, DFS2 are the per-component degrees of freedom values.

In other words, for each uncertainty component, U1, U2, ..., U10 there's an associated number of degrees of freedom. Similarly DFS1 is the degrees of freedom value associated with S1, and DFS2 is the degrees of freedom value associated with S2.

DF1, DF2, ..., DF10, DFS1, DFS2 are used only when the Welch-Satterthwaite mode is enabled.

Legal values for DF1, DF2, ..., DF10, DFS1, DFS2 are any numeric value or the string "INF". "INF" designates infinity.

By default DF2 is derived from DFS1, DFS2, CS1, CS2, and U2. For DF1, DF3, …, and DF10 the default value is "INF" (infinite degrees of freedom). The default value for DFS2 is "INF". The default value for DFS1 is (NMEAS – 1).

Procedure writers should take care not to specify inappropriate values for the per-component degrees of freedom.

A direct specification of DF2 overrides the uses of DFS1 and DFS2.

The DF1, DF2, ..., DF10, DFS1, DFS2 are used in the Welch-Satterthwaite approximation to determine the effective degrees of freedom.

DF1, DF2, ..., DF10, DFS1, DFS2 cannot be specified in the MET/CAL initialization file.

Example:

```
TSET DF1 = 8
TSET DF3 = 100
```

In this example, the degrees of freedom for the (Type B) uncertainty of the reference is set to 8. (DF1 is associated with U1, and U1 is the uncertainty component derived from the reference instrument in the test.)

The degrees of freedom for the optional U3 uncertainty component is set to 100.

DF2 is not directly set, and so defaults to NMEAS - 1.

A DF1, DF2, ..., DF10, DFS1, DFS2 specification makes no contribution to the uncertainty calculation unless the corresponding uncertainty component and corresponding sensitivity coefficient are both non-zero.

Values for DF1, DF2, …, DF10 are saved in the V7 Results Table.

Values for DFS1 and DFS2 are not available in the Results Table, but are available in the MFILE (if the procedure enables the generation of that file).

Compatibility:

DFS1 and DFS2 require V7.01.

EXP_UNC

EXP_UNC is the expanded measurement uncertainty.

If measurement uncertainty is enabled, MET/CAL normally calculates the expanded uncertainty as:

EXP_UNC = STD_UNC * COV_FAC

where STD_UNC is the standard uncertainty and COV_FAC is the coverage factor.

However, it is possible to directly specify the expanded uncertainty in a procedure by using a VSET statement. This overrides the built-in calculation of expanded uncertainty.

Example:

```
VSET EXP_UNC = 0.01
```

Setting EXP_UNC directly is appropriate when MET/CAL's built-in measurement uncertainty calculation does not yield correct results for a particular test, and where the procedure writer has externally determined the uncertainty.

To reset the overriding of EXP_UNC, use the standard VSET reset convention:

```
VSET EXP_UNC = *
```

Directly specifying the value of the expanded uncertainty in this way removes any dependency on the measured values, number of measurements, UUT resolution, confidence value, and Student's T distribution, for those tests. The dependency is removed only for the expanded uncertainty, however, not for the standard uncertainty, which will still be calculated in the normal way, unless its calculation is also overridden using a VSET statement.

In general, in cases where the procedure writer has calculated the measurement uncertainty externally, it will usually make more sense to use VSET to override STD_UNC and, possibly, COV_FAC, and allow MET/CAL to continue to calculate the expanded uncertainty as:

EXP_UNC = STD_UNC * COV_FAC

F

F is a factor based on the Student's T distribution and the number of degrees of freedom.

Recall that the basic measurement uncertainty calculation is:

Standard Uncertainty = RSS(U1, U2, U3, ..., U10)

where

U2 = RSS(S1, S2)

and where

S1 = (SDEV / (NMEAS ^ 0.5)) * F

SDEV is the standard deviation of the measurements, NMEAS is the number of measurements, and S2 is based on the resolution of the UUT.

Unless overridden or disabled the value of F is determined per Table G.2 of Annex G of the document ANSI/NCSL Z540-2-1997. The values of F used by MET/CAL are exactly half the values shown in the 95.45% column of Table G.2.

Note that MET/CAL uses the simplifying assumption that the number of degrees of freedom is one less than the number of measurements (NMEAS). If this assumption is not acceptable, it may be possible for the metrologist / procedure writer to directly calculate F and override MET/CAL's built-in determination of F (see below).

Overriding F

There are two ways to override the value of F:

1. F can be specified in the "[startup]" section of the initialization file. Specifying F in this way is of limited use, however, because it applies to all measurement uncertainty calculations, regardless of the number of measurements, unless overridden at the procedure level in a VSET statement. (If you don't want to use the factor F at all in the measurement uncertainty calculation, see the section "Disabling F" below.)
2. F can be directly specified at the procedure level in a VSET statement. A VSET specification of F overrides the normal built-in calculation of F, and also overrides an initialization file specification, if any. It does not, however, enable the use of F if it is disabled.

Example:

```
VSET F = 1.5
```

Disabling F

Some metrologists believe that the calculation of S1 should be simply:

S1 = (SDEV / (NMEAS ^ 0.5)

To disable the use of F in the calculation of S1, set the USE_ST parameter to "no". This can be done at the database, workstation, or procedure level. See the description of USE_ST below.

GB

GB specifies the guardband method.

The following parameter values are supported:

DIRECT

The DIRECT method causes MET/CAL to tighten the specification limits by a specified factor. The factor is specified using the GBF parameter.

MU

MU is the measurement uncertainty method. The guardbanded test limits are determined by tightening the specification limits by an amount equal to the expanded measurement uncertainty.

The measurement uncertainty calculation must be enabled to use the MU guardband method.

The MU method may be modified by specifying a guardband factor. For example, if GBF is 0.8, the guardband limits will be determined by tightening the specification limits by 80% of the expanded measurement uncertainty.

NTUR

NTUR is a table-based guardband method in which the lookup parameter is the normalized test uncertainty ratio. The normalized test uncertainty ratio is calculated as:

normalized UUT spec / std uncertainty

The normalized UUT specification is determined by dividing the stated UUT specification by a confidence factor. The UCONF parameter is used to specify the confidence. (The default is 2.0).

OFF

OFF unconditionally disables guardbanding.

Specifying "VSET GB = OFF" is useful if you specify a default guardbanding method in the guardbanding initialization file or the the MET/CAL initialization file, and wish to selectively disable guardbanding for a particular procedure or for particular tests within a procedure.

Note

"OFF" is not supported in V7.10 and V7.11. You must have version V7.11b or later to use the "OFF" GB parameter value.

RDS

RDS is the root difference square guardband method.

The RDS method tightens the specification limits by:

sqrt(tol^2 - emu^2)

where "tol" is the UUT specification and "emu" is the expanded measurement uncertainty.

TSR

TSR is the test specification ratio method.

This is a table-based method where the lookup parameter is the TSR.

TSR is defined as:

(UUT spec) / (reference accuracy)

TUR

TUR is the test uncertainty ratio method.

This is a table-based method where the lookup parameter is the TUR.

This is the real TUR, not the TSR, which MET/CAL has traditionally called the "TUR".

TUR, for guardbanding, is defined as:

(UUT spec) / (EMU)

where EMU is the expanded measurement uncertainty.

Guardbanding is disabled by default.

Specifying:

VSET GB = *

disables the procedure-based guardbanding specification. The guardbanding method reverts to the MET/CAL initialization file specification, if any. In the absence of a MET/CAL initialization file specification the guarbanding method reverts to the guardbanding initialization file specification, if any. If the guardbanding method is specified neither in the MET/CAL initialization file nor in the guardbanding initialization file, a "VSET GB = *" specification causes guardbanding to be disabled (i.e., in this case "VSET GB = *" is the same as "VSET GB = OFF").

GBF

GBF specifies the guardband factor.

When the guardband method is DIRECT:

GBF species the factor by which to tighten the specification limits to produce the guardband limits.

GBF must be specified when the guardband method is DIRECT.

When the guardband method is MU:

GBF specifies a factor applied to the expanded measurement uncertainty prior to calculating the guardband limits from the specification limits. In other words the spec limits are tightened by:

EMU * GBF

where EMU is the expanded measurement uncertainty and GBF is the guardband factor.

When the guardband method is MU GBF defaults to 1.0.

GBF is not used when the guardband method is a method other than DIRECT or MU.

GB_INIT

GB_INIT specifies the name of the guardband initialization file.

The specified file may be placed on a network drive, allowing multiple workstations to share the same guardbanding parameters.

The MET/CAL intialization file overrides the guardband initialization file.

For example, if the guardband method, GB, is set to DIRECT in the guardband initialization file, but also set to MU in the MET/CAL intialization file, then the method will be MU for all procedures run on the workstation (assuming, of course, that the procedure does not directly specify a GB value using VSET or TSET statements).

GB_MODE

GB_MODE specifies the guardband table lookup mode.

GB_MODE applies only to table-based methods (TSR, TUR, NTUR).

The choices are:

STEP

Interpret the guardband table as a step function. If a lookup value falls between two rows of the table, use the row with the smaller lookup value.

INTERP

Linearly interpolate between rows of the guardband table when a lookup value falls between two rows.

GB_OVERFLOW

GB_OVERFLOW configures the handling of a guardbanding "overflow" condition when the guardbanding method is "MU".

An overflow condition occurs when the calculated uncertainty of the measurement exceeds the tolerance of the test.

Recall that when the method is MU the guardbanded test limits are determined by tightening the specification limits by an amount equal to the expanded measurement uncertainty.

Therefore, if the expanded measurement uncertainty exceeds the test tolerance it is not possible to tighten the test limits by the required amount. This is because a test cannot have a test tolerance less than zero.

There are two situations which, individually or in combination, may give rise to an overflow condition:

(a) If NMEAS is greater than 1 and the UUT values vary excessively the standard deviation will be large. A large standard deviation causes a large measurement uncertainty.

(b) If the reference is inadequate relative to the UUT, the reference accuracy may dominate the calculated measurement uncertainty. In this case the test is not metrologically sound. I.e., the Test Uncertainty Ratio is close to 1 (or even less than 1).

GB_OVERFLOW allows the procedure writer or system administator to configure how MET/CAL handles an overflow condition. There are 4 choices for the GB_OVERFLOW value:

LIMIT

When GB_OVERFLOW is set to LIMIT, an overflow condition causes MET/CAL to set the guardbanded test tolerance to zero. This prevents the test from passing outright, but allows Pass Indeterminate, Fail Indeterminate, and Fail as possible test results.

LIMIT_W

LIMIT_W is the same as LIMIT, except that a run time warning is generated to notify the operator that a guardbanding overflow condition has occurred.

DISABLE

When GB_OVERFLOW is set to DISABLE, MET/CAL handles an overflow condition by turning guardbanding off for the test.

DISABLE_W

DISABLE_W is the same as DISABLE, except that a run time warning is generated to notify the operator that a guardband overflow condition has occurred.

The default value of GB_OVERFLOW is LIMIT_W.

In addition to being specified in the procedure in a VSET or TSET statement, GB_OVERFLOW may also be specified in the MET/CAL initialization file or in the guardbanding initialization file.

When a guardbanding overflow condition occurs, MET/CAL annotates the guardbanding method name in the database Results Table by appending the overflow indicator "*". In other words, the method name in the Results Table will be "MU *" instead of "MU". Report writers may make use of the "*" annotation to flag test results which are doubtful due to a guardbanding overflow.

Compatibility: GB_OVERFLOW is not supported in V7.11 SP1 or prior versions. The first released version of MET/CAL which supports GB_OVERFLOW is V7.20.

GB_PTS

GB_PTS is used to control Post Test Summary window when guardbanding is enabled.

Procedures often include an:

ASK- F

specification. The effect of this is to cause the Post Test Summary window to be shown after each test with a FAIL result, but not after test with a PASS result. When guardbanding is enabled the situation is more complex. For a guardbanded test, the result is PASS, PASS INDETERMINATE, FAIL INDETERMINATE, or FAIL. GB_PTS allows the procedure writer to configure the operation of MET/CAL in this respect.

Legal values for GB_PTS are:

F

Specifying "F" configures MET/CAL so that the the Post Test Summary is shown only after a FAIL result. The Post Test Summary is not shown after a PASS, PASS INDETERMINATE, or FAIL INDETERMINATE result.

P

Specifying "P" configures MET/CAL so that the the Post Test Summary is suppressed after a PASS result. The Post Test Summary is shown after a FAIL, FAIL INDETERMINATE, or PASS INDETERMINATE result.

PF

Specifying "PF" configures MET/CAL to suppress the Post Test Summary after a PASS or PASS INDETERMINATE result, and to display the Post Test Summary after a FAIL or FAIL INDETERMINATE result.

RESULT

Specifying "RESULT" causes the GB_PTS parameter to take the same value as the GB_RESULT parameter.

The following table shows how the GB_PTS value and the test result determine whether or not the Post Test Summary is shown:

```
           Test Result
         | Pass | Pass Indeterm | Fail Indeterm | Fail |
  GB_PTS | ---- | ------------- | ------------- | ---- |
      F  |  No  |      No       |      No       |  Yes |
      P  |  No  |      Yes      |      Yes      |  Yes |
      PF |  No  |      No       |      Yes      |  Yes |
```

GB_PTS may be specified in the MET/CAL initialization file or in the guardbanding initialization file, as well as using VSET and/or TSET statements.

The default value for GB_PTS is RESULT.

Specifying:

VSET GB_PTS = *

causes the GB_PTS specification to be as it would be without any procedure specification of GB_PTS.

GB_PTS is not supported in MET/CAL V7.10 and V7.11. You must have V7.11b or later to use the GB_PTS parameter. In V7.10 and V7.11 the behavior of the software with regard to the Post Test Summary display after a guardbanded test is equivalent to a GB_PTS = P specification.

GB_PTS has no effect on tests to which guardbanding cannot be applied (e.g., EVAL tests, go / no go tests, and operator-terminated tests).

GB_PTS also has no effect if the ASK 'A' flag is used to configure the system to always display (ASK+ A), or never display (ASK- A), the Post Test Summary.

GB_RESULT

GB_RESULT specifies the guardband procedure result mode.

GB_RESULT allows the overall result determination method to be configured in cases where guardbanding produces one or more "indeterminate" results.

The choices are:

P

Specifying P causes MET/CAL to interpret indeterminate results as PASS results for purposes of determining the overall procedure result.

PF

Specifying PF causes MET/CAL to interpret pass indeterminate results as PASS results for purposes of determining the overall procedure result, and interpret fail indeterminate results as FAIL results for purposes of determining the overall procedure result. In otherwords, the overall result is determined just as if guardbanding was not enabled in the first place.

F

Specifying F causes MET/CAL to interpret indeterminate results as FAIL results for purposes of determining the overall procedure result.

The GB_RESULT default value is PF.

GB_TABLE

GB_TABLE specifies the name of the guardband table.

The guardband table is a simple text file containing two columns of numbers.

Column one specifies lookup parameter values.

Column two specifies guardband factor values.

Comment lines may be specified by preceding the line with a '#' or a ';' character.

The GB_MODE parameter controls whether MET/CAL interpolates between rows of the table.

If a lookup value is less than the value in the first row, the guardband factor from the first row is used.

If a lookup value is greater than the value in the last row, the guardband factor from the last row is used.

The table is used only for table-based methods: TSR, TUR, and NTUR.

Here's a very simple example:

```
#TSR GBF
 1.0 0.4
```

```
2.0 0.6
3.0 0.8
4.0 1.0
```

Suppose the guardband method is TSR and the guardband mode is STEP. If the TSR is less than 2, the guardband factor will be 0.4.

If the TSR is greater than or equal to 2, but less than 3, the guardband factor will be 0.6.

If the TSR is greater than or equal to 3, but less than 4, the guardband factor will be 0.8.

If the TSR is greater than or equal to 4, but less than 4, the guardband factor will be 1.0 (that is, in effect, no guardbanding).

The table above is just an example -- not a recommended guardband algorithm.

KCONF

KCONF specifies the confidence at which the expanded uncertainty is to be reported when Welch-Satterthwaite mode is enabled.

Legal values for KCONF are:

68.27%, 1s, 1sigma

90.00%

95.00%

95.45%, 2s, 2sigma

99.00%

99.73%, 3s, 3sigma

The values on each row in the table above are equivalent.

KCONF has no effect unless Welch-Satterthwaite mode is enabled, and the coverage factor (COV_FAC) is not directly specified in the procedure or in the initialization file.

In Welch-Satterthwaite mode MET/CAL determines the effective degrees of freedom (DF), and then looks up the coverage factor in a T-distribution table at the specified confidence (KCONF).

For example, for 6 degrees of freedom, with 95.45% (2 sigma) confidence, the coverage factor is 2.52.

The default value for KCONF is 2 sigma.

MATH_EPSILON

MATH_EPSILON specifies the epsilon factor used in MATH comparisons, which involve relational operators.

Any value between 1^{-15} and 1^{-5} legal.

The default value is 1^{-13}

As a special case, setting MATH_EPSILON to zero causes relational comparisons to be done using exact double-precision floating-point arithmetic.

The MATH_EPSILON parameter is not supported in V7.01 SP1 or earlier.

The epsilon factor affects numeric relational comparisons in the MATH FSC, as well as other FSCs which use the MATH expression parser (for example, IF, JMPL, WHILE…).

Refer to the MATH FSC help file for additional information. See the "Relational Operators and Floating-Point Comparisons" section.

MEAS

MEAS is a parameter, which can be set to "SA" or "UI".

The default is "UI" if MEAS is not specified.

MEAS affects the measurement uncertainty calculation when the evaluation step is a MEMC or MEMCX statement in which a numeric NOMINAL value is not specified. The problem which MEAS is designed to address is that for some MEMC or MEMCX evaluations it is not possible to determine from procedure information whether the UUT Indicated or the System Actual is the measurement. This ambiguity does not arise when a literal numeric value is specified in the MEMC NOMINAL field because, in that case, the UUT Indicated (NOMINAL) is a constant and the System Actual must be the measurement. Similarly, the ambiguity does not arise when a literal numeric value is specified in the MEMCX NOMINAL field because, in that case, the System Actual (NOMINAL) is a constant and the UUT Indicated must be the measurement. However, when there's no numeric MEMC or MEMCX NOMINAL, it can go either way. In the case where the standard is a meter, the System Actual is the measurement (i.e., the System Actual is the parameter which can vary each time through the measurement uncertainty loop), and the System Actual is therefore the parameter which must be averaged, and must be used to calculate the standard deviation of the measurements. On the other hand, if the standard is a source device, the system actual is the output (stimulus) of the source, and does not vary, so the measurement is the UUT Indicated value. These considerations apply both to manual procedures, as well as to procedures where the standard and/or UUT are remotely controlled using IEEE or PORT statements.

The MEAS parameter did not exist in V6.00. V6.01 or later is required to use the MEAS parameter.

Example:

```
VSET MEAS = SA
```

MEASURE_ONLY

MEASURE_ONLY is a parameter, which can be set to "Yes" or "No".

If MEASURE_ONLY is "Yes", MET/CAL meter drivers do not re-setup the meter on the 2nd and subsequent measurements of a sequence of measurements.

This can speed up execution of certain meter-based procedures when NMEAS is greater than 1.

It is up to the metrologist and/or procedure writer to determine whether the increased speed compromises the measurement uncertainty calculation. Re-setting up the meter prior to each measurement will, if nothing else, slow down the procedure and may slightly increase the chance of seeing significant deviations from one measurement to the next.

There are two ways to specify MEASURE_ONLY:

(1) Initialization File

MEASURE_ONLY can be specified in the "[startup]" section of the MET/CAL initialization file. Legal values are "yes" and "no".

The initialization file specification, if any, applies to all executions of MET/CAL meter drivers when NMEAS is greater than 1 and the current measurement is not the first measurement in a sequence of measurements, unless overridden at the procedure level in a VSET statement.

(2) VSET Statement

MEASURE_ONLY can be specified at the procedure level in a VSET statement.

Example:

```
VSET measure_only = yes
```

A VSET specification of MEASURE_ONLY overrides an initialization file specification, if any, and remains in effect for the duration of the procedure until changed or reset in a subsequent VSET statement.

MEASURE_ONLY defaults to "no".

MEMC_IRPT

MEMC_IRPT is a parameter, which can be set to "Yes" to "No". If MEMC_IRPT is "Yes", instrument SETUP and NOMSET statements in MEMC and MEMCX tests are, by default, repeated on the second and subsequent pass through the test for the measurement uncertainty calculation.

If MEMC_IRPT is "No", instrument SETUP and NOMSET statements in

MEMC and MEMCX tests are, by default, skipped on the second and subsequent pass through the test for the measurement uncertainty calculation.

MEMC_IRPT may be specified in the [Startup] section of the MET/CAL initialization file. A VSET specification of MEMC_IRPT overrides an initialization file specification.

If MEMC_IRPT is not specified in the initialization file or in the procedure, it defaults to "Yes".

A "TARGET" or "TARGET -m" statement in a MEMC or MEMCX test overrides a MEMC_IRPT specification. It is critical for a procedure writer to understand that a test which has the structure:

```
1.001  HEAD        Stimulus Instrument Setup Statement

1.002  IEEE        ...

1.003  MEME

1.004  MEMC        <Units w/o Numeric NOMINAL> ...
```

must, for measurement uncertainty to work properly re-execute the instrument setup statement prior to each measurement. Failure to meet this requirement, either by setting MEMC_IRPT to "No", or by inserting a "TARGET" or "TARGET -m" statement after X.001, causes the System Actual value to be incorrectly reported in the results.

(The underlying problem is that the MEME statement interchanges MEM and MEM1 each time through the measurement uncertainty loop. Because of this the instrument setup statement must be allowed to re-establish the System Actual in register MEM1 at the beginning of each loop execution.)

Compatibility: Requires V6.01 or later.

MFILE

MFILE, if set, specifies the name of the optional measurement uncertainty output file.

The measurement uncertainty output file contains intermediate data used in the measurement uncertainty calculation. The file may be useful for understanding, validating, or trouble-shooting the calculation.

There is a choice of formats for the output file. Refer to the description of the MFILE_FORMAT parameter below for an explanation of the file formats.

If the file name is a full path specification, the name is used as specified.

If the file name is a partial path specification, or a simple file name (base name + extension), the name is taken to be relative the user data directory, if any, specified in the MET/CAL initialization file. If no user data directory is specified, the name is used as specified, even if it is not a full path specification.

The user data directory can be specified using the "user_data_dir" parameter in the initialization file.

If the name of the output file is changed during a procedure run, the currently open output file, if any, is closed, and the new file is opened.

Output can be enabled for selected tests by specifying a value for MFILE before the first test for which output is to be generated, and then resetting MFILE ("VSET MFILE=*") after the last test for which output is to be generated.

If the specified output file already exists, measurement uncertainty data are appended to it. MET/CAL will never delete or clear a measurement uncertainty output file.

If the measurement uncertainty calculation is not enabled, no data are written to the output file.

The output file, if any, is automatically closed at the termination of procedure execution.

Example:

```
1.001  ASK+           K

1.002  VSET         NMEAS = 5

1.003  VSET         MFILE = meas.txt

1.004  5700         1.00V         1%                                    2W
```

MFILE may be specified in the MET/CAL initialization file, if desired. If MFILE is specified in the initialization file, measurement uncertainty data for all procedure executions, for which the measurement uncertainty calculation is enabled, are written to the specified file. In this case a VSET MFILE specification in a procedure can redirect the data to a different file, but cannot turn off the output. Executing a "VSET MFILE = *" statement will cause output to revert to the file specified in the initialization file.

Compatibility: Requires V6.10 or later.

MFILE_FORMAT

MFILE_FORMAT specifies the format of the measurement uncertainty output file.

There are four format choices:

1. DELIM
2. DELIM-Q
3. DELIM-STD
4. VERBOSE

The default is DELIM. However, a per-workstation default can be specified in the MET/CAL initialization file. If MFILE_FORMAT is specified in the initialization file, the specified value is used as the format unless overridden by a VSET specification at the procedure level.

DELIM Format

If MFILE_FORMAT is set to DELIM, the output file contains one line of separated data values for each test. Values, which are not set in the calculation, are left blank in the output file. The first line of the file contains column headers, which can be used to identify the data values.

The DELIM format is designed for importation into other programs (e.g., Microsoft Excel). It is not designed to be easy to read with a plain text editor. Columns will not necessarily line up from row to row, nor will they necessarily line up with the column headers.

In DELIM format the list separator and decimal separator are based on system locale settings.

In the United States the list separator will typically be a comma and the decimal separator will typically be a period.

In Europe the decimal separator will typically be a comma, so a comma is not a good choice for the list separator when DELIM format is used. A semi-colon might make a good list separator in this case.

DELIM-Q Format

DELIM-Q format is the same as DELIM format except that all value, including column headers, are surrounded by double quotes. When DELIM-Q is used, it may be possible to have the system locale list separator the same as the system local decimal separator. For example, the system could be configured so that the comma was used for both separators, and, in that case, programs like Microsoft Excel will still be able to read the file.

DELIM-STD Format

DELIM-STD format is the same as DELIM format except that the system locale settings are not used to determine the list separator and the decimal separator. In DELIM-STD format the list separator is always a comma and the decimal separator is always a period. I.e., DELIM-STD is identical to DELIM for a typical PC in the United States.

VERBOSE Format

If MFILE_FORMAT is set to VERBOSE, the output file contains one multi-line record for each test step. The format of each line is *name* = *value*, where *name* is the parameter name and *value* is the numeric data value. Values, which are not set in the calculation, are shown as "N/A" in the output file.

The system locale information is used to determine the decimal separator.

In all formats numeric values are shown with up to 10 significant digits.

In all formats the output file contains the following data items for each test:

Step Number

Welch-Satterthwaite Flag

Asset

Start Date

Start Time

UUT Indicated

System Actual

Expanded Uncertainty

Standard Uncertainty

Confidence

Coverage

F

System Accuracy

S1

S2

Standard Deviation

RSS

U1

U2

U3

U4

U5

U6

U7

U8

U9

U10

C1

C2

C3

C4

C5

C6

C7

C8

C9

C10

CS1

CS2

DF

DF1

DF2

DF3

DF4

DF5

DF6

DF7

DF8

DF9

DF10

DFS1

DFS2

UUT Resolution

NThrow

Number of Measurements

Value #1

Value #2

Value #*N* where *N* is the number of measurements.

In VERBOSE format, the output file also contains a timestamp for each record, as well as a blank line used to separate records.

The "Asset", "Start Date", and "Start Time" data items are available only in Run Time, not in Test Run. In Run Time, the "Start Date" format is YYYY-MM-DD and the "Start Time" format is HH:MM:SS.

Example:

```
1.001  ASK+            K

1.002  VSET          NMEAS = 5

1.003  VSET          MFILE = meas.txt

1.004  VSET          MFILE_FORMAT = VERBOSE

1.005  5700          1.00V          1%                                  2W
```

Compatibility: Requires V6.10 or later.

DF, DF1, …, DF10, C1, …, C10, and

Welch-Satterthwaite Flag require V7.00b or later.

DFS1, DFS2, CS1, and CS2 require V7.01 or later.

N5532A-504
N5532A-518
N5532A-526
N5532A-550

These parameters are used to set the frequency cross-over points for the Agilent N5532A sensor modules. The parameters are used in conjunction with the N5531 FSC.

Legal parameter values have the form:

lower bound - *upper bound*

where *lower bound* and *upper bound* are frequency values. The units specifier is a required part of the value specification.

Example:

VSET N5532A-504 = 100 kHz - 3 GHz

The bounds specified for any parameter must be within the physical limits of the sensor. The limits are:

N5532A-504: 100 kHz - 4.2 GHz

N5532A-518: 10 MHz - 18 GHz

N5532A-526: 30 MHz - 26.5 GHz

N5532A-550: 50 MHz - 50 GHz

The presence of one or more of these parameters in a procedure does not imply that the specified sensor is required by the procedure.

The purpose of these parameters is to allow a procedure writer, when writing an N5531S-based procedure, to specify the frequency at which to automatically switch from one sensor module to another, in accordance with UUT or measurement uncertainty requirements.

If the procedure specifies freuquency ranges for two or more of the N5532A sensors, it is ok if the ranges overlap.

However, if the workstation has configured two or more sensors for which the specified frequency ranges overlap, MET/CAL chooses the lower-numbered sensor to perform the test.

Example:

Suppose the workstation has an N5531S and 3 sensor modules: N5532A-504, N5532A-518, and N5532A-526.

Suppose the procedure requires frequencies from 100 MHz to 10 GHz and includes the VSET statements:

VSET N5532A-504 = 100 kHz - 3 GHz

VSET N5532A-518 = 3 GHz - 10 GHz

VSET N5532A-526 = 3 GHz - 10 GHz

When the frequency exceeds 3 GHz MET/CAL will automatically prompt the operator to disconnect the 504 and connect the 518. The procedure will make no use of the 526, because the 518 covers all required frequencies above 3 GHz.

These parameters may also be specified in the MET/CAL initialization file. A TSET specification overrides a VSET specification, and a VSET specification overrides an initialization file specification.

If no frequency range specification exists anywhere, MET/CAL uses the physical limits of the sensors to define the frequency cross-over points.

Example:

Suppose the workstation has an N5531S, an N5532A-504, and a N5532A-518. If no N5532A or N5532A-518 exists in the procedure or in the initialization file, all tests which require a sensor module between 100 kHz and 4.2 GHz will use the 504. Tests above 4.2 GHz will use the 518.

Specifications of these parameters in the initialization file may not specify overlapping frequency ranges. In this respect an initialization file specification is different from a VSET or TSET specification. The reason for the difference is that the initialization file specification is based on workstation requirements, whereas the procedure specification is based on UUT requirements.

Example:

Suppose the workstation has an N5531S, an N5532A-504, and a N5532A-518. If the system administrator decides that for all N5531S-based procedures which use the N5532A sensor modules, the system should switch from the 504 to the 518 for all tests above 3 GHz, the in that case it the initialization file should be modified to include:

N5532A-504 = 100 kHz - 3 GHz

N5532A-518 = 3 GHz - 18 GHz

The design of the N5531 FSC, and the N5532A sensor module VSET parameters, allows procedures to be written which do not hardware the requirement for a particular sensor for particular tests. To make use of this capability, N5531-based procedures must be written to use automatic connection messages, and must not use the N5531 FSC in a way which requires a specific sensor module.

Compatibility: Requires V7.20 or later.

See Also:

Refer to the N5531 FSC help file.

Refer to the VSET "SensorChange" parameter.

NMEAS

NMEAS specifies the number of measurements to take for the measurement uncertainty calculation.

Legal values for NMEAS range from 0 to 1000.

Setting NMEAS to zero disables the measurement uncertainty calculation.

The basic measurement uncertainty calculation is:

Standard Uncertainty = RSS(U1, U2, ..., U10)

where U2 is calculated as:

U2 = RSS(S1, S2)

and where S1 is calculated as:

S1 = (SDEV / (NMEAS ^ 0.5)) * F

In other words, S1 is based on the standard deviation of a series of measurements, where the number of measurements is specified using the NMEAS parameter.

Although it is legal to set NMEAS to 1, notice that this means that the standard deviation is, in effect, zero. This, in turn, means that U2 becomes just S2, and the entire 2^{nd} uncertainty component is then based only on the UUT resolution.

In general, it is therefore not a good idea to set NMEAS to 1.However; there may be some cases where it is acceptable to do so. One such case involves the pre-calculation of S1 or U2, which can then be directly specified at the procedure level.

A second case where setting NMEAS to 1 may be acceptable is when the accuracy of the standard is sufficiently greater than the resolution of the UUT so that any practical sequence of measurements is very likely to result in a standard deviation of zero (i.e., where all measurements are the same).

When NMEAS is set to a value greater than 1, MET/CAL automatically repeats each test step the specified number of times, unless the test step is incompatible with the measurement uncertainty calculation.

Incompatible test steps are:

1. EVAL, DOSE, and PICE

These are Go / No Go evaluations. There are no numerical measurements on which to base the uncertainty calculation.

2. Tests where ASK+ K Not Set

   When an instrument evaluation step is performed, MET/CAL supports three distinct measurement modes:

   (i) Keyboard Entry

   (ii) Slewing

   (iii) Go / No Go

   Only the first mode, keyboard entry, allows the measurement uncertainty calculation to be done.

   The second mode, slewing, is not compatible with the measurement uncertainty calculation because by slewing the calibrator until the UUT reading matches an expected value, one would produce a series of measurement (UUT readings) in which all values were the same. The standard deviation would therefore be zero, the calculated uncertainty would not be valid. A future version of MET/CAL may support slewing in the measurement uncertainty calculation by taking the standard deviation of the sequence of calibrator output values. In V6.0, however, this is not supported.

   The third mode, go / no go, is incompatible with measurement uncertainty for the same reason that the EVAL, DOSE, and PICE FSCs are. There is no sequence of numerical measurements on which to base the standard deviation calculation.

3. Tests where ASK+ U Not Set

   Although the Test Uncertainty Ratio (T.U.R.) calculation is not strictly dependent on the measurement uncertainty calculation, both calculations normally require that a MET/CAL accuracy file be accessed to determine the accuracy of the standard. Since, in the current implementation, clearing the ASK 'U' flag (ASK- U) disables access to accuracy files, it disables the measurement uncertainty calculation as well as the T.U.R. calculation.

   Note, however, than when ASK- U is in effect, the measurement will still be repeated the specified number of times, and the reported UUT Indicated value will be the average of the sequence of measurements. The measurement uncertainty will not calculated, however, and MU_STD$, MU_EXP$, and MU_COV$ will be blank.

As previously mentioned, when NMEAS is greater than 1, MET/CAL automatically repeats each test step the specified number of times, unless the test is incompatible with the measurement uncertainty calculation (see above). It is important to understand how MET/CAL determines which procedure statements to repeat when it automatically repeats a test step.

1. If the procedure test contains a blank "TARGET" statement, or a "TARGET -m" statement, the TARGET statement defines the sequence point for beginning the 2nd and subsequent repetitions of a test step.

   Refer to the on-line help for the TARGET FSC for more information.

2. If the statement is a source (stimulus) or sensor (meter) instrument evaluation step, and there's no applicable TARGET statement in the test, only the instrument evaluation statement is repeated.

   Example:

   ```
   1.001 DISP  Please connect A to B.
   ```

   ```
   1.002 5700  1V 1%
   ```

   In this example the test consists of two procedure statements, When the measurement is automatically repeated, only the 5700 statement will be executed

3. If the test step is a MEMC or MEMCX evaluation, and there's no applicable TARGET statement in the test, the repeat target is determined by scanning forward from the first statement of the test until one of the following statements is found:

   CALL

   IEEE

   IEEE2

   INSTR SENSOR SETUP or NOMSET

   JMP

   JMPF

   JMPL

   JMPT

   JMPZ

   MATH

   MEM*

   MEM+

   MEM-

MEM/

MEM2

MEMI

PORT

SCPI

This implies that the following statements are skipped over in the scan to find the repeat target for the measurement uncertainty calculation in a MEMC or MEMCX test:

ACC

ASK+

ASK-

CON

DISP

DRAW

HEAD

INSTR SRC SETUP or NOMSET

MESS

PIC

RNG

RSLT

SET

STD

TOL

The procedure writer must be aware of how MET/CAL automatically determines repeat targets for the measurement uncertainty calculation, and add "TARGET" or "TARGET -m" statements as needed if the automatic determination is not adequate for a particular test.

There are three ways to set NMEAS:

1. Database

   As shipped, the number of measurements is set to zero in the V6.0 database. This is also the case in the V6.1 database.) That is, the measurement uncertainty calculation is, by default, not enabled. To change the database specification choose "Uncertainty..." in the "Configure" menu of the Metrology Database Customization and Configuration application. A dialog will appear which allows the number of measurements to be specified. This value will apply to all workstations at your site, unless overridden at the workstation level by an initialization file specification or at the procedure level by a VSET specification.

2. Initialization File

   NMEAS may be specified in the "[startup]" section of the MET/CAL Initialization file. An initialization file specification overrides the database specification for all measurement uncertainty calculations on the workstation.

3. VSET Statement

   NMEAS may be set at the procedure level in a VSET statement.

   For example:

   ```
   VSET nmeas = 5
   ```

   A VSET specification of NMEAS overrides any initialization file and database specification, and remains in effect for the duration of procedure execution until overridden or reset in a subsequent VSET statement.

   Suppose, for example, it were necessary to disable the measurement uncertainty calculation for a particular test. This could be done by specifying:

   ```
   VSET nmeas = 0
   ```

   as the first statement of the test, and then specifying:

   ```
   VSET nmeas = *
   ```

   as the initial statement of the following test. (This example assumes linear procedure flow. The procedure writer and/or operator must not jump around the second VSET statement.)

NSD

NSD is used to specify the number of significant digits in the reported values of the expanded uncertainty (EXP_UNC), the standard uncertainty (STD_UNC), and the coverage factor (COV_FAC).

The number of significant digits may be specified at any time during procedure execution using the VSET FSC. When the number of significant digits is specified in a VSET statement, the specification remains in effect until it is changed or reset using a subsequent VSET statement.

The number of significant digits may also be specified on a per-workstation basis in the initialization file. To do this specify "nsd = *n*", where *n* is the number of significant digits, in the [startup] section of "metcal.ini".

Lastly, the number of significant digits may also be specified on a per-site basis in the database. To do this start the "Metrology Database Customization and Configuration" application and choose "Uncertainty..." in the top-level "Configure" menu.

A procedure specification of NSD overrides an initialization file specification or a database specification. An initialization file specification overrides a database specification.

The default is 6 significant digits if no NSD specification exists.

NSD allows the number of significant digits to be specified, but does not provide full formatting control of the uncertainty values. In V6.10 the measurement uncertainty values are always shown in base units, using scientific notation (E-format). The units are referenced to the NOMINAL units, but they are not shown with the uncertainty value.

For example, if the NOMINAL value is specified in mV, the uncertainty values are reported in volts (not millivolts), and the units are not shown.

Compatibility: Requires V6.10 or later.

NTHROW

NTHROW specifies the number of measurements to be discarded before the sequence of measurements to be saved and used in the measurement uncertainty calculation.

The NTHROW parameter setting has not effect if the measurement uncertainty calculation is not enabled. For example, a procedure includes:

```
VSET NMEAS = 0
VSET NTHROW = 1
```

Will ignore the NTHROW specification.

In V6.00 and V6.01 NTHROW affects only MET/CAL's meter drivers. Corresponding FSCs are: { 2000, 2001, 2002, 34401, 34420, 3458, 437, 45, 5335, 5790, 6666, 6680, 6681, 6685, 8505, 8506, 8560, 8566, 8568, 8590, 8842, 8901, 8902, 8903, 8920, HP60, HP63, and P700 }.

In V6.10 NTHROW applies to all evaluations.

Legal values for NTHROW are -1 to 100.

If NTHROW is -1, meter drivers are compatible with V5.1 and earlier. In some cases this means that the driver will take and discard some number of readings, possibly dependent on the value of the MOD3 field. Refer to on-line help for individual meter-type FSCs for details.

If NTHROW is 0, no readings are discarded.

There are two ways to specify NTHROW:

1. Initialization File

   NTHROW can be specified in the "[startup]" section of the MET/CAL initialization file.

   The initialization file specification, if any, applies to all executions of MET/CAL meter drivers, unless overridden at the procedure level in a VSET statement.

2. VSET Statement

   NTHROW can be specified at the procedure level in a VSET statement.

   Example:

   ```
   VSET nthrow = 3
   ```

   A VSET specification of NTHROW overrides an initialization file specification, if any, and remains in effect for the duration of the procedure until changed or reset in a subsequent VSET statement.

The default value of NTHROW is -1. That is, if NTHROW is not specified in the initialization file, and is not specified in the procedure in a VSET statement, the meter drivers run in "compatibility mode".

NTHROW does not directly affect the measurement uncertainty calculation. However, to the extent that it is necessary to discard one or more initial meter readings in order to get a reliable reading, NTHROW certainly can affect the sequence of readings, and thereby change the standard deviation and affect the calculated measurement uncertainty.

REMCON

REMCON controls the "Please Remove All Connections..." message which appears after the termination of a calibration procedure.

Legal values are "yes" and "no".

If REMCON is "yes", the "Please Remove All Connections..." message is displayed at the termination of procedure execution. If REMCON is "no" the message is not displayed.

There are two ways to specify REMCON:

1. Initialization File

   REMCON may be specified in the "[startup]" section of the MET/CAL initialization file. Legal values are "yes" and "no".

   The initialization file specification, if any, applies to all executions of ET/CAL procedures, unless overridden at the procedure level in a VSET statement.

2. VSET Statement

   REMCON can be specified at the procedure level in a VSET statement.

   Example:

   ```
   VSET remcon = no
   ```

   A VSET specification of REMCON overrides an initialization file specification, if any, and remains in effect for the duration of the procedure until changed or reset in a subsequent VSET statement.

REMCON defaults to "yes".

Compatibility: Requires V6.11g or later.

RSM

RSM (Result Save Mode) controls the method MET/CAL uses to save repeated test results.

Legal Values

Legal values are "All", "FirstLast", and "Last".

RSM = All

If RSM is "All" all executions of each test are saved in the database Results Table.

RSM = FirstLast

If RSM is "FirstLast" only the first and last executions of each test are saved in the database Results Table.

RSM = Last

If RSM is "Last" only the last execution of each test is saved in the database Results Table.

Parameter Specification

There are two ways to specify RSM:

1. Initialization File

    RSM may be specified in the "[Startup]" section of the MET/CAL initialization file.

    The initialization file specification, if any, applies to all executions of MET/CAL procedures, unless overridden at the procedure level in a VSET statement.

2. VSET or TSET Statement

    RSM may be specified at the procedure level in a VSET statement.

   A VSET specification of RSM overrides an initialization file specification, if any, and remains in effect for the duration of the procedure until changed or reset in a subsequent VSET statement.

Legacy Results

RSM has no effect on the "Cal Results" database table. In the "Cal Results" database table the first and last executions of each test are saved. This is compatible with MET/CAL V6 and prior.

Test Results

RSM has no effect on the "Test Results" window in Run Time or Test Run.

Default Value

The default value for RSM is "FirstLast". The default applies when neither the MET/CAL initialization file, nor the procedure, specifies a value for RSM.

Note that, by default, MET/CAL V7 is compatible with V6 and prior.

Recommended Usage

Although MET/CAL allows RSM to be specified at the procedure level (using a VSET statement), in general, the method for saving results should be established on a per-site or per-workstation basis.

MET/CAL V7.00 does not, however, support a per-site specification (for example, by allowing the mode to be specified in the database). Therefore, users who wish to change the default are advised to make the required change in the initialization file on each workstation.

Example

```
1.001 VSET RSM = All
1.002 5700 1.00V 0.01%
2.001 VSET RSM = FirstLast
2.002 5700 1.00V 0.01%
3.001 VSET RSM = Last
3.002 5700 1.00V 0.01%
```

The procedure fragment above contains 3 tests (evaluation steps): 1.002, 2.002, and 3.002.

Assume the operator executes each evaluation step 3 times. All 3 executions of 1.002 will be saved in the Results Table. For 2.002, 2 executions, the first and the last, will be saved. For 3.002, only the last execution will be saved.

Compatibility: Requires V7.00 or later.

S1

The basic measurement uncertainty calculation is:

Standard Uncertainty = RSS(U1, U2, ..., U10)

where U2 is calculated as:

U2 = RSS(S1, S2)

and where S1 is normally calculated as:

S1 = (SDEV / (NMEAS ^ 0.5)) * F

In other words, S1 is normally based on the standard deviation of a series of measurements, where the number of measurements is specified using the NMEAS parameter.

However, it is possible to use a VSET statement override the normal calculation of S1 at the procedure level and directly assign its value.

Example:

```
VSET S1 = 0.1
```

To reset the overriding of S1, use the standard VSET reset convention:

```
VSET S1 = *
```

If a VSET statement is used to override the value of S1 for one or more tests, this removes any dependency on the number of measurements in the measurement uncertainty calculation for those tests. The procedure writer should, in that case, set NMEAS to 1, unless it is specifically expected that the UUT Indicated value be reported as an average of values rather than as a single measurement.

S2

The basic measurement uncertainty calculation is:

Standard Uncertainty = RSS(U1, U2, ..., U10)

where U2 is calculated as:

U2 = RSS(S1, S2)

and where S2 is normally calculated as:

S2 = (UUT_RES * 0.5) / (3 ^ 0.5)

In other words, S2 is normally a function of the UUT resolution.

However, it is possible to use a VSET statement override the normal calculation of S2 at the procedure level and directly assign its value.

Example:

```
VSET S2 = 0.05
```

To reset the overriding of S2, use the standard VSET reset convention:

```
VSET S2 = *
```

If a VSET statement is used to override the value of S2 for one or more tests, this removes any dependency on the UUT resolution in the measurement uncertainty calculation for those tests.

SensorChange

The SensorChange parameter allows the procedure writer to prevent MET/CAL from automatically changing sensor modules.

SensorChange is used in conjunction with the N5531 FSC.

By default MET/CAL automatically prompts the operator to change sensor modules at the frequency cross-over points specified using the N5531A-504, N5531A-518, N5531A-526, and N5531A-550 parameters, or, in the absence of such a specification, at the frequency cross-over points defined by the physical limits of the Agilent N5531A-504, N5531A-518, N5531A-526, and N5531A-550 sensor modules.

Legal values for SensorChange are "Yes" and "No". The default, used when SensorChange is not specified, is "Yes".

Parameter values are interpretted as follows:

Yes

> Allow MET/CAL to automatically decide when to switch N5532A power sensors based on (a) configuration, (b) procedure frequency requirements, and (c) optional N5532A frequency bands specified in MET/CAL TSET statements, VSET statements, or the intialization file.

No

> Inhibit MET/CAL's automatic sensor changing algorithm. If a single, configured sensor module covers all frequencies specified in the procedure, use that sensor for the entire procedure.

The advantage of setting SensorChange to "No" is that it may reduce the number of connections, thus speeding up procedure execution. The potential disadvantage is that it may increase measurement uncertainties at certain frequencies. This trade-off must be evaluated by the procedure writer and/or metrologist.

SensorChange cannot be specified in the MET/CAL initialization file.

Compatibility: Requires V7.20 or later.

See Also:

> (a) VSET N5532A-504, N5531A-518, N5531A-526, N5531A-550
>
> (b) N5531 FSC Help File

SLEWSTART

SLEWSTART is used to specify the initially highlighted digit in the slew dialog when the dialog is invoked by a name/value instrument FSC which supports slewing.

The specified digit must be between -11 and 11. Zero is legal but has no effect.

A positive value highlights a digit to the right of the decimal point.

A negative value highlights a digit to the left of the decimal point.

Compatibility: SLEWSTART requires V7.20 or later.

In the V7.20 release the only FSC which uses the SLEWSTART parameter is "9640".

Example:

TSET SLEWSTART = 3

The TSET specification above causes the 9640 slew dialog to highlight the 3rd digit to the right of the decimal point.

The SLEWSTART VSET/TSET parameter should not be confused with the "SlewStart" MATH FSC function. (The "SlewStart" MATH FSC function is one of a group of MATH functions used to configure and invoke the MET/CAL slew dialog for use with a user-configured instrument.)

SRQDELAY

SRQDELAY is used to specify the delay, in milliseconds, to be used in MET/CAL's wait-for-SRQ retry loop.

The specified delay must be between 0 and 1000 milliseconds.

The delay affects both IEEE statements which use an SRQ construction and the built-in wait-for-SRQ operation used in the IEEE2 and SCPI FSCs.

The specified delay has no effect unless SRQRETRY is used to specify a maximum number of retries which is greater than zero. In other words, the delay specified by SRQDELAY takes effect only in situations where MET/CAL is waiting for an SRQ, an SRQ is detected, but the waited-for device does not acknowledge the the SRQ when it is serial polled. The reason SRQRETRY must be at least one in order for SRQDELAY to be meaningful, is that if MET/CAL has not been instructed to retry the serial poll, there's no point in delaying after the initial serial poll.

The default for SRQDELAY is 0 (zero). That is, by default there's no delay in the serial poll retry loop.

It's also possible to specify SRQDELAY in the MET/CAL initialization file.

See Also: SRQHOLDOFF and SRQRETRY.

Compatibility: SRQDELAY requires V7.11p or later.

SRQHOLDOFF

SRQHOLDOFF is used to specify the delay, in milliseconds, to be used prior to the initial serial poll in MET/CAL's wait-for-SRQ operation.

The specified delay must be between 0 and 1000 milliseconds.

The holdoff delay affects both IEEE statements which use an SRQ construction and the built-in wait-for-SRQ operation used in the IEEE2 and SCPI FSCs.

The default for SRQHOLDOFF is 0 (zero). That is, by default there's no initial delay in the wait-for-SRQ serial poll.

It's also possible to specify SRQHOLDOFF in the MET/CAL initialization file. Note, however, that the preferred method is to use VSET and/or TSET statements to specify SRQHOLDOFF on an as-needed basis. The vast majority of instruments do in fact acknowledge the service request when immediately serial polled after an SRQ has been detected. Therefore, specifying a non-zero value for SRQHOLDOFF in the MET/CAL initialization file would unnecessarily penalize all instruments. (Of course, if the delay is very small, it might not be noticed.)

See Also: SRQDELAY and SRQRETRY.

Compatibility: SRQHOLDOFF requires V7.11p or later.

SRQRETRY

SRQRETRY is used to specify the maximum number of serial poll retries in MET/CAL's wait-for-SRQ operation.

SRQRETRY affects both IEEE statements which use an SRQ construction and the built-in wait-for-SRQ operation used in the IEEE2 and SCPI FSCs.

The general approach used by MET/CAL when it waits for an SRQ is as follows:

(1) Wait (up to a specified timeout) for the system to detect an SRQ. Any SRQ terminates this operation.

(2) As soon as an SRQ has been detected, serial poll the the device from which the SRQ was expected. MET/CAL expects the device to respond, per the IEEE-488 standard, by returning a status byte in which the RQS bit is set.

Specifying an SRQRETRY value greater than zero instructs MET/CAL to retry step (2), as needed, up to SRQRETRY times.

SRQRETRY must be between 0 and 100.

The default value is zero.

Retrying is useful only in cases where a device is slow to acknowledge the SRQ. It is not useful, however, if any of the following conditions occur:

(a) An SRQ is detected from a device on a different IEEE-488 interface.

(b) The waited-for device is not IEEE-488 compliant. I.e., the device generates and SRQ, but never acknowledges it by setting the RQS bit in the status byte.

SRQRETRY may also be specified in the MET/CAL initialization file.

See Also: SRQDELAY and SRQHOLDOFF.

Compatibility: SRQRETRY requires V7.11p or later.

STD_UNC

The basic measurement uncertainty calculation is:

STD_UNC = RSS(U1, U2, ..., U10)

where STD_UNC is the standard uncertainty.

However, it is possible to use a VSET statement override the normal calculation of STD_UNC at the procedure level and directly assign its value.

Example:

```
VSET STD_UNC = 0.05
```

To reset the overriding of STD_UNC, use the standard VSET reset convention:

```
VSET STD_UNC = *
```

Overriding the normal calculation of STD_UNC is appropriate only where the procedure writer has externally determined the measurement uncertainty associated with a test.

Directly specifying the value of the standard uncertainty in this way removes any dependency on the measured values, number of measurements, UUT resolution, confidence value, and Student's T distribution, for those tests.

The only subsequent calculation performed using the specified standard uncertainty is:

EXP_UNC = STD_UNC * COV_FAC

where EXP_UNC is the Expanded Uncertainty, and

where COV_FAC is the Coverage Factor.

Refer to the descriptions of EXP_UNC and COV_FAC in this on-line help file for more information.

SYS_ACC

The basic measurement uncertainty calculation is:

Standard Uncertainty = RSS(U1, U2, ..., U10)

where U1 is the Normalized System Accuracy, calculated as:

SYS_ACC / CONF

where SYS_ACC is the system accuracy and

where CONF is the confidence.

System Accuracy is represented in absolute units (e.g., 0.1 V), and Confidence is expressed as a sigma value (e.g., 2.58 sigma).

Normally the System Accuracy is looked up in a MET/CAL accuracy file. The accuracy file used is typically selected automatically, based on the instrument (the calibration standard), and the calibration interval specified for the particular configured standard in use. (The ACCF FSC can be used to force the use of a particular accuracy file.)

However, it is possible to use a VSET statement override the normal determination of SYS_ACC at the procedure level and directly assign its value.

Example:

VSET SYS_ACC = 0.01

To reset the overriding of SYS_ACC, use the standard VSET reset convention:

VSET SYS_ACC = *

It is important to understand that using a VSET statement to override the determination of the system accuracy does not affect the T.U.R. calculation, which is still based on the accuracy file lookup.

An alternative approach, which can be used in closed-loop, MEMC or MEMCX-based tests, is to use the ACC FSC to directly specify the system accuracy in a way, which affects both the T.U.R. and the measurement uncertainty.

Using VSET to specify the System Accuracy is particularly useful in cases where MET/CAL's built-in accuracy file lookup is not adequate to determine the accuracy of a standard.

For example, counter accuracies typically cannot be represented as:

(percentage of NOMINAL) + floor

and therefore the standard accuracy file lookup does not work for these devices.

The procedure writer may wish to directly specify the system accuracy in these cases in order to allow the measurement uncertainty calculation to proceed.

TDESC

TDESC specifies the Test Description.

The default value of Test Description is a string constructed by appending MOD1 to the Cardinal Point of the test, with an intervening "at sign" ('@'). (That is, by default, Test Description is similar to the V6 Legacy Results variable FN$.)

The MOD1 part of Test Description is always taken from the evaluation statement of the test, never from a preceding instrument setup or ACC statement.

To override the default, Test Description may be directly specified using a VSET or TSET statement in a procedure.

Example:

```
TSET TDESC = 1.00 mV, 10 kHz, square
```

In V6 Legacy Results, FN$ would have the value "1.00mV @ 10kHz".

The specified Test Description is written to the V7 Results Table, where it is available for use in calibration reports.

TOL_REF

Legal values for TOL_REF are "UUT_INDICATED" and "NOMINAL". The default value (as MET/CAL is shipped) is "UUT_INDICATED".

TOL_REF is normally specified on a per-workstation basis in the MET/CAL initialization file.

However, it is possible to use a VSET statement to override the initialization file setting of TOL_REF.

Example:

```
VSET TOL_REF = NOMINAL
```

To reset the overriding of TOL_REF, use the standard VSET reset convention:

```
VSET TOL_REF = *
```

The TOL_REF parameter specifies the reference value for the calculation of the test tolerance.

The TOL_REF setting has no effect unless the TOLERANCE field specifies the test tolerance as a percentage or PPM value.

The following calculated quantities are affected by the TOL_REF setting:

1. Test Tolerance

    If TOL_REF is set to NOMINAL, the test tolerance is calculated with respect to the Nominal value.

    If TOL_REF is set to UUT_INDICATED, the test tolerance is calculated with respect to the UUT Indicated value.

    Example:

    Suppose you have a MET/CAL test like:

```
1.001  ASK+           K
1.002  5500          10V           1%                                   2W
```

Suppose also that the UUT (a meter) reads 10.1V.

If TOL_REF is NOMINAL the test tolerance is +/- 0.1V, because 0.1V is 1% of 10V.

If TOL_REF is UUT_INDICATED the test tolerance is +/- 0.101, because 0.101 is 1% of 10.1V.

2. Test Uncertainty Ratio (T.U.R.)

   The test tolerance is the numerator of the T.U.R., so changing the test tolerance calculation changes the T.U.R.

3. Error

   Except in some special cases (like dBm in the NOMINAL field), MET/CAL displays the error for a particular test as a percentage.

   If TOL_REF is UUT_INDICATED, the error is displayed as a percentage of the UUT Indicated value.

   If TOL_REF is NOMINAL, the error is displayed as a percentage of the Nominal value.

4. Error % Tol

   MET/CAL calculates the error for a test as the difference between the System Actual and the UUT Indicated. It then displays the error as a percentage of the test tolerance. Since the test tolerance is affected by the TOL_REF setting, as described above, the error expressed as a percentage of the test tolerance is also affected by TOL_REF.

It is important to remember that TOL_REF makes a difference only for tests where the UUT Indicated and Nominal values are different.

If the system instrument is a source instrument (like a 5700A or 5500A), and the UUT is a meter, TOL_REF makes a difference for keyboard-entry (ASK+ K) and closed-loop tests, but does not make a difference for tests where the actual output of the calibrator is slewed until the meter reading matches the Nominal value.

U1

The basic measurement uncertainty calculation is:

Standard Uncertainty = RSS(U1, U2, ..., U10)

where U1 is the Normalized System Accuracy, calculated as:

SYS_ACC / CONF

where SYS_ACC is the system accuracy and where CONF is the confidence.

However, it is possible to use a VSET statement to override the normal determination of U1 and directly assign its value.

Example:

```
VSET U1 = 0.03
```

To reset the overriding of U1, use the standard VSET reset convention:

```
VSET U1 = *
```

When U1 is directly specified in a VSET statement the calculated measurement uncertainty no longer depends on the System Accuracy or Confidence, both of which are usually based on accuracy file lookup.

U2

The basic measurement uncertainty calculation is:

Standard Uncertainty = RSS(U1, U2, ..., U10)

where U2 is calculated as:

U2 = RSS(S1, S2)

and where S1 is normally calculated as:

S1 = (SDEV / (NMEAS ^ 0.5)) * F

and where S2 is normally calculated as:

S2 = (UUT_RES * 0.5) / (3 ^ 0.5)

However, it is possible to use a VSET statement to override the normal determination of U2 and directly assign its value.

Example:

```
VSET U2 = 0.016
```

To reset the overriding of U2, use the standard VSET reset convention:

```
VSET U2 = *
```

When U2 is directly specified in a VSET statement the calculated measurement uncertainty no longer depends on the measured values, the number of measurements, the Student's T distribution, or the UUT resolution.

Directly specifying U2 is appropriate in cases where the procedure writer or metrologist has determined that MET/CAL should calculate measurement uncertainty using the usual RSS (root sum square) calculation, including the normalized system accuracy component, and, possibly, optional uncertainty components U3, U4, ..., U10, but where the usual (empirical) determination of uncertainty component U2 based on the standard deviation of the measured values and the resolution of the UUT (Unit Under Test) is incorrect or inappropriate.

U3, U4, U5, U6, U7, U8, U9, and U10

The basic measurement uncertainty calculation is:

STD_UNC = RSS(U1, U2, U3, ..., U10)

where STD_UNC is the Standard Uncertainty,

and where U3, U4, ..., U10 are optional uncertainty components which can be directly specified to augment the measurement uncertainty calculation.

U3, U4, ..., U10 can be directly specified using a VSET statement. The default value for each of these components is zero. Thus, in the absence of a VSET statement to assign non-zero values to one or more of these optional uncertainty components, they make no contribution to the RSS (root sum square) calculation, and therefore no contribution to the measurement uncertainty.

Recall also that the Expanded Uncertainty is calculated as:

EXP_UNC = STD_UNC * COV_FAC

Thus, a specification of U3, U4, ..., and/or U10 affects both the Standard Uncertainty (STD_UNC) and the Expanded Uncertainty (EXP_UNC).

Example:

```
VSET U3 = 0.1
```

To reset the VSET specification of an optional uncertainty component use, for example:

```
VSET U3 = *
```

It is up to the metrologist or procedure writer to decide when it is appropriate to assign values to the optional uncertainty components U1, U2, ..., U10. In general, these optional uncertainty components are intended for Type B uncertainties. These uncertainties are not directly based on the sequence of measured values, the accuracy of the main calibration standard, or the resolution of the UUT, because those uncertainty components are incorporated in U1 and U2, which are, typically, automatically calculated by MET/CAL. As stated in ANSI/NCSL Z540-2-1997, information used to determine Type B uncertainties includes:

- previous measurement data

- knowledge of relevant behavior and properties of

  materials and instruments

- manufacturer's specifications
- calibration certificates
- uncertainties assigned to reference data taken from handbooks

In practice, sources of additional, optional uncertainty components may include:

- test leads
- terminators
- attenuators
- power splitters
- thermocouples
- other signal conditioners
- environmental factors (temperature, humidity)

In some cases it may be appropriate to leave all optional uncertainty components unassigned (i.e., set to zero) For example, if you are using a Fluke 5720 to calibrate a Fluke 10 DMM, the resolution of the UUT may well dominate the measurement uncertainty calculation, and any uncertainty contribution from, say, test leads, will probably be negligible. On the other hand, if you are using, for example, an HP 3458A to measure a precision resistor, uncertainty due to test leads and temperature fluctuations in the lab may be important.

U2M

U2M specifies the method used to calculate the U2 uncertainty component.

Legal values are "RSS" and "SINGLE".

U2 is the uncertainty component, which directly expresses the uncertainty associated with the unit under test (UUT). There are two source of uncertainty which relate directly to the UUT.

First, there is the standard deviation of the measurements. The standard deviation is non-zero only if two or more measurements were taken, and not all measurements are the same.

MET/CAL uses the uncertainty sub-components S1 to express the uncertainty due to the standard deviation of the readings. Recall that:

S1 = (SDEV / (NMEAS ^ 0.5)) * F

The second uncertainty sub-component related to the UUT is the uncertainty associated with the resolution of the UU2. This is sub-component called S2. Recall that, by default:

S2 = (UUT_RES * 0.5) / (3 ^ 0.5)

Method 1: U2M = RSS

When the specified method is "RSS", U2 is calculated as:

U2 = RSS(S1, S2)

Method 2: U2M = SINGLE

When the specified method is "SINGLE", U2 is equal to either S1 or S2. If he standard deviation of the measurements is non-zero, U2 is set to S1. Otherwise, when the standard deviation is zero, U2 is set to S2.

In other words, when U2M is "SINGLE":

if (SDEV > 0)

U2 = S1

else

U2 = S2

MET/CAL V6 always used the "RSS" method, because the U2M parameter did not exist, and there was no option.

In MET/CAL V7, the procedure writer may specify either "RSS" or "SINGLE". The default is "RSS"

There are two ways to specify U2M:

1. Initialization File

   U2M may be specified in the "[startup]" section of the MET/CAL initialization file. Legal values are "RSS" and "SINGLE".

   The initialization file specification, if any, applies to all executions of MET/CAL procedures, unless overridden at the procedure level in a VSET or TSET statement.

2. VSET or TSET Statement

   U2M may be specified at the procedure level in a

   VSET or TSET statement.

Example:

```
VSET U2M = SINGLE
```

A VSET or TSET specification of U2M overrides an initialization file specification, if any.

A VSET specification remains in effect for the duration of the procedure until changed or reset in a subsequent VSET statement.

A TSET specification applies only to the current test. After the evaluation, the value of U2M reverts to the default or to the initialization file specification, if any.

USE_ST

The USE_ST parameter is used to enable or disable the use of the Student's T distribution to determine the factor F used in the measurement uncertainty calculation.

Legal values for USE_ST are "Yes" and "No".

The basic measurement uncertainty calculation is:

Standard Uncertainty = RSS(U1, U2, U3, ..., U10)

where

U2 = RSS(S1, S2)

and where

S1 = (SDEV / (NMEAS ^ 0.5)) * F

Recall that F is a factor based on the Student's T distribution and the number of degrees of freedom.

(In MET/CAL's uncertainty calculation the simplifying assumption is made that the number of degrees of freedom is one less than number of measurements.)

When USE_ST is set to "Yes", the factor F is determined, unless overridden or disabled, per Table G.2 of Annex G of the document ANSI/NCSL Z540-2-1997. The values of F used by MET/CAL are exactly half the values shown in the 95.45% column of Table G.2.

When USE_ST is set to "No", the factor F is set to 1.0, so the calculation of S1 becomes simply:

S1 = (SDEV / (NMEAS ^ 0.5))

By default (as distributed) MET/CAL V6.0 sets USE_ST to "No". In other words, the factor F is set to 1 and it is presumed that the Coverage Factor (COV_FAC), typically set to 2, and used to determine the Expanded Uncertainty based on the Standard Uncertainty, is sufficient to incorporate the confidence in the standard deviation of the measured values as a function of the number of measurements. When NMEAS is 10 or more, F is close to 1 in any case, and so this presumption would appear to be justified.

For small NMEAS values, on the other hand, the Student's T-based F value can be significant (for example, F is 6.985 when NMEAS is 2), and the decision as to whether it's appropriate to set F to 1 unconditionally or not has to be based on the judgement of the metrologist. Based on comments from various European and American sources, it was determined that the best approach for MET/CAL is to provide the option and allow each site to decide how to implement this aspect of the uncertainty calculation.

There are three ways to set USE_ST:

1. Database

    As shipped, USE_ST is set to "No" in the V6.0 database. That is, the use of the Student's T-based factor F in the uncertainty calculation is, by default, not enabled. To change the database specification choose "Uncertainty..." in the "Configure" menu of the Metrology Database Customization and Configuration application. A dialog will appear which allows the USE_ST parameter specified. This value will apply to all workstations at your site, unless overridden at the workstation level by an initialization file specification or at the procedure level by a VSET specification.

2. Initialization File

    USE_ST may be specified in the "[startup]" section of the MET/CAL initialization file. An initialization file specification overrides the database specification for all measurement uncertainty calculations on the workstation.

3. VSET Statement

    USE_ST may be set at the procedure level in a VSET statement.

    For example:

    ```
    VSET use_st = yes
    ```

    A VSET specification of USE_ST overrides any initialization file and database specification, and remains in effect for the duration of procedure execution until overridden or reset in a subsequent VSET statement.

    To reset a VSET specification of USE_ST specify:

    ```
    VSET use_st = *
    ```

UUT_RES

The basic measurement uncertainty calculation is:

Standard Uncertainty = RSS(U1, U2, ..., U10) where U2 is calculated as:

U2 = RSS(S1, S2)

and where S1 is normally calculated as:

S1 = (SDEV / (NMEAS ^ 0.5)) * F

and where S2 is normally calculated as:

S2 = (UUT_RES * 0.5) / (3 ^ 0.5)

Unless overridden, MET/CAL attempts to infer the UUT's resolution based on information in the procedure. (Actually, MET/CAL has always done this, but prior to V6.0 the inferred information was used only to control the formatting of certain result variables.) In V6.0, the resolution is needed to determine the measurement uncertainty.

If the automatically determined UUT resolution is incorrect or inadequate, the procedure writer can directly specify the UUT resolution in a VSET statement.

For example:

```
VSET UUT_RES = .0001
```

The UUT resolution is expressed in absolute units (Volts, Amps, etc.)

To reset the overriding of UUT_RES, use the standard VSET reset convention:

```
VSET UUT_RES = *
```

The following description explains how MET/CAL attempts to infer the UUT resolution based on procedure information. Procedure writers should attempt to understand what happens, because in some cases it may be necessary to override the automatic determination of the UUT resolution in order ensure correctness of the measurement uncertainty calculation.

1. If the test evaluation step is an instrument FSC statement:

(1.1) If the NOMINAL value is specified in the procedure statement:

The UUT resolution is based on the specified NOMINAL value.

(1.2) If the NOMINAL value is taken from MEM:

(2.2.1) If the test tolerance is specified in absolute units ('U') and there are 1 or more digits to the right of the decimal point:

The UUT resolution is based on the specified test tolerance.

(2.2.2) If the test tolerance is not specified in absolute units ('U') or there no digits to the right of the decimal point:

An attempt is made to guess the UUT resolution based on the NOMINAL value. The algorithm involves formatting the NOMINAL value with up to 10 significant digits, and then counting the number of digits to the right of the decimal point.

(2. If the test evaluation step is a MEMC statement:

(1.1) If the MEMC statement specifies a literal numeric value in the NOMINAL field, the UUT resolution is based on the number of digits to the right of the decimal point in the MEMC NOMINAL value.

(1.1) Otherwise, if the test contains a prior ACC statement, and T.U.R. checking is enabled, and there's a literal numeric value in the ACC NOMINAL field, the UUT resolution is based on the number of digits to the right of the decimal point in the ACC NOMINAL value.

(1.1) Otherwise, if the test contains a prior instrument setup statement, and .U.R. checking is enabled, and there's a literal numeric value in the NOMINAL field of the setup statement, the UUT resolution is based on the number of digits to the right of the decimal point in the setup statement's NOMINAL value.

(1.1) Otherwise, if the MEMC TOLERANCE field specifies a tolerance in absolute units ('U'), and there are one or more digits to the right of the decimal point, the UUT resolution is based on the number of digits to the right of the decimal point in the tolerance field specification.

(1.1) Otherwise, an attempt is made to guess the resolution of the UUT based on the NOMINAL value. The algorithm involves formatting the NOMINAL value with up to 10 significant digits, and then counting the number of digits to the right of the decimal point.

In this case the NOMINAL value is determined as follows:

(2.5.1) If there's a prior ACC statement in the test and T.U.R. checking is enabled, use the ACC NOMINAL value.

(2.5.2) Otherwise, if there's a prior instrument setup statement in the test, and T.U.R. checking is enabled, use the setup NOMINAL value.

(2.5.3) Otherwise, use the system actual value, which, since the current statement is a MEMC statement, is just the value in memory register MEM at the time of the MEMC statement's execution.

WS

WS is a flag parameter used to enable or disable the Welch-Satterthwaite mode for the measurement uncertainty calculation.

Legal values for WS are "Yes", "No, "1", and "0". "Yes" is equivalent to "1", and "No" is equivalent to "0".

When enabled, the Welch-Satterthwaite formula is used to approximate the effective degrees of freedom. The effective degrees of freedom, together with a specified confidence (KCONF), is then used to determine the coverage factor. The coverage factor is looked up in a t-distribution table.

The t-distribution table used in MET/CAL is taken from "Guidelines on the Evaluation and Expression of Measurement Uncertainty", SAC-SINGLAS TECHNICAL GUIDE 1, 2nd Edition, March 2001.

If the calculated value for the effective degrees of freedom is not in the t-distribution table, MET/CAL linearly interpolates the t-distribution value at the specified output confidence.

If the effective degrees of freedom value is greater than 100, but not infinity, the value for 100 is used.

When Welch-Satterthwaite mode is enabled, the coverage factor used to calculate expanded uncertainty from standard uncertainty is based on the t-distribution table referred to above, unless overridden at the procedure or initialization file level by a direct specification of COV_FAC. Note that the database specification of the coverage factor is ignored when WS is set to "Yes" (or "1").

For a detailed explanation of the Welch-Satterthwaite formula, refer to page 15 of SAC-SINGLAS TECHNICAL GUIDE 1, 2nd Edition.

You may also wish to refer to:
http://www.itl.nist.gov/div898/handbook/mpc/section5/mpc571.htm for information on the Welch-Satterthwaite formula.

USE_ST, which controls whether or not the t-distribution-based factor F should be used to calculate S1, should be set to "No" (the default) when Welch-Satterthwaite mode is enabled.

UNITS

1. All VSET Specifications are in Base Units

   Many of the quantities, which can be specified in a VSET statement, refer to quantities with physical units (voltage, current, frequency, etc.) A VSET specification of a dimensioned quantity is always taken to be a base units specification, with the units determined by reference to a corresponding instrument setup or evaluation statement.

   Example:

```
1.001  VSET        U3 = 0.001
```

```
1.002   5700          10mV           0.1%                            2W
```

In this example, the optional uncertainty component, U3, is set to 0.001V. Note that U3 is not 0.001mV, even though the NOMINAL field in the 5700 statement specifies mV.

2. dBm Specifications are Linearized

   For tests where the UUT indicates a value specified in dBm, or where the standard is programmed or specified in dBm, MET/CAL linearizes all dBm values by converting to RMS Volts before calculating the uncertainty.

   All VSET specifications, which apply to dBm tests, must be in Vrms.

   Example:

```
1.001   VSET          NMEAS = 5

1.002   VSET          U3 = 0.0025

1.003   5700          10D            0.1%          10kH              2W
```

   The 5 dBm measurements are converted to Vrms before the mean and standard deviation are calculated.

   The optional uncertainty component, U3, is taken to be a Vrms specification, even though the units of the evaluation quantity are dBm ("D").

   For dBm tests, the reported average value and reported uncertainty are converted back to dBm, but the internal calculations are done in terms of RMS voltage.

MEASUREMENT UNCERTAINTY HINTS

To enable the measurement uncertainty calculation in V6.0, the following requirement must be satisfied:

1. Number of Measurements

   The number of measurements must be set to a number greater than or equal to 1.

   Normally this parameter is set in the database. However, it can be specified in an individual procedure. For example:

      VSET nmeas = 5

2. ASK+ K

   Measurement uncertainty is not calculated unless the ASK 'K' flag is set.

   Note that most closed-loop procedures, as shipped, do not specify ASK+ K. This is true even if those procedures make no use of slewing mode.

3. Reporting Measurement Uncertainty

V7 Results

The V7 Results Table includes many measurement uncertainty-related values:

Degrees of Freedom

Degrees of Freedom 1, 2, ..., 10

Expanded Uncertainty

Number of Measurements

Nthrow

Sensitivity 1, 2, ..., 10

Standard Deviation

Standard Uncertainty

Student's T Factor

Student's T Flag

System Accuracy

System Coverage Factor

S1

S2

Uncertainty Component 1, 2, ..., 10

Welch-Satterthwaite Flag

In addition, the MET/CAL V7 database includes an auxiliary table containing the raw measurement values.

For example, if NMEAS is 10, there are 10 individual measurements which make up the reported average measurement, and which are used to determine the standard deviation. The 10 measurements are stored in the auxiliary table, keyed by row number to the corresponding line in the Results Table.

V6 Legacy Results

In V6 Legacy Results, the measurement uncertainty variables, which can be written to results, are:

MU_STD$ - standard uncertainty

MU_EXP$ - expanded uncertainty

MU_COV$ - coverage factor

To write one or more of these quantities to the formatted result line (C2501) you must modify the "rslt_db.frm" (default name) format file. For example, TU$ (the T.U.R.) could be replaced by "MU_EXP$". This would also require a change to the column header in the Crystal Reports report file.

The standard uncertainty is also shown in the Post Test dialog when that dialog appears.

The measurement uncertainty is not shown in the Test Results window.

4. Using the MEMC FSC

Measurement uncertainty can be calculated for tests, which perform MEMC evaluations, however:

(a) If the MEMC test contains a MEME statement to swap the values of register MEM and MEM1, do not place a "TARGET" or "TARGET -m" statement after the statements which set up the standard. Otherwise, incorrect values of System Actual and/or UUT Indicated will be reported, and the calculated measurement uncertainty will be incorrect.

(b) For some MEMC tests it is necessary to tell the system which quantity is the measurement quantity. This is done by specifying "MEAS = SA" or "MEAS = UI". Refer to the description of the VSET MEAS parameter for additional information. Remember that VSET parameter values persist for the duration of procedure execution until changed or reset. For this reason, it may be better to use TSET to specify MEAS.

USING THE DATRON 4950

In most respects the Datron 4950 functions like any other supported system instrument. However, since the 4950 is designed to internally take a sequence of measurements and return to the user the mean of the measurements and the standard error, MET/CAL handles the 4950 as a special case. When the number of measurements (NMEAS) is set to 1, and when the 4950 is in a mode in which the sample size is greater than 1, MET/CAL uses the standard error calculated by the 4950 as the basis for the determination of the standard deviation.

The calculation is:

Standard Deviation = Standard Error * (N ^ 0.5)

where N is the sample size.

Note that this operation is different from the normal operation when NMEAS is 1. Normally, when NMEAS is 1, no standard deviation is determined, which causes S1 to be zero, which in turn causes U2 to be based only on the UUT's resolution.

It remains possible, even with the Datron 4950, for the procedure writer to override the default calculation. For example, if the procedure includes a VSET statement which directly specifies the value of S1, MET/CAL will no longer use the Standard Error calculated by the 4950, even if NMEAS is set to 1 and the 4950 sample size is greater than 1.

Setting NMEAS to any value greater than 1 disables the built-in use of the standard error calculated by the 4950. For example, suppose NMEAS is 5 and the 4950 is in high accuracy DCI mode. The sample size is 32, and the 4950 calculates the standard error, but MET/CAL will make no use of the calculated standard error in the measurement uncertainty calculation. Rather, in this case, MET/CAL will simply calculate the standard deviation of 5 readings (each of which is really based on 32 internal readings).

If the 4950 is used in a mode in which the sample size is 1 (for example, low accuracy ACV), the procedure writer should set the number of measurements to a value greater than 1 in order to include in the measurement uncertainty calculation the standard deviation of a sequence of measurements.

For additional information refer to the "Sample Size and Resolution" table on page 6-17 of the "Wavetek Model 4950 Multifunction Transfer Standard Instrument User's Handbook" (December 1998).

WAIT

Miscellaneous FSC

Description

The WAIT FSC is used to specify a programmed delay.

The WAIT statement may be used to display a pop-up window which includes a procedure specified message and a count-down timer showing hours, minutes, and seconds.

The WAIT statement may also be used to generate a pop-up window which remains displayed for a specified number of milliseconds.

Format

The WAIT statement has the following forms:

WAIT -a -t *time message*

WAIT -t *time message*

WAIT *message*[D *delay*]

WAIT [D *delay*]

where:

time is a count-down time in the form HH:MM:SS,

delay is a delay time in milliseconds, and

message is a text message which appears in a pop-up window.

Rules

- If the WAIT statement includes a "-t" argument, the "-t" must be followed by a count-down time specification in the form HH:MM:SS.

  Example 1:

  WAIT -t 1:10:30 Please Standby...

  A window containing the message "Please Standby..." will appear with a count-down timer starting at 1 hour, 10 minutes, and 30 seconds.

- The hours and minutes fields are optional in an HH:MM:SS time specification.

  Example 2:

  WAIT -t 10:30 Please Standby...

  The count-down time will begin at 0 hours, 10 minutes, and 30 seconds.

  Example 3:

  WAIT -t 45 Please Standby...

  The count-down time will begin at 0 hours, 0 minutes, and 45 seconds.

- If the WAIT statement includes a "-a" argument, the pop-up window includes an "Advance" button. During procedure execution, when the operator chooses "Advance" in the WAIT window, the count-down delay terminates immediately and the procedure continues with the next procedure statement. This is not an error condition.

  Example 4:

  WAIT -a -t 5:00 Please Standby...

- The WAIT statement may contain at most one "-t" specification and at most one "-a" specification. The "-t" and "-a" arguments may appear in any order, but both must precede the message portion of the statement, if any.
- Spaces after the "-t" argument and before the HH:MM:SS time specification are optional.
- The WAIT statement may include special constructions. The constructions may appear in the HH:MM:SS time specification, or in the message text specification.

  Legal constructions are:

  [D*delay*]

  [MEM]

  [MEM1]

  [MEM2]

  [M*N*]

  [S*N*]

  [SREG*N*]

  [V*variable*]

  [*N*]

When special constructions are used in the HH:MM:SS time specification, the result of evaluating the constructions must produce a valid HH:MM:SS time value.

The [D*delay*] construction may be used only when the WAIT statement does not specify the count-down time using the "-t" argument.

Example 5:

MATH MEM2 = "15:20"

WAIT -t [MEM2] Please Standby...

Example 6:

MATH MEM2 = "Please Standby"

WAIT -t 15:20 [MEM2]

- If the WAIT statement does not contain a "-t" argument, text specified in the WAIT statement appears in a pop-up window, but the window does not include a count-down time display.

  When used in this mode, the WAIT statement must include a delay special construction to control the duration of the delay.

  In addition, since the statement is evaluated left to right, if the statement includes text for a pop-up window, the delay construction must appear after the message text in the procedure statement.

  When no "-t" argument is specified, "-a" should not be used, because pressing "Advance" will not terminate the evaluation of the

  [D*delay*] construction which controls the duration of the pop-up window.

  Example 7:

  WAIT Please Standby...[D500]

  The message "Please Standby" will be displayed in a pop-up window for 500 milliseconds.

  Example 8:

  WAIT [D250]

  A 250 millisecond delay occurs when the statement is executed. There's no pop-up window, because no message is specified.

- Two-line messages are possible as shown in the following example:

Example 9:

```
MATH S[1] = "Please standby while\n"
MATH S[2] = "the instrument warms up."
MATH S[3] = S[1] & S[2]
WAIT -a -t 10:11:12 [S3]
```

This method should not be used to construct pop-up messages which contain more than two lines, because the WAIT FSC window is not automatically sized and cannot accommodate more than two text lines.

WHILE, ENDW, DO, UNTIL

Procedure Control FSCs

Description

The WHILE, ENDW, DO, and UNTIL FSCs are used to loop over a specified block of procedure statements until a specified condition is true.

Format

WHILE	[*expression*]
ENDW	[*comment*]
DO	[*comment*]
UNTIL	[*expression*]

Rules

- The expression in a WHILE or UNTIL statement may be any valid math expression, as defined by the MATH FSC. Note that the expression cannot be an assignment. That is, WHILE and UNTIL cannot be used to change the value of a register. The rule is that anything valid on the right-hand side of an assignment in a MATH statement is also valid as a expression (space permitting).
- A WHILE statement must always be paired with a following ENDW statement.
- A DO statement must always be paired with a following UNTIL statement.
- When an WHILE statement executes, if the expression evaluates to a non-zero value, control transfers to the following statement. If the expression evaluates to zero, control transfers to the associated ENDW statement.
- When an ENDW statement executes, control transfers to the following statement if the previous evaluation of the WHILE expression resulted in zero. Otherwise, control transfers back to the associated WHILE statement.
- When a DO statement executes control transfers to the following statement.

- When an UNTIL statement executes, if the expression evaluates to a non-zero value, control transfers to the associated DO statement. Otherwise, control transfers to the statement following the UNTIL statement.
- ENDW and DO statements may be followed by optional comments on the same line. The comment must be preceded by a valid comment symbol ('#' or ';').
- The expression in a WHILE or UNTIL statement is evaluated as a numeric expression. If the specified expression produces a string value, the string is converted to numeric form for purposes of the WHILE or UNTIL statement. In general, this is not recommended, because it usually makes the procedure less readable.
- Proper program structure should be maintained. Jumping directly into or out of a WHILE ... ENDW procedure block, or a DO ... UNTIL procedure block, is not recommended. (It is not illegal to do so, however. If a procedures jumps into such a block, execution continues as if the preceding part of the block were not present.)
- If is very important for procedure writers to recognize that in general one should not write a procedure which loops over one or more evaluation steps.

  Such loops are legal programming constructs, but usually will not generate the expected results, because MET/CAL involves all executions of an evaluation step (as identified by the step number) as repetitions of the same test.

Examples

Example 1:

```
1.001  MATH     MEM = 10
1.002  WHILE    (MEM > 0)
1.003  HEAD     [MEM][D1000]
1.004  MATH     MEM = MEM - 1
1.005  ENDW
```

This procedure fragment will execute the loop 10 times while it counts down the value of MEM.

Example 2:

```
1.001  MATH     MEM = 0
```

1.002	DO	
1.003	HEAD	[MEM][D1000]
1.004	MATH	MEM = MEM + 1
1.005	UNTIL	(MEM == 10)

This procedure fragment will execute the loop 10 times while it counts up the value of MEM.

Appendix A
How to Access MET/SUPPORT™

Introduction

Fluke Metrology Software is supported by a highly skilled and conscientious team of professionals who are available to answer questions, help solve unique problems, and assist in troubleshooting in the event you run into difficulties.

Telephone Support

Free telephone support is available, but only to registered users of Fluke software. Be sure to register your software as soon as possible so you can make use of this service should the need arise.

Within the United States, toll free telephone support is available from 8:00 AM to 4:30 PM, Pacific Standard Time at **1-800-825-7411.**

To call Fluke from anywhere in the world, call **1-425-446-5500.**

Mail, E-mail, and FAX

You may also contact us by mail, E-mail, and FAX.

FLUKE Corporation		**E-mail**	metsupport@fluke.com
PO Box 9090		**FAX**	1-425-446-5992
Everett, WA 98206-9090			
Attention: MET/SUPPORT, M/S 275G			

Before Calling Technical Support

You may be able to discover the answer for yourself, so take the following steps before calling for support:

- Check the manual
- Check the on-line help
- Check the FLUKE World Wide Web site at www.fluke.com

Please Have the Following Information Available

If you do find it necessary to call for assistance, take a few moments to jot down some information. If this information is readily available, the support person can more quickly get to the exact details of the difficulty you are having, and will be able to resolve the issue more efficiently.

- Product name, applicable licenses, version and serial numbers
- Manual title, part number and version
- Operating system and version
- Network information if applicable
- List of steps necessary to recreate the problem
- Version of *Crystal Reports*

International Support

For more information on international MET/SUPPORT™, please contact the Fluke office nearest you or your local representative.

	TELEPHONE	FAX
Fluke US	+1-800-825-7411	+1-425-446-5992
Fluke Canada	+1-905-890-7600	+1-905-890-6866
Fluke China	+86-10-6 512-3435	+86-10-6-516-3437
Fluke Japan	+81-3-3434-0181	+81-3-3434-0170
Fluke Singapore	+65-276-5161	+65-276-5759
Fluke UK	+44-1603-256600	+44-1603-256688
All other locations	+1-425-446-6476	+1-425-446-5992

Web Support

Fluke provides a web site exclusively for the Metrology Software user. This site provides the most current phone numbers, downloadable procedures, reports, application notes, and other pertinent information. To access this support site:

1. Enter http://support.fluke.com/register in your browser's URL address input box.
2. Enter **met-support** in the "**Name of the Site where you want to go:**" box.
3. Click **Register.**
4. Complete the registration questionnaire.

Approval of your registration should be complete within one or two days. You will receive an email notice of your Web/Support user name, password and the Web/Support site address.