

Hybrid 2000
AC/DC/IR/DCR Analyzer
Instruction Manual
Form 150827/A5

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Domestic Sales 800-253-1230

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WARNING

Potentially dangerous voltages may be present on front and rear panel terminals. Follow all warnings in this manual when operating or servicing this instrument. Dangerous levels of energy may be stored in capacitive devices tested by this unit. Always make sure the high voltage indicator is **not** on when connecting or disconnecting the device under test.

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Warranty



QuadTech warrants that Products are free from defects in material and workmanship and, when properly used, will perform in accordance with QuadTech's applicable published specifications. If within one (1) year after original shipment it is found not to meet this standard, it will be repaired, or at the option of QuadTech, replaced at no charge when returned to a QuadTech service facility.

Changes in the Product not approved by QuadTech shall void this warranty.

QuadTech shall not be liable for any indirect, special or consequential damages, even if notice has been given of the possibility of such damages.

This warranty is in lieu of all other warranties, expressed or implied, including, but not limited to any implied warranty or merchantability of fitness for a particular purpose.

SERVICE POLICY

QuadTech's service policy is to maintain product repair capability for a period of at least five (5) years after original shipment and to make this capability available at the then prevailing schedule of charges.

Specifications

AC Dielectric Withstand Voltage (WVAC)

AC Output Voltage:	Range:	0.05 to 5kV AC, in 1V steps
	Regulation:	\pm (1% of setting +5V)
	Frequency:	50/60Hz selectable
Voltage Display:	Accuracy:	\pm (1% of reading +5V)
	Resolution:	1V steps
AC Current Display:	Total & Real current	
	Range:	0.001mA to 30mA AC, in 1 μ A steps
	Accuracy:	\pm (1% of reading + 5 counts) (Total)
	Accuracy:	\pm (5% of reading + 20 counts) (Real)

DC Dielectric Withstand Voltage (WVDC)

DC Output Voltage:	Range:	0.05 to 6kV DC, in 1V steps
Voltage Display:	Accuracy:	\pm (1% of reading +5V)
	Resolution:	1V steps
DC Current Display:	Range:	0.0001mA to 10mA DC
	3 Ranges:	.0001mA - .2999mA, 0.3mA-2.999mA, 3mA-10mA
	Accuracy:	\pm (1% of reading + 5 counts)

Insulation Resistance (IR)

Insulation Resistance:	Voltage:	50 - 5000V DC in 1V steps
	Accuracy:	\pm (1.5% of reading + 5V)
	Range:	1M Ω - 50G Ω (voltage dependent)
	Accuracy:	

>1000V:

- 1M Ω ~1G Ω : \pm (3% of reading + 0.1% of full scale)
- 1G Ω ~10G Ω : \pm (7% of reading + 2% of full scale)
- 10G Ω ~50G Ω : \pm (10% of reading + 1% of full scale)

\geq 500V and \leq 1000:

- 0.1M Ω ~1G Ω : \pm (3% of reading + 0.1% of full scale)
- 1G Ω ~10G Ω : \pm (7% of reading + 2% of full scale)
- 10G Ω ~50G Ω : \pm (10% of reading + 1% of full scale)

< 500V:

- 0.1M Ω ~1G Ω : \pm [3% of reading + (0.2 x 500V /Vs)% of full scale]

Full Scale based on Measurement range:

Range	IR Display	
	When voltage set to 50V~499V	When voltage set to 500V~5000V
10mA(2.7~10mA)	0.1M Ω ~2.4M Ω	0.1M Ω ~7.7M Ω
3mA (0.27~3mA)	0.1M Ω ~7.7M Ω	0.1M Ω ~24.5M Ω
300uA(27~300uA)	0.1M Ω ~24.5M Ω	0.1M Ω ~49.9M Ω

		50MΩ~245MΩ
30uA(2.7~30uA)	0.1MΩ~49.9MΩ 50MΩ~245MΩ	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~2.45GΩ
3uA(0.27~3uA)	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~2.45GΩ	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~4.99GΩ 5.0GΩ~49.9GΩ
300nA(27~300nA)	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~2.45GΩ	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~4.99GΩ 5.0GΩ~49.9GΩ 50GΩ~245GΩ
30nA(1~30nA)	-----	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~4.99GΩ 5.0GΩ~49.9GΩ 50GΩ~500GΩ

DC Resistance (DCR)

DC Resistance: Range: 10mΩ - 500kΩ
Accuracy:

2 Terminals measure		
Range	Test range	Measurement Accuracy
1Ω	010.0mΩ~1.000Ω	± (2% of reading + 0.5% of range)
10Ω	0.010Ω~10.00Ω	
100Ω	9.00Ω~100.0Ω	
1kΩ	90.0Ω~1.000kΩ	
10kΩ	0.900kΩ~10.00kΩ	
100kΩ	9.00kΩ~100.0kΩ	
4 Terminals measure		
Range	Test range	Measurement Accuracy
1Ω	010.0mΩ~1.000Ω	± (0.5% of reading + 0.5% of range)
10Ω	0.900Ω~10.00Ω	± (0.5% of reading + 0.05% of range)
100Ω	9.00Ω~100.0Ω	
1kΩ	90.0Ω~1.000kΩ	
10kΩ	0.900kΩ~10.00kΩ	
100kΩ	9.00kΩ~100.0kΩ	

Temperature Compensation:

Temperature Measurement Range	Temperature Measurement Accuracy (without PT100 temperature probe)	Temperature Compensation Accuracy (with the accuracy of resistance measurement)
-10.0 °C to 39.9°C (-14.0 to 103.8°F)	±0.3% of reading ±0.5°C (0.9°F)	±0.3%
40.0 to 99.9°C (104 to 211.8°F)	±0.3% of reading ±1.0°C (1.8°F)	±0.6%

Note: It is necessary to add the probe error (PT100 temperature probe is < ±0.5°C in typical) when measuring temperature.

Open/Short Check (OSC)

Open/Short:

Detection mode to verify proper connection of DUT

Voltage: < 100V

Frequency: 600Hz

Open: programmable: 10% - 100%, default: 50%

Short: programmable: 100% - 500%, default: 300%

Specifications (Continued)

General Features

ARC Detection:	Detection Current: Range: 0.1mA – 15mA AC and 10mA DC Pulse Width: Minimum: 10µs
Ground Fault Interrupt (GFI):	Instrument Shutdown when current imbalance > 0.5mA
Fast Output Cutoff:	HV output voltage terminated <0.4mS after NG (Fail) result
Fast Discharge:	<0.2s (Typical) Discharge of DUT upon termination of HV.
Time:	Ramp: 0.1sec – 999 sec, OFF Dwell: 0.1sec – 999 sec, OFF (DC only) Test*: 0.3sec – 999 sec, Continuous Fall: 0.1sec – 999 sec, OFF <i>*Test Time ≤ 60seconds when the voltage and high current limit is > 100VA AC and 40VA DC</i>
Limits:	HI/LO programmable during Test Time LO can be set to OFF during Hipot Test HI can be set to OFF during IR Test
Indication:	Pass/fail LEDs, audible alarm
Setup Storage:	50 Memory Locations, 20 Steps each
Interlock:	Safety Mechanism Terminal Strip
Standard Interfaces:	RS232, 9-pin male D-Series
Scanner:	8 Channel HV Internal Scanner, Front Panel access
Connectors:	Front Panel Connection HV OUTPUT: Custom Banana Sockets (8) RTN/LOW: Banana Socket (1)
Front Panel Lockout:	11 Digit Password with or without setup recall LED Display: LOCK
Display:	240x300 LCD with status LEDs: LOCK, ERR, RMT, CORR View as single step or list of all programmed steps in a test setup.

Specifications (Continued)

General Features

Mechanical:	Bench Mount Dimensions: (w x h x d): 17 x 6.8 x 17.7 inches; 430 x 175 x 450 mm	
Weight:	44 lbs (20 kg) net, 50 lbs (22 kg) shipping	
Environmental:	Operating: 0°C to + 40°C Humidity: <70% RH Storage: -10°C to + 60°C Warm-up Time: 15 minutes	
Power:	<ul style="list-style-type: none">• 90 - 130V AC• 200 - 250V AC	<ul style="list-style-type: none">• 50 or 60Hz• 500W max
Supplied:	<ul style="list-style-type: none">• Instruction Manual• Calibration Certificate	<ul style="list-style-type: none">• Power Cable• Test Leads
Ordering Information:	<u>Description</u> AC/DC/IR/DCR Analyzer	<u>Catalog No.</u> Hybrid 2000

Accessories

Accessories Included

Item	Quantity	QuadTech P/N
AC Power Cord	1	4200-0300
Power Line Fuse 5A 250V SB	1	520068
Power Line Fuse 2.5A 250V SB	1	520134
High Voltage Lead Set, 1m with alligator clips	1	S02
Ground Continuity Lead	1	700100
HV Lead Set (8), Banana to non-terminated ends	1	G40
Instruction Manual	1	150827
Calibration Certificate	1	N/A

Accessories/Options Available

Item	Quantity	QuadTech P/N
High Voltage Lead Set, high & low, 1m (std. with unit)	1	S02
Corded Product Adaptor, 115V	1	S03
High Voltage Lead Set, high & low, 2m	1	S04
Foot Switch	1	S05
High Voltage Probe	1	S06
Power Entry Adaptor Cable	1	S07
Gun Probe	1	S08
High Voltage Lead, 1m, un-terminated	1	S09
High Voltage Lead, 2m, un-terminated	1	S10
Gun Probe with Remote Start	1	S11
Load Box, resistive	1	S12
Load Box, custom resistors	1	S14
Pass/Fail Load Box	1	S14-01
Load Box, Power Entry Adapter, Pass/Fail	1	S14-03
Ground Continuity Lead (standard with unit)	1	700100
International Power Strip	1	G16
Corded Product Adaptor, 240V	1	G25
HV Lead Set (8) with clips (G1030S)	1	G40
RS-232 Cable (9-pin male to female), 10' length	1	630157

Safety Precautions

WARNING

The Hybrid 2000 Analyzer can provide an output voltage as high as 6000V DC (5000V AC) to the external device under test (DUT). Although the Hybrid unit is designed with full attention to operator safety, serious hazards could occur if the instrument is used improperly and these safety instructions are not followed.

1. The Hybrid 2000 unit is designed to be operated with its chassis connected to earth ground. The instrument is shipped with a three-prong power cord to provide this connection to ground. This power cord should only be plugged in to a receptacle that provides earth ground. Serious injury can result if the Hybrid 2000 is not connected to earth ground.
2. Tightly connect cable(s) to the (blue) **RTN/LOW** terminal. If this is not done, the DUT's casing can be charged to the high voltage test level and serious injury or electrical shock hazards could result if the DUT is touched.
3. Never touch the metal of the High Voltage probe directly. Touch only the insulated parts of the lead(s).
4. Never touch the test leads, test fixture or DUT in any manner (this includes insulation on all wires and clips) when the high voltage is applied and the red **DANGER** light is ON.
5. Before turning on the Hybrid unit, make sure there is no device (DUT) or fixture connected to the test leads.
6. After each test, press the **[STOP]** (red) button for safety if there is any concern that HV may still be applied to the output terminals.
7. When the red **DANGER** LED is lit or flashing, NEVER touch the device under test, the lead wires or the output terminals.
8. Before touching the test lead wires or output terminals make sure:
 - a) The red **[STOP]** button has been pressed
 - b) The red **DANGER** LED is OFF.
9. **In the case of an emergency**, turn OFF the POWER switch using a "hot stick" and disconnect the AC power cord from the wall. **DO NOT TOUCH THE Hybrid 2000 INSTRUMENT.**
Position the equipment so it is easy to disconnect. Always disconnect by means of the power plug or power connector.
10. If the **DANGER** LED does not go OFF when the **[STOP]** button is pressed, immediately stop using the tester. It is possible that the output voltage is still being delivered regardless of the TEST ON/OFF control signal.
11. When the Hybrid 2000 instrument is used in remote control mode, be extremely careful. The High Voltage Output is being turned on and off with an external signal.

While Under Remote Control: The operator or service personnel must NOT touch the device under test, the test leads or the test probes in any manner when the instrument is under test. Caution must be used to ensure that the unintentional access to the rear panel remote start control (via gun probe, foot switch or other means) cannot occur.

Safety Symbols

The product is marked with the following safety symbols.



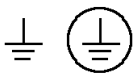
Product will be marked with this symbol (ISO#3864) when it is necessary for the user to refer to the instruction manual in order to prevent injury or equipment damage.



Product marked with this symbol (IEC417) indicates presence of direct current.



Product will be marked with this symbol (ISO#3864) when voltages in excess of 1000V are present.



Indicates the grounding protect terminal, which is used to prevent electric shock from the leakage on chassis. The ground terminal must connect to earth before using the product.

Warning Procedure can cause hazard to human if the warning is neglected.

Caution Avoid product misuse. It may cause damage to the product itself and the DUT if the caution is neglected.

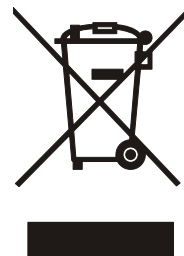
Note Important information or tips for the procedures and applications.

Warning Signal During Testing

“DANGER – HIGH VOLTAGE TEST IN PROGRESS, UNAUTHORIZED PERSONS KEEP AWAY”

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal.



Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr ⁶⁺	PBB	PBDE
PCBA	×	O	O	O	O	O
CHASSIS	×	O	O	O	O	O
ACCESSORY	×	O	O	O	O	O
PACKAGE	O	O	O	O	O	O
<p>“O” indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.</p> <p>“×” indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.</p> <ol style="list-style-type: none"> 1. QuadTech is not fully transitioning to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant. 2. The environment-friendly usage period of the product is assumed under the operating environment specified in each product’s specification. 						

Condensed Operating Instructions

WARNING

High Voltage is applied to the white HV Output Terminal anytime the red **DANGER** LED is ON or flashing. Always make sure the **DANGER** LED is OFF when connecting or disconnecting the device under test (DUT).

General Information

The Hybrid 2000 AC/DC/IR/DCR Analyzer is a measuring instrument for direct readout of dielectric withstand voltage and leakage current; insulation resistance and DC resistance. The voltage applied to the device under test is adjustable from 50V – 5kV AC and 50V to 6kV DC. The trip current limit is programmable from 1uA to 30mA AC and from 0.1uA to 10mA DC (range dependent). The output voltage for Insulation Resistance tests is 50V to 5000V DC over a measurement range of 1M Ω to 50G Ω . DC Resistance (DCR) is measurable from 50m Ω to 100k Ω . The Open/Short Circuit (OS) detection mode verifies the proper connection of the DUT by comparing the test reading to a standard capacitance value, Cs.

Start-Up

The Hybrid 2000 unit can be operated from a power source between 90 and 250VAC at a power line frequency of 50 or 60Hz. The standard Hybrid 2000 unit is shipped from QuadTech with a 5A fuse in place for AC 90-130V operation. (A 2.5A fuse is included for 200-250V operation). The Hybrid 2000 unit is shipped with the line voltage selector set for 120V. Refer to paragraph 1.4.3 for instructions on changing the fuse or line voltage selector.

Connect the Hybrid 2000 unit AC power cord to the source of proper voltage. Operate the Hybrid 2000 instrument with its chassis connected to earth ground. The Hybrid 2000 instrument is shipped with a three-prong power cord to provide this connection to ground. This power cord should only be plugged into a receptacle that provides earth ground. Serious injury may result if the Hybrid 2000 instrument is not connected to earth ground.

Press the [POWER] button on the front panel to apply power. To switch the power off, press the [POWER] button again or if measurements are to be made proceed with the Test Parameter Setup in Table COI-1. The Hybrid 2000 instrument should warm up for 15 minutes prior to use.

NOTE

Please read this instruction manual in its entirety before operating this instrument. These condensed operating instructions are not a substitute for all the information provided in the remainder of this manual.

NOTE

Refer to paragraphs 2.3 through 2.11 for a full description of programming test parameters and instruction on how to store the test setup. Test parameters must be set before the Hybrid 2000 instrument can be zeroed.

Condensed Operating Instructions (Continued)

There are several menus within the Hybrid 2000 instrument. Familiarize yourself with these menus prior to programming a test. Figure COI-1 illustrates the STAND BY display and lists the functions that can be accessed by pressing the [F1] through [F4] keys.

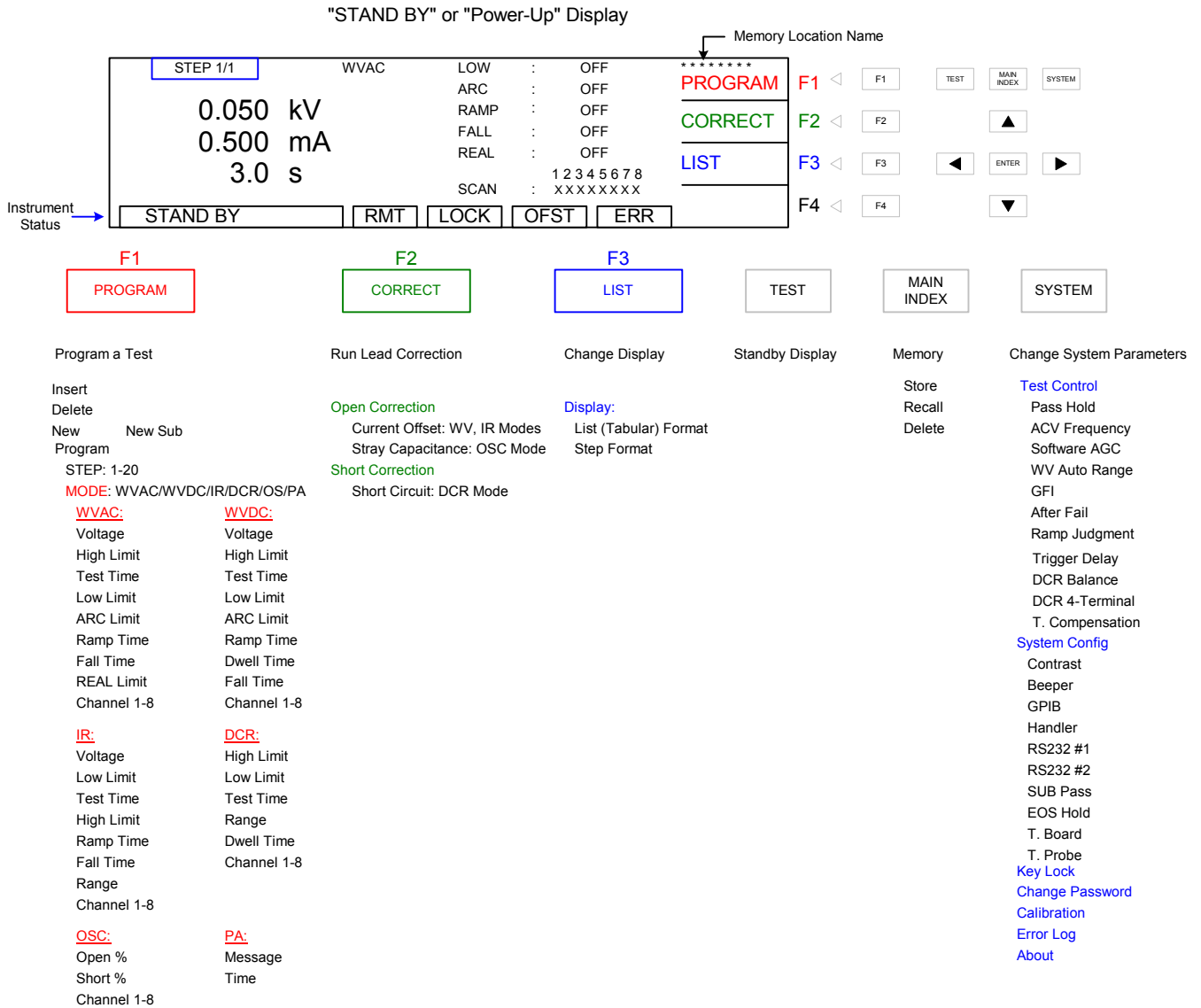


Figure COI-1: Hybrid 2000 Menus

Condensed Operating Instructions (Continued)

With the Hybrid 2000 instrument in “STAND BY” (or power-up display) status, follow the steps in Table COI-1 to program an OSC, WVAC, WVDC, IR and/or DCR test. A pause (PA) can be inserted between tests.

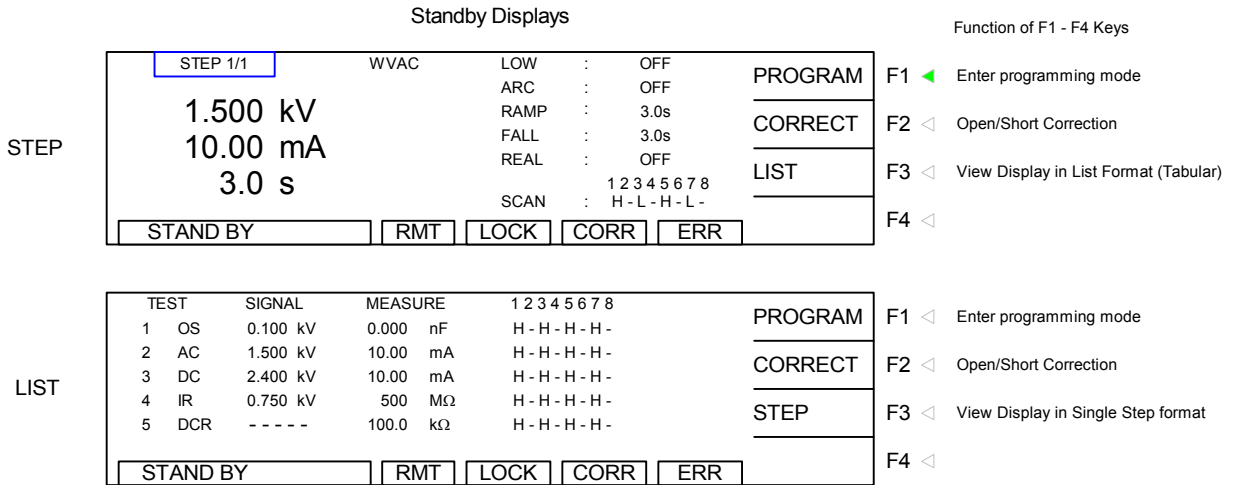


Figure COI-2: STAND BY Displays: STEP and LIST

Table COI-1: Test Parameter Setup

	OSC	AC Hipot	DC Hipot	IR	DCR	PA
1	Test Step	Test Step	Test Step	Test Step	Test Step	Test Step
	1-20	1-20	1-20	1-20	1-20	1-20
2	Test Mode	Test Mode	Test Mode	Test Mode	Test Mode	Test Mode
	OSC	WVAC	WVDC	IR	DCR	PA
3	Open Check	Voltage	Voltage	Voltage	High Limit	Message
	10-100%	0.05-5kV	0.05-6kV	0.05-5kV	0.01Ω-500kΩ	15 characters
4	Short Check	High Limit	High Limit	Low Limit	Low Limit	Time
	0, 100-500%	0.001-30mA	0.0001-10mA	1-50000MΩ	0.01Ω-500kΩ	0, 0.1-999s
5	Output CH	Test Time	Test Time	Test Time	Test Time	
	1-8: H, L, -	0, 0.3-999s	0, 0.3-999s	0, 0.3-999s	0, 0.1-999s	
6		Low Limit	Low Limit	High Limit	Range	
		0 - High	0 - High	0, Low-50GΩ	A, 1, 10, 100, 1k, 10k, 100k	
7		Arc Limit	Arc Limit	Ramp Time	Dwell Time	
		1-15mA	1-10mA	0-999s	0, 0.1-999s	
8		Ramp Time	Ramp Time	Fall Time	Output CH	
		0-999s	0-999s	0-999s	1-8: H, L, -	
9		Fall Time	Dwell Time	Range	DCR 4W	
		0-999s	0-999s	A, 30nA, 300nA, 3uA, 30uA, 300uA,	High Limit	

				,3mA, 10mA		
10		Real Current	Fall Time	Output CH	0.01 – 500kΩ	
		0 - High	0-999s	1-8: H, L, -	Low Limit	
11		Output CH	Output CH		0.01 – 500kΩ	
		1-8: H, L, -	1-8: H, L, -		Output CH 1,3,5,7: H, L, -	

Condensed Operating Instructions (Continued)

Offset Correction

After setting your test parameters, zero the Hybrid 2000 instrument by using the automatic offset correction. With no device connected, connect the appropriate cable (or other fixture) into the front panel output connectors. Refer to paragraph 2.15 cable connections based on test to be performed. Test leads for WVAC, WVDC and OSC should be open.

Prior to performing the Offset Correction:

- Allow the instrument to warm up for 15 minutes
- Connect the test cables (fixture) to the front panel output (CH_) and/or RTN/LOW connectors
- Program the test steps

With the instrument in STAND BY status:

- Press [F2] = CORRECT
- Press [F1] = OPEN
- Follow instructions on display: i.e.: Remove DUT from test fixture
- Press green [START] button
- Wait while instrument gets correction value
- The CORR block at the bottom of the display is now highlighted (back lit)
- Press [F4] = ABORT to return to STAND BY status

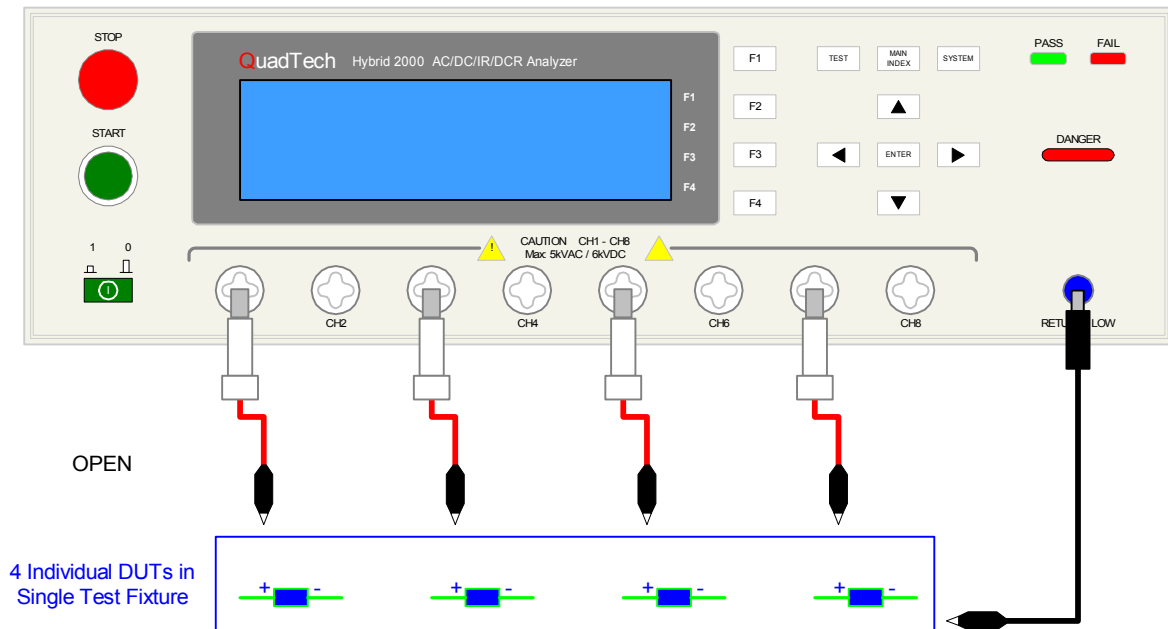


Figure COI-3: Offset Correction OPEN Configuration

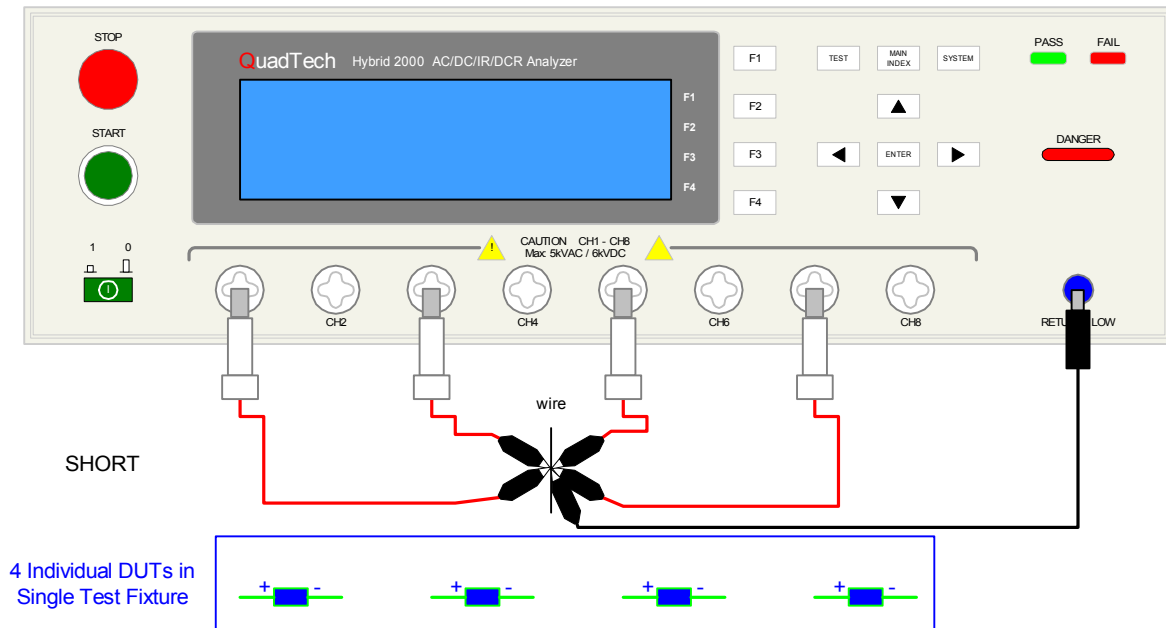
Condensed Operating Instructions (Continued)

NOTE:

To obtain consistent results, the Offset Correction must be performed when using OSC mode. The Offset Correction is performed prior to the Get Cs function.

For DCR Mode run the Short correction:

- Press [F2] = CORRECT
- Press [F2] = SHORT CIRCUIT
- Follow instructions on display: i.e.: Place Short Circuit Kit
- Press green [START] button
- Wait while instrument gets correction value
- The CORR block at the bottom of the display is now highlighted (back lit)
- Press [F4] = ABORT to return to STAND BY status



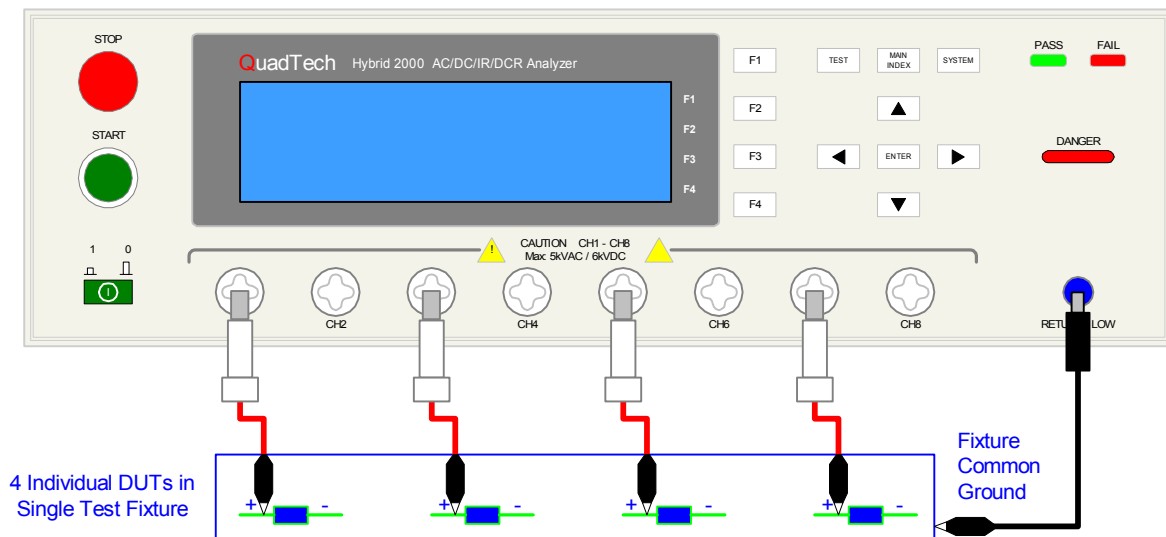
For OSC Mode run the Get Cs correction:

- Press [F2] = CORRECT
- Press [F3] = SAMPLE TEST
- Follow instructions on display: i.e.: Get C Nominal (OSC); Place Sample DUT
- Press green [START] button
- Wait while instrument gets correction value
- The CORR block at the bottom of the display is now highlighted (back lit)
- Press [F4] = ABORT to return to STAND BY status

Condensed Operating Instructions (Continued)

Connection to Device under Test (DUT)

Figure COI-4 illustrates the connection of the Hybrid 2000 unit to four DUTs in a test fixture using the lead set that comes standard with the instrument. The custom white banana plug/red alligator clip is connected between the output terminal (CH_) on the Hybrid 2000 unit and the high side of the device under test. The black banana plug/alligator clip is connected between the RTN/LOW terminal on the Hybrid 2000 unit to the low side of the DUT.



COI-4: Connection to Device under Test

Measurement Mode

1. Turn [POWER] ON. Allow Hybrid 2000 instrument a 15-minute warm up time.
2. Connect Black ground cable to Hybrid 2000 unit RTN/LOW terminal
3. Connect White/red HV cable to Hybrid 2000 unit HV output terminal(s) = CH_.
4. Press [F1] = PROGRAM and enter test parameters. When finished programming, press [TEST] to return to Stand By status.
5. Press [F2] = CORRECT to access Correction function. Press [F1] = OPEN CIRCUIT. Follow instructions. Press [F2] = SHORT CIRCUIT. Follow instructions. When Offset is complete, press [F4] = EXIT to go to Stand By.
6. Press [F2] = CORRECT to access GET Cs function. Press [F3] = SAMPLE TEST. Follow Get Cs instructions. When Get Cs is done press [F4] = EXIT to go to Stand By.
7. Connect device under test (DUT) to test leads.
8. Press [START].
9. Record measurement.
10. Press [STOP].

Section 1: Introduction

1.1 Unpacking and Inspection

Inspect the shipping carton before opening. If damaged, contact the carrier agent immediately. Inspect the Hybrid 2000 instrument for any damage. If the instrument appears damaged or fails to meet specifications notify QuadTech (refer to instruction manual front cover) or its local representative. Retain the original shipping carton and packing material for future use such as returning the instrument for recalibration or service.

1.2 Product Overview

The Hybrid 2000 provides AC Dielectric Withstand, DC Dielectric Withstand, Insulation Resistance and DC Resistance testing capability. The dielectric withstand test can be programmed over a voltage range of 0.05 to 5kV AC and 0.05 to 6kV DC with a min/max leakage current detection range of 0.001 to 30mA AC and 0.0001 to 10mA DC. Insulation resistance measurements are possible to 50G Ω at programmable DC test voltages between 50 and 5000V. DC Resistance (DCR) is measurable from 50m Ω to 500k Ω in two-wire mode and 10m Ω to 500k Ω in four wire mode. An option for Temperature Compensation is available for customers making temperature sensitive measurements. The Hybrid 2000 also provides open/short circuit detection mode to ensure proper connection of the DUT and pause mode for adding a hold time between tests. The Hybrid 2000 instrument has automatic offset correction to zero out stray capacitance and resistance of the test leads/fixture.

The Hybrid 2000 incorporates multiple safety features including GFI, fast HV output cutoff and quick DUT discharge. Danger LED indicates high voltage and Pass/Fail LEDs accompanied by audible warnings indicate test result. The instrument provides internal storage of 50 test setups with 20 steps each. The enhanced LCD has two viewing modes - Step and List - to view the programmed test as a single step or view all the steps of a single test in list format. The display also has status indicators for Remote, Lock, Correction and Error functions. The Key Lock function provides password-protected front panel lockout. The RS232 interface is standard equipment as is the internal 8 channel HV scanner for multi-point and multi-device testing.

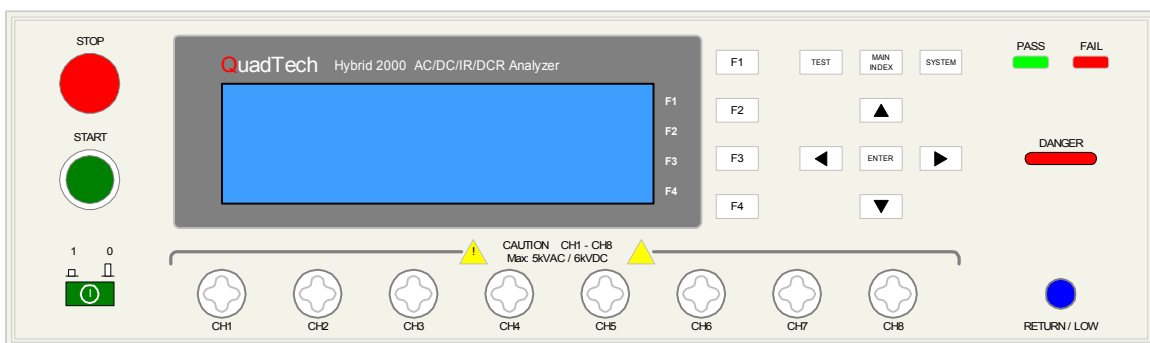


Figure 1-1: Hybrid 2000 AC/DC/IR/DCR Analyzer

1.3 Controls and Indicators

1.3.1 Front Panel Controls and Indicators

Figure 1-2 illustrates the controls and indicators on the front panel of the Hybrid 2000 AC/DC/IR/DCR Analyzer. Table 1-1 identifies them with description and function.

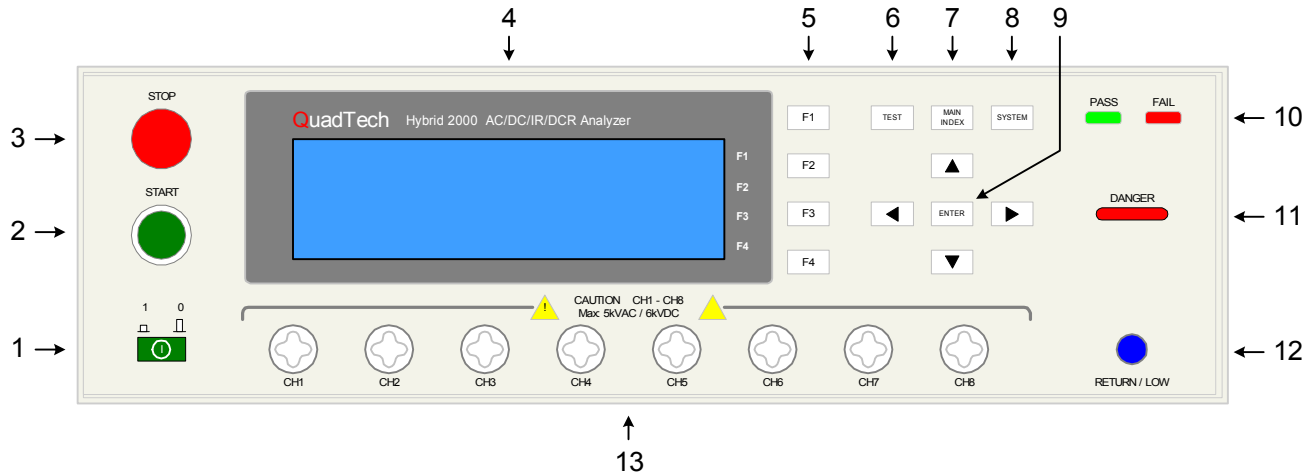


Figure 1-2: Hybrid 2000 Front Panel Controls & Indicators

Table 1-1: Hybrid 2000 Front Panel Controls & Indicators

Ref # Fig 1-2	Name	Type	Function
1	Power	Green Push Button	Apply AC Power: 1=ON, 0=OFF
2	START	Green Push Button	Initiate Test: HV applied to OUTPUT terminal
3	STOP	Red Push Button	Stop Test: HV terminated at OUTPUT terminal
4	Display	LCD	Program Menu, Test Setup, Measurement Results, Memory Contents, Calibration STEP = View Single Step of Test with parameters LIST = View all Steps of Test in list format
5	F1, F2, F3 and F4	Gray Push Buttons	Select Instrument Functions Keys perform different functions under different menus. Right side of display shows corresponding key function.
6	TEST	Gray Push Button	Select Standby Menu: Program, Correct, DSP (Display)
7	MAIN INDEX	Gray Push Button	Select Memory Menu: Store, Recall, Delete Test Setups
8	SYSTEM	Gray Push Button	System Setup: Test Control, System Configuration, Key Lock, Calibration, Error Log and About Functions
9	▲ ▼ ◀ ▶	Gray Push Buttons	Move backlit box (highlighted parameter) UP, DOWN, LEFT and RIGHT within Program Mode.
	ENTER	Gray Push Button	In Program Mode: Accept Value in backlit box
10	PASS	Green LED	When lit, DUT judged as PASS
	FAIL	Red LED	When lit, DUT judged as FAIL. Output voltage is immediately cut off. Press [STOP] to disable FAIL LED
11	DANGER	Red LED	When lit, high voltage is present at OUTPUT terminals
12	RTN/LOW	Blue Banana Socket	RTN: Low voltage reference terminal LOW: Common ground reference terminal
13	CH1-8	8 White Custom Banana Sockets	High Voltage Output Channels Programmed: H (High); L (Low) or – (unused)

1.3.2 Rear Panel Controls and Connectors

Figure 1-3 illustrates the controls and connectors on the rear panel of the Hybrid 2000 AC/DC/IR/DCR Analyzer. Table 1-2 identifies them with description and function.

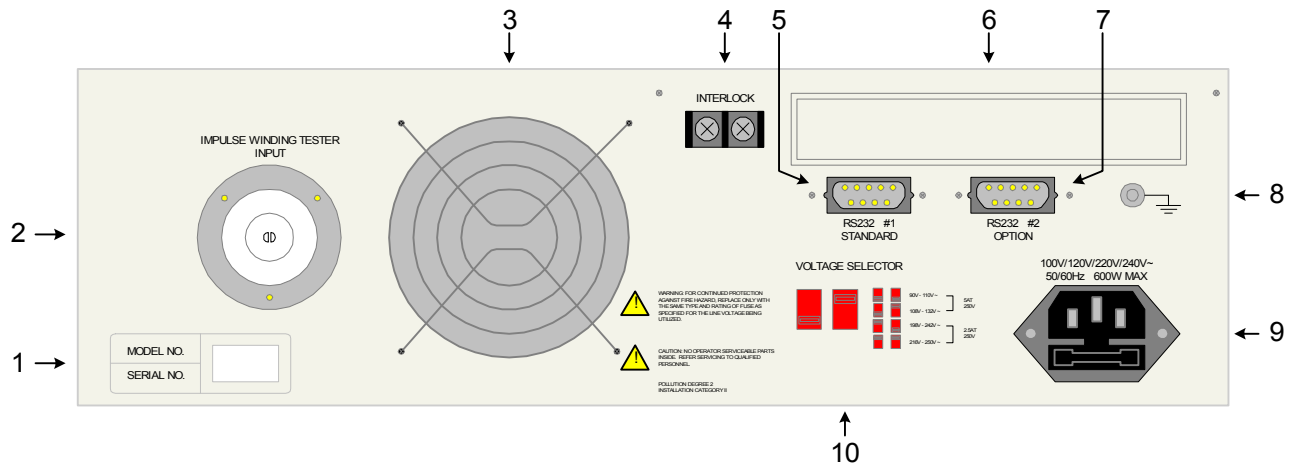


Figure 1-3: Rear Panel Hybrid 2000 Instrument

Table 1-2: Hybrid 2000 Rear Panel Controls & Connectors

Reference # Figure 1-3	Name	Type	Function
1	Model No. Serial No.	White Barcode Sticker	Instrument Identifiers Model No. Hybrid 2000; Serial No. Unique ID
2	IWT Input	Black 11-screw	Remote Connection to Impulse Winding Tester
3	Fan	# AD0824HB A70GL DC 24V 0.16A	Temperature Control Fan to cool unit: ON $\geq 50^{\circ}\text{C}$, OFF $< 50^{\circ}\text{C}$
4	INTERLOCK	Black 2-screw Terminal Strip	Safety Function: Control HV output to front channels Jumper in place: HV is available at front channels
5	RS232 #1	Silver 9-pin Male	RS232 Interface connector
6			Temperature Compensation IEEE-488 and Handler
7	RS232 #2	Silver 9-pin Male	Optional 2 nd RS232 Interface connector
8	Chassis Ground	Silver Banana, Screw	Chassis Ground Connection
9	AC Line Input	Black 3-wire inlet module & fuse holder	Connection to AC power source Fuse Drawer: 5A 250V or 2.5A 250V (see #10)
10	VOLTAGE SELECTOR	2 Red 2-position Slide Switches	Select Voltage Level corresponding to AC Source 90V – 110V: 5A 250V Slow Blow 110V – 130V: 5A 250V Slow Blow 200V – 240V: 2.5A 250V Slow Blow 220V – 250V: 2.5A 250V Slow Blow

1.4 Installation

1.4.1 Dimensions

The Hybrid 2000 unit is supplied in a bench configuration, i.e., in a cabinet with resilient feet for placement on a table. Flip feet are provided under the front feet so that the Hybrid 2000 instrument can be tilted up for convenient operator viewing.

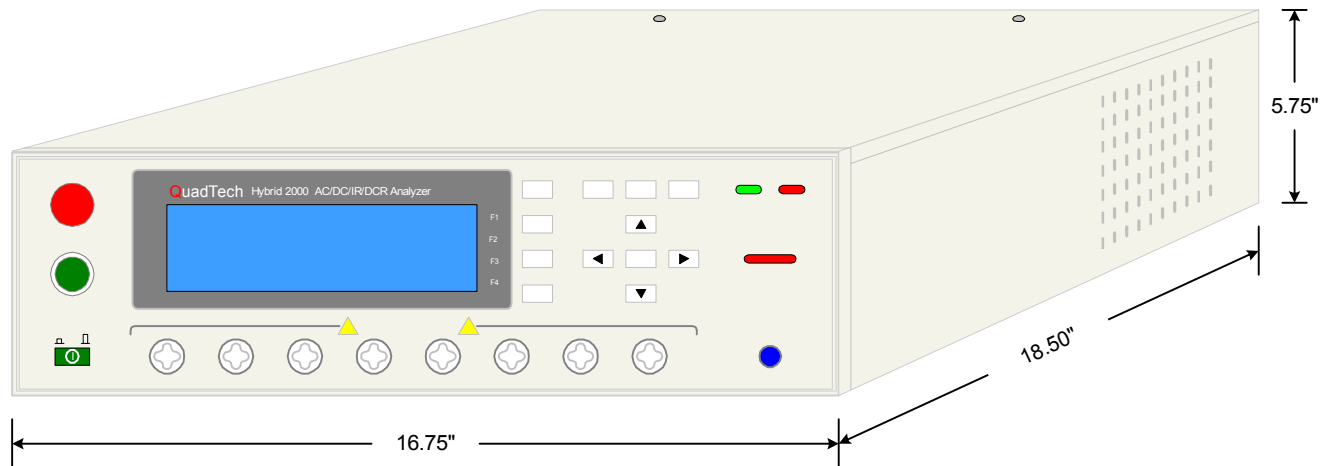


Figure 1-4: Hybrid 2000 Instrument Dimensions

1.4.2 Instrument Positioning

The Hybrid 2000 unit contains one (1) graphic display for direct readout of measured parameters. The optimum angle for viewing is slightly down and about 10 degrees either side of center. For bench operation the front flip feet should always be used to angle the instrument up. In bench or rack mount applications the instrument should be positioned with consideration for ample air flow around the rear panel fan ventilation hole. An open space of at least 3 inches (75mm) is recommended behind the rear panel. Testing should be performed on a non-conductive surface. An ESD mat is not a recommended test platform.

1.4.3 Power Requirements

The Hybrid 2000 can be operated from a power source of 90 to 132V AC or 198 to 250V AC. Power connection is via the rear panel through a standard receptacle. Before connecting the 3-wire power cord between the unit and AC power source, make sure the voltage selection switches on the rear panel (Figure 1-5) are in accordance with the power source being used. For a 90-132V source, use a 5A 250V fuse. For a 198-250V source, use a 2.5A 250V fuse. Always use an outlet that has a properly connected protection ground.

WARNING

MAKE SURE THE UNIT HAS BEEN DISCONNECTED FROM ITS AC POWER SOURCE FOR AT LEAST FIVE MINUTES BEFORE PROCEEDING.

Procedure for Changing a Hybrid 2000 Instrument Fuse

Remove the fuse drawer, by inserting a flat head screwdriver behind the small tab located just below the 3-prong receptacle, and force outward.

Once the fuse drawer has been removed from the instrument snap the fuse from the holder and replace. Make sure the new fuse is of the proper rating. Note that the fuse drawer can also be used to store a spare fuse.

Install the fuse drawer back in the inlet module (fuse down) by pushing in until it locks securely in place.

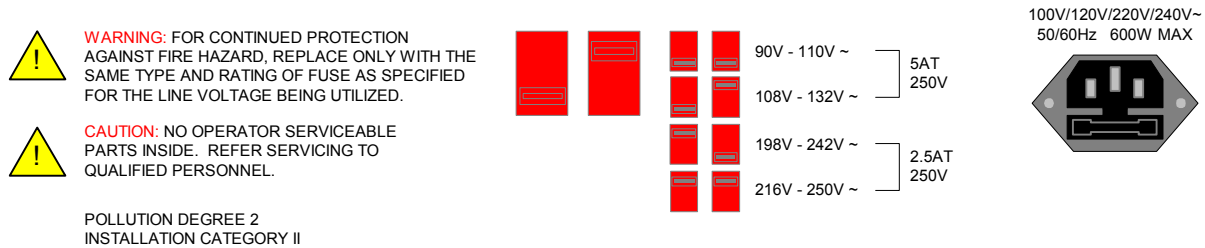


Figure 1-5: Close-Up of Hybrid 2000 Rear Panel

1.4.4 Safety Inspection

Before operating the instrument inspect the power inlet module on the rear of the Hybrid 2000 to ensure that the properly rated fuse is in place, otherwise damage to the unit is possible. Make sure that the voltage selector switches are set in accordance with the power source in use. Refer to paragraph 1.4.3 and Figure 1-5.

The Hybrid 2000 instrument is shipped with a standard U.S. power cord, QuadTech P/N 4200-0300 (with Belden SPH-386 socket or equivalent, and a 3-wire plug conforming to IEC 320). Make sure the instrument is only used with these cables (or other approved international cord set) to ensure that the instrument is provided with connection to protective earth ground.

The surrounding environment should be free from excessive dust to prevent contamination of electronic circuits. The surrounding environment should also be free from excessive vibration. Do not expose the Hybrid 2000 instrument to direct sunlight, extreme temperature or humidity variations, or corrosive chemicals.

Section 2: Operation

2.1 Terms and Conventions

Table 2-1: Measurement Unit Prefixes

<u>Multiple</u>	<u>Scientific</u>	<u>Engineering</u>	<u>Symbol</u>
1000000000000000	10 ¹⁵	Peta	P
1000000000000	10 ¹²	Tera	T
1000000000	10 ⁹	Giga	G
1000000	10 ⁶	Mega	M
1000	10 ³	Kilo	k
.001	10 ⁻³	milli	m
.000001	10 ⁻⁶	micro	u
.000000001	10 ⁻⁹	nano	n
.000000000001	10 ⁻¹²	pico	p
.000000000000001	10 ⁻¹⁵	femto	f

ARCing: Sparking or ‘flashing over’ caused by a breakdown of electrical insulation.

Current:

AC: Alternating Current. AC is an electrical current that has one polarity during part of the cycle and the opposing polarity during the other part of the cycle. Residential electricity is AC.

DC: Direct Current. Non-reversing polarity. The movement of charge is in one direction. Used to describe both current and voltage. Batteries supply direct current (DC).

Charging Current: An insulated product exhibits the basic characteristics of a capacitor. Application of a voltage across the insulation causes a current to flow as the capacitor charges. This current instantaneously rises to a high value as voltage is applied then exponentially decays to zero as the DUT becomes fully charged. Charging current decays to zero much faster than dielectric absorption.

DC Resistance (DCR):	The electrical characteristic that impedes the flow of current through a circuit to which voltage has been applied. $DCR = V_{DC}/I$.
Dielectric Absorption:	The physical phenomenon in which insulation appears to absorb and retain an electrical charge slowly over time. Apply a voltage to a capacitor for an extended period of time. Then quickly discharge it to zero voltage. Leave the capacitor open circuited for a period of time then connect a voltmeter to it and measure the residual voltage. The residual voltage is caused by the dielectric absorption of the capacitor.
Dielectric Strength:	The ratio between the voltage at which breakdown of the insulating material occurs and the distance between the two points subject to the applied voltage.
Dielectric Withstand Test:	This is the most common electrical safety test performed. A high voltage (either AC or DC) is applied to determine if a breakdown will occur in the insulation of the DUT. Dielectric Withstand is also referred to as a hipot (high potential) test.
Discharge:	The act of draining off an electrical charge to ground. Devices that retain charge should be discharged after an IR test or DC hipot test.
DUT:	Device Under Test. (i.e. the product being tested).
Frequency:	The rate at which current or voltage reverses polarity and then back again completing a full cycle, measured in Hertz (Hz) or cycles/second. AC Line Frequency = 50/60 Hz.

Ground:

Ground:	The base reference from which voltages are measured, nominally the same potential as the earth. Ground is also the side of a circuit that is at the same potential as the base reference.
Ground Bond Test:	Test to verify that all conductive parts of a product that are exposed to user contact are connected to the power line ground. The ground bond test verifies the integrity of the ground connection using a high current AC signal with current level as high as 30Amps. Ground bond provides a better simulation of how a product will perform under an actual fault condition.

Ground Continuity: Test to verify that all conductive parts of a product that are exposed to user contact are connected to the power line ground. GC Test normally performed with a low current DC signal that checks to ensure the ground connection has a resistance of $<1\Omega$.

Insulation Resistance: Measures the total resistance between any two points separated by electrical insulation. The IR test determines how effective the dielectric (insulation) is in resisting the flow of electrical current.

Interface:

IEEE-488: General Purpose Interface Bus (GPIB). GPIB is an industry standard definition of a Parallel bus connection for the purpose of communicating data between devices.

RS232: An industry standard definition for a Serial line communication link or port.

Scanner: An electronic device designed to switch or matrix signals.

Leakage Current (LC):

Leakage Current: The residual flow of current that flows through the insulation after a high voltage has been applied for a period of time. The leakage current is equal to the applied voltage divided by the insulation resistance. Leakage current is the main measured value for AC hipot and DC hipot tests.

Applied Part LC Test: A line leakage current test that measures the current that would flow from, to or between applied parts such as sensor and patient leads. This test is the most complicated and time-consuming line leakage test.

Earth LC Test: The most important and most common of the line leakage tests. Earth leakage current is basically the current flowing back through the ground conductor on the power cord. It is measured by opening the ground conductor, inserting a circuit with the simulated impedance of the human body then measuring the voltage across part of the circuit with a true RMS voltmeter.

Enclosure LC Test: A line leakage test that measures the current that flows through the human body if the body had touched the enclosure of the DUT.

Limits:

High Limit:

The high limit is the upper value for a test to be considered a pass. If the measured value is higher than the high limit the test is considered a fail. In dielectric withstand (hipot), leakage current and ground bond test modes a high limit is required.

Low Limit:

The low limit is the lower value for a test to be considered a pass. If the measured value is lower than the low limit the test is considered a fail. In insulation resistance test mode a low limit is required. In an AC or DC hipot test, the low limit FAIL decision occurs at the end of the programmed test time.

Mode:

The test which is to be performed such as AC Dielectric Withstand Voltage (WVAC), DC Dielectric Withstand Voltage (WVDC), Insulation Resistance (IR) or DC Resistance (DCR)

RAMPing:

The gradual increase or decrease of voltage or current over a period of time (step).

Step:

The Hybrid 2000 instrument can perform up to 20 steps in one test setup. The step number indicates the order in which the tests will be performed. If step 1 is an OSC test, step 2 a WVAC test and step 3 an IR measurement then when a test is started the Hybrid 2000 will perform an Open/Short Circuit check, followed by an AC hipot test then an insulation resistance test.

Test Current:

Real Current:

The real current test is a measure of the resistive current component of the device under test. The resistive component is attributed to the resistance of the device's insulation.

Total Current:

The total current test is a measure of the resistive and reactive current components of the device under test. The reactive component is attributed to the capacitive or inductive components of the circuit

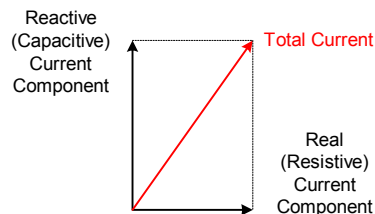


Figure 2-1: Total Current

2.2 Startup

Check to make sure the Red Voltage Selector Switches on the rear panel agree with the power source available. Depending on the power source the switch positions should be in the up or down positions as shown in Figure 1-5 (Close-Up of Hybrid 2000 Rear Panel).

WARNING

NEVER TOUCH THE TEST LEADS IN ANY MANNER (this includes insulation on all wires and clips) when HIGH VOLTAGE IS APPLIED and red **DANGER** LED is ON.

USE ALL PRECAUTIONS NECESSARY TO AVOID TOUCHING THE DEVICE UNDER TEST WHEN THE RED **DANGER** LED IS ON OR FLASHING.

Connect the instrument power cord to the source of proper voltage. **The instrument is to be used only with three-wire grounded outlets.**

Power is applied to the Hybrid 2000 instrument by pressing the green [POWER] switch on the front panel to the ON (1 position). The Hybrid 2000 unit should warm up for a period of at least 15 minutes prior to use.

WARNING

DO NOT TURN INSTRUMENT POWER ON OR OFF WITH TEST DEVICES CONNECTED.

2.3 Programming Electrical Safety Tests

The Hybrid 2000 instrument is capable of performing the tests listed in Table 2-2. A single-step test can be performed on a device and is programmed as described in paragraphs 2.4 – 2.8 respectively. When the device under test requires a multi-step test the order of test precedence is important. Refer to paragraph 2.10 for programming a multi-step test.

Table 2-2: Hybrid 2000 Electrical Safety Tests

Test	Software Designation	Program Instructions Paragraph
Open/Short Circuit	OSC	2.4
AC Hipot	WVAC	2.5
DC Hipot	WVDC	2.6
Insulation Resistance	IR	2.7
DC Resistance	DCR	2.8
Pause	PA	2.9
Multi-Step	--	2.10
Sub Step	NEW SUB	2.11

The output channels are programmed in the last step of an OSC, WVAC, WVDC, IR and DCR test setup. Channels (CH) 1-8 can be programmed to H (High), L (Low) or – (unused). At least one of the 8 channels must be programmed for output. Four-Wire DCR Channels (CH) 1, 3, 5, 7, can be programmed to H(High), L (Low) or – (unused). Channels 2,3,6,8 are used for Sense.

2.3.1 Function keys of the STAND BY Display

The function keys on the right hand side of the display allow the operator to access the various menus imbedded within the Hybrid 2000 instrument software. Familiarize yourself with these menus prior to programming a test. Figure 2-2 illustrates the STAND BY display and lists the functions that can be accessed by pressing the [F1] through [F4] keys.

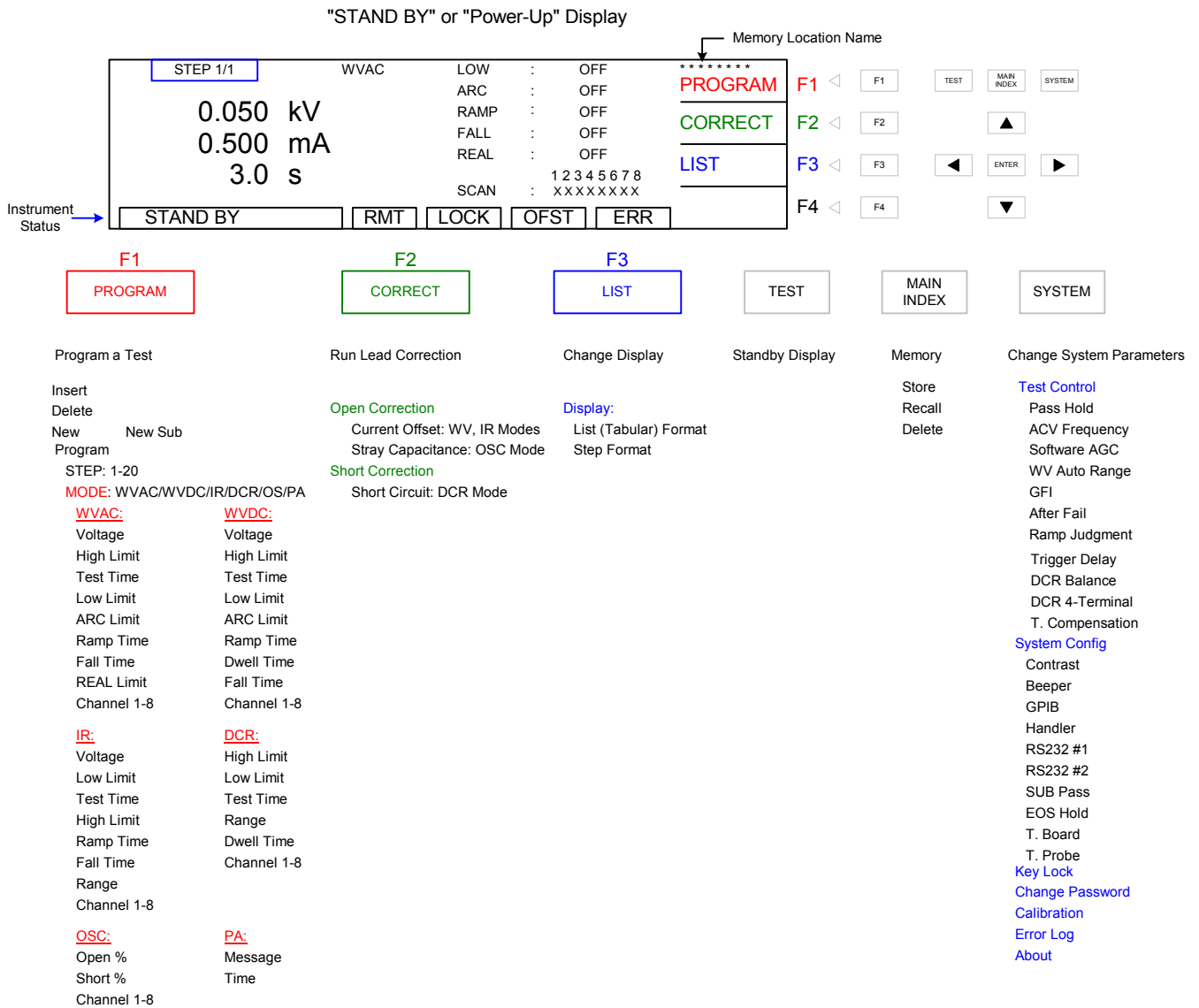


Figure 2-2: STAND BY Function Key Menus

To clarify the various functions of the Hybrid 2000 software, this instruction manual will illustrate the menu displays in a (hopefully) logical format. The function keys (F1, F2, F3 & F4) perform different tasks depending upon the menu currently shown on the display. Figure 2-3 illustrates the Standby STEP display and LIST display shown upon instrument 'power-up'.

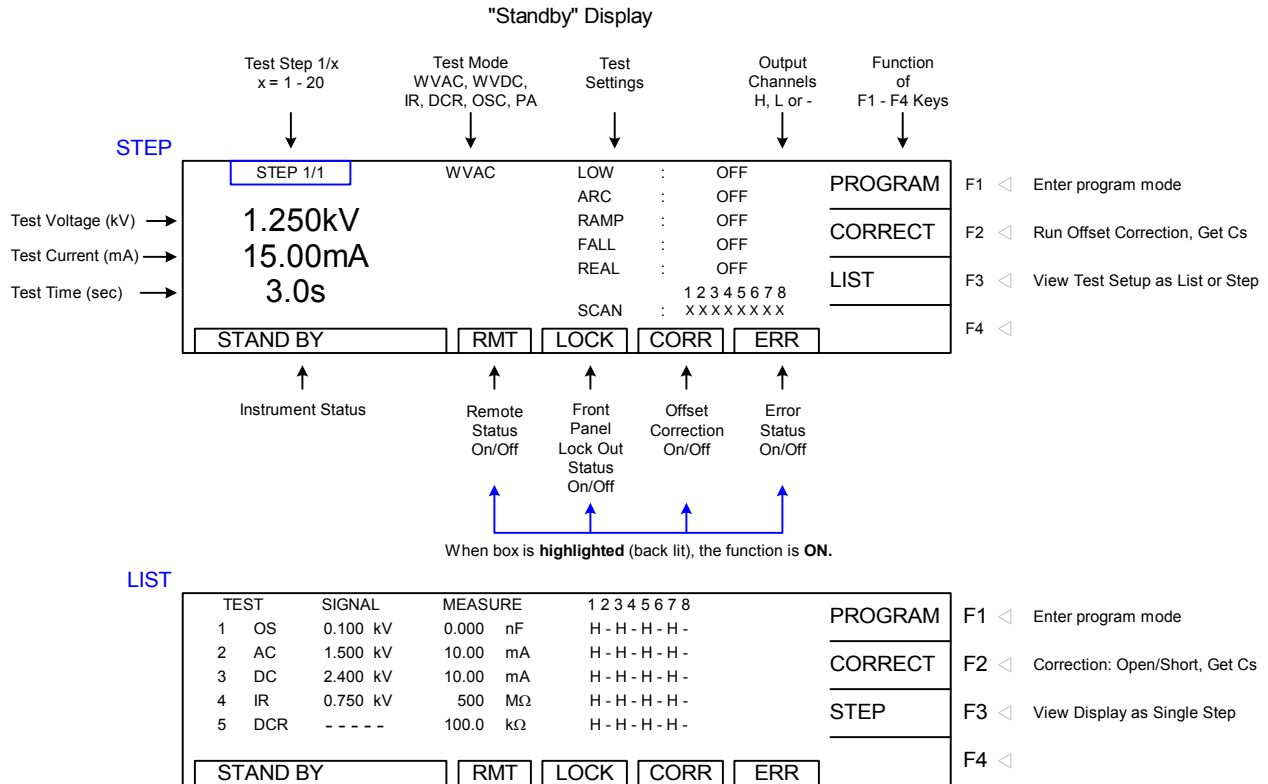


Figure 2-3: Standby Display

To access the programming function of the Hybrid 2000 instrument in the Standby menu, press the [F1] key (PROGRAM). Once in the PROGRAM display, select the test step.

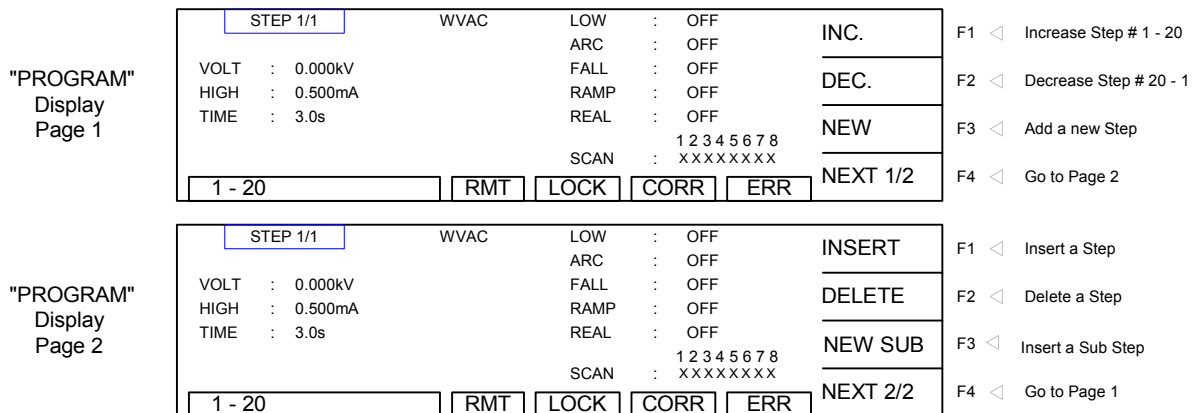


Figure 2-4: Program Display: Setting the Step Number

NOTE: To navigate the menus use the UP, DOWN, RIGHT and LEFT arrow keys to move the highlighted (backlit) box around the display. Use the [ENTER] key to select the parameter to modify. Use the F1 – F4 keys (or arrows) to modify selected parameter. Press [ENTER] again to accept modified value.

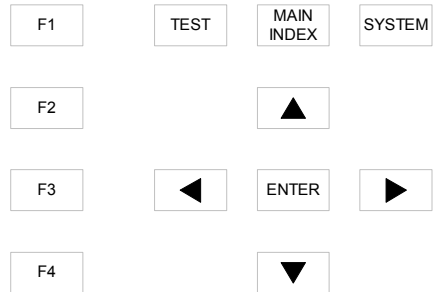


Figure 2-5: Keys for Menu Navigation

Next: Select the test mode (OSC, WVAC, WVDC, IR, DCR or PA). Figure 2-6 illustrates the “Standby” display and the test mode displays. Paragraphs 2.4, 2.5, 2.6, 2.7, 2.8 and 2.9 illustrate how to program the specific parameters of each of the 6 modes. For clarity, a **green** arrow (□) is used to denote which function key (F1 – F4) is pressed to get to the next display screen.

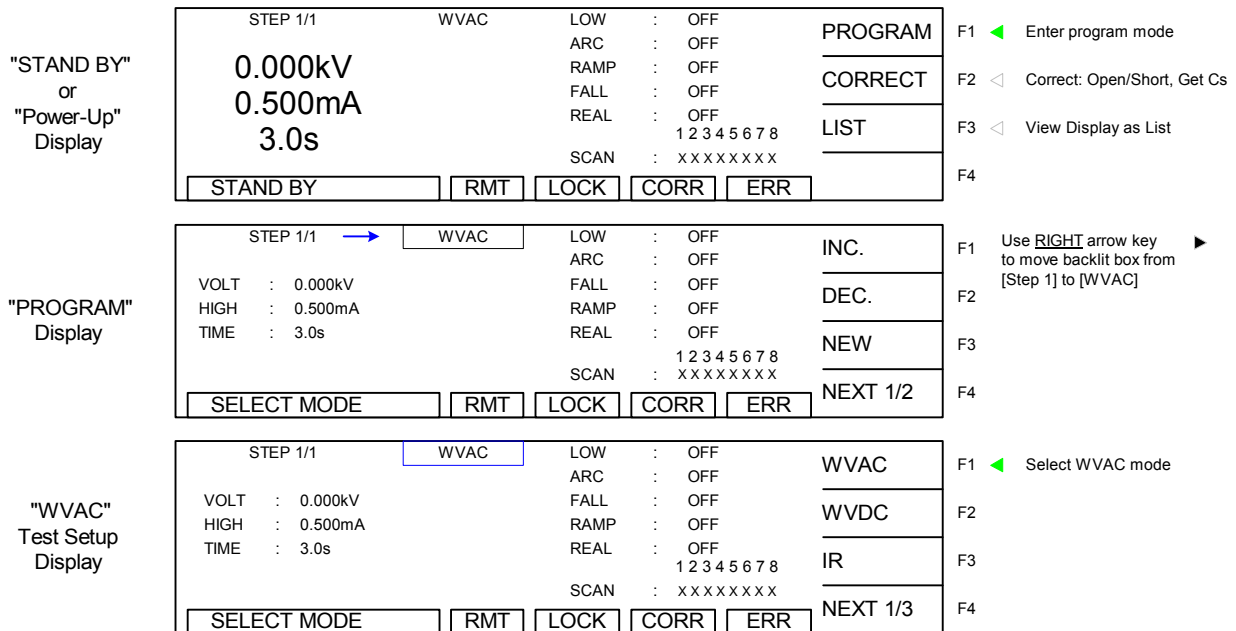


Figure 2-6a: STAND BY, PROGRAM and Test Mode Displays

Mode Displays continued on next page.

Mode Displays – continued

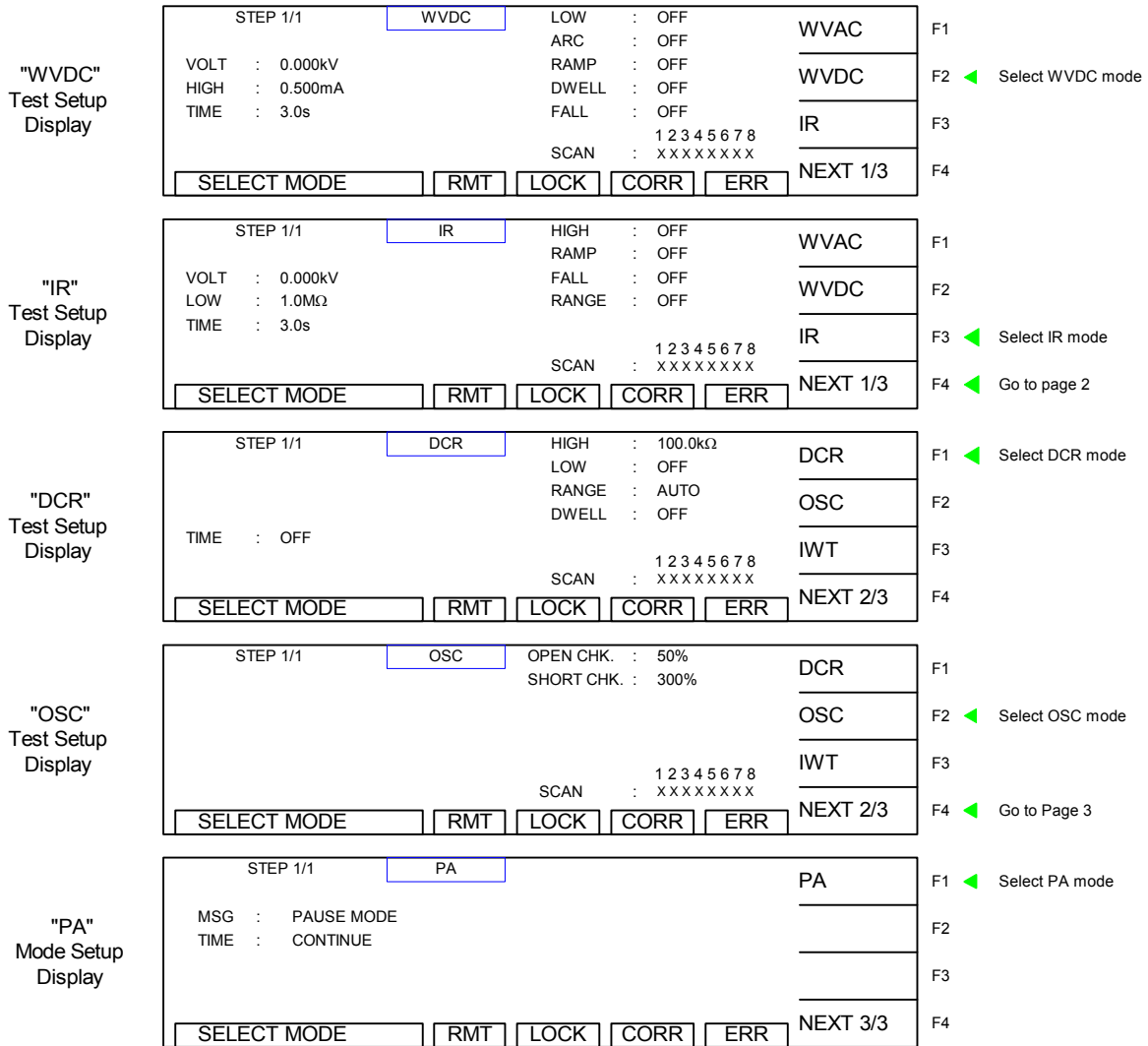


Figure 2-6b: Mode Displays

2.4 Programming an Open/Short Circuit (OSC) Check

The Open/Short Circuit Detection Mode will ensure the Device under Test is connected properly and does not have a short circuit. In Program mode OSC can be selected as one of the steps within the test. There are two programmable parameters Open % and Short %. Open % is equivalent to a low limit. Short % would be considered a high limit. Once programming is finalized, an offset should be performed and the Get Cs function must be ran to learn the Capacitance of the device under test. This learned Capacitance value will then be compared to the Open % and Short % for Pass/Fail judgment. This function is typically programmed prior to a hipot test to check the connection to the device under test before applying high voltage.

Open Check: In hipot testing, a low leakage current may generate a PASS. If the connection is faulty between the hipot and the DUT, the test could pass even if the DUT was not tested. Open Check is similar to using a low limit in an AC hipot test to ensure the connection of the DUT. In some cases, such as DC Hipot, a low limit is not feasible. Open Check will ensure that the DUT is connected.

The Open Check sets the judgment test result (Pass/Fail) to open circuit condition and compares the test reading with the standard capacitance value (Cs). If the test reading is within the programmed % then the judgment is Pass. The Open Check can be programmed from 10% - 100% and the default 50%.

Short Check: In some cases, the DUT is shorted prior to testing. If the product is shorted, there is no need to perform hipot.

The Short Check sets the judgment test result (Pass/Fail) to short circuit condition and compares the test reading to the standard capacitance value (Cs). If the test reading is within the programmed % then the judgment is Pass. The Short Check can be set to Off or programmed from 100% - 500%. The default value is 300%.

When using OSC mode, program the test, attach the DUT, press [F2] = CORRECT and then [F3] = SAMPLE TEST to obtain the DUT's nominal capacitance value. The Cs value is saved with the test program in instrument memory. The Cs value is applicable to that product only.

To illustrate this function: for a particular DUT, the Hybrid instrument learned Cs = 0.241nF and the Open Check is set to 50%. If the measured Cs is within 50% of the learned Cs, then the OSC result is a PASS. If the measured Cs is greater than 0.121nF (50% of .241nF), then the OSC result is a PASS. If the measured Cs is less than 0.121nF, then the OSC result is an OPEN.

If the Short Check is set to 300%. If the measured Cs is less than 300% of the learned Cs, then the OSC result is a PASS. If the measured Cs is greater than 300% of the learned Cs, then the OSC result is a FAIL. If the measured Cs is greater than 0.723nF (300% of .241nF), then the OSC result is a SHORT.

NOTE:

To obtain consistent results, the Offset correction must be performed when using OSC mode. The Offset correction is performed prior to the Get Cs function.

Open/Short Circuit (OSC) Check

Follow the **green** arrows (□) on the right side of this diagram to program the individual OSC parameters. With the instrument in 'stand-by' status:

Press [F1] = PROGRAM.

Press RIGHT [▶] arrow key to move backlit box from **STEP** to **WVAC**

Press [F4] = NEXT 1/3 to got to page 2.

Press [F2] = OSC to select Open/Short Circuit mode.

Press RIGHT [▶] arrow key to move backlit box from **OSC** to **50%**

Press [F1] – [F4] keys to set Open % value. Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **50%** to **300%**

Press [F1] – [F4] keys to set Short % value. Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **300%** to **XXXXXXXX**

Press [F1] – [F4] keys to set Output Channels. Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **XXXXXXXX** to **STEP**

Press [TEST] to EXIT program mode

OR

Press [F3] = NEW to program the next test step.

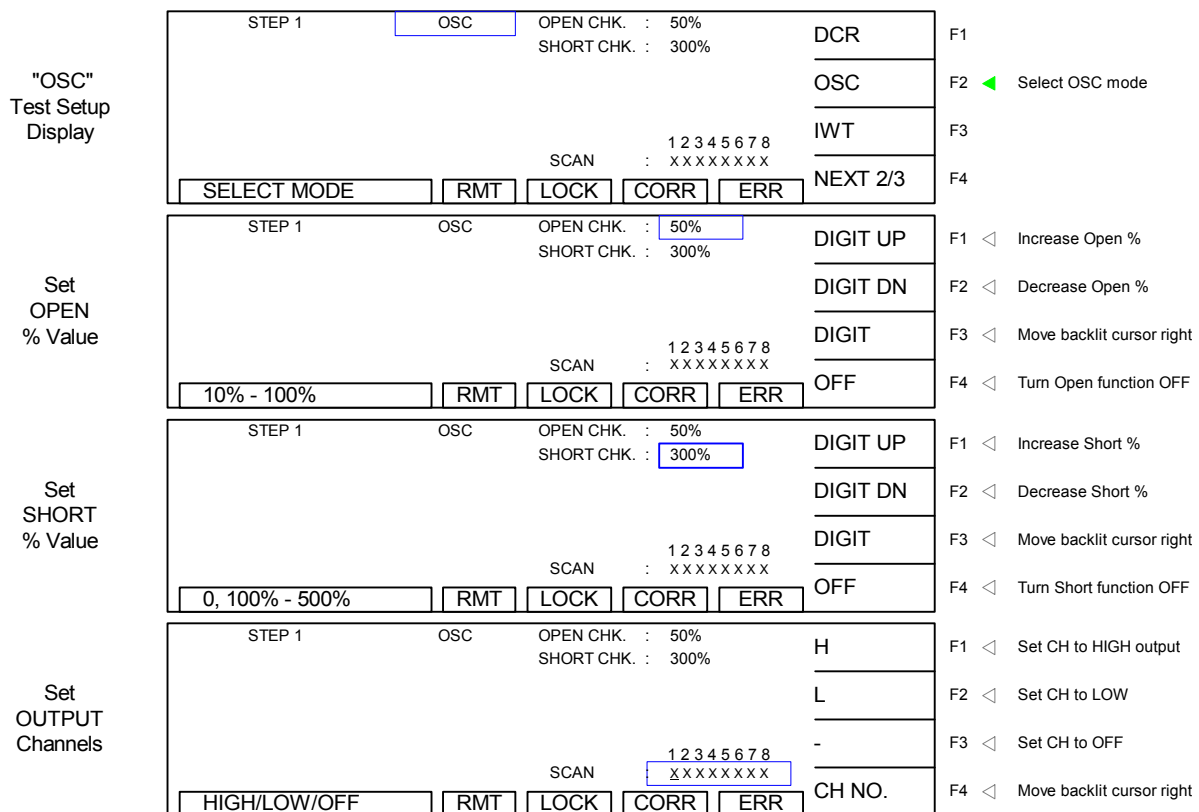


Figure 2-7: Mode Displays

End OSC programming. Press [F3] = ENTER to start programming STEP 2-20 OR press [TEST] to exit program mode and return to STAND BY status.

2.5 Programming an AC Dielectric Withstand Voltage (WVAC) Test

If programming a single WVAC test with the instrument in “stand-by” status: press [F1] = PROGRAM. Select Step # then press RIGHT [▶] arrow key to move backlit box from [STEP] to [WVAC]. Follow instructions below starting with setting AC output voltage.

If continuing the multi-step example (OSC = Step 1) here is how to program an AC test in Step 2:

Press [F3] = NEW.

Press RIGHT [▶] arrow key to move backlit box from [STEP] to [WVAC]

Press DOWN [▼] arrow key to move backlit box from [WVAC] to [0.050kV]

Press [F1] – [F3] keys to set AC output voltage (50V – 5kV).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [0.050kV] to [0.500mA]

Press [F1] – [F4] keys to set high current limit (0.001 – 30mA).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [0.500mA] to [3.0s]

Press [F1] – [F4] keys to set test time (0, 0.3 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [3.0s] to [OFF]

Press [F1] – [F4] keys to set low current limit (0 - high limit).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [OFF]

Press [F1] – [F4] keys to set arc limit (0.1 – 15mA).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [OFF]

Press [F1] – [F4] keys to set ramp time (0.1 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [OFF]

Press [F1] – [F4] keys to set fall time (0.1 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [OFF]

Press [F1] – [F4] keys to set real current limit (0 – high limit).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [XXXXXXXXXX]

Press [F1] – [F4] keys to set output channel 1 (H, L, -).

Press [F4] to move backlit cursor right to next channel.

Press [F1] – [F3] keys to set output channels 2-8 (H, L, -).

Press [ENTER] when finished entering all Channel Settings.

Press DOWN [▼] arrow key to move backlit box from [H-H-H-H-] to [STEP]

Continue on next page.

Programming a WVAC Test (illustrated)

STEP 1/1	WVAC	LOW	: OFF	PROGRAM	F1
VOLT	: 0.050 kV	ARC	: OFF	CORRECT	F2
HIGH	: 0.500 mA	RAMP	: OFF	LIST	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
STAND BY					
RMT LOCK CORR ERR					
STEP 1/1	WVAC	LOW	: OFF	INC.	F1
VOLT	: 0.050 kV	ARC	: OFF	DEC.	F2
HIGH	: 0.500 mA	RAMP	: OFF	NEW	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
1 - 20					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	WVAC	F1
VOLT	: 0.050 kV	ARC	: OFF	WVDC	F2
HIGH	: 0.500 mA	RAMP	: OFF	IR	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
SELECT MODE					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	DIGIT UP	F1
VOLT	: 0.050 kV	ARC	: OFF	DIGIT DN	F2
HIGH	: 0.500 mA	RAMP	: OFF	DIGIT	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
0.05 - 5kV					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	DIGIT UP	F1
VOLT	: 0.050 kV	ARC	: OFF	DIGIT DN	F2
HIGH	: 0.500 mA	RAMP	: OFF	DIGIT	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
0.001 - 30mA					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	DIGIT UP	F1
VOLT	: 0.050 kV	ARC	: OFF	DIGIT DN	F2
HIGH	: 0.500 mA	RAMP	: OFF	DIGIT	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
0, 0.3 - 999s					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	DIGIT UP	F1
VOLT	: 0.050 kV	ARC	: OFF	DIGIT DN	F2
HIGH	: 0.500 mA	RAMP	: OFF	DIGIT	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
0 - High, 0 = Off					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	DIGIT UP	F1
VOLT	: 0.050 kV	ARC	: OFF	DIGIT DN	F2
HIGH	: 0.500 mA	RAMP	: OFF	DIGIT	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
0, 0.1 - 15mA					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	DIGIT UP	F1
VOLT	: 0.050 kV	ARC	: OFF	DIGIT DN	F2
HIGH	: 0.500 mA	RAMP	: OFF	DIGIT	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
0, 0.1 - 999s					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	DIGIT UP	F1
VOLT	: 0.050 kV	ARC	: OFF	DIGIT DN	F2
HIGH	: 0.500 mA	RAMP	: OFF	DIGIT	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
0, 0.1 - 999s					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	DIGIT UP	F1
VOLT	: 0.050 kV	ARC	: OFF	DIGIT DN	F2
HIGH	: 0.500 mA	RAMP	: OFF	DIGIT	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
0 - High, 0 = Off					
RMT LOCK CORR ERR					
STEP 2/2	WVAC	LOW	: OFF	H	F1
VOLT	: 0.050 kV	ARC	: OFF	L	F2
HIGH	: 0.500 mA	RAMP	: OFF	-	F3
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4
HIGH/LOW/OFF					
RMT LOCK CORR ERR					

End WVAC programming. Press [F3] = NEW to start programming STEP 3-20 OR press [TEST] to exit program mode and return to STAND BY status.

2.6 Programming a DC Dielectric Withstand Voltage (WVDC) Test

If programming a single WVDC test, with the instrument in 'stand-by' status, press [F1] = PROGRAM. Select Step # then press RIGHT [▶] arrow key to move backlit box from **STEP** to **WVAC**. Press [F2] = WVDC. Follow instructions below starting with setting DC output voltage.

If continuing the multi-step example (OSC = Step 1, WVAC = Step 2) here is how to program a WVDC test in Step 3:

Press [F3] = NEW.

Press RIGHT [▶] arrow key to move backlit box from **STEP** to **WVAC**

Press [F2] = WVDC

Press DOWN [▼] arrow key to move backlit box from **WVDC** to **0.050kV**

Press [F1] – [F3] keys to set DC output voltage (50V – 6kV).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **0.050kV** to **0.500mA**

Press [F1] – [F4] keys to set high current limit (0.0001 – 10mA).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **0.500mA** to **3.0s**

Press [F1] – [F4] keys to set test time (0, 0.3 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **3.0s** to **OFF**

Press [F1] – [F4] keys to set low current limit (0 - high limit).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **OFF** to **OFF**

Press [F1] – [F4] keys to set arc limit (0.1 – 10mA).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **OFF** to **OFF**

Press [F1] – [F4] keys to set ramp time (0.1 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **OFF** to **OFF**

Press [F1] – [F4] keys to set dwell time (0.1 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **OFF** to **OFF**

Press [F1] – [F4] keys to set fall time (0.1 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **OFF** to **XXXXXXXXXX**

Press [F1] – [F4] keys to set output channel 1 (H, L, -).

Press [F4] to move backlit cursor right to next channel.

Press [F1] – [F3] keys to set output channels 2-8 (H, L, -).

Press [ENTER] when finished entering all Channel Settings.

Press DOWN [▼] arrow key to move backlit box from **H-H-H-H-** to **STEP**

Continue on next page.

Programming a WVDC Test (illustrated)

STEP 1/1	WVAC	LOW	: OFF	PROGRAM	F1 <
VOLT : 0.050 kV		ARC	: OFF	CORRECT	F2 <
HIGH : 0.500 mA		RAMP	: OFF	LIST	F3 <
TIME : 3.0 s		FALL	: OFF	1 2 3 4 5 6 7 8	F4 <
		REAL	: 1 2 3 4 5 6 7 8		
		SCAN	: -----		
STAND BY	RMT	LOCK	CORR	ERR	

STEP 1/1	WVAC	LOW	: OFF	INC.	F1 <
VOLT : 0.050 kV		ARC	: OFF	DEC.	F2 <
HIGH : 0.500 mA		RAMP	: OFF	NEW	F3 <
TIME : 3.0 s		FALL	: OFF	NEXT 1/2	F4 <
		REAL	: 1 2 3 4 5 6 7 8		
		SCAN	: -----		
1 - 20	RMT	LOCK	CORR	ERR	

STEP 3/3	WVAC	LOW	: OFF	WVAC	F1 <
VOLT : 0.050 kV		ARC	: OFF	WVDC	F2 <
HIGH : 0.500 mA		RAMP	: OFF	IR	F3 <
TIME : 3.0 s		FALL	: OFF	NEXT 1/3	F4 <
		REAL	: 1 2 3 4 5 6 7 8		
		SCAN	: -----		
SELECT MODE	RMT	LOCK	CORR	ERR	

STEP 3/3	WVDC	LOW	: OFF	DIGIT UP	F1 <
VOLT : 0.050 kV		ARC	: OFF	DIGIT DN	F2 <
HIGH : 0.500 mA		RAMP	: OFF	DIGIT	F3 <
TIME : 3.0 s		DWELL	: OFF	1 2 3 4 5 6 7 8	F4 <
		FALL	: OFF		
		SCAN	: -----		
0.05 - 6kV	RMT	LOCK	CORR	ERR	

STEP 3/3	WVDC	LOW	: OFF	DIGIT UP	F1 <
VOLT : 0.050 kV		ARC	: OFF	DIGIT DN	F2 <
HIGH : 0.500 mA		RAMP	: OFF	DIGIT	F3 <
TIME : 3.0 s		DWELL	: OFF	1 2 3 4 5 6 7 8	F4 <
		FALL	: OFF		
		SCAN	: -----		
0.001 - 10mA	RMT	LOCK	CORR	ERR	

STEP 3/3	WVDC	LOW	: OFF	DIGIT UP	F1 <
VOLT : 0.050 kV		ARC	: OFF	DIGIT DN	F2 <
HIGH : 0.500 mA		RAMP	: OFF	DIGIT	F3 <
TIME : 3.0 s		DWELL	: OFF	1 2 3 4 5 6 7 8	F4 <
		FALL	: OFF		
		SCAN	: -----		
0, 0.3 - 999s	RMT	LOCK	CORR	ERR	

STEP 3/3	WVDC	LOW	: OFF	DIGIT UP	F1 <
VOLT : 0.050 kV		ARC	: OFF	DIGIT DN	F2 <
HIGH : 0.500 mA		RAMP	: OFF	DIGIT	F3 <
TIME : 3.0 s		DWELL	: OFF	1 2 3 4 5 6 7 8	F4 <
		FALL	: OFF		
		SCAN	: -----		
0 - High, 0 = Off	RMT	LOCK	CORR	ERR	

STEP 3/3	WVDC	LOW	: OFF	DIGIT UP	F1 <
VOLT : 0.050 kV		ARC	: OFF	DIGIT DN	F2 <
HIGH : 0.500 mA		RAMP	: OFF	DIGIT	F3 <
TIME : 3.0 s		DWELL	: OFF	1 2 3 4 5 6 7 8	F4 <
		FALL	: OFF		
		SCAN	: -----		
0, 0.1 - 10mA	RMT	LOCK	CORR	ERR	

STEP 3/3	WVDC	LOW	: OFF	DIGIT UP	F1 <
VOLT : 0.050 kV		ARC	: OFF	DIGIT DN	F2 <
HIGH : 0.500 mA		RAMP	: OFF	DIGIT	F3 <
TIME : 3.0 s		DWELL	: OFF	1 2 3 4 5 6 7 8	F4 <
		FALL	: OFF		
		SCAN	: -----		
0, 0.1 - 999s	RMT	LOCK	CORR	ERR	

STEP 3/3	WVDC	LOW	: OFF	DIGIT UP	F1 <
VOLT : 0.050 kV		ARC	: OFF	DIGIT DN	F2 <
HIGH : 0.500 mA		RAMP	: OFF	DIGIT	F3 <
TIME : 3.0 s		DWELL	: OFF	1 2 3 4 5 6 7 8	F4 <
		FALL	: OFF		
		SCAN	: -----		
0, 0.1 - 999s	RMT	LOCK	CORR	ERR	

STEP 3/3	WVDC	LOW	: OFF	DIGIT UP	F1 <
VOLT : 0.050 kV		ARC	: OFF	DIGIT DN	F2 <
HIGH : 0.500 mA		RAMP	: OFF	DIGIT	F3 <
TIME : 3.0 s		DWELL	: OFF	1 2 3 4 5 6 7 8	F4 <
		FALL	: OFF		
		SCAN	: -----		
0, 0.1 - 999s	RMT	LOCK	CORR	ERR	

STEP 3/3	WVDC	LOW	: OFF	H	F1 <
VOLT : 0.050 kV		ARC	: OFF	L	F2 <
HIGH : 0.500 mA		RAMP	: OFF	-	F3 <
TIME : 3.0 s		DWELL	: OFF	1 2 3 4 5 6 7 8	F4 <
		FALL	: OFF		
		SCAN	: -----		
HIGH/LOW/OFF	RMT	LOCK	CORR	ERR	CH NO.

End WVDC programming. Press [F3] = ENTER to start programming STEP 4-20 OR press [TEST] to exit program mode and return to STAND BY status.

2.7 Programming an Insulation Resistance (IR) Test

If programming a single IR test, with the instrument in 'stand-by' status, press [F1] = PROGRAM. Select Step # then press RIGHT [▶] arrow key to move backlit box from [STEP] to [WVAC]. Press [F3] = IR. Follow instructions below starting with setting IR output voltage.

If continuing the multi-step example (OSC = Step 1, WVAC = Step 2, WVDC = Step 3) here is how to program an IR test in Step 4:

Press [F3] = NEW.

Press RIGHT [▶] arrow key to move backlit box from [STEP] to [WVAC]

Press [F3] = IR

Press RIGHT [▼] arrow key to move backlit box from [IR] to [0.050kV]

Press [F1] – [F3] keys to set IR output voltage (50V – 5kV).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [0.050kV] to [1.0MΩ]

Press [F1] – [F4] keys to set low resistance limit (1MΩ – 50GΩ).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [1.0MΩ] to [3.0s]

Press [F1] – [F4] keys to set test time (0, 0.3 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [3.0s] to [OFF]

Press [F1] – [F4] keys to set high resistance limit (0, Low – 50GΩ).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [OFF]

Press [F1] – [F4] keys to set ramp time (0.1 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [OFF]

Press [F1] – [F4] keys to set fall time (0.1 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [OFF]

Press [F1] – [F4] keys to set resistance range (Auto, 30nA - 10mA, 7 ranges).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [XXXXXXXX]

Press [F1] – [F4] keys to set output channel 1 (H, L, -).

Press [F4] to move backlit cursor right to next channel.

Press [F1] – [F3] keys to set output channels 2-8 (H, L, -).

Press [ENTER] when finished entering all Channel Settings.

Press DOWN [▼] arrow key to move backlit box from [H-H-H-H-] to [STEP]

Continue on next page.

Programming an IR Test (illustrated)

STEP 1/1	WVAC	LOW	: OFF	PROGRAM	F1 <
VOLT	: 0.050 kV	ARC	: OFF	CORRECT	F2 <
HIGH	: 0.500 mA	RAMP	: OFF	LIST	F3 <
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4 <
STAND BY					
RMT LOCK CORR ERR					
STEP 1/1	WVAC	LOW	: OFF	INC.	F1 <
VOLT	: 0.050 kV	ARC	: OFF	DEC.	F2 <
HIGH	: 0.500 mA	RAMP	: OFF	NEW	F3 <
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4 <
1 - 20					
RMT LOCK CORR ERR NEXT 1/2					
STEP 4/4	WVAC	LOW	: OFF	WVAC	F1 <
VOLT	: 0.050 kV	ARC	: OFF	WVDC	F2 <
HIGH	: 0.500 mA	RAMP	: OFF	IR	F3 <
TIME	: 3.0 s	FALL	: OFF	SCAN : 1 2 3 4 5 6 7 8	F4 <
SELECT MODE					
RMT LOCK CORR ERR NEXT 1/3					
STEP 4/4	IR	HIGH	: OFF	DIGIT UP	F1 <
VOLT	: 0.050 kV	RAMP	: OFF	DIGIT DN	F2 <
LOW	: 1.0 MΩ	FALL	: OFF	DIGIT	F3 <
TIME	: 3.0 s	RANGE	: AUTO	SCAN : 1 2 3 4 5 6 7 8	F4 <
0.05 - 6kV					
RMT LOCK CORR ERR					
STEP 4/4	IR	HIGH	: OFF	DIGIT UP	F1 <
VOLT	: 0.750 kV	RAMP	: OFF	DIGIT DN	F2 <
LOW	: 1.0 MΩ	FALL	: OFF	DIGIT	F3 <
TIME	: 3.0 s	RANGE	: AUTO	SCAN : 1 2 3 4 5 6 7 8	F4 <
0.001 - 10mA					
RMT LOCK CORR ERR D.P.					
STEP 4/4	IR	HIGH	: OFF	DIGIT UP	F1 <
VOLT	: 0.750 kV	RAMP	: OFF	DIGIT DN	F2 <
LOW	: 500 MΩ	FALL	: OFF	DIGIT	F3 <
TIME	: 3.0 s	RANGE	: AUTO	SCAN : 1 2 3 4 5 6 7 8	F4 <
0, 0.3 - 999s					
RMT LOCK CORR ERR CONTINUE					
STEP 4/4	IR	HIGH	: OFF	DIGIT UP	F1 <
VOLT	: 0.750 kV	RAMP	: OFF	DIGIT DN	F2 <
LOW	: 500 MΩ	FALL	: OFF	DIGIT	F3 <
TIME	: 3.0 s	RANGE	: AUTO	SCAN : 1 2 3 4 5 6 7 8	F4 <
0 - High, 0 = Off					
RMT LOCK CORR ERR OFF					
STEP 4/4	IR	HIGH	: OFF	DIGIT UP	F1 <
VOLT	: 0.750 kV	RAMP	: OFF	DIGIT DN	F2 <
LOW	: 500 MΩ	FALL	: OFF	DIGIT	F3 <
TIME	: 3.0 s	RANGE	: AUTO	SCAN : 1 2 3 4 5 6 7 8	F4 <
0, 0.1 - 10mA					
RMT LOCK CORR ERR OFF					
STEP 4/4	IR	HIGH	: OFF	DIGIT UP	F1 <
VOLT	: 0.750 kV	RAMP	: 3.0s	DIGIT DN	F2 <
LOW	: 500 MΩ	FALL	: OFF	DIGIT	F3 <
TIME	: 3.0 s	RANGE	: AUTO	SCAN : 1 2 3 4 5 6 7 8	F4 <
0, 0.1 - 999s					
RMT LOCK CORR ERR OFF					
STEP 4/4	IR	HIGH	: OFF	DIGIT UP	F1 <
VOLT	: 0.750 kV	RAMP	: 3.0s	DIGIT DN	F2 <
LOW	: 500 MΩ	FALL	: 3.0s	DIGIT	F3 <
TIME	: 3.0 s	RANGE	: AUTO	SCAN : 1 2 3 4 5 6 7 8	F4 <
0, 0.1 - 999s					
RMT LOCK CORR ERR OFF					
STEP 4/4	IR	HIGH	: OFF	H	F1 <
VOLT	: 0.750 kV	RAMP	: 3.0s	L	F2 <
LOW	: 500 MΩ	FALL	: 3.0s	--	F3 <
TIME	: 3.0 s	RANGE	: AUTO	SCAN : 1 2 3 4 5 6 7 8	F4 <
HIGH/LOW/OFF					
RMT LOCK CORR ERR CH NO.					

End IR programming. Press [F3] = NEW to start programming STEP 5-20 OR press [TEST] to exit program mode and return to STAND BY status.

2.8 Programming a DC Resistance (DCR) Test

2.8.1 Two-Wire DCR

If programming a single DCR test, with the instrument in 'stand-by' status, press [F1] = PROGRAM. Select Step # then press RIGHT [▶] arrow key to move backlit box from [STEP] to [WVAC]. Press [F4] = NEXT 1/3. Press [F1] = DCR. Follow instructions below starting with setting high resistance limit.

If continuing multi-step example (OSC = Step 1, WVAC = Step 2, WVDC = Step 3, IR = Step 4) here is how to program a DCR test in Step 5:

Press [F3] = NEW.

Press RIGHT [▶] arrow key to move backlit box from [STEP] to [WVAC]

Press [F4] = NEXT 1/3

Press [F1] = DCR

Press DOWN [▼] arrow key to move backlit box from [DCR] to [OFF]

Press [F1] – [F4] keys to set test time (0, 0.1 – 999s).

Press [ENTER] to accept value.

Press UP [▲] and RIGHT [▶] arrow key to move backlit box from [OFF] to [100.0 kΩ]

Press [F1] – [F4] keys to set high resistance limit (0.01Ω – 500kΩ).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [100.0kΩ] to [OFF]

Press [F1] – [F4] keys to set low resistance limit (0, 0.01Ω - HIGH).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [AUTO]

Press [F1] – [F3] keys to set resistance range (Auto, 6 ranges: 1Ω – 100kΩ).

Press DOWN [▼] arrow key to move backlit box from [AUTO] to [OFF]

Press [F1] – [F4] keys to set dwell time (0, 0.1 – 999s).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from [OFF] to [XXXXXXXX]

Press [F1] – [F3] keys to set output channel 1 (H, L, -).

Press [F4] to move backlit cursor right to next channel.

Press [F1] – [F3] keys to set output channels 2-8 (H, L, -).

Press [ENTER] when finished entering all Channel Settings.

Press DOWN [▼] arrow key to move backlit box from [H-H-H-H] to [STEP]

Continued on next page

Programming a DCR Test (illustrated):

STEP 1/1	WVAC	LOW	: OFF	PROGRAM	F1 ◀
		ARC	: OFF		F2 ◀
VOLT	: 0.050 kV	RAMP	: OFF	CORRECT	F3 ◀
HIGH	: 0.500 mA	FALL	: OFF	LIST	F4 ◀
TIME	: 3.0 s	REAL	: OFF		
		SCAN	: 1 2 3 4 5 6 7 8		
STAND BY		RMT	LOCK	CORR	ERR

STEP 1/1	WVAC	LOW	: OFF	INC.	F1 ◀
		ARC	: OFF		F2 ◀
VOLT	: 0.050 kV	RAMP	: OFF	DEC.	F3 ◀
HIGH	: 0.500 mA	FALL	: OFF	NEW	F4 ◀
TIME	: 3.0 s	REAL	: OFF		
		SCAN	: 1 2 3 4 5 6 7 8		
1 - 20		RMT	LOCK	CORR	ERR
					NEXT 1/2

STEP 5/5	WVAC	LOW	: OFF	WVAC	F1 ◀
		ARC	: OFF	WVDC	F2 ◀
VOLT	: 0.050 kV	RAMP	: OFF	IR	F3 ◀
HIGH	: 0.500 mA	FALL	: OFF		F4 ◀
TIME	: 3.0 s	REAL	: OFF		
		SCAN	: 1 2 3 4 5 6 7 8		
SELECT MODE		RMT	LOCK	CORR	ERR
					NEXT 1/3

STEP 5/5	WVAC	LOW	: OFF	DCR	F1 ◀
		ARC	: OFF	OSC	F2 ◀
VOLT	: 0.050 kV	RAMP	: OFF	IWT	F3 ◀
HIGH	: 0.500 mA	FALL	: OFF		F4 ◀
TIME	: 3.0 s	REAL	: OFF		
		SCAN	: 1 2 3 4 5 6 7 8		
SELECT MODE		RMT	LOCK	CORR	ERR
					NEXT 2/3

STEP 5/5	DCR	HIGH	: 100.0kΩ	DIGIT UP	F1 ◀
		LOW	: OFF	DIGIT DN	F2 ◀
		RANGE	: AUTO	DIGIT	F3 ◀
		DWELL	: OFF	CONTINUE	F4 ◀
TIME	: OFF	SCAN	: 1 2 3 4 5 6 7 8		
0.01 - 999s		RMT	LOCK	CORR	ERR

STEP 5/5	DCR	HIGH	: 100.0kΩ	DIGIT UP	F1 ◀
		LOW	: OFF	DIGIT DN	F2 ◀
		RANGE	: AUTO	DIGIT	F3 ◀
		DWELL	: OFF	D.P./OFF	F4 ◀
TIME	: OFF	SCAN	: 1 2 3 4 5 6 7 8		
0.01 - 100kΩ		RMT	LOCK	CORR	ERR

STEP 5/5	DCR	HIGH	: 100.0kΩ	DIGIT UP	F1 ◀
		LOW	: OFF	DIGIT DN	F2 ◀
		RANGE	: AUTO	DIGIT	F3 ◀
		DWELL	: OFF	D.P./OFF	F4 ◀
TIME	: OFF	SCAN	: 1 2 3 4 5 6 7 8		
0.001 - HIGH		RMT	LOCK	CORR	ERR

STEP 5/5	DCR	HIGH	: 100.0kΩ	DIGIT UP	F1 ◀
		LOW	: OFF	DIGIT DN	F2 ◀
		RANGE	: AUTO	DIGIT	F3 ◀
		DWELL	: OFF	AUTO	F4 ◀
TIME	: OFF	SCAN	: 1 2 3 4 5 6 7 8		
		RMT	LOCK	CORR	ERR

STEP 5/5	DCR	HIGH	: 100.0kΩ	DIGIT UP	F1 ◀
		LOW	: OFF	DIGIT DN	F2 ◀
		RANGE	: AUTO	DIGIT	F3 ◀
		DWELL	: OFF	OFF	F4 ◀
TIME	: OFF	SCAN	: 1 2 3 4 5 6 7 8		
0.01 - 999s		RMT	LOCK	CORR	ERR

STEP 5/5	DCR	HIGH	: 100.0kΩ	H	F1 ◀
		LOW	: OFF	L	F2 ◀
		RANGE	: AUTO	--	F3 ◀
		DWELL	: OFF	CH NO.	F4 ◀
TIME	: OFF	SCAN	: 1 2 3 4 5 6 7 8		
HIGH / LOW / OFF		RMT	LOCK	CORR	ERR

End DCR programming. Press [F3] = ENTER to start programming STEP 6-20 OR press [TEST] to exit program mode and return to STAND BY status.

2.8.2 Four-Wire DCR Programming

Enable DCR Four-Wire Mode in System: Test Control (see section 2.12.1.9)

If programming a single DCR test, with the instrument in “stand-by” status, press [F1] = PROGRAM. Select Step # then press RIGHT [▶] arrow key to move backlit box from **STEP** to

WVAC. Press [F4] = NEXT 1/3. Press [F1] = DCR. Follow instructions below starting with setting high resistance limit.

If continuing multi-step example (OSC = Step 1, WVAC = Step 2, WVDC = Step 3, IR = Step 4) here is how to program a DCR test in Step 5:

Press [F3] = NEW.

Press RIGHT [**▶**] arrow key to move backlit box from **STEP** to **WVAC**

Press [F4] = NEXT 1/3

Press [F1] = DCR

Press DOWN [**▼**] arrow key to move backlit box from **DCR** to **OFF**

Press [F1] – [F4] keys to set test time (0, 0.1 – 999s).

Press [ENTER] to accept value.

Press UP [**▲**] and RIGHT [**▶**] arrow key to move backlit box from **OFF** to **100.0 kΩ**

Press [F1] – [F4] keys to set high resistance limit (0.01Ω – 500kΩ).

Press [ENTER] to accept value.

Press DOWN [**▼**] arrow key to move backlit box from **100.0kΩ** to **OFF**

Press [F1] – [F4] keys to set low resistance limit (0, 0.1Ω - HIGH).

Press [ENTER] to accept value.

Press DOWN [**▼**] arrow key to move backlit box from **OFF** to **AUTO**

Press [F1] – [F3] keys to set resistance range (Auto, 6 ranges: 1Ω – 100kΩ).

Press DOWN [**▼**] arrow key to move backlit box from **AUTO** to **OFF**

Press [F1] – [F4] keys to set dwell time (0, 0.1 – 999s).

Press [ENTER] to accept value.

Press DOWN [**▼**] arrow key to move backlit box from **OFF** to **X X X X**

Press [F1] – [F3] keys to set output channel 1 (H, L, -).

Press [F4] to move backlit cursor right to next channel.

Press [F1] – [F3] keys to set output channels 3, 5, 7 (H, L, -).

Press [ENTER] when finished entering all Channel Settings.

Press DOWN [**▼**] arrow key to move backlit box from **H H H L** to **STEP**

Continued on next page

Programming a DCR Test (illustrated):

All steps are the same as two wire programming with the exception of the Scanner. The Scanner allows for four channels to be programmed.

CH1 set to High means:

CH1 output terminal is Drive+

CH2 output terminal is Sense +

CH3 set to Low means:

CH3 output terminal is Drive -

CH4 output terminal is Sense -

STEP 5/5	DCR	HIGH :	100.0kΩ	H	F1 <
		LOW :	OFF	L	F2 <
		RANGE :	AUTO		F3 <
		DWELL :	OFF		F4 <
TIME :	OFF	SCAN	1 2 3 4 5 6 7 8	--	
HIGH / LOW / OFF	RMT	LOCK	CORR	ERR	CH NO.

End DCR programming. Press [F3] = ENTER to start programming STEP 6-20 OR press [TEST] to exit program mode and return to STAND BY status.

2.9 Programming a Pause (PA)

If programming a PAUSE in the test setup, with the instrument in 'stand-by' status, press [F1] = PROGRAM. Select Step # then press RIGHT [▶] arrow key to move backlit box from **STEP** to **WVAC**. Press [F4] = NEXT 1/3. Press [F4] = NEXT 2/3. Press [F1] = PA. Follow instructions below starting with entering pause message.

If continuing multi-step example (OSC = Step 1, WVAC = Step 2, WVDC = Step 3, IR = Step 4, DCR = Step 5) here is how to program a PA in Step 6:

Press [F3] = NEW

Press RIGHT [▶] arrow key to move backlit box from **STEP** to **WVAC**

Press [F4] = NEXT 1/3

Press [F4] = NEXT 2/3

Press [F1] = PA

Press DOWN [▼] arrow key to move backlit box from **PA** to **PAUSE-MODE**

Press [F1] – [F3] keys to enter message (15 character alpha-numeric: 0-9; A-Z; -).

Press [ENTER] to accept message.

Press DOWN [▼] arrow key to move backlit box from **PAUSE-MODE** to **CONTINUE**

Press [F1] – [F3] keys to set pause time (0, 0.1 – 999sec).

Press [ENTER] to accept value.

Press DOWN [▼] arrow key to move backlit box from **CONTINUE** to **STEP**

Continued on next page.

Programming a PAUSE (illustrated):

STEP 1/1	WVAC	LOW	: OFF	PROGRAM	F1
VOLT	: 0.050 kV	ARC	: OFF		F2
HIGH	: 0.500 mA	RAMP	: OFF	CORRECT	F3
TIME	: 3.0 s	FALL	: OFF	DSP - LIST	F4
		REAL	: OFF		
		SCAN	: 1 2 3 4 5 6 7 8		
STAND BY	RMT	LOCK	CORR	ERR	

STEP 1/1	WVAC	LOW	: OFF	INC.	F1
VOLT	: 0.050 kV	ARC	: OFF		F2
HIGH	: 0.500 mA	RAMP	: OFF	DEC.	F3
TIME	: 3.0 s	FALL	: OFF	NEW	F4
		REAL	: OFF		
		SCAN	: 1 2 3 4 5 6 7 8		
1 - 20	RMT	LOCK	CORR	ERR	NEXT 1/2

STEP 6/6	WVAC	LOW	: OFF	WVAC	F1
VOLT	: 0.050 kV	ARC	: OFF	WVDC	F2
HIGH	: 0.500 mA	RAMP	: OFF	IR	F3
TIME	: 3.0 s	FALL	: OFF		F4
		REAL	: OFF		
		SCAN	: 1 2 3 4 5 6 7 8		
SELECT MODE	RMT	LOCK	CORR	ERR	NEXT 1/3

STEP 6/6	WVAC	LOW	: OFF	DCR	F1
VOLT	: 0.050 kV	ARC	: OFF	OSC	F2
HIGH	: 0.500 mA	RAMP	: OFF	IWT	F3
TIME	: 3.0 s	FALL	: OFF		F4
		REAL	: OFF		
		SCAN	: 1 2 3 4 5 6 7 8		
SELECT MODE	RMT	LOCK	CORR	ERR	NEXT 2/3

STEP 6/6	WVAC	LOW	: OFF	PA	F1
VOLT	: 0.050 kV	ARC	: OFF		F2
HIGH	: 0.500 mA	RAMP	: OFF		F3
TIME	: 3.0 s	FALL	: OFF		F4
		REAL	: OFF		
		SCAN	: 1 2 3 4 5 6 7 8		
SELECT MODE	RMT	LOCK	CORR	ERR	NEXT 3/3

STEP 6/6	PA	EDITING		F1	
MSG	: PAUSE-MODE			F2	
TIME	: CONTINUE			F3	
15 CHAR	RMT	LOCK	CORR	ERR	F4

STEP 6/6	PA			F1	
MSG	: PAUSE-MODE	0	1 2 3 4 5 6 7	LEFT	F2
TIME	: CONTINUE	8	9 A B C D E F	RIGHT	F3
15 CHAR	RMT	LOCK	CORR	ERR	EXIT
		G	H I J K L M N		
		O	P Q R S T U V		
		W	X Y Z - ← →		

To write message:

Use Arrow Keys to Select Character

Press ENTER to accept each character

Press [F3] = ENTER to accept message string

0	1	2	3	4	5	6	7
8	9	A	B	C	D	E	F
G	H	I	J	K	L	M	N
O	P	Q	R	S	T	U	V
W	X	Y	Z	-	←	→	



ENTER

F3

STEP 6/6	PA	EDITING		F1	
MSG	: CHANGE-LEAD			F2	
TIME	: CONTINUE			F3	
15 CHAR	RMT	LOCK	CORR	ERR	F4

STEP 6/6	PA	DIGIT UP		F1	
MSG	: CHANGE-LEAD	DIGIT DN		F2	
TIME	: CONTINUE	DIGIT		F3	
0.01 - 999s	RMT	LOCK	CORR	ERR	CONTINUE

STEP 6/6	PA	INC.		F1	
MSG	: CHANGE-LEAD	DEC.		F2	
TIME	: 10.0s	NEW		F3	
1 - 20	RMT	LOCK	CORR	ERR	NEXT 1/2

End PA programming. Press [F3] = ENTER to start programming STEP 7-20 OR press [TEST] to exit program mode and return to STAND BY status.

2.10 Programming a Multi-Step Test

Paragraphs 2.4, 2.5, 2.6, 2.7, 2.8 and 2.9 illustrate the programming of a 6-step test (OSC, WVAC, WVDC, IR, DCR & PA). To program a multiple step test, power-up the Hybrid 2000 instrument so the 'Stand By' display is shown (Figure 2-7). Use the parameters in Table 2-3 and follow the instructions to program a 6-step test and save it as "EXAMPLE" to memory location 01.

Table 2-3: Parameter Settings for 6-Step Example

	OSC	WVAC	WVDC	IR	DCR	PA
1	Test Step #	Test Step #	Test Step #	Test Step #	Test Step #	Test Step #
	1	2	3	4	5	6
2	Test Mode	Test Mode	Test Mode	Test Mode	Test Mode	Test Mode
	OSC	WVAC	WVDC	IR	DCR	PA
3	Open Check	Voltage	Voltage	Voltage	High Limit	Message
	50%	1.250kV	2.400kV	0.750kV	100.0kΩ	CHANGE LEAD
4	Short Check	High Limit	High Limit	Low Limit	Low Limit	Time
	300%	15mA	10mA	500MΩ	OFF	10.0s
5	Output CH	Test Time	Test Time	Test Time	Test Time	
	1, 3, 5, 7 = H	3.0s	3.0s	3.0s	3.0s	
6		Low Limit	Low Limit	High Limit	Range	
		OFF	OFF	OFF	Auto	
7		Arc Limit	Arc Limit	Ramp Time	Dwell Time	
		OFF	OFF	3.0s	3.0s	
8		Ramp Time	Ramp Time	Fall Time	Output CH	
		3.0s	3.0s	3.0s	1, 3, 5, 7 = H	
9		Fall Time	Dwell Time	Range		
		3.0s	3.0s	Auto		
10		Real Limit	Fall Time	Output CH		
		OFF	3.0s	1, 3, 5, 7 = H		
11		Output CH	Output CH			
		1, 3, 5, 7 = H	1, 3, 5, 7 = H			

From the Standby Menu:

"STAND BY"
or
"Power-Up"
Display

STEP 1/1	WVAC	LOW : OFF	PROGRAM
		ARC : OFF	
	0.000kV	RAMP : OFF	CORRECT
	0.500mA	FALL : OFF	
	3.0s	REAL : OFF	LIST
		SCAN : xxxxxxxx	
STAND BY		RMT	LOCK
		CORR	ERR

F1 ◀ Enter program mode

F2 ◀ Correct: Open/Short, Get Cs

F3 ◀ View Display as List

F4

"PROGRAM"
Display

STEP 1/1	WVAC	LOW : OFF	INC.
		ARC : OFF	
VOLT :	0.000kV	FALL : OFF	DEC.
HIGH :	0.500mA	RAMP : OFF	
TIME :	3.0s	REAL : OFF	NEW
		SCAN : xxxxxxxx	
SELECT MODE		RMT	LOCK
		CORR	ERR
		NEXT 1/2	

F1 ▶ Use RIGHT arrow key to move backlit box from [Step 1] to [WVAC]

F2

F3

F4

Figure 2-8: Hybrid 2000 Standby Menu & Program Menu

Press [F1] = PROGRAM.
 Press RIGHT [▶] arrow key to move backlit box from to
 Press [F4] = NEXT 1/3 to got to page 2.
 Press [F2] = OSC to select Open/Short Circuit mode.
 Press [ENTER] to accept Open % = 50%.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [ENTER] to accept Short % = 300%.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [F1] – [F4] keys to set Output Channels 1, 3, 5, & 7=H. Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from to

Press [F3] = NEW to program the next test step.
 Press RIGHT [▶] arrow key to move backlit box from to
 Press DOWN [▼] arrow key to move backlit box from to
 Press [F1] – [F3] keys to set AC output voltage to 1.250kV.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [F1] – [F3] keys to set high current limit = 15.00mA.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [ENTER] to accept test time = 3.0sec.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [ENTER] to accept low current limit = Off.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [ENTER] to accept arc limit = Off.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [F1] – [F3] keys to set ramp time = 3.0sec.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [F1] – [F3] keys to set fall time = 3.0sec.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [ENTER] to accept real current limit = Off.
 Press DOWN [▼] arrow key to move backlit box from to
 Press [F1] – [F3] keys to set output channels 1, 3, 5 & 7 = H.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from to

Press [F3] = NEW to program the next test step.
 Press RIGHT [**▶**] arrow key to move backlit box from **STEP** to **WVAC**
 Press [F2] = WVDC
 Press DOWN [**▼**] arrow key to move backlit box from **WVDC** to **0.050kV**
 Press [F1] – [F3] keys to set DC output voltage = 2.400kV.
 Press [ENTER] to accept value.
 Press DOWN [**▼**] arrow key to move backlit box from **2.400kV** to **0.500mA**
 Press [F1] – [F3] keys to set high current limit = 10.00mA.
 Press [ENTER] to accept value.
 Press DOWN [**▼**] arrow key to move backlit box from **10.00mA** to **3.0s**
 Press [ENTER] to accept test time = 3.0sec.
 Press DOWN [**▼**] arrow key to move backlit box from **3.0s** to **OFF**
 Press [ENTER] to accept low current limit = Off.
 Press DOWN [**▼**] arrow key to move backlit box from **OFF** to **OFF**
 Press [ENTER] to accept arc limit = Off.
 Press DOWN [**▼**] arrow key to move backlit box from **OFF** to **OFF**
 Press [F1] – [F3] keys to set ramp time = 3.0sec.
 Press [ENTER] to accept value.
 Press DOWN [**▼**] arrow key to move backlit box from **3.0s** to **OFF**
 Press [F1] – [F3] keys to set dwell time = 3.0sec.
 Press [ENTER] to accept value.
 Press DOWN [**▼**] arrow key to move backlit box from **3.0s** to **OFF**
 Press [F1] – [F3] keys to set fall time = 3.0sec.
 Press [ENTER] to accept value.
 Press DOWN [**▼**] arrow key to move backlit box from **3.0s** to **XXXXXXXXXX**
 Press [F1] – [F3] keys to set output channels 1, 3, 5, & 7 = H.
 Press [ENTER] to accept value.
 Press DOWN [**▼**] arrow key to move backlit box from **H-H-H-H-** to **STEP**

Press [F3] = NEW to program the next test step.
 Press RIGHT [**▶**] arrow key to move backlit box from **STEP** to **WVAC**
 Press [F3] = IR
 Press [ENTER]
 Press RIGHT [**▶**] arrow key to move backlit box from **IR** to **0.050kV**
 Press [F1] – [F3] keys to set IR output voltage = 0.750kV.
 Press [ENTER] to accept value.
 Press DOWN [**▼**] arrow key to move backlit box from **0.750kV** to **1.0MΩ**
 Press [F1] – [F3] keys to set low resistance limit = 500MΩ.
 Press [ENTER] to accept value.
 Press DOWN [**▼**] arrow key to move backlit box from **500MΩ** to **3.0s**
 Press [ENTER] to accept test time 3.0sec.
 Press DOWN [**▼**] arrow key to move backlit box from **3.0s** to **OFF**
 Press [ENTER] to accept high resistance limit = Off.

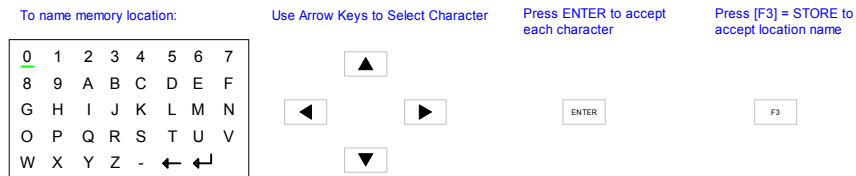
Press DOWN [▼] arrow key to move backlit box from OFF to OFF
 Press [F1] – [F3] keys to set ramp time = 3.0 sec
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from 3.0s to OFF
 Press [F1] – [F3] keys to set fall time = 3.0 sec.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from 3.0s to OFF
 Press [ENTER] to accept resistance range = Auto.
 Press DOWN [▼] arrow key to move backlit box from Auto to XXXXXXXXX
 Press [F1] – [F3] keys to set output channels 1, 3, 5, & 7 = H.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from H-H-H-H- to STEP

 Press [F3] = NEW to program the next test step.
 Press RIGHT [▶] arrow key to move backlit box from STEP to WVAC
 Press [F4] = NEXT 1/3
 Press [F1] = DCR
 Press [ENTER]
 Press DOWN [▼] arrow key to move backlit box from DCR to OFF
 Press [F1] – [F4] keys to set test time = 3.0s.
 Press [ENTER] to accept value.
 Press RIGHT [▶] arrow key to move backlit box from 3.0s to 100.0 kΩ
 Press [ENTER] to accept high resistance limit = 100kΩ.
 Press DOWN [▼] arrow key to move backlit box from 100.0kΩ to OFF
 Press [ENTER] to accept low resistance limit = Off.
 Press DOWN [▼] arrow key to move backlit box from OFF to AUTO
 Press [ENTER] to accept resistance range = Auto.
 Press DOWN [▼] arrow key to move backlit box from AUTO to OFF
 Press [F1] – [F4] keys to set dwell time 3.0s.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from 3.0s to XXXXXXXXX
 Press [F1] – [F3] keys to set output channels 1, 3, 5, & 7 = H.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from H-H-H-H- to STEP

Press [F3] = NEW to program the next test step.
 Press RIGHT [▶] arrow key to move backlit box from **STEP** to **WVAC**
 Press [F4] = NEXT 1/3
 Press [F4] = NEXT 2/3
 Press [F1] = PA
 Press DOWN [▼] arrow key to move backlit box from **PA** to
 Press [F1] – [F3] keys to enter message (15 character alpha-numeric: 0-9; A-Z; -).
 Press [ENTER] to accept message = CHANGE-LEAD.
 Press DOWN [▼] arrow key to move backlit box from **CHANGE-LEAD** to **CONTINUE**
 Press [F1] – [F3] keys to set pause time = 10.0sec.
 Press [ENTER] to accept value.
 Press DOWN [▼] arrow key to move backlit box from **10.0s** to **STEP**

Press [MAIN INDEX] to access to Store/Recall Menu. Follow the next instructions to save the 6-Step Test to Memory Location 1 and give it the label “EXAMPLE”.

Press [F1] = STORE/RECALL
 Display shows memory location 01 backlit: **01. (00)**
 Press [F1] = STORE



Press the [▶], [◀], [▼], [▲] arrows to move the backlit cursor around alpha-numeric box and select character. Press [ENTER] after each character is selected:

[E] [ENTER]
 [X] [ENTER]
 [A] [ENTER]
 [M] [ENTER]
 [P] [ENTER]
 [L] [ENTER]
 [E] [ENTER]
 Press [F3] = STORE
 Press [F1] = YES

Continued on next page.

NOTE:
 Instrument **PRESET** values can be programmed and stored for your specific test setup.
 Therefore **before storing** your tests, program the preset values.

Store “EXAMPLE” test (illustrated):

The sequence of screens for storing a test is as follows:

- Screen 1:** MAIN INDEX. < MAIN INDEX >. STORE/RECALL. F1 ◀ Enter Store/Recall Function.
- Screen 2:** F1. < STORE / RECALL >. STORE. F1 ◀ Store to backlit location.
- Screen 3:** F1. < STORE / RECALL >. LEFT, RIGHT, STORE, EXIT. F1 ◀ Move backlit cursor left, F2 ◀ Move backlit cursor right.
- Screen 4:** F1. < STORE / RECALL >. STORE?. F1 ◀ Store to backlit location.
- Screen 5:** F1. < STORE / RECALL >. STORE, RECALL, DELETE. F1 ◀ Store to backlit location, F2 ◀ Recall from backlit location, F3 ◀ Delete test in backlit location.

Press [TEST] to return to Standby Menu. The test setup name ‘EXAMPLE’ is in the upper right hand corner above [PROGRAM].

The test parameters and list are as follows:

Parameters Screen:

- STEP 1/6
- OSC
- OPEN : 50%
- SHORT : 300%
- EXAMPLE PROGRAM
- CORRECT
- LIST
- SCAN : 1 2 3 4 5 6 7 8
- SCAN : H - H - H - H -

Test List Screen:

TEST	SIGNAL	MEASURE	1	2	3	4	5	6	7	8	EXAMPLE PROGRAM
1	OS	0.100 kV	0.000	nF	H	-	H	-	H	-	EXAMPLE PROGRAM
2	AC	1.500 kV	10.00	mA	H	-	H	-	H	-	CORRECT
3	DC	2.400 kV	10.00	mA	H	-	H	-	H	-	STEP
4	IR	0.750 kV	500	MΩ	H	-	H	-	H	-	
5	DCR	-----	100.0	kΩ	H	-	H	-	H	-	

Figure 2-9: Programmed “EXAMPLE” Display

2.12 System Setup

Under [SYSTEM] setup there are seven functions. The Test Control function applies to each test setup. The System Configuration function applies to the instrument setup. The Key Lock function provides password-protected front panel lockout capability. Change Password changes allows customization of the password. Calibration provides instrument verification. The Error Log function returns RS232/IEEE communication errors. The About function is a list of the manufacturer and firmware version of the Hybrid 2000 instrument.

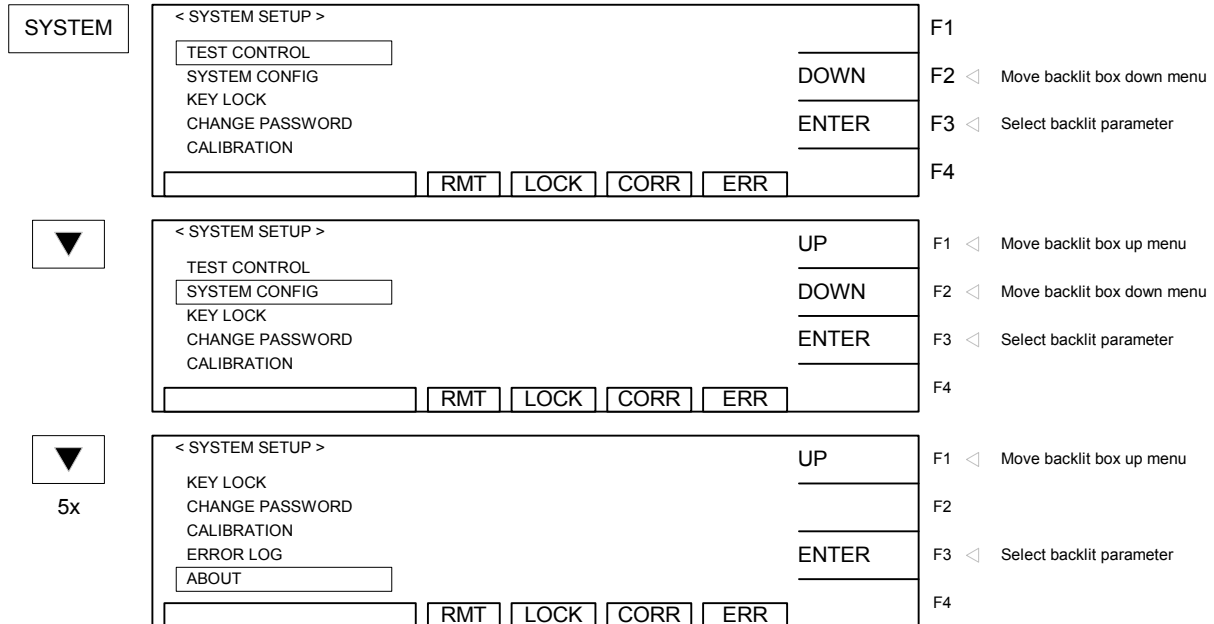


Figure 2-10: System Setup Menu

Table 2-5: System Setup Parameters

Parameter	Description
Test Control	Set initial parameters for test setups; saved with setup
System Config	Set instrument parameters
Key Lock	Lockout front panel access (Disable Program & Correct functions)
Change Password	Change Password from default (AAAA)
Calibration	Enter instrument calibration routine
Error Log	View status of error queue
About	View instrument manufacturer, firmware version & date

2.12.1. Test Control Parameters

A number of initial parameters or default conditions may be programmed and stored as the ‘power-up’ conditions. On the Hybrid 2000 instrument, this function is labeled Test Control and is accessible in the [SYSTEM] menu. Table 2-6 lists the Hybrid 2000 Test Control parameters including parameter range and initial (default) value.

The figure shows a sequence of four menu screens for the Test Control function. Each screen has a title bar and a list of options. The first screen is the SYSTEM menu, where TEST CONTROL is selected. The second screen is the TEST CONTROL menu, showing parameters like PASS HOLD (0.2 s) and ACV FREQUENCY (60Hz). The third screen is another TEST CONTROL menu, showing parameters like AFTER FAIL (OFF) and RAMP JUDGMENT (ON). The fourth screen is a further TEST CONTROL menu, showing parameters like RAMP JUDGMENT (ON) and T. COMPENSATION (OFF). A magnification indicator '11x' is shown on the left side of the fourth screen.

Figure 2-11: Test Control Menu

Table 2-6: Test Control Parameters

Parameter	Range	Initial (Default) Value	Description
Pass Hold	0.2 – 99.9 sec	0.5	Set hold time for a PASS result
AC-V Frequency	50 or 60Hz	60	Set frequency for WVAC test
Software AGC	ON or OFF	ON	Set software automatic gain control function ON or OFF
WV Auto Range	ON or OFF	OFF	Set auto range function ON or OFF
GFI	ON or OFF	ON	Set ground fault interrupt to trip if current imbalance >0.5mA
After Fail	ON or OFF	OFF	Set instrument to continue test if a step fails
Ramp Judgment	ON or OFF	ON	Set ON/OFF to have high limit applied during ramp or not
Trigger Delay	0 (OFF); increments by 10 up to 9999µs	0 (OFF)	At setting 0, this function is OFF. Pressing the UP key increments the delay by 10 µs up to 9999µs.

DCR Balance	0, 0.001 – 999Ω	0 (OFF)	Compares DCR measurements. If difference in measurements exceeds DCR Balance value, result is Fail.
DCR 4-Terminal	ON or OFF	OFF	Set ON to apply 4 wire DCR Measurement
T. Compensation	SETUP		Access to Setup the Temperature Compensation.

2.12.1.1 Pass Hold

The Pass Hold setting allows the option of programming a hold time for the PASS relay (at Remote Interface) after a single test or multiple step tests. The range for Pass Hold is 0.2 – 99.9 sec and the instrument default setting is 0.5sec. Refer to Figure 2-12.

< TEST CONTROL >		DIGIT UP	F1 < Increase pass hold time
PASS HOLD	: 0.2 s	DIGIT DN	F2 < Decrease pass hold time
ACV FREQUENCY	: 60Hz	DIGIT	F3 < Move decimal place
SOFTWARE AGC	: ON	EXIT	F4
WV AUTO RANGE	: OFF		
GFI	: ON		
0.2 - 99.9 s	RMT	LOCK	CORR
			ERR

To access Pass Hold:

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD: 0.2sec

Press [F1] = UP or [F2] = DOWN to increase or decrease the Pass Hold time

Press [ENTER] to accept Pass Hold Time

or

Press [F4] = EXIT to exit Test Control Menu and return to System Setup Menu.

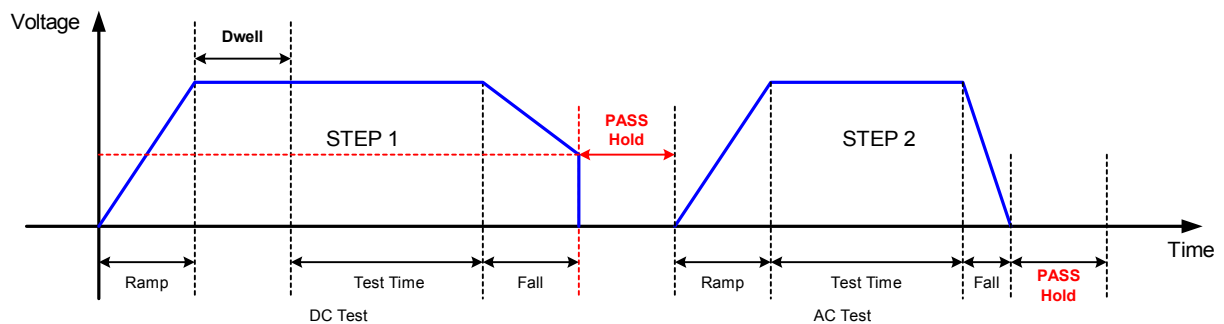


Figure 2-12: Pass Hold

2.12.1.2 ACV Frequency

The AC V Frequency setting allows the option of selecting the frequency for the WVAC dielectric withstand voltage test. The range of AC-V Freq. is 50 or 60Hz and the instrument default setting is 60Hz.

< TEST CONTROL >		60 Hz	F1 < 60Hz			
PASS HOLD	: 0.2 s	_____				
ACV FREQUENCY	: 60Hz	50 Hz	F2 < 50Hz			
SOFTWARE AGC	: ON	_____				
WV AUTO RANGE	: OFF	_____	F3			
GFI	: ON	_____				
50Hz/60Hz	RMT	LOCK	CORR	ERR	EXIT	F4

To access AC-V FREQ:

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD: 0.2sec

Press DOWN [▼] arrow key so that backlit box is next to: AC-V FREQ: 60Hz

Press [F1] = 60Hz or [F2] = 50Hz to change the AC-V Frequency

Press [ENTER] to accept ACV Frequency

or

Press [F4] = EXIT to exit Test Control Menu and return to System Setup Menu.

2.12.1.3 Software AGC

The Software Automatic Gain Control (SOFTWARE AGC) setting allows the option of correcting the output voltage (ON). This is satisfactory when measuring resistors but under special circumstances when measuring large capacitive devices it is best to select Software AGC OFF. The default value is ON.

< TEST CONTROL >		ON	F1 < Output voltage corrected			
PASS HOLD	: 0.2 s	_____				
ACV FREQUENCY	: 60Hz	OFF	F2 < Output voltage not corrected			
SOFTWARE AGC	: ON	_____				
WV AUTO RANGE	: OFF	_____	F3			
GFI	: ON	_____				
ON/OFF	RMT	LOCK	CORR	ERR	EXIT	F4

To access SOFT AGC:

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD: 0.2sec

Press DOWN [▼] arrow key so that backlit box is next to: SOFTWARE AGC: ON

Press [F1] = ON or [F2] = OFF to change Software AGC to ON/OFF

Press [ENTER] to accept Software AGC setting.

or

Press [F4] = EXIT to exit Test Control Menu and return to System Setup Menu.

2.12.1.4 WV Auto Range

The WV Auto Range setting allows the option of using the full-scale current range (ON) or using the user programmed maximum current limit (OFF) in the WVAC and WVDC tests. The low current range (3mA full scale) results in increased measurement resolution. The default value of WV Auto Range is OFF.

< TEST CONTROL >		ON	F1 <	Use the instrument full-scale current range				
PASS HOLD	: 0.2 s	_____						
ACV FREQUENCY	: 60Hz	OFF	F2 <	Use the user-programmed maximum current limit				
SOFTWARE AGC	: ON	_____						
WV AUTO RANGE	: <input type="text" value="OFF"/>	_____	F3					
GFI	: ON	_____						
<input type="text" value="ON/OFF"/>		<input type="text" value="RMT"/>	<input type="text" value="LOCK"/>	<input type="text" value="CORR"/>	<input type="text" value="ERR"/>	EXIT	F4	

To access WV AUTO RANGE:

Press [SYSTEM]

The backlit box is on:

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD:

Press DOWN [▼] arrow key so that backlit box is next to: WV AUTO RANGE:

Press [F1] = ON or [F2] = OFF to change WV Auto Range to ON/OFF

Press [ENTER] to accept WV Auto Range setting

or

Press [F4] = EXIT to exit Test Control Menu and return to System Setup Menu.

2.12.1.5 GFI

The Ground Fault Interrupt (GFI) function can be programmed ON or OFF. The instrument default setting is ON. When GFI is activated, the ground fault interrupt circuit will trip when a current imbalance >0.5mA occurs. The high voltage output is immediately shutdown.

< TEST CONTROL >		ON	F1 <	Instrument shutdown if current imbalance exceeds 0.5mA				
PASS HOLD	: 0.2 s	_____						
ACV FREQUENCY	: 60Hz	OFF	F2 <	GFI Circuit OFF				
SOFTWARE AGC	: ON	_____						
WV AUTO RANGE	: OFF	_____	F3					
GFI	: <input type="text" value="ON"/>	_____						
<input type="text" value="ON/OFF"/>		<input type="text" value="RMT"/>	<input type="text" value="LOCK"/>	<input type="text" value="CORR"/>	<input type="text" value="ERR"/>	EXIT	F4	

To access GFI:

Press [SYSTEM]

The backlit box is on:

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD:

Press DOWN [▼] arrow key so that backlit box is next to: GFI:

Press [F1] = ON or [F2] = OFF to change the Ground Fault Interrupt to ON/OFF

Press [ENTER] to accept GFI setting

or

Press [F4] = EXIT to exit Test Control Menu and return to System Setup Menu.

2.12.1.6 After Fail

The After Fail function can be programmed ON or OFF and the default setting is OFF. This selection determines if the unit will stop testing or proceed to the next test on fail during a multi-step test. When ON is selected if a test fails, then the instrument proceeds to the next step in the program. The exception to this: if Ground Fault Interrupt (GFI) is ON and a GFI failure occurs, the instrument will not proceed to the next step but will shut down.

< TEST CONTROL >		ON	F1 < Test continues on fail
ACV FREQUENCY	: 60Hz	OFF	F2 < Test stops on fail
SOFTWARE AGC	: ON		F3
WV AUTO RANGE	: OFF		F4
GFI	: ON		
AFTER FAIL	: OFF		
ON/OFF		RMT	LOCK
		CORR	ERR

To access AFTER FAIL:

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD: 0.2sec

Press DOWN [▼] arrow key so that backlit box is next to: AFTER FAIL : OFF

Press [F1] = ON or [F2] = OFF to change AFTER Fail to ON/OFF

Press [ENTER] to accept AFTER Fail setting.

OR Press [F4] = EXIT to exit Test Control Menu and return to System Setup Menu.

After Fail will function as follows when used with SUB STEPS

Setting TEST CONTROL	Test Result	Execution Status
Set After Fail to OFF	Main Step result is Fail	Sub Step test starts
		Test stops when Sub Step result is Fail.
	Main Step result is Pass	The next Main Step test is not started when all Sub Steps are complete. (All Sub Steps are judged as Pass).
		It does not start Sub Step test.
Set After Fail to ON	Main Step result is Fail	It starts the next Main Step test.
		It starts the Sub Step test.
	Main Step result is Pass	It continues to test the next Sub Step when the Sub Step is judged as Fail.
		It starts the next Main Step test.

2.12.1.7 Ramp Judgment

The Ramp Judgment setting allows the option of applying the high current limit during the ramp time of a WVAC or WVDC test or just having the high limit applied during test time. Applying the high current limit before the device is fully charged can give a better indication of breakdown prior to the voltage being applied. The range for Ramp Judgment is ON or OFF and the instrument default setting is ON.

< TEST CONTROL >		ON	F1	High limit applied during ramp
SOFTWARE AGC	: ON	ON	F2	High limit not applied during ramp
WV AUTO RANGE	: OFF	OFF	F3	
GFI	: ON		F4	
AFTER FAIL	: OFF			
RAMP JUDGMENT	: OFF			
ON/OFF		RMT	LOCK	CORR
		ERR		

To access Ramp Judgment:

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD: 0.2sec

Press DOWN [▼] arrow key so that backlit box is next to: RAMP JUDGMENT: OFF

Press [F1] = ON or [F2] = OFF to change the Ramp Judgment setting

Press [ENTER] to accept Ramp Judgment setting

OR Press [F4] = EXIT to exit Test Control Menu and return to System Setup Menu.

2.12.1.8 Trigger Delay

Trigger delay is the time delay from when START is pressed or sent to when the test begins. Trigger delay is programmed from 10 - 999 mS and can be turned off.

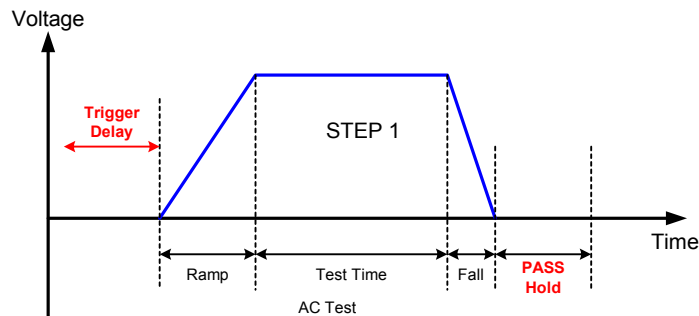


Figure 2-13 Trigger Delay

< TEST CONTROL >		DIGIT UP	F1 <	Increases Delay Time
WV AUTO RANGE	: OFF	DIGIT DN	F2 <	Decreases Delay Time
GFI	: ON	DIGIT	F3 <	Moves Cursor
AFTER FAIL	: OFF	OFF	F4 <	Disables Delay Time
RAMP JUDGMENT	: OFF			
TRIGGER DELAY	: OFF			
0, 10-9999mS	[RMT] [LOCK] [CORR] [ERR]			

To access Trigger Delay:

Press [SYSTEM]

The backlit box is on: **TEST CONTROL**

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD: **0.2sec**

Press DOWN [▼] arrow key so that backlit box is next to: Trigger Delay: **OFF**

Press [F1] = Digit Up or [F2] = Digit Down to change the Trigger Delay setting

Press DOWN [▼] to accept Trigger Delay setting and move to DCR Balance

2.12.1.9 DCR Balance

DCR Balance is useful for wound motor testing. When the DC Resistance value of the windings within a motor is unbalanced the rotation will be unbalanced as well and may cause long time issues. The DCR Balance Setting subtracts the minimum DCR Reading from the Maximum DCR Reading. If the difference is greater than the DCR Balance setting, the result is fail.

< TEST CONTROL >		DIGIT UP	F1 <	Increases Resistance
GFI	: ON	DIGIT DN	F2 <	Decreases Resistance
AFTER FAIL	: OFF	DIGIT	F3 <	Moves Cursor
RAMP JUDGMENT	: OFF	OFF	F4 <	Moves Decimal Place / Disables DCR Balance
TRIGGER DELAY	: OFF			
DCR BALANCE	: OFF			
0, 0.001-999Ω	[RMT] [LOCK] [CORR] [ERR]	D.P./ OFF		

To access DCR Balance:

Press [SYSTEM]

The backlit box is on: **TEST CONTROL**

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD: **0.2sec**

Press DOWN [▼] arrow key so that backlit box is next to: DCR Balance: **OFF**

Press [F1] = Digit Up or [F2] = Digit Down to change the DCR Balance resistance

Press DOWN [▼] to accept DCR Balance setting and move to DCR 4-Terminal

2.12.1.10 DCR 4-Terminal

DCR 4-Terminal allows for a Kelvin (4- Wire) DCR Measurement when set to ON. When this mode is ON, during DCR Programming Channels 1, 3, 5 and 7 are programmable High, Low or OFF. When set to High, the channel will be Drive+, when set to Low the channel will be Drive-. Channels 2, 4, 6, and 8 are Sense lines and not programmable.

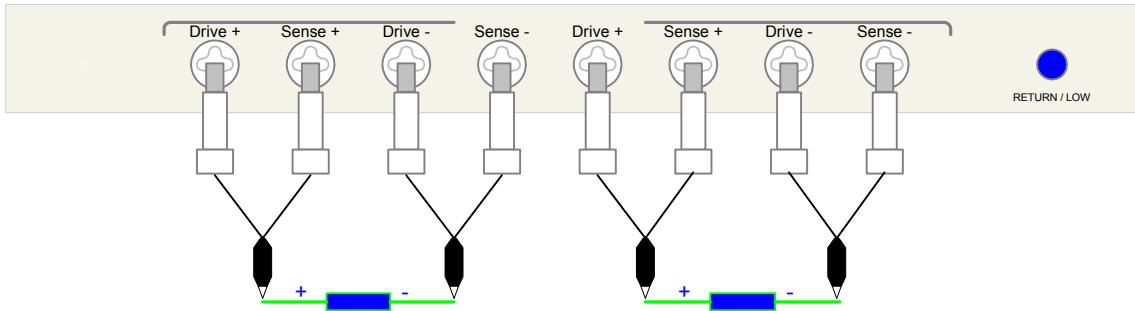


Figure 2-14: Sample DCR 4 Wire Connection

< TEST CONTROL >		ON	F1 <	Enables DCR 4 wire mode
AFTER FAIL	: OFF	_____	F2 <	Disables DCR 4 wire mode
RAMP JUDGMENT	: OFF	_____	F3 <	
TRIGGER DELAY	: OFF	_____	F4 <	
DCR BALANCE	: OFF	_____		
DCR 4-TERMNAL	: OFF	_____		
ON/OFF		RMT	LOCK	CORR
		ERR	EXIT	

To access DCR 4-Terminal:

Press [SYSTEM]

The backlit box is on: **TEST CONTROL**

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD: **0.2sec**

Press DOWN [▼] arrow key so that backlit box is next to: DCR 4-Terminal: **OFF**

Press [F1] = ON or [F2] = OFF to change the DCR 4-Terminal setting

Press [ENTER] to accept DCR 4-Terminal setting

OR Press [F4] = EXIT to exit Test Control Menu and return to System Setup Menu.

2.12.1.11 T. Compensation

The temperature measurement function is available for the Hybrid 2000 when the temperature interface and temperature probe are purchased for use. It can measure the DUT and environment temperature. The temperature measurement function of the Hybrid only works when appropriate interface and probe are purchased for application.

< TEST CONTROL >		SETUP	F1 <	Enter Temperature Compensation Setup
RAMP JUDGMENT	: OFF	_____	F2 <	
TRIGGER DELAY	: OFF	_____	F3 <	
DCR BALANCE	: OFF	_____	F4 <	
DCR 4-TERMNAL	: OFF	_____		
T. COMPENSATOIN	: OFF	_____		
_____		RMT	LOCK	CORR
		ERR	EXIT	

To access T. Compensation:

Press [SYSTEM]

The backlit box is on: **TEST CONTROL**

Press [F3] = ENTRY

The backlit box is next to: PASS HOLD: **0.2sec**

Press DOWN [▼] arrow key so that backlit box is next to: T. Compensation: **OFF**

Press [F1] = SETUP to configure the Hybrid 2000 for Temperature Compensation

Press [F4] = EXIT to exit Temperature Compensation Setup

OR Press [F4] = EXIT to exit Test Control Menu and return to System Setup Menu.

Table 2-7 T. Compensation Settings

Items	Range	Default	Description
REAL TEMP.			Displays the measured temperature. NONE is shown if the hardware is not installed
TEMP. UNIT	°C /°F	°C	Selects the unit of temperature
THERMAL COEFF.	0~9999ppm	3930ppm	Sets the temperature coefficient (□)
BASE TEMP.	-10°C ~ 99.9°C (14°F ~ 211.8°F)	20°C (68°F)	Sets the reference temperature (T _o)
TEMP. SETTING	-10°C ~ 99.9°C (14°F ~ 211.8°F)	20°C (68°F)	Sets the measured or environment temperature when in Manual mode (T).
T. COMPENSATION	AUTO/MANUAL /OFF	OFF	Sets the temperature compensation function. AUTO uses the measured (Real) temperature for compensation, MANUAL uses temperature set by TEMP. SETTING for compensation, OFF disables temperature compensation.

< T.COMPENSATION >		F1 <
REAL TEMP.	: NONE	_____
TEMP. UNIT	: °C	_____
THERMAL COEFF.	: 3930ppm	_____
BASE TEMP	: 20.0° C	_____
TEMP. SETTING	: 20.0° C	_____
	[RMT] [LOCK] [CORR] [ERR] EXIT	F4 <

The following formula is applied when temperature compensation is on:

$$\rho = \rho_0(1 + \alpha(T - T_0))$$

ρ = measured resistance

ρ_0 = resistance at reference temperature (typically 20° C)

T = measured temperature
To = reference temperature
 α = temperature coefficient of resistivity

For example

The measured temperature is 30°C and the measured copper wire resistance is 100Ω. To calculate the resistance at 20°C, the user needs to set the Base Temperature to (20°C) and the temperature coefficient (the temperature coefficient of copper is 3930 ppm.)

The calculation condition is that the resistance of copper wire measured is 100Ω under the measured environment temperature 30°C. The process of converting the 3930 ppm temperature coefficient to the resistance at 20°C is shown below.

ρ_0 :	unknown resistance
ρ :	100Ω
α	3930 ppm
t(°C):	30 °C
ρ_0 (°C):	20°C

$$\rho_0 = 100 / \{1 + (3930 \text{ e-6}) * (30 - 20)\} = 96.21 \Omega$$

The Hybrid 2000 will display the resistance as 96.21 Ω when corrected to 20°C.

2.12.2 System Configuration

A number of system parameters may be programmed and stored as the ‘power-up’ conditions. On the Hybrid 2000 instrument, this function is labeled SYSTEM CONFIG and is accessible in the [SYSTEM] menu. Table 2-8 lists the Hybrid 2000 System Configuration parameters including parameter range and initial (default) value.

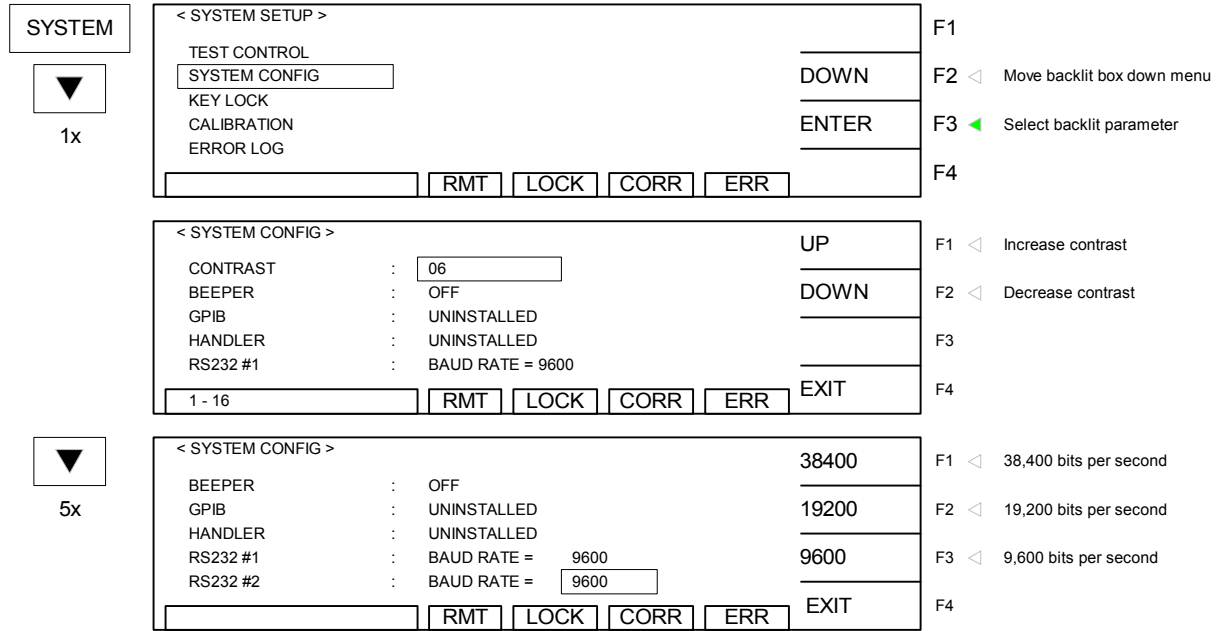


Figure 2-15: System Config Menu

Table 2-8: System Configuration Parameters

Parameter	Range	Default Value	Description
Contrast	1 – 16	06	Change Display Contrast: 0=Lightest; 16=Darkest
Beeper	High, , Low, Off	Low	Set loudness of beeper: High, Low or Off
GPIB	Unistalled/ Address = 0 - 30	03	Set address of IEEE interface: 00 – 30. Unistalled is displayed if GPIB card is not installed
Handler	Unistalled / Installed	NA	Displays if the Handler Card is installed.
RS232 #1	9600 - 38400	9600	Set Baud Rate: 9600, 19200 or 38400
RS232 #2	9600 - 38400	9600	Optional interface: Set Baud Rate: 9600, 19200 or 38400
T.Board	Uninstalled/ Installed	NA	Displays if the Temperature card is installed.
T. Probe	None/PT100/PT500	NA	Displas the type of Temperature probe being used.

2.12.2.1 Contrast

The contrast parameter adjusts the brightness of the LCD display. The range is 1-16 with 16 being the darkest. The initial default setting is 6.

< SYSTEM CONFIG >		UP	F1 < Increase contrast		
CONTRAST	: 06	DOWN	F2 < Decrease contrast		
BEEPER	: OFF		F3		
GPIB	: UNINSTALLED		F4		
HANDLER	: UNINSTALLED				
RS232 #1	: BAUD RATE = 9600	EXIT			
1 - 16	RMT	LOCK	CORR	ERR	

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press DOWN [▼] arrow key so that backlit box is on: SYSTEM CONFIG

Press [ENTER]

The backlit box is next to: CONTRAST: 06

Press [F1] = UP or [F2] = DOWN to increase/decrease the contrast of the display.

Press [ENTER] to accept contrast setting.

Press [F4] = EXIT to exit SYSTEM CONFIG and return to SYSTEM SETUP.

2.12.2.2 Beeper

The beeper volume can be adjusted from low to high or it can be turned OFF. The initial default setting is high.

< SYSTEM CONFIG >		HIGH	F1 < Loud audible warning		
CONTRAST	: 06	LOW	F2 < Soft audible warning		
BEEPER	: OFF	OFF	F3 < Shut beeper OFF		
GPIB	: UNINSTALLED		F4		
HANDLER	: UNINSTALLED				
RS232 #1	: BAUD RATE = 9600	EXIT			
	RMT	LOCK	CORR	ERR	

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press DOWN [▼] arrow key so that backlit box is on: SYSTEM CONFIG

Press [ENTER]

The backlit box is next to: CONTRAST: 06

Press DOWN [▼] arrow key so that backlit box is next to: BEEPER: HIGH

Press [F1] = HIGH, [F2] = LOW or [F3] = OFF to set the loudness of the beeper.

Press [ENTER] to accept beeper setting.

Press [F4] = EXIT to exit SYSTEM CONFIG and return to SYSTEM SETUP.

2.12.2.3 GPIB

Within the GPIB menu there is one programmable function: GPIB address. The range for the IEEE-488 address is 0-30 and the initial instrument setting is 3.

< SYSTEM CONFIG >		F1
CONTRAST	: 06	_____
BEEPER	: OFF	_____
GPIB	: UNINSTALLED	_____
HANDLER	: UNINSTALLED	_____
RS232 #1	: BAUD RATE = 9600	_____
<input type="button" value="RMT"/> <input type="button" value="LOCK"/> <input type="button" value="CORR"/> <input type="button" value="ERR"/> <input type="button" value="EXIT"/>		F4

2.12.2.4 Handler

The Handler display shows if the Handler has been installed and is recognized by the Hybrid.

< SYSTEM CONFIG >		F1
CONTRAST	: 06	_____
BEEPER	: OFF	_____
GPIB	: UNINSTALLED	_____
HANDLER	: UNINSTALLED	_____
RS232 #1	: BAUD RATE = 9600	_____
<input type="button" value="RMT"/> <input type="button" value="LOCK"/> <input type="button" value="CORR"/> <input type="button" value="ERR"/> <input type="button" value="EXIT"/>		F4

2.12.2.5 RS232 #1

Within the RS232 menu there is one programmable parameter: baud rate. The baud rate is adjustable as 9600, 19200 or 38400 bps. The initial setting is 9600.

< SYSTEM CONFIG >		38400	F1 <	38,400 bits per second
CONTRAST	: 06	_____		
BEEPER	: OFF	_____	F2 <	19,200 bits per second
GPIB	: UNINSTALLED	_____		
HANDLER	: UNINSTALLED	_____	F3 <	9,600 bits per second
RS232 #1	: BAUD RATE = 9600	_____		
<input type="button" value="RMT"/> <input type="button" value="LOCK"/> <input type="button" value="CORR"/> <input type="button" value="ERR"/> <input type="button" value="EXIT"/>			F4	

Press [SYSTEM]

The backlit box is on:

Press DOWN [▼] arrow key so that backlit box is on:

Press [ENTER]

The backlit box is next to: CONTRAST:

Press DOWN [▼] arrow key so that backlit box is next to: RS232 #1:

Press [F1] = 38400, [F2] = 19200 or [F3] = 9600 to set the baud rate.

Press [ENTER] to accept baud rate setting.

Press [F4] = EXIT to exit SYSTEM CONFIG and return to SYSTEM SETUP.

2.12.2.6 RS232 #2

An optional 2nd RS232 interface is available for the Hybrid 2000 instrument. The baud rate is adjustable as 9600, 19200 or 38400 bps. The initial setting is 9600.

< SYSTEM CONFIG >		38400	F1 <	38,400 bits per second
BEEPER	: OFF			
GPIB	: UNINSTALLED	19200	F2 <	19,200 bits per second
HANDLER	: UNINSTALLED			
RS232 #1	: BAUD RATE = 9600	9600	F3 <	9,600 bits per second
RS232 #2	: BAUD RATE = 9600			
		EXIT	F4	
		RMT	LOCK	CORR
		ERR		

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press DOWN [▼] arrow key so that backlit box is on: SYSTEM CONFIG

Press [ENTER]

The backlit box is next to: CONTRAST: 06

Press DOWN [▼] arrow key so that backlit box is next to: RS232 #2: BAUD RATE = 9600

Press [F1] = 38400, [F2] = 19200 or [F3] = 9600 to set the baud rate.

Press [ENTER] to accept baud rate setting.

Press [F4] = EXIT to exit SYSTEM CONFIG and return to SYSTEM SETUP.

2.12.2.7 T.Board

The T. Board display shows if the Temperature Board has been installed and is recognized by the Hybrid.

< SYSTEM CONFIG >			F1	
GPIB	: UNINSTALLED			
HANDLER	: UNINSTALLED		F2	
RS232 #1	: BAUD RATE = 9600			
RS232 #2	: BAUD RATE = 9600		F3	
T. BOARD	: UNINSTALLED			
		EXIT	F4	
		RMT	LOCK	CORR
		ERR		

2.12.2.8 T. Probe

The T. Probe setting allows for selection of the temperature probe being used. Options are None, PT100 and PT500.

< SYSTEM CONFIG >			F1	
HANDLER	: UNINSTALLED			
RS232 #1	: BAUD RATE = 9600		F2	
RS232 #1	: BAUD RATE = 9600			
T. BOARD	: UNINSTALLED		F3	
T. PROBE	: NONE			
		EXIT	F4	
		RMT	LOCK	CORR
		ERR		

2.12.3 Key Lock

To lock out the Program and Test Control functions of the Hybrid 2000 instrument use the KEY LOCK function in the MENU parameters. The range of KEY LOCK is ON or OFF and the initial instrument setting is OFF. To activate the KEY LOCK function:

Press [SYSTEM]

The backlit box is on: **TEST CONTROL**

Press DOWN [▼] arrow key so that backlit box is on: **KEY LOCK**

Press [ENTER]

Display prompts 'LOCK KEY: NEW PASSWORD []'

Press [A] [A] [A] [A] [ENTER]

Display prompts 'LOCK KEY: CONFIRM PASSWORD []'

Press [A] [A] [A] [A] [ENTER] again

NOTE: AAAA is the default password. If password has been changed use the new password.

The **LOCK** block at bottom of display is backlit.

PROGRAM and CORRECT functions are no longer visible or functional.

The figure illustrates the steps to activate the Key Lock function through the instrument's menu system. It consists of five sequential screenshots:

- Screen 1:** The 'SYSTEM' menu is selected. The 'TEST CONTROL' option is highlighted. Navigation keys shown: F1 (none), F2 (DOWN), F3 (ENTER), F4 (none).
- Screen 2:** The 'KEY LOCK' option is highlighted. Navigation keys shown: F1 (UP), F2 (DOWN), F3 (ENTER), F4 (none).
- Screen 3:** The 'LOCK KEY: NEW PASSWORD:' prompt is shown. Navigation keys shown: F1 (A), F2 (B), F3 (ENTER), F4 (EXIT).
- Screen 4:** The 'LOCK KEY: CONFIRM PASSWORD:' prompt is shown. Navigation keys shown: F1 (A), F2 (B), F3 (ENTER), F4 (EXIT).
- Screen 5:** The main menu is shown with 'LOCK' highlighted in yellow. Navigation keys shown: F1 (none), F2 (none), F3 (STEP), F4 (none).

Figure 2-16: Key Lock Display

To disable the KEY LOCK function:

Press [SYSTEM]

The backlit box is on: **TEST CONTROL**

Press DOWN [▼] arrow key so that backlit box is on: **KEY LOCK**

Press [ENTER]

Display prompts ‘UNLOCK KEY: NEW PASSWORD []’

Press [A] [A] [A] [A] [ENTER]

Display prompts ‘UNLOCK KEY: CONFIRM PASSWORD []’

Press [A] [A] [A] [A] [ENTER] again

NOTE: AAAA is the default password. If password has been changed use the new password.

The **LOCK** block at bottom of display is OFF.

PROGRAM and CORRECT functions are now visible and functional.

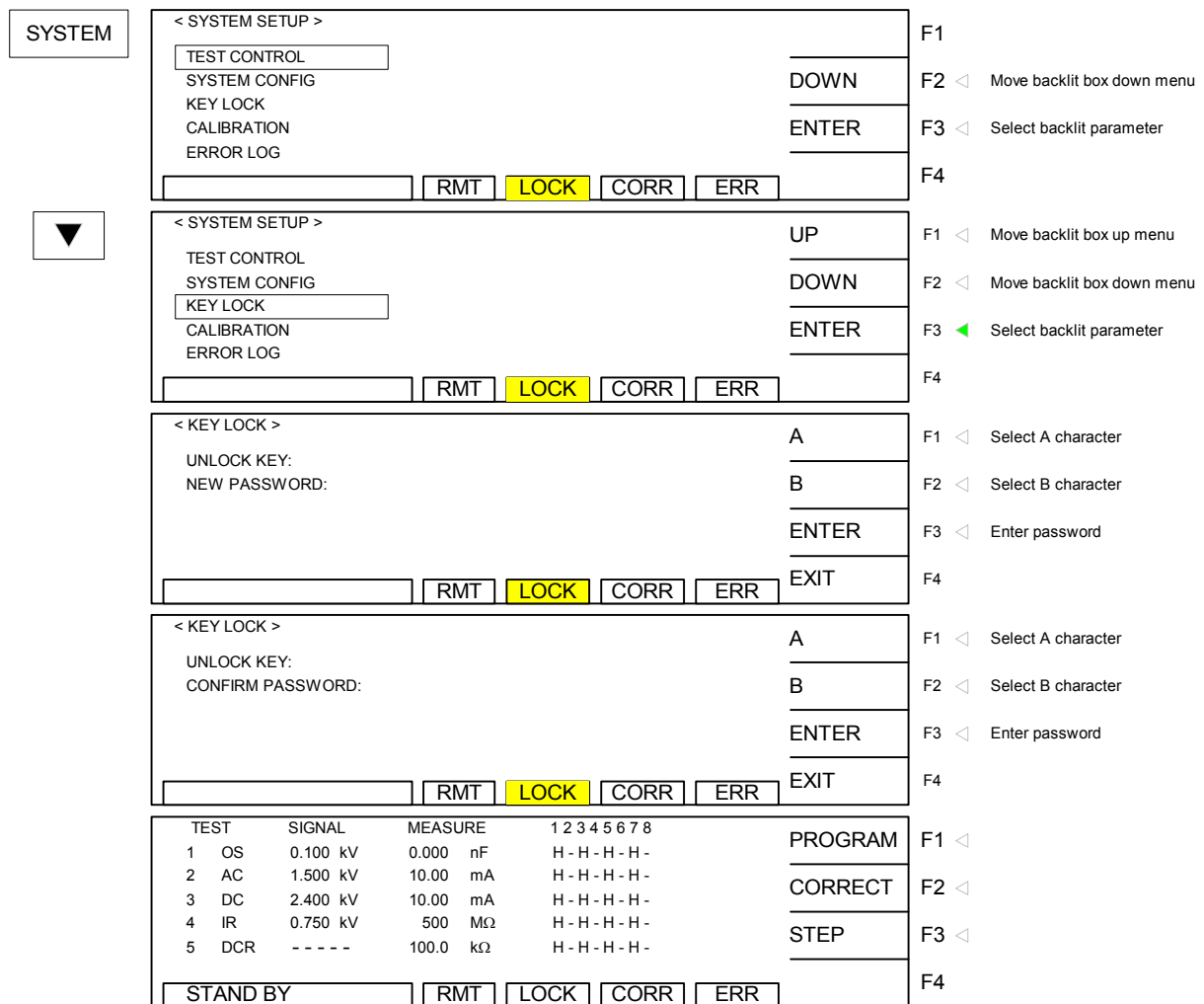


Figure 2-17: Disabling Key Lock

2.12.4 Change Password

The CHANGE PASSWORD function will change the Hybrid password from default (AAAA).

<div style="border: 1px solid black; padding: 2px; display: inline-block;">SYSTEM</div> <div style="text-align: center;">▼</div> 3x	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">< SYSTEM SETUP ></p> <p>TEST CONTROL</p> <p>SYSTEM CONFIG</p> <p>KEY LOCK</p> <p style="border: 1px solid black; display: inline-block; padding: 2px;">CHANGE PASSWORD</p> <p>CALIBRATION</p> </div>	UP DOWN ENTER 	F1 ◀ Move backlit box up menu F2 ◀ Move backlit box down menu F3 ◀ Select backlit parameter F4
	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">< CHANGE PASSWORD ></p> <p>USER PASSWORD : <input type="text"/></p> </div>	A B ENTER EXIT	F1 ◀ Select A character F2 ◀ Select B character F3 Enter password F4

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press DOWN [▼] arrow key so that backlit box is on: CHANGE PASSWORD

Press [ENTER]

Display prompts PASSWORD

Press [A] [A] [A] [A] [ENTER]

Display prompts USER PASSWORD

Press [A] [B] combination to create new password followed by [ENTER]

Press [EXIT] to exit System Setup

2.12.5 Calibration

The CALIBRATION function requires a password to enter the instrument routine. Only qualified service personnel with NIST traceable standards should perform instrument calibration. Refer to paragraph 4.3 for the Hybrid 2000 calibration procedure.

<div style="border: 1px solid black; padding: 2px; display: inline-block;">SYSTEM</div> <div style="text-align: center;">▼</div> 4x	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">< SYSTEM SETUP ></p> <p>TEST CONTROL</p> <p>SYSTEM CONFIG</p> <p>KEY LOCK</p> <p style="border: 1px solid black; display: inline-block; padding: 2px;">CHANGE PASSWORD</p> <p style="border: 1px solid black; display: inline-block; padding: 2px;">CALIBRATION</p> </div>	UP DOWN ENTER 	F1 ◀ Move backlit box up menu F2 ◀ Move backlit box down menu F3 ◀ Select backlit parameter F4
	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">< CALIBRATION ></p> <p>ENTER CAL. PASSWORD : <input type="text"/></p> </div>	A B ENTER EXIT	F1 ◀ Select A character F2 ◀ Select B character F3 Enter password F4

Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press DOWN [▼] arrow key so that backlit box is on: CALIBRATION

Press [ENTER]

2.12.6 Error Log

The Hybrid 2000 instrument has an Error Log to track communication errors when the RS232 interface is being used. Refer to paragraph 3.2.5 and Table 3-2 for a list of error message numbers and their respective description. When the **ERR** block on the bottom of the display is backlit, there is an error message in the queue. To view the contents of the error log:

The screenshot shows the instrument's menu system. On the left, a 'SYSTEM' button is shown with a downward arrow and '5x' below it. The main display area is titled '< SYSTEM SETUP >' and lists several menu items: SYSTEM CONFIG, KEY LOCK, CHANGE PASSWORD, CALIBRATION, and ERROR LOG. The 'ERROR LOG' item is highlighted with a white background. Below the menu items is a row of buttons: RMT, LOCK, CORR, and ERR. To the right of the display, a legend for function keys is provided: F1 (left arrow) for 'Move backlit box up menu', F2 (left arrow) for 'Move backlit box down menu', F3 (left arrow) for 'Select backlit parameter', and F4 for 'Exit'.

Press [SYSTEM]

The backlit box is on: **TEST CONTROL**

Press DOWN [▼] arrow key so that backlit box is on: **ERROR LOG**

Press [ENTER]

Display lists the contents of the Error Log.

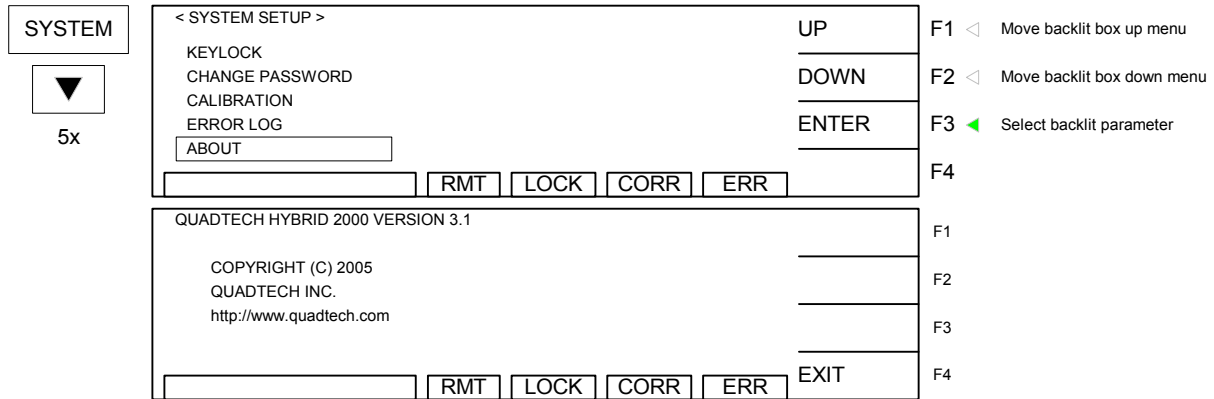
If there were errors in the queue:

The screenshot shows the instrument's error log. The display is titled '< ERROR LOG >' and lists four error messages: 1 -102, Syntax error; 2 -151, Invalid string; 3 -222, Data out of range; 4 -291, Out of memory. Below the list is a row of buttons: RMT, LOCK, OFST, ERR, and EXIT. The 'ERR' button is highlighted in yellow. To the right of the display, a legend for function keys is provided: F1 (UP) for 'Move up list of errors', F2 (DOWN) for 'Move down list of errors', F3 for 'Exit', and F4 for 'Exit'.

The queue will clear itself once the log has been viewed.

2.12.7 About

The Hybrid 2000 instrument has a parameter labeled 'About' which lists the instrument manufacturer, software version and date. To view the contents of ABOUT:



Press [SYSTEM]

The backlit box is on: TEST CONTROL

Press DOWN [▼] arrow key so that backlit box is on: ABOUT

Press [ENTER]

Display lists the contents of ABOUT.

2.13 Main Index

Within the [MAIN INDEX] menu is the STORE/RECALL function. There are 50 memory locations, each of which can store a test setup that has up to 20 steps.

2.13.1 Storing a Test Setup

To store the previous example of the programmed 6-step test, put the instrument in ‘Standby’ status and:

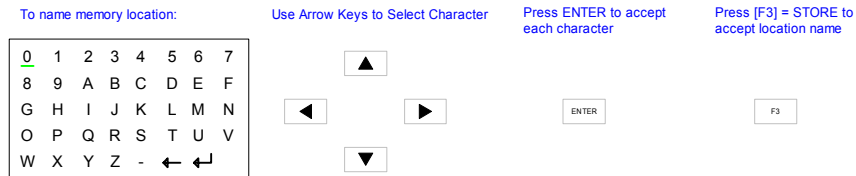
Press [MAIN INDEX] to access the memory function.

Press [F1] = STORE/RECALL to enter the memory function.

Press [F1] = STORE to access the store function.

The backlit box is next to memory location 01: 01. (00)

Press [ENTER] to select memory location 01



Press the [▶], [◀], [▼], [▲] arrow keys to move the backlit cursor around alpha-numeric box to select each character. Press [ENTER] after each character is selected:

[E] [ENTER]

[X] [ENTER]

[A] [ENTER]

[M] [ENTER]

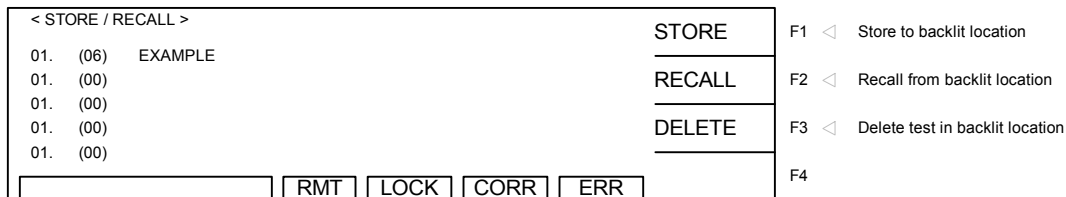
[P] [ENTER]

[L] [ENTER]

[E] [ENTER]

Press [F3] = STORE

Press [F1] = YES



Press [TEST] to return to the Standby menu.

NOTE: If you tell the instrument to store a setup to a location that already has a setup stored in it, the Hybrid 2000 will write-over the first setup with the new setup.

2.13.2 Recalling a Test Setup

To recall a test from one of the 50 memory locations, put the instrument in ‘Standby’ status and:

Press [MAIN INDEX] to access the memory menu.

Press [F1] = STORE/RECALL to enter the memory function.

Press [F2] = RECALL to access the recall function.

The backlit box is next to memory location 01: 01. (06) EXAMPLE

Press DOWN [▼] arrow to move backlit box to the desired memory location

Press [ENTER] to select that memory location

Display prompts ‘RECALL?’

Press [F1] = YES

< STORE / RECALL >		YES	F1		
01. (06) EXAMPLE	RECALL?	NO	F2		
01. (00)			F3		
01. (00)			F4		
01. (00)					
01. (00)					
	RMT	LOCK	CORR	ERR	

F1 ◀ Recall test from backlit location

Press [TEST] to return to Standby menu.

2.13.3 Deleting a Test From Memory

To delete a test from one of the 50 memory locations, put the instrument in ‘Standby’ status and:

Press [MAIN INDEX] to access the memory menu.

Press [F1] = STORE/RECALL to enter the memory function.

The backlit box is next to memory location 01: 01. (06) EXAMPLE

Press DOWN [▼] arrow to move backlit box to the desired memory location

Press [ENTER] to select that memory location

Press [F3] = DELETE to access the delete function.

Display prompts ‘DELETE?’

Press [F1] = YES

< STORE / RECALL >		YES	F1		
01. (06) EXAMPLE	DELETE?	NO	F2		
01. (00)			F3		
01. (00)			F4		
01. (00)					
01. (00)					
	RMT	LOCK	CORR	ERR	

F1 ◀ Delete test from backlit location

Press [TEST] to return to Standby menu.

2.14 Instrument Offset Correction

The Hybrid 2000 instrument provides automatic offset for lead and/or fixture effects. During the offset process a correction is made (subtracted out) as the result of lead leakage current and stored in instrument memory to be applied to ongoing measurements. For maximum measurement accuracy it is recommended that the Offset Correction be performed on the Hybrid 2000 instrument after power up, any time the test parameters are changed and any time the test leads or fixture is changed.

Prior to performing the Offset Correction:

Allow the instrument to warm up for 15 minutes.

Connect the Test cables (or fixture) to the OUTPUT and RTN/LOW connectors.

Program the test steps.

With the instrument in STAND BY status:

Press [F2] = CORRECT

Press [F1] = OPEN

Follow instructions on display: i.e.: “Open Circuit Correction – Current Offset (WV & IR)”.

Press green [START] button.

Wait while instrument gets Offset Correction value.

The **CORR** block at the bottom of the display is now highlighted (back lit).

OR

To undo the Offset Correction:

Press [F2] = CORRECT

Press [F1] = OPEN CIRCUIT

Press [F2] = OFF to turn **off** Offset Correction.

The **CORR** block at the bottom of the display is **OFF** now.

The following formulas apply to the offset function:

For Total Offset Current $\leq 100\mu\text{A}$:

$$\text{Display Current} = \sqrt{(\text{Measured total current})^2 - (\text{Offset total current})^2}$$

For Real Current & Total Current $> 100\mu\text{A}$:

$$\text{Display Current} = (\text{Measured real current}) - (\text{Offset real current})$$

NOTE:

To obtain consistent results, the Offset Correction must be performed when using OSC mode.
The Offset Correction is performed prior to the Get Cs function.

2.14.1 Offset Correction

Using the pre-programmed example from paragraphs 2.4-2.9 of the OSC, WVAC, WVDC, IR, DCR and PA 6-step test the offset correction is illustrated herein. There is an open correction for WVAC, WVDC and IR; a short correction for DCR and a Get Cs correction for OSC mode.



LIST	TEST	SIGNAL	MEASURE	1 2 3 4 5 6 7 8	EXAMPLE PROGRAM	F1			
	1	OS	0.100 kV	0.000 nF	H - H - H - H -	PROGRAM	F1		
	2	AC	1.500 kV	10.00 mA	H - H - H - H -	CORRECT	F2		
	3	DC	2.400 kV	10.00 mA	H - H - H - H -	STEP	F3		
	4	IR	0.750 kV	500 MΩ	H - H - H - H -		F4		
	5	DCR	-----	100.0 kΩ	H - H - H - H -				
	STAND BY					RMT	LOCK	CORR	ERR
	< CORRECTION >					OPEN CIRCUIT	F1	▶	
						SHORT CIRCUIT	F2	◀	
						SAMPLE TEST	F3	◀	
							F4	◀	
	< CORRECTION >						F1	◀	
	OPEN CIRCUIT CORRECTION						F2	◀	
	1. CURRENT OFFSET (WV & IR)						F3	◀	
	2. GET STRAY CAP (OSC)						F4	◀	
	REMOVE DUT FROM TEST FIXTURE					ABORT			
	PRESS < START > TO START								
									
LIST	TEST	SIGNAL	MEASURE	1 2 3 4 5 6 7 8	< EXAMPLE PROGRAM	F1			
	1	OS	0.100 kV	0.000 nF	H - H - H - H -	PROGRAM	F1		
	2	AC	1.500 kV	10.00 mA	H - H - H - H -	CORRECT	F2	▶	
	3	DC	2.400 kV	10.00 mA	H - H - H - H -	STEP	F3	◀	
	4	IR	0.750 kV	500 MΩ	H - H - H - H -		F4	◀	
	5	DCR	-----	100.0 kΩ	H - H - H - H -				
	STAND BY					RMT	LOCK	CORR	ERR
	< CORRECTION >					OPEN CIRCUIT	F1	◀	
						SHORT CIRCUIT	F2	▶	
						SAMPLE TEST	F3	◀	
							F4	◀	
	< CORRECTION >						F1	◀	
	SHORT CIRCUIT CORRECTION (DCR)						F2	◀	
							F3	◀	
	PLACE SHORT CIRCUIT KIT!					ABORT	F4	◀	
	PRESS < START > TO START								
									
LIST	TEST	SIGNAL	MEASURE	1 2 3 4 5 6 7 8	EXAMPLE PROGRAM	F1			
	1	OS	0.100 kV	0.000 nF	H - H - H - H -	PROGRAM	F1		
	2	AC	1.500 kV	10.00 mA	H - H - H - H -	CORRECT	F2	▶	
	3	DC	2.400 kV	10.00 mA	H - H - H - H -	STEP	F3	◀	
	4	IR	0.750 kV	500 MΩ	H - H - H - H -		F4	◀	
	5	DCR	-----	100.0 kΩ	H - H - H - H -				
	STAND BY					RMT	LOCK	CORR	ERR

Figure 2-18: Correction

2.15 GET Cs

GET Cs is applicable to the OSC mode only. OSC is normally programmed prior to a WVAC or WVDC test to ensure the DUT is properly connected before the high voltage is applied. Refer to ¶2.4 for full explanation of the Open/Short Circuit check. The GET Cs function is illustrated herein using the pre-programmed example from ¶2.4-2.9 of the OSC, WVAC, WVDC, IR, DCR and PA 6-step test.

After performing the OFFSET Correction, attach the known good DUT and press [F2] = CORRECT.

LIST

TEST	SIGNAL	MEASURE	1	2	3	4	5	6	7	8	EXAMPLE	
1	OS	0.100 kV	0.000	nF	H	-	H	-	H	-	PROGRAM	F1 <
2	AC	1.500 kV	10.00	mA	H	-	H	-	H	-	CORRECT	F2 <
3	DC	2.400 kV	10.00	mA	H	-	H	-	H	-	STEP	F3 <
4	IR	0.750 kV	500	MΩ	H	-	H	-	H	-		F4 <
5	DCR	-----	100.0	kΩ	H	-	H	-	H	-		F4 <


STAND BY RMT LOCK CORR ERR

< CORRECTION >

OPEN CIRCUIT	F1 <
SHORT CIRCUIT	F2 <
SAMPLE TEST	F3 <
	F4 <

< CORRECTION - SAMPLE TEST >

SAMPLE TEST (GET SAMPLE)		F1 <
1. GET C NOMINAL (OSC)		F2 <
2. SAMPLE TEST (IWT)		F3 <
PALCE SAMPLE DUT!	ABORT	F4 <
PRESS < START > TO START		

START 

LIST

TEST	SIGNAL	MEASURE	1	2	3	4	5	6	7	8	EXAMPLE	
1	OS	0.100 kV	0.000	nF	H	-	H	-	H	-	PROGRAM	F1 <
2	AC	1.500 kV	10.00	mA	H	-	H	-	H	-	CORRECT	F2 <
3	DC	2.400 kV	10.00	mA	H	-	H	-	H	-	STEP	F3 <
4	IR	0.750 kV	500	MΩ	H	-	H	-	H	-		F4 <
5	DCR	-----	100.0	kΩ	H	-	H	-	H	-		F4 <

STAND BY RMT LOCK CORR ERR

Figure 2-19: Get Cs

The Get Cs value is saved with the test setup. To delete the Get Cs correction value, press [F2] = CORRECT. Press [F3] = SAMPLE TEST. Press [F2] = OFF. The **CORR** led will turn off.

2.15.1 Connection to Device under Test

Figure 2-17 illustrates the connection of the Hybrid 2000 unit to a single DUT using the S02 1-meter HV cable set that comes standard with the instrument. The custom white banana plug/red alligator clip is connected between one output channel on the Hybrid 2000 unit and the high side of the device under test. The black banana plug/alligator clip is connected between the RTN/LOW terminal on the Hybrid 2000 unit to the low side of the DUT.

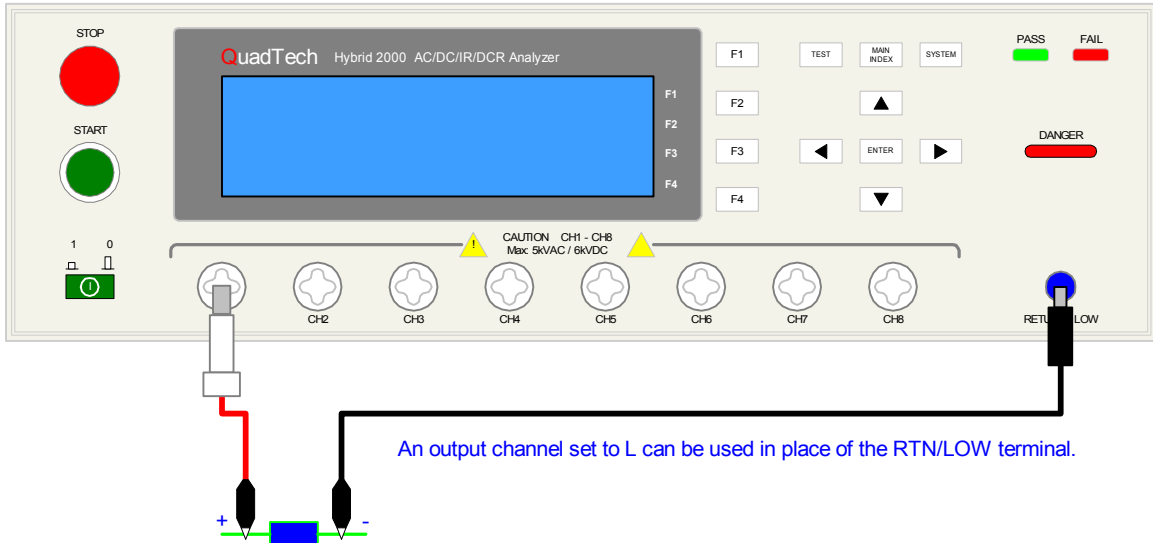


Figure 2-20: S02 Cable Connection

Figure 2-18 illustrates the connection of the Hybrid 2000 unit for a multi-device/multi-point test. The custom white banana plug/white wires are connected between the output channels (CH1-8) designated as H (high) and the high side of the device under test. The black banana plug/alligator clip is connected between the RTN/LOW terminal on the Hybrid 2000 unit to a common ground on the test fixture.

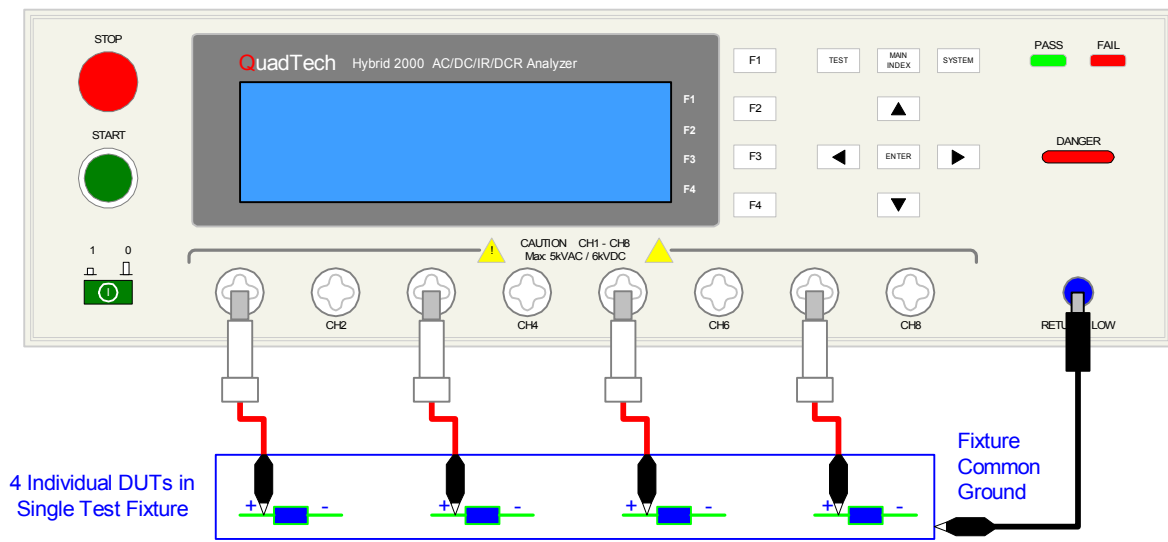


Figure 2-21: Multi-Cable Connection

With the test fixture as shown in Figure 2-18, Channels 1, 3, 5 & 7 are designated H (high) and a common ground is connected between the RTN/LOW terminal on the Hybrid 2000 and ground on the test fixture. In this case the Channels 2, 4, 6 & 8 would be designated X (not used). Another configuration for the multi-point test illustrated in Figure 2-18 is to assign Channels 2, 4, 6 & 8 as L (low) and connect these channels to the low side of each of the four DUTs.

Refer to paragraphs 3.2 through 3.7 for the description and illustration of the connection of several QuadTech accessories to the Hybrid 2000 instrument.

2.16 Measurement Procedure

Before a measurement is made verify the following:

1. Hybrid 2000 instrument [POWER] ON.
2. 15-minute warm-up.
3. Test parameters programmed and shown on Standby display.
4. Test cables or fixture connected.
5. Offset Correction initiated.
6. Device under test connected.

The operator has the option of performing a test at power-up conditions (test conditions at which the instrument was last powered down) or recalling one of 50 stored test setups. Refer to paragraphs 2.4 – 2.10 for test programming and storage/recall instructions.

To initiate a test:

Press [STOP] to make sure instrument is in Standby status.

Press [START]. DANGER led flashes.

The test voltage is shut **off** when all test steps are completed,

OR when a test result is judged a FAIL per programmed test limits,

OR when the [STOP] button is pressed.

Press [STOP] at any time to terminate the output voltage and stop the test.

To view the test results, press [F3] = LIST to go to the tabular display. Use the UP/DOWN [▲] [▼] arrow keys to scroll to the next page. When “UUUU” is displayed as the result, it indicates that the unit has exceeded the upper measurement limit for leakage current or insulation resistance.

<p>NOTE: Exiting the tabular display will clear your test results.</p>

The Hybrid 2000 instrument judges the measurement value as GOOD or NO GOOD. A GOOD judgment means the DUT passed all programmed steps. Upon completion of the test the output voltage is terminated and the display shows PASS.

If the measurement value of the test (or any one step of the test) is abnormal, the DUT is judged as NO GOOD, the display will show FAIL and the buzzer will sound until the [STOP] button is

pressed. Press [STOP] at any time to terminate the output voltage and stop the test.

2.16.1 Error Messages (FAIL result)

When the measurement value was judged NO GOOD and FAIL is shown on the display, an error message denoting the test result will be shown on the display also. Table 2-9 lists the possible error messages for a NO GOOD/FAIL judgment.

Table 2-9: Error Messages

Error Message	Description
HIGH FAIL	Measured value (current or resistance) is over the programmed high limit.
OUTPUT FAIL	Unit's output voltage is unable to reach 95%
LOW FAIL	Measured value (current or resistance) is below the programmed low limit.
ARC FAIL	Current arc is over the programmed high limit.
SHORT	Current/Resistance Measured exceeds the hardware high limit.
GFI FAIL	Ground Fault Interrupt failed.
REAL FAIL	Measured Real Current value is over the programmed high limit.
PROBE FAIL	Unit is unable to measure the temperature.
OPEN FAIL	The setting of Open/Capacitance Reading is less than OPEN
SHORT FAIL	The setting of Short/Capacitance Reading is greater than Short

Section 3: Interface

3.1 Interlock

On the rear panel of the Hybrid 2000 instrument is a black 2-screw terminal strip labeled INTERLOCK. The Interlock is an important safety feature for protection of the operator and instrument.

Before connecting the instrument to its power source, the interlock function on the rear panel remote connector (terminal strip) must be properly utilized. When the INTERLOCK jumper is removed, there is **no** high voltage at the output channels. Therefore, to initiate a test make sure the interlock jumper is in place.

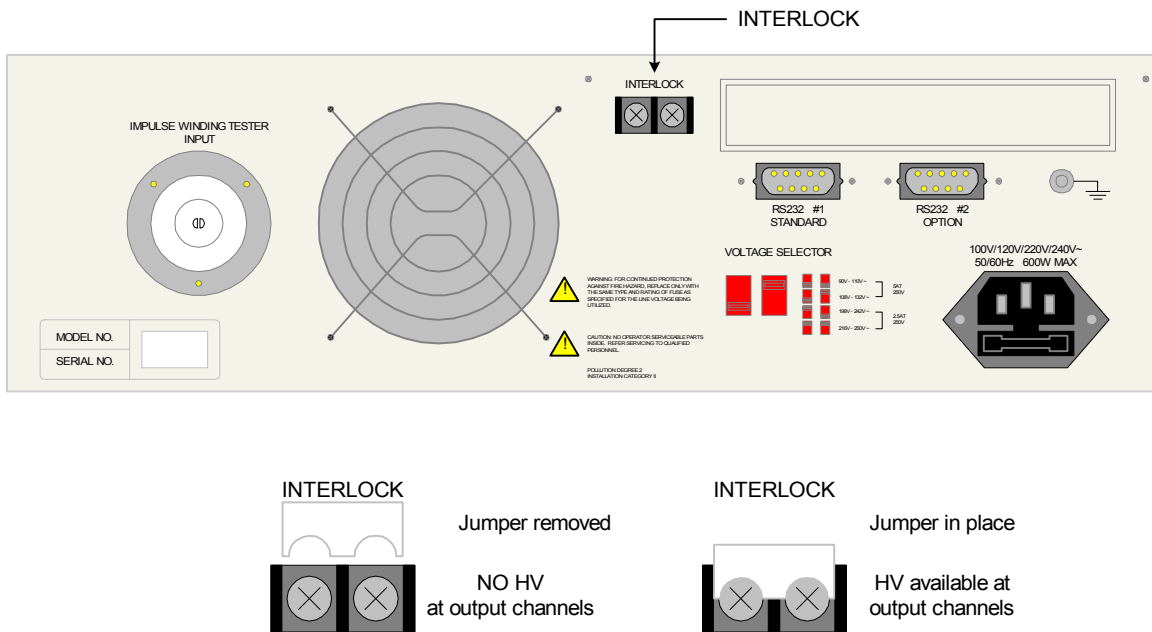


Figure 3-1: Hybrid 2000 Interlock Connector

3.2 RS232 Interface

3.2.1 Pin Configuration

The Hybrid 2000 instrument comes standard with an RS232 Interface for remote operation. A second RS232 interface is available as an option. Connection is through the silver 9-pin connector labeled 'RS232 #1' on the rear panel of the Hybrid 2000 instrument. Figure 3-2 illustrates the designation of the pins on the RS232 connector. The connection cable must be a 'straight through' cable for the Hybrid 2000 unit to communicate.

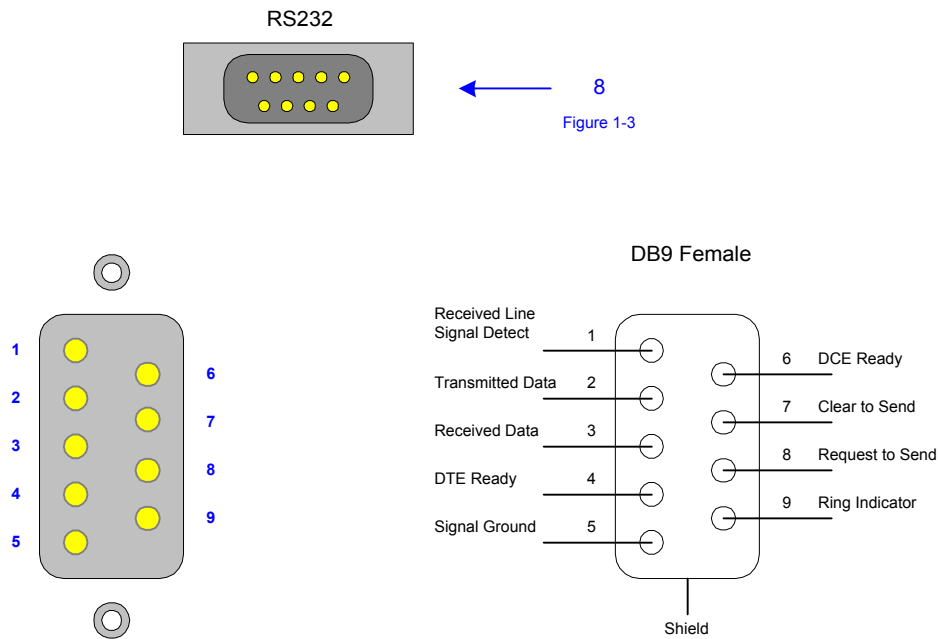


Figure 3-2: RS232 Pin Configuration

When the **ERR** box is backlit on the bottom of the display, there are error messages in the queue. Refer to paragraph 3.2.4, Table 3-2 for explanation of error messages. Refer to paragraph 2.11.5 for instructions on how to access and clear the error log.

3.2.2 RS232 Specifications

Data Bits: 8
 Stop Bits: 1
 Parity: None, Odd, Even
 Baud Rate: 9600, 19200 or 38400 bps, Software selectable
 EOS: LF or CR + LF
 Echo: Off

Setting the Baud Rate is done in the SYSTEM CONFIG function in the SYSTEM SETUP menu:

< SYSTEM CONFIG >		38400	F1 <	38,400 bits per second
CONTRAST	: 06			
BEEPER	: OFF	19200	F2 <	19,200 bits per second
GPIB	: UNINSTALLED			
HANDLER	: UNINSTALLED	9600	F3 <	9,600 bits per second
RS232 #1	: BAUD RATE = <input type="text" value="9600"/>			
		EXIT	F4	
		RMT	LOCK	CORR
		ERR		

From the Standby display, press [SYSTEM]
 Press the DOWN [▼] arrow key to highlight **SYSTEM CONFIG**.
 Press [ENTER]
 Press the DOWN [▼] arrow key until the box next to RS232 #1: BAUD RATE = is backlit
 Press [ENTER]
 Press [F1] = 38400 or [F2] = 19200 or [F3] = 9600 to select Baud Rate
 Press [F4] to EXIT

3.2.3 RS232 Commands

The command set for the RS232 interface is listed on the following pages. **NOTE:** CR + LF is the necessary end code for the RS232 commands. There are additional RS232-only commands listed herein.

RS232-Only Commands

These commands are for RS232 use only. These commands follow the SCPI version 1999.0.

:SYSTEM:LOCK:RELease	Change status to Local, as GPIB Go To Local.
:SYSTEM:LOCK:REQuest?	Change status to Remote, return '1' if successful.
:SYSTEM:LOCK:OWNeR?	Query the status.
:SYSTEM:LOCK <Boolean>	As GPIB Local Lockout.
:SYSTEM:LOCK?	Query the Key Lock status.

The Hybrid 2000 unit is in a remote control status when the **RMT** block on the bottom right hand side of display is backlit.

RS232 Interface Commands

The interface function is controlled by ASCII commands that include:

{[command + parameter] ; [command + parameter] + ending code}

The maximum string length is consists of 1024 characters. It is not necessary to input any sign or space between the command and parameter. Any two commands can be connected by "," and [Ending Code]. Ending Code is CR + LF.

Table 3-1: RS232 Commands

Command	Name	Function	Output Format
*CLS	Clear Status	Clear standard event status register. Clear status bit group register except for bit 4 (MAV)	
*ESE	Event Status Enable	Enable standard event status register value.	0 – 255
*ESE?	Event Status Enable	Query standard event status of device enable register	0 – 255
*ESR?	Event Status Register	Query standard event register value of device. After this command, the standard register is cleared to 0.	0 – 255
*SRE	Service Request Enable	Enable service request register value.	0 – 255
*SRE?	Service Request Enable	Query/Read service request register value.	0 – 255
*STB?	Status Byte Register	Query/Read status byte register value	0 – 255
*OPC	Operation Complete	Operation is complete.	
*OPC?	Operation Complete	Query operation complete.	1
*PSC 0 1	Power On	Clear status of Power On	
*PSC?	Power On	Query Power On.	1 or 0
*IDN?	Identification	Query/Read basic device data. (A comma separates the identification fields.)	4 ID: Manufacturer, Device Model, Serial Number, Firmware Version
*SAV	Save	Save current status to memory.	1 – 50
*RCL	Recall	Recall saved status from memory.	1 – 50

3.2.4 SCPI Command Summary

The SCPI (Standard Commands for Programmable Instruments) parameter syntax format is listed on the following pages. To illustrate the order of precedence the entire command list is scrolled through. The dual arrow symbol “<>” denotes the defined parameter is a standard SCPI command. The symbol “<numerical value>” denotes the metric system value. The symbol “<boolean>” denotes the Boolean equation data and its value is 0 or 1. The vertical line “|” denotes the OR parameter. When sending the Hybrid 2000 unit a decimal number it is necessary to have a zero before the decimal point. Example: DC: LIMit: HIGH: 0.004

- SCPI Command

```

:MEMory
|   :DELeTe
|   |   [:NAME]      < name >
|   |   :LOCation    < register number >
|   :STATe
|   |   :DEFine     < name >, < register number >
|   |   :DEFine?    < name >
|   :FREE
|   |   :STATe?
|   NSTates?
:SYSTem
|   :ERRor
|   |   [:NEXT]?
|   :KLOCK <boolean> / ON / OFF           (RS232 only)
|   :KLOCK?
|   :LOCK
|   |   :OWNer?
|   |   :RELease     (RS232 only)
|   |   :REQuest?    (RS232 only)
|   :TCONtrol
|   |   :AGC
|   |   |   [:SOFTware] <boolean> | ON | OFF
|   |   |   [:SOFTware]?
|   |   :DCRBalance <number value> / OFF
|   |   :DCRBalance?
|   |   :FCONtinuity <boolean> / ON / OFF
|   |   :FCONtinuity?
|   |   :FTErMinal <boolean> / ON / OFF
|   |   :FTErMinal?
|   |   :GFI <boolean> / ON / OFF
|   |   :GFI?
|   |   :RJUDgment <boolean> / ON / OFF
|   |   :RJUDgment?
|   |   :TEMPerature
|   |   |   [:COMPEnsation]
|   |   |   |   [:ENABle] OFF / MANUal / AUTO
|   |   |   |   [:ENABle]?
|   |   |   |   :UNIT      C / F
|   |   |   |   :UNIT?
|   |   |   |   :TCOefficient <number value>
|   |   |   |   :TCOefficient?
|   |   |   |   :BTEMperature <temperature>

```



```

:TIME
    [:ELAPsed]
    :DWELl?
    :FALL?
    :RAMP?
    [:TEST]?
:TOTAl
    [:JUDGment]?
:SNUMber?
:STARt
    [:ONCE]
    :CORRection
    :OPEN    GET / OFF
    :OPEN?
    :SHORT   GET / OFF
    :SHORT?
    :SAMPle  GET
    :SAMPle?
:STOP
:STATus?
:STEP<n>
    [:MAIN]
    :DELeTe
    :MODE?
    :SET?
    :WVAC
    :CHANnel
    [:HIGH] <channel list>
    [:HIGH]?
    :LOW    <channel list>
    :LOW?
    [:LEVel] <number value>
    [:LEVel]?
    :LIMit
    :ARC    <number value> / OFF
    :ARC?
    [:HIGH] <number value>
    [:HIGH]?
    :LOW    <number value> / OFF
    :LOW?
    :REAL   <number value> / OFF
    :REAL?
    :TIME
    :FALL   <number value> / OFF
    :FALL?
    :RAMP   <number value> / OFF
    :RAMP?
    [:TEST] <number value> / CONTinue
    [:TEST]?
:WVDC
    :CHANnel
    [:HIGH] <channel list>
    [:HIGH]?
    :LOW    <channel list>

```

```

| :LOW?
| [:LEVel] <number value>
| [:LEVel]?
| :LIMit
| :ARC <number value> / OFF
| :ARC?
| [:HIGH] <number value>
| [:HIGH]?
| :LOW <number value> / OFF
| :LOW?
| :TIME
| :DWELl <number value> / OFF
| :DWELl?
| :FALL <number value> / OFF
| :FALL?
| :RAMP <number value> / OFF
| :RAMP?
| [:TEST] <number value> / CONTINUE
| [:TEST]?
:IR
| :CHANnel
| [:HIGH] <channel list>
| [:HIGH]?
| :LOW <channel list>
| :LOW?
| [:LEVel] <number value>
| [:LEVel]?
| :LIMit
| :HIGH <number value> / OFF
| :HIGH?
| [:LOW] <number value>
| [:LOW]?
| :RANGe
| :UPPer <number value>
| :UPPer?
| [:LOWer] <number value>
| [:LOWer]?
| :AUTO <boolean> / ON / OFF
| :AUTO?
| :TIME
| :FALL <number value> / OFF
| :FALL?
| :RAMP <number value> / OFF
| :RAMP?
| [:TEST] <number value> / CONTINUE
| [:TEST]?
:DCR
| :CHANnel
| [:HIGH] <channel list>
| [:HIGH]?
| :LOW <channel list>
| :LOW?
| :LIMit
| [:HIGH] <number value>

```



```

:ARC?
[:HIGH] <number value>
[:HIGH]?
:LOW <number value> / OFF
:LOW?
:REAL <number value> / OFF
:REAL?
:TIME
:FALL <number value> / OFF
:FALL?
:RAMP <number value> / OFF
:RAMP?
[:TEST] <number value> / CONTINUE
[:TEST]?
:WVDC
:CHANnel
|   [:HIGH] <channel list>
|   [:HIGH]?
|   :LOW <channel list>
|   :LOW?
[:LEVel] <number value>
[:LEVel]?
:LIMit
|   :ARC <number value> / OFF
|   :ARC?
|   [:HIGH] <number value>
|   [:HIGH]?
|   :LOW <number value> / OFF
|   :LOW?
:TIME
|   :DWELl <number value> / OFF
|   :DWELl?
|   :FALL <number value> / OFF
|   :FALL?
|   :RAMP <number value> / OFF
|   :RAMP?
|   [:TEST] <number value> / CONTINUE
|   [:TEST]?
:IR
:CHANnel
|   [:HIGH] <channel list>
|   [:HIGH]?
|   :LOW <channel list>
|   :LOW?
[:LEVel] <number value>
[:LEVel]?
:LIMit
|   :HIGH <number value> / OFF
|   :HIGH?
|   [:LOW] <number value>
|   [:LOW]?
:RANGe
|   :UPPer <number value>
|   :UPPer?

```


***RCL <decimal data>**

It is command of read back.

This command reads back the settings saved in the memory of the device. The parameter is the memory serial no.

***SAV <decimal data>**

It is command of save.

This command is to save the settings at present of the device to memory. The parameter is the memory serial no.

***SRE <decimal data>**

It sets the value for service request register. The value is a <decimal data> within 0~255.

***SRE?**

It reads the value of service request enable register. The output format is <decimal data> within 0~255.

***STB?**

It reads the value of status bit register. The output format is <decimal data> within 0~255.

■ SCPI Command

:MEMory:DELete[:Name] < name >

It deletes the parameter data specified by <name> in main memory. <name> is a string.

:MEMory:DELete:LOCation < register number >

It deletes the parameter data specified by < register number > in main memory.
< register number > is an integer.

:MEMory:STATe:DEFine < name >, < register number >

It sets a name for memory specified by <register number >.

:MEMory:STATe:DEFine? < name >

It queries the memory's < register number > specified by < name >.

:MEMory:FREE:STATe?

It queries the unused capacity in main memory.

:MEMory:NSTATes?

It queries the capacity of main memory. The value returned is one greater than the maximum that can be sent as a parameter to the *SAV and *RCL commands.

:SYSTem:ERRor[:NEXT]?

This command reads the messages in Error Queue. See Section 6.6 Error Messages for the returned messages.

:SYSTEM:KLOCK < *boolean* > / *ON* / *OFF*

It locks the panel control. The command does not affect the Remote/Local state of GPIB.

:SYSTEM:KLOCK?

It queries if the panel is locked.

:SYSTEM:LOCK:OWNER?

It queries if the Scanner is in panel control or remote control state.

:SYSTEM:LOCK:RELEASE

It switches back to panel control state.

:SYSTEM:LOCK:REQUEST?

It switches to remote control state. It returns 1 if success or it returns 0.

:SYSTEM:TCONTROL:AGC[:SOFTWARE] < *boolean* > / *ON* / *OFF*

It sets if enabling the software AGC function.

:SYSTEM:TCONTROL:AGC[:SOFTWARE]?

It queries if the software AGC function is enabled.

:SYSTEM:TCONTROL:DCRBALANCE < *number value* >

It sets the value of DCR Balance in the unit of ohm.

:SYSTEM:TCONTROL:DCRBALANCE?

It queries the value of DCR Balance in the unit of ohm.

:SYSTEM:TCONTROL:FCONTINUITY < *boolean* > / *ON* / *OFF*

It sets if continuing next test step when FAIL occurred.

:SYSTEM:TCONTROL:FCONTINUITY?

It queries if FCONTINUITY is enabled.

:SYSTEM:TCONTROL:FTE RMINAL < *boolean* > / *ON* / *OFF*

It enables the DCR 4-wire measurement function.

:SYSTEM:TCONTROL:FTE RMINAL?

It queries if the DCR 4-wire measurement function is enabled.

:SYSTEM:TCONTROL:GFI < *boolean* > / *ON* / *OFF*

It sets if enabling GFI.

:SYSTEM:TCONTROL:GFI?

It queries if GFI is enabled with 0 or 1 returned. (0 means GFI is disabled and 1 means GFI is enabled.)

:SYSTEM:TCONTROL:RJUDgment < *boolean* > / *ON* / *OFF*
It sets if enabling RAMP JUDGMENT.

:SYSTEM:TCONTROL:RJUDgment?
It queries if RAMP JUDGMENT is enabled with 0 or 1 returned. (0 means OFF that is disabled and 1 means ON.)

:SYSTEM:TCONTROL:TEMPerature[:COMPensation] [:ENABLE] *OFF* / *MANUal* / *AUTO*
It enables the temperature compensation function.

:SYSTEM:TCONTROL:TEMPerature[:COMPensation] [:ENABLE]?
It queries if the temperature compensation function is enabled.

:SYSTEM:TCONTROL:TEMPerature[:COMPensation]:UNIT *C* / *F*
It sets the temperature unit.

:SYSTEM:TCONTROL:TEMPerature[:COMPensation]:UNIT?
It queries the temperature unit.

:SYSTEM:TCONTROL:TEMPerature[:COMPensation]:TCOefficient < *numeric value* >
It sets the temperature coefficient with the unit in ppm.

:SYSTEM:TCONTROL:TEMPerature[:COMPensation]:TCOefficient?
It queries the temperature coefficient with the unit in ppm.

:SYSTEM:TCONTROL:TEMPerature[:COMPensation]:BTEMPerature < *numeric value* >
It sets the standard site temperature in the unit of °C or °F following the setting of :SYSTEM:TCONTROL:TEMPerature[:COMPensation]:UNIT.

:SYSTEM:TCONTROL:TEMPerature[:COMPensation]: BTEMPerature?
It queries the standard site temperature in the unit of °C or °F following the setting of :SYSTEM:TCONTROL:TEMPerature[:COMPensation]:UNIT.

:SYSTEM:TCONTROL:TEMPerature[:COMPensation]:ETEMPerature < *numeric value* >
It sets the environment temperature in the unit of °C or °F following the setting of :SYSTEM:TCONTROL:TEMPerature[:COMPensation]:UNIT. Use this parameter when :SYSTEM:TCONTROL:TEMPerature[:COMPensation] [:ENABLE] set to MANUAL.

:SYSTEM:TCONTROL:TEMPerature[:COMPensation]:ETEMPerature?
It queries the environment temperature in the unit of °C or °F following the setting of :SYSTEM:TCONTROL:TEMPerature[:COMPensation]:UNIT.

:SYSTem:TCONtrol:TIME:PASS <numeric_value>

It sets the time for PASS HOLD duration. The unit is second.

:SYSTem:TCONtrol:TIME:PASS?

It queries the time for PASS HOLD duration.

:SYSTem:TCONtrol:TRIGger[:DELay] <numeric_value>

It sets the time delayed for trigger. The unit is second.

:SYSTem:TCONtrol:TRIGger[:DELay]?

It queries the time delayed for trigger. The unit is second..

:SYSTem:TCONtrol:WVAC:FREQuency < numeric value >

It sets the output voltage frequency when under AC withstand voltage test.

:SYSTem:TCONtrol:WVAC:FREQuency?

It queries the output voltage frequency when under AC withstand voltage test.

:SYSTem:TCONtrol:WRANge[:AUTO] < boolean > / ON / OFF

It sets if enabling the withstand voltage auto range function.

:SYSTem:TCONtrol:WRANge[:AUTO]?

It queries if the withstand voltage auto range function is enabled with 0 or 1 returned. (0 means OFF is disabled and 1 means ON.)

:SYSTem:VERSion?

It queries supported SCPI version of this device.

[:SOURce]:SAFety:FETCh? [< item >] [, < item >]

It queries the measurement result of the Scanner. <item> is string as listed below:

String	Returned Data
STEP	The present STEP No.
MODE	The present MODE
OMETerge	The present reading of output meter (DCR resistance reading)
MMETerge	The present reading of measure meter (The resistance after DCR temperature compensation.)
RMETerge	The present reading of real current meter (Environment temperature when in DCR.)
RELapsed	The time executed for RAMP
RLEAve	The time remained for RAMP
DELapsed	The time executed for DWELL
DLEAve	The time remained for DWELL
TELapsed	The time executed for TEST
TLEAve	The time remained for TEST

FELapsed	The time executed for FALL
FLEave	The time remained for FALL

[:SOURCE]:SAFety:RESult:ALL[:JUDGment]?

It queries all judgment results. The return format is First Step Result, Second Step Result, ..., Last Step Result. The meaning of Code is listed as below:

Hybrid 2000 Judgment Code

Mode	WVAC		WVDC		IR		DCR		OSC		IWT		ALL		
	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	
UNCOMPLETED														70	112
ABORT														71	113
TESTING														73	115
PASS/SKIPPED /COMPLETED														74	116
HIGH FAIL	21	33	31	49	41	65	11	17							
LOW FAIL	22	34	32	50	42	66	12	18							
ARC FAIL	23	35	33	51											
REAL FAIL	2A	42													
PROBE FAIL							14	20							
OUTPUT FAIL	21	33	31	49	42	66									
GFI FAIL	24	36	34	52	44	68									
SHORT	24	36	34	52	44	68			61	97					
OPEN									62	98					
IWT FAIL											51	81			
DWX ERROR											54	84			

Note: Since the DCR Balance Fail is the combined judgment result of several steps instead of a single step, so please use [:SOURCE]:SAFety:RESult:TOTal[:JUDGment]? command to read the judgment result.

[:SOURCE]:SAFety:RESult:ALL:MMETerage?

It queries the MEASURE METER readings of all STEPs. It is the temperature compensated resistance in DCR mode. It is the resistance reading if temperature compensation is not enabled.

[:SOURCE]:SAFety:RESult:ALL:RMETerage?

It queries the REAL CURRENT METER readings of all STEPs. It is the environment temperature when in DCR mode.

[:SOURCE]:SAFety:RESult:ALL:MODE?

It queries the MODE of all STEPs and returns string.

WVAC|WVDC|IR|DCR|OSC|IWT|PA.

[:SOURCE]:SAFety:RESult:ALL:OMETerage?

It queries the OUTPUT METER readings of all STEPs. It is the resistance reading when in DCR mode.

[:SOURCE]:SAFety:RESult:ALL:TIME[:ELAPsed]:DWELI?

It queries the DWELL of all STEPs.

[[:SOURCE]:SAFety:RESult:ALL:TIME[:ELAPsed]:FALL?

It queries the voltage fall time of all STEPs.

[[:SOURCE]:SAFety:RESult:ALL:TIME[:ELAPsed]:RAMP?

It queries the voltage ramp time of all STEPs.

[[:SOURCE]:SAFety:RESult:ALL:TIME[:ELAPsed][:TEST]?

It queries the test time of all STEPs.

[[:SOURCE]:SAFety:RESult:AREPort <boolean > / ON / OFF

It sets if auto reporting the test result. (For RS232 interface only)

[[:SOURCE]:SAFety:RESult:AREPort?

It queries if the device is auto reporting the test result with 1 or 0 returned. (For RS232 interface only)

[[:SOURCE]:SAFety:RESult:TOTal[:JUDGment]?

It queries the final judgment result. When the return is 0 it indicates there is no test result, - 1 indicates FAIL and 1 indicates PASS.

[[:SOURCE]:SAFety:RESult:COMPLETED?

It queries if the device has completed all test steps by returning 1 or 0.

[[:SOURCE]:SAFety:RESult[:LAST][:JUDGment]?

It queries the judgment code of the last executed STEP.

[[:SOURCE]:SAFety:RESult: STEP<n>[:MAIN][:JUDGment]?

[[:SOURCE]:SAFety:RESult: STEP<n>:SUB<s>[:JUDGment]?

It queries the judgment result of selected STEP. <s> is the value data, 1 means A, 2 means B and so forth. For instance, :SOURCE:SAFety:RESult: STEP1:SUB2:JUDGment? means to query the judgment result of STEP 1.B.

[[:SOURCE]:SAFety:RESult:STEP<n>[:MAIN]:MMETerage?

[[:SOURCE]:SAFety:RESult:STEP<n>:SUB<s>:MMETerage?

It queries the MEASURE METER readings of selected STEP.

[[:SOURCE]:SAFety:RESult: STEP<n>[:MAIN]:RMETerage?

[[:SOURCE]:SAFety:RESult: STEP<n>:SUB<s>:RMETerage?

It queries the REAL CURRENT METER readings of selected STEP.

[[:SOURCE]:SAFety:RESult: STEP<n>[:MAIN]:OMETerage?

[[:SOURCE]:SAFety:RESult: STEP<n>:SUB<s>:OMETerage?

It queries the OUTPUT METER readings of selected STEP.

[[:SOURCE]:SAFety:RESult: STEP<n>[:MAIN]:TIME[:ELAPsed]:DWELI?

[[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:TIME[:ELAPsed]:DWELL?
It queries the DWELL time of selected STEP.

[[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:TIME[:ELAPsed]:FALL?
[[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:TIME[:ELAPsed]:FALL?
It queries the voltage fall time of selected STEP.

[[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:TIME[:ELAPsed]:RAMP?
[[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:TIME[:ELAPsed]:RAMP?
It queries the voltage ramp time of selected STEP.

[[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:TIME[:ELAPsed][:TEST]?
[[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:TIME[:ELAPsed][:TEST]?
It queries the test time of selected STEP.

[[:SOURce]:SAFety:SNUMber?
It queries the STEP set in the working memory including the sum of MAIN STEP and SUB STEP.

[[:SOURce]:SAFety:STARt[:ONCE]
It starts the test.

[[:SOURce]:SAFety:STARt:CORRection:OPEN GET / OFF
When the parameter is set to GET, it gets the correction of OPEN. The main system may output high voltage at the time, and the correction is disabled when the parameter is set to OFF.

[[:SOURce]:SAFety:STARt:CORRection:OPEN?
It queries if OPEN correction is enabled.

[[:SOURce]:SAFety:STARt:CORRection:SHORT GET / OFF
It gets the correction of SHORT when the parameter is set to GET. The main system may output high voltage at the time, and the correction is disabled when the parameter is set to OFF.

[[:SOURce]:SAFety:STARt:CORRection:SHORT?
It queries if SHORT correction is enabled.

[[:SOURce]:SAFety:STARt:CORRection:SAMple GET
It gets the sample correction when the parameter is set to GET. The main system may output high voltage at the time.

[[:SOURce]:SAFety:STARt:CORRection:SAMple?
It queries if sample correction is enabled.

[[:SOURCE]:SAFety:STOP

It stops the test.

[[:SOURCE]:SAFety:STATus?

It queries the status of current device. The returned data is RUNNING or STOPPED.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DELe

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DELe

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DELe command will delete the <n> STEPs and the SUB STEPs underneath, the STEPs following <n> will forward to fill.

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DELe command will delete the <n>.<s> STEPs and the STEPs following <n>.<s> will forward to fill. <s> is a numeric data, in which 1 means A, 2 indicates B so forth. Ex: SOURCE:SAFety:STEP2:SUB3:DELe means to delete the STEP of 2.C.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:MODE?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:MODE?

It queries the MODE of selected STEP and the returned data is WVAC, WVDC, IR, DCR, OSC, IWT and PA.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:SET?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:SET?

It queries all settings of selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:WVAC:CHANnel[: HIGH] <channel_list>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:WVAC:CHANnel[: HIGH] <channel_list>

It sets the high voltage output channel status during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:WVAC:CHANnel[: HIGH]?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:WVAC:CHANnel[: HIGH]?

It queries the high voltage output channel status during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:WVAC:CHANnel: LOW <channel_list>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:WVAC:CHANnel: LOW <channel_list>

It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:WVAC:CHANnel: LOW?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:WVAC:CHANnel: LOW?

It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC[:LEVel] < numeric value >
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC[:LEVel] < numeric value >

It sets the required voltage during withstand voltage AC test for the selected STEP. The unit is volt

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC[:LEVel]?
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC[:LEVel]?

It queries the required voltage during withstand voltage AC test for the selected STEP. The unit is volt

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:LIMit:ARC < numeric value > / OFF
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:LIMit:ARC < numeric value > / OFF

It sets the ARC test of the selected STEP. The unit is ampere. The ARC setting is disabled when the parameter is set to OFF

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:LIMit:ARC?
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:LIMit:ARC?

It queries the ARC test of the selected STEP. The unit is ampere.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:LIMit[:HIGH] < numeric value >
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:LIMit[:HIGH] < numeric value >

It sets the high limit of leakage current in withstand voltage AC for the selected STEP. The unit is ampere.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:LIMit[:HIGH]?
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:LIMit[:HIGH]?

It queries the high limit of leakage current in withstand voltage AC for the selected STEP. The unit is ampere.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:LIMit:LOW < numeric value > / OFF
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:LIMit:LOW < numeric value > / OFF

It sets the low limit of leakage current in withstand voltage AC for the selected STEP. The unit is ampere. The Low Limit setting is disabled when the parameter is set to OFF.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:LIMit:LOW?
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:LIMit:LOW?

It queries the low limit of leakage current in withstand voltage AC for the selected STEP. The unit is ampere.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:LIMit:REAL < numeric value > / OFF
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:LIMit:REAL < numeric value > / OFF

It sets the high limit of real leakage current in withstand voltage AC for the selected STEP. The unit is ampere. The Real Current setting is disabled when the parameter is set to OFF.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:LIMit:REAL?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:LIMit:REAL?

It queries the high limit of real leakage current in withstand voltage AC for the selected STEP. The unit is ampere.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:TIME:FALL < numeric value > / OFF

[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:TIME:FALL < numeric value > / OFF

It sets the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second. The Fall Time setting is disabled when the parameter is OFF.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:TIME:FALL?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:TIME:FALL?

It queries the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:TIME:RAMP < numeric value > / OFF

[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:TIME:RAMP < numeric value > / OFF

It sets the time required to ramp to the voltage set for test for the selected STEP. The unit is second. The Ramp Time setting is disabled when the parameter is set to OFF.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:TIME:RAMP?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:TIME:RAMP?

It queries the time required to ramp to the voltage set for test for the selected STEP. The unit is second.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:TIME[:TEST] < numeric value > / CONTInue

[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:TIME[:TEST] < numeric value > / CONTInue

It sets the time required for test for the selected STEP. The unit is second. The test runs continuously when the parameter is set to CONTInue.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:TIME[:TEST]?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:TIME[:TEST]?

It queries the time required for test for the selected STEP. The unit is second.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC:CHANnel[: HIGH] <channel_list>

[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC:CHANnel[: HIGH] <channel_list>

It sets the status of high voltage output channel during scan test for the selected STEP.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC:CHANnel[: HIGH]?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC:CHANnel[: HIGH]?

It queries the status of high voltage output channel during scan test for the selected STEP.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC:CHANnel: LOW <channel_list>
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC:CHANnel: LOW <channel_list>
It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC:CHANnel: LOW?
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC:CHANnel: LOW?
It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC[:LEVel] < numeric value >
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC[:LEVel] < numeric value >
It sets the voltage required during withstand voltage DC test for the selected STEP. The unit is volt.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC[:LEVel]?
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC[:LEVel]?
It queries the voltage required during withstand voltage DC test for the selected STEP. The unit is volt.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC:LIMit:ARC < numeric value > /
OFF
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC:LIMit:ARC < numeric value > /
OFF

It sets the ARC test of the selected STEP. The unit is ampere. The ARC setting is disabled when the parameter is set to OFF

[[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC:LIMit:ARC?
[[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC:LIMit:ARC?
It queries the ARC test of the selected STEP. The unit is ampere.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:LIMit[:HIGH] < numeric value >
[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:LIMit[:HIGH] < numeric value >
It sets the high limit of leakage current in withstand voltage DC for the selected STEP. The unit is ampere.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:LIMit[:HIGH]?
[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:LIMit[:HIGH]?
It queries the high limit of leakage current in withstand voltage DC for the selected STEP. The unit is ampere.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:LIMit:LOW < numeric value > / OFF

[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:LIMit:LOW < numeric value > / OFF

It sets the low limit of leakage current in withstand voltage DC for the selected STEP. The unit is ampere. The Low Limit setting is disabled when the parameter is set to OFF.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:LIMit:LOW?

[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:LIMit:LOW?

It queries the low limit of leakage current in withstand voltage DC for the selected STEP. The unit is ampere.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:TIME:DWELl < numeric value > / OFF

[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:TIME:DWELl < numeric value > / OFF

It sets the time required for DWELL for the selected STEP. The unit is second. The Dwell Time setting is disabled when the parameter is set to OFF.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:TIME:DWELl?

[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:TIME:DWELl?

It queries the time required for DWELL for the selected STEP. The unit is second.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:TIME:FALL < numeric value > / OFF

[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:TIME:FALL < numeric value > / OFF

It sets the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second. The Fall Time setting is disabled when the parameter is OFF.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:TIME:FALL?

[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:TIME:FALL?

It queries the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:TIME:RAMP < numeric value > / OFF

[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:TIME:RAMP < numeric value > / OFF

It sets the time required to ramp to the voltage set for test for the selected STEP. The unit is second. The Ramp Time setting is disabled when the parameter is set to OFF.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:WVDC:TIME:RAMP?

[[:SOURce:]SAFety:STEP<n>:SUB<s>:WVDC:TIME:RAMP?

It queries the time required to ramp to the voltage set for test for the selected STEP. The unit is second.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:WVDC:TIME[:TEST] < numeric value > / CONTInue

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:WVDC:TIME[:TEST] < numeric value > / CONTInue

It sets the time required for test for the selected STEP. The unit is second. The test runs continuously when the parameter is set to CONTInue.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:WVDC:TIME[:TEST]?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:WVDC:TIME[:TEST]?

It queries the time required for test for the selected STEP. The unit is second.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:CHANnel[: HIGH] <channel_list>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:CHANnel[: HIGH] <channel_list>

It sets the status of high voltage output channel during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:CHANnel[: HIGH]?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:CHANnel[: HIGH]?

It queries the status of high voltage output channel during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:CHANnel: LOW <channel_list>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:CHANnel: LOW <channel_list>

It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:CHANnel: LOW?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:CHANnel: LOW?

It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR[:LEVel] < numeric value >

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR[:LEVel] < numeric value >

It sets the voltage required for insulation resistance test for the selected STEP. The unit is volt.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR[:LEVel]?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR[:LEVel]?

It queries the voltage required for insulation resistance test for the selected STEP. The unit is volt.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:LIMit:HIGH < numeric value > / OFF

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:LIMit:HIGH < numeric value > / OFF

It sets the high limit of insulation resistance for the selected STEP. The unit is ohm. The High Limit setting is disabled when the parameter is set to OFF.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:LIMit:HIGH?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:LIMit:HIGH?

It queries the high limit of insulation resistance for the selected STEP. The unit is ohm.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:LIMit[:LOW] < numeric value >

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:LIMit[:LOW] < numeric value >

It sets the low limit of insulation resistance for the selected STEP. The unit is ohm.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:LIMit[:LOW]?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:LIMit[:LOW]?

It queries the low limit of insulation resistance for the selected STEP. The unit is ohm.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe:UPPer < numeric value >

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe:UPPer < numeric value >

It sets the current range for test for the selected STEP. The unit is ampere. The set current range should be larger than the input current.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe:UPPer?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe:UPPer?

It queries the current range for test for the selected STEP. The unit is ampere.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe[:LOWer] < numeric value >

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe[:LOWer] < numeric value >

It sets the current range for test for the selected STEP. The unit is ampere. The set current range should be smaller than the input current.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe[:LOWer]?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe[:LOWer]?

It queries the current range of test for the selected STEP. The unit is ampere.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe:AUTO < boolean > / ON /OFF

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe:AUTO < boolean > / ON /OFF

It sets the current range for test to auto for the selected STEP.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe:AUTO?

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe:AUTO?

It queries if the current range for test is set to auto for the selected STEP.

[[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:TIME:FALL < numeric value > / OFF

[[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:TIME:FALL < numeric value > / OFF

It sets the time required for the set voltage to fall to the low voltage for the selected STEP.

The unit is second. The Fall Time setting is disabled when the parameter is OFF.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:TIME:FALL?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:TIME:FALL?

It queries the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:TIME:RAMP < numeric value > / OFF

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:TIME:RAMP < numeric value > / OFF

It sets the time required to ramp to the voltage set for test for the selected STEP. The unit is second. The Ramp Time setting is disabled when the parameter is set to OFF.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:TIME:RAMP?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:TIME:RAMP?

It queries the time required to ramp to the voltage set for test for the selected STEP. The unit is second.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:TIME[:TEST] < numeric value > / CONTinue

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:TIME[:TEST] < numeric value > / CONTinue

It sets the time required for test for the selected STEP. The unit is second. The test runs continuously when the parameter is set to CONTinue.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IR:TIME[:TEST]?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IR:TIME[:TEST]?

It queries the time required for test for the selected STEP. The unit is second.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DCR:CHANnel[: HIGH] <channel_list>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DCR:CHANnel[: HIGH] <channel_list>

It sets the status of high voltage output channel during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DCR:CHANnel[: HIGH]?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DCR:CHANnel[: HIGH]?

It queries the status of high voltage output channel during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DCR:CHANnel: LOW <channel_list>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DCR:CHANnel: LOW <channel_list>

It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DCR:CHANnel: LOW?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DCR:CHANnel: LOW?

It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:LIMit[:HIGH] < numeric value >
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:LIMit[:HIGH] < numeric value >

It sets the high limit of DC resistance for the selected STEP. The unit is ohm.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:LIMit[:HIGH]?
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:LIMit[:HIGH]?

It queries the high limit of DC resistance for the selected STEP. The unit is ohm.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:LIMit:LOW < numeric value > / OFF
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:LIMit:LOW < numeric value > / OFF

It sets the low limit of DC resistance for the selected STEP. The unit is ohm. The setting of Low Limit is disabled when the parameter is OFF.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:LIMit:LOW?
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:LIMit:LOW?

It queries the low limit of DC resistance for the selected STEP. The unit is ohm.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:RANGe:UPPer < numeric value >
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:RANGe:UPPer < numeric value >

It sets the DC resistance range for test for the selected STEP. The unit is ohm. The set DC resistance range should be larger than the input DC resistance.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:RANGe:UPPer?
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:RANGe:UPPer?

It queries the DC resistance range for test for the selected STEP. The unit is ohm.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:RANGe[:LOWer] < numeric value >
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:RANGe[:LOWer] < numeric value >

It sets the DC resistance range for test for the selected STEP. The unit is ohm. The set DC resistance range should be smaller than the input DC resistance.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:RANGe[:LOWer]?
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:RANGe[:LOWer]?

It queries the DC resistance range for test for the selected STEP. The unit is ohm.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:RANGe:AUTO < boolean > / ON / OFF
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:RANGe:AUTO < boolean > / ON / OFF

It sets the DC resistance range for test to auto for the selected STEP.

[[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:RANGe:AUTO?
[[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:RANGe:AUTO?

It queries if the DC resistance range for test is set to auto for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DCR:TIME:DWELl < numeric value > / OFF
[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DCR:TIME:DWELl < numeric value > / OFF
It sets the time required for DWELL for the selected STEP. The unit is second. The Dwell Time setting is disabled when the parameter is set to OFF.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DCR:TIME:DWELl?
[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DCR:TIME:DWELl?
It queries the time required for DWELL for the selected STEP. The unit is second.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DCR:TIME[:TEST] < numeric value > / OFF / CONTInue
[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DCR:TIME[:TEST] < numeric value > / OFF / CONTInue
It sets the time required for test for the selected STEP. The unit is second. The Test Time setting is disabled when the parameter is set to OFF. The test runs continuously when the parameter is set to CONTInue.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:DCR:TIME[:TEST]?
[[:SOURCE]:SAFety:STEP<n>:SUB<s>:DCR:TIME[:TEST]?
It queries the time required for test for the selected STEP. The unit is second. When DCR is set to OFF, the return value is 9.91E37, and when DCR is set to CONTInue, the return value is 0.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:OSC:CHANnel[:HIGH] <channel_list>
[[:SOURCE]:SAFety:STEP<n>:SUB<s>:OSC:CHANnel[:HIGH] <channel_list>
It sets the status of high voltage output channel during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:OSC:CHANnel[:HIGH]?
[[:SOURCE]:SAFety:STEP<n>:SUB<s>:OSC:CHANnel[:HIGH]?
It queries the status of high voltage output channel during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:OSC:CHANnel:LOW <channel_list>
[[:SOURCE]:SAFety:STEP<n>:SUB<s>:OSC:CHANnel:LOW <channel_list>
It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:OSC:CHANnel:LOW?
[[:SOURCE]:SAFety:STEP<n>:SUB<s>:OSC:CHANnel:LOW?
It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:OSC:LIMit[:OPEN] < numeric value >
[[:SOURCE]:SAFety:STEP<n>:SUB<s>:OSC:LIMit[:OPEN] < numeric value >
It sets the percentage of Open judgment for OSC for the selected STEP.

[[:SOURCE]: SAFety: STEP<n>[:MAIN]:OSC:LIMit[:OPEN]?

[[:SOURCE]: SAFety: STEP<n>:SUB<s>:OSC:LIMit[:OPEN]?

It queries the percentage of Open judgment for OSC for the selected STEP.

[[:SOURCE]: SAFety: STEP<n>[:MAIN]:OSC:LIMit:SHORTt < numeric value > / OFF

[[:SOURCE]: SAFety: STEP<n>:SUB<s>:OSC:LIMit:SHORTt < numeric value > / OFF

It sets the percentage of Short judgment for OSC for the selected STEP. The SHORTt setting is disabled when the parameter is set to OFF.

[[:SOURCE]: SAFety: STEP<n>[:MAIN]:OSC:LIMit:SHORTt?

[[:SOURCE]: SAFety: STEP<n>:SUB<s>:OSC:LIMit:SHORTt?

It queries the percentage of Short judgment for OSC for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IWT:NAME <string data>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IWT:NAME <string data>

It sets the filename saved in the memory of ECG DWX-05/10 for the selected STEP. See ECG DWX-05/10 manual for its format.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IWT:NAME?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IWT:NAME?

It queries the filename from the ECG DWX-05/10 memory for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IWT:CHANnel[:HIGH] <channel_list>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IWT:CHANnel[:HIGH] <channel_list>

It sets the status of high voltage output channel during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IWT:CHANnel[:HIGH]?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IWT:CHANnel[:HIGH]?

It queries the status of high voltage output channel during scan test for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IWT:CHANnel:LOW <channel_list>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IWT:CHANnel:LOW <channel_list>

It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:IWT:CHANnel:LOW?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:IWT:CHANnel:LOW?

It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:PA[:MESSAge] <string>

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:PA[:MESSAge] <string>

It sets the message string of PA MODE.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:PA[:MESSAge]?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:PA[:MESSAge]?

It queries the message string of PA MODE.

**[[:SOURCE]:SAFety:STEP<n>[:MAIN]:PA:TIME[:TEST] < *numeric value* > /
CONTinue**

**[[:SOURCE]:SAFety:STEP<n>:SUB<s>:PA:TIME[:TEST] < *numeric value* > /
CONTinue**

It sets the execution time of PA MODE. The unit is second. The test runs continuously when the parameter is set to CONTinue.

[[:SOURCE]:SAFety:STEP<n>[:MAIN]:PA:TIME[:TEST]?

[[:SOURCE]:SAFety:STEP<n>:SUB<s>:PA:TIME[:TEST]?

It queries the execution time of PA MODE. The unit is second.

3.2.5 Error Messages

Error messages are saved in an error queue that is accessed by the FIFO method. The first return error message is the first saved in the queue. When the error message queue is over 30 messages, the error message “Queue overflow” will be displayed. The error queue cannot save any more error messages until this queue is cleared. When there is no error in the queue, the first position in the queue displays “No error”. Table 3-2 lists the error messages by number and description. When the **ERR** box is backlit on the bottom of the display, there are error messages in the queue.

Table 3-2: RS232 Error Messages

#	Type	Description
-102	Syntax Error	Command includes a prohibited character or symbol
-108	Parameter Not Allowed	Device received a prohibited parameter
-109	Missing Parameter	Parameter missing from programming
-112	Mnemonic Too Long	Command program header is > 12 characters
-113	Undefined Header	Device received undefined header.
-114	Header Suffix Out of Range	Header suffix is out of range
-151	Invalid String of Data	Invalid string (usually missing double quotation marks)
-158	String Not Allowed	Data string is not allowed
-170	Expression Error	Device received incomplete parameter data
-222	Data Out of Range	Data is out of range
-291	Out of Memory	No memory left
-292	Referenced Name	Queried a name that does not exist
-293	Referenced Name	Cannot save a name that already exists
-361	Parity Error	Wrong parity in program message
-363	Input Buffer Overrun	Device received over 1024 characters
-365	Time Out Error	Device did not receive end character within certain time
-400	Queue Error	Output queue data is > 256 characters
-410	Query Interrupted	Query interrupted because query result from previous query has not yet been read.
-420	Query Terminated	Query terminated because the output queue data cannot be read when there is NO data in the queue.

3.7 G16 International Power Strip

The Hybrid 2000 instrument can be connected to the G16 International Power Strip as illustrated in Figure 3-3 for safety testing of many European corded products.

- | | | |
|----------------|-----------------|--------------|
| *Australia | *United Kingdom | *Denmark |
| *North America | *Norway | *Finland |
| *Sweden | *Germany | *Netherlands |
| *Austria | *Switzerland | *Italy |

The three G-16 ground connectors are connected to the Hybrid 2000 RTN/LOW terminal.

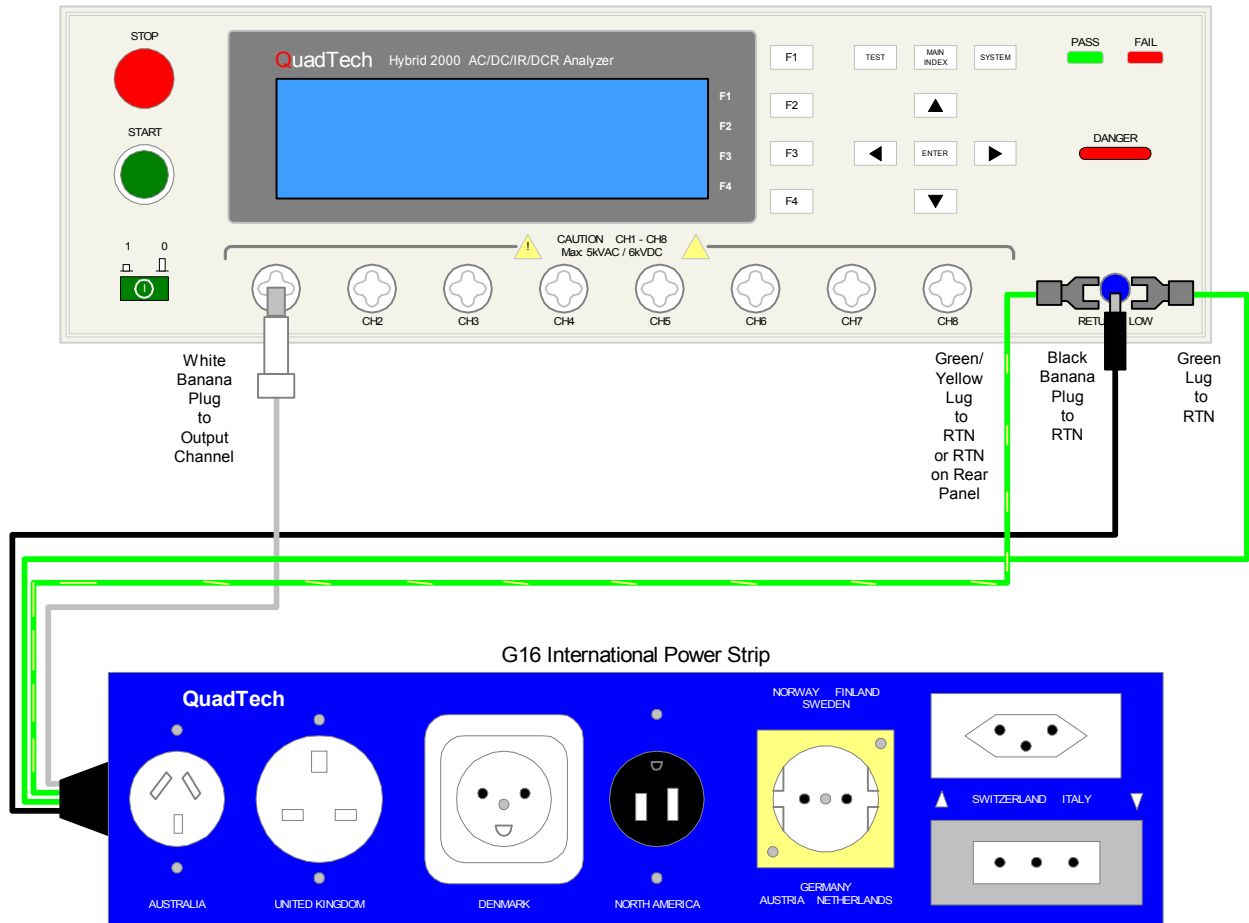


Figure 3-3: G16 International Power Strip Connection to Hybrid 2000 Instrument

3.7 S07 Power Entry Adaptor Cable

The S07 Power Entry Adaptor Cable is a 3-wire AC inlet receptacle for precise testing of corded products. The S07 cable is connected to the Hybrid 2000 instrument via a two-lead set. The white custom banana plug is connected to an output channel on the Hybrid 2000 unit. The black banana plug with retaining bracket is connected to the RTN/LOW terminal on the Hybrid 2000 unit. Figure 3-4 illustrates this connection of the S07 cable to a Hybrid 2000 instrument.

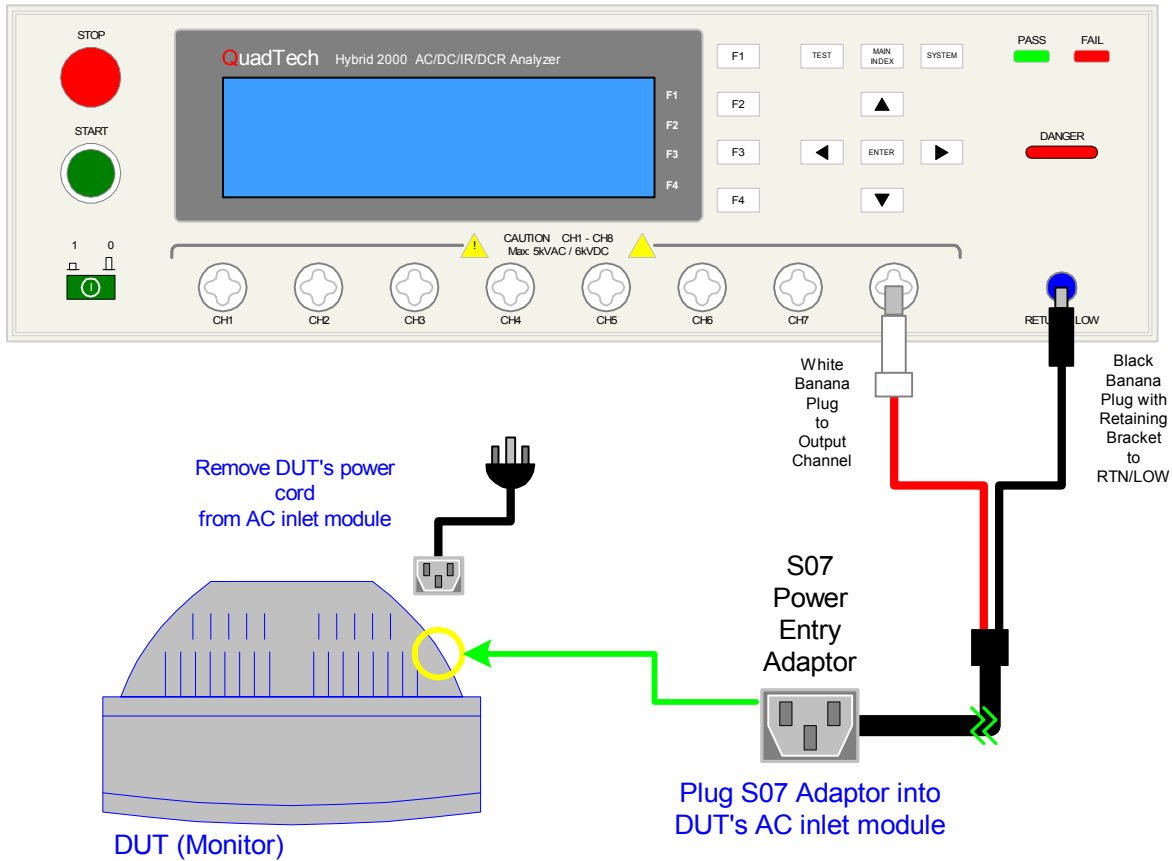


Figure 3-4: S07 Power Entry Adaptor Cable

3.7 S03 Corded Product Adaptor (115V)

The S03 Corded Product Adaptor is a 3-prong electrical outlet box to facilitate testing of corded products. The S03 cable is connected to the Hybrid 2000 instrument via a two-lead set. The white custom banana plug is connected to an output channel on the Hybrid 2000 unit. The black banana plug is connected to the RTN/LOW terminal on the Hybrid 2000 unit. Figure 3-5 illustrates this connection of the S03 cable to a Hybrid 2000 instrument.

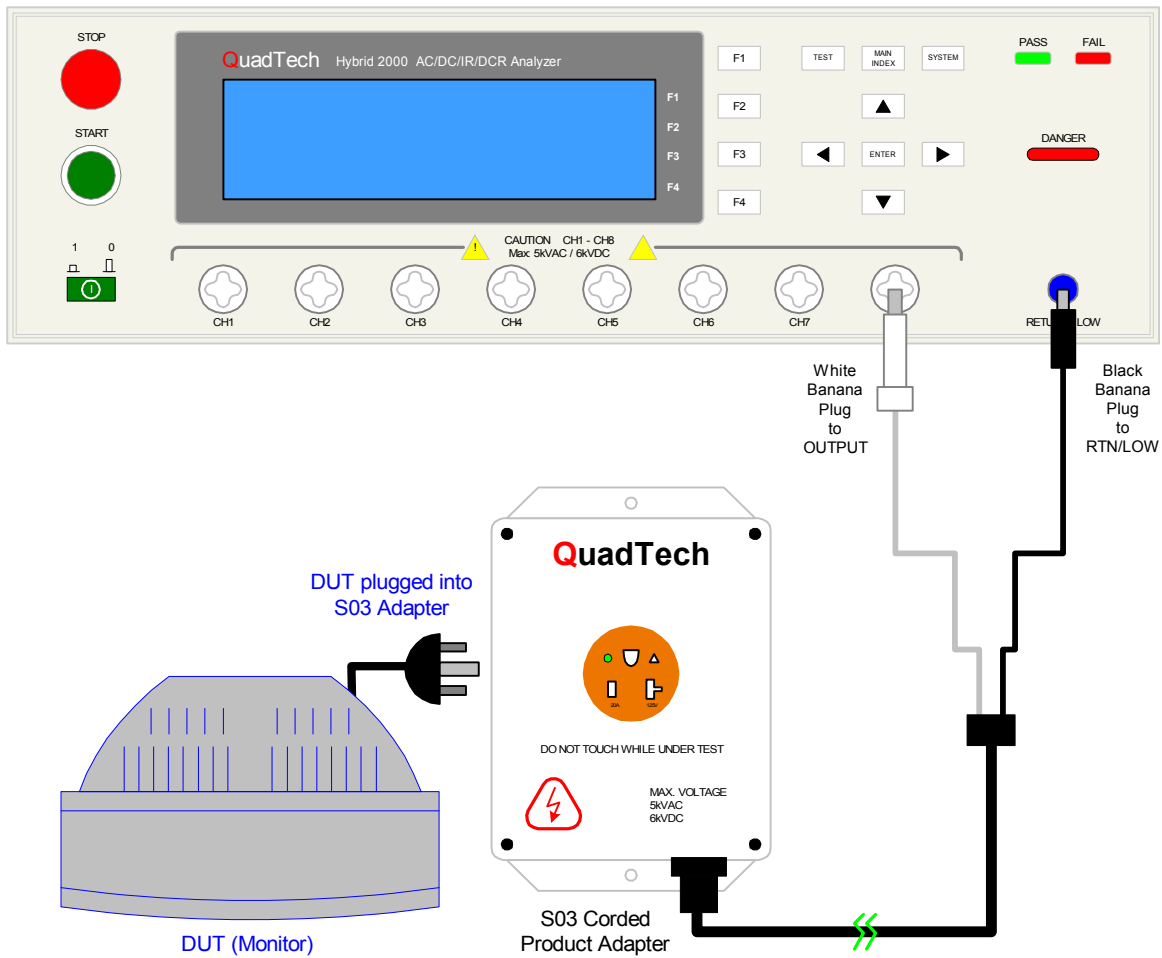


Figure 3-5: S03 Corded Product Adaptor

3.7 S08 Gun Probe

The S08 Gun Probe provides fast testing capability with pinpoint control. The custom white banana plug is connected to an output channel on the front panel of the Hybrid 2000 instrument. Figure 3-6 illustrates this connection of the S08 probe to the Hybrid 2000 instrument.

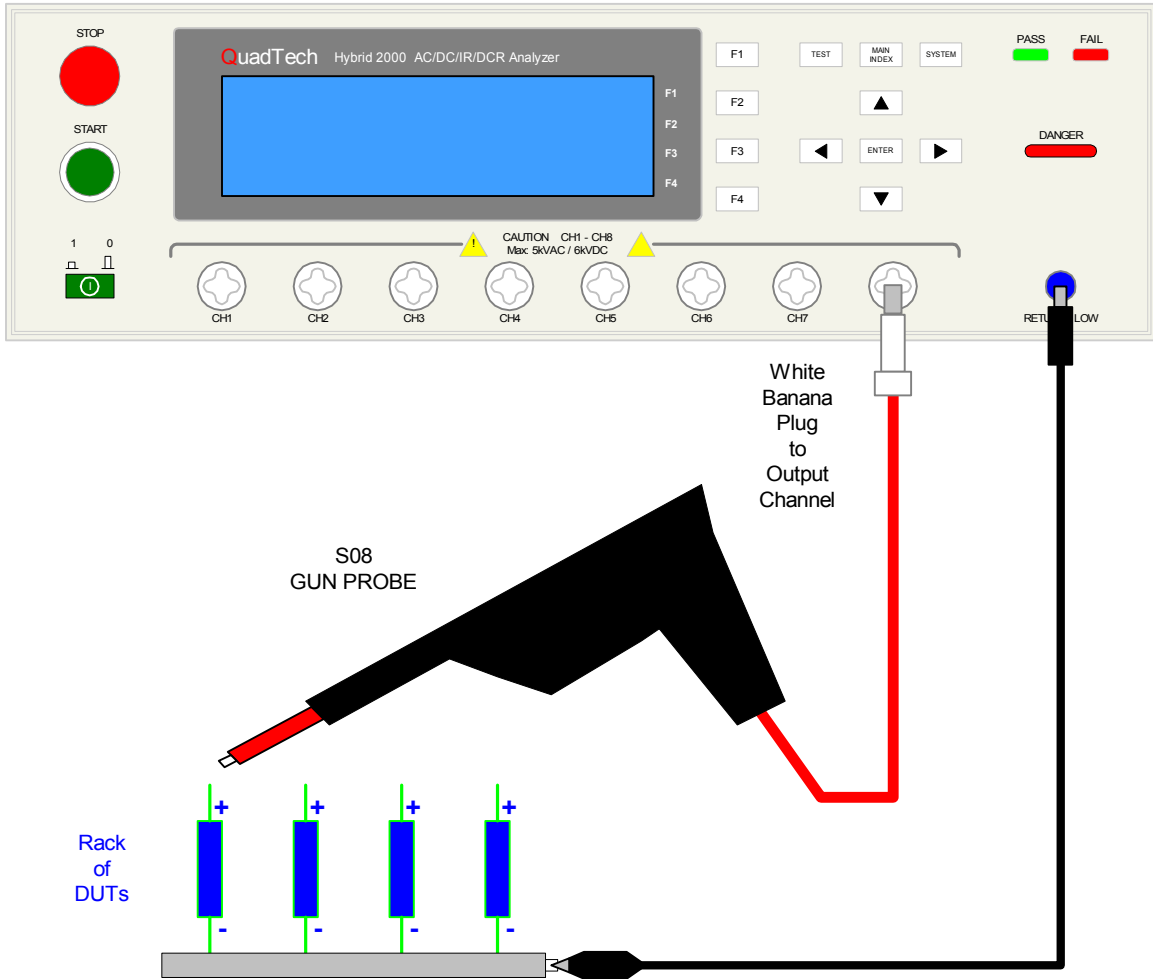


Figure 3-6: S08 Gun Probe

3.7 Guardian 1050 Ground Bond Tester

The Hybrid 2000 instrument can be connected to the Guardian 1050 Ground Bond Tester for high current ground testing between chassis and power cord ground. The output current is programmable from 1A to 30A AC in 0.01A increments and resistance can be measured over the range 0.1mΩ to 510mΩ. The rear panels of the Hybrid 2000 instrument and Guardian 1050 instrument are connected via the S15 9-pin interconnection cable. Figure 3-7 illustrates the front panel connections of the two instruments.

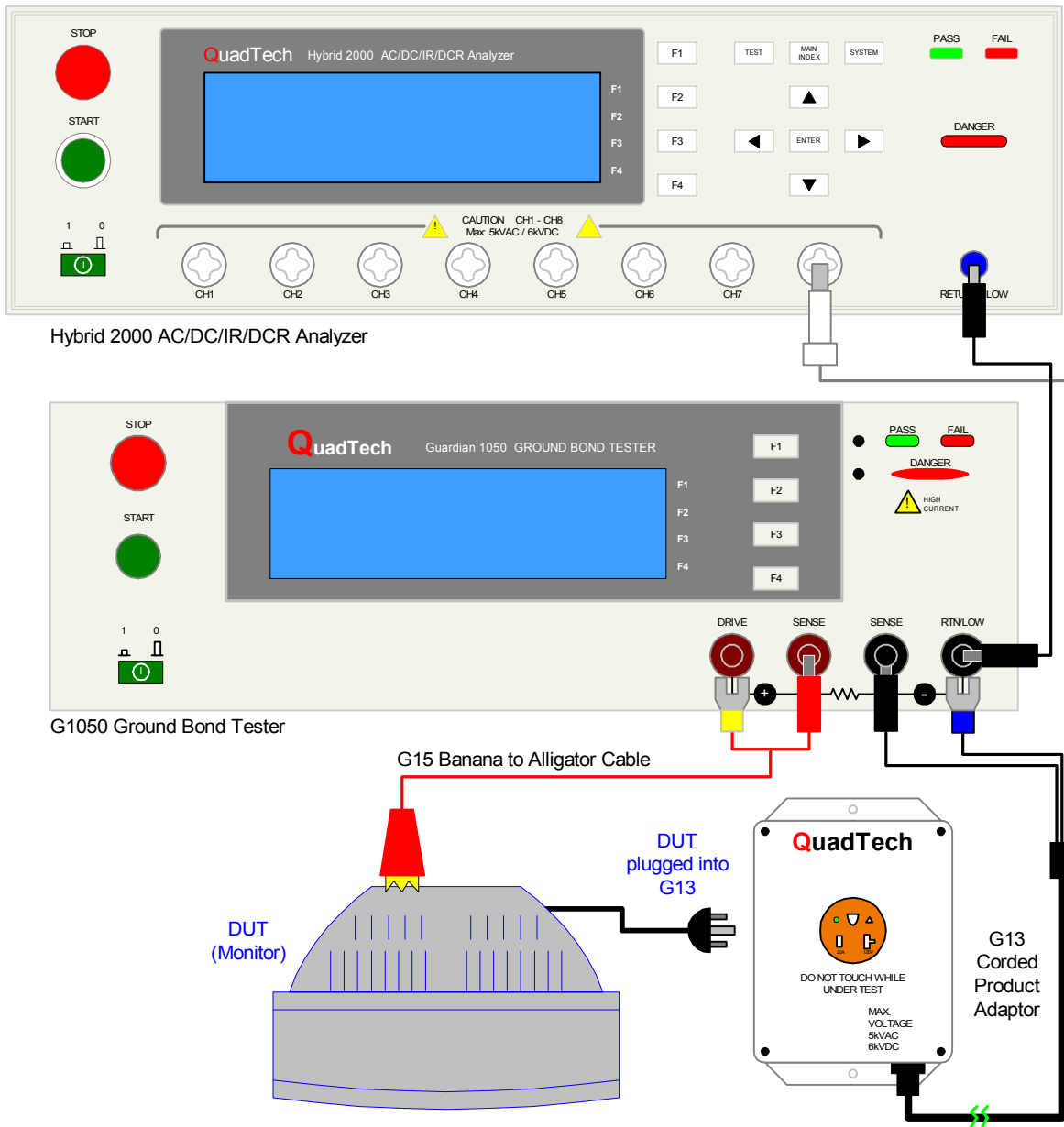


Figure 3-7: Hybrid 2000 & Guardian 1050 Connection

3.8 2000-AB 8 to 16 Channel Scanner

The 2000-AB external scanner can be used with the Hybrid 2000 to allow for additional test points.

External Scanner 2 Terminal Connection – 8 CH to 16 CH HV BOX

Figure 3-8 illustrates Hybrid 2000 connected to the 8 CH to 16 CH HV Box for a 2 terminal connection to DUT.

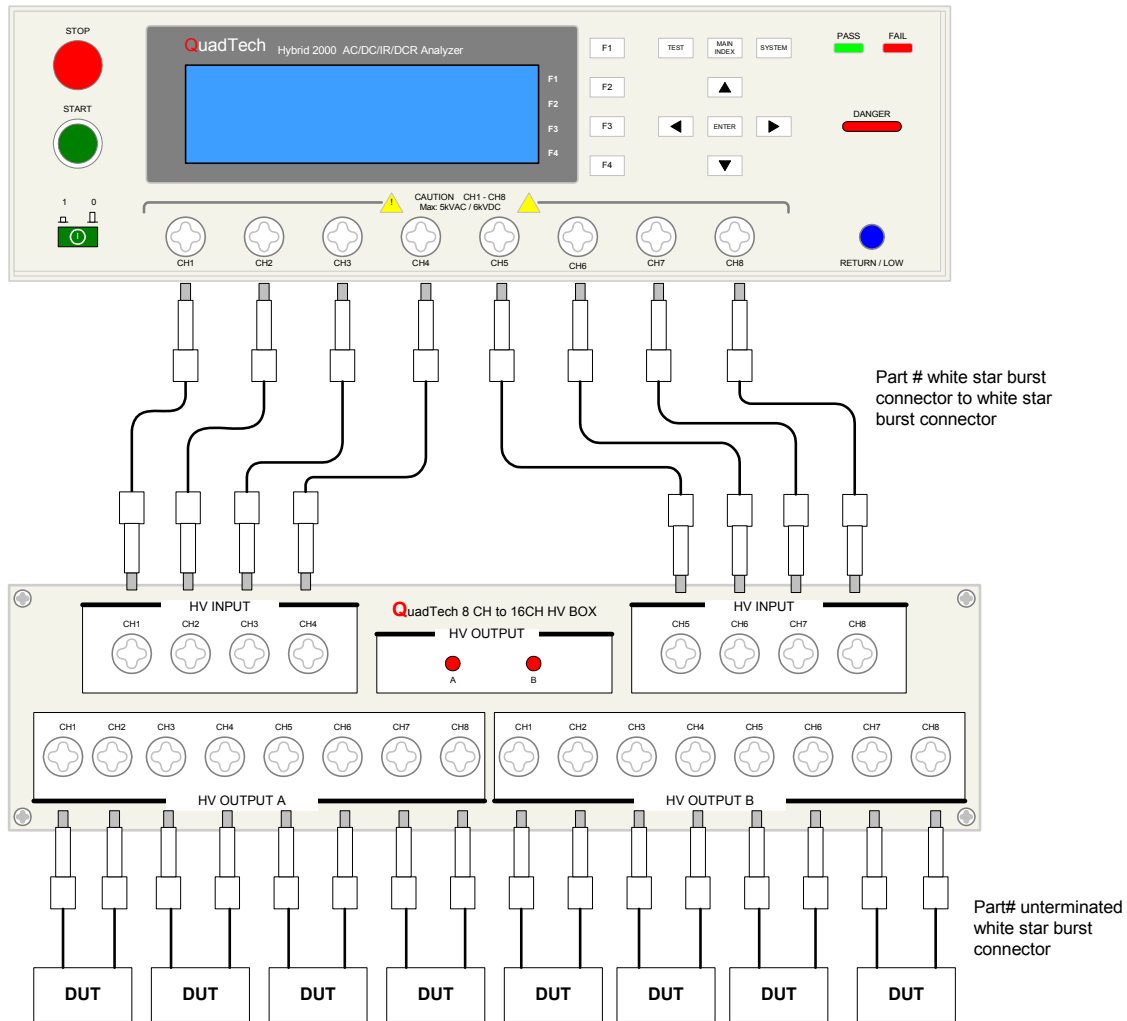


Figure 3-8: Hybrid 2000 connection to 8 CH to 16 CH HV BOX (AC/DC Hipot, IR, and DCR Tests)

External Scanner 4 Terminal Connection – 8 CH to 16 CH HV BOX

Figure 3-9 illustrates Hybrid 2000 connected to the 8 CH to 16 CH HV Box for a 4 terminal connection to the DUT. The scanner is connected to the output Channel from the Hybrid 2000 to HV INPUT of the 2000-AB HV Box as shown.

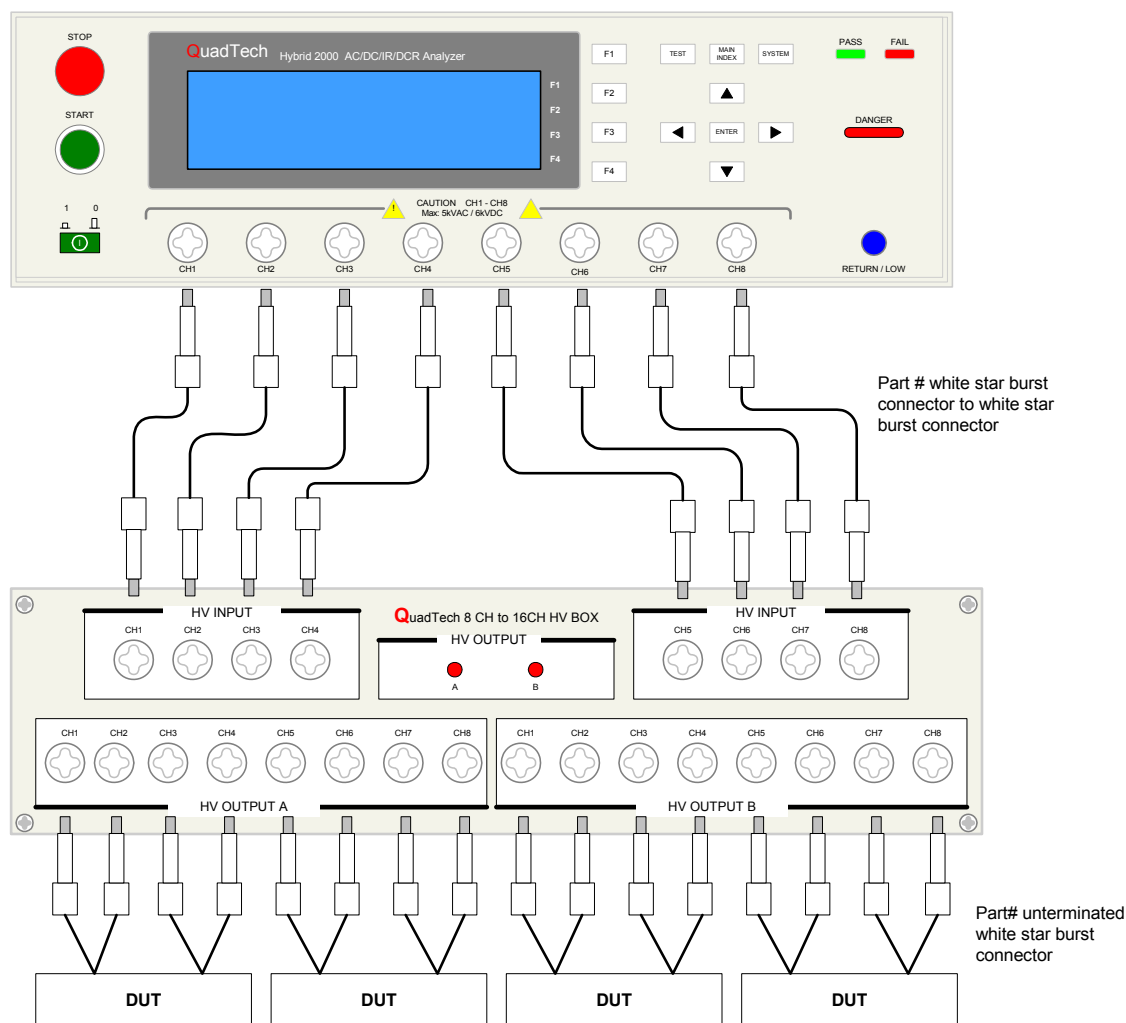


Figure 3-9 Hybrid 2000 connection to 8 CH to 16 CH HV BOX (AC/DC Hipot, IR, and DCR Tests)

Rear Panel Connection: 8 CH to 16 CH HV BOX

The 8 input connectors in the scan box will be short-circuited with HV OUTPUT A when A/B and GND are open circuit and the 8 input connectors in the scan box will be short-circuited with HV OUTPUT B when terminal A/B and GND are shorted. Switching from HV OUTPUT A to HV OUTPUT B will be control by a Pause step in the Hybrid 2000 test program. First Pause mode in test sequence will pull PIN 18 to be in LOW State (short to ground). This will activate Scan Box to switch to HV OUTPUT B. The next Pause mode in the test sequence will pull PIN 18 to be in HIGH State. This will activate Scan box to switch into HV OUTPUT A. If there is no Pause mode in test sequence, PIN 18 will be in HIGH State and Scan Box will remain in HV OUTPUT A for the entire test program.

The input electrical requirement is power by a 24V adapter. The HV Box can be power by other DC power supply via 24V and 0V screw terminal. The external power supply for DC 24V INPUT and 24V/0V can't be use simultaneously (only one is available). OPT1 and OPT2 are not operational.

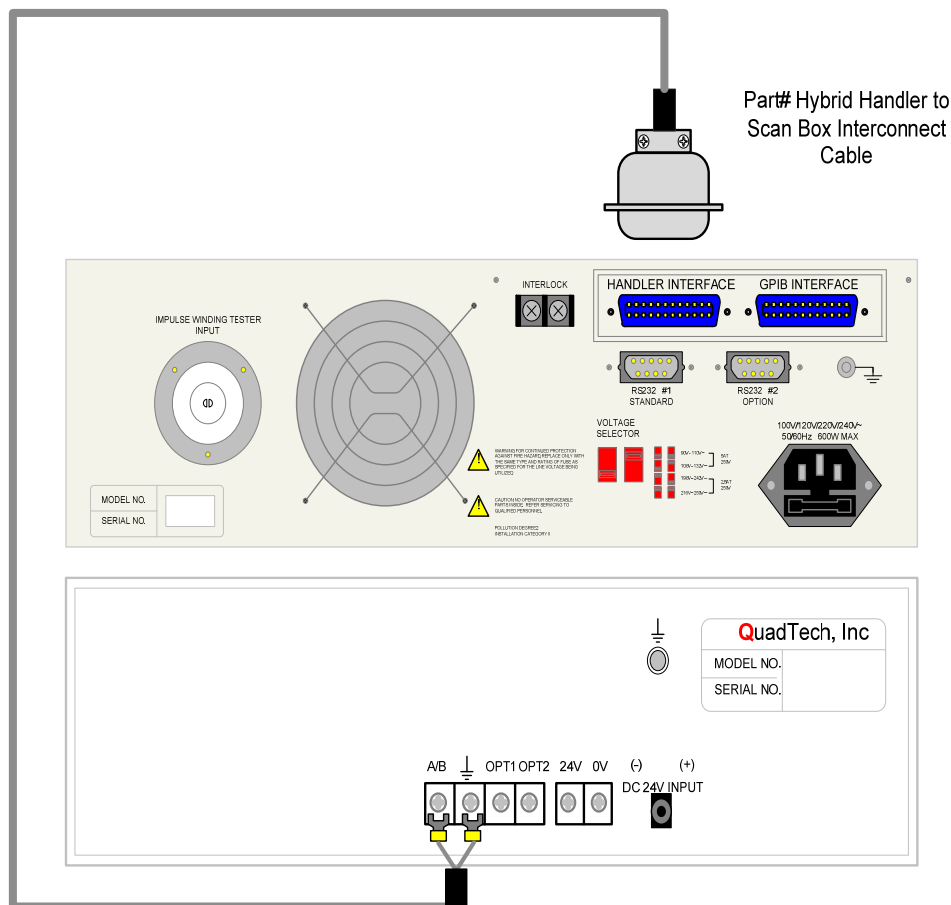


Figure 3-10 Rear panel Hybrid 2000 handler interface connection to 8 CH to 16 CH HV BOX

Handler Interface to Scan Box Pin Configuration

Table 3-3 illustrates pins configuration of Hybrid 2000 Hander Interface to HV Scan Box. Pin 18 of handler interface connects to terminal A/B of HV Scan Box and Pin 21 of handler interface connects to terminal GND of HV Scan Box.

Table 3-3 - Pins Configuration

HYBRID HANDLER		HV SCAN BOX
PIN#	CONNECT TO	PIN#
18		A/B
21		GND

Programming Hybrid 2000 to switch from HV OUTPUT A to HV OUTPUT B

Figure 3-11 illustrate an example on how to program the switch between HV OUTPUT A and HV OUTPUT B in the Hybrid 2000 program function. HV Scan Box “HV OUTPUT A” and “HV OUTPUT B” are control by a Pause mode in the Hybrid 2000.

LIST	TEST	SIGNAL	MEASURE	1 2 3 4 5 6 7 8	EXAMPLE		
	1	DCR	-----	100.0 kΩ	H L - -	PROGRAM	F1 <
	2	PA PAUSE-MODE				CORRECT	F2 <
	3	DCR	-----	100.0 kΩ	- - H L	STEP	F3 <
	STAND BY		RMT	LOCK	CORR	ERR	F4 <

Figure 3-11: Hybrid 2000 Programming Example to switch between HV OUTPUT A and HV OUTPUT B

3.9 Handler Interface

A Handler interface (Figure 3-12) is an available option for the Hybrid 2000 instrument. Connection is made through the blue 24-pin connector labeled ‘HANDLER INTERFACE’ on the rear panel of the Hybrid 2000 instrument.

Specifications:

Driving Capability

Internal Signal Output Specification: DC 5V, 40~60mA

External Signal Input Specification: DC 3V~26V (HIGH), 10mA± 4mA

Table 3-4: Pin Assignment

Pin No.	Signal	Input/Output	Description
1	/STN0	Output	/STN0~/STN4 signals indicate the test step code output. 5 bits are used to indicate 20 test steps. The output format is binary code. (/STN0 is low bit and /STN4 is high bit.) Note (1)
2	/STN1		
3	/STN2		
4	/STN3		
5	/STN4		
6	/PASS_FAIL	Output	It outputs LOW when the test result is PASS. At this time no output for /HIGH, /LOW, /ARC_FAIL & IWT_FAIL signals (all are HIGH.) It outputs HIGH when the test result is FAIL. At this time there is output for /HI, /LO, /ARC_FAIL & IWT_FAIL signals (acting LOW.)
7	/HIGH		
8	/LOW		
9	/ARC_FAIL		
10	/IWT_FAIL		
11	/EXT_STOP	Input	External STOP signal input when signal state is LOW.
12	/EXT_START	Input	External START signal input when signal state is LOW.
13,14	EXT_DCV	Input	External DC voltage input, the range is between +3V~+26V.
15,16	+5V	Output	The internal DC voltage output.
17	/SYSTEM ERROR	Output	The signal output pin for system internal error. It means the system has internal error when output is LOW.
18	/PA	Output	The signal is LOW when enabled for test. Later, the /PA signal and the HIGH or LOW level of COM will change once every time it goes through the PA mode.
19	/EOT	Output	When the signal is HIGH, it indicates the test program is running. When the signal is LOW, it indicates the test program is ended or is ready mode.

20	/EOS		When the signal is HIGH, it indicates the test step is running. When the signal is LOW, it indicates the test step is done before going to the next or all if they are ended.
21,22	COM	---	It is the low voltage terminal for input/output signal.
23,24	GND	---	It is the low voltage terminal for internal voltage output.

Note (1) The test step code signal of Handler Board will send out sequentially no matter it is Main Step or Sub Step.

Example of External Control Circuit

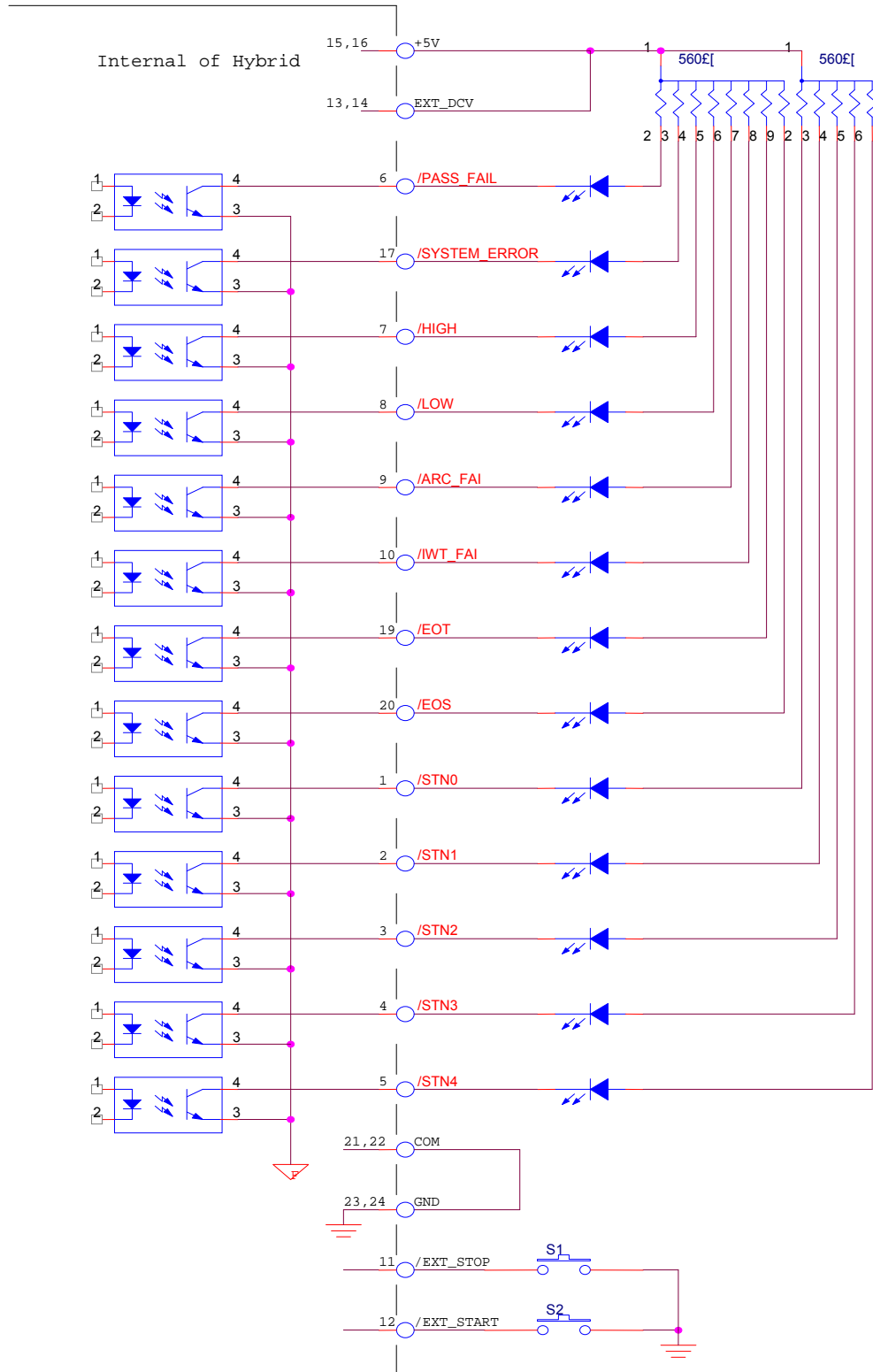


Figure 3-12 Example Using Internal Power Supply

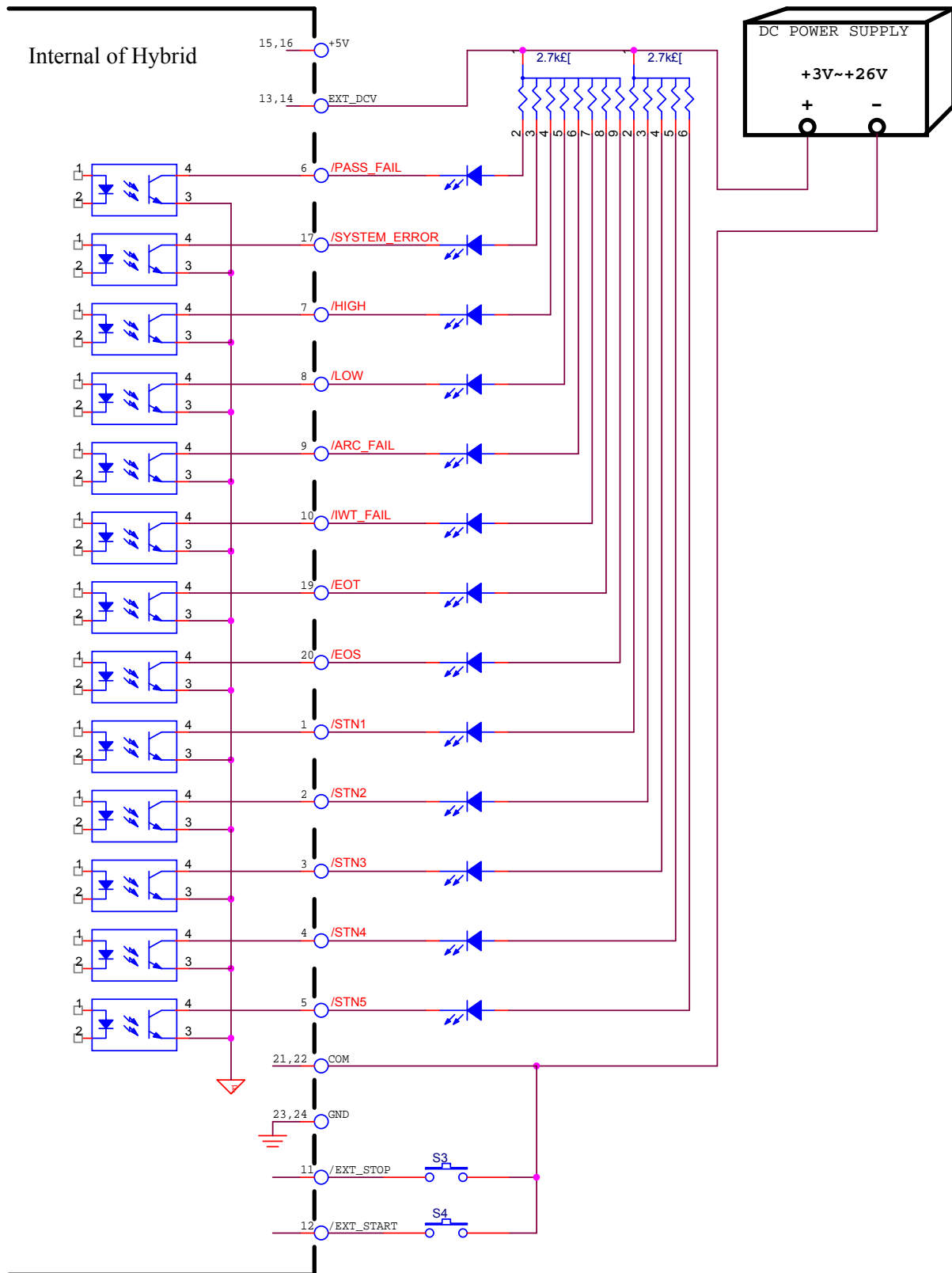


Figure 3-13 Example of Using External Power Supply

Timing Diagram

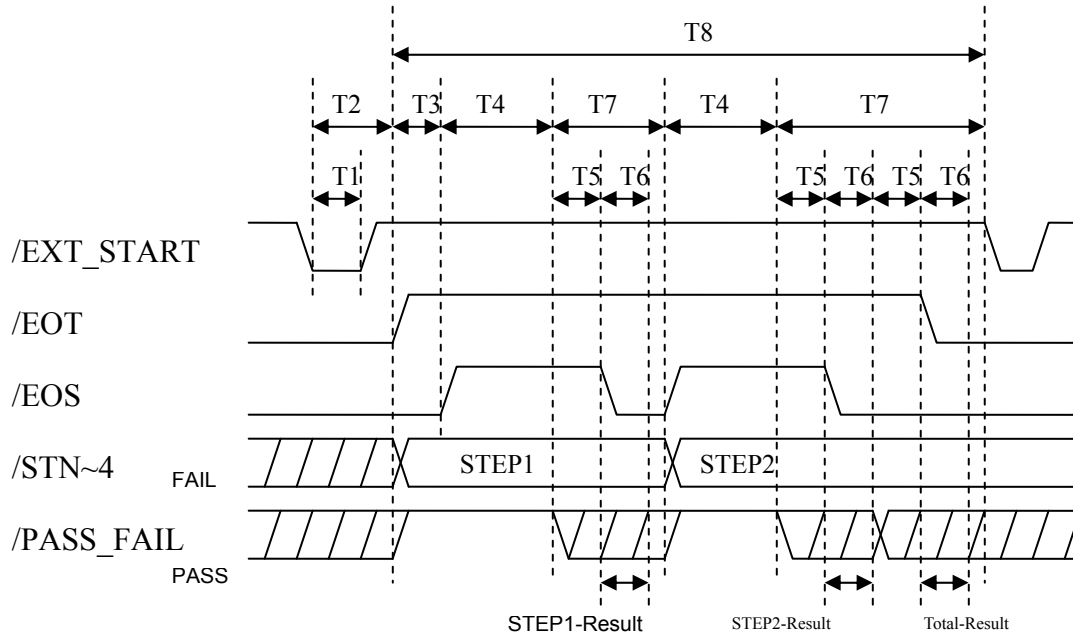


Figure 3-14 Timing Diagram – Example of 2 Test Steps

Table 3-5 Timing

Timing	Limit	Description
T1	> 10mS	It sets the time required for external trigger signal (/EXT_START) to sustain. It should be more than 10mS.
T2	< 20mS	It sets the time for clear from external trigger signal (/EXT_START) to /EOT signal. It should be less than 20mS.
T3	-	It sets the time for Trigger Delay.
T4	-	It sets the time required for each test step.
T5	> 10mS	The waiting time will be more than 10mS for /PASS_FAIL signal to be stable.
T6	> 10mS	The waiting time will be more than 10mS for EOS HOLD time, EOS HOLD time + SUB PASS time or /EOT signals to be stable.
T7	-	The time required for each test step to end.
T8	-	The time required for a test program.

Hybrid 2000 HANDLER Interface: Rear Panel View

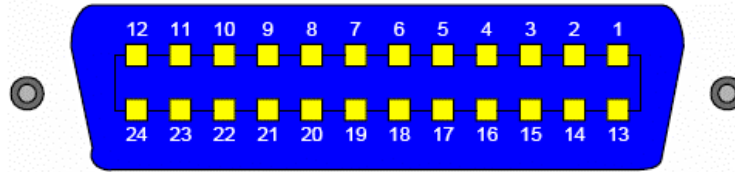


Figure 3-15 Handler Interface Pin Configuration

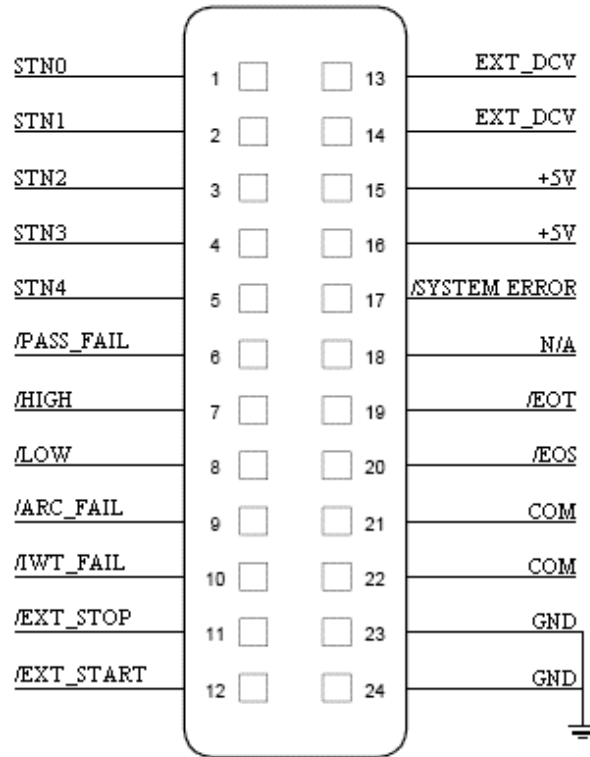


Figure 3-16 illustrates a simple START switch using the Handler interface.

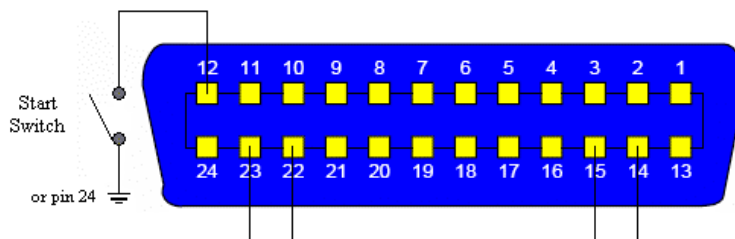


Figure 3-17 Simple Start Switch

Figure 3-18 illustrates a simple circuit used to start and stop a test along with status LED's (NOTE: all pull up resistors are 330Ω). When one of the pass/fail LED's turns on, it will remain on until a new test is started.

The ground must be shorted to common by attaching either pin 23 or 24 to pin 21 or 22 (pin 23 to pin 22 shown in Figure 3-18). The internal DC voltage output can be used as the external voltage input by attaching either pin 15 or 16 to pin 13 or 14 (pin 15 to pin 14 shown in Figure 3-18)

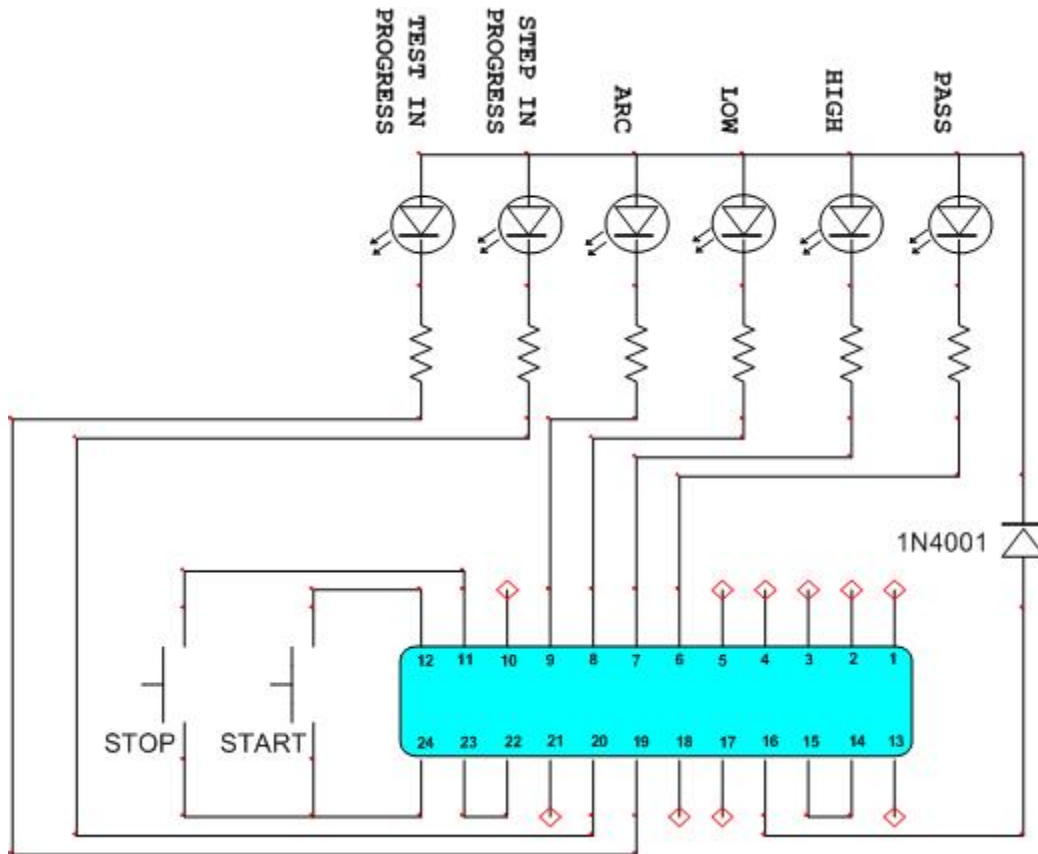


Figure 3-18: Basic Handler Simulator

Section 4: Service & Calibration

4.1 General

Our warranty (at the front of this manual) attests to the quality of materials and workmanship in our products. If malfunction should be suspected or other information be desired, applications engineers are available for technical assistance. Application assistance is available in the U.S. by calling 800-253-1230 and asking for Applications Support. For support outside of the United States, please contact your local [QuadTech Distributor](#).

4.2 Instrument Return

Before returning an instrument to QuadTech for [Service](#) please obtain an [online Return Materials Authorization Number \(RMA#\)](#). This number, when placed on the outside of the shipping package, will speed processing at our Service Lab and will serve as a reference number for the time your unit is at QuadTech. Please contact our **Customer Care Center (CCC)** at **800-253-1230** for additional support. The CCC phone line is staffed from 8:00am to 5:00pm (EST).

It will be necessary to include a Purchase Order Number and credit card information to insure expedient processing, although units found to be in warranty will be repaired at no-charge. For any questions on repair costs or shipment instructions please contact our CCC Department at the above number. To safeguard an instrument during storage and shipping please use packaging that is adequate to protect it from damage, i.e., equivalent to the original packaging and mark the box "Delicate Electronic Instrument". Please follow online instructions for shipping materials back to QuadTech.

4.3 Calibration

Calibration of the Hybrid 2000 instrument is recommended on an annual basis. If the unit is returned to QuadTech for factory calibration, refer to paragraph 4.2 for RMA and shipping instructions. Using the calibration procedure in paragraph 4.3.1, the Hybrid 2000 instrument may be calibrated by a qualified service person IF traceable calibration equipment and standards are available. The instrument should be powered up for a minimum of 1 hour prior to calibration to ensure maximum stability.

4.3.1 Calibration Procedure

Before performing the calibration procedure listed in this chapter, the Scanner should be warm up for at least 30 minutes. While unit is OFF remove the top cover and press down the calibration switch (SW102) on the KEY BOARD inside the front panel. This switch has hardware protection circuit to prevent data loss.

Following are the items to be calibrated:

Voltage Calibration

ACV 5kV Offset (0.050kV)	; AC Voltage OFFSET point
ACV 5kV Full (4kV)	; AC Voltage FULL point
OSCV 100V Offset (50V)	; OSC Voltage OFFSET point
OSCV 100V Full (100V)	; OSC Voltage FULL point
DCV 6kV Offset (0.050kV)	; DC Voltage OFFSET point
DCV 6kV Full (4kV)	; DC Voltage FULL point

Current Calibration

ACA 3mA Offset (0.12mA)	; AC total current 2.999mA range OFFSET point
RACA 3mA Offset (0.12mA)	; AC real current 2.999mA range OFFSET point
ACA 3mA Full (2.4mA)	; AC total current 2.999mA range FULL point
RACA 3mA Full (2.4mA)	; AC real current 2.999mA range FULL point
ACA30mA Offset (2.4mA)	; AC total current 30mA range OFFSET point
RACA 30mA Offset (2.4mA)	; AC real current 30mA range OFFSET point
ACA 30mA Full (12mA)	; AC total current 30mA range FULL point
RACA 30mA Full (12mA)	; AC real current 30mA range FULL point
DCA 3mA Offset (0.12mA)	; DC 2.999mA range OFFSET point
DCA 3mA Full (2.4mA)	; DC 2.999mA range FULL point
DCA 10mA Offset (2.4mA)	; DC 10mA range OFFSET point
DCA 10mA Full (4.8mA)	; DC 10mA range FULL point

Insulation Resistance Calibration

IRR GET OFFSET	; IR Resistor Offset Calibration
IRR 200MΩ OFFSET (4MΩ)	; IR Resistor 200MΩ OFFSET point
IRR 200MΩ FULL (20MΩ)	; IR Resistor 200MΩ FULL point
IRR 2GΩ OFFSET (40MΩ)	; IR Resistor 2GΩ OFFSET point
IRR 2GΩ FULL (200MΩ)	; IR Resistor 2GΩ FULL point
IRR 20GΩ OFFSET (400MΩ)	; IR Resistor 20GΩ OFFSET point
IRR 20GΩ FULL (2GΩ)	; IR Resistor 20GΩ FULL point
IRR 200GΩ OFFSET (4GΩ)	; IR Resistor 200GΩ OFFSET point
IRR 200GΩ FULL (20GΩ)	; IR Resistor 200GΩ FULL point
IRR 550GΩ OFFSET (40GΩ)	; IR Resistor 550GΩ OFFSET point
IRR 550GΩ FULL (200GΩ)	; IR Resistor 550GΩ FULL point

DC Resistance Calibration

DC Resistance Calibration (DCR 4-Terminal Model)

DCR GET SHORT	; DCR Resistor Short Calibration
DCR 1Ω OFFSET (100mΩ)	; DCR Resistor 1Ω OFFSET point
DCR 1Ω FULL (900mΩ)	; DCR Resistor 1Ω FULL point
DCR 10Ω OFFSET (0.9Ω)	; DCR Resistor 10Ω OFFSET point
DCR 10Ω FULL (9Ω)	; DCR Resistor 10Ω FULL point
DCR 100Ω OFFSET (9Ω)	; DCR Resistor 100Ω OFFSET point
DCR 100Ω FULL (90Ω)	; DCR Resistor 100Ω FULL point
DCR 1kΩ OFFSET (0.09kΩ)	; DCR Resistor 1kΩ OFFSET point
DCR 1kΩ FULL (0.9kΩ)	; DCR Resistor 1kΩ FULL point
DCR 10kΩ OFFSET (0.9kΩ)	; DCR Resistor 10kΩ OFFSET point
DCR 10kΩ FULL (9kΩ)	; DCR Resistor 10kΩ FULL point
DCR 100kΩ OFFSET (9kΩ)	; DCR Resistor 100kΩ OFFSET point
DCR 100kΩ FULL (90kΩ)	; DCR Resistor 100kΩ FULL point

DC Resistance Calibration (DCR 2-Terminal Model)

DCR GET SHORT	; DCR Resistor Short Calibration
DCR 10Ω OFFSET (0.9Ω)	; DCR Resistor 10Ω OFFSET point
DCR 10Ω FULL (9Ω)	; DCR Resistor 10Ω FULL point
DCR 100Ω OFFSET (9Ω)	; DCR Resistor 100Ω OFFSET point
DCR 100Ω FULL (90Ω)	; DCR Resistor 100Ω FULL point
DCR 1kΩ OFFSET (0.09kΩ)	; DCR Resistor 1kΩ OFFSET point
DCR 1kΩ FULL (0.9kΩ)	; DCR Resistor 1kΩ FULL point
DCR 10kΩ OFFSET (0.9kΩ)	; DCR Resistor 10kΩ OFFSET point
DCR 10kΩ FULL (9kΩ)	; DCR Resistor 10kΩ FULL point
DCR 100kΩ OFFSET (9kΩ)	; DCR Resistor 100kΩ OFFSET point
DCR 100kΩ FULL (0kΩ)	; DCR Resistor 100kΩ FULL point

Entering Calibration Screen

Press **SYSTEM**

Select CALIBRATION

Press **ENTER**

Display ENTER CAL. PASSWORD:

Press Function Key [A] [A] [A] [B] **ENTER** to enter into a calibration mode.

4.3.2 Voltage Calibration

Calibrating ACV

- Connect an ACV high voltage meter to the Scanner with high voltage terminal connected to CH1 and low voltage terminal connected to RETURN/LOW.

ACV 5kV OFFSET (0.05kV) Calibration Screen:

ACV 5kV OFFSET (0.05kV)				
OUTPUT	READING	UP		
0.050kV	0.050kV	DOWN		
STANDARD: 0.050kV		SETUP		
DEF=0.05kV	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACV 5kV FULL (4kV) calibration.

ACV 5kV FULL (4kV) Calibration Screen:

ACV 5kV FULL (4kV)				
OUTPUT	READING	UP		
4.000kV	4.000kV	DOWN		
STANDARD: 4.000kV		SETUP		
DEF=4kV	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.

2. Press **START** to output voltage and read data from the high voltage meter (change range on volt meter for better accuracy).
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to OSCV 100V OFFSET (50V) calibration.

4.3.3 Calibrating OSCV

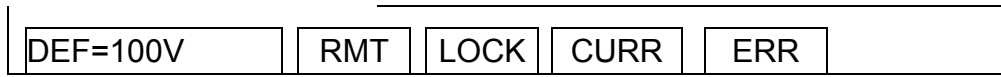
OSCV 100V OFFSET (50V) Calibration Screen:

OSCV 100V OFFSET (50V)				
OUTPUT	READING		UP	
			DOWN	
	50V	50V		
STANDARD: 50V			SETUP	
DEF=50V	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to OSCV 100V FULL (100V) calibration.

4.3.4 OSCV 100V FULL (100V) Calibration Screen:

OSCV 100V FULL (100V)				
OUTPUT	READING		UP	
			DOWN	
	100V	100V		
STANDARD: 100V			SETUP	

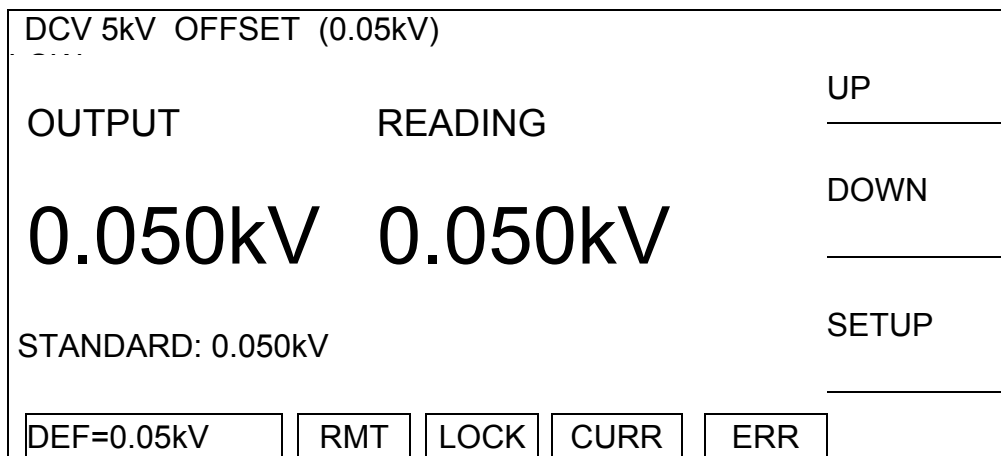


1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to OSCV 100V FULL (100V) calibration.

4.3.5 Calibrating DCV

Connect a DCV high voltage meter to this Scanner with high voltage terminal connected to CH1 and low voltage connected to RETURN/LOW.

DCV 6kV OFFSET (0.05kV) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCV 6kV FULL (4kV) calibration.

DCV 6kV FULL (4kV) Calibration Screen:

DCV 6kV FULL (4kV)				
OUTPUT	READING			UP
4.000kV	4.000kV			DOWN
STANDARD: 4.000kV				SETUP
DEF=4kV	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACA 3mA OFFSET (0.12mA) calibration.

Current Calibration

Caution! The virtual load has to be in between high potential terminal and ammeter input terminal, or it may cause hazard.

4.3.6 Calibrating ACA Current

Connect a 12M Ω 0.5 Watt or high power simulated load resistance in between the high voltage output terminal (CH1) of this Scanner and the high potential terminal of AC meter, also connect the low potential terminal (RETURN/LOW) of this Scanner to the low potential terminal of AC meter.

ACA 3mA OFFSET (0.12mA) Calibration Screen:

ACA 3mA OFFSET (0.12mA)				
OUTPUT	READING	UP		
1.200kV	0.100mA	DOWN		
STANDARD: 0.100mA		SETUP		
LOAD=10MΩ	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to RACA 3mA OFFSET (0.12mA) calibration.

RACA 3mA OFFSET (0.12mA) Calibration Screen:

RACA 3mA OFFSET (0.12mA)				
OUTPUT	READING	UP		
1.200kV	0.100mA	DOWN		
STANDARD: 0.100mA		SETUP		
LOAD=10MΩ	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACA 3mA FULL (2.4mA) calibration.

Change the simulated load resistance to 480kΩ 10watt or higher power.

ACA 3mA FULL (2.4mA) Calibration Screen:

ACA 3mA OFFSET (2.4mA)					
OUTPUT	READING	UP			
1.200kV	2.382mA	DOWN			
STANDARD: 2.392mA		SETUP			
LOAD=500kΩ	RMT	LOCK	CURR	ERR	

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go RACA 3mA FULL (2.4mA) calibration.

RACA 3mA FULL (2.4mA) Calibration Screen:

RACA 3mA FULL (2.4mA)					
OUTPUT	READING	UP			
1.200kV	2.384mA	DOWN			
STANDARD: 2.382mA		SETUP			
LOAD=500kΩ	RMT	LOCK	CURR	ERR	

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.

5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACA 30mA OFFSET (2.4mA) calibration.

ACA 3mA FULL (2.4mA) Calibration Screen:

ACA 30mA OFFSET (2.4mA)				
OUTPUT	READING	UP		
1.200kV	2.40mA	DOWN		
STANDARD: 2.40mA		SETUP		
LOAD=500kΩ	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to RACA 30mA OFFSET (2.4mA) calibration.

RACA 30mA OFFSET (2.4mA) Calibration Screen:

RACA 30mA OFFSET (2.4mA)				
OUTPUT	READING	UP		
1.200kV	2.38mA	DOWN		
STANDARD: 2.39mA		SETUP		
LOAD=500kΩ	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.

5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACA 30mA FULL (12mA) calibration.

Change the simulated load resistance to 80kΩ 50watt or higher power.

ACA 30mA FULL (12mA) Calibration Screen:

ACA 30mA OFFSET (2.4mA)				
OUTPUT	READING			UP
				DOWN
1.200kV	15.26mA			SETUP
STANDARD: 15.32mA				
LOAD=100kΩ	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to RACA 30mA FULL (12mA) calibration.

RACA 30mA FULL (12mA) Calibration Screen:

RACA 30mA FULL (12mA)				
OUTPUT	READING			UP
				DOWN
1.200kV	15.26mA			SETUP
STANDARD: 15.32mA				
LOAD=100kΩ	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.

3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCA 3mA OFFSET (0.12mA) calibration.

4.3.7 Calibrating DCA Current

Connect a 12MΩ 0.5 Watt or high power simulated load resistance in between the high voltage output terminal (CH1) of this Scanner and the high potential terminal of DC meter, also connect the low potential terminal (RETURN/LOW) of this Scanner to the low potential terminal of DC meter.

DCA 3mA OFFSET (0.12mA) Calibration Screen:

DCA 3mA OFFSET (0.12mA)				
OUTPUT	READING		UP	
1.200kV	0.100mA		DOWN	
STANDARD: 0.100mA			SETUP	
LOAD=10MΩ	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the DC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from DC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCA 3mA FULL (2.4mA) calibration.

Change the simulated load resistance to 480kΩ 10watt or higher power.

DCA 3mA FULL (2.4mA) Calibration Screen:

DCA 3mA FULL (2.4mA)					
OUTPUT	READING	UP			
1.200kV	2.392mA	DOWN			
STANDARD: 2.391mA		SETUP			
LOAD=500kΩ	RMT	LOCK	CURR	ERR	

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the DC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from DC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCA 10mA OFFSET (2.4mA) calibration.

DCA 10mA OFFSET (2.4mA) Calibration Screen:

DCA 10mA OFFSET (2.4mA)					
OUTPUT	READING	UP			
1.200kV	2.40mA	DOWN			
STANDARD: 2.40mA		SETUP			
LOAD=500kΩ	RMT	LOCK	CURR	ERR	

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the DC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from DC meter.
4. Press **ENTER** to confirm the input data.

5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCA 10mA FULL (4.8mA) calibration.

Change the simulated load resistance to 240kΩ 20watt or higher power.

DCA 10mA FULL (4.8mA) Calibration Screen:

DCA 10mA OFFSET (4.8mA)				
OUTPUT	READING			UP
1.200kV	4.82mA			DOWN
STANDARD <input type="checkbox"/> 4.82mA				SETUP
LOAD=250kΩ	RMT	LOCK	CURR	ERR

1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the DC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from DC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to IRR GET OFFSET calibration.

4.3.8 Insulation Resistance (IR) Calibration

Do not connect the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) to any DUT or wires for the following calibration procedure.

IRR GET OFFSET Calibration Screen:

IRR GET OFFSET					
R3= 0	R6= 0				UP
R4= 0	R7= 0				DOWN
R5= 0					
	RMT	LOCK	CURR	ERR	

1. Press **START** to begin IR GET OFFSET.
2. When the status line at the lower left corner shows [COMPLETED], it indicates the OFFSET calibration is done.
3. Press Function Key [DOWN] to go to IRR 200MΩ OFFSET (4MΩ) calibration.

Connect a 4MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 200MΩ OFFSET (4MΩ) Calibration Screen:

IRR 200MΩ OFFSET (4MΩ)					
OUTPUT	READING				UP
1.000kV	4.0MΩ				DOWN
STANDARD: 4.0MΩ					
LOAD=4MΩ	RMT	LOCK	CURR	ERR	

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.

- Press Function Key [DOWN] to go to IRR 200MΩ FULL (20MΩ) calibration.

Connect a 20MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 200MΩ FULL (20MΩ) Calibration Screen:

IRR 200MΩ FULL (20MΩ)				
OUTPUT	READING		UP	
1.000kV	20.0MΩ		DOWN	
STANDARD: 20.0MΩ				
LOAD=20MΩ	RMT	LOCK	CURR	ERR

- Press **START** to output voltage.
- Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
- Press **ENTER** to confirm the input data.
- Press **STOP** to stop high voltage output.
- Press Function Key [DOWN] to go to IRR 2GΩ OFFSET (40MΩ) calibration.

Connect a 40MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 2GΩ OFFSET (40MΩ) Calibration Screen:

IRR 2GΩ OFFSET (40MΩ)				
OUTPUT	READING		UP	
1.000kV	40.0MΩ		DOWN	
STANDARD: 40.0MΩ				
LOAD=40MΩ	RMT	LOCK	CURR	ERR

- Press **START** to output voltage.

2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 2GΩ FULL (200MΩ) calibration.

Connect a 200MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 2GΩ FULL (200MΩ) Calibration Screen:

IRR 2GΩ FULL (200MΩ)				
OUTPUT	READING		UP	
1.000kV	200MΩ		DOWN	
STANDARD: 200MΩ				
LOAD=200MΩ	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 20GΩ OFFSET (400MΩ) calibration.

Connect a 400MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 20GΩ OFFSET (400MΩ) Calibration Screen:

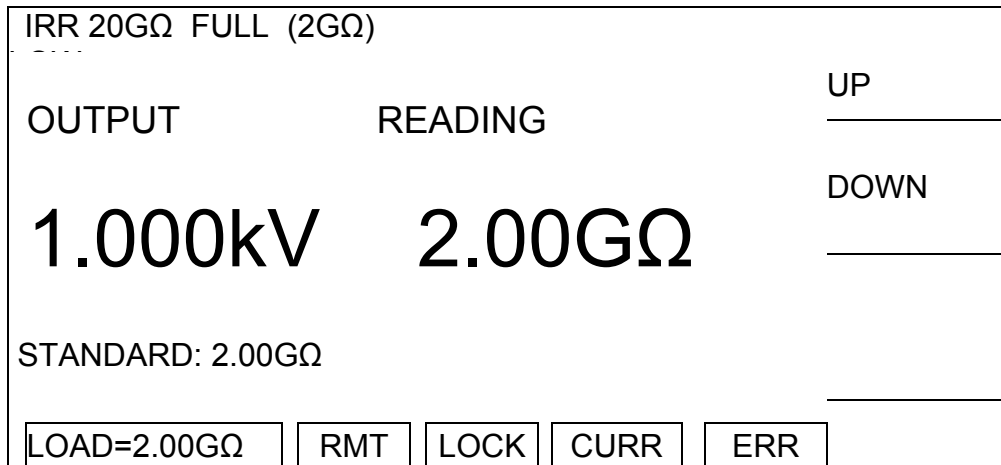
IRR 20GΩ OFFSET (400MΩ)				
OUTPUT	READING		UP	
1.000kV	400MΩ		DOWN	
STANDARD: 400MΩ				



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 20GΩ FULL (2GΩ) calibration.

Connect a 2GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 20GΩ FULL (2GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 200GΩ OFFSET (4GΩ) calibration.

Connect a 4GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 200GΩ OFFSET (4GΩ) Calibration Screen:

IRR 200GΩ OFFSET (4GΩ)				
OUTPUT	READING	UP		
1.000kV	4.00GΩ	DOWN		
STANDARD: 4.00GΩ				
LOAD=4GΩ	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 200GΩ FULL (20GΩ) calibration.

Connect a 20GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 200GΩ FULL (20GΩ) Calibration Screen:

IRR 200GΩ FULL (20GΩ)				
OUTPUT	READING	UP		
1.000kV	20.0GΩ	DOWN		
STANDARD: 20.0GΩ				
LOAD=20GΩ	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 550GΩ OFFSET (40GΩ) calibration.

Connect a 40GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 550GΩ OFFSET (40GΩ) Calibration Screen:

IRR 200GΩ OFFSET (4GΩ)		
OUTPUT	READING	UP
1.000kV	40.0GΩ	DOWN
STANDARD: 40.0GΩ		
LOAD=40GΩ	RMT	LOCK
CURR	ERR	

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 200GΩ FULL (20GΩ) calibration.

Connect a 200GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.

IRR 550GΩ FULL (200GΩ) Calibration Screen:

IRR 200GΩ FULL (20GΩ)		
OUTPUT	READING	UP
1.000kV	200GΩ	DOWN
STANDARD: 200GΩ		
LOAD=200GΩ	RMT	LOCK
CURR	ERR	

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual

resistance.

3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR GET SHORT calibration.

4.3.9 DC Resistance Calibration

Use test wire to short circuit the output terminal (CH1), CH2, CH3 and CH4 for the following calibration procedures.

DCR GET SHORT Calibration Screen:

DCR GET SHORT				
2-R1= 0.0 mΩ	4-R1= 0.0 mΩ	UP		
2-R2= 0.000 Ω	4-R2= 0.000Ω	DOWN		
2-R3= 0.00 Ω	4-R3= 0.00Ω			
2-R4= 0.0 Ω	4-R4= 0.0Ω			
2-R5= 0.000kΩ	4-R5= 0.000kΩ			
2-R6= 0.00kΩ	4-R6= 0.00kΩ			
LOAD=0Ω	RMT	LOCK	CURR	ERR

1. Press **START** to perform DCR GET SHORT.
2. When the status line at the lower left corner shows [COMPLETED] it indicates the OFFSET calibration is done.
3. Press Function Key [DOWN] to go to DCR 1Ω OFFSET (100mΩ) calibration.

Connect the high voltage output terminal CH1, CH2 to one end of the standard 100mΩ resistance and CH3, CH4 to the other end.

DCR 1Ω OFFSET (100mΩ) Calibration Screen:

DCR 1Ω OFFSET (100mΩ)				
2-TERMINAL	4-TERMINAL	UP		
95.4 mΩ	96.8 mΩ	DOWN		
STANDARD: 100.0mΩ				
LOAD=100mΩ	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.

4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 1Ω FULL (900mΩ) calibration.

Connect the high voltage output terminal CH1, CH2 to one end of the standard 900mΩ resistance and CH3, CH4 to the other end.

DCR 1Ω FULL (900mΩ) Calibration Screen:

DCR 1Ω FULL (900mΩ)					
2-TERMINAL		4-TERMINAL			UP
895.4 mΩ		896.8 mΩ			DOWN
STANDARD: 900.0mΩ					
LOAD=900mΩ	RMT	LOCK	CURR	ERR	

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 10Ω OFFSET (0.9Ω) calibration.

DCR 10Ω OFFSET (0.9Ω) Calibration Screen:

DCR 10Ω OFFSET (0.9Ω)					
2-TERMINAL		4-TERMINAL			UP
0.888 Ω		0.886 Ω			DOWN
STANDARD: 0.900Ω					
LOAD=0.9Ω	RMT	LOCK	CURR	ERR	

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 10Ω FULL (9Ω) calibration.

Connect the high voltage output terminal CH1, CH2 to one end of the standard 9Ω resistance and CH3, CH4 to the other end.

DCR 10Ω FULL (9Ω) Calibration Screen:

DCR 10Ω FULL (9Ω)				
2-TERMINAL		4-TERMINAL		UP
8.881 Ω		8.877 Ω		DOWN
STANDARD: 9.000Ω				
LOAD=9Ω	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 100Ω OFFSET (9Ω) calibration.

Connect the high voltage output terminal CH1, CH2 to one end of the standard 9Ω resistance and CH3, CH4 to the other end.

DCR 100Ω OFFSET (9Ω) Calibration Screen:

DCR 100Ω OFFSET (9Ω)				
2-TERMINAL		4-TERMINAL		UP
8.86 Ω		8.85 Ω		DOWN
STANDARD: 9.00Ω				
LOAD=9Ω	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 100Ω FULL (90Ω) calibration.

Connect the high voltage output terminal CH1, CH2 to one end of the standard 90Ω resistance and CH3, CH4 to the other end.

DCR 100Ω FULL (90Ω) Calibration Screen:

DCR 100Ω FULL (90Ω)				
2-TERMINAL		4-TERMINAL		UP
88.71 Ω		88.70 Ω		DOWN
STANDARD: 90.00 Ω				
LOAD=90Ω	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 1kΩ OFFSET (90Ω) calibration.

DCR 1kΩ OFFSET (90Ω) Calibration Screen:

DCR 1kΩ OFFSET (90Ω)				
2-TERMINAL		4-TERMINAL		UP
88.6 Ω		88.5 Ω		DOWN
STANDARD: 90.00Ω				
LOAD=90Ω	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 1kΩ FULL (900Ω) calibration.

Connect the high voltage output terminal CH1, CH2 to one end of the standard 900Ω resistance and CH3, CH4 to the other end.

DCR 1kΩ FULL (900Ω) Calibration Screen:

DCR 1kΩ FULL (900Ω)				
2-TERMINAL	4-TERMINAL		UP	
892.1 Ω	892.0 Ω		DOWN	
STANDARD: 900.0 Ω				
LOAD=900Ω	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 10kΩ OFFSET (0.9kΩ) calibration.

DCR 10kΩ OFFSET (0.9kΩ) Calibration Screen:

DCR 10kΩ OFFSET (0.9kΩ)				
2-TERMINAL	4-TERMINAL		UP	
0.889 Ω	0.889 Ω		DOWN	
STANDARD: 0.900kΩ				
LOAD=0.9kΩ	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 10kΩ FULL (9kΩ) calibration.

Connect the high voltage output terminal CH1, CH2 to one end of the standard 9kΩ resistance and CH3, CH4 to the other end.

DCR 10kΩ FULL (9kΩ) Calibration Screen:

DCR 10kΩ FULL (9kΩ)				
2-TERMINAL		4-TERMINAL		UP
8.854 kΩ		8.854 kΩ		DOWN
STANDARD: 9.000kΩ				
LOAD=9kΩ	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 100kΩ OFFSET (9kΩ) calibration.

DCR 100kΩ OFFSET (9kΩ) Calibration Screen:

DCR 100kΩ OFFSET (9kΩ)				
2-TERMINAL		4-TERMINAL		UP
8.89kΩ		8.89kΩ		DOWN
STANDARD: 9.00kΩ				
LOAD=9kΩ	RMT	LOCK	CURR	ERR

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 100kΩ FULL (90kΩ) calibration.

Connect the high voltage output terminal CH1, CH2 to one end of the standard 90kΩ resistance and CH3, CH4 to the other end.

DCR 100kΩ FULL (90kΩ) Calibration Screen:

DCR 100kΩ FULL (90kΩ)					
2-TERMINAL		4-TERMINAL		UP	
88.54kΩ		88.54kΩ		DOWN	
STANDARD: 90.00kΩ					
LOAD=90kΩ	RMT	LOCK	CURR	ERR	

1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to AC ARC 15mA FULL (7mA) calibration.

4.3.10 ARC Calibration

Arc calibration is factory only. Please contact QuadTech for more details.

4.4 Complete Calibration

When the calibration is complete, turn off unit, press the calibration switch (SW102) on the KEY BOARD inside the front panel to open the protection circuit for backing up hardware data and prevent data loss.

4.5 Verification Procedure

This section outlines the relevant information to verify performance of the Hybrid 2000 Electrical Safety Analyzer. It is recommended that performance be performed at least once a year using this outline procedure. Instrument should be warmed up for a minimum of 15 minutes prior to verification. Verification should be performed under the following conditions: Temperature equal to 23 °C ± 1.2 °C and Relative Humidity (RH) between 35% and 55%.

Recommended standards are listed below.

Tools Due:

Date:

S/N:

Firmware Version:

Safety	YES	NO
Unit operates with interlock		

GFI Operation	CH 1	Yes	NO
Fails before 2M Ω	Unit fails to operate w/o interlock		

AC Output Voltage	CH 1-2	Specification: $\pm 1\%$ of Setting + 0.005			
Voltage Setting (kV)	Measured Voltage (kV)	Displayed Voltage (kV)	LOW Limit (kV)	HIGH Limit (kV)	Within Spec
0.050			0.045	0.055	PASS
0.500			0.490	0.510	PASS
1.000			0.985	1.015	PASS
2.000			1.975	2.025	PASS
5.000			4.945	5.055	PASS

AC Output Current @ 1.2kVAC	CH 5-6	Specification: $\pm 1\%$ of Measured + 5 counts	
Load (kΩ/mA)	Measured Current (mA)	Displayed Current (mA)	Within Spec
45/26.7			PASS
80/15			PASS
120/10			PASS
240/5			PASS
480/2.5			PASS
5000/0.24			PASS

AC Output Current @ 5kVAC	CH 5-6	Specification: $\pm 1\%$ of Measured + 5 counts	
Load (kΩ/mA)	Measured Current (mA)	Displayed Current (mA)	Within Spec
500/10			PASS

DC Output Voltage	CH 3-4	Specification: $\pm 1\%$ of Setting + 0.005	
Voltage Setting (kV)	Measured Voltage (kV)	Displayed Voltage (kV)	Within Spec
0.050			
0.500			
2.500			
6.000			

DC Output Current @ 1.2kVDC	CH 7-8	Specification: $\pm 1\%$ of Measured + 5 counts	
Load (kΩ)	Measured Current (units same as Load Current)	Displayed Current (units same as Load Current)	Within Spec
120/10mA			
240/5mA			
480/2.5mA			

DC Output Current @ 3kVDC	CH 7-8	Specification: $\pm 1\%$ of Measured + 5 counts	
Load (kΩ/mA)	Measured Current (mA)	Displayed Current (mA)	Within Spec
500/6			
5000/200 μ A			

IR Output Voltage	CH 1- 2	Specification: $\pm 1\%$ of Setting + 0.005	
Voltage Setting (kV)	Measured Voltage (kV)	Displayed Voltage (kV)	Within Spec
0.050			
0.500			
1.000			
5.000			

IR Resistance *Verify Displayed Value is within: 3% + 10ct for 1M - 1G 7% + 10ct for 1G - 10G >= 0.5kV
 10% + 10ct for 10G - 50G >= 0.5kV CH 1-2

Voltage Setting (kV)	Standard (Ω)	Actual Value (Ω)	Displayed Resistance (Ω)	Within Spec
0.050	10M			
0.500	100M			
0.500	500M			
0.500	1G			
0.500	5G			
0.500	10G			
1.000	1G			

DC Resistance	CH 1-2-3-4	2-Wire	Specification: ± (2% +0.5% range)	
Range (Ω)	Standard (Ω)	Actual Value (Ω)	Displayed Resistance (Ω)	Within Spec
10	1			
10	9			
100	9			
100	90			
1000	90			
1000	900			
10000	900			
10000	9000			
100000	9000			
100000	90000			

DC Resistance	CH 1-2-3-4	Specification: ±(0.5% +0.5% of range)		1Ω Range
	4Wire	Specification: ±(0.5% +0.05% of range)		All other ranges
Range (Ω)	Standard (Ω)	Actual Value (Ω)	Displayed Resistance (Ω)	Within Spec
1	0.1			
1	1			
10	1			
10	9			
100	9			
100	90			
1000	90			
1000	900			
10000	900			
10000	9000			
100000	9000			
100000	90000			

