Chroma

Power Measurement System

ANALYZER 6630r

OPERATOR'S MANUAL

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Document Notes:

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CONTENTS

Document revision history

Revision 1.03:

':CONFigure:MULTimeter:FSOurce' command changed.

':SENSe:FUNCtion:ON' now supports fluctuating harmonics

Section 4.1.2 -> 4.1.5 updated.

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Section 1

THE INSTRUMENT

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1.1 THE INSTRUMENT - ANALYZER 6630r

Figure 1-1
ANALYZER 6630r

Thank you for choosing the ANALYZER 6630r!

Our intention when we designed this instrument was to simplify design and verification of mains connected equipment according to EN 60 555-2, EN 60 555-3, EN 61000-3-2 and EN 61000-3-3.

The unique combination of programmable AC power sources and the ANALYZER 6630r makes it possible to perform complex tests with ease.

ANALYZER 6630r is more than an EN standard test instrument, you can make accurate measurements of voltage, current, real power, reactive power, apparent power and more.

In this manual you will find all information you need to use the instrument connected to a computer via GPIB or a serial port and more so please read this manual carefully before using the instrument!

If you purchased an AC source for use together with the ANALYZER 6630r, please read section 6 and the AC source manual before attempting to connect the two units together.

This manual mainly contains information about remote controlling the ANALYZER 6630r. To fully understand the information, it requires that you have good knowledge about the IEEE 488.1 and 488.2 standards and the *Standard Commands for Programmable Instruments* - SCPI standard. The manual will not serve as a tutor of remote controlling techniques so if you are new to terms such as GPIB, SCPI, Device Clear, Common Command etc. you will probably be better off reading some books about the topic including the IEEE standards and the SCPI standard before continuing.

The IEEE standards can be obtained from your local standards distributor.

> ANSI/IEEE 488.1 Std. 488.1 - 1987 (Revision of ANSI/IEEE Std. 488 - 1978)
> *IEEE Standard Digital Interface for Programmable Instrumentation*
> ISBN 471-62222-2
>
> IEEE 488.2 Std. 488.2 - 1992 (Revision of IEEE Std. 488.2 - 1987)
> *IEEE Standard Codes, Formats, Protocols and Common Commands*
> ISBN 1-55937-238-9

Both standards published by:

> The Institute of Electrical and Electronics Engineers, Inc.,
> 345 East 47th Street, New York, NY 10017, USA
>
>
> SCPI - Standard Commands for Programmable Instruments
> VERSION 1994.0, February, 1994 (or later)

SCPI standard published by:

> SCPI Consortium
> 8380 Hercules Drive, Suite P3
> La Mesa, CA 91942, USA
> Phone: (619) 697-8790
> FAX: (619 697-5955

Also recommended:

> Tutorial Description of the Hewlett-Packard Interface Bus
> HP part number 5021-1927

Available from your local Hewlett-Packard dealer.

1.2 ABOUT THIS MANUAL

This manual describes an ANALYZER 6630r with all options installed. Certain parts of the manual may be irrelevant depending on which options your instrument was delivered with.

Remote controlling an instrument as complex as the ANALYZER 6630r not only requires good knowledge about GPIB, the instrument is really 5 in 1 so understanding the instruments measurement functions is imperative.

SAFETY FIRST!
For your and your instruments protection please read this manual before making any connections to the rear panel connectors!

On the instrument you will find the ⚠ symbol.

This symbol informs you that you should consult this manual before using or modifying any parts in its close proximity.

NOTE!
Carefully fill in the registration card and mail it today!

If you don't, we have no way of knowing where to send information and upgrades.

This manual is divided into the following sections:

Section 1
Contains instrument description, warranty information and a short introduction to considerations about remote controlling the ANALYZER 6630r.

Section 2
Contains an introduction to the command languages used with conformance information.

Section 3
Contains a detailed command summary with information about commands parameters and response messages.

Section 4
Contains information about the instruments extensive status reporting structures.

Section 5
Contains information about communication procedures, restrictions and demands. Read this section thoroughly before attempting to communicate with the ANALYZER 6630r. Also contains information about using a serial interface.

WARRANTY FORMS:
Be sure to fill out and return the warranty form today and you will receive warranty, free instrument software update and free technical support!

1.3 UNPACKING AND INSPECTION

Inspect the instrument box for any damages caused during transit. If damage has occurred, please contact the shipping company that delivered your instrument.

Carefully unpack the instrument.

Your instruments standard accessories are:

> This manual.
> A power cord.
> Spare mains fuses
> Calibration report and certificate

If your delivery does not match the packing list, contact your local dealer. Refer to part 2.3 for information about additional accessories and instrument options.

Please save the original packing material should it be necessary to return the instrument.

If damage has occurred to the instrument or accessories, contact your local dealer for advice and Return Authorization before returning any equipment. The added repair cost of inadequately packaged goods will be invoiced separately so please use the original packing material.

INSTRUMENT STORAGE
The ANALYZER 6630r should be stored in its original container in a clean, dry environment.
Protect the instrument from high humidity and extreme temperatures.

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1.4 INSTRUMENT OPTIONS AND ACCESSORIES

Below is a list of available instrument options and accessories.
Please contact your local dealer for an up to date list of available products.

Instrument options available:

70-10   Standard ANALYZER 6630r measurement module.
               A maximum of three measurement modules can be installed
               in the ANALYZER 6630r.

70-20   High performance ANALYZER 6630r measurement module.
               The high performance module is needed to perform fluctuating
               harmonics measurements according to EN 60 555-2. am. 2 and
               EN 61000-3-2 It will also make steady state harmonics faster.

Instrument accessories available:

70-90   Rack mounting kit containing brackets and rails enabling the
               instrument to be mounted in a standard 19" rack.

70-91   1 meter GPIB cable for connecting an AC source.

70-92   3 meter parallel cable (25M DSUB <-> CENTRONICS)
               for connecting a hard copy device.

70-93   2 meter null modem serial cable for connecting a computer.

70-94   Measurement inputs cable kit. Use these insulated connectors
               to avoid electrical shock hazard when making cables for your
               measurement objects.

70-95   Measurement connection box. Ready to use for single phase
               measurements. For ANALYZER 6630r *only*.

70-96   Spare current measurement input fuse.
               WARNING! Always use a fuse with the correct ratings!

70-97   Measurement connection box. Ready to use for single phase
               measurements. For ANALYZER 6630r *together* with .

               See Section 6 for technical data.

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1.5 WARRANTY

ANALYZER 6630r, hereafter referred to as the *product*, is warranted for operation according to specifications under normal use for a period of one year from the date of shipment.

The *product* software is tested and believed to be functional but is delivered 'as is' and is not covered by any warranty. However, the warranty does include free of charge software updates within the warranty period. The point of time of a new software release is solely at CHROMA's discretion.

In the event of a warranty claim, CHROMA undertakes within the warranty period to repair or replace the *product* free of charge if after examination it can be proved that the *product* failure was due to workmanship or materials. A warranty claim will not be accepted if the examination rules that the *product* failure was caused by misuse, neglect, accident or abnormal conditions or operations.

The purchaser is responsible for all transportation costs to and from the servicing facility such as transportation charges, insurance, customs charges and similar. After repair or replacement, the *product* will be returned prepaid by the servicing facility and the return shipping costs will be invoiced separately.

This warranty is in lieu of any other warranties, expressed or implied.

CHROMA shall not be held responsible for any consequential damages as a result of the use of the *product*, whether in contract or otherwise.

NOTE!
Please fill in the product registration form and mail it today. In order to keep you updated about new instrument features, hard/software upgrades and applications we need to now where you are!

Also, only registered owners are entitled to technical support.

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1.6 PRODUCT ASSISTANCE

The purpose of this manual is to provide enough information about the ANALYZER 6630r instrument for normal use. We believe that most of what you need to know is in here so keep on reading!

However, after a while questions may arise so if you need assistance, please contact your local dealer for advice. They will be happy to answer your questions and in the case where they don't have the immediate answer, they will forward the questions to the proper persons.

1.7 MAINTENANCE

The following maintenance procedures can/should be made at regular intervals or when needed:

> Cleaning,
> Dusting,
> Checking for damaged cables,
> Checking for damaged connectors,
> Checking for loose screws,
> Changing fuses

For cleaning, use a soap-water damped cotton cloth. Never use other detergents or chemicals.

Refer to section 7 - SPECIFICATIONS for information about fuses. Always use a fuse of the correct rating and type. Failure to do so may cause personal injury.

There are no user serviceable components inside the instrument. Do not open the cover unless instructed to by your dealer.

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1.8 INSTRUMENT FEATURES

The ANALYZER 6630r is a module based instrument using the latest digital electronics to make it a reliable tool for long term use. The use of modules makes it possible to upgrade the instrument hardware in the future without replacing the entire instrument.

ANALYZER 6630r uses a multiprocessor architecture with one central processor taking care of measurement results post-processing, display, communication and a processor in each measurement module that continuously makes several different calculations on the input signals and delivers the results to the central processor.

The central and measurement module processors have their system software loaded in FLASH (erasable ROM) memories. This makes it possible to upgrade the system software without returning or disassembling the instrument. A diskette with the new software will be sent to you and is then simply loaded into the instrument FLASH memories via remote control. This guarantees that your instrument will never become obsolete due to changing test standards.

ANALYZER 6630r is equipped with extensive communication hardware such as one GPIB port and one RS-232C serial port. This gives you great freedom of choice when building your measurement setup.

Both the GPIB port and the serial port will provide access to extensive remote control functions using the industry standard IEEE 488.2 and SCPI command languages.

The use of a software key enables the user to customize the instrument by only purchasing measurement functions of interest. The instrument can easily be expanded by purchasing new measurement functions at will. A new software key will then be delivered which when entered, immediately enables the new functions, no soft- or hardware changes are needed.

Figure 1-2 shows a block diagram of the instrument. The dark shaded blocks indicate instrument options.

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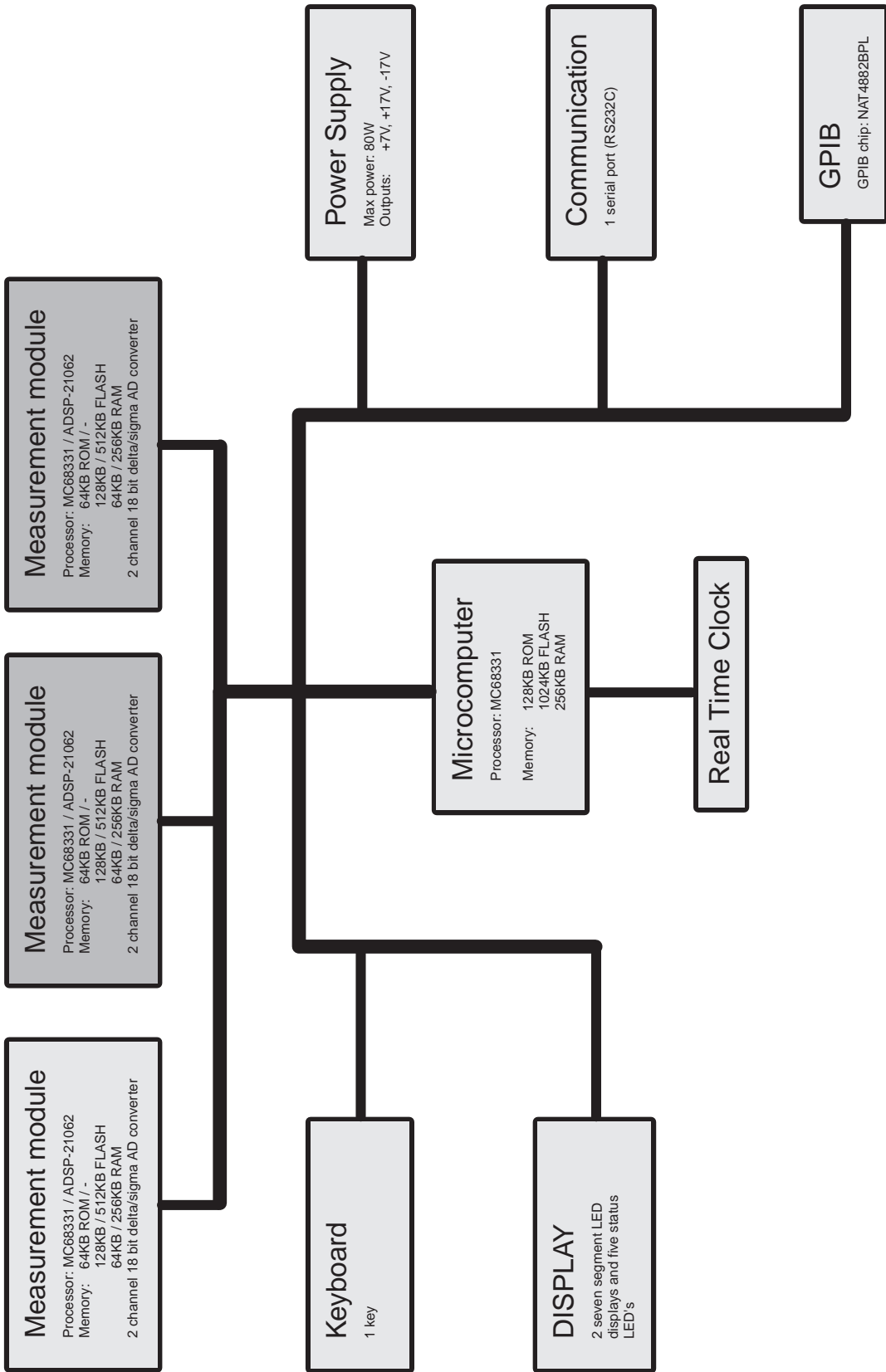
Figure 1-2
ANALYZER 6630r block diagram

Measurement module
Processor: MC68331 / ADSP-21062
Memory: 64KB ROM / -
128KB / 512KB FLASH
64KB / 256KB RAM
2 channel 18 bit delta/sigma AD converter

Measurement module
Processor: MC68331 / ADSP-21062
Memory: 64KB ROM / -
128KB / 512KB FLASH
64KB / 256KB RAM
2 channel 18 bit delta/sigma AD converter

Measurement module
Processor: MC68331 / ADSP-21062
Memory: 64KB ROM / -
128KB / 512KB FLASH
64KB / 256KB RAM
2 channel 18 bit delta/sigma AD converter

Power Supply
Max power: 80W
Outputs: +7V, +17V, -17V

Communication
1 serial port (RS232C)

GPIB
GPIB chip: NAT4882BPL

Microcomputer
Processor: MC68331
Memory: 128KB ROM
1024KB FLASH
256KB RAM

Real Time Clock

Keyboard
1 key

DISPLAY
2 seven segment LED
displays and five status
LED's

1.9 FRONT PANEL

Figure 1-3 shows the front panel with its components grouped in function families.
It consists of the display, keyboard groups, power switch and the diskette drive.

1: The instruments power on /off switch.

2: GPIB address / port select key
This key is used to select GPIB port and address or the serial port as port for remote control. The display will show a numeric range from 0 to 30 which is a legal GPIB address. Select an unused address by pressing the address select key repeatedly until the correct address number is shown on the display.

To select the serial port, step until the display shows SE. SE appears after GPIB address 30. At power-on, the instrument will always default to 9600 baud, 8 data bits, 1 stop bit and no parity. Use commands described in section 3 to alter the serial port parameters.

3: The display
This display is normally used to display the instruments communication port selection. A steady glowing digit in the range of 0 to 30 indicates that the instruments uses the GPIB port and has the address shown on the display. If SE is shown, the serial port is selected for communication. Use the address select key to communication port/address.

The display is also used to indicate instrument problems. A flashing error code will be shown if a problem is detected. The error codes has the following meaning and suggested action:

Code	Description	Action code
00	Software protection failure	1
01	BIOS checksum error	2
02	RAM error	2
03	System initialization failed	2
04	Display initialization failed	2
05	Keyboard initialization failed	2
06	Not used	-
07	Not used	-
08	Serial port initialization failed	2
09	GPIB port initialization failed	2
10	Clock initialization failed	2
11	Module initialization failed	2

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(1) - Power switch

(2) - GPIB address / port select key

Power Measurement System
ANALYZER 300r

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SRQ
Remote
Talker
Listener
Error

GPIB Address

(3) - Display

(4) - GPIB/Remote
system status LED:s
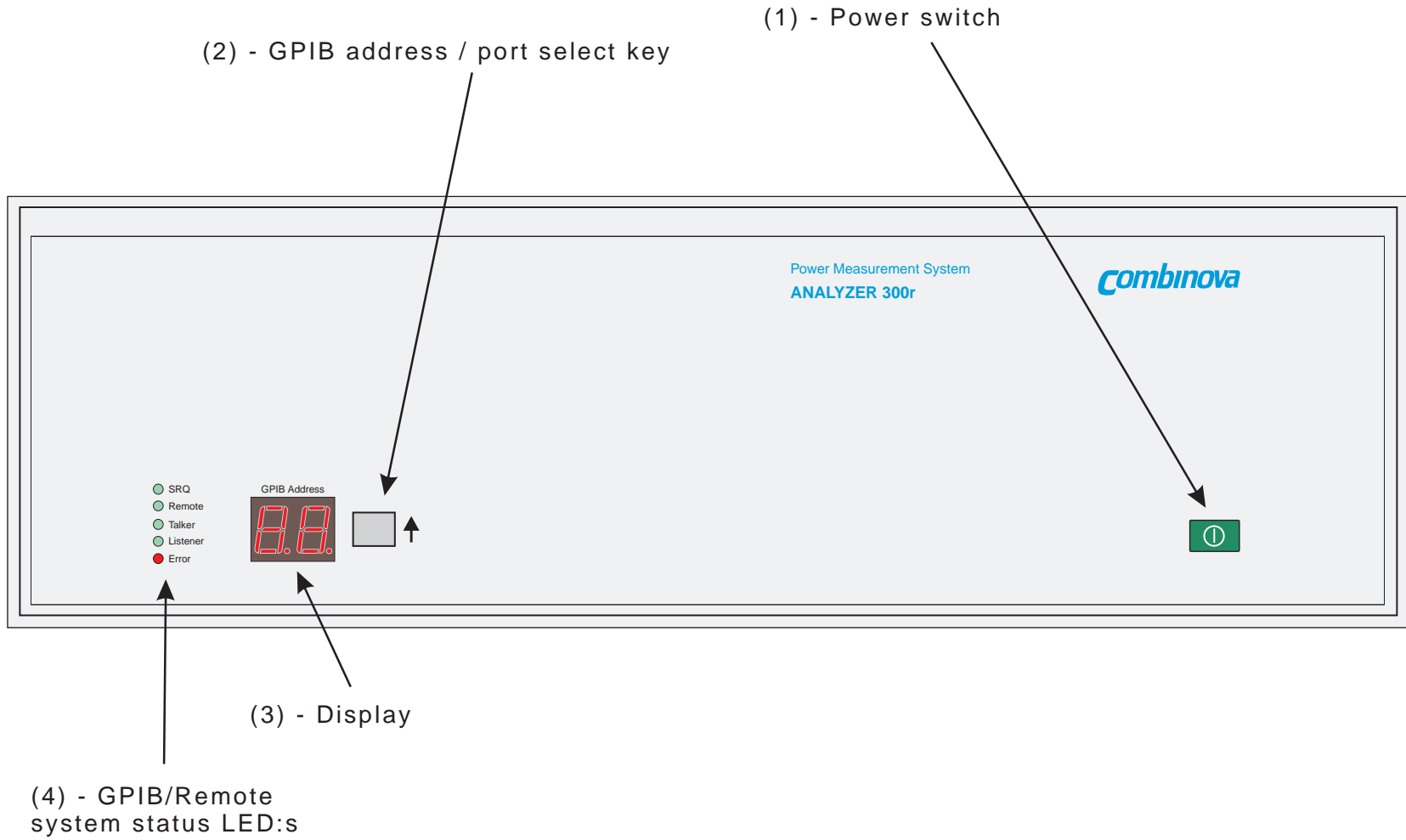
Figure 1-3
Front panel

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Code	Description	Action code
20	Display system error	1
21	Keyboard system error	1
22	Not used	-
23	Not used	-
24	Serial port system error	1
25	GPIB system error	1
26	Clock system error	1
27	Memory management system error	1
28	General system error	1

Code	Description	Action code
50	Instrument stopped by *MEM command	3
51	Main board FLASH checksum error	4
52	Module start error	5
53	Module FLASH checksum error	6

Code	Description	Action code
60	Measurement module 1 uncalibrated	5
61	Measurement module 1 + 2 uncalibrated	5
62	Measurement module 1 + 3 uncalibrated	5
63	Measurement module 2 uncalibrated	5
64	Measurement module 2 + 3 uncalibrated	5
65	Measurement module 3 uncalibrated	5
66	Measurement module 1 + 2 + 3 uncalibrated	5
67	Incompatible main board BIOS version	2
68	New main board BIOS version available	2

Recommended action,

for **Code 1**:
Indicates an instrument software problem. Please record as detailed as possible how this problem occurred. If the problem can be re-created it will be *very* much more easy to correct it. Make an as complete problem description as possible before contacting technical support, including hardware and software setup descriptions. If the remote control software is custom designed, it will also help if a copy of the software can be provided.

for **Code 2**:
This indicates a hardware problem. Most likely, the instrument will need repair or an upgrade. Contact local technical support. Code 68 is only a recommendation to upgrade and can be by-passed by the front panel key.

for **Code 3**:
This message will be shown when updating the instrument software and does not indicate any problem, merely that the instrument is stopped during the update. Please refer to the software installation instructions which is included with the instrument software installation utility that can be found on the instrument software disk delivered with the instrument. Please contact local technical support to obtain the latest instrument software in order to achieve maximum performance of the instrument.

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for **Code 4**:
This indicates that the main system software has become corrupt and needs to re-loaded. Instructions for loading the instrument software can be found on the software installation disk delivered with the instrument. Pressing the address setting key once will display the current communication port setting. Use the same key to chose the required port type for software installation. Do *not* change port during software installation. Also see **Code 3**.

for **Code 5**:
This indicates a hardware problem in one or more measurement modules. Most likely, the instrument will need repair or an upgrade. Contact local technical support. Codes 60 - 66 may be by-passed by pressing the front panel key. The instrument will still operate but with a reduced measurement accuracy of about ±10%.

for **Code 6**:
This indicates that the system software in one or more measurement modules has become corrupt and needs to re-loaded. Instructions for loading the instrument software can be found on the software installation disk delivered with the instrument. Also see **Code 3**.

4: GPIB/Remote system status LED:s
These five LED:s indicates status of the remote system as follows:

SRQ LED: Indicates that the instrument is requesting service. Works with both the GPIB and serial port.

Remote: Indicates that the instrument is in remote state. ANALYZER 6630r requires that the instrument is in remote state in order to accept commands. This LED will *not* work if the serial port is selected for communication. Any properly formatted command received via the serial port will place the instrument in remote state. Also see section 5.2.

Talker: Indicates that the instrument is addressed to talk. This LED will *not* work if the serial port is selected.

Listener: Indicates that the instrument is addressed to listen. This LED will *not* work if the serial port is selected.

Error: Indicates that a by the controller enabled error event has occurred. A controller enabled error event is an error event programmed using the status structures Enable registers to be reported in the Status Byte Register. Events classified as errors include the Standard Event Status Register bits 2-5 and some or all bits in the Status Questionable status structure. The Error LED will be cleared when there are no error conditions currently reported in the Status Byte Register which includes reading and thus clearing one or more status registers or by blocking the condition from being reported in the Status Byte by programming the Enable registers. See section 4 for more information about the instruments status structure.

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1.10 REAR PANEL

Figure 1-4 shows the rear panel.

The callouts are as follows:

1: Measurement inputs

These are the measurement modules input connectors and current measurement input fuses. See specifications about fuses!

Your instrument may have less modules than shown in figure 1-4 but at least one is present in the rightmost slot. Empty measurement modules slots will be covered with a blindpanel.

Additional modules are installed right to left. ANALYZER 6630r can have a maximum of three installed measurement modules.

Current inputs

Current input fuse

Voltage inputs

2: Spare module slot

This spare module slot is reserved for instrument options such as future expansion of the instrument.

3: The GPIB interface connector.

ANALYZER 6630r is equipped with an extensive GPIB implementation for remote control of the instrument.

Fuse holder

4: The power input connector and fuseholder.

The connector accepts a standard IEC type apparatus power cord. No voltage range selection need be done, the instrument does this automatically. See specifications about fuses!

5: Serial port

The RS-232C compatible serial port can be used to remote control the instrument in the case where remote controlling via GPIB is not preferable. See section 5 for a description about using the serial port.

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(1) - Measurement inputs

(2) - Spare module slot

(3) - GPIB connector

(4) - Power input connector
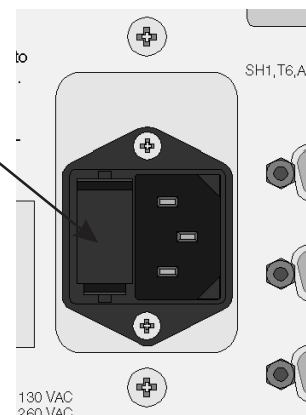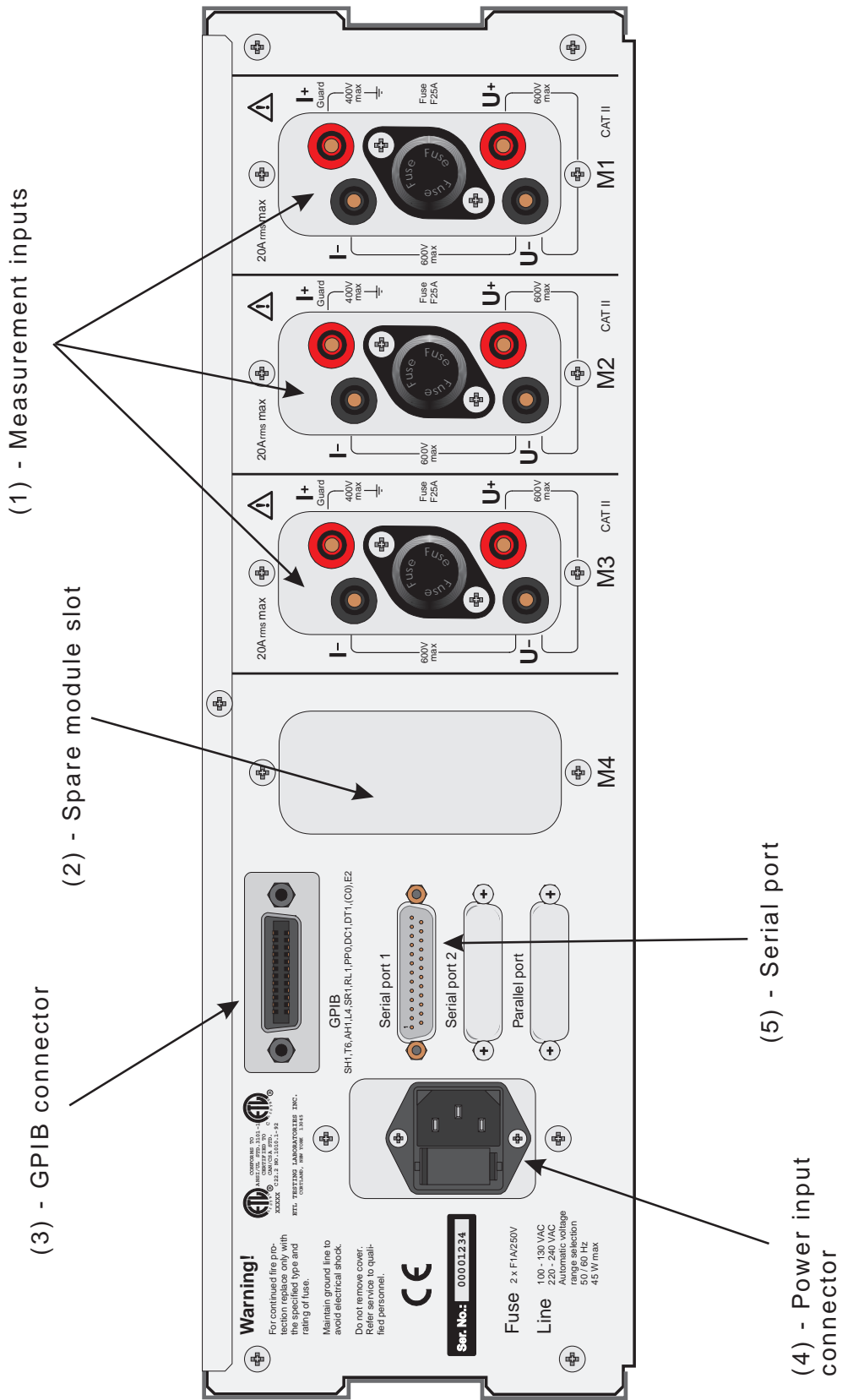
(5) - Serial port

Figure 1-4
Rear panel

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1.11 SELECTING INTERFACE

Before incorporating the ANALYZER 6630r into a remote control setup, a choice of interface must be done. ANALYZER 6630r is capable of being remote controlled through the GPIB and the serial port. The most common way is of course to use the GPIB port but the serial port may also have advantages.

Technically the GPIB interface and the RS-232 interface differs substantially, the GPIB interface is in its design more a computer bus with interrupt signaling, 8 bit parallel data bus and a host of bus commands for synchronization and up to 1 Megabyte of data per second transfer rate. Comparably, the RS-232 interface is much less capable, a serial 8 bit bus with a few handshake lines for synchronization. The maximum throughput is only about 3000 bytes per second.

So why include support for the serial port?

Just about every computer has got a serial port available and knowledge about the serial interface is much more widespread than knowledge of the GPIB bus. The less demanding user can easily hook up the ANALYZER 6630r to their PC:s serial port and write a simple program to do basic remote controlling.

For maximum performance, the GPIB port should be used since some of the result messages can be quite large which means that receiving through the serial port will take substantially longer times.

1.11.1 The GPIB port

To use the GPIB interface it requires that a valid instrument GPIB address is selected using the front panel key. Step up the address until the desired one is reached. Addresses in the 0 to 30 range are a valid GPIB address. When a valid address is shown on the display, it also indicates that the GPIB port is selected.

1.11.2 The RS-232 port

To use the serial port, step the address indicator using the front panel key until it reads SE. Only when the display shows SE will the serial port be selected. At power-on, the baud rate and the format settings are reset to their default setting as indicated in section 3.

The serial port implementation in the ANALYZER 6630r is an emulation of the GPIB port. This imposes strict regulations about the use of the serial port and usually means that a special driver has to be created for a particular software/hardware development environment.

See **5.2 - USING THE SERIAL PORT** for detailed hard- and software information about remote controlling via serial port.

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1.12 COMBINOVA AB - The company behind the product

The Power Measurement System - ANALYZER 6630r has been developed by Combinova AB, who are also responsible for manufacturing, marketing and central after-sales service of the product.
It is a member of a growing family of power analyzing and sourcing equipment which also includes:

* ANALYZER 300   - Stand-alone analyzer with keyboard and display.
* AC SOURCE 304   - Single phase, 400 W power source.
* AC SOURCE 308   - Single phase, 800 W power source.
* AC SOURCE 330   - Single phase, 3000 W power source.
* AC SOURCE 390   - Three phase, 3000 W/phase power source.

Other Combinova products are:

* EFM 100   - Electric Field Meter, alternating electrical fields.
* EFM 200   - Electric Field Meter, electrostatic and alternating electrical fields.
* MFM 1000   - Magnetic Field Meter in the VLF (2-400 kHz) range.
* MFM 10   - Magnetic Field Meter in the ELF (5-2,000 Hz) range.
* MFM 1020   - Automatic Systems for VDT magnetic field measurements.
* FD 1   - Hand-held magnetic and electric field meter in the ELF (5-2000Hz) range.
* FD 2   - Hand-held magnetic and electric field meter in the VLF (2-400kHz) range.
* FD 3   - Portable magnetic field logger/dosimeter in the ELF (5-2000Hz) range.

In addition to the instrument product line Combinova AB also works as development partner for Swedish and international customers covering a broad area of technical development.

The principle areas of technical expertise are:

- instrument development
- measurement solutions and technical trouble shooting
- design and production of special manufacturing equipment.

The depth and wide range of technical expertise in the company makes it possible to handle all stages of product development.

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Visit us at **www.combinova.se** where you will find information about our products, news, instrument updates, measurement application reports and much more.

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Section 2

REMOTE CONTROL LANGUAGE

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2.1 REMOTE CONTROL LANGUAGE

The ANALYZER 6630r conforms to the demands of SCPI 1994.0 which is a standard built on the IEEE 488.2 standard for Codes, Formats, Protocols and Common Commands. The IEEE 488.2 standard is originally thought of as an extension to the IEEE 488.1 (GPIB) hardware standard but since its only the IEEE 488.1 that defines hardware, IEEE 488.2 and consequently SCPI may be used on any kind of communication interface (with some exception, mainly the use of Service Request which is an IEEE 488.1 interface function).

This makes the combination of standardized Codes, Formats, Protocols and Common Commands (IEEE 488.2) and standardized high level commands (SCPI) very powerful.

The ANALYZER 6630r implements all the required commands and functions to make it fully compliant with SCPI. Commands are available for use of all the powerful measurement features of the ANALYZER 6630r. Several commands and functions has been included to support functions not covered by SCPI such as commands to make the instrument fully programmable.

The interface independence of SCPI is proven by the possibility to use an RS-232 port for remote control. It includes an emulation of the GPIB ports handshake and service request possibilities to make it equally powerful to use.

See **5.2 - USING THE SERIAL PORT** for detailed information about the serial port.

2.2 IEEE 488.1 AND 488.2

The IEEE 488.1 is the hardware standard defining connectors, signal lines and basic communication procedures. It is in the ANALYZER 6630r based on a powerful NI chip, the NAT 4882, which provides full talker, listener and controller capabilities. Bus drivers used are the three-state SN75160B and the SN75162B chips enabling high bus speeds.

The IEEE 488.2 standard defines data and command formats, communication procedures and a common command set of low level commands. The command and data formats are used by the SCPI standard and the level of IEEE 488.2 compliance is ultimately decided by SCPI.

2.2.1 Conformance information

IEEE 488.1:

SH1:	Source Handshake	- Complete capability
T6:	Talker	- Complete except Talk Only
AH1:	Acceptor Handshake	- Complete capability
L4:	Listener	- Complete except listen only
SR1:	Service Request	- Complete capability
RL1:	Remote Local	- Complete capability
PP0:	Parallel Poll	- No capability
DC1:	Device Clear	- Complete Capability
DT1:	Device Trigger	- Complete Capability
(C0):	Controller	- See description *

*(ANALYZER 6630 only): The ANALYZER 6630 can enter active controller state for the sake of communicating with an external AC source device. This will cause a controller collision if remote control is done over the GPIB port at the same time as communication must be done with the AC source. If the AC source is to be controlled by the ANALYZER 6630 via GPIB, remote control of the ANALYZER 6630 must be done via RS-232.

IEEE 488.2:

Implemented common commands

*CLS	*ESE <enable value>
*RST	*ESE?
*ESR?	*SRE <enable value>
*IDN?	*SRE?
*OPC	*STB?
*OPC?	*WAI
*TST	*TRG

The related standards contains more detailed descriptions.

2.2.2 Command summary

The following is a summary of the supported IEEE 488.2 common commands. Section 3 contains a description of each command. For a full description, see the IEEE 488.2 standard.

For a detailed description of how to communicate with the ANALYZER 6630r, see **5.1 - COMMUNICATING WITH THE ANALYZER 6630r**.

Command	Description
*CLS	- Clear status, section 3.1.2.
*STB?	- Status Byte Query, section 3.1.2
*SRE <enable value>	- Service Request Enable, section 3.1.4
*SRE?	- Service Request Enable query, section 3.1.4
*ESR?	- Standard Event Status query, section 3.1.2
*ESE <enable value>	- Standard Event Enable, section 3.1.2
*ESE?	- Standard Event Enable query, section 3.1.2
*OPC	- Operation Complete, section 3.1.4
*OPC?	- Operation Complete query, section 3.1.4
*WAI	- Wait for completion, section 3.1.4
*RST	- Reset instrument, section 3.1.1
*IDN?	- Instrument ID query, section 3.1.1
*TST?	- Instrument self-test, section 3.1.1
*TRG	- Instrument trig, section 3.1.4

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2.3 SCPI

SCPI is the standard that defines the structure and syntax of the high level language used to communicate with the ANALYZER 6630r. It is based on the IEEE 488.2 standard for data and commands with the important difference that commands uses the <compound command program header> as opposed to the <common command program header> used by the IEEE 488.2 common commands. The <compound command> specifications allows the construction of more logical command trees with command names of a descriptive nature. Command strings in the SCPI language can almost always be directly understood by just reading them. This should be compared to the older way of having to memorize a new command language for each instrument, often commands using completely incomprehensible abbreviations. Another advantage is that if you write remote control software using SCPI standardized commands to, for example, measure voltage you may loose the device dependence. If you wish to use another brand of voltmeters, you will only have to make sure the new meter is SCPI compliant and supports the measurement commands used. If it does, its only a matter of plugging it in. No need to rewrite the remote control software.

2.3.1 Conformance information

The ANALYZER 6630r's SCPI implementation conforms to the SCPI Standard Version 1994.0, February, 1994 with the following comments:

All SCPI confirmed commands will be marked with the **SCPI CONFIRMED** label in the Command Summary. Commands listed in the SCPI Command Summary not carrying this label are ANALYZER 6630r SCPI command extensions.

The transmission and reception of units has not been implemented. Parameters with units will always be in its fundamental unit such as Watt, Volt, Ampere etc. In this manual, each command described accessing a parameter having a unit will clearly state the unit of reception and transmission.

2.3.2 Command Summary

The SCPI commands have been divided into families to make the search for a particular command easier. Commands enclosed in brackets ([...]) are SCPI default branches.

The families are as follows:

System Administration

Commands for global instrument functions such as setting the instrument clock and reading the instrument error/event queue.

Status Reporting

Commands for managing the ANALYZER 6630r status structure.

Measurement Functions

Commands for setting up measurement conditions and reading results.

Trigger Management

Commands for managing the trigger system. These functions are closely related to the measurement commands since the trigger is the function that actually starts a measurement.

Adjustment Functions

Commands for instrument adjustments.

The following is a summary of the remote commands. For information about the current state of implementation, please contact your local dealer.

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System Administration, page 3-3

:SYSTem:ERRor?

:SYSTem:VERSion?

:SYSTem:TIME
:SYSTem:DATE

:SYSTem:SKEY

:SYSTem:APPLication:ACSource:ONLine
:SYSTem:APPLication:ACSource:SETTing<n>:VOLTage
:SYSTem:APPLication:ACSource:SETTing<n>:FREQuency
:SYSTem:APPLication:ACSource:DPON
:SYSTem:APPLication:ACSource:DPOFf

:SYSTem:APPLication:MODules

:SYSTem:APPLication:CTRatio
:SYSTem:APPLication:VTRatio

:SYSTem:APPLication:HLIMits:IECFff_t:NORMal
:SYSTem:APPLication:HLIMits:IECFff_t:PTOols
:SYSTem:APPLication:HLIMits:IECFff_t:LUMiniare
:SYSTem:APPLication:HLIMits:IECFff_t:TV
:SYSTem:APPLication:HLIMits:IECFff_t:USOurce
:SYSTem:APPLication:HLIMits:IECFff_t:UTVSource

:SYSTem:APPLication:HLIMits:IECT_t_t:ACLass
:SYSTem:APPLication:HLIMits:IECT_t_t:BCLass
:SYSTem:APPLication:HLIMits:IECT_t_t:CCLass
:SYSTem:APPLication:HLIMits:IECT_t_t:DCLass
:SYSTem:APPLication:HLIMits:IECT_t_t:ACJapan
:SYSTem:APPLication:HLIMits:IECT_t_t:USOurce
:SYSTem:APPLication:HLIMits:IECT_t_t:LPCClass
:SYSTem:APPLication:HLIMits:IECT_t_t:LPDClass

:SYSTem:COMMunicate:SERial:RECeive:BAUD
:SYSTem:COMMunicate:SERial:RECeive:BITS
:SYSTem:COMMunicate:SERial:RECeive:PACE
:SYSTem:COMMunicate:SERial:RECeive:PARity:[TYPE]
:SYSTem:COMMunicate:SERial:RECeive:SBITs

Status Reporting, page 3-17

:STATus:QUEue:[NEXT]?
:STATus:QUEue:ENABle

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:STATus:QUEStionable:[EVENt]?
:STATus:QUEStionable:ENABle
:STATus:QUEStionable:INSTrument:[EVENt]?
:STATus:QUEStionable:INSTrument:ENABle
:STATus:QUEStionable:INSTrument:ISUMmary(x):[EVENt]?
:STATus:QUEStionable:INSTrument:ISUMmary(x):ENABle

:STATus:OPERation:[EVENt]?
:STATus:OPERation:ENABle
:STATus:OPERation:INSTrument:[EVENt]?
:STATus:OPERation:INSTrument:ENABle
:STATus:OPERation:INSTrument:ISUMmary(x):[EVENt]?
:STATus:OPERation:INSTrument:ISUMmary(x):ENABle

:STATus:PRESet

Measurement Functions, page 3-25

Many of these parameters are coupled which means they affect other parameters or are affected by other parameters. A good understanding of the ANALYZER 6630r's measurement machines will be of great help to understand these commands. See chapter 4 (ANALYZER 6630 only) for an in-depth description of the ANALYZER 6630's measurement machines where each parameter will be described with its respective remote command (if any) shown.

The 'CONFigure' branch is used to set parameters for the different measurement machines.

Configuration commands for the multimeter:

:CONFigure:MULTimeter:MODule<n>:IRANge
:CONFigure:MULTimeter:MODule<n>:URANge

:CONFigure:MULTimeter:VMETer<n>:INPut
:CONFigure:MULTimeter:VMETer<n>:MODE
:CONFigure:MULTimeter:VMETer<n>:PARameter
:CONFigure:MULTimeter:VMETer<n>:PROPerty
:CONFigure:MULTimeter:VMETer<n>:RTYPe

:CONFigure:MULTimeter:FFOLlow:ACTive
:CONFigure:MULTimeter:FFOLlow:THReshold

:CONFigure:MULTimeter:MWINdow:TIME
:CONFigure:MULTimeter:MWINdow:MEAN
:CONFigure:MULTimeter:MWINdow:TYPE

:CONFigure:MULTimeter:FSOurce
:CONFigure:MULTimeter:FMEThod

Configuration commands for the harmonics analyzer:

    :CONFigure:HARMonics:SOURce
    :CONFigure:HARMonics:PERiods
    :CONFigure:HARMonics:FSOurce
    :CONFigure:HARMonics:DSOurce

    :CONFigure:HARMonics:LIMit:SELect
    :CONFigure:HARMonics:LIMit:STANdard
    :CONFigure:HARMonics:LIMit:CLASs

    :CONFigure:HARMonics:OTIMe
    :CONFigure:HARMonics:SSIZe
    :CONFigure:HARMonics:LPFilter
    :CONFigure:HARMonics:SWINdow
    :CONFigure:HARMonics:MDALimit
    :CONFigure:HARMonics:MRFDeviation

    :CONFigure:HARMonics:URANge
    :CONFigure:HARMonics:IRANge

Configuration commands for the flicker meter:

    :CONFigure:FLICker:TEST

    :CONFigure:FLICker:SHORt:WTIMe
    :CONFigure:FLICker:SHORt:LIMit

    :CONFigure:FLICker:LONG:COUNt
    :CONFigure:FLICker:LONG:LIMit

    :CONFigure:FLICker:VCHange:SSTate:WTIMe
    :CONFigure:FLICker:VCHange:SSTate:HYSTeres
    :CONFigure:FLICker:VCHange:SSTate:DCLimit
    :CONFigure:FLICker:VCHange:SSTate:DMAXlimit

    :CONFigure:FLICker:VCHange:TLIMit
    :CONFigure:FLICker:VCHange:THReshold

    :CONFigure:FLICker:IMPedance:REAL
    :CONFigure:FLICker:IMPedance:IMAGinary
    :CONFigure:FLICker:IMPedance:METHod

    :CONFigure:FLICker:SOURce
    :CONFigure:FLICker:URANge
    :CONFigure:FLICker:IRANge
    :CONFigure:FLICker:DSOurce

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Configuration commands for the waveform function:

> :CONFigure:WAVeform:SOURce
> :CONFigure:WAVeform:IRANge
> :CONFigure:WAVeform:URANge
> :CONFigure:WAVeform:TRIGger:SOURce
> :CONFigure:WAVeform:TRIGger:SLOPe
> :CONFigure:WAVeform:TRIGger:LEVel
> :CONFigure:WAVeform:TRIGger:POSition
> :CONFigure:WAVeform:PERiods
> :CONFigure:WAVeform:TEST
> :CONFigure:WAVeform:LIMit
> :CONFigure:WAVeform:FSOurce

The 'FETCh' branch is used to retrieve the results of the different measurement functions. In order to get a new result, the corresponding measurement function must have been executed. Measurement function execution is controlled by the trigger.

Fetch commands for the multimeter:

> :FETCh:MULTimeter:VMETer<n>?

Fetch commands for the harmonics analyzer:

> :FETCh:HARMonics<n>:CURRent?
> :FETCh:HARMonics<n>:VOLTage?
> :FETCh:HARMonics<n>:FREQuency?
> :FETCh:HARMonics<n>:POWer?
> :FETCh:HARMonics<n>:THDistorsion?
> :FETCh:HARMonics<n>:LIMit?
> :FETCh:HARMonics<n>:SPECtrum:LEVel?
> :FETCh:HARMonics<n>:SPECtrum:LIMit?

Fetch commands for the flicker meter:

> :FETCh:FLICker:EVALuation:STERm:PST?
> :FETCh:FLICker:EVALuation:STERm:DMAX?
> :FETCh:FLICker:EVALuation:STERm:DC?
> :FETCh:FLICker:EVALuation:STERm:T?
> :FETCh:FLICker:EVALuation:LTERm:PST?
> :FETCh:FLICker:EVALuation:LTERm:PLT?
> :FETCh:FLICker:EVALuation:LTERm:DMAX?
> :FETCh:FLICker:EVALuation:LTERm:DC?
> :FETCh:FLICker:EVALuation:LTERm:T?
> :FETCh:FLICker:EVALuation:LTERm:TRESult?
> :FETCh:FLICker:MEASurement:VDRop?
> :FETCh:FLICker:MEASurement:VFLuctuation?
> :FETCh:FLICker:MEASurement:SSLevel?
> :FETCh:FLICker:MEASurement:DMAX?

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:FETCh:FLICker:MEASurement:DC?
:FETCh:FLICker:MEASurement:PFLicker?
:FETCh:FLICker:MEASurement:VOLTage?
:FETCh:FLICker:MEASurement:CURRent?
:FETCh:FLICker:MEASurement:FREQuency?
:FETCh:FLICker:MEASurement:PFACtor?

Fetch commands for the wave form function:

:FETCh:WAVeform:VOLTage<n>:LEVel?
:FETCh:WAVeform:VOLTage<n>:PLOT?
:FETCh:WAVeform:CURRent<n>:LEVel?
:FETCh:WAVeform:CURRent<n>:PLOT?
:FETCh:WAVeform:CURRent<n>:ENVelope?
:FETCh:WAVeform:FREQuency?

The 'SENSe:FUNCtion' branch is used to select which measurement functions that will be executed once the instruments trigger is satisfied.

:SENSe:FUNCtion:[ON]

Trigger Management, page 3-73

The trigger commands sets the conditions for the instruments trigger. A properly configured trigger must be active for the instrument to make any measurements.

:TRIGger:[SEQuence]:SOURce
:TRIGger:[SEQuence]:DELay

:INITiate:[IMMediate]:[ALL]
:INITiate:CONTinuous

:ABORt

Adjustment Functions, page 3-77

These functions are used to make input module measurement adjustmets. Only the :ADJustement:VOLTage:NOISe and the ADJustment:CURRent:NOISe commands are available to the normal user. The rest of the commands requires that the correct password is sent to the instrument using the ADJustment:PASSword function before they can be used. This is to prevent the normal user from altering the instruments measurement accuracy. Contact your dealer if you need to use these commands for on-site input module adjustments.

NOTE:
Aquiring the adjustment password will void the measurement accuracy warranty since the input module(s) adjustments are no longer under our control.

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:ADJustment:PASSword
:ADJustment:FREQuency
:ADJustment:MODule<n>:SAVE

:ADJustment:MODule<x>:VOLTage:FACTor
:ADJustment:MODule<x>:VOLTage:OFFSet
:ADJustment:MODule<x>:VOLTage:NOISe
:ADJustment:MODule<x>:VOLTage:ACDCrelative

:ADJustment:MODule<x>:CURRent:FACTor
:ADJustment:MODule<x>:CURRent:OFFSet
:ADJustment:MODule<x>:CURRent:NOISe
:ADJustment:MODule<x>:CURRent:ACDCrelative

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2.3.3 General Information

Generally, there are three types of SCPI commands:

1: The execute command which never takes parameters and never directly produces any result data. An example of this is the 'ABORt' command that puts the trigger system to idle but does not have any corresponding parameters to set or query.

2: The set and query command that takes parameters when setting and produces result data when queried. This is by far the most common command type. Almost all instrument parameters that can be reached via remote control can be both set and queried. An example would be the 'SYSTem:TIME 12,00,00' which sets the instrument clock and the 'System:TIME?' which reads the instrument clock.

3: The query only command that does not take any parameters and only produces result data to be placed in the output queue. This command is used to access data produced internally in the instrument such as measurement results or to access data that can or should not be altered by the user such as instrument serial numbers and firmware revisions.

The command description will describe the function of each command. The *NOTES* field will say 'Query Only' if the command is the third type and 'No Query' if it is the first type. If none of these comments are present, the command is type 2, set and query.

Understanding the command description

Each command will have a description similar to this:

COMMAND:	**:SYSTem:TIME**
PARAMETERS:	<hour> , <minute> , <second>
RESULT DATA:	<hour> , <minute> , <second>
DEFAULT VALUE:	-
NOTES:	**SCPI COMPLIANT**

Description:

Sets or queries the ANALYZER 6630r real time clock.

The set command parameters should be in the <NRf> numeric format with <hour> = 0-23, <minute> = 0-59 and <second> = 0-59 separated by commas.

The query command produces a result string with the <NR1> numeric format and <hour> = 0-23, <minute> = 0-59 and <second> = 0-59 separated by commas.

The *COMMAND* line will show the described command in its full length with the short command in capitals. For example, the command ':SYSTem:TIME' is equal to the command ':SYST:TIME'. A command enclosed in brackets ([...]) indicates a SCPI default branch.

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A command mnemonic may have a <n> suffix. This indicates the use of numeric suffixes for selecting multiples of the same command. Adding a suffix to a command or branch level that does not accept a numeric suffix will generate a command syntax error.
See the SCPI standard Volume 1 for a description of Mnemonic Generation Rules.

The second line, *PARAMETERS* will show what parameters the command, set and/or query, takes. They will be shown with functional names such as <hour>. Multiple parameters are always separated by commas.

The third line, *RESULT DATA* will show what data the QUERY version of the command will produce. They are shown with functional names such as <minute>. Multiple result data are always separated by commas.

The actual numeric format of command and query data is described in the 'Description' section. The format description is using the IEEE 488.2 naming for *DEVICE LISTENING FORMAT* and *DEVICE TALKING ELEMENTS* and the SCPI namings. A short description of the used formats follows, for a full description, see the IEEE 488.2 standard chapter 7, 8 and the SCPI standard.

<NR1>	-	Decimal integer, '[+|-]1234'.
<NR2>	-	Decimal with fraction, '[+|-]1234.56'
<NR3>	-	Scientific notation, [+|-]1234.56 E [+|-]123
<NRf>	-	Any of the three <NR1-3> formats.

<CHARACTER ... DATA>

An unenclosed character string containing only upper/lower case letters, digits and underscore. The first character must be a letter and it has a maximum length of 12 characters. Similar to command mnemonics, character data may have a long and a short form such as 'DEFault' where 'DEF' is the short form. When using character data in *RESULT DATA* messages, the short form is always used.

<STRING ... DATA>

An enclosed character string containing any legal ASCII character including the control characters 1-31. Special care must be taken when receiving this data, the ASCII character line feed (10, 0AH) should not be mistaken for the IEEE 488.2 message terminating character.

The fourth line *DEFAULT VALUE* shows the value loaded into the parameter at power-on (ANALYZER 6630r only) , when the instrument enters remote state (ANALYZER 6630 only) or receives the *RST common command. It is up to the remote controller to change all necessary parameters in order to set the instrument to the preferred state. Going from remote to local mode by sending the IEEE 488.1 GTL (go to local) command will not change any parameters, all parameters changed by the remote controller will be preserved.

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The fifth line *NOTES* contains standard related notes such as No Query, Query Only, **SCPI COMPLIANT** and Coupled.

The last field, Description, contains an in depth description of the command with command parameter and query response formats, data limits and other vital information about side effects, error conditions and more. Normally, no description of the actual *use* or *effect* of the parameter will be given.

Section 3

COMMANDS REFERENCE

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3.1 COMMANDS REFERENCE

This sections contains descriptions of all the SCPI commands listed in the section 2.3.2 command summary. For an explanation of the command description layout used in this section, see section 2.3.3.

This section also contains explanations of the implemented IEEE 488.2 common commands listed in section 2.2.2.

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3.1.1 System Administration

COMMAND: **:SYSTem:ERRor?**
PARAMETERS: -
RESULT DATA: See description
DEFAULT VALUE: -
NOTES: Query Only, **SCPI COMPLIANT**

Description:

Places the next entry in the SCPI Error/Event queue in the output queue for reading. If the SCPI Error/Event queue is empty, the result message will be '0, "No error"'. For a description of the SCPI Error/Event queue, see **5.5.2 - SCPI Error/Event Queue**.

COMMAND: **:SYSTem:VERSion?**
PARAMETERS: -
RESULT DATA: <version>
DEFAULT VALUE: -
NOTES: Query Only, **SCPI COMPLIANT**

Description:

Places an <NR2> formatted numeric value corresponding to the SCPI version number for which the instrument complies to. The response is in the form *YYYY.V* where *YYYY* represent the year-version and the *V* represents an approved revision number for that year.

At this manuals writing, the response is '*1994.0*'.

COMMAND: **:SYSTem:TIME**
PARAMETERS: <hour> , <minute> , <second>
RESULT DATA: <hour> , <minute> , <second>
DEFAULT VALUE: -
NOTES: **SCPI COMPLIANT**

Description:

Sets or queries the ANALYZER 6630r clock time.

The set command parameters should be in the <NRf> numeric format with <hour> = 0-23, <minute> = 0-59 and <second> = 0-59 separated by commas.

The query command produces a result in the <NR1> numeric format with <hour> = 0-23, <minute> = 0-59 and <second> = 0-59 separated by commas.

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COMMAND: **:SYSTem:DATE**
PARAMETERS: <year> , <month> , <day>
RESULT DATA: <year> , <month> , <day>
DEFAULT VALUE: -
NOTES: **SCPI COMPLIANT**

Description:

Sets or queries the ANALYZER 6630r calendar date.

The set command parameters should be in the <NRf> numeric format with <year> = 1997-2096, <month> = 1-12 and <day> = 1-31 separated by commas.

The query command produces a result in the <NR1> numeric format with <year> = 1997-2096, <month> = 1-12 and <day> = 1-31 separated by commas.

COMMAND: **:SYSTem:SKEY**
PARAMETERS: <software key>
RESULT DATA: <function>[,<function>.....]
DEFAULT VALUE: -
NOTES:

Description:

Sets or queries the instruments software enable key.

The set command parameters should be in the <STRING PROGRAM DATA> format and contain the 17 digit software enable key.

The query returns the enabled instrument functions in the <CHARACTER RESPONSE DATA> format where <function> can be:

HARMONICS
FLICKER
MULTIMETER
WAVEFORM

If more than one instrument function is enabled, the <function> data fields are separated by commas.

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COMMAND:	**:SYSTem:APPLication:ACSource:ONLine**
PARAMETERS:	<Boolean>
RESULT DATA:	<Boolean>
DEFAULT VALUE:	0 (OFF)
NOTES:	ANALYZER 6630 only

Description:

Sets or queries whether the AC source should be controlled by the ANALYZER 6630.

The set command has a single boolean value in the <character program data> , 'OFF' or 'ON', or the <NRf> format, 0 or 1. If the parameter commands the ANALYZER 6630 to turn ON the control of the AC source and remote control is done via GPIB, an execution error will occur (controlling the AC source and remote controlling the ANALYZER 6630 via GPIB concurrently is not possible).

The query command returns a single boolean value in the <NR1> format, 0 or 1.

COMMAND:	**:SYSTem:APPLication:ACSource:SETTing<n>:VOLTage**
PARAMETERS:	<generator voltage>
RESULT DATA:	<generator voltage>
DEFAULT VALUE:	**OFF**
NOTES:	ANALYZER 6630 only

Description:

Sets or queries the AC source voltage level for the selected entry. Entry's can be 1-5. If a nonexisting entry is selected, an execution error will be generated. Setting 1 also acts as the instruments nominal voltage. The value(s) will be sent to the AC source at the start of certain measurement functions if the AC source is online. The unit for parameter and response data is volt.

The set command parameter is in <NRf> format. The value should be in the 0.00-1300.00 range.The special <numeric_value> **DEFault** may be used to select **OFF**.

The query will return the selected entry's value in the <NR2> format.

NOTE!
If the setting of the AC source is not successful, the returned value may not be reflecting the true AC source output frequency.

COMMAND:	**:SYSTem:APPLication:ACSource:SETTing<n>:FREQuency**
PARAMETERS:	<generator frequency>
RESULT DATA:	<generator frequency>
DEFAULT VALUE:	**OFF**
NOTES:	ANALYZER 6630 only

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Description:

Sets or queries the AC source frequency for the selected entry. Entry's can be 1-5. If a nonexisting entry is selected, an execution error will be generated. Setting 1 also acts as the instruments nominal frequency. The value(s) will be sent to the AC source at the start of certain measurement functions if the AC source is online. The unit for parameter and response data is herz.

The set command parameter is in <NRf> format. The value should be in the 39.9 - 70.1 range.The special <numeric_value> **DEFault** may be used to select **OFF**.

The query will return the selected entry's value in the <NR2> format.

NOTE!
If the setting of the AC source is not successful, the returned value may not be reflecting the true AC source output frequency.

COMMAND:	**:SYSTem:APPLication:ACSource:DPON**
PARAMETERS:	<time>
RESULT DATA:	<time>
DEFAULT VALUE:	2
NOTES:	ANALYZER 6630 only

Description:

Sets or queries the AC source power on delay before measurement start.

The set command parameter <time> is in the <NRf> format and must be in the 0.90 - 100.00 range:

The query command produces a result message in the <NR2> format.

COMMAND:	**:SYSTem:APPLication:ACSource:DPOFf**
PARAMETERS:	<time>
RESULT DATA:	<time>
DEFAULT VALUE:	2
NOTES:	ANALYZER 6630 only

Description:

Sets or queries the AC source power off delay after measurement end.

The set command parameter <time> is in the <NRf> format and must be in the 0 - 100.00 range:

The query command produces a result message in the <NR2> format.

COMMAND: **:SYSTem:APPLication:MODules**
PARAMETERS: <module mode>
RESULT DATA: <module mode>
DEFAULT VALUE: DISCRETE_MODULE_MODE
NOTES: Coupled

Description:

Sets or queries ANALYZER 6630r's use of multiple measurement modules. This setting affects many of the configuration commands.

The set command parameter <module mode> is in the <character program data> format and may have the following values:

DMMode	Discrete - all modules are used independently.
TPYMode	Triple-Y - the instrument will be in true three phase Y mode.

This parameter is meaningless with instruments equipped with less than 3 modules. Setting this parameter to **TPYMode** on an instrument with 1 or 2 modules will produce an execution error.

The query command produces a result string in the <string program data> format:

"DMM"	Discrete modules mode
"TPYM"	True three phase Y mode

COMMAND: **:SYSTem:APPLication:CTRatio**
PARAMETERS: <current transfer ratio>
RESULT DATA: <current transfer ratio>
DEFAULT VALUE: 1
NOTES:

Description:

Sets or queries the the current input transfer ratio. This parameter is global, i.e. it will affect all installed measurement modules.

The set command parameter <current transfer ratio> is in the <NRf> format and may be between 1 and 1000.

The query command produces a result in the <NR1> format.

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COMMAND: **:SYSTem:APPLication:VTRatio**
PARAMETERS: <voltage transfer ratio>
RESULT DATA: <voltage transfer ratio>
DEFAULT VALUE: 1
NOTES:

Description:

Sets or queries the the voltage input transfer ratio. This parameter is global, i.e. it will affect all installed measurement modules.

The set command parameter <voltage transfer ratio> is in the <NRf> format and may be between 1 and 1000.

The query command produces a result in the <NR1> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECFff_t:NORMal**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECFff_t means IEC555-2

Description:

Sets or queries the IEC555-2 'Normal' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECFff_t:PTOols**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECFff_t means IEC555-2

Description:

Sets or queries the IEC555-2 'Portable tools' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

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COMMAND: **:SYSTem:APPLication:LIMits:IECFff_t:LUMiniare**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECFff_t means IEC555-2

Description:

Sets or queries the IEC555-2 'LUMiniare' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECFff_t:TV**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECFff_t means IEC555-2

Description:

Sets or queries the IEC555-2 'TV set' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECFff_t:USOurce**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECFff_t means IEC555-2

Description:

Sets or queries the IEC555-2 'Voltage source' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECFff_t:UTVSource**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECFff_t means IEC555-2

Description:

Sets or queries the IEC555-2 'Voltage source(TV)' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECT_t_t:ACLass**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECT_t_t means IEC1000-3-2

Description:

Sets or queries the IEC1000-3-2 'Class A' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECT_t_t:BCLass**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECT_t_t means IEC1000-3-2

Description:

Sets or queries the IEC1000-3-2 'Class B' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

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COMMAND: **:SYSTem:APPLication:LIMits:IECT_t_t:CCLass**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECT_t_t means IEC1000-3-2

Description:

Sets or queries the IEC1000-3-2 'Class C' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00.The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECT_t_t:DCLass**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECT_t_t means IEC1000-3-2

Description:

Sets or queries the IEC1000-3-2 'Class D' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECT_t_t:ACJapan**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECT_t_t means IEC1000-3-2

Description:

Sets or queries the IEC1000-3-2 'Class A-1 Japan' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

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COMMAND: **:SYSTem:APPLication:LIMits:IECT_t_t:USOurce**
PARAMETERS: <limit factor>
RESULT DATA: <limit factor>
DEFAULT VALUE: 0.9
NOTES: IECT_t_t means IEC1000-3-2

Description:

Sets or queries the IEC1000-3-2 'Voltage source' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format and may be between 0.1 and 10.00. The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECT_t_t:LPCClass**
PARAMETERS: <power limit>
RESULT DATA: <power>
DEFAULT VALUE: 25 (W)
NOTES: IECT_t_t means IEC1000-3-2

Description:

Sets or queries the IEC1000-3-2 'Low power limit for class C' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format without unit and may be between 1.00 and 25.00 Watt (active power).

The query command produces a result in the <NR2> format.

COMMAND: **:SYSTem:APPLication:LIMits:IECT_t_t:LPDClass**
PARAMETERS: <power limit>
RESULT DATA: <power limit>
DEFAULT VALUE: 75 (W)
NOTES: IECT_t_t means IEC1000-3-2

Description:

Sets or queries the IEC1000-3-2 'Low power limit for class D' parameter user defined limit for the harmonics analyzer.

The set command parameter <limit factor> is in the <NRf> format without unit and may be between 1.00 and 75.00 Watt (active power).

The query command produces a result in the <NR2> format.

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COMMAND: **:SYSTem:COMMunicate:SERial\<n\>:RECeive:BAUD**
PARAMETERS: \<baud rate\>
RESULT DATA: \<baud rate\>
DEFAULT VALUE: 9600
NOTES: **SCPI COMPLIANT**, *RST has no effect on this parameter, only port 1 is available in the ANALYZER 6630r

Description:

Sets or queries the selected, by \<n\>, serial ports baudrate. This command applies to receiver *and* transmitter. The command effect is immediate.

The set command parameter \<baudrate\> is in the \<NRf\> format and may select the following rates:

        110
        150
        300
        600
        1200
        2400
        4800
        9600
        19200
        38400

The query command produces a result in the \<NR1\> format.

COMMAND: **:SYSTem:COMMunicate:SERial\<n\>:RECeive:BITS**
PARAMETERS: \<number of data bits\>
RESULT DATA: \<number of data bits\>
DEFAULT VALUE: 8
NOTES: **SCPI COMPLIANT**, *RST has no effect on this parameter, only port 1 is available in the ANALYZER 6630r

Description:

Sets or queries the selected, by \<n\>, serial ports word length. This command applies to receiver *and* transmitter. The command effect is immediate.

The set command parameter \<number of data bits\> is in the \<NRf\> format and may select the following lengthes:

        7
        8

The query command produces a result in the \<NR1\> format.

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COMMAND:	**:SYSTem:COMMunicate:SERial\<n\>:RECeive:PACE**
PARAMETERS:	\<pacing scheme\>
RESULT DATA:	\<pacing scheme\>
DEFAULT VALUE:	NONE
NOTES:	**SCPI COMPLIANT**, *RST has no effect on this parameter, only port 1 is available in the ANALYZER 6630r, this parameter has no effect if the port is used for remote control

Description:

Sets or queries the selected, by \<n\>, serial ports pacing scheme. This command applies to receiver *and* transmitter. The command effect is immediate. Has no effect when port is used for remote control.

The set command parameter \<pacing scheme\> is in the \<character program data\> format and may select the following pacing schemes:

    XON
    ACK
    NONE

The query command produces a result in the \<string response data\> format:

    "XON"
    "ACK"
    "NONE"

COMMAND:	**:SYSTem:COMMunicate:SERial\<n\>:RECeive:PARity:[TYPE]**
PARAMETERS:	\<parity type\>
RESULT DATA:	\<parity type\>
DEFAULT VALUE:	NONE
NOTES:	**SCPI COMPLIANT**, *RST has no effect on this parameter, only port 1 is available in the ANALYZER 6630r

Description:

Sets or queries the selected, by \<n\>, serial ports parity checking. This command applies to receiver *and* transmitter. The command effect is immediate.

The set command parameter \<parity type\> is in the \<character data\> format and may select the following lengthes:

    EVEN
    ODD
    NONE

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The query command produces a result in the <string response data> format:

"EVEN"
"ODD"
"NONE"

COMMAND:	**:SYSTem:COMMunicate:SERial<n>:RECeive:SBITs**
PARAMETERS:	<number of stop bits>
RESULT DATA:	<number of stop bits>
DEFAULT VALUE:	2
NOTES:	**SCPI COMPLIANT**, *RST has no effect on this parameter, only port 1 is available in the ANALYZER 6630r

Description:

Sets or queries the selected, by <n>, serial ports stop bit count. This command applies to receiver *and* transmitter. The command effect is immediate.

The set command parameter <number of stop bits> is in the <NRf> format and may select the following counts:

1
2

The query command produces a result in the <NR1> format.

Command: *RST

This command places the ANALYZER 6630r in the power on state with the exception of the remote control system. All altered instrument parameters will be restored to their default volatile remote control values.

Command: *IDN?

This query will place the following identification string in the output queue:

`CHROMA,ANALYZER 6630r,00001234,` — see explanation of field 4 —

Fields 1-3 are according to the IEEE 488.2 standard. Field 4 is formatted as follows:

XXXX 00001.01 0000.900: ...... next module ......

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The first component, 'XXXX', is the ID code of the module. The possible ID codes at this manuals printing are:

    0000   No module present
    1166   Main unit
    1167   Standard input module
    1408   High performance (DSP) measurement module

A space separates the ID code from the next component which is the BIOS software version followed by another space and finally the system software version. These three components are then terminated by a colon which is a complete module field. There are five module fields in the response, one for the main unit and four for the input module slots. Empty slots will be reported as ID code '0000'. The response message is terminated with new line (ASCII 10) and EOI.

NOTE!
The response message of the *IDN command may be up to 150 characters long. This is in violation of the IEEE 488.2 standard that specifies a maximum size of 72 characters but has been deemed necessary in order to report the full capability of the instrument.

This query must be last in a terminated program message since the reply is a indefinite length ASCII string terminated by the EOI. If not, SCPI standard error message -440 will be generated and no result will be placed in the output queue.

Command: ***TST?**

This query starts an internal self test. The result is in the <NR1> format as follows:

Response	Meaning
0	Test OK
Not 0	Fault code

More specific error codes will be included when they are available.

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3.1.2 Status Reporting

COMMAND: **:STATus:QUEue:[NEXT]?**
PARAMETERS: -
RESULT DATA: <status>
DEFAULT VALUE: 0
NOTES: Query Only, **SCPI COMPLIANT**

Description:

Places the next entry in the SCPI Error/Event queue in the output queue for reading. If the SCPI Error/Event queue is empty, the result message will be '0, "No error"'. For a description of the SCPI Error/Event queue, see **5.5.2 - SCPI Error/Event Queue**. This command is functionally identical to ':SYSTem:ERRor?'.

COMMAND: **:STATus:QUEue:ENABle**
PARAMETERS: <message type>
RESULT DATA: <message type>
DEFAULT VALUE: **ALL_ERRORS_EVENTS**
NOTES:

Description:

Controls the types of errors/events reported in the SCPI error/event queue.

The set command parameter is in the <NRf> format. The valule selects one of the possible modes as follows:

Value	Meaning
0	No errors/events are reported
1	Only SCPI standard errors/events are reported
2	Only instrument dependent errors/events are reported
3	All type of errors/events are reported

The query will return the selected mode in the <STRING_RESPONSE_DATA> format as follows:

"NO_ERRORS_EVENTS"
"STANDARD_ERRORS_EVENTS"
"INSTRUMENT_ERRORS_EVENTS"
"ALL_ERRORS_EVENTS"

COMMAND:	**:STATus:QUEStionable:[EVENt]?**
PARAMETERS:	-
RESULT DATA:	<status>
DEFAULT VALUE:	0
NOTES:	Query Only, **SCPI COMPLIANT**

Description:

This query converts the register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. This register will be cleared after reading. See 5.5 - STATUS REPORTING for a desricption of the ANALYZER 6630r status structure.

COMMAND:	**:STATus:QUEStionable:ENABle**
PARAMETERS:	<bit mask>
RESULT DATA:	<bit mask>
DEFAULT VALUE:	0
NOTES:	**SCPI COMPLIANT**

Description:

The set command parameter should be in <NRf> or <NON DECIMAL DATA> format. The value forms a bit map that is loaded into the register. Values outside 0-32767 will cause an error.

The query converts the register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. See 5.5 - STATUS REPORTING for a description of the ANALYZER 6630r status structure.

COMMAND:	**:STATus:QUEStionable:INSTrument:[EVENt]?**
PARAMETERS:	-
RESULT DATA:	<status>
DEFAULT VALUE:	0
NOTES:	Query Only

Description:

This query converts the register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. This will be cleared after reading. See 5.5 - STATUS REPORTING for a description of the ANALYZER 6630r status structure.

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COMMAND: **:STATus:QUEStionable:INSTrument:ENABle**
PARAMETERS: <bit mask>
RESULT DATA: <bit mask>
DEFAULT VALUE: 0
NOTES:

Description:

The set command parameter should be in <NRf> or <NON DECIMAL DATA> format. The value forms a bit map that is loaded into the register. Values outside 0-32767 will cause an error.

The query converts the register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. See 5.5 - STATUS REPORTING for a description of the ANALYZER 6630r status structure.

COMMAND: **:STATus:QUEStionable:INSTrument:ISUMmary<n>:[EVENt]?**
PARAMETERS: -
RESULT DATA: <status>
DEFAULT VALUE: 0
NOTES: Query Only, **SCPI COMPLIANT**

Description:

This query converts the selected logical instruments register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. This register will be cleared after reading. See 5.5 - STATUS REPORTING for a desricption of the ANALYZER 6630r status structure.

COMMAND: **:STATus:QUEStionable:INSTrument:ISUMmary<n>:ENABle**
PARAMETERS: <bit mask>
RESULT DATA: <bit mask>
DEFAULT VALUE: 0
NOTES:

Description:

The selected logical instruments set command parameter should be in <NRf> or <NON DECIMAL DATA> format. The value forms a bit map that is loaded into the register. Values outside 0-32767 will cause an error.

The query converts the selected logical instruments register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. See 5.5 - STATUS REPORTING for a description of the ANALYZER 6630r status structure.

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COMMAND:	**:STATus:OPERation:[EVENt]?**
PARAMETERS:	-
RESULT DATA:	<status>
DEFAULT VALUE:	0
NOTES:	Query Only, **SCPI COMPLIANT**

Description:

This query converts the register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. This register will be cleared after reading. See 5.5 - STATUS REPORTING for a desricption of the ANALYZER 6630r status structure.

COMMAND:	**:STATus:OPERation:ENABle**
PARAMETERS:	<bit mask>
RESULT DATA:	<bit mask>
DEFAULT VALUE:	0
NOTES:	**SCPI COMPLIANT**

Description:

The set command parameter should be in <NRf> or <NON DECIMAL DATA> format. The value forms a bit map that is loaded into the register. Values outside 0-32767 will cause an error.

The query converts the register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. r. See 5.5 - STATUS REPORTING for a description of the ANALYZER 6630r status structure.

COMMAND:	**:STATus:OPERation:INSTrument:[EVENt]?**
PARAMETERS:	-
RESULT DATA:	<status>
DEFAULT VALUE:	0
NOTES:	Query Only

Description:

This query converts the register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. This will be cleared after reading. See 5.5 - STATUS REPORTING for a description of the ANALYZER 6630r status structure.

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COMMAND: **:STATus:OPERation:INSTrument:ENABle**
PARAMETERS: <bit mask>
RESULT DATA: <bit mask>
DEFAULT VALUE: 0
NOTES:

Description:

The set command parameter should be in <NRf> or <NON DECIMAL DATA> format. The value forms a bit map that is loaded into the register. Values outside 0-32767 will cause an error.

The query converts the register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. See 5.5 - STATUS REPORTING for a description of the ANALYZER 6630r status structure.

COMMAND: **:STATus:OPERation:INSTrument:ISUMmary<n>:[EVENt]?**
PARAMETERS: -
RESULT DATA: <status>
DEFAULT VALUE: 0
NOTES: Query Only, **SCPI COMPLIANT**

Description:

This query converts the selected logical instruments register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. This register will be cleared after reading. See 5.5 - STATUS REPORTING for a desricption of the ANALYZER 6630r status structure.

COMMAND: **:STATus:OPERation:INSTrument:ISUMmary<n>:ENABle**
PARAMETERS: <bit mask>
RESULT DATA: <bit mask>
DEFAULT VALUE: 0
NOTES:

Description:

The selected logical instruments set command parameter should be in <NRf> or <NON DECIMAL DATA> format. The value forms a bit map that is loaded into the register. Values outside 0-32767 will cause an error.

The query converts the selected logical instruments register contents to a binary-weighted sum of all bits in the <NR1> format. The result is placed in the output queue for reading. See 5.5 - STATUS REPORTING for a description of the ANALYZER 6630r status structure.

COMMAND: **:STATus:PRESet**
PARAMETERS: -
RESULT DATA: -
DEFAULT VALUE: -
NOTES: No Query, **SCPI COMPLIANT**

Description:

This command will preset the ANALYZER 6630r status data structures such that ANALYZER 6630r events are reported at a higher level through the status report mechanism. The Preset command only affects the enable registers of the ANALYZER 6630r status structures. It does not affect either the 'status byte' or the 'standard event status' as defined as defined by IEEE 488.2. It does not clear any of the event registers or any item in the error/event queue.

The PRESet command sets the STATus:QUEStionable:ENABle,STATus:QUEStionable:INSTrument:ENABle and STATus:QUEStionable:INSTrument:ISUMmary:ENABle registers to all 1's thus enabling detection in the STATus:QUEStionable:EVENt status bits summary register. It will set the STATus:QUEStionable:ENABle register to all 0's blocking the bit summaries from being reported in the 'status register'. The above description of the STATus:QUEStionable register structure does also apply to the STATus:OPERation register structure.

It will set the error/event queue to report only errors.

It is up to the application programmer to finish the setup by accessing the IEEE 488.2 'service request enable' and 'standard event status enable' registers in order for certain events to cause service request.

See 5.5 - STATUS REPORTING for a description of the ANALYZER 6630r status structure.

Command: ***CLS**

This command clears the status structures of the ANALYZER 6630r as follows:

Registers cleared	Complies with
Standard Event Status Register (SESR)	IEEE 488.2
OPERation Status Register (OSR)	SCPI
QUEStionable Status Register (QSR)	SCPI
Error/Event Queue	SCPI

It will also place the instrument in No Operation Pending state.

For further information, see **4.1 - STATUS REPORTING**.

Command: *STB?

This query reads the contents of the 8 bit IEEE 488.2 status register and places the result in the output queue in the <NR1> format for reading.

Status Register Bit Summary:

      Bit 0:   Not Used (Always zero)
      Bit 1:   Not Used (Always zero)
      Bit 2:   Error/Event Queue Status
      Bit 3:   QUEStionable Status Register bit summary
      Bit 4:   MAV (Message Available)
      Bit 5:   Standard Event Status Register bit Summary
      Bit 6:   MSS (Master Summary Status)
      Bit 7:   OPERation Status Register bit summary

For further information, see **4.1 - STATUS REPORTING**.

Command: *ESR?

This query reads the contents of the 8 bit IEEE 488.2 Standard Event Status Register and places the result in the output queue in the <NR1> format for reading.

Standard Event Status Register Bit Summary:

      Bit 0:   Operation Complete
      Bit 1:   Not Used (always zero)
      Bit 2:   Query Error
      Bit 3:   Device Dependent Error
      Bit 4:   Execution Error
      Bit 5:   Command Error
      Bit 6:   Not Used (always zero)
      Bit 7:   Power On

For further information, see **4.1 - STATUS REPORTING**.

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Command: ***ESE <enable value>**

This command sets the Standard Event Status Enable Register mask for the 8 bit IEEE 488.2 Standard Event Status Register. <enable value > must be in <NRf> format and is rounded to an integer. It is then checked for the limits 0-255 and if within limits, the value is loaded into the Standard Event Status Enable register (ESE).
If an invalid value is received, the Execution Error bit 4 in the Standard Event Status Register is set . The contents of the ESE register remains unchanged.

For further information, see **4.1 - STATUS REPORTING**.

Command: ***ESE?**

This query reads the contents of the 8 bit IEEE 488.2 Standard Event Status Enable Register (ESE) and places the result in the output queue in the <NR1> format for reading.

For further information, see **4.1 - STATUS REPORTING**.

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3.1.3 Measurement Functions

COMMAND:	**:CONFigure:MULTimeter:MODule\<n\>:IRANge**
PARAMETERS:	\<expected peak current\>
RESULT DATA:	\<range\>
DEFAULT VALUE:	**AUTO**
NOTES:	Coupled, if the instrument is set to **TPYmode**, with the SYSTem: APPLication:MODules command, the module selection suffix \<n\> is not available, the selected range will be set in all modules

Description:

The parameter selects the current measurement range for the selected module. If a nonexisting measurement module is selected, an execution error will be generated and the error message '-241, "Hardware missing"' will be placed in the error/event queue.

The unit for parameters and response data is ampere.

The set command parameter is in \<NRf\> format. The value should be the expected peak current for the measurements. The instrument will choose the best measurement range for the expected value. No parameter range checking is done.
The special \<numeric_value\> **DEFault** may be used to select autoranging.

The query will return the selected modules current measurement range in the \<STRING RESPONSE DATA\> format as follows:

Response	Meaning
"0.1"	0.1 A peak range
"0.3"	0.3 A peak range
"1"	1 A peak range
"3"	3 A peak range
"10"	10 A peak range
"30"	30 A peak range
"100"	100 A peak range
"300"	300 A peak range
"AUTO"	Autorange

COMMAND:	**:CONFigure:MULTimeter:MODule\<n\>:URANge**
PARAMETERS:	\<expected peak voltage\>
RESULT DATA:	\<range\>
DEFAULT VALUE:	**AUTO**
NOTES:	Coupled, if the instrument is set to **TPYmode**, with the SYSTem: APPLication:MODules command, the module selection suffix \<n\> is not available, the selected range will be set in all modules

Description:

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The parameter selects the voltage measurement range for the selected module. If a non-existing measurement module is selected, an execution error will be generated and the error message '-241, "Hardware missing"' will be placed in the error/event queue.

The unit for parameters and response data is volt.

The set command parameter is in <NRf> format. The value should be the expected peak voltage for the measurements. The instrument will choose the best measurement range for the expected value. No parameter range checking is done.
The special <numeric_value> **DEFault** may be used to select autoranging.

The query will return the selected modules voltage measurement range in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"6"	6 V peak range
"20"	20 V peak range
"60"	60 V peak range
"200"	200 V peak range
"600"	600 V peak range
"2000"	2000 V peak range
"AUTO"	Autorange

COMMAND:	**:CONFigure:MULTimeter:VMETer\<n\>:INPut**
PARAMETERS:	\<virtual meter source\>
RESULT DATA:	\<virtual meter source\>
DEFAULT VALUE:	**MODULE_1**
NOTES:	Coupled, only available if the instrument is set to **DMMode** with the SYSTem:APPLication:MODules command

Description:

The parameter selects the measurement source for the selected virtual meter. If a nonexisting virtual meter or source is selected, an execution error will be generated. Valid virtual meters are 1-6.

The set command parameter is in <NR1> format. The value selects one of the possible modules as follows:

Value	Meaning
0	M1
1	M2
2	M3

The query will return the virtual meters selected module in the <STRING RESPONSE DATA> format as follows:

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Response
"MODULE_1"
"MODULE_2"
"MODULE_3"

COMMAND: **:CONFigure:MULTimeter:VMETer\<n>:MODE**
PARAMETERS: \<virtual meter mode>
RESULT DATA: \<virtual meter mode>
DEFAULT VALUE: **AC**
NOTES:

Description:

The parameter selects the measurement mode for the selected virtual meter. If a nonexisting virtual meter or mode is selected, an execution error will be generated. Valid virtual meters are 1-6.

The set command parameter is in \<NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	AC and DC
1	DC
2	AC

The query will return the virtual meters selected mode in the \<STRING RESPONSE DATA> format as follows:

Response	Meaning
"AC_AND_DC"	AC and DC
"DC"	DC
"AC"	AC

COMMAND: **:CONFigure:MULTimeter:VMETer\<n>:PARameter**
PARAMETERS: \<virtual meter parameter>
RESULT DATA: \<virtual meter parameter>
DEFAULT VALUE: **SKIP**
NOTES: Coupled, the available choises varies with the setting of the CONFigure:MULTimeter:VMETer\<n>:MODE parameter

Description:

The parameter selects the measurement parameter for the selected virtual meter. If a nonexisting virtual meter or parameter is selected, an execution error will be generated. Valid virtual meters are 1-6.

The set command parameter is in <NR1> format. The value selects one of the possible parameters as follows:

Value	AC	DC	AC+DC	Meaning
0	Yes	Yes	Yes	Skip
1	Yes	Yes	Yes	Current
2	Yes	No	Yes	Crestfactor I
3	Yes	Yes	Yes	Voltage
4	Yes	No	Yes	Crestfactor U
5	Yes	No	Yes	Frequency I
6	Yes	No	Yes	Frequency U
7	Yes	Yes	Yes	Active power
8	Yes	No	No	Reactive power
9	Yes	No	Yes	Apparent power
10	Yes	No	Yes	Power factor
11	Yes	No	No	Phase angle
12	Yes	Yes	Yes	Active energy
13	Yes	No	No	Reactive energy
14	Yes	No	Yes	Apparent energy
15	No	Yes	Yes	Charge
16	Yes	No	Yes	THD I
17	Yes	No	Yes	THD U

The query will return the virtual meters selected parameter in the <STRING RESPONSE DATA> format as follows:

Response
"SKIP"
"CURRENT"
"CRESTFACTOR_I"
"VOLTAGE"
"CRESTFACTOR_U"
"FREQUENCY_I"
"FREQUENCY_U"
"ACTIVE_POWER"
"REACTIVE_POWER"
"APPARENT_POWER"
"POWER_FACTOR"
"PHASE_ANGLE"
"ACTIVE_ENERGY"
"REACTIVE_ENERGY"
"APPARENT_ENERGY"
"CHARGE"
"THD_I"
"THD_U"

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COMMAND:	**:CONFigure:MULTimeter:VMETer\<n>:PROPerty**
PARAMETERS:	\<virtual meter unit>
RESULT DATA:	\<virtual meter unit>
DEFAULT VALUE:	**RMS**
NOTES:	Coupled, available when CONFigure:MULTimeter:VMETer\<n>:MODE is set to **AC** or **AC and DC**

Description:

The parameter selects the measurement property for the selected virtual meter. If a nonexisting virtual meter or property is selected, an execution error will be generated. Valid virtual meters are 1-6.

The set command parameter is in \<NR1> format. The value selects one of the possible properties as follows:

Value	Meaning
0	Rms
1	Peak+
2	Peak-
3	PeakPeak

The query will return the virtual meters selected property in the \<STRING RESPONSE DATA> format as follows:

Response	Meaning
"RMS"	Rms
"PEAK_PLUS"	Peak+
"PEAK_MINUS"	Peak-
"PEAK_PEAK"	PeakPeak

COMMAND:	**:CONFigure:MULTimeter:VMETer\<n>:RTYPe**
PARAMETERS:	\<3 phase result type>
RESULT DATA:	\<3 phase result type>
DEFAULT VALUE:	**MEAN_OF_3**
NOTES:	Coupled, only available if the instrument is set to **TPYmode** with the SYSTem:APPLication:MODules command

Description:

The parameter selects the measurement result type for true 3 phase measurements. If a nonexisting virtual meter of type is selected, an execution error will be generated. Valid meters are 1-6.

The set command parameter is in \<NR1> format. The value selects one of the possible types as follows:

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Value	Meaning
0	Mean of 3
1	Sum of 3
2	Split into 3

The query will return the virtual meters selected type in the <STRING RESPONSE DATA> format as follows:

Response
"MEAN_OF_3"
"SUM_OF_3"
"SPLIT_INTO_3"

COMMAND: **:CONFigure:MULTimeter:FFOLlow:ACTive**
PARAMETERS: <fast follow active>
RESULT DATA: <fast follow active>
DEFAULT VALUE: **1 (ON)**
NOTES:

Description:

The parameter turns the fast follow feature on or off.

The set command parameter is in <Boolean> format. The value selects one of the possible properties as follows:

Value	Meaning
**0	OFF**	No
**1	ON**	Yes

The query will return the setting in the <NR1> format as follows:

Response	Meaning
0	No
1	Yes

COMMAND: **:CONFigure:MULTimeter:FFOLlow:THReshold**
PARAMETERS: <fast follow threshold>
RESULT DATA: <fast follow threshold>
DEFAULT VALUE: **1**
NOTES:

Description:

The command will set the fast follow threshold.

The setting unit is percent.

The set command parameter is in <NR2> format. The value should be in the 0.10 - 10.00 range.

The query will return the setting in the <NR2> format.

COMMAND: **:CONFigure:MULTimeter:MWINdow:TIME**
PARAMETERS: <measurement window time>
RESULT DATA: <measurement window time>
DEFAULT VALUE: **1_SECOND**
NOTES:

Description:

The parameter sets the measurement window time.

The set command parameter is in <NR1> format. The value selects one of the possible properties as follows:

Value	Meaning
0	0.5s (DSP only)
1	1.0s
2	2.0s
3	3.0s
4	4.0s
5	5.0s

The query will return the selected measurement window time in the <STRING RE-SPONSE DATA> format as follows:

Response
"0_5_SECONDS"
"1_SECOND"
"2_SECONDS"
"3_SECONDS"
"4_SECONDS"
"5_SECONDS"

COMMAND: **:CONFigure:MULTimeter:MWINdow:MEAN**
PARAMETERS: <windows in mean>
RESULT DATA: <windows in mean>
DEFAULT VALUE: **1**
NOTES:

1.03

Description:

The parameter sets the number of measurement windows to use for mean calculations. Selecting 1 turns the mean function off.

The set command parameter is in <NR1> format. The value should be in the 1 - 10 range.

The query will return the setting in the <NR2> format.

COMMAND:	**:CONFigure:MULTimeter:MWINdow:TYPE**
PARAMETERS:	<measurement window type>
RESULT DATA:	<measurement window type>
DEFAULT VALUE:	**ADAPTED**
NOTES:	

Description:

The parameter sets the measurement window type.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	Fixed
1	Adapted

The query will return the selected mode in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"FIXED"	Fixed
"ADAPTED"	Adapted

COMMAND:	**:CONFigure:MULTimeter:FSOurce**
PARAMETERS:	<frequency source>
RESULT DATA:	<frequency source>
DEFAULT VALUE:	**VOLTAGE**
NOTES:	

Description:

The parameter sets the measurements frequency synchronization source in module 1

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	Voltage
1	Current

The query returns the selected source in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"VOLTAGE"	Voltage
"CURRENT"	Current

COMMAND: **:CONFigure:MULTimeter:FMEThod**
PARAMETERS: <frequency determination method>
RESULT DATA: <frequency determination method >
DEFAULT VALUE: **AUTOCORR**
NOTES:

Description:
The parameter sets the frequency determination method.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	Autocorrelation
1	Level crossing

The query will return the selected mode in the <STRING RESPONSE DATA> format as follows:

Response
"AUTOCORR"
"LEVELCROSS"

COMMAND:	**:CONFigure:HARMonics:SOURce**
PARAMETERS:	<source>
RESULT DATA:	<source>
DEFAULT VALUE:	**MODULE_1**
NOTES:	Coupled, only available if the instrument is set to **DMMode** with the SYSTem:APPLication:MODules command

Description:

The parameter selects the measurement source. If a nonexisting source is selected, an execution error will be generated.

The set command parameter is in <NR1> format. The value selects one of the possible modules as follows:

Value	Meaning
0	M1
1	M2
2	M3

The query will return the selected source in the <STRING RESPONSE DATA> format as follows:

Response
"MODULE_1"
"MODULE_2"
"MODULE_3"

COMMAND:	**:CONFigure:HARMonics:PERiods**
PARAMETERS:	<number of periods>
RESULT DATA:	<number of periods>
DEFAULT VALUE:	**4**
NOTES:	

Description:

The parameter sets the number of periods used for calculations.

The set command parameter is in <NRf> format. The value should be in the 1-47 range.

The query will return the selected entry's value in the <NR1> format.

1.03

COMMAND: **:CONFigure:HARMonics:FSOurce**
PARAMETERS: <frequency source>
RESULT DATA: <frequency source>
DEFAULT VALUE: **VOLTAGE**
NOTES:

Description:

The parameter sets the measurements frequency source.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	Voltage
1	Current

The query will return the selected mode in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"VOLTAGE"	Voltage source
"CURRENT"	Current source

COMMAND: **:CONFigure:HARMonics:DSOurce**
PARAMETERS: <data source>
RESULT DATA: <data source>
DEFAULT VALUE: **CURRENT**
NOTES:

Description:

The parameter sets the measurements data source.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	Voltage
1	Current

The query will return the selected mode in the <STRING RESPONSE DATA> format as follows:

1.03

Response	Meaning
"VOLTAGE"	Voltage source
"CURRENT"	Current source

COMMAND:	**:CONFigure:HARMonics:LIMit:SELect**
PARAMETERS:	<limit source>
RESULT DATA:	<limit source>
DEFAULT VALUE:	**NO**
NOTES:	Selecting User Defined will impose the limit factors found under SYSTem:APPLication:LIMits:.....

Description:

The parameter selects the test limits for the measurements.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	No
1	User defined
2	Standard

The query will return the selected limit in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"NO_LIMITS"	No testing against limits
"USER_DEFINED_LIMITS"	Test against user defined limits
"STANDARD_LIMITS"	Test against standard defined limits

COMMAND:	**:CONFigure:HARMonics:LIMit:STANdard**
PARAMETERS:	<limit standard>
RESULT DATA:	<limit standard>
DEFAULT VALUE:	**IEC1000_3_2**
NOTES:	Coupled, only used if the :CONFigure:HARMonics:LIMit:SELect parameter is not set to NO_LIMITS

Description:

The parameter selects the test limits standard.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

1.03

Value	Meaning
0	IEC555-2
1	IEC1000-3-2
2	Japan

The query will return the selected limit in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"IEC555_2"	IEC555-2 limits
"IEC1000_3_2"	IEC1000-3-2 limits
"JAPAN"	Japan limits

COMMAND:	**:CONFigure:HARMonics:LIMit:CLASs**
PARAMETERS:	<limit class>
RESULT DATA:	<limit class>
DEFAULT VALUE:	**A** or **NORMAL**
NOTES:	Coupled, only used if the :CONFigure:HARMonics:LIMit:SELect parameter is not set to NO_LIMITS

Description:

The parameter selects the test limit class. This parameter has different settings depending on the setting of the :CONFigure:HARMonics:LIMits:STANdard and :CONFigure:HARMonics:DSOurce parameters. This is to maintain compatibility with the menu system.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows *with* data source set to **CURRENT**:

Value	IEC555-2	IEC1000-3-2	Japan
0	Normal	Class A	Class A
1	Portable	Class B	Class B
2	Luminiare	Class C	Class C
3	TV	Class D	Class D
4			Class A-1

The query will return the selected limit in the <STRING RESPONSE DATA> format as follows *with* data source set to **CURRENT**:

IEC555-2	IEC1000-3-2	Japan
"NORMAL"	**"CLASS_A"**	**"CLASS_A"**
"PORTABLE"	**"CLASS_B"**	**"CLASS_B"**
"LUMINIARE"	**"CLASS_C"**	**"CLASS_C"**
"TV"	**"CLASS_D"**	**"CLASS_D"**
		"CLASS_A-1"

1.03

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows *with* data source set to **VOLTAGE**:

Value	IEC555-2	IEC1000-3-2	Japan
0	Volt	Volt	Volt
1	Volt_TV		

The query will return the selected limit in the <STRING RESPONSE DATA> format as follows *with* data source set to **VOLTAGE**:

IEC555-2	IEC1000-3-2	Japan
"VOLT"	**"VOLT"**	**"VOLT"**
"VOLT_TV"		

COMMAND:	**:CONFigure:HARMonics:OTIMe**
PARAMETERS:	<observation time>
RESULT DATA:	<observation time>
DEFAULT VALUE:	600
NOTES:	Coupled, only used if the selected source module is of DSP type

Description:

Sets or queries the fluctuating harmonics observation time. The unit is seconds.

The set command parameter is in the <NRf> format and may be between 150 and 30000.

The query command produces a result in the <NR1> format.

COMMAND:	**:CONFigure:HARMonics:SSIZe**
PARAMETERS:	-
RESULT DATA:	<slot size>
DEFAULT VALUE:	**16**
NOTES:	Query only, Coupled, only used if the selected source module is of DSP type

Description:

The parameter sets the fluctuating harmonics slot size.

The unit is periods.

The query will return the selected size in the <NR1> format.

COMMAND: **:CONFigure:HARMonics:LPFilter**
PARAMETERS: <low pass filter active>
RESULT DATA: <low pass filter active>
DEFAULT VALUE: **1 (ON)**
NOTES: Coupled, only used if the selected source module is of DSP type

Description:

The parameter turns the fluctuating harmonics low pass filter on or off.

The set command parameter is in <Boolean> format. The value selects one of the possible properties as follows:

Value	Meaning
0 | OFF	No
1 | ON	Yes

The query will return the setting in the <NR1> format as follows:

Response	Meaning
0	No
1	Yes

COMMAND: **:CONFigure:HARMonics:SWINdow**
PARAMETERS: -
RESULT DATA: <sliding window time>
DEFAULT VALUE: **150**
NOTES: Query only, Coupled, only used if the selected source module is of DSP type
Description:

The parameter sets the time of the fluctuating harmonics sliding window.

The unit is seconds.

The query will return the selected time in the <NR1> format.

COMMAND: **:CONFigure:HARMonics:MDALimit**
PARAMETERS: <max duration above limit>
RESULT DATA: <max duration above limit>
DEFAULT VALUE: 10
NOTES: Coupled, only used if the selected source module is of DSP type

Description:

1.03

Sets or queries the fluctuating harmonics max duration above limit. The unit is precent.

The set command parameter is in the <NRf> format and may be between 0 and 100.

The query command produces a result in the <NR1> format.

COMMAND:	**:CONFigure:HARMonics:MRFDeviation**
PARAMETERS:	<maximum relative frequency deviation>
RESULT DATA:	<maximum relative frequency deviation>
DEFAULT VALUE:	0.03
NOTES:	Coupled, only used if the selected source module is of DSP type

Description:

Sets or queries the fluctuating harmonics maximum relative frequency deviation. The unit is precent.

The set command parameter is in the <NRf> format and may be between 0.01 and 0.1.

The query command produces a result in the <NR2> format.

COMMAND:	**:CONFigure:HARMonics:URANge**
PARAMETERS:	<expected peak voltage>
RESULT DATA:	<range>
DEFAULT VALUE:	**AUTO**
NOTES:	Coupled, if the instrument is set to **TPYmode**, with the SYSTem: APPLication:MODules command, the command sets the range for all modules

Description:

The parameter selects the voltage measurement range.

The unit for parameter is volt.

The set command parameter is in <NRf> format. The value should be the expected peak voltage for the measurements. The instrument will choose the best measurement range for the expected value. No parameter range checking is done.
The special <numeric_value> **DEFault** may be used to select autoranging.

The query will return the selected modules voltage measurement range in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"6"	6 V peak range
"20"	20 V peak range

"60"	60 V peak range
"200"	200 V peak range
"600"	600 V peak range
"2000"	2000 V peak range
"AUTO"	Autorange

COMMAND:	**:CONFigure:HARMonics:IRANge**
PARAMETERS:	<expected peak current>
RESULT DATA:	<range>
DEFAULT VALUE:	**AUTO**
NOTES:	Coupled, if the instrument is set to **TPYmode**, with the SYSTem: APPLication:MODules command, the command sets the range for all modules

Description:

The parameter selects the current measurement range.

The unit for parameter data is ampere.

The set command parameter is in <NRf> format. The value should be the expected peak current for the measurements. The instrument will choose the best measurement range for the expected value. No parameter range checking is done.
The special <numeric_value> **DEFault** may be used to select autoranging.

The query will return the selected modules current measurement range in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"0.1"	0.1 A peak range
"0.3"	0.3 A peak range
"1"	1 A peak range
"3"	3 A peak range
"10"	10 A peak range
"30"	30 A peak range
"100"	100 A peak range
"300"	300 A peak range
"AUTO"	Autorange

COMMAND: **:CONFigure:FLICker:TEST**
PARAMETERS: <limit type>
RESULT DATA: <limit type>
DEFAULT VALUE: **STANDARD**
NOTES:

Description:

The parameter selects the test limits.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	No test
1	Standard
2	User defined

The query will return the selected limit in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"NO_TEST"	No test
"STANDARD"	Flicker standard
"USER_DEFINED"	User defined limits

IMPORTANT!
The setting of this parameter will affect certain other parameters of the flicker meter. Please select this flicker test method before trying to access the flicker meter parameters. Affected parameters will have a remark in the *NOTES* field. This is similar to the manual instrument behaviour.

Selecting NO TEST or STANDARD configures the flicker meter according to preset standard values. In this mode parameters can only queried, setting will generate an error. Selecting USER_DEFINED will make all parameters valid.

COMMAND: **:CONFigure:FLICker:SHORt:WTIMe**
PARAMETERS: <window time>
RESULT DATA: <window time>
DEFAULT VALUE: **10**
NOTES: Coupled, only used when the :CONFigure:FLICker:TEST parameter
                     is set to USER_DEFINED
Description:

The parameter sets the measurement window time.

The unit for parameter and response data is minutes.

The set command parameter is in <NRf> format. The value should be in the 1-30 range.

The query will return the selected time in the <NR1> format.

COMMAND:	**:CONFigure:FLICker:SHORt:LIMit**
PARAMETERS:	<short flicker limit>
RESULT DATA:	<short flicker limit>
DEFAULT VALUE:	**1.00**
NOTES:	Coupled, only used when the :CONFigure:FLICker:TEST parameter is set to USER_DEFINED

Description:

The parameter sets the short term flicker limit.

The set command parameter is in <NRf> format. The value should be 0 or in the 0.50-2.00 range.

The query will return the selected limit in the <NR2> format.

COMMAND:	**:CONFigure:FLICker:LONG:COUNt**
PARAMETERS:	<long flicker count>
RESULT DATA:	<long flicker count>
DEFAULT VALUE:	**12**
NOTES:	Coupled, only used when the :CONFigure:FLICker:TEST parameter is set to USER_DEFINED

Description:

The parameter sets the number of short term flicker results to use for a complete long term flicker measurement.

The set command parameter is in <NRf> format. The value should be in the 1-1500 range.

The query will return the selected limit in the <NR1> format.

COMMAND:	**:CONFigure:FLICker:LONG:LIMit**
PARAMETERS:	\<long flicker limit\>
RESULT DATA:	\<long flicker limit\>
DEFAULT VALUE:	**0.65**
NOTES:	Coupled, only used when the :CONFigure:FLICker:TEST parameter is set to USER_DEFINED

Description:

The parameter sets the long term flicker limit.

The set command parameter is in \<NRf\> format. The value should be 0 or in the 0.30-1.50 range.

The query will return the selected limit in the \<NR2\> format.

COMMAND:	**:CONFigure:FLICker:VCHange:SSTate:WTIMe**
PARAMETERS:	\<window time\>
RESULT DATA:	\<window time\>
DEFAULT VALUE:	**1**
NOTES:	Coupled, only used when the :CONFigure:FLICker:TEST parameter is set to USER_DEFINED

Description:

The parameter sets voltage change steady state window time.

The unit for parameter and response data is seconds.

The set command parameter is in \<NRf\> format. The value should be in the 1.00 - 5.00 range.

The query will return the selected limit in the \<NR2\> format.

COMMAND:	**:CONFigure:FLICker:VCHange:SSTate:HYSTeres**
PARAMETERS:	\<steady state hysteres\>
RESULT DATA:	\<steady state hysteres\>
DEFAULT VALUE:	**0.03**
NOTES:	Coupled, only used when the :CONFigure:FLICker:TEST parameter is set to USER_DEFINED

Description:

The parameter sets voltage change steady state hysteres.

The unit for parameter and response data is percent.

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The set command parameter is in <NRf> format. The value should be in the 0.01 - 0.50 range.

The query will return the selected limit in the <NR2> format.

COMMAND:	**:CONFigure:FLICker:VCHange:SSTate:DCLimit**
PARAMETERS:	<limit>
RESULT DATA:	<limit>
DEFAULT VALUE:	**3**
NOTES:	Coupled, only used when the :CONFigure:FLICker:TEST parameter is set to USER_DEFINED

Description:

The parameter sets voltage change steady state 'dc' limit.

The unit for parameter and response data is percent.

The set command parameter is in <NRf> format. The value should be 0 or in the 0.5 - 10.00 range.

The query will return the selected limit in the <NR2> format.

COMMAND:	**:CONFigure:FLICker:VCHange:SSTate:DMAXlimit**
PARAMETERS:	<limit>
RESULT DATA:	<limit>
DEFAULT VALUE:	**4**
NOTES:	Coupled, only used when the :CONFigure:FLICker:TEST parameter is set to USER_DEFINED

Description:

The parameter sets voltage change steady state 'dmax' limit.

The unit for parameter and response data is percent.

The set command parameter is in <NRf> format. The value should be 0 or in the 0.5 - 10.00 range.

The query will return the selected limit in the <NR2> format.

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COMMAND:	**:CONFigure:FLICker:VCHange:TLIMit**
PARAMETERS:	<limit>
RESULT DATA:	<limit>
DEFAULT VALUE:	**0.2**
NOTES:	Coupled, only used when the :CONFigure:FLICker:TEST parameter is set to USER_DEFINED

Description:

The parameter sets voltage change 'd(t)' time.

The unit for parameter and response data is second.

The set command parameter is in <NRf> format. The value should be in the 0.00 - 1.00 range.

The query will return the selected limit in the <NR2> format.

COMMAND:	**:CONFigure:FLICker:VCHange:THReshold**
PARAMETERS:	<limit>
RESULT DATA:	<limit>
DEFAULT VALUE:	**3**
NOTES:	Coupled, only used when the :CONFigure:FLICker:TEST parameter is set to USER_DEFINED

Description:

The parameter sets voltage change 'd(t)' threshold.

The unit for parameter and response data is percent.

The set command parameter is in <NRf> format. The value should be in the 0.50 - 10.00 range.

The query will return the selected limit in the <NR2> format.

COMMAND:	**:CONFigure:FLICker:IMPedance:REAL**
PARAMETERS:	<real impedance>
RESULT DATA:	<real impedance>
DEFAULT VALUE:	**0.4**
NOTES:	

Description:

The parameter sets the real reference impedance.

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The unit for parameter and response data is ohm.

The set command parameter is in <NRf> format. The value should be in the 0.04-50.00 range. The standard dictates 0.4 ohm.

The query will return the selected limit in the <NR2> format.

COMMAND: **:CONFigure:FLICker:IMPedance:IMAGinary**
PARAMETERS: <imaginary impedance>
RESULT DATA: <imaginary impedance>
DEFAULT VALUE: **0.25**
NOTES:

Description:

The parameter sets the imaginary reference impedance.

The unit for parameter and response data is ohm.

The set command parameter is in <NRf> format. The value should be in the 0.025-50.00 range. The standard dictates 0.25 ohm.

The query will return the selected limit in the <NR2> format.

COMMAND: **:CONFigure:FLICker:IMPedance:METHod**
PARAMETERS: <reference impedance method>
RESULT DATA: <reference impedance method>
DEFAULT VALUE: **NUMERICAL**
NOTES:

Description:

The parameter sets the reference impedance usage method.

The set command parameter is in <NR1> format. The value selects one of the following modes as follows:

Value	Meaning
0	Physical
1	Numerical

1.03

The query will return the selected limit in the <STRING RESPONSE DATA> format as follows:

> Response
> "**PHYSICAL**"
> "**NUMERICAL**"

COMMAND:	**:CONFigure:FLICker:SOURce**
PARAMETERS:	<source module>
RESULT DATA:	<source module>
DEFAULT VALUE:	**MODULE_1**
NOTES:	Coupled, only available if the instrument is set to **DMMode** with the SYSTem:APPLication:MODules command

Description:

The parameter selects the measurement source module. If a nonexisting module is selected, an execution error will be generated. Valid channels are 1-3.

The set command parameter is in <NR1> format. The value selects one of the possible modules as follows:

Value	Meaning
0	M1
1	M2
2	M3

The query will return the selected module in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"MODULE_1"	M1
"MODULE_2"	M2
"MODULE_3"	M3

COMMAND:	**:CONFigure:FLICker:URANge**
PARAMETERS:	<expected peak voltage>
RESULT DATA:	<range>
DEFAULT VALUE:	**AUTO**
NOTES:	Coupled, if the instrument is set to **TPYmode**, with the SYSTem:APPLication:MODules command, the command sets the range for all modules

Description:

The parameter selects the voltage measurement range.

The unit for parameter is volt.

The set command parameter is in <NRf> format. The value should be the expected peak voltage for the measurements. The instrument will choose the best measurement range for the expected value. No parameter range checking is done. The special <numeric_value> **DEFault** may be used to select autoranging.

The query will return the selected modules voltage measurement range in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"6"	6 V peak range
"20"	20 V peak range
"60"	60 V peak range
"200"	200 V peak range
"600"	600 V peak range
"2000"	2000 V peak range
"AUTO"	Autorange

COMMAND:	**:CONFigure:FLICker:IRANge**
PARAMETERS:	<expected peak current>
RESULT DATA:	<range>
DEFAULT VALUE:	**AUTO**
NOTES:	Coupled, if the instrument is set to **TPYmode**, with the SYSTem:APPLication:MODules command, the command sets the range for all modules

Description:

The parameter selects the current measurement range.
The unit for parameter data is ampere.

The set command parameter is in <NRf> format. The value should be the expected peak current for the measurements. The instrument will choose the best measurement range for the expected value. No parameter range checking is done. The special <numeric_value> **DEFault** may be used to select autoranging.

The query will return the selected modules current measurement range in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"0.1"	0.1 A peak range
"0.3"	0.3 A peak range
"1"	1 A peak range
"3"	3 A peak range
"10"	10 A peak range
"30"	30 A peak range
"100"	100 A peak range
"300"	300 A peak range
"AUTO"	Autorange

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COMMAND: **:CONFigure:FLICker:DSOurce**
PARAMETERS: <data source>
RESULT DATA: <data source>
DEFAULT VALUE: **CURRENT**
NOTES:

Description:

The parameter sets the measurements data source.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	Voltage
1	Current

The query will return the selected mode in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"VOLTAGE"	Voltage source
"CURRENT"	Current source

1.03

COMMAND: **:CONFigure:WAVeform:SOURce**
PARAMETERS: <waveform source>
RESULT DATA: <waveform source>
DEFAULT VALUE: **MODULE_1**
NOTES: Coupled, only available if the instrument is set to **DMMode**
with the SYSTem:APPLication:MODules command

Description:

The parameter selects the measurement source for the waveform function. If a nonexisting module is selected, an execution error will be generated and the error message '-241, "Hardware missing"' will be placed in the error/event queue. Selecting a source will load the related parameters such as range and trigger into the selected module.

The set command parameter is in <NR1> format. The value selects one of the possible modules as follows:

Value	Meaning
0	M1
1	M2
2	M3

The query will return the virtual meters selected module in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"MODULE_1"	M1
"MODULE_2"	M2
"MODULE_3"	M3

COMMAND: **:CONFigure:WAVeform:IRANge**
PARAMETERS: <expected peak current>
RESULT DATA: <range>
DEFAULT VALUE: **AUTO**
NOTES: Coupled, if the instrument is set to **TPYmode**, with the SYSTem:
APPLication:MODules command, the command sets the range
for all modules

Description:

The parameter selects the current measurement range for the selected module.
The unit for parameters and response data is ampere.

The set command parameter is in <NRf> format. The value should be the expected peak current for the measurements. The instrument will choose the best measurement range for the expected value. No parameter range checking is done. The special <numeric_value> **DEFault** may be used to select autoranging.

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The query will return the selected modules current measurement range in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"0.1"	0.1 A peak range
"0.3"	0.3 A peak range
"1"	1 A peak range
"3"	3 A peak range
"10"	10 A peak range
"30"	30 A peak range
"100"	100 A peak range
"300"	300 A peak range
"AUTO"	Autorange

COMMAND:	**:CONFigure:WAVeform:URANge**
PARAMETERS:	<expected peak voltage>
RESULT DATA:	<range>
DEFAULT VALUE:	**AUTO**
NOTES:	Coupled, if the instrument is set to **TPYmode**, with the SYSTem: APPLication:MODules command, the command sets the range for all modules

Description:

The parameter selects the voltage measurement range for the selected module.

The unit for parameters and response data is volt.

The set command parameter is in <NRf> format. The value should be the expected peak voltage for the measurements. The instrument will choose the best measurement range for the expected value. No parameter range checking is done.
The special <numeric_value> **DEFault** may be used to select autoranging.

The query will return the selected modules voltage measurement range in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"6"	6 V peak range
"20"	20 V peak range
"60"	60 V peak range
"200"	200 V peak range
"600"	600 V peak range
"2000"	2000 V peak range
"AUTO"	Autorange

1.03

COMMAND:	**:CONFigure:WAVeform:TRIGger:SOURce**
PARAMETERS:	<trigger source>
RESULT DATA:	<trigger source>
DEFAULT VALUE:	**NONE**
NOTES:	

Description:

The parameter selects the source for the waveform trigger function.

The set command parameter is in <NR1> format. The value selects one of the possible modules as follows:

Value	Meaning
0	None
1	U-Sample
2	U-Period-RMS
3	I-Sample
4	I-Period-RMS

The query will return the selected source in the <STRING RESPONSE DATA> format as follows:

Response
"NONE"
"U_SAMPLE"
"U_PERIOD_RMS"
"I_SAMPLE"
"I_PERIOD_RMS"

COMMAND:	**:CONFigure:WAVeform:TRIGger:SLOPe**
PARAMETERS:	<trigger slope>
RESULT DATA:	<trigger slope>
DEFAULT VALUE:	**FALLING**
NOTES:	Coupled, only used if the CONFigure:WAVeform:TRIGger:SOURce parameter is not set to NONE

Description:

The parameter selects the slope for the waveform trigger function.

The set command parameter is in <NR1> format. The value selects one of the possible modules as follows:

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Value	Meaning
0	Falling
1	Rising

The query will return the selected slope in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"RISING"	Rising
"FALLING"	Falling

COMMAND:	**:CONFigure:WAVeform:TRIGger:LEVel**
PARAMETERS:	<trigger level>
RESULT DATA:	<trigger level>
DEFAULT VALUE:	**0**
NOTES:	Coupled, only used if the CONFigure:WAVeform:TRIGger:SOURce parameter is not set to NONE

Description:

The parameter sets the trigger level for the waveform trigger function.

The unit for parameters and response data is volt or ampere depending on the :CONFigure:WAVeform:TRIGger:SOURce setting.

The set command parameter is in <NRf> format. The value should be in the following ranges:

SOURCE	RANGE
U-Sample	±0.00 - 2000.00 volt
U-Period-RMS	0.00 - 1300.00 volt
I-Sample	±0.00 - 300.00 ampere
I-Period-RMS	0.00 - 200.00 ampere

The query will return the selected level in the <NR2> format.

COMMAND:	**:CONFigure:WAVeform:TRIGger:POSition**
PARAMETERS:	<trigger position>
RESULT DATA:	<trigger position>
DEFAULT VALUE:	**50**
NOTES:	Coupled, only used if the CONFigure:WAVeform:TRIGger:SOURce parameter is not set to NONE

Description:

The parameter sets the trigger position for the waveform trigger function.

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The set command parameter is in <NR1> format. The value selects one of the possible modules as follows:

Value	Meaning
0	0%
1	25%
2	50%
3	75%
4	100%

The query returns the selected trigger condition in the <STRING RESPONSE DATA> format as follows:

Response
"0%"
"25%"
"50%"
"75%"
"100%"

COMMAND:	**:CONFigure:WAVeform:PERiods**
PARAMETERS:	<waveform periods>
RESULT DATA:	<waveform periods>
DEFAULT VALUE:	**TWO_PERIODS**
NOTES:	

Description:
The parameter selects the number of periods to be aquired.

The set command parameter is in <NR1> format. It selects as follows:

Value	Meaning
0	1 period
1	2 periods
2	4 periods
3	8 periods
4	16 periods

The query will return the selected number of periods in the <STRING RESPONSE DATA> format as follows:

Response
"ONE_PERIOD"
"TWO_PERIODS"
"FOUR_PERIODS"
"EIGHT_PERIODS"
"SIXTEEN_PERIODS"

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COMMAND: **:CONFigure:WAVeform:TEST**
PARAMETERS: <waveform test>
RESULT DATA: <waveform test>
DEFAULT VALUE: **STANDARD**
NOTES:

Description:

The parameter selects if the waveform should be tested against the IEC1000-3-2 limit.

The set command parameter is in <NR1> format. The value selects one of the possible modules as follows:

Value	Meaning
0	No test
1	IEC1000-3-2 test
2	User defined limit

The query will return the selected test in the <STRING RESPONSE DATA> format as follows:

Response	Meaning
"NO_TEST"	No test
"STANDARD"	IEC 1000-3-2 test
"USER_DEFINED"	User defined limits

IMPORTANT!
The setting of this parameter will affect the limit parameter of the waveform class D test function which is accessed with the :CONFigure:WAVeform:LIMit command.. Please select the waveform test type before trying to access the limit parameter.

Selecting NO TEST or STANDARD configures the flicker meter according to a preset standard value. In this mode the limit can only queried, setting will generate an error. Selecting USER_DEFINED will make the limit parameter fully programmable.

COMMAND: **:CONFigure:WAVeform:LIMit**
PARAMETERS: <limit>
RESULT DATA: <limit>
DEFAULT VALUE: **95**
NOTES: See note at the :CONFigure:WAVeform:TEST command.

Description:

The parameter sets the IEC 1000-3-2 class D test limit.

The unit for parameter and response data is percent.

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The set command parameter is in <NRf> format. The value should be in the 10 - 100 range.

The query will return the selected limit in the <NR1> format.

COMMAND: **:CONFigure:WAVeform:FSOurce**
PARAMETERS: <frequency source>
RESULT DATA: <frequency source>
DEFAULT VALUE: **VOLTAGE**
NOTES:

Description:

The parameter sets the measurements frequency source.

The set command parameter is in <NR1> format. The value selects one of the possible modes as follows:

Value	Meaning
0	Voltage
1	Current

The query returns the selected source in the <STRING RESPONSE DATA> format as follows:

Response
"VOLTAGE"
"CURRENT"

COMMAND:	**:FETCh:MULTimeter:VMETer\<n\>?**
PARAMETERS:	\<resolution\>
RESULT DATA:	\<Mx result\> [, \<M2 result\>, \<M3 result\>]
DEFAULT VALUE:	-
NOTES:	Query Only

Description:

The query places the result of the latest virtual meter measurement in the output queue for reading. The numerical suffix \<n\> may be used to select virtual meter 1 - 6.

If the instrument is working in three phase mode and the **CONFigure:MULTimeter:VME-Ter\<n\>:RTYPe** parameter is set to **SPLIT_INTO_3**, the message will contain three results, one for each input module, separated by commas.

The optional parameter \<resolution\> may be used to specify a result resolution. The \<resolution\> parameter is in the \<NRf\> format. It specifies the resolution in the same units as the measurement function, NOT in number of digits. If no \<resolution\> is specified, maximum resolution is used.
The result is in the \<NRf\> format. The result unit depends on which measurement function that is used in the selected virtual meter. The following table shows the unit of each measurement function:

Function	Unit
Current	A (ampere)
Crestfactor - Current	Unitless
Voltage	V (volt)
Crestfactor - Voltage	Untiless
Frequency I	Hz (herz)
Frequency U	Hz (herz)
Active power	W (watt)
Reactive power	var (volt-ampere-reactive)
Apparent power	VA (volt-ampere)
Power factor	Unitless
Phase angle	Degree
Active energy	Wh (watt-hour)
Reactive energy	varh (volt-ampere-reactive-hour)
Apparent energy	VAh (volt-ampere-hour)
Charge	Ah (ampere-hour)
THD I	Percent (%)
THD U	Percent (%)

No unit suffix is used, the result is always in its fundamental unit. The special \<numeric_value\> NAN (not-a-number) will be used if the result is considered unusable. Unusable results may be a result of conditions like overrrange. The QUEStionable status structure will also indicate when the result quality is questionable.

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If, the multimeter is not the currently active measurement function as selected by the SENSe:FUNCtion command, the multimeter has not executed at least one measurement or an unused virtual meter is queried, the result will be the special <numeric_value> NAN (not-a-number) value.

COMMAND:	**:FETCh:HARMonics<n>:CURRent?**
COMMAND:	**:FETCh:HARMonics<n>:VOLTage?**
COMMAND:	**:FETCh:HARMonics<n>:FREQuency?**
COMMAND:	**:FETCh:HARMonics<n>:POWer?**
COMMAND:	**:FETCh:HARMonics<n>:THDistorsion?**
PARAMETERS:	<resolution>
RESULT DATA:	<measurement result>
DEFAULT VALUE:	-
NOTES:	Query Only

Description:

The query places the current result of the latest harmonics measurement in the output queue for reading.The numerical suffix <n> may be used to select source module 1 - 3. The optional parameter <resolution> may be used to specify a result resolution. The <resolution> parameter is in the <NRf> format. It specifies the resolution in the same units as the measurement function, NOT in number of digits. If no <resolution> is specified, maximum resolution is used.

The result is in the <NRf> format. The result unit is as follows:

Result	Unit
Current	Ampere
Voltage	Volt
Frequency	Herz
Power	Watt
THD	Percent

No unit suffix is used, the result is always in its fundamental unit. The special <numeric_value> NAN (not-a-number) will be used if the result is considered unusable. Unusable results may be a result of conditions like overrrange. The QUEStionable status structure will also indicate when the result quality is questionable.

If the harmonics function is not the currently active measurement function as selected by the SENSe:FUNCtion command or if no measurement has been done, the result will be the special <numeric_value> NAN (not-a-number) value.

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COMMAND:	**:FETCh:HARMonics\<n>:LIMit?**
PARAMETERS:	-
RESULT DATA:	\<limit test result>
DEFAULT VALUE:	-
NOTES:	Query Only

Description:

The query places the result of the latest harmonics measurements test against selected standard in the output queue for reading. The numerical suffix \<n> may be used to select source module 1 - 3.

The result is in the \<CHARACTER RESPONSE DATA> format as follows:

Message	Meaning
FAIL	The limit test failed
PASS	The limit test passed

COMMAND:	**:FETCh:HARMonics\<n>:SPECtrum:LEVel?**
PARAMETERS:	*\<resolution>*
RESULT DATA:	\<harmonic 1 level>,\<harmonic 2 level>, ... ,\<harmonic 40 level>
DEFAULT VALUE:	-
NOTES:	Query Only

Description:

The query places the current result of the latest harmonics measurement in the output queue for reading.The numerical suffix \<n> may be used to select source module 1 - 3. The optional parameter \<resolution> may be used to specify a result resolution. The \<resolution> parameter is in the \<NRf> format. It specifies the resolution in the same units as the measurement function, NOT in number of digits. If no \<resolution> is specified, maximum resolution is used.
The response message consists of the individual harmonics levels in the \<NRf> format separated by commas. The result unit is either volt or ampere depending on which signal used as data source.

No unit suffix is used, the results are always in its fundamental unit. The special \<numeric_value> NAN (not-a-number) will be used if the result is considered unusable. Unusable results may be a result of conditions like overrange. The QUEStionable status structure will also indicate when the result quality is questionable.

If the harmonics function is not the currently active measurement function as selected by the SENSe:FUNCtion command or if no measurement has been done, the results will be the special \<numeric_value> NAN (not-a-number) value.

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COMMAND:	**:FETCh:HARMonics<n>:SPECtrum:LIMit?**
PARAMETERS:	*<resolution>*
RESULT DATA:	<harmonic 1 limit>,<harmonic 2 limit>, ... ,<harmonic 40 limit>
DEFAULT VALUE:	-
NOTES:	Query Only

Description:

The query places the currently selected test limits for the harmonics analyzer in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3. The optional parameter <resolution> may be used to specify a result resolution. The <resolution> parameter is in the <NRf> format. It specifies the resolution in the same units as the measurement function, NOT in number of digits. If no <resolution> is specified, maximum resolution is used.

The response message consists of the individual harmonics limits in the <NRf> format separated by commas. The result unit is either volt or ampere depending on which signal used as data source.

No unit suffix is used, the results are always in its fundamental unit.

If the harmonics function is not the currently active measurement function as selected by the SENSe:FUNCtion command or if no measurement has been done, the results will be the special <numeric_value> NAN (not-a-number) value.

1.03

COMMAND: **:FETCh:FLICker<n>:EVALuation:STERm:PST?**
PARAMETERS: -
RESULT DATA: <short term flicker severity>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the short term flicker severity result of the latest short term measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <NR2> format. The result has no unit.

COMMAND: **:FETCh:FLICker<n>:EVALuation:STERm:DMAX?**
PARAMETERS: -
RESULT DATA: <dmax result>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the short term voltage change steady state 'dmax' result of the latest short term flicker measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <NR2> format. The result unit is percent.

COMMAND: **:FETCh:FLICker<n>:EVALuation:STERm:DC?**
PARAMETERS: -
RESULT DATA: <dc result>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the short term voltage change steady state 'dc' result of the latest short term flicker measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <NR2> format. The result unit is percent.

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COMMAND: **:FETCh:FLICker<n>:EVALuation:STERm:T?**
PARAMETERS: *-*
RESULT DATA: <t result>
DEFAULT VALUE: *-*
NOTES: Query Only

Description:

The query places the short term voltage change steady state 't' result of the latest short term flicker measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <NR2> format. The result unit is second.

COMMAND: **:FETCh:FLICker<n>:EVALuation:LTERm:PST?**
PARAMETERS: *-*
RESULT DATA: <worst short term flicker severity>
DEFAULT VALUE: *-*
NOTES: Query Only

Description:

The query places the worst short term flicker severity result of the latest long term flicker measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <NR2> format. The result has no unit.

COMMAND: **:FETCh:FLICker<n>:EVALuation:LTERm:PLT?**
PARAMETERS: *-*
RESULT DATA: <worst short term flicker severity>
DEFAULT VALUE: *-*
NOTES: Query Only

Description:

The query places the long term flicker severity result of the latest flicker measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <NR2> format. The result has no unit.

COMMAND: **:FETCh:FLICker<n>:EVALuation:LTERm:DMAX?**
PARAMETERS: -
RESULT DATA: <dmax result>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the long term voltage change steady state 'dmax' result of the latest long term flicker measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <NR2> format. The result unit is percent.

COMMAND: **:FETCh:FLICker<n>:EVALuation:LTERm:DC?**
PARAMETERS: -
RESULT DATA: <dc result>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the long term voltage change steady state 'dc' result of the latest long term flicker measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <NR2> format. The result unit is percent.

COMMAND: **:FETCh:FLICker<n>:EVALuation:LTERm:T?**
PARAMETERS: -
RESULT DATA: <t result>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the long term voltage change steady state 't' result of the latest long term flicker measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <NR2> format. The result unit is second.

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COMMAND: **:FETCh:FLICker<n>:EVALuation:LTERm:TRESult?**
PARAMETERS: -
RESULT DATA: <test result>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the result of the latest long term flicker measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The response message is in the <STRING RESPONSE DATA> format as follows:

Message
"PASSED"
"FAILED"

COMMAND: **:FETCh:FLICker<n>:MEASurement:VDRop?**
PARAMETERS: -
RESULT DATA: <relative voltage drop>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the average relative voltage drop 'd(t)' in the output queue for reading.
The numerical suffix <n> may be used to select source module 1 - 3.
This result will only be updated *during* a flicker measurement.

The response message is in the <NR2> format. The result unit is percent.

COMMAND: **:FETCh:FLICker<n>:MEASurement:VFLuctuation?**
PARAMETERS: -
RESULT DATA: <relative voltage fluctuation>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the average relative voltage fluctuation 'dpp' in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.
This result will only be updated *during* a flicker measurement.

The response message is in the <NR2> format. The result unit is percent.

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COMMAND:	**:FETCh:FLICker\<n\>:MEASurement:SSLevel?**
PARAMETERS:	*-*
RESULT DATA:	\<dt at a steady state level\>
DEFAULT VALUE:	*-*
NOTES:	Query Only

Description:

The query places the result of the steady state check in the output queue for reading. The numerical suffix \<n\> may be used to select source module 1 - 3.
This result will only be updated *during* a flicker measurement.

The response message is in the \<STRING RESPONSE DATA\> format as follows:

       <u>Message</u>
        "YES"
        "NO"

COMMAND:	**:FETCh:FLICker\<n\>:MEASurement:DMAX?**
PARAMETERS:	*-*
RESULT DATA:	\<last transition swing\>
DEFAULT VALUE:	*-*
NOTES:	Query Only

Description:

The query places the last transition swing 'dmax' in the output queue for reading. The numerical suffix \<n\> may be used to select source module 1 - 3.
This result will only be updated *during* a flicker measurement.

The response message is in the \<NR2\> format. The result unit is percent.

COMMAND:	**:FETCh:FLICker\<n\>:MEASurement:DC?**
PARAMETERS:	*-*
RESULT DATA:	\<last relative steady state level change\>
DEFAULT VALUE:	*-*
NOTES:	Query Only

Description:

The query places the last relative steady state level change 'dc' in the output queue for reading. The numerical suffix \<n\> may be used to select source module 1 - 3.
This result will only be updated *during* a flicker measurement.

The response message is in the \<NR2\> format. The result unit is percent.

1.03

COMMAND: **:FETCh:FLICker\<n>:MEASurement:PFLicker?**
PARAMETERS: -
RESULT DATA: \<normalized peak flicker>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the normalized peak flicker 'Pp' in the output queue for reading. The numerical suffix \<n> may be used to select source module 1 - 3.

This result will only be updated *during* a flicker measurement.

The response message is in the \<NR2> format. The result has no unit.

COMMAND: **:FETCh:FLICker\<n>:MEASurement:VOLTage?**
PARAMETERS: -
RESULT DATA: \<voltage>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the current voltage level in the output queue for reading. The numerical suffix \<n> may be used to select source module 1 - 3.

This result will only be updated *during* a flicker measurement.

The response message is in the \<NR2> format. The result unit is Volt.

COMMAND: **:FETCh:FLICker\<n>:MEASurement:CURRent?**
PARAMETERS: -
RESULT DATA: \<currrent>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the current current level in the output queue for reading. The numerical suffix \<n> may be used to select source module 1 - 3.

This result will only be updated *during* a flicker measurement.

The response message is in the \<NR2> format. The result unit is Ampere.

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COMMAND: **:FETCh:FLICker\<n\>:MEASurement:FREQuency?**
PARAMETERS: -
RESULT DATA: \<frequency\>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the current signal frequency in the output queue for reading. The numerical suffix \<n\> may be used to select source module 1 - 3.

This result will only be updated *during* a flicker measurement.

The response message is in the \<NR2\> format. The result unit is Herz.

COMMAND: **:FETCh:FLICker\<n\>:MEASurement:PFACtor?**
PARAMETERS: -
RESULT DATA: \<power factor\>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the current power factor in the output queue for reading. The numerical suffix \<n\> may be used to select source module 1 - 3.

This result will only be updated *during* a flicker measurement.

The response message is in the \<NR2\> format. The result has no unit.

COMMAND: **:FETCh:WAVeform\<n\>:VOLTage:LEVel?**
PARAMETERS: \<resolution\>
RESULT DATA: \<voltage level\>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the voltage result of the latest waveform measurement in the output queue for reading. The numerical suffix \<n\> may be used to select source module 1 - 3. The optional parameter \<resolution\> may be used to specify a result resolution. The \<resolution\> parameter is in the \<NRf\> format. It specifies the resolution in the same units as the measurement function, NOT in number of digits. If no \<resolution\> is specified, maximum resolution is used.

The response message is in the \<NRf\> format. The result unit is volt.

No unit suffix is used, the result is always in its fundamental unit. The special \<numeric_value\> NAN (not-a-number) will be used if the result is considered unusable. Unusable results may be a result of conditions like overrange.

If waveform is not the currently active measurement function as selected by the SENSe:FUNCtion command or waveform has not executed at least one measurement, the result will be the special \<numeric_value\> NAN (not-a-number) value.

COMMAND: **:FETCh:WAVeform\<n\>:VOLTage:PLOT?**
PARAMETERS: \<resolution\>
RESULT DATA: \<value 1\> , ... , \<value 480\>
DEFAULT VALUE: -
NOTES: Query Only

Description:

The query places the waveform plot result of the latest measurement in the output queue for reading. The numerical suffix \<n\> may be used to select source module 1 - 3. The optional parameter \<resolution\> may be used to specify a result resolution. The \<resolution\> parameter is in the \<NRf\> format. It specifies the resolution in the same units as the measurement function, NOT in number of digits. If no \<resolution\> is specified, maximum resolution is used.

The response message consists of the individual levels in the \<NRf\> format separated by commas. The result unit is volt.

No unit suffix is used, the result is always in its fundamental unit. The special \<numeric_value\> NAN (not-a-number) will be used if the result is considered unusable. Unusable results may be a result of conditions like overrange.

1.03

If waveform is not the currently active measurement function as selected by the SENSe:FUNCtion command or the recorder has not executed at least one measurement, the result will be the special <numeric_value> NAN (not-a-number) value.

COMMAND:	**:FETCh:WAVeform\<n>:CURRent:LEVel?**
PARAMETERS:	\<resolution>
RESULT DATA:	\<current level>
DEFAULT VALUE:	-
NOTES:	Query Only

Description:

The query places the current result of the latest waveform measurement in the output queue for reading. The numerical suffix \<n> may be used to select source module 1 - 3. The optional parameter \<resolution> may be used to specify a result resolution. The \<resolution> parameter is in the \<NRf> format. It specifies the resolution in the same units as the measurement function, NOT in number of digits. If no \<resolution> is specified, maximum resolution is used.

The response message is in the \<NRf> format. The result unit is ampere.

No unit suffix is used, the result is always in its fundamental unit. The special \<numeric_value> NAN (not-a-number) will be used if the result is considered unusable. Unusable results may be a result of conditions like overrange.

If waveform is not the currently active measurement function as selected by the SENSe:FUNCtion command or waveform has not executed at least one measurement, the result will be the special \<numeric_value> NAN (not-a-number) value.

COMMAND:	**:FETCh:WAVeform\<n>:CURRent:PLOT?**
PARAMETERS:	\<resolution>
RESULT DATA:	\<value 1> , ... , \<value 480>
DEFAULT VALUE:	-
NOTES:	Query Only

Description:

The query places the waveform plot result of the latest measurement in the output queue for reading. The numerical suffix \<n> may be used to select source module 1 - 3. The optional parameter \<resolution> may be used to specify a result resolution. The \<resolution> parameter is in the \<NRf> format. It specifies the resolution in the same units as the measurement function, NOT in number of digits. If no \<resolution> is specified, maximum resolution is used.

The response message consists of the individual levels in the \<NRf> format separated by commas. The result unit is ampere.

No unit suffix is used, the result is always in its fundamental unit. The special <numeric_value> NAN (not-a-number) will be used if the result is considered unusable. Unusable results may be a result of conditions like overrange.

If waveform is not the currently active measurement function as selected by the SENSe:FUNCtion command or the recorder has not executed at least one measurement, the result will be the special <numeric_value> NAN (not-a-number) value.

COMMAND:	**:FETCh:WAVeform<n>:CURRent:ENVelope?**
PARAMETERS:	-
RESULT DATA:	<limit test result>
DEFAULT VALUE:	-
NOTES:	Query Only

Description:

The query places the result of the latest waveform measurement current envelope test in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3.

The result is in the <CHARACTER RESPONSE DATA> format as follows:

Message	Meaning
FAILED	The limit test failed
PASSED	The limit test passed

WARNING
If the instrument is programmed to skip the test, the query result is undefined and the Command Warning bit 13 in the corresponding questionable status register will be set.

COMMAND:	**:FETCh:WAVeform<n>:FREQuency?**
PARAMETERS:	<resolution>
RESULT DATA:	<frequency>
DEFAULT VALUE:	-
NOTES:	Query Only

Description:

The query places the frequency result of the latest waveorm measurement in the output queue for reading. The numerical suffix <n> may be used to select source module 1 - 3. The optional parameter <resolution> may be used to specify a result resolution. The <resolution> parameter is in the <NRf> format. It specifies the resolution in the same units as the measurement function, NOT in number of digits. If no <resolution> is specified, maximum resolution is used.

The response message is in the <NRf> format. The result unit is herz.

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No unit suffix is used, the result is always in its fundamental unit. The special <numeric_value> NAN (not-a-number) will be used if the result is considered unusable. Unusable results may be a result of conditions like overrange.

If waveform is not the currently active measurement function as selected by the SENSe:FUNCtion command or waveform has not executed at least one measurement, the result will be the special <numeric_value> NAN (not-a-number) value.

COMMAND: **:SENSe:FUNCtion:[ON]**
PARAMETERS: <measurement function>
RESULT DATA: <current active measurement function>
DEFAULT VALUE: **""**
NOTES: **SCPI COMPLIANT**

Description:

The set command sets the selected measurement function as active. The active function is the function that will be executed when a valid trigger condition occurs. The selection works as a one-of-x selector switch, turning one function ON will turn all other functions OFF. The parameter is in the <STRING PROGRAM DATA> format as follows:

Parameter	Function
"NONE"	No function selected
"MULTimeter"	The multimeter function
"HARMonics"	The steady state harmonics function
"FLICker"	The flicker function
"WAVeform"	The waveform function
"FHARMonics"	The fluctuating harmonics function

The query places the currently active measurement function in the <STRING RESPONSE FORMAT> format (see table above) in the output queue for reading. If no function is active, a null string is returned.

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3.1.4 Trigger Management

COMMAND: **:TRIGger:[SEQuence]:SOURce**
PARAMETERS: <trigger source>
RESULT DATA: <trigger source>
DEFAULT VALUE: **"IMM"**
NOTES: **SCPI COMPLIANT**

Description:

The set command sets the trigger source. Selecting BUS will cause the trigger to wait for a bus command such as IEEE 488.1 GET command or IEEE 488.2 *TRG command. Selecting IMMediate will cause the trigger to execute immediately at the reception of the ':INITiate:IMMediate' commands. The parameter is in the <CHARACTER PROGRAM DATA> format as follows:

Parameter	Source
BUS	The selected interface (IEEE 488.1 of RS-232)
IMMediate	Immediate, no waiting for an event

The query places the currently selected trigger source in the <STRING RESPONSE DATA> format in the output queue for reading:

Response	Source
"BUS"	The selected interface
"IMM"	Immediate trigger

COMMAND: **:TRIGger:[SEQuence]:DELay**
PARAMETERS: <trigger delay>
RESULT DATA: <trigger delay>
DEFAULT VALUE: **0**
NOTES: **SCPI COMPLIANT**

Description:

The set command sets the trigger delay. The parameter is in the <NRf> format. The parameter unit is seconds. Delay times between 0 and 3600 seconds may be used.

The query places the current trigger delay time in the <NRf> format in the output queue for reading.

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COMMAND: **:INITiate:[IMMediate]:[ALL]**
PARAMETERS: -
RESULT DATA: -
DEFAULT VALUE:
NOTES: No Query, Overlapped, **SCPI COMPLIANT**

Description:

The command sets the trigger function to its active state. The selected function will be executed once the trigger condition(s) have been satisfied.

COMMAND: **:INITiate:CONTinuous**
PARAMETERS: <Boolean>
RESULT DATA: <Boolean>
DEFAULT VALUE: **OFF**
NOTES: No Query, **SCPI COMPLIANT**

Description:

The command sets the triggers function continuously active. The selected function will be continuously executed once the trigger conditions have been satisfied. The ABORt command is used to exit this state.

The set parameter <Boolean> is in the <CHARACTER PROGRAM DATA> format as follows:

Parameter	Meaning
OFF	Trigger is *not* continuous
ON	Trigger *is* continuous

The query will produce a result message in the <STRING RESPONSE DATA> format:

Response
"OFF"
"ON"

WARNING
Turning this function ON will set the Operation-Pending flag continuously TRUE making the synchronization common commands useless. See section 5.6

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COMMANDS REFERENCE   **3 - 74**

COMMAND:	**:ABORt**
PARAMETERS:	-
RESULT DATA:	-
DEFAULT VALUE:	-
NOTES:	No Query, **SCPI COMPLIANT**

Description:

The command sets the trigger function to idle and aborts all trigger initiated instrument functions. As a result of this, the No-Operation Pending flag will become TRUE.

Command: *SRE <enable value>

This command sets the service request generation mask for the 8 bit IEEE 488.2 status register. <enable value > must be in <NRf> format and is rounded to an integer. It is then checked for the limits 0-255 and if within limits, the value is loaded into the Service Request Enable Register (SRE). If an invalid value is received, the Execution Error bit 4 in the Standard Event Status Register is set . The contents of the SRE register remains unchanged. For further information, see **4.1 - STATUS REPORTING**.

Command: *SRE?

This query reads the contents of the 8 bit IEEE 488.2 Service Request Enable Register (SRE) and places the result in the output queue in the <NR1> format for reading.

For further information, see **4.1 - STATUS REPORTING**.

Command: *OPC

This command will set the Operation Complete status bit, bit 0 in the Standard Event Status Register when the No-Operation-Pending flag is set TRUE. A service request may be generated if the corresponding bit in the Standard Event Status Enable Register is set.

For further information, see **4.1 - STATUS REPORTING** and **5.1 - COMMUNICATING WITH THE ANALYZER 6630r 300**.

Command: ***OPC?**

This command will place the ASCII character '1' in the output queue. As a consequence of this, the MAV bit in the Status Byte will become TRUE.

NOTE:
Required by SCPI 1994 to be implemented as a sequential command thus limiting its usefulness.

For further information, see **4.1 - STATUS REPORTING** and **5.1 - COMMUNICATING WITH THE ANALYZER 6630r**.

Command: ***WAI**

Waits until the no-operation-flag-pending is TRUE, in effect holds off all further remote commands. See **5.1 - COMMUNICATING WITH THE ANALYZER 6630r** for further information.

Command: ***TRG**

The trigger command is identical to the IEEE 488.1 Group Execute Trigger (GET) interface message and has exactly the same effect as a GET when received.

3.1.5 Adjustment Functions

COMMAND:	**:ADJustment:PASSword**
PARAMETERS:	<password>
RESULT DATA:	-
DEFAULT VALUE:	-
NOTES:	No Query

Description:

This command 'unlocks' all the locked instrument adjustment commands. Sending the wrong password will cause an error.

COMMAND:	**:ADJustment:FREQuency**
PARAMETERS:	<frequency compensation>
RESULT DATA:	<frequency compensation>
DEFAULT VALUE:	**-**
NOTES:	Requires unlock

Description:

The set command sets the system oscillator frequency compensation factor for the main board. The parameter is in the <NRf> format. The parameter must be in the 0.9 - 1.1 range.

The query places the current factor in the <NRf> format in the output queue for reading.

COMMAND:	**:ADJustment:MODule<n>:SAVE**
PARAMETERS:	-
RESULT DATA:	-
DEFAULT VALUE:	**-**
NOTES:	No Query, Requires unlock

Description:

The command saves the adjustment data to its non-volatile EEPROM in the selected module.

COMMAND: **:ADJustment:MODule\<n\>:VOLTage:FACTor**
PARAMETERS: \<voltage factor\>
RESULT DATA: \<voltage factor\>
DEFAULT VALUE: **-**
NOTES: Requires unlock

Description:

The set command sets the voltage adjustment factor for the selected module and the *currently selected* range. If the currently selected range is 'Auto', an errror will be generated. The parameter is in the \<NRf\> format. The parameter has no unit. The parameter must be in the 0.9 - 1.1 range.

The query places the current factor in the \<NRf\> format in the output queue for reading.

COMMAND: **:ADJustment:MODule\<n\>:VOLTage:OFFSet**
PARAMETERS: \<voltage offset\>
RESULT DATA: \<voltage offset\>
DEFAULT VALUE: **-**
NOTES: Requires unlock

Description:

The set command sets the voltage adjustment offset for the selected module and the *currently selected* range. If the currently selected range is 'Auto', an errror will be generated.The parameter is in the \<NRf\> format. The parameter unit is Volt. The parameter must be ±10% of range.

The query places the current factor in the \<NRf\> format in the output queue for reading.

COMMAND: **:ADJustment:MODule\<n\>:VOLTage:NOISe**
PARAMETERS: \<noise compensation\>
RESULT DATA: \<noise compensation\>
DEFAULT VALUE: **-**
NOTES:

Description:

The set command sets the voltage noise compensation for the selected module and the *currently selected* range. If the currently selected range is 'Auto', an errror will be generated. The parameter is in the \<NRf\> format. The parameter unit is xx. The parameter must be \< 2% of range.

1.03 The query places the current factor in the \<NRf\> format in the output queue for reading.

COMMANDS REFERENCE   **3 - 78**

COMMAND: **:ADJustment:MODule\<n\>:VOLTage:ACDCrelative**
PARAMETERS: \<DC correction factor\>
RESULT DATA: \<DC correction factor\>
DEFAULT VALUE: **-**
NOTES: Requires unlock

Description:

The set command sets the DC relative AC measurement correction factor for the selected module. The parameter is in the \<NRf\> format. The parameter must be between 1.000 and 1.002.

The query places the current factor in the \<NRf\> format in the output queue for reading.

COMMAND: **:ADJustment:MODule\<n\>:CURRent:FACTor**
PARAMETERS: \<current factor\>
RESULT DATA: \<current factor\>
DEFAULT VALUE: **-**
NOTES: Requires unlock

Description:

The set command sets the current adjustment factor for the selected module and the *currently selected* range. If the currently selected range is 'Auto', an errror will be generated. The parameter is in the \<NRf\> format. The parameter has no unit. The parameter must be in the 0.9 - 1.1 range.

The query places the current factor in the \<NRf\> format in the output queue for reading.

COMMAND: **:ADJustment:MODule\<n\>:CURRent:OFFSet**
PARAMETERS: \<current offset\>
RESULT DATA: \<current offset\>
DEFAULT VALUE: **-**
NOTES: Requires unlock

Description:

The set command sets the current adjustment offset for the selected module and the *currently selected* range. If the currently selected range is 'Auto', an errror will be generated. The parameter is in the \<NRf\> format. The parameter unit is Volt. The parameter must be ±10% of range.

The query places the current factor in the \<NRf\> format in the output queue for reading.

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COMMAND:	**:ADJustment:MODule<n>:CURRent:NOISe**
PARAMETERS:	<noise compensation>
RESULT DATA:	<noise compensation>
DEFAULT VALUE:	**-**
NOTES:	

Description:

The set command sets the current noise compensation for the selected module and the *currently selected* range. If the currently selected range is 'Auto', an errror will be generated. The parameter is in the <NRf> format. The parameter unit is xx. The parameter must be <2% of range.

The query places the current factor in the <NRf> format in the output queue for reading.

COMMAND:	**:ADJustment:MODule<n>:CURRent:ACDCrelative**
PARAMETERS:	<DC correction factor>
RESULT DATA:	<DC correction factor>
DEFAULT VALUE:	**-**
NOTES:	Requires unlock

Description:

The set command sets the DC relative AC measurement correction factor for the selected module. The parameter is in the <NRf> format. The parameter must be between 1.000 and 1.002.

The query places the current factor in the <NRf> format in the output queue for reading.

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Section 4

STATUS REPORTING

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STATUS REPORTING
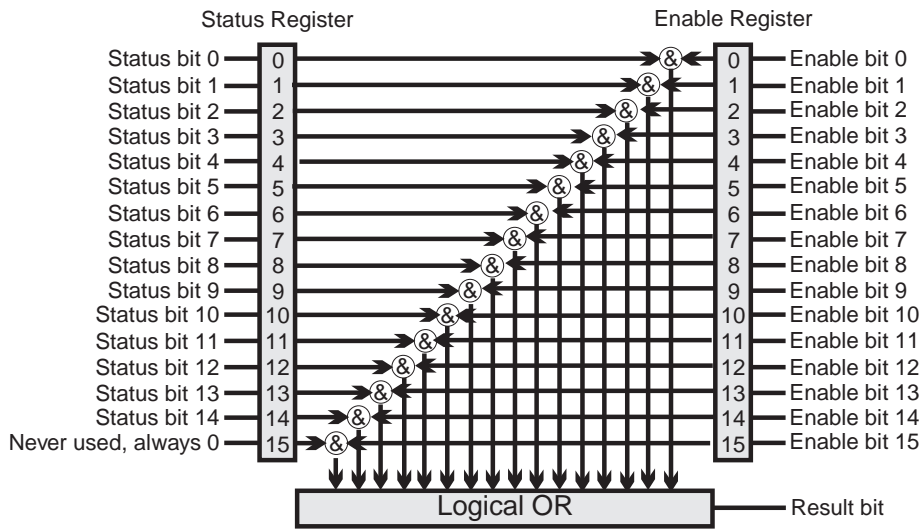
4.1 STATUS REPORTING

The ANALYZER 6630r is in many cases quite a complex instrument to remote control. Several of the measurement functions have multiple result 'outputs', in effect forming virtual instruments inside a single function. The 'Multimeter' function is a good example, its 6 'Virtual Meters' really makes it 6 multimeters in one package.

Reporting status from these varying measurement function sources should be uniform for all functions to keep the complexity to a minimum. The ANALYZER 6630r uses the SCPI Logical Instruments status structure as described in SCPI 1994 -Volume 1, section 9.5.

By using this method, the status structure will always be in a known format as opposed to having a separate structure for each measurement function. Some of the measurement functions does not have logical instruments such as 'Harmonics' thus reducing the complexity of the status structure.

### 4.1.1 IEEE 488.2 and SCPI status structure

Figure 4-1 shows the construction of a status register:

Figure 4-1
Status register construction

A status registers contains bits which report implementation dependent events. A status bit remains cleared until the associated event becomes TRUE when it is set. It will then remain set until the status register is either *read* or *cleared* with the *CLS command, forming so called 'sticky' status bits.

All status registers have a corresponding enable register which is used to enable one or more status bits to be reported in the result bit. The result bit state is determined by AND-
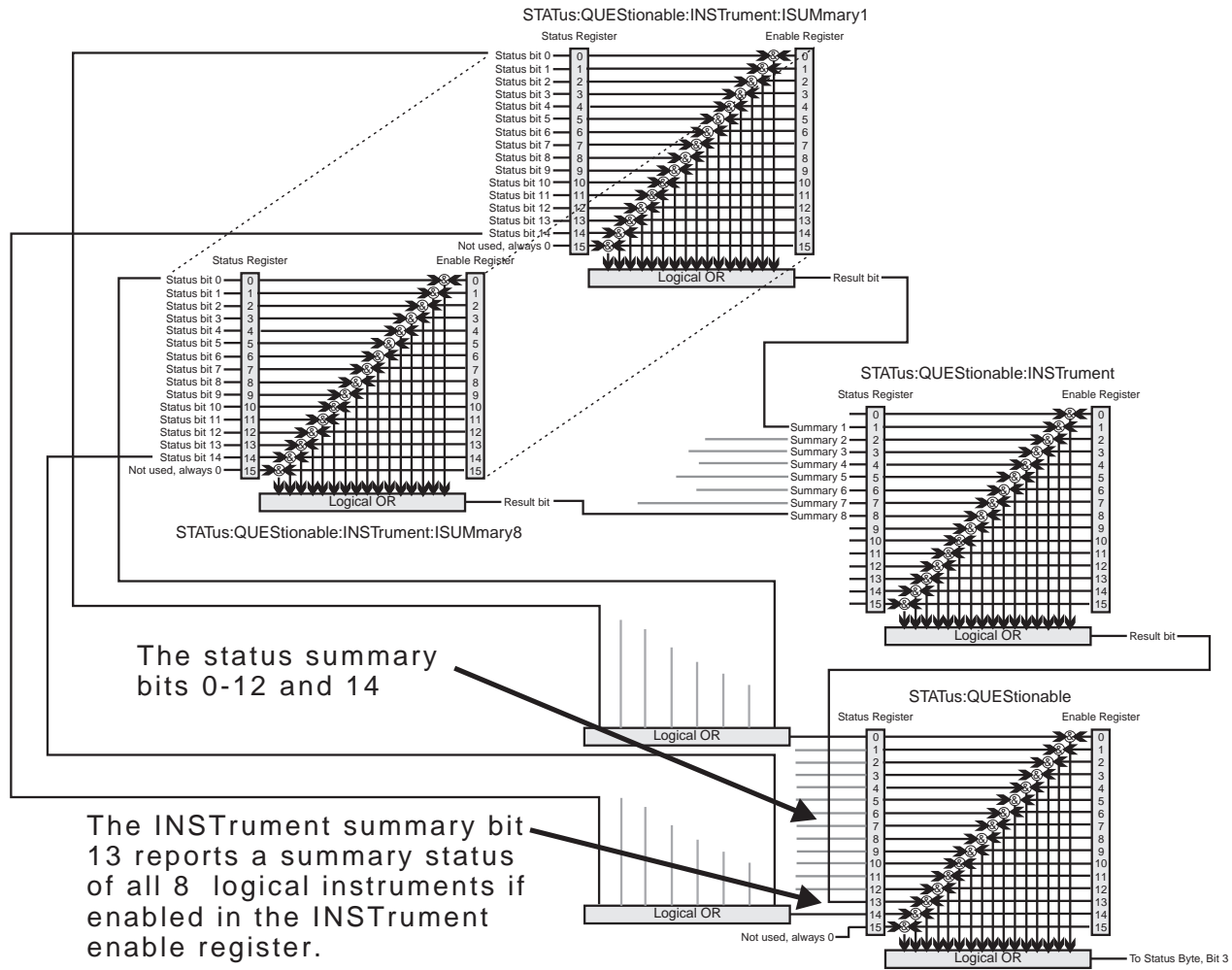
Figure 4-2
The SCPI status register structure

ing the status register with the enable register and then ORing the result together to the result bit. The result bit is connected to other status registers forming a complete status structure. The enable register is *not* cleared by reading, power-on will clear it but otherwise it is up to the user to set its contents.

SCPI requires the implementation of two status registers, the 'QUEStionable' status register which is used to report events or results of 'questionable' quality and the 'OPERation' status register which is used to report instrument actions. Since the ANALYZER 6630r may have multiple result outputs in a single function, an extended status structure is needed.

The SCPI 'Multiple Logical Instrument' status structure is used to expand the status system. A total of 8 'QUEStionable' and 'OPERation' registers are available forming the structure shown in figure 4-2.

NOTE:
The structure shown in figure 4-2 and explanations also apply to the 'OPERation' register's. The only difference is that the structure result bit from STATus:OPERation goes to status byte bit 7.

The 8 ISUMmary registers is the status source in the structure. The INSTrument register is used to collect the 8 result bits into one which is then reported in the INSTrument summary bit 13 of the STATus:QUEStionable register.

The rest of the bits of the STATus:QUEStionable register are summary bits of the 8 ISUMmary registers. Depending on the bit assignments in the ISUMmary registers, they may be used to report cases such as 'if a voltage measurement in *any* of the logical instruments is questionable, bit 0 in STATus:QUEStionable will be set.

The SCPI standard bit definition for the QUEStionable register is as follows:

Bit 0:   The voltage result is of questionable quality
Bit 1:   The current result is of questionable quality
Bit 2:   The time result is of questionable quality
Bit 3:   The power result is of questionable quality
Bit 4:   The temperature result is of questionable quality
Bit 5:   The frequency result is of questionable quality
Bit 6:   The phase result is of questionable quality
Bit 7:   The modulation result is of questionable quality
Bit 8:   The calibration is of questionable quality.
Bit 9:   Available to the designer
Bit 10:   Available to the designer
Bit 11:   Available to the designer
Bit 12:   Available to the designer
Bit 13:   Instrument summary
Bit 14:   Command warning
Bit 15:   Never used, always 0

The SCPI standard bit definition for the OPERation register is as follows:

Bit 0:   Calibrating - The instrument is currently calibrating
Bit 1:   Setting - The instrument is waiting for signals to settle
Bit 2:   Ranging - The instrument is changing measurement range
Bit 3:   Sweeping - A sweep is on progress
Bit 4:   Measuring - The instrument is actively measuring
Bit 5:   Waiting for trig - The instrument is waiting for trigger
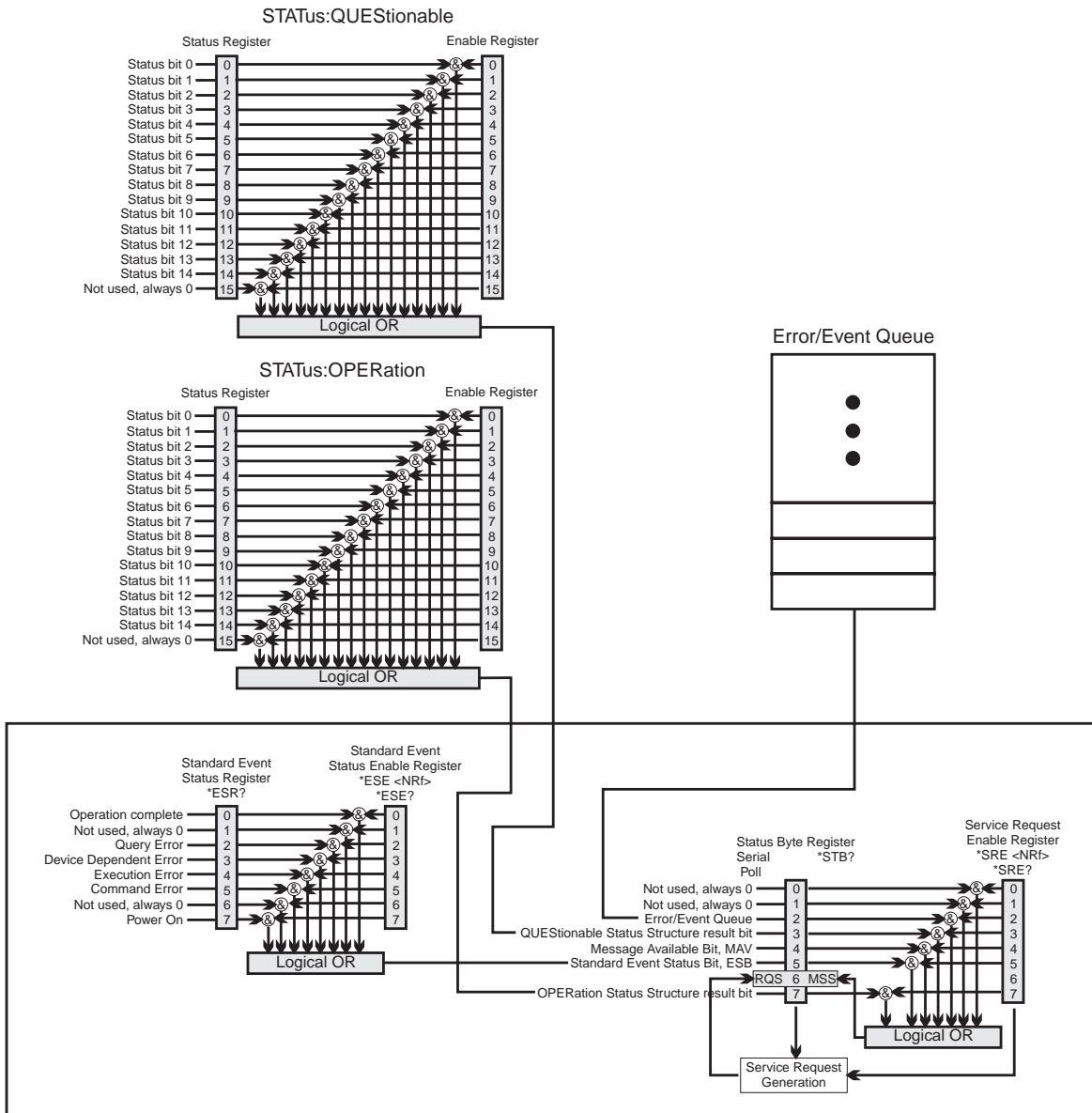
Figure 4-3
The IEEE 488.2 Status Structure with the SCPI connections

Bit 6:   Waiting for arm - The instrument is waiting for arm state
Bit 7:   Correcting - The instrument is performing a correction
Bit 8:   Available to the designer.
Bit 9:   Available to the designer
Bit 10:   Available to the designer
Bit 11:   Available to the designer
Bit 12:   Available to the designer
Bit 13:   Instrument summary
Bit 14:   Program running - A user defined instrument program is running
Bit 15:   Never used, always 0

These are the SCPI default status bits. See the description of status bit assignments in the ANALYZER 6630r for each measurement function later in this section.

Another effect of this structure is that when only one of the ISUMmary status registers is used, the summary bits in STATus:QUEStionable will become copies of the ISUMmary bits. This makes the INSTrument register unnecessary, simplifying the status structure. (In order for this to work, one and *only* one of the ISUMmary registers must be in use, the others must be clear, and the user must also clear both the ISUMmary and the STATus:QUEStionable register after reading the status).

The STATus:QUEStionable and STATus:OPERation structure result bits are reported in the IEEE 488.2 status structure as shown in figure 4-3. This is the lowest level of the complete status structure where service requests are generated. It has two components, the Status Byte Register with the Service Request Enable register and the Standard Event Status Register with its corresponding enable register.

The Status Byte Register
The Status Byte Register is a 'live' status register which means that the status bits are updated according to the state of the higher parts of the structure including set *and* clear, no 'sticky' bits. Reading the Status Byte Register with a serial poll or with the *STB? query will *not* clear the register.

The corresponding Service Request Enable Register is used to enable events to generate a service request. Setting a bit will cause a service request generation once the corresponding bit in the Status Byte Register gets set.

Reading the Status Byte Register can be done in two ways, by a serial poll or with the *STB? common command. As figure 4-3 shows, bit 6 reports different information when using the two ways. When reading the Status Byte Register with a serial poll, bit 6 will show the status of the *service request generator*, meaning it will show if this is the device that currently is requesting service.

When reading the Status Byte Register with the *STB? common command, bit 6 reflects if there is one or more reasons for service request generation.

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The bits in the Status Byte Register have the following use:

Bit 0: Not used, always 0
Bit 1: Not used, always 0
Bit 2: The Error/Event Queue status bit. When set, indicates that there is at least one entry in the Error/Event Queue waiting to be read. See section 4.1.7
Bit 3: The QUEStionable SCPI status structure summary bit.
Bit 4: The Message AVailable (MAV) bit. Will be set as long as the output queue is not empty.
Bit 5: The Standard Event Status register summary bit.
Bit 6: The RQS/MSS bit. See the above explanation.
Bit 7: The OPERation SCPI status structure summary bit.

The Standard Event Status Register
The Standard Event Status Register is, as the name implies, a register that reports more general events in the instrument. The bits have the following meaning:

Bit 0: The *OPC common command response bit. See section 5.1.4 for more information about synchronization.
Bit 1: Not used, always 0.
Bit 2: Query error bit. This bit is set when an attempt to read from an empty output queue was made or when data in the output queue was lost.
Bit 3: Device Specific Error bit. Standard Event Error that was neither a Query Error, an Execution Error or a Command Error.
Bit 4: Execution Error bit. The Execution Error bit will be set when the instrument detects command parameters that are of wrong type or out of range.
Bit 5: Command Error bit. Will be set in the following cases:
        If the instrument receives a command containing syntax errors.
        If the instrument receives commands having semantic errors such as un-recognized commands.
        If a Group Execute Trigger is received inside a <PROGRAM MESSAGE>.
Bit 6: Not used, always 0.
Bit 7: Power On. Will be set upon an off-on transition in the instrument power.

The Standard Event Status Register is cleared when read.

Recommendations:
The status structure is very powerful when used correctly. Some thought must be made about how the enable registers should be setup to achieve status reporting that is not to overwhelming and at the same time does the job.

Normally, the status should be checked between every command or procedure where the likelihood is high and/or tolerance is low of instrument faults. During development of a remote control application, checking status may be necessary between every command in order to find command or procedure errors.

Remember that only a power off-on will clear the enable registers, after that it is up to the

user to set and clear enable register bits.

The commands used to access the status registers are as follows:

The SCPI QUEStionable status register
:STATus:QUEStionable:[EVENt]
:STATus:QUEStionable:ENABle
:STATus:QUEStionable:INSTrument:[EVENt]
:STATus:QUEStionable:INSTrument:ENABle
:STATus:QUEStionable:INSTrument:ISUMmary<n>:[EVENt]
:STATus:QUEStionable:INSTrument:ISUMmary<n>:ENABle

The SCPI OPERation status register
:STATus:OPERation:[EVENt]
:STATus:OPERation:ENABle
:STATus:OPERation:INSTrument:[EVENt]
:STATus:OPERation:INSTrument:ENABle
:STATus:OPERation:INSTrument:ISUMmary<n>:[EVENt]
:STATus:OPERation:INSTrument:ISUMmary<n>:ENABle

The IEEE 488.2 Status Byte Register
An IEEE 488.1 Serial Poll bus command
*STB? common command query
*SRE common command
*SRE? common command query

The IEEE 488.2 Standard Event Status Register
*ESR? common command
*ESE common command
*ESE? common command query

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4.1.2 Status reporting in the Multimeter function

The STATus:QUEStionable:INSTrument:ISUMmary registers 1-6, one for each virtual meter, status bits are defined as follows:

Bit 0:   Voltage
Bit 1:   Current
Bit 2:   Not used, always 0
Bit 3:   Power
Bit 4:   Not used,always 0
Bit 5:   Frequency
Bit 6:   Phase
Bit 7:   Not used, always 0
Bit 8:   Calibration
Bit 9:   Result
Bit 10: Not used, always 0
Bit 11: Not used, always 0
Bit 12: Not used, always 0
Bit 13: Not used, always 0
Bit 14: Command Warning
Bit 15: Not used, always 0

The STATus:OPERation:INSTrument:ISUMmary registers 1-6, one for each virtual meter, status bits are defined as follows:

Bit 0:   Reads 0 until further notice
Bit 1:   Not used, always 0
Bit 2:   Reads 0 until further notice
Bit 3:   Not used, always 0
Bit 4:   Measuring
Bit 5:   Waiting for trigger
Bit 6:   Not used, always 0
Bit 7:   Not used, always 0
Bit 8:   Reads 0 until further notice
Bit 9:   Measurement results updated (cycle completed)
Bit 10: Reads 0 until further notice
Bit 11: Reads 0 until further notice
Bit 12: Reads 0 until further notice
Bit 13: Not used, always 0
Bit 14: Not used, always 0
Bit 15: Not used, always 0

4.1.3 Status reporting in the Harmonics function

The STATus:QUEStionable:INSTrument:ISUMmary register status bits are defined as fol-lows:

    Bit 0:   Voltage
    Bit 1:   Current
    Bit 2:   Not used, always 0
    Bit 3:   Power
    Bit 4:   Not used,always 0
    Bit 5:   Frequency
    Bit 6:   Not used, always 0
    Bit 7:   Not used, always 0
    Bit 8:   Calibration
    Bit 9:   Result
    Bit 10:   Not used, always 0
    Bit 11:   Not used, always 0
    Bit 12:   Not used, always 0
    Bit 13:   Not used, always 0
    Bit 14:   Command Warning
    Bit 15:   Not used, always 0

The STATus:OPERation:INSTrument:ISUMmary register status bits are defined as fol-lows:

    Bit 0:   Reads 0 until further notice
    Bit 1:   Not used, always 0
    Bit 2:   Reads 0 until further notice
    Bit 3:   Not used, always 0
    Bit 4:   Measuring
    Bit 5:   Waiting for trigger
    Bit 6:   Not used, always 0
    Bit 7:   Not used, always 0
    Bit 8:   Not used, always 0
    Bit 9:   Measurement results updated (cycle completed)
    Bit 10:   Reads 0 until further notice
    Bit 11:   Reads 0 until further notice
    Bit 12:   Reads 0 until further notice
    Bit 13:   Not used, always 0
    Bit 14:   Not used, always 0
    Bit 15:   Not used, always 0

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4.1.4 Status reporting in the Flicker function

The STATus:QUEStionable:INSTrument:ISUMmary register status bits are defined as follows:

      Bit 0:   Voltage
      Bit 1:   Current
      Bit 2:   Not used, always 0
      Bit 3:   Not used, always 0
      Bit 4:   Not used,always 0
      Bit 5:   Frequency
      Bit 6:   Not used, always 0
      Bit 7:   Not used, always 0
      Bit 8:   Calibration
      Bit 9:   Result
      Bit 10: Not used, always 0
      Bit 11: Not used, always 0
      Bit 12: Not used, always 0
      Bit 13: Not used, always 0
      Bit 14: Command Warning
      Bit 15: Not used, always 0

The STATus:OPERation:INSTrument:ISUMmary register status bits are defined as follows:

      Bit 0:   Reads 0 until further notice
      Bit 1:   Not used, always 0
      Bit 2:   Reads 0 until further notice
      Bit 3:   Not used, always 0
      Bit 4:   Measuring
      Bit 5:   Waiting for trigger
      Bit 6:   Not used, always 0
      Bit 7:   Not used, always 0
      Bit 8:   Reads 0 until further notice
      Bit 9:   Measurement results updated (cycle completed)
      Bit 10: Short term cycle completed
      Bit 11: Reads 0 until further notice
      Bit 12: Reads 0 until further notice
      Bit 13: Not used, always 0
      Bit 14: Not used, always 0
      Bit 15: Not used, always 0

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4.1.5 Status reporting in the Waveform function

The STATus:QUEStionable:INSTrument:ISUMmary registers 1-3, one for each channel, status bits are defined as follows:

    Bit 0:   Voltage
    Bit 1:   Current
    Bit 2:   Not used, always 0
    Bit 3:   Not used, always 0
    Bit 4:   Not used,always 0
    Bit 5:   Frequency
    Bit 6:   Not used, always 0
    Bit 7:   Not used, always 0
    Bit 8:   Calibration
    Bit 9:   Result   - Class D envelope test
    Bit 10:   Not used, always 0
    Bit 11:   Not used, always 0
    Bit 12:   Not used, always 0
    Bit 13:   Not used, always 0
    Bit 14:   Command Warning
    Bit 15:   Not used, always 0

The STATus:OPERation:INSTrument:ISUMmary registers 1-3, one for each channel, status bits are defined as follows:

    Bit 0:   Reads 0 until further notice
    Bit 1:   Not used, always 0
    Bit 2:   Reads 0 until further notice
    Bit 3:   Not used, always 0
    Bit 4:   Measuring
    Bit 5:   Waiting for trigger
    Bit 6:   Not used, always 0
    Bit 7:   Not used, always 0
    Bit 8:   Reads 0 until further notice
    Bit 9:   Measurement results updated (trigger satisfied)
    Bit 10:   Reads 0 until further notice
    Bit 11:   Reads 0 until further notice
    Bit 12:   Reads 0 until further notice
    Bit 13:   Not used, always 0
    Bit 14:   Not used, always 0
    Bit 15:   Not used, always 0

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4.1.6 SCPI Error/Event queue

The SCPI Error/Event queue is a queue where errors and/or events can be reported in a more human readable form. The messages consists of two components, an error number followed by an error message.

Example:
    -200,"Execution error"

The user should check this queue on a regular basis for messages. Messages are placed in the output queue for reading using the 'SYSTem:ERROr?' or 'STATus:QUEue:[NEXT]?' commands. If a message is available, it will be placed in the output queue for reading. If no message is available, the 0, "No error" message will be placed in the output queue. The controller should keep on reading messages with the SYSTem:ERRor? command until the 0, "No error" message is received.

Error messages with negative error numbers are SCPI defined messages. They are grouped in the following manner:

The -100 group, Command Errors

An error message with error numbers in the -199 -> -100 range indicates some sort of IEEE 488.2 syntax error. It is caused by an illegal character, unknown command, missing or extra data etc. This type of error will also be reflected in the Command Error bit 5 in the Standard Event Status Register.

The -200 group, Execution Errors

An error message with error numbers in the -299 -> -200 range indicates some sort of execution error. It is caused by an illegal data type, illegal data value etc. This type of error will also be reflected in the Execution Error bit 4 in the Standard Event Status Register.

The -300 group, Device Specific Errors

An error message with error numbers in the -399 -> -300 range indicates some sort of device specific error. It indicates an error which is not a command error, a query error or an execution error, some device operation did not properly complete. This type of error will also be reflected in the Device Specific Error bit 3 in the Standard Event Status Register.

The -400 group, Query Errors

An error message with error numbers in the -499 -> -400 range indicates some sort a query error. It is caused by problems with the message exchange protocol of the output queue. This type of error will also be reflected in the Query Error bit 2 in the Standard Event Status Register.

For more detailed information, see the SCPI standard, Volume 2.

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Positive error numbers are instrument defined messages. Since the range of instrument defined messages may wary, no list of messages has been included. The descriptive nature of these message really makes an error list unnecessary, when an error is received, use the text in the message to alert the user.

NOTES:
The controller must empty the queue on a regular basis using the 'SYSTem:ERROr?' / 'STATus:QUEue:[NEXT]?' commands or the queue will overflow and messages will be lost.

The contents of the error/event queue is cleared by the *CLS command.

The queue will hold about 50 messages before overflowing. If the queue overflows, the discarded message will be replaced by the -350, "Queue overflow" which will be sent in the order they occur. This means that messages that where placed in the queue before the overflow will not be affected.

The types of messages reported in the error/event queue can be controlled with the :STATus:QUEue:ENABle command including disabling it. The SCPI Error / Event Queue is disabled at power-on or by a *CLS command.

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STATUS REPORTING

Section 5

COMMUNICATING WITH THE ANALYZER 6630r

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5.1 COMMUNICATING WITH THE ANALYZER 6630r

Remote controlling a complex instrument such as the ANALYZER 6630r requires well thought through and disciplined procedures. The user has to in addition to the basic use of starting measurements and reading results, carefully program the instrument to perform in the desired manner and during the course of measurements, check that the acquired results are of usable quality. The ANALYZER 6630r has an extensive status structure for checking measurement and command results and a programmable trigger system for synchronization purposes.

This section will describe what happens inside the ANALYZER 6630r as well as demands and features when using remote control.

The terms used and procedures described in this section assumes that remote control is done through the GPIB port. If remote control is done through one of the RS-232 ports, see section 5.2 for information about the serial port GPIB emulation.

5.1.1 Preparing for remote control

Before communicating with the instrument, the instrument must be configured correctly for remote control. Section 1 (ANALYZER 6630r) or section 4 (ANALYZER 6630) contains information about preparing the instrument such as selecting the desired remote control port, address, time-outs and mode.

Only use high quality cables when connecting to the controller to prevent problems with interference and noise. If you are using a serial port, see section 5.2 for cable information. Also see the Declaration of Conformity for information about cables.

5.1.2 Entering and leaving remote state

When the ANALYZER 6630r receives the IEEE 488.1 REN (Remote ENable) message it will enter into remote state.

ANALYZER 6630 only: All front panel keys will become inoperative except the QUIT key. Pressing QUIT is equal to the reception of the IEEE 488.1 GTL (Go To Local) command and will return the instrument to local state. Returning to local state by pressing the QUIT key may be blocked by sending the IEEE 488.1 LLO (Local Lock Out) command. The only way then to return to local state is by addressing the instrument with REN set to FALSE or by sending the IEEE 488.1 GTL message.

IMPORTANT! The ANALYZER 6630r will not respond to any commands when in local state. In order to control the instrument it *must* be in remote state.

When the instrument enter remote state for the first time (ANALYZER 6630r, at power-on), the instrument parameters will be reset to their default values as listed in section 3.

The contents of the instruments parameter save area (EEPROM) will never be affected, setting and querying will be done on *volatile* parameters, i.e. all settings will be lost at power-off.

ANALYZER 6630 only: Returning to local state will retain the current parameter settings. This means that all parameter changes done via remote control are view able on the display. Returning to remote state *will not* alter any parameter settings. If the application is modified manually while in local mode, the modifications will be retained when entering remote mode.

5.1.3 Communication procedures

The ANALYZER 6630r remote system receives the characters in the order they are sent. Command interpretation and execution of a message will not start until a complete <TERMINATED PROGRAM MESSAGE> has been received.

To maintain message/event/queue synchronization, the instrument will not accept the reception of a new <TERMINATED PROGRAM MESSAGE> until the previous one has been executed completely. Sending a new <TERMINATED PROGRAM MESSAGE> to the instrument before the previous has been executed will hang the GPIB bus until the instrument has finished execution.

If a <TERMINATED PROGRAM MESSAGE> contains one or more commands that generates results messages, the output queue must be cleared before a new <TERMINATED PROGRAM MESSAGE> is sent to the instrument, otherwise a QUERY error will be generated and the contents of the output queue is lost.

All ANALYZER 6630r response messages will be terminated with the ASCII character LF (line feed, 0x0A) together with the IEEE 488.1 EOI message. Always read a complete response message, i.e until the EOI message is received. Reading partial response messages can create confusion and hard to find errors.

5.1.4 Synchronization

One of the most important issues when dealing with remote control is synchronization. Events must be executed in certain sequences in order to complete a task successfully. There is little point in reading a measurement result before the measurement is completed so the remote control system must provide ways to wait for and detect completion, to *synchronize* events.

The IEEE 488.2 standard provides the following three commands:

> 1: The *WAI common command
> 2: The *OPC common command
> 3: The *OPC? common command query

In order to understand the use of these commands, an explanation of the IEEE 488.2 concept of sequential commands versus overlapped commands must be done.

A system that only incorporates so called sequential commands is fairly straight forward, each command in a message is interpreted and executed completely before the next one. This makes it easier for the system designer since the command start and end points in time are clearly visible.

However, the use of sequential commands severely limits the power of remote control. For example, if we start a measurement, how will we know when the measurement is finished if we can't access the status registers *during* a measurement. There may also be a need of reading part results.

This is why the overlapped command type is needed. The overlapped command system allows the controller to start a measurement and then access other parts of the system while the measurement is executed. There is of course a drawback with every advantage, increased complexity. In an overlapped command system we need a way to report when an event is ready or to wait for completion before the next command is executed.

IEEE 488.2 introduces two flags to be used in conjunction with overlapped commands, the *Pending-Operation Flag* and the *No-Operation-Pending Flag*. In an overlapped command system, each overlapped command has a corresponding Pending-Operation Flag that reports to the system that there are overlapped commands waiting to be executed. The No-Operation-Pending Flag is simply an inversion of all Pending-Operation Flags ORed into one bit. When all Pending-Operation's are done the No-Pending-Operation Flag becomes true.

Overlapped commands that affect the above flags will be marked **Overlapped** in the *Note* field in the command reference.

The three commands *WAI, *OPC and *OPC? listed earlier uses these flags to create synchronization when used properly.

The *WAI command

This is the simplest but least powerful way to achieve synchronization. The ANALYZER 6630r command interpreter is on hold at the *WAI command and waits for the No-Operation-Pending flag to become TRUE, effectively preventing further commands from being executed.

The following is an example of the *WAI command:

```
:ABORt;
:SENSe:FUNCtion:ON MULTIMETER;
:INITiate:IMMediate;

*WAI;

:FETCh:MULTimeter:VMETer1?<PMT>
```

The example will start a single multimeter measurement, wait for the measurement and place the result in the output queue for reading.

Since the *WAI command halts the input queue, it is mainly used when contact with the instrument during command execution is not needed. However, the Status Byte Register may be accessed during the *WAI command hold by a serial poll. Preset the status structure so that the command completion is reported in the status byte and use serial poll to check the status. In the example above the status byte MAV flag can used for synchronization. It becomes set when the result produced by the FETCh command is placed in the output queue.

The *OPC? command

The SCPI 1994 standard requires that the *OPC? command shall be implemented as a sequential command which makes it redundant. The only effect will be that the ASCII character '1' will be placed *immediately* in the output queue for reading thus voiding its real time use. It is only supported for compatibility.

The *OPC command

The *OPC command is very effective if used properly. Sending this command will instruct the instrument to set the Operation Complete status bit in the Standard Event Status register when the No-Operation-Pending flag becomes TRUE. This is only done once, another *OPC command must be sent to restart this function. By setting the Standard Event Status Enable register bit 0 high, the Operation Complete flag can be reported in the Status Byte register ESB bit 5 which can then be detected by using serial poll.

The following example shows the use of the *OPC command:

```
:ABORt;
*ESE 1;
:SENSe:FUNCtion:ON MULTIMETER;
:INITiate:IMMediate;
*OPC<PMT>
```

This command sequence presets the Standard Event Status Enable register to set the ESB bit in the Status Byte when the measurement is ready. The controller is free to send other commands while waiting for the Operation Complete flag to become true *including* response message generating commands because no message will be created in the output queue as a result of the measurement completion.

When the ESB bit is sensed high, the result is read using the following command:

```
:FETCh:MULTimeter:VMETer1?<PMT>
```

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5.1.5 General guidelines

<u>Clearing the instrument</u>

A basic rule of remote control is to place the instrument in a known state before starting a remote control session. The following command sequence may be used to reset the instrument and remote control system:

1:      :IEEE 488.1 DCL command (or *SDL)

2:      *RST;
        *CLS;
        *SRE 0;
        *ESE 0;

3:      :STATus:QUEStionable:ENABle 0;
        :STATus:QUEStionable:INSTrument:ENABle 0;
        :STATus:QUEStionable:INSTrument:ISUMmary1:ENABle 0;
        :STATus:QUEStionable:INSTrument:ISUMmary2:ENABle 0;
        :STATus:QUEStionable:INSTrument:ISUMmary3:ENABle 0;
        :STATus:QUEStionable:INSTrument:ISUMmary4:ENABle 0;
        :STATus:QUEStionable:INSTrument:ISUMmary5:ENABle 0;
        :STATus:QUEStionable:INSTrument:ISUMmary6:ENABle 0;
        :STATus:QUEStionable:INSTrument:ISUMmary7:ENABle 0;
        :STATus:QUEStionable:INSTrument:ISUMmary8:ENABle 0;

        :STATus:OPERation:ENABle 0;
        :STATus:OPERation:INSTrument:ENABle 0;
        :STATus:OPERation:INSTrument:ISUMmary1:ENABle 0;
        :STATus:OPERation:INSTrument:ISUMmary2:ENABle 0;
        :STATus:OPERation:INSTrument:ISUMmary3:ENABle 0;

        :STATus:OPERation:INSTrument:ISUMmary4:ENABle 0;
        :STATus:OPERation:INSTrument:ISUMmary5:ENABle 0;
        :STATus:OPERation:INSTrument:ISUMmary6:ENABle 0;
        :STATus:OPERation:INSTrument:ISUMmary7:ENABle 0;
        :STATus:OPERation:INSTrument:ISUMmary8:ENABle 0
        <PROGRAM MESSAGE TERMINATOR>

The above command sequence may look daunting but it is required to place the ANALYZER 6630r in the power on state as explained below:

1 is the IEEE 488.1 Device CLear command which places the remote control system in re-set-idle state. This is a bus command generated by the controller. See the controller manual for information about generating the DCL message. The *SDL command may also be used in the case where a global clear is not desirable.

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2 is four IEEE 488.2 common commands:

The *RST command places the instrument (*except* the remote control system) in the power on state.

*CLS clears the remote system's status structure including the SCPI status registers but *not* the status registers event enable registers. Also places the instrument in No-Pending-Operation TRUE state.

*SRE 0 clears the Service Request Enable register.

*ESE 0 clears the Standard Event Status Enable register.

3 is commands required to clear the complete SCPI status structure's event enable registers. Practically, you may not need to clear all depending on the application but there is really no reason not too. See section 4 for a description of the status structure.

As a top-level of the remote control engine, the SCPI commands really forms the way to put the instrument to work. They can be divided into these groups:

The configuration commands
These commands are used to program the instrument to perform in a desired manner. CONFigure and SYSTem:APPLication are configuration commands.

The status commands
They are used to access the extensive SCPI status structure which reports instrument events from measurement errors to remote command syntax problems. SYSTem:ERRor and STATus are such commands.

Result retrieval commands
The FETCh branch is used to read measurement results.

Commands for starting and stopping functions
The SENSe command is used to select a measurement function and the TRIGger, INITiate and ABORt are used to start and stop the selected function.

Below follows a few recommendations:

Understand the status and error message system
The status and error report system is very powerful if used correctly.

Understand synchronization
The synchronization commands are needed to make full use of the remote system.

Understanding the instrument
A good knowledge about operating the ANALYZER 6630r will be of great help to understand the extensive command set.

Understanding remote control concepts
Since the ANALYZER 6630r adapts to the rules of IEEE 488 and SCPI, having a good knowledge about GPIB and SCPI is half the work.

Do not overflow either the input buffer or the output queue
Use command procedures that do not fill the input buffer. The input buffer length is 8192 characters. Do not create remote system lockup where the input buffer and output queue is filled up, preventing the controller to give commands for emptying the output queue. The output queue length is 16384 characters.

Triggering
After preparing a measurement function in the desired manner, it has to be started or *triggered*. The 'SENSe' command selects the desired measurement function to be executed. In order to start the execution of the selected function it must know when to start, be *triggered*. The 'TRIGger', 'INITiate' and 'ABORt' commands are used to start and stop measurement functions.

The 'TRIGger:[SEQuence]:SOURce' command is used to select the trigger type. 'IMMediate' is the default type which means the selected function will be executed immediately after the 'INITiate:IMMediate' command. If 'TRIGger:[SEQuence]:SOURce' is set to 'BUS' the selected measurement function will not execute until the IEEE 488.1 bus trigger command Group Execute Trigger, GET, is received.

The 'INITiate:[IMMediate]' command is used to arm the trigger. At reception, the instrument will wait for the selected trigger condition to become true before executing the selected function.

The 'INITiate:CONTinuous' command may be used to set the trigger continuously true which means that the selected function will be continuously executed once the selected trigger condition has been satisfied.

NOTE:
Setting the trigger continuously active will cause the No-Operation Pending flag discussed earlier to *not* become true since the currently selected function will be in continuous mode. This will affect the synchronization common commands.The only way to exit this state is to use the 'ABORt' command (does not otherwise alter the instrument state), the *CLS command or the *RST common command (alters the instrument state).

Example of the immediate trigger:

```
:ABORt;
:SENSe:FUNCtion:ON MULTIMETER;
:INITiate:IMMediate;

*WAI;

:FETCh:MULTimeter:VMETer1?<PMT>
```

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'ABORt' stops any previous execution. 'SENSe' selects multimeter as the active function. 'INITiate:IMMediate' arms the trigger. We are assuming that the instrument is in the power on state which means that 'TRIGger:SOURce' will be 'IMMediate' so the measurement function will start immediately. The *WAI command waits for the No-Operation Pending flag to become true before executing the 'FETCh' command which places the desired result in the output queue for reading.

Example of a trigger sequence:

```
:ABORt;
:SENSe:FUNCtion:ON MULTIMETER;
:TRIGger:SEQuence:SOURce BUS;
:INITiate:IMMediate<PMT>
```

Waiting for the GET bus command or the *TRG command.........

```
*WAI;
:FETCh:MULTimeter:VMETer1?<PMT>
```

The difference from the first trigger example is the 'TRIGger' command. It selects the trigger source to be 'BUS'. It is now up to the controller to start the measurement by sending the GET bus command or the *TRG common command. This will start the measurement. The third message waits for the No-Operation Pending flag to become true which releases the *WAI command and the 'FETCh' command gets executed.

NOTE:
This example must be broken down into two or more terminated messages because a GET bus command is not allowed to appear inside a program message. The 'ABORt' to 'INITiate' part of the example makes up the first message. The controller can then send the GET or *TRG command as message 2 and then the *WAI and 'FETCh' part as the third message. It can also send *TRG together with the *WAI and 'FETCh' command as a second message.

Example of an *erroneous* continuous trigger condition:

```
:ABORt;
:SENSe:FUNCtion:ON MULTIMETER;
:INITiate:CONTinuous ON;
:INITiate:IMMediate;

*WAI;

:FETCh:MULTimeter:VMETer1?<PMT>
```

The above example will never exit since the 'INITiate:CONTinuous ON' command will cause the No-Operation Pending flag to never become true thus causing the *WAI

function to wait ''forever'. Since the command parser is blocked, the only way to exit this state is through a Device Clear, *DCL, IEEE 488.1 bus command that resets the remote system and consequently the *WAI instruction. The measurement will still be executing after the *DCL command causing a really undesired situation.

An example of the *correct* way to use the continuous trigger:

```
:ABORt;
:SENSe:FUNCtion:ON MULTIMETER;
:INITiate:CONTinuous ON;
:INITiate:IMMediate<PMT>
```

This first terminated message will select function, select continuous mode and start the measurement. The measurement function is now running continuously and the controller can use the 'FETCh' commands to read the desired results in real time. The result registers will of course be updated according to the measurement function setup so reading a result value more often than there is a new value available will only return the previously read value.

```
:FETCh:MULTimeter:VMETer1?;
:FETCh:MULTimeter:VMETer2?;
:FETCh:MULTimeter:VMETer3?;
:FETCh:MULTimeter:VMETer4?<PMT>
```

This terminated message will place the result from four virtual meters in the output queue. The controller then reads the 4 results from the output queue.

The preferred way to exit this mode is to send the 'ABORt' command which will place the trigger into the idle state.

```
:ABORt<PMT>
```

Remember though that the trigger is still in the continuous mode so retriggering the measurement function will start it in the continuous mode again. Reset the continuous mode with the 'INITiate:CONTinuous OFF' command.

The continuous mode may be less powerful to use depending on the application. The power of the synchronization commands is lost so there is really no way of knowing when a result is ready. It is more suited for the more 'continuous' feeling functions such as the multimeter.

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Reading the Status Byte Register

To maximize the performance of the instrument, try to minimize the remote control traffic, especially important during measurements. Preset the status structure so that events are reported to the Status Byte Register and then use serial poll to read the status. Serial poll is a hardware function which uses very little bus traffic. Making a serial poll every millisecond is normally more than enough and gives the ANALYZER 6630r a chance to concentrate on measuring.

The other way of checking status, polling the instrument by sending status register queries, for ex. 'STATus:OPERation:INSTrument:EVENt?' or *STB?, is *not* recommended! It may require so much bus traffic that the instrument performance suffers greatly, it gets too busy with receiving, interpreting and executing remote commands instead of making measurements.

The most efficient way of synchronizing to real time events is to use the Service Request function. Program the status structure to report the desired events to the Status Byte and then program the Service Request Enable Register to generate a Service Request. Most GPIB software's provides functions that automates the detection of a service request and finding the instrument in need of service.

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5.1.5.1 Guidelines for the Multimeter function

The Multimeter function may be used in single-shot or continuous mode. Pre-set the Multimeter function to the desired mode of operation with the 'CONFigure:MULTimeter:xxxx' commands. When using continuous trigger mode, use the ':INITiate:CONTinuous ON' command.

Start the Multimeter function with the 'INITiate:IMMediate:ALL' command. The Multimeter requires at least two complete measurement window time cycle (:CONFigure:MULTimeter:MWINdow:TIME) to stabilize, both in single-shot and continuous.

To synchronize the result reading in single-shot mode, the *WAI command can be used. Both single-shot and continuous can make good use of the ':STATus:OPERation:INSTrument:ISUMmary<n>' registers bit 9, (see section 4.1.2). This bit is set high at the completion of every measurement cycle. Program the corresponding enable bits so it gets reported in Status Byte bit 7 (section 4.1.1) and use serial poll to wait for bit 7 to become high.

After detecting the Status Byte bit 7 high, use the ':STATus:OPERation:INSTrument:ISUMmary<n>?' query to check bit 9 and determine which VMETer's are ready. This query also clears the status bit. When it has been established that a measurement is completed, use the ':FETCh:MULTimeter:VMETer<n>?' query to fetch the desired results from the ready VMETer's. In single-shot mode, issue another 'INITiate:IMMediate:ALL' command to start a new measurement or in continuous mode, wait for the next result by checking Status Byte bit 7 again. After detecting a result update, the results must be read within the measurement cycle time or the results will be overwritten by the next cycle.

When using more than one VMETer, it is advantageous to try to read as many VMETer's as possible per fetch operation. The status bits in the ':STATus:OPERation:INSTrument:ISUMmary<n>' registers are updated in sequence from 1 to 6. In order to eliminate multiple read cycles (for ex. detecting VMETer1 bit 9 high and then starting a result fetch before bit 9 in the other register 2-6 is set), use bit 9 only in the *last* of the active VMETer's to be reported to bit 7 in the Status Byte register, then, as mentioned earlier, use the ':STATus:OPERation:INSTrument:ISUMmary<n>?' query to check which VMETer's that are ready.

In addition to bit 9 in the ':STATus:OPERation:INSTrument:ISUMmary<n>' register, the quality of the results can also be checked with the ':STATus:QUEStionable:INSTrument:ISUMmary<n>?' queries (see section 4.1.2). These registers will indicate measurement error conditions such as overrange and frequency measurement synchronization lost. Updates are made in real-time, i.e. when the error occurs and can also be used very efficiently by programming their respective enable register to report errors in the Status Byte's bit 3 which, again, can be checked using serial poll or service request.

When querying a result that is unusable for reasons such as overrange, the result message will be the <CHARACTER PROGRAM DATA> data type 'NAN' message which stands for 'Not A Number'. This is a message defined in IEEE 754 and is used as a substitute when a valid result can not be presented.

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5.1.5.2 Guidelines for the Harmonics function

Steady State Harmonics
The steady state Harmonics function is of a single shot nature which makes the IEEE 488.2 synchronization commands *WAI and *OPC ideal to use. After preparing the measurement function in the desired manner by using the ':CONFigure:HARMonics:xxx' commands, select the Harmonics function with the 'SENSe' command, setup the trigger in the desired manner and start the measurement.

When a harmonics measurement is started, the No-Operation-Pending flag becomes FALSE. Use the *WAI or *OPC commands for waiting for completion (see section 5.1.4). An alternative is to program the ':STATus:OPERation:INSTrument:ISUMmary' register bit 9, (see section 4.1.2) to be reported in the Status Byte bit 7. The Status Byte is best checked by a serial poll or by generating a Service Request.

After the measurement is completed, use the ':FETCh:HARMonics:xxxx?' queries to retrieve the results. Also check the ':STATus:QUEStionable:INSTrument:ISUMmary' register for measurement errors.

Fluctuating Harmonics
When doing a fluctuating harmonics measurement, the *WAI or *OPC synchronization commands can be used to check the completion of the *complete* measurement. However, the fluctuating harmonics measurement produces intermediate results which can also be queried during the measurement. Use the ':STATus:OPERation:INSTrument:ISUMmary' register bit 9, (see section 4.1.2) to synchronize the reading of these results.

IMPORTANT:
If the current/voltage measurement range is set to AUTO, the fluctuating harmonics function selects the range *at the start* of the measurement. This may cause the function to abort if an overrange condition occurs. Always use a fixed range that handle the anticipated input levels.

The fluctuating harmonics function requires that the installed measurement module(s) is of the high performance DSP type.

When querying a result that is unusable for reasons such as overrange, the result message will be the <CHARACTER PROGRAM DATA> data type 'NAN' message which stands for 'Not A Number'. This is a message defined in IEEE 754 and is used as a substitute when a valid result can not be presented.

5.1.5.3 Guidelines for the Flicker function

When a flicker measurement is started, the No-Operation-Pending flag becomes FALSE. This makes the IEEE 488.2 synchronization commands *WAI and *OPC ideal to use. After preparing the measurement function in the desired manner by using the ':CONFigure:FLICker:xxx' commands, select the Flicker function with the 'SENSe' command, setup the trigger in the desired manner and start the measurement.

Use the *WAI or *OPC synchronization commands to check the completion of the *complete* measurement. However, the flicker measurement produces intermediate results which can also be queried during the measurement. Use the ':STATus:OPERation:INSTrument:ISUMmary' register bit 9, (see section 4.1.2) to synchronize the reading of the measurement window time updated results. These results are read by using the ':FETCh:FLICker<n>:MEASurement:xxx?' queries. These results are only valid *during* a flicker measurement.

The completion of a short term evaluation can be checked with the ':STATus:OPERation:INSTrument:ISUMmary' register bit 10. These results are read by using the ':FETCh:FLICker<n>:EVALuation:STERm:xxx?' queries. The short term evaluation results are invalid before the completion of the first short term evaluation.

After the flicker measurement is completed, the long term flicker evaluation can be read using the ':FETCh:FLICker<n>:EVALuation:LTERm:xxx?' queries. The ':FETCh:FLICker<n>:EVALuation:STERm:xxx?' queries will now report the *worst case* short term results during the entire measurement.

Both bit 9 and 10 of the ':STATus:OPERation:INSTrument:ISUMmary' register can be programmed to be reported in the Status Byte. The Status Byte is best checked by a serial poll or by generating a Service Request.

During a measurement, the ':STATus:QUEStionable:INSTrument:ISUMmary' register can be checked for measurement errors.

IMPORTANT:
If the current/voltage measurement range is set to AUTO, the flicker function will start at the highest sensitivity range. If the measurement range is changed during the measurement, this change is irreversible.

When querying a result that is unusable for reasons such as overrange, the result message will be the <CHARACTER PROGRAM DATA> data type 'NAN' message which stands for 'Not A Number'. This is a message defined in IEEE 754 and is used as a substitute when a valid result can not be presented.

5.1.5.4 Guidelines for the Waveform function

The Waveform function is of a single shot nature which makes the IEEE 488.2 synchronization commands *WAI and *OPC ideal to use. After preparing the measurement function in the desired manner by using the ':CONFigure:WAVeform:xxx' commands, select the Waveform function with the 'SENSe' command, setup the GPIB bus trigger in the desired manner and start the measurement.

When a Waveform measurement is started, the No-Operation-Pending flag becomes FALSE. If the Waveform trigger features are used, it will remain FALSE until the trigger is satisfied and a collection has been done. Use the *WAI or *OPC commands for waiting for completion (see section 5.1.4).

Another way of using the Waveform function is to set the trigger system into continuous mode with the ':INITiate:CONTinuous ON' command. This mode is best used together with the Waveform function trigger, providing time to read the results before a new trigger occurs. When the trigger is satisfied, a collection is done and the ':STATus:OPERation:INSTrument:ISUMmary' register bit 9, (see section 4.1.5) is set indicating that new data is available. The Waveform function is then immediately restarted, waiting for a new trigger. The ':STATus:OPERation:INSTrument:ISUMmary' register bit 9 can be programmed to be reported in the Status Byte bit 7. The Status Byte is best checked by a serial poll or by generating a Service Request. In this mode the *WAI and *OPC commands can not be used. Use the ':ABORt' command to stop the Waveform function.

After the measurement is completed, use the ':FETCh:WAVeform:xxxx?' queries to retrieve the results. Also check the ':STATus:QUEStionable:INSTrument:ISUMmary' register for measurement errors.

When querying a result that is unusable for reasons such as overrange, the result message will be the <CHARACTER PROGRAM DATA> data type 'NAN' message which stands for 'Not A Number'. This is a message defined in IEEE 754 and is used as a substitute when a valid result can not be presented.

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5.2 USING THE SERIAL PORT

The GPIB and RS 232 hardware differs quite substantially. The GPIB bus communication is highly structured, every byte is handshaked, there are two modes of transmission - command and data mode and it has interrupt capabilities.

In order to make the RS 232 interface usable for remote control, the structured GPIB interface has to emulated to a degree where it will fit into the existing remote control system.

Below follows a description of the implementation. All signals described with pin number and direction (input/output) will be signals on the ANALYZER 6630r serial port, see figure 5-4 for corresponding controller connections.

Handshaking
The byte for byte handshake system is not really practical on a serial bus so it will not be implemented, the ANALYZER 6630r will use the RTS signal on pin 4 to inform the controller when the input buffer is full. Similarly, when ANALYZER 6630r is transmitting, the CTS pin 5 will be sensed for controller busy.

Levels used for buffer handshaking, ANALYZER 6630r and controller input buffers:

Signal	Mark, +12V	Space, -12V
RTS (O)	ANALYZER 6630r ready	ANALYZER 6630r busy
CTS (I)	Controller is ready	Controller is busy.

When ANALYZER 6630r signals busy, the controller must stop sending within 32 characters. Similarly, when the controller signals busy, it must have a 32 character response time buffer. Be aware of that the ANALYZER 6630r has the newer serial communication ports with an on-chip 16 character transmitter and receiver buffer. A controller serial port may also be having this kind of chip (known as the 16550 chip).

Service Request
The GPIB bus service request is emulated with the DTR pin 20.

Signal	Mark, +12V	Space, -12V
DTR (O)	Service Request passive	Service Request active

When the controller senses the Service Request Active state, it must read the Status Byte Register using a serial poll to clear the service request.

Sending commands
While sending data to the ANALYZER 6630r, a distinction between data characters and command characters will be made. Characters with codes between 0 - 31 (ASCII control codes) will be treated as command characters. Character codes between 0 - 31 that are received inside a <PROGRAM MESSAGE> and that are *not* a part of a <STRING PRO-GRAM DATA> element will generate a command error message.

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Character codes between 0 - 31 that are received outside a terminated <PROGRAM MES-SAGE> will be treated as GPIB bus commands and will be executed *immediately*.

Supported bus commands are:

Character code	IEEE 488.1 Bus command emulation
ASCII code 0x01	GTL (Go To Local)
ASCII code 0x04	SDL (Selective Device Clear)
ASCII code 0x08	GET (Group Execute Trigger)
ASCII code 0x11	LLO (Local Lockout)
ASCII code 0x14	DCL (Device CLear)
ASCII code 0x18	SPE (Serial poll enable)

Codes not listed will be ignored.

Serial Poll
Performing a serial poll via RS 232 is done by sending the ASCII code 0x18 (SPE - Serial Poll Enable). Upon reception of this code, the contents of the Status Byte Register will be sent *immediately* as a single byte. It is up to the controller to make sure that serial poll is *not* done while reading from the ANALYZER 6630r or the status byte will be lost inside the read message.

Reading messages
The DSR signal on pin 6 will be sensed for read requests.

Signal	Mark, +12V	Space, -12V
DSR (I)	Read requested	Read not requested

The DSR signal is edge detected, only a *transition* from Space to Mark will start a read transmission.

If no data is present in the output queue when a read is requested, no data will be sent and the query error bit in the Standard Event Status Register will be set.

If data exists in the output queue when a read is requested, transmission of one complete, terminated <RESPONSE MESSAGE> will be done. Monitoring of the CTS controller busy signal will be done during the transmission. It is up to the controller to make a read request to empty the output queue. Read requests during a read request transmission are ignored.

All <RESPONSE MESSAGES> are terminated with the ASCII LF (0x0A) character. Since there is no EOI bus message sent in conjunction with the ASCII LF character, care must be taken to not mistake the ASCII LF character for a termination character when transmitted inside a <STRING RESPONSE DATA> element.

NOTE:
When using a custom made cable or a non-approved cable it will be in violation of the Declaration of Conformity since the quality of the cable is beyond our control. See the Declaration of Conformity for more details.

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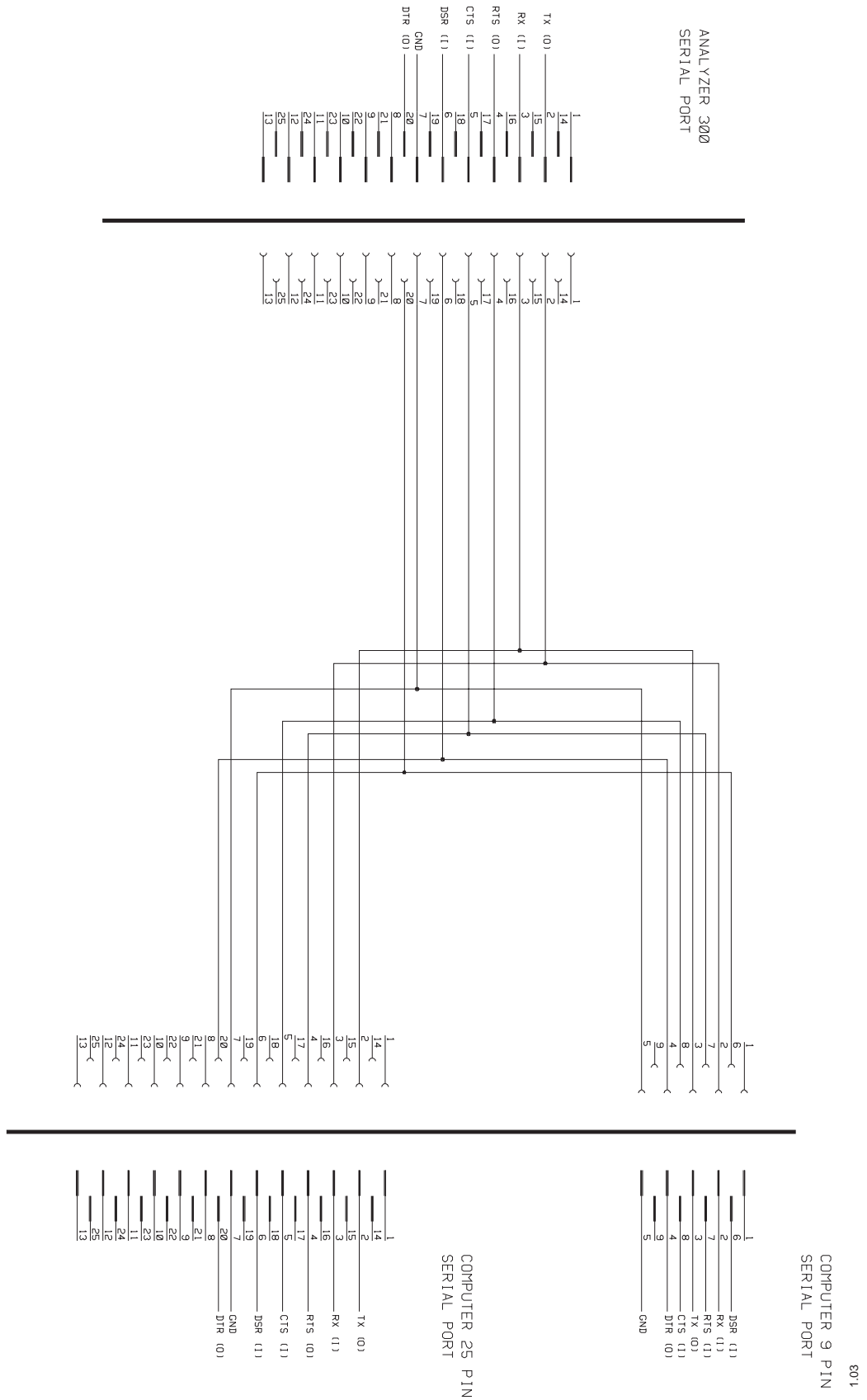
Figure 5-1
RS 232 remote control cable. See note on page 18

Section 7

SPECIFICATIONS

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intentionally blank!**

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7.1 INSTRUMENT SPECIFICATIONS

7.1.1   Multimeter

MEASUREMENT SETUP AND REPORTING

Parameters:	Voltage (U)	Power factor (PF)
	Current (I)	Phase angle (φ)
	Frequency (f)	Active energy (W)
	Active power (P)	Reactive energy (Wr)
	Reactive power (Q)	Apparent energy (Wa)
	Apparent power (S)	
	Crest factor (CF)	
	THD (I and U)	Total Harmonic Distortion (%)

Measurement mode: AC, DC or (AC+DC)

Presented value: Rms, peak± and peak to peak (for U and I only)

Phases/channels   One or three phase mode. At three phase measurements
the result generation may be setup to either mean or
sum values for all phases or values split into phases

Frequency source: Voltage or current channel

Measurement window: 0.5-5 s

Window type: Fixed or adapted to full periods of source frequency fundamental

Measurement average: Moving of 1-100 measurements.

Fast follow: Yes or no. If yes is selected, averaging will restart when the fast
follow threshold is exceeded

Fast follow threshold: 0.1-10% of reading + 10% of lowest range

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COMMON TO ALL MULTIMETER PARAMETERS

Frequency range:	DC and 40-70Hz fundamental
Filter:	LP 2 kHz
Crest factor:	< 5
Power factor:	-1 to +1
A/D conversion:	Simultaneous sampling of U and I channels
Phase error between U and I inputs:	Less than 0.05° at 70Hz

VOLTAGE   U

Ranges (AC peak and DC):	2000V / 600V / 200V / 60V / 20V / 6V Automatic or manual range selection
Maximum input voltage:	U+to U- or U+/U- to I+/I- 600Vrms (AC+DC) or 2000Vpeak U+/U- to case 400Vrms (AC+DC)

Uncertainty	AC rms:	±(0.2% of rdg + 0.05% of range)
at 23±5°C	DC and (AC+DC) rms:	±(AC spec. + 15mV)
③	Peak:	±(AC spec. + 0.1% of rdg)

Temp. coeff. (0-18 and 28-40)°C:	±0.01%/°C of rdg AC and ±2mV/°C DC
Common mode voltage influence:	Less than 0.02% of any voltage range at a common mode voltage level of 400Vrms 50Hz ①
Result resolution:	Better than 0.01% of range or 1mV
Input impedance:	2x1M//470pF

CURRENT   I

Ranges (AC peak and DC):	300A / 100A / 30A / 10A / 3A / 1A / 0.3A / 0.1A Automatic or manual range selection
Maximum input current:	20Arms (AC+DC) continuous 300Apeak or 200Arms 20ms every 2sec
Maximum common mode voltage:	I+/I- to case 400Vrms (AC+DC)

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Uncertainty at 23±5°C ③	AC rms:	±(0.3% of rdg + 0.05% of range)
	DC and (AC+DC) rms:	±(AC spec. + 0.5mA)
	Peak:	±(AC spec + 0.1% of rdg)

Temp. coeff. (0-18 and 28-40)°C: ±0.01%/°C of rdg AC and ±0.05mA/°C DC

Common mode voltage influence: Less than 0.02% of any current range at a common mode voltage level of 400Vrms 50Hz ②

Result resolution: Better than 0.02% of range or 10µA

Input resistance: ~18mΩ

Protection: Littlefuse KLK 25A fuse on rear panel

①   Ucm is applied between U+/U- and case. I+or I- is connected to U+ or U-. If I+ or I- is connected to case, the influence is less than 0.02% of common mode voltage.
②   Ucm is applied between I+/I- and case
③   Conditions: 30 min warm up time. Sine wave. Within 6 month after cal. I+ connected to source. Measurement time 2s adapted.

POWER   **S, P, Q**

Ranges: 48 ranges from 0.6VA to 12kVA. Automatic or manual selection of voltage and current range

Power range: Voltage range * Current range

Maximum input: 600Vrms and 20Arms

Uncertainty at 23±5°C ③
Apparent AC and active AC: ④   ±(0.4% of rdg + 0.1% of range)
Reactive: ±(0.4+D)% of rdg S + 0.1% of range
                                     $D=0.01*(U_{THD}\%)*(I_{THD}\%)$

Temp. coeff. and common mode
voltage influence: Refer to voltage and current spec.

Result resolution: Better than 0.02% of range or 0.1mVA

Calculation methods: (apparent) $S = U \bullet I$ VA

                                      (active) $P = \dfrac{1}{N} \sum_{1}^{N} (U_n \bullet I_n)$ W

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(reactive) $\qquad Q = \dfrac{1}{N} \sum\limits_{1}^{N} (Un \bullet I(n+x))$ var

N = number of samples in acquisition time
x = number of samples corresponding to 90° at the
    fundamental frequency

FREQUENCY f

Measurement range: 40 - 70Hz

Source: Voltage or current input

Principle: Auto correlation

Uncertainty: ±0.01% of rdg

Resolution: 0.001Hz

④ At DC or (AC+DC) power, add (0.015*Irdg + 0.0005*Urdg)

ENERGY   W,Wr,Wa

Measurement range: 0 - 999 999 kWh

Ranges and uncertainty: refer to power spec.

Timer uncertainty: ±0.01% (fixed measurement window)

Timer value: Elapsed time from start is displayed

Result resolution: Better than 0.05% of rdg or
                             0.02% of (power range *1h)

Calculation methods: ⑤   (apparent) $\qquad Wa = \sum\limits_{1}^{M} Sm \bullet ta$ VAh

                               (active) $\qquad W = \sum\limits_{1}^{M} Pm \bullet ta$ Wh

                               (reactive) $\qquad Wr = \sum\limits_{1}^{M} Qm \bullet ta$ varh

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CHARGE   **Ch**

Measurement range:	0 - 999 999 Ah
Measurement mode:	DC single channel only
Ranges and uncertainty:	Refer to current spec.
Timer uncertainty:	±0.01% (fixed measurement window)
Timer value:	Elapsed time from start is displayed
Result resolution:	Better than 0.05% of rdg or 0.02% of (current range *1h)
Calculation method: ⑤	$Ch = \sum\limits_{1}^{M} lm \bullet ta$

COMPUTED PARAMETERS

Name:	Calculation method:	Range:	Resolution:	Unit:
Power factor	$PF = \dfrac{P}{S}$	-1 to +1	0.0001	none
Phase angle	$\varphi = \arctan\dfrac{Q}{P}$	-180 to +180	0.01	deg
Crest factor U	$CF_U = \dfrac{U_{peak}}{U}$	1 to 5	0.001	none
Crest factor I	$CF_I = \dfrac{I_{peak}}{I}$	1 to 5	0.001	none

⑤   ta = acquisition time   M = number of acquisitions

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7.1.2 Harmonics Analysis

GENERAL

Compliance measurements acc. to:	IEC555-2, EN60555-2, IEC1000-3-2 and EN 61000-3-2
Testing:	Preprogrammed limits according to standards for pass/fail testing. User specified limits may be added

REPORTING

Limits:	On or off, both in graph and table
Reported parameters:	Total rms value of U and I, source frequency, active power, rms value of fundamental and THD

MEASUREMENT

Harmonic order:	1-40
Frequency of fundamental:	40-70Hz
Frequency source:	Voltage or current
Data source:	Voltage or current
Voltage and current ranges:	Refer to voltage and current spec.
Phases/channels:	One or three
Calculation method:	FFT with 32 bit floating point math
AD-conversion:	18 bit resolution
Measurement window:	Rectangular
Analyzed periods (window with):	1-47
Synchronization uncertainty:	±0.01%
Antialiasing filter attenuation:	80dB
Measurement time:	3.5 s when analyzing 6 periods
Uncertainty at 23±5°C, rms: ⑥	±(0.5% of rdg + 0.03% of range)

⑥ Conditions: 30 min warm up time. Within 6 month after cal. 6 periods/measurement

7.1.3   Fluctuations and Flicker Analysis

GENERAL

Compliance measurements acc. to:	IEC555-3, EN60555-3, IEC1000-3-3 and EN 61000-3-2
Method of analysis:	Implementation of IEC868/EN60868, flicker meter specification.
Testing:	Preprogrammed limits according to standard for pass/fail testing. User specified limits may be added

REPORTING

Reported parameters:	P_{st} Short-term flicker
	P_{lt} Long-term flicker
	dc Relative steady state voltage change
	dmax Max relative voltage change
	d(t) Relative voltage change
	Test voltage and frequency with deviations for the collection period
Limits:	On or off for pass/fail decision

MEASUREMENT

Voltage and current ranges:		Refer to voltage and current spec.
Range	P_{st}:	0.1 to 20
	P_{lt}:	0.1 to 20
	d:	0 to 25%
Frequency range:		40-70 Hz
Phases/channels:		1-3. One phase at a time
Reference impedance:		R + jX simulated in calculation with compensation possibility for physical reference impedance.
Impedance range (R and X):		0.01-70 Ω
Reference lamp:		230V, 60W
Measurement time:		1-15 min
Number of measurements:		1-1100

Uncertainty	P_{st}:	± 4% of rdg	for	0.5 < Pst < 20
at 23±5°C	P_{lt}:	± 4% of rdg	for	0.5 < Plt < 20
	d:	± 2% of rdg	for	dmax > 0.1%

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7.1.4 Waveform

GENERAL

Testing: Mask for pass/fail testing acc. to IEC1000-3-2 class D

Phases/channels: One or three

REPORTING

Reported input parameters: Rms values of voltage and current. Frequency of
                                             frequency source

No. of waveforms: 2 at single phase and 3 at three phase

MEASUREMENT

Frequency range: 40-70 Hz fundamental

Frequency source (upper trace):   Voltage or current

Measurement mode: AC+DC

Filter: LP 6 kHz

Horizontal axis length: 1, 2, 4, 8 or 16 periods

Vertical axis: Normalized to peak values

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COMBINOVA

7.1.5 Remote Control

Interface: GPIB (IEEE488.1-87)
                                     RS232

Connectors   GPIB: According to IEEE488.1-87
                RS232:   25 pin D-sub

GPIB interface capabilities: Talker, Listener and Controller.
                                     SH1, T6, AH1, L4, SR1, RL1, PP0,
                                     DC1, DT1, (C0), E2

Remote control language: IEEE488.2-87 and SCPI-1994.0 (Standard Commands
                                     for Programmable Instruments)

GPIB address: User selectable to 0-30

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7.1.6   General Specifications

Display: 2 digit seven segment LED display

Rack mounting: With optional rack mount kit. Size 19" 3HE

Dimensions: (HxWxL)   132x425x340 mm   (5.2x16.7x13.4 inches)

Weight: Single phase 9 kg (20 lbs), three phase 11.4 kg (25 lbs)

Operating environment: 0 to +40°C <80% R.H. non condensing

Storage environment: -30 to +60°C non condensing

Power supply: 100-130V or 200-260V, automatic range selection

Power line frequency: 45-65 Hz

Power consumption: 45 W max

Fuses (rear panel):   Instrument power: 2 x F1A
                              Current measurement: Littlefuse KLK 25A
NOTE:
Failiure to use the specified type and rating of fuse may result in property damage and/or personal injury.

Safety: Designed to comply with the Low Voltage Directive
                              73/23/EEC plus parts of 93/68/EEC.
                              Applied standard, EN61010-1:1993
                              Installation Category II, CAT II

EMC: Designed to comply with the EMC Directive
                              89/336/EEC and 92/31/EEC
                              Applied standards, EN50081-1:92 and EN50082-1:92

Warranty: See section 2.4

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