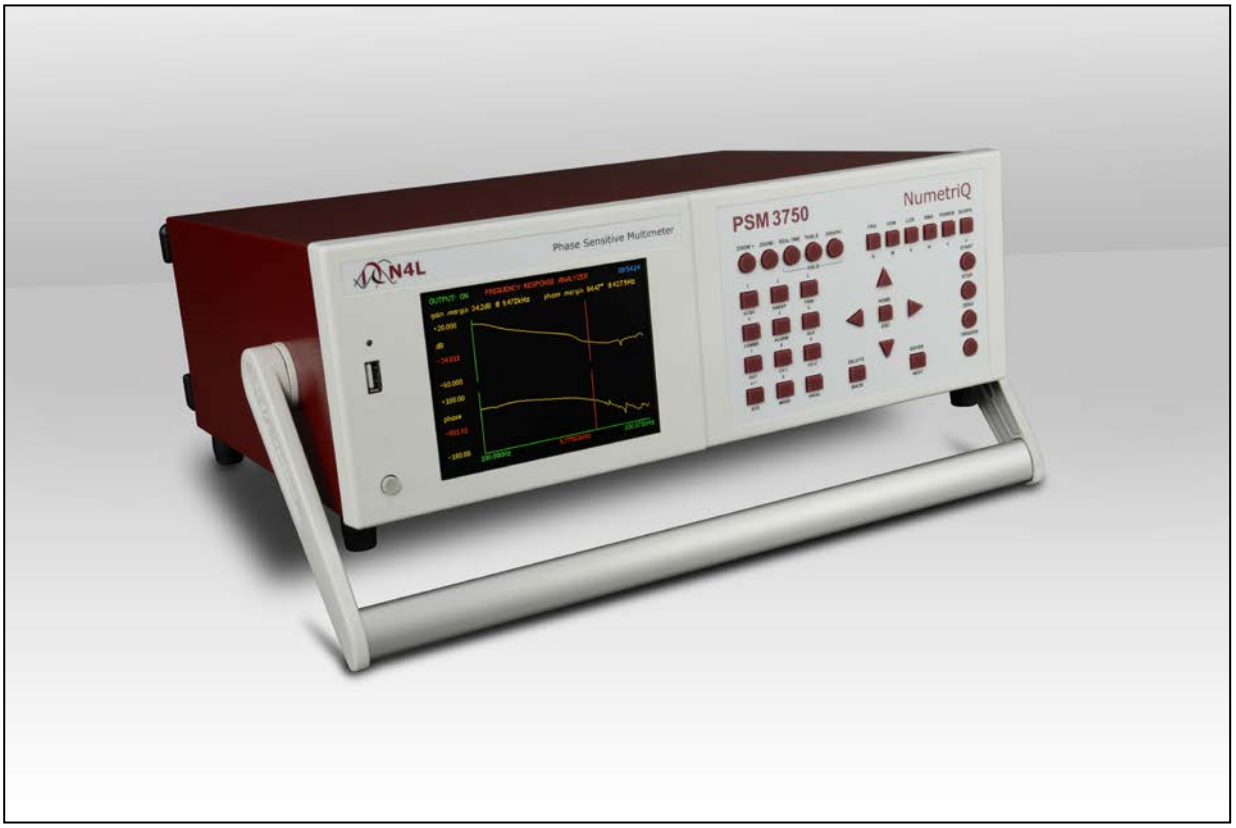
Newtons4th Ltd

PSM3750 - *NumetriQ*

COMMUNICATIONS MANUAL



IMPORTANT SAFETY INSTRUCTIONS

This equipment is designed to comply with BSEN 61010-1 (Safety requirements for electrical equipment for measurement, control, and laboratory use) – observe the following precautions:

- This appliance ***must*** be earthed. Ensure that the instrument is powered from a properly grounded supply.
- The input connectors are High Voltage safety types for use up to 500V peak input from earth, overvoltage category II. Do not exceed 500V peak on any input connection. Only use test leads that are fitted with approved High Voltage safety connectors when working with hazardous voltages.
- The inputs must not be connected to signals greater than is indicated on the front panel.
- Keep the ventilation holes on the underneath and sides free from obstruction.
- Do not operate or store under conditions where condensation may occur or where conducting debris may enter the case.
- There are no user serviceable parts inside the instrument – do not attempt to open the instrument, refer service to the manufacturer or his appointed agent.

Note: Newtons4th Ltd. shall not be liable for any consequential damages, losses, costs or expenses arising from the use or misuse of this product however caused.

ABOUT THIS MANUAL

This manual gives details of the communication commands recognized by the PSM3750 instrument over RS232, USB, LAN or GPIB. For more general operating instructions for the instrument refer to the specific user manual.

Each command is listed alphabetically with details of any arguments and reply. A one line summary of each command is given in the appendix. Although most of the commands apply to all instruments in the range there are some commands that are specific to one instrument or another.

The information in this manual is believed to be accurate and complete but Newtons4th Ltd cannot accept any liability whatsoever for any consequential damage or losses arising from any errors, inaccuracies, or omissions.

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1 Using remote control

The instrument is fitted with an RS232 serial communications port as standard, and may have an IEEE488 (GPIB) interface or LAN interface fitted as an option. All the interfaces use the same ASCII protocol with the exception of the end of line terminators:

	Rx expects	Tx sends
RS232, LAN, USB	carriage return (line feed ignored)	carriage return and line feed
IEEE488	carriage return or line feed or EOI	carriage return with EOI

All the functions of the instrument can be programmed via either interface, and results read back. When the IEEE488 interface is set to ‘remote’ the RS232 port is ignored.

The commands are not case sensitive and white space characters are ignored (e.g. tabs and spaces). Replies from the instrument are always upper case, delimited by commas, without spaces.

Only the first six characters of any command are important – any further characters will be ignored. For example, the command to set the generator frequency is FREQUE but the full word FREQUENCY may be sent as the redundant NCY at the end will be ignored.

Fields within a command are delimited by comma, multiple commands can be sent on one line delimited with a semi-colon. Eg.

AMPLIT,1.5;OUTPUT,ON

Mandatory commands specified in the IEEE488.2 protocol have been implemented, (e.g. *IDN?, *RST) and all commands that expect a reply (query commands) are terminated with a question mark.

The instrument maintains an error status byte consistent with the requirements of the IEEE488.2 protocol (called the standard event status register) that can be read by the mandatory command *ESR? (see section 5.1).

The instrument also maintains a status byte consistent with the requirements of the IEEE488.2 protocol, that can be read either with the IEEE488 serial poll function or by the mandatory command *STB? over RS232 or IEEE or LAN (see section 5.2).

The IEEE address defaults to 23 and can be changed via the COMMS menu.

The keyboard is disabled when the instrument is set to “remote” using the IEEE. Press HOME to return to “local” operation.

RS232 data format is: start bit, 8 data bits (no parity), 1 stop bit. Flow control is RTS/CTS (see section 5.2), baud rate is selectable via the COMMS menu.

A summary of the available commands is given in the Appendix. Details of each command are given in the communication command section of the manual.

Commands are executed in sequence except for two special characters that are immediately obeyed:

Control T (20) – reset interface (device clear)
Control U (21) – warm restart

1.1 Standard event status register

PON		CME	EXE	DDE	QYE		OPC

bit 0 OPC (operation complete)
cleared by most commands
set when data available or sweep complete
bit 2 QYE (unterminated query error)
set if no message ready when data read
bit 3 DDE (device dependent error)
set when the instrument has an error
bit 4 EXE (execution error)
set when the command cannot be executed
bit 5 CME (command interpretation error)
set when a command has not been recognised
bit 7 PON (power on event)
set when power first applied or unit has reset

The bits in the standard event status register except for OPC are set by the relevant event and cleared by specific command (*ESR?, *CLS, *RST). OPC is also cleared by most commands that change any part of the configuration of the instrument (such as MODE or START).

1.2 Serial Poll status byte

		ESB	MAV	ALM		SDV	RDV

bit 0 RDV (result data available)
set when results are available to be read as enabled by DAVER

bit 1 SDV (sweep data available)
set when sweep results are available to be read as enabled by DAVER

bit 3 ALA (alarm active)
set when an alarm is active and enabled by ALARMER

bit 4 MAV (message available)
set when a message reply is waiting to be read

bit 5 ESB (standard event summary bit)
set if any bit in the standard event status register is set as well as the corresponding bit in the standard event status enable register (set by *ESE).

1.3 RS232 connections

The RS232 port on the instrument uses the same pinout as a standard 9 pin serial port on a PC or laptop (9-pin male ‘D’ type).

Pin	Function	Direction
1	DCD	in (+ weak pull up)
2	RX data	in
3	TX data	out
4	DTR	out
5	GND	
6	DSR	not used
7	RTS	out
8	CTS	in
9	RI	not used

The instrument will only transmit when CTS (pin 8) is asserted, and can only receive if DCD (pin 1) is asserted. The instrument constantly asserts (+12V) DTR (pin 4) so this pin can be connected to any unwanted modem control inputs to force operation without handshaking. The instrument has a weak pull up on pin 1 as many null modem cables leave it open circuit. In electrically noisy environments, this pin should be driven or connected to pin 4.

To connect the instrument to a PC, use a 9 pin female to 9 pin female null modem cable:

1 & 6	-	4
2	-	3
3	-	2
4	-	1 & 6
5	-	5
7	-	8
8	-	7

2 Communication commands

***CLS** ***CLS**

Function:	Clear status
Description:	Clears the *standard event status register.*
Format:	*CLS
Arguments:	none
Reply:	none
Example:	*CLS *ESR? 0
Notes:	

***ESE** ***ESE**

Function: Set standard event status enable register.

Description: Enable which bits of the *standard event status register* set the ESB bit in the serial poll status byte..

Format: *ESE, value

Arguments: decimal equivalent of bits in standard event status enable register

Reply: can be read by *ESE?

Example: *ESE, 60

Notes: The following bits in the standard event status enable register have been implemented:

bit 0 OPC (operation complete)
bit 2 QYE (unterminated query error)
bit 3 DDE (device dependent error)
bit 4 EXE (execution error)
bit 5 CME (command interpretation error)
bit 7 PON (power on event)

For example, *ESE, 60 enables all the error bits so that the ESB bit in the serial poll status byte is set in the event of any error.

***ESR?** ***ESR?**

Function: Standard event status register query

Description: Returns the contents of the *standard event status register* and clears it.

Format: *ESR?

Arguments: none

Reply: decimal equivalent of bits in standard event status register

Example: *ESR?
33

Notes: The following bits in the standard event status register have been implemented:

bit 0 OPC (operation complete)
bit 2 QYE (unterminated query error)
bit 3 DDE (device dependent error)
bit 4 EXE (execution error)
bit 5 CME (command interpretation error)
bit 7 PON (power on event)

For example, if a command is sent incorrectly and is not recognised, the CME bit will be set and the value of 33 will be returned.

***IDN?** ***IDN?**

Function:	Identify query
Description:	Returns a standard format identification string.
Format:	*IDN?
Arguments:	none
Reply:	An ASCII string in the IEEE488.2 format: manufacturer,model,serial no,version
Example:	*IDN? NEWTONS4TH,PSM3750,01234,1.00
Notes:	

***OPC?** ***OPC?**

Function:	Test for operation complete
Description:	Returns 1 if previous operation is completed, 0 if not.
Format:	*OPC?
Arguments:	none
Reply:	0 or 1
Example:	START *OPC? 0 *OPC? 0 *OPC? 1
Notes:	*OPC? can be used to indicate when data is available or when a frequency sweep has completed.

***RST** ***RST**

Function: Reset

Description: Resets the instrument to the default state and clears the *standard event status register*.

Format: *RST

Arguments: none

Reply: none

Example: *RST

Notes: The *RST command loads the default configuration. This is the same as loading the default configuration via the PROGRAM menu.

Any preceding setup commands will be overwritten.

*RST should be followed by an end of line not a message separator. It may be helpful to follow it with a short pause to allow the new configuration to become active before sending further commands.

***SRE** ***SRE**

Function:	Set service request enable register.
Description:	Enable which bits of the *status byte register* initiate a service request.
Format:	*SRE, value
Arguments:	decimal equivalent of bits in status byte register
Reply:	can be read by *SRE?
Example:	*SRE, 1 generate a service request when data available.
Notes:	

***SRE?** ***SRE?**

Function: Read service request enable register.

Description: Read back the present setting of the service request enable register.

Format: *SRE?

Arguments:

Reply: decimal equivalent of bits in status byte register that would generate a service request.

Example: *SRE?
1

Notes:

***STB?** ***STB?**

Function:	Read serial poll status byte
Description:	Returns the decimal value of the serial poll status byte.
Format:	*STB?
Arguments:	none
Reply:	decimal value of the serial poll status byte
Example:	*STB? 1
Notes:	The following bits in the serial poll status register have been implemented: bit 0 RDV (results data available) bit 1 SDV (sweep data available) bit 3 ALA (alarm active) bit 4 MAV (message available) bit 5 ESB (standard event summary bit)

***TRG** ***TRG**

Function:	Trigger
Description:	Initiates a new measurement, resets the ranging and filtering.
Format:	*TRG
Arguments:	none
Reply:	none
Example:	MODE,VRMS *TRG VRMS?
Notes:	

***TST?** ***TST?**

Function: Self test query

Description: Returns the results of self test

Format: *TST?

Arguments: none

Reply: single integer
bit 0 – set if uncalibrated
bit 1 – set if error with analogue zero
> 15 – major system error

Example: *TST?
0

Notes:

***WAI** ***WAI**

Function:	Wait for operation complete
Description:	Suspends communication until the previous operation has completed
Format:	*WAI
Arguments:	none
Reply:	none
Example:	GAINPH START *WAI GAINPH,SWEEP?
Notes:	In the example, the query command GAINPH,SWEEP? can be sent immediately after the *WAI command and the sweep data will be returned as soon as the sweep has completed.

ABORT **ABORT**

Function:	Abort sweep
Description:	Abort an active sweep
Format:	ABORT
Arguments:	none
Reply:	none
Example:	FSWEEP,50,1000,1e6 OUTPUT,ON START ABORT

Notes:

ACTRIM **ACTRIM**

Function: Set ac control parameters

Description: Sets the specified signal level, tolerance and input channel. for the ac control (amplitude compression).

Format: ACTRIM,*channel,level,tolerance*

Arguments: channel:
DISABL
CH1
CH2
CH3
level:
required ac level in V or A or dBm
tolerance:
required accuracy in percent

Reply: none

Example: ACTRIM,CH1,1.0,5 (1.0V, 5%)

Notes: The level should be set in dBm if dBm mode is selected (OUTPUT,DBM)

It is not necessary to send all the arguments but those that are sent must be in the correct sequence.

ALARM **ALARM**

Function: Set common controls for alarm1 and alarm2.

Description: Set the alarm latch and sounder control.

Format: ALARM,*latch,sounder*

Arguments: latch:
ON
OFF
sounder:
ENABLED
DISABLED

Reply: none

Example: ALARM,ON,DISABLED

Notes:

ALARM? **ALARM?**

Function: Read alarm status.

Description: Reads the status of the measurements and 2 alarms.

Format: ALARM?

Arguments: none

Reply: single integer

bit 0 data available
bit 1 data error
bit 2 alarm 1
bit 3 alarm 2

Example: ALARM?

1

Notes: An alarm is present if bit 0 is high (data is available) and either alarm 1 or alarm 2 bits are high.

ALARM1 **ALARM1**

Function: Set parameters for alarm1.

Description: Set alarm1 type and thresholds.

Format: ALARM1,DISABLED
ALARM1,*type,data,high,low*

Arguments: type:
HIGH
LOW
INSIDE
OUTSIDE
LINEAR
data
1-4
high:
high threshold
low:
low threshold

Reply: None

Example: ALARM1,HIGH,1,2,0
ALARM1,DISABLED

Notes: DISABLED does not have any further arguments otherwise both thresholds must be sent even if only one is used.

ALARM2 **ALARM2**

Function: Set parameters for alarm2.

Description: Set alarm2 type and thresholds.

Format: ALARM2,DISABLED
ALARM2,*type,data,high,low*

Arguments: type:
HIGH
LOW
INSIDE
OUTSIDE
data
1-4 for zoom data
high:
high threshold
low:
low threshold

Reply: None

Example: ALARM2,LOW,3,0,0.5

Notes: DISABLED does not have any further arguments otherwise both thresholds must be sent even if only one is used.
There is no LINEAR option for alarm 2.

ALARME **ALARME**

Function:	Set alarm status enable register
Description:	Sets bits in the alarm status enable register to control which alarm bit if any set the alarm active bits in the status byte.
Format:	ALARME,*value*
Arguments:	decimal equivalent of alarm bits bit2 set bit 3 of status byte when alarm 1 is active bit3 set bit 3 of status byte when alarm 2 is active
Reply:	none
Example:	ALARME, 12 *SRE,8 set bit 3 in status byte when either alarm 1 or alarm 2 is active and generate a service request
Notes:	default value is 0

ALARME? **ALARME?**

Function:	Read alarm status enable register
Description:	Read back present bits in the alarm status enable register which controls the alarm active bit in the status byte.
Format:	ALARME?
Arguments:	none
Reply:	decimal equivalent of alarm bits
Example:	ALARME? 12
Notes:	

AMPLIT **AMPLIT**

Function:	Set output amplitude
Description:	Sets the output amplitude in Volts or dBm for the generator.
Format:	AMPLIT,*amplitude*
Arguments:	peak amplitude in Volts or amplitude in dBm
Reply:	none
Example:	AMPLIT,0.5 (set peak amplitude to 0.5V)
Notes:	dBm mode is selected by OUTPUT,DBM

AUXILI **AUXILI**

Function: Controls the auxiliary device

Description: Controls the auxiliary device connected to the extension port.

Format: AUXILI,*device,value*

Arguments: device:
IAI
value:
LOW
NORMAL
HIGH
VHIGH

Reply: None

Example: AUXILI,IAI,HIGH

Notes: Arguments will be extended to include other auxiliary devices as they become available

BANDWI **BANDWI**

Function: Select bandwidth or selective (heterodyning) measurements.

Description: Selective measurement automatically starts at around 10kHz for those functions that support it. It can be disabled by forcing the bandwidth to “wide”. For low noise measurements at low frequency the bandwidth can be restricted to “low”.

Format: BANDWI,*type*

Arguments: type:
AUTO
WIDE
LOW

Reply: none

Example: BANDWI,WIDE

Notes: In wide bandwidth mode the frequency range is limited to 5MHz.
In low bandwidth mode, the frequency is restricted to 30kHz

BEEP **BEEP**

Function: Sound the buzzer

Description: Makes a “beep” from the instrument.

Format: BEEP

Arguments: none

Reply: none

Example: BEEP

Notes:

BLANKI **BLANKI**

Function: Select blanking

Description: Enable or disable low value blanking.

Format: BLANKI,*value*

Arguments: value:
ON
OFF

Reply: none

Example: BLANKI,OFF

Notes:

CONFIG **CONFIG**

Function:	Direct access of configuration parameters
Description:	Sets configuration parameter for which there may not be a direct command.
Format:	CONFIG,*index*,*data*
Arguments:	index is the number of the parameter data is the data for that parameter
Reply:	none
Example:	CONFIG,6,1 (set phase convention)
Notes:	The list of configurable parameters is given in the appendix. CONFIG goes through the same limit checking as when entering data from the menus.

CONFIG? **CONFIG?**

Function:	Configurable parameter query
Description:	Reads the present value of a single parameter.
Format: or:	CONFIG,*index?* CONFIG?*index*
Arguments:	index is the parameter number
Reply:	Value of parameter, real or integer as appropriate.
Example:	CONFIG,6? (read phase convention) 0 CONFIG,6,1 CONFIG,6? 1
Notes:	The list of configurable parameters is given in the appendix.

COUPLI **COUPLI**

Function: Set ac or dc coupling.

Description: Selects the input coupling for a given input channel.

Format: COUPLI,*channel*,*coupling*

Arguments: channel:
CH1
CH2
coupling:
AC+DC
ACONLY

Reply: none

Example: COUPLI,CH2,AC+DC

Notes:

CYCLES **CYCLES**

Function: Set the minimum number of cycles for a measurement.

Description: The measurement window is normally set according to a time value but subject to a whole cycle of the frequency. Setting a minimum number of cycles to a value greater than 1 extends the measurement window at frequencies where the periodic time is longer than the set window time.

Format: CYCLES,*cycles*

Arguments: minimum number of cycles

Reply: none

Example: CYCLES,4

Notes:

DATALO **DATALO**

Function: Set up datalog

Description: Sets datalog parameters or accesses datalog non-volatile store.

Format: DATALO,*function,interval*

Arguments: function:
- DISABLE
- RAM
- NONVOL
- RECALL
- DELETE

interval:
- datalog interval in seconds

Reply: none

Example: DATALOG,NONVOL,10

Notes:

DATALO? **DATALO?**

Function: Read back datalog results

Description: Return datalog values, one record per line

Format: DATALO,*start,records*

Arguments: start:
first record to return
records:
number of records to return

Reply: 3 to 6 data values depending on settings:
index 1-n
elapsed time in hours
data1
data2 (if stored)
data3 (if stored)
data4 (if stored)
one record per line

Example:
```
DATALOG,NONVOL,36
START
wait for datalog
STOP
DATALOG,20,4?
20,1.9000E-1,1.2345E0
21,2.0000E-1,1.2345E0
22,2.1000E-1,5.6789E3
23,2.2000E-1,1.2345E0
```

Notes: if no arguments are sent then DATALOG? returns all data in the same format

DAV? **DAV?**

Function: Data available query

Description: Returns data availability status.

Format: DAV?

Arguments: none

Reply: Decimal equivalent of data available bits:

bit0	new data available
bit1	data available
bit2	new full sweep data available
bit3	sweep data available
bit5	harmonic data available
bit6	integration data available
bit7	datalog data available

Example:

```
START        (trigger sweep)
DAV?
0
DAV?
11           (first data available)
DAV?
11
DAV?
11
DAV?
15           (full sweep data available)
```

Notes: DAV? does not modify the status bits.

DAVER **DAVER**

Function: Set data available enable register

Description: Sets bits in the data available enable register to control which status bits set the data available bits in the status byte.

Format: DAVER,value

Arguments: decimal equivalent of data available bits
bit0 set bit 0 of status byte when new data available
bit1 set bit 0 of status byte when data available
bit2 set bit 1 of status byte when new full sweep data available
bit3 set bit 1 of status byte when sweep data available

Reply: none

Example: DAVER, 4
set bit 1 in status byte only when full sweep data is ready

Notes: default value is 6:
bit 0 of status byte is set whenever data is available
bit 1 of status byte is set when full sweep data is available.

DAVER? **DAVER?**

Function:	Read data available enable register
Description:	Read back present setting of the data available enable register, which controls the status bits that set the data available bits in the status byte.
Format:	DAVER?
Arguments:	none
Reply:	decimal equivalent of bits
Example:	DAVER? 4
Notes:	

DELAY **DELAY**

Function:	Set a delay time between frequency points
Description:	Applies a settling time when changing frequency for systems which need some settling time after the frequency changes before a measurement should be made.
Format:	DELAY,*time*
Arguments:	delay time in seconds from 1 to 60
Reply:	none
Example:	DELAY,1
Notes:	Whole seconds only

FAST **FAST**

Function: Set fast communications mode.

Description: Disables the screen drawing for high speed operation.

Format: FAST,*value*

Arguments: value:
ON
OFF

Reply: none

Example: FAST,ON

Notes: FAST mode does not suppress the data acquisition which continues in the background. See SUSPEND to disable all non-communication functions.

FILTER **FILTER**

Function: Select the filtering

Description: Sets the filter time constant and dynamic response.

Format: FILTER,*type,dynamics*

Arguments: type:
- NONE
- NORMAL
- SLOW

dynamics:
- AUTO
- FIXED

Reply: none

Example: FILTER,NORMAL,FIXED
FILTER,NONE

Notes: It is not necessary to send both parameters if it is only required to set the type. Both arguments must be sent to set the dynamics.

FRA **FRA**

Function:	Set frequency response analyser mode.
Description:	Set frequency response analyser mode.
Format:	FRA
Arguments:	
Reply:	none
Example:	FRA
Notes:	This command has the same effect as MODE,GAINPH. FRA, GAINPH, TFA are aliases for the same command.

FRA? **FRA?**

Function:	frequency response analyser query
Description:	Read frequency response analyser results. Sets frequency response analyser mode if not already set. Waits for next unread data if necessary. Clears new data available bit read by DAV?
Format: or:	FRA? FRA,SWEEP?
Arguments:	none, or SWEEP
Reply:	6 data values separated by commas freq,mag1,mag2,db,phase,delay + 4 values if 3 channels in use mag3,db3,phase3,delay3 one line per result for sweep data
Example:	OUTPUT,ON FRA FSWEEP,20,10,20E3 START DAV? 3 DAV? 15 FRA?SWEEP data returned
Notes:	FRA? waits for next unread data. FRA?SWEEP does not wait for new data. FRA, GAINPH, TFA are aliases for the same command

FREQUE **FREQUE**

Function:	Set the output frequency
Description:	Sets the generator output frequency in Hz.
Format:	FREQUE,*frequency*
Arguments:	frequency in Hz
Reply:	none
Example:	FREQUE,5e4 (set frequency to 50kHz)
Notes:	

FSWEEP **FSWEEP**

Function: Set the frequency sweep parameters

Description: Sets the start frequency in Hz, the end frequency, the number of steps and log/linear for the selected function.

Format: FSWEEP,*steps,start,end,type*

Arguments:
steps:
number of steps
start:
start frequency in Hz
end:
end frequency in Hz
type:
LOGARI
LINEAR

Reply: none

Example:
MODE,GAINPH
FSWEEP,50,1000,1e6
(set 50 steps between 1kHz and 1MHz)

Notes: It is not necessary to send all the arguments, but if they must be in the specified order.
The action at the end of the sweep is specified in the OUTPUT command.

GAINPH **GAINPH**

Function:	Set gain/phase analyser mode.
Description:	Set gain/phase analyser mode.
Format:	GAINPH
Arguments:	
Reply:	none
Example:	GAINPH
Notes:	This command has the same effect as MODE,GAINPH. FRA, GAINPH, TFA are aliases for the same command.

GAINPH? **GAINPH?**

Function:	Gain/phase query
Description:	Read gain/phase analyser results.
Format: or:	GAINPH? GAINPH,SWEEP?
Arguments:	none, or SWEEP
Reply:	See FRA?
Example:	OUTPUT,ON GAINPH FSWEEP,20,10,20E3 START DAV? 3 DAV? 15 GAINPH?SWEEP data returned
Notes:	GAINPH? is the same as FRA?

HARMON **HARMON**

Function: Set harmonic analyser mode.

Description: Set harmonic analyser mode and parameters.

Format: HARMON,*scan*,*parameter,harmonic,max*

Arguments: scan:
SINGLE
THDD
THDS
parameter:
PERCEN
DB
harmonic:
single harmonic 2-100 for display
max:
harmonic series 2-100 for series thd

Reply: none

Example: HARMON,SINGLE,PERCEN,3

Notes: It is not necessary to send any arguments, but if any are sent they must be in the specified order.

HARMON? **HARMON?**

Function:	Harmonic analyser query
Description:	Read harmonic results. Sets harmonic analyser mode if not already set. Waits for next unread data if necessary. Clears new data available bit read by DAV?
Format: or: or:	HARMON? HARMON,SWEEP? HARMON,SERIES?
Arguments:	none, or SWEEP, or SERIES
Reply: single: thd: series:	7 data values separated by commas: freq,mag1,mag2,h1,h2,harm1,harm2 freq,mag1,mag2,thd1,thd2,harm1,harm2 1 line per result for sweep data 6 data values separated by commas: mag1,%1,phase1,mag2,%2,phase2
Example:	HARMON? data returned
Notes:	HARMON? waits for next unread data. HARMON?SWEEP does not wait for new data – data can be read multiple times.

HOLD **HOLD**

Function:	Set/clear HOLD mode
Description:	HOLD mode stops the instrument from updating the measured values
Format:	HOLD,*value*
Arguments:	value: ON OFF
Reply:	none
Example:	HOLD,ON
Notes:	

INPUT **INPUT**

Function:	Set input mode
Description:	Selects the input type of the instrument
Format:	INPUT,*channel*,*type*
Arguments:	channel: CH1 CH2 CH3 type: VOLTAGE CURRENT
Reply:	None
Example:	INPUT,CH1,CURRENT SHUNT,CH1,0.1
Notes:	Current input needs an external shunt

KEYBOA **KEYBOA**

Function: Disable front panel keyboard.

Description: The front panel keyboard can be disabled to prevent accidental operation.

Format: KEYBOARD*,value*

Arguments: value:
ENABLE
DISABLE

Reply: none

Example: KEYBOARD,DISABLE

Notes: The keyboard can be re-enabled from the front panel only by pressing the HOME key.

LCR **LCR**

Function: Set LCR meter mode.

Description: Set LCR mode and conditions.

Format: LCR,*conditions,parameter,head*

Arguments: conditions:
- AUTO
- MANUAL

parameter:
- AUTO
- CAPACITANCE
- INDUCTANCE
- IMPEDANCE
- ADMITTANCE

head:
- NONE
- LOW (only valid for IAI)
- NORMAL
- HIGH
- VHIGH

Reply: none

Example: LCR,AUTO,IMPEDA,NORMAL

Notes: It is not necessary to send any arguments, but if any are sent they must be in the specified order.

LCR? **LCR?**

Function:	LCR meter query
Description:	Read LCR meter results. Sets LCR meter mode if not already set. Waits for next unread data if necessary. Clears new data available bit read by DAV?
Format: or: or:	LCR? LCR?SWEEP LCR,SWEEP?
Arguments:	none, or SWEEP
Reply:	14 data values separated by commas: freq, mag1, mag2, impedance, phase, series R, series C, series L, //R, //C, //L, tanδ, Q, reactance
or	11 data values separated by commas: freq, mag1, mag2, impedance, phase, resistance, reactance, admittance, phase, conductance, susceptance
sweep reply:	8 data values per line per sweep result: freq,Q,tanδ,impedance,phase,L,C,R
Example:	OUTPUT,ON LCR? data returned
Notes:	LCR? waits for next unread data. LCR?SWEEP does not wait for new data – data can be read multiple times.

LOWFRE **LOWFRE**

Function: Set low frequency mode

Description: Sets the low frequency option for external frequency measurement.

Format: LOWFRE,*value*

Arguments: value:
ON
OFF

Reply: none

Example: LOWFRE,ON

Notes: LOWFRE is mainly used for measuring low frequencies when not using the instrument generator for the frequency reference. However, as it applies digital filtering, it may also be useful when analysing any signals below a few hundred Hertz.

MARKER **MARKER**

Function: Set frequency marker

Description: Enable or disable frequency marker.

Format: MARKER,*value,frequency*

Arguments: value:
ON
OFF
frequency:
marker frequency in Hz

Reply: none

Example: MARKER,OFF
MARKER,ON,25e3

Notes: It is not necessary to send the frequency when enabling the marker if it has already been set.

MODE **MODE**

Function: Set mode

Description: Sets the fundamental operating mode of the instrument.

Format: MODE,*type*

Arguments: type:

VRMS	(rms voltmeter)
GAINPH	(gain/phase analyser)
VECTOR	(vector voltmeter)
POWER	(power meter)
LCR	(LCR meter)
HARMON	(harmonic analyser)
SCOPE	(oscilloscope)

Reply: none

Example: MODE,GAINPH

Notes: MODE sets the measurement mode of the instrument

MULTIL **MULTIL**

Function: Selects data for multi string reply

Description: Selects data values across phases and functions that can be read in a single string.

Format: MULTILOG,*index,phase,function*

Arguments:

index:

0	clear all
1-30	select data 1-30

phase:

1-3	phase 1-3
4	sum
5	neutral

function:

1-99	see appendix

Reply: none

Example:

```
MULTIL,0
MULTIL,1,1,2          (phase 1 Watts)
MULTIL,2,2,2          (phase 2 watts)
MULTIL,3,4,3          (sum VA)
MULTIL?
   3 data values returned
```

Notes:

MULTIL? **MULTIL?**

Function: Reads multi string reply

Description: Waits for data to be available then returns selected results.

Format: MULTILOG?
or: MULTILOG,*lines*?

Arguments: Lines:
Integer

Reply: Up to 60 data values as selected by the MULTILOG command in a single reply string
OR
Up to 60 data values as selected by the MULTILOG command in a single reply string, replying "*lines*" times.

Example:
MULTIL,0
MULTIL,1,1,2 (phase 1 Watts)
MULTIL,2,2,2 (phase 2 watts)
MULTIL,3,4,3 (sum VA)
MULTIL?
3 data values returned
MUTLIL,5?
Replies 5 times, each containing 3 data values

Notes: The MULTILOG,*lines*? command will reply each time a new data point is available.

NEWLOC **NEWLOC**

Function:	Waits for new data then holds so that multiple commands can be used on the same data set.
Description:	Reads multiple sets of data
Format:	NEWLOC
Arguments:	None
Reply:	none
Example:	NEWLOC;HARMON?SERIES;HPOWER? Harmonic series and Power data returned
Notes:	After the command the data will still be held so to release the lock send SUSPEND,OFF

NOOVER **NOOVER**

Function: Disable overranging

Description: Prevents an overrange error from blanking out results in manual ranging.

Format: NOOVER,*value*

Arguments: value:
ON
OFF

Reply: none

Example: NOOVER,ON

Notes: This can be useful when testing devices in a noisy environment. The range can be set to the correct range for the signal to be measured even if sporadic noise spikes would push it up on to the next range.

PFCONV **PFCONV**

Function: Set power factor sign convention.

Description: Fundamental power factor is given a sign depending convention either:
negative if lagging current
negative if leading current

Format: PFCONV,*type*

Arguments: type:
NEGLAG
NEGLEA

Reply: none

Example: PFCONV,NEGLAG

Notes: An inductive load would have a lagging current, a capacitive load would have a leading current.
The sign given to VAr can be independently set: see VARCON

OFFSET **OFFSET**

Function:	Set the output offset	
Description:	Sets the output generator offset in Volts.	
Format:	OFFSET,*offset*	
Arguments:	offset in Volts	
Reply:	none	
Example:	OFFSET,5e-3	(set offset to 5mV)
Notes:		

OUTPUT **OUTPUT**

Function: Set output

Description: Turns the output on or off, or sets the level mode to dBm or voltage. Also specifies the action at the end of a sweep

Format: OUTPUT,*command,sweep,phase*

Arguments: command:
- OFF
- ON
- DCONLY
- VOLT
- DBM

sweep:
- OFF
- ON
- DCONLY

Reply: none

Example: OUTPUT,ON

Notes: For safety, the output defaults to off and must be turned on explicitly.
It is not necessary to send all the arguments, but if they are sent they must be in the specified order

PAV **PAV**

Function: Set phase angle voltmeter mode.

Description: Set phase angle voltmeter mode and parameter.

Format: PAV,*parameter,lvdt scale*

Arguments: parameter:
- INPHAS
- QUADR
- TANPHI
- MAGNIT
- POLAR
- A2/1
- RMS2
- RMS2/1
- LVDT-D
- LVDT-R

lvdt scale:
- scale factor in m for lvdt applications

Reply: none

Example: PAV,LVDT-D,0.1

Notes: It is not necessary to send any arguments, but those that are sent must be in the specified order.
PAV and VECTOR are aliases for the same command.

PAV? **PAV?**

Function:	Phase angle voltmeter query
Description:	Read phase angle voltmeter results. Sets phase angle voltmeter mode if not already set. Waits for next unread data if necessary. Clears new data available bit read by DAV?
Format: or: or:	PAV? PAV,RMS? PAV,SWEEP?
Arguments:	none, or SWEEP
Reply:	7 data values separated by commas: freq,mag1,mag2,ratio,phase,a,b +5 data values if CH3 enabled mag3,ratio3,phase3,a3,b3 + rms values if PAV,RMS? 1 line per result for sweep data
Example:	FREQ,3300 OUTPUT,ON PAV? data returned
Notes:	PAV? waits for next unread data. PAV?SWEEP does not wait for new data – data can be read multiple times. PAV and VECTOR are aliases for the same command.

PHASEM **PHASEM**

Function:	Set phase meter mode.
Description:	Select phase meter mode.
Format:	PHASEM
Arguments:	as FRA
Reply:	none
Example:	PHASEM
Notes:	PHASEM is an alias for FRA to support early instruments

PHASEM? **PHASEM?**

Function:	Phase meter query
Description:	Reads phase meter results
Format:	PHASE?
Arguments:	none
Reply:	as FRA?
Example:	PHASE? Data returned
Notes:	PHASEM is an alias for FRA to support early instruments.

PHCONV **PHCONV**

Function: Set phase convention

Description: Set phase convention

Format: PHCONV,*convention*

Arguments: convention:
180: -180 to +180
-360: 0 to -360
+360: 0 to +360

Reply: none

Example: PHCONV, -360

Notes:

PHREF **PHREF**

Function:	Set phase reference
Description:	Select measurement of phase as CH2 relative to CH1 or as CH1 relative to CH2
Format:	PHREF,*channel*
Arguments:	channel: CH1: phase = ch2 wrt ch1 CH2: phase = ch1 wrt ch2
Reply:	none
Example:	PHREF, CH2
Notes:	This parameter influences the phase meter mode and the phase angle voltmeter mode

POWER **POWER**

Function:	Set up power meter mode.
Description:	Configure power meter with integration type
Format:	POWER,*integration type*
Arguments:	integration type: MAGNITUDE SIGNED
Reply:	none
Examples:	POWER,SIGNED POWER
Notes:	It is not necessary to send the integration type argument.

POWER? **POWER?**

Function: Read power meter results

Description: Reads back latest power meter results.
Sets power meter mode if not already set.
Waits for next unread data if necessary.
Clears new data available bit read by DAV?

Format: POWER?
or: POWER?*results*
or: POWER,*results*?

Arguments: results:
- WATTS
- RMS
- INTEGR

Reply: WATTS:
- 9 data values separated by commas
  W,W.f,VA,VA.f,pf,pf.f,Wdc,W.h,freq

RMS:
- 8 data values separated by commas
  rms1,2,dc1,2,f1,2,phase1,2

INTEGR:
- 9 data values separated by commas
  Wh,Wh.f,VAh,VAh.f,avpf,avpf.f,
  Ah,Ah.f,time

no argument:
- 26 data values separated by commas
  WATTS, RMS, INTEGR

Example: POWER?WATTS

Notes:

PROGRA **PROGRA**

Function: Access non volatile program stores.

Description: Recall, store or delete non-volatile program store.

Format: PROGRA,*function,number*

Arguments: function:
RECALL
STORE
DELETE
number
0-999

Reply: none

Example: PROGRA,RECALL,13

Notes: Number 0 represents factory default, which can only be recalled.

PROGRA? **PROGRA?**

Function: Identify program.

Description: Reads the name of the last program to be loaded or recalled or a program is memory.

Format:
PROGRA,NAME?
PROGRA,NAME,*number*?
PROGRA,FILES?

Arguments: number
0-999

Reply: NAME: text string
FILES: 1 text string per stored program:
number,name,date

Example: PROGRA,NAME?
factory default

Notes:

RANGE **RANGE**

Function: Set channel ranging.

Description: Select minimum range and range control for a given input channel.

Format: RANGE,*channel*,*ranging*,*range*

Arguments: channel:
- CH1
- CH2

ranging:
- AUTO
- UPAUTO
- MANUAL

range:
- nominal range value

Reply: none

Example: RANGE,CH2,MANUAL,3V

Notes:

RESOLU **RESOLU**

Function: Set the data resolution

Description: Data is returned in scientific format with exponent and mantissa. The resolution of the mantissa may be selected to be 5 digit (NORMAL) or 6 digit (HIGH).

Format: RESOLU,*format*

Arguments: format:

NORMAL	(5 digit mantissa)
HIGH	(6 digit mantissa)
BINARY	(raw binary format)

Reply: none

Example: RESOLU,HIGH

Notes: The resolution only changes the real number replies.
Data format for NORMAL is:
[-]1.2345E[-]00
Data format for HIGH is:
[-]1.23456E[-]00
The signs of the mantissa and exponent, shown as [-] in the above examples, are only sent if they are negative.
Data format for BINARY is a proprietary floating point format which returns raw data in a minimum number of data bytes.

RESULT **RESULT**

Function: Access non volatile result stores.

Description: Recall, store or delete non-volatile result.

Format: RESULT,*function,number*

Arguments: function:
RECALL
STORE
DELETE
number
0-999

Reply: none

Example: RESULT,RECALL,13

Notes:

RESULT? **RESULT?**

Function: Identify available results.

Description: Reads the name of the stored results.

Format: RESULT,NAME,*number*?
RESULT,FILES?

Arguments: number
0-999

Reply: NAME: text string
FILES: 1 text string per stored result:
number,name,date

Example: RESULT,NAME,13?
PSU stability sweep #3

Notes:

REZERO **REZERO**

Function:	Rezero front end
Description:	Request the DSP to re-compensate for dc offset and compute a new autozero
Format:	REZERO
Arguments:	none
Reply:	none
Example:	REZERO
Notes:	

SCALE **SCALE**

Function: Set channel scale factor.

Description: Set a multiplying scale factor for a given input channel.

Format: SCALE,*channel*,*factor*

Arguments: channel:
CH1
CH2
CH3
factor:
multiplying scale factor

Reply: none

Example: SCALE,CH2,10

Notes:

SCOPE? **SCOPE?**

Function: Fetch raw scope data.

Description: Read back raw oscilloscope data.

Format: SCOPE,*channel*?
SCOPE,*phase*,*channel*?

Arguments: phase:
- PHASE1
- PHASE2
- PHASE3
- NEUTRA

channel:
- VOLTAGE
- CURRENT

Reply: 252 signed integers:
- range
- trigger
- 250 x data

Example:
```
HOLD,ON
SCOPE,PHASE1,VOLTAGE?
read data
SCOPE,PHASE2,VOLTAGE?
read data
SCOPE,PHASE3,VOLTAGE?
read data
HOLD,OFF
```

Notes:

SCREEN? **SCREEN?**

Function:	Read the screen data
Description:	Returns a bit map of screen pixel display in ascii and hex format
Format:	SCREEN?
Arguments:	none
Reply:	Multiple data bit values
Example:	SCREEN? data returned

Notes: SCREEN? response:

ASCII coded Hex
(2 characters for each byte)
240 lines of 40 bytes (each line represents one line of the display)
preceded by #H
Each byte represents 8 dots where the lsb is the leftmost dot of the display
The bit is set for on and cleared for off

SETUP **SETUP**

Function: Upload instrument set up

Description: All the settings within the instrument may be read by SETUP? The same settings may then be stored by ending the same data back to the instrument. As it sends all settings in a compressed format it is quicker than setting individual parameters.

Format: SETUP,index,data

Arguments: index:
0-15
data:
ASCII hex as returned by SETUP?

Reply: none

Example: SETUP?
Read 16 lines of data
SETUP,00,data00
SETUP,01,data01
.
.
SETUP,15,data15

Notes: The settings are only updated when the 16th line has been received and the checksum has been verified.

SETUP? **SETUP?**

Function:	Read instrument set up
Description:	All the settings within the instrument may be read by SETUP? The same settings may then be stored by ending the same data back to the instrument. As it sends all settings in a compressed format it is quicker than setting individual parameters.
Format:	SETUP?
Arguments:	none
Reply:	16 lines of ASCII data
Example:	SETUP? Read 16 lines of data
Notes:	

SHUNT **SHUNT**

Function: Set channel shunt value

Description: Set the resistance factor of a current shunt to be divided into the measured voltage for a given input channel.

Format: SHUNT,*channel*,*resistance*

Arguments: channel:
CH1
CH2
CH3
resistance:
shunt resistance in Ohms

Reply: none

Example: SHUNT,CH1,10

Notes: The SHUNT command is still accepted if the channel has not been configured for current. The value stored will be used when the channel is configured for current.

SMOOTH **SMOOTH**

Function: Select the smoothing

Description: Sets the filter time constant and dynamic response.

Format: SMOOTH,*type,dynamics*

Arguments: type:
- NONE
- NORMAL
- SLOW

dynamics:
- AUTO
- FIXED

Reply: none

Example: SMOOTH,NORMAL,FIXED
SMOOTH,NONE

Notes: It is not necessary to send both parameters if it is only required to set the type. Both arguments must be sent to set the dynamics.
FILTER is an alias for SMOOTH

SPEED **SPEED**

Function: Sets the measurement speed

Description: Sets the minimum window size for the measurement.

Format: SPEED,*value*
SPEED,WINDOW,*time*

Arguments: value:
FAST
MEDIUM
SLOW
VSLOW
WINDOW

Reply: none

Example: SPEED,SLOW
SPEED,WINDOW,0.1

Notes:

START **START**

Function:	Start sweep
Description:	Initiate sweep in those functions that have a sweep or resets filtering in others.
Format:	START
Arguments:	none
Reply:	none
Example:	MODE,GAINPH (set gain phase analyser) START
Notes:	

STATUS? **STATUS?**

Function: Read back channel ranging status.

Description: Read back condition of selected channel:
- range number (1-16)
- range text
- overflow/underflow status

Format: STATUS?
or: STATUS,*channel?*

Arguments: channel:
- CH1
- CH2
- CH3

Reply: If no channel specified:
- OVER if any channel overflow
- LOW if any channel underflow
- OK if all channels in range

Else, range number,range text,status
- 1-16
- range as per RANGE command
- OVER if overflow
- LOW if underflow
- OK if in range

Example: STATUS,CH1?
6,3V,OK

Notes:

STOP **STOP**

Function:	Stop sweep
Description:	Stop an active sweep, or data streaming.
Format:	STOP
Arguments:	none
Reply:	none
Example:	MODE,PHASE,STREAM,0.01 START *read data values as required* STOP *read remaining data values*
Notes:	

SUSPEND **SUSPEND**

Function: Suspend data acquisition

Description: Suspends the background data acquisition to maximise the communications speed.

Format: SUSPEND,*command*

Arguments: command
OFF
ON

Reply: none

Example:
```
DATALOG,NONVOL,36
START
wait for datalog
STOP
SUSPEND,ON
DATALOG?
data,data,data,data, ……
SUSPEND,OFF
```

Notes:

TAGREP **TAGREP**

Function:	Set up a reply tag
Description:	Select a reply tag to identify the instrument in a multi-instrument environment
Format:	TAGREP,*on/off*
Arguments:	on/off: ON OFF
Reply:	none
Example:	TAGREP,ON *ESR? PPA5530:00635:1
Notes:	When “tag reply” is turned on every reply string has a prefix of an identification string comprising the model and serial number

TFA **TFA**

Function:	Set transfer function analyser mode.
Description:	Set transfer function analyser mode.
Format:	TFA
Arguments:	
Reply:	none
Example:	TFA
Notes:	This command has the same effect as MODE,GAINPH. FRA, GAINPH, TFA are aliases for the same command.

TFA? **TFA?**

Function:	transfer function analyser query
Description:	Read transfer function analyser results.
Format: or:	TFA? TFA,SWEEP?
Arguments:	none, or SWEEP
Reply:	As for FRA?
Example:	OUTPUT,ON TFA FSWEEP,20,10,20E3 START DAV? 3 DAV? 15 TFA?SWEEP data returned
Notes:	FRA, GAINPH, TFA are aliases for the same command

USER? **USER?**

Function: Read the user data

Description: Returns up to 3 lines of user data

Format: USER?

Arguments: none

Reply: 3 lines of ASCII terminated by CR

Example: USER?
Newtons4th Ltd
R&D department
PSM3750 #4

Notes:

VARCON **VARCON**

Function: Set VAr sign convention.

Description: Fundamental VAr measurement is given a sign depending convention either:
negative if lagging current
negative if leading current

Format: VARCON,*type*

Arguments: type:
NEGLAG
NEGLEA

Reply: none

Example: VARCON,NEGLAG

Notes: An inductive load would have a lagging current, a capacitive load would have a leading current.
The sign given to power factor can be independently set: see PFCONV

VECTOR **VECTOR**

Function:	Set vector voltmeter mode.
Description:	Set vector voltmeter mode and parameter.
Format:	VECTOR,*parameter,lvdt scale*
Arguments:	As PAV
Reply:	none
Example:	VECTOR,LVDT-D,0.1
Notes:	PAV and VECTOR are aliases for the same command.

VECTOR? **VECTOR?**

Function:	Vector voltmeter query
Description:	Read vector voltmeter results.
Format: or:	VECTOR? VECTOR,SWEEP?
Arguments:	none, or SWEEP
Reply:	As PAV
Example:	FREQ,3300 OUTPUT,ON VECTOR? data returned
Notes:	PAV and VECTOR are aliases for the same command.

VERSIO? **VERSIO?**

Function:	Read the instrument code versions.
Description:	Returns an ASCII string with the details of the various parts of the instrument firmware.
Format:	VERSIO?
Arguments:	none
Reply:	date code, type, cpu, dsp, fpga, boot
Examples:	VERSION? PQ3504,1,1.12,1.12,1.01,2.01
Notes:	This data can be displayed on the screen by pressing SYSTEM then BACK

VRMS **VRMS**

Function:	Set up rms voltmeter.
Description:	Set mode to rms voltmeter.
Format:	VRMS
Arguments:	none
Reply:	none
Examples:	VRMS
Notes:	This has the same effect as MODE,VRMS

VRMS? **VRMS?**

Function: Read true rms voltmeter results

Description: Reads back latest voltmeter results.
Sets voltmeter mode if not already set.
Waits for next unread data if necessary.
Clears new data available bit read by DAV?

Format: VRMS?
or: VRMS,*results*?

Arguments: results:
RMS
SURGE

Reply: RMS:
8 data values separated by commas
rms1,2,dc1,2,ac1,2,dbm1,2
SURGE:
6 data values separated by commas
pk1,2,cf1,2,surge1,2
no argument:
14 data values separated by commas
RMS results then SURGE

Example: VRMS?RMS

Notes: As VRMS? does not send the same data twice but waits instead for the next result, it is not necessary to check the data available bits before sending the VRMS? command.

WAVEFO **WAVEFO**

Function: Set the output waveform

Description: Selects the output waveform for the signal generator.

Format: WAVEFO,*type*

Arguments: type:
SINEWAVE
SQUARE
TRIANGLE
SAWTOOTH
PULSE
WHITENOISE

Reply: None

Example:
```
FREQUE,500
WAVEFO,TRIANG    (triangle wave)
OUTPUT,ON
```

Notes:

WIRING **WIRING**

Function: Set the wiring configuration

Description: Selects 2 channel or 3 channel operation.

Format: WIRING,*type*

Arguments: type:
CH2
CH3

Reply: None

Example: WIRING,CH3

Notes:

ZERO **ZERO**

Function: Apply or remove the zero

Description: Applies or removes a zero function depending on the measurement mode (same as pressing ZERO key).
Performs lead compensation in LCR mode.

Format:
ZERO
ZERO,DELETE
ZERO,DB,*offset*
ZERO,PHASE,*offset*

LCR compensation:
ZERO,SINGLE
ZERO,SWEEP,*steps,start,finish*
ZERO,OPEN
ZERO,SHORT
ZERO,STORE
ZERO,RECALL

Arguments:
offset:
offset value
steps:
LCR sweep compensation steps
start:
LCR compensation start frequency
stop:
LCR compensation stop frequency

Reply: none

Example:
ZERO,SWEEP,100,1e3,1e6
ZERO,OPEN
performs open circuit compensation

Notes:

ZOOM **ZOOM**

Function: Sets the display zoom parameters.

Description: Sets the zoom level and data.

Format: ZOOM,*level,data1,data2,data3,data4*

Arguments: level:
- 0 – no zoom
- 1 – normal
- 2 – 4 line display
- 3 – 3 line display

data1-4:
- function data for zoom

data consists of line number for channel 1
or line number + 64 for channel 2
or line number + 128 for channel 3

Reply: None

Example: VRMS
ZOOM,1,1,12 (level 1, ch1 rms, ch2 rms)

Notes: It is not necessary to send all the parameters, but whatever parameters are sent must be in the correct order.

ZOOM? **ZOOM?**

Function:	Read the display zoom parameters.
Description:	Reads the zoom level and data.
Format:	ZOOM?
Arguments:	
Reply:	5 integers separated by commas: Level,data1,data2,data3,data4 data consists of line number for channel 1 or line number + 64 for channel 2 or line number + 128 for channel 3
Example:	ZOOM? 1,1,129,0,0 (level 1, ch1 rms, ch2 rms)
Notes:	

Appendices

COMMAND SUMMARY

CONFIGURABLE PARAMETERS

COMMAND SUMMARY

command format	reply format
*CLS	
*ESE,value	
*ESE?	single integer data value
*ESR?	single integer data value
*IDN?	company,product,serial no,version
*OPC?	0 or 1
*RST	
*SRE,value	single integer data value
*SRE?	
*STB?	single integer data value
*TRG	
*TST?	single integer data value
*WAI	
ABORT	
ACTRIM,channel,level,tol	
ALARM,latch,sounder	
ALARM?	single integer data value
ALARME,value	
ALARME?	single integer data value
ALARM1,type,data,high,low	
ALARM2,type,data,high,low	
AMPLIT,amplitude	
AUXILI,device,value	
BANDWI,type	
BEEP	
BLANKI,on/off	
CONFIG,parameter,data	
CONFIG,parameter?	single integer or real data value
COUPLI,channel,coupling	
COUPLI,channel?	single integer data value
CYCLES,cycles	
DATALO,function,interval	
DATALO,start,records?	index,time,data... one record per line
DAV?	single integer data value
DAVER,value	
DAVER?	single integer data value
DELAY,time	
FAST,on/off	

FILTER,type,dynamics	
FRA	
FRA?	freq,mag1,mag2,dB,phase,delay
FRA,SWEEP?	n lines of FRA? data
FREQUE,frequency	
FSWEEP,steps,start,end,log	
GAINPH	
GAINPH?	freq,mag1,mag2,dB,phase,delay
GAINPH,SWEEP?	n lines of GAINPH? data
HARMON,scan,para,h,hmax	
HARMON?	freq,mag1,mag2,hmag1,hmag2,h1,h2
or	freq,mag1,mag2,thd1,thd2,h1,h2
HARMON,SERIES?	mag1,%1,ϕ1,mag2,%2,ϕ2
HARMON,SWEEP?	n lines of HARMON? data
HOLD,on/off	
INPUT,channel,type	
INPUT,channel?	single integer data value
KEYBOA,value	
LCR,conditions,param,head	
LCR?	freq, mag1, mag2, impedance, phase, R, L, C (series), R, L, C (parallel), tanδ, Q, reactance
or	freq, mag1, mag2, impedance, phase, resistance, reactance, admittance, phase, conductance, susceptance
LCR,SWEEP?	n lines of data: freq,QF,tanδ,impedance,phase,L,C,R
or	freq,QF,tanδ,admittance,phase,L,C,R
LOWFRE,on/off	
MARKER,on/off,frequency	
MODE,type	
MULTIL,index,ch,func	
MULTIL?	up to 60 floating point values
NEWLOC	
NOOVER,on/off	
OFFSET,offset	
OUTPUT,type,sweep,phase	
PAV,parameter,scaling	
PAV?	freq,mag1,mag2,parameter,phase,a,b
PAV,SWEEP?	n lines of VECTOR? data
PFCONV,type	
PHASEM	
PHASEM?	same as FRA
PHCONV,convention	

PHREF,channel	
POWER,integration type	
POWER,WATTS?	W,W.f,VA,VA.f,pf,pf.f,Wdc,W.h,freq
POWER,RMS?	rms1,rms2,dc1,dc2,fnd1,fnd2,ϕ1,ϕ2
POWER,INTEGR?	Wh,Wh.f,VAh,VAh.f,pf,pf.f,Ah,Ah.f,t
PROGRAM,function,number	
PROGRAM?	CR terminated text string
RANGE,ch,ranging,range	
RESOLU.format	
RESULT,function,number	
RESULT?	CR terminated text string
REZERO	
SCALE,channel,factor	
SCALE,channel?	single real data value
SCOPE,channel?	252 signed integers
SCREEN?	240 lines of 40 bytes
SETUP,index,data	
SETUP?	16 lines of ASCII data
SHUNT,channel,resistance	
SHUNT,channel?	single real data value
SMOOTH,type,dynamics	
SPEED,speed	
START	
STATUS,channel?	range number,range text,over/low/ok
STOP	
SUSPEND,on/off	
TAGREP,on/off	
TFA	
TFA?	freq,mag1,mag2,dB,phase,delay
TFA,SWEEP?	n lines of TFA? data
USER?	3 CR terminated text strings
VARCON,type	
VECTOR,parameter,scaling	
VECTOR?	freq,mag1,mag2,parameter,phase,a,b
VECTOR,SWEEP?	n lines of VECTOR? data
VERSION?	datecode,type,cpu,dsp,fpga,boot
VRMS	
VRMS?	RMS? data followed by SURGE?
VRMS,RMS?	rms1,rms2,dc1,dc2,ac1,ac2,db1,db2
VRMS,SURGE?	pk1,pk2,cf1,cf2,surge1,surge2
WAVEFO,type	
WIRING,type	
ZERO	
ZERO,DELETE	

ZOOM,level,d1,d2,d3,d4	
ZOOM?	level,d1,d2,d3,d4

calibration commands

CALAPP	
CALAUX,string	
CALCOM,freq	
CALDCO,value	
CALFIL,index,value	
CALFIL?	six real data values
CALFRQ,index,freq	
CALFRQ?	seven real data values
CALIAI,freq,res,reac	
CALIBR,index,value	
CALIBR?	single integer data value
CALIDS,string	
CALIDS?	string
CALOUT,index,value	
CALPHA,index	
CALRES	
CALSAV,password	
CALSNO,serial number	
CALSTR,string	
CALSTR?	string

Appendix B – Configurable parameters

All parameters can be accessed using the CONFIG command:

CONFIG,number,*parameter*?
CONFIG,*parameter,data*

Number	Function	*Parameter*
	System parameters	
1	Operating mode, (Sets main mode)	0=RMS Voltmeter 1=Frequency Response analyser 2=Power Meter 3=LCR Meter 4=Harmonic Analyser 5= Vector Voltmeter 6=Oscilloscope
2	Language, (System Options if installed)	0=English 1=Other (if installed)
3	Bandwidth, (Acquisition Control)	0=Auto 1=Wide
4	Autozero, (System Options)	0=Auto 1=Manual
5	Low blanking, (System Options & RMS Voltmeter)	0=Off 1=On
6	Phase convention, (System Options)	0=-180° to +180° 1=0° to -360° 2=0° to +360°
7	Generator output, (Output Options)	0=Off 1=On

2=dc only

8 Graph, (System Options)
0=Dots
1=Lines

9 Keyboard beep, (System Options)
0=Off
1=On

11 Low frequency mode, (Acquisition Control)
0=Off
1=On

12 Speed “window size”, (Acquisition Control, Enter figures)

13 Speed, (Acquisition Control)
0=Very slow
1=Slow
2=Medium
3=Fast
4=Very fast
5=Window

14 Filter, (Acquisition control)
0=Normal
1=Slow
2=None

15 Filter dynamics, (Acquisition Control, “Filter normal/slow”)
0=Auto reset
1=Fixed time

16 Baud rate, (Comms-Remote Options, RS232)
0=19200
1=9600
2=4800
3=2400
4=1200

18 Sweep steps, (Sweep Control-Enter step number figures)

19 Sweep start frequency, (Sweep Control-Enter figures)

20 Sweep end frequency, (Sweep Control-Enter figures)

21 Sweep-type, (Sweep Control)
0=Single
1=Repeat

22 Conditions, (LCR Meter)
0=Auto frequency
1=Manual
2=Auto shunt

23 Shunt, (System Options)
0=Default
1=Manual

Input parameters

24 Input 1 (CH1), (CH1-Input 1)
0=Direct
1=External shunt
2=External attenuator

25 Input 2 (CH2), (CH2-Input 2)
As Ch1

26 Input 3 (CH3), (CH3-Input 3)
As Ch1

27 Minimum range (CH1), (CH1-Input 1)
0=1mv
1=3mv
2=10mv
3=30mv
4=100mv
5=300mv
6=1v
7=3v
8=10v

28 Minimum range (CH2), (CH2-Input 2)
As CH1

29 Minimum range (CH3), (CH3-Input 3)
As CH1

30 Autoranging (CH1), (CH1-Input 1)
As Ch1

31 Autoranging (CH2), (CH2-Input 2)
As Ch1

32 Autoranging (CH3), (CH3-Input 3)
0=Full Autorange
1=Autorange up
2=Manual

33 Coupling (CH1), (CH1-Input 1)
0=ac+dc
1=ac

34 Coupling (CH2), (CH2-Input 2)
As Ch1

35 Coupling (CH3), (CH23-Input 3)
As Ch1

36 Scale (CH1), (CH1-Input, Enter figures)

37 Scale (CH2), (CH2-Input, Enter figures)

38 Scale (CH3), (CH3-Input, Enter figures)

39 External shunt (CH1), (CH1-Input, Enter figures)

40 External shunt (CH2), (CH2-Input, Enter figures)

41 External shunt (CH3), (CH3-Input, Enter figures)

Display parameters

42 Zoom level, (Main Display)
0=Zoom -
1=Zoom +
2=Second zoom +

43 Display zoom characters on line 1
44 Display zoom characters on line 2
45 Display zoom characters on line 3

46 Display zoom characters on line 4

47 Display type, (Main display-datalog or sweep display mode)
0=Real Time
1=Table
2=Graph

Signal generator parameters

48 Generator frequency, (Output Options-Enter figures)

49 Generator amplitude, (Output Options-Enter figures)

50 Generator offset, (Output Options-Enter figures)

51 Generator waveform, (Output Options)
0=Sinewave
1=Triangle
3=Square wave
4=sawtooth
5=pulse
6=white noise

52 Frequency step, (Output options-Enter figures)

53 Amplitude step, (Output options-Enter figures)

54 Amplitude dBm (Output options-[116 system control]-Enter figures)

55 Generator after sweep, (Sweep Control)
0=Off
1=On

Datalog parameters

58 Datalog, (Acuisition Control-memory type)
0=Disabled
1=RAM
2=Non volatile

59 Interval, (Acuisition Control-RAM/Non volatile-Enter time figures)

General parameters

64 Frequency marker, (Sweep Control)
0=Off
1=On

65 Marker frequency, (Enter frequency-Graph display-After sweep, alters marker position)

66 Program 1-6 direct load, (System Options)
0=Disabled
1=Enabled

Power meter parameters

83 Integration type, (Power meter)
0=Signed
1=Magnitude

Harmonic analyser parameters

99 Scan, (Harmonic analyser)
0=Single
1=Difference thd
2=Series thd

100 Harmonic, (Harmonic analyser)
0, 1 & 2=2
3=3
4=4
5=5
etc up to 64

101 Harmonics (Max), (Harmonic analyser-scan-series thd)
0, 1 & 2=2
3=3
4=4
5=5
etc up to 64

102 Parameter, (Harmonic analyser)
0=%

1=dB

103 Bargraph Scale, (Harmonic analyser-scan-series thd-Enter figure)

LCR sweep zero parameters

106 Frequency, (LCR Mode-Zero)
0=Single
1=Sweep

107 Sweep start (frequency), (LCR Mode-Zero-Enter figures)

108 Sweep end (frequency), (LCR Mode-Zero-Enter figures)

109 Steps, (LCR Mode-Zero-Enter figures)

System parameters

116 Control, (System options)
0=Volts
1=dBm

117 Step message, (System options)
0=Enabled
1=Disabled

118 Display sequence, (Graph display- After sweep alters screen display)
0=Primary Parameter
1=Secondary Parameter
2=Both Parameters

119 Length units, (System options)
0=Metres
1=Inch

LCR meter parameters

137 Parameter, (LCR Meter)
0=Auto
1=Capacitance
2=Inductance
3=Impedance

4=Admittance

138 Sweep, (LCR Meter)
0=Series
1=Parallel

139 Graph, (LCR Meter)
0=Single
1=Tanδ/QF
2=Resistance

140 LCR head shunt, (Auxiliary control-fixture-LCR active head)
0=Low
1=Normal
2=High
3=Very high

141 Graph, (LCR meter-impedance)
0=Linear
1=Log

142 Phase reference, (Mode-LCR-Zero-LCR Compensation-Enter figures)

143 Reference (Value), (Mode-LCR-Zero-LCR Compensation-Enter figures)

144 Reference, (Mode-LCR-Zero-LCR Compensation)
0=Capacitance
1=Resistance
2=Inductance

145 Connection, (LCR Meter)
0=Shunt
1=Divider Zx low
2=Divider Zx high

Gain/Phase analyser parameters

147 Graph (time selection), (FRA)
0=Phase
1=Delay

148 dB offset, (FRA-Enter figures)

149 Gain/Phase margins, (FRA)
0=Disabled
1=Enabled

150 Ratio, (FRA)
0=ch2/ch1
1=ch1/ch2

System parameters

151 Minimum cycles, (Acquisition control-Enter figures)

152 Delay time, (Acquisition control-Enter figures)

153 IEEE address, (Comms-Remote options-interface-GPIB-Enter figures)

154 Interface, (Comms-Remote options)
0=RS232
1=LAN
2=GPIB

Alarm functions (Monitor 1)

156 Monitor 1 data, (Alarm-monitor options)
0=Zoom1
1=Zoom2
2=Zoom3
3=Zoom4

157 Alarm type, (Alarm-monitor options)
0=Disabled
1=Linear
2=Alarm if high
3=Alarm if low
4=Outside window
5=Inside window

158 High threshold (Alarm type), (Alarm-monitor options-Enter figures)

159 low threshold (Alarm type), (Alarm-monitor options-Enter

figures)

160 Alarm latch (Alarm type), (Alarm-monitor options)
0=Off
1=On

161 Alarm sounder (Alarm type), (Alarm-monitor options)
0=Enabled
1=Disabled

Alarm functions (Monitor 2)

167 Monitor 2 data, (Alarm-monitor options)
0=Zoom1
1=Zoom2
2=Zoom3
3=Zoom4

168 Alarm 2 type, (Alarm-monitor options)
0=Disabled
1=Linear
2=Alarm if high
3=Alarm if low
4=Outside window
5=Inside window

169 High threshold (Alarm type), (Alarm-monitor options-Enter figures)

170 Low threshold, (Alarm type), (Alarm-monitor options-Enter figures)

Graph functions

173 Graph 2 scaling, (Sweep control)
0=Auto
1=Manual

174 Upper limit (Graph 2 scaling), (Sweep control-Enter figures)

175 Lower limit (Graph 2 scaling), (Sweep control-Enter figures)

Phase angle voltmeter parameters

177 Parameter, (Vector voltmeter)

0=In-phase
1=Quadrature
2=Tanδ
3=Magnitude
4=Phase
5=In-phase ratio
6=rms
7=rms2/rms1
8=LVDT diff
9=LVDT ratio
10=User interface

178 Scale factor (LVDT), (Vector voltmeter-Enter figures)

179 Null meter, (Vector voltmeter)

0=Off
1=Auto
2=Manual

180 Upper limit (Null meter), (Vector voltmeter-Enter figures)

181 Offset (Parameter), (Vector voltmeter-Enter figures)

Trim parameters

186 ac trim data, (Trim control)

0=Disabled
1=CH1
2=CH2

188 ac level (Trim data), (Vector voltmeter-Enter figures)

190 Trim tolerance (Trim data), (Vector voltmeter-Enter figures)

Other parameters

192 Steps, (Sweep control)

0=Log
1=Linear

193 Graph 1 scaling, (Sweep control)
0=Auto
1=Manual

194 Upper limit (Graph 1 scaling), (Sweep control-Enter figures)

195 Upper limit (Graph 2 scaling), (Sweep control-Enter figures)

198 Resolution, Comms-Remote Options)
0=Normal
1=High
2=Binary

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