Newtons4th Ltd

PPA3500

KinetiQ

Communications Manual

Firmware v2.10

12th May 2016

IMPORTANT SAFETY INSTRUCTIONS

This equipment is designed to comply with BSEN 61010-1 (2010) (Safety requirements for electrical equipment for measurement, control, and laboratory use) – observe the following precautions:

- Ensure that the supply voltage agrees with the rating of the instrument printed on the back panel ***before*** connecting the mains cord to the supply.
- This appliance ***must*** be earthed. Ensure that the instrument is powered from a properly grounded supply.
- The inputs are rated at 1kV rms or dc cat II; 600V rms or dc cat III. **Do not exceed the rated input**.
- Keep the ventilation slots in the top and sides of the cover 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 PPA35xx series of instruments over RS232, USB, or LAN. 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. 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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CONTENTS

1 Using remote control

The instrument is fitted with an RS232 serial communications port and USB interface as standard, and may have a LAN interface fitted as an option. All the interfaces use the same ASCII protocol:

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

All the functions of the instrument can be programmed via any interface, and results read back.

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.

FQREF,CURRENT;POWER?

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

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 2).

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 LAN (see section 2).

RS232 data format is: start bit, 8 data bits (no parity), 1 stop bit. Flow control is RTS/CTS (see section 1.3), baud rate is selectable via the MONITOR 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	ALA			RDV

bit 0 RDV (result data available)
set when 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 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

1.4 Data format

Non integer results are sent as ASCII characters in a scientific format consisting of 5 or 6 digit mantissa plus exponent:

+1.2345+E00
+1.23456+E00

For higher speed transfer a proprietary binary format can be selected which compresses the data into 4 bytes, each of which is sent with the msb set to distinguish them from ASCII control characters. The data is sent as a 7 bit signed exponent, a mantissa sign, and a 20 bit mantissa:

byte	data
1	7 bit signed exponent +63 to -64
2	bit 6 = mantissa sign bit 5:0 = mantissa bit 19:14
3	mantissa bit 13:7
4	mantissa bit 6:0

The value is coded as a binary fraction between 0.5 and 0.9999…, a multiplier of 2^n and a sign ie:

Value = (mantissa / 2^20) x 2^exponent x -1^sign

value	equivalent	hex data transmitted
3.0	0.75 x 2^2	0x82,0xB0,0x80,0x80
0.1	0.8 x 2^-3	0xFD,0xB3,0x99,0xCD
-320	-0.625 x 2^9	0x89,0xE8,0x80,0x80

Any valid number would have the msb of the mantissa set; any number without the msb of the mantissa set is zero.

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,PPA3530 KinetiQ, 196-01234,1.00
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.

***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:

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 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 range and smoothing.
Format:	*TRG
Arguments:	none
Reply:	none
Example:	MODE,VRMS *TRG VRMS,SURG?
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 DSP zero error
bit 2 – set if DSP run error
bit 3 – not used
bit 4 – System error, FPGA
bit 5 – System error, DSP RAM
bit 6 – System error, DSP run
bit 7 – System error, external RAM
bits 8 – 14 not used
> 15 – major system

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:	*TRG *WAI POWER,PHASE1?
Notes:	

ABORT ABORT

Function:	Abort datalog
Description:	Abort datalog data acquisition.
Format:	ABORT
Arguments:	none
Reply:	none
Example:	DATALOG,RAM,0.02 START *wait for data values* ABORT

Notes:

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?

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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,*type,data,high,low*

Arguments: type:
- DISABLED
- HIGH
- LOW
- INSIDE
- OUTSIDE
- LINEAR

data
- 1-4

high:
- high threshold

low:
- low threshold

Reply: none

Example: ALARM1,HIGH,1,2,0

Notes: 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,*type,data,high,low*

Arguments: type:
- DISABLED
- 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: 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:

APPLIC **APPLIC**

Function: Select application mode.

Description: Some applications require special settings within the instrument for optimum measurement

Format: APPLIC*,type,setting*

Arguments: type:
- NORMAL
- PWM
- BALLAST
- INRUSH
- POWERT
- STANDB

setting:
- filter 0-6 (PWM only)
- speed 0-3 (ballast only)
  - 0: fixed time
  - 1: fast
  - 2: medium
  - 3: slow

Reply: none

Example: APPLIC,POWERT
APPLIC,BALLAST,1

Notes:

Function: Selects the hardware bandwidth filter

Description: The bandwidth may be set to “wide” or “low” to minimise high frequency noise in noisy environments.

Format: BANDWI,*setting*

Arguments: Setting:
LOW
WIDE
HIGH

Reply: None

Example: BANDWI,LOW

Notes: WIDE and HIGH are the same.

BEEP **BEEP**

Function: Sound the buzzer

Description: Makes a “beep” from the instrument.

Format: BEEP

Arguments: none

Reply: none

Example: BEEP

Notes:

Function: Select blanking

Description: Enable or disable low value blanking.

Format: BLANKI,*value*

Arguments: value:
ON
OFF

Reply: none

Example: BLANKI,OFF

Notes:

CALSTR **CALSTR**

Function: Load a calibration string.

Description: When calibrated, the instrument stores a text string which can be read on the front panel (press SYS and LEFT). This shows the date of calibration. Users who subsequently verify the accuracy in their own calibration facilities can enter an alternative string with the new date. The original string is not overwritten but the alternative string is displayed instead.

Format: CALSTR,*string*

Arguments: *string* is any sequence of printable alpha numeric characters. Use the underscore character to add a space between words. CALSTR without a string argument clears the previously stored string.

Reply: none

Example: CALSTR,12_DEC_2015_AMW

Notes: As all white space is stripped from any communications string, the underscore character (ASCII 95 or 0x5F) must be used to space out the words. Underscore is shown as a space on the screen.

CALSTR? **CALSTR?**

Function: Read back the calibration string.

Description: When calibrated, the instrument stores a text string which can be read on the front panel (press SYS and LEFT). This shows the date of calibration. Users who subsequently verify the accuracy in their own calibration facilities can enter an alternative string with the new date. The original string is not overwritten but the alternative string is displayed instead.

Format: CALSTR?

Arguments: none.

Reply: alphanumeric string

Example: CALSTR?
12_DEC_2015_AMW

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 (set phase convention) CONFIG,6? 1
Notes:	The list of configurable parameters is given in the appendix.

COUPLI **COUPLI**

Function: Set ac or ac+dc coupling.

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

Format: COUPLI,*phase*,*coupling*

Arguments: phase:
- PHASE1
- PHASE2
- PHASE3
- PHASE4
- PHASE5
- PHASE6

coupling:
- AC+DC
- ACONLY
- DCONLY

Reply: none

Example: COUPLI,PHASE2,AC+DC

Notes: In multi phase applications, the coupling on phase 1 is applied to other phases unless “independent input control” is enabled.
PHASE4-6 may also be set by using PHASE1-3 when group 2 is the active group.

COUPLI? **COUPLI?**

Function: Read ac/dc coupling setting.

Description: Returns a numerical value for the coupling setting.

Format: COUPLI,*phase*,*coupling?*
or: COUPLI?*phase*,*coupling*

Arguments: phase:
PHASE1
PHASE2
PHASE3
PHASE4
PHASE5
PHASE6

Reply: 0 = AC+DC
1 = ACONLY
2 = DCONLY

Example: COUPLI,PHASE2,AC+DC
COUPLI,PHASE2?
0

Notes: In multi phase applications, the coupling on phase 1 is applied to other phases unless “independent input control” is enabled.

DATALO **DATALO**

Function: Set up datalog

Description: Sets datalog parameters.

Format: DATALO,*function,interval,speed*

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

interval:
- datalog interval in seconds

speed:
- HIGH

Reply: none

Example: DATALO,RAM,10
DATALO,RAM,0,HIGH

Notes: set interval to 0 to record every measurement as fast as possible.
Set HIGH to select high speed mode for any combination of W, VA, VAr, pf, Vrms, Arms, and frequency. If HIGH is not sent then high speed mode is reset.

DATALO? **DATALO?**

Function: Read back datalog results

Description: Return datalog values, one record per line, or the number of lines available

Format: DATALO,*start,records?*
DATALO,0?
DATALO,LINES?

Arguments: start:
first record to return
records:
number of records to return
0:
return all new records since last read

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:
```
DATALO,RAM,10
START
wait for datalog
STOP
DATALO,LINES?
30
DATALO,21,3?
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 DATALO? returns all the available lines of data

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 harmonic series data available
bit6 integration data available
bit7 datalog data available

Example:

```
SPEED,SLOW
*TRG
DAV?
0
DAV?
0
DAV?
0
DAV?
3            (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

Reply: none

Example: DAVER, 1
set bit 0 in status byte when new data is available

Notes: default value is 2:
bit 0 of status byte is set whenever 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:	

DISPLAY **DISPLAY**

Function: Set the display page

Description: Selects the page on the display for the active group.

Format: DISPLAY,*page*

Arguments: page:

- PHASE1
- PHASE2
- PHASE3
- SUM
- NEUTRAL
- TOTAL
- FUNDAMENTAL
- VOLTAGE
- CURRENT

Reply: None

Example: DISPLAY,FUNDAMENTAL

Notes: VOLTAGE is the same as TOTAL; CURRENT is the same as FUNDAMENTAL. They refer to the multiphase display modes.

DISPLAY? **DISPLAY?**

Function:	Read the displayed data
Description:	Returns all the values presently on the screen for the active group.
Format:	DISPLAY?
Arguments:	none
Reply:	Multiple floating point values separated by commas
Example:	DISPLAY?
Notes:	

EFFICI **EFFICI**

Function: Set efficiency calculation

Description: Selects the data to be used for the efficiency calculation for the active group.

Format: EFFICI,*formula*

Arguments: formula:

0 – disabled
1 – phase / next phase
2 – next phase / phase
3 – group 2 / group 1
4 – group 1 / group 2
5 – mechanical / sum
6 – sum / mechanical
7 – phase 3 / sum
8 – sum /phase 3

Reply: none

Example: EFFICIENCY,3

Notes:

EFFICI? **EFFICI?**

Function:	Read efficiency result
Description:	Reads back the total and fundamental efficiency results.
Format:	EFFICI?
Arguments:	none
Reply:	2 data values separated by commas: total, fundamental or 6 data values
Example:	EFFICI? data returned
Notes:	6 data values returned if efficiency option is phase / next phase and 3 phase wiring is configured

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.

FQLOCK **FQLOCK**

Function: Lock frequency.

Description: Fix the frequency for analysis to the present value.

Format: FQLOCK,*mode,frequency*

Arguments: value:

ON
OFF
NORMAL
CONSTANT [,frequency]
DYNAMIC

Reply: none

Example: FQLOCK,ON

Notes: OFF is the same as NORMAL
To fix the analysis to a specified frequency, either first lock the frequency with FQLOCK,ON and send the desired frequency with the FREQUE command or send CONSTANT followed by the frequency.

FQREF **FQREF**

Function: Set frequency reference.

Description: Select the channel to be used for measuring the frequency on the active group.

Format: FQREF,*phase*
FQREF,*channel*
FQREF,*phase,channel*

Arguments: channel:
- voltage
- current

phase:
- PHASE1
- PHASE2
- PHASE3

Reply: none

Example: FQREF,CURRENT

Notes: Measured phase is always referred to phase 1 voltage no matter what channel is selected to measure the frequency, unless phase 1 is not active (eg phase 2 only mode).

FREQUE **FREQUE**

Function:	Set the analysis frequency
Description:	Sets the analysis frequency in Hz for frequency lock mode.
Format:	FREQUE,*frequency*
Arguments:	frequency in Hz
Reply:	none
Example:	FQLOCK,ON FREQUE,5e4 (set frequency to 50kHz)
Notes:	Lock the frequency with FQLOCK,ON before sending the desired frequency with the FREQUE command.

FSD? **FSD?**

Function: Read the full scale of all input channels at once or that of an individually selected input channel.

Description: Returns the full scale value for all channels or that of a single selected channel.

Format: FSD?
FSD,*channel*

Arguments: Channel:
CH1
CH2
CH3
CH4
CH5
CH6

Reply: Up to six data values separated by commas

Example: FSD,CH1?
Data returned

Notes: Number of channels that can be read and the number of data values returned is dependent on the number of phases selected in the instruments settings.
CH1 = PH1: Voltage Input
CH2 = PH1: Current Input
CH3 = PH2: Voltage Input
CH4 = PH2: Current Input
CH5 = PH3: Voltage Input
CH6 = PH3: Current Input

GROUP **GROUP**

Function: Set the active group.

Description: Select the group to which all future commands will be directed.

Format: GROUP,*group*

Arguments: group:
1 or 2

Reply: none

Example: GROUP,2

Notes:

GROUP1 **GROUP1**

Function: Set the number of phases in group 1.

Description: If there are more than three phases in group 1 then the instrument will operate in single group mode, otherwise the instrument will operate with two independent groups. A six phase unit always has at least three phases in group 1; a four phase unit could have one to four phases in group1

Format: GROUP1,*phases*

Arguments: phases:
1 to 6

Reply: none

Example: GROUP1,6

Notes: For a four phase unit, set group 1 to
1 for 1 : 2+3+4
2 for 1+2 : 3+4
3 for 1+2+3 : 4
4 for 1+2+3+4 (single group)

HARMON **HARMON**

Function: Set harmonic analyser mode.

Description: Set harmonic analyser mode and parameters.

Format: HARMON,*para*,*harmonic,max*

Arguments: para:

THDD	difference formula THD
THDS	harmonic series THD
TIF	Telephone Influence Factor
THF	Telephone Harmonic Factor
TDD	Total Demand Distortion
TRD	Total Rated Distortion
HPHASE	harmonic phase
HRMS	harmonic rms
HFACTO	harmonic factor
PH-PH	phase to phase

harmonic:

individual harmonic for display

max:

length of harmonic series (to 50)

Reply: none

Example: HARMON,THDS,3,50

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: HARMON?
or: HARMON,*phase*?
or: HARMON,SERIES?
or: HARMON,*phase*,SERIES?

Arguments: phase:
- PHASE1
- PHASE2
- PHASE3
- PHASE4
- PHASE5
- PHASE6
- NEUTRAL
- PHASES

Reply: 11 data values separated by commas:
freq,mag1,mag2,hmag1,hmag2,h%1,
h%2,thd%1,thd%2,hphase1,hphase2
or: magnitude and percentage for each harmonic, one channel per line
or: magnitude and phase for each harmonic, one channel per line

Example: HARMON,PHASE2?
data returned

Notes: HARMON? waits for next unread data.

HOLD **HOLD**

Function: Set data hold

Description: Turns data hold on or off. Useful for reading data from different phases without it being changed between reads.

Format: HOLD,state

Arguments: state:
ON
OFF

Reply: none

Example:
```
HOLD,ON
POWER,PHASE1,WATTS?
POWER,PHASE2,WATTS?
POWER,PHASE3,WATTS?
HOLD,OFF
```

Notes:

Function:	Set harmonic power parameters
Description:	Sets power parameters but does not change to power mode so that power can be measured in harmonic series mode.
Format:	See POWER
Arguments:	See POWER
Reply:	none
Example:	See POWER
Notes:	

HPOWER? **HPOWER?**

Function: Read harmonic power results

Description: Reads power results but does not change to power mode so that power can be read in harmonic series mode.

Format: See POWER?

Arguments: See POWER?

Reply: None

Example: See POWER?

Notes:

Function: Set input mode

Description: Selects the input type of the instrument

Format: INPUT,*channel*,*type*

Arguments:
channel:
- CH1
- CH2
- CH3
- CH4
- CH5
- CH6

type:
- INTERN
- EXTATT
- EXTSHU
- INTX10

Reply: None

Example: INPUT,CH1,EXTSHU

Notes:
CH1 applies to all voltage channels (unless in single phase 2 or 3 wiring)
CH2 applies to all current channels (unless in single phase 2 or 3 wiring)
CH3 and 4 apply to phase 2 voltage and current when in single phase 2 wiring
CH5 and 6 apply to phase 3 voltage and current when in single phase 3 wiring

Function: Set integrated power mode.

Description: Set integrated power mode, whether the integration for Watts and current use signed or unsigned values, and whether accumulated or averaged values are computed.
Also sets up run time for integration over a specific interval.

Format: INTEGR,*type,display*
INTEGR,RUNTIM,*hours,minutes*

Arguments: type:
SIGNED
MAGNITUDE
display:
TOTAL
AVERAGE
hours:
integer
minutes:
integer

Reply: none

Example: INTEGR,MAGNITUDE,TOTAL

Notes:

Function: Read integrated power mode.

Description: Read integrated power mode for the selected phase.

Format: INTEGR,*phase?*

Arguments: phase:
- PHASE1
- PHASE2
- PHASE3
- PHASE4
- PHASE5
- PHASE6
- PHASES
- SUM

Reply: 13 values separated by commas
time,Wh,WH.f,VAh,VAh.f,VArh,Varh.f
pf,pf.f,V,V.f,Ah,Ah.f

Example:
START
wait for integration time
INTEGR,PHASE1?
data returned

Notes: INTEGR? without specifying the phase returns the appropriate single phase data.

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,*parameter*

Arguments: parameter:
AUTO
CAPACITANCE
INDUCTANCE
IMPEDANCE

Reply: none

Example: LCR,IMPEDA

Notes:

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: LCR,*phase*?

Arguments: phase:
PHASE1
PHASE2
PHASE3
PHASE4
PHASE5
PHASE6
PHASES

Reply: 11 data values separated by commas:
freq, Vmag, Amag, impedance,
phase, R, C, L, tanδ, Qf, reactance

Example: LCR,IMPEDA
LCR,PHASES?
data returned

Notes: LCR? waits for next unread data.
LCR? without specifying the phase returns the appropriate single phase data.

LOWFRE **LOWFRE**

Function: Set low frequency mode

Description: Sets the low frequency option for extending the measurement window.

Format: LOWFRE,*value*

Arguments: value:
ON
OFF

Reply: none

Example: LOWFRE,ON

Notes: LOWFRE is mainly used for measuring low frequencies (<5 Hz). However, as it applies digital filtering, it may also be useful when analysing any signals below a few hundred Hertz.

MODE **MODE**

Function: Set mode

Description: Sets the basic operating mode of the instrument.

Format: MODE,*type*

Arguments: type:

POWER	(power meter)
INTEGR	(integrator)
HARMON	(harmonic analyser)
RMS	(rms voltmeter)
LCR	(LCR meter)
SCOPE	(oscilloscope)
PHASEM	(phase meter)

Reply: none

Example: MODE,LCR

Notes:

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: MULTIL,*index,phase,function*

Arguments:

index:

0	clear all
1-30	select data 1-30

phase:

1-3	phase 1-3
4	sum
5	neutral
6	ADI40
7-9	phase 4-6
10	sum 2
11	neutral 2

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: MULTIL?

Arguments: none:

Reply: Up to 64 data values as selected by the MULTIL command in a single reply string

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: For further information and assistance with the Multilog application please go to page 2-93 where you will find an application guide to assist with this function

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:	Data as per returned parameter query. ie from power, harmonics etc.
Example:	NEWLOC HARMON,SERIES? HPOWER? Harmonic series and Power data returned from the same data.
Notes:	After the command the data will still be held so to release the lock send SUSPEND,OFF

NOISEF **NOISEF**

Function: Set the digital noise filter

Description: Select the noise filter and set the filter frequency to reduce the presence of high frequency noise.

Format: NOISEF,*setting,frequency*

Arguments: setting:
ON
OFF
Frequency:
corner frequency in Hz

Reply: none

Example: NOISEF,ON,150E3

Notes: Minimum filter frequency is 1kHz.
Because the same digital filter is applied to voltage and current there is no introduced phase error.

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

PHASEM **PHASEM**

Function: Set phase meter mode.

Description: Select phase meter mode and reference.

Format: PHASEM,*reference*

Arguments: reference:

CH1	ratio = ch2/ch1
CH2	ratio = ch1/ch2

Reply: none

Example: PHASEM,CH2

Notes:

PHANGR **PHANGR**

Function: Set phase angle reference

Description: Fourier transform analysis can be phase referred to current or voltage fundamental

Format: PHANGR,*reference*

Arguments: reference:
VOLTAGE
CURRENT

Reply: none

Example: PHANGR,CURRENT

Notes: If measuring current without any voltage present it is important to set the phase angle reference to CURRENT for the fundamental to be accurate.

PHASEM? **PHASEM?**

Function: Phase meter query

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

Format: PHASEM?
PHASEM,*phase*?

Arguments: phase:
PHASE1
PHASE2
PHASE3
PHASE4
PHASE5
PHASE6
PHASES?

Reply: 5 data values separated by commas
freq,mag1,mag2,dB,phase

Example: PHASEM,CH1
PHASEM,PHASE1?
data returned

Notes: The phase convention can be set to 0° to -360°, 0° to +360°, or +180° to -180° in the SYSTEM menu or using PHCONV command.
PHASEM? without specifying the phase returns the appropriate single phase data.

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: 0 to -360 degrees is usually used for power analysis applications

POWER **POWER**

Function: Set up power analyser mode.

Description: Configure power analyser with sum current display type

Format: POWER,*sum type*

Arguments: sum type:
TOTAL
AVERAGE

Reply: none

Examples: POWER,TOTAL

Notes:

POWER? **POWER?**

Function: Read power analyser results

Description: Reads back latest power analyser results.
Sets power analyser mode.
Waits for next unread data if necessary.
Clears new data available status bit.

Format: POWER,*phase*,*results*?

Arguments: phase:
- PHASE1
- PHASE2
- PHASE3
- PHASE4
- PHASE5
- PHASE6
- PHASES
- SUM
- NEUTRAL (current only)

results:
- WATTS
- VOLTAGE
- CURRENT
- VECTORS
- RMS
- WVA
- PH-PH

Reply:

WATTS:
freq,W,W.f,VA,VA.f,VAr,VAr.f,pf,pf.f,
Wdc,W.h
VOLTAGE or CURRENT:
freq,rms,mag,dc,phase,pk,cf,mean,
form factor,harm
VECTORS:
freq,vmag1,vlag1,amag1,alag1…..
RMS:
freq,vrms1,vdc1,arms1,adc1…..
WVA:
freq,w1,vrms1,arms1,w2…..
PH-PH:
freq,rms1,mag1,lag1,rms2...

Example:

POWER,VECTORS?
data returned

Notes:

POWER? without specifying the phase returns the appropriate single phase data. PHASES returns the data for all valid phases 1-3.

Function: Select only primary functions.

Description: Sets the instrument to only compute total functions not fundamentals, in order to allow shorter measurement windows..

Format: PRIMAR,*value*

Arguments: value:
ON
OFF

Reply: none

Example: PRIMAR,ON

Notes: When primary is on, fundamental values will be displayed as zero.

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
0-100

Reply: none

Example: PROGRA,RECALL,13

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

PROGRA? **PROGRA?**

Function: Identify current program.

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

Format: PROGRA,NAME?
PROGRA,FILES?

Arguments: none

Reply: Name of last recalled program or result
List of all stored programs

Example:
```
PROGRA,FILES?
   10,AMW1,18/01/2016
   11,AMW2,21/01/2016
PROGRA,RECALL,11
PROGRA,NAME?
   AMW2
```

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:
- range number 1-8

Reply: none

Example: RANGE,CH2,MANUAL,4

Notes:
CH1 sets the voltage range
CH2 sets the current range
Refer to the user manual for the range corresponding to each range number

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) or 20 bit (BINARY).

Format: RESOLU,*format*

Arguments: format:

NORMAL	(5 digit mantissa)
HIGH	(6 digit mantissa)
BINARY	(compressed format)

Reply: none

Example: RESOLU,HIGH

Notes: Data format for NORMAL is:
[-]1.2345E[-]00
Data format for HIGH is:
[-]1.23456E[-]00
The sign of the mantissa and exponent are only sent if negative shown as [-] in the above examples
BINARY format encodes each non-integer value in a proprietary 4 byte format for higher speed data transfer.

[Further notes on data format are included in section 1.4]

RESULT **RESULT**

Function: Access results stores.

Description: Recall, store or delete results.

Format: RESULT,*function,number*

Arguments: function:
- RECALL
- STORE
- DELETE

number
- 1-99

Reply: none

Example: RESULT,RECALL,13

Notes:

RESULT? **RESULT?**

Function: Identify used result stores.

Description: Reads a directory of the result locations.

Format:
RESULT,NAME?
RESULT,FILES?

Arguments: none

Reply:
Name of last recalled result or program
List of names of all stored results

Example:
```
RESULT,FILES?
   10,AMW1,18/01/2016
   11,AMW2,21/01/2016
RESULT,RECALL,11
RESULT,NAME?
   AMW2
```

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
factor:
multiplying scale factor

Reply: none

Example: SCALE,CH2,10

Notes: CH1 sets the scale for all voltage channels
CH2 sets the scale for all current channels

SCOPE? **SCOPE?**

Function: Fetch raw scope data.

Description: Read back raw oscilloscope data.

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

Arguments: phase:
- PHASE1
- PHASE2
- PHASE3
- PHASE4
- PHASE5
- PHASE6
- 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?
SCREEN,COLOUR?
SCREEN,*group*
SCREEN,COLOUR,*group*?

Arguments: Group
GROUP1
GROUP2

Reply: Multiple lines of data bit values

Example:
SCREEN?
data returned

Notes:
SCREEN? response:
272 lines of 60 bytes in ASCII coded Hex (2 characters for each byte) 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
SCREEN,COLOUR? response:
1088 lines of 120 bytes preceded by #C
Each line of the display is sent as four lines of data from left to right
Each byte represents a single RGB dot in binary format: 0 1 r1 r0 g1 g0 b1 b0

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:
0-31
data:
ASCII hex as returned by SETUP?

Reply: None

Example: SETUP?
Read 31 lines of data
SETUP,00,data00
SETUP,01,data01
.
.
SETUP,31,data31

Notes: The settings are only updated when the 32nd 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: 32 lines of ASCII data

Example: SETUP?
Read 32 lines of data

Notes:

SHUNT **SHUNT**

Function: Set channel shunt value

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

Format: SHUNT,*channel*,*resistance*

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

Reply: none

Example: SHUNT,CH1,10

Notes: The shunt value is set for all current channels

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 target window size for the measurement.

Format: SPEED,*value,window*

Arguments: value:
- VERY FAST
- FAST
- MEDIUM
- SLOW
- VSLOW
- WINDOW

Reply: none

Example: SPEED,SLOW
SPEED,WINDOW,0.1

Notes: The window size argument is only needed for the WINDOW option
The actual window size used depends on the frequency of the signal.

START **START**

Function: Start datalog

Description: Initiate datalog data acquisition.

Format: START

Arguments: none

Reply: none

Example: DATALOG,RAM,0.02
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
- .
- .
- CH6

Reply: range number,range text,over/under/ok
- 1-8
- range as per RANGE command
- OVER if overflow
- LOW if underflow
- OK if in range

Example:
```
STATUS,CH1?
6,300V,OK
STATUS?
OK
```

Notes: STATUS? gives a summary value reporting OK only if all channels are not overrange or underrange

STOP **STOP**

Function:	Stop datalog
Description:	Stop datalog data acquisition.
Format:	STOP
Arguments:	none
Reply:	none
Example:	DATALOG,RAM,0.02 START *wait for data values* STOP *read data values*
Notes:	

SUSPEN **SUSPEN**

Function: Suspend data acquisition.

Description: Disable the data acquisition to maximise the communication speed.

Format: SUSPEN,*value*

Arguments: value:
ON
OFF

Reply: none

Example:
```
FAST,ON
SUSPEN,ON
MULTILOG?
SUSPEN,OFF
FAST,OFF
```

Notes:

TAGREP **TAGREP**

Function: Set the comms reply tag

Description: When TAGREP is enabled any reply string is preceded by an identifier string in order to identify a message from a given instrument connected to a network.

Format: TAGREP,*setting*

Arguments: setting:
DISABLED or OFF
ENABLED or ON

Reply: none

Example:
```
*ESR?
   1
TAGREP,ON
*ESR?
   PPA3560:04656:1
```

Notes: All reply strings will be preceded with:
Instrument type:serial number:

TORQSP **TORQSP**

Function: Set up the torque and speed measurement

Description: Analog inputs for torque and speed may be scaled and offset so suit various transducers. Pulsed input has a value for the number of pulses per revolution

Format: TORQSP,*type,scale1,scale2*
TORQSP,OFFSET,*offset1,offset2*

Arguments: Type:
DISABLED
ANALOG
PULSED
scale1 and scale 2
multiplying factor in Nm/V or rpm/V
pulses/rev
offset1 and offset2
zero level in V

Reply: none

Example: TORQSP,ANALOG,10,1

Notes:

TORQSP? **TORQSP?**

Function: Read the torque and speed measurement

Description: Returns torque, speed and mechanical power

Format: TORQSP?

Arguments: none

Reply: 3 data values separated by commas
- Mechanical power in Watts
- Torque in Nm
- Speed in rpm

Example: TORQSP?
Data returned

Notes:

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
KinetiQ #4

Notes:

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

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 type: 0 – 20A 4 – 30A
Examples:	VERSIO? KQ4715,4,2.11,2.11,2.02,2.01
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.
Waits for next unread data if necessary.
Clears new data available status bit.

Format: VRMS,*phase*,*results*?

Arguments: results:
- RMS
- MEAN
- SURGE

phase:
- PHASE1
- PHASE2
- PHASE3
- PHASE4
- PHASE5
- PHASE6
- PHASES

Reply: RMS:
- 6 data values separated by commas
- Vrms,Arms,Vdc,Adc,Vac,Aac

MEAN:
- 6 data values separated by commas
- Vrms,Arms,Vmean,Amean,Vff,Aff

SURGE:
- 8 data values separated by commas
- Vrms,Arms,Vpk,Apk,Vcf,Acf,
- Vsurge,Asurge

Example: VRMS,PHASE1,RMS?

Notes: VRMS? without specifying the phase returns the appropriate single phase data.

Function: Select wiring mode.

Description: Set wiring mode for computation of SUM and neutral data.

Format: WIRING,*type*

Arguments: type:
- SINGLE (single ph 1)
- 2PHASE (2 ph 2 wattmeter)
- 3PH2WA (3 ph 2 wattmeter)
- 3PH3WA (3 ph 3 wattmeter)
- INDPH3 (3 ph 2 wattmeter + ph3)
- PHASE1 (single ph 1)
- PHASE2 (single ph 2)
- PHASE3 (single ph 3)

Reply: none

Examples: WIRING,PHASE2

Notes: WIRING,SINGLE is the same as WIRING,PHASE1
Use GROUP1 command to set a single group with four or more phases.

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).
Resets the integration data and timer if in power integration mode.

Format: ZERO
ZERO,DELETE

Arguments: none

Reply: none

Example: ZERO

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 – normal
- 1 – zoom data larger font (zoom level 1)
- 2 – zoom data only (zoom level 2)
- 3 – first three zoom data only (zoom level 3)

data1-4:

- zoom data

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

Reply: None

Example: VRMS
ZOOM,1,1,65 (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:
- 0 – normal
- 1 – zoom data larger font (zoom level 1)
- 2 – zoom data only (zoom level 2)
- 3 – first three zoom data only (zoom level 3)

data1-4:
- zoom data

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

Example: ZOOM?
1,1,65,0,0 (level 1, ch1 rms, ch2 rms)

Notes:

3 Multilog Application Guide

Configuring the N4L PPA Power Analyzer for Data logging

The Multilog (MULTIL) command provides an excellent method for data logging up to 64 parameters of information via one query command - MULTIL?

The instrument will return a comma-separated string which relates to the MULTIL,X,X,X setup commands previously entered by the relevant communication method. This enables the system to send one query and return up to 64 different parameters, from different phases in one response.

Step 1.

Reset “MULTILOG” using the **MULTIL,0** command
This will clear any previously entered Multilog parameters and ensure the instrument does not return unwanted results.

Step 2.

Set up the Multilog parameters
The format of the Multilog command is as follows

MULTILOG, Index, Phase, function

Index is the order in which the value is returned (Effectively allocating a “slot” for the parameter in the returned string)

Phase is the phase (PH1, PH2, PH3 etc) from which the result should be acquired.

Function is the parameter type (eg. Watts, VAr, Frequency etc) of the return.

The Function ID is chosen from Appendix C which is a continually growing list due to firmware upgrades of the power analyzers at N4L, at present the PPA3500 has 87 possible functions:

Function	Measurement	Notes
1	frequency	
2	watts	
3	VA	
4	VAr	
5	power factor	
6	fundamental watts	
7	fundamental VA	
8	fundamental VAr	
9	fundamental PF	
10	harmonic watts	
11	harmonic watts %	
12	impedance	
13	resistance	

Example extract from the Multilog function list

Required Parameters

Order parameter to be returned within string	Phase (channel) of data returned	Parameter required
1	1	Frequency
2	1	Watts Phase 1
3	2	Watts Phase 2
4	3	Watts Phase 3
5	1	RMS Voltage Phase 1
6	2	RMS Voltage Phase 1
7	3	RMS Voltage Phase 1

MULTILOG Pattern

Command	Index	Phase	Function
MULTIL,	1	1	1
MULTIL,	2	1	2
MULTIL,	3	2	2
MULTIL,	4	3	2
MULTIL,	5	1	50
MULTIL,	6	2	50
MULTIL,	7	3	50

Command strings to sent, reference the above Multilog pattern;

MULTIL,0 // clears Multilog

MULTIL,1,1,1 // set Frequency as parameter 1

MULTIL,2,1,2 // set Phase 1 Watts as parameter 2

MULTIL,3,2,2 // set Phase 2 Watts as parameter 3

MULTIL,4,3,2 // set Phase 3 Watts as parameter 4

MULTIL,5,1,50 // set Phase 1 RMS Voltage as parameter 5

MULTIL,6,2,50 // set Phase 2 RMS Voltage as parameter 6

MULTIL,7,3,50 // set Phase 3 RMS Voltage as parameter 7

Step 3.

Send Multil query and read return string.

MULTIL? // returns a comma separated string as

Example return string:

5.0000E1, 2.4500E2, 2.4320E2, 2.5421E2, 1.0232E3, 1.0152E3, 1.0546E3

Frequency	PH1 Watts	PH2 Watts	PH3 Watts	PH1 RMS Volt	PH2 RMS Volt	PH3 RMS Volt

Appendix A – Configurable parameters

All parameters can be accessed using the CONFIG command:

CONFIG,*number*,*parameter*

Send GROUP,GROUP2 to access the parameters for group 2. All subsequent commands will be applied to group 2 until GROUP,GROUP1 is sent.

Note that not all parameters have a corresponding value for group 2. For example the selection of COM port is common to both groups.

number	Function	*parameter*
1	Operating mode, (sets Main Mode)	0=RMS Voltmeter 1=Phase Meter 2=Power Analyser 3=Impedance Analyser 4=Power Integrator 5=Harmonic Analyser 7=Oscilloscope
2	Resolution, (remote options – digit resolution)	0=Normal 1=High 2=Binary
4	Autozero manual or auto, (System options)	0=Auto 1=Manual
6	Phase convention, (System options)	0=-180° to +180° 1=0° to -360°

2=0° to +360°

7 Frequency lock on/off, (Acquisition advance options)
0=Off
1=On

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

9 Keyboard beep on/off, (System options)
0=Off
1=On

10 Ignore overload,(Acquisition advance options)
0=Off
1=On

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

12 Window size, (Acquisition control, speed-window)
0=mS
1=Sec's

13 Speed, (Acquisition control or Phase meter)
0=Very Slow
1=Slow
2=Medium
3=Fast
4=Very Fast
5=Window

14 Smoothing (Acquisition Control or Phase Meter)
0=Normal
1=Slow
2=None

15 Smoothing Response (Acquisition Control or Phase meter)
0=Auto reset
1=Fixed time

16 Baud rate, (Remote options , RS232)

0=38400
1=19200
2=9600
3=1200

18 LAN IP address nibble 3, (Remote options - LAN - enter figure as required)
19 LAN IP address nibble 2, (Remote options - LAN - enter figure as required)
20 LAN IP address nibble 1, (Remote options - LAN - enter figure as required)
21 LAN IP address nibble 0, (Remote options - LAN - enter figure as required)

22 Independent ranging, (System options)
0=Disabled
1=Enabled

23 Grouping, (number of phases in group 1)

24 Enable channel 1, (Range – voltage input)
1=Internal
3=External Attenuator
4=Internal x 10

25 Enable channel 2, (Range – current input)
1=Internal
2=External Shunt
4=Internal x10

26 Input range channel 1, (Range – minimum range voltage)
0=1V
1=3V
2=10V
3=30V
4=100V
5=300V
6=1kV
7=3kV

27 Input range channel 2, (Range – minimum range current)
0=300mA
1=1A
2=3A
3=10A
4=30A
5=100A
6=300A

7=1kA

28 Input ranging channel 1, (Range – autoranging voltage)
0=Full Autorange
1=Range up only
2=Manual

29 Input ranging channel 2, (Range – autoranging current)
0= Full Autorange
1=Range up only
2=Manual

30 Coupling, (Coupling)
0=ac+dc
1=ac
2=dc

32 Scale factor channel 1 voltage, (Ranging - Enter figures as required)

33 Scale factor channel 2 current, (Ranging - Enter figures as required)

34 External attenuator channel 1, (Ranging – voltage input - attenuator ratio – Enter figures as required)

35 External shunt channel 2, (Ranging – current input - resistance value- Enter figures as required)

36 Phase 1 noise filter, (Acqu
0 = Off
1 = On

37 Phase 1 noise filter frequency, (Acqu corner frequency in Hertz)
0 = Off
1 = On

38 Frequency reference voltage/current, (Acquisition control)
0=Voltage
1=Current

40 Frequency reference phase, (Acquisition control)
0=Phase 1
1=Phase 2
2=Phase 3

41 Display page, (Main display)
0=Phase 1 page
1=Phase 2 page

2=Phase 3 page
3=Sum page
4=Phase 1,2 & 3 page
5=Phase 1,2 & 3 fundamentals page
6=NEU page

42 Zoom level, (Main display)
0=Zoom level 0
1=Zoom level 1
2=Zoom level 2 – 4 figures
3=Zoom level 3 – 3 figures

43 Function zoomed on 1, (Main display)
0=Voltage, Current & Frequency
1=Watts, Current, Voltage & Frequency
2= VA, Current, Voltage & Frequency
3= VAr, Current, Voltage & Frequency
4= pf, Current, Voltage & Frequency

44 Function zoomed on 2, (Main display)
0=Current & Frequency
1= Watts, Current & Frequency
2= VA, Current & Frequency
3= VAr, Current & Frequency
4= pf, Current & Frequency
5= Current, Voltage & Frequency

45 Function zoomed on 3, (Main display)
0= Watts & Frequency
2= Watts, VA & Frequency
3= Watts, VAr & Frequency
4= Watts, pf & Frequency
5= Watts, Voltage & Frequency
6= Watts, Current & Frequency

46 Function zoomed on 4, (Main display)
0= Watts & VA
3= Watts, VA & VAr
4= Watts, VA & pf
5= Watts, VA & Voltage
6= Watts, VA & Current
7= Watts, VA & Frequency
8= Watts, VA & Harmonic
9= Watts, VA & dc watts

10= Watts, VA & V Ph-Ph

47 Datalog display type, (Datalog display information mode)
0=Real Time
1=Table
2=Graph

48 Manual frequency, (Acqu advanced options – frequency in Hertz)

49 DFT selectivity, (Acqu advance options)
0=Normal
1=Narrow

50 Program 1-4 direct load, (System options)
0=Disabled
1=Enabled

51 Language, (System options)
0=English
1=Other language if installed

52 Frequency filter, (Acquisition control)
0=Disabled
1=Enabled, fundamental>1kHz
2=Enabled, fundamental<1kHz

53 Phase reference, (Acquisition control)
0=Voltage
1=Current

54 Datalog Zoom1, (Datalog-RAM)
0=Enabled
1=Disabled

55 Datalog Zoom2, (Datalog-RAM)
0=Enabled
1=Disabled

56 Datalog Zoom3, (Datalog-RAM)
0=Enabled
1=Disabled

57 Datalog Zoom4, (Datalog-RAM)
0=Enabled

1=Disabled

58 Datalog memory type, (Datalog)
0=Disabled
1=RAM

59 Datalog Interval, (Datalog) (Enter interval time figure in seconds)

60 Datalog graph, (Datalog-RAM)
0=Together
1=Separate

61 Formula, (Maths)
0=Disabled
1=(term1 + term2/term3 + term4)
2=(term1 + term2) x term3/term4
3=term1 x term2/(term3 + term4)

62 Argument term 1
0=Disabled
1=Constant
2=Voltage
3=Current
4=Torque
5=Speed

63 Sub argument term 1, (For voltage and current arguments only)
0=rms
1=dc
2=ac
3=Fundamental
4=Peak
5=Mean
6= Ph-Ph rms
7=Ph-Ph mag

64 Term 1 coefficient, (Enter value)

65 Argument term 2,
0=Disabled
1=Constant
2=Voltage
3=Current
4=Torque

5=Speed

66 Sub argument term 2, (For voltage and current arguments only)
0=rms
1=dc
2=ac
3=Fundamental
4=Peak
5=Mean
6= Ph-Ph rms
7=Ph-Ph mag

67 Term 2 coefficient, (Enter value)

69 Low frequency mode minimum frequency, (Enter value)

70 Application mode,
0=Normal
1=PWM
2=Lighting ballast
3=Inrush current
4=Transformer mode
5=Standby power
6=Calibration mode

72 Frequency tracking speed, (Application options mode - Lighting Ballast)
0=Fixed time
1=Fast
2=Medium
3=Slow

73 PWM and ballast low frequency, (Application options modet)
0=Off
1=On

74 Argument term 3
0=Disabled
1=Constant
2=Voltage
3=Current
4=Torque
5=Speed

75 Sub argument term 3, (For voltage and current arguments only)

0=rms
1=dc
2=ac
3=Fundamental
4=Peak
5=Mean
6= Ph-Ph rms
7=Ph-Ph mag

76 Term 3 coefficient, (Enter value)

77 Argument term 4
0=Disabled
1=Constant
2=Voltage
3=Current
4=Torque
5=Speed

78 Sub argument term 4, (For voltage and current arguments only)
0=rms
1=dc
2=ac
3=Fundamental
4=Peak
5=Mean
6= Ph-Ph rms
7=Ph-Ph mag

79 Term 4 coefficient, (Enter value)

82 Wiring configuration, (Acquisition control)
0=Single phase 1
1=2 phase 2 wattmeter
2=3 phase 2 wattmeter
3=3 phase 3 wattmeter
4=Single phase 2
5=Single phase 3
6=3 phase 2 wattmeter + PH3
7=group2 uses group1 data

83 Integration, (Power analyzer - Power integrator)
0=Signed
1=Magnitude

84 Torque + speed, (Application options – PWM motor drive)
0=Disabled
1=Analogue speed
2=Pulsed speed

85 Torque scaling Nm/V, (Applications – PWM motor drive) (Also transformer scale factor Deg/v)(Enter Nm/v value)

86 Speed scaling Hz/V,(Applications – PWM motor drive)(Enter rpm/v value)

87 Pulses per revolution,(Applications–PWM motor drive)(Enter pulses/rev value)

88 Integration display, (Mode - Power integrator)
0=Total
1=Average

89 Sum current average, (Power analyzer)
0=Total
1=Average

90 Input compensation, (Mode)
0=Disabled
1=Enabled

91 Power factor sign, (Power analyzer)
0=Negative lagging
1=Negative leading

92 VAr sign, (Power analyzer)
0= Negative lagging
1=Negative leading

93 Efficiency computation, (Power analyzer)
0=Disabled
1=Phase / next
2=Next / Phase
3=group2/group1
4=group1/group2
5=mechanical/sum
6=sum/mechanical
7=Phase 3/Sum
8=Sum/Phase 3

94 Torque offset, (Mode – value in Volts)

95 Speed offset, (Mode – value in Volts)

96 Voltage rating for HVF, (Harmonic mode – value in Volts)

99 Computation mode, (Harmonic analyzer)
- 0=Difference formula
- 1=Harmonic series
- 2=TIF
- 3=THF
- 4=TRD
- 5=TDD
- 6=Series harmonic phase
- 7=Harmonic rms
- 8=Harmonic factor

100 Selected harmonic, (Harmonic analyzer - figure = harmonic required)

101 Harmonic series up to, (Harmonic analyzer - figure = harmonic max)

102 Voltage bargraph scale, (Harmonic analyzer - figure = % required)

103 Current rating (TRD), (Harmonic analyzer – TRD mode – enter figure)

104 Current bargraph scale, (Harmonic analyzer - figure = % required)

106 Timebase, (Scope - Enter figure/div)

107 trigger level, (Scope - Enter figure/div)

108 Pretrigger, (Scope)
- 0=None
- 1=25%
- 2=50%
- 3=75%

109 trigger polarity, (Scope)
- 0=Rising edge
- 1=Falling edge

110 trigger Mode, (Scope)
- 0=Auto
- 1=Normal
- 2=Single shot

111 trigger reference, (Scope)
0=Voltage
1=Current

112 trigger phase, (Scope)
0=Phase 1
1=Phase 2
2=Phase 3

113 cursors enable, (Scope)
0=Off
1=On

114 trigger HF reject, (Scope)
0=Off
1=On

115 Trace, (Scope)
0=Dual
1=Voltage
2=Current

117 DFT phase angle ref, (System)
0=Cosine
1=SIne

119 Zoom 2 high resolution, (System)
0=Disabled
1=Enabled

120 Brightness, (System)
0=Low
1=High

122 Auxiliary device, (Aux control)
0=None
6=PCIS
9-12=ADI40

128 Switch phase offset, (Aux control – PCIS device)
0=0°
1=45°
2=90°
3=135°
4=180°

5=225°
6=270°
7=315°

129 Switch on cycles, (Aux control – PCIS device)
0=Single cycle
1=Continuous
2=Half cycle

131 2 Wattmeter sum computation, (Power Analyser)(select in acquisition wiring-2 phase 2 wattmeter)
0=Low distortion
1=High Distortion

132 Integrator-run time (Hours), (Mode – Power integrator - enter figure)

133 Integrator-Run time (mins), (Mode - Power integrator – enter figure)

134 Ph – Ph Measurement, (Power analyser)
0=rms
1=Mean
2=star-delta
3=delta-star

135 Difference THD, (Power analyser – penultimate line - Vthd)
0=Disabled
1=Enabled including dc
2=Enabled excluding dc

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

138 Measurement, (Impedance analyzer)
0=Series
1=Parallel

139 Phase offset, (Impedance analyzer - Enter figures)

140 Voltage peak, (rms voltmeter)
0=Signed
1=Separate
2=Unfiltered

144 Rectified mean, (rms voltmeter)
0=Absolute
1=Normalised

148 dB offset, (Phase meter - Enter figures)

150 Computation, (Phase meter)
0=ch2/ch1
1=ch1/ch2

152 RS232 printer enable, (Remote options)
0=Disabled
1=Enabled

154 Interface, (Remote options)
0=RS232
1=USB
2=LAN
3=GPIB

155 Recall with program, (Remote options)
0=Off
1=On

156 Alarm 1 data, (Alarm options)
0=Zoom1
1=Zoom 2
2=Zoom3
3=Zoom 4

157 Alarm 1 type, (Alarm options)
0=Disabled
1=Linear
2=Alarm if high
3=Alarm if low
4=Outside window5=Inside window

158 Alarm 1 high threshold, (Alarm options – alarm if high – enter figure)

159 Alarm 1 low threshold, (Alarm options – alarm if low – enter figure)

160 Alarm latch, (Alarm options – alarm if high)
0=Off
1=On

161 Alarm sounder, (Alarm options – alarm if high)

0=Enabled
1=Disabled

167 Alarm 2 data, (Alarm options)
0=Zoom1
1=Zoom 2
2=Zoom 3
3=Zoom 4

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

169 Alarm 2 high threshold, (Alarm options – alarm if high – enter figure)

170 Alarm 2 low threshold, (Alarm options – alarm if low – enter figure)

176 Enable channel 3, (Range–voltage input)(Sys - independent ranging enabled)
1=Internal
3=External Attenuator
4=Internal x10

177 Enable channel 4, (Range – current input)(Sys independent ranging enabled)
1=Internal
2=External Shunt
4=Internal x10

178 Input range channel 3, (Range – minimum range voltage) (Sys independent ranging enabled)
0=1V
1=3V
2=10V
3=30V
4=100V
5=300V
6=1kV
7=3kV

179 Input range channel 4, (Range – minimum range current) (Sys independent ranging enabled)
0=300mA

1=1A
2=3A
3=10A
4=30A
5=100A
6=300A
7=1kA

180 Input ranging channel 3, (Range – autoranging voltage) (Sys independent ranging enabled)
0=Full Autorange
1=Range up only
2=Manual

181 Input ranging channel 4, (Range – autoranging current) (Sys independent ranging enabled)
0= Full Autorange
1=Range up only
2=Manual

182 Coupling phase 2, (Coupling) (Sys independent ranging enabled)
0=ac +dc
1=ac
2=dc

184 Scale factor channel 3 voltage, (Ranging - Enter figures as required)(Sys independent ranging enabled)

185 Scale factor channel 4 current, (Ranging - Enter figures as required) (Sys independent ranging enabled)

186 External attenuator channel 3,(Ranging – voltage input - attenuator ratio Enter figures as required)(Sys independent ranging enabled)

187 External shunt channel 4, (Ranging – current input – resistance value Enter figures as required) (Sys independent ranging enabled)

188 Phase 2 noise filter, (Acqu)
0 = Off
1 = On

189 Phase 2 noise filter frequency, (Acqu corner frequency in Hertz)
0 = Off
1 = On

196 ID tag prepends comms replies
0 = Off
1 = On

197 High speed mode
0 = Off
1 = On

200 Enable channel 5, (Range – voltage input) (Sys independent ranging enabled)
1=Internal
3=External Attenuator
4=Internal x10

201 Enable channel 6, (Range – current input) (Sys independent ranging enabled)
1=Internal
2=External Shunt
4=Internal x10

202 Input range channel 5, (Range – minimum range voltage)
0=1V
1=3V
2=10V
3=30V
4=100V
5=300V
6=1kV
7=3kV

203 Input range channel 6, (Range – minimum range current) (Sys independent ranging enabled)
0=300mA
1=1A
2=3A
3=10A
4=30A
5=100A
6=300A
7=1kA

204 Input ranging channel 5, (Range – autoranging voltage) (Sys independent ranging enabled)
0=Full Autorange
1=Range up only
2=Manual

205 Input ranging channel 6, (Range – autoranging current) (Sys independent ranging enabled)

0= Full Autorange
1=Range up only
2=Manual

206 Coupling phase 3, (Coupling) (Sys independent ranging enabled)

0=ac +dc
1=ac
2=dc

208 Scale factor channel 5 voltage, (Ranging - Enter figures as required) (Sys independent ranging enabled)

209 Scale factor channel 6 current, (Ranging - Enter figures as required) (Sys independent ranging enabled)

210 External attenuator channel 5, (Ranging – voltage input - attenuator ratio as required) (Sys independent ranging enabled)

211 External shunt channel 6, (Ranging – current input – resistance value as required) (Sys independent ranging enabled)

212 Phase 3 noise filter, (Acqu)

0 = Off
1 = On

213 Phase 3 noise filter frequency, (Acqu corner frequency in Hertz)

0 = Off
1 = On

231 Memory, (Program)

0=Internal
1=USB Memory stick

232 Data, (Program)

0=Program
1=Results
2=Datalog

233 Action, (Program)

0=Recall
1=Store
2=Delete

234 Location, (Program - Enter figures as required)

Appendix B – MULTIL parameters

function	measurement	notes
1	frequency	
2	watts	
3	VA	
4	VAr	
5	power factor	
6	fundamental watts	
7	fundamental VA	
8	fundamental VAr	
9	fundamental PF	
10	harmonic watts	
11	harmonic watts %	
12	impedance	
13	resistance	
14	reactance	
15	impedance phase	
16	efficiency	
17	fundamental efficiency	
18	maths	
19	integrated watts	integrator mode
20	integrated VA	integrator mode
21	integrated VAr	integrator mode
22	integrated rms current	integrator mode
23	average power factor	integrator mode
24	integrated fundamental watts	integrator mode
25	integrated fundamental VA	integrator mode
26	integrated fundamental VAr	integrator mode
27	integrated fundamental current	integrator mode
28	average fundamental power factor	integrator mode
29	average integrated watts	integrator mode
30	average integrated VA	integrator mode
31	average integrated VAr	integrator mode
32	average integrated fundamental watts	integrator mode
33	average integrated fundamental VA	integrator mode
34	average integrated fundamental VAr	integrator mode
35	average rms voltage	integrator mode
36	average fundamental voltage	integrator mode
37	Standby mode frequency	
38	DC watts	

39	average rms current	integrator mode
40	average fundamental current	integrator mode
41	delta watts	
42	fundamental delta watts	
43	elapsed time	integrator mode
44	LCR resistance	
45	LCR inductance	
46	LCR capacitance	
47	LCR tan delta	
47	LCR Q factor	
49	reserved for future expansion	
50	rms voltage	
51	rms current	
52	fundamental voltage	
53	fundamental current	
54	voltage phase	
55	current phase	
56	harmonic voltage	
57	harmonic current	
58	dc voltage	
59	dc current	
60	ac voltage	
61	ac current	
62	peak voltage	
63	peak current	
64	voltage crest factor	
65	current crest factor	
66	rectified mean voltage	
67	rectified mean current	
68	voltage form factor	
69	current form factor	
70	voltage harmonic	
71	current harmonic	
72	voltage harmonic percentage	
73	current harmonic percentage	
74	voltage thd	harmonic mode
75	current thd	harmonic mode
76	voltage tif	harmonic mode
77	current tif	harmonic mode
78	phase to phase rms voltage	
79	phase to phase fundamental voltage	
80	phase to phase voltage phase angle	
81	phase to phase rms voltage	

82	voltage surge	
83	current surge	
84	voltage rms deviation	transformer mode
85	voltage fundamental deviation	transformer mode
86	voltage phase deviation	transformer mode
87	voltage positive peak	
88	current positive peak	
89	voltage negative peak	
90	current negative peak	
91	voltage positive peak unfiltered	
92	current positive peak unfiltered	
93	voltage negative peak unfiltered	
94	current negative peak unfiltered	
95	In-phase component of voltage	
96	Quadrature component of voltage	
97	In-phase component of current	
98	Quadrature component of current	
99	reserved for future expansion	

Phase selection:

1 = phase 1
2 = phase 2
3 = phase 3
4 = sum
5 = neutral

Newtons4th Ltd. contact details

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