PPA5500
KinetiQ
COMMUNICATIONS MANUAL

Firmware v2.159
10th April 2017
IMPORTANT SAFETY INSTRUCTIONS

This equipment is designed to comply with BSEN 61010-1 (2001) (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 holes on the underneath and rear 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 PPA55xx series of instruments 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.

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Firmware Revision 2.159

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PPA55xx communications manual

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Appendix A – command summary
Appendix B – configurable parameters
Appendix C – MULTILOG parameters
1 Using remote control

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

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<th>Rx expects</th>
<th>Tx sends</th>
</tr>
</thead>
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<tr>
<td>RS232</td>
<td>carriage return</td>
<td>carriage return</td>
</tr>
<tr>
<td>USB, LAN</td>
<td>(line feed ignored)</td>
<td>and line feed</td>
</tr>
<tr>
<td>IEEE488</td>
<td>carriage return or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>line feed or EOI</td>
<td>carriage return with EOI</td>
</tr>
</tbody>
</table>

All the functions of the instrument can be programmed via any interface, and results read back. When the IEEE488 interface is set to ‘remote’ the other ports are 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 redundantNCY 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 IEEE or LAN (see section 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 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

<table>
<thead>
<tr>
<th></th>
<th>PON</th>
<th>CME</th>
<th>EXE</th>
<th>DDE</th>
<th>QYE</th>
<th>OPC</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>ESB</th>
<th>MAV</th>
<th>ALA</th>
<th>RDV</th>
</tr>
</thead>
</table>

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).

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>in (+ weak pull up)</td>
</tr>
<tr>
<td>2</td>
<td>RX data</td>
<td>in</td>
</tr>
<tr>
<td>3</td>
<td>TX data</td>
<td>out</td>
</tr>
<tr>
<td>4</td>
<td>DTR</td>
<td>out</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>not used</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>out</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>in</td>
</tr>
<tr>
<td>9</td>
<td>RI</td>
<td>not used</td>
</tr>
</tbody>
</table>

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
```
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:

<table>
<thead>
<tr>
<th>byte</th>
<th>data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7 bit signed exponent +63 to -64</td>
</tr>
<tr>
<td>2</td>
<td>bit 6 = mantissa sign</td>
</tr>
<tr>
<td></td>
<td>bit 5:0 = mantissa bit 19:14</td>
</tr>
<tr>
<td>3</td>
<td>mantissa bit 13:7</td>
</tr>
<tr>
<td>4</td>
<td>mantissa bit 6:0</td>
</tr>
</tbody>
</table>

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

\[
\text{Value} = (\text{mantissa} / 2^{20}) \times 2^{\text{exponent}} \times (-1)^{\text{sign}}
\]

<table>
<thead>
<tr>
<th>value</th>
<th>equivalent</th>
<th>hex data transmitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>0.75 \times 2^{2}</td>
<td>0x82,0xB0,0x80,0x80</td>
</tr>
<tr>
<td>0.1</td>
<td>0.8 \times 2^{-3}</td>
<td>0xFD,0xB3,0x99,0xCD</td>
</tr>
<tr>
<td>-320</td>
<td>-0.625 \times 2^{9}</td>
<td>0x89,0xE8,0x80,0x80</td>
</tr>
</tbody>
</table>

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

**Function:** Clear status

**Description:** Clears the *standard event status register*.

**Format:** *CLS

**Arguments:** none

**Reply:** none

**Example:**

```
*CLS
*ESR?
0
```

**Notes:**
**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.*
**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?  

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,PPA2530 KinetiQ,
01234,1.00

Notes:
**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.
**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.
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?  

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)
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?  

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, FPA initialisation  
  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 error  

Example: *TST?  
          0  

Notes:
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**

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:
The ADIMAP command is used to map the results of a MULTILOG output to an ADI40 output. It sets the source result, the zero and the scaling factor for an ADI output.

**Function:** Map the results used for a MULTILOG? To an ADI40 output.

**Description:** Set the source result, the zero and the scaling factor for an ADI output.

**Format:** ADIMAP,channel,result,zero,scale

**Arguments:**
- **channel:** 1 to 20
- **result:** 1 to 64

**Reply:** none

**Example:** ADIMAP,2,1,40.0,2.0

**Notes:** The ADI output voltage is set to the (selected result – zero) * scale, limited to +/-10V.
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?

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**

**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**

**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**

**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
| **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**

**Function:** Select application mode.

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

**Format:** `APPLIC,type,setting`

**Arguments:**
- **type:**
  - NORMAL
  - PWM (PWM Motor Drive)
  - BALLAST (Lighting ballast)
  - INRUSH (Inrush Current)
  - POWERT (Transformer mode)
  - STANDB (Standby power)
  - CALIBR (Calibration)
  - IEC610 (IEC Harmonics/Flicker)
  - TVF105 (Aircraft TVF105)
- **setting:**
  - filter 0-2 (PWM only)
    - 0: 4kHz
    - 1: 1kHz
    - 2: 250Hz
  - speed 0-3 (ballast only)
    - 0: fixed time
    - 1: fast
    - 2: medium
    - 3: slow

**Reply:** none

**Example:**
- `APPLIC,POWERT`
- `APPLIC,PWM,1`

**Notes:**
**BANDWI**

**Function:** Select bandwidth.

**Description:** The analogue bandwidth of the instrument can be selected as “wide” (to 3MHz). For low noise measurements at low frequency the bandwidth can be restricted to “low” (to 40kHz). For measurements of dc in the presence of large ac signal, the bandwidth can be further restricted to “dc only” (to 10Hz).

**Format:** BANDWI,phase,type

**Arguments:**

<table>
<thead>
<tr>
<th>phase</th>
<th>type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHASE1</td>
<td>WIDE</td>
</tr>
<tr>
<td>PHASE2</td>
<td>LOW</td>
</tr>
<tr>
<td>PHASE3</td>
<td>DCONLY</td>
</tr>
</tbody>
</table>

**Reply:** none

**Example:** BANDWI,WIDE

**Notes:** Only use DCONLY to improve accuracy of measurement of small dc in the presence of a large ac signal. For normal dc measurements use bandwidth = LOW.
**BANDWI?**

**Function:** Read bandwidth setting.

**Description:** Returns a numerical value for the bandwidth setting.

**Format:** BANDWI,phase?

**Arguments:** phase:

- PHASE1
- PHASE2
- PHASE3

**Reply:**

- 0 = WIDE
- 1 = LOW
- 2 = DCONLY

**Example:**

BANDWI,PHASE3,LOW
BANDWI,PHASE3?

1

**Notes:** If independent input control has not been enabled then the setting for phase 1 is used for all phases.
BEEP

Function: Sound the buzzer
Description: Makes a “beep” from the instrument.
Format: BEEP
Arguments: none
Reply: none
Example: BEEP
Notes:
BLANKI

Function: Select blanking
Description: Enable or disable low value blanking.
Format: BLANKI,value
Arguments: value:
  ON
  OFF
Reply: none
Example: BLANKI,OFF
Notes:
CALVER

Function: Load a calibration verification 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: CALVER,string

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

Reply: none

Example: CALVER,12_DEC_2008_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.
**CALVER?**

**Function:** Read back the calibration verification 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:** CALVER?

**Arguments:** none.

**Reply:** alphanumeric string

**Example:** CALVER?
12_DEC_2008_AMW
CAPTUR?

Function: Read back Capture mode data.

Description: Returns captured oscilloscope data. Data is returned in 200 lines of 250 values per channel.

Format: CAPTUR?

Arguments: none

Reply: Multiple data values.

Example: CAPTUR?

Notes: This command only applies to PPA5532 firmware. Capture mode operates as a sub function of the normal oscilloscope mode – When “capture mode” is enabled in the menu data is stored in a 50000 byte circular buffer per channel. Set the trigger mode to single shot and trigger as normal. Sending the CAPTUR? command reads this data.

Each line of data should return as follows:

[#3503] [h1][h2][d1.1][d1.2][d2.1] [2.2] ......[d250.1][d250.2] [error] [CR] [LF]

Each line consists of:

5 bytes that represent #3503 (ASCII)
2 bytes that represent the Header bits including channel number [h1][h2]
500 bytes that represent the actual data.
250 pieces of data each made up of 2 bytes. d1.1 is data 1 bit 1, d1.2 is data 1 bit 2, d2.1 is data 2 bit 1, d2.2 is data 2 bit 2 etc.

1 byte that represents the error checking bit [error].
1 byte that represents Carriage return [CR].
1 byte that represents Line Feed [LF]

Each 8 bit byte has the msb set in order to prevent any misinterpretation of data within drivers and software which otherwise could mistake data for carriage return etc. so 14 bit data values are returned.
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?**

**Function:** Configurable parameter query

**Description:** Reads the present value of a single parameter.

**Format:**
- CONFIG,index?
- or:
  - 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)
  - 1

**Notes:** The list of configurable parameters is given in the appendix.
**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

- **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.
**COUPLI?**

**Function:** Read ac/dc coupling setting.

**Description:** Returns a numerical value for the coupling setting.

**Format:** `COUPLI,phase,coupling`

**Arguments:**
- `phase:`
  - PHASE1
  - PHASE2
  - PHASE3

**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

Function: Set up datalog
Description: Sets datalog parameters or accesses datalog non-volatile store.
Format: DATALO, function, interval, speed
Arguments: function:
  DISABLE
  RAM
  NONVOL
  RECALL
  DELETE
interval:
  datalog interval in seconds
speed:
  HIGH
Reply: none
Example: DATALOG, NONVOL, 10
         DATALOG, 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?**

**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:**
```
DATALOG,NONVOL,10
START
wait for datalog
STOP
DATALOG,LINES?
30
DATALOG,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 DATALOG?
returns all the available lines of data
### DAV?

<table>
<thead>
<tr>
<th>Function:</th>
<th>Data available query</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Returns data availability status.</td>
</tr>
<tr>
<td>Format:</td>
<td>DAV?</td>
</tr>
<tr>
<td>Arguments:</td>
<td>none</td>
</tr>
<tr>
<td>Reply:</td>
<td>Decimal equivalent of data available bits:</td>
</tr>
<tr>
<td></td>
<td>- bit0  new data available</td>
</tr>
<tr>
<td></td>
<td>- bit1  data available</td>
</tr>
<tr>
<td></td>
<td>- bit2  harmonic series data available</td>
</tr>
<tr>
<td></td>
<td>- bit6  integration data available</td>
</tr>
<tr>
<td></td>
<td>- bit7  datalog data available</td>
</tr>
<tr>
<td>Example:</td>
<td>SPEED,SLOW</td>
</tr>
<tr>
<td></td>
<td>*TRG</td>
</tr>
<tr>
<td></td>
<td>DAV?</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DAV?</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DAV?</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DAV?</td>
</tr>
<tr>
<td></td>
<td>3 (data available)</td>
</tr>
<tr>
<td>Notes:</td>
<td>DAV? does not modify the status bits.</td>
</tr>
</tbody>
</table>
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.
<table>
<thead>
<tr>
<th>Function:</th>
<th>Read data available enable register</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>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.</td>
</tr>
<tr>
<td>Format:</td>
<td>DAVER?</td>
</tr>
<tr>
<td>Arguments:</td>
<td>none</td>
</tr>
<tr>
<td>Reply:</td>
<td>decimal equivalent of bits</td>
</tr>
<tr>
<td>Example:</td>
<td>DAVER? 4</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
</tbody>
</table>
**DISPLAY**

**Function:** Set the display page

**Description:** Selects the page on the display so that the zoom data can be used for alarms.

**Format:** DISPLAY, *page*

**Arguments:**
- 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?

**Function:** Read the displayed data

**Description:** Returns all the values presently on the screen.

**Format:** DISPLAY?

**Arguments:** none

**Reply:** Multiple floating point values separated by commas

**Example:** DISPLAY?

**Notes:**
EFFICI

Function: Set efficiency calculation

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

Format: EFFICI,formula

Arguments:
- formula:
  - 0 – disabled
  - 1 – phase 1 / phase 2
  - 2 – phase 2 / phase 1
  - 3 – slave / master
  - 4 – master /slave
  - 5 – mechanical sum
  - 6 – sum / mechanical
  - 7 – phase 3 / sum
  - 8 – sum /phase

Reply: none

Example: EFFICIENCY,2

Notes:
<table>
<thead>
<tr>
<th>Function</th>
<th>Read efficiency result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Reads back the total and fundamental efficiency results.</td>
</tr>
<tr>
<td>Format</td>
<td>EFFICI?</td>
</tr>
<tr>
<td>Arguments</td>
<td>none</td>
</tr>
<tr>
<td>Reply</td>
<td>2 data values separated by commas: total, fundamental</td>
</tr>
<tr>
<td>Example</td>
<td>EFFICI?</td>
</tr>
<tr>
<td></td>
<td>data returned</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
</tbody>
</table>
**FAST**

**Function:** Set fast communications mode.

**Description:** Disables the screen drawing for high speed operation.

**Format:** \texttt{FAST,value}

**Arguments:**
- \texttt{value}:
  - \texttt{ON}
  - \texttt{OFF}

**Reply:** none

**Example:** \texttt{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

Function: Lock frequency.
Description: Set the technique for determining the frequency for analysis.
Format: FQLOCK,value,frequency
Arguments: value:
ON
OFF
NORMAL
CONSTANT
DYNAMIC

frequency (optional)
CONSTANT - enter frequency
DYNAMIC-enter minimum frequency

Reply: none
Example: 
FQLOCK,ON
FQLOCK,DYNAMIC,100

Notes: 
FQLOCK,CONSTANT
Without an argument locks the frequency to the present value.

ON is the same as CONSTANT
OFF is the same as NORMAL

When Dynamic is selected the minimum frequency can be set between 0.010Hz (10mHz) and 500Hz.
Function: Set frequency reference.
Description: Select the channel to be used for measuring the frequency.
Format: FQREF,phase
         FQREF,channel
         FQREF,phase,channel
Arguments: channel:
            voltage
            current
            Speed
            Ac Line

            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).
<table>
<thead>
<tr>
<th>FREQFI</th>
<th>FREQFI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function:</strong></td>
<td>Set the frequency filter</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Selects a filter to be applied to the data used for frequency measurement to help synchronise in noisy environments.</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>FREQFI, value</td>
</tr>
<tr>
<td><strong>Arguments:</strong></td>
<td>value:</td>
</tr>
<tr>
<td></td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td><strong>Reply:</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>FREQFI, ON</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td>The filter is applied only to the data used for frequency measurement and does not change the data used for the measurements.</td>
</tr>
</tbody>
</table>
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?

<table>
<thead>
<tr>
<th>Function:</th>
<th>Read the full scale of all input channels at once or that of an individually selected input channel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Returns the full scale value for all channels or that of a single selected channel.</td>
</tr>
</tbody>
</table>
| Format: | FSD?  
FSD,CH? |
| Arguments: | None  
CH1, CH2, CH3, CH4, CH5, CH6 |
| Reply: | Up to six data values separated by commas |
| Example 1: | FSD?  
Data returned, data returned, data returned, data returned, data returned, data returned |
| Example 2: | 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 |
HARMON

Function: Set harmonic analyser mode.
Description: Set harmonic analyser mode and parameters.
Format: HARMON,para,harmonic,max,stepsize
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 Series harmonic phase
- INTERH Interharmonic sweep
- HRMS Harmonic RMS
- PH-PH Phase to Phase harmonics
harmonic:
- individual harmonic for display
max:
- length of harmonic series
stepsize:
- frequency step size (0.5Hz – 100Hz)

Reply: none
Example:
- HARMON,TRD
- HARMON,THDS,3,50
- HARMON,INTERH,3,7500,20

Notes: It is not necessary to send any arguments, but if any are sent they must be in the specified order. PH-PH command
is reset by any THD command.

The maximum value for length of harmonic series is as follows:

100 for harmonic factor, harmonic RMS, TIF, THF, TDD and TRD.
125 for Harmonic Series and Series Harmonic Phase.
9999 for Interharmonic sweep.

The stepsize argument only applies to Interharmonic Sweep.
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
- 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

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:
<table>
<thead>
<tr>
<th><strong>INPUT</strong></th>
<th><strong>INPUT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function:</strong></td>
<td>Set input mode</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Selects the input type of the instrument</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>INPUT,channel,type</td>
</tr>
</tbody>
</table>
| **Arguments:** | channel:  
| | CH1  
| | CH2  
| | type:  
| | INTERN  
| | EXTATT  
| | EXTSHU |
| **Reply:** | none |
| **Example:** | INPUT,CH1,EXTSHU |
| **Notes:** | CH1 applies to all voltage channels  
| | CH2 applies to all current channels |
INTEGR

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:
INTEGR?

Function: Read integrated power mode.

Description: Read integrated power mode for the selected phase.

Format: INTEGR,\textit{phase}?

Arguments: phase:
- PHASE1
- PHASE2
- PHASE3
- 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.
<table>
<thead>
<tr>
<th>Function:</th>
<th>Disable front panel keyboard.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>The front panel keyboard can be disabled to prevent accidental operation.</td>
</tr>
<tr>
<td>Format:</td>
<td>KEYBOARD,value</td>
</tr>
<tr>
<td>Arguments:</td>
<td>value:</td>
</tr>
<tr>
<td></td>
<td>ENABLE</td>
</tr>
<tr>
<td></td>
<td>DISABLE</td>
</tr>
<tr>
<td>Reply:</td>
<td>none</td>
</tr>
<tr>
<td>Example:</td>
<td>KEYBOARD,DISABLE</td>
</tr>
<tr>
<td>Notes:</td>
<td>The keyboard can be re-enabled from the front panel only by pressing the HOME key.</td>
</tr>
</tbody>
</table>
Function: Set LCR meter mode.
Description: Set LCR mode and conditions.
Format: LCR,\textit{parameter}
Arguments: parameter:
\hspace{1em} AUTO
\hspace{1em} CAPACITANCE
\hspace{1em} INDUCTANCE
\hspace{1em} IMPEDANCE
Reply: none
Example: LCR,IMPEDANCE
Notes:
**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,\textit{phase}?

**Arguments:** phase:
- PHASE1
- PHASE2
- PHASE3
- PHASES

**Reply:** 11 data values separated by commas: freq, V\text{mag}, A\text{mag}, impedance, phase, R, C, L, tan\theta, 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

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**

**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:**
**MSLAVE**

**Function:** Set master/slave mode

**Description:** Enables the instrument to synchronise with a second instrument to simultaneously measure up to 6 phases.

**Format:** `MSLAVE,type`

**Arguments:**

- **type:**
  - DISABLE
  - MASTER
  - SLAVE

**Reply:** none

**Example:** `MSLAVE,MASTER`

**Notes:**
**MULTIL**

**Function:** Selects data for multi string reply

**Description:** Selects data values across phases and functions that can be read in a single string using the MULTIL? command.

**Format:** `MULTILOG,index,phase,function`

**Arguments:**

- **index:**
  - 0       clear all
  - 1-64   select data 1-64

- **phase:**
  - 1-3    phase 1-3
  - 4      sum
  - 5      neutral

- **function:**
  - 1-99   see appendix C

**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:**

For further information and assistance with the Multilog application please go to page 2-108 where you will find an application guide to assist with this function.
**MULTIL?**

Function: Reads multi string reply

Description: Waits for data to be available (if required) then returns selected results. Either a single string or multiple string replies can be selected.

Format: MULTIL?
MULTIL,number?

Arguments: number: The required number of data string replies

Reply: A single reply string containing up to 64 data values as selected by the MULTIL command.

Multiple reply strings each containing the same number of data values (maximum of 64) as selected by the MULTIL command.

Example: MULTIL,0
MULTIL,1,1,2 (phase 1 Watts)
MULTIL,2,2,2 (phase 2 Watts)
MULTIL,3,4,3 (sum VA)

MULTIL?
In the above example a single string reply containing 3 data values is returned.

MULTIL,10?
In the above example 10 data strings are returned, each string containing 3 data values.

Notes:
For further information and assistance with the Multilog application please go to page 2-108 where you will find an application guide to assist with this function.
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

Notes: After the command the data will still be held so to release the lock send SUSPEND,OFF
NOISEF

Function: Sets the noise filter.

Description: Sets noise filter to value sent in string between 1KHz and 250KHz.

Format: NOISEF,[PHASEx],value,frequency

Arguments:

[PHASEx]:
   Phase1
   Phase2
   Phase3

Value:
   ON
   OFF

frequency:
   Between: 1000 – 250000

Reply: none

Example: NOISEF,PHASE1,ON,1500

Notes: Applies a digital filter for use in high noise environments. When in independent mode use [PHASEx] command to set noise filter on individual phases. [PHASESx] command is not required in any other wiring mode.
**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.
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
PHANGREF

Function: Set phase angle reference.
Description: Select phase angle reference to current or voltage.
Format: PHANGREF,reference
Arguments: reference:
    Current
    Voltage
Reply: none
Example: PHANGREF,current
    PHANGREF,voltage
Notes:
PHASEM

Function: Set phase meter mode.

Description: Select phase meter mode and reference.

Format: PHASE,reference

Arguments: reference:

CH1 \( \text{ratio} = \frac{\text{ch2}}{\text{ch1}} \)

CH2 \( \text{ratio} = \frac{\text{ch1}}{\text{ch2}} \)

Reply: none

Example: PHASEM,CH2

Notes:
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
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

Function: Set phase convention and the harmonic angle.

Description: Set phase convention and optionally the harmonic angle.

Format: PHCONV, convention, angle

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

Angle:
Cosine
Sine

Reply: none

Example: PHCONV, -360
PHCONV, 180
PHCONV, 180, cosine

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

The Harmonic Angle argument is optional so does not have to be specified. However, to update the Harmonic phase angle argument the phase convention must be included in the command. See examples above. The default setting in the SYS menu is Cosine.
**POWER**

**Function:** Set up power analyser mode.

**Description:** Configure power analyser with sum current display type

**Format:** POWER, \textit{sum type}

**Arguments:**

\textit{sum type:}

- TOTAL
- AVERAGE

**Reply:** none

**Examples:** POWER,TOTAL

**Notes:**
**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  
  - 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: 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.
<table>
<thead>
<tr>
<th>Function</th>
<th>Identify current program.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Reads the name of the last program to be loaded or recalled.</td>
</tr>
<tr>
<td>Format</td>
<td>PROGRA?</td>
</tr>
<tr>
<td>Arguments</td>
<td>none</td>
</tr>
<tr>
<td>Reply</td>
<td>text string</td>
</tr>
<tr>
<td>Example</td>
<td>PROGRA?</td>
</tr>
<tr>
<td></td>
<td>factory default</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
</tbody>
</table>
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 1-9
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**

**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

Function: Access non volatile results stores.
Description: Recall, store or delete non-volatile results.
Format: RESULT,function,number
Arguments: function:
            RECALL
            STORE
            DELETE
number
            1-20
Reply: none
Example: RESULT,RECALL,13
Notes: There are 3 types of result: normal, harmonic and scope. Harmonic and scope results occupy 3 locations each.
RESULT?

Function: Identify used result stores.
Description: Reads a directory of the 20 non-volatile result locations.
Format: RESULT?
Arguments: none
Reply: 20 integers separated by commas
Example: RESULT?
        0,0,1,3,-1,-1,0,2,-1,-1,0,0,0,0,0,0,0,0,0
Notes: 0 = empty
        1 = normal result
        2 = harmonic result
        3 = scope result
        -1 = continuation of previous
REZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZEROREZERE
## 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?

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:
<table>
<thead>
<tr>
<th>Function:</th>
<th>Read the screen data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Returns a bit map of screen pixel display in ascii and hex format</td>
</tr>
<tr>
<td>Format:</td>
<td>SCREEN?</td>
</tr>
<tr>
<td>Arguments:</td>
<td>none</td>
</tr>
<tr>
<td>Reply:</td>
<td>Multiple data bit values</td>
</tr>
<tr>
<td>Example:</td>
<td>SCREEN?</td>
</tr>
<tr>
<td></td>
<td>data returned</td>
</tr>
<tr>
<td>Notes:</td>
<td>SCREEN? response:</td>
</tr>
<tr>
<td></td>
<td>ASCII coded Hex</td>
</tr>
<tr>
<td></td>
<td>(2 characters for each byte)</td>
</tr>
<tr>
<td></td>
<td>240 lines of 40 bytes (each line represents one line of the display)</td>
</tr>
<tr>
<td></td>
<td>preceded by #H</td>
</tr>
<tr>
<td></td>
<td>Each byte represents 8 dots where the lsb is the leftmost dot of the display</td>
</tr>
<tr>
<td></td>
<td>The bit is set for on and cleared for off</td>
</tr>
</tbody>
</table>
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?**

**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:**
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
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**

**Function:** Sets the measurement speed

**Description:** Sets the minimum window size for the measurement.

**Format:** SPEED, value, window

**Arguments:**

- value:
  - VFAST
  - 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
Function: Start datalog
Description: Initiate datalog data acquisition.
Format: START
Arguments: none
Reply: none
Example: DATALOG,RAM,0.02
START

Notes:
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?
STATUS? channel

Arguments: channel:
  CH1
  .
  .
  CH6

Reply: range number, range text, over/under/ok
  1-16
  range as per RANGE command
  OVER if overflow
  LOW if underflow
  OK if in range

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

Notes:
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

<table>
<thead>
<tr>
<th>Function:</th>
<th>Suspend data acquisition.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Disable the data acquisition to maximise the communication speed.</td>
</tr>
<tr>
<td>Format:</td>
<td>SUSPEN,\textit{value}</td>
</tr>
<tr>
<td>Arguments:</td>
<td>value: \begin{itemize} \item ON \item OFF \end{itemize}</td>
</tr>
<tr>
<td>Reply:</td>
<td>none</td>
</tr>
<tr>
<td>Example:</td>
<td>FAST,ON \newline SUSPEN,ON \newline MULTILOG? \newline SUSPEN,OFF \newline FAST,OFF</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
</tbody>
</table>
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
**TEMPER**

**Function:** Set up temperature measurement

**Description:** Set scaling and offset for a temperature sensor connected to the torque input (power transformer application mode)

**Format:** `TEMPER,type,scalefactor,offset`

**Arguments:**
- **type:**
  - DISABLED
  - CENTIG
  - FARHEN

- **scale:** multiplying factor in degrees/Volt

- **offset:** additive zero in Volts

**Reply:** none

**Example:**
```
TEMPER,CENTIG,5,-2
```

Sensor scaling = 5°C/V

0V = 10°C

**Notes:**
**TEMPER?**

**Function:** Read the temperature

**Description:** Returns the measured temperature from a sensor connected to the torque input

**Format:** TEMPER?

**Arguments:** none

**Reply:** single data value

**Example:** TEMPER?
  data returned

**Notes:**
TORQSP

Function: Set up torque and speed measurement

Description: Set scaling for torque and speed measurements

Format: TORQSP,type,torquescaling,speedscaling
        TORQSP,OFFSET,torqueoffset,speedoffset

Arguments: type:
            DISABLED
            ANALOG
            PULSED
            OFFSET

Reply: none

Example: TORQSP,PULSED,10,50
        speed measured by pulse
        torque scaling = 10Nm/V
        50 pulses/revolution

Notes: If type = ANALOG then speed scaling is in
        rpm/V, if type = PULSED then speed
        scaling is pulses/rev
        Torque scaling is always Nm/V
**TORQSP?**

Function: Read the mechanical power
Description: Returns measured mechanical data values
Format: TORQSP?
Arguments: none
Reply: 3 data values separated by commas: power, torque, speed
Example: TORQSP?
data returned

Notes:
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?

Newton4th Ltd
R&D department
KinetiQ #4

Notes:
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 PFCNV
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 – normal (30A)
- 2 – low current version (10A)
- 4 – high current version (50A)

Examples: VERSION?
KQ1306,0,1.10,1.10,1.10,1.01

Notes: This data can be displayed on the screen by pressing SYSTEM then BACK
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
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
  - 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,
  Vsurge1, Asurge
Example: VRMS, PHASE1, RMS?
Notes: VRMS? without specifying the phase returns the appropriate single phase data.
WIRING

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)
- INDEP (independent)
- 3PH3WA,DELTA (Delta – Star)
- 3PH3WA,PPRMS (PH-PH RMS)
- 3PH3WA,PPMEAN (Rectified mean)
- 3PH3WA,STARDE (Star – Delta)

Reply: none
Examples: WIRING,PHASE2
Notes: WIRING,SINGLE is the same as WIRING,PHASE1
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

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 – 2 line display (zoom level 1)
    2 – single line display (zoom level 2)
    3 – single line display (zoom level 3)
  data1:
    first data (zoom level 1)
    or data for single line (zoom level 2)
  data2-4:
    other data (zoom level 1)

  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.
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 – 2-4 value display (zoom level 1)
  2 – single line display (zoom level 2)
  3 – single line display (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:
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 PPA5500 has 93 possible functions:

<table>
<thead>
<tr>
<th>Function</th>
<th>Measurement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>frequency</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>watts</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VA</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>VAr</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>power factor</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>fundamental watts</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>fundamental VA</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>fundamental VAr</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>fundamental PF</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>harmonic watts</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>harmonic watts %</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>impedance</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>resistance</td>
<td></td>
</tr>
</tbody>
</table>

Example extract from the Multilog function list
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 – command summary

COMMAND SUMMARY
command format

*CLS
*ESE, value
*ESE?
*ESR?
*IDN?
*OPC?
*RST
*SRE, value
*SRE?
*STB?
*TRG
*TST?
*WAI

reply format

ABORT
ALARM, latch, sounder
ALARM?
ALARME, value
ALARME?
ALARM1, type, data, high, low
ALARM2, type, data, high, low
APPLIC, type, setting
BANDWI, phase, type
BEEP
BLANKI, on/off, threshold
CALVER, string
CALVER?
CAPTR?
CONFIG, parameter, data
CONFIG, parameter?
COUPLI, phase, coupling
DATALO, func, interval, speed
DATALO, LINES?
DATALO, 0?
DATALO, start, records?
DAV?
DAVER, value
DAVER?
DISPLAY, page
DISPLAY?
EFFICI, type
EFFICI?

single integer data value
single integer data value
company, product, serial no, version
0 or 1
single integer data value
single integer data value
single integer data value

String
String

single integer or real data value

single integer
index, time, data... one record per line
index, time, data... one record per line

single integer data value
single integer data value
multiple real data values

total efficiency, fundamental efficiency
PPA55xx communications manual

FAST, on/off
FQLOCK, on/off
FQREF, phase, channel
FREQFI, on/off, filter
FREQUE, frequency
FSD?
HARMON, para, h, hmax
HARMON, phase?
Or
HARMON, phase, SERIES?
Or
HOLD, on/off
INPUT, channel, type
INTEGR, type, display
INTEGR, RUNTIM, hours, mins
INTEGR, phase?
KEYBOA, value
LCR, conditions, param, head
LCR, phase?
LOWFRE, on/off
MODE, type
MSLAVE, type
MULTILOG, index, phase, func
MULTILOG?
PFCONV, convention
PHASEM, ratio
PHASEM, phase?
PHCONV, convention
POWER, sum A
POWER, PHASE, WATTS?
POWER, PHASE, VOLTAGE?
POWER, PHASE, CURRENT?
POWER, PH-PH?
POWER, RMS?

Single or multiple real data values
freq, mag1, mag2, hmag1, hmag2, h1, h2,
thd1, thd2, hphase1, hphase2
mag, %, x n harmonics
mag, phase, x n harmonics
Time, Wh, Wh.f, Varh, Varh.f, Vah, Vah.f,
pf, pf.f, Vav, Vav.f Ah, Ah.f
Freq, mag1, mag2, impedance, phase, R,
L, C (series), R, L, C (parallel), tan δ, Q
1-30 floats as selected
Freq, mag1, mag2, dB, phase
Freq, W, W.f, VA, VA.f, Var, Var.f, pf, pf.f,
Wdc, W.h
Freq, rms, mag, dc, ϕ, peak, cf, mean, ff,
harmonic
Freq, rms, mag, dc, ϕ, peak, cf, mean, ff,
harmonic
Freq, rms1, mag1, ϕ1, rms2, mag2, ϕ2,
rms3, mag3, ϕ3
Freq, vrms1, vdc1, arms1, adc1, vrms2,
vdc2, arms2, adc2, vrms3, vdc3, arms3,
adc3
POWER, VECTORS?
Freq, mag1, φ1, mag2, φ2, mag3, φ3, mag4, φ4, mag5, φ5, mag6, φ6

POWER, WVA?
Freq, w1, vrms1, arms1, w2, vrms2, arms2, w3, vrms3, arms3

PROGRAM, function, number
PROGRAM?
CR terminated text string

RANGE, ch, ranging, range
RESOLU.format
RESULT, function, number
RESULT
multiple integers
REZERO
SCALE, channel, factor
SCALE, channel?
Single real data value
SCOPE, PHASE, v/a?
Range, trigger, 250 signed integer values

SHUNT, channel, resistance
SHUNT, channel?
Single real data value
SMOOTH, type, dynamics
SPEED, value, window
START
STATUS, channel?
Range number, range text, over/low/ok
STOP
STREAM, enable, window
STREAM, disable
STREAM?
Data, data, data, data, data, ..... 
SUSPEN, on/off
TAGREP, on/off
TEMPER, type, scale, offset
TEMPER?
TORQSP, type, tscale, sscale
TORQSP, OFFSET, toff, soff
TORQSP?
mechanical power, torque, speed
USER?
3 CR terminated text strings
VARCON, convention
datecode, cpu, dsp, fpga, boot
VERSION?
VRMS
VRMS, PHASE, RMS?
rms1, rms2, dc1, dc2, ac1, ac2
VRMS, PHASE, MEAN?
rms1, rms2, mean1, mean2, ff1, ff2
VRMS, PHASE, SURGE?
.pk1, pk2, cf1, cf2, surge1, surge2
WIRING, configuration
ZERO
ZERO, DELETE
level, d1, d2, d3, d4
ZOOM?
level, d1, d2, d3, d4
calibration commands

CALAPP
CALCOM,freq
CALFIL,index,value
CALFIL?
CALFRQ,index,freq
CALFRQ?
CALIBR,index,value,inputs
CALIBR?
CALIDS,string
CALIDS?
CALJIG,value
CALMOD,value
CALPHA,index,inputs
CALRES
CALSAV,password
CALSYS,index,value,inputs
CALSNO,serial number
CALSTR,string
CALSTR?
CALTQS,index,value
CALTQS?
CALVER,string
CALVER?
Appendix B – Configurable parameters
All parameters can be accessed using the CONFIG command:

```
CONFIG,number,parameter

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

3  Master/slave, (Aux control)
   0=Disabled
   1=Master
   2=Slave

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
   2=Dynamic
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
<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>LAN IP address nibble 3, (Remote options - LAN - enter figure as required)</td>
</tr>
<tr>
<td>19</td>
<td>LAN IP address nibble 2, (Remote options - LAN - enter figure as required)</td>
</tr>
<tr>
<td>20</td>
<td>LAN IP address nibble 1, (Remote options - LAN - enter figure as required)</td>
</tr>
<tr>
<td>21</td>
<td>LAN IP address nibble 0, (Remote options - LAN - enter figure as required)</td>
</tr>
</tbody>
</table>
| 22   | Independent ranging, (System options)  
0=Disabled  
1=Enabled |
| 24   | Enable channel 1, (Range – voltage input)  
1=Internal  
3=External Attenuator |
| 25   | Enable channel 2, (Range – current input)  
1=Internal  
2=External Shunt |
| 26   | Input range channel 1, (Range – minimum range voltage)  
0=300mV  
1=1V  
2=3V  
3=10V  
4=30V  
5=100V  
6=300V  
7=1kV  
8=3kV |
| 27   | Input range channel 2, (Range – minimum range current)  
0=30mA  
1=100mA  
2=300mA  
3=1A  
4=3A  
5=10A  
6=30A  
7=100  
8=300A |
| 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

31  Bandwidth, (Coupling - bandwidth)
   0=Wide (dc-2MHz)
   1=Low (dc-200KHz)
   2=dc (dc-5Hz)

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)

38  Frequency reference voltage/current, (Acquisition control)
   0=Voltage
   1=Current
   2=Speed
   3=ac line

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 –
    1=Zoom +
    2=Second Zoom +
    3=Third Zoom +

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**, (Acquisition advance options – frequency lock on)
    0 = Frequency in µHz
    1 = Frequency in Hz

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

50  **Program 1-6 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

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
   2=Internal Flash
   3=USB Memory stick

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
Term 1 coefficient, (Enter value)

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

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

Term 2 coefficient, (Enter value)

Frequency lock, minimum freq, (ACQU, advanced options)
Enter value (0.010 to 500)

Application mode,
0=Normal
1=PWM motor Drive
2=Lighting ballast
3=Inrush current
4=Transformer mode
5=Standby power
6=Calibration mode
7=Harmonics / Flicker
8=TVF105 mode
9=Capture mode (PPA5532 only)
Frequency filter, (Application options mode - PWM Motor Drive)
0=4KHz
1=1KHz
2=250Hz

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

Low frequency, (Application options mode - PWM Motor Drive)
0=Off
1=On

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

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

Term 3 coefficient, (Enter value)

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

Term 4 coefficient, (Enter value)

Temperature, (Application-Transformer mode)
0=Disabled
1=Enabled °C
2=Enabled °F

Sum watts, (Auxiliary-Master)
0=Master
1=Master + Slave

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=Independent

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

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

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

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

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

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

Phase 3 reference, (Acquisition control – 3 phase 2 wattmeter + PH3)
  0 = Voltage
  1 = Current
  2 = ac line
  3 = Phase 1 & 2

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

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

Efficiency computation, (Power analyzer)
  0 = Disabled
  1 = Phase 1 / Phase 2
  2 = Phase 2 / Phase 1
  3 = Slave/Master
  4 = Master/Slave
  5 = Mechanical/Sum
  6 = Sum/Mechanical
  7 = Phase 3/Sum
  8 = Sum/Phase 3

Range lock across phases, (Range – when acquisition is using 3 phases)
  0 = Disabled
  1 = Enabled

Torque offset, (Applications – PWM motor drive) (Also transformer mode) (Enter Nm offset value)
PPA55xx communications manual

96  Speed offset, (Application options mode – PWM motor drive – rpm offset value)

99  Computation mode, (Harmonic analyzer)
    0=Difference formula
    1=Harmonic series
    2=TIF
    3=THF
    4=TRD
    5=TDD
    6=Series harmonic phase
    7=Interharmonic sweep
    8=Harmonic RMS
    9=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)

105 Frequency range up to 417 Harmonics, (Harmonic analyzer)
    0=Normal
    1=Extended Frequency range

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

B-12
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

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

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

121 Display, (System)
   0=Colour
   1=White on black
   2=Black on white
<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Auxiliary device</strong></td>
<td>(Aux control)</td>
</tr>
<tr>
<td></td>
<td>0=None</td>
</tr>
<tr>
<td></td>
<td>6=PCIS</td>
</tr>
<tr>
<td><strong>Switch phase offset</strong></td>
<td>(Aux control – PCIS device)</td>
</tr>
<tr>
<td></td>
<td>0=0°</td>
</tr>
<tr>
<td></td>
<td>1=45°</td>
</tr>
<tr>
<td></td>
<td>2=90°</td>
</tr>
<tr>
<td></td>
<td>3=135°</td>
</tr>
<tr>
<td></td>
<td>4=180°</td>
</tr>
<tr>
<td></td>
<td>5=225°</td>
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<tr>
<td></td>
<td>6=270°</td>
</tr>
<tr>
<td></td>
<td>7=315°</td>
</tr>
<tr>
<td><strong>Switch on cycles</strong></td>
<td>(Aux control – PCIS device)</td>
</tr>
<tr>
<td></td>
<td>0=Single cycle</td>
</tr>
<tr>
<td></td>
<td>1=Continuous</td>
</tr>
<tr>
<td></td>
<td>2=Half cycle</td>
</tr>
<tr>
<td><strong>Gear ratio</strong></td>
<td>(Aux control – frequency reference – speed - Enter ratio value)</td>
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<tr>
<td><strong>2 Wattmeter sum computation</strong></td>
<td>(Power Analyser)( select in acquisition wiring-2 phase 2 wattmeter)</td>
</tr>
<tr>
<td></td>
<td>0=Low distortion</td>
</tr>
<tr>
<td></td>
<td>1=High Distortion</td>
</tr>
<tr>
<td><strong>Integrator-run time</strong></td>
<td>(Hours), (Mode – Power integrator - enter figure)</td>
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<tr>
<td><strong>Integrator-Run time</strong></td>
<td>(mins), (Mode - Power integrator – enter figure)</td>
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<td><strong>Ph – Ph Measurement</strong></td>
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</tr>
<tr>
<td></td>
<td>0=ph-ph rms</td>
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<tr>
<td></td>
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<td>2=Star - Delta</td>
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<td></td>
<td>3=Delta - Star</td>
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<tr>
<td><strong>Difference THD</strong></td>
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</tr>
<tr>
<td></td>
<td>0=Disabled</td>
</tr>
<tr>
<td></td>
<td>1=Enabled including dc</td>
</tr>
<tr>
<td></td>
<td>2=Enabled excluding dc</td>
</tr>
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</table>
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

143 Sampling Rate / compensation  (ACQU - sampling)
   0=Auto
   1=Fast
   2=Medium
   3=Slow
   4=19.2uS compensation
   5=3.857uS compensation

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

153 IEEE address,  (Remote options – GPIB mode – enter address figures)
Interface, (Remote options)
0=RS232
1=USB
2=LAN
3=GPIB

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

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

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

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

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

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

Alarm sounder, (Alarm options – alarm if high)
0=Enabled
1=Disabled
Analog output, (Alarm options – alarm if high)
0=Disabled
1=Zoom 1
2=Zoom 2
3=Zoom 3
4=Zoom 4
5=Manual

Analog zero, (Alarm options – enter figure)

Analog full scale, (Alarm options – enter figure)

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

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

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

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

Sync on alarm, (Alarm options – alarm if high)
0=Disabled
3=Enabled

Enable channel 3, (Range – voltage input)(Sys independent ranging enabled)
1=Internal
3=External attenuator

Enable channel 4, (Range – current input)(Sys independent ranging enabled)
1=Internal
2=External shunt
178  **Input range channel 3**, (Range – minimum range voltage) (Sys independent ranging enabled)

0 = 300mV  
1 = 1V  
2 = 3V  
3 = 10V  
4 = 30V  
5 = 100V  
6 = 300V  
7 = 1kV  
8 = 3KV

179  **Input range channel 4**, (Range – minimum range current) (Sys independent ranging enabled)

0 = 30mA  
1 = 100mA  
2 = 300mA  
3 = 1A  
4 = 3A  
5 = 10A  
6 = 30A  
7 = 100A  
8 = 300A

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

183  **Bandwidth phase 2**, (Coupling - bandwidth) (Sys independent ranging enabled)  
0 = Wide (dc–2MHz)  
1 = Low (dc-200KHz)  
2 = dc (dc-5Hz)
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<td>185</td>
<td>Scale factor channel 4 current, (Ranging - Enter figures as required) (Sys independent ranging enabled)</td>
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<tr>
<td>186</td>
<td>External attenuator channel 3, (Ranging – voltage input – attenuation ratio Enter figures as required) (Sys independent ranging enabled)</td>
</tr>
<tr>
<td>187</td>
<td>External shunt channel 4, (Ranging – current input – resistance value Enter figures as required) (Sys independent ranging enabled)</td>
</tr>
</tbody>
</table>
| 200  | Enable channel 5, (Range – voltage input) (Sys independent ranging enabled)  
1 = Internal  
3 = External attenuator |
| 201  | Enable channel 6, (Range – current input) (Sys independent ranging enabled)  
1 = Internal  
2 = External shunt |
| 202  | Input range channel 5, (Range – minimum range voltage)  
0 = 300mV  
1 = 1V  
2 = 3V  
3 = 10V  
4 = 30V  
5 = 100V  
6 = 300V  
7 = 1kV  
8 = 3kV |
| 203  | Input range channel 6, (Range – minimum range current) (Sys independent ranging enabled)  
0 = 30mA  
1 = 100mA  
2 = 300mA  
3 = 1A  
4 = 3A  
5 = 10A  
6 = 30A  
7 = 100A  
8 = 300A |
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

207 **Bandwidth phase 3,** (Coupling - bandwidth) (Sys independent ranging enabled)
   - 0=Wide (dc–2MHz)
   - 1=Low (dc-200KHz)
   - 2=dc (dc-5Hz)

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)

217 **Memory,** (Program)
   - 0=Internal
   - 1=USB Memory stick

218 **Data,** (Program)
   - 0=Program
   - 1=Results
   - 2=Datalog
219  Action, (Program)
      0=Recall
      1=Store
      2=Delete

220  Location, (Program - Enter figures as required)

226  Set clock hours, (System – Enter figures as required)

227  Set clock minutes, (System – Enter figures as required)

228  Set clock Seconds, (System – Enter figures as required)

229  Set date day, (System – Enter figures as required)

230  Set date month, (System – Enter figures as required)

231  Set date year, (System – Enter figures as required)
Appendix C – MULTILOG parameters

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<td>fundamental watts</td>
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<td>7</td>
<td>fundamental VA</td>
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<td>fundamental VAr</td>
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<td>harmonic watts</td>
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<td>integrated fundamental VAr</td>
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<td>integrated fundamental current</td>
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<td>average fundamental power factor</td>
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<td>average integrated watts</td>
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<td>average integrated VA</td>
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<td>average integrated fundamental watts</td>
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<td>38</td>
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<td></td>
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</tr>
</tbody>
</table>

Notes:

Function 48 is used to measure Q-factor in Imp meter mode AND to measure corrected power in Transformer mode.

Functions 78 and 81 are the same.

Phase selection:

1 = phase 1
2 = phase 2
3 = phase 3
4 = sum
5 = neutral
There are some special functions:

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<th>Measurement (function)</th>
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</table>

Notes:

These special functions must use the Neutral Phase (Phase 5)

Due to the limited number of function numbers available these Special functions re-use function numbers that apply to other measurements for Phases 1 to 3.

Examples for setting up each measurement:

- `multil,0` Setting to clear any previous data
- `multil,1,5,58` Setting for Mechanical speed in Hz
- `multil,1,5,60` Setting for Mechanical speed in rpm
- `multil,1,5,50` Setting for Torque in Nm
- `multil,1,5,2` Setting for Mechanical Power in nW
- `multil?` Setting to read back and display data

Example script to return results for Mechanical Power, Torque & Speed (in rpm):

```
> multil,0
> multil,1,5,2
> multil,2,5,50
> multil,3,5,60
> multil?
-1.8846E-7,-2.0984E-3,8.5765E-4
```
Newtons4th Ltd. contact details

Please direct all queries or comments regarding the PPA55xx instruments or this manual to:

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               office@newtons4th.com

Web site: www.newtons4th.com

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