PPA5500

COMMUNICATIONS MANUAL

Firmware v2.180

Version v3.02

06th February 2020
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.

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

Version v3.02                                  Firmware Revision v2.180

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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:

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

Value = (mantissa / $2^{20}$) x $2^\text{exponent}$ x $-1^\text{sign}$

<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 x $2^2$</td>
<td>0x82,0xB0,0x80,0x80</td>
</tr>
<tr>
<td>0.1</td>
<td>0.8 x $2^{-3}$</td>
<td>0xFD,0xB3,0x99,0xCD</td>
</tr>
<tr>
<td>-320</td>
<td>-0.625 x $2^9$</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? *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,5530, 01234,1.78
Notes:
*OPC?  

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

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

**Format:** *RST

**Arguments:** none

**Reply:** none

**Example:** *RST

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

Any preceding setup commands will be overwritten.
*SRE

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:
**Function:** Read service request enable register.

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

**Format:** *SRE?*

**Arguments:**

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

**Example:**

```
*SRE?
1
```

**Notes:**
**STB?**

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:
ADIMAP

Function: Map multilog parameters to outputs

Description: Applies offset and scaling to a multilog value and maps value to chosen ADI output

Format: ADIMAP,output,multilog,offset,scale

Arguments:
- output: 1-20
- multilog: 1-64
- offset: Float
- scale: Float

Reply: None

Example:
- MULTIL,0
- MULTIL,2,1,1 (PH1 Frequency)
- ADIMAP,1,2,0.2,0.5

Output 1 = 0.5 * (PH1 frequency – 0.2)

Notes: Offset is subtracted from multilog value, then scale is applied within the limits of +/- 10
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.
**Function:** Set alarm status enable register

**Description:** Sets bits in the alarm status enable register to control which alarm bit if any set the alarm active bits in the status byte.

**Format:** ALARME, *value*

**Arguments:** decimal equivalent of alarm bits  
  - bit2 set bit 3 of status byte when alarm 1 is active  
  - bit3 set bit 3 of status byte when alarm 2 is active

**Reply:** none

**Example:** ALARME, 12  
* SRE, 8  
set bit 3 in status byte when either alarm 1 or alarm 2 is active and generate a service request

**Notes:** default value is 0
**ALARME?**

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?

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Notes:
**ANALOG**

**Function:** Interface with ADI40

**Description:** Write to individual ADI40 outputs

**Format:** ANALOG,channel,value

**Arguments:**
- **Channel:** 1-20
- **Value:** -10.00 to +10.00

**Reply:** None

**Example:** ANALOG,5,-3.14

**Notes:** Up to 9 outputs can be written to with one CommView transfer, by separating each instance with a “;”. 
**ANALOG?**

Function: Interface with ADI40
Description: Read from individual ADI40 inputs
Format: ANALOG,channel?
Arguments: Channel:
1-20
Reply: ASCII characters in scientific format:
   1 - 16 in Volts
   17- 20 in °C
Example: ANALOG,12?
Notes: Up to 9 inputs can be read back at once with this command by separating each instance with a “;”.
Function: Select application mode.

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

Format: \texttt{APPLIC,type,setting}

Arguments:

\textbf{type:}

- \texttt{NORMAL}
- \texttt{PWM} (PWM Motor Drive)
- \texttt{BALLAST} (Lighting ballast)
- \texttt{INRUSH} (Inrush Current)
- \texttt{POWERT} (Transformer mode)
- \texttt{STANDB} (Standby power)
- \texttt{CALIBR} (Calibration)
- \texttt{IEC610} (IEC Harmonics/Flicker)
- \texttt{TVF105} (Aircraft TVF105)
- \texttt{CAPTURE} (Capture / Raw Data)

\textbf{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:

\texttt{APPLIC,POWERT}
\texttt{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: phase:
- PHASE1
- PHASE2
- PHASE3

Type:
- WIDE
- LOW
- DCONLY

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:
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.
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: \texttt{CALVER?}

Arguments: none.

Reply: alphanumeric string

Example: \texttt{CALVER?} \texttt{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. The data capture is triggered on the falling edge.

**Format:**
- CAPTUR?
- CAPTUR,EXTTRGG?

**Arguments:** none

**Reply:** Multiple data values.

**Example:**
- CAPTUR?
  
  Data is captured using the PPA’s Internal Trigger.

- CAPTUR,EXTTRGG?
  
  Data is captured using the PPA’s External Trigger.

**Notes:** This command only applies to PPA5512 and 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)
CONFIG,6?
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?

Function:   Data available query
Description: Returns data availability status.
Format:     DAV?
Arguments:  none
Reply:      Decimal equivalent of data available bits:
             bit0  new data available  
             bit1  data available  
             bit2  harmonic series data available  
             bit6  integration data available  
             bit7  datalog data available  
Example:    SPEED,SLOW
             *TRG
             DAV?
             0
             DAV?
             0
             DAV?
             0
             DAV?
             3  (data available)
Notes:      DAV? does not modify the status bits.
Function: Set data available enable register
Description: Sets bits in the data available enable register to control which status bits set the data available bits in the status byte.
Format: DAVER, value
Arguments: decimal equivalent of data available bits
  bit0  set bit 0 of status byte when new data available
  bit1  set bit 0 of status byte when data available
Reply: none
Example: DAVER, 1
  set bit 0 in status byte when new data is available
Notes: default value is 2:
  bit 0 of status byte is set whenever data is available.
**DAVER?**

**Function:** Read data available enable register

**Description:** Read back present setting of the data available enable register, which controls the status bits that set the data available bits in the status byte.

**Format:** DAVER?

**Arguments:** none

**Reply:** decimal equivalent of bits

**Example:** DAVER?

4

**Notes:**
**DISPLAY**

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

Reply: None

Example: `DISPLAY,FUNDAMENTAL`

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

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<th>Read the displayed data</th>
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<tr>
<td>Description</td>
<td>Returns all the values presently on the screen.</td>
</tr>
<tr>
<td>Format</td>
<td>DISPLAY?</td>
</tr>
<tr>
<td>Arguments</td>
<td>none</td>
</tr>
<tr>
<td>Reply</td>
<td>Multiple floating point values separated by commas</td>
</tr>
<tr>
<td>Example</td>
<td>DISPLAY?</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
</tbody>
</table>
**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:
EFFICI?

Function: Read efficiency result
Description: Reads back the total and fundamental efficiency results.
Format: EFFICI?
Arguments: none
Reply: 2 data values separated by commas:
        total, fundamental
Example: EFFICI?
        data returned
Notes:
**FAST**

Function: Set fast communications mode.

Description: Disables the screen drawing for high speed operation.

Format: FAST,value

Arguments: value:
            - ON
            - OFF

Reply: none

Example: FAST,ON

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

**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).
FREQFI

Function: Set the frequency filter
Description: Selects a filter to be applied to the data used for frequency measurement to help synchronise in noisy environments.
Format: FREQFI,value
Arguments: value:
    ON
    OFF
Reply: none
Example: FREQFI,ON
Notes: The filter is applied only to the data used for frequency measurement and does not change the data used for the measurements.
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?

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

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

Format: FSD?
FSD, 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:
**INPUT**

Function: Set input mode

Description: Selects the input type of the instrument

Format: INPUT,\textit{channel},\textit{type}

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: \( \text{INTEGR,} \text{type,} \text{display} \)
        \( \text{INTEGR,} \text{RUNTIM,} \text{hours,} \text{minutes} \)

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

Arguments:

- phase:
  - PHASE1
  - PHASE2
  - PHASE3
  - PHASES

Reply: 11 data values separated by commas:

- freq, Vmag, Amag, impedance,
- phase, R, C, L, tanδ, Qf, reactance

Example:

```
LCR,IMPEDA
LCR,PHASES?
data returned
```

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

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: \texttt{MSLAVE,type}

Arguments: type:
- DISABLE
- MASTER
- SLAVE

Reply: none

Example: \texttt{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
  - 6 ADI40
- **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 2-115 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: The MULTILOG, number? command will reply each time a new data point is available.

For further information and assistance with the Multilog application please go to page 2-115 where you will find an application guide to assist with this function.
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<th><strong>NEWLOC</strong></th>
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<tbody>
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</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Reads multiple sets of data</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>NEWLOC</td>
</tr>
<tr>
<td><strong>Arguments:</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Reply:</strong></td>
<td>Data as per returned parameter query. ie from power, harmonics etc.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>NEWLOC;HARMON?SERIES;HPOWER? Harmonic series and Power data returned</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td>After the command the data will still be held so to release the lock send SUSPEND,OFF</td>
</tr>
</tbody>
</table>
NOISEF

Function: Sets the noise filter.

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

Format: NOISEF,[PHASEEx],value,frequency

Arguments:

[PHASEEx]:
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 [PHASEEx] command to set noise filter on individual phases. [PHASESEx] 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.
**NORMAL**

**Function:** Sets the Normalise reference to Current or Voltage.

**Description:** Sets the Reference for the NORMALISE function. Press ZERO on the instrument to action the function.

**Format:** NORMAL,reference

**Arguments:**

Reference:
- CURRENT
- VOLTAGE

**Reply:** none

**Example:**
- NORMAL,VOLTAGE
- NORMAL,CURRENT
- NORMALISE,VOLTAGE
- NORMALISE,CURRENT

**Notes:** The “normalise” function adjusts the scale factors on each current channel so that they read the same as phase 1. The reference can be either the current measured on phase 1 or if there is a reference CT it can be connected to the external input of phase 1 voltage and used as a reference.
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
<table>
<thead>
<tr>
<th>PHANGREF</th>
<th>PHANGREF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function:</strong></td>
<td>Set phase angle reference.</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Select phase angle reference to current or voltage.</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>PHANGREF, <em>reference</em></td>
</tr>
</tbody>
</table>
| **Arguments:** | reference:  
| | Current  
| | Voltage  |
| **Reply:** | none |
| **Example:** | PHANGREF, current  
| | PHANGREF, voltage |
| **Notes:** | |
Function: Set phase meter mode.
Description: Select phase meter mode and reference.
Format: PHASE, reference
Arguments: 
  reference:
  "CH1" ratio = ch2/ch1
  "CH2" ratio = ch1/ch2
Reply: none
Example: PHASEM, CH2
Notes:
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.
FUNCTION: Set up power analyser mode.
DESCRIPTION: Configure power analyser with sum current display type
FORMAT: POWER, sum type
ARGUMENTS: sum type:
            TOTAL
            AVERAGE
REPLY: none
EXAMPLES: POWER, TOTAL
NOTES:
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.
PRIMAR

Function: Select only primary functions.
Description: Sets the instrument to only compute total functions not fundamentals, in order to allow shorter measurement windows.
Format: PRIMAR,value
Arguments: value:
  ON
  OFF
Reply: none
Example: PRIMAR,ON
Notes: When primary is on, fundamental values will be displayed as zero.

On the Instrument this command adjusts the HIGH SPEED mode option that can be found in the ACQU > Advanced menu options:

  PRIMAR, ON = HIGH SPEED > ENABLED
  PRIMAR, OFF = HIGH SPEED > DISABLED
## PROGRA

<table>
<thead>
<tr>
<th>Function</th>
<th>Access non volatile program stores.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Recall, store or delete non-volatile program store.</td>
</tr>
<tr>
<td>Format</td>
<td>PROGRA,\textit{function},\textit{number}</td>
</tr>
<tr>
<td>Arguments</td>
<td>function: \begin{itemize} \item RECALL \item STORE \item DELETE \end{itemize} \textit{number} 0-100</td>
</tr>
<tr>
<td>Reply</td>
<td>none</td>
</tr>
<tr>
<td>Example</td>
<td>PROGRA,RECALL,13</td>
</tr>
<tr>
<td>Notes</td>
<td>Number 0 represents factory default, which can only be recalled.</td>
</tr>
</tbody>
</table>
**PROGRA?**

**Function:** Identify current program or list all stored programs.

**Description:**
Sending the argument FILES? – Lists all stored programs. The reply includes the location, file name and date saved for each program. 
Sending the argument NAME? - Displays the name of the last program to be loaded or recalled.

**Format:**

**Arguments:** FILES? 
NAME?

**Reply:** text string

**Example:**

- PROGRA,FILES?
  2,PCIS,21/11/2017
  3,,21/11/2017
  10,remote program,11/01/18

- PROGRA,NAME?
  factory default

- PROGRAM,NAME?
  Remote program

**Notes:** If a program is stored but not given a name the return string will display no data for the name. See example above.

Only the first six digits of the command are required so PROGRA and PROGRAM are both valid, both return the same data.
RANGE

Function: Set channel ranging.
Description: Select minimum range and range control for a given input channel.
Format: RANGE,channel,ranging,range
Arguments:
  channel: CH1, CH2
  ranging: AUTO, UPAUTO, MANUAL
  range: range number 1-9
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,-1,0,0,0,0,0,0,0,0,0,0,0
Notes: 0 = empty
1 = normal result
2 = harmonic result
3 = scope result
-1 = continuation of previous
REZERO

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

**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
Function: Fetch raw scope data.
Description: Read back raw oscilloscope data.
Format: \texttt{SCOPE,channel?}
\texttt{SCOPE,phase,channel?}
Arguments: phase:
\begin{itemize}
  \item PHASE1
  \item PHASE2
  \item PHASE3
  \item NEUTRA
\end{itemize}
channel:
\begin{itemize}
  \item VOLTAGE
  \item CURRENT
\end{itemize}
Reply: 252 signed integers:
\begin{itemize}
  \item range
  \item trigger
  \item 250 x data
\end{itemize}
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>SCREEN?</th>
<th>SCREEN?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function:</strong></td>
<td>Read the screen data</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Returns a bit map of screen pixel display in ascii and hex format</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>SCREEN?</td>
</tr>
<tr>
<td><strong>Arguments:</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>Reply:</strong></td>
<td>Multiple data bit values</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>SCREEN?</td>
</tr>
<tr>
<td></td>
<td>data returned</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td>SCREEN? response:</td>
</tr>
</tbody>
</table>

- ASCII coded Hex
- (2 characters for each byte)
- 240 lines of 40 bytes (each line represents one line of the display)
- preceded by #H
- Each byte represents 8 dots where the lsb is the leftmost dot of the display
- The bit is set for on and cleared for off
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 16\textsuperscript{th} line has been received and the checksum has been verified.
### SETUP?

<table>
<thead>
<tr>
<th>Function:</th>
<th>Read instrument set up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>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.</td>
</tr>
<tr>
<td>Format:</td>
<td>SETUP?</td>
</tr>
<tr>
<td>Arguments:</td>
<td>none</td>
</tr>
<tr>
<td>Reply:</td>
<td>16 lines of ASCII data</td>
</tr>
</tbody>
</table>
| Example:        | SETUP?                 
|                 | Read 16 lines of data  |
| Notes:          |                        |
SHUNT

Function: Set channel shunt value

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

Format: SHUNT,channel,resistance

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

Reply: none

Example: SHUNT,CH1,10

Notes: The shunt value is set for all current channels
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
START

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:
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, value</td>
</tr>
<tr>
<td>Arguments:</td>
<td>value:</td>
</tr>
<tr>
<td></td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td>Reply:</td>
<td>none</td>
</tr>
<tr>
<td>Example:</td>
<td>FAST,ON</td>
</tr>
<tr>
<td></td>
<td>SUSPEN,ON</td>
</tr>
<tr>
<td></td>
<td>MULTILOG?</td>
</tr>
<tr>
<td></td>
<td>SUSPEN,OFF</td>
</tr>
<tr>
<td></td>
<td>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 and offset for torque and speed measurements. Pulsed input has a value for the number of pulses per revolution.
Format: TORQSP,type,scale1,scale2
         TORQSP,OFFSET,offset1,offset2
Arguments: type:
            DISABLED
            ANALOG
            PULSED (SPEED)
            OFFSET
            scale1 and scale 2
            multiplying factor in Nm/V or rpm/V
            pulses/rev
            offset1 and offset2
            zero level in V
Reply: none
Examples: TORQSP,PULSED,10,50
          speed measured by pulse
          torque scaling = 10Nm/V
          50 pulses/revolution
          TORQSP,ANALOG,10,1
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
<table>
<thead>
<tr>
<th>Function:</th>
<th>Read the mechanical power, torque and speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Returns measured mechanical power value along with the torque and speed values</td>
</tr>
<tr>
<td>Format:</td>
<td>TORQSP?</td>
</tr>
<tr>
<td>Arguments:</td>
<td>none</td>
</tr>
<tr>
<td>Reply:</td>
<td>3 data values separated by commas: power, torque, speed</td>
</tr>
<tr>
<td>Example:</td>
<td>TORQSP? data returned</td>
</tr>
<tr>
<td>Notes:</td>
<td>Mechanical power displayed in Watts Torque displayed in Nm Speed displayed in rpm</td>
</tr>
</tbody>
</table>
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
PPA5530 #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 PFCOV
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
<table>
<thead>
<tr>
<th>Function:</th>
<th>Set up rms voltmeter.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Set mode to rms voltmeter.</td>
</tr>
<tr>
<td>Format:</td>
<td>VRMS</td>
</tr>
<tr>
<td>Arguments:</td>
<td>none</td>
</tr>
<tr>
<td>Reply:</td>
<td>none</td>
</tr>
<tr>
<td>Examples:</td>
<td>VRMS</td>
</tr>
<tr>
<td>Notes:</td>
<td>This has the same effect as MODE,VRMS</td>
</tr>
</tbody>
</table>
**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,DELTAS (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
**Function:** Enables extended system calibration mode

**Description:** Enable External system scaling in the AUX menu. Select the required range (1 to 4) for each channel.

**Format:**
- Xscale,function,
- Xscale,channel,range

**Arguments:**
- **Function**
  - Enable
  - Disable

- **Channel:**
  - CH1
  - CH2
  - CH3
  - CH4
  - CH5
  - CH6

- **Range:**
  - 1 (1 ohm)
  - 2 (2.5 ohm)
  - 3 (5 ohm)
  - 4 (10 ohm)

**Reply:** none

**Examples:**

- Xscale,enable
  
  This example enables the mode.

- Xscale,CH4,2
  
  This example loads the 2.5ohm range (range 2) for phase 2 current.
Notes: To use this command it is necessary to first enable the mode and then resend the command to individually set up each channel.

This command provides a multiple scaling option for the system calibration of the PPA35xx with a LEM6.

Sending this command automatically enables independent ranging.
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.
**ZOOM?**

**Function:** Read the display zoom parameters.

**Description:** Reads the zoom level and data.

**Format:** ZOOM?

**Arguments:**

**Reply:** 5 integers separated by commas:

- **level:**
  - 0 – normal
  - 1 – 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
### Required Parameters

<table>
<thead>
<tr>
<th>Order parameter to be returned within string</th>
<th>Phase (channel) of data returned</th>
<th>Parameter required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Frequency</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Watts Phase 1</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Watts Phase 2</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>Watts Phase 3</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>RMS Voltage Phase 1</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>RMS Voltage Phase 1</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>RMS Voltage Phase 1</td>
</tr>
</tbody>
</table>

### MULTILOG Pattern

<table>
<thead>
<tr>
<th>Command</th>
<th>Index</th>
<th>Phase</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>MULTIL,0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MULTIL,1,1,1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>MULTIL,2,1,2</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>MULTIL,3,2,2</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>MULTIL,4,3,2</td>
<td>5</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>MULTIL,5,1,50</td>
<td>6</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>MULTIL,6,2,50</td>
<td>7</td>
<td>3</td>
<td>50</td>
</tr>
</tbody>
</table>

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
```

<table>
<thead>
<tr>
<th></th>
<th>PH1 Watts</th>
<th>PH2 Watts</th>
<th>PH3 Watts</th>
<th>PH1 RMS Volt</th>
<th>PH2 RMS Volt</th>
<th>PH3 RMS Volt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix – command summary

COMMAND SUMMARY
command format | reply format
---|---
*CLS |  
*ESE,value | single integer data value  
*ESE? |  
*ESR? | single integer data value  
*IDN? | company,product,serial no,version  
*OPC? | 0 or 1  
*RST |  
*SRE,value | single integer data value  
*SRE? |  
*STB? | single integer data value  
*TRG |  
*TST? | single integer data value  
*WAI |  
ABORT |  
ADIMAP |  
ALARM,latch,sounder | single integer data value  
ALARM? |  
ALARME,value | single integer data value  
ALARME? |  
ALARM1,type,data,high,low | single integer data value  
ALARM2,type,data,high,low |  
ANALOG |  
ANALOG? |  
APPLIC,type,setting |  
BANDWI,phase,type |  
BEEP |  
BLANKI,on/off,threshold |  
CALVER,string |  
CALVER? | String  
CAPTUR? | String  
CONFIG,parameter,data |  
CONFIG,parameter? | single integer or real data value  
COUPLI,phase,coupling |  
DATALO,func,interval,speed |  
DATALO,LINES? | single integer  
DATALO,0? | index,time,data... one record per line  
DATALO,start,records? | index,time,data... one record per line  
DAV? | single integer data value  
DAVER,value |  
DAVER? | single integer data value  
DISPLAY,page |  

A-2
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISPLAY?</td>
<td>multiple real data values</td>
</tr>
<tr>
<td>EFFICI,type</td>
<td>total efficiency, fundamental efficiency</td>
</tr>
<tr>
<td>FAST,on/off</td>
<td></td>
</tr>
<tr>
<td>FQLOCK,on/off</td>
<td></td>
</tr>
<tr>
<td>FQREF,phase,channel</td>
<td></td>
</tr>
<tr>
<td>FREQFI,on/off,filter</td>
<td></td>
</tr>
<tr>
<td>FREQUE,frequency</td>
<td></td>
</tr>
<tr>
<td>FSD?</td>
<td></td>
</tr>
<tr>
<td>HARMON,para,h,hmax</td>
<td></td>
</tr>
<tr>
<td>HARMON,phase?</td>
<td>freq,mag1,mag2,hmag1,hmag2,h1,h2, thd1,thd2,hphase1,hphase2</td>
</tr>
<tr>
<td></td>
<td>Or</td>
</tr>
<tr>
<td>HARMON,phase,SERIES?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Or</td>
</tr>
<tr>
<td>HOLD,on/off</td>
<td></td>
</tr>
<tr>
<td>INPUT,channel,type</td>
<td></td>
</tr>
<tr>
<td>INTEGR,type,display</td>
<td></td>
</tr>
<tr>
<td>INTEGR,RUNTIM,hours,mins</td>
<td></td>
</tr>
<tr>
<td>INTEGR,phase?</td>
<td>Time,Wh,Wh.f, Varh,Varh.f, Vah, Vah.f, pf, pf.f, Vav, Vav.fAh, Ah.f</td>
</tr>
<tr>
<td>KEYBOA,value</td>
<td>Freq,mag1,mag2, impedance, phase, R, L,C (series), R, L,C (parallel), tanδ, Q</td>
</tr>
<tr>
<td>LCR,conditions,param,head</td>
<td></td>
</tr>
<tr>
<td>LCR,phase?</td>
<td>1-30 floats as selected</td>
</tr>
<tr>
<td>LOWFRE,on/off</td>
<td></td>
</tr>
<tr>
<td>MODE,type</td>
<td></td>
</tr>
<tr>
<td>MSLAVE,type</td>
<td></td>
</tr>
<tr>
<td>MULTILOG,index,phase,func</td>
<td></td>
</tr>
<tr>
<td>MULTILOG?</td>
<td>Freq,mag1,mag2, dB, phase</td>
</tr>
<tr>
<td>PFCONV,convention</td>
<td></td>
</tr>
<tr>
<td>PHASEM,ratio</td>
<td></td>
</tr>
<tr>
<td>PHASEM,phase?</td>
<td>Freq,mag1,mag2, dB, phase</td>
</tr>
<tr>
<td>PHCONV,convention</td>
<td></td>
</tr>
<tr>
<td>PRIMAR</td>
<td></td>
</tr>
<tr>
<td>POWER,sum A</td>
<td></td>
</tr>
<tr>
<td>POWER,PHASE,WATTS?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freq, W, W.f, VA, VA.f, Var, Var.f, pf, pf.f, Wdc, W.h</td>
</tr>
<tr>
<td>POWER,PHASE,VOLTAGE?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freq, rms, mag, dc, φ, peak, cf, mean, ff, harmonic</td>
</tr>
<tr>
<td>POWER,PHASE,CURRENT?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freq, rms, mag, dc, φ, peak, cf, mean, ff, harmonic</td>
</tr>
<tr>
<td>POWER,PH-PH?</td>
<td>Freq, rms1, mag1, φ1, rms2, mag2, φ2, rms3, mag3, φ3</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>POWER,RMS?</td>
<td>Freq,vrms1,vdc1,arms1,adc1,vrms2,vdc2,arms2,adc2,vrms3,vdc3,arms3,adc3</td>
</tr>
<tr>
<td>POWER,VECTORS?</td>
<td>Freq,mag1,ϕ1,mag2,ϕ2,mag3,ϕ3,mag4,ϕ4,mag5,ϕ5,mag6,ϕ6</td>
</tr>
<tr>
<td>POWER,WVA?</td>
<td>Freq,w1,vrms1,arms1,w2,vrms2,arms2,w3,vrms3,arms3</td>
</tr>
<tr>
<td>PROGRAM,function,number</td>
<td>CR terminated text string</td>
</tr>
<tr>
<td>PROGRAM?</td>
<td></td>
</tr>
<tr>
<td>RANGE,ch,ranging,range</td>
<td></td>
</tr>
<tr>
<td>RESOLU.format</td>
<td></td>
</tr>
<tr>
<td>RESULT,function,number</td>
<td>multiple integers</td>
</tr>
<tr>
<td>RESULT</td>
<td></td>
</tr>
<tr>
<td>REZERO</td>
<td></td>
</tr>
<tr>
<td>SCALE,channel,factor</td>
<td></td>
</tr>
<tr>
<td>SCALE,channel?</td>
<td></td>
</tr>
<tr>
<td>SCOPE,PHASE,v/a?</td>
<td>Range, trigger, 250 signed integer values</td>
</tr>
<tr>
<td>SHUNT,channel,resistance</td>
<td></td>
</tr>
<tr>
<td>SHUNT,channel?</td>
<td></td>
</tr>
<tr>
<td>SMOOTH,type,dynamics</td>
<td></td>
</tr>
<tr>
<td>SPEED,value,window</td>
<td></td>
</tr>
<tr>
<td>START</td>
<td></td>
</tr>
<tr>
<td>STATUS,channel?</td>
<td>Range number, range text, over/low/ok</td>
</tr>
<tr>
<td>STOP</td>
<td></td>
</tr>
<tr>
<td>STREAM,enable,window</td>
<td></td>
</tr>
<tr>
<td>STREAM,disable</td>
<td></td>
</tr>
<tr>
<td>STREAM?</td>
<td>Data, data, data, data, data, data, .....</td>
</tr>
<tr>
<td>SUSPEN,on/off</td>
<td></td>
</tr>
<tr>
<td>TAGREP,on/off</td>
<td></td>
</tr>
<tr>
<td>TEMPER,type,scaling,offset</td>
<td></td>
</tr>
<tr>
<td>TEMPER?</td>
<td>single real data value</td>
</tr>
<tr>
<td>TORQSP,type,tscale,sscale</td>
<td></td>
</tr>
<tr>
<td>TORQSP,OFFSET,offset</td>
<td></td>
</tr>
<tr>
<td>TORQSP?</td>
<td>mechanical power, torque, speed</td>
</tr>
<tr>
<td>USER?</td>
<td>3 CR terminated text strings</td>
</tr>
<tr>
<td>VARCON,convention</td>
<td>datecode,cpu,dsp,fpga,boot</td>
</tr>
<tr>
<td>VERSION?</td>
<td></td>
</tr>
<tr>
<td>VRMS</td>
<td></td>
</tr>
<tr>
<td>VRMS,PHASE,RMS?</td>
<td>rms1,rms2,dc1,dc2,ac1,ac2</td>
</tr>
<tr>
<td>VRMS,PHASE,MEAN?</td>
<td>rms1,rms2,mean1,mean2,ff1,ff2</td>
</tr>
<tr>
<td>VRMS,PHASE,SURGE?</td>
<td>pk1,pk2,cf1,cf2,surge1,surge2</td>
</tr>
<tr>
<td>WIRING,configuration</td>
<td></td>
</tr>
</tbody>
</table>
XSX
ZE
ZE,DE
ZOOM,level,d1,d2,d3,d4
ZOOM?
level,d1,d2,d3,d4

calibration commands

CALAPP
CALCOM,freq
CALFIL,index,value
CALFIL? Six real data values
CALFRQ,index,freq
CALFRQ? Seven real data values
CALIBR,index,value,inputs
CALIBR? Single integer data value
CALIDS,string
CALIDS? String
CALJIG,value
CALMOD,value
CALPHA,index,inputs
CALRES
CALSAV,password
CALSYS,index,value,inputs
CALSNO,serial number
CALSTR,string
CALSTR? String
CALTQS,index,value
CALTQS? Four real data values
CALVER,string
CALVER? String
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

5. **Phase convention**, (System options)
   - 0=-180° to +180°
   - 1=0° to -360°
   - 2=0° to +360°

6. **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
LAN IP address nibble 3, (Remote options - LAN - enter figure as required)
LAN IP address nibble 2, (Remote options - LAN - enter figure as required)
LAN IP address nibble 1, (Remote options - LAN - enter figure as required)
LAN IP address nibble 0, (Remote options - LAN - enter figure as required)

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

Enable channel 1, (Range – voltage input)
   1=Internal
   3=External Attenuator

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

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

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

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

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

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

Scale factor channel 1 voltage, (Ranging - Enter figures as required)
Scale factor channel 2 current, (Ranging - Enter figures as required)
External attenuator channel 1, (Ranging – voltage input - attenuator ratio
– Enter figures as required)
External shunt channel 2, (Ranging – current input - resistance value- Enter figures as required)

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

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

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
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
</table>
| 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 (PPA5512/5532 only)
71 Frequency filter, (Application options mode - PWM Motor Drive)
   0=4KHz
   1=1KHz
   2=250Hz

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

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

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

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

76 Term 3 coefficient, (Enter value)

77 Argument term 4
   0=Disabled
   1=Constant
   2=Voltage
   3=Current
   4=Torque
   5=Speed
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)
86 Speed scaling Hz/V, (Applications – PWM motor drive) (Enter rpm/v value)
87 Pulses per revolution, (Applications – PWM motor drive) (Enter pulses/rev value)
88 Integration display, (Mode – Power integrator)
     0 = Total
     1 = Average
89 Sum current average, (Power analyzer)
     0 = Total
     1 = Average
90 Input compensation, (Mode)
     0 = Disabled
     1 = Enabled
91 Power factor sign, (Power analyzer)
     0 = Negative lagging
     1 = Negative leading
92 VAr sign, (Power analyzer)
     0 = Negative lagging
     1 = Negative leading
93 Efficiency computation, (Power analyzer)
     0 = Disabled
     1 = Phase 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
94 Range lock across phases, (Range – when acquisition is using 3 phases)
     0 = Disabled
     1 = Enabled
95 Torque offset, (Applications – PWM motor drive) (Also transformer mode) (Enter Nm offset value)
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
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
122 Auxiliary device, (Aux control)
   0=None
   6=PCIS

128 Switch phase offset, (Aux control – PCIS device)
   0=0°
   1=45°
   2=90°
   3=135°
   4=180°
   5=225°
   6=270°
   7=315°

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

130 Gear ratio, (Aux control – frequency reference – speed - Enter ratio value)

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

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

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

134 Ph – Ph Measurement, (Power analyser)
   0=ph-ph rms
   1=ph-ph Mean
   2=Star - Delta
   3=Delta - Star

135 Difference THD, (Power analyser)
   0=Disabled
   1=Enabled including dc
   2=Enabled excluding dc
Parameter, (Impedance analyzer)
0=Auto
1=Capacitance
2=Inductance
3=Impedance

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

Phase offset, (Impedance analyzer - Enter figures)

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

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

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

dB offset, (Phase meter - Enter figures)

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

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

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

164 Analog zero, (Alarm options – enter figure)

165 Analog full scale, (Alarm options – enter figure)

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

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

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

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

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

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

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

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

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

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

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

Bandwidth phase 2, (Coupling - bandwidth) (Sys independent ranging enabled)
0 = Wide (dc–2MHz)
1 = Low (dc-200KHz)
2 = dc (dc-5Hz)
184 Scale factor channel 3 voltage, (Ranging - Enter figures as required) (Sys independent ranging enabled)

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

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

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

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

197 High speed Mode (ACQU - Advanced options)
   0=Off
   1=On

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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</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
6 = ADI40
There are some special functions:

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<td>mechanical power</td>
<td>neutral</td>
<td>Watts (function 2)</td>
</tr>
</tbody>
</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
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