PPA5500
KinetiQ
COMMUNICATIONS MANUAL
IMPORTANT SAFETY INSTRUCTIONS

This equipment is designed to comply with BSEN 61010-1 (2001) (Safety requirements for electrical equipment for measurement, control, and laboratory use) – observe the following precautions:

- Ensure that the supply voltage agrees with the rating of the instrument printed on the back panel before connecting the mains cord to the supply.
- This appliance must be earthed. Ensure that the instrument is powered from a properly grounded supply.
- The inputs are rated at 1kV rms or dc cat II; 600V rms or dc cat III. Do not exceed the rated input.
- Keep the ventilation holes on the underneath and rear free from obstruction.
- Do not operate or store under conditions where condensation may occur or where conducting debris may enter the case.
- There are no user serviceable parts inside the instrument – do not attempt to open the instrument, refer service to the manufacturer or his appointed agent.

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

This manual gives details of the communication commands recognized by the PPA55xx series of instruments over RS232, USB, LAN or GPIB. For more general operating instructions for the instrument refer to the specific user manual.

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

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Revision 2.64

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02nd July 2014
CONTENTS

1 Using remote control ..................................................... 1-1
  1.1 Standard event status register ..................................... 1-3
  1.2 Serial Poll status byte ............................................. 1-4
  1.3 RS232 connections .................................................. 1-5
  1.4 Data format .......................................................... 1-6

2 Communication commands ............................................. 2-1
  *CLS ................................................................. 2-1
  *ESE ................................................................. 2-2
  *ESR? ................................................................. 2-3
  *IDN? ................................................................. 2-4
  *OPC? ................................................................. 2-5
  *RST ................................................................. 2-6
  *SRE ................................................................. 2-7
  *SRE? ................................................................. 2-8
  *STB? ................................................................. 2-9
  *TRG ................................................................. 2-10
  *TST? ................................................................. 2-11
  *WAI ................................................................. 2-12
  ABORT ............................................................... 2-13
  ALARM ............................................................... 2-14
  ALARM? .............................................................. 2-15
  ALARM1 .............................................................. 2-16
  ALARM2 .............................................................. 2-17
  ALARME ............................................................ 2-18
  ALARME? ............................................................ 2-19
  APPLIC .............................................................. 2-20
  BANDWI .............................................................. 2-21
  BANDWI? ............................................................. 2-22
  BEEP ................................................................. 2-23
  BLANKI .............................................................. 2-24
  CALVER .............................................................. 2-25
  CALVER? ............................................................ 2-26
  CAPTUR? ............................................................. 2-27
  CONFIG ............................................................. 2-29
  CONFIG? ............................................................ 2-30
  COUPLI .............................................................. 2-31
  COUPLI? ............................................................. 2-32
  DATALO .............................................................. 2-33
  DATALO? ............................................................. 2-34
<table>
<thead>
<tr>
<th>Command</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAV?</td>
<td>2-35</td>
</tr>
<tr>
<td>DAVER</td>
<td>2-36</td>
</tr>
<tr>
<td>DAVER?</td>
<td>2-37</td>
</tr>
<tr>
<td>DISPLAY</td>
<td>2-38</td>
</tr>
<tr>
<td>DISPLAY?</td>
<td>2-39</td>
</tr>
<tr>
<td>EFFICI</td>
<td>2-40</td>
</tr>
<tr>
<td>EFFICI?</td>
<td>2-41</td>
</tr>
<tr>
<td>FAST</td>
<td>2-42</td>
</tr>
<tr>
<td>FQLOCK</td>
<td>2-43</td>
</tr>
<tr>
<td>FQREF</td>
<td>2-44</td>
</tr>
<tr>
<td>FREQFI</td>
<td>2-45</td>
</tr>
<tr>
<td>FREQUE</td>
<td>2-46</td>
</tr>
<tr>
<td>FSD?</td>
<td>2-47</td>
</tr>
<tr>
<td>Function:</td>
<td>2-47</td>
</tr>
<tr>
<td>HARMON</td>
<td>2-48</td>
</tr>
<tr>
<td>HARMON?</td>
<td>2-49</td>
</tr>
<tr>
<td>HOLD</td>
<td>2-50</td>
</tr>
<tr>
<td>INPUT</td>
<td>2-51</td>
</tr>
<tr>
<td>INTEGR</td>
<td>2-52</td>
</tr>
<tr>
<td>INTEGR?</td>
<td>2-53</td>
</tr>
<tr>
<td>KEYBOA</td>
<td>2-54</td>
</tr>
<tr>
<td>LCR</td>
<td>2-55</td>
</tr>
<tr>
<td>LCR?</td>
<td>2-56</td>
</tr>
<tr>
<td>LOWFRE</td>
<td>2-57</td>
</tr>
<tr>
<td>MODE</td>
<td>2-58</td>
</tr>
<tr>
<td>MSLAVE</td>
<td>2-59</td>
</tr>
<tr>
<td>MULTIL</td>
<td>2-60</td>
</tr>
<tr>
<td>MULTIL?</td>
<td>2-61</td>
</tr>
<tr>
<td>NEWLOC</td>
<td>2-62</td>
</tr>
<tr>
<td>NOISEF</td>
<td>2-63</td>
</tr>
<tr>
<td>NOOVER</td>
<td>2-64</td>
</tr>
<tr>
<td>PFCONV</td>
<td>2-65</td>
</tr>
<tr>
<td>PHASEM</td>
<td>2-66</td>
</tr>
<tr>
<td>PHASEM?</td>
<td>2-67</td>
</tr>
<tr>
<td>PHCONV</td>
<td>2-68</td>
</tr>
<tr>
<td>POWER</td>
<td>2-69</td>
</tr>
<tr>
<td>POWER?</td>
<td>2-70</td>
</tr>
<tr>
<td>PROGRA</td>
<td>2-72</td>
</tr>
<tr>
<td>PROGRA?</td>
<td>2-73</td>
</tr>
<tr>
<td>RANGE</td>
<td>2-74</td>
</tr>
<tr>
<td>RESOLU</td>
<td>2-75</td>
</tr>
<tr>
<td>RESULT</td>
<td>2-76</td>
</tr>
<tr>
<td>RESULT?</td>
<td>2-77</td>
</tr>
<tr>
<td>REZERO</td>
<td>2-78</td>
</tr>
<tr>
<td>Command</td>
<td>Page</td>
</tr>
<tr>
<td>------------------</td>
<td>------</td>
</tr>
<tr>
<td>SCALE</td>
<td>2-79</td>
</tr>
<tr>
<td>SCOPE?</td>
<td>2-80</td>
</tr>
<tr>
<td>SCREEN?</td>
<td>2-81</td>
</tr>
<tr>
<td>SETUP</td>
<td>2-82</td>
</tr>
<tr>
<td>SETUP?</td>
<td>2-83</td>
</tr>
<tr>
<td>SHUNT</td>
<td>2-84</td>
</tr>
<tr>
<td>SMOOTH</td>
<td>2-85</td>
</tr>
<tr>
<td>SPEED</td>
<td>2-86</td>
</tr>
<tr>
<td>START</td>
<td>2-87</td>
</tr>
<tr>
<td>STATUS?</td>
<td>2-88</td>
</tr>
<tr>
<td>STOP</td>
<td>2-89</td>
</tr>
<tr>
<td>SUSPEN</td>
<td>2-90</td>
</tr>
<tr>
<td>TAGREP</td>
<td>2-91</td>
</tr>
<tr>
<td>TEMPER</td>
<td>2-92</td>
</tr>
<tr>
<td>TEMPER?</td>
<td>2-93</td>
</tr>
<tr>
<td>TORQSP</td>
<td>2-94</td>
</tr>
<tr>
<td>TORQSP?</td>
<td>2-95</td>
</tr>
<tr>
<td>USER?</td>
<td>2-96</td>
</tr>
<tr>
<td>VARCON</td>
<td>2-97</td>
</tr>
<tr>
<td>VERSIO?</td>
<td>2-98</td>
</tr>
<tr>
<td>VRMS</td>
<td>2-99</td>
</tr>
<tr>
<td>VRMS?</td>
<td>2-100</td>
</tr>
<tr>
<td>WIRING</td>
<td>2-101</td>
</tr>
<tr>
<td>ZERO</td>
<td>2-102</td>
</tr>
<tr>
<td>ZOOM</td>
<td>2-103</td>
</tr>
<tr>
<td>ZOOM?</td>
<td>2-104</td>
</tr>
</tbody>
</table>

Multilog Application Guide...........................................2-105

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</td>
<td>carriage return (line feed ignored)</td>
<td>carriage return and line feed</td>
</tr>
<tr>
<td>USB, LAN</td>
<td></td>
<td></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></th>
<th>PON</th>
<th>CME</th>
<th>EXE</th>
<th>DDE</th>
<th>QYE</th>
<th>OPC</th>
</tr>
</thead>
</table>

bit 0  **OPC**  (operation complete)
cleared by most commands
set when data available or sweep complete

bit 2  **QYE**  (unterminated query error)
set if no message ready when data read

bit 3  **DDE**  (device dependent error)
set when the instrument has an error

bit 4  **EXE**  (execution error)
set when the command cannot be executed

bit 5  **CME**  (command interpretation error)
set when a command has not been recognised

bit 7  **PON**  (power on event)
set when power first applied or unit has reset

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

<table>
<thead>
<tr>
<th></th>
<th>ESB</th>
<th>MAV</th>
<th>ALA</th>
<th>RDV</th>
</tr>
</thead>
<tbody>
<tr>
<td>bit 0</td>
<td>RDV (result data available) set when results are available to be read as enabled by DAVER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bit 3</td>
<td>ALA (alarm active) set when an alarm is active and enabled by ALARMER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bit 4</td>
<td>MAV (message available) set when a message reply is waiting to be read</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bit 5</td>
<td>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).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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
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 $2^{exponent}$ x $-1^{sign}$

<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.
Communication commands

*CLS

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

Notes:
**ESE**

Function: Set standard event status enable register.

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

Format: **ESE**, value

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

Reply: can be read by **ESE**?

Example: **ESE**, 60

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

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

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

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

**Format:**
*ESR?*

**Arguments:**
none

**Reply:**
decimal equivalent of bits in standard event status register

**Example:**
*ESR?
33

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

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

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

Function: Identify query  
Description: Returns a standard format identification string.  
Format: *IDN?  
Arguments: none  
Reply: An ASCII string in the IEEE488.2 format: manufacturer,model,serial no,version  
Example: *IDN? NEWTONS4TH,PPA2530 KinetiQ, 01234,1.00  
Notes:
*OPC?  *OPC?

Function:  Test for operation complete

Description:  Returns 1 if previous operation is completed, 0 if not.

Format:  *OPC?

Arguments:  none

Reply:  0 or 1

Example:  START
           *OPC?
           0
           *OPC?
           0
           *OPC?
           1

Notes:  *OPC? can be used to indicate when data is available or when a frequency sweep has completed.
<table>
<thead>
<tr>
<th><strong>Function:</strong></th>
<th>Reset</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Resets the instrument to the default state and clears the <em>standard event status register</em>.</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>*RST</td>
</tr>
<tr>
<td><strong>Arguments:</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>Reply:</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>*RST</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>
*SRE

Function: Set service request enable register.

Description: Enable which bits of the status byte register initiate a service request.

Format: *SRE, value

Arguments: decimal equivalent of bits in status byte register

Reply: can be read by *SRE?

Example: *SRE, 1 generate a service request when data available.

Notes:
**SRE?**

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 error with analogue zero  
  > 15 – major system error  
**Example:**  
  *TST?*  
  0  
**Notes:**
*WAI

Function: Wait for operation complete
Description: Suspends communication until the previous operation has completed
Format: *WAI
Arguments: none
Reply: none
Example: *TRG
         *WAI
         POWER,PHASE1?

Notes:
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:
Function: Set common controls for alarm1 and alarm2.
Description: Set the alarm latch and sounder control.
Format: ALARM, \textit{latch}, \textit{sounder}
Arguments: latch:
\hspace{1cm} ON
\hspace{1cm} OFF
sounder:
\hspace{1cm} ENABLED
\hspace{1cm} 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:** \texttt{ALARM2,type,data,high,low}

**Arguments:**
- \texttt{type}:
  - DISABLED
  - HIGH
  - LOW
  - INSIDE
  - OUTSIDE
- \texttt{data}:
  - 1-4 for zoom data
- \texttt{high}:
  - high threshold
- \texttt{low}:
  - low threshold

**Reply:** None

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

Function: Select application mode.

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

Format: APPLIC,type,setting

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

setting:
- filter 0-2 (PWM only)
  - 0: 4kHz
  - 1: 1kHz
  - 2: 250Hz
- speed 0-3 (ballast only)
  - 0: fixed time
  - 1: fast
  - 2: medium
  - 3: slow

Reply: none

Example: APPLIC,POWERT
         APPLIC,PWM,1

Notes:
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 = DONLY`

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

Function: Load a calibration verification string.

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

Format: CALVER, string

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

Reply: none

Example: CALVER, 12_DEC_2008_AMW

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

**Function:** Read back the calibration verification string.

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

**Format:** CALVER?

**Arguments:** none.

**Reply:** alphanumeric string

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

**Function:** Read back Capture mode data.

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

**Format:** CAPTUR?

**Arguments:** none

**Reply:** Multiple data values.

**Example:** CAPTUR?

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

Each line of data should return as follows:

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

Each line consists of:

- 5 bytes that represent #3503 (ASCII)
- 2 bytes that represent the Header bits including channel number [h1][h2]
- 500 bytes that represent the actual data.
- 250 pieces of data each made up of 2 bytes. d1.1 is data 1 bit 1, d1.2 is data 1 bit 2, d2.1 is data 2 bit 1, d2.2 is data 2 bit 2 etc.
1 byte that represents the error checking bit [error].
1 byte that represents Carriage return [CR].
1 byte that represents Line Feed [LF]

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

Function: Direct access of configuration parameters

Description: Sets configuration parameter for which there may not be a direct command.

Format: CONFIG,index,data

Arguments: index is the number of the parameter
data is the data for that parameter

Reply: none

Example: CONFIG,6,1 (set phase convention)

Notes: The list of configurable parameters is given in the appendix. CONFIG goes through the same limit checking as when entering data from the menus.
<table>
<thead>
<tr>
<th>Function:</th>
<th>Configurable parameter query</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Reads the present value of a single parameter.</td>
</tr>
<tr>
<td>Format:</td>
<td></td>
</tr>
<tr>
<td>or:</td>
<td></td>
</tr>
<tr>
<td>CONFIG, index?</td>
<td></td>
</tr>
<tr>
<td>CONFIG?index</td>
<td></td>
</tr>
<tr>
<td>Arguments:</td>
<td>index is the parameter number</td>
</tr>
<tr>
<td>Reply:</td>
<td>Value of parameter, real or integer as appropriate.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>CONFIG,6? (read phase convention)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CONFIG,6,1 (set phase convention)</td>
<td></td>
</tr>
<tr>
<td>CONFIG,6?</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Notes:</td>
<td>The list of configurable parameters is given in the appendix.</td>
</tr>
</tbody>
</table>
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
  AONLY
  DONLY

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.
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.
**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:**

```
DATALO,NONVOL,10
DATALO,RAM,0,HIGH
```

**Notes:**

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

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

Format: DATALO,\textit{start},\textit{records}?
        DATALO,0?
        DATALO,LINES?

Arguments: \textit{start}:
            first record to return
            \textit{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

2-34
DAV?  

Function: Data available query  
Description: Returns data availability status.  
Format: DAV?  
Arguments: none  
Reply: Decimal equivalent of data available bits:
  bit0  new data available
  bit1  data available
  bit2  harmonic series data available
  bit6  integration data available
  bit7  datalog data available

Example: SPEED,SLOW  
  *TRG  
  DAV?  
  0  
  DAV?  
  0  
  DAV?  
  0  
  DAV?  
  3  (data available)

Notes: DAV? does not modify the status bits.
**DAVER**

**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,\textit{value}

**Arguments:** decimal equivalent of data available bits
- \textit{bit0} set bit 0 of status byte when new data available
- \textit{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:**
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?**

<table>
<thead>
<tr>
<th>Function:</th>
<th>Read the displayed data</th>
</tr>
</thead>
<tbody>
<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>
Function: Set efficiency calculation

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

Format: EFFICI,\textit{formula}

Arguments: \textit{formula}:

\begin{itemize}
  \item 0 – disabled
  \item 1 – phase 1 / phase 2
  \item 2 – phase 2 / phase 1
  \item 3 – slave / master
  \item 4 – master / slave
  \item 5 – mechanical sum
  \item 6 – sum / mechanical
  \item 7 – phase 3 / sum
  \item 8 – sum / phase
\end{itemize}

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.
FQLOCK

Function: Lock frequency.

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

Format: FQLOCK, value

Arguments: value:
            ON
            OFF

Reply: none

Example: FQLOCK, ON

Notes: To fix the analysis to a specified frequency, first lock the frequency with FQLOCK, ON then send the desired frequency with the FREQUE command.
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 (e.g., phase 2 only mode).
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`

**Arguments:** `para:

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

harmonic:

- individual harmonic for display

max:

- length of harmonic series (to 100)

**Reply:** none

**Example:** `HARMON,THDS,3,50`

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

<table>
<thead>
<tr>
<th>Function:</th>
<th>Harmonic analyser query</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>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?</td>
</tr>
<tr>
<td>Format:</td>
<td>HARMON? or HARMON,phase? or HARMON,SERIES? or HARMON,phase,SERIES?</td>
</tr>
<tr>
<td>Arguments:</td>
<td>phase: PHASE1, PHASE2, PHASE3, NEUTRAL, PHASES</td>
</tr>
<tr>
<td>Reply:</td>
<td>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</td>
</tr>
<tr>
<td>Example:</td>
<td>HARMON,PHASE2? data returned</td>
</tr>
<tr>
<td>Notes:</td>
<td>HARMON? waits for next unread data.</td>
</tr>
</tbody>
</table>
HOLD

Function: Set data hold
Description: Turns data hold on or off. Useful for reading data from different phases without it being changed between reads.
Format: HOLD,state
Arguments: State:
           ON
           OFF
Reply: none
Example: HOLD,ON
         POWER,PHASE1,WATTS?
         POWER,PHASE2,WATTS?
         POWER,PHASE3,WATTS?
         HOLD,OFF

Notes:
Function: Set input mode
Description: Selects the input type of the instrument
Format: INPUT,channel,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
Function: Set integrated power mode.

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

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

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

Reply: none

Example: INTEGR,MAGNITUDE,TOTAL

Notes:
**INTEGR?**  

**Function:** Read integrated power mode.  
**Description:** Read integrated power mode for the selected phase.  
**Format:** `INTEGR,phase?`  
**Arguments:** phase:  
  - PHASE1  
  - PHASE2  
  - PHASE3  
  - PHASES  
  - SUM  
**Reply:** 13 values separated by commas  
  - time,Wh,WH.f,VAh,VAh.f,VARh,Varh.f  
  - pf,pf.f,V,V.f,Ah,Ah.f  
**Example:** START  
  - wait for integration time  
  - INTEGR,PHASE1?  
  - data returned  
**Notes:** INTEGR? without specifying the phase returns the appropriate single phase data.
<table>
<thead>
<tr>
<th><strong>Function:</strong></th>
<th>Disable front panel keyboard.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>The front panel keyboard can be disabled to prevent accidental operation.</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>KEYBOARD,\textit{value}</td>
</tr>
<tr>
<td><strong>Arguments:</strong></td>
<td>\textit{value}:</td>
</tr>
<tr>
<td></td>
<td>ENABLE</td>
</tr>
<tr>
<td></td>
<td>DISABLE</td>
</tr>
<tr>
<td><strong>Reply:</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>KEYBOARD,DISABLE</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td>The keyboard can be re-enabled from the front panel only by pressing the HOME key.</td>
</tr>
</tbody>
</table>
**LCR**

**Function:** Set LCR meter mode.

**Description:** Set LCR mode and conditions.

**Format:** `LCR,parameter`

**Arguments:**
- **parameter:**
  - AUTO
  - CAPACITANCE
  - INDUCTANCE
  - IMPEDANCE

**Reply:** none

**Example:** `LCR,IMPEDANCE`

**Notes:**
## LCR?

**Function:** LCR meter query

**Description:**
- Read LCR meter results.
- Sets LCR meter mode if not already set.
- Waits for next unread data if necessary.
- Clears new data available bit read by DAV?

**Format:**
- `LCR, 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:** MSLAVE,type

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

**Reply:** none

**Example:** MSLAVE,MASTER

**Notes:**
**MULTIL**

Function: Selects data for multi string reply

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

Format: \texttt{MULTILOG,index,phase,function}

Arguments:

- **index:**
  - 0 clear all
  - 1-30 select data 1-30

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

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

Reply: none

Example:

- \texttt{MULTIL,0}
- \texttt{MULTIL,1,1,2} (phase 1 Watts)
- \texttt{MULTIL,2,2,2} (phase 2 watts)
- \texttt{MULTIL,3,4,3} (sum VA)

\texttt{MULTIL?}

3 data values returned

Notes:

For further information and assistance with the Multilog application please go to page 2-102 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 then returns selected results.

**Format:** MULTILOG?

**Or:** MULTILOG, *lines*?

**Arguments:** Lines:

- Integer

**Reply:** Up to 60 data values as selected by the MULTILOG command in a single reply string

**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

MULTIL,5?

Replies 5 times, each containing 3 data values

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

Function: Waits for new data then holds so that multiple commands can be used on the same data set.

Description: Reads multiple sets of data

Format: NEWLOC

Arguments: None

Reply: Data as per returned parameter query. ie from power, harmonics etc.

Example: NEWLOC;HARMON?SERIES;HPower?
Harmonic series and Power data returned

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

**Function:**
Sets the noise filter.

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

**Format:**
NOISEF,[PHASEx],value,frequency

**Arguments:**

- **[PHASEx]:**
  - Phase1
  - Phase2
  - Phase3

- **Value:**
  - ON
  - OFF

- **frequency:**
  - Between: 1000 – 250000

**Reply:**
none

**Example:**
NOISEF,PHASE1,ON,1500

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

Function: Disable overranging
Description: Prevents an overrange error from blanking out results in manual ranging.
Format: NOOVER,value
Arguments:
  value:
    ON
    OFF
Reply: none
Example: NOOVER,ON
Notes: This can be useful when testing devices in a noisy environment. The range can be set to the correct range for the signal to be measured even if sporadic noise spikes would push it up on to the next range.
PFCONV

Function: Set power factor sign convention.

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

Format: PFCONV,type

Arguments: type:
  NEGLAG
  NEGLEA

Reply: none

Example: PFCONV,NEGLAG

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

Function: Phase meter query
Description: Reads phase meter results. Sets phase meter mode if not already set. Waits for next unread data if available. Clears new data available bit read by DAV?
Format: PHASEM?
       PHASEM,phase?
Arguments: phase:
           PHASE1
           PHASE2
           PHASE3
           PHASES?
Reply: 5 data values separated by commas
       freq,mag1,mag2,dB,phase
Example: PHASEM,CH1
         PHASEM,PHASE1?
         data returned
Notes: The phase convention can be set to 0° to -360°, 0° to +360°, or +180° to -180° in the SYSTEM menu or using PHCONV command. PHASEM? without specifying the phase returns the appropriate single phase data.
<table>
<thead>
<tr>
<th>Function:</th>
<th>Set phase convention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Set phase convention</td>
</tr>
<tr>
<td>Format:</td>
<td>PHCONV, convention</td>
</tr>
<tr>
<td>Arguments:</td>
<td></td>
</tr>
<tr>
<td>convention:</td>
<td>180: -180 to +180</td>
</tr>
<tr>
<td></td>
<td>-360: 0 to -360</td>
</tr>
<tr>
<td></td>
<td>+360: 0 to +360</td>
</tr>
<tr>
<td>Reply:</td>
<td>none</td>
</tr>
<tr>
<td>Example:</td>
<td>PHCONV, -360</td>
</tr>
<tr>
<td>Notes:</td>
<td>0 to -360 degrees is usually used for power analysis applications</td>
</tr>
</tbody>
</table>
### POWER

<table>
<thead>
<tr>
<th>Function:</th>
<th>Set up power analyser mode.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Configure power analyser with sum current display type</td>
</tr>
<tr>
<td>Format:</td>
<td>POWER, (sum \text{ type})</td>
</tr>
<tr>
<td>Arguments:</td>
<td>(sum \text{ type}:)</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
</tr>
<tr>
<td></td>
<td>AVERAGE</td>
</tr>
<tr>
<td>Reply:</td>
<td>none</td>
</tr>
<tr>
<td>Examples:</td>
<td>POWER, TOTAL</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
</tbody>
</table>
POWER?

Function: Read power analyser results

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

Format: POWER,phase,results?

Arguments:

phase:
PHASE1
PHASE2
PHASE3
PHASES
SUM
NEUTRAL (current only)

results:
WATTS
VOLTAGE
CURRENT
VECTORS
RMS
WVA
PH-PH

Reply:
WATTS:
freq,W,W.f,VA,VA.f,VAR,VAR.f,pf,pf.f,
Wdc,W.h

VOLTAGE or CURRENT:
freq,rms,mag,dc,phase,pk,cf,mean,
form factor,harm

VECTORS:
freq,vmag1,vlag1,amag1,alag1.....

RMS:
freq,vrms1,vdc1,arms1,adc1.....

WVA:
freq,w1,vrms1,arms1,w2.....
PH-PH:
  freq,rms1,mag1,lag1,rms2...

Example:    POWER,VECTORS?
data returned

Notes:      POWER? without specifying the phase returns the appropriate single phase data. PHASES returns the data for all valid phases 1-3.
Function: Access non volatile program stores.

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

Format: PROGRA, function, number

Arguments: function:
- RECALL
- STORE
- DELETE

number 0-100

Reply: none

Example: PROGRA, RECALL, 13

Notes: Number 0 represents factory default, which can only be recalled.
<table>
<thead>
<tr>
<th>Function:</th>
<th>Identify current program.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Reads the name of the last program to be loaded or recalled.</td>
</tr>
<tr>
<td>Format:</td>
<td>PROGRA?</td>
</tr>
<tr>
<td>Arguments:</td>
<td>none</td>
</tr>
<tr>
<td>Reply:</td>
<td>text string</td>
</tr>
<tr>
<td>Example:</td>
<td>PROGRA?</td>
</tr>
<tr>
<td></td>
<td>factory default</td>
</tr>
</tbody>
</table>

Notes:
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
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[0]00
Data format for HIGH is:
[-]1.23456E[0]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**

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

Function: Fetch raw scope data.
Description: Read back raw oscilloscope data.
Format: SCOPE,channel?
         SCOPE,phase,channel?
Arguments: phase:
           PHASE1
           PHASE2
           PHASE3
           NEUTRA
channel:
           VOLTAGE
           CURRENT
Reply: 252 signed integers:
       range
       trigger
       250 x data
Example: HOLD,ON
        SCOPE,PHASE1,VOLTAGE?
        read data
        SCOPE,PHASE2,VOLTAGE?
        read data
        SCOPE,PHASE3,VOLTAGE?
        read data
        HOLD,OFF
Notes:
SCREEN?

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

Notes: SCREEN? response:

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

**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?

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

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

Format: \texttt{SHUNT,channel,resistance}

Arguments: channel:
- CH1
- CH2

resistance: shunt resistance in Ohms

Reply: none

Example: \texttt{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:** \textit{SPEED, value, window}

**Arguments:**
- \textit{value}:
  - VERY FAST
  - FAST
  - MEDIUM
  - SLOW
  - VSLOW
  - WINDOW

**Reply:** none

**Example:**
- SPEED, SLOW
- SPEED, WINDOW, 0.1

**Notes:** The window size argument is only needed for the SINDOW 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
description: Stop data acquisition.
Format: STOP
Arguments: none
Reply: none
Example: DATALOG, RAM, 0.02
START
wait for data values
STOP
read data values
Notes:
Function: Suspend data acquisition.
Description: Disable the data acquisition to maximise the communication speed.
Format: SUSPEN, value
Arguments: value:
  ON
  OFF
Reply: none
Example: FAST, ON
         SUSPEN, ON
         MULTILOG?
         SUSPEN, OFF
         FAST, OFF

Notes:
**TAGREP**

**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:
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Format</th>
<th>Arguments</th>
<th>Reply</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEMPER?</td>
<td>Read the temperature</td>
<td>TEMPER?</td>
<td>none</td>
<td>single data value</td>
</tr>
</tbody>
</table>
Function: Set up torque and speed measurement
Description: Set scaling for torque and speed measurements
Format: TORQSP,type,torquescaling,speedscaling
         TORQSP,OFFSET,torqueoffset,speedoffset
Arguments: type:
            DISABLED
            ANALOG
            PULSED
            OFFSET
Reply: none
Example: TORQSP,PULSED,10,50
         speed measured by pulse
         torque scaling = 10Nm/V
         50 pulses/revolution
Notes: If type = ANALOG then speed scaling is in rpm/V, if type = PULSED then speed scaling is pulses/rev
       Torque scaling is always Nm/V
TORQSP?

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

Function: Read the user data
Description: Returns up to 3 lines of user data
Format: USER?
Arguments: none
Reply: 3 lines of ASCII terminated by CR
Example:

   USER?
   Newtons4th Ltd
   R&D department
   KinetiQ #4

Notes:
Function: Set VAr sign convention.

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

Format: VARCON,type

Arguments: 
- type:
  - NEGLAG
  - NEGLEA

Reply: none

Example: VARCON,NEGLAG

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

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

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)

Reply: none

Examples: WIRING,PHASE2

Notes: WIRING,SINGLE is the same as WIRING,PHASE1
ZERO

Function: Apply or remove the zero
Description: Applies or removes a zero function depending on the measurement mode (same as pressing ZERO key). Resets the integration data and timer if in power integration mode.
Format: ZERO

zero,DELETE
Arguments: none
Reply: none
Example: ZERO
Notes:
Function: Sets the display zoom parameters.
Description: Sets the zoom level and data.
Format: \texttt{ZOOM,level,data1,data2,data3,data4}
Arguments:
- \texttt{level:}
  0 – normal
  1 – 2 line display (zoom level 1)
  2 – single line display (zoom level 2)
  3 – single line display (zoom level 3)
- \texttt{data1:}
  first data (zoom level 1)
  or data for single line (zoom level 2)
- \texttt{data2-4:}
  other data (zoom level 1)

Data consists of line number for channel 1
or line number + 128 for channel 2

Reply: None

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

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

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 + 128 for channel 2

Example: ZOOM?

1,1,129,0,0  (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 87 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,</td>
<td>1,1,1</td>
<td>1,1</td>
<td>1</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>2,1,2</td>
<td>2,2</td>
<td>2</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>3,2,2</td>
<td>2,2</td>
<td>2</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>4,3,2</td>
<td>3,3</td>
<td>2</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>5,1,50</td>
<td>5,1</td>
<td>50</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>6,2,50</td>
<td>6,2</td>
<td>50</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>7,3,50</td>
<td>7,3</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>Frequency</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></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0000E1</td>
<td>2.4500E2</td>
<td>2.4320E2</td>
<td>2.5421E2</td>
<td>1.0232E3</td>
<td>1.0152E3</td>
<td>1.0546E3</td>
</tr>
</tbody>
</table>
Appendix – command summary

COMMAND SUMMARY
command format | reply format
--- | ---
*CLS | single integer data value
*ESE,value | single integer data value
*ESE? | company, product, serial no, version
*ESR? | 0 or 1
*IDN? | single integer data value
*OPC? | single integer data value
*RST | single integer data value
*SRE,value | single integer data value
*SRE? | single integer data value
*STB? | single integer data value
*TRG | single integer data value
*TST? | single integer data value
*WAI | single integer data value

ABORT
ALARM,latch,sounder
ALARM? | single integer data value
ALARME,value
ALARME? | single integer data value
ALARM1,type,data,high,low
ALARM2,type,data,high,low
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?
DAVER,value
DAVER? | single integer data value
DISPLAY,page
DISPLAY? | multiple real data values
EFFICI,type
EFFICI? | total efficiency, fundamental efficiency
FAST, on/off
FQLOCK, on/off
FQREF, phase, channel
FREQFI, on/off, filter
FREQUE, frequency
FSD?
HARMON, para, h, hmax
HARMON, phase?
  Or
HARMON, phase, SERIES?
  Or
HOLD, on/off
INPUT, channel, type
INTEGR, type, display
INTEGR, RUNTIM, hours, mins
INTEGR, phase?
KEYBOA, value
LCR, conditions, param, head
LCR, phase?
LOWFRE, on/off
MODE, type
MSLAVE, type
MULTILOG, index, phase, func
MULTILOG?
PFCONV, convention
PHASEM, ratio
PHASEM, phase?
PHCONV, convention
POWER, sum A
POWER, PHASE, WATTS?
POWER, PHASE, VOLTAGE?
POWER, PHASE, CURRENT?
POWER, PH-PH?
POWER, RMS?
POWER, VECTORS? Freq, mag1, φ1, mag2, φ2, mag3, φ3, mag4, φ4, mag5, φ5, mag6, φ6
POWER, WVA? Freq, w1, vrms1, arms1, w2, vrms2, arms2, w3, vrms3, arms3
PROGRAM, function, number
PROGRAM? CR terminated text string
RANGE, ch, ranging, range
RESULT, function, number
RESULT multiple integers
RESOLVE format
RESOLVE
RESULT, function, number
RESULT multiple integers
REZERO
SCALE, channel, factor
SCALE, channel?
SCOPE, PHASE, v/a? Single real data value
SHUNT, channel, resistance Single real data value
SHUNT, channel?
SMOOTH, type, dynamics
SPEED, value, window
START
STATUS, channel?
STOP
STREAM, enable, window
STREAM, disable
STREAM?
SUSPEN, on/off
TAGREP, on/off
TEMPER, type, scale, offset
TEMPER?
TORQSP, type, tscale, sscale
TORQSP, OFFSET, toff, soff
TORQSP? mechanical power, torque, speed
USER? 3 CR terminated text strings
VARCON, convention
datecode, cpu, dsp, fpga, boot
VERSION? VRMS
VRMS, PHASE, RMS? rms1, rms2, dc1, dc2, ac1, ac2
VRMS, PHASE, MEAN? rms1, rms2, mean1, mean2, ff1, ff2
VRMS, PHASE, SURGE? pk1, pk2, cf1, cf2, surge1, surge2
WIRING, configuration
ZERO
ZERO, DELETE
ZOOM, level, d1, d2, d3, d4
ZOOM? level, d1, d2, d3, d4
calibration commands

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

<table>
<thead>
<tr>
<th>number</th>
<th>Function</th>
<th>parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Operating mode (sets Main Mode)</td>
<td>n number</td>
</tr>
<tr>
<td>0</td>
<td>RMS Voltmeter</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>Phase Meter</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Power Analyser</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Impedance Analyser</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Power Integrator</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Harmonic Analyser</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Oscilloscope</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Resolution, (remote options – digit resolution)</td>
<td>n number</td>
</tr>
<tr>
<td>0</td>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>High</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Binary</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Master/slave, (Aux control)</td>
<td>n number</td>
</tr>
<tr>
<td>0</td>
<td>Disabled</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>Master</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Slave</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Autozero manual or auto, (System options)</td>
<td>n number</td>
</tr>
<tr>
<td>0</td>
<td>Auto</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>Manual</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Phase convention, (System options)</td>
<td>n number</td>
</tr>
<tr>
<td>0</td>
<td>-180° to +180°</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0° to -360°</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>0° to +360°</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Frequency lock on/off, (Acquisition advance options)</td>
<td>n number</td>
</tr>
<tr>
<td>0</td>
<td>Off</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>On</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Graph, (System options)</td>
<td>n number</td>
</tr>
<tr>
<td>0</td>
<td>Dots</td>
<td>0</td>
</tr>
</tbody>
</table>
1 = Lines

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

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

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

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

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

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

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

16 Baud rate, (Remote options, RS232)
   0 = 38400
   1 = 19200
   2 = 9600
   3 = 1200

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

Enable channel 2, (Range – current input)
0=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
<table>
<thead>
<tr>
<th>30</th>
<th><strong>Coupling</strong>, (Coupling)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ac+dc</td>
</tr>
<tr>
<td>1</td>
<td>ac</td>
</tr>
<tr>
<td>2</td>
<td>dc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>31</th>
<th><strong>Bandwidth</strong>, (Coupling - bandwidth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Wide (dc–2MHz)</td>
</tr>
<tr>
<td>1</td>
<td>Low (dc-200KHz)</td>
</tr>
<tr>
<td>2</td>
<td>dc (dc-5Hz)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>32</th>
<th><strong>Scale factor channel 1 voltage</strong>, (Ranging - Enter figures as required)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>33</th>
<th><strong>Scale factor channel 2 current</strong>, (Ranging - Enter figures as required)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>34</th>
<th><strong>External attenuator channel 1</strong>, (Ranging - voltage input - attenuator ratio - Enter figures as required)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>35</th>
<th><strong>External shunt channel 2</strong>, (Ranging - current input - resistance value - Enter figures as required)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>38</th>
<th><strong>Frequency reference voltage/current</strong>, (Acquisition control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Voltage</td>
</tr>
<tr>
<td>1</td>
<td>Current</td>
</tr>
<tr>
<td>2</td>
<td>Speed</td>
</tr>
<tr>
<td>3</td>
<td>ac line</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>40</th>
<th><strong>Frequency reference phase</strong>, (Acquisition control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Phase 1</td>
</tr>
<tr>
<td>1</td>
<td>Phase 2</td>
</tr>
<tr>
<td>2</td>
<td>Phase 3</td>
</tr>
</tbody>
</table>
41 Display page, (Main display)
   0=Phase 1 page
   1=Phase 2 page
   2=Phase 3 page
   3=Sum page
   4=Phase 1,2 &3 page
   5=Phase 1,2 & 3 fundamentals page
   6=NEU page

42 Zoom level, (Main display)
   0=Zoom –
   1=Zoom +
   2=second Zoom +

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
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

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

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

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

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

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

Frequency filter, (Acquisition control)
0 = Disabled
1 = Enabled

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

Datalog Zoom1, (Datalog-RAM)
0 = Enabled
1 = Disabled
55 Datalog Zoom2, \((\text{Datalog-RAM})\)  
  0=Enabled  
  1=Disabled  

56 Datalog Zoom3, \((\text{Datalog-RAM})\)  
  0=Enabled  
  1=Disabled  

57 Datalog Zoom4, \((\text{Datalog-RAM})\)  
  0=Enabled  
  1=Disabled  

58 Datalog memory type, \((\text{Datalog})\)  
  0=Disabled  
  1=RAM  

59 Datalog Interval, \((\text{Datalog})\) (Enter interval time figure in seconds)  

60 Datalog graph, \((\text{Datalog-RAM})\)  
  0=Together  
  1=Seperate  

61 Formula, \((\text{Maths})\)  
  0=Disabled  
  1\(=(\text{term1 + term2}/\text{term3 + term4})\)  
  2\(=(\text{term1 + term2} \times \text{term3}/\text{term4})\)  
  3\(=\text{term1} \times \text{term2}/(\text{term3 + term4})\)  

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

63 Sub argument term 1, \((\text{For voltage and current arguments only})\)  
  0=\text{rms}  
  1=\text{dc}  
  2=\text{ac}  
  3=\text{Fundamental}  
  4=\text{Peak}
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)

application mode,

0=Normal
1=PWM motor Drive
2=Lighting ballast
3=Inrush current
4=Transformer mode
5=Standby power

Frequency filter, (Application options mode - PWM Motor Drive)

0=4KHz
1=1KHz
2=250Hz

Frequency tracking speed, (Application options mode - Lighting Ballast)

0=Fixed time
1=Fast
2=Medium
3=Slow
Low frequency, (Application options mode - PWM Motor Drive)
0=Off
1=On

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

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

Term 3 coefficient, (Enter value)

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

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

Term 4 coefficient, (Enter value)
Temperature, (Application-Transformer mode)
0=Disabled
1=Enabled °C
2=Enabled °F

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

Wiring configuration, (Acquisition control)
0=Single phase 1
1=2 phase 2 wattmeter
2=3 phase 2 wattmeter
3=3 phase 3 wattmeter
4=Single phase 2
5=Single phase 3
6=3 phase 2 wattmeter + PH3
7=Independent

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

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

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

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

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

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

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

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

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

100 Selected harmonic, (Harmonic analyzer - figure = harmonic required)
Harmonic series up to, (Harmonic analyzer - figure = harmonic max)

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

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

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

Timebase, (Scope - Enter figure/div)

trigger level, (Scope - Enter figure/div)

Pretrigger, (Scope)

0 = None
1 = 25%
2 = 50%
3 = 75%

trigger polarity, (Scope)

0 = Rising edge
1 = Falling edge

trigger Mode, (Scope)

0 = Auto
1 = Normal
2 = Single shot

trigger reference, (Scope)

0 = Voltage
1 = Current

trigger phase, (Scope)

0 = Phase 1
1 = Phase 2
2 = Phase 3

cursors enable, (Scope)

0 = Off
1 = On

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

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

Ph – Ph Measurement, (Power analyser)
  0=Rms
  1=Mean

Difference THD, (Power analyser)
  0=Disabled
  1=Enabled

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

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

Phase offset, (Impedance analyzer - Enter figures)

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
PPA55xx communications manual

1=USB
2=LAN
3=GPIB

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

Alarm functions

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

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

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

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

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

161 Alarm sounder, (Alarm options – alarm if high)
   0=Enabled
   1=Disabled

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)
   0=Internal
   3=External attenuator
177 Enable channel 4, (Range – current input)(Sys independent ranging enabled)
   0=Internal
   2=External shunt
178 Input range channel 3, (Range – minimum range voltage) (Sys independent ranging enabled)
   0=300mv
   1=1v
   2=3v
   3=10v
   4=30v
   5=100v
   6=300v
   7=1kV
179 **Input range channel 4**, (Range – minimum range current) (Sys independent ranging enabled)
   
   0 = 30ma  
   1 = 100ma  
   2 = 300ma  
   3 = 1A  
   4 = 3A  
   5 = 10A  
   6 = 30A  
   7 = 100  
   8 = 300A

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

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

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

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

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

Enable channel 5, (Range – voltage input) (Sys independent ranging enabled)
0=Internal
3=External attenuator

Enable channel 6, (Range – current input) (Sys independent ranging enabled)
0=Internal
2=External shunt

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

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=100
8=300A

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

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)

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

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

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

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

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

<table>
<thead>
<tr>
<th>function</th>
<th>measurement</th>
<th>notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>frequency</td>
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</tr>
<tr>
<td>2</td>
<td>watts</td>
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</tr>
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<td>VA</td>
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</tr>
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</tr>
<tr>
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<tr>
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</tr>
<tr>
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</tr>
<tr>
<td>22</td>
<td>integrated rms current</td>
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<td>Mode</td>
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</tr>
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<td>current surge</td>
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</tr>
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<td>voltage rms deviation</td>
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</tr>
<tr>
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<td>voltage fundamental deviation</td>
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Some special functions:

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<tr>
<th>measurement</th>
<th>phase</th>
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Phase selection:

1 = phase 1
2 = phase 2
3 = phase 3
4 = sum
5 = neutral
Newtons4th Ltd. contact details

Please direct all queries or comments regarding the PPA25xx instruments or this manual to:

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