IMPORTANT SAFETY INSTRUCTIONS

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

• Ensure that the supply voltage agrees with the rating of the instrument printed on the back panel before connecting the mains cord to the supply.

• This appliance must be earthed. Ensure that the instrument is powered from a properly grounded supply.

• The inputs are rated at 1kV rms or dc cat II; 600V rms or dc cat III. Do not exceed the rated input.

• Keep the ventilation slots in the top and sides of the cover free from obstruction.

• Do not operate or store under conditions where condensation may occur or where conducting debris may enter the case.

• There are no user serviceable parts inside the instrument – do not attempt to open the instrument, refer service to the manufacturer or his appointed agent.

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

This manual gives details of the communication commands recognized by the PPA35xx series of instruments over RS232, USB, or LAN. For more general operating instructions for the instrument refer to the specific user manual.

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

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

Revision v3.00

This manual is copyright © 2015-2019 Newtons4th Ltd. and all rights are reserved. No part may be copied or reproduced in any form without prior written consent.

4th January 2019
CONTENTS

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

2 Communication commands ................................... 7
  *CLS ............................................................. 7
  *ESE ............................................................. 8
  *ESR? ............................................................ 9
  *IDN? ............................................................ 10
  *OPC? ............................................................ 11
  *RST ............................................................. 12
  *SRE ............................................................. 13
  *SRE? ............................................................ 14
  *STB? ............................................................ 15
  *TRG ............................................................. 16
  *TST? ............................................................ 17
  *WAI .............................................................. 18
  ABORT .................................................................. 19
  ADIMAP .................................................................. 20
  ALARM .................................................................. 21
  ALARM? .................................................................. 22
  ALARM1 .................................................................. 23
  ALARM2 .................................................................. 24
  ALARME .................................................................. 25
  ALARME? .................................................................. 26
  ANALOG .................................................................. 27
  ANALOG? .................................................................. 28
  APPLIC .................................................................. 29
  BANDWI ............................................................... 30
  BEEP ..................................................................... 31
  BLANKI .................................................................. 32
  CALSTR .................................................................. 33
  CALSTR? .................................................................. 34
  CONFIG .................................................................. 35
  CONFIG? .................................................................. 36
  COUPLI .................................................................. 37
  COUPLI? .................................................................. 38
  DATALO .................................................................. 39
PPA35xx communications manual

<table>
<thead>
<tr>
<th>Command</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATALO?</td>
<td>40</td>
</tr>
<tr>
<td>DAV?</td>
<td>41</td>
</tr>
<tr>
<td>DAVER</td>
<td>42</td>
</tr>
<tr>
<td>DAVER?</td>
<td>43</td>
</tr>
<tr>
<td>DISPLAY</td>
<td>44</td>
</tr>
<tr>
<td>DISPLAY?</td>
<td>45</td>
</tr>
<tr>
<td>EFFICI</td>
<td>46</td>
</tr>
<tr>
<td>EFFICI?</td>
<td>47</td>
</tr>
<tr>
<td>FAST</td>
<td>48</td>
</tr>
<tr>
<td>FQLOCK</td>
<td>49</td>
</tr>
<tr>
<td>FQREF</td>
<td>50</td>
</tr>
<tr>
<td>FREQUE</td>
<td>51</td>
</tr>
<tr>
<td>FSD?</td>
<td>52</td>
</tr>
<tr>
<td>GROUP</td>
<td>53</td>
</tr>
<tr>
<td>GROUP1</td>
<td>54</td>
</tr>
<tr>
<td>HARMON</td>
<td>55</td>
</tr>
<tr>
<td>HARMON?</td>
<td>56</td>
</tr>
<tr>
<td>HOLD</td>
<td>57</td>
</tr>
<tr>
<td>HPOWER</td>
<td>58</td>
</tr>
<tr>
<td>HPOWER?</td>
<td>59</td>
</tr>
<tr>
<td>INPUT</td>
<td>60</td>
</tr>
<tr>
<td>INTEGR</td>
<td>61</td>
</tr>
<tr>
<td>INTEGR?</td>
<td>62</td>
</tr>
<tr>
<td>KEYBOA</td>
<td>63</td>
</tr>
<tr>
<td>LCR</td>
<td>64</td>
</tr>
<tr>
<td>LCR?</td>
<td>65</td>
</tr>
<tr>
<td>LOWFRE</td>
<td>66</td>
</tr>
<tr>
<td>MODE</td>
<td>67</td>
</tr>
<tr>
<td>MULTIL</td>
<td>68</td>
</tr>
<tr>
<td>MULTIL?</td>
<td>69</td>
</tr>
<tr>
<td>NEWLOC</td>
<td>70</td>
</tr>
<tr>
<td>NOISEF</td>
<td>71</td>
</tr>
<tr>
<td>NOOVER</td>
<td>72</td>
</tr>
<tr>
<td>NORMAL</td>
<td>73</td>
</tr>
<tr>
<td>PFCONV</td>
<td>74</td>
</tr>
<tr>
<td>PHASEM</td>
<td>75</td>
</tr>
<tr>
<td>PHANGR</td>
<td>76</td>
</tr>
<tr>
<td>PHASEM?</td>
<td>77</td>
</tr>
<tr>
<td>PHCONV</td>
<td>78</td>
</tr>
<tr>
<td>POWER</td>
<td>79</td>
</tr>
<tr>
<td>POWER?</td>
<td>80</td>
</tr>
<tr>
<td>PRIMAR</td>
<td>82</td>
</tr>
<tr>
<td>PROGRA</td>
<td>83</td>
</tr>
<tr>
<td>PROGRA?</td>
<td>84</td>
</tr>
<tr>
<td>Command</td>
<td>Page</td>
</tr>
<tr>
<td>--------------</td>
<td>------</td>
</tr>
<tr>
<td>RANGE</td>
<td>85</td>
</tr>
<tr>
<td>RESOLU</td>
<td>86</td>
</tr>
<tr>
<td>RESULT</td>
<td>87</td>
</tr>
<tr>
<td>RESULT?</td>
<td>88</td>
</tr>
<tr>
<td>REZERO</td>
<td>89</td>
</tr>
<tr>
<td>SCALE</td>
<td>90</td>
</tr>
<tr>
<td>SCOPE?</td>
<td>91</td>
</tr>
<tr>
<td>SCREEN?</td>
<td>92</td>
</tr>
<tr>
<td>SETUP</td>
<td>93</td>
</tr>
<tr>
<td>SETUP?</td>
<td>94</td>
</tr>
<tr>
<td>SHUNT</td>
<td>95</td>
</tr>
<tr>
<td>SMOOTH</td>
<td>96</td>
</tr>
<tr>
<td>SPEED</td>
<td>97</td>
</tr>
<tr>
<td>START</td>
<td>98</td>
</tr>
<tr>
<td>STATUS?</td>
<td>99</td>
</tr>
<tr>
<td>STOP</td>
<td>100</td>
</tr>
<tr>
<td>SUSPEN</td>
<td>101</td>
</tr>
<tr>
<td>TAGREP</td>
<td>102</td>
</tr>
<tr>
<td>TORQSP</td>
<td>103</td>
</tr>
<tr>
<td>TORQSP?</td>
<td>104</td>
</tr>
<tr>
<td>USER?</td>
<td>105</td>
</tr>
<tr>
<td>VARCON</td>
<td>106</td>
</tr>
<tr>
<td>VERSIO?</td>
<td>107</td>
</tr>
<tr>
<td>VRMS</td>
<td>108</td>
</tr>
<tr>
<td>VRMS?</td>
<td>109</td>
</tr>
<tr>
<td>WIRING</td>
<td>110</td>
</tr>
<tr>
<td>ZERO</td>
<td>111</td>
</tr>
<tr>
<td>ZOOM</td>
<td>112</td>
</tr>
<tr>
<td>ZOOM?</td>
<td>113</td>
</tr>
</tbody>
</table>

3 Multilog Application Guide ......................... 114

Appendix A – configurable parameters

Appendix B – MULTIL parameters
1 Using remote control

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

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

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

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

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

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

FQREF,CURRENT;POWER?

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

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

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

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

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

- Control T (20) – reset interface (device clear)
- Control U (21) – warm restart
### 1.1 Standard event status register

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

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></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 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 i.e.:

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.
2  Communication commands

*CLS  *CLS

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

Notes:
*ESE

Function: Set standard event status enable register.

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

Format: *ESE, value

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

Reply: can be read by *ESE?

Example: *ESE, 60

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

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

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

**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,PPA3560,196-04676,2.48  
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.
**Function:** Reset

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

**Format:** *RST

**Arguments:** none

**Reply:** none

**Example:** *RST

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

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

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

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

**Format:**
*SRE?

**Arguments:**

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

**Example:**
*SRE?
1

**Notes:**
**Function:** Read serial poll status byte  
**Description:** Returns the decimal value of the serial poll status byte.  
**Format:** `*STB?`  
**Arguments:** none  
**Reply:** decimal value of the serial poll status byte  
**Example:**  
```
*STB?
1
```

**Notes:** The following bits in the serial poll status register have been implemented:

- bit 0  RDV  (results data available)  
- bit 3  ALA  (alarm active)  
- bit 4  MAV  (message available)  
- bit 5  ESB  (standard event summary bit)
*TRG

Function: Trigger
Description: Initiates a new measurement, resets the range and smoothing.
Format: *TRG
Arguments: none
Reply: none
Example: MODE,VRMS
         *TRG
         VRMS,SURG?

Notes:
*TST?  *TST?

Function: Self-test query
Description: Returns the results of self-test
Format: *TST?
Arguments: none
Reply: single integer
  bit 0 – set if uncalibrated
  bit 1 – set if DSP zero error
  bit 2 – set if DSP run error
  bit 3 – not used
  bit 4 – System error, FPGA
  bit 5 – System error, DSP RAM
  bit 6 – System error, DSP run
  bit 7 – System error, external RAM
  bits 8 – 14 not used
  > 15 – major system

Example: *TST?
0

Notes:
*WAI

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:
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.
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.
<table>
<thead>
<tr>
<th>ALARME</th>
<th>ALARME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function:</strong></td>
<td>Set alarm status enable register</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Sets bits in the alarm status enable register to control which alarm bit if any set the alarm active bits in the status byte.</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>ALARME,<em>value</em></td>
</tr>
<tr>
<td><strong>Arguments:</strong></td>
<td>decimal equivalent of alarm bits&lt;br&gt;bit2  set bit 3 of status byte when alarm 1 is active&lt;br&gt;bit3  set bit 3 of status byte when alarm 2 is active</td>
</tr>
<tr>
<td><strong>Reply:</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>ALARME, 12&lt;br&gt;*SRE,8&lt;br&gt;set bit 3 in status byte when either alarm 1 or alarm 2 is active and generate a service request</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td>default value is 0</td>
</tr>
</tbody>
</table>
ALARME?

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

Function: Select application mode.

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

Format: APPLIC, type, setting

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

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

Reply: none

Example: APPLIC, POWERT
         APPLIC, BALLAST, 1

Notes:
Function: Selects the hardware bandwidth filter
Description: The bandwidth may be set to “wide” or “low” to minimise high frequency noise in noisy environments.
Format: \texttt{BANDWI,setting}
Arguments: Setting:
\begin{itemize}
  \item \texttt{LOW}
  \item \texttt{WIDE}
  \item \texttt{HIGH}
\end{itemize}
Reply: None
Example: \texttt{BANDWI,LOW}
Notes: WIDE and HIGH are the same.
### BEEP

<table>
<thead>
<tr>
<th>Function:</th>
<th>Sound the buzzer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Makes a “beep” from the instrument.</td>
</tr>
<tr>
<td>Format:</td>
<td>BEEP</td>
</tr>
<tr>
<td>Arguments:</td>
<td>none</td>
</tr>
<tr>
<td>Reply:</td>
<td>none</td>
</tr>
<tr>
<td>Example:</td>
<td>BEEP</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
</tbody>
</table>
Function: Select blanking
Description: Enable or disable low value blanking.
Format: BLANKI,value
Arguments: value:
  ON
  OFF
Reply: none
Example: BLANKI,OFF
Notes:
CALSTR

Function: Load a calibration string.

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

Format: CALSTR,string

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

Reply: none

Example: CALSTR,12_DEC_2015_AMW

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

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

Format: CALSTR?

Arguments: none.

Reply: alphanumeric string

Example: CALSTR?
12_DEC_2015_AMW

Notes:
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"?
- 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.
Function: Set ac or ac+dc coupling.
Description: Selects the input coupling for a given input channel.
Format: COUPLI,phase,coupling
Arguments: phase:
  PHASE1
  PHASE2
  PHASE3
  PHASE4
  PHASE5
  PHASE6
coupling:
  AC+DC
  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.
  PHASE4-6 may also be set by using PHASE1-3 when group 2 is the active group.
**COUPLI?**

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

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

**Format:**

COUPLI,phase,coupling?
or:

COUPLI?phase,coupling

**Arguments:**

phase:

- PHASE1
- PHASE2
- PHASE3
- PHASE4
- PHASE5
- PHASE6

**Reply:**

0 = AC+DC
1 = AONLY
2 = DONLY

**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.
Format: DATALO, function, interval, speed
Arguments: function:
            DISABLE
            RAM
            NONVOL
            RECALL
            DELETE
interval:
            datalog interval in seconds
speed:
            HIGH
Reply: none
Example: DATALO, RAM, 10
         DATALO, RAM, 0, HIGH
Notes: set interval to 0 to record every measurement as fast as possible.
       Set HIGH to select high speed mode for any combination of W, VA, VAr, pf, Vrms, Arms, and frequency. If HIGH is not sent, then high speed mode is reset.
**DATALO?**  

**Function:** Read back datalog results  
**Description:** Return datalog values, one record per line, or the number of lines available  
**Format:**  
DATALO,start,records?  
DATALO,0?  
DATALO,LINES?  
**Arguments:**  
- start:  
  - first record to return  
- records:  
  - number of records to return  
- 0:  
  - return all new records since last read  
**Reply:**  
3 to 6 data values depending on settings:  
- index 1-n  
- elapsed time in hours  
- data1  
- data2 (if stored)  
- data3 (if stored)  
- data4 (if stored)  
  - one record per line  
**Example:**  
DATALO,RAM,10  
START  
wait for datalog  
STOP  
DATALO,LINES?  
30  
DATALO,21,3?  
21,2.0000E-1,1.2345E0  
22,2.1000E-1,5.6789E3  
23,2.2000E-1,1.2345E0  
**Notes:**  
if no arguments are sent then DATALO?  
returns all the available lines of data
**DAV?**

**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.
<table>
<thead>
<tr>
<th><strong>Function:</strong></th>
<th>Set data available enable register</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Sets bits in the data available enable register to control which status bits set the data available bits in the status byte.</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>DAVER,\textit{value}</td>
</tr>
</tbody>
</table>
| **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 for the active group.

**Format:** DISPLAY, *page*

**Arguments:**

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

**Reply:** None

**Example:** DISPLAY, FUNDAMENTAL

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

**Function:** Read the displayed data

**Description:** Returns all the values presently on the screen for the active group.

**Format:** DISPLAY?

**Arguments:** none

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

**Example:** DISPLAY?

**Notes:**
EFFICI

Function: Set efficiency calculation

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

Format: EFFICI, formula

Arguments:

formula:

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

Reply: none

Example: EFFICIENCY, 3

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

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, mode, frequency

Arguments: value:
  - ON
  - OFF
  - NORMAL
  - CONSTANT [,frequency]
  - DYNAMIC

Reply: none

Example: FQLOCK, ON

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

**Function:** Set frequency reference.

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

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

**Arguments:**
- channel:
  - voltage
  - current
- phase:
  - PHASE1
  - PHASE2
  - PHASE3

**Reply:** none

**Example:** FQREF,CURRENT

**Notes:** Measured phase is always referred to phase 1 voltage no matter what channel is selected to measure the frequency, unless phase 1 is not active (eg phase 2 only mode).
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.
**Function:**
Read the full scale of all input channels at once or that of an individually selected input channel.

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

**Format:**
FSD?
FSD, channel

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

**Reply:**
Up to six data values separated by commas

**Example:**
FSD, CH1?
Data returned

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

Function: Set the active group.
Description: Select the group to which all future commands will be directed.
Format: GROUP, group
Arguments: group:
          1 or 2
Reply: none
Example: GROUP, 2
Notes:
Function: Set the number of phases in group 1.

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

Format: GROUP1,phases

Arguments: phases:
            1 to 6

Reply: none

Example: GROUP1,6

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

**Function:**
Set harmonic analyser mode.

**Description:**
Set harmonic analyser mode and parameters.

**Format:**
HARMON,\textit{para,harmonic,max}

**Arguments:**
para:

<table>
<thead>
<tr>
<th>THDD</th>
<th>difference formula THD</th>
</tr>
</thead>
<tbody>
<tr>
<td>THDS</td>
<td>harmonic series THD</td>
</tr>
<tr>
<td>TIF</td>
<td>Telephone Influence Factor</td>
</tr>
<tr>
<td>THF</td>
<td>Telephone Harmonic Factor</td>
</tr>
<tr>
<td>TDD</td>
<td>Total Demand Distortion</td>
</tr>
<tr>
<td>TRD</td>
<td>Total Rated Distortion</td>
</tr>
<tr>
<td>HPHASE</td>
<td>harmonic phase</td>
</tr>
<tr>
<td>HRMS</td>
<td>harmonic rms</td>
</tr>
<tr>
<td>HFACTO</td>
<td>harmonic factor</td>
</tr>
<tr>
<td>PH-PH</td>
<td>phase to phase</td>
</tr>
</tbody>
</table>

harmonic:
individual harmonic for display

max:
length of harmonic series (to 50)

**Reply:**
none

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

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

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

Format: HARMON?
or: HARMON,phase?
or: HARMON,SERIES?
or: HARMON,phase,SERIES?

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

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

Example: HARMON,PHASE2?
data returned

Notes: HARMON? waits for next unread data.
Function: Set data hold

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

Format: HOLD,state

Arguments: state:
- ON
- OFF

Reply: none

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

Notes:
<table>
<thead>
<tr>
<th><strong>Function:</strong></th>
<th>Set harmonic power parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Sets power parameters but does not change to power mode so that power can be measured in harmonic series mode.</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>See POWER</td>
</tr>
<tr>
<td><strong>Arguments:</strong></td>
<td>See POWER</td>
</tr>
<tr>
<td><strong>Reply:</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>See POWER</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td></td>
</tr>
</tbody>
</table>
**HPOWER?**

<table>
<thead>
<tr>
<th>Function:</th>
<th>Read harmonic power results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Reads power results but does not change to power mode so that power can be read in harmonic series mode.</td>
</tr>
<tr>
<td>Format:</td>
<td>See POWER?</td>
</tr>
<tr>
<td>Arguments:</td>
<td>See POWER?</td>
</tr>
<tr>
<td>Reply:</td>
<td>None</td>
</tr>
<tr>
<td>Example:</td>
<td>See POWER?</td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
</tr>
</tbody>
</table>
**PPA35xx communications manual**

**INPUT**

Function:  Set input mode

Description:  Selects the input type of the instrument

Format:  INPUT,channel,type

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

type:
- INTERN
- EXTATT
- EXTSHU
- INTX10

Reply:  None

Example:  INPUT,CH1,EXTSHU

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

Function: Set integrated power mode.

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

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

Arguments: type:
            SIGNED
            MAGNITUDE

display:
        TOTAL
        AVERAGE

hours:
   integer

minutes:
    integer

Reply: none

Example: INTEGR,MAGNITUDE,TOTAL

Notes:
**INTEGR?**

**Function:** Read integrated power mode.

**Description:** Read integrated power mode for the selected phase.

**Format:** INTEGR, *phase*?

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

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

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

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

Function: Disable front panel keyboard.
Description: The front panel keyboard can be disabled to prevent accidental operation.
Format: KEYBOARD, value
Arguments: value:
  ENABLE
  DISABLE
Reply: none
Example: KEYBOARD, DISABLE
Notes: The keyboard can be re-enabled from the front panel only by pressing the HOME key.
**LCR**

Function: Set LCR meter mode.

Description: Set LCR mode and conditions.

Format: \textit{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,\textit{phase}?  

Arguments: phase:  

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

Reply: 11 data values separated by commas: freq, Vmag, Amag, impedance, phase, R, C, L, tan\(\delta\), 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:
**MULTIL**

Function: Selects data for multi string reply

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

Format: MULTIL,index,phase,function

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

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

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

Reply: none

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

Notes:
**MULTIL?**

**Function:** Reads multi string reply

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

**Format:** MULTIL?

**Arguments:** none:

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

**Example:**
- MULTIL,0
- MULTIL,1,1,2 (phase 1 Watts)
- MULTIL,2,2,2 (phase 2 watts)
- MULTIL,3,4,3 (sum VA)
- MULTIL?
  
  3 data values returned

**Notes:** For further information and assistance with the Multilog application please go to page 2-93 where you will find an application guide to assist with this function
Function: Waits for new data then holds so that multiple commands can be used on the same data set.

Description: Reads multiple sets of data

Format: NEWLOC

Arguments: None

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

Example: NEWLOC
HARMON, SERIES?
HPOWER?
Harmonic series and Power data returned from the same data.

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

Function: Set the digital noise filter
Description: Select the noise filter and set the filter frequency to reduce the presence of high frequency noise.
Format: NOISEF,setting,frequency
Arguments: setting:
ON
OFF
Frequency:
corner frequency in Hz
Reply: none
Example: NOISEF,ON,150E3
Notes: Minimum filter frequency is 1kHz. Because the same digital filter is applied to voltage and current there is no introduced phase error.
Function: Disable overranging
Description: Prevents an overrange error from blanking out results in manual ranging.
Format: NOOVER,value
Arguments: value:
            ON
            OFF
Reply: none
Example: NOOVER,ON
Notes: This can be useful when testing devices in a noisy environment. The range can be set to the correct range for the signal to be measured even if sporadic noise spikes would push it up on to the next range.
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.
### PFCONV

**Function:** Set power factor sign convention.

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

**Format:** PFCONV,type

**Arguments:**
- **type:**
  - NEGLAG
  - NEGLEA

**Reply:** none

**Example:** PFCONV,NEGLAG

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

Function: Set phase meter mode.
Description: Select phase meter mode and reference.
Format: PHASEM, reference
Arguments: reference:
            CH1  ratio = ch2/ch1
            CH2  ratio = ch1/ch2
Reply: none
Example: PHASEM, CH2
Notes:
**PHANCR**

**Function:** Set phase angle reference

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

**Format:** PHANCR, reference

**Arguments:**
- reference:
  - VOLTAGE
  - CURRENT

**Reply:** none

**Example:** PHANCR, CURRENT

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

**Function:** Phase meter query

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

**Format:**
PHASEM?
PHASEM, phase?

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

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

**Example:**
PHASEM, CH1
PHASEM, PHASE1?
data returned

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

Function: Set phase convention
Description: Set phase convention
Format: PHCONV,\textit{convention}
Arguments: \textit{convention}:
\begin{itemize}
  \item 180: -180 to +180
  \item -360: 0 to -360
  \item +360: 0 to +360
\end{itemize}
Reply: none
Example: PHCONV, -360
Notes: 0 to -360 degrees is usually used for power analysis applications
**POWER**

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

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

**Format:** `POWER, sum type`

**Arguments:**
- sum type:
  - TOTAL
  - AVERAGE

**Reply:** none

**Examples:** `POWER, TOTAL`

**Notes:**
POWER?

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,\textit{phase},\textit{results}?
Arguments: phase:
- PHASE1
- PHASE2
- PHASE3
- PHASE4
- PHASE5
- PHASE6
- PHASES
- SUM
- NEUTRAL (current only)
results:
- WATTS
- VOLTAGE
- CURRENT
- VECTORS
- RMS
- WVA
- PH-PH
Reply:

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

Example:
  POWER, VECTORS?
  data returned

Notes:
  POWER? without specifying the phase returns the appropriate single-phase data. PHASES returns the data for all valid phases 1-3.
<table>
<thead>
<tr>
<th>PRIMAR</th>
<th>PRIMAR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function:</strong></td>
<td>Select only primary functions.</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Sets the instrument to only compute total functions not fundamentals, in order to allow shorter measurement windows.</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>PRIMAR,value</td>
</tr>
<tr>
<td><strong>Arguments:</strong></td>
<td>value:</td>
</tr>
<tr>
<td></td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td><strong>Reply:</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>PRIMAR,ON</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td>When primary is on, fundamental values will be displayed as zero.</td>
</tr>
</tbody>
</table>
Function: Access non-volatile program stores.

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

Format: PROGRA,\textit{function},\textit{number}

Arguments: function:
\begin{itemize}
  \item RECALL
  \item STORE
  \item DELETE
\end{itemize}
number 0-100

Reply: none

Example: PROGRA,RECALL,13

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

**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 1-8

Reply: none

Example: `RANGE,CH2,MANUAL,4`

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

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 results stores.
Description: Recall, store or delete results.
Format: RESULT, function, number
Arguments: function:
- RECALL
- STORE
- DELETE
number
1-99
Reply: none
Example: RESULT, RECALL, 13
Notes:
RESULT?

Function: Identify used result stores.
Description: Reads a directory of the result locations.
Format: RESULT,NAME?
RESULT,FILES?
Arguments: none
Reply: Name of last recalled result or program
List of names of all stored results
Example: RESULT,FILES?
  10,AMW1,18/01/2016
  11,AMW2,21/01/2016
RESULT,RECALL,11
RESULT,NAME?
  AMW2

Notes:
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
            PHASE4
            PHASE5
            PHASE6
            NEUTRA

channel:
        VOLTAGE
        CURRENT

Reply: 252 signed integers:
        range
        trigger
        250 x data

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

Notes:
**SCREEN?**

**Function:** Read the screen data

**Description:** Returns a bit map of screen pixel display in ascii and hex format

**Format:**

- `SCREEN?`
- `SCREEN,COLOUR?`
- `SCREEN,group`
- `SCREEN,COLOUR,group?`

**Arguments:** Group
- `GROUP1`
- `GROUP2`

**Reply:** Multiple lines of data bit values

**Example:** `SCREEN?` data returned

**Notes:**

SCREEN? response:
- 272 lines of 60 bytes in ASCII coded Hex (2 characters for each byte) preceded by #H.
- Each byte represents 8 dots where the lsb is the leftmost dot of the display.
- The bit is set for on and cleared for off.

SCREEN,COLOUR? response:
- 1088 lines of 120 bytes preceded by #C.
- Each line of the display is sent as four lines of data from left to right.
- Each byte represents a single RGB dot in binary format: 0 1 r1 r0 g1 g0 b1 b0.
SETUP

Function: Upload instrument set up

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

Format: SETUP,index,data

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

Reply: None

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

Notes: The settings are only updated when the 32nd line has been received and the checksum has been verified.
Function: Read instrument set up
Description: All the settings within the instrument may be read by SETUP? The same settings may then be stored by ending the same data back to the instrument. As it sends all settings in a compressed format it is quicker than setting individual parameters.
Format: SETUP?
Arguments: none
Reply: 32 lines of ASCII data
Example: SETUP?
Read 32 lines of data
Notes:
**SHUNT**

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 target window size for the measurement.

**Format:** SPEED,value,window

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

**Reply:** none

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

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

Arguments: channel:

   CH1
   .
   .
   CH6

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

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

Notes: STATUS? gives a summary value reporting OK only if all channels are not over range or under range
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:
<table>
<thead>
<tr>
<th>SUSPEN</th>
<th>SUSPEN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function:</strong></td>
<td>Suspend data acquisition.</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Disable the data acquisition to maximise the communication speed.</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>SUSPEN,\textit{value}</td>
</tr>
<tr>
<td><strong>Arguments:</strong></td>
<td>value:</td>
</tr>
<tr>
<td></td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td><strong>Reply:</strong></td>
<td>none</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>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><strong>Notes:</strong></td>
<td></td>
</tr>
</tbody>
</table>
TAGREP

Function: Set the comms reply tag

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

Format: TAGREP,setting

Arguments: setting:
- DISABLED or OFF
- ENABLED or ON

Reply: none

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

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

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,10,1none

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.
**TORQSP?**

**Function:** Read the mechanical power, torque and speed

**Description:** Returns measured mechanical power value along with the torque and speed values

**Format:** TORQSP?

**Arguments:** none

**Reply:** 3 data values separated by commas: power, torque, speed

**Example:**
TORQSP?
Data returned

**Notes:** Mechanical power displayed in Watts
Torque displayed in Nm
Speed displayed in rpm
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
    PPA3560 #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 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 – 20A
   4 – 30A

Examples: VERSIO?
   KQ4715,4,2.11,2.11,2.02,2.01

Notes: This data can be displayed on the screen by pressing SYSTEM then BACK
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
PHASE4
PHASE5
PHASE6
PHASES
Reply: RMS:
6 data values separated by commas
Vrms,Arms,Vdc,Adc,Vac,Aac
MEAN:
6 data values separated by commas
Vrms,Arms,Vmean,Amean,Vff,Aff
SURGE:
8 data values separated by commas
Vrms,Arms,Vpk,Apk,Vcf,Acf,
Vsurge,Asurge
Example: VRMS,PHASE1,RMS?
Notes: VRMS? without specifying the phase returns the appropriate single phase data.
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)

Reply: none

Examples: WIRING,PHASE2

Notes: WIRING,SINGLE is the same as WIRING,PHASE1
Use GROUP1 command to set a single group with four or more phases.
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: ZOOM, level, data1, data2, data3, data4

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

data1-4: zoom data

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

Reply: None

Example: VRMS
- ZOOM, 1, 1, 65 (level 1, ch1 rms, ch2 rms)

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

Function: Read the display zoom parameters.
Description: Reads the zoom level and data.
Format: `ZOOM?`
Arguments: 5 integers separated by commas:
- `level`:
  - 0 – normal
  - 1 – zoom data larger font (zoom level 1)
  - 2 – zoom data only (zoom level 2)
  - 3 – first three zoom data only (zoom level 3)
- `data1-4`:
  - zoom data
  - data consists of line number for channel 1 or line number + 64 for channel 2

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

Notes:
3 Multilog Application Guide

**Configuring the N4L PPA Power Analyzer for Data logging**

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

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

**Step 1.**
Reset “MULTILOG” using the MULTIL,0 command
This will clear any previously entered Multilog parameters and ensure the instrument does not return unwanted results.

**Step 2.**
Set up the Multilog parameters
The format of the Multilog command is as follows

MULTILOG, Index, Phase, function

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

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

Function is the parameter type (e.g. Watts, VAr, Frequency etc) of the return.
The Function ID is chosen from Appendix C which is a continually growing list due to firmware upgrades of the power analyzers at N4L, at present the PPA3500 has 99 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 2</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</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>5</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>MULTIL,</td>
<td>6</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>MULTIL,</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
PPA35xx communications manual

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:

<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>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 A – Configurable parameters

All parameters can be accessed using the CONFIG command:

```
CONFIG,number,parameter
```

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

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

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

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

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

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

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

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

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

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

14 Smoothing (Acquisition Control or Phase Meter)
   0 = Normal
   1 = Slow
   2 = None
15  **Smoothing Response** (Acquisition Control or Phase meter)
    0=Auto reset
    1=Fixed time

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

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

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

23  **Grouping**, (number of phases in group 1)

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

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

26  **Input range channel 1**, (Range – minimum range voltage)
    0=1V
    1=3V
    2=10V
    3=30V
    4=100V
    5=300V
    6=1kV
    7=3kV
PPA35xx communications manual

27 **Input range channel 2,** (Range – minimum range current)
   - 0 = 300mA
   - 1 = 1A
   - 2 = 3A
   - 3 = 10A
   - 4 = 30A
   - 5 = 100A
   - 6 = 300A
   - 7 = 1kA

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

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

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

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

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

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

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

36 **Phase 1 noise filter,** (Acqui
   - 0 = Off
   - 1 = On

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

38 **Frequency reference voltage/current,** (Acquisition control)
   - 0 = Voltage
   - 1 = Current
40 Frequency reference phase, (Acquisition control)
   0=Phase 1
   1=Phase 2
   2=Phase 3

41 Display page, (Main display)
   0=Phase 1 page
   1=Phase 2 page
   2=Phase 3 page
   3=Sum page
   4=Phase 1,2 & 3 page
   5=Phase 1,2 & 3 fundamentals page
   6=NEU page

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

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

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

45 Function zoomed on 3, (Main display)
   0= Watts & Frequency
   2= Watts, VA & Frequency
   3= Watts, VAr & Frequency
   4= Watts, pf & Frequency
   5= Watts, Voltage & Frequency
   6= Watts, Current & Frequency
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, (Acqu advanced options – frequency in Hertz)

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

Program 1-4 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, fundamental > 1kHz
2 = Enabled, fundamental < 1kHz

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

Datalog Zoom1, (Datalog-RAM)
0 = Enabled
1 = Disabled
55  Datalog Zoom2,  (Datalog-RAM)
    0=Enabled
    1=Disabled

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

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

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

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

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

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

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

Low frequency mode minimum frequency, (Enter value)

Application mode,
0=Normal
1=PWM
2=Lighting ballast
3=Inrush current
4=Transformer mode
5=Standby power
6=Calibration mode
72 Frequency tracking speed, (Application options mode - Lighting Ballast)
   0=Fixed time
   1=Fast
   2=Medium
   3=Slow

73 PWM and ballast low frequency, (Application options mode)
   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)

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

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

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

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

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

94  Torque offset, (Mode – value in Volts)

95  Speed offset, (Mode – value in Volts)

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

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

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

101 Harmonic series up to, (Harmonic analyzer - figure = harmonic max)
102 Voltage bargraph scale,  (Harmonic analyzer - figure = % required)
103 Current rating (TRD),  (Harmonic analyzer - TRD mode - enter figure)
104 Current bargraph scale,  (Harmonic analyzer - figure = % required)
106 Timebase,  (Scope - Enter figure/div)
107 trigger level,  (Scope - Enter figure/div)
108 Pretrigger,  (Scope)  
   0=None
   1=25%
   2=50%
   3=75%
109 trigger polarity,  (Scope)  
   0=Rising edge
   1=Falling edge
110 trigger Mode,  (Scope)  
   0=Auto
   1=Normal
   2=Single shot
111 trigger reference,  (Scope)  
   0=Voltage
   1=Current
112 trigger phase,  (Scope)  
   0=Phase 1
   1=Phase 2
   2=Phase 3
113 cursors enable,  (Scope)  
   0=Off
   1=On
114 trigger HF reject,  (Scope)  
   0=Off
   1=On
Trace, (Scope)
0=Dual
1=Voltage
2=Current

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

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

Brightness, (System)
0=Low
1=High

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

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

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

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
2=star-delta
3=delta-star

Difference THD, (Power analyser – penultimate line - Vthd)
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

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

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

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

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

### Alarm 2 high threshold,
**Alarm options – alarm if high – enter figure**

### Alarm 2 low threshold,
**Alarm options – alarm if low – enter figure**

### Enable channel 3,
**(Range – voltage input)**
- 1 = Internal
- 3 = External Attenuator
- 4 = Internal x10

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

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

### Input range channel 4,
**(Range – minimum range current)**
- 0 = 300mA
- 1 = 1A
- 2 = 3A
- 3 = 10A
- 4 = 30A
- 5 = 100A
- 6 = 300A
- 7 = 1kA
180  Input ranging channel 3, (Range – autoranging voltage) (Sys independent ranging enabled)
    0=Full Autorange
    1=Range up only
    2=Manual

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

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

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

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

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

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

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

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

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

197  High speed mode
    0 = Off
    1 = On
Enable channel 5, (Range – voltage input) (Sys independent ranging enabled)
1=Internal
3=External Attenuator
4=Internal x10

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

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

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

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

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

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

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

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

212 Phase 3 noise filter, (Acqu)
   0 = Off
   1 = On

213 Phase 3 noise filter frequency, (Acqu corner frequency in Hertz)
   0 = Off
   1 = On

231 Memory, (Program)
   0=Internal
   1=USB Memory stick

232 Data, (Program)
   0=Program
   1=Results
   2=Datalog

233 Action, (Program)
   0=Recall
   1=Store
   2=Delete

234 Location, (Program - Enter figures as required)
## Appendix B – MULTIL parameters

<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>
<tr>
<td>14</td>
<td>reactance</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>impedance phase</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>efficiency</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>fundamental efficiency</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>maths</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>integrated watts</td>
<td>integrator mode</td>
</tr>
<tr>
<td>20</td>
<td>integrated VA</td>
<td>integrator mode</td>
</tr>
<tr>
<td>21</td>
<td>integrated VAr</td>
<td>integrator mode</td>
</tr>
<tr>
<td>22</td>
<td>integrated rms current</td>
<td>integrator mode</td>
</tr>
<tr>
<td>23</td>
<td>average power factor</td>
<td>integrator mode</td>
</tr>
<tr>
<td>24</td>
<td>integrated fundamental watts</td>
<td>integrator mode</td>
</tr>
<tr>
<td>25</td>
<td>integrated fundamental VA</td>
<td>integrator mode</td>
</tr>
<tr>
<td>26</td>
<td>integrated fundamental VAr</td>
<td>integrator mode</td>
</tr>
<tr>
<td>27</td>
<td>integrated fundamental current</td>
<td>integrator mode</td>
</tr>
<tr>
<td>28</td>
<td>average fundamental power factor</td>
<td>integrator mode</td>
</tr>
<tr>
<td>29</td>
<td>average integrated watts</td>
<td>integrator mode</td>
</tr>
<tr>
<td>30</td>
<td>average integrated VA</td>
<td>integrator mode</td>
</tr>
<tr>
<td>31</td>
<td>average integrated VAr</td>
<td>integrator mode</td>
</tr>
<tr>
<td>32</td>
<td>average integrated fundamental watts</td>
<td>integrator mode</td>
</tr>
<tr>
<td>33</td>
<td>average integrated fundamental VA</td>
<td>integrator mode</td>
</tr>
<tr>
<td>34</td>
<td>average integrated fundamental VAr</td>
<td>integrator mode</td>
</tr>
<tr>
<td>35</td>
<td>average rms voltage</td>
<td>integrator mode</td>
</tr>
<tr>
<td>36</td>
<td>average fundamental voltage</td>
<td>integrator mode</td>
</tr>
<tr>
<td>37</td>
<td>Standby mode frequency</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>DC watts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Mode</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>39</td>
<td>average rms current</td>
<td>integrator</td>
</tr>
<tr>
<td>40</td>
<td>average fundamental current</td>
<td>integrator</td>
</tr>
<tr>
<td>41</td>
<td>delta watts</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>fundamental delta watts</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>elapsed time</td>
<td>integrator</td>
</tr>
<tr>
<td>44</td>
<td>LCR resistance</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>LCR inductance</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>LCR capacitance</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>LCR tan delta</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>LCR Q factor</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>reserved for future expansion</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>rms voltage</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>rms current</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>fundamental voltage</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>fundamental current</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>voltage phase</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>current phase</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>harmonic voltage</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>harmonic current</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>dc voltage</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>dc current</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>ac voltage</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>ac current</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>peak voltage</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>peak current</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>voltage crest factor</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>current crest factor</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>rectified mean voltage</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>rectified mean current</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>voltage form factor</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>current form factor</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>voltage harmonic</td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>current harmonic</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>voltage harmonic percentage</td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>current harmonic percentage</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>voltage thd</td>
<td>harmonic</td>
</tr>
<tr>
<td>75</td>
<td>current thd</td>
<td>harmonic</td>
</tr>
<tr>
<td>76</td>
<td>voltage tif</td>
<td>harmonic</td>
</tr>
<tr>
<td>77</td>
<td>current tif</td>
<td>harmonic</td>
</tr>
<tr>
<td>78</td>
<td>phase to phase rms voltage</td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>phase to phase fundamental voltage</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>phase to phase voltage phase angle</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>phase to phase rms voltage</td>
<td></td>
</tr>
</tbody>
</table>
### PPA35xx communications manual

<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>82</td>
<td>Voltage surge</td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>Current surge</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>Voltage rms deviation</td>
<td>transformer mode</td>
</tr>
<tr>
<td>85</td>
<td>Voltage fundamental deviation</td>
<td>transformer mode</td>
</tr>
<tr>
<td>86</td>
<td>Voltage phase deviation</td>
<td>transformer mode</td>
</tr>
<tr>
<td>87</td>
<td>Voltage positive peak</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>Current positive peak</td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>Voltage negative peak</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>Current negative peak</td>
<td></td>
</tr>
<tr>
<td>91</td>
<td>Voltage positive peak unfiltered</td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>Current positive peak unfiltered</td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>Voltage negative peak unfiltered</td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>Current negative peak unfiltered</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>In-phase component of voltage</td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>Quadrature component of voltage</td>
<td></td>
</tr>
<tr>
<td>97</td>
<td>In-phase component of current</td>
<td></td>
</tr>
<tr>
<td>98</td>
<td>Quadrature component of current</td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>Reserved for future expansion</td>
<td></td>
</tr>
</tbody>
</table>

### Phase selection:

1 = phase 1  
2 = phase 2  
3 = phase 3  
4 = sum  
5 = neutral  
6 = ADI40  
7 = Phase 4  
8 = Phase 5  
9 = Phase 6  
10 = Sum 2  
11 = Neutral 2

### There are some special functions:

<table>
<thead>
<tr>
<th>Measurement (function)</th>
<th>phase</th>
<th>Previous function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical speed in Hz</td>
<td>neutral</td>
<td>dc voltage (function 58)</td>
</tr>
<tr>
<td>Mechanical speed in rpm</td>
<td>neutral</td>
<td>ac voltage (function 60)</td>
</tr>
<tr>
<td>Torque in Nm</td>
<td>neutral</td>
<td>rms voltage (function 50)</td>
</tr>
<tr>
<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 individual special function measurements:

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

Example script to return results for Mechanical Power, Torque & Speed (in rpm):
> 
> 
> multil,0
> multil,1,5,2
> multil,2,5,50
> multil,3,5,60
> multil?
-1.8846E-7,-2.0984E-3,8.5765E-4
Newtons4th Ltd. contact details

Please direct all queries or comments regarding the PPA35xx instruments or this manual to:

Newtons4th Ltd.
1 Bede Island Road
Leicester
LE2 7EA
United Kingdom

Tel: (0116) 230 1066     international   +44 116 230 1066
Fax: (0116) 230 1061     international   +44 116 230 1061

E-mail address: sales@newtons4th.com
               office@newtons4th.com

web site: www.newtons4th.com

At Newtons4th Ltd. we have a policy of continuous product improvement and are always keen to hear comments, whether favourable or unfavourable, from users of our products. Please telephone, fax, write or e-mail with your comments.