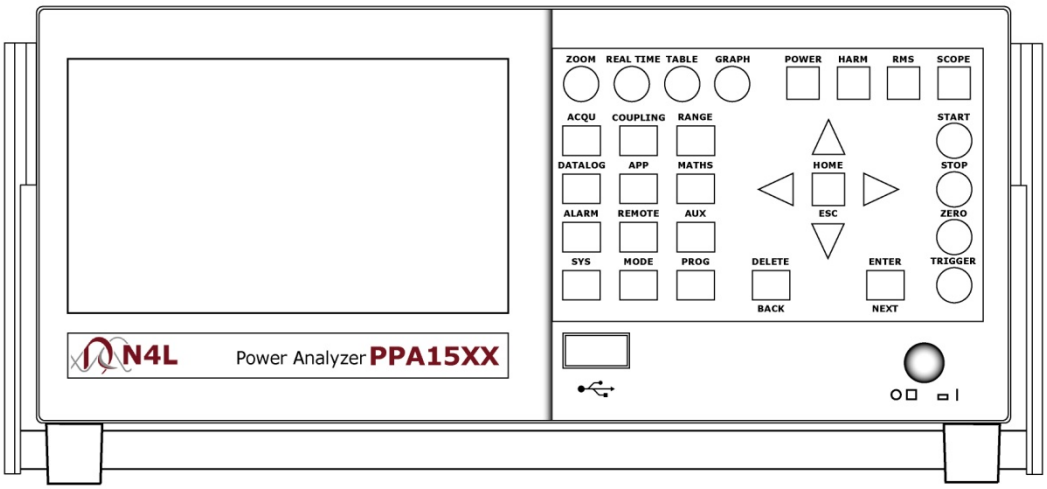
Newtons4th Ltd

PPA5xx/15xx series

START UP GUIDE



Firmware v2_50

DECLARATION OF CONFORMITY

CE

Manufacturer: Newtons4th Ltd.
Address: 30 Loughborough Rd.
Mountsorrel
Loughborough
Leics.
LE12 7AT

We declare that the product:

Description: Power Analyser
Product name: KinetiQ
Model: PPA5xx/15xx Family

Conforms to the requirements of Council Directives:

89/336/EEC relating to electromagnetic compatibility:
EN 61326:1997 Class A

73/23/EEC relating to safety of laboratory equipment:
EN 61010-1

Oct 2012

Eur Ing Allan Winsor BSc CEng MIEE
(Director Newtons4th Ltd.)

CONTENTS

1 Getting Started

1.1 UNPACKING

When you receive your product, check that the following items are included for the appropriate PPA. Refer to the contents list below for each model. If any item is missing or damaged during transportation, immediately contact your N4L office or local sales distributor

	CONTENTS									
MODEL	Mains Lead	4mm Yellow Lead	4mm Black Lead	4mm Red Lead	Yellow Croc Clip	Black Croc Clip	Red Croc Clip	Modem Cable	Start Up Guide Manual	Comms Manual
PPA510/1510	1	1	2	1	1	2	1	1	1	1
PPA520/1520	1	2	4	2	2	4	2	1	1	1
PPA530/1530	1	3	6	3	3	6	3	1	1	1

1.2 Fitment of the PPA series Carry/Tilt handle

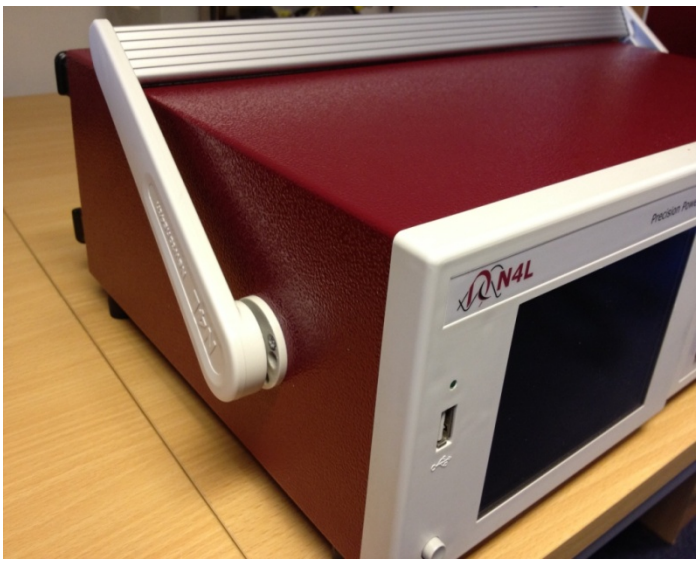
PPA5/15/45/55 series power analyzers are supplied with a Carry/Tilt Handle that is located within the accessory pack.

The handle allows a user to position the instrument upwards at one of two angles for easier viewing when the instrument is positioned below the line of sight. The design also allows storage under the unit without obstruction of the rubber feet so that instruments can be stacked and is easily removed to allow the connection of rack mounting brackets without the need to remove instrument covers.

Correct installation of the handle is important to ensure the correct operation and long life the handle.

The following pictures illustrate correct and incorrect handle fitment:

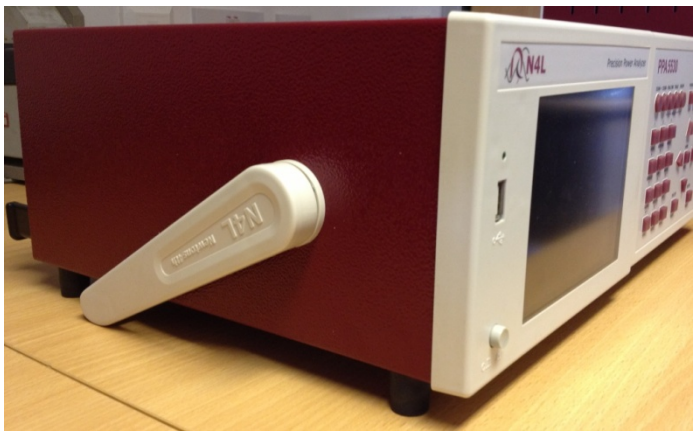
Correct 1



Correct 2

Correct 1/2 – Correct fitting is from the top of the unit as shown here

Correct 3



Correct 4

A correctly fitted handle will have the ‘N4L Newtons4th’ wording in the correct reading plane when the handle is to the front of the instrument (Pic. 3)

Also, a correctly fitted handle will allow storage under the unit (Pic. 4)

Incorrect 1

Incorrect 2

Fitting the handle from the bottom of the unit as shown here wrong (Incorrect 1)

Incorrect fitting can be seen because the handle does not fit correctly under the unit and handle sides do not fit flush with the registration washer (Incorrect 2)

2 Safety

2.1 IMPORTANT SAFETY INSTRUCTIONS

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

- Ensure that the supply voltage agrees with the rating of the instrument printed on the back panel ***before*** connecting the mains cord to the supply
- This appliance ***must*** be earthed. Ensure that the instrument is powered from a properly grounded supply
- The inputs are rated at 1kV rms or dc cat II; 600V rms or dc cat III. **Do not exceed the rated input**
- Keep the ventilation holes on the underneath and rear free from obstruction
- 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

2.2 CAUTIONS

- **Do not use a damaged power cord or cables**

  Doing so may cause an electric shock or a fire

- **Do not place any object on this instrument**

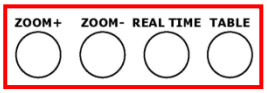
- **Do not use this instrument if faulty**

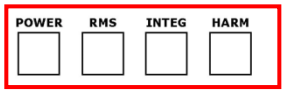
  If you suspect the instrument to be faulty, contact your local N4L office or representative for repair (see section 7)

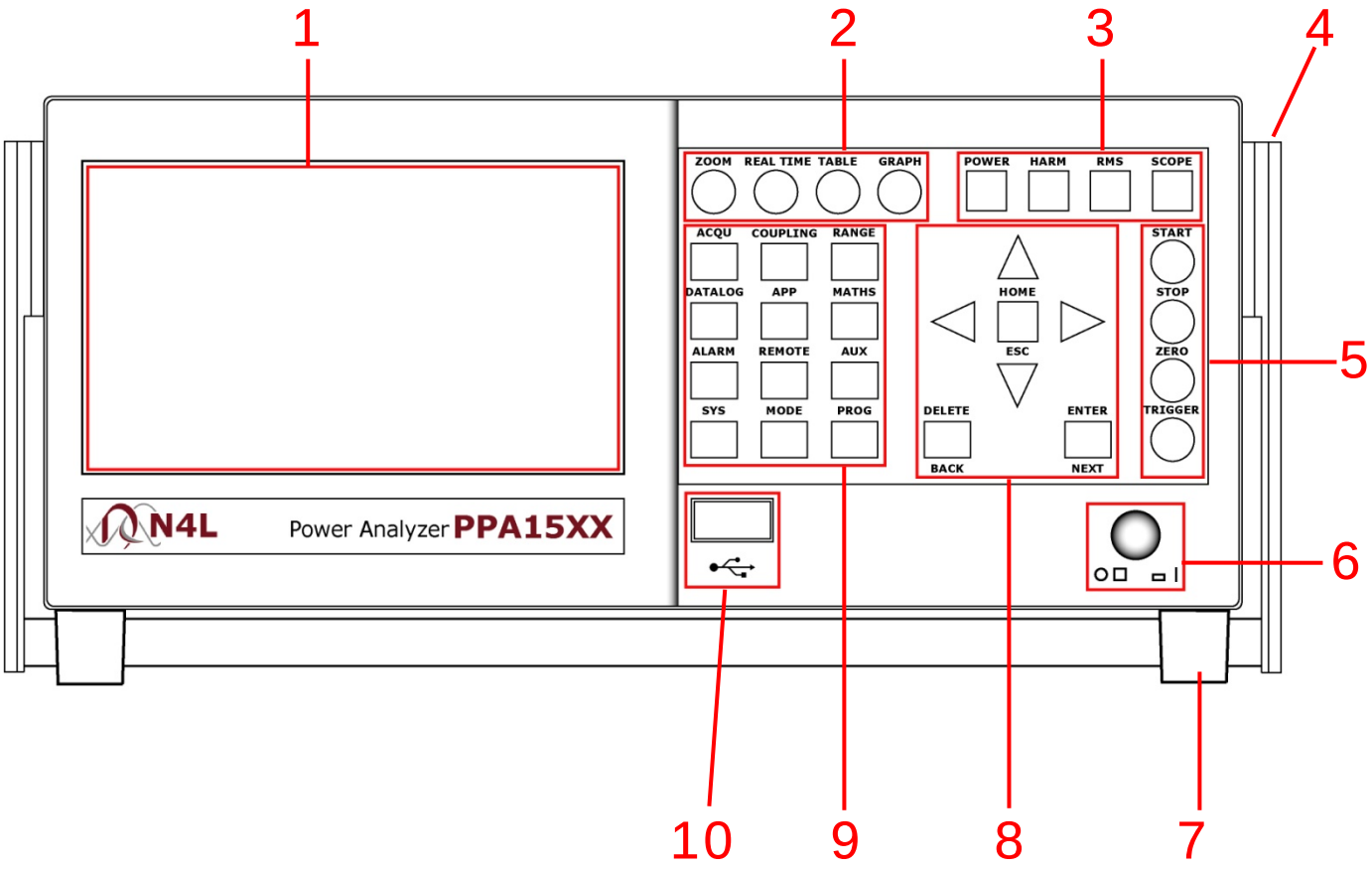
3 Front Panel Layout

1. Display Screen
2. Screen Display Function Buttons
3. Power Analyzer Mode Buttons
4. Handle
5. Measurement Control Function Keys
6. Power On / Off Button
7. Rubber Feet
8. Menu Selection and Cursor Controls
9. Measurement Settings Buttons
10. Front USB Port

PPA5xx







3.1 PPA5xx/15xx DISPLAY KEY FUNCTIONS

1	**Display Screen**	480x272 dot full colour TFT screen for displaying all information, Note: screen brightness can be set as described in section 5 of this user guide

2	**Screen Display Function Buttons**	
Zoom (PPA15xx)		Increase or Decrease font size of selected parameters on display screen
Zoom+ Zoom- (PPA5xx)		Individual buttons to increase or decrease selected parameters font size
Real Time		Displays data information in real time within display screen press again to place on screen information into hold
Table		Displays results from Datalog/Harmonics in table format
Graph (PPA15xx)		Displays results from Datalog/Harmonics in graph format

3	**Power Analyzer Mode Buttons**	
Power		Sets PPA into Power Analyzer measurement mode
Harm		Sets PPA into Harmonic measurement mode
RMS		Sets PPA into True RMS Voltmeter measurement mode
Scope (PPA15xx)		Sets PPA into Scope measurement mode
Integ (PPA5xx)		Sets PPA into Power Integrator measurement mode

4	**Handle Fixture**	Carrying handle utilised to site the instrument in an angular position

5	**Measurement Control Function Keys**	
Start		Press to enable any Datalog measurement (see section 9)
Stop		Press to stop any Datalog measurement
Zero		Press to re-zero measurement inputs
Trigger		Press to re-synchronise instrument to input signal

6	**Power Button**	Power On / Off button

7	**Rubber Feet**	Rubber standoff feet

8	**Menu Selection and Cursor Control Buttons**	
Enter / Next		Press to confirm any parameter configuration setting or move through selected mode screen displays
Delete / Back		Press to delete any inputted data or scroll back within any results screen display
Home / Esc		Press to return to the home page when any parameters have been adjusted and entered, or will escape from any screen view and return to the selected mode's home screen

9	**Measurement Settings Buttons**	
ACQU		
Wiring		Select wiring configuration to reflect instruments connections to DUT
Speed		Select speed to which the instrument will update computed results
Smoothing		Smoothing filter settings, enables smoother data results in noisy environments
Smoothing Response		Filtering reset settings, in response to significant input signal change - auto or fixed
Frequency Reference		Allows the frequency to be measured from voltage or current reference
Frequency Reference		Allows the frequency to be measured from any channel on a multi phase instrument
Phase Angle Reference		Input reference point for phase angle measurements
Frequency Filter		Frequency filter for a PWM waveform, to detect fundamental frequency (parallel digital filter)
Low Frequency		Low fundamental frequency measurement option, enable if fundamental is below 5Hz
ADVANCED OPTIONS:		
DFT Selectivity		Bandwidth settings for DFT analysis
Ignore Overload		Ignores over ranging spikes in measurements caused in noisy environments
Frequency Lock		Manually input a frequency to be used for measurements, or use dynamic when input frequency is fluctuating / ramping

COUPLING	
Coupling	Set instrument fundamental frequency detection range; ac+dc = dc to 2MHz ac = 5Hz to 2MHz dc = No frequency detection
Noise Filter	Set to remove noisy frequency components from any measurements (in-line digital filter)

RANGE	
Voltage Input	Set voltage input to external BNC or internal voltage attenuator
Autoranging	Will allow the instrument to take full control and select correct ranges, or set manually as required
Minimum Range	Select minimum voltage range
Scale Factor	Manually enter any scale factor required
Current Input	Set current input to external BNC or internal current shunt
Autoranging	Will allow the instrument to take full control and select correct ranges, or set as required
Minimum Range	Select minimum current range
Scale Factor	Manually select any scale factor required

DATALOG	
Datalog	Enables user to select memory format to save log measurements and to set log data information

APP	
Mode	Select appropriate application mode for measurements
Default Settings	Select to set instrument into default settings for respective APP mode

MATHS	
Formula	Maths calculation functions are available from a dropdown menu. To display maths functions on the main display screen it will be necessary to set the “penultimate/last line” parameter to “maths functions” This is found within the MODE menu (section 9-**MODE**) and selecting power analyzer/RMS mode

ALARM	
Alarm 1 Data	Select parameter to be monitored with alarm settings
Alarm Type	Select alarm rules
High Threshold	Set upper limit threshold, selected parameter will activate alarm
Low Threshold	Set lower limit threshold, selected parameter will activate alarm
Alarm 2 Data	Select parameter to be monitored with alarm settings
Alarm Type	Select alarm rules
High Threshold	Set upper limit threshold, selected parameter will activate alarm
Low Threshold	Set lower limit threshold, selected parameter will activate alarm

REMOTE	
Resolution	Press to set the data resolution and change the format to which the instrument responds to future commands Normal = Data Resolution to 5 decimal points High = Data Resolution to 6 decimal points Binary = Transmitted in Binary Format
Interface	Press to select mode for communications interface connection between PPA and PC
Recall with Program	When enabled recalls communication port settings from any stored memory location
Screen Print	Print screen options, when USB memory stick is enabled, press and hold the “START” button to dump screen data to memory stick

AUX	
Auxiliary Device	Select if any auxiliary device is to be connected to the instrument

SYSTEM	
System	View all instruments current firmware levels and update user information

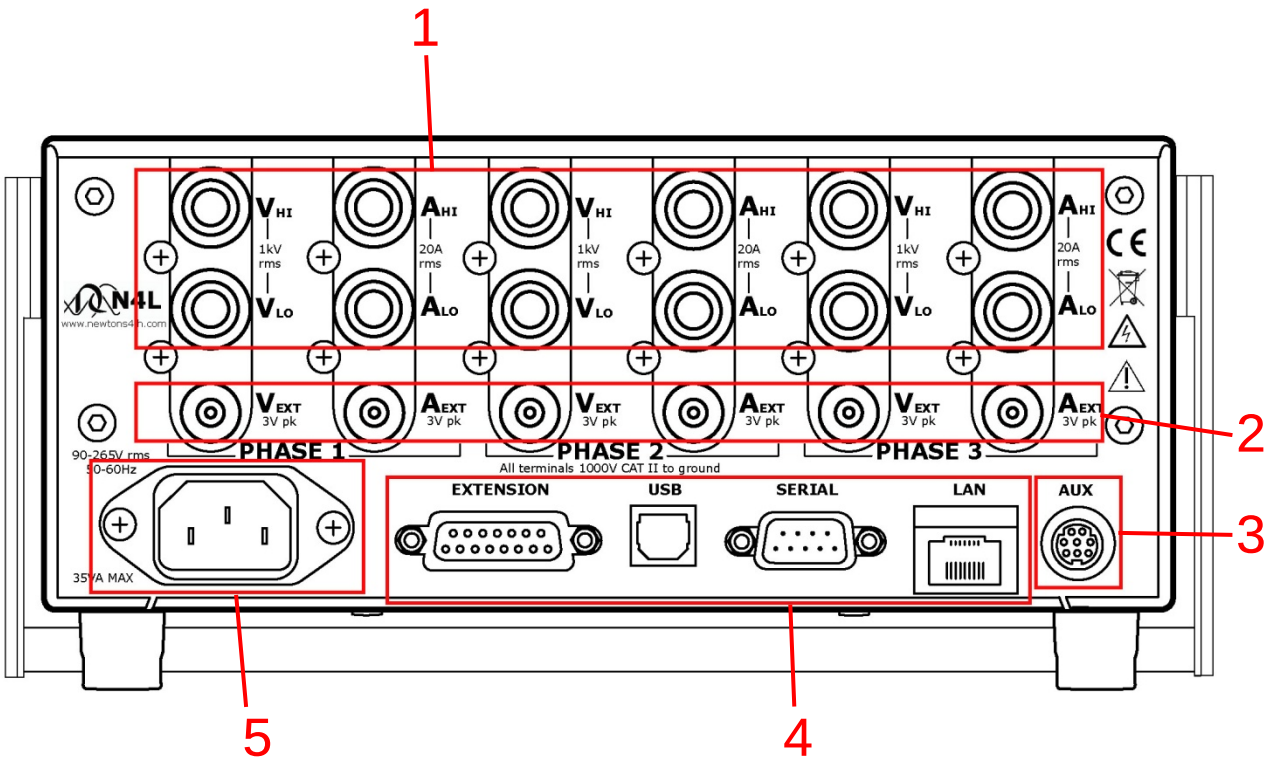
MODE	
Mode	Mode specific settings, see user manual for more information

PROG	
Memory	Select memory application: internal or USB memory stick
Data	Select data type to be stored
Action	Select action to be applied to data
Location	Select memory location to store test parameters / results
Name	Name selected stored test
Execute	Select to execute any changes made within the above PROG menus

10	**USB Port**	USB port for memory stick device. Note when rear USB port is in use front USB port will be disabled

4 Rear Panel Layout

1. Voltage & Current Internal Inputs
2. Voltage & Current External Analogue Inputs
3. Auxiliary Port
4. Communication Ports
5. Mains Supply Inlet



5 Basic Key Operations

This chapter is designed to help the user familiarise themselves with the instrument by setting up some basic functions

5.1 SET UP FOR POWER ON

Install Equipment	⇨	Installation of Equipment
Plug in and turn on power	⇨	Power Supply Connection

5.2 SETTING THE TIME

Power Analyzer Default Screen Appears

Press “SYS” Key	⇨	System Option Screen Opens
Press ▼ Key	⇨	Flashing Red Cursor will surround Hours
Use Numerical Keys	⇨	Set Hours within cursor
Press Enter Key	⇨	Hours in clock now set
Press ▼ Key	⇨	Flashing Red Cursor moves to Minutes
Use Numerical Keys	⇨	Set Minutes within cursor
Press Enter Key	⇨	Minutes in clock now set
Press ▼ Key	⇨	Flashing Red Cursor moves to Seconds
Use Numerical Keys	⇨	Set Seconds within cursor
Press Enter Key	⇨	Clock timings will now be complete

5.3 SET THE DATE

Press ▼ Key	⇨	Flashing Red Cursor moves to Date
Use Numerical keys	⇨	Set Date within Cursor
Press Enter Key	⇨	Numerical Day of Month is set
Press ▼ Key	⇨	Flashing Red Cursor moves to Month
Press ▶ Key	⇨	Month Calendar Opens
Press ▼ Key	⇨	Select Month to be entered
Press Enter Key	⇨	Month will be set
Press ▼ Key	⇨	Flashing Red Cursor moves to Year
Use Numerical Keys	⇨	Set Year within Cursor
Press Enter Key	⇨	Date will now be Set

5.4 ADJUSTING THE BRIGHTNESS

Press ▼ Key	⇨	Flashing Red Cursor moves to Brightness
Press ◀ Key	⇨	Changes between High or Low option
Press Enter Key	⇨	Screen Brightness will now be set

5.5 ADJUST KEYBOARD BEEP

Press ▼ Key Twice	⇨	Red cursor moves to Keyboard beep
Press ◀ Key	⇨	Changes between Enable / Disable option
Press Enter Key	⇨	Keyboard beep now set

Now that you have familiarised yourself with the instruments keypad we can now complete this section by filling in the User Data Information

5.6 USER DATA

Press “SYS” Key	⇨	System Option Screen Opens
Press ▶ Key	⇨	User settings screen appears
Press ▼ Key	⇨	Red cursor moves to supervisor access
Press ◀ Key	⇨	Changes between Enable / Disable option
Press Enter Key	⇨	Supervisor access selected
Press ▼ Key	⇨	Red cursor moves to user data
Use Numerical Keys	⇨	On this line we can enter a Company Name
Press Enter Key	⇨	Company Name now set
Press ▼ Key	⇨	Red Cursor moves to user data
Use Numerical Keys	⇨	Enter an Individuals Name or Department
Press Enter Key	⇨	Name / Department now set
Press ▼ Key	⇨	Red cursor moves to User Data
Use Numerical Keys	⇨	Enter a unique ID for the instrument
Press Enter Key	⇨	User Data now set
Press ▼ Key	⇨	Red cursor moves to Save
Press Enter Key	⇨	All User Data details will be saved

6 PPA15xx Quick User Guide

N4L Power Analyzers cover 1 to 3 phase applications depending on the model and up to 12 phases via N4L's PPALoG software application in both low and high current models. Each phase input has wide ranging voltage and current channels which are fully isolated from each other and from ground

The voltage and current inputs are simultaneously sampled and the data is analysed in real time by a high speed DSP (digital signal processor). A separate CPU (central processing unit) takes the DSP results for display and communications. At the heart of the system is an FPGA (field programmable gate array) that interfaces the various elements

This powerful, versatile structure allows the measurement of a wide range of power related parameters

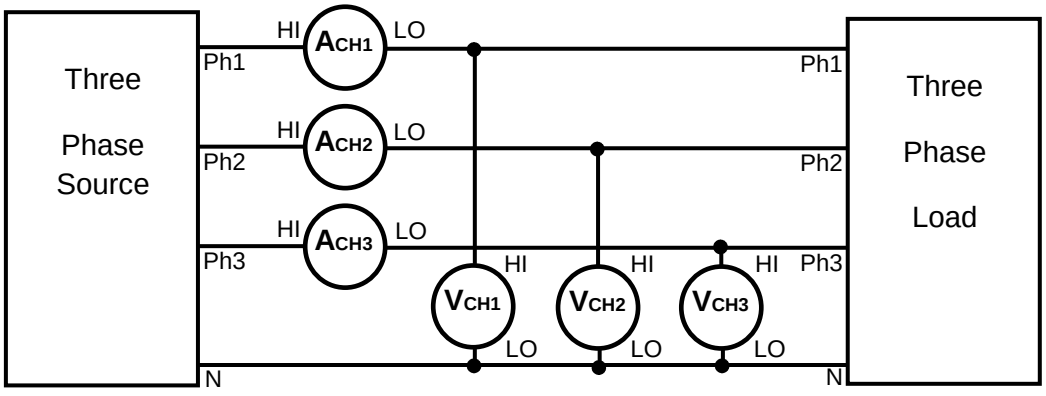
6.1 WIRING

Care must be taken when connecting up the instrument

Remember to configure the Voltage and Current inputs as per the drawing shown

Current in Series – (Hi in Low out)

Voltage in Parallel



Example shown is a 3 phase 3 wattmeter configuration

6.2 START UP

Once connected, power on the instrument and the analyzers factory default settings from memory location 0 will be displayed as per Fig 1 Note: these can be altered to your own desired settings (see the User Data section under System Options, section 6 of the main user guide)

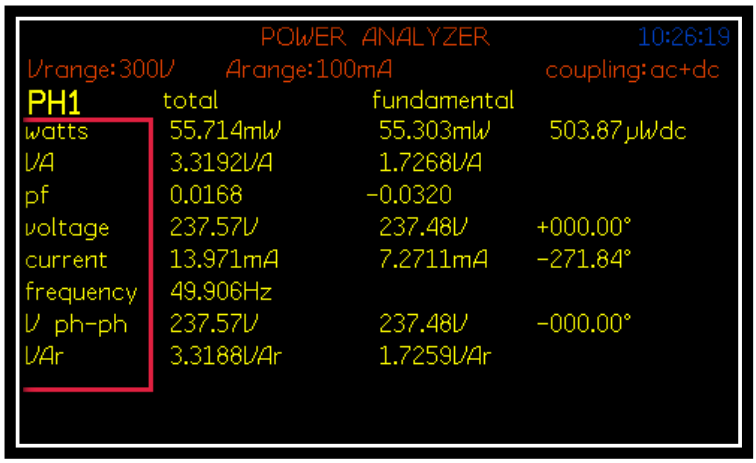


Fig 1

Within the Power screen you will notice 2 sets of measurements; "Total" and "Fundamental" as seen in Fig 2

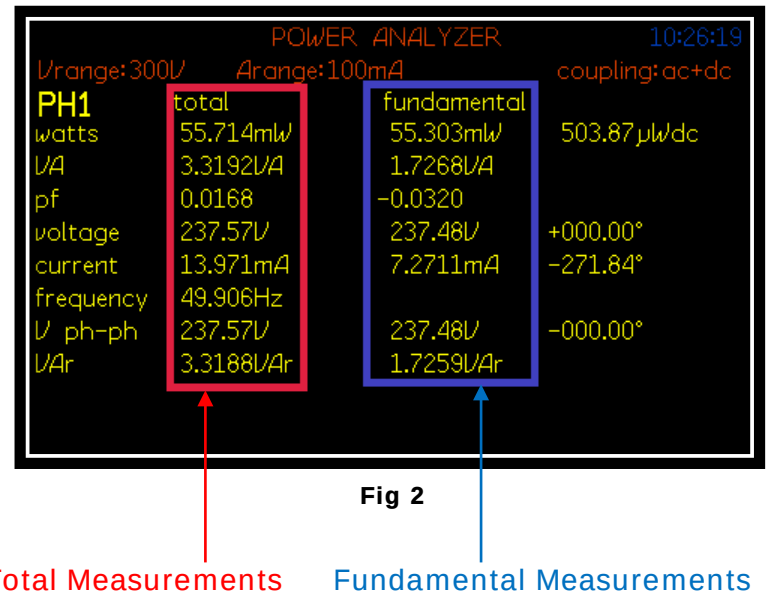


Fig 2

Total Measurements = Fundamental + Harmonics + Noise

Fundamental = Fundamental Power Measurements (All Distortion Removed)

Each measurement mode is pre-configured to display relevant parameters. Up to 4 functions can be selected and zoomed in. These can be viewed within 3 zoom screens, the Zoom function is described in the next section of this manual

6.3 ZOOM FUNCTION

Within the Power screen you are able to select up to 4 measurements that can be made more prominent from the rest, these can be selected and changed by the user as required

To select or change any zoom measurement

Action	**Result**
Press “ZOOM” until:	4 flashing red boxes appear
Press “DELETE”	Red boxes will disappear replaced by 1 white flashing box
Press ▲ ▼ ◀ ▶ Keys	Move box to desired measurement
Press “ENTER”	Measurement will be selected
Press ▲ ▼ ◀ ▶ Keys	Move box to desired measurement
Press “ENTER”	Measurement will be selected

Continue until all measurements you require are selected, up to a maximum of 4

By pressing the “ZOOM” button you can now alter the on screen display to show a different configuration of the selected measurements

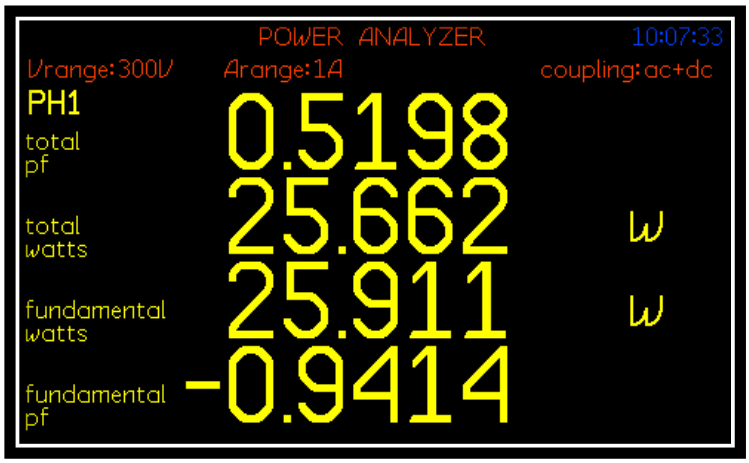


Fig 3

Zoom 3:

In zoom 3 mode you will display only the 4 selected zoomed measurements as shown (Fig 3)

Note: These will be displayed in the order they were selected

Zoom 4:

In zoom 4 mode you will display only the first 3 selected zoomed measurements as shown (Fig 4)

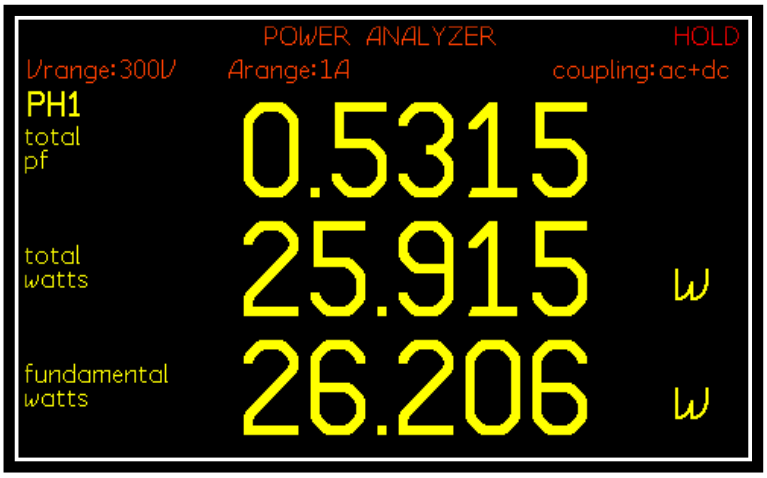


Fig 4

Continue to press the “ZOOM” button to scroll through all screen options

6.4 RESULTS SCREEN

We will now take a look at the results screen as shown in Fig 5 and explain why we have a difference in the “pf” readings between the Total and Fundamental readings

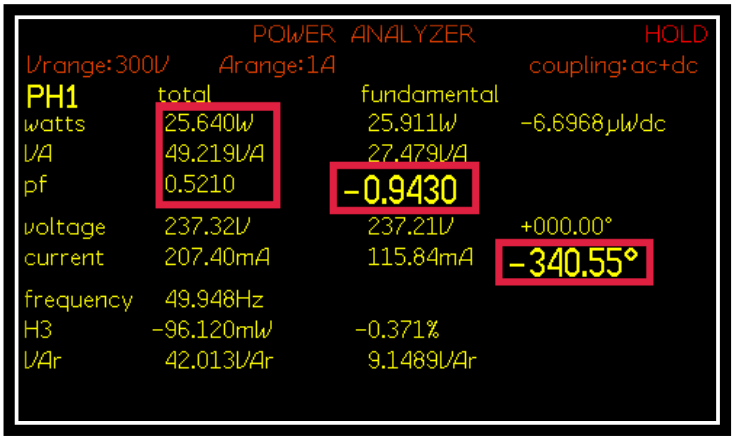


Fig 5

As you will notice there is quite a difference within the Power Factor readings from the same DUT (Device Under Test)

In the Total measurement the Power Factor is calculated by W / VA or (V x I x Cos **ϑ)**

In the Fundamental Measurement the Power Factor is derived by taking the Cos of the Phase Angle, often referred to as “cos phi”

Total Measurement = 25.640 ÷ 49.219 = pf 0.5210

Fundamental measurement = 360° – 340.55° = 19.45° Cos (19.45) = pf 0.9430

The difference in the pf measurements is the result of distortion being present

You will now be able to see this distortion within the next set of screenshots using Harmonics and Oscilloscope Mode

6.5 HARMONICS MODE

By selecting the "HARM" mode button we are now able to see the Harmonic Analyzer results screen Fig 6, showing all distortion present

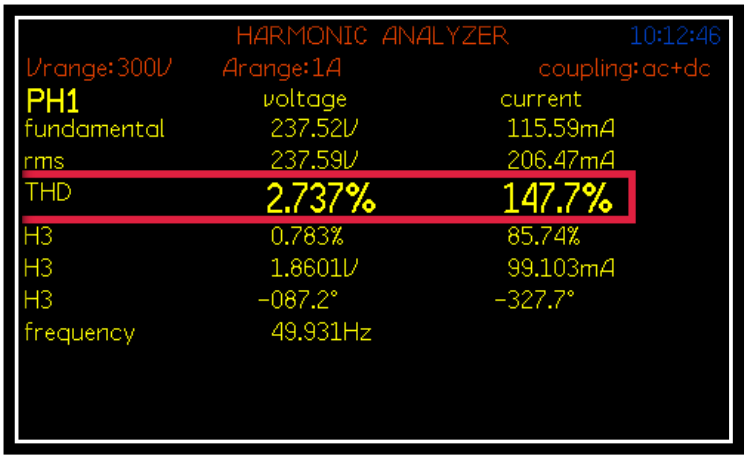
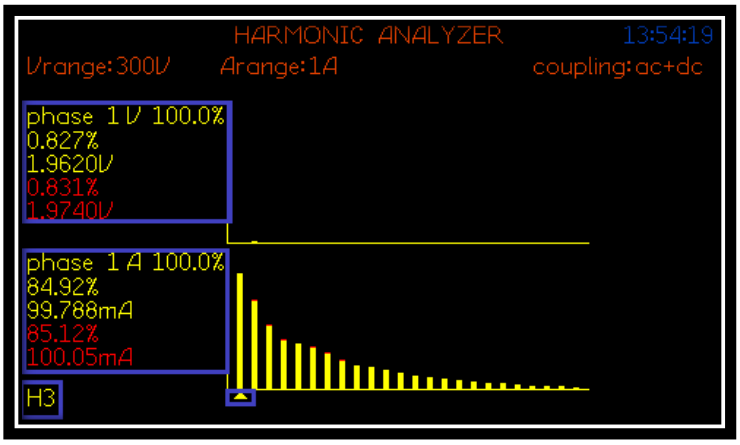


Fig 6

As you will see we are showing both the Voltage and Current THD (total harmonic distortion) with the Current exhibiting a greater value



Now press the "GRAPH" button (PPA15xx) and you will see a representation of the distortion as a bar graph as shown in Fig 7

Fig 7

Fig 7 displays a full bar graph of results over all of the harmonic range; it will also allow you to see any individual harmonic data on its own. In the bar graph above we can see that a significant amount of distortion is appearing within the Current which corresponds with the results seen in Fig 6, you can also see a set of selected data on the left hand side of the bar graph, these are the results collected from the 3rd harmonic (H3). To scroll through and select other harmonic data use the left and right arrow buttons to move the cursor at the bottom of the bar graph to your desired harmonic

Within Fig 6 there was a small amount of Voltage distortion but this was not visible within the bar graph of Fig 7. In default mode both the Voltage and Current graphs will be set and viewed at 100% of the set range as shown in Fig 8

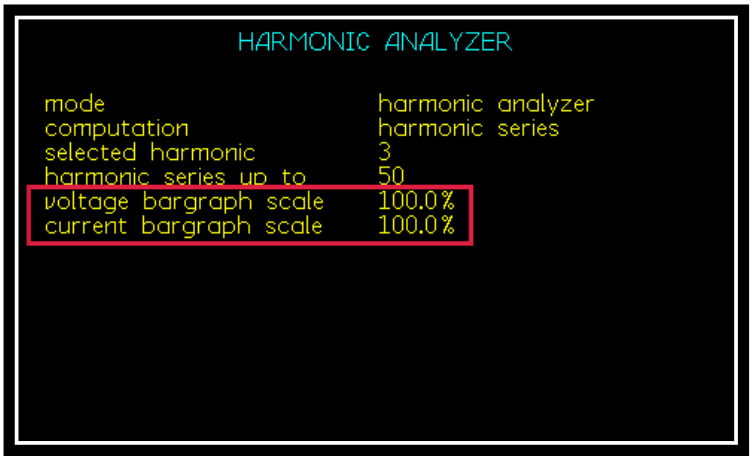


Fig 8

To view a small amount of distortion you will need to reset the bar graph scaling to a smaller value of the maximum scale

To view the Harmonic Distortion within the Voltage in this case it is required to reconfigure the Harmonic bar graph scale parameters as shown in Fig 9. To change the bar graph scaling you need to access the Harmonic Analyzer screen as shown

ACTION	**RESULT**
Press “HARM”	Harmonic Analyzer Screen will appear
Press ▼ 5 Times	Cursor will move to Voltage Bargraph Scale
Press “5”	5.000% will now be selected
Press “ENTER”	Scaling will now be set to 5% of max Voltage
Press “HOME” 2 Times	Display will return to results screen

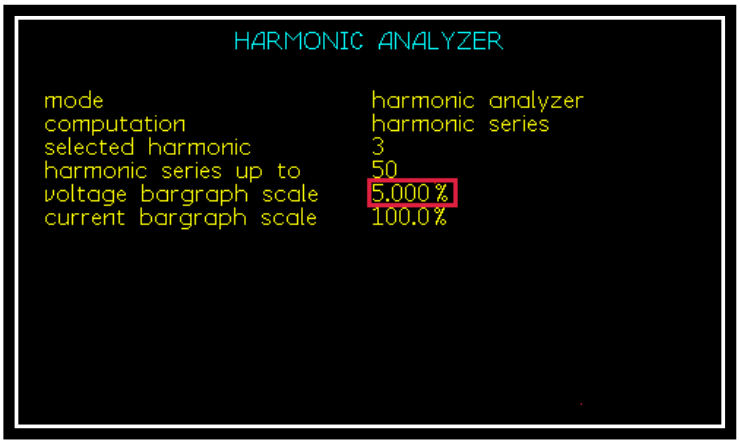


Fig 9

Press “GRAPH” to show the new bar graph results with the voltage results set to 5% of full voltage range as shown in Fig 10

As you can now see, a bar graph of Voltage distortion is present, the data on the left stays the same but due to the fact we are now only looking at a graph that is 5% of the voltage range the small amount of distortion is clearly visible

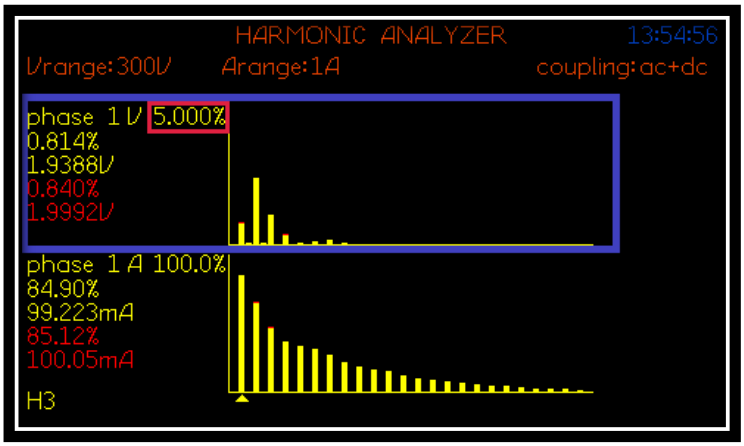


Fig 10

6.6 OSCILLOSCOPE MODE

By pressing the "SCOPE" button we can now confirm that the distortion seen within the power results is present visually on the oscilloscope

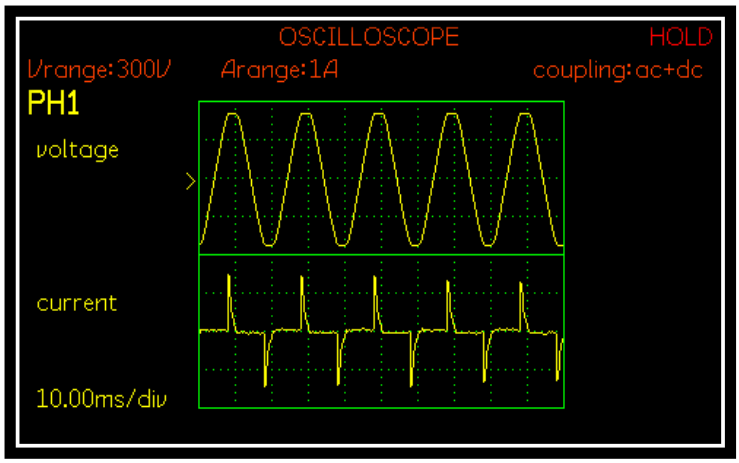


Fig 11

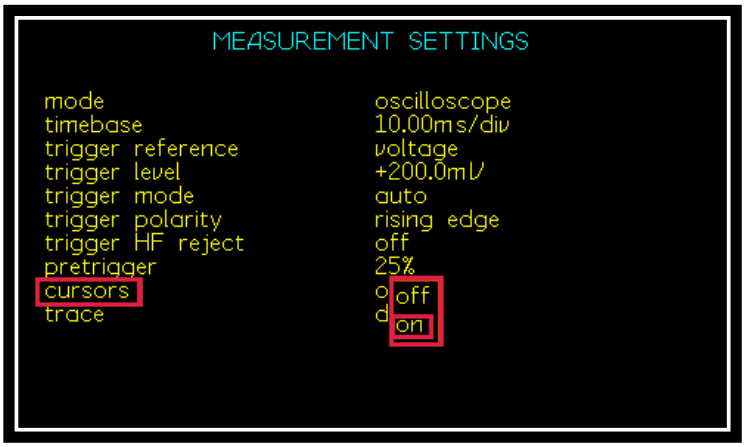
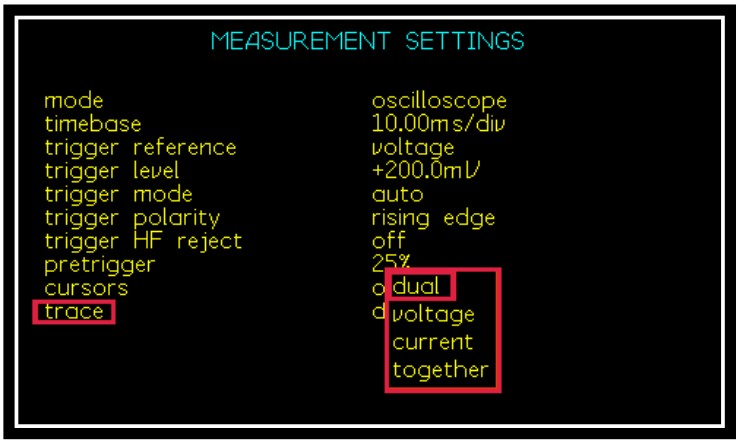


Fig 12

Press "SCOPE" again to go to the Oscilloscope's settings page. Here we will enable the screens cursors in order to obtain a measurement on both the Voltage and Current Waveforms

ACTION	**RESULT**
Press ▼ 9 Times	Red box will move to cursors parameter
Press ▶ Key	Select "ON" from the dropdown menu (Fig 12)
Press "ENTER" Key	Cursors will become active on scope screen



Now we will set which of the waveforms are to be viewed on the scope screen. All options can be seen in Fig 13, on this occasion we will select dual

Fig 13

ACTION	**RESULT**
Press ▼ Key	Red box will move to trace parameter
Press ▶ Key	Select “DUAL” from the dropdown menu (Fig 13)
Press “ENTER” Key	Dual graphs will now be displayed upon the screen
Press “SCOPE” Key	Screen will show Voltage & Current waveforms with cursors present (Fig 14)

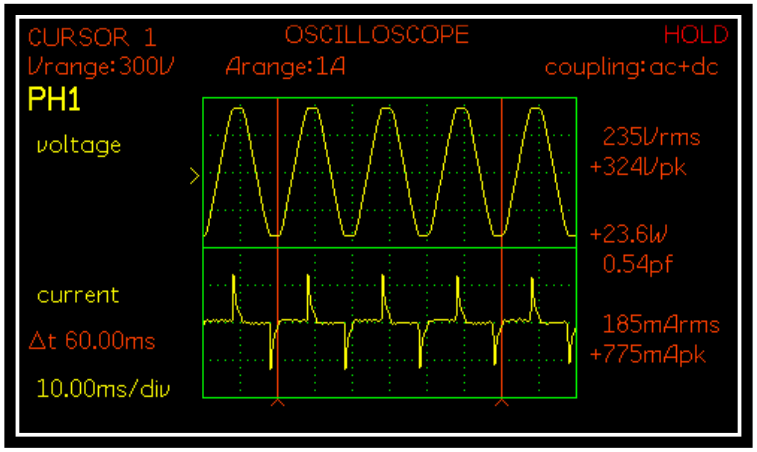


Fig 14

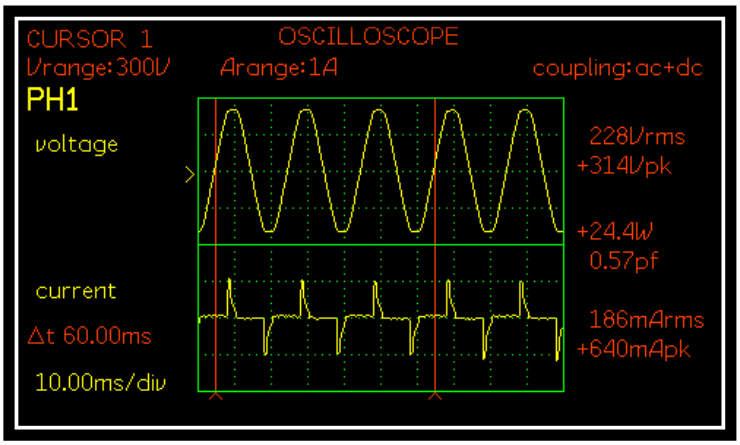


Fig 15

Fig 15 shows the measurements relating to cursor 1 and its position within the Voltage and Current waveforms

To switch between the cursors on the screen display use the ▼▲ keys

Fig 16 shows the measurements relating to cursor 2 and its position within the Voltage and Current waveforms

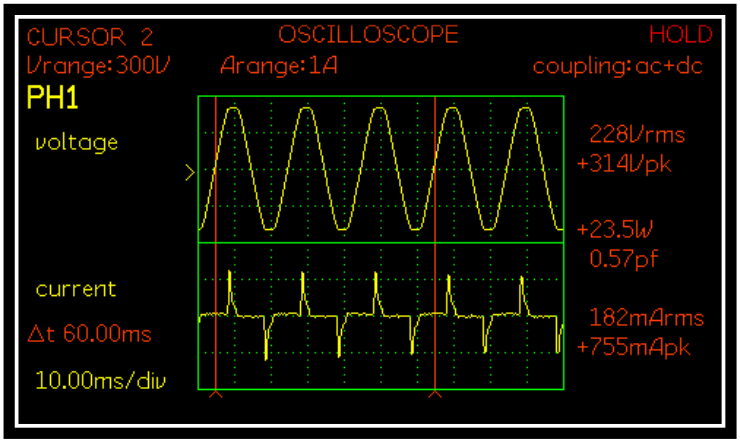


Fig 16

Viewing both Fig's 15 & 16 above and looking at the measurements from the Voltage waveform we can see that by setting both cursor 1 and cursor 2 to encompass an integral number of cycles the Vrms value is the same as in the "POWER" mode

It is important to remember that an **integral** number of cycles are required (within the cursors) in order for the instrument algorithms to output correct results

7 Datalogs including transfer to a USB Memory stick

Datalogs can be stored to the PPA RAM or directly to a USB memory stick. Datalogs saved to RAM can later be transferred to a USB memory stick.

This section explains the procedure for setting up and running a datalog. The procedure for exporting the datalog from internal RAM to a USB memory Stick is then described.

It is recommended to use N4L USB sticks.

1. Setup Datalog (DATALOG MENU)

Press the datalog button on the front panel.

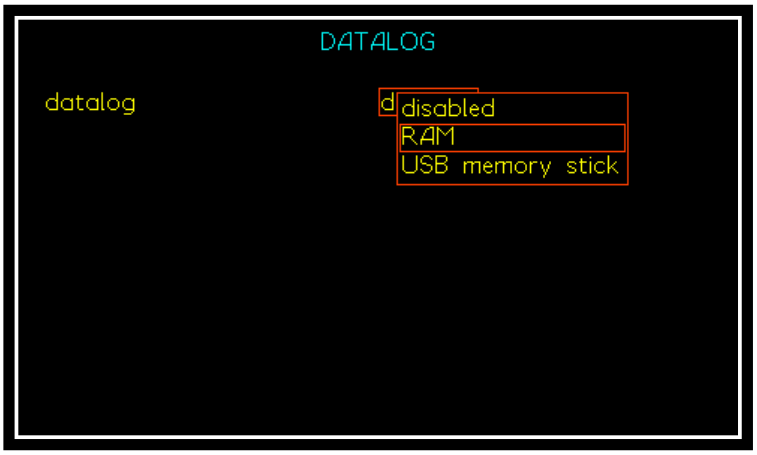


Fig 17

Use the ▼ key to step down to datalog.

Select either RAM or USB memory stick from the drop down menu.

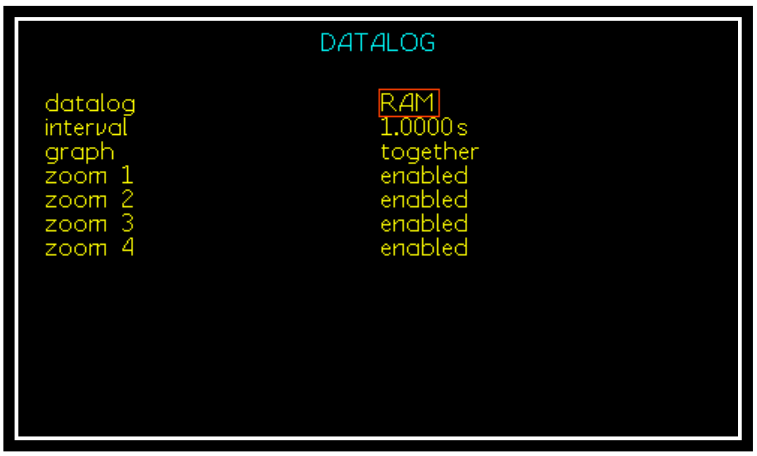
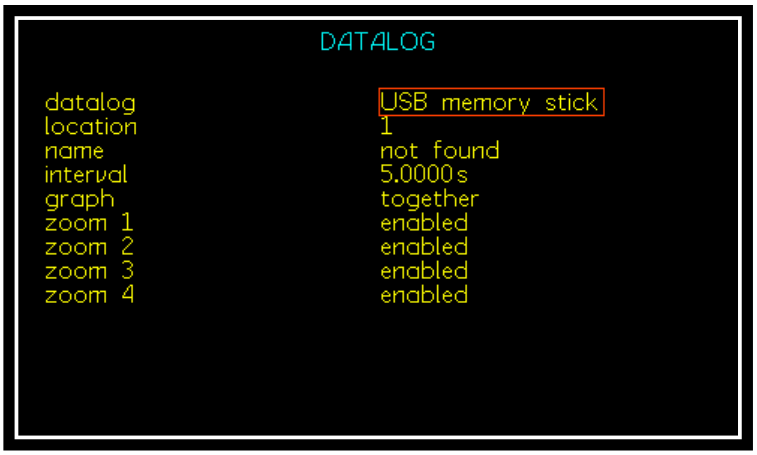


Fig18

When the RAM option is selected: Use the ▼ key to step down to “interval” and enter the time between datalog measurements.



When the USB memory stick option is selected:

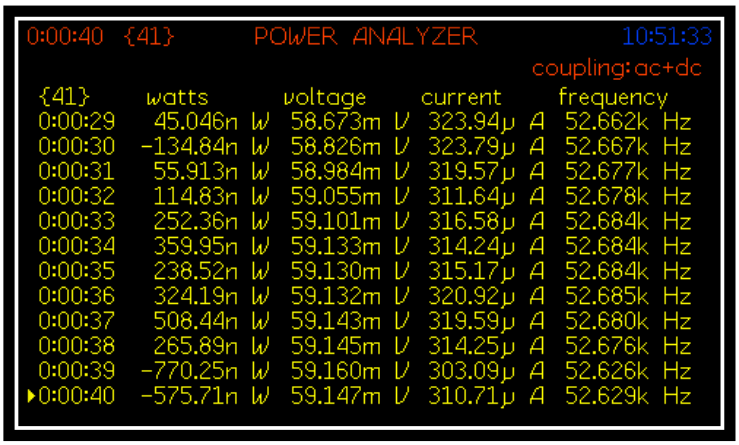
Use the ▼ key to step down to “location” and the number of the location on the memory stick where the datalog is to be stored.

Fig 19

Use the ▼ key to step down to “name” and give the location a name.

Use the ▼ key to step down to “interval” and enter the time between datalog measurements.

2. Starting / Stopping the Datalog.



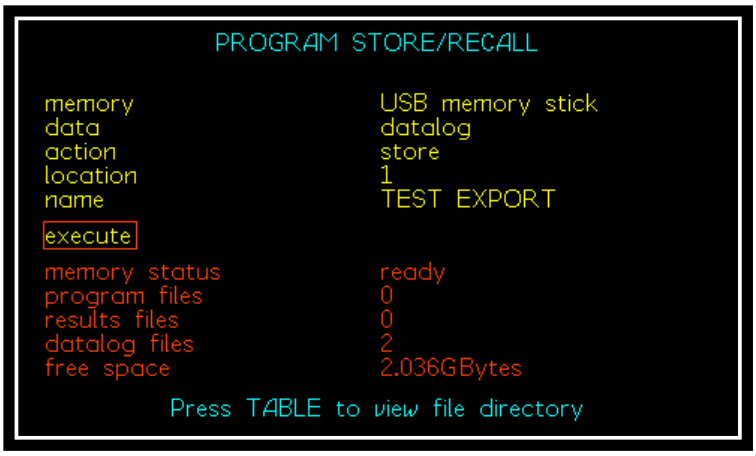
Press the start button on the front panel of the PPA to start the datalog.

Press the Stop button to end the datalog.

Fig 20

3. Store Datalog to External USB Memory Stick

To store the Datalog to a USB stick, press the PROG button on the front panel.



Use the ▼ key to step down to “memory”. Select USB memory stick from the drop down menu.

Use the ▼ key to step down to “data” and select datalog from the drop down menu.

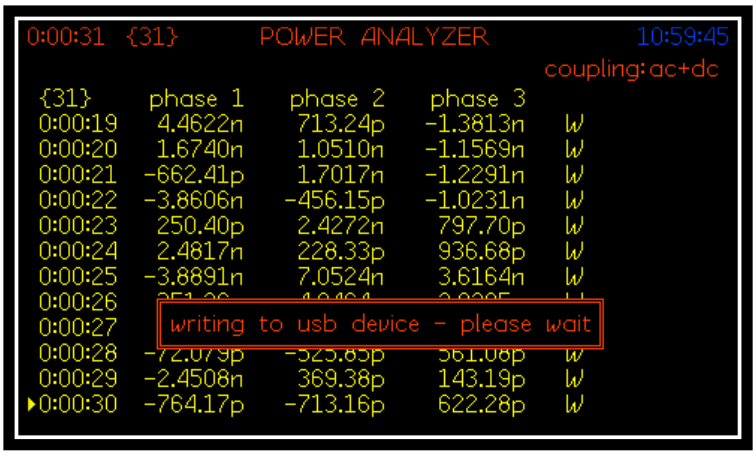
Fig 21

Use the ▼ key to step down to “action” and select store from the drop down menu.

Use the ▼ key to step down to “location” and the number of the location on the memory stick where the datalog is to be stored.

Use the ▼ key to step down to “name” and give the location a name.

Use the ▼ key to step down to “execute” and then press “Enter”

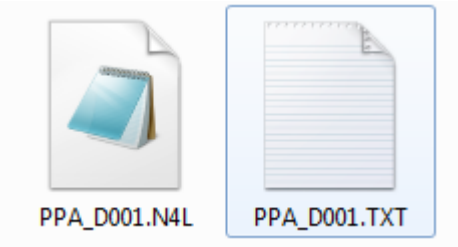


The datalog will then be transferred to the USB stick.

The message will be displayed during transfer but will disappear once the transfer is complete.

Fig 22

4. Locate file on memory stick, the file format will have a .txt extension



D001 represents “location 1” as specified in item 3 above.

5. NOTE: Data presented within the .txt file for time will be displayed as a fraction of an hour, to convert this data back into real time the user will need to multiply the data by 3600 (seconds within an hour)

8 Repair / Recalibration

In the event of any problem with the instrument, during or outside of the guarantee period, contact your local representative

Newtons4th Ltd offer a full repair and re-calibration service

It is recommended that the instrument be re-calibrated annually

Contact details:

1 Newtons4th Ltd
30 Loughborough Road
Mountsorrel
Loughborough
LE12 7AT
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

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

9 Specifications

Frequency Range	
Normal:	DC and 10mHz to 1MHz
x10 mode:	DC and 10mHz to 100kHz

Voltage Input	
Ranges:	Normal - 1Vpk to 2500Vpk (1000Vrms) in 8 ranges x10 mode - 100mVpk to 300Vpk in 8 ranges
Accuracy:	Normal - 0.05%Rdg +0.1%Rng +(0.005% x kHz) +5mV* x10 mode - 0.05%Rdg +0.1%Rng +(0.01% x kHz) +1mV*
External sensor input:	1mVpk to 3Vpk in 8 ranges – BNC connector Accuracy 0.05%Rdg +0.1%Rng +(0.005% x kHz) +1µV*

Current Input	
20Arms	
Accuracy:	Normal - 0.05%Rdg +0.1%Rng +(0.005% x kHz) +500uA* x10 mode - 0.05%Rdg +0.1%Rng +(0.01% x kHz) +100uA*
30Arms	
Accuracy:	Normal - 0.05%Rdg +0.1%Rng +(0.005% x kHz) +1A* x10 mode - 0.05%Rdg +0.1%Rng +(0.01% x kHz) +300uA*
External sensor input:	1mVpk to 3Vpk in 8 ranges – BNC connector Accuracy 0.05%Rdg +0.1%Rng +(0.005% x kHz) +1µV *

Phase Accuracy	
Normal:	10 millidegrees + (10 millidegrees x kHz)
x10 mode:	10 millidegrees + (20 millidegrees x kHz)

Watts Accuracy	
Normal:	[0.1% +0.1%/pf +(0.015% x kHz)/pf] Rdg +0.1%VA Rng
x10 mode:	[0.1% +0.1%/pf +(0.02% x kHz)/pf] Rdg +0.1%VA Rng

40Hz-850Hz Accuracy – V,A and Watts	As above with range error reduced from +0.1%V,A,VA Rng to +0.05%V,A,VA Rng

DC Accuracy	
Voltage:	0.1% Rdg + 0.1% Rng + 10mV (or +2mV in X10 mode)
Current:	
(20Arms)	0.1% Rdg + 0.1% Rng + 1mA (or +200µA in X10 mode)
(30Arms)	0.1% Rdg + 0.1% Rng + 3mA (or +600µA in X10 mode)
External sensor input:	0.1% Rdg + 0.1% Rng + 10µV

Total Harmonic Distortion (THD) Accuracy

$$THD + THD\ Error = \left(\frac{1}{h1 + h1\ error}\right)\sqrt{\sum_{i=2}^{i=n}(hi + hi\ error)^2}$$

Voltage:	
Normal:	hi error (Voltage) = 0.05% hi rdg + 0.1% rng + 0.005% * KHz + 5mV
x10 mode:	hi error (Voltage) = 0.05% hi rdg + 0.1% rng + 0.01% * KHz + 1mV
Current:	
20A Normal:	hi error (Current) = 0.05% hi rdg + 0.1% rng + 0.005% * KHz + 500uA
20A x10 Mode:	hi error (Current) = 0.05% hi rdg + 0.1% rng + 0.01% * KHz + 100uA
30A Normal:	hi error (Current) = 0.05% hi rdg + 0.1% rng + 0.005% * KHz + 1A
30A x10 Mode:	hi error (Current) = 0.05% hi rdg + 0.1% rng + 0.01% * KHz + 300uA
External Sensor Input:	
	hi error (Voltage) = 0.05% hi rdg + 0.1% rng + 0.005% * KHz + 1uV

Common Mode Rejection
Total Common Mode and Noise effect on current channels
Applied 250V @ 50Hz – typical 1mA (150dB)
Applied 100V @ 100kHz – typical 3mA (130dB)

Datalog	
Functions	Up to 4 measured functions user selectable (30 with optional PC software)
Datalog window	From 10ms with no gap between each log
Memory	RAM up to 16,000 records

General	
Crest factor	Voltage and Current – 20
Sample rate	Real time no gap - 1Ms/s on all channels
Low power accuracy	Compliant with IEC62301 using internal shunt Refer to low power measurement application note
Remote operation	Full capability, control and data
Application modes	Ballast Inrush Standby Power Calibration

Ports	
RS232	Baud rate to 38400 – RTS/CTS flow control
LAN (option L)	10/100 Base-T Ethernet auto sensing RJ45
USB	USB device – 2.0 and 1.1 compatible
Extension	N4L accessory port
Aux	N4L auxiliary port

Physical	
Display	480 x 272 pixel 4.3” colour TFT
Size	91H x 213W x 313D mm – excluding feet
Weight	3.6kg – 1 phase; 4kg – 3 phase
Safety isolation	1000V rms or dc – category II
Power supply	90-265 rms 50-60Hz 35VA max

* measured fundamental value

10 Comparisons

Model	PPA15xx	PPA45xx	PPA55xx
Item			
USB Port on front	Y	Y	Y
Colour Display	Y	Y	Y
Speed and Torque Standard	N	Y	Y
GPIB, LAN Standard	N	N	Y
IEC61000 Standard	N	N	Y
Current Options	20, 30	10,30,50	10,30,50
Bandwidth	1MHz	2MHz	2MHz
V&I Accuracy	0.05 + 0.1	0.03 + 0.04	0.01 + 0.038
W Accuracy	0.1 + 0.1	0.04 + 0.05	0.03 + 0.02
PWM Mode	N	Y	Y
Transformer Mode	N	Y	Y
Minimum Window Size	2ms	10ms	2ms
Scope	Y	Y	Y
Harm order	50	100	417
PWM Filter options	NA	7	7
Internal Datalog	16000 records	16000 records	10M records
Internal logging parameters	4	16	16
TTV 105		N	
Harm comp/sec	300	600	1800
Range	8	8	9
Internal Memory	192kB	200MB	1GB