

## Precision Power Analyzers

KinetiQ

### **UPDATE!**

FEB 2016 PPA5500: Transformer Edition **PPA5500-TE** 

NOV 2015 PPA5500: IMPROVED POWER ACCURACY 0.02%rdg + 0.01%rng

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## PPA4500 Series PPA5500 Series





Leading wideband accuracy	Basic 0.01%(PPA5500) with class leading high frequency performance
Wide frequency range	DC, 10mHz to 2MHz
Fast sample rate and No-Gap	2.2M samples/s
Leading phase accuracy	0.005 Degrees plus 0.01 degrees per kHz (0.003 Degrees - Transformer Edition)
Built in high precision current shunt	10Arms, 30Arms or 50Arms with up to 1000Apk direct plus a wide range of external sensors
Versatile interfaces	RS232, USB, LAN, GPIB as standard (PPA5500) plus direct torque and speed
Range of PC software options	Remote control, monitoring and recording of real time data, tables and graphs
PWM Motor Drive Measurements	Highest performance Analyzer on the market for PWM Motor Drive Evaluation
External Voltage BNC Connector	Unique External BNC connector with high sensitivity to interface with external High Voltage Probes

# PPA5530 Precision Power Analyzer



#### **② FRONT USB PORT**

USB memory port allows data or screendumps to be saved directly to a USB pen drive

#### **③ DISPLAY SCREEN**

White LED backlight colour TFT display with high contrast and wide viewing angle

#### **4 SCREEN DISPLAY OPTIONS**

Zoom, Real time, Table and Graph options

#### **5 MEASUREMENT FUNCTION SELECTION BUTTONS**

- POWER ANALYZER
- POWER INTEGRATOR
- HARMONIC ANALYZER
- TRUE RMS VOLTMETER and AMMETER
- IMPEDANCE METER
- OSCILLOSCOPE



Measurement Mode Contro

#### **6 MEASUREMENT SETTINGS BUTTONS**

Acquisition settings - Sets wiring configuration,

Smoothing and data logging

Coupling - Set coupling to AC, DC or AC+DC, also set bandwidth

Range - Internal or external attenuator, autoranging settings, scale factors

Application mode - PWM, ballast, inrush current, power transformer, standby power, IEC61000 (PPA5500)

Plus direct configuration of - Alarm, Auxiliary, Remote, System and Program functions

#### **⑦ MENU SELECTION AND CURSOR CONTROL**

#### **⑧** START, STOP, ZERO AND TRIGGER

Trigger button refreshes measurement, Zero resets datalog or allows an offset trim Start and Stop buttons provide manual control of a measurement period

### **REAR VIEW**



#### **9 PHASE INPUTS**

Direct voltage Input: 3kVpk (1kVrms) in 9 ranges\* Direct current Input: 300Apk (30Arms) Standard Model, 30Apk (10Arms) Low Current Model, 1000Apk (50Arms) High Current Model

External voltage and current sensor inputs to 3Vpk in 9 ranges\* - BNC Connector

#### **10 SYNC CONNECTOR**

All PPA models can offer up to 12 phase analysis using the PPALoG PC program Additionally two PPA45/5530's can be connected via the extension port and sync BNC connector to form a 6 phase analyzer when a PC is not available

#### **11 EXTERNAL SENSOR INPUTS**

+/-10V or pulsed input from torque and speed sensors provides direct measurement of mechanical power + analogue output

#### **12 PC INTERFACE CONNECTIONS**

Standard interfaces RS232 + USB + LAN + GPIB (Standard on PPA5500, LAN + GPIB optional on PPA4500)

#### **13 LOW NOISE COOLING FANS**

Air bearing low noise fans are utilized to ensure minimum audible and electrical noise while maintaining a stable operating temperature for the high precision low inductance internal current shunts

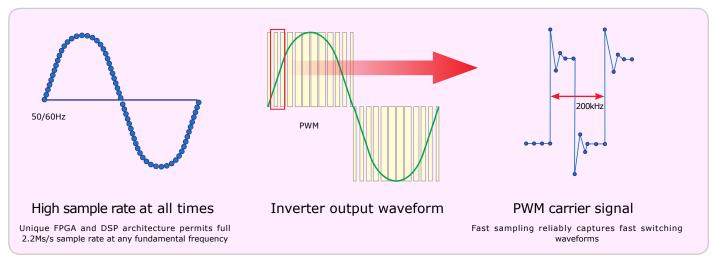


\*PPA4500 - 8 ranges

## **FEATURES**

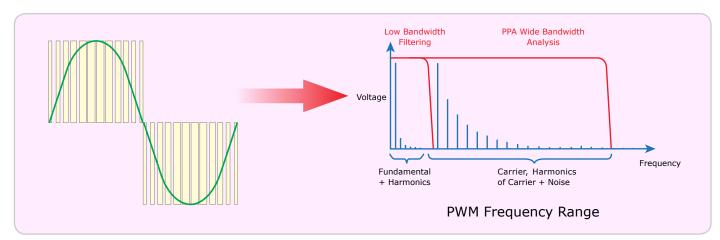
### High Speed Power Measurement - 2ms\* Datalog Interval PPA5500 PPA4500

Measurements include all frequency components in power waveforms for example, fundamental, harmonics of the fundamental and the carrier of a PWM inverter output by maintaining 2.2Ms/s sampling at any drive frequency \*\*PPA4500 10ms datalog interval



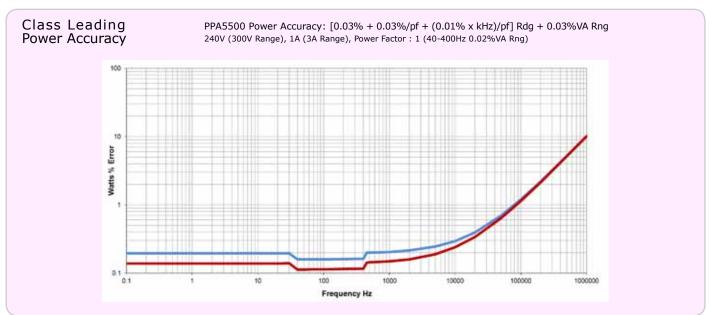
### 2MHz Wideband Frequency Response PPA4500 PPA4500

With 2MHz bandwidth and exceptionally flat response, the PPA provides precision analysis of total power in applications such as lighting ballasts or PWM drives that involve a wide range of frequency components. Proprietary to N4L, a digital process called Expanded Nyquist Sampling ensures no alias components



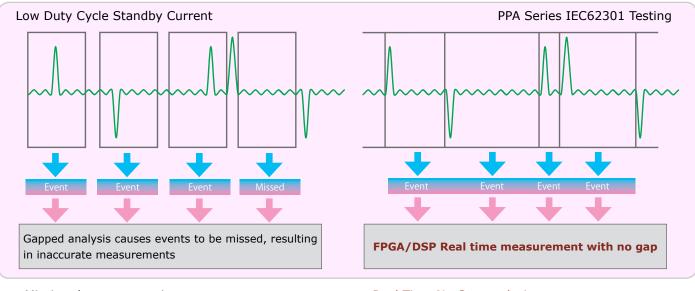
## High Accuracy PPA5500 PPA4500

Unique voltage and current analogue card design ensures high accuracy for both power and harmonic analysis



### DFT Real Time No Gap Analysis PPA5500 PPA4500

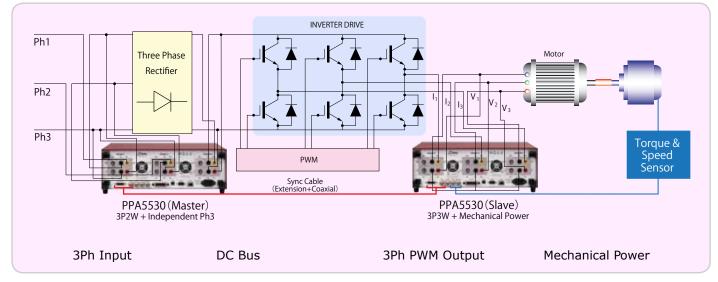
Many power applications have fast changing asynchronous current pulses which are not suited to fixed data length FFT analysis. The PPA series combine a real time DFT (Discrete Fourier Transform) technique with variable window no gap analysis to ensure the optimum speed and accuracy at all times



- Missing data compromises power accuracy
- Long term measurement integration achieves approximately correct average power
- Real Time No Gap analysis ensures correct
   power measurement
- Simultaneous fundamental and pulse frequency synchronization quickly obtains the correct power

#### Up to 6 Phase Analysis PPA5500 PPA4500

Master/Slave mode enables two PPA45/5530's to be fully synchronized into a single 6 phase measurement system \*4 or more phase measurements provided via N4L PC software or master slave mode



#### Advantages of Dual PPA vs Single instrument

- Twice the processing power as one unit
- Flexibility between different applications
- Units fully synchronized giving single point of control

#### Measurement parameter examples

- Input/Output power measurement
- Efficiency of the inverter
- Inverter output voltage harmonics
- Motor drive characteristics



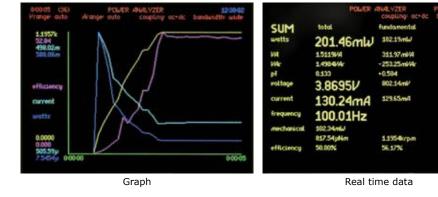
## FUNCTIONS

## Input Torque and Speed Sensor PPA5500 PPA4500

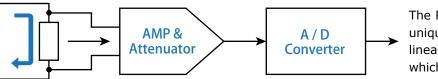
Direct measurement of torque and speed from dedicated inputs that are fully synchronized with the voltage and current channels permits true real time power conversion efficiency to be evaluated



①TORQUE Bipolar±10V / pulsed
 ②SPEED Bipolar±10V / pulsed
 ③ANALOGUE Analogue output of selected function ±10V



## Built in Amplifier and Unique Shunt Resistor PPA5500 PPA4500



The PPA series use a single shunt resistor unique to N4L that combines exceptional linearity and no need for relay switching which can cause measurement errors

Model	Low Current Model Standard Model		High Current Model
PPA5500	9 ranges: 3mApk - 30Apk (10Arms)	9 ranges: 30mApk - 300Apk (30Arms)	9 ranges: 100mApk - 1000Apk (50Arms)
100mΩ Shunt		10mΩ Shunt	3 mΩ Shunt
PPA4500	8 ranges: 10mApk - 30Apk (10Arms)	8 ranges: 100mApk - 300Apk (30Arms)	8 ranges: 300mApk - 1000Apk (30Arms)
PPA4300	100mΩ Shunt	10mΩ Shunt	3mΩ Shunt

#### External shunt options

(DC  $\sim$  1MHz, 0.1% Accuracy, Inductance<1nH)

	, 0.1 % Accuracy	, inductance < 1			
Model	Maximun	n Current	Bandwidth	JEN4L	
Model	Rated A	Peak	Danuwiuun	Information Constant Toward	
HF500	500Arms	5000Apk		Conservation Conservation	٠.
HF200	200Arms	2000Apk		Children and Sharrows	
HF100	100Arms	1000Apk	$ m DC \sim 1 MHz$	CE	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
HF020	20Arms	200Apk			
HF006	6Arms	60Apk			
HF003	3Arms	30Apk		HF003	HF500



#### Power Analysis PPA5500 PPA4500

## Any parameters can be enlarged with the zoom function

PH1	Arange: 30A total	fundamental	bondwidth wid	Vrange: 300V	POWER ANALYZER Arange: 30A coupling: ac+do	16:26:42 bandwidth: wide
watts	3.2513kW	3.2510kLJ		PH1		
VA VAr	3.2513kVA 1.0000VAr	3.2510kl/A 3.1755ml/Ar		total watts	3.2513k	ω
pf voltage	1000 111.13V	-1.000 111134/	+000.00"	rms voltage	111.13	ν
current	29.257A	29.256A	-360.00*	Polloge		
frequency	59.895Hz			rms current	29.257	A
H3	-252.97nLJ	-0.000%			20.201	
dc watts V ph-ph	148.76mW 157.15V	15.831 <i>m</i> V	-000.24	frequency	59.895	Hz

Zoom function enabled on total watts, rms voltage, rms current and frequency

	POL	VER ANALYZER coupling: ad	t+dc bandwidth	6:26:44 wide
	phase 1	phase 2	phase 3	
watts	3.2514k	3.2566k	3.2748k	ω
VA	3.2514k	3.2566k	3.2748k	VA
VAr	1.7321	1.7321	2.0000	VAr
pf	1.000	1.000	1.000	
Vrms	111.13	111.11	111.48	V
Arms	29.257	29.309	29.376	A
frequency	59.895			Hz
H3	-0.000	0.000	0.000	*
dc watts	148.52m	147.88m	150.44m	ω
₽ ph-ph	157.15	157.40	157.41	V

All power measurement and RMS values are computed simultaneously allowing measured values to be selected and viewed during analysis

Here, three phase total power is selected with all primary power functions in each phase plus frequency, a selected harmonic, dc watts and phase to phase voltage

Mechanical power, Maths and Efficiency functions can also be added to this screen giving real time analysis of electrical or electrical to mechanical systems

3 Phase analysis display selectable in both Total and Fundamental values

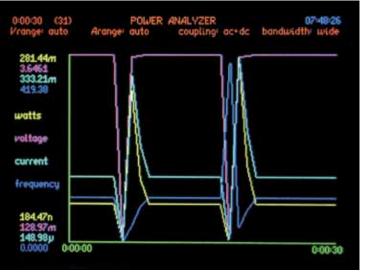
#### MEMORY

Large 1GB (PPA5500 series) internal memory, data logging from 2ms intervals with synchronization to the fundamental frequency and no gap between measurements

Datapoint storage up to 10M in the PPA5500 series

Alternatively the data can be stored in an external USB pen drive or directly to PPALoG PC software

Voltage, Current, Frequency and Power - Examples of graph mode



Trend analysis

## Power Integrator (power consumption) Mode, RMS Meter Mode and

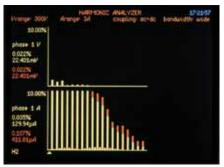
Impedance Meter Mode PPA5500 PPA4500

00244	POLA	coupling of	-dc bondwidt	b uide	Pranse 2002	TRUE Rons MOLT	ALTER 17044 ing scrdt bandwidth wide		1797	EDANCE METER	erde bandusis	
W hours We hours pi eng pi eng K eng K hours	2.9979m 15.790m 1546= 0.190	3.1055m 15.862m <sup>35556</sup> 0.196 1986 4.4203m	3.3086n 16.477n 56.85m 0.201	11 MA.	PH1 rms dc cc profit crivet factor runge rectifiled immon form factor threaemog	+41564 104.25U 37.02449 24.25V 24.25V 24.25V 24.25V 24.25V 24.00 24.00 24.00 25.0504z	550.07mA 78237p4 50007m4 -1954 383 -20984 2843m4 2843m4 2867	impedance resistance resctance phase frequency	2048 1 343.9 2048 -7654 -61326 41394	phose 2	phone 3	
	Power In	tegrator m	node		R	MS Voltmeter	mode	I	impedanc	e meter n	node	

#### Note

In addition to detailed measurements of the phase power parameters, you can check the balance of power between the phases and observe computed neutral current when 3 phase 4 wire connection is selected

#### Harmonic Analyzer and Oscilloscope PPA5500 PPA4500



Harmonic analyzer (Bar graph)

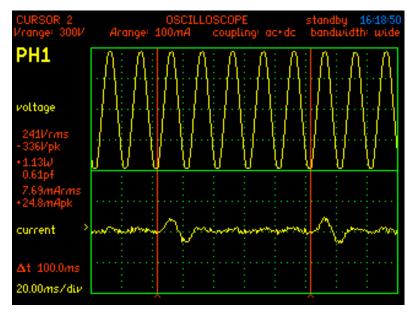
Oscillosope - Voltage and Current display

Three phase display of voltage or current



Wonger 3004	Aranger	WRHICKED 34	ANALYZER COUBLING SC+ SC	bandwidthy wide
PH1	andb		DATE	mt
	104.06/	100.0%	361.81/44	100.01
2	66-940mil	0.06-04	1.0017 (144	0.2 90%
2	106864	1.027N 0.058N 0.783N	315.02 m4	90.00%
	60.454 mil	0.058 %	1.2036/64	0.335% 83.14% 9.442%
	814.55/16	0.78356	243.55m4 1.7566m4	83.1456
1	59.873mW		1,7168/m4	0.442%
6	111144	0.058N 1.071N 0.047N	12627 mA	70.85%
	1.1544 48.725#5 264.27#5/ 45.601#6/	0.04074	1262/ m/s	0.595%
10	and full and	0.044	97.590mA 1.2786mA	55,75%
11	455.45.46	0.254% 0.044% 0.028% 0.028%	65 228 mA	0.700% 42.16%
12	28.432/14	0.02856	1.1443.m4	0.74056
	363.67.44	0.350%	62 921/04	29.115
54	17.174.mb	0.057%	10905mil	0.70506
35	2957 4/4	0.275%	60.453 m/s	20.20%
55	10224-6	0.05856	1.4858 mA	0.626%
17	228.83-6/	0.220%	48.063 m4	15.01%
0304532	16.673M	0.016%	1.3997 mil	0.55356
13	14815-6	0.142%	37 543 44	12.2406

Harmonic analyzer table



Oscillosope Cursors - Enable cursors and display Vrms, Vpk, Watts, Power Factor, Arms and Apk

#### Note

In Harmonic Analyzer Mode, the PPA4500 provides up to 100 Harmonics with real time, table or bar graph presentation. Measurements are in absolute magnitude and percentage of fundamental with harmonic phase also available. The PPA5500 extends the harmonic range to 417 for aerospace applications and also includes a DFT based interharmonic analysis mode for aircraft standards testing (TVF105)

#### Harmonic analyzer summary page

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## ACQUISITION SETTINGS

## Auto-Ranging, Range Up Only or Manual PPA5500 PPA4500

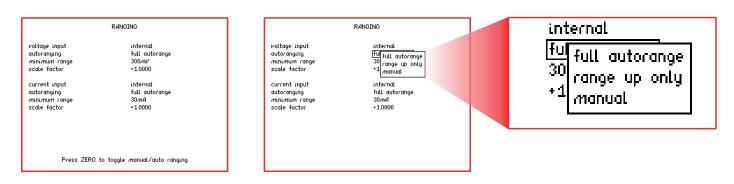
#### Range modes are selectable

1 Auto-Ranging

Performs automatic switching of voltage and current ranges up and down depending on the level of the measured value with all inputs linked or ranged independently to ensure optimum accuracy Performs automatic ranging when the input is 120% of range, ranging up only

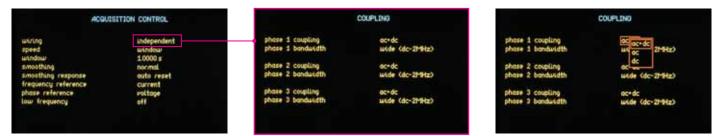
2Range up only3Manual

No automatic ranging, user specifies the range in which to operate (used when input voltages and currents are known) or during inrush current testing



### Independently Set Input Coupling PPA5500 PPA4500

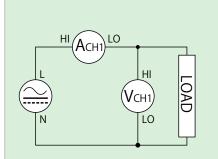
Independently set input coupling so different methods of sensing can be implemented. Such as a CT on phase 1 and shunt sensing on phases 2 + 3

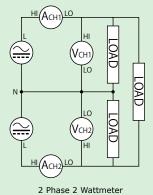


### Wiring Settings PPA5500 PPA4500

wiring speed smoothing smoothing response frequency reference phase reference low frequency	ind single phase 1 me 2 phase 2 wattmeter no 3 phase 2 wattmeter au 3 phase 3 wattmeter vo single phase 2 vo single phase 3 of 3 phase 2 wattmeter + PH3 independent
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Various wiring arrangement settings to satisfy a complete range of setups found in power analysis





3-phase 3 Wattmeter(Reference to neutral)

## ACQUISITION SETTINGS

### Bandwidth Settings PPA5500 PPA4500

DC(DC-5Hz) Low(DC-200kHz)

Wide(DC-2MHz)

#### DC measurements up to 5Hz Basic power (50/60Hz) including harmonics of the fundamental while rejecting high frequency noise Wideband applications such as PWM inverter drives including all power components for true total power



Example of independent wiring configuration showing 3 phase individual coupling settings

Note

The PPA45/5500 series includes a programmable digital filter that allows users to set a preferred bandwidth

## Display Settings, Smoothing Response and Frequency Reference PPA5500 PPA4500

#### ①Display update rate

Various settings for the display update rate ( $2ms \sim 100s$ ) which also increases the smoothing when used together with the smoothing option. A 'window' option permits direct control of the measurement window size (Note: Minimum window size for PPA4500 - 10ms)

#### ②Smoothing settings

Working in conjunction with the speed setting, a smoothing filter can then be applied to the measurements. Normal and slow options are available which apply an increasing time constant to the output of the measurement window

ACOUT	SITION CONTROL
wiring speed window smoothing smoothing response frequency reference phase reference low frequency	independent if yery stow ff stow ne medium of fast re lukindow of

ACQUI	ISITION CONTROL
wiring speed smoothing response frequency reference phase reference low frequency	3 phase 3 wattmeter medium no normal vo slow vo none vorrage off

ACQUI	SITION CONTROL
wiring	independent
speed	window
window	1.0000 s
smoothing	normal
smoothing response	outo reset
frequency reference	current
phase reference	voltage
low frequency	att

Example of setting the window, eg (50Hz set to 20ms)

speed	update rate	normal time constant	slow time constant
Very Fast	1/80s	0.05s	0.25
fast	1/20s	0.2s	0.85
medium	1/3s	1.5s	6s
slow	2.5s	12s	48s
very slow	10s	48s	192s

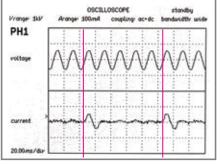
Display update speed settings

Setting the filter (normal/slow)

#### Frequency Reference PPA5500 PPA4500

When making a precision measurement of ac power, correct synchronization with the fundamental frequency is essential. The PPA series provides a solution to frequency synchronization in a wide range of applications including Standby Power, Variable Speed Drives, Electronic Ballasts and DC to AC Inverters with the option to select voltage, current, speed or ac line input as the frequency reference. The PPA45/5500 series also provide fully independent frequency detection an all phase inputs





1:5 cycle (10Hz standby current period) Power measurements synchronized to low duty cycle current pulses of a power supply in standy mode

Vrangei 300V	POWER Arange: \$100mA	ANALVZER coupling: ac+c	standby ic bandwidth wide
PH1	total.	fundamental.	
watts	1.3360W	1.33236/	
104	2.09551/4	1.3323694	
19Ar	1.6138Wer	2.6926-mM/4r	
pł	0.638	-1.000	
voltage	244,764	244.536/	+000.00*
current	8.5597mA	5.4486-mA	-359.80*
frequency	50.071Hz		10.014Hz
H2	211.88yW	0.016%	
dc watts	-2.1145µW		

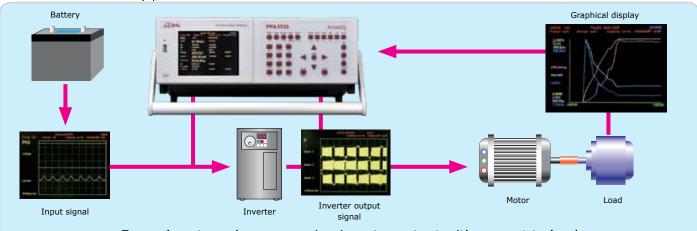
1:5 duty cycle standby power measurement cycle

/ranse: 300/	Aronger 100mA	coupling: dc+r	standby ac bandwidth wide
PH1	total.	fundamental	
watts	628.64mW	626.74HW	
1VA	926.50mi/4	626.75m94	
194e	680.59mi/4r	2.088%mi/Ar	
pf	0.679	-1.000	
voltage	244.562	244.439	+000.00*
current	3.7884mA	2.5642mA	-359.81*
frequency	50.105Hz		1.0021Hz
H3	93.046pW	0.015%	
dc watts	-601.00mb/		

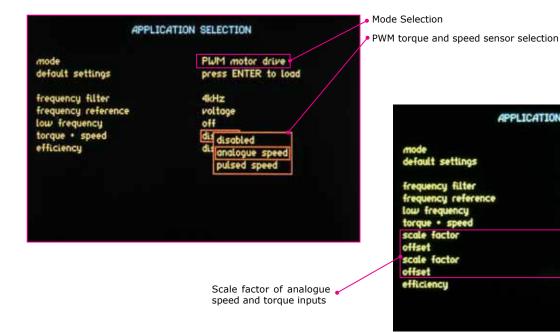
1:50 low duty cycle (1Hz) power measurement

## Application Modes PPA5500 PPA4500

In addition to the usual power measurements, various modes are pre programmed into the instrument including "PWM motor drive", "ballast lighting system", "inrush current", "power transformer", "Harmonics and Flicker\*", \*PPA5500 only "TVF105\*" and "standby power"



Example setup when measuring inverter output with respect to load



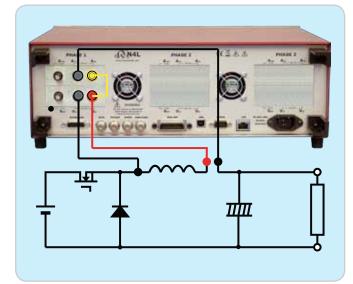
PIJM motor drive press ENTER to Load

current off gue speed +0.0000 V qn 00 -0.0000V mechanical / sum

APPLICATION SELECTION

## Inductance Loss Analysis PPA5500 PPA4500

An example of analysis of dynamic inductance losses

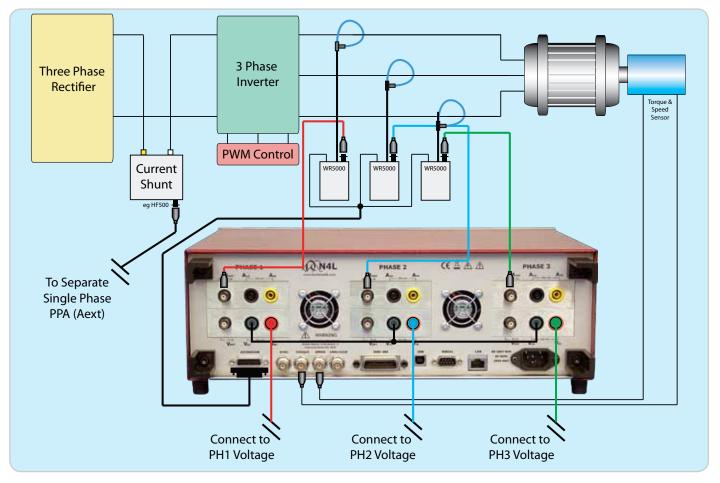


/range: 301/	Arange 300mA	coupling ac+dc	bandwidth wide
PH1	total	fundamental	
watts	23.813mW	11.320mW	
VA	325.76ml/A	193.59ml/A	
VAr	324.89ml/Ar	-193.26ml/Ar	
pŧ	0.073	•0.058	
voltage	3.6878V	2.28991/	+000.00*
current	88.335mA	84.539mA	-086.65*
frequency	30.000kHz		
H3	4.9618mW	43.83%	
dc watts	68.838 July		

Real time data

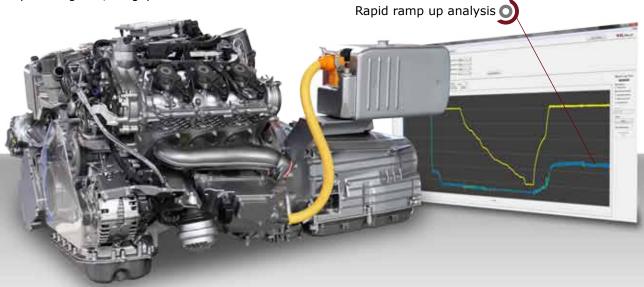
## PWM Motor Drive Evaluation PPA5500 PPA4500

The PPA5500 is the perfect solution for Inverter Drive evaluation and analysis. Utilising proprietary digital filtering algorithms, the N4L power analyzer range offers unrivalled performance. The PPA5500 can be used in conjunction with external current sensors such as the WR5000 - a 1MHz 5000A Rogowski Coil in high current applications. Inverter efficiency is available via either 3 Phase 2 Wattmeter method + CH3 (utilising CH3 for the DC Bus measurement). Alternatively a second single phase PPA can be connected to the DC Bus and the two analyzers are configured in a Master Slave arrangement, all data is available via N4L Software.



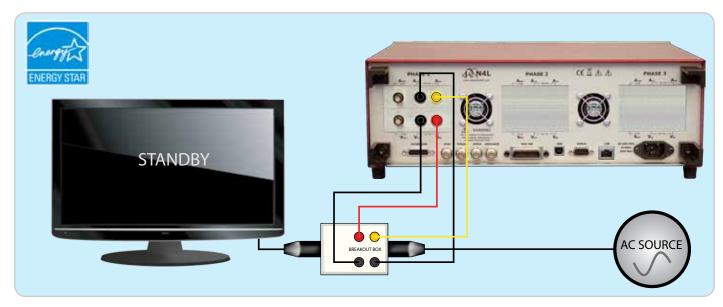
## High Speed Analysis PPA5500

The PPA5500 features the fastest signal processing on the market, this enables high speed tracking of changing inverter drive frequencies and power parameters during ramp up and ramp down conditions, for example in electric vehicle applications. N4L's free to download software package (PPALoG) offers datalog intervals down to 5ms, providing fast, no-gap real-time data direct to software.



### Standby Power (IEC62301 Ed 2.0) PPA5500 PPA4500

The PPA4520 and PPA5520 units offer unrivalled dynamic range which enables the user to comply with IEC62301 and Energy Star testing standards. Utilising "Standby Power Mode" the PPA employs proprietary standby power signal processing algorithms to provide accurate no gap analysis of high crest factor (CF) signals, importantly the entire N4L power analyzer range benefit from a guaranteed accuracy specification up to a crest factor of 20.



### Guaranteed Accuracy up to Crest Factor 20 PPA5500 PPA4500

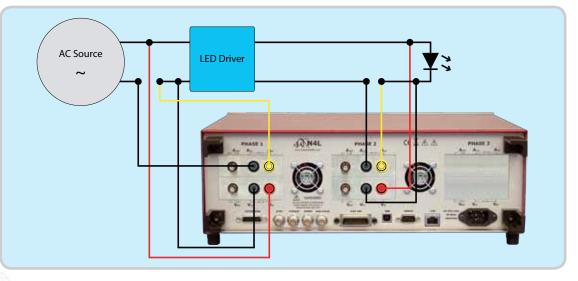
As stated in IEC62301, typical standby power current waveform crest factors can exceed values of 10. In such cases it is important for the Power Analyzer to guarantee accuracy at crest factors expected of the application under test.



Newtons4th are the only Power Analyzer Manufacturer in the world\* to provide ISO17025 calibration certificates on all new Power Anlayzers as standard. Our ISO17025 Schedule of Accredition includes Voltage, Current, Phase, Power, Harmonics and Flicker. With traceable certification of power accuracy down to 0.5W, N4L offer the ideal measurement solution for certified standby power measurement.

#### LED Driver Efficiency PPA5500 PPA4500

The PPA4520 and PPA5520 offer an ideal solution for LED driver efficiency measurements, dimming techniques such as reverse phase control are easily analyzed by the N4L Power Analyzers.



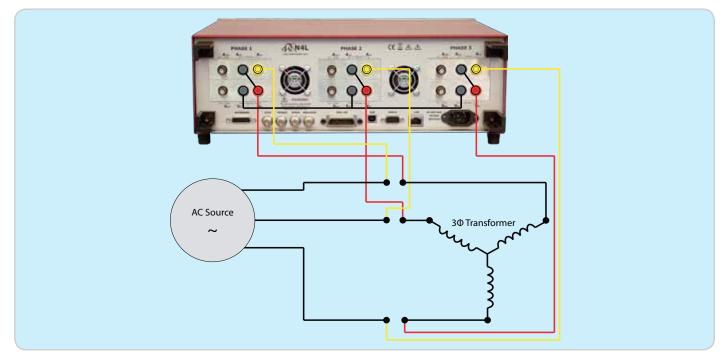
Efficiency can be viewed either directly on the PPA display using the "Phase/Next Phase" efficiency option or calculated in PPALoG software.

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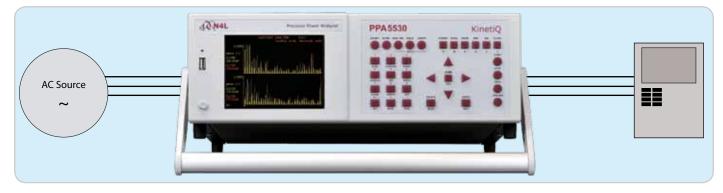
## Power Transformer Loss Testing PPA5500 PPA5500-TE Transformer Edition

Both the PPA4500 and PPA5500 series Power Analyzers incorporate a unique analogue input design and proprietary digital signal processing techniques that exhibit a market leading standard phase accuracy of 0.005°. This inherent phase accuracy is optimised further within the new PPA5500-Transformer Edition to provide an ideal transformer core loss testing solution in accordance with the IEC60076-8 standard. See our separate PPA5500-TE brochure for full specification details including UKAS ISO17025 accredited certification and extended calibration interval.

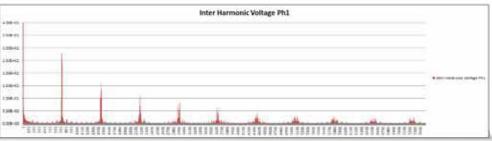


### Aircraft Avionics Industry - 417 Harmonics + Interharmonics PPA5500

The PPA5500, featuring high speed FPGA and DSP processors is able to compute up to 417 Harmonics and also meet interharmonic measurement requirements of ABD0100.1.8. The Harmonic Analyzer mode and special TTVF105 Interharmonic mode in the PPA5500 offer the Avionics Engineer an accurate, simple to use solution.



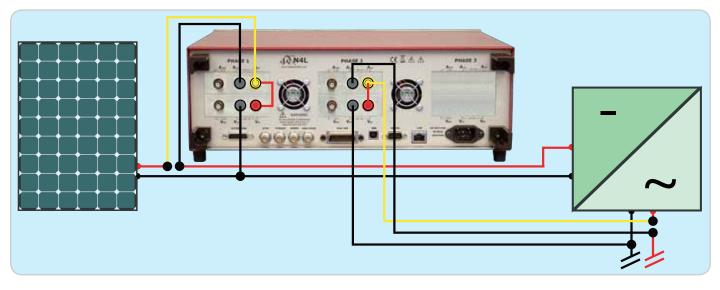
#### Example ABD0100.1.8 Interharmonic Results, up to 150kHz (Sample Waveform analyzed for illustration)



Note: PPA4500 up to 100 Harmonics

## Solar Inverter Performance Analysis PPA5500 PPA4500

The PPA5500 and PPA4500 provide a highly accurate solar inverter analysis and evaluation solution, featuring independant frequency detection N4L Power Analyzers exhibit the ability to synchronise to the 50/60Hz output signal along with with the DC input signal from the solar array. Both efficiency of the inverter, quality of the AC output and many other performance parameters can be recorded.

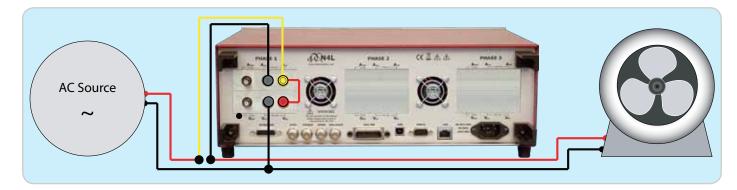


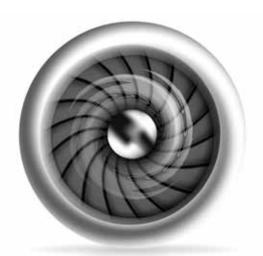
#### Inrush Current PPA5500 PPA4500

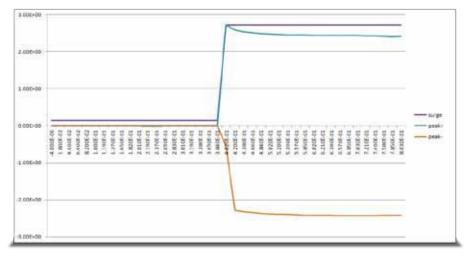
Accurate inrush current measurements rely upon two factors aside from fundamental measurement accuracy, these are gapless measurement and a high sampling rate;

1. Gapless Measurement - Inrush waveforms by their nature are transient; gapless measurement is vitally important in order to ensure that inrush waveform data is not missed.

2. High Sampling Rate - When working with mains frequencies, many power analyzers have low sample rates due to the computation of measured values from a data block of finite size. The PPA4500 and PPA5500 utilise a proprietary real time signal processing technique that maintains full 2.2Ms/s sample rate irrespective of the measured load frequency, ensuring that high frequency events are captured without aliasing.







Example Inrush current data, datalogging at nominally 20ms intervals directly to PPALoG

## Calibration and ISO17025 Certification

#### UKAS PPA5500 PPA4500

Newtons4th are an accredited UKAS Calibration laboratory, all PPA4500 and PPA5500 Power Analyzers are supplied with an ISO17025 UKAS Calibration Certifcate as standard. Calibration of N4L Power Analyzers is an integral and important part of our service to our clients, we offer quick turnaround times at a competitive price. Re-Calibration is also available at our international offices and various distributors throughout the world\*.



#### Schedule of Accreditation PPA5500 PPA4500

N4L's schedule of accreditation to ISO17025 is wide ranging and an overview of the schedule is detailed below, for more specific information please see the UKAS website to view the full accreditation schedule.

	ISO17025 UKAS Accredita	ation Schedule
	Signal Amplitude	Frequency Range
Voltage Sine Amplitude	1V to 1008V	16Hz to 850Hz
Voltage Harmonic Amplitude	0V to 302V	16Hz to 6kHz
Current Sinewave Amplitude	100mA to 48A	16Hz to 850Hz
Current Harmonic Amplitude	0A to 15A	16Hz to 6kHz
Current to Voltage Phase Angle	-180° to +180°	16Hz to 850Hz
Apparent Power (VA Product)	100mVa to 48.4kVA	16Hz to 850Hz
AC Power	0W to 48.4kW	16Hz to 850Hz
Current Harmonic Amplitude to IEC61000-4-7	0A to 6A	16Hz to 6kHz
	Pinst(Sinusoidal Modulation)	
	Pinst(Rectangular Modulation)	
	Pst	
Flicker to IEC61000-4-15	Frequency Changes	As per IEC61000
	Distorted Voltage with Multiple Zero Crossings	AS DEL LECOLOGO
	Harmonics with Sidebands	
	Phase Jumps	
	Rectangular Changes with Duty Cycle	





### Optional PPA5500-E Spec Calibration PPA5500

If the standard accuracy of the PPA5500 is not tight enough for the most demanding of applications, an optional "Extra Calibration" procedure is available which improves the 12 month guaranteed accuracy to 0.01% VArng. The PPA500-E Spec is the only power analyzer in the world to feature 0.01% VArng Power Accuracy.\*\* Specify PPA5500-E\_SPEC\_OPTION when ordering.

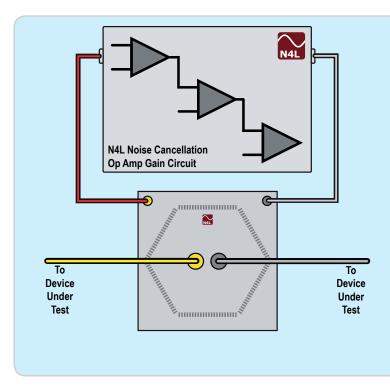
Due to the specialist nature of Power Measurement Instrumentation Calibration, N4L utilise both commercially available calibration equipment (such as the Fluke 6105A for UKAS Certification) along with N4L bespoke designed signal generation equipment in order to calibrate our instruments over the full frequency range (up to 2MHz). Calibration over the full frequency range is uncommon given that such signal generation equipment is not commercially available. When supplied with an N4L analyzer, all customers will receive a calibration certificate covering the complete frequency range.



## **Ranging Principles**

## 9 Stage Solid State Ranging System - PPA5500 PPA4500

Combining highly linear voltage attenuator and current shunt designs with a proprietary 9 stage (PPA5500) or 8 stage (PPA4500) solid state ranging system on every phase input, the PPA series achieve a uniquely wide dynamic range, with no need to switch between voltage attenuators or current shunts when ranging up or down.



#### Design features:

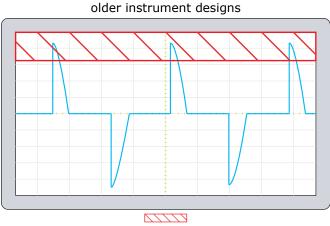
- Single attenuator on each voltage input High impedance low capacitance Single shunt on each current input
  - Low impedance low inductance
- Auto peak detect High speed solid state ranging High Noise rejection
- Auto DC offset trimming

#### Benefits:

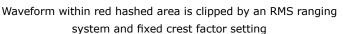
Overload protected on any range Low shunt affect on voltage connections Low voltage burden on current connections Market leading phase accuracy Peak detect ranging ensures no signal clipping Low attenuator/shunt operating temparature Fast range switching Constant frequency response on all ranges Signal can be applied with instrument powered off

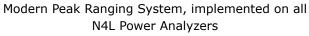
## Auto Peak Ranging Ensures Complete Waveform Analysis PPA5500 PPA4500

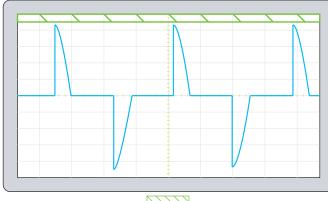
It is often overlooked that for an instrument to correctly calculate power parameters, the entire waveform must be digitised for analysis. The Peak Ranging system employed by all N4L Power Analyzers ensures that the entire waveform is digitised and the correct power parameters are calculated.



Example RMS Ranging system, commonly used in







Peak Ranging system auto-detects the peak of the input signal and selects the ideal range

#### Note

An RMS Ranging system requires the user to have prior knowledge of the crest factor which in many applications is not practical, either because the user cannot reasonably be expected to know this value before a measurement, or because the crest factor is changing during a measurement period. The ideal ranging system is therefore based upon peak detection which does not require the user to be concerned with a crest factor setting. While many RMS ranging systems are only guaranteed to support a Crest Factor of 6, all N4L Power Analyzers guarantee to auto-range with any crest factor and maintain full accuracy with a CF of at least 20. While waveforms with a true CF above 20 are very unusual, 'auto range up' or 'manual' ranging combined with a market leading range sensitivity enables the PPA to achieve a dynamic range equal to a CF >300.

17

## PC CONTROL AND DATA ACQUISITION

#### PC Software PPA5500 PPA4500

Analysis carried out by the instrument can easily be transferred to a PC via USB, RS232 or LAN

① **PPALoG** Exceptional flexibility and ease of use with all the functions included in the orginal PPAcomm program plus multiple instrument control for 4-12 phase applications and data export to Text file, Excel, Bitmap or Clipboard

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a. Measurement parameters are chosen by the user from tick box options b. Real time results can be displayed as latest value, table or graph

c. Datalogging results are then saved in the selected format

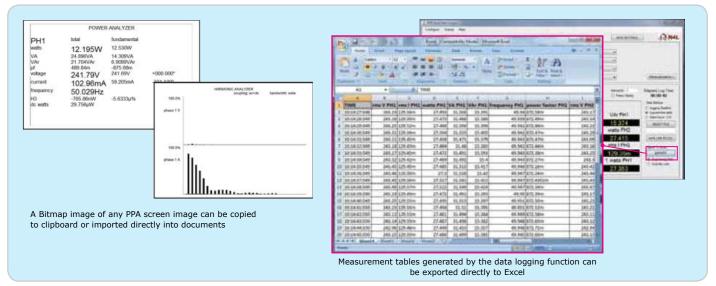
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Capture up to 60 measured functions per line

Simultaneous display of master and slave units

#### Real time Datalog

#### Data Export options



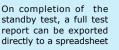
<sup>(2)</sup> **PPA Standby Power** Full compliance testing to IEC62301. Meets or exceeds the requirements and methodology of U.S. EPA (Energy Star), U.S.DOE, California Energy Commission (CEC), among others.



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Standby power test screen with real time update of IEC62301 criteria

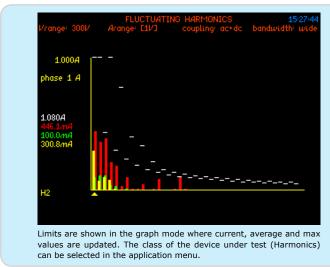
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## PC CONTROL AND DATA ACQUISITION

### Fully Compliant IEC61000-3-2/3-3 Harmonics and Flicker Testing PPA5500

The PPA55xx series Power Analyzers provide fully compliant ISO17025 certified Harmonics and Flicker testing, Newtons4th offer the ability to display the results of many tests within the instrument and all tests to PC software.



PH1	voltage	current
ms	238.53V	177.98mA
frequency	50.000Hz	
weighted fluctuation	-0.059%	
IFS	0.008	0.008
Pst	0.082	0.082
PLt	0.541	12
	D455	
	PASS	

A screen shot can be downloaded to software, alternatively the test can be controlled and monitored in software.

More information is available in a separate IEC61000 Harmonics and Flicker brochure. Dedicated models called the PPA5511 and PPA5531 include low impedance shunts (see \*\* on page 20) and adjusted filter response for full compliance testing.

### Connection Interface PPA5500 PPA4500

RS232 (standard), USB (standard), LAN (standard on PPA5500), GPIB (standard on PPA5500)



### Data Logging PPA5500 PPA4500

Utilizing sophisticated frequency detection techniques, synchronization with the fundamental AC waveform is automatically achieved. Datalog intervals can be set from 2ms with measurements saved to a PC or internal memory.

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## SPECIFICATION

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Image: <td>Current</td> <td></td> <td>0.03%Kdg</td> <td>-0.04%K</td> <td>hig+(0.004%×K12 Kug)+5µV</td> <td></td> <td>0.01%Rug+0.038%Rig+(0.004%×Ri2 Rug)+3µV</td>	Current		0.03%Kdg	-0.04%K	hig+(0.004%×K12 Kug)+5µV		0.01%Rug+0.038%Rig+(0.004%×Ri2 Rug)+3µV	
		input	10Arms Low Current	Ranges	$10$ mApk $\sim 30$ Apk(10Arms) in 8 ranges	Ranges	3mApk ~ $30$ Apk(10Arms) in 9 ranges	
Solves Current length         Renge Solves Current length         Solves Current length         Solves Current length           Marker Solves Current length         Colves Apple Colves Length         Colves Apple Colves Length         Solves Current length           Marker Solves Current length         Renge Solves Current length         Colves Apple Colves Length         Colves Apple Colves Length         Solves Current length           Marker Solves Current length         Renge Solves Current length         Colves Apple Colves Length         Colves Apple Colves Length         Solves Current length           Current solves Current length         Renge Solves Current length         Colves Apple Colves Length         Solves Current length           Current solves Current length         Renge Solves Current length         Solves Current length         Solves Current length           Current solves Current length         Renge Solves Current length         Solves Current length         Solves Current length           Current solves Current length         Colves Solves Current length         Solves Current length         Solves Current length           Current solves Current length         Colves Solves Current length         Solves Current length         Solves Current length           Current solves Current length         Colves Solves Current length         Solves Current length         Solves Current length           Colves Solves Curent length			· /	-	0.03% Rdg+0.04% Rng+(0.004%×kHz	-		
Acture         Acture         Online Mage 2000/A           Some High Current (MNS000-HC)         Manage 2000/A         Acture         0.01% https-0.03% https/0.004% solute Rdg) i 900/A           External Hout (MNS000-HC)         Acture 2000/A         0.01% https-0.03% https/0.004% solute Rdg) i 900/A           External Hout (MNS000-HC)         Acture 2000/A         0.01% https-0.03% https/0.004% solute Rdg) i 900/A           External Hout (Larent External Hout (Larena H	Internal			Ranges	100mApk ~ 300Apk(30Arms) in 8 ranges	Ranges	30mApk ~ 300Apk(30Arms) in 9 ranges	
SMMIP Sign/LCPTPE         0.0% R0g1-0.04% R0g1-0.04% M0g1-0.04% M1         Accuracy         D.0.1% R0g1-0.04% M1         Accuracy           External Input Carent assess         MPC Connector (Max Muture)         Rmga         Smga	Internal		· /		Rdg)+ 300µA			
Clearnel Input (External Input (External Input (External Input)         Connector (New Input 3VDI)         Connector (New Input 3VDI)         Connector (New Input 3VDI)         Respect (Input 3VDI)         Respect 3VDI) <threspect 3vdi)<="" th="">         Respect 3VDI)         Res</threspect>			-	-		-		
Cleaned and part of the part of								
Quines (app)         Quines (app)<	(Externa	l shunt				5		
Bit         0.05depr(0.01depr(0.0		· ·		Accuracy		Accuracy		
Prover Accuracy         See PPA5500-TE Expectification           00.04% +0.05%/pf+(0.01% xkH2)/pf] Rdg+0.04%vA Rog         [0.03%+0.03%/pf+(0.01% xkH2)/pf] Rdg+0.03%vA Rog           04-00hr:         [0.03%+0.04%/pf+(0.01% xkH2)/pf] Rdg+0.03%vA Rog         [0.02%+0.03%/pf+(0.01% xkH2)/pf] Rdg+0.03%vA Rog           Creat Factor         200/voltage and Current)         Sample Rate         201/voltage and Current)           Sample Rate         1EC5200 Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Nush, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Drive, Power Transformer, Standby Power         PDM Motor Drive, Ballast, Drive, Power Transformer, Standby Power         PDM Motor Drive, Standby	A HUSC A	cearacy					s), PPA45/5500(30Arms)]	
Instrument         Instrument         Instrument           40-4001/         Instrument         Instrument         Instrument           6-4001/         Instrument         Instrument         Instrument           6-4001/         Instrument         Instrument         Instrument           6-4001//         Instrument         Instrument         Instrument         Instrument           6-4001//         Instrument	Power A	ccuracy			0.01deg+(0.02deg×kHz	) [PPA45/5500-		
General         20(Voltage and Current)           Sample Rate         1EC23201 Standby Power           LEC Modes         IECEC3201 Standby Power           Application Modes         PWM Motor Drive, Ballast, Innsh, Power Transformer, Standby Power           Application Mode         PWM Motor Drive, Ballast, Innsh, Power Transformer, Standby Power           CRR - Common         Mode Rejection Ratio           200V (© 100kHz - 2 3mA (130dB)           Measurement Parameters           W JA, Var., pf., V & A - rms, rectified mean, AC, DC, Peak, Surge , Crest Factor, Form Factor, Star to Delta Voltage, +ve Pk, -ve Pk           Frequency (Mz), Phase (Geg), Findamentalis, Inngétance           Harmonics, THID, TH, THF, TRD, TDD           Integrated Values, Datalog, Sum and Neutral values           Datalog Unit to start Start Distands           Memory         16,000 records           Datalog Unit to Start Distands         INo-Gap analysis, Minimum window 2ms           Memory         16,000 records         10M records into flash RAM (Non-Wolatile)           Communication Ports         Start Distands         INo-Gap analysis, Minimum window 2ms           Start Distands         USB 2 and 1.1 compatible         (Rited as standard) 1000 Base-T Ethernet auto sensing           Grito         100,010 cese-T Ethernet auto sensing         (Rited as standard) 10000 Base-T Ethernet auto sensing			[0.04%+0.059	%/pf+(0.0	1%×kHz)/pf] Rdg+0.04%VA Rng	[0	.03%+0.03%/pf+(0.01%×kHz)/pf] Rdg+0.03%VA Rng	
Crest Factor         20/Vortage and Current)           Sample Rate         2.2Ms/so mail channels, No-Gap           ER Modes         IEC62301 Standby Power         IEC61000 Harmonics and Flicker, IEC62301 Standby Power           Application Modes         PWM Motor Drive, Ballast, Innush, Power Transformer, Standby Power         PWH Motor Drive, Ballast, Innush, Power Transformer, Standby Power, PWH Motor Drive, Ballast, Innush, Power Transformer, Standby Power, PWH Motor Drive, Ballast, Innush, Power Transformer, Standby Power, Application Modes           CMRR - Common         -         250V @ 50Hz - ± ImA (150dB)           Mosurement Prover         -         -           Mosurement Prover         -         -           Mosurement Prover         -         -           Mosurement Prover         -         -           More Registry Marker         -         -           Mosurement Prover         -         -           Datalog Window         No-Cap analysis, Minimum window I0ms         No-Cap analysis, Minimum window 2ms           Monoy         10M records into flash RAM (Non-Volatile)         -           Communication Prover         -         10M records into flash RAM (Non-Volatile)           Communication Prover Science         -         10M records into flash RAM (Non-Volatile)           Communication Prover Science         -         10M records	40-400H	z	[0.03%+0.049	%/pf+(0.0	1%×kHz)/pf] Rdg+0.03%VA Rng	[0	.02%+0.03%/pf+(0.01%×kHz)/pf] Rdg+0.01%VA Rng	
Sample Rate         2.2Ms/s on all channels, No-Gap           IEC Modes         IEC62301 Standby Power         IEC63000 Harmonics and Filcker, IEC62301 Standby Power           Application Modes         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power           CMRR - Common Mode Rejection Ratio         250V @ 50Hz - 2 ImA (150dB)         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power           MRR - Common Mode Rejection Ratio         250V @ 50Hz - 2 ImA (150dB)         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power           MRR - Common Mode Rejection Ratio         250V @ 50Hz - 2 ImA (150dB)         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power           MRR - Common Mode Rejection Ratio         250V @ 50Hz - 2 ImA (150dB)         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power           MRR - Common Mode Rejection Ratio         250V @ 50Hz - 2 ImA (150dB)         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Divertion Ratio           Memory         Transformer, Standby Divertion Ratio         Frequency (Hz), Phase (deg), Fundamentals, Impedance           Batalog Window         No-Gap analysis, Minimum window Zms         Mone-Cap analysis, Minimum window Zms           Batalog Window         No-Gap analysis, Minimum window Zms         Mone-Cap analysis, Minimum window Zms           Batalog Window         No-Gap analysis, Minimu					2000	1.0		
IEC Modes         IEC G2301 Standby Power         IEC G2301 Standby Power           Application Mode         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power           CMRR         250V @ 50Hz - ≥ ImA (150dB)         Flictuating Harmonics, Flicker Heter, TVF105 Interharmonics           CMRR         250V @ 50Hz - ≥ ImA (150dB)         Interharmonics           Measurement R         250V @ 50Hz - ≥ ImA (150dB)         Interharmonics           Measurement R         W, VA, Var., pf, V. & A. rms, rectified mean, AC, DC, Peak, Surge, Creat Factor, Form Factor, Star to Delta Voltage, +ve Pk, -ve Pk         Pk, -ve Pk           Measurement R         W, VA, Var., pf, V. & A. rms, rectified mean, AC, DC, Peak, Surge, Creat Factor, Form Factor, Star to Delta Voltage, +ve Pk, -ve Pk         Pk, -ve Pk           Datalog UN to Vers estectable measurement functions (30 with phonal PC softwar)         Totage UN records into Tablas PAM (Non-Volatile)           Communication Ports         Integrated Values, Datalog, Sum and Neutral values         Totage UN records into Tabs PAM (Non-Volatile)           Communication Ports         Estatus         Integrated Values, Datalog, Sum and Neutral values         Totage UN records into Tabs PAM (Non-Volatile)           Communication Ports         Estatus         Integrated Values, Datalog, UN records into Tabs PAM (Non-Volatile)         Totage UN records into Tabs PAM (Non-Volatile) <td< td=""><td></td><td></td><td></td><td></td><td>· · ·</td><td>· · · · ·</td><td>Can</td></td<>					· · ·	· · · · ·	Can	
Application Mode Application Mode September 2014         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power (BRC + Common Mode Rejection Ratio         PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power (BRC + Common Mode Rejection Ratio           CMRR - Common Mode Rejection Ratio         250V @ 50Hz - 2 ImA (130dB)           Measurement Parameters         W,VA, Var., pf, V& A - rms, rectified mean, AC, DC, Peak, Surge, Creat Factor, Form Factor, Star to Delta Voltage, +ve Pk, -ve Pk           W,VA, Var., pf, V& A - rms, rectified mean, AC, DC, Peak, Surge, Creat Factor, Form Factor, Star to Delta Voltage, +ve Pk, -ve Pk           Prequency (Hz), Phase (deg), Fundamentals, Inpedance           Batalog - Up to 4 user selectable measurement functions (30 with optional PC software)           Datalog Window         No-Gap analysis, Minimum window 1ms           Memory         16,000 records           Batalog Window         No-Gap analysis, Minimum window 1ms           R5232         Bud rate up to 38.4Kbps,RTS/CT5 flow control           LAN         (Option L) 10/100 Base-T Ethernet auto sensing           (GHB         (Uption G) IEE448.2 Compatible           USB         0 Li compatible           Analogue Output         BNC Bipolari 10V or Pulse count 1Hz to 1HHz 0.01% Rdg           Sync         4 ~ 6 Phase measurement (Master/Slave) + Auxilary           Standard Accessores         Power, R5232, USB, CPIB           Connection Cables </td <td>· ·</td> <td></td> <td></td> <td>IEC6230</td> <td></td> <td colspan="3"></td>	· ·			IEC6230				
CMRR - Common Mode Rejection Ratio           250V @ 50Hz - 2 ImA (150dB)           Messurement Parameters           W,VA,Var, pf,V&A - rms, rectified mean,AC, DC, Peak, Surge,Crest Factor,Form Factor,Star to Data Voltage, +ve Pk, -ve Pk           Frequency (Hz), Phase (deg), Fundamentals, Impedance           Harmonics, THD, TIP, THF, TRAD, TDO           Datalog - Up to 4 user selectable measurement functions (30 with optional PC software)           Datalog Vidow         No-Gap analysis, Minimum window 2ms           Memory         16,000 records         10M records into flash RAM (Non-Volatile)           Communication Ports         82322         Baud rate up to 38.4kbps,RTS/CTS flow control           LN         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) IEEE488.2 Compatible           US8         USB 2.0 and 1.1 compatible         (Fitted as standard) IEEE488.2 Compatible           Speed Input         Bipolar ±10V GP Vuise count 1Ht to 1MHz 0.01% Rdg           Sync         4 ~ 6 Phase (Master/Slave) + Auxilary           Standard Accessores         36A 1.5m long 4drm stackbeit terminals           Connection Cables         1x red, 1x yellow and 2x black per phase (Ix red and 1x black with HC version)           Connection Cables         4m terminated ali			PWM Motor Drive, B			PWM Mo	tor Drive, Ballast, Inrush, Power Transformer, Standby Power,	
100 (0 pluk - 2 mA (150dB)           Measurement Permeters           W,VA,Var,pf,V&A - rms,rectifed mean,AC,DC,Peak,Surge,Crest Factor,Form Factor,Star to Delta Voltage, +ve Pk, -ve Pk           Frequency (Hz), Phase (dg), Fundamentals, Impedance           Harmonics, THD, TIF, THS, TND           The prevence of the phase (dg), Fundamentals, Impedance           Datalog V to 4 user selectable measurement functions (30 with optional PC software)           Datalog Window         No-Gap analysis, Minimum window 10ms           Memory         16,000 records           Datalog Window         No-Gap analysis, Minimum window 10ms           Memory         16,000 records           Baud rate up to 38.kbps,RTS/CTS flow control           Communication Ports           R5232         Baud rate up to 38.kbps,RTS/CTS flow control           Analogue Output         (Option 6) IEEE488.2 Compatible           VBB         (Option 6) IEEE488.2 Compatible           VBB         (Option 6) IEEE488.2 Compatible           Standard Component Bipolar ±10V or Pulse count 1Hz to 1HHz 0.01% Rdg           Torque         BNC Bipolar ±10V or Pulse count 1Hz to 1HHz 0.01% Rdg           Standard Accessore         4 ~ 6 Phase (Master/Slave) Auxiary           Standard Accessore         4 ~ 6 Phase (Master/Slave) Auxiary           Standard Accessore         11 Yeel Aux Aux 2 Jus Aux 2 Jus Au	CMRR -	Common	Mode Rejection Ratio			Fluc	Lualing Harmonics, Flicker Meter, 197105 Internationics	
Measurement Parameters           W, VA, Var, pf, V& A - rms, rectified mean, AC, DC, Peak, Surge, Crest Factor, Frent To Delta Voltage, + ve Pk, -ve Pk           Frequency (H2), Phase (deg), Fundamentals, Impedance           Harmonics, THD, TIF, THF, TRD, TDD           Datalog - Up to 4 user selectable measurement functions (30 with optional PC software)           Datalog Window         No-Gap analysis, Minimum window 10ms         No-Gap analysis, Minimum window 2ms           Memory         16,000 records         10M records into flash RAM (Non-Volatile)           Communication Ports         Baud rate up to 38.4kbps,RTS/CTS flow control           LN         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option L) 10/100 Bas					250V @ 50H;	z - ≥ 1mA (150a	1B)	
W, VA, Var, pf, V& A - rms, rectified mean, AC, DC, Peak, Surge, Crest Factor, Form Factor, Star to Delta Voltage, +ve Pk, -ve Pk           AFRequency (H2), Phase (deg), Fundamentals, Impedance           Harmonics, TND, TIF, TRD, TDD           Other Pathone           Datalog U-tp to 4 user selectable measurement functions (30 with optional PC softwar)           Datalog Window         No-Gap analysis, Minimum window 10ms           Memory         166,000 records           Datalog Window         No-Gap analysis, Minimum window 2ms           Memory         166,000 records           Communication         10M records into flash RAM (Non-Volatile)           Communication         Sever selectable measurement functions (30 with optional PC softwar)           K232         Baud rate up to 38.4kbps,RTS/CTS flow control           LAN         (Option 1) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option G) IEEE488.2 Compatible         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option G) IEEE488.2 Compatible         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           Grade         BNC Bipolar±10V or Puise count 1Hz to 1MH2 0.01% Rdg           Sync         BNC Bipolar±10V or Puise count 1Hz to 1MH2 0.01% Rdg           Sync         Soft 1.5m long Amm stackable terminals					100V @ 100kH	z - ≥ 3mA (130dB)		
Harmonics, THD, TIF, THF, TRD, TDD           Integrated Values, Data[o_Sum and Neutral values           Datalog -U to 4 user selectable measurement functions (30 with optional PC software)           Datalog Window         No-Gap analysis, Minimum window 10ms         No-Gap analysis, Minimum window 2ms           Datalog Window         No-Gap analysis, Minimum window 10ms         No-Gap analysis, Minimum window 2ms           Memory         16,000 records         10M records into flash RAM (Non-Volatile)           Communication Ports         (Pitted as standard) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option C) IEEE488.2 Compatible         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           Speci Input         Secondard 1.1 compatible         (Pitted as standard) IEEE488.2 Compatible           Analoge Output         BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         (Pitted as standard) IEEE488.2 Compatible           Speci Input         Secondart 10 Control Second 1Hz to 1MHz 0.01% Rdg         Power, RS232         Secondart 1Hz to 1MHz 0.01% Rdg           Speci Input         Secondart 1MZ to 1MHz 0.01% Rdg         Power, RS232, USB         Power, RS232, USB, GPIB           Standard Accessite         Secondart 1MZ to 1MHz 0.01% Rdg         Power, RS232, USB, GPIB           Connection Cables         Power, RS232, USB, CPID second 1Ax beter prinals <td>Measure</td> <td>ment Par</td> <td></td> <td>,pf ,V &amp; /</td> <td></td> <td colspan="3" rowspan="2">deg), Fundamentals, Impedance</td>	Measure	ment Par		,pf ,V & /		deg), Fundamentals, Impedance		
Integrated Values, Datalog, Sum and Neutral values           Datalog Vindow         No-Gap analysis, Minimum window 2ms           Datalog Window         No-Gap analysis, Minimum window 2ms           Memory         IOM colspan="2">IOM records into flash RAM (Non-Volatile)           Communication Ports           RS232         Baud rate up to 38.4kbps,RTS/CTS flow control           Communication Ports           RS232         Baud rate up to 38.4kbps,RTS/CTS flow control           Communication Ports           RS232         Baud rate up to 38.4kbps,RTS/CTS flow control           Communication Ports           RS232         Communication Ports           Communication Ports           Communication Ports           Communication Ports           RS232         Communication Ports								
Datalog - Up to 4 user selectable measurement functions (30 with optional PC software)         No-Gap analysis, Minimum window 2ms           Datalog Window         No-Gap analysis, Minimum window 10ms         No-Gap analysis, Minimum window 2ms           Memory         10M records into flash RAM (Non-Volatile)           Communication Ports         Baud rate up to 38.4kbps,RTS/CTS flow control           RS232         Baud rate up to 38.4kbps,RTS/CTS flow control           CMN         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option G) IEEE488.2 Compatible         (Fitted as standard) IEEE488.2 Compatible           Analogue Output         BINC Bipolar ±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Torque           Sync         4 ~ 6 Phase measurement (Master/Slave)         Ketnsion           Ketnsion         4 ~ 6 Phase measurement (Master/Slave)         Ketnsion           Connection Cables         1 x red, 1 x yellow and 2 x black per phase (1 x red and 1 x black per phase with PPAS500-HC version)           CD-ROM         CommUiew2 (RS232/USB/LAN), Command line, Script based communication software           Documents         User manual, Communications manual, Calibration certificate, Quick start guide           Mechanical/Environmental         User manual, Communications manual, Calibration certificate, Quick start guide           Mechanical/Environmental <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="3"></td>								
Datalog Window         No-Gap analysis, Minimum window 10ms         No-Gap analysis, Minimum window 2ms           Memory         16,000 records         10M records into flash RAM (Non-Volatile)           Communication Ports         R5232         Baud rate up to 38.4kbps,RTS/CTS flow control           RAM         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option G) IEEE488.2 Compatible         (Fitted as standard) IEEE488.2 Compatible           Analogue Output         (Option G) IEEE488.2 Compatible         (Fitted as standard) IEEE488.2 Compatible           Analogue Output         USB 2.0 and 1.1 compatible         (Fitted as standard) IEEE488.2 Compatible           Analogue Output         BINC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Tomped           Sync         Genetion BINC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Tomped           Sync         4 ~ 6 Phase measurement (Master/Slave)         Extension           Standard Accessites         Standard Accessites         Standard Accessites           Connection Cables         1 x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)           Connection Calles         4 mm terminated aligator clips - 1 x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)           Connection Clips         4 mm terminated aligator clips - 1 x	Datalog	- Up to 4	user selectable measure	ement fun		nog, Sum and N		
Communication Ports           RS232         Baud rate up to 38.4kbps,RTS/CTS flow control           LAN         (Option L) 10/100 Base-T Ethernet auto sensing         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option G) IEEE488.2 Compatible         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option G) IEEE488.2 Compatible         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           GPIB         (Option G) IEEE488.2 Compatible         (Fitted as standard) 10/100 Base-T Ethernet auto sensing           Speed Input         BipOlar±10V GPUIse count 1Hz to 1MHz 0.01% Rdg         10/100 Base-T Ethernet auto Sensing           Speed Input         BNC Bipolar±10V or Puise count 1Hz to 1MHz 0.01% Rdg         Sync           Sync         4 ~ 6 Phase measurement (Master/Slave)         Extension           Standard Accessories         28andard Accessories         Standard Accessories           Leads         Power, RS232, USB         Power, RS232, USB, GPIB           Connection Clips         4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red and 1x black with H2A500-HC version)           CD-ROM         CommView2 (RS232/USB/LAN), Command line, Script based communication software           Documents         User manual, Communications manual, Calibration certificate, Quick start guide           Mechanical/Environmental         Vol							No-Gap analysis, Minimum window 2ms	
RS232     Baud rate up to 38.4kbps,RTS/CTS flow control       LAN     (Option L) 10/100 Base-T Ethernet auto sensing     (Fitted as standard) 10/100 Base-T Ethernet auto sensing       GPIB     (Option G) IEEE488.2 Compatible     (Fitted as standard) IEEE488.2 Compatible       USB     0     USB 2.0 and 1.1 compatible       Analogue Output     Binolar ±10V or Pulse count 1Hz to 1MHz 0.01% Rdg       Speed Input     BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg       Torque     BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg       Sync     Control BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg       Extension     4 ~ 6 Phase measurement (Master/Slave)       Extension     4 ~ 6 Phase (Master/Slave) + Auxilary       Standard Accessores     Soft 1 xr ed, 1 x yellow and 2 x black per phase (1 xr ed, 1 x black with HC version)       Connection Cables     1 xr ed, 1 x yellow and 2 x black per phase (1 xr ed, 1 x black with PA5500-HC version)       CoheROM     CommView2 (RS232/USB/LAN), Commanication software       Documents     User manual, Communication smanual, Calibration certificate, Quick start guide       Mechanical/Environmental     Softward Accessore       Weight     320×240 dot full colour TFT, White LED Backlit       Dimensions     320×240 dot full colour TFT, White LED Backlit       Dimensions     320×240 dot full colour TFT, White LED Backlit       Dimensions     320×240 dot full colour TFT	Memory			16,	000 records		10M records into flash RAM (Non-Volatile)	
LAN       (Option L) 10/100 Base-T Ethernet auto sensing       (Fitted as standard) 10/100 Base-T Ethernet auto sensing         GPIB       (Option G) IEEE488.2 Compatible       (Fitted as standard) IEEE488.2 Compatible         USB       USB 2.0 and 1.1 compatible         Analogue Output       Bipolar ±10V GNC)         Speed Input       BNC Bipolar ±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Torque       BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Sync       4 ~ 6 Phase measurement (Master/Slave)         Extension       4 ~ 6 Phase (master/Slave)         Standard Accessories       250 Automatic transmitter         Leads       Power, RS232, USB       Power, RS232, USB, GPIB         Connection Cables       1x red, 1x yellow and 2x black per phase (1x red, at black with HC version)         Connection Clips       4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red at black per phase with PPA5500-HC version)         CD-ROM       CommView2 (RS232/USB/LAN), Command line, Script based communication software         Documents       User manual, Communications manual, Calibration certificate, Quick start guide         Mechanical/Environmental       Input Impedance         Uispala       320×240 dot full colour TFT, White LED Backlit         Display       320×240 dot full colour TFT, White LED Backlit         Dimensions		nication P	orts					
GPIB       (Option G) IEEE488.2 Compatible       (Fitted as standard) IEEE488.2 Compatible         USB       USB 2.0 and 1.1 compatible         Analogue Output       Bipolar ±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Speed Input       BNC Bipolar ±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Sync       4 ~ 6 Phase measurement (Master/Slave)         Extension       4 ~ 6 Phase (Master/Slave) + Auxilary         Standard Accessories       BNC Bipolar 100 or Pulse count 1Hz to 1MHz 0.01% Rdg         Connection Cables       1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)         Connection Cables       1x red, 1x yellow and 2x black per phase (1x red, and 1x black per phase with PPA5500-HC version)         CO-ROM       CommWiew2 (R5232/USB/LAN), Command line, Script based communication software         Documents       User manual, Communications manual, Calibration certificate, Quick start guide         Mechanica/Environmental       130H×400W×315D nm excluding feet         Display       320×240 dot full colour TFT, White LED Backlit         Dimensions       130H×400W×315D nm excluding feet         Weight       5.4%(1 Phase), 6%(3 Phase)         Safety Isolation       1000Vrms or DC(CATIII)         Power supply       90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax         Operating       23°C ± 5°C Ambient Temperature when rack mounted), 20-90% Non-Condensing R			(0.11	40/400 0	· · · · · · · · · · · · · · · · · · ·			
USB       USB 2.0 and 1.1 compatible         Analogue Output       Bipolar ±10V (BNC)         Speed Input       BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Torque       BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Sync       4 ~ 6 Phase measurement (Master/Slave)         Extension       4 ~ 6 Phase (Master/Slave) + Auxilary         Standard Accessories       Eads         Power, RS232, USB       Power, RS232, USB, GPIB         Connection Cables       36A 1.5m long 4mm stackable terminals         1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)         Connection Clips       4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red and 1x black per phase with PPA5500-HC version)         CD-ROM       CommView2 (RS232/USB/LAN), Command line, Script based communication software         Documents       User manual, Communications manual, Calibration certificate, Quick start guide         Mechanical/Environmental       130Hx400Wx315D mm excluding feet         Display       320×240 dot full colour TFT, White LED Backlit         Dimensions       130Hx400Wx315D mm excluding feet         Weight       5.4(g1 Phase), 6(g3 Phase)         Safety Isolation       1000Vrms or DC(CATIII), 600Vrms or DC(CATIII)         Power supply       90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax			,	· · · · · · · · · · · · · · · · · · ·		(Fit	· · · ·	
Analogue Output       Bipolar ±10V (BNC)         Speed Input       BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Torque       BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Sync       4 ~ 6 Phase measurement (Master/Slave)         Extension       4 ~ 6 Phase (Master/Slave) + Auxilary         Standard Accessories       Eads         Leads       Power, RS232, USB         Onnection Cables       1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)         Connection Cables       1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)         Connection Cables       0 CommView2 (RS232/USB/LAN), Command line, Script based communication software         Documents       User manual, Communications manual, Calibration certificate, Quick start guide         Mechanical/Environmental       Voltage Attenuator and External Inputs 1MΩ [] 30pF         Display       320×240 dot full colour TFT, White LED Backlit         Dimensions       130H×400W×315D mm excluding feet         Weight       5.4.(g1 Phase), 6kg(3 Phase)         Safety Isolation       1000Vrms or DC(CATIII), 600Vrms or DC(CATIII)         Power supply       0.2 °C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.			(0			d 1.1 compatibl		
Torque       BNC Bipolar±10V or Pulse count 1Hz to 1MHz 0.01% Rdg         Sync       4 ~ 6 Phase measurement (Master/Slave)         Extension       4 ~ 6 Phase (Master/Slave) + Auxilary         Standard Accessories       Power, RS232, USB         Leads       Power, RS232, USB         Connection Cables       1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)         Connection Clips       4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red and 1x black per phase with PPA5500-HC version)         CD-ROM       CommView2 (RS232/USB/LAN), Command line, Script based communication software         Documents       User manual, Communications manual, Calibration certificate, Quick start guide         Mechanical/Environmental       Voltage Attenuator and External Inputs 1MΩ    30pF         Display       320×240 dot full colour TFT, White LED Backlit         Dimensions       130H×400W×315D mm excluding feet         Weight       5.4kg(1 Phase), 6kg(3 Phase)         Safety Isolation       1000/rms or DC(CATIII), 600/rms or DC(CATIII)         Power supply       90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax         Operating       23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.		e Output				· · ·		
Sync       4 ~ 6 Phase measurement (Master/Slave)         Extension       4 ~ 6 Phase (Master/Slave) + Auxilary         Standard Accessories       Standard Accessories         Leads       Power, RS232, USB       Power, RS232, USB, GPIB         Connection Cables       1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)         Connection Clips       4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red and 1x black per phase with PPA5500-HC version)         CD-ROM       CommView2 (RS232/USB/LAN), Command line, Script based communication software         Documents       User manual, Communications manual, Calibration certificate, Quick start guide         Mechanical/Environmental       Voltage Attenuator and External Inputs 1MΩ    30pF         Display       320×240 dot full colour TFT, White LED Backlit         Dimensions       130H×400W×315D mm excluding feet         Weight       5.4kg(1 Phase), 6kg(3 Phase)         Safety Isolation       1000/rms or DC(CATIII)         Power supply       90 ~ 265/rms, 50 ~ 60Hz, 40VAmax         Operating       23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.	Speed In	iput			BNC Bipolar±10V or Pulse	count 1Hz to 1	MHz 0.01% Rdg	
Extension       4 ~ 6 Phase (Master/Slave) + Auxilary         Standard Accessories         Leads       Power, RS232, USB       Power, RS232, USB, GPIB         Connection Cables       1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)         Connection Clips       4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red and 1x black per phase with PPA5500-HC version)         CD-ROM       CommView2 (RS232/USB/LAN), Command line, Script based communication software         Documents       User manual, Communications manual, Calibration certificate, Quick start guide         Mechanical/Environmental       Voltage Attenuator and External Inputs 1MΩ    30pF         Display       320×240 dot full colour TFT, White LED Backlit         Dimensions       130Hx400W×315D mm excluding feet         Weight       5.4kg(1 Phase), 6kg(3 Phase)         Safety Isolation       1000Vrms or DC(CATII), 600Vrms or DC(CATIII)         Power supply       90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax         Operating       23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.	-				•			
Standard Accessories           Leads         Power, RS232, USB         Power, RS232, USB, GPIB           Connection Cables         36A 1.5m long 4mm stackable terminals           1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)           Connection Clips         4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red and 1x black per phase with PPA5500-HC version)           CD-ROM         CommView2 (RS232/USB/LAN), Command line, Script based communication software           Documents         User manual, Communications manual, Calibration certificate, Quick start guide           Mechanical/Environmental         Voltage Attenuator and External Inputs 1MΩ    30pF           Display         320×240 dot full colour TFT, White LED Backlit           Dimensions         130H×400W×315D mm excluding feet           Weight         5.4kg(1 Phase), 6kg(3 Phase)           Safety Isolation         1000Vrms or DC(CATII), 600Vrms or DC(CATIII)           Power supply         90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax           Operating         23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.	-							
LeadsPower, RS232, USBPower, RS232, USB, GPIBConnection Cables36A 1.5m long 4mm stackable terminals 1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)Connection Clips4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red and 1x black per phase with PPA5500-HC version)CD-ROMCommView2 (RS232/USB/LAN), Command line, Script based communication softwareDocumentsUser manual, Communications manual, Calibration certificate, Quick start guideMechanical/EnviromentalVoltage Attenuator and External Inputs 1MΩ    30pFDisplay320×240 dot full colour TFT, White LED BacklitDimensions130H×400W×315D mm excluding feetWeight5.4kg(1 Phase), 6kg(3 Phase)Safety Isolation1000Vrms or DC(CATII), 600Vrms or DC(CATIII)Power supply90 ~265Vrms, 50 ~ 60Hz, 40VAmaxOperating23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.			ries		4 ~ 6 Phase (Ma	ster/Slave) + A		
36A 1.5m long 4mm stackable terminals         1x red, 1x yellow and 2x black per phase (1x red, 1x black with HC version)         Connection Clips       4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red and 1x black per phase with PPA5500-HC version)         CD-ROM       CommView2 (RS232/USB/LAN), Command line, Script based communication software         Documents       User manual, Communications manual, Calibration certificate, Quick start guide         Mechanical/Environmental       Voltage Attenuator and External Inputs 1MΩ    30pF         Display       320×240 dot full colour TFT, White LED Backlit         Dimensions       130H×400W×315D mm excluding feet         Weight       5.4kg(1 Phase), 6kg(3 Phase)         Safety Isolation       1000Vrms or DC(CATII), 600Vrms or DC(CATIII)         Power supply       90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax         Operating       23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.		A ACCESSO		Powe	r, RS232, USB		Power, RS232, USB, GPIB	
Connection Clips4mm terminated aligator clips - 1x red, 1x yellow and 2x black per phase (1x red and 1x black per phase with PPA5500-HC version)CD-ROMCommView2 (RS232/USB/LAN), Command line, Script based communication softwareDocumentsUser manual, Communications manual, Calibration certificate, Quick start guideMechanical/EnviromentalVoltage Attenuator and External Inputs 1MΩ    30pFDisplay320×240 dot full colour TFT, White LED BacklitDimensions130H×400W×315D mm excluding feetWeight5.4kg(1 Phase), 6kg(3 Phase)Safety Isolation1000Vrms or DC(CATII), 600Vrms or DC(CATIII)Power supply90 ~265Vrms, 50 ~ 60Hz, 40VAmaxOperating23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.		on Cables			36A 1.5m long 4n		rminals	
Documents         User manual, Communications manual, Calibration certificate, Quick start guide           Mechanical/Environmental         Voltage Attenuator and External Inputs 1MΩ    30pF           Display         320×240 dot full colour TFT, White LED Backlit           Dimensions         130H×400W×315D mm excluding feet           Weight         5.4kg(1 Phase), 6kg(3 Phase)           Safety Isolation         1000Vrms or DC(CATII), 600Vrms or DC(CATIII)           Power supply         90 ~265Vrms, 50 ~ 60Hz, 40VAmax           Operating         23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.	Connecti	on Clips	4mm term	inated ali				
Mechanical/Environmental           Input Impedance         Voltage Attenuator and External Inputs 1MΩ    30pF           Display         320×240 dot full colour TFT, White LED Backlit           Dimensions         130H×400W×315D mm excluding feet           Weight         5.4kg(1 Phase), 6kg(3 Phase)           Safety Isolation         1000Vrms or DC(CATII), 600Vrms or DC(CATIII)           Power supply         90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax           Operating         23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.								
Input Impedance         Voltage Attenuator and External Inputs 1MΩ    30pF           Display         320×240 dot full colour TFT, White LED Backlit           Dimensions         130H×400W×315D mm excluding feet           Weight         5.4kg(1 Phase), 6kg(3 Phase)           Safety Isolation         1000Vrms or DC(CATII), 600Vrms or DC(CATIII)           Power supply         90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax           Operating         23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.			nmontol		User manual, Communications manua	al, Calibration c	ertificate, Quick start guide	
Display         320×240 dot full colour TFT, White LED Backlit           Dimensions         130H×400W×315D mm excluding feet           Weight         5.4kg(1 Phase), 6kg(3 Phase)           Safety Isolation         1000Vrms or DC(CATII), 600Vrms or DC(CATIII)           Power supply         90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax           Operating         23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.			onmental			External Innut		
Dimensions         130H×400W×315D mm excluding feet           Weight         5.4kg(1 Phase), 6kg(3 Phase)           Safety Isolation         1000Vrms or DC(CATII), 600Vrms or DC(CATIII)           Power supply         90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax           Operating         23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.		pedance			· · · · · · · · · · · · · · · · · · ·			
Weight         5.4kg(1 Phase), 6kg(3 Phase)           Safety Isolation         1000Vrms or DC(CATII), 600Vrms or DC(CATIII)           Power supply         90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax           Operating         23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.		ons						
Safety Isolation         1000Vrms or DC(CATII), 600Vrms or DC(CATIII)           Power supply         90 ~ 265Vrms, 50 ~ 60Hz, 40VAmax           Operating         23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.	Weight						-	
Operating 23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.	-	olation						
	Power su	ipply			90 ~ 265Vrms,	50 $\sim$ 60Hz, 40V	Amax	
Conditions Temperature coefficient ±0.01% per °C of reading at 5-18°C and 28-40°C			23°C ±	5°C Amb				
	Condition	าร			Temperature coefficient ±0.01% p	er C of reading	at 5-18°C and 28-40°C	

## **SPECIFICATION**

	PPA4500	PPA5500
Harmonic Specific	cation	
Bandwidth	DC,10mHz ~ 2MHz - PPA4500-LC(10Arms), PPA4500(30Arms)	DC,10mHz ~ 2MHz - PPA5500-LC(10Arms), PPA5500(30Arms)
	DC,10mHz ~ 1MHz - PPA4500-HC(50Arms)	DC,10mHz ~ 1MHz - PPA5500-HC(50Arms)
No. of Harmonics	100	417
Sampling Frequency	21	Ms/s
Signal Processing	DFT ( Discreet F	ourier Transform)
Crest Factor		20
Power Factor	0	to 1
Harmonic Accura	Cy	
Voltage	0.03% Rdg+0.04% Rng+(0.004%×kHz)+5mV	0.01% Rdg+0.038% Rng+(0.004%×kHz)+5mV
	PPA4500-LC 0.03% Rdg+0.04% Rng+(0.004%×kHz Rdg)+10uA	PPA5500-LC 0.01% Rdg+0.038% Rng+(0.004%×kHz Rdg)+10uA
Current	PPA4500 0.03% Rdg+0.04% Rng+(0.004%×kHz Rdg)+300uA	PPA5500 0.01% Rdg+0.038% Rng+(0.004%×kHz Rdg)+300uA
	PPA4500-HC 0.03% Rdg+0.04% Rng+(0.004%×kHz Rdg)+900uA	PPA5500-HC 0.01% Rdg+0.038% Rng+(0.004%×kHz Rdg)+900uA
	Harmonic Accuracy (above) still applies w	vith Frequency Filter set
IEC61000 Harmo	nic Accuracy	
Voltage	-	0.2% Rdg+0.038% Rng+(0.004%×kHz Rdg)+5mV
		PPA5500-LC 0.2% Rdg+0.038% Rng+(0.004%×kHz Rdg)+10uA
Current	-	PPA5500 0.2% Rdg+0.038% Rng+(0.004%×kHz Rdg)+300uA
		PPA5500-HC 0.2% Rdg+0.038% Rng+(0.004%×kHz Rdg)+900uA
	ilysis direct to PC - 2Ms/s sample rate (Window setting)	
Data Rate	10ms	5ms
	lysis direct to Internal RAM - 2Ms/s sample rate	
Data Rate	10ms	2ms
	Overload Capability	
20ms	4.2kVpk (3kVrms)	4.2kVpk (3kVrms)
5s	3.1kVpk (2.2kVrms)	3.1kVpk (2.2kVrms)
Continuous	3kVpk (1kVrms)	3kVpk (1kVrms)
	Measurement at Full Accuracy	
PPA5500-LC	45uArms	45uArms
PPA5500	220uArms	220uArms
PPA5500-HC	700uArms	700uArms

## ACCESSORIES SUPPLIED AS STANDARD

Leads and Interfacing	
Туре	Specification
36A Connection lead set	1.5 Meter - 36A lead set with 4mm stackable safety terminals 1x Red, 1x Yellow and 2x Black per phase plus alligator clips
36A 4mm to spade (Option)	1.5 Meter - 36A lead set with 4mm to spade for HC terminals
RS232 cable	RS232 9pin serial Cable
USB cable	USB 2 Meter A male to B male
USB to 9-pin RS232 (Option)	USB $\sim$ 9-pin RS232 Serial Converter
Master-Slave cable (Option)	Leads for connecting 2x PPA5500 in master/slave mode
GPIB Cable (PPA5500)	GPIB Interface Cable

#### Documents (Standard) Specification Туре Calibration/Test & Inspection Certificate PPA Certificate of Calibration UKAS ISO17025 Certificate UKAS ISO17025 Certificate of Calibration User manual Spare set of manuals Comms manual

Connection and extension port accessories (Optional)				
Туре	Specification			
Breakout box	Simple analyzer connection between source and DUT			
PCIS	10Arms 300Apk rated Phase Controlled Inrush Switch			
GPIB Communication	GPIB Communication Cable Option (Port Fitted as			
Cable	standard on PPA5500)			

Breakout Box

Rack Mount Kit (Optional)

Rack Mount brackets

Interface (Optional)

PPA-GPIB interface

Rack Mount panel

Туре

Туре PPA-LAN interface

## **OPTIONAL ACCESSORIES**

PC Software (Optional CD, Free to Download)				
Туре	Specification			
PPALoG	PC control and data acquisition of $1\sim12$ phases with selectable Real Time data, Graphing, Datalog and versatile export options			
PPAcomm	Basic PC Control, Data storage, Print features			
PPA Standby Power	Standby power measurements and reporting to IEC62301			
PPAsoft PC software	LabView based software, PC Control, Data storage and Print			
IECSoft	IEC61000 Testing Software			

PPAsoft PC software LabView based software, PC Control, Data storage and P					
IECSoft IEC61000 Testing Software					
Carry cases (Optional)					
Туре	Specification				

туре	Specification
Soft carrying case	Black nylon with shoulder strap
Hard flight case	Hard case with moulded lining suitable for shipping

PPA Series Hard Carrying Case



## PPA500/1500 MODELS

For more details see separate brochure

Phases	Model	Specification
1 Ph	PPA1510/510*	DC,
2 Ph	PPA1520/520*	$10$ mHz $\sim$ 1MHz $100$ mApk $\sim$ 300 Apk
3 Ph	PPA1530/530*	(20Arms)
1 Ph	PPA1510/510-HC*	DC,
2 Ph	PPA1520/520-HC*	$10 \mathrm{mHz} \sim 1 \mathrm{MHz}$ $300 \mathrm{mApk} \sim 1000 \mathrm{Apk}$
3 Ph	PPA1530/530-HC*	(30Arms)

\*PPA500 DC, 10mHz  $\sim$  500kHz





Specification PPA26/5500 19in rack mount brackets (model specific)

Specification

Option L - LAN Interface - (Standard on 55 series) Option G - GPIB(IEEE488)Interface - (Standard on 55

PPA2500 19in rack fascia panel

PPA1500 3 Phase model

series)

### ACCESSORIES

High Performance Voltage Attenuating Probes						
Model	Voltage Range	Frequency Range	Details			
TT-HV250	2500Vpk	300MHz	High Voltage Probe (Passive) 2.5kVpk 100:1			
TTV-HVP	1500Vpk	50MHz	High Voltage Probe (Passive) 15kVpk 1000:1			
ATT10	30Vpk	30MHz	10:1 Voltage Attenuator Box (For use in conjunction with HV Probes when output voltage of probe is >3Vpk, BNC Input/BNC Output)			
ATT20	60Vpk	30MHz	20:1 Voltage Attenuator Box (For use in conjunction with HV Probes when output voltage of probe is >3Vpk, BNC Input/BNC Output)			
ULCP	3000Vpk	2MHz	1000:1 Ultra Low Capacitance Probe (Active), For use in applications such as Ballast Testing (<1pF Capacitance)			



High Performance External Current Measurment Options								
Model Number	Measuring Range	Frequency Range	Basic Accuracy	Phase Accuracy	Details			
HF003	3Arms - 30Apk	DC - 2MHz	470mΩ (±0.1%)	0.0001° / kHz	3Arms External Current Shunt, BNC Output (Use with PPA External Input)			
HF006	6Arms - 60Apk	DC - 2MHz	100mΩ (±0.1%)	0.001° / kHz	6Arms External Current Shunt, BNC Output (Use with PPA External Input)			
HF020	20Arms - 200Apk	DC - 2MHz	10mΩ (±0.1%)	0.01° / kHz	20Arms External Current Shunt, BNC Output (Use with PPA External Input)			
HF100	100Arms - 1000Apk	DC - 2MHz	1mΩ (±0.1%)	0.05° / kHz	100Arms External Current Shunt, BNC Output (Use with PPA External Input)			
HF200	200Arms - 2000Apk	DC - 2MHz	0.5mΩ (±0.1%)	0.1° / kHz	200Arms External Current Shunt, BNC Output (Use with PPA External Input)			
HF500	500Arms - 5000Apk	DC - 2MHz	0.2mΩ (±0.1%)	0.1° / kHz	500Arms External Current Shunt, BNC Output (Use with PPA External Input)			



External Shunt HF-003



External Shunt HF-100



External Shunt HF-200



External Shunt HF-500

Probe/Current Clamp Transformer: AC						
Model Number	Measuring range	Frequency range	Accuracy	Details	Clamp diameter	Category
M3 UB 50A-1V	100mA ~ 50A	40Hz ~ 5kHz	1%	100mA to 50A AC Current Clamp	15mm×17mm	600V CATIII
M3 U 100A-1V	$1A \sim 100A$	$40$ Hz $\sim$ 5kHz	1%	1A to 100A AC Current Clamp	15mm×17mm	600V CATIII
S UE 200A-1V	$1A \sim 200A$	$40$ Hz $\sim$ 5kHz	1%	1 A to 200A AC Current Clamp	50mm ø	600V CATIII
S UE 250 500 1000-1V	1A~250A/500A/1000A	40Hz ~ 5kHz	1%(250A) 0.5%(500+1000A)	1 A to 250/500/1000A AC Current Clamp	50mm ø	600V CATIII
US UE 1000A-1V	$1A \sim 1000A$	40Hz ~ 5kHz	1%	1A to 1000A AC Current Clamp	43mm ø	600V CATIII
SM UE 1000A-1V	0.5A~1000A(1%>100A)	$15 \mathrm{Hz} \sim 15 \mathrm{kHz}$	1%	0.5A to 1000A AC Current Clamp	54mm ø	600V CATIII
SM UB 1000A-1V	0.5A~1000A(0.5%>10A)	15Hz ~ 15kHz	0.5%	0.5A to 1000A AC Current Clamp	54mm ø	600V CATIII
P32 UE 1000A-1V	5A~1000A	40Hz ~ 5kHz	1%	5 A to 1000A AC Current Clamp	83mm ø (125mm×47mm or 100m m×58mm)	600V CATIII
P32 UE 3000A-1V	5A~3000A	40Hz ~ 5kHz	1%	5 A to 3000A AC Current Clamp	83mm ø	600V CATIII



Current Clamp M3-UB 50A-1V



Current Clamp S-UE 200A-1V



Current Clamp SM-UB 1000A-1V



Current Clamp P32-UE 1000A-1V

Probe / Current Clamp (Hall effect): AC + DC						
Model number	Measuring range	Frequency range	Accuracy	Details	Clamp diameter	Category
SC 3C 100A-1V	$1 \mathrm{A} \sim 100 \mathrm{A}$	$DC \sim 5 kHz$	2%	1A to 100A AC+DC Current Clamp	50mm ø	600V CATIII
SC 3C 1000A-1V	$1A \sim 1000A$	DC ~ 2kHz	1%	1A to 1000A AC+DC Current Clamp	59mm ø	600V CATIII
P20 3C 2000A-2V	$40A \sim 1000/2000A$	DC ~ 2kHz	1%	40A to 2000A AC+DC Current Clamp	83mm ø	600V CATIII
P40 3C 4000A-2V	$40A \sim 2000/4000A$	DC ~ 2kHz	1.5%	40A to 4000A AC+DC Current Clamp	83mm ø	600V CATIII
P50 3C 5000A-2V	$50\mathrm{A}{\sim}1000/5000\mathrm{A}$	$DC \sim 2 kHz$	1.5%	50A to 5000A AC+DC Current Clamp	83mm ø	600V CATIII



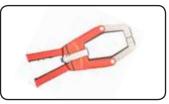
Current Clamp SC 3C 100A-1V



Current Clamp SC 3C 1000A-1V



Current Clamp P20 3C 2000A-2V



Current Clamp P50 3C 5000A-2V

Rogowski Current Transducer: AC / Zero Flux Current Transducer: AC+DC							
Model number	Measuring range	Frequency range	Accuracy	Details	Coil/Through Hole Circumference	Category	
WR5000 Rogowski	$1 \mathrm{A} \sim 5000 \mathrm{A}$	$1 { m Hz} \sim 1 { m MHz}$	0.05%	1A to 5000A AC Rogowski Coil	600mm	600V CATIII	
WR10000 Rogowski	1A~10000A	$1 { m Hz} \sim 1 { m MHz}$	0.05%	1A to 5000A AC Rogowski Coil	600mm	600V CATIII	
Zero Flux Current Transducer	0A~200A	$DC \sim 250 kHz$	0.01%	200A Zero Flux Current Transducer	27.6mm	600V CATIII	
Zero Flux Current Transducer	$0 \mathrm{A} \sim 600 \mathrm{A}$	DC ~ 250kHz	0.01%	600A Zero Flux Current Transducer	27.6mm	600V CATIII	



WR5000 Rogowski Coil

## PPA5500 SERIES MODELS

Phases	Model	Specification
1 Ph	PPA5510-LC	
2 Ph	PPA5520-LC	DC,
3 Ph	PPA5530-LC	10mHz ~ 2MHz
4 Ph	PPA5540-LC	$3$ mApk $\sim$ $30$ Apk
5 Ph	PPA5550-LC	(10Arms)
6 Ph	PPA5560-LC	

Phases	Model	Specification			
1 Ph	PPA5510				
2 Ph	PPA5520	DC,			
3 Ph	PPA5530	10mHz ~ 2MHz			
4 Ph	PPA5540	30mApk ~ 300Apk			
5 Ph	PPA5550	(30Arms)			
6 Ph	PPA5560				

Touchproof 50A screw connectors used on  $\ensuremath{\mathsf{PPA5500\text{-}HC}}$  versions

Phases	Model	Specification		
1 Ph	PPA5510-HC			
2 Ph	PPA5520-HC	DC,		
3 Ph	PPA5530-HC	10mHz ~ 1MHz		
4 Ph	PPA5540-HC	100mApk ~ 1000Apk		
5 Ph	PPA5550-HC	(50Arms)		
6 Ph	PPA5560-HC			





PPA5500 3 Phase model



Danisense DS600

## PPA4500 SERIES MODELS

Pha	ases	Model	Specification
1	Ph	PPA4510-LC	
2	Ph	PPA4520-LC	DC,
3	Ph	PPA4530-LC	10mHz ~ 2MHz
4	Ph	PPA4540-LC	$10 mApk \sim 30 Apk$
5	Ph	PPA4550-LC	(10Arms)
6	Ph	PPA4560-LC	

Phases	Model	Specification
1 Ph	PPA4510	
2 Ph	PPA4520	DC,
3 Ph	PPA4530	10mHz ~ 2MHz
4 Ph	PPA4540	100mApk ~ 300Apk
5 Ph	PPA4550	(30Arms)
6 Ph	PPA4560	

Touchproof 50A screw connectors used on PPA4500-HC versions

Phases	Model	Specification
1 Ph	PPA4510-HC	
2 Ph	PPA4520-HC	DC.
3 Ph	PPA4530-HC	10mHz ~ 1MHz
4 Ph	PPA4540-HC	300mApk $\sim$ 1000Apk
5 Ph	PPA4550-HC	(50Arms)
6 Ph	PPA4560-HC	



PPA5500 units in Master/Slave mode, synchronised for 4-6 Phase measurements

	Р	RODUCT (	COMPARISO	D N	
	PPA500	PPA1500	PPA3500	PPA4500	PPA5500
Basic Accuracy					
V, A rdg error	0.05%	0.05%	0.05%	0.03%	0.01%
Power rdg error	0.10%	0.10%	0.06%	0.04%	0.02%
Phase Options					
Internal	1~3	1~3	1~6	1~3	1~3
Master/Slave operation	-	-	—	$4\sim 6$	4~6
Bandwidth					
20 & 30A Shunt	DC $\sim$ 500kHz	$DC \sim 1MHz$	DC ~ 1MHz	-	_
10 & 30A Shunt	_	_	_	$DC \sim 2MHz$	DC ~ 2MHz
50A Shunt	_	_	_	$DC \sim 1MHz$	$DC \sim 1MHz$
Voltage Input				DC - IWIIZ	DC - IWIIZ
Max input voltage	2500Vpk	2500Vpk	2500Vpk	3000Vpk	3000Vpk
No. of ranges	2300Vpk 8	2300Vpk	2300Vpk	<u> </u>	9
Direct Current Input					
10Arms model	_	_	_	0	0
20Arms model	0	0	0	_	_
30Arms model	ŏ	ŏ	ŏ	0	0
50Arms model	_	<u> </u>	_	ŏ	ŏ
No. of ranges	8	8	8	8	9
Features					
Scope and Graph Modes	_	0	0	0	0
USB Memory port	0	Ō	0	Ō	Ō
LAN Port	0	0	0	0	0
GPIB Port	0	0	۲	0	0
RS232 Port	0	0	0	0	0
Real time clock	0	0	0	0	0
19in Rack mount option	0	0	۲	0	<u> </u>
Torque and Speed	-	-	0	0	0
IEC61000 Mode	-	-	—	-	0
PWM Motor Drive Mode	-	Limited Functionality	<b>O</b>	0	0
Oscilloscope	-	0	<b>O</b>	0	0
Transformer Mode	-	-	0	0	TE version
PWM Filter Options	-	2	7	7	7
Speed/Harmonics/Sec	300/sec	300/sec	300/sec	600/sec	1800/sec
Internal Datalogging	4 Parameters	4 Parameters	32 Parameters	16 Parameters	16 Parameters
Datalog Records	16000	16000	5M	5M	10M
ABD0100.1.8 Mode	-	-	-	-	0
Internal Memory	192kB	192kB	500MB	500MB	1GB
Harmonics	50	50	100	100	417
Minimum Window Size	10ms	5ms	5ms	2ms	2ms
Dimensions - Excl. Feet H x W x D (mm)	92 x 215 x 312	92 x 215 x 312	87.5H x 400W x 347D mm	130 x 400 x 315	130 x 400 x 315
Weight	3.3 - 4kg	3.3 - 4kg	5 - 7kg	5.4 - 6kg	5.4 - 6kg
- 5 -		– Not Applic		Standard	

All specifications at 23°C ± 5°C. These specifications are quoted in good faith but Newtons4th Ltd reserves the right to amend any specification at any time without notice

The N4L product range also includes Frequency Response and Impedance Analyzers, Selective Level Meters and Laboratory Power



#### Applications



- Power supply phase margin and gain margin (FRA)
- Inductance, Capacitance and Resistance (LCR)
- Analysis of mechanical vibration (HARM)
- Phase Angle Voltmeter (PAV)

Contact your local N4L Distributor for further details

#### Newtons4th

Newtons4th Ltd (abbreviated to N4L) was established in 1997 to design, manufacture and support innovative electronic equipment to a world-wide market, specialising in sophisticated test equipment particularly related to phase measurement. The company was founded on the principle of using the latest technology and sophisticated analysis techniques in order to provide our customers with accurate, easy to use instruments at a lower price than has been traditionally associated with these types of measurements. Flexibility in our products and an attitude to providing the solutions that our customers really want has allowed us to develop many innovative functions in our ever increasing product range.



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In recognition of the technical innovation and commercial success of the PPA series, N4L received the "Innovation 2010" Queen's award for enterprise

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