**PPA3500 Series**

1~6 Phase Power Analyzer

**The Complete Solution for Variable Speed Drive Motor Development**

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PPA3500 Precision Power Analyzer

FRONT VIEW

① POWER BUTTON
② FRONT USB PORT
   USB memory port allows data or screendumps to be saved directly to a USB pen drive
③ WIDE ANGLE VIEW DISPLAY SCREEN
   Double white LED backlit 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
   • HARMONIC ANALYZER
   • TRUE RMS VOLTMETER and AMMETER
   • OSCILLOSCOPE
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,
   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
PHASE INPUTS
Direct voltage Input: 2.5kVpk (1kVrms) in 10 ranges
Direct current Input: 1000Apk (30Arms) Standard Model, 300Apk (20Arms) Low Current Model in 10 ranges
External voltage and current sensor inputs to 3Vpk in 8 ranges - BNC Connector

SYNC CONNECTOR
Can be utilised for external triggering

EXTERNAL SENSOR INPUTS
+/-10V or pulsed input from torque and speed sensors provides direct measurement of mechanical power + analogue output
Extension Port: Connection of auxiliary devices such as the ADI40 40 Channel Analogue Input/Output Interface for Multi-Channel Sensor and Direct Thermocouple Measurement

PC INTERFACE CONNECTIONS
Standard interfaces : RS232 + USB + LAN
Optional Interfaces : GPIB

Safety Earth Connection
Screw type safety earth connection
FEATURES

■ High Speed Power Measurement - 5ms Datalog Interval
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 1Ms/s sampling at any drive frequency.

■ 1MHz Wideband Frequency Response
With 1MHz bandwidth and exceptionally flat response, the PPA3500 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
Unique voltage and current analogue card design ensures high accuracy for both power and harmonic analysis.

Class Leading Power Accuracy
PPA3500 Power Accuracy: [0.06% + 0.1%/pf + (0.01%xpf)/pf] Rdg + 0.03%VA Rng
240V (300V Range), 2A (3A Range), Power Factor : 1 (40-400Hz 0.01%VA Rng)

50/60Hz
High sample rate at all times
Inverter output waveform
PWM carrier signal

Fast sampling reliably captures fast switching waveforms
**PWM Control**

**3 Phase Inverter**

Torque & Speed Sensor

**Three Phase Rectifier**

N4L N4Ax
AC Power Source

3 PH INPUT  DC BUS  3 PH PWM OUTPUT  MECHANICAL POWER

FPGA Core

- Simultaneous data acquisition, time synchronising phases
- High speed harmonic analysis
- True "Real Time" power computation with no gap

Measurement parameter examples

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

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**DFT Real Time No Gap Analysis**

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

FPGA/DSP Real time measurement with no gap

- Real Time No Gap analysis ensures correct power measurement
- Simultaneous fundamental and pulse frequency synchronization quickly obtains the correct power

**Up to 6 Phase (8 Wire) Analysis**

The PPA3560 offers 12 channel, 6 Wattmeter measurements from a single chassis. All measurements are time synchronised utilising a central FPGA core which acquires the sample points from all 12 channels simultaneously, avoiding serialised data acquisition. This enables the PPA3560 to achieve unrivalled channel to channel phase angle accuracy and is one of the key contributors to the market leading 0.005deg phase accuracy.

- Missing data compromises power accuracy
- Long term measurement integration achieves approximately correct average power

FPGA/DSP Real time measurement with no gap

- Real Time No Gap analysis ensures correct power measurement
- Simultaneous fundamental and pulse frequency synchronization quickly obtains the correct power
FUNCTIONS

- **Input Torque and Speed Sensor**
  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.

  ① **TORQUE**
  Isolated Bipolar±10V / pulsed

  ② **SPEED**
  Isolated Bipolar±10V / pulsed

  ③ **SYNC**
  Isolated Bipolar±10V / pulsed

- **Built in Amplifier and Unique Shunt Resistor**
  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.

<table>
<thead>
<tr>
<th>Model</th>
<th>Low Current Model</th>
<th>Standard Model</th>
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</thead>
<tbody>
<tr>
<td>PPA3500</td>
<td>10 ranges: 10mApk - 30Apk (20Arms)</td>
<td>10 ranges: 30mApk - 1000Apk (30Arms)</td>
</tr>
<tr>
<td></td>
<td>10mΩ Shunt</td>
<td>3mΩ Shunt</td>
</tr>
</tbody>
</table>

**External shunt options**

(DIS ~ 1MHz, 0.1% Accuracy, Inductance<1nH)

<table>
<thead>
<tr>
<th>Model</th>
<th>Maximum Current</th>
<th>Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF500</td>
<td>500Arms</td>
<td>5000Apk</td>
</tr>
<tr>
<td>HF200</td>
<td>200Arms</td>
<td>2000Apk</td>
</tr>
<tr>
<td>HF100</td>
<td>100Arms</td>
<td>1000Apk</td>
</tr>
<tr>
<td>HF020</td>
<td>20Arms</td>
<td>200Apk</td>
</tr>
<tr>
<td>HF006</td>
<td>6Arms</td>
<td>60Apk</td>
</tr>
<tr>
<td>HF003</td>
<td>3Arms</td>
<td>30Apk</td>
</tr>
</tbody>
</table>

Utilising external shunt resistors
Large 500MB internal memory, data logging from 5ms intervals with synchronization to the fundamental frequency and no gap between measurements

Datapoint storage up to 5M

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

All power measurement and RMS values are computed simultaneously across 6 phases, allowing measured values to be selected and viewed during analysis.

Here, three phase input and 3 phase output power can be 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
MEASUREMENT MODES

■ Power Integrator (power consumption) Mode, RMS Meter Mode and Impedance Meter Mode

- Power Integrator mode
- RMS Voltmeter mode
- Impedance meter mode

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, this can be performed over 6 phases with 3 Phase 3 Wattmeter + 3 Phase 3 Wattmeter wiring configuration.

■ Harmonic Analyzer and Oscilloscope

In Harmonic Analyzer Mode, the PPA3500 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 Discrete Fourier Transform (DFT) is utilised, resulting in highly accurate harmonic analysis. With accuracy figures matching the headline Voltage and Current specification the PPA3500 is a highly capable harmonic analyzer. The use of the DFT is made possible via high speed parallel FPGA signal processing as well as proprietary low level DSP algorithms. The DFT was selected for signal decomposition due to the fact that sample by sample window resolution is possible, instead of the restrictive $2^n$ sample window size of the FFT, the DFT is capable of minimal leakage without the need of error prone window filtering functions.

**Harmonic Accuracy**

- **Voltage**
  - PPA3500-LC: 0.04% Rdg+0.1% Rng+(0.005%×kHz Rdg)+300μA
  - PPA3500: 0.04% Rdg+0.1% Rng+(0.005%×kHz Rdg)+900μA

- **Current**
  - PPA3500-LC D.04% Rdg+0.1% Rng+(0.005%×kHz Rdg)+300μA
  - PPA3500 0.04% Rdg+0.1% Rng+(0.005%×kHz Rdg)+900μA

**Oscilloscope - Voltage and Current display**

**Three phase display of voltage**
ACQUISITION SETTINGS

■ Auto-Ranging, Range Up Only or Manual

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.

② Range up only
Performs automatic ranging when the input is 120% of range, ranging up only.

③ Manual
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
Independently set input coupling so different methods of sensing can be implemented. Such as CT's on phase 1+2, resistive shunt sensing on phase 3 and Rogowski coils on phase 4~6.

DC Waveforms

AC Waveforms

AC+DC and DC coupling both provide 1MHz bandwidth measurements, the coupling setting ensures the instrument is synchronised to the largest power component of the measured waveform. DC coupling should be used for DC bus measurements and AC+DC coupling used for Inverter Output and AC input power measurements.

■ Wiring Settings

The PPA3500 utilises a dual control menu system, the instrument is divided into 2 distinct groups. Group 1 is controlled via display 1(left hand) and group 2 is controlled via display 2(right hand).
ACQUISITION SETTINGS

■ Bandwidth Settings

Low (DC-200kHz) Basic power (50/60Hz) including harmonics of the fundamental while rejecting high frequency noise
Wide (DC-1MHz) Wideband applications such as PWM inverter drives including all power components for true total power

Example of wiring configuration showing 1 phase, individual coupling settings also available.

The PPA3500 series includes a programmable digital filter that allows users to set a preferred bandwidth

■ Display Settings, Smoothing Response and Frequency Reference

① Display update rate

Various settings for the display update rate (5ms ~ 100s) which also increases the smoothing when used together with the smoothing option. A 'window' option permits direct control of the measurement window size.

Example of setting the window, eg (100Hz set to 10ms)

② Smoothing 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.

■ Frequency Reference

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.

Example of wiring configuration showing 1 phase, individual coupling settings also available.

The PPA3500 series includes a programmable digital filter that allows users to set a preferred bandwidth

■ Simultaneous Dual Mode Capability

The PPA3500 has the capability to output two modes simultaneously utilising N4L's proprietary "Dual Core Power Processing" Architecture, providing great flexibility to the user. Of particular interest is the ability to display both Power Analysis and Oscilloscope data at the same time, while maintaining full sample rate. Traditionally, it is common for instruments to decrease raw sample rate within the power analyzer function when another mode is enabled. The PPA3500's "Dual Core" architecture allows for maximum performance of both modes.

Example Dual Core Operation
**PWM Motor Drive Evaluation**

The PPA3500 is the ideal solution for 6 Phase Analysis within a single instrument, a typical application is Variable Speed Inverter Drive analysis. Utilising proprietary digital filtering algorithms, the N4L power analyzer range offers unrivalled performance. The PPA3500 can be used in conjunction with external current sensors such as the WR5000 - a 1MHz 5000A Rogowski Coil in high current applications as well as the LEM range of Zero Flux Current Transducers. Inverter efficiency is available via 3 Phase 2 Wattmeter method + CH3 + 3 Phase 3 Wattmeter, whereby PH1+PH2 are utilised to measure the input power to the three phase rectifier, PH3 is used to monitor DC bus power and PH4~PH6 are used to monitor the output power of the variable speed inverter drive.

**High Speed Analysis**

The PPA3500 features high speed parallel digital signal processing, 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.
Applications

### 4 Phase Solar Inverter Performance Analysis

The PPA3500 provides a highly accurate solar inverter analysis and evaluation solution from one measurement chassis, featuring independent frequency detection N4L Power Analyzers exhibit the ability to synchronise to the 50/60Hz output signal simultaneously 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. In the application below, the PPA3500 is configured as a 4-Channel solution which allows the user to display DC Input to 3 Phase output efficiency data along with THD power quality measurements from one measurement chassis.

### Inrush Current

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 PPA3500 utilises a proprietary real time signal processing technique that maintains full 1Ms/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
Guaranteed Accuracy up to Crest Factor 20

The Newtons4th Power Analyzers feature a guaranteed accuracy up to a crest factor of 20, meaning the auto-ranging system of the PPA3500 is able to peak detect automatically upon waveforms with a crest factor (peak/rms) of up to 20.

Newton4th are the only Power Analyzer Manufacturer in the world** to provide ISO17025 calibration certificates on all new Power Analyzers as standard. Our ISO17025 Schedule of Accreditation 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.

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.

* N4L’s UKAS ISO17025 Laboratory is based in the UK, international accreditation is dependent upon local distributor calibration capabilities
** According to N4L research, 2015
Auto Peak Ranging Ensures Complete Waveform Analysis

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.

### Ranging Principles

#### Example RMS Ranging system, commonly used in older instrument designs

- Waveform within red hashed area is clipped by an RMS ranging system and fixed crest factor setting

#### Modern Peak Ranging System, implemented on all N4L Power Analyzers

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

### 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 temperature
- Fast range switching
- Constant frequency response on all ranges
- Signal can be applied with instrument powered off

### 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.
PC CONTROL AND DATA ACQUISITION

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

PPALoG
Exceptional flexibility and ease of use with all the functions included in the original PPAcomm program plus multiple instrument control for 7-24 phase applications and data export to Text file, Excel, Bitmap or Clipboard.

Data Export options
- Measurement parameters are chosen by the user from tick box options.
- Real time results can be displayed as latest value, table or graph.
- Datalogging results are then saved in the selected format.

PPA Standby Power
Full compliance testing to EN50564 (IEC62301). Meets or exceeds the requirements and methodology of U.S. EPA (Energy Star), U.S.DOE, California Energy Commission (CEC), among others.

Standby power test screen with real time update of EN50564 (IEC62301) criteria.
**SPECIFICATION**

### Frequency Range
- **Normal**
  - PPA3500-LC(20Arms) DC, 10mHz ~ 1MHz; PPA3500(30Arms) DC, 10mHz ~ 1MHz
  - Range 1+2 **:** DC, 10mHz ~ 100kHz

### No. of Phases
- 3~6

### Voltage Input
- **Internal**
  - Range: Normal : 100mVpk ~ 2500Vpk(1000Vrms) in 10 ranges (240Vrms within 300Vpk range, using 20% overrange)
  - Accuracy
    - 1V ~ 2500V range : 0.04% Rdg+0.1% Rng+(0.005%/kHz Rdg)+5mV
    - Range 1+2 **:** 0.04% Rdg+0.1% Rng+(0.01%/kHz Rdg)+1mV

- **External**
  - Range: 1mVpk ~ 3Vpk in 8 ranges [BNC connector 3Vpk max input]
  - Accuracy
    - 0.04% Rdg+0.1% Rng+(0.005%/kHz Rdg)+3µV

### Current Input
- **20Arms Low Current** (PPA3500-LC) 4mm safety connectors
  - Ranges: 10mApk ~ 300Apk(20Arms) in 10 ranges
  - Accuracy
    - 10mApk ~ 30Apk ranges: 0.04% Rdg+0.1% Rng+(0.005%/kHz Rdg)+300µA
    - 10mApk ~ 300Apk ranges: 0.04% Rdg+0.1% Rng+(0.01%/kHz Rdg)+100µA

- **30Arms (PPA3500)** 4mm safety connectors
  - Ranges: 30mA ~ 1000Apk ranges: 0.04% Rdg+0.1% Rng+(0.005%/kHz Rdg)+900µA
  - Accuracy
    - 30mA ~ 1000Apk ranges: 0.04% Rdg+0.1% Rng+(0.01%/kHz Rdg)+300µA

### External input (External shunt Current sensor)
- BNC Connector (Max input 3Vpk)
  - Ranges: 1mVpk ~ 3Vpk in 8 ranges
  - Accuracy
    - 0.04% Rdg+0.1% Rng+(0.005%/kHz Rdg)+3µV

### Phase Accuracy
- **Normal**
  - Normal : 0.005deg+(0.01deg×kHz) Range 1+2 **:** 0.005deg+(0.02deg×kHz)

### Power Accuracy
- [0.1% + 0.1%/pf + (0.01%/kHz)/pf] Rdg + 0.05%VA Rng
  - Range 1+2 **:** [0.1% + 0.1%/pf + (0.02%/kHz)/pf] Rdg + 0.05%VA Rng

### 40-850Hz
- [0.06% + 0.1%/pf + (0.01%/kHz)/pf] Rdg + 0.03%VA Rng

### General
- Crest Factor: 20(Voltage and Current)
- Sample Rate: 1Ms/s on all channels, No-Gap
- IEC Modes: IEC50564 (Replaced IEC62301) and Energy Star
- Application Modes: PWM Motor Drive, Ballast, Inrush, Power Transformer, Standby Power
- CMMR - Common Mode Rejection Ratio
  - 250V @ 50Hz - ≥ 1mA (150dB)
  - 100V @ 10kHz - ≥ 3mA (130dB)

### Measurement Parameters
- 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
- Frequency (Hz), Phase (deg), Fundamentals, Impedance
- Harmonics, THD, TIF, THF, TRD, TDD
- Integrated Values, Datalog, Sum and Neutral values

### Datalog - Up to 6 user selectable measurement functions across 6 phases, 32 total (60 with optional PC software)
- **DataLog Window No-Gap analysis, Minimum window 5ms**
- **Memory** 500MB, 5M records

### Communication Ports
- **RS232**
  - Baud rate up to 38.4kbps,RTS/CTS flow control
- **LAN**
  - 10/100 Base-T Ethernet auto sensing
- **GPIB**
  - (Option G - External Adapter) IEEE488.2 Compatible
- **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

### Standard Accessories
- ** Leads**
  - Power, RS232, USB
- **Connection Cables**
  - 36A 1.5m long 4mm stackable terminals
  - 1x red, 1x yellow and 2x black per phase
- **Connection Clips**
  - 4mm terminated alligator clips - 1x red, 1x yellow and 2x black per phase
- **CD-ROM**
  - CommView2 (RS232/USB/LAN), Command line, Script based communication software
- **Documents**
  - Communications manual, Calibration certificate, Quick start guide

### Mechanical/Environmental
- **Input Impedance**
  - Voltage Attenuator and External Inputs 3.3MΩ || 25pF
- **Display**
  - 2 x 480x272 dot full colour TFT, White LED Backlit
- **Dimensions**
  - 92H x 404W x 346D mm excluding feet
- **Weight**
  - 5.9kg(3 Phase), 8.8kg(6 Phase)
- **Safety Isolation**
  - 1000Vrms or DC(CATIIR), 600Vrms or DC(CATIII)
- **Power supply**
  - 90 ~ 265Vrms, 50 ~ 60Hz, 50VAmax
- **Operating Conditions**
  - 23°C ± 5°C Ambient Temperature (or air intake temperature when rack mounted), 20-90% Non-Condensing Relative Humidity.
  - Temperature coefficient ±0.01% per °C of reading at 5-18°C and 28-40°C


Note *:** Voltage Range[x] 1 + 2 : [1]100mV + [2]300mV
### SPECIFICATION

#### Harmonic Specification

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPA3500</td>
<td></td>
</tr>
</tbody>
</table>

#### Bandwidth
- DC, 10mHz – 1MHz
- PPA3500-LC (20Arms), PPA3500 (30Arms)

#### No. of Harmonics
- 100

#### Sampling Frequency
- 1M/s

#### Signal Processing
- DFT (Discrete Fourier Transform)

#### Crest Factor
- 20

#### Power Factor
- 0 to 1

#### Harmonic Accuracy
- Voltage: 0.04% Rdg + 0.1% Rng + (0.005% x kHz Rdg) + 5mV
- Current: PPA3500-LC 0.04% Rdg + 0.1% Rng + (0.005% x kHz Rdg) + 300μA
- PPA3500 0.04% Rdg + 0.1% Rng + (0.005% x kHz Rdg) + 900μA

Harmonic Accuracy (above) still applies with Frequency Filter set.

#### Cycle by Cycle Analysis direct to PC
- Data Rate: 10ms (all channels active)

#### Cycle by Cycle Analysis direct to Internal RAM
- Data Rate: 5ms (all channels active)

#### Voltage Attenuator Overload Capability
- 20ms: 4.2kVp (3kVRms)
- 5s: 3.1kVp (2.2kVRms)
- Continuous: 3kVp (2kVRms)

#### Voltage Attenuator Input Impedance
- 20Arms: 10mΩ
- 30Arms: 3mΩ

#### Selectable Analogous Filter
- 250kHz

#### Minimum Current Measurement at Full Accuracy
- PPA3500-LC: 220μArms
- PPA3500: 700μArms

### ACCESSORIES SUPPLIED AS STANDARD

#### Leads and Interfacing

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>36A Connection lead set</td>
<td>1.5 Metre - 36A lead set with 4mm stackable safety terminals 1x Red, 1x Yellow and 2x Black per phase plus alligator clips</td>
</tr>
<tr>
<td>RS232 cable</td>
<td>RS232 9pin serial Cable</td>
</tr>
<tr>
<td>USB cable</td>
<td>USB 2 Metre A male to B male</td>
</tr>
<tr>
<td>LAN Interface</td>
<td>LAN fitted as standard</td>
</tr>
<tr>
<td>USB to 9-pin RS232 (Option)</td>
<td>USB ~ 9-pin RS232 Serial Converter</td>
</tr>
<tr>
<td>GPIB Option</td>
<td>GPIB Interface Option</td>
</tr>
<tr>
<td>RS232 cable</td>
<td>RS232 9pin serial Cable</td>
</tr>
<tr>
<td>USB cable</td>
<td>USB 2 Metre A male to B male</td>
</tr>
<tr>
<td>LAN Interface</td>
<td>LAN fitted as standard</td>
</tr>
<tr>
<td>USB to 9-pin RS232 (Option)</td>
<td>USB ~ 9-pin RS232 Serial Converter</td>
</tr>
<tr>
<td>GPIB Option</td>
<td>GPIB Interface Option</td>
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</tbody>
</table>

#### Documents (Standard)

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration/Test &amp; Inspection Certificate</td>
<td>PPA Certificate of Calibration</td>
</tr>
<tr>
<td>UKAS ISO17025 Certificate</td>
<td>UKAS ISO17025 Certificate of Calibration</td>
</tr>
<tr>
<td>Spare set of manuals</td>
<td>Quick Start Guide</td>
</tr>
<tr>
<td></td>
<td>Comms manual</td>
</tr>
<tr>
<td></td>
<td>PPAloG user guide available as website download</td>
</tr>
</tbody>
</table>

#### Connection and extension port accessories (Optional)

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakout box</td>
<td>Simple analyzer connection between source and DUT</td>
</tr>
<tr>
<td>PCIe1</td>
<td>10Arms 300Apc rated Phase Controlled Inrush Switch</td>
</tr>
<tr>
<td>ADI40</td>
<td>40 Channel Analogue Input/Output Interface</td>
</tr>
<tr>
<td>GPIB Communication Cable</td>
<td>GPIB Communication Cable Option</td>
</tr>
</tbody>
</table>

#### OPTIONAL ACCESSORIES

##### PC Software (Optional CD, Free to Download)

- **PPALoG**: PC control and data acquisition of 1 – 24 phases with selectable Real Time data, Graphing, Datalog and versatile export options
- **User Manual for PPALoG available as a free download from our website**

##### Carry cases (Optional)

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft carrying case</td>
<td>Black nylon with shoulder strap</td>
</tr>
</tbody>
</table>

##### Rack Mount Kit (Optional)

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rack Mount brackets</td>
<td>PPA3500 19in rack mount brackets</td>
</tr>
</tbody>
</table>

##### Interface (Optional)

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPA-GPIB interface</td>
<td>Option G - GPIB(IEEE488) Interface</td>
</tr>
</tbody>
</table>
## ACCESSORIES

### High Performance Voltage Attenuating Probes

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage Range</th>
<th>Frequency Range</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT-HV250</td>
<td>2500Vpk</td>
<td>300MHz</td>
<td>High Voltage Probe (Passive) 2.5kVpk 100:1</td>
</tr>
<tr>
<td>TTV-HVP</td>
<td>1500Vpk</td>
<td>500MHz</td>
<td>High Voltage Probe (Passive) 15kVpk 1000:1</td>
</tr>
<tr>
<td>ATT10</td>
<td>30Vpk</td>
<td>30MHz</td>
<td>10:1 Voltage Attenuator Box (For use in conjunction with HV Probes when output voltage of probe is &gt;3Vpk, BNC Input/BNC Output)</td>
</tr>
<tr>
<td>ATT20</td>
<td>60Vpk</td>
<td>30MHz</td>
<td>20:1 Voltage Attenuator Box (For use in conjunction with HV Probes when output voltage of probe is &gt;3Vpk, BNC Input/BNC Output)</td>
</tr>
<tr>
<td>ULCW</td>
<td>3000Vpk</td>
<td>2MHz</td>
<td>1000:1 Ultra Low Capacitance Probe (Active), For use in applications such as Ballast Testing (&lt;1pF Capacitance)</td>
</tr>
</tbody>
</table>

### High Performance External Current Measurement Options

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

### Probe/Current Clamp Transformer: AC

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Measuring range</th>
<th>Frequency range</th>
<th>Accuracy</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3 UB 50A-1V</td>
<td>100mA ~ 50A</td>
<td>40Hz ~ 5kHz</td>
<td>1%</td>
<td>100mA to 50A AC Current Clamp 15mm×17mm 600V CATIII</td>
</tr>
<tr>
<td>M3 U 100A-1V</td>
<td>1A ~ 100A</td>
<td>40Hz ~ 5kHz</td>
<td>1%</td>
<td>1A to 100A AC Current Clamp 15mm×17mm 600V CATIII</td>
</tr>
<tr>
<td>S UE 200A-1V</td>
<td>1A ~ 200A</td>
<td>40Hz ~ 5kHz</td>
<td>1%</td>
<td>1 A to 200A AC Current Clamp 50mm ø 600V CATIII</td>
</tr>
<tr>
<td>S UE 250 500</td>
<td>1A ~ 250A/500A/1000A</td>
<td>40Hz ~ 5kHz</td>
<td>1% (250A), 0.5% (500A) 1% (1000A)</td>
<td>I A to 250/500/1000A AC Current Clamp 50mm ø 600V CATIII</td>
</tr>
<tr>
<td>US UE 100A-1V</td>
<td>1A ~ 1000A</td>
<td>40Hz ~ 5kHz</td>
<td>1%</td>
<td>1A to 1000A AC Current Clamp 43mm ø 600V CATIII</td>
</tr>
<tr>
<td>SM UE 1000A-1V</td>
<td>0.5A ~ 2000A(1%≈1800A)</td>
<td>15Hz ~ 15kHz</td>
<td>1%</td>
<td>0.5A to 2000A AC Current Clamp 54mm ø 600V CATIII</td>
</tr>
<tr>
<td>SM UB 1000A-1V</td>
<td>0.5A ~ 1000A(0.5%≈10A)</td>
<td>15Hz ~ 15kHz</td>
<td>0.5%</td>
<td>0.5A to 1000A AC Current Clamp 54mm ø 600V CATIII</td>
</tr>
<tr>
<td>P32 UE 1000A-1V</td>
<td>5A ~ 1000A</td>
<td>40Hz ~ 5kHz</td>
<td>1%</td>
<td>5 A to 1000A AC Current Clamp 83mm ø (125mm×47mm or 100mm×58mm) 600V CATIII</td>
</tr>
<tr>
<td>P32 UE 3000A-1V</td>
<td>5A ~ 3000A</td>
<td>40Hz ~ 5kHz</td>
<td>1%</td>
<td>5 A to 3000A AC Current Clamp 83mm ø 600V CATIII</td>
</tr>
</tbody>
</table>
PPA3500 SERIES MODELS

<table>
<thead>
<tr>
<th>Phases</th>
<th>Model</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Ph</td>
<td>PPA3530-LC</td>
<td>DC, 10mHz ~ 1MHz</td>
</tr>
<tr>
<td>4 Ph</td>
<td>PPA3540-LC</td>
<td>DC, 10mHz ~ 1MHz, 10mApk ~ 300Apk (20Arms)</td>
</tr>
<tr>
<td>5 Ph</td>
<td>PPA3550-LC</td>
<td>DC, 10mHz ~ 1MHz, 30mApk ~ 1000Apk (30Arms)</td>
</tr>
<tr>
<td>6 Ph</td>
<td>PPA3560-LC</td>
<td>DC, 10mHz ~ 1MHz, 30mApk ~ 1000Apk (30Arms)</td>
</tr>
</tbody>
</table>

PPA3500 SERIES UPGRADE PATH

<table>
<thead>
<tr>
<th>Model</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>3500-CH+LC</td>
<td>PPA3500 Additional Input Channel (Voltage and Current) 20A</td>
</tr>
<tr>
<td>3500-CH+</td>
<td>PPA3500 Additional Input Channel (Voltage and Current) 30A</td>
</tr>
</tbody>
</table>
The N4L product range also includes Frequency Response and Impedance Analyzers, Selective Level Meters and Laboratory Power Amplifiers.

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

Newtons4th

Newton4th 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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