

APPLICATION GUIDE

PPA Series Calibration Guide

Introduction

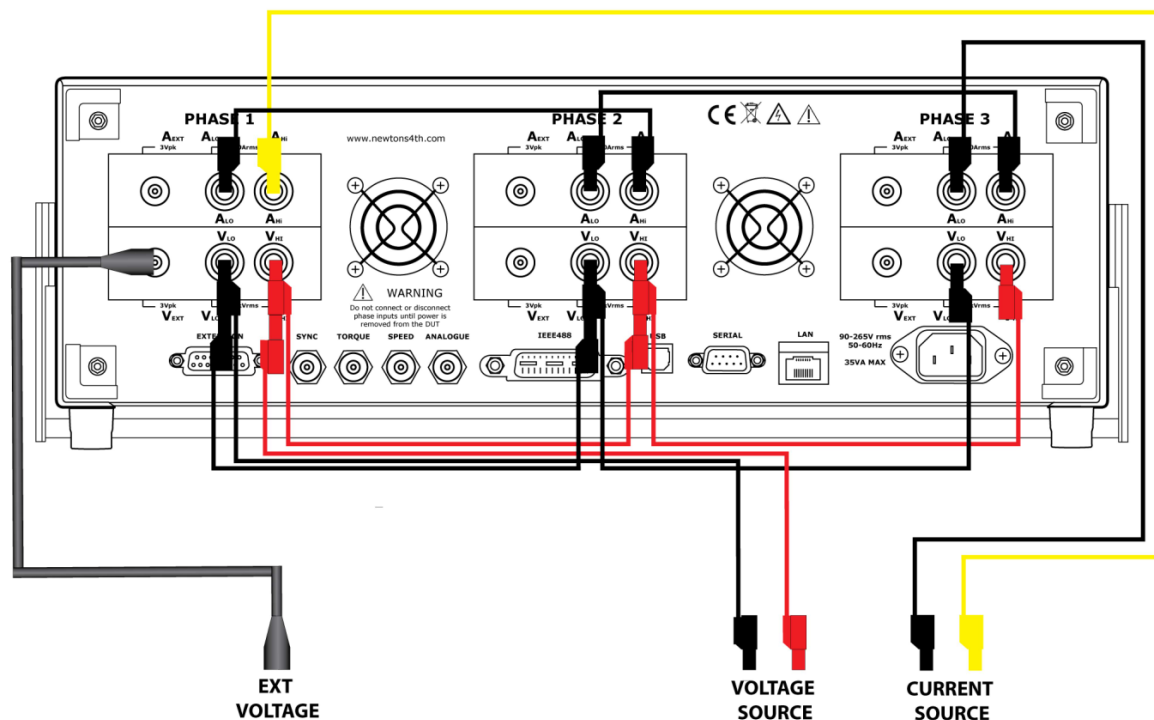
Designed for use in a wide range of power measurement applications, PPA series power analyzers offer an extensive range of configuration settings. While this flexibility enables our analyzers to provide an optimum measurement solution to many applications, it follows that incorrect configuration may compromise the accuracy of measurements.

This application guide will discuss the correct instrument configuration and additional considerations that should be understood when calibrating any PPA series power analyzer. This guide is based on the PPA45/55 Precision Power analyser, but applies to our entire range of power analyzers.

Connections

Providing up to three power measurement phases with fully isolated voltage and current channels, calibration of PPA units involves up to 6 inputs, comprising 3 voltage and 3 current cards.

While calibration engineers may instinctively consider the connection and calibration of each card separately, the fully isolated design of the PPA inputs permits simultaneous connection of all 3 voltage cards in parallel and all 3 current cards in series as shown below:



Where it is not possible to generate reference voltage and current signals at the same time, it is still recommended that voltage or current signals are applied to all 3 respective inputs.

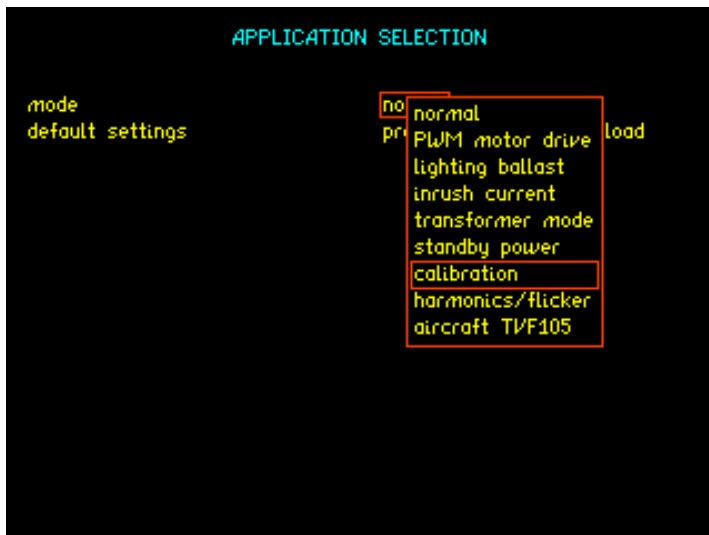
APP GUIDE - PPA Series Power Analyzer Calibration Guide	D000198	November 2020
Newtons4th Ltd 1 Bede Island Road Leicester LE2 7EA UK	Tel: +44 (0)116 2301066	

We recommend this connection technique for the following reasons:

- Calibration time is reduced
- Voltage and current signal levels applied to all inputs is then known to be equal
- Default frequency synchronisation on PH1 will remain suitable for all three input calibrations
- By reducing the number of connection and source activation stages, the opportunity for errors is reduced

Note: The isolated BNC external input (EXT Voltage) can be used for frequency synchronisation or to offer low voltage ranges (from 3Vpk - 300uVpk in 9 ranges)

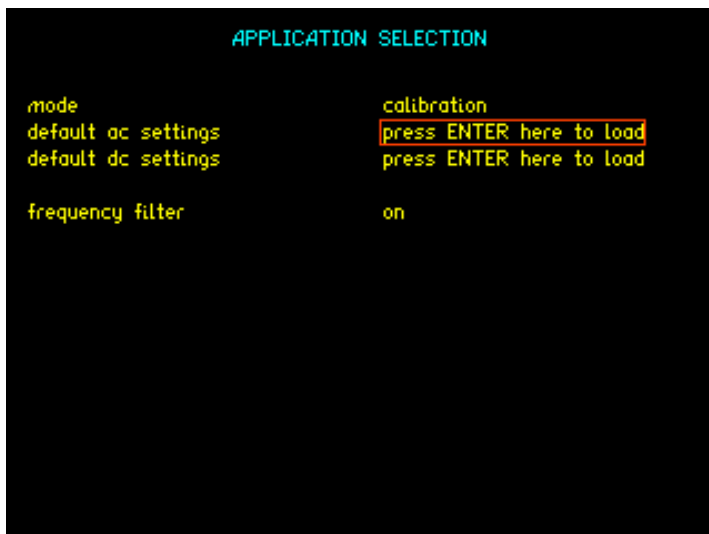
Configuring the PPA for calibration



In order to simplify instrument configuration during calibration, the application menu (APP button on the PPA front panel) includes a calibration option as shown here.

Using the ▼ navigation key, the calibration option can be selected and then entered by pressing the ENTER key.

AC Calibration



After selecting calibration mode, the screen shown here will be visible.

By selecting the 'default ac settings' option via the ▼ key followed by the ENTER key, the PPA will be configured correctly for AC calibration.

POWER ANALYZER 12:03:16
 Vrange: 300V Arange: 3.000A ac+dc bandwidth: wide

PH1	total	fundamental	
watts	100.06W	100.05W	
VA	100.06VA	100.05VA	
VAr	-572.82mVAr	-565.31µVAr	
pf	1.0000	+1.0000	
voltage	100.04V	100.03V	+000.00°
current	1.0002A	1.0002A	-000.00°
frequency	50.000Hz		
H3	-355.89nW	-0.000%	
dc watts	2.5512mW		
V ph-ph	4.9428mV	3.0406mV	-321.29°

Here we have applied a nominal 100Vrms and 1Arms @ 50Hz.

Notice that the voltage and current measurements being observed are those in the fundamental column. Calibration against a sinusoidal reference signal should always be made relative to the fundamental measurement, because these values will exclude any noise or dc offset components of the applied signal. It is for this reason that we recommend use of the POWER mode display not the RMS display.

POWER ANALYZER 12:04:59
 ac+dc bandwidth: wide

	phase 1	phase 2	phase 3	
watts.f	100.05	100.04	100.05	W
VA.f	100.05	100.04	100.05	VA
VAr.f	-565.31µ	1.3279m	-1.1025m	VAr
pf.f	1.0000	-1.0000	1.0000	
V.f	100.03	100.03	100.02	V
A.f	1.0002	1.0001	1.0004	A
frequency	50.000			Hz
V.f	+000.00	-000.00	-360.00	°
A.f	-000.00	-000.00	-000.00	°
V.f ph-ph	3.0406m	13.244m	15.398m	V

Having connected all three voltage and current inputs as shown on page 1, the NEXT key can be pressed to progress through channel display options until the three phase fundamental screen is visible as shown here.

Clearly, it is convenient to observe the same voltage and/or current on all three phases at the same time.

NOTE: Selection of the functions to be viewed in a larger font as shown here is via the ZOOM± buttons. (Explained fully in the PPA quick start guide)

DC Calibration

APPLICATION SELECTION

mode	calibration
default ac settings	press ENTER here to load
default dc settings	press ENTER here to load
disconnect all measurement inputs for manual zero	
	press ENTER here to execute
fit 50Ohm terminators to external inputs for manual zero	
	press ENTER here to execute

By selecting the 'default dc settings' option via the ▼ key followed by the ENTER key, the PPA will be configured correctly for DC calibration.

Having selected default dc settings, additional options are presented that permit manual zero of either direct or external inputs.

```

APPLICATION SELECTION

mode                               calibration
default ac settings                press ENTER here to load
default dc settings                press ENTER here to load

disconnect all measurement inputs for manual zero
                                     press ENTER here to execute
fit 500ohm terminators to external inputs for manual zero
                                     press ENTER here to execute
  
```

In most cases, calibration will be associated with direct voltage or current inputs, therefore the first manual zero option shown here will be the one most commonly used.

After first ensuring that there are no connections to the PPA input terminals, selecting the option shown here and pressing the ENTER key will force a DC compensation.

This compensation is automatically stored in the PPA and is reset if required by repeating the process.

```

TRUE RMS VOLTMETER                               12:21:19
coupling: dc                                     bandwidth: dc

A
rms      phase 1      phase 2      phase 3      A
dc       20.018m    19.887m    20.090m    A
ac       0.0000     0.0000     0.0000     A
peak    21.15m     19.89m     21.14m     A
cf       1.06      1.00      1.05
surge   22.07m    20.51m    21.73m     A
mean    19.95m    22.04m    21.77m     A
ff       1.004     0.902     0.923
frequency 0.0000     Hz
  
```

Here we have applied a nominal 20mAdc to all three direct current inputs. This is 60% of range 1 on a standard PPA5530.

When calibrating with a low level voltage or current input, optimum accuracy is achieved by pressing the TRIGGER button prior to a reading.

The maximum and minimum RMS signal level associated with all ranges is defined together with the defined accuracy specification in a 'Performance Test Specification' document available from N4L.

General Notes

Frequency detection

Unlike many conventional power analyzers or a DMM, the PPA series is designed to quantify the dc, ac and harmonic components of a total RMS signal. It is therefore **essential** that correct frequency synchronisation is achieved with an applied AC input. In normal use where voltage and current signals are measured simultaneously, a default frequency reference of phase 1 voltage is appropriate. However, where signals are applied individually to any voltage or current input, it is **essential** that the corresponding setting is selected in the acquisition (ACQU) menu, shown above. Never calibrate if the frequency is incorrect.

```

frequency reference      voltage
frequency reference     ph phase 1
phase angle reference    vo phase 2
frequency filter         on  phase 3
low frequency           of
  
```

DC Specification

It should be remembered that the DC specification is different to the AC specification.

Range 1 maximum input

The DC or AC peak applied signal level on Range 1 of either the voltage and current inputs should not exceed 60% of the specified peak range.

Low signal levels

The external inputs (BNC) support low signal level measurement from external sensors or shunts and may also be used for external frequency synchronisation.

APP GUIDE - PPA Series Power Analyzer Calibration Guide	D000198	November 2020
Newtons4th Ltd 1 Bede Island Road Leicester LE2 7EA UK	Tel: +44 (0)116 2301066	