POWER AUTOMATION TECHNOLOGIES

HV Power hints and tips:
PQ-Box Power Quality Recorder

Issue 12a **August 22nd 2014**

[WinPQ mobil V2.1.3]
Single phase update 20-5-2016

Single Phase Measurements

By selecting ...Configuration...System = 'U:1-wire System', this essentially turns off voltage channels L2 & L3 and current channels L2 & L3 **& Neutral**. The PQ-Box 100/150/200 ignores these inputs, so:

- Their values are not recorded to file, so file size is smaller
- Voltage L2 & L3 values & Current L2,L3, N are shown as zero values in the LCD and online measurement screens etc
- The PQ-Box does not auto flag, or give low voltage events/warnings for Voltage L2 & L3 (so you no longer need to parallel up L1+L2+L3 voltage leads to avoid this)
- Trigger levels for L2, L3 & N are not active, so you do not get false triggering of Oscilloscope and RMS recorders if the inputs are floating
- It is still permissible to have voltage/current applied to the L2 & L3 inputs (the values are ignored) - the inputs can be left floating, but a good practice is to connect those voltage leads to the ground lead.

If you need to also measure Neutral Current in addition to L1 current in a single phase circuit, you will need to set the PQ-Box 100 up for a "4-wire system" and parallel up the L2& L3 Voltage leads with L1.

Note in WinPQ mobil V3.0.0 and earlier, transducer factor and Oscilloscope/RMS recorder (etc) trigger setting ability is shown for the neutral current channel. These are not active and disregarded. We expect these to be removed in the next version.

Reactive Power Measurement - Direction

As reactive power calculations use a root mean square, no sign indication of direction of the reactive power flow is possible (all values are shown as +ve values).

Where reactive power flow direction is required, it is recommend to use the Fundamental [QV] value, which does indicate reactive power direction with +ve & -ve signs as appropriate.

This applies to both of the available 'Power measurement' selections:

- DIN 40110-2: (prior method, and current default)
  - This includes the calculation of the unbalanced reactive power, so Q L1+Q L2 + Q l3 ≠ Qtotal. The measurement is essentially the root mean square calculation of fundamental reactive power + distortion power + unbalanced reactive power
- Power calculation without Unbalance-reactive power
  - This simplified calculation disregards unbalanced reactive power, so Q L1+ QL2+ Q L3=Qtotal. The measurement is essentially the root mean square calculation of fundamental reactive power + distortion power This allows compatibility of measurement to the simple "industry standard" that many other instruments are only capable of.

HV POWER MEASUREMENTS & PROTECTION LTD
8 Rongotai Road, Kilbirnie, Wellington
P O Box 14-385, Kilbirnie, Wellington 6241, New Zealand

TEL: +64-4- 387 7339
Fax: +64-9-302 2142
email: info@hvpowerautomation.com

IMPORTANT:
From WinPQ Mobil 1.8.9 (DSP 1.255 and MCU 1.151) the LCD reactive power values were changed from Q to QV to show the fundamental values and thus also the +ve, -ve directional sign of this (50Hz) reactive power. QV values were also added to the Online "Details" display screen.

Q = Reactive Power kVAr [not signed]
QV = Reactive Power fundamental (50 Hz reactive power component only) [signed]

Measuring Intervals, PLT, PST etc

When the PQ-Box 100 recording is started, Permanent recording only starts on the appropriate increment of the measuring interval from the hour. For example if the PQ-Box 100 is started at 13:02 with a 10 minute measuring interval, the first measuring interval will be from 13:10 to 13:20. The first data point will be time stamped 13:20, being the end of the first measuring interval.

Permanent Recorded Data from the first incomplete measuring interval (i.e. 13:02 to 13:10) is not retained. However, should Oscilloscope, RMS or other event data occur during this first incomplete measuring interval, the event data is retained.

PLT
Long Term Flicker (PLT) uses a 2 hour measurement period. This is also synchronised to the clock, from 12:00. That is PLT will be reported at 12:00, 02:00, 04:00 etc. It is not simply calculated and reported every 2 hours from the first measuring interval.

As PLT requires 2 hours of data, using the above example of starting at 13:20, the first PLT value will be time stamped 16:00. A 14:00 value would not be reported as the calculation would have only being based on 40 minutes of data.

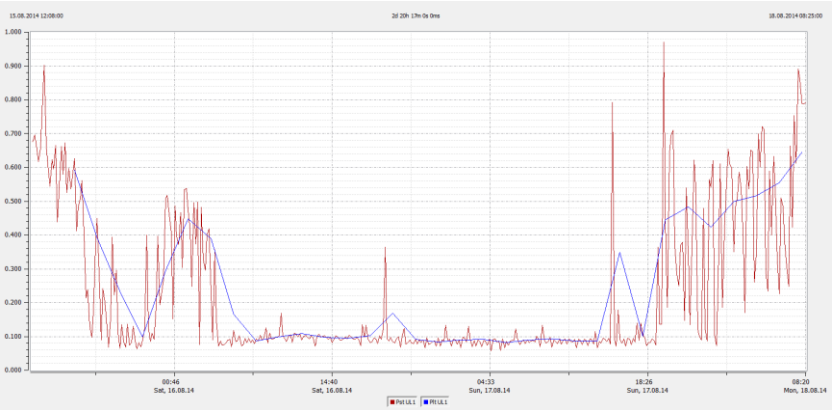


Figure 1. Example PST and PLT data.

Figure 1 shows the example of PST (Red) and PLT (Blue). While PST data is graphed from the start of the recording, the first PLT value does not occur till 16:00, some 3 hrs 40 min from the start of the recording.

Interval Trigger

HV POWER MEASUREMENTS & PROTECTION LTD
8 Rongotai Road, Kilbirnie, Wellington
P O Box 14-385, Kilbirnie, Wellington 6241, New Zealand

TEL: +64-4- 387 7339
Fax: +64-9-302 2142
email: info@hvpowerautomation.com

MCU 2.004 for the PQ-Box 100 introduced the Interval Trigger, where the Oscilloscope Recorder can be triggered at a periodic time, such as each 60 minutes (setting range 1 min to 240 minutes in 1 minute increments). This trigger interval is based on the time the PQ-Box 100 recording starts – it is not synchronised to an increment of the hour.

Other Uses for Power Interval setting

MCU 2.004 for the PQ-Box 100 introduced the option for a 10 minute power interval (in addition to the 15 minute and 30 minute choices).

Recently the range of permanently recorded values available in the 'Power(15 min)' selection have also been expanded and now includes 'Ueff (15 min).

Thus for the customer who wanted 60 second averaged and 600 second averaged voltage data, there is now a solution, that does not require them to export 60 second values and average these to get 10 minute data. Simply set the Measuring Interval to 60 seconds and the Power Interval to 10 minutes and both data classes are available for graphing and CSV exporting.

Note for those who want more data classes, the fixed installed PQ devices PQI-D, PQI-DA and PQI-DA Smart should be considered. With these products, 200 ms, 3 second, 10 minute (or other set interval), 2 hour and 24 hour values are recorded.

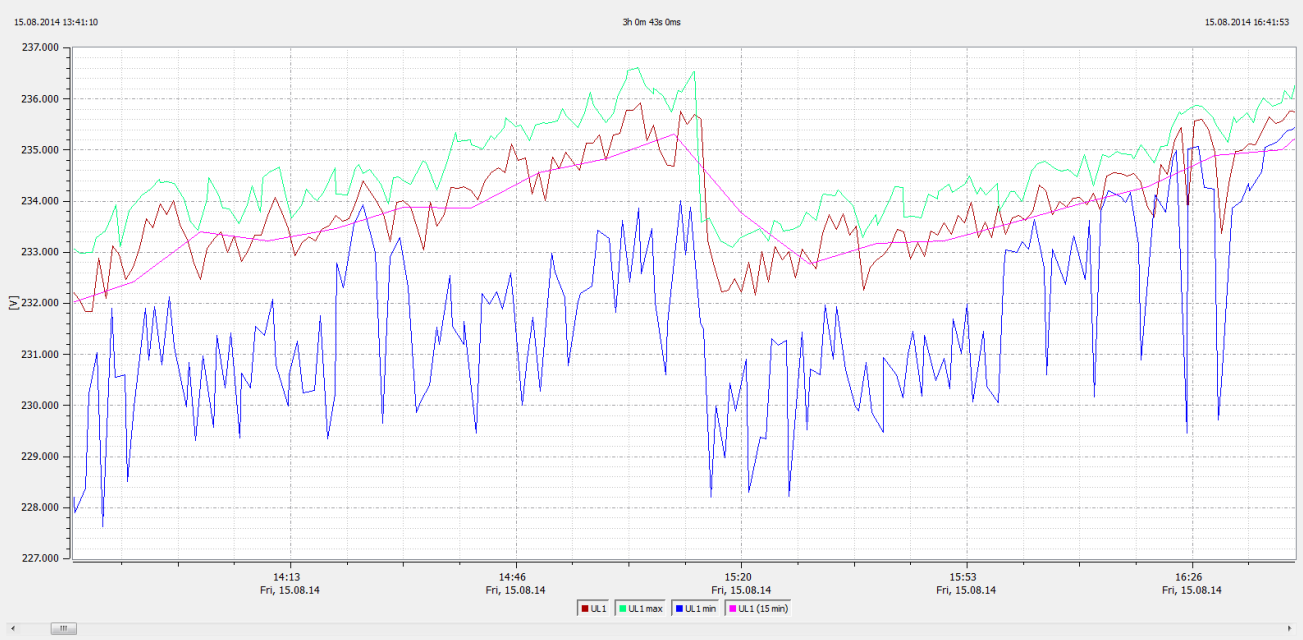


Figure 2. Example 10 ms Max/Min, 60 second and 10 minute voltage data.

HV POWER MEASUREMENTS & PROTECTION LTD
8 Rongotai Road, Kilbirnie, Wellington
P O Box 14-385, Kilbirnie, Wellington 6241, New Zealand

TEL: +64-4- 387 7339
Fax: +64-9-302 2142
email: info@hvpowerautomation.com

Record only voltage & Record only basic data

Here is a reminder about the new setups to limit the extent of the data logged.

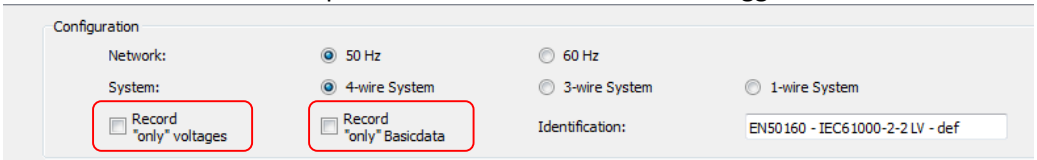


Figure 3. Options to limit recorded data.

Configuration Setting	Effect
Record only voltages	Records voltage and frequency information only All current, power and other related/calculated data display/measurement is disabled. *That is, just measurements under the Frequency & Voltage 'branches' in the Permanent Recording selection 'menu tree' are made (including individual voltage harmonics, flicker etc.)* This reduces the file size by approx. 60 %
Record only basic data	This disables the recording of individual (current/voltage) harmonics, interharmonics and the phase angle of harmonics. *THD is still recorded.* This reduced file size by approx. 40 %
Combination	Selection of both tick boxes is permitted, which causes the individual harmonic measurements to be excluded from the "Only voltage" data subset.

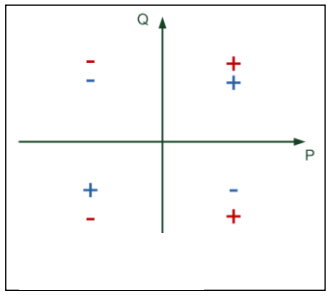
Table 1. PQ-Box configuration selections.

Notes:

- These settings also apply to the LCD (where current and power data respectively is shown as zero values). It also applies to current/power data in Oscilloscope and RMS Event recordings etc.
- In the software, if non-recorded permanent values are selected to be displayed, no value will be displayed (that is, zero values will not be displayed, to avoid confusion).
- There is no indication of these selections via the PQ-Box 100 LCD. In a recorded file, the status of these selections can be found via the "More" information setting screenshot.

Cos(phi) VDE-AR-4105

The new permanent recording data 'cos(phi VDE-AR-N4105)' provides different signs to support VDE-AR-N4105, which is a German application guide concerning decentralised power generation infeed. Figure 4 shows the signs for the different power flow quadrants.



Red: cos(phi)
Blue: cos(phi) to VDE-AR –N4105

Figure 4. cos(phi) sign for normal and VDE-AR-N4105 values.

HV POWER MEASUREMENTS & PROTECTION LTD
8 Rongotai Road, Kilbirnie, Wellington
P O Box 14-385, Kilbirnie, Wellington 6241, New Zealand

TEL: +64-4- 387 7339
Fax: +64-9-302 2142
email: info@hvpowerautomation.com

Rapid Voltage Changes

Rapid Voltage Change (RVC) according to IEC 61000-4-30 has been added to the Limits setting.

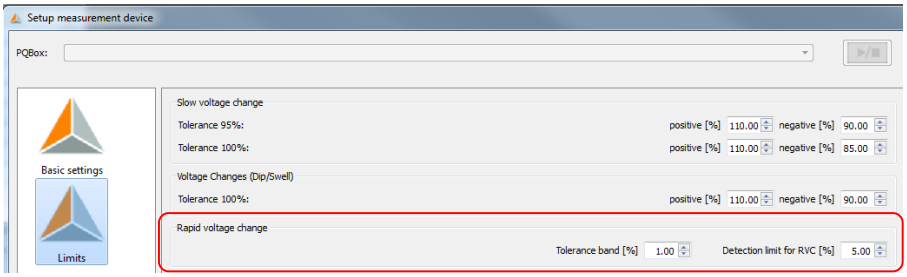


Figure 5. 'Rapid Voltage Change' added.

A Rapid Voltage Change is a voltage change that occurs between two steady states. The 'Tolerance band' defines the acceptable voltage range permissible to be considered 'steady state'. The voltage must be within this range for at least 1 second. The 'Detection limit for RVC' sets the trigger threshold limit that must be exceeded between two sequential steady state conditions for the event to be classified as a RVC event.

The typical settings for rapid voltage change are:

- Tolerance Band = 1 %
- Detection Limit for RVC (%) = 5 % (Normally in range of 5-10 %, but less than Dip/Swell limits)
- Note that any voltage excursion beyond the Dip/Swell limits will not be a RVC, but rather a Dip/Swell event.

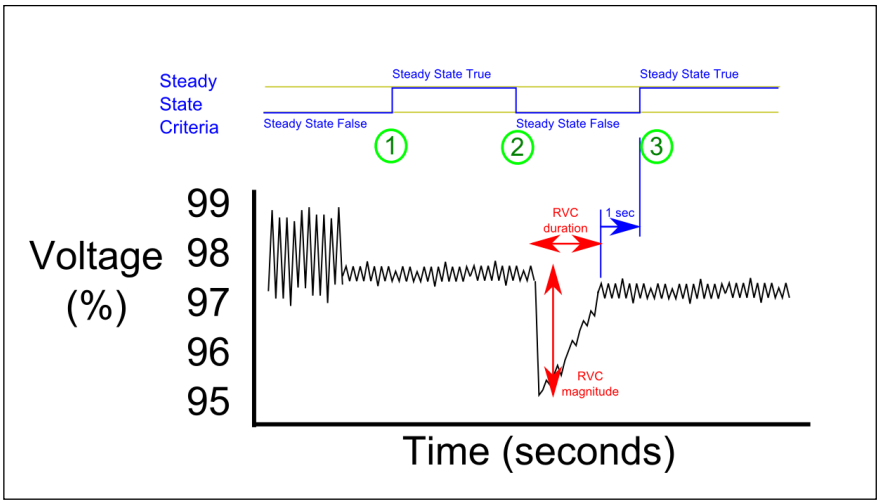


Figure 6. 'Rapid Voltage Change' defined.

Figure 6 is provided to give an illustration of a RVC event. The first steady state true condition (1) occurs after nominal voltage variations have been within the 1 % tolerance for 1 second. This steady state ends (2) when voltage variation exceeds the 1 % setting. A second steady state condition occurs at (3) as voltage variations returned to within 1 % tolerance for at least 1 second. As the maximum magnitude of the change occurring between the two steady states was a) greater than the 5 % detection limit and b) less than the dip/swell setting, this event is classified as a RVC, with its duration and magnitude being recorded.

HV POWER MEASUREMENTS & PROTECTION LTD
8 Rongotai Road, Kilbirnie, Wellington
P O Box 14-385, Kilbirnie, Wellington 6241, New Zealand

TEL: +64-4- 387 7339
Fax: +64-9-302 2142
email: info@hvpowerautomation.com

As RVC's are not an EN 50160 evaluation criteria, the RVC data is only available via the PQ-events tab. In Table 2, an example RVC event shows a negative 15.5334 voltage change has occurred, with a 200 ms duration.

	Event	Start Time	Max. Value	Harmonic	End Time	Duration
1	Rapid voltage change UL1	17.08.2014 15:14:05	-15.5334	---	17.08.2014 15:14:05	0s 200ms
2	Rapid voltage change UL1	17.08.2014 19:40:54	-11.5433	---	17.08.2014 19:40:54	0s 80ms

Table 2. Example 'Rapid Voltage Change' event report.

Harmonic Grouping

The option of harmonic groups is to support an alternative harmonic calculation that better suits equipment testing applications, rather than power quality measurement.

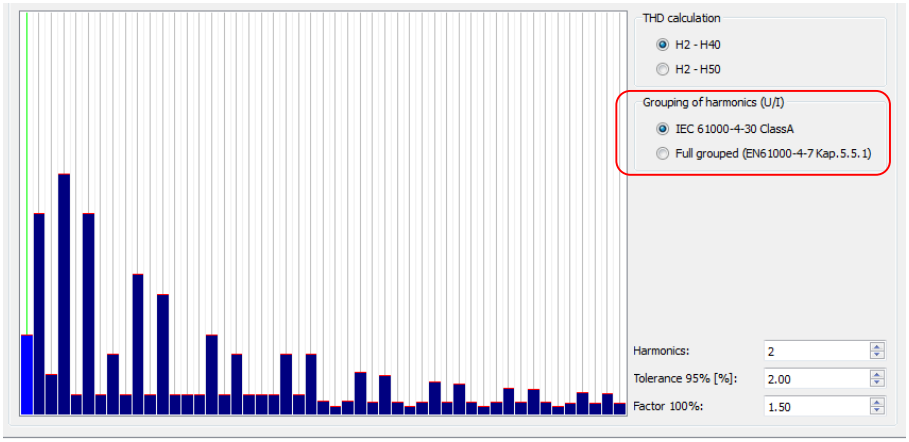


Figure 7. "Harmonic Grouping.

Method	2nd Harmonic	2nd Interharmonic
	5 Hz bands monitored	
IEC 61000-4-30 Class A	95 – 105 Hz	55 – 95 Hz
Fully grouped EN 61000-4-7 Kap.5.5.21	75 – 125 Hz	55 – 95 Hz

Table 3. Measurement difference example showing 2nd harmonic values.

Prior method and default – IEC 61000-4-30 Class A:

- For power quality testing to EN 50160

New method "Full grouped" – EN 61000-4-7 Kap.5.5.21

- For equipment tests according to IEC 61000-3-X
- For the measurement of harmonics, this 'fully grouped' method includes a larger range of frequency values centering each harmonic.
- Interharmonic measurement is the same for both methods

HV POWER MEASUREMENTS & PROTECTION LTD
8 Rongotai Road, Kilbirnie, Wellington
P O Box 14-385, Kilbirnie, Wellington 6241, New Zealand

TEL: +64-4- 387 7339
Fax: +64-9-302 2142
email: info@hvpowerautomation.com