Unilyzer 900

Unilyzer 900 Hardware installation and configuration manual

English version 25.0

Introduction

An increasing number of non-linear loads, such as computers, office equipment and frequency converters are currently being connected to the public electricity distribution network. Electrical equipment of this type affects the power quality in the network in a negative way and is frequently more sensitive to disturbances than older equipment. It has never been more important to measure and monitor power quality in the electricity distribution network in order to detect disturbances before serious and costly faults occur.
Unilyzer 900 and PQ Secure are the results of targeted efforts by Unipower and our customers to create an advanced, user-friendly and reliable power quality monitoring system.

Yours sincerely,

Unipower AB

Alingsås, Sweden

E-mail: mail@unipower.se
Internet: www.unipower.se

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1 Safety information

This section contains basic safety instructions relating to this product. These instructions are always applicable unless expressly stated otherwise. Read through all the information before starting work on the product.

⚠ **Only authorized and well-informed personnel should use the recorders, as normal use of the instrument involves dangerous high voltages, which can cause death or serious injury. Only trained Unipower personnel may carry out any intervention in the measure instrument.**

1.1 Installation conditions

Make sure the area in which you plan to install the meter, is clean, dry and dust-free. Follow these recommendations to maintain a safe working environment and to avoid accidents:

- Avoid installing and handling the instrument if there is a risk of ***thunderstorms***, as these can cause injury or damage.
- Check that the measure site has *no unprotected wires* or *standing water* near the measure instrument.
- The instrument case must *never be dismantled* under any circumstances.
- Make sure that *no loose* or *hanging items*, e.g. chains, bracelets, etc., can cause problems during installation.
- Use gloves and a helmet if there is a risk you might come into *contact* with live components.
- Follow the local regulations and standards at the measure site.
- Never work on electrical installations on your own.
- Assure that you have the right knowledge or are correctly informed about the potential dangers of high voltage sites.

1.2 Installing the instrument

The following conditions must be met in order to achieve the best measuring results, to avoid installation errors and to exclude the risk of accidents:

- You must always connect the transducers to the inputs of the meter connecting them to the object to measure.
- You must never connect/disconnect the transducers, while the measure instrument is switched on.
- Use the meter within the electrical ratings indicated on the transducers or on the case of the instrument.

1.3 Power supply

Use a "clean" and regulated power source, as free of disturbances as possible. Use only Unipower approved power connectors. The meter is equipped with a battery which acts as a UPS unit. Note that the meter may only be turned off if the instrument is not connected to a power supply

1.4 Product end of life

At end of life, the product must be disposed of in accordance with the relevant national laws relating to electronic waste handling.
The product contains lithium batteries, which must be handled correctly, in order to prevent environmental pollution/damage. Rest of product is standard electronic components and treated as per relevant national laws. Contact your local authority for advice.

2 Undertaking and warranty

Unipower undertakes to comply with the following legislation and recommendations relating to marketing and product liability.

2.1 Liability

Unipower AB retains the right to make changes to the instrument or in the instrument specification as described in this manual without notice. Unipower AB encourages customers to obtain the latest version of all documentation before making a purchase.
In the absence of a written agreement with the other party, Unipower AB does not accept liability in respect of customers' failure to observe clauses and copyrights of Unipower and its suppliers, and third-party products of systems or applications. Unipower AB cannot be held liable for circumstances in which license agreements expire for systems or applications installed in the customer's property. In addition, Unipower AB or its suppliers cannot be held liable for direct or indirect faults that occur when our products are installed or used.
Unipower AB cannot be held liable for material damage or personal injury arising during the use of our products if such damage/injury has been caused by a failure to observe guidelines or health and safety rules.

2.2 Warranties

Unipower AB warrants the absence of material or manufacturing faults during the warranty period. The provided warranty is limited to one year from the date of delivery inclusive. The warranty does **not** apply if:
- The product fault is caused by the customer's incorrect handling
- The product has been used beyond the intended area of application
- The product has been opened by the customer or a third party
- The purchaser or a third party has attempted to repair, or made modifications to the item

In the event of a claim for repair under the warranty, Unipower AB is entitled to choose whether to repair or replace the product. The purchaser's claim under the warranty must be made in writing to Unipower AB before the warranty expires. Items must not be returned without Unipower’ s prior written authorization.
If the purchaser claims that the product is not in accordance with Unipower’ s product specification, full details of the claimed infringement must be submitted. Compensation will not be provided until the fault has been documented and approved by the manufacturer. Apart from the warranty obligations above, Unipower AB is not bound by other warranties or obligations unless these have been agreed between the parties or are imposed by law.

2.3 Patent

Unipower AB´s products are covered by one or more of the following patents/patent applications:
Swedish Pat. No. SE525331
Chinese Pat. No ZL200380109063.0
European Pat. No. EP1581816
German Pat. No EP11341
U.K. Pat. No 1581816
French Pat. No EP11341
US Pat. No US 7,640,118 B2

3 Quick Guide

This Quick Guide will help you get started with the measurement.
Please note that this guide is not complete, and is only a complement to the rest of this manual.

3.1 On site pre-configured meter

If you wish to configure the instrument before taking it to the site, follow these steps.

Step:	Action:	Chapter:
	Do this at office:	
1:	Install PQ Online on your computer, this software will be used for installation/configuration of the meter	5.3
2:	Choose the desired template configurations using PQ Online and send it to the recorder	9.6- 9.7
	Do this on site:	
3:	Connect the instrument to power supply	6.1
4:	Connect the voltage and current transducers	6.1
5:	Connect the clamps and plugs to voltage and current	6.1
6:	Navigate to the “Configure” tab on the instrument and complete the wizard	6.2
7:	Navigate to the “Measure” tab. Start the measurement	4.4.4
8:	When the measurement is finished, stop the measurement in the “Measure” tab, remove the clamps and plugs.	4.4.4
9:	Download the measurement data using PQ Online	9.11

3.2 Configuration with PQ-Online on site

If you wish to configure the instrument on site with a laptop, follow these steps.

Step:	Action:	Chapter:
1	Install PQ Online on the laptop to be used for installation and configuration of the recorder.	5.3
2	On site: Connect the Unilyzer to a power supply	6.1
3	Connect the transducers to the instrument	6.1
4	Connect the clamps and plugs to voltage and current	6.1
5	Connect your PC to the Unilyzer and connect using PQ Online	9.2
6	Either select a saved configuration template or use the wizard to configure a new one	9.3
7	Start the measurement by clicking “Start measuring”	4.4.4
8	In order to stop the measurement, press stop at the same menu in which the measurement was started.	4.4.4
9	Download the data using PQ Online	9.11

4 Connectors and interface

The Unilyzer 900 has 3 data inputs. The inputs as well as the casing are compliant with IP65 classification. This makes the Unilyzer 900 a rugged dust/splash-proof high performance power quality analyzer.

The meter is EN50160 and EN 61000-4-30 compliant and is able to determine the direction of transients and sag/swells due to storing of voltage and current simultaneously. This will help in analyzing whether the disturbance originates from the load or the network.

4.1 Connection terminals

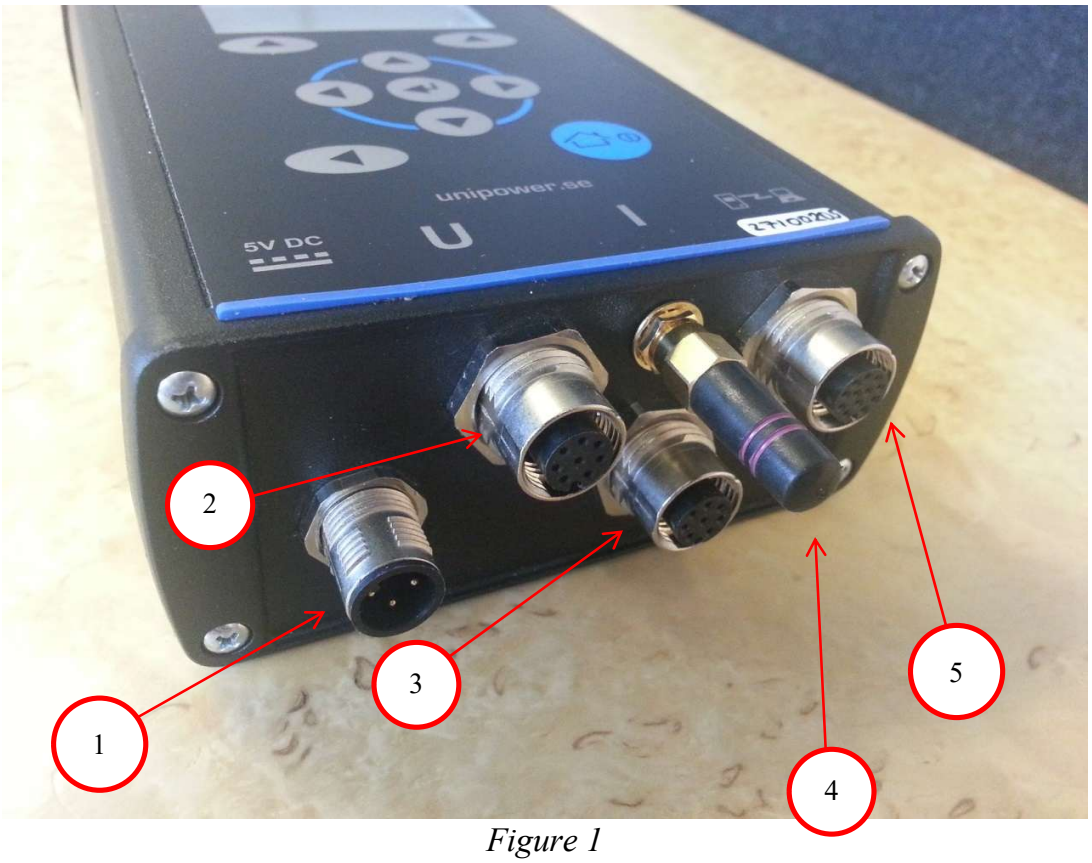


Figure 1

1. **Power input**: The Unilyzer 900 comes with a 5V DC converter. The converter may use a power supply at 85-264V AC (47 to 63 Hz) or 110-375V DC.

2. **Voltage connector**: The Unilyzer 900 comes with a set of voltage connectors at customer specified voltage levels. The meter is designed for phase to neutral voltage on both direct measuring or through a PT (Potential Transformer).

3. **Current connector**: The Unilyzer 900 comes with a set of current clamps at customer specified current levels.
   Remember to connect the polarities correctly, since an incorrect polarity will shift the current signal 180°, which in turn will affect the power calculations.

4. **WLAN antenna**: The Unilyzer 900 comes equipped with a standard WLAN antenna. This allows a wireless connection with your Windows/Android device. The standard antenna is easily exchangeable in case a more powerful one is desired.

5. **Communication connector**: The Unilyzer 900 comes with a USB connector. The recorder may also be delivered with an Ethernet cable.

Note: Only use Unipower approved transducers and connectors.

4.2 Transducers

The Unilyzer 900 comes equipped with a set of voltage and current transducers.
The connection terminals for the transducers are specially constructed to sustain the IP 65 classification.
The Unilyzer 900 has specific inputs for voltage and current transducers, inserting the voltage transducers into the current transducers slot (or vice versa) will result in a warning message and sound from the meter.

4.2.1 Voltage transducers

The input consists of 3 phase connectors (red, yellow and blue) and one neutral connector (black). **Always connect the meter to phase-neutral voltage.** The standard set of transducers handles 1000V RMS although other voltage levels are available on customer demand.

4.2.2 Current transducers

When current is measured in an AC system, such as an electricity network, it is practical to use clamp-on ammeters or flexible current clamps. When these types of transducers are used it is not necessary to interrupt the circuit, as it is enough to simply attach the transducer around the conductor.

If you are only measuring the current, the direction in which the transducer is connected is insignificant. However, if you are measuring power, power factor, etc., the transducer must be attached in the correct direction.
Connect the current transducer to the incoming phase of the load so that the direction arrow on the transducer points the same direction as the load.

The Unilyzer 900 uses Rogowski coils and delivers with 1000A RMS clamps as standard. Transducers at other current levels can be delivered at customer request.

Note that a transducer with a current level lower than the load might cause the transducer to take damage. Using a transducer with a current level that exceeds the load might cause a faulty/inaccurate measurement.

Always use transducers as equal to the load as possible.

4.3 Display interface

This is the front of the Unilyzer 900. The individual buttons/ LEDs are described below. The casing is solidly built and meets qualifications for IP 65 classification.
The LED indicators (marked A-D) at the top indicates status for various functions of the meter, these are described more in depth below.
The buttons (marked 1-5) are used for navigation through the different menus of the meter, these are described in section 4.4

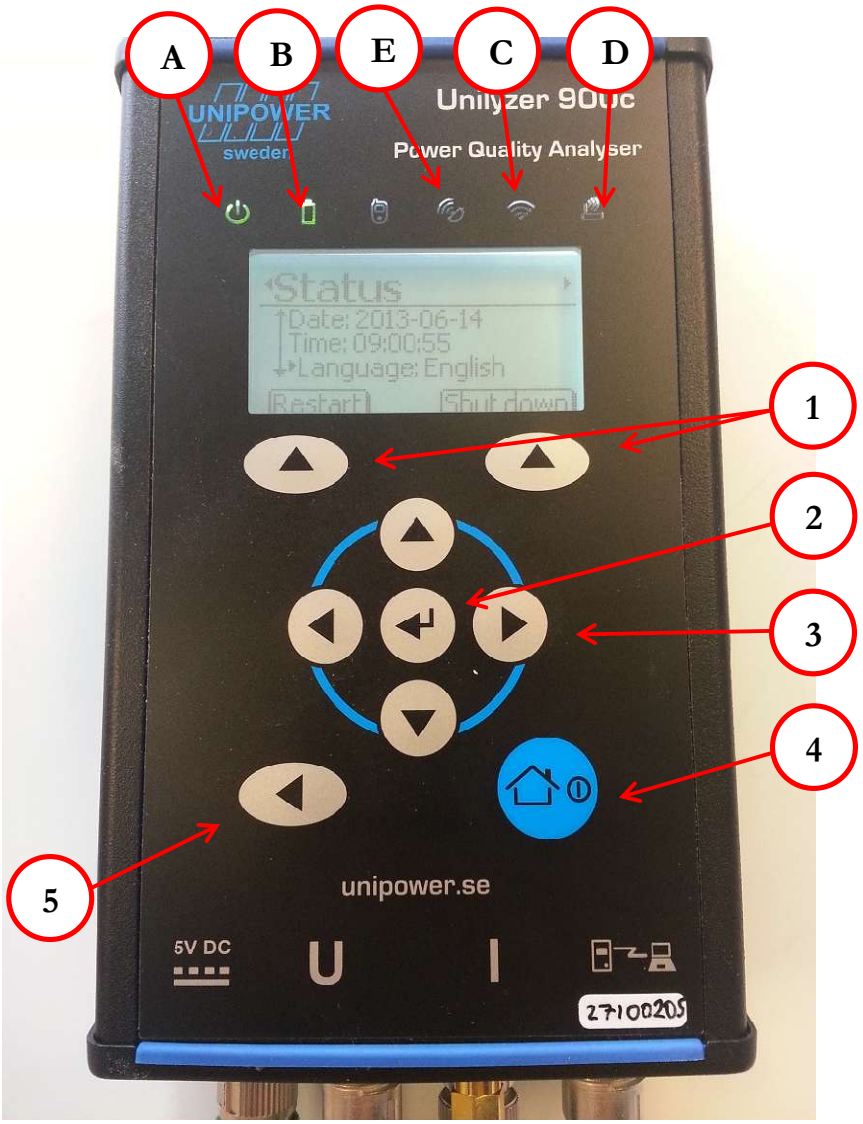


Figure 2

A. **Power indicator**
The meter's power indicator has 3 stages depending on the power mode of the meter.

Steady- the unit is turned on.
Blink- the unit is turned on and measuring.
Off – the unit is not turned on.

In order to power the meter off, hold the on/off button until the Unipower logo is displayed and finally the screen turns off. Pressing the button for a short while will **not** power the unit off.

B. **Battery indicator**
The meter's battery indicator has 3 stages depending on the battery level of the meter.

Steady- the unit is running on battery with the power cable unplugged.
Blink- the units' battery is charging
Off – the battery is fully charged and the unit is running on net voltage

Remember that the meter can only be turned off if it is not connected to a power supply.

C. **WLAN network association**
This LED indicator is only interesting if the meter is set to *connect to* an access point. For configuration see section 4.4.3

Steady- not associated with a network
Blinking rapidly- transferring data
Off- associated with a network, connection is OK

D. **WLAN connection status**
This LED indicator is only interesting if the meter is set to *act as* an access point. For configuration see section 7.3.1

Blinking fast- no IP address acquired
Blinking slowly- IP acquired and in standby

E. **GPS connection status**
This LED indicator is only active if meter has the GPS option.

Blinking – GPS signal received and time is synchronized
Off – No GPS option or no GPS signal.

1. **Action buttons**- these buttons vary in function depending on the meter menu placement. For more detailed description, see section 4.4
2. **Enter/action-button-** enters a setting, selecting menu.
3. **Navigation buttons-** navigates in menus or switches between menus.
4. **Home button-** moves to the home tab which is the measurement screen.

5. **Back button-** moves out of a configuration. For example. If the language is to be changed, the back button will take you out of the selection once the language has been changed.

4.4 Menu

The following menus are displayed on the meter and are a useful tool to either set up a new measurement or check settings during an ongoing measurement.
Not every option in the menus are changeable (for example serial number) these are read only.
In order to edit options, navigate to the desired tab using the left and right navigator keys.
Move down to find the desired option, select it with the select button, and press up or down on the navigation buttons to edit the settings to your preference. Press the back button to be able to switch through tabs again.

Note also that the menus differ depending on if the measurement is on or off. When the measurement is on the configurable settings will no longer be available, the network tab will not be visible and the multimeter tab splits in to five more in depth menus.

4.4.1 Network menu

Contains information on the meters: DHCP, IP address, subnet mask, gateway and DNS
All of these options are changeable except for the DHCP. Remember that these settings are not changeable when the meter is measuring.
The action buttons have no effect on this menu.

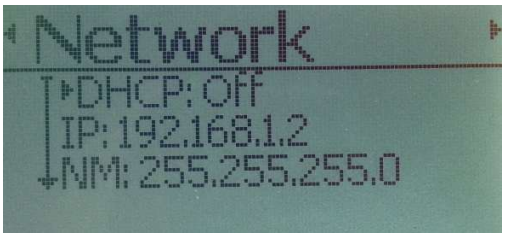


Figure 3

4.4.2 Status menu

The status tab contains information about the meters: serial number, software version, set date and time, language, storage quantity, battery level, CPU load, battery voltage level and the voltage level in to the recorder from the net adapter.
Only the language can be changed in this tab.
In this tab the recorder can be restarted using the left action button or shut off using the right action button.

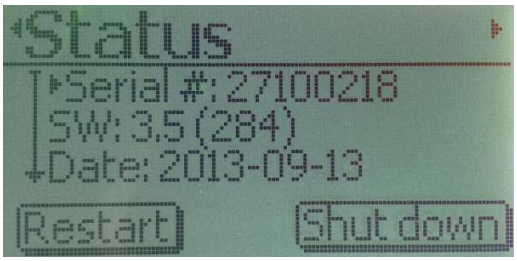


Figure 4

Note: The meter may only be shut off while the power cable is unplugged!

4.4.3 WLAN menu

The WLAN menu contains information about: mode setting (connect to or act as access point), SSID (name of nearby networks), passphrase for the selected SSID, DHCP (on or off), IP of the meter etc.
The left action button allows for scanning off nearby networks.
The right action button applies the settings.

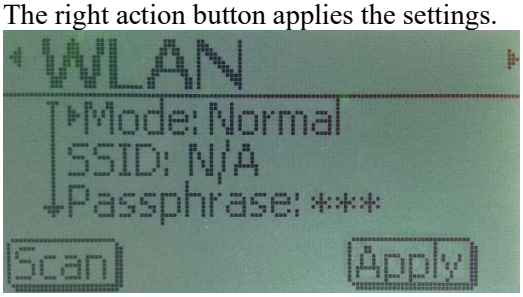


Figure 5

4.4.4 Measure menu

The measure menu contains information about: the meter's measurement configuration, the specific number for the current measurement, the set date and time, number of sags/swells, transients, slowscans recorded.
The left action button starts/stops the measurement.

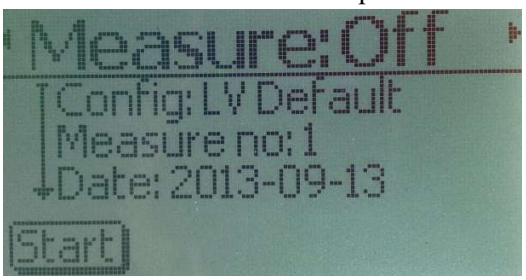


Figure 6

4.4.5 Configure menu

Note that the configure screen is only visible when the meter is not measuring.
This screen is used for the configuration wizard when starting a measurement.
The right action button starts the wizard. For further instructions on checking the connectors see section 9.9 Real time values.

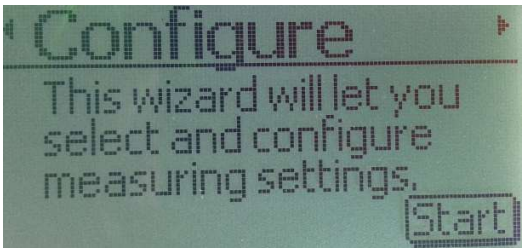


Figure 7

4.4.6 Multimeter menu

The multimeter tab gives quick information on the real time value. It contains parameters such as: voltage ($U_1 - U_4$), current ($I_1 - I_4$), the voltage and current imbalance, the active, reactive and apparent power in all 3 phases as well as the short and long term flicker in all 3 phases

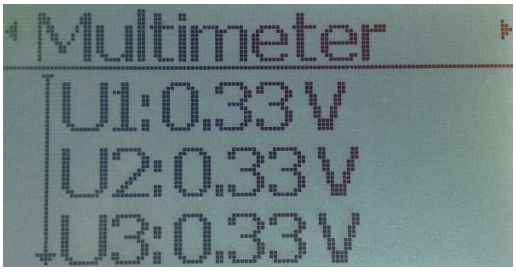


Figure 8

Note! When the recorder is measuring the multimeter menu is split to separate menus voltage, current, power (covers active, reactive, apparent and power factor), THD and flicker.

5 Installing the software

There are three software's that are used with the Unilyzer 900: PQ Online, PQ Secure Light and UniLauncher. These and other useful software and information are delivered on a CD along with the meter.

PQ Online	This software is used to configure the measurements, view real time data and to download measurement files.
PQ Secure Light	This software is used to evaluate and analyze measurement data obtained from the Unilyzer 900. PQ Secure Light also contains a report generator for creating reports according to norms.
UniLauncher	This software is an application which detects when a Unipower product is plugged in to your pc. The program will then prompt you with what action you wish to take, open PQ Online, download data, etc.

5.1 Computer performance

The Unilyzer 900 software runs on any computer running Windows operating system. When doing evaluation and analysis on measurements we recommend using a desktop computer with a larger screen, but you can also evaluate on a laptop. Unipower recommends the following minimum performance:

- Operating system – Microsoft Windows 7
- CPU – 2 cores or more
- RAM – 1 GB
- Hard disk – at least 100MB free
- 1024x768 graphics resolution

5.2 Installing device driver software

On the disc delivered with your Unilyzer 900 is a driver required to install if you wish to connect your meter using USB. First check if your computer uses a 64 or 32-bit operating system. In order to do so, open the control panel and go to **Control Panel\System and Security\System**. In the window that opens, the operating system can be read.

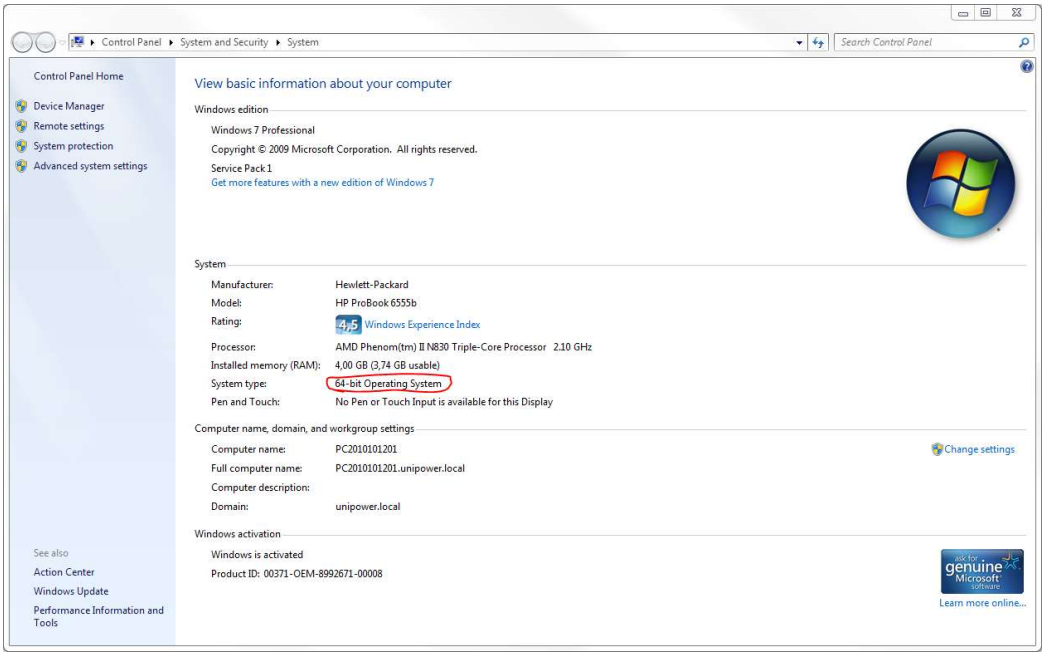


Figure 9

If you have 64 bit windows, choose the file named CP210xVCPInstaller_**X64.**
If you have 32 bit windows, choose the file named CP210xVCPInstaller_**X86.**
Double click the file according to your windows version, accept the license agreement and finish the installation.

5.3 Installing PQ Online

Start by closing all running programs. Insert the PQ Secure Installation CD, navigate to the PQ Online folder and run the setup file. An installation wizard guides you through the installation process. Usually there is no need to make any changes, so you can simply accept the recommended settings.
Check that the search path is correct. Unipower recommends:
C:\Program Files\Unipower\PQ Online
Should the installation not start automatically, click on the Windows **Start** button and select *Run*. Use the Browse button to open the file "*Setup.exe*" in **PQ Online\Disk1**, and click on **OK**.

5.4 Installing PQ Secure Light

Refer to the *PQ Secure Light User and software installation manual*.

5.5 Installing UniLauncher

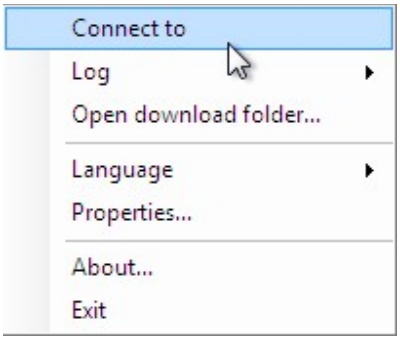
UniLauncher is a utility application that helps you to connect to your Unipower meters via USB. When you connect the USB cable UniLauncher will automatically connect with the meter and launch PQ Online.

Start by closing all running programs. Insert the PQ Secure Installation CD and wait for the Installation program to open. Select "***UniLauncher***" and complete the installation wizard. Usually there is no need to make any changes, so you can simply accept the recommended settings.

If the installation doesn't start automatically, click on the Windows **Start** button and select *Run*. Use the Browse button to open the file "*UniLauncherSetup.msi*" in the **\UniLauncher** cd folder, and click on **OK**.

After installation the icon  should be seen in the system tray bottom right on the screen.

You can right-click on it to access the menu:



The settings can be found under *Properties*:

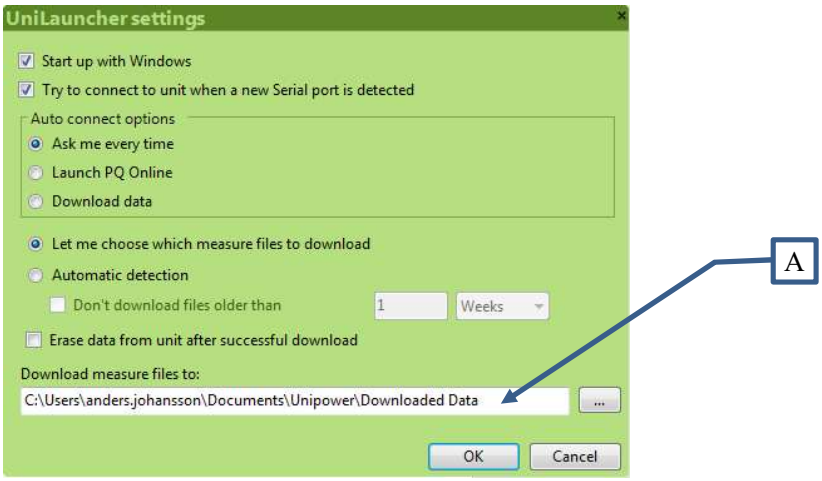


Figure 10

We recommend the above default settings.

The path to the folder in Figure 10, **A** is the location where data will be automatically downloaded by UniLauncher.
To use UniLauncher, first connect the USB cable to the meter. Then connect it to the PC. After a few seconds you should see a message that the meter is being connected and then a menu like in Figure 11 - Connecting the USB cable. You can choose to start PQ Online (for configuration or realtime analysis) or you could select download to transfer data. This is very practical and convenient.

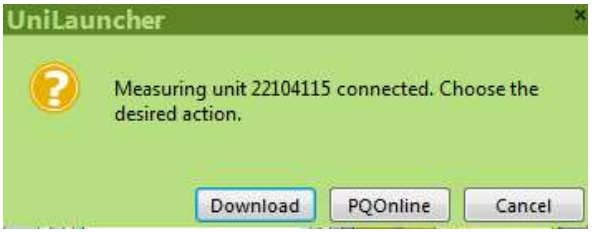


Figure 11 - Connecting the USB cable

The very first time you connect your meter to the PC the system needs to install some drivers. Be patient and wait (*don't pull out the USB cable and retry to fast! It could take 30-60 seconds to do the installation*)

6 Connection procedure

With its rugged casing and convenient size, the Unilyzer 900 is a practical, easy to use power quality analyzer. Suitable for installation and measurement wherever there is a need.
Connecting the meter to a measurement site is achieved in two steps, the configuration and the connectors.
For ease of installation the Unilyzer 900 comes with a fabric case equipped with magnets. This allows for storing of the instrument in tight corners.

Figure 12

6.1 Connecting connectors

At the measurement site, follow these steps in the stated order to ensure a **safe** and **correct** operation:

1. Connect the Power supply, the meter will automatically start
2. Start the configuration wizard (section 6.2)
3. Connect the voltage and current transducers
4. Connect the current clamps and voltage leads to the measure object
5. Complete the configuration wizard

The current clamps are marked with an arrow for correct installation, it is *very important* to make sure that the arrows are facing in the direction of the load. If you fail to do this the sign of the calculated power will be incorrect and the total 3-phase power will be incorrect. The

real-time analysis in PQ Online is equipped with both an oscilloscope and a vector diagram to ensure that the voltages and currents are pointing in the same direction (see 8.8.2 and 8.8.5). Make a habit of <u>always</u> checking the phase sequence and directions of the current clamps using either PQ Online or PQ Droid.

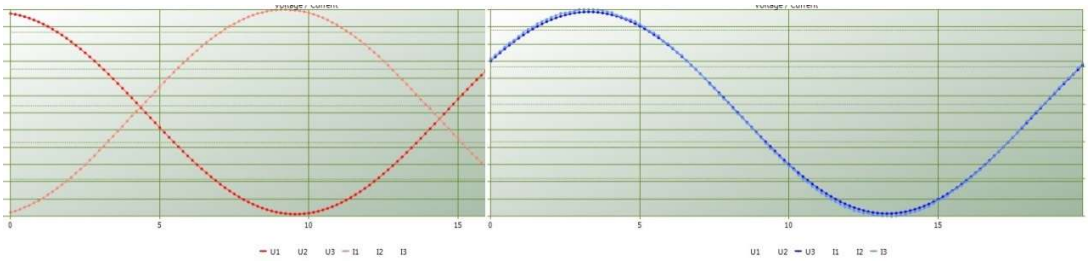


Figure 13

Current clamp connected **incorrectly**. Phase angles exceed 90˚

Current clamp connected correctly.

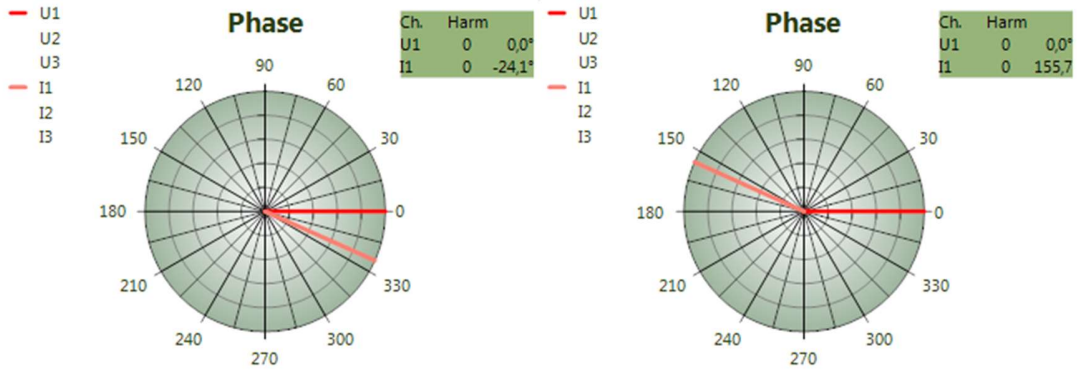


Figure 14

Correct!
In this case the load is inductive and the current is lagging.

Incorrect!
Current clap mounted in the wrong direction. Current is approx. 180° out of phase. Normally the phase angle between voltage and current must be less than 90°.

Calculated power and energy

	Phase 1	Phase 2	Phase 3	Total
P [W]	1,4678	1,8309	-711,24 m	2,588
Q [VAr]	58,843	-97,091	226,35	188,11
S [VA]	565,15	375,11	687,77	1,6280 k
PF	0,0026	0,0049	0,0010	0,0016
Cos(ϕ)	0,9399	0,9666	0,8201	

Incorrect!
The active power (P) should normally be positive. If the current clamp is mounted in the wrong direction both P and Q change sign.

Calculated power and energy

	Phase 1	Phase 2	Phase 3	Total
P [W]	6,9228	10,105	8,0580	25,09
Q [VAr]	2,6137	4,2176	3,4010	10,232
S [VA]	575,47	391,69	708,70	1,6759 k
PF	0,0120	0,0258	0,0114	0,0150
Cos(ϕ)	0,9272	0,9741	0,9485	

Correct!
Active power (P) is positive.

For further instructions on checking connectors see section 9.9 Real time values

6.2 Configuration wizard

After a measure template is created and the meter is connected to the measurement site follow these steps in order to start the measurement.
The following steps are also shown on the display. Press **next** after each step is completed.
For a more in depth explanation of the configuration, see section 9.

1. Once in the configuration tab, press **start.**
2. Select your previously defined config (the Unilyzer 900 comes with three pre-defined configurations).
   Note that choosing the template EN50160LV/MV/HV provides a norm compliant power quality measurement setting.
3. Connect all transducers.
4. Check the real-time values. If these are incorrect, adjust them on the following screen
5. Adjust the constants. In this tab adjust according to the transformers upper and lower ratio separated with colon punctuation. For example: 22kV/10kV transformer. Adjust the constant for **U1-U3** to 22,00 : 10,00 then adjust the current constants in the same manner.
6. Re-check the real time values.
7. Press start to begin metering.

It is also important to ensure that the voltage transducers are connected correctly, with the red connector attached to phase, and the black connector attached to the neutral conductor. The configuration diagram in PQ Online helps you work out how to connect the transducers to the measured object, showing a graphical representation of how to attach each transducer to the relevant phase.

Note: **An important factor to remember is that you must use a transducer that is designed for the voltage/current you will be measuring. A range that is too low may result in damage to the transducer and a range that is too high results in lower accuracy!**

6.3 Checking configuration with PQ Online

In order to check the configuration of the measurement, connect to it using either PQ Droid (see section 8) or PQ Online. In order to connect you must have access to a computer or Windows based tablet with PQ Online installed. Connect to the instrument as seen in section 9.2
Press the real-time button and investigate if the values are within reasonable limits. If the connectors are properly connected the values should all be positive (unless the measurement site is producing energy, in that case, negative power consumption is normal). Continue to the oscilloscope and make sure that the phase sequence is correct. The correct order is: red, green blue.
Incorrect sequence or improperly placed current clamps will cause faulty measurement!
Once you are sure that the connectors are correctly set, the measurement may proceed.
For further instructions on checking the configuration using PQ Online see section 9.9 Real time values.

6.4 Single-phase measurement

The voltage measurement is done between phase (L1) and neutral (N) and on the same phase for the current. When configuring in PQ Online, choose **Single Phase** and set the reference voltage as equal to the phase-neutral voltage.

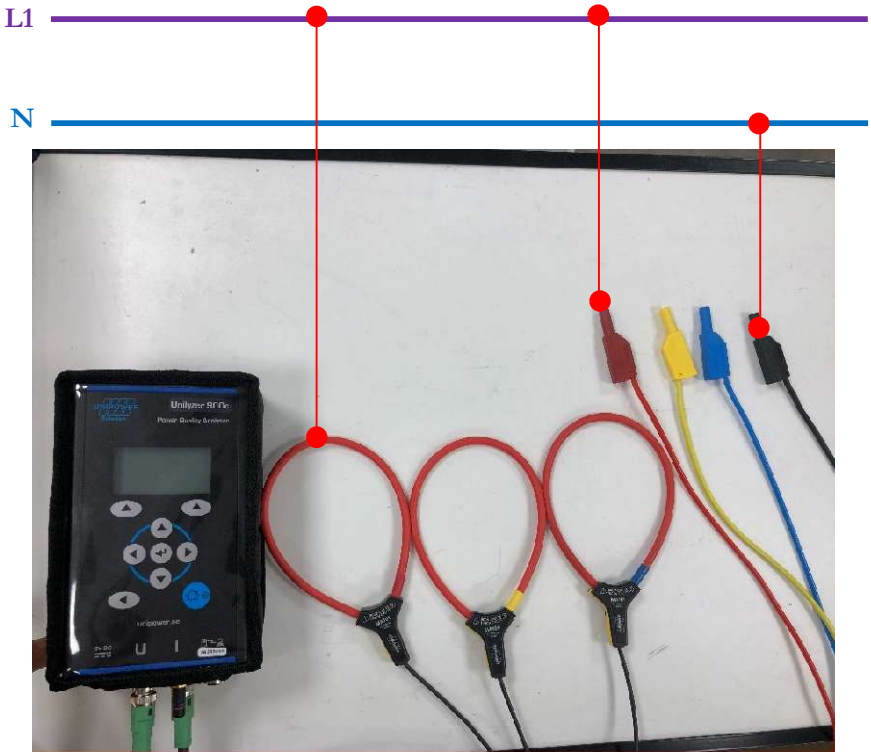


Figure 15

6.5 Three-wire measurement – Phase voltage (High voltage)

The voltage measurement is done between phase and a constructed neutral (**Earth)** and on the phases for the current. When configuring in PQ Online, choose the amount of instrument transformers and set the reference voltage as equal to the phase-earth voltage.

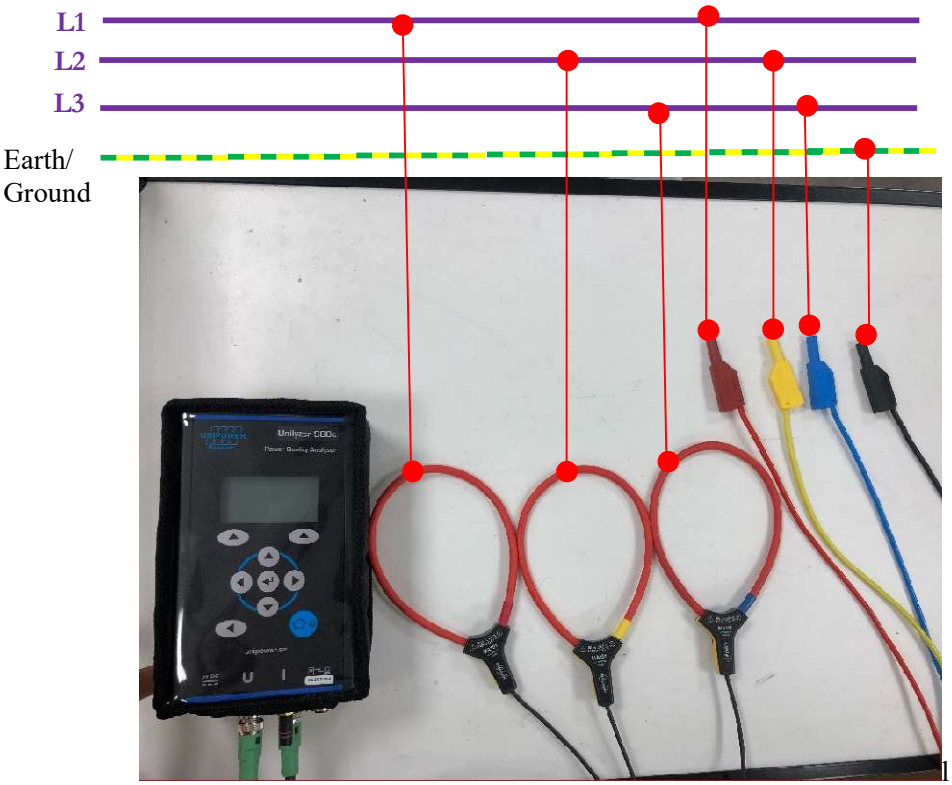


Figure 16

Note: **Unilyzer 900 should only be connected to phase to neutral voltage. The phase to phase voltage will then be calculated in the instrument.**

Note: **The same earth point can only be used when there is no risk of potential differences between the recorder and the object to be measured.**

6.6 Four-wire measurement (low voltage)

The connection is similar to the one above, with the difference, that the voltage is connected to the neutral instead. The voltage measurement is done between phase and neutral and on the phases for the current. When configuring in PQ Online, choose three-phase and set the reference voltage as equal to the phase-neutral voltage.

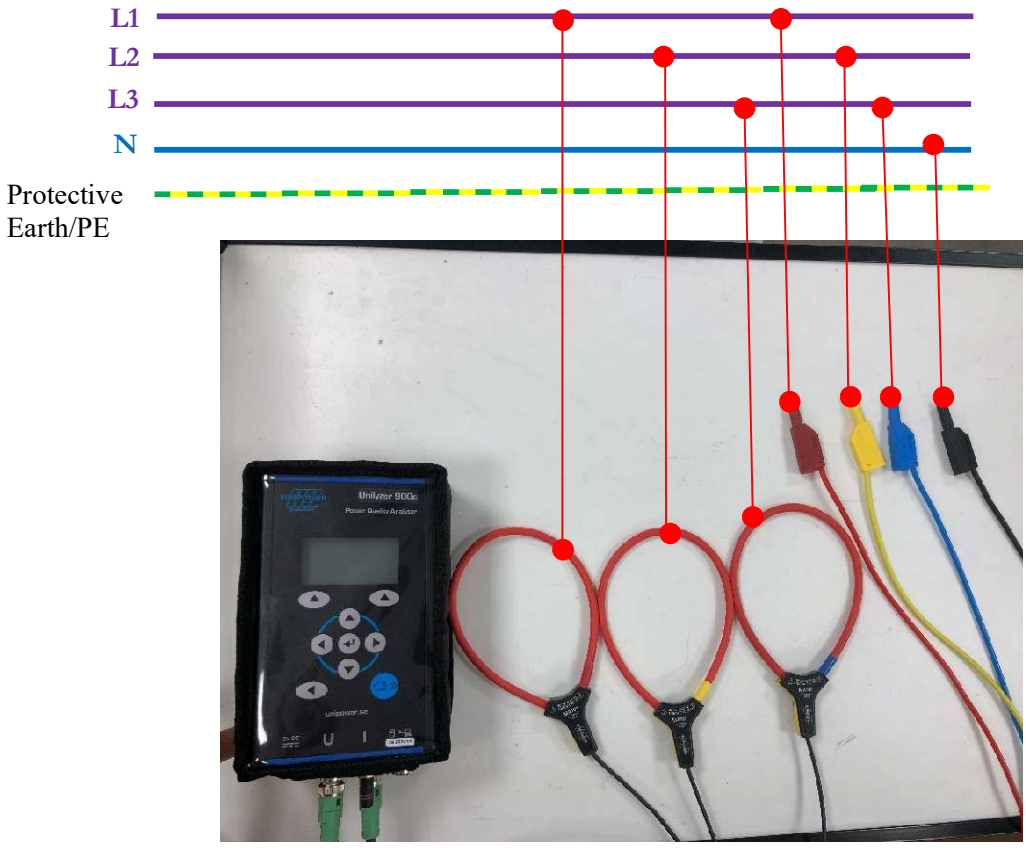


Figure 17

7 Communication

The communication between the Unilyzer 900and the windows/android unit may be established in a number of ways. Most common is direct communication using USB, but there are other alternatives suitable for remote operation. Remote communication can be used with both PQ Secure Light and PQ Online. If you wish to use automatic remote downloading of measurement data with your Unilyzer 900 contact your local Unipower representative.

This section of the manual covers the various options, including the brands recommended and sold by Unipower. The recorders have standard interfaces and are not restricted to particular brands.

7.1 Ethernet at measure point

Ethernet is a standard feature in the Unilyzer 900, although the Ethernet cable is not delivered as standard.

Unilyzer 900 uses the **100Base-T interface** for Ethernet communication. In order to connect to an Ethernet outlet, use an RJ-45 cable that is specially designed to work with the Unilyzer 900 that may be ordered from Unipower.

When you use Ethernet communication in a network, it is required that you have access to specific IP addresses for planning and configuration at an early stage. The IP address should be unique and if routers / firewalls are used in the network **you must open the UDP-port 16421 for the communication to work.**

7.2 GPRS

A wireless GPRS router is a good way to access meters remotely via a wireless network. This allows for the meter's measurement data to be downloaded remotely and automatically.
There are many wireless routers available, check with your Unipower representative for recommendations of tested solutions.
To use a router with a meter the following must be done:

- The SIM card used must not have a PIN-code and it must have a public, static IP-address.
- The router must be set up to forward UDP and TCP traffic on port 16421 to the meter's local IP-address on the inside LAN of the router. If multiple meters are connected to the same router you can use different port numbers on the outside and route them to UDP 16421 on the inside to each meter's local IP.
- Connect the meter to the router using RJ-45 Ethernet cable. If multiple meters are used you may need to connect a standard Ethernet switch between the router and the meters.

Example of settings from a typical router:

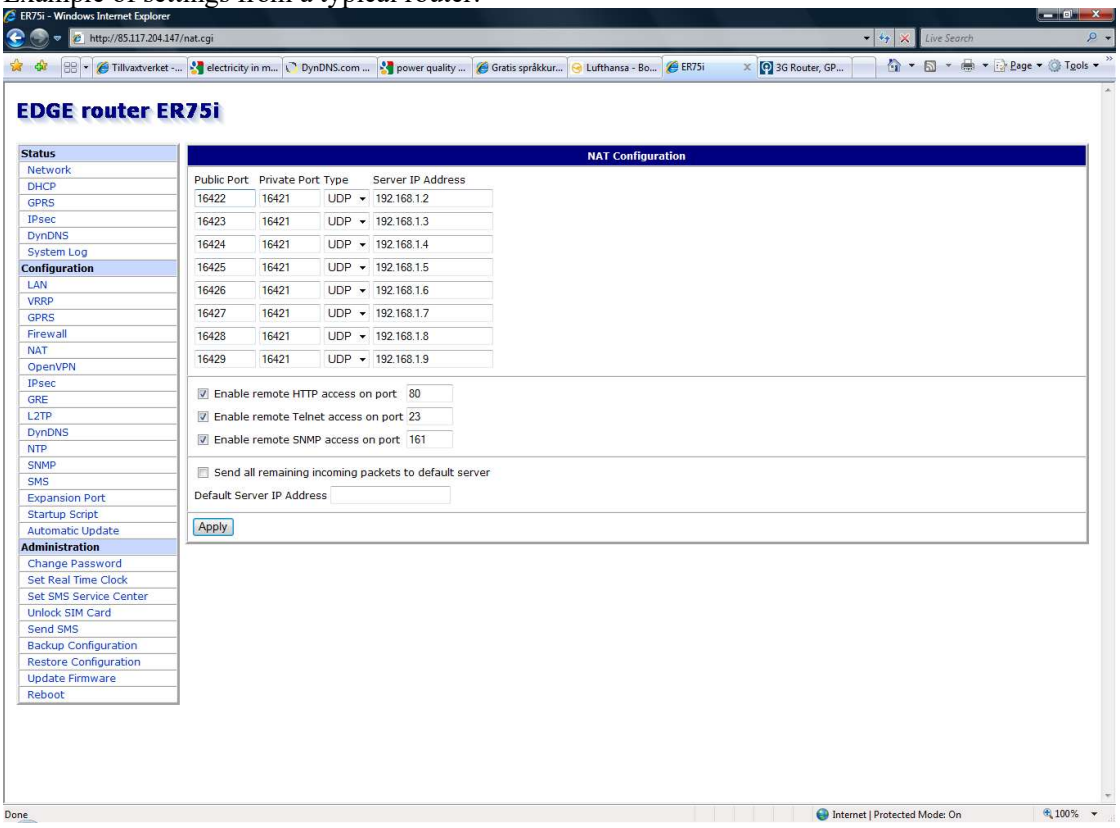


Figure 18

Note how UDP 16427 is routed to UDP 16421 IP 192.168.1.7. The meter given the IP 192.168.1.7 will respond to communication on UDP port 16427 to the router's (actually the SIM card's) public IP.

Figure 19 shows two Unilyzer 900s connected to a router with multiple LAN outputs.

Figure 19

7.2.1 DHCP Settings

The Unilyzer must never be set to receive an IP address from a DHCP. If you enable DHCP on the router to make it possible to also connect a laptop or other equipment, make sure that the router starts addressing IP's higher than for example 10. This will leave the first 10 IPs for static addressing of Unilyzer 900 devices.

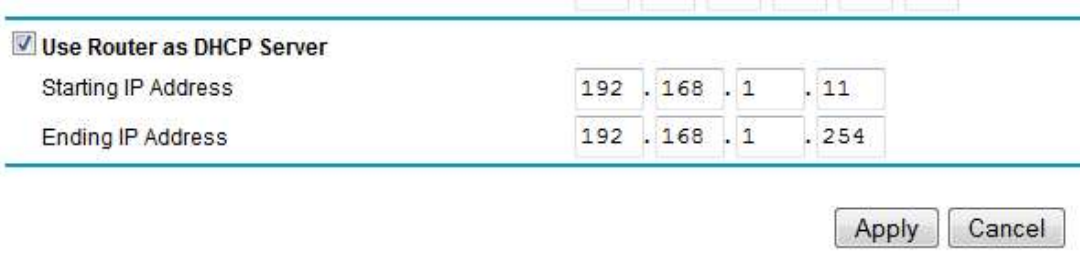


Figure 20

7.2.2 Settings in the Unilyzer 900

When the equipment is connected you must change the communications settings in Unilyzer 900. Use PQ Online to do this.
An example of the configuration is as follows: Set the first recorder with IP address 192.168.1.2, set the Gateway to the IP address of the router (usually 192.168.1.1) and set the subnet mask according to the IP range of the network.

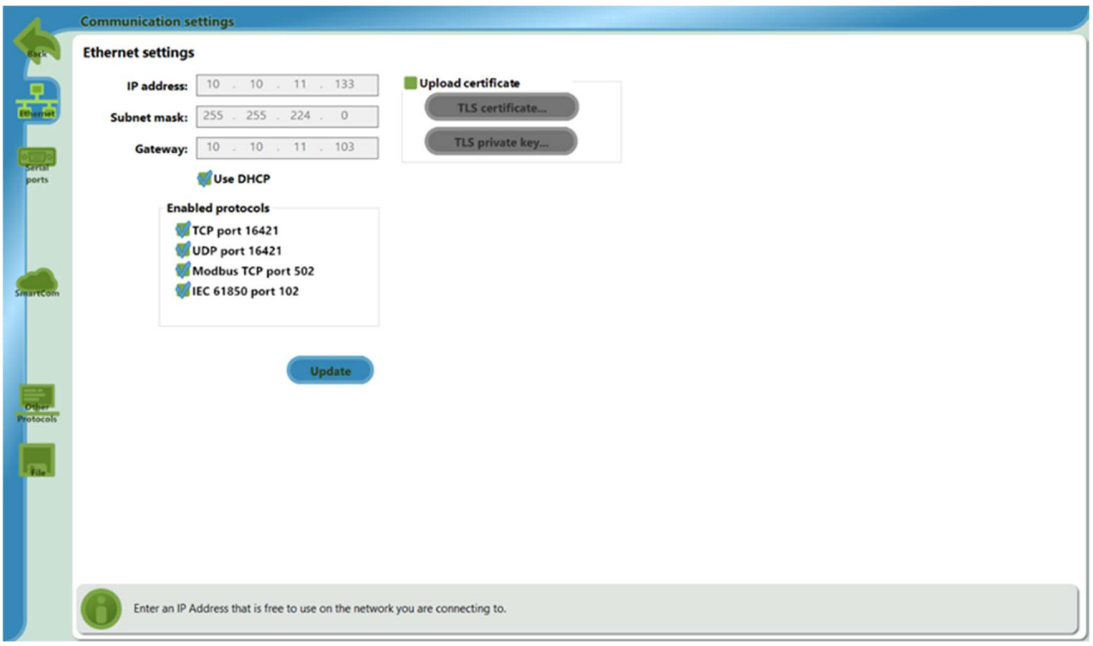


Figure 21

7.2.3 Enabled protocols

Shows all active and inactive protocols for a meter. When a protocol is deactivated, the corresponding port is also disabled and will not be possible to use. Disabling all protocols will disable all communication over ethernet. Reconfiguration after this requires USB connection to the meter.

7.3 WLAN/Wi-Fi (Wireless Network)

Note WLAN (Wireless Local Area Network) and Wi-Fi are considered synonyms in this manual.

In order to connect to the Unilyzer using the meters built in WLAN function the meter must first be set to either ap-mode or normal-mode. In ap (access point)-mode the meter creates its own network, allowing other equipment to connect to it.
In normal mode the meter connects to access points (routers, laptops etc.) to change connection method see section 4.4.1.
When a connection is established, the measurement data can be downloaded/evaluated using either PQ Online (see section 9.10) or it can be checked with PQ Droid (see section 8)
The meter's standard antenna can be replaced if a stronger antenna is required.

7.3.1 Connect with WLAN (Unilyzer as access point)

When using the meter as an access point the user connects directly to the meter using either a laptop or android phone/tablet, you may also connect with a windows based tablet which may use both PQ Online and PQ Secure. In order to do so,

- Set the **mode** setting in the **w-lan** tab (section 4.4.3) to **ap** (**a**ccess **p**oint).
- Turn DHCP on and
- Remember the meters IP-number.
- Proceed to your device/laptops Wi-Fi settings and connect to network **UNILYZER 900-[serial number]**".

Then use either PQDroid (for android), or open PQOnline (for windows) and access the meter as in section 9.2. If you wish to connect with your android device you must first download the latest version of PQDroid from Play Store.

In order to connect to the Unilyzer with PQ Online:

- Connect your laptop to the meter's network.
- Open PQ Online.
- Choose connect.
- Check the "Ethernet" box (**1**).
- in the "Host name" window, type the IP address of the meter (**2**). (checking the IP is available in section 4.4.1)
- use the default port (**3**), then press **Ok**

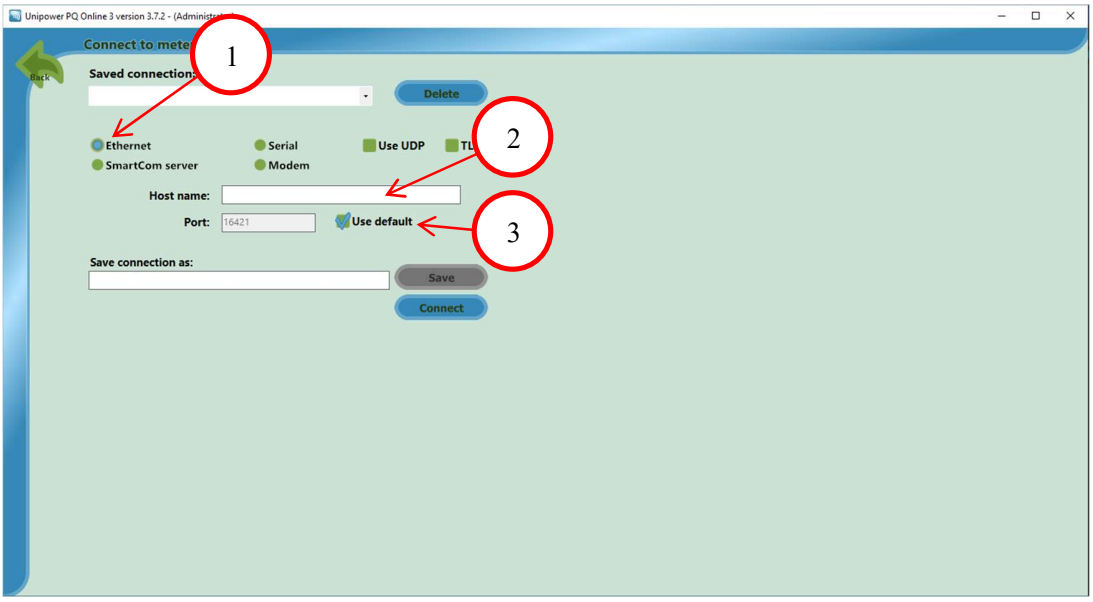


Figure 22

7.3.2 Connect with WLAN (Unilyzer connects to an access point)

Alternatively the meter can connect to an access point. The Unilyzer will then connect to a nearby network. (This requires a router in proximity to the meter).
To do so,

- Set the meter to **client** mode in the WLAN tab (section 4.4.3).
- Press scan
- Select the desired network in which you wish to access the meter.

- Connect your laptop to the same network as the meter

The connection to the meter is now almost complete. Now simply connect to the meter with PQ Online as follows:

- Open PQ Online and connect as you would with Ethernet connection (section 9.2.1)
- Select connect
- Check the "Ethernet" box (**1**)
- In the "Host name" window, type the IP address of the meter (**2**). (Checking the IP is available in section 4.4.1)
- Use the default port (**3**), then press **Ok**

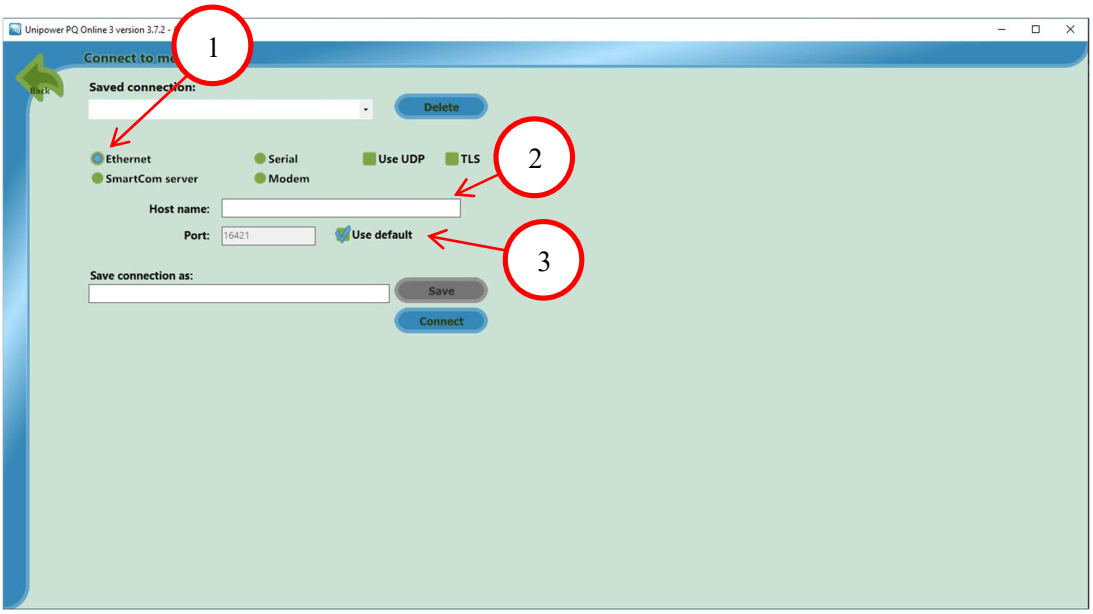


Figure 23

7.4 GPS

GPS is an optional function.
The main purpose to connect a GPS to the meter is to receive accurate time synchronization. Meters with internal GPS will have an additional antenna connector on the bottom side of the meter.

Connect the antenna to the meter. Place the antenna with free sight to the sky (it could be close to a window).

Activate GPS time synchronization in PQ Online. See section 9.13 A1.

Watch the GPS LED on the meter (section 4.3 E). It should start blinking after a few minutes, which means it is receiving signals from the satellites and is correctly time synchronized.

7.5 TLS Encryption

If communication security is of a great concern, there is an option to enable TLS encryption. This is an optional feature which requires a license to enable. Furthermore, a certificate and a private key need to be uploaded to the measuring device. Such a certificate and a key can be generated using a tool like OpenSSL (downloadable from www.openssl.org). The only supported file format is ".PEM".
The following Command Prompt example generates a certificate using OpenSSL:

```
C:\Program Files\OpenSSL-Win64\bin>openssl req -new -newkey ec -pkeyopt
ec_paramgen_curve:prime256v1 -x509 -nodes -days 3650 -subj "/C=PQ" -out
C:\whatever\outputdir\2210hardwarecert.pem -keyout
C:\whatever\outputdir\2210hardwarekey.pem
```

The "2210hardwarecert.pem" and "2210hardwarekey.pem" files can then be uploaded to the meter using PQ Online under Communication Settings/Ethernet.

Tick the upload certificate checkbox and click "TLS Certificate…" and select "2210hardwarecert.pem". Click "TLS private key…" and select "2210hardwarekey.pem" and click "Update" to install the certificate.

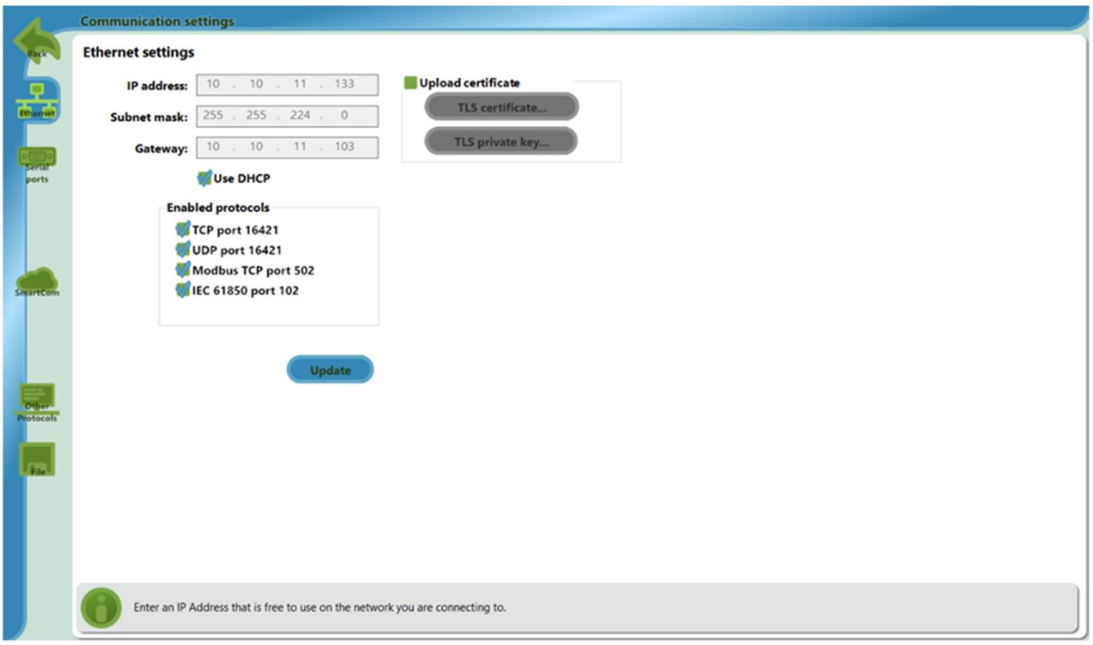


Figure 24

8 PQ Droid/connect with mobile device

PQ Droid is a Unipower developed android application used for quick power quality evaluation off a Unilyzer 900. The application is free of charge and available for download for anyone on Play Store.

In order to connect using your android device,

- Set the meter to AP-mode (section 4.4.3)
- Set DHCP to ON.

- Navigate to your mobile devices network setting and access the network named "**Unilyzer900-[serial number]"**
- Open PQ Droid.

The applications opening screen can be seen in Figure 25. In the "address to meter" field a local IP address may be entered. The IP number is usually 192.168.1.1 but may be changed to any desired IP. After entering the IP Number click **connect**.

PQDroid may also connect to a permanent Unipower analyzer UP 2210/UP2210R using "Connect UDP".

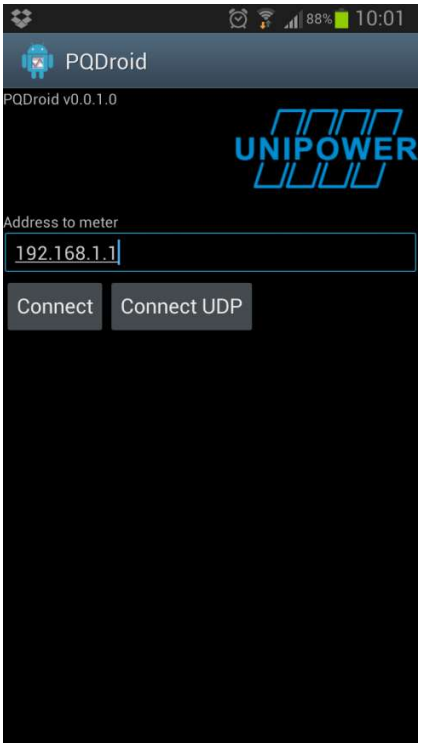


Figure 25

Once the meter has been accessed three clickable options are available: real time values (**1**), voltage waveform (**2**) and current waveform (**3**). The respective windows are a helpful tool to ensure that correct connection has been achieved.

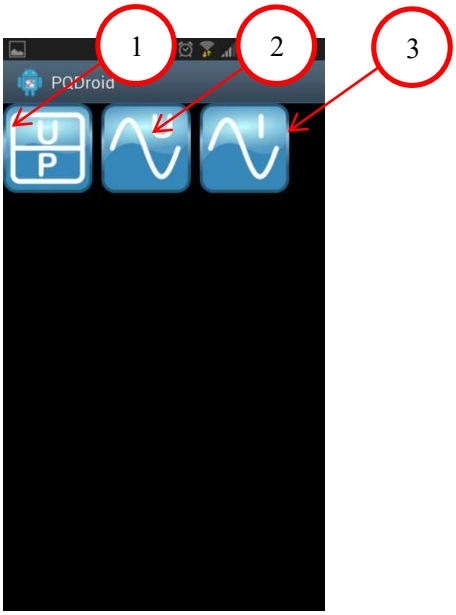


Figure 26

8.1 Waveform tabs

The PQ Droid application comes with both a voltage and a current waveform. These tabs help to ensure correct connection.

8.1.1 Voltage tab

The **voltage** tab is a useful tool for checking the phase sequence of the connected transducers (Figure 27). Looking at the waveform you may also briefly see the effect of voltage harmonics in the system.

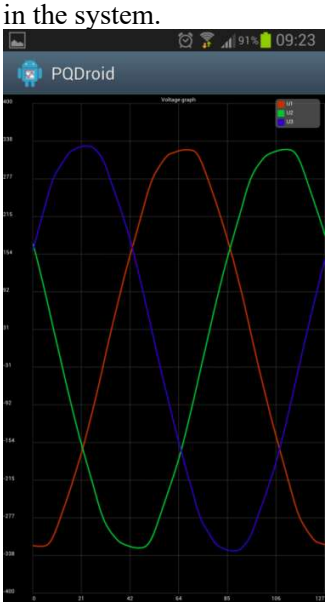


Figure 27

8.1.2 Current waveform

Looking at the current waveforms (Figure 28) reassures that the phase sequence is equal for the voltage and current, e.g. same color sequence for both waveforms (blue, red, green for both voltage and current) this assures correct installation. A brief overlook of the waveform shows the effect of harmonics in a network.

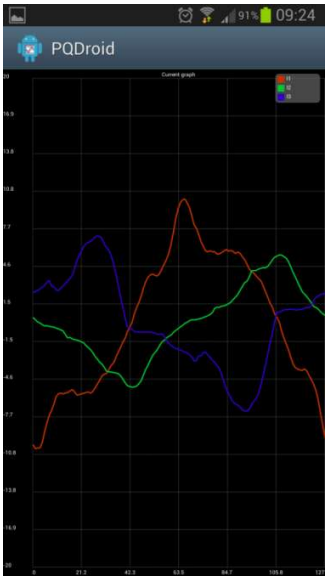


Figure 28

8.2 Real time values

In the real time values window you may quickly evaluate some power quality parameters. Reasonable values ensure a correct installation.
Note that the real-time values cannot replace measurement data over a longer period of time and may only be used to ensure correct polarities, phase sequence and constants!

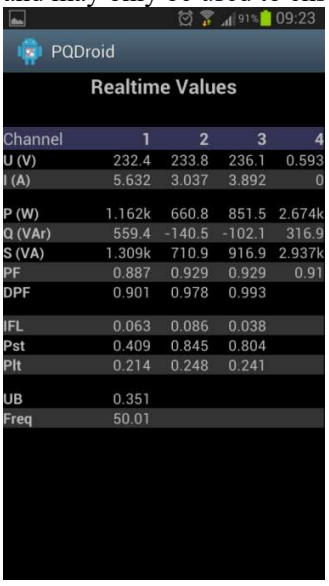


Figure 29

9 PQ Online

PQ Online is mainly used for configuration of the meter, but is also used as a communication program between the measure site and the office. In that case, PQ Online is used for the manual polling of measure data or for real-time analysis.

9.1 Main window

When starting PQ Online you will be met with the main window.

Figure 30

The buttons have the following functionality when the program is initially started.

- Connect, allows you to connect to a meter. (section 9.2)
- Meter settings, measurement parameters. (section 9.3)
- Communication settings, communication settings such as IP address.
- Open settings, opens meter settings from file.
- Save settings, saves meter settings to file.

Meter settings can be edited without being connected to a meter so that they can be saved to file.
You can change the language of PQ Online by clicking on the language in the bottom left corner.

After connecting to a meter, the main window changes to the following.

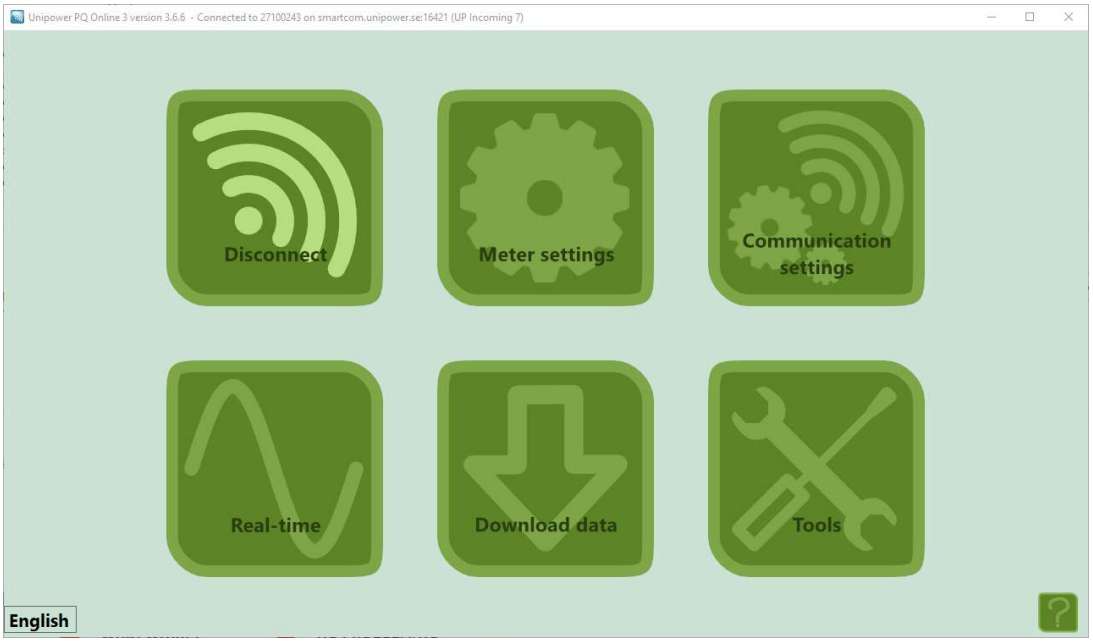


Figure 31

While connected to a meter, the following changes occur

- Realtime, shows real time measurement data (section 9.9).
- Download data, allows for manual download of stored data.
- Tools, contains various settings such as time synchronization.
- Disconnect replaces connect.

9.2 Connecting

Connection to the meter may be achieved either by direct connection through a USB-cable, through a network or wirelessly. The meter may also connect with an external GPRS modem using a com-port to Ethernet cable. For information on configuration with GPRS see the user manual of the modem.
The wireless connection is described in detail in section 7.
Connection with a USB-cable or Ethernet is described below.

9.2.1 Connect with USB

When you try to establish a connection you will be prompted by the following window (Figure 32). Here you may connect to the meter with a previously saved connection or a new configuration method.
If the connection method has been used before, simply select it under “Saved connections” and press OK.

If the meter you wish to connect to has **not** been previously connected to or has changed connection procedure, you must configure the connection. If you wish to do so, follow these steps:

- Plug the instrument to your computers USB port.
- If UniLauncher is installed (section 5.5) you may automatically connect to the meter.

If UniLauncher is not installed:

- Set the connection to serial (**1**)
- Identify the comport number (**2**) of the USB port. (Preferably by using the trial and error method)
- Give the connection a name and save the connection for future use* (**3**)

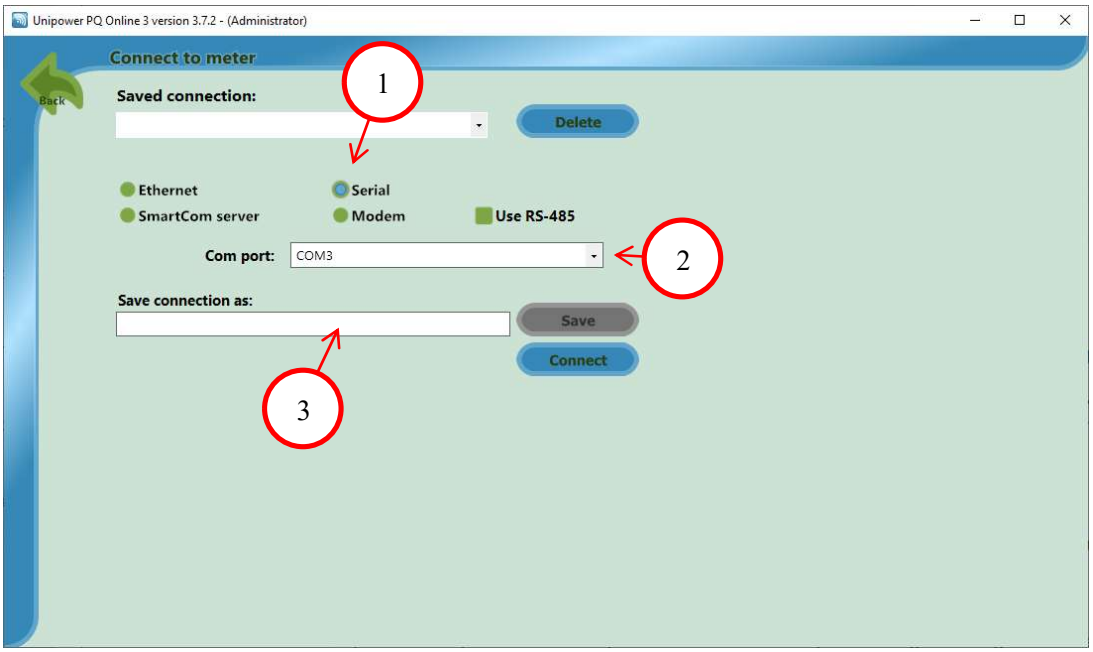


Figure 32

*When connecting with USB, the saved connection method will work for **any** Unilyzer 900. This means that you only need to save one USB connection setting.

9.2.2 Connect with Ethernet

When connecting via Ethernet the Unilyzer 900 must be connected to a network. Either connect the instrument in to the network with a com-port to Ethernet cable or connect it using WLAN.
For more information on how to use the meters built in WLAN see section 7.

If the connection method has been used before, simply select it under “Saved connections” and press OK.

If the meter you wish to connect to has not been previously connected to or has changed connection procedure, you must configure the connection. If you wish to do so, follow these steps:

- Set the connection to Ethernet (**1**)
- Check “Use UDP” if you prefer to connect using UDP-protocol instead of the default TCP-protocol. (**2**)
- Type the meters IP address or URL in the host name box. The IP address can be found on the display on the meter. **(3)**
- If the meter has been given a specific port, set the port number in the box. Usually, you can just check the box “Use Default” (4)
- Save the connection for future use.

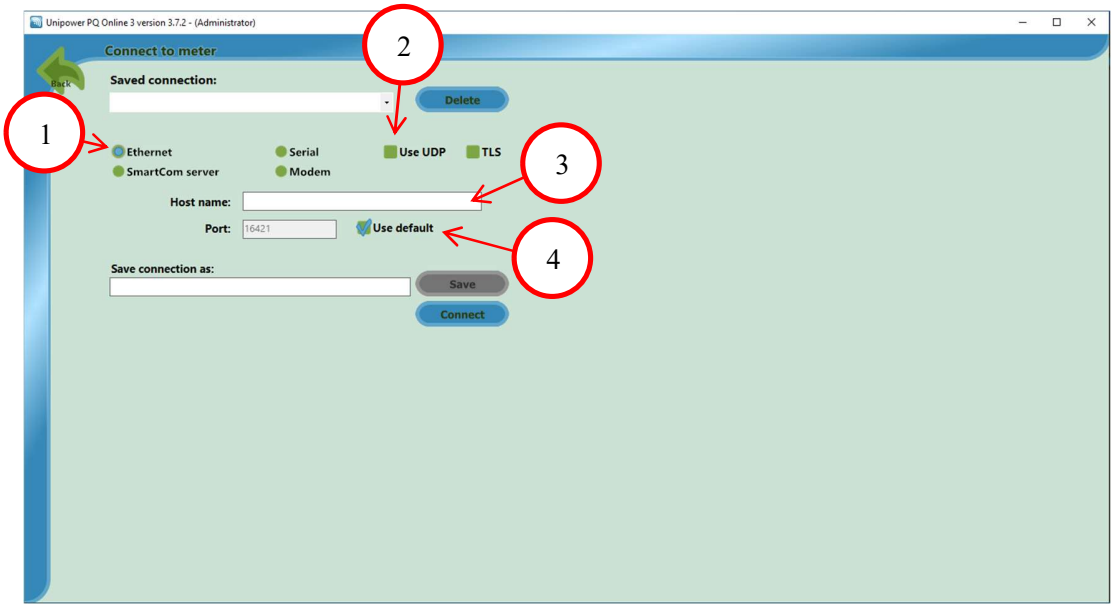


Figure 33

TLS should only be checked if the TLS encruption option is activated and is described in section 7.5 TLS Encryption.

9.3 Meter settings

The section **Meter settings** is used for checking and editing the configuration of the meter. The configuration contains information about how the meter is connected to the measure site, the reference levels on the voltage and current, and the storage intervals for PQ parameters. At the bottom of the page you may choose to start or stop the measurement. The meter will then begin or end measuring with the current settings. This name of this setting is stated on the top of the page.
In the bottom right corner you may choose to “change settings”. This allows you to reconfigure the current setting or create new configuration for the meter. You can also check that the measurement device has been correctly configured with “Check connection”.

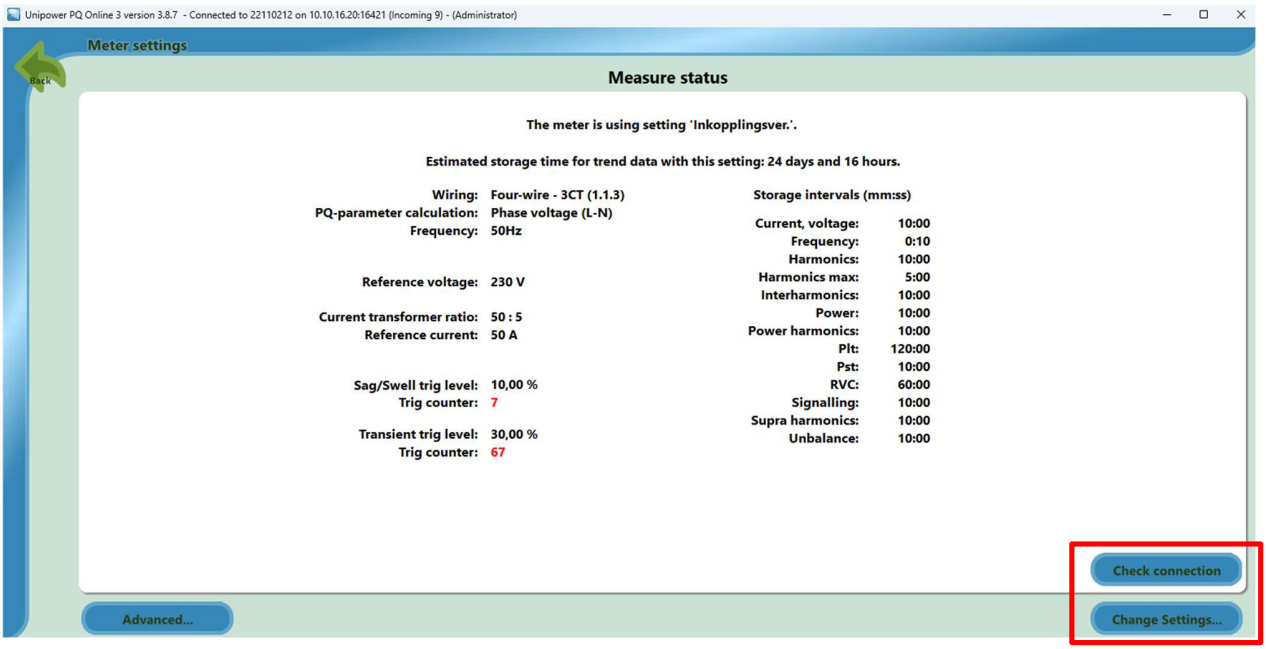


Figure 34

If for example the voltage on the meter inputs deviates from the reference voltage a warning sign is shown in the bottom of the window.

9.4 Change settings using the configuration wizard

In order to change a configuration or create a preset, access the “change settings” section under meter settings button (see section 9.3).
Creating or changing configuration settings is achieved by the following steps:

- Select to create a new template from scratch, create from a template already in the meter or create a template from a saved template file on your computer
- Set the wiring, constants and nominal levels (section 9.4.2) (if you choose to read settings from file or from meter the program will use the wiring set in the file/template automatically)
- Set reference and trig levels (Section 9.4.2)
- Review the configuration (section 9.4.3)
- Save the template (Section 9.6)

These steps are described in detail below.

It is also possible to create a template and save it to file without connecting a meter in case you wish to send a configuration. Simply start PQ Online and click Measurement Settings -> Change settings -> New Settings. Configure the template and save it to your computer.

Note: choosing the template EN50160LV/MV/HV provides a norm compliant power quality measurement setting. (see 9.4.1)

9.4.1 EN50160 templates

When the software has been installed the installer places three preconfigured measure templates under *C:\Program Files (x86)\Unipower\PQ Online 3\Templates*
These templates are compatible with the standard EN50160 and comes in three different voltage levels: Low voltage, Medium voltage and High voltage. Choosing the measurement template for the appropriate voltage level provides a norm compliant power quality measurement.
These measurement templates come with pre-set transformer ratios and nominal levels. If these do not apply to the system you must reconfigure these.

The presets are as follows:
EN50160LV: $U_{LL} = 400V$ $I_{Nom} = 16$ No transformer ratios
EN50160MV: $U_{LL} = 11kV$ $I_{Nom} = 400$ Voltage transformer ratio: 11kV/110V Current transformer ratio: 400A/5A
EN50160HV: $U_{LL} = 130kV$ $I_{Nom} = 400$ Voltage transformer ratio: 130kV/110V Current transformer ratio: 400A/5A

9.4.2 Creating a new measurement template

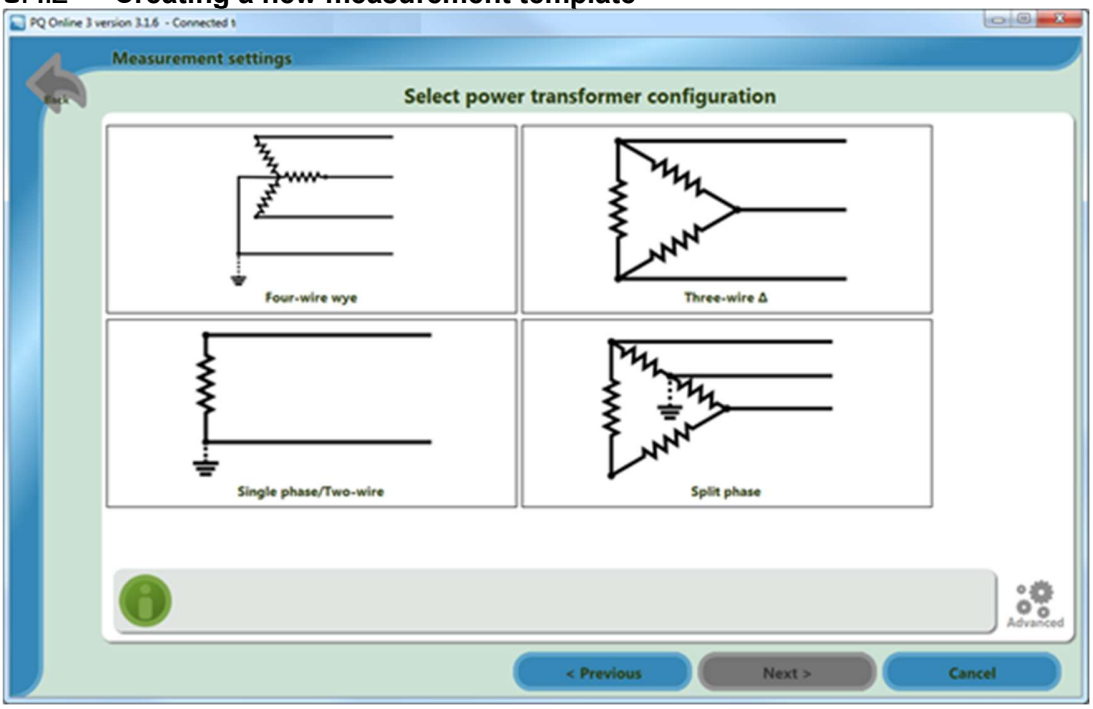


Figure 35

Begin with choosing the transformer configuration that fits your system. If possible Unipower always recommends measuring on a four-wire wye configuration.

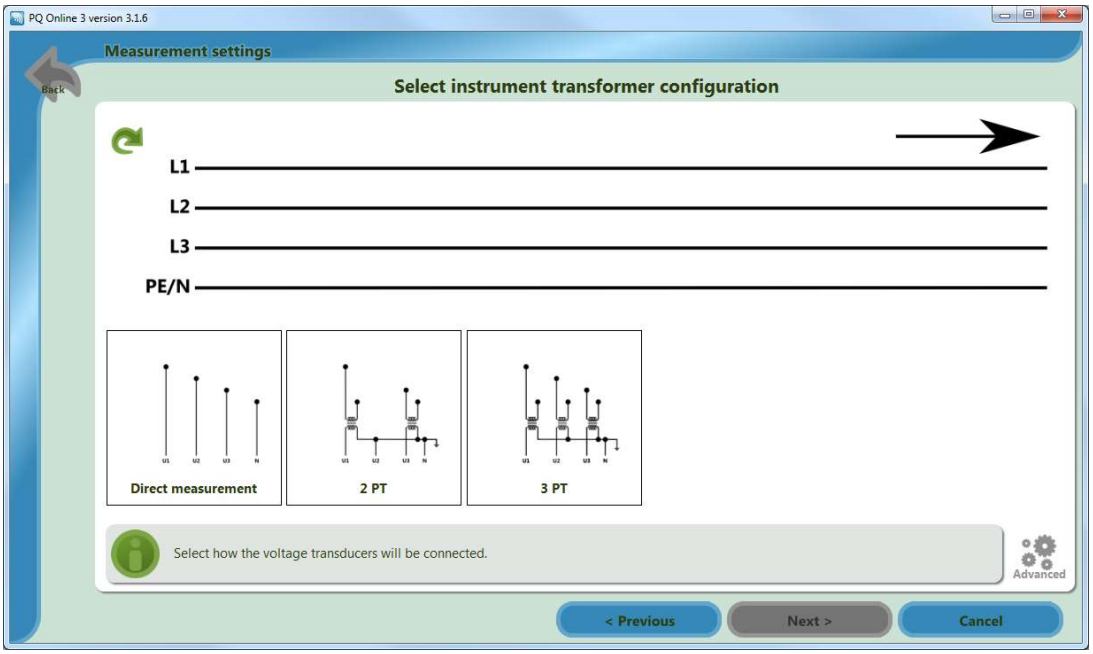


Figure 36

After you have set the system configuration you will be prompted to configure the wiring. You will first set how many PT:s you are measuring over or if it is a direct measurement. After you have set the voltage transformers you set the current transformers in the same matter.

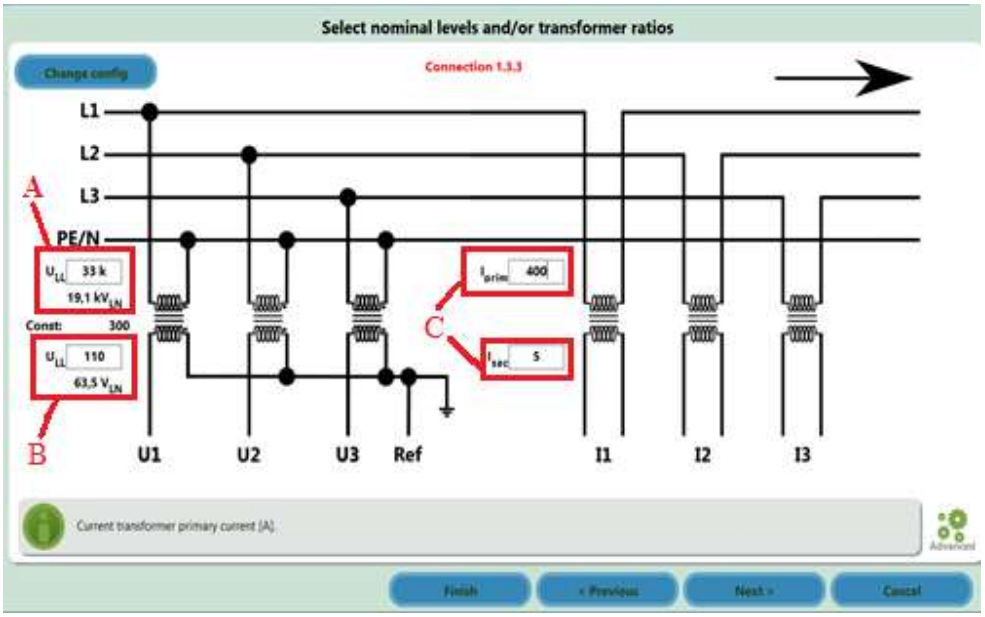


Figure 37

When you have set the wiring of the system you must set the transformer ratios and nominal levels. The nominal levels are automatically set to the values you put on the primary side of the transformer (**A**). Set the voltage on the secondary side of the transformer, this is the voltage that is the output of the instrument transformer (**B**). Then proceed to set the same for the current transformer(**C**).

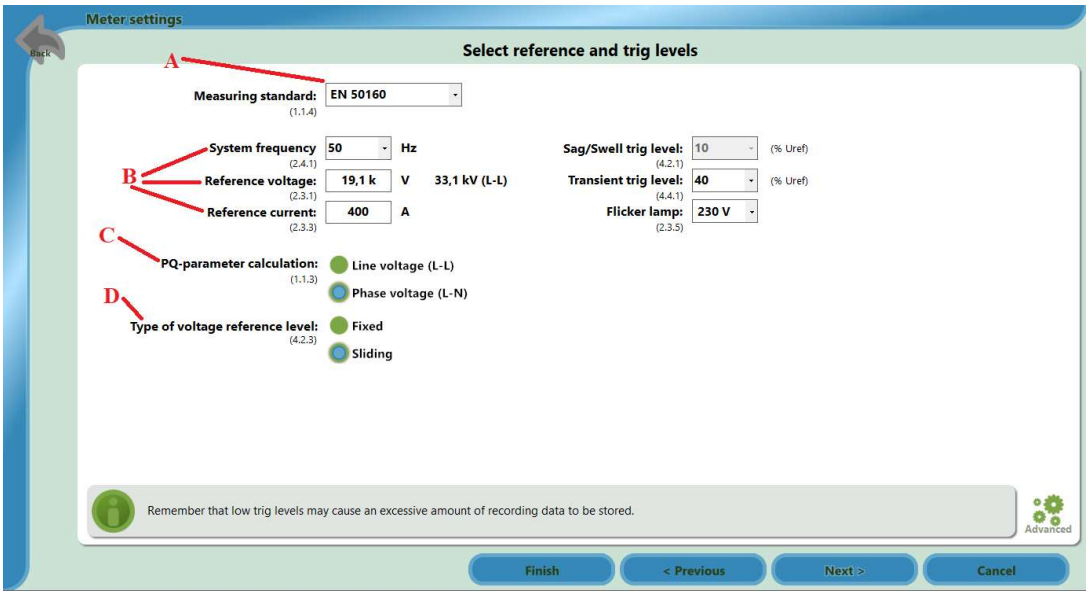


Figure 38

- In the following window choose a Measurement standard(**A**).
- Then proceed and fill in the system frequency, reference voltage and current(**B**).
- Choose if you wish to calculate the PQ Parameters (harmonics, unbalance etc.) on phase-neutral or phase-phase voltage (**B**). International norms require that for HV networks L-L voltages shall be considered and for LV networks where there is a neutral or ground conductor L-N voltages shall be considered for power quality. For troubleshooting purposes both perspectives could be considered depending on the application.
- Set the voltage reference level to either Fixed or Sliding. If you are measuring over a high/medium voltage network the reference level should be set to **sliding** and while measuring over a low voltage network the voltage level should be set to **fixed**. For further explanation of sliding reference see section 9.4.5 (Sags/Swells events)
- Continue to set the trig-levels and flicker measurement level. The flicker level measurement should be set to the voltage-level in your lamp socket.

Note! Calculating PQ Parameters on phase-to-phase voltage is not the same as measuring over phase-to-phase voltage.

9.4.3 Review configuration

Review the configuration before saving it and begin measurement. Make sure that all parameters are correct according to the load measured upon.

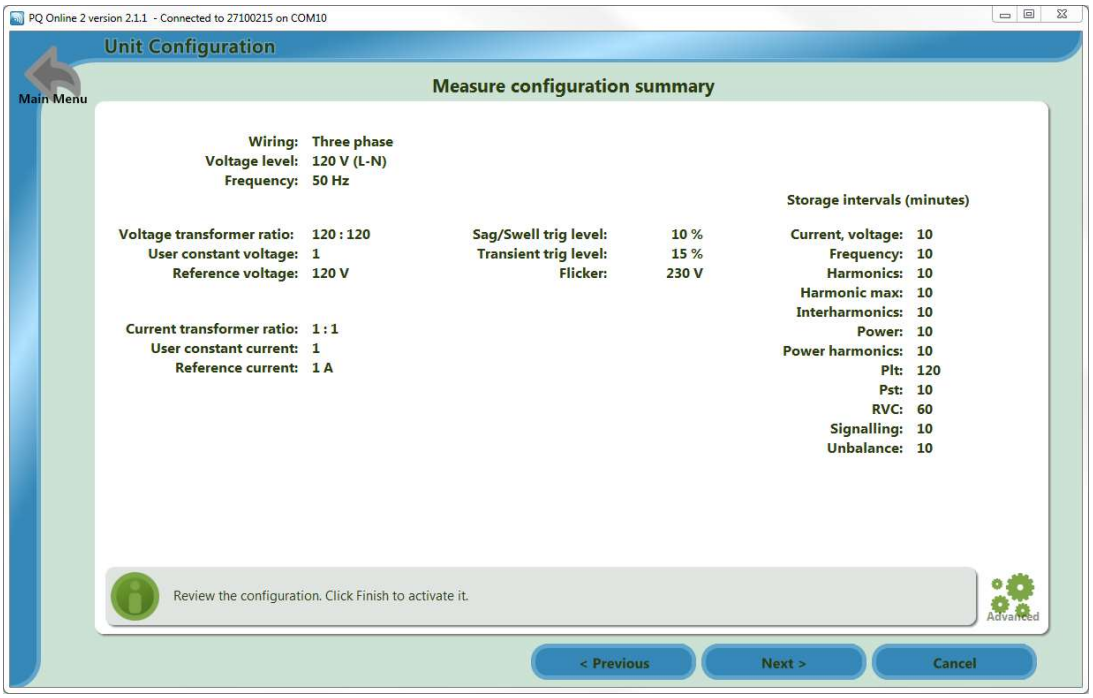


Figure 39

9.4.4 Store settings

The last step in the wizard has you chose how to store the configuration.

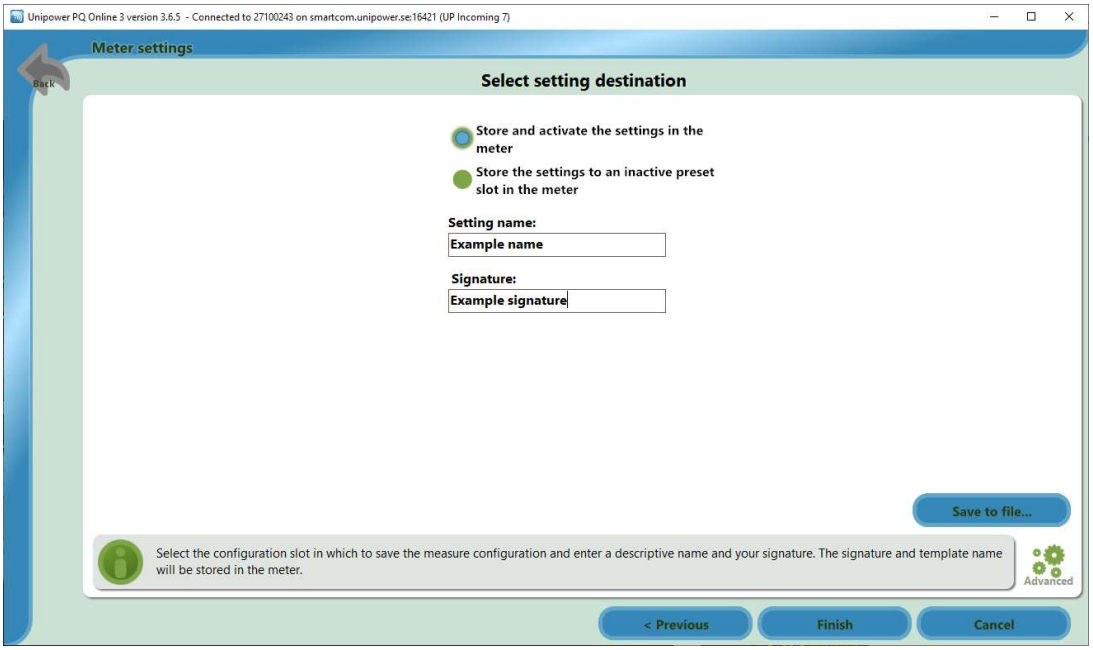


Figure 40

You can either store the configuration in the active configuration slot in the meter or to an inactive preset slot for later use. When storing the configuration make sure to use a descriptive name for the configuration such as the address of the measurement or the name of the substation and transformer. Make sure to check that the signature is correct. You can also store the finalized configuration to a file for later use. Once you press Finnish the configuration will be stored in the meter.

9.4.5 Advanced settings

In advanced settings you have five overall setting icons.

1. General settings
2. Measure site properties
3. Storage intervals
4. Disturbance
5. Slowscan settings
6. Digital in
7. Digital out

These are described below.

General settings (1)

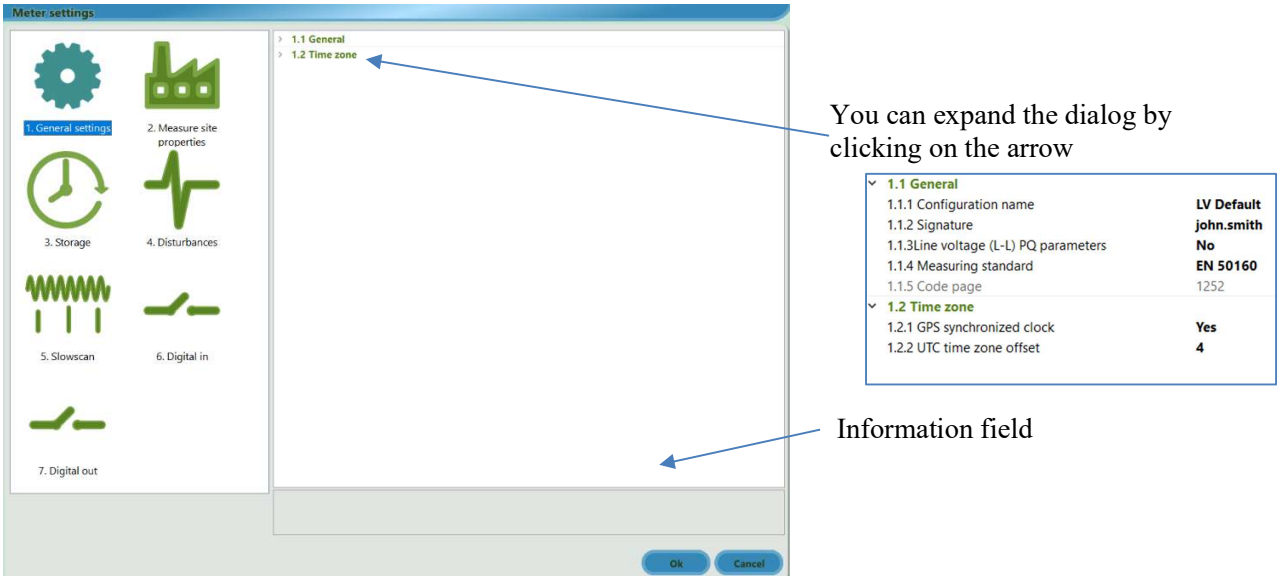


Figure 41

General settings are measurement settings for the meter. If you want to edit a value, highlight the row by clicking on it and edit the value.
In the selected description information field there is information about the actual highlighted row.

Measure site properties (2)

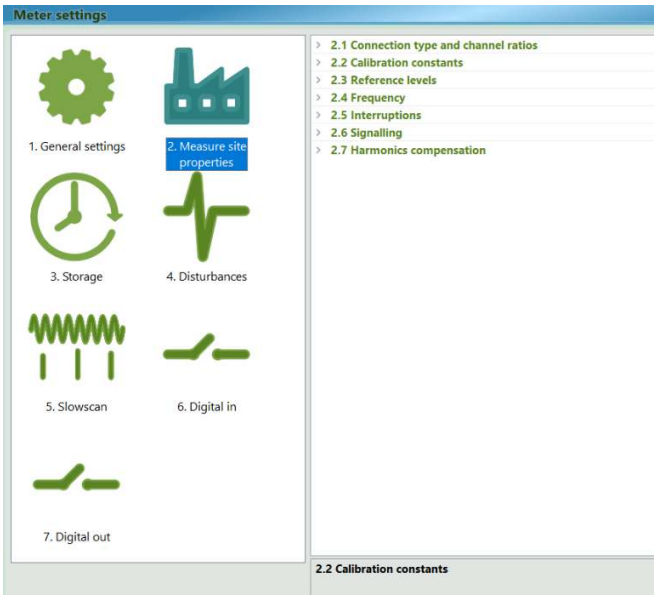
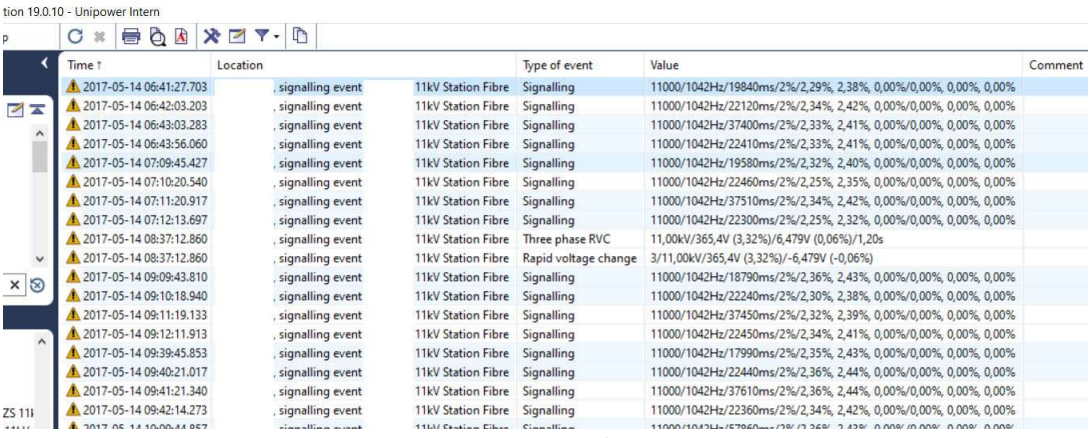


Figure 42

In measure site settings you have several settings. You can also here highlight a row and get information about the setting and edit the value.

Signalling (2.6)

Signalling are always activated by factory default in the meters. That is not a function which can be turned on/off. However, there are two parameters which can be set in the signaling when you have a known frequency (not a harmonic) which you want to create trig for. For an exaplme 1070 Hz. These two are Detection threshold and Ripple frequency. The event can be shown in the event viewer in PQ Secure (see **Error! Reference source not found.**). Or as an event line in any graph (see **Error! Reference source not found.**). See separate manual for PQ Secure.



Time ↑	Location		Type of event	Value	Comment
2017-05-14 06:41:27.703	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/19840ms/2%/2,29%, 2,38%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 06:42:03.203	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/22120ms/2%/2,34%, 2,42%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 06:43:03.283	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/37400ms/2%/2,33%, 2,41%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 06:43:56.060	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/22410ms/2%/2,33%, 2,41%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 07:09:45.427	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/19580ms/2%/2,32%, 2,40%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 07:10:20.540	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/22460ms/2%/2,25%, 2,35%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 07:11:20.917	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/37510ms/2%/2,34%, 2,42%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 07:12:13.697	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/22300ms/2%/2,25%, 2,32%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 08:37:12.860	, signalling event	11kV Station Fibre	Three phase RVC	11,00kV/365,4V (3,32%)/6,479V (0,06%)/1,20s	
2017-05-14 08:37:12.860	, signalling event	11kV Station Fibre	Rapid voltage change	3/11,00kV/365,4V (3,32%)/-6,479V (-0,06%)	
2017-05-14 09:09:43.810	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/18790ms/2%/2,36%, 2,43%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 09:10:18.940	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/22240ms/2%/2,30%, 2,38%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 09:11:19.133	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/37450ms/2%/2,32%, 2,39%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 09:12:11.913	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/22450ms/2%/2,34%, 2,41%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 09:39:45.853	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/17990ms/2%/2,35%, 2,43%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 09:40:21.017	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/22440ms/2%/2,36%, 2,44%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 09:41:21.340	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/37610ms/2%/2,36%, 2,44%, 0,00%/0,00%, 0,00%, 0,00%	
2017-05-14 09:42:14.273	, signalling event	11kV Station Fibre	Signalling	11000/1042Hz/22360ms/2%/2,34%, 2,42%, 0,00%/0,00%, 0,00%, 0,00%	

Figure 43

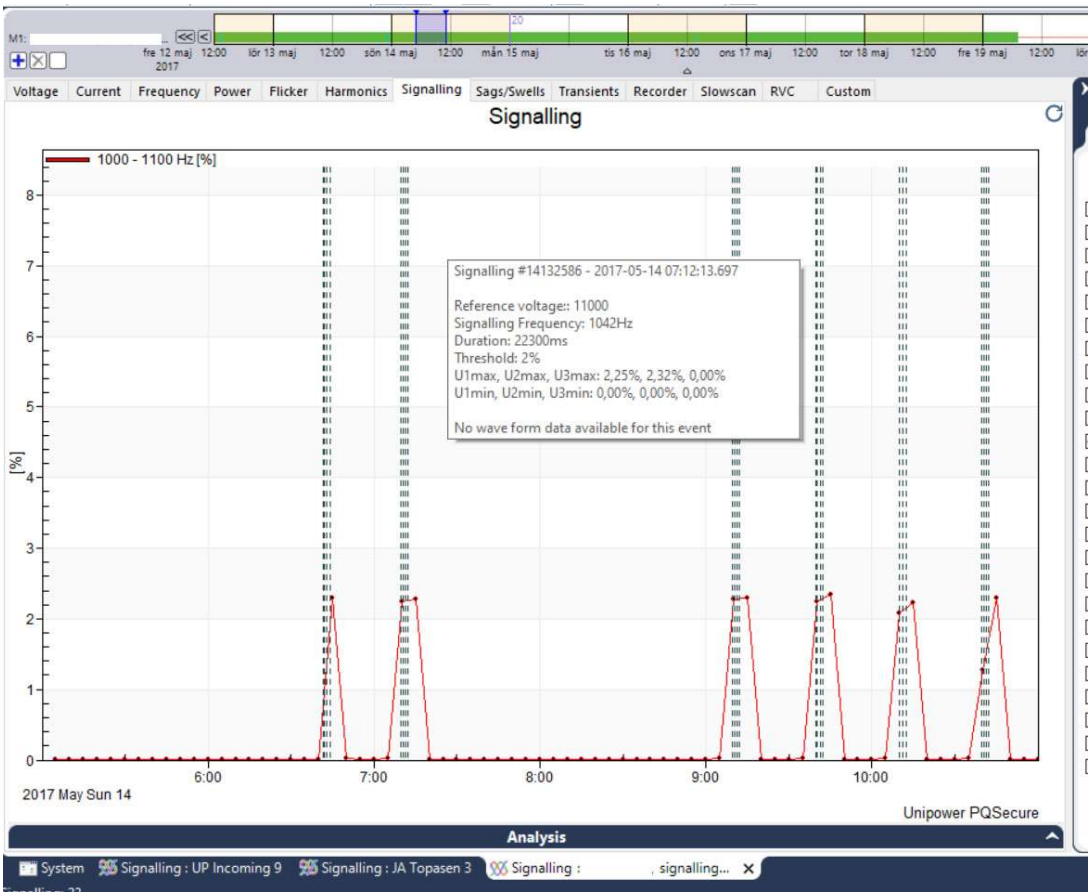


Figure 44

Detection threshold (2.6.1)

Here you set a value (% of nominal voltage) to be the trig condition. If the signaling value exceed this set value an event will be created which can be shown in the event viewer.

Ripple frequency (2.6.2)

Here you set which frequency to be the trig condition. (see **Error! Reference source not found.**).

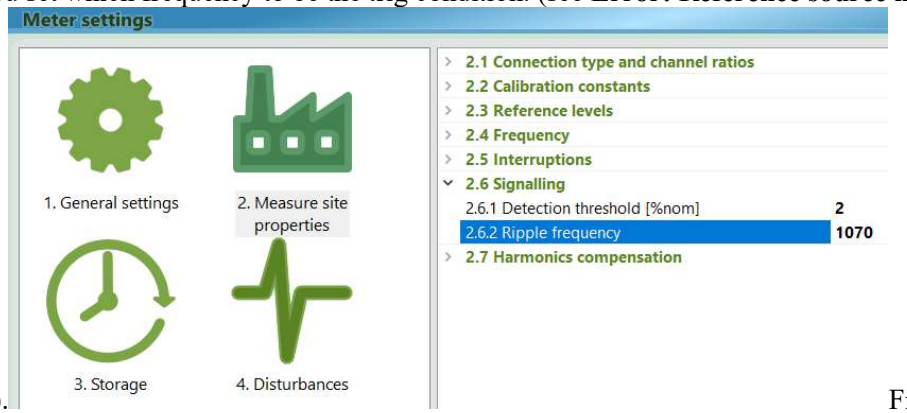


Figure 45

Storage intervals (3)

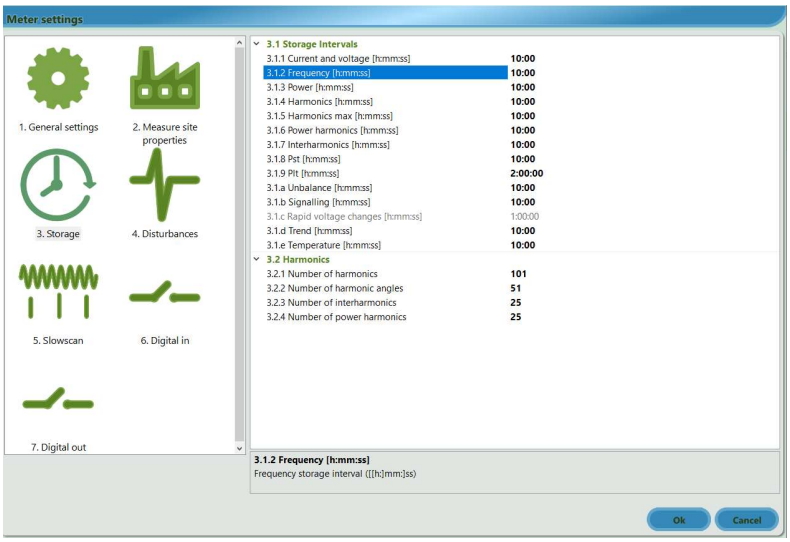


Figure 46

In storage interval you set the intervals how often values will be stored to the memory.

Disturbances (4)

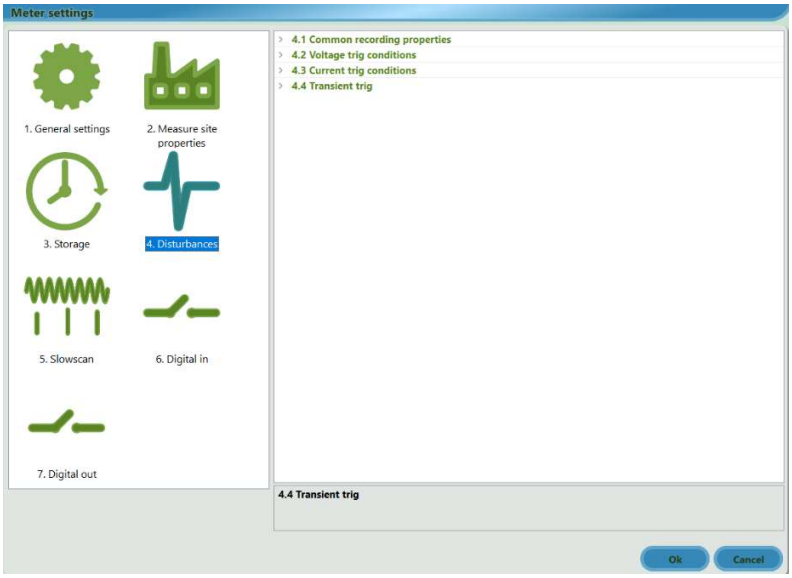
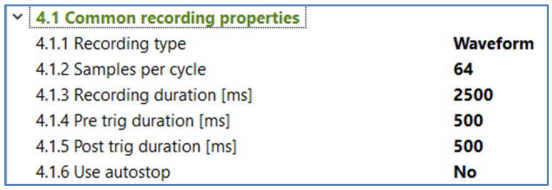


Figure 47

In disturbances you set values for disturbances such as sags/swells and transients.

9.4.5.1 Sags/Swells events

The recorder can do a high-speed recording to allow detailed analysis of, for instance, a sag/swell event. The storage time is the total recording length and is set so that the event you want to capture is covered. A typical sag in the power distribution network is less than 1 second. The pre trig is a short time that allows study of the time just before the event starts, the maximum pre trig is 10 seconds with waveform enabled and 10 seconds with only RMS recording.
If waveform is not enabled, you will lose the ability to see disturbances in line-line/line-neutral voltage. In **waveform** mode the meter stores sample points in the selected rate. In **RMS** mode only the RMS1/2-values are stored, every half cycle. The RMS recording takes much less memory space and allows for storing more events. With the auto stop function you can also save memory. In this mode, if the event goes back to normal condition before the total storage time has passed the recording stops and memory space is saved. An extra delay (post trig) before the stop is added.



Recording type
Decides wether recording should be stored as waveform or RMS

Samples per cycle
Samples per cycle. This value controls the sampling frequency for waveform recording.

Recording duration [ms]
Max recording duration. Including pre trig and eventual post trig.

Pre trig duration [ms]
Decides for how long before the actual trig occurs data should be saved.

Post trig duration [ms]
Recording duration after the measured values has returned to normal state. Only used when auto stop is enabled.

Use autostop
Enabling autostop will automatically stop the recording when the status has returned to normal state.

To start (trig) the recording there are a number of different trigging methods.

Example of sag event:
According to IEC 61000-4-30 standard: a sag/dip begins when the voltage on one or more channels is below the trig threshold (level) and ends when the voltage on all measured channels is equal to or above the dip threshold plus the hysteresis voltage.

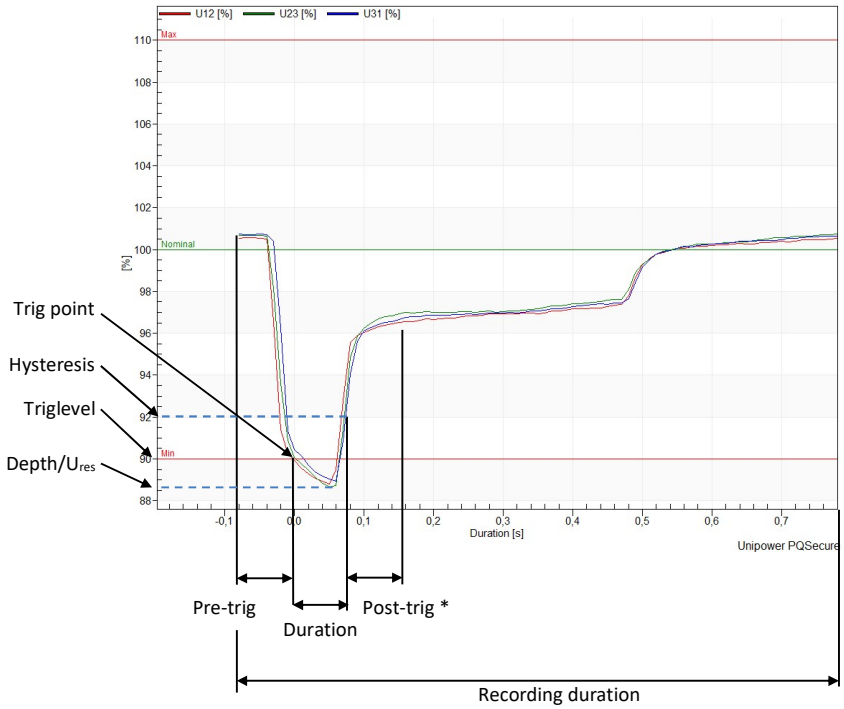


Figure 48

*) Post-trig is only used with auto-stop function. Recording duration is then = pre-trig + duration + post-trig

Voltage triggers (4.2)

4.2 Voltage trig conditions	
4.2.1 U1 - U3 trigs at deviation [% Uref]	10
4.2.2 Hysteresis [% Uref]	2
4.2.3 Use sliding reference	**No**
4.2.4 U4 trig level [V]	**Disabled**
4.2.5 Voltage sum trig level [V]	**Disabled**
4.2.6 RVC Threshold [%nom]	**0**
4.2.7 RVC Hysteresis [%nom]	**0**

4.2.1 U1 - U3 trigs at deviation [% Uref]
The value at which a sag or swell is registered and a recording is started. 0 = Disabled

4.2.2 Hysteresis [% Uref]
Trig end value = (trig level - hysteresis). Example: trig value 10%, hysteresis 2%. Trig end value=ref ±(10-2=8%)

4.2.3 Use sliding reference
If enabled, the reference level will be following the actual voltage, instead of remaining at a fixed level.

4.2.4 U4 trig level [V]
The value at which a sag or swell is registered and a recording is started. 0 = Disabled

4.2.5 Voltage sum trig level [V]
A recording will begin at this voltage sum level. 0 = Disabled

4.2.6 RVC Threshold [%nom]
The value at which a rapid voltage change is registered.

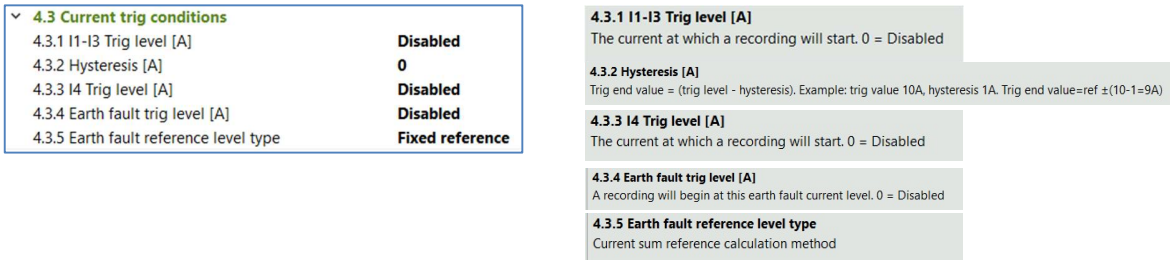
4.2.7 RVC Hysteresis [%nom]
Trig end value = (trig level - hysteresis). Example: trig value 3%, hysteresis 1,5%. Trig end value=ref ±(3-1,5=1,5%)

a) U1-U3 trigs at deviation [% Uref] (4.2.1)
A voltage sag (or swell) recording begins when the voltage one of the phases U1-U3 passes the Uref value +/- the trig level as in Figure 48. The recording will have the timing as described above.
The *duration* of the sag/swell event is calculated to the point where the voltage of all phases U1-U3 is back within the trig level + the **hysteresis** value as in Figure 48 in accordance to IEC 61000-4-30 Class A.
The purpose of the hysteresis level is to avoid recording secondary events that occur directly following an important sag/swell. The meter also calculates the *depth* of the sag/swell as the lowest (sag) or highest (swell) voltage value during the event. This value is expressed as the residual voltage level in accordance to IEC 61000-4-30 Class A.
If the nominal level in the system is changing, for example in high voltage networks, you can use a **sliding reference** nominal level (see Figure 48). The recorder will calculate the average value of the reference voltage channel (U1) according to the norm IEC 61000-4-30 and create its own reference level. The value of the sliding reference level will be shown along with each sag/swell.
Normally, if sliding reference is not active, the fixed reference value is used as the nominal voltage.

b) U4 trig level [V] (4.2.4)
If the voltage on channel U4 is higher or lower than the reference value +/- the trig level a sag/swell recording starts.

c) Voltage sum trig level [V] (4.2.5)
This trig gives you the possibility to trig on earth faults. Normally the voltage sum U1+U2+U3=0. If this is not the case you probably have an earth fault and this trigger starts a recording.

Current triggers (4.3)



a) I1-I3 high trigger (4.3.1)

Whenever one of the current phases I1-I3 exceeds the trig level a sag/swell recording starts as described above. For current you also have the possibility to specify Hysteresis (4.3.2). Compare with Figure 48. Hysteresis is specified as a current value and is added to the trig level. By specifying a hysteresis level you avoid recording secondary events that occur directly following an important current trig event.

b) I4 trig level [A] (4.3.3)

If the current on I4 exceeds the trig level a sag/swell recording is started.

c) Earth fault trig level [A] (4.3.4)

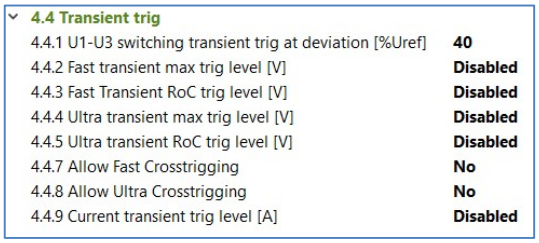
This trig gives you the possibility to trig on earth faults. Earth faults are detected by calculating the sum of the currents. Normally the current sum I1+I2+I3+I4=0. If this is not the case you probably have an earth fault and this trigger starts a recording.
On high voltage systems you don't have a neutral conductor and normally don't use channel I4. In this case, select 0 as constant on channel I4 and this trigger will work as intended anyway.

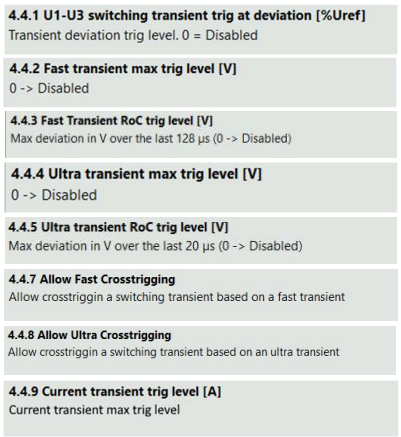
d) Earth fault reference level type (4.3.5)

With setting fixed reference the earth fault trig compares the actual current to 0 Amps and trigs when current is higher than the trig level (c). With setting sliding reference the earth fault trig compares the actual current to a sliding mean current value and trigs when difference is larger than the trig level (c). This is useful if there is an offset (starting) value for the current sum and you want to trig on small deviations from this level. The offset could be because of current unbalance. The sliding reference is a mean value calculated over 1 minute.

Transient triggers (4.4)

Transients are sub-cycle events that are captured on sample level rather then rms values, like sags/swells.



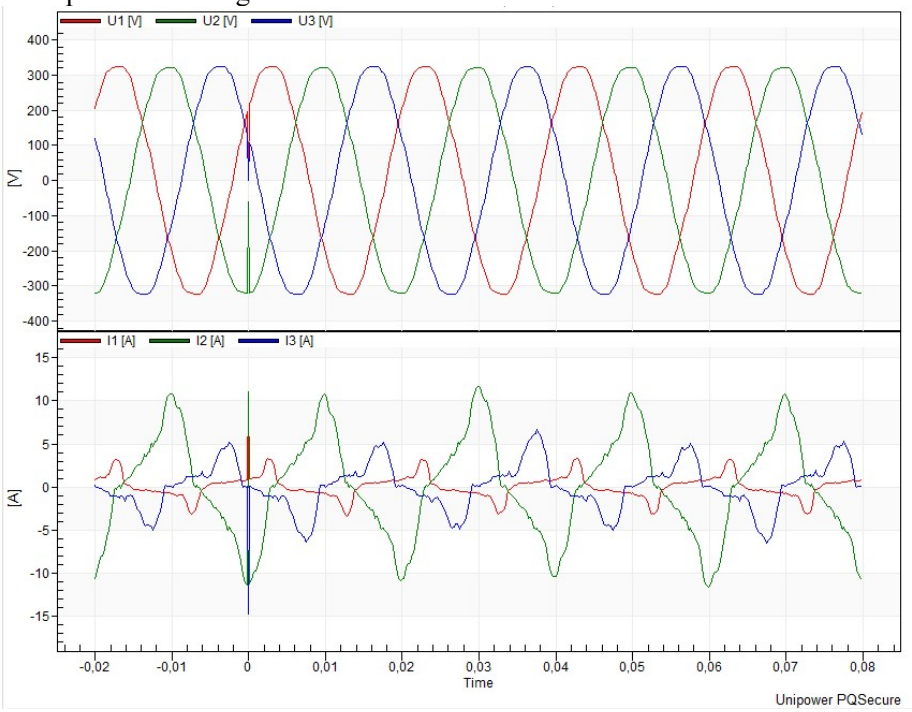


a) Switching transients

Switching transients are the most common ones in the power system. They have a duration in the magnitude of ca 1/256 cycle or ca 57 us @ 50 Hz.
The waveform is compared sample by sample to the previous waveform and whenever there is a deviation between the voltage value in a sample point there is a trig. The trig level is set in % of the reference voltage. 40% Uref is a good starting point but you may have to adjust this level if measuring in the LV network or in an industry where there are more disturbances.

The transient recording is 1 cycle pre-trig and 4 cycles post-trig (a total of 5 recorded cycles).

Example of switching transient:



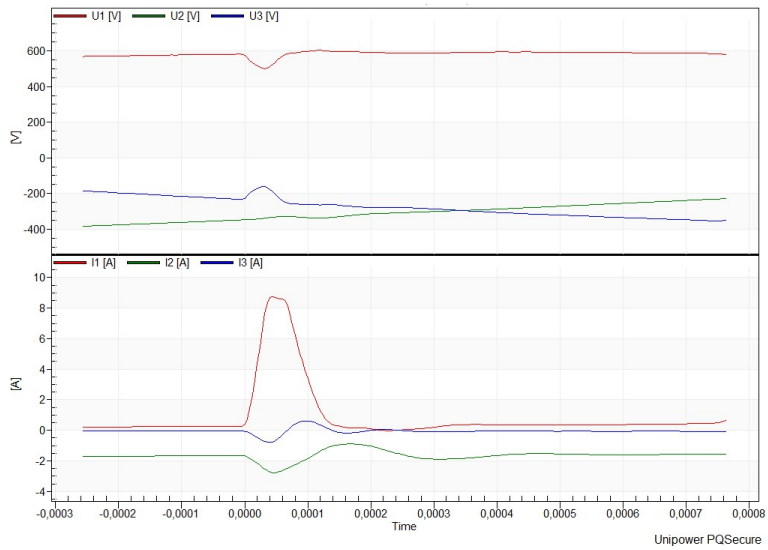
b) Fast transients
Fast transients have a duration in the magnitude of ca 4 us (1/5000 cycle @ 50 Hz or 1/4200 cycle @ 60 Hz)
A fast transient is captured if:

i) Max level exceeds the 4.4.2 trig level setting in Volts. Remember that the in the normal case the max value = voltage RMS *√2. On 230V LV network peak value is
230*√2=+/-326 V. Max level should be set to 400 V or more.
You need to experiment with trig levels depending on situation.

ii) If the deviation in Volts between each sample point and the 128 us previous sample point exceeds the 4.4.3 trig level setting in Volts. This is a rate of change (RoC) trig.
A good starting value could be 50% of Uref.
You need to experiment with trig levels depending on situation.

A fast transient is recorded during 1000 us with a 250 us pre-trig.

Example of a fast transient:



c) Ultra-fast transients

Ultra-fast transients have a duration in the magnitude of ca 650 ns (1/31000 cycle @ 50 Hz or 1/26000 cycle @ 60 Hz)

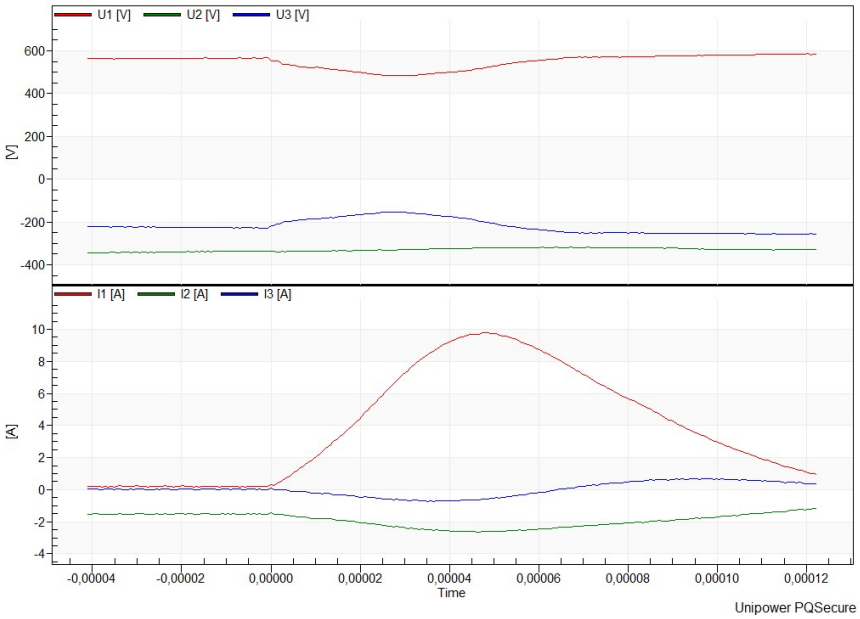
An ultra-fast transient is captured if:

i) Max level exceeds the 4.4.4 trig level setting in Volts. Remember that the in the normal case the max value = voltage RMS *√2. On 230V LV network peak value is
230*√2=+/-326 V. Max level should be set to 400 V or more.
You need to experiment with trig levels depending on situation.

ii) If the deviation in Volts between each sample point and the 20 us previous sample point exceeds the 4.4.5 trig level setting in Volts. This is a rate of change (RoC) trig.
A good starting value could be 50% of Uref.
You need to experiment with trig levels depending on situation.

An ultra-fast transient is recorded during 160 us with a 40 us pre-trig.

Example of an ultra-fast transient:



Slowscan Settings (5)

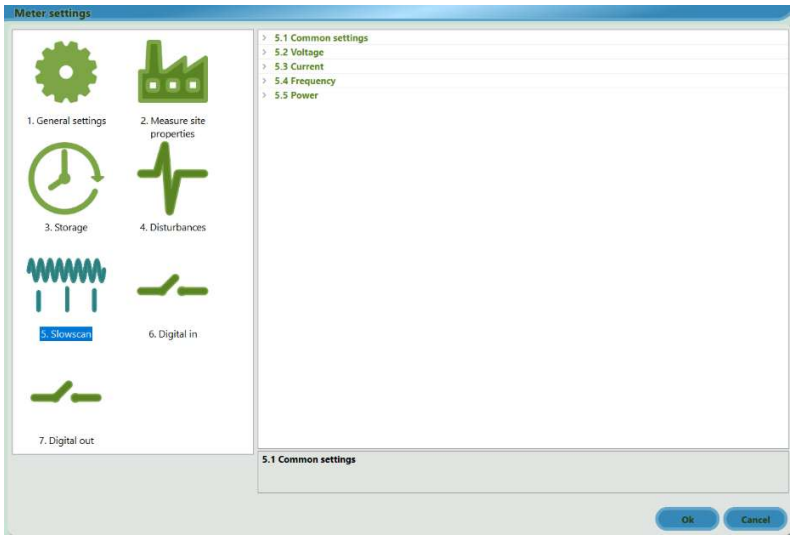


Figure 49

Slowscan is an optional module. Slowscan recording is often used to verify longer disturbances in the electrical network. The type of disturbance could be caused by instability or other major events that influence the network.
During a slowscan recording the RMS values of the parameters are stored with a resolution of 10-100 samples per second.
Since the resolution is lower a longer recording can be made. Maximum pre trig is 30 seconds and maximum recording length (including pre trig) is 300 seconds. For typical grid operations Unipower recommends a configuration of 10 seconds pre trig, 120 seconds post trig. Note that appropriate settings might take some trial and error before you find optimal storage length for your system. If you wish you can configure the meter to automatically stop recording when values are within the limits again.

Common settings (5.1)

5.1 Common settings	
5.1.1 Number of stored values/second	10
5.1.2 Recording duration [s]	60
5.1.3 Pre trig duration [s]	10
5.1.4 Use autostop	No

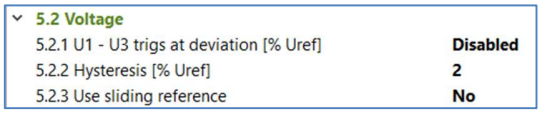
5.1.1 Number of stored values/second
Number of values per second that will be stored.

Recording duration [s]
The total recording length including pre trig time. If auto stop is active this will be the total maximum length. [s].

Pre trig duration [s]
The time before the registered trig occurs for which information will be stored [s].

Use autostop
Enabling autostop will automatically stop the recording when the status has returned to normal state.

Voltage triggers (5.2)



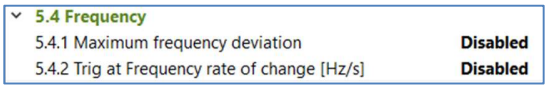
U1 - U3 trigs at deviation [% Uref]
Maximum voltage deviation before a recording starts [% Uref].

Use sliding reference
If enabled, the reference level will be following the actual voltage, insted of remaining at a fixed level.

Current triggers (5.3)

5.3.1 Trig at current rate of change [kA/s]
Storing 10 times/s and the change dI is 2A between two samples -> dI/dt=2A * 10 = 0,02 kA/s

Frequency triggers (5.4)



Maximum frequency deviation
Maximum frequency deviation before a recording starts [%Fnom].

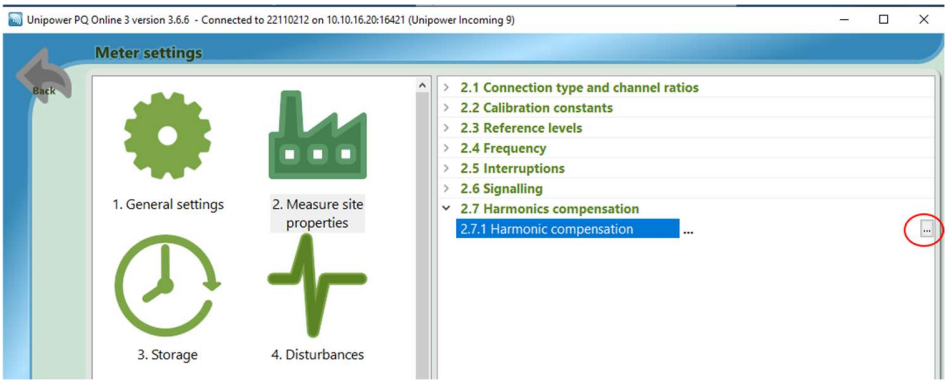
Power triggers (5.5)

Trig at Frequency rate of change [Hz/s]
Maximum Frequency rate of change that is allowed before a recording starts [Hz/s].

For power parameters the trigger is set on the rate of change (RoC). The system stores 5 values per second. If the change dP is 20 kW between to values, then dP/dt (rate of change) is 20 kW * 5 = 0,1 MW/s. Use the setting 0,1 MW/s.
Reactive power Q works in a similar way.

9.5 Harmonic bandwidth extension HBE (option)

The harmonic bandwidth extension is used for Voltage Transformer frequency correction. The compensation is done for each harmonic component, both amplitude and phase angle error. The compensation is done in PQ Online, in the advanced meter configuration window (2.7.1). Press the three dots.



Harmonic	U1 Amplitude	U1 Phase	U2 Amplitude	U2 Phase	U3 Amplitude	U3 Phase	U4 Amplitude	U4
0	1	0	1	0	1	0	1	
1	1	0	1	0	1	0	1	
2	1	0	1	0	1	0	1	
3	1	0	1	0	1	0	1	
4	1	0	1	0	1	0	1	
5	1,05	+10	1	0	1	0	1	
6	1	0	1	0	1	0	1	
7	1	0	1	0	1	0	1	
8	1	0	1	0	1	0	1	
9	1	0	1	0	1	0	1	
10	1	0	1	0	1	0	1	
11	1	0	1	0	1	0	1	
12	1	0	1	0	1	0	1	
13	1	0	1	0	1	0	1	
14	1	0	1	0	1	0	1	
15	1	0	1	0	1	0	1	

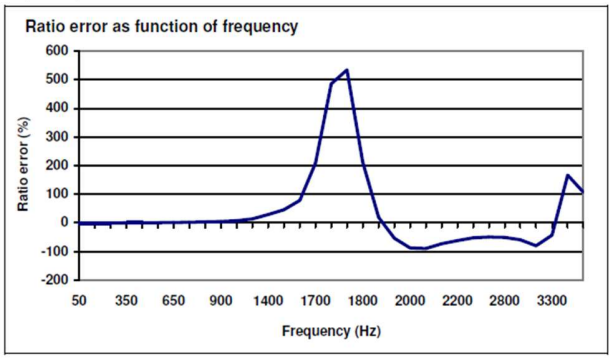
Reset to default | Ok | Cancel

To remove all compensation, you can press the button “Reset to default”. This will set all amplitude compensation to 1.0 and all phase angles to 0°. The amplitude compensation range can be set to between 0.0 and 10.0 and the phase angle compensation is between -180° to +180°.

Parameters that will be influenced by the harmonic compensation parameters are:
Harmonic Amplitude, Harmonic Phase, THD values, Voltage Unbalance, Current Unbalance, K-factor.

Text information can be copied from Excel into the Harmonic compensation sheet.

The picture below shows an amplitude/frequency graph of a magnetic 130kV voltage transformer. In this case the amplitude compensation for harmonic 35 (1750Hz) can be set to 0.2 to eliminate the majority of the PT error.



9.6 Saving the configuration

When doing configurations in PQ Online last step is to save the configuration. You may choose to save it either as a file or directly into the meter. A file is a good way to make a backup of the settings or if you want to send the settings to someone else that will do the configuration of the meter. If you choose to save it directly to the meter you have the option to save it either as the active into the meter and apply the configuration instantly or save it to one of the six *template (or preset) slots.* Templates can be selected directly from the display menu in an easy way when you are on site.

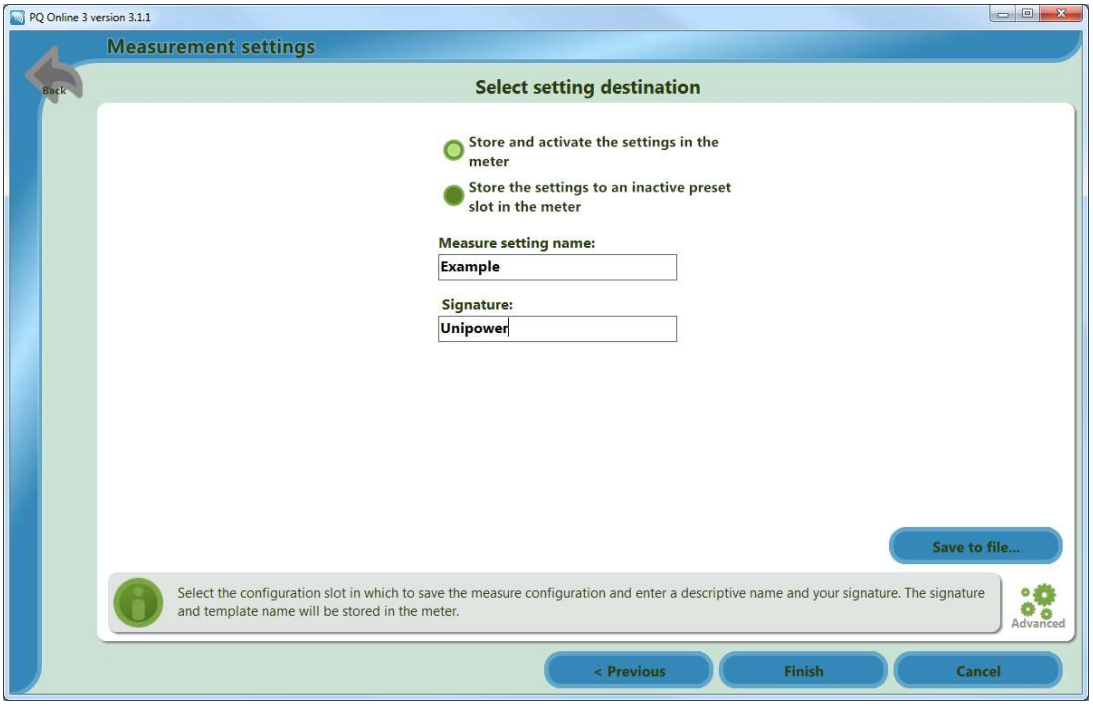


Figure 50

9.7 Working with templates

A template is a pre-defined setting that you can easily choose from the display menu on site, without having to connect to a tablet or computer.

When doing configurations in PQ Online, at the last step you have the possibility to save the configuration as a template (Figure 50). There are six *template (or preset) slots* in the meter memory (Figure 51). The name of the template will be the Measure setting name you state in Figure 50.

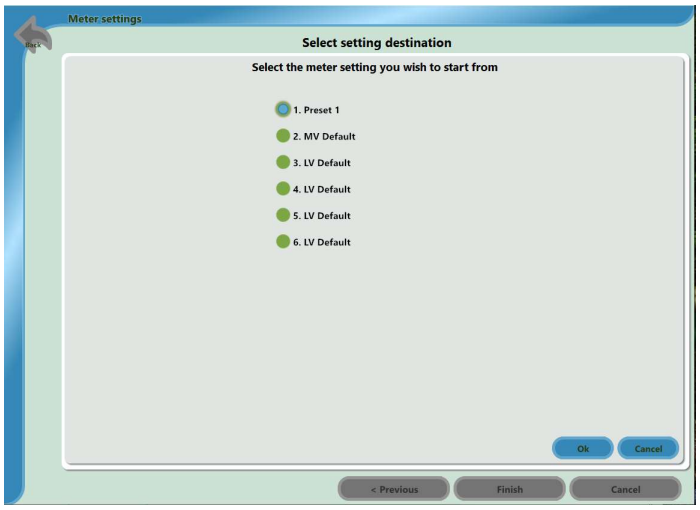


Figure 51

9.8 Load a configuration from file

By choosing "Get settings from file…" you can load a configuration that you saved before or was handed. By having saved templates you can always go back and see the settings you've used for a specific measurement. Here you may also choose to read the settings that are currently active in the meter.

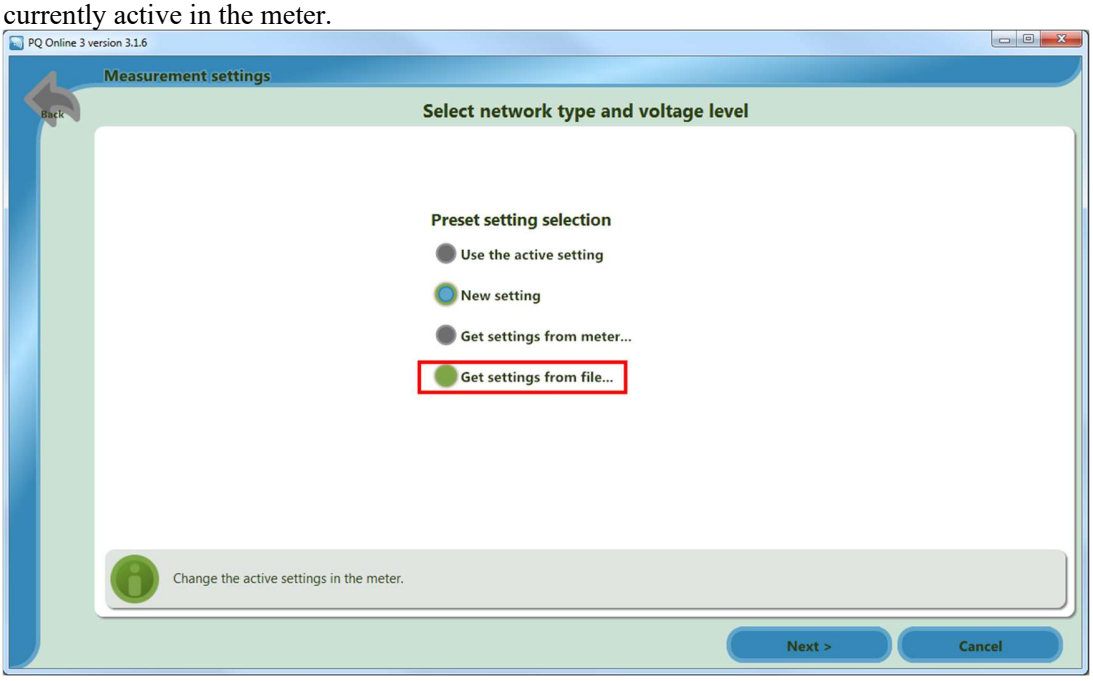


Figure 52

9.9 Real time values

The real time values accessible from PQ Online are a useful tool when ensuring correct installation and configuration.
Make a habit of always checking installation and configuration through real time analysis before starting a measurement!

In order to investigate the real time values of the measure site click the **real-time** button in the home screen of PQ Online.

Figure 53

9.9.1 Values tab

The first of the real time tabs accessible is the values tab. In this tab you may access numeric values and plots of basic electric power parameters.
When investigating values before a measurement, focus on the quantity of each parameter. Make sure that all parameters are within plausible levels.

- Check the voltage, current and frequency levels*
- Check active, reactive and apparent power levels and polarity**
- Plot a graph over some of the parameters
- Move on to the oscilloscope tab

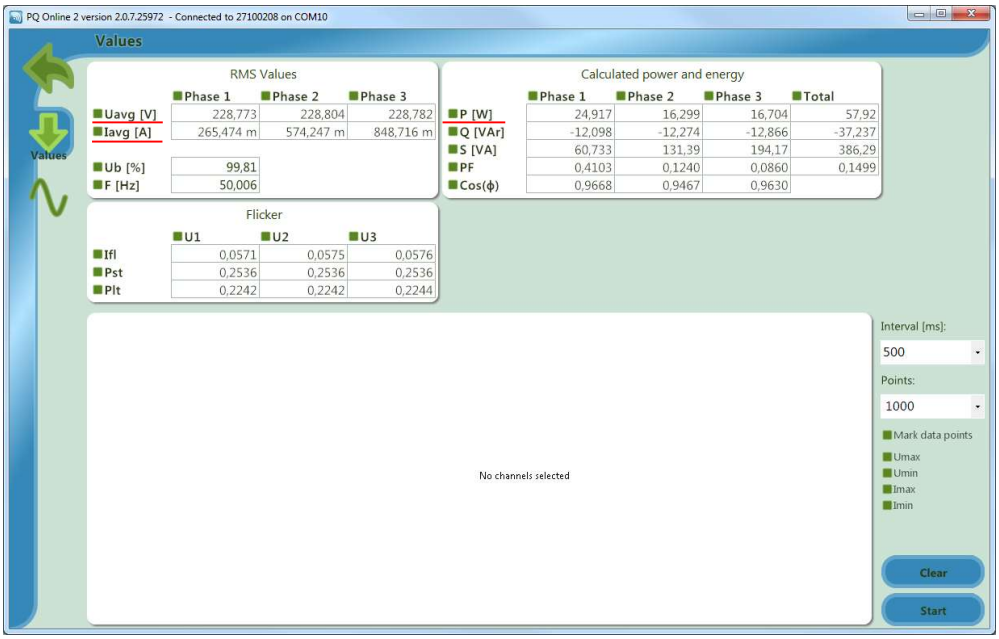


Figure 54

Plotting PQ parameters in a trend graph gives a brief overview of the power quality at the measure site. And can be a good way of quickly oversee the electrical network in the local measurement area.
Note that real time measurements may never replace logging of data under a longer period.

* If the voltage or current has faulty RMS values, revise the constants under the wiring tab in the configuration (see section 9.344)
**If the power quantities are presented with wrong polarity (for example + instead of -) revise the direction of the current clamps, alternatively change the calibration constant to a negative.

9.9.2 Trend graph

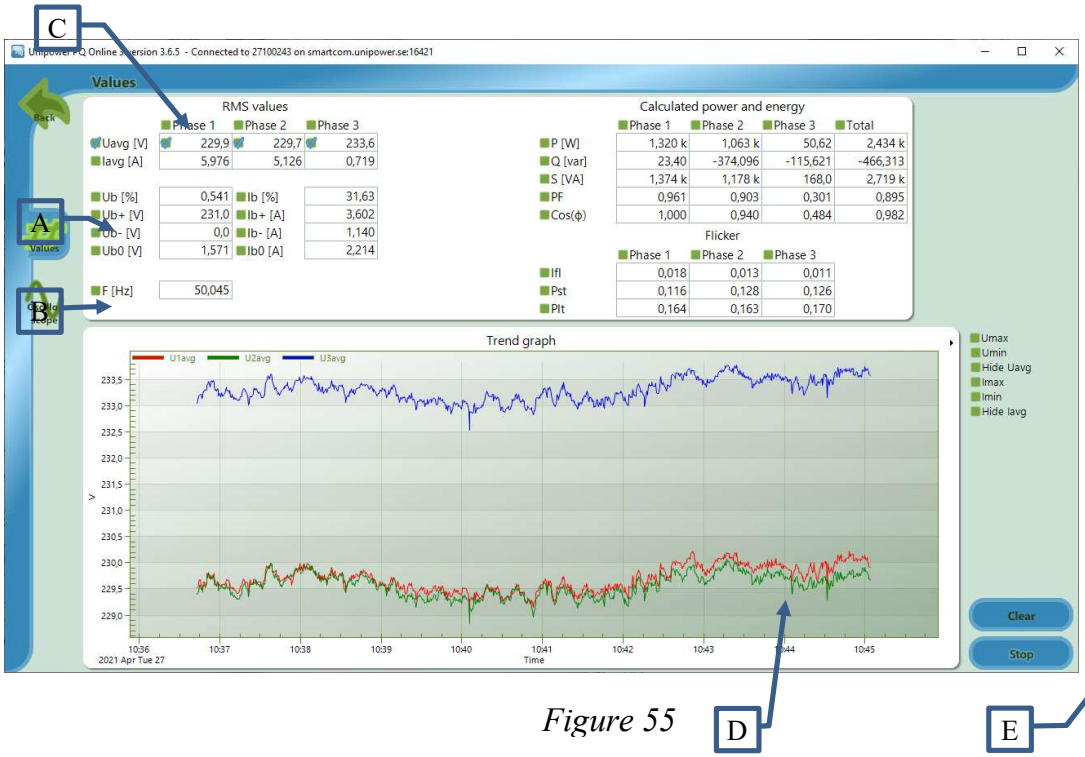


Figure 55

PQ Online includes a real-time function allowing you to contact a meter in order to study the measured power quality parameters in real time. The dialogue contains two tabs **A** and **B**, each with a different way of presenting the information. This function is also very useful for verifying that the meter has been installed correctly before starting the actual measurement.

You can also click the start button **E** to show the variation of the selected **C** power quality parameters over time. The purpose of the trend monitor is to give a quick overview of the power quality without having to download data. If you wish to see more parameters or view events that occurred further in the past, downloading is necessary.

By clicking on the Y axis of the graph you can manually lock the max and min values of the axis so that it is not automatically scaled.

Figure 56

*Right clicking on the graph **D** brings up the context menu with multiple options to adjust the graph, specifically note the Interval and History size options.*

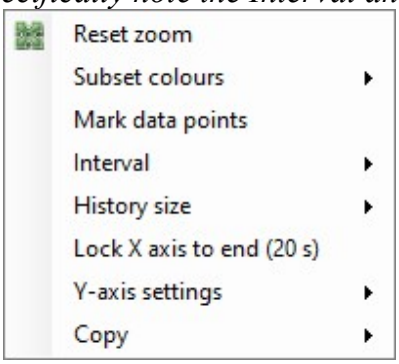


Figure 57

- Reset zoom: Undoes all zoom actions performed on the graph.
- Subset colors: Allows you to change the colors used in the graph.
- Mark data points: Turns on or off marks for individual data points in the graph.
- Interval: Specifies the interval between each datapoint in the graph, adjustable between 100ms and 5s.
- History size: Specifies the maximum number of datapoints in the history of the graph, adjustable between 30 and 2000 points.
- Lock X axis to end: changes the size of the viewing windows without affecting the size of the history while always showing the latest data the length of the window is configurable up to the length of the total data.
- Copy: Copies either the graph data or the graph image to the clipboard.

9.9.3 Oscilloscope tab

The second tab in the real time window is the oscilloscope. This tab shows the waveform of the measured voltage and current.

- To plot the graphs, vectors or bars click the desired PQ parameter (marked in red below)
- Check that the phase angle between phases are between -90˚ and 90˚ (in the first and fourth quadrant) *
- If the phase angles seem to mismatch check the direction of the arrow on the current clamps. The arrow should always point in the direction of the load.
- To maximize one of the windows, press the top right maximize symbol in each window.
- If the graphs show correct connection and configuration proceed to start the measurement.

Figure 58

*The phase angle should always be between -90˚ and 90˚ (phase angle < ±90˚) if the meter is measuring over a load, respectively the phase angles should be more than 90˚ and -90˚ (phase angle > ±90˚) if the meter is measuring over a production of energy

9.10 Manual trigging

The Unilyzer 900 may be set to manually trig a transient or sag/swell, this means that you can start a recording with very high resolution on both the voltage and current channels on your demand. In order to do this, navigate to PQ Onlines main menu and click the submenu "Maintenance". Here you can choose which recording you wish to trig, the meter will then directly trig to your preference.

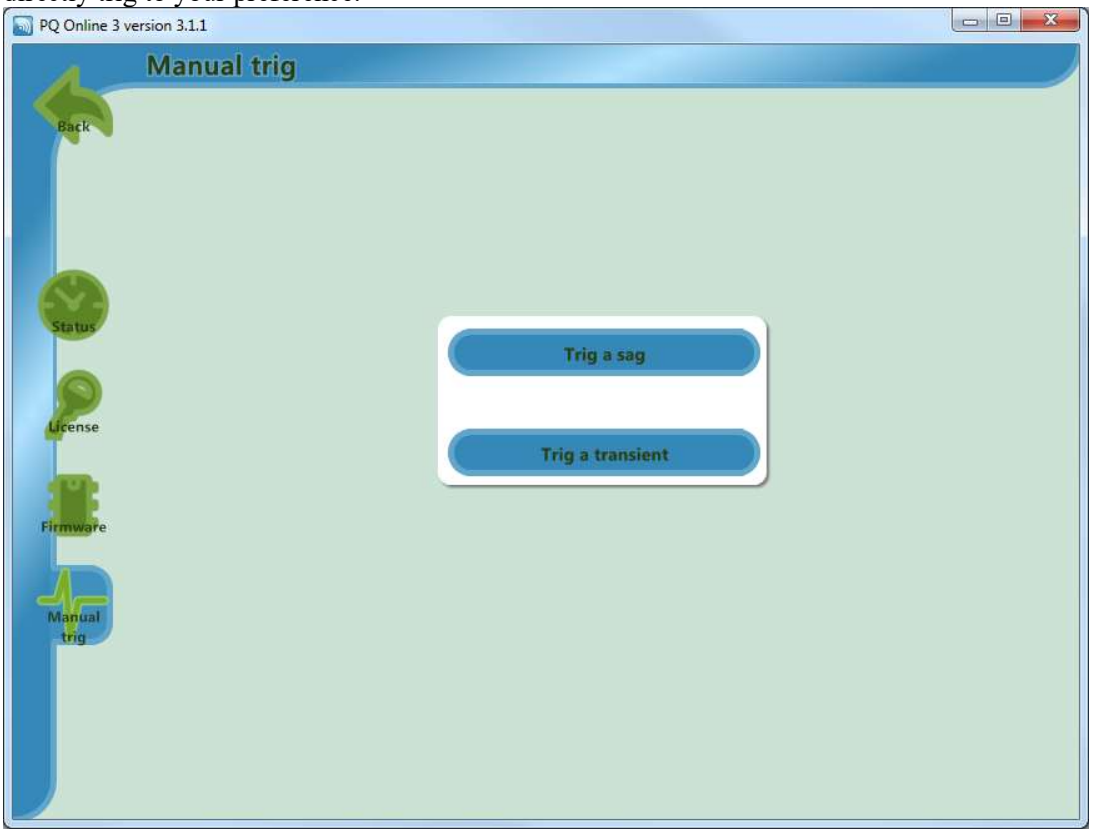


Figure 59

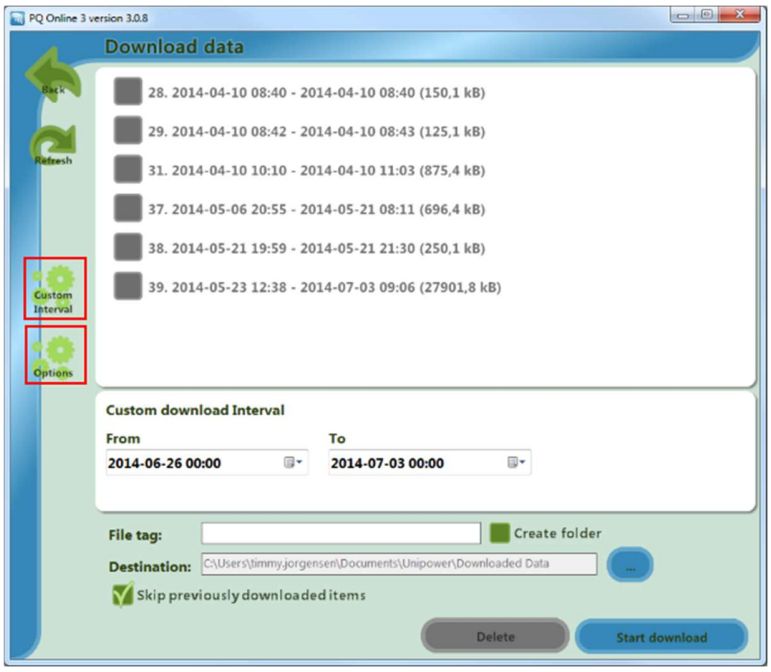
9.11 Download data

This function is used to manually transfer (download) stored measure data from the recorder to the computer. A .upm *file* is created which can be evaluated with Unipower' s analysis software **PQ Secure**.

Figure 60

In order to do so:

1. Connect to the recorder using the previously determined method described in section 9 "PQ Online" (Transfer can only take place when communication is established between the computer and the meter).
2. Choose the desired measure interval measured in date to date and the desired save location (see Figure 61). To simplify choose a folder to save all your measurement files, make subfolders to keep track of your measurement files. The default path chosen by PQ Online is: *C:\users\[your windows user]\Documents\Unipower\Downloaded Data*
   If you wish to download a custom interval of measurement data (not recommended) press "Custom interval" and if you wish to change file name or download destination (recommended) press the "Options" button.



3. The measurement file will automatically open in PQ Secure when double clicked.

Note: Manual download is used primarily for portable meters that are not included in a PQ Secure system. If the meter is a fixed installation used in a PQ Secure system, the measure data is transferred automatically via a pre-programmed calendar and PQ Schedule.

The portable instrument Unilyzer 900 is able to store multiple measurement series. If there are several intervals available in the recorder, a list of these will be shown. Select the measurement series or the measurement interval you wish to download.

9.12 Erasing measurement data

In order to erase measurement data go to the download measurement data segment (see Figure 60), select the measurement file you want to delete, a checkbox will appear when the data is selected. Then press the delete selected items button to the left of the screen. Normally there is no need to remove data due to the fact that the meter's memory is *circular*, meaning that when the memory is full, the oldest values will be overwritten.

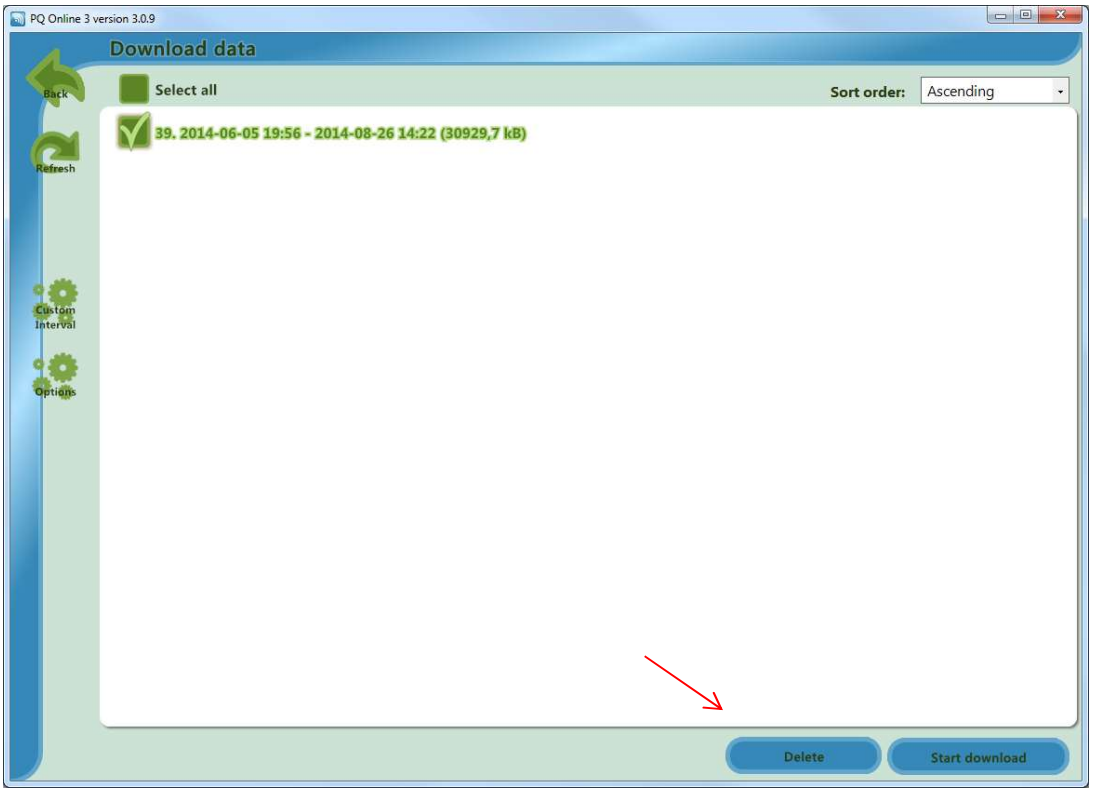


Figure 61

9.13 Tools

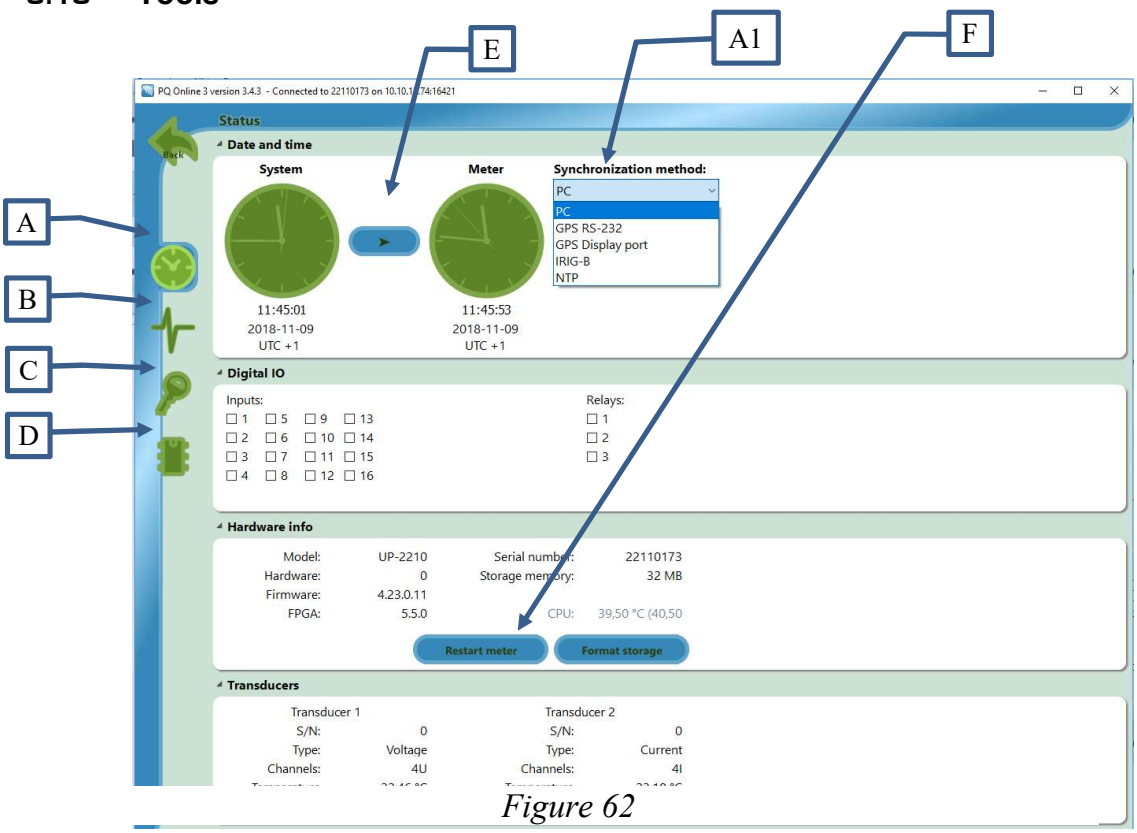


Figure 62

In Tools there are four tabs.
A, Status tab. In status tab you can see Date and time info for the meter, Hardware info and transducer info. You can set the time in meter to same time as in System by clicking on arrow **E**.
You can restart the meter by pressing on restart meter button **F**. Select type of clock synchronization you want to use, PC, GPS, IRIG-B or NTP. (optional)
B, Manual trig tab. Her you can manually trig a sag, transient or a slowscan.
C, License tab. In license tab you see the actual licenses for the meter.
D, Firmware tab. Here you can upgrade the firmware in the meter.

9.14 Language

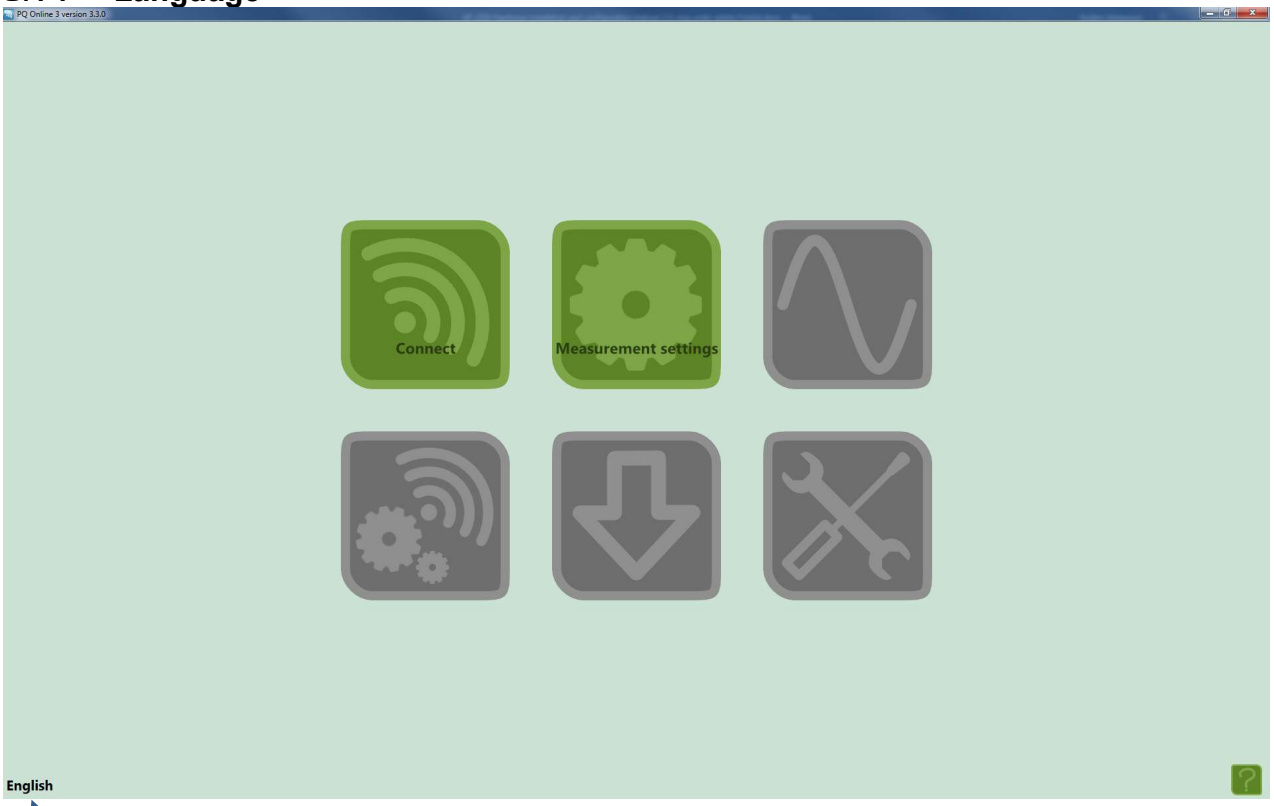


Figure 63

In the startup window for PQ Online you can set language by clicking on the actual language **A**. Choose the language you want from the dropdown list.

9.15 USB port

The meter UP-2210 is equipped with a USB port. This port doesn't need any settings. We recommend you install and use the *UniLauncher* software (see "PQ Secure SQL User and software installation manual"). Just connect the USB cable between meter and computer and UniLauncher will automatically connect PQ Online.

9.16 Upgrading meter firmware

The meter firmware controlling all the meter's functions is software upgradable. If you have a support agreement you have access to service upgrades of the meter firmware. Check further with your local representative on how to get files and upgrade codes.

This is how you do the upgrade.

1. Connect the meter to AC power. **Important! Do not run only on battery and do not interrupt power during the process. Your meter can be severely damaged!**

2. Start PQ Online and connect to the meter. Go to the Tools menu. Select the firmware update menu:

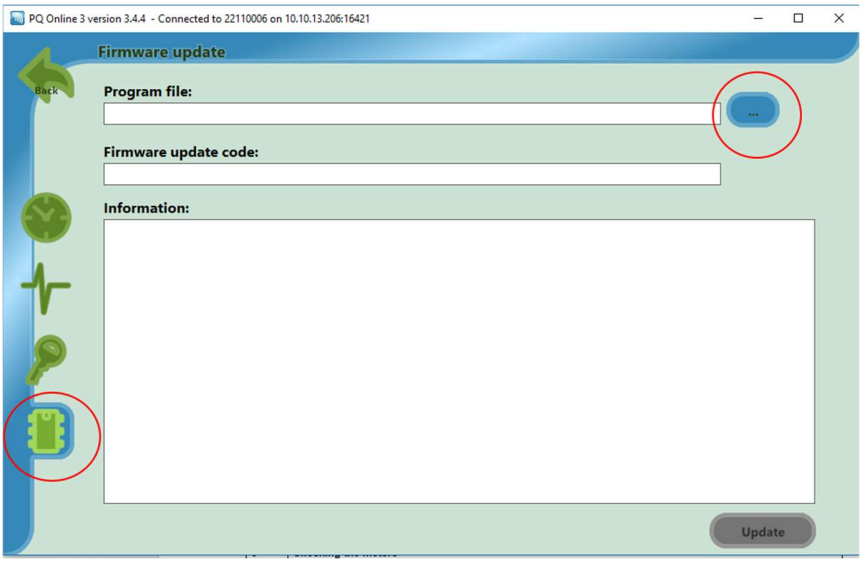


Figure 64

3. Browse to the firmware (program) file. **Important! Only try upgrade with certified and approved firmware files for your meter from Unipower! Your meter can be severely damaged!**

4. Enter the **update code** and press Update:

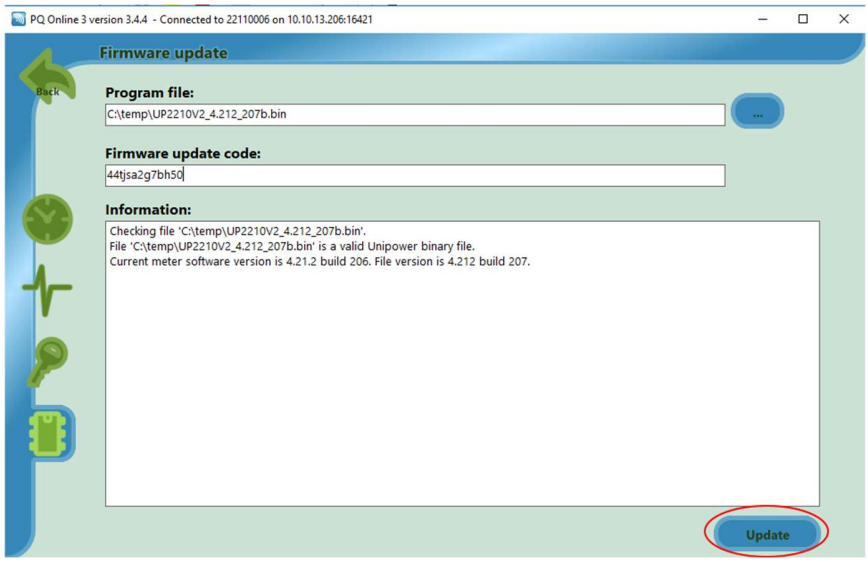


Figure 65

5. Let the process finish, it can take several minutes. Don't disconnect or unplug the meter during the update!

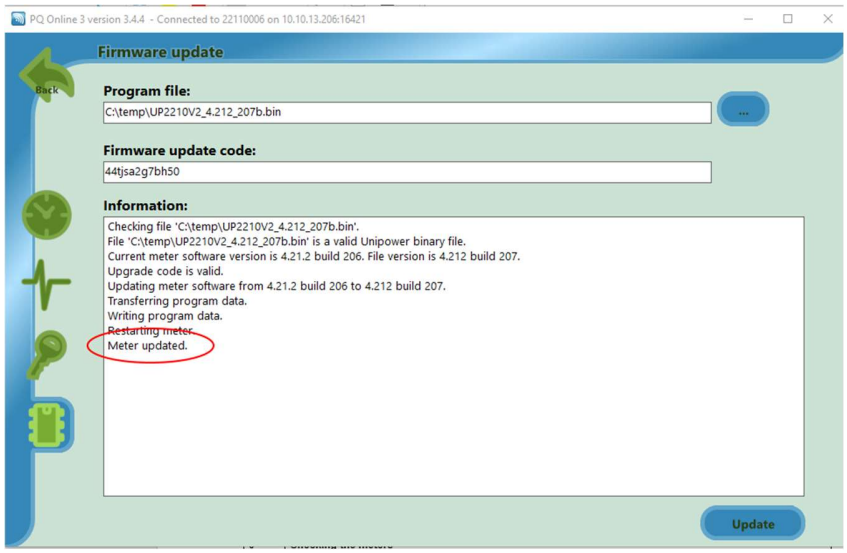


Figure 66

6. When the meter is ready the text "**Meter updated**" is written in the information window.

7. You can verify that the update was successful by checking the version in the Status window:

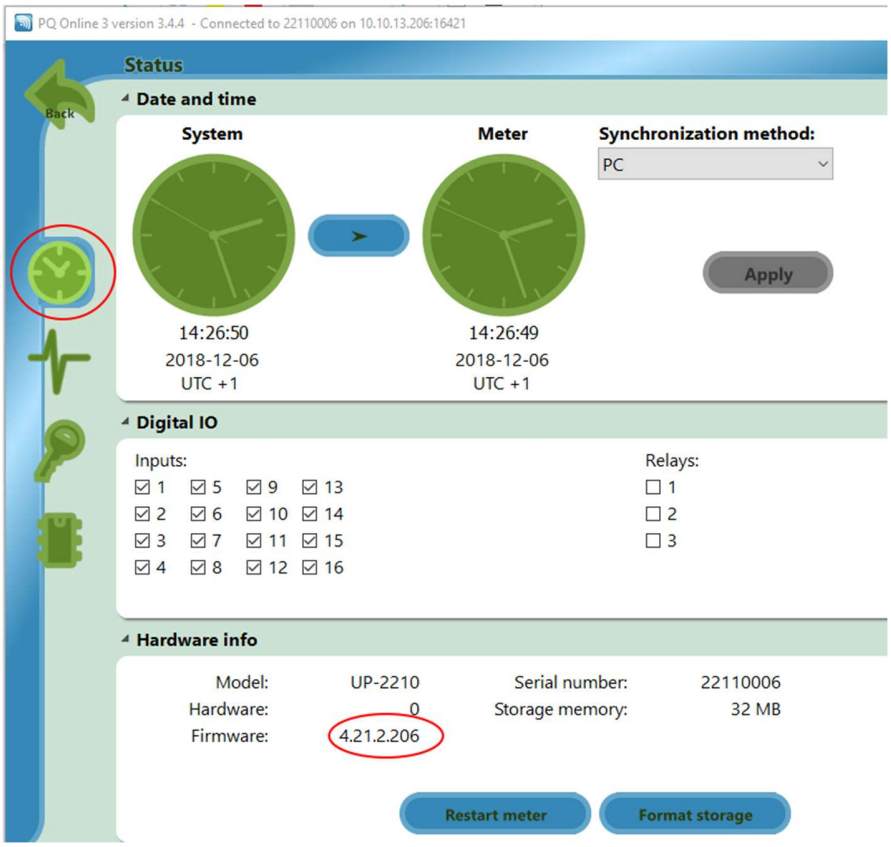

PQ Online 3 version 3.4.4 - Connected to 22110006 on 10.10.13.206:16421
Status
Back
Date and time
System
Meter
Synchronization method:
PC
Apply
14:26:50
2018-12-06
UTC +1
14:26:49
2018-12-06
UTC +1
Digital IO
Inputs:
1 5 9 13
2 6 10 14
3 7 11 15
4 8 12 16
Relays:
1
2
3
Hardware info
Model: UP-2210
Serial number: 22110006
Hardware: 0
Storage memory: 32 MB
Firmware: 4.21.2.206
Restart meter
Format storage

Figure 67

9.17 Adding meter options

Some meter options are “soft” and can be activated by a license code. Check further with your local representative on your meter’s capabilities and on how to get license codes.

To activate a soft meter option, go to the Tools menu, enter the license code and press **Add**. The option/license will appear in the window.

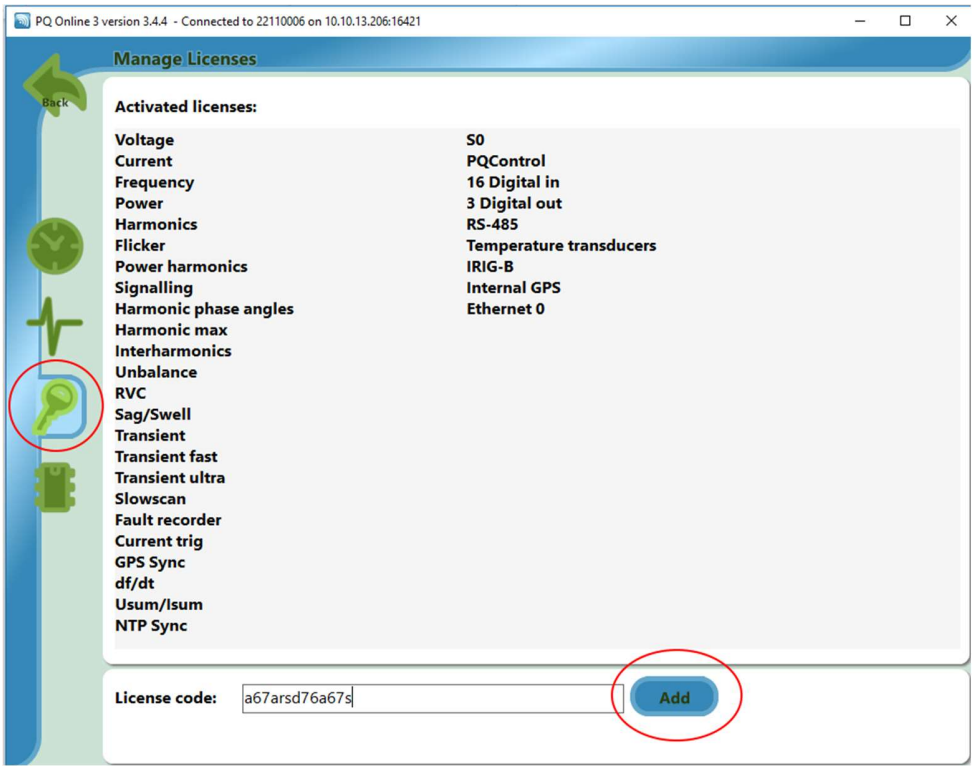


Figure 68

10 PQ Secure, evaluation and analysis

PQ Secure is the software used to evaluate the measure data in the monitoring system.

Please refer to the *PQ Secure Light User and software installation manual*.

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