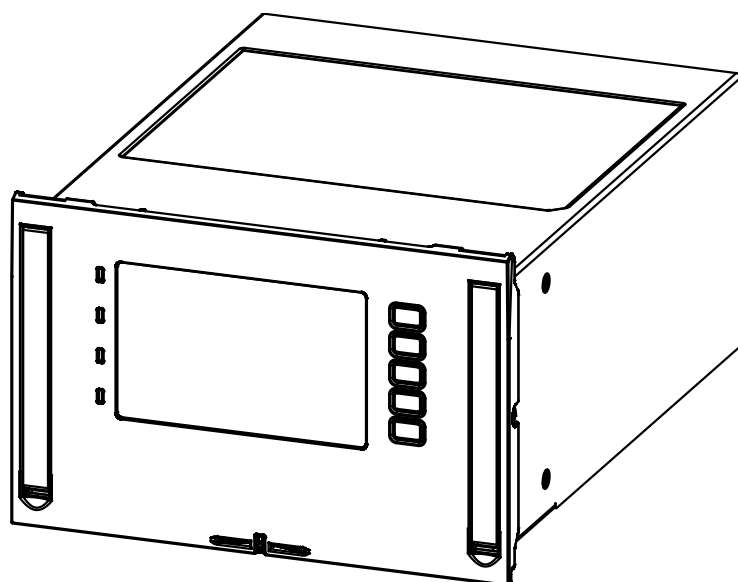


ProQ 100

Revenue meter with power quality

Type: PQM



User manual

BGX501-991-R02

	CE MARKING DECLARATION OF CONFORMITY
ProQ 100 (PQM) conforms to all the essential requirements of Radio Equipment Directive (RED) (2014/53/EU) and WEEE Directive (2012/19/EU).	

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1 Introduction

This manual discusses the ProQ 100 meter features and provides the information needed to configure and use the meter. The manual covers all variants of ProQ 100 rack-mount meter.

Note: This manual serves as an instruction manual, maintenance manual and user manual for ProQ 100.

By the time you are ready to use this guide, your meter should be installed, most basic setup should have been performed, and communications/basic operation should have been verified. If the unit is not yet installed and operational, refer to the quick installation guide shipped with the meter.

This document is intended for commercial and industrial users who want to manage their systems in a cost effective and proactive manner.

1.1 Disclaimer

This user manual covers all variants of the ProQ 100 (PQM) power quality and energy meter. Depending on the product offering based on business proposal, some features or functionalities may or may not be available in the supplied version. It is therefore recommended to refer the features or functionalities according to the product proposal.

The details of features of the software used for configuration, reading and maintenance are out of the scope for this document, please contact concern sales representative for its details, if required.

Note that due to variations between computers and improvements in software, the screen shots shown in this manual may vary slightly from the appearance of the software on your system. Product complies and covers all the risk as per relevant safety standards, hence additional risk assessment is not applicable.

In the unlikely event of suspicion that the product is not functioning correctly, confirm by verifying the product functionality with that of the reference product/instrument. Product complies and covers all the risk as per relevant safety standards, hence additional risk assessment is not applicable.

Note: 'Type' and 'Model' are same for ProQ 100. You can use the terms 'Type' and 'Model' synonymously in the document, wherever needed.

2 Outline description

ProQ 100 meter provides revenue-accurate measurements of voltage, current, power and energy; and is complemented by extensive I/O capabilities, comprehensive logging, RMS value on half cycle for the last cycle, advanced power quality measurement and compliance verification functions. The meter is intended for indoor installation and come with an extensive selection of pre-configured data screens and measurements, so you can use the meter as it is shipped from the factory or customise it to fit your unique requirements.

You can integrate the meter with software such as M-Cubed 100, ConfigView, ProQ View or with other energy management, SCADA, automation and billing systems, using multiple industry-standard communication channels and protocols such as Modbus and IEC 61850 (Ed. 1.0 and Ed. 2.0).

Common meter applications

- Transmission and distribution metering
- Revenue and tariff metering
- Power quality compliance monitoring
- Power quality analysis for utility supply and industrial networks
- Total harmonic distortion monitoring

You can use ProQ 100 meter as standalone device, but its extensive capabilities are fully realised when used with software as part of an energy management system (EMS). EMS gives energy suppliers, service providers, and large industrial and commercial energy consumers the tools to meet all the challenges and opportunities of the new energy environment. EMS uses real-time information and control to directly address a broad range of requirements throughout the power delivery chain. This system offers an integrated solution to managing new billing structures, distributed generation, energy purchasing, energy cost control, operational efficiency, power quality and reliability.

Display and analysis software tools are almost always used to manage, interpret and distribute the data measured or logged by a meter. There are usually a variety of tools used, and often these tools are connected using different communications standards and protocols. In many cases, a meter must also provide control capabilities and device-level data sharing.

Advanced communications allow data to be shared simultaneously across multiple networks, built-in I/O provides monitoring and control capabilities, and a variety of display and analysis tools to help you get the most from your power system.

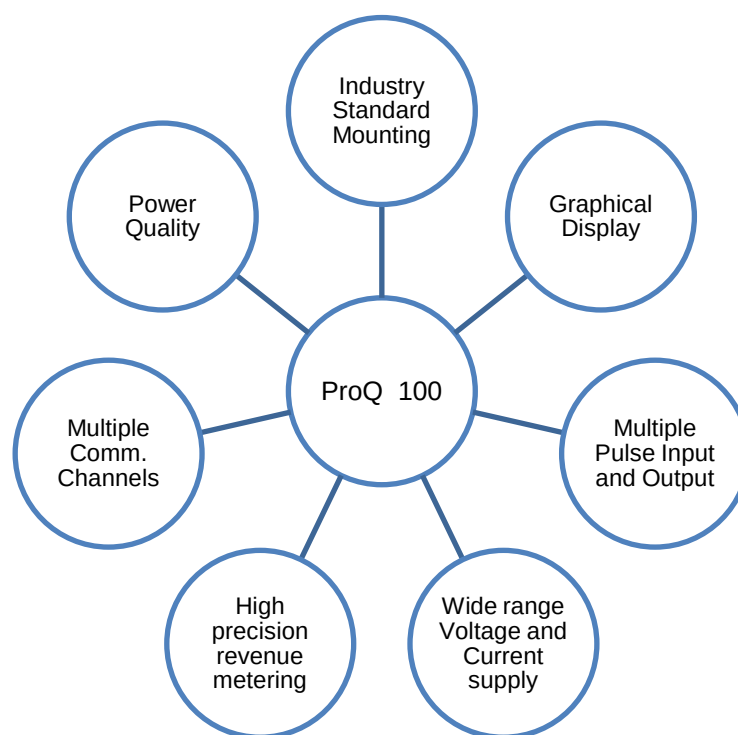


Figure 1: An Overview

2.1 Type of meter

ProQ 100 is configurable for HV 3-phase 3-wire, HV 3-phase 4-wire or LV 3-phase 4-wire and is suitable for mounting in a rack compatible to DIN 43862.

ProQ 100 has an auxiliary-powered variant. The auxiliary-powered variant comes with dual auxiliary support so that you can put AC or DC ($\sim$) voltage for main and backup supply for powering up the meter. The auxiliary-powered variant is configurable for HV3, HV4 and LV4.

The meter provides four current measurement channels R/L1, Y/L2, B/L3 and Neutral; and has reference frequency as 50/60 Hz $\pm$ 5%.

Details for the power supply and measurement options are shown below:

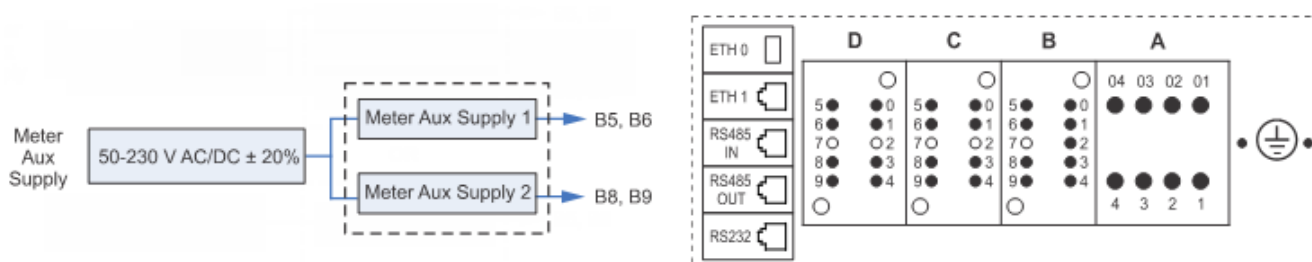


Figure 2: Power supply options and terminals

Variants	Main supply	Backup supply	Range of supply	Connections supported
Auxiliary power supply	Aux. supply input (Aux 1)	Aux 2 (optional)	Both Aux. as: 50-230 V AC/DC $\pm$ 20%, 50/60 Hz	HV3, HV4 and LV4

Table 1: Power supply variants

- In case of auxiliary powered variants, meter will draw power from Aux 1 supply input. In its absence it will shift to Aux 2 supply. The status of auxiliary supply source can be seen on the meter display.

Note: Refer to alarm information for details on indication for auxiliary power supply failure.

- Do not connect voltage transformer (VT) to any of the Aux supply input terminal as a general practice. If it is necessary to connect VT secondary to Aux input then make sure to connect it to the Aux 2 supply only in presence of Aux 1 so that burden on measurement VT secondary can be minimal.
- Connect your reliable auxiliary supply source like DC bank/AC lighting load/ Aux power transformer etc to Aux 1 terminal only so that meter burden will be handled by it; or take your best judgment to connect auxiliary supply source considering the rating and suitable operation of meter and best installation practices followed.
- Ensure that the correct auxiliary voltage rating is used with the meter. The wrong voltage rating could cause damage to the meter. Therefore it is recommended to verify and crosscheck the rating-plate on the front cover of the meter in use, at the site.

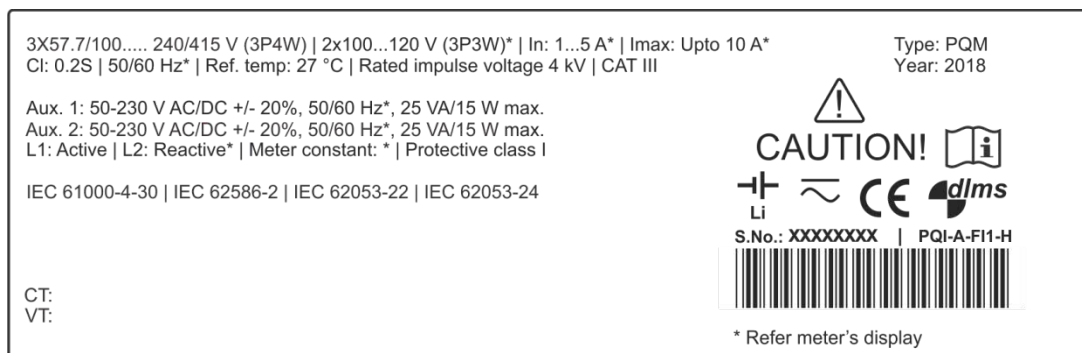


Figure 3: Rating plate of ProQ 100

If information of CT/VT ratio is known during manufacturing, then it will be marked along with other name plate information in the factory.

Note: Barcode reader that is suitable for reading Direct Part Marking (DPM) should be used to read the barcode information on the rating plate.

- Ensure that the meter auxiliary supply source, always have an isolation of 4 kV from other voltage measurement input and secondary voltage.
- The internal battery  is used as a RTC backup and it supports meter RTC for 15 years (including shelf life of 5 years).

2.2 Power quality features

The meter monitors the power quality parameters and has the following features:

- Monitor all power quality parameters and events as per IEC 61000-4-30 class A
- Log power quality events for sags/ dips, swells, interruptions and rapid voltage change
- Records harmonics and inter-harmonics up to 50th order
- Support of PQDIF (power quality interface format) file format IEEE 1159.3
- RMS value (half cycle) streaming and capture
- Capture waveform for power quality events
- Built-in web server to access real time values and power quality data
- Provides IEEE 519 and EN 50160 compliance statistics and reports that can be configured using ConfigView and viewed using ProQView

2.2.1 Power quality standards compliance

The ProQ 100 has additional frameworks and settings related to the power quality standards below.

EN 50160

The EN 50160 framework is composed of numerous functions including: mains signaling evaluation, harmonics evaluation, voltage harmonics, flicker and more.

IEEE 519

ProQ 100 complies with the IEEE 519 for harmonic control in the electrical power system.

IEC 61000-4-30

The ProQ 100 meter complies with IEC 61000-4-30 edition 3 power quality standard and meets class A. This compliance is provided by a variety of functions in ProQ 100 including: power quality aggregator, harmonics measurement, symmetrical components, sag/swell and more.

IEC 62586-2 edition 2

ProQ 100 complies with the IEC 62586-2 edition 2 for Power quality measurement in power supply systems.

The meter records all the data which is required to generate the CBEMA\ ITIC curve in ProQ View.

You can identify the power quality problems quickly and easily, with EN 50160 and IEEE 519 reporting; and monitor the electrical parameters and power quality events in real time using ProQ View.

2.3 Types of software for reading and programming

ConfigView is an application which is used for configuring meters and reading data from meters. Refer to ConfigView help for details.

ProQ View is a power quality data acquisition and analysis software which is used for comprehensive monitoring of electrical parameters, power quality parameters in real time and help keep a check on overall system performance. Refer to ProQ View help for details.

2.4 Supported protocols

You can integrate the meter into various industry-standard networks. Measured meter data can be made available to other devices using Modbus RTU, Modbus TCP, DLMS TCP and serial, FTP, HTTP and IEC 61850 protocols.

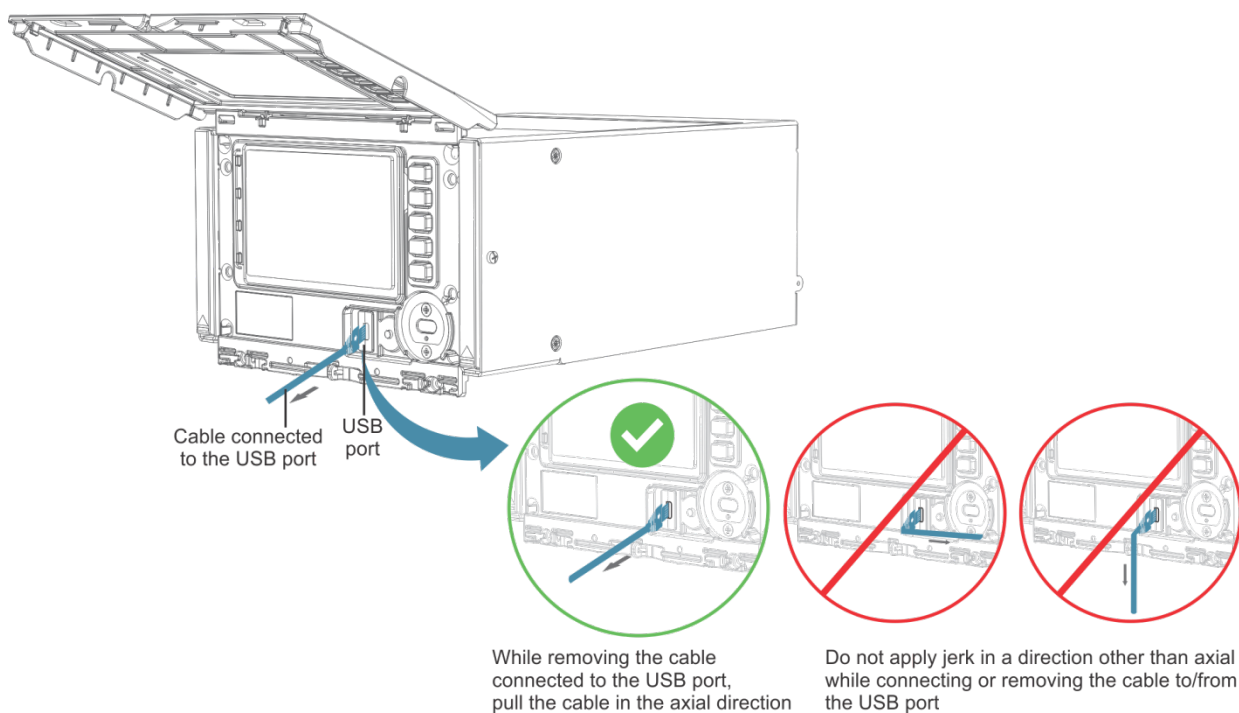
2.5 Communication options

The meter has an optical port (common port for IEC 1107 and ANSI), RS232, RS485, Ethernet, Ethernet (SFP bay for OFC or copper) and USB port (micro B connector) for communication.

3 Important safety information

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

- Apply appropriate personal protective equipment and follow safe electrical work practices.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Short the CTs using test terminal block before unplugging the current connector.
- It is recommended to use overvoltage and overcurrent protection devices for voltage circuit.
- Local best practices and regulatory stipulations must be observed.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not perform Dielectric (Hi-Pot) or Megger testing on this device.
- Connect protective ground (earth) before turning on any power supplying this device.
- Live parts inside the meter so always disconnect all wires carrying dangerous voltages if opening the meter cover.
- Do not use solvents or abrasive materials to clean the unit, use only a soft and dry cloth and isolate the unit from the supply before cleaning it.
- Exercise caution while connecting or removing the cable to/from the USB port, do not apply jerk in a direction other than axial. Ensure that there is no stress on the cable connected to the USB port.





Observe local safety norms when disposing of the product and any batteries that it contains, at the end of their life, to ensure that they do not enter the household waste stream.

Secure Meters (UK) Ltd Battery Producers Registration Number: BPRN03577



Danger of Electrocution



Read the instructions carefully before installing and using the product.



Failure to comply with the above safety measures could cause serious injuries.

If the meter is used in a manner not specified by the manufacturer, the protection provided by connections may be impaired. The manufacturer shall not be held responsible for failure to comply with the instructions in this manual.

3.1 Disposal

ProQ 100 meters should be disposed of in a safe and responsible manner. The regulations applicable within the country of operation for disposal of the product should be followed.

3.2 Maintenance

ProQ 100 is maintenance-free meter as it has no interchangeable or serviceable parts. To ensure a robust user experience, adhere to the environmental and technical specifications; and follow the instructions and safety measures to avoid risk of injury or damage to the equipment. For any further queries, you may contact the nearest sales representative.

4 Hardware features

This section explains the various hardware features of ProQ 100.

4.1 Dimensions

This section illustrates the dimensions of meter, 11" and 19" rack to help you with installation.

4.1.1 Meter dimensions

Product dimensions are compatible to DIN 43862, but in case if product is to be fitted in already available rack or user wants to install it in a specific customised rack then suitable back plate can be used to fit the product.

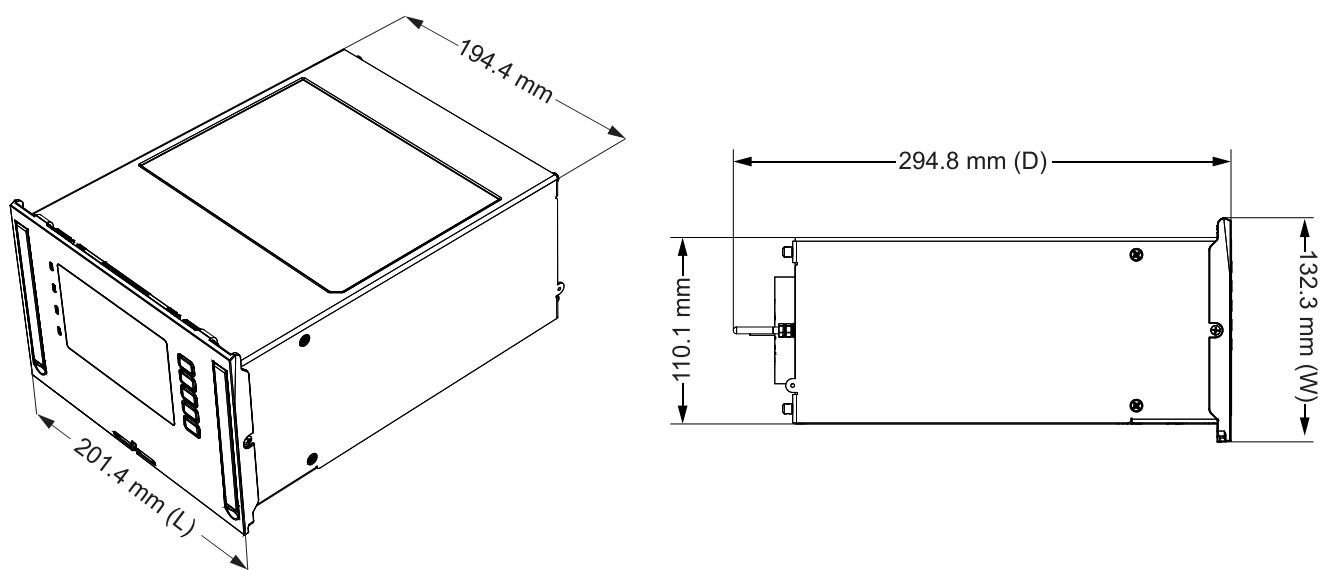


Figure 4: Meter dimensions

4.1.2 Rack dimensions

The ProQ 100 can be supplied with an 11" or 19" rack. The depth dimensions are the same for both installations.

The following figure shows the 11" rack dimensions with panel cut-out details.

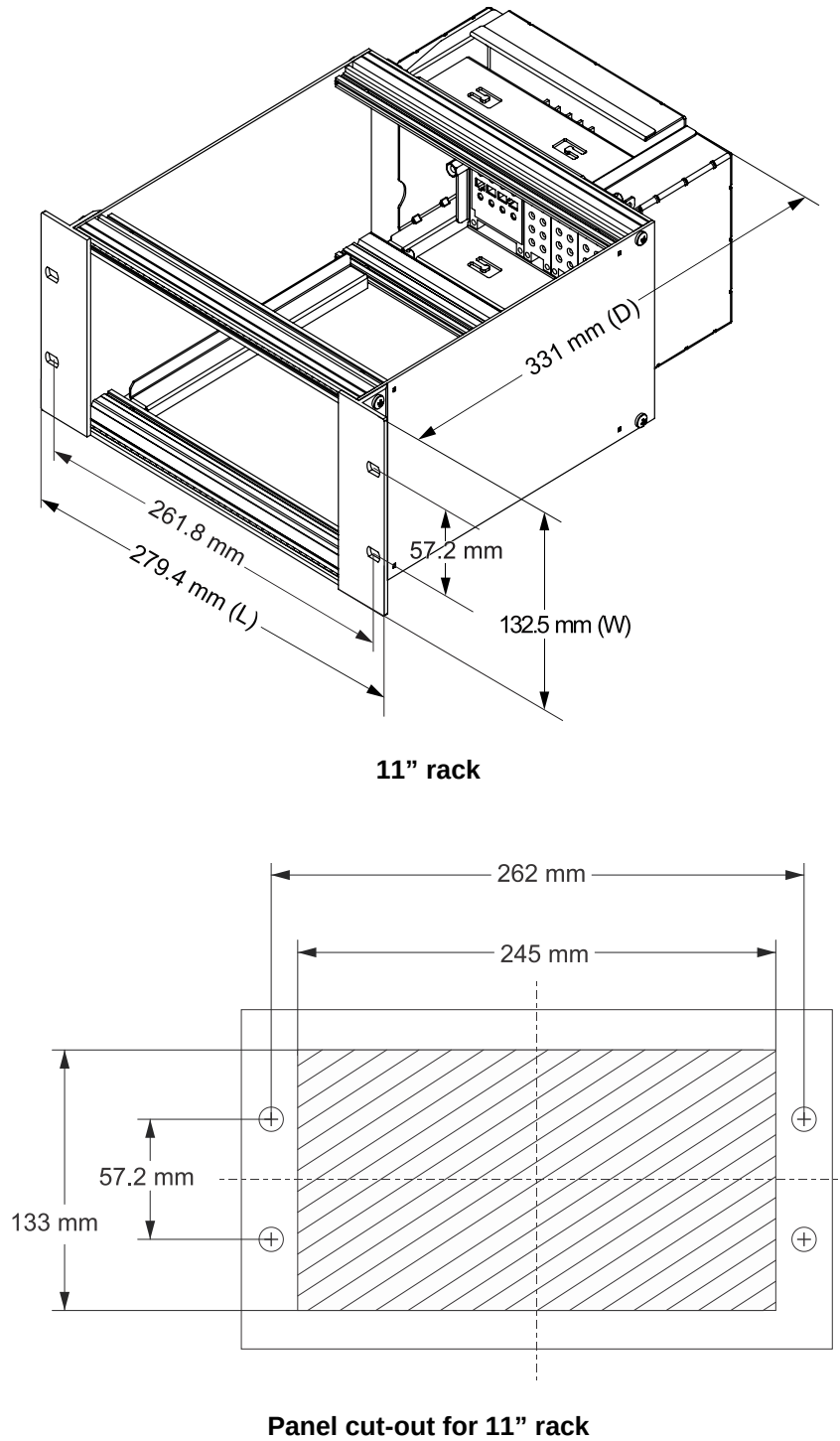


Figure 5: 11" rack dimensions

The following figure shows the 19" rack dimensions with panel cut-out details.

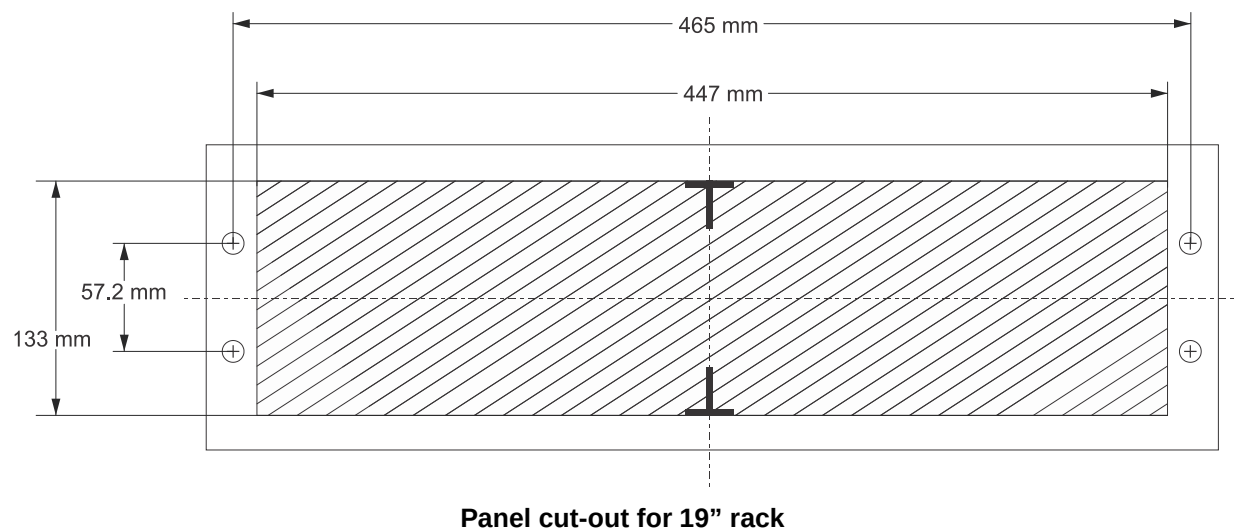
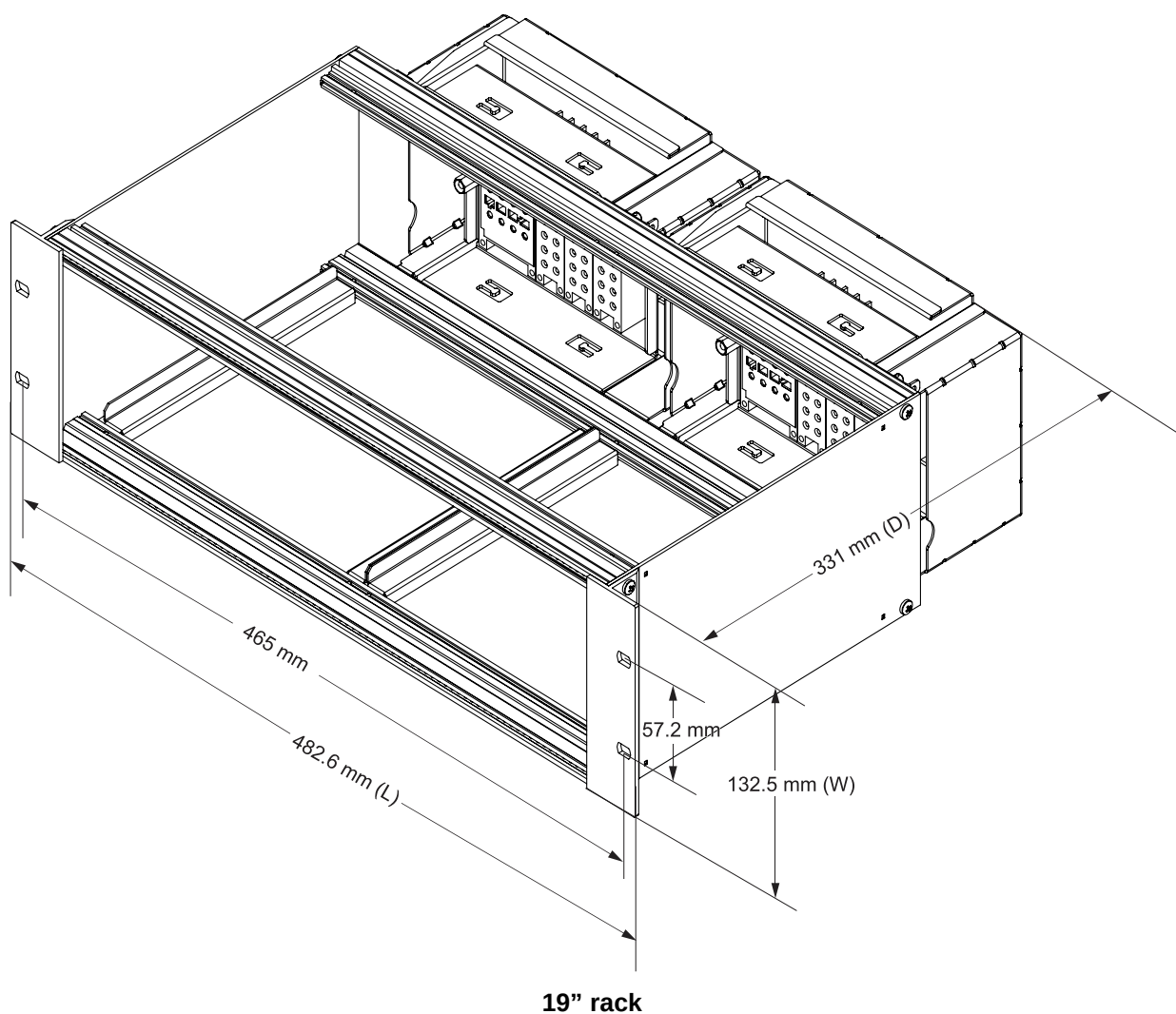
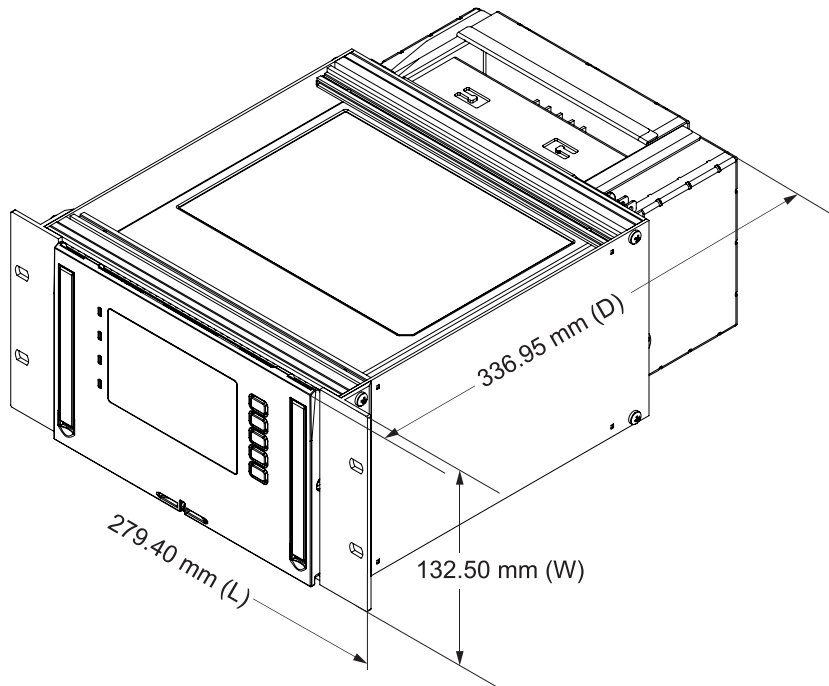


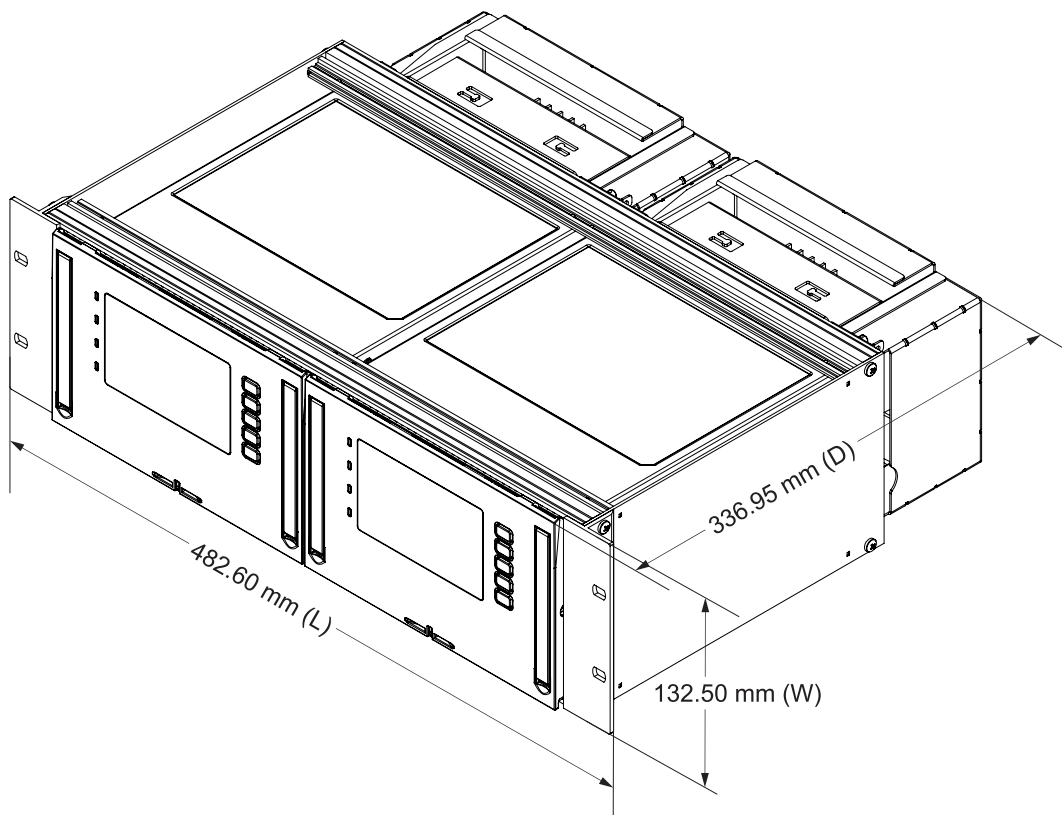
Figure 6: 19" rack dimensions

4.1.3 Meter with rack dimensions

The following figures show a meter fitted into 11" and 19" rack.



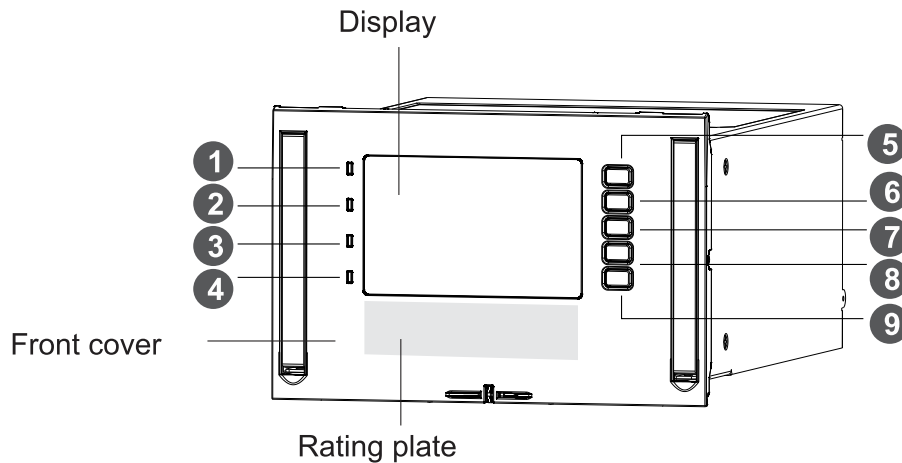
Meter fitted into 11" rack



Meter fitted into 19" rack

Figure 7: Meter fitted into 11" and 19" rack

4.2 Front view of ProQ 100



1	L1	Calibration LED 1 (Active total/fundamental)
2 and 3		Alarm/ Pulse output LEDs
4	L2	Calibration LED 2 (Reactive/Apparent)
5		Home
6		Up
7		Enter
8		Down
9		Back

Figure 8: Front view

The front cover is made of plastic with a transparent window to view the display. The cover has two top hinges which allow the front cover to swing-up, allowing access to the special function button, optical port and USB port. The front cover can swing-up to a maximum of 120 degree. The cover is snap-fitted and also has provision to seal it.

The meter has two calibration LEDs for Active (total/fundamental) and Reactive/Apparent energy; and two alarm/ pulse output LEDs which can be configured for visual indication of different status or events. The calibration LED constant depends on the CT/VT ratio configured in the meter and can be selected from the available options through display or ConfigView.

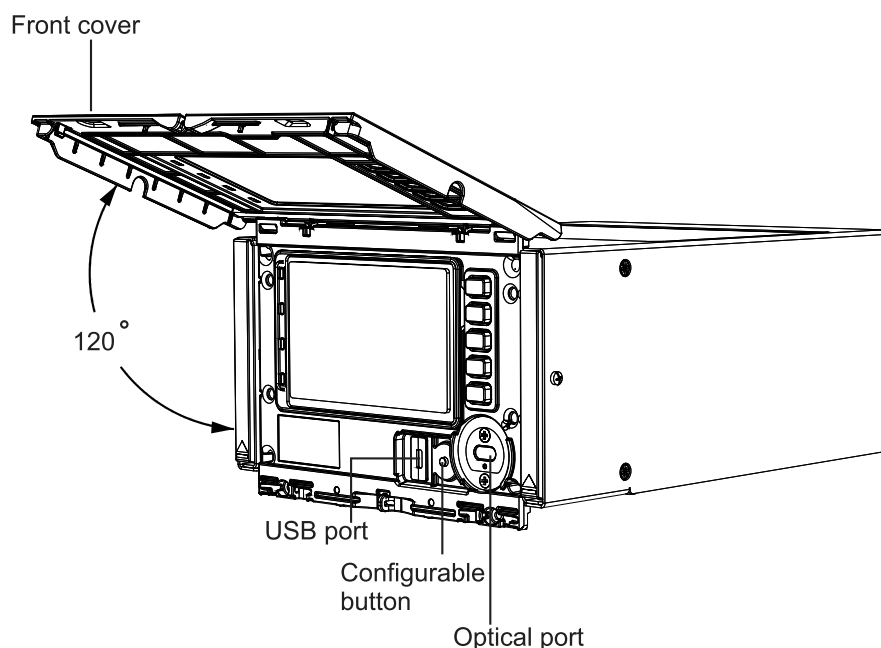


Figure 9: Front cover opened

ProQ 100 has 4.3 inch graphical colour display. The meter display is legible up to a distance of 0.75 m and viewing angle up to six o' clock excluding information being displayed in graphs, waveform and table.

The meter display can be set to following languages - English, Swedish, German, French, Italian, Russian and Arabic. The status of the communication ports can be seen on the meter display.

The meter has five push buttons which are used for navigating through the display and configuration menu options. Additionally, the meter has a special function button under the front cover which can be used for performing functions such as energy reset depending on the requirement. The push buttons support 100,000 operations.

4.3 Pulse inputs and outputs

The product support multiple pulse inputs and outputs. A maximum of four pulse outputs and four configurable pulse input/ output can be provided as per the specification agreed at the time of order.

The pulse outputs can be linked to two LEDs indication as available on front side of meter so that user can have a visualisation sort of feature by physically seeing the LEDs. The pulse outputs 3 and 4 (refer to Figure 11 for details) are linked to the upper and lower output LEDs.

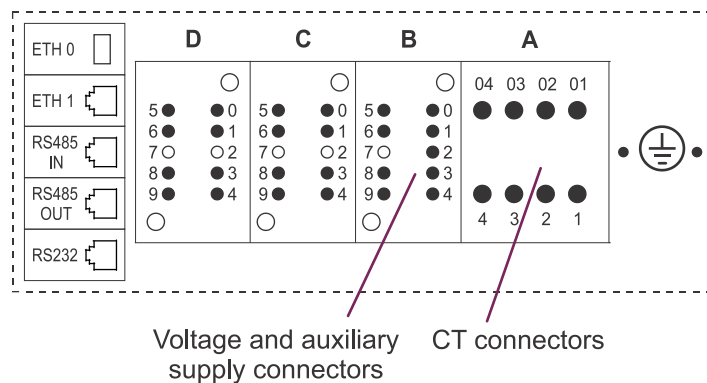
The LEDs can be configured through ConfigView either at factory or in field.

Optical isolation will be available for each individual input/output through optocoupler. Pulse input/output can withstand 6 kV impulses. In case of overvoltage, pulse inputs are protected by clamping the input voltage to 300 V AC. The outputs are of solid-state photo MOSFET type and when the meter is turned off, they are open. Pulse outputs can be configured as inverted or non-inverted type with a maximum of 20 pulses per second. Pulse output used for system status alarm will have certain life expectancy as it will be used in inverted logic.

Pulse output rating: 24 to 230 V AC/DC at maximum continuous current 100 mA (Pulse outputs will have voltage free contact).

4.4 Connections to the ProQ 100

The diagram shows the rear connector with pin details for the meter. There are different variants that may be provided as per the specification agreed with the customer at the time of order.



Connect	R/L1	Y/L2	B/L3	N
CT IN	A01	A02	A03	A04
CT OUT	A1	A2	A3	A4
VT	B1	B2	B3	B0

Dual AUX Supply	L/+ Terminal	N/- Terminal
AUX1	B5	B6
AUX2	B8	B9

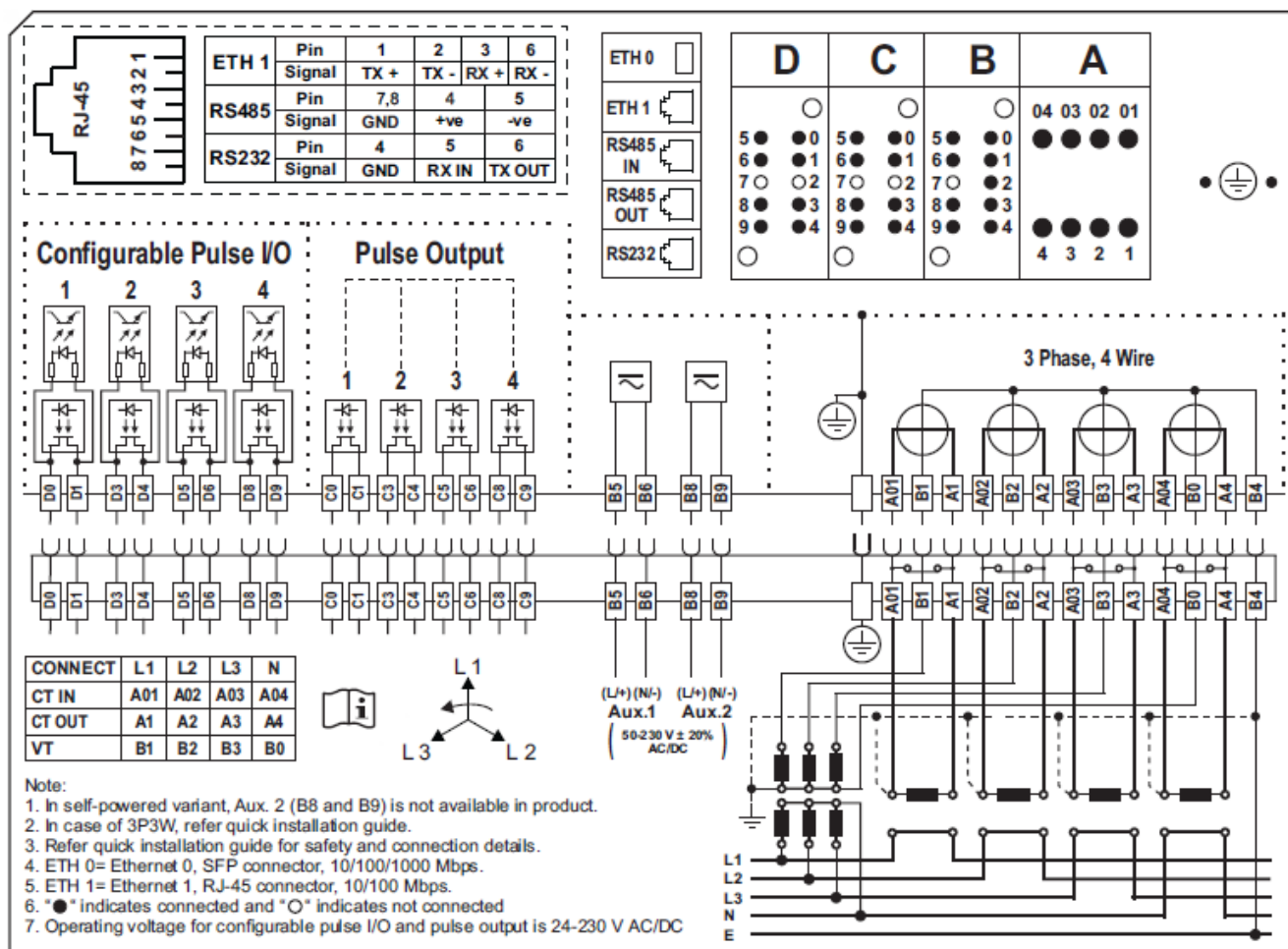
Digital Input/Output			
4 Outputs and 4 configurable Input/Output			
O/P 1	C0, C1	I/O 1	D0, D1
O/P 2	C3, C4	I/O 2	D3, D4
O/P 3	C5, C6	I/O 3	D5, D6
O/P 4	C8, C9	I/O 4	D8, D9

Note:

O/P - Fixed output

I/O - Configurable as input or output

Figure 10: Rear connector with pin details



Note:

In case of 3-phase 3-wire, L2 phase voltage (B2) is connected to Neutral (B0).

Figure 11: Connection diagram

Note: One side of the CT secondary wiring should be earthed according to local practice.

The recommended size of the CT, VT and Aux power supply cable is 2.5 mm² with lugs type as ring (M3 type) for CT and H type for Aux and VT terminals. The recommended size of the pulse input/output cable is 1.5 mm².

It is recommended to use the following cables:

- For voltage and current terminals - PVC multi strand, voltage grade up to 1100 V, current rating up to 20 A (rated up to 105 °C).
- For auxiliary and pulse I/O terminals - PVC multi strand, voltage grade up to 1100 V, current rating up to 2.5 A (rated up to 105 °C).
- For earthing - PVC multi strand, voltage grade up to 1100 V, current rating up to 20 A (rated up to 105 °C).

In case of ProQ 100 the internal earthing cable between the meter and the rack should also be connected, and for this an M4 size screw is used in the meter and in the rack. The same ring type connector as used in the CT connection can also be used. For earthing, draw-out type arrangement can also be provided.

The internal earthing cable should be about 5-10 cm in length to allow for ease of fitting and access and not fouling with sharp edges of rack etc. Finally a proper earthing cable from rack to earth should be put up by installer. Other accessories or shipway kit is supplied based on the requirement like seals, communication cords etc.

Product dimensions are compatible to DIN 43862 and IEC 60297, but in case if product is to be fitted in already available rack or user wants to install it in a specific customised rack then suitable back plate can be used to fit the product.

Note:

- For installing the meter into rack having third party back-plate connector, check connections' compatibility before installation.
- The protective earth connector  shall be connected first and should not be removed until supply to the meter is fully isolated.
- A switch or circuit breaker should be used at a suitable location before meter connections. It is recommended to mark it as a disconnecting device.

Rack carries the female part of Essailec connector and meter carries the male part of Essailec connector with all the back side communication ports in the form of RJ-45 connector.

4.5 Sealing arrangement in ProQ 100

This section describes the front and rear sealing arrangement in ProQ 100.

4.5.1 Front cover sealing

The front cover can be sealed in the closed position. This will stop the front cover from being opened and restrict unauthorised access to the optical port, special function button, USB port and internal areas and hence no additional sealing provision is provided for the optical port and USB port. There are also sealing points on either side of the meter for securing it to a rack. The sealing bore diameter is 2.0 mm and is suitable for seals.

4.5.2 Rear sealing arrangement

When the meter is fitted into the rack, a cover can be fitted which conceals all the rear connectors. The figure below show the sealing points for the rear cover. The following diagram shows the front and rear sealing points. The sealing points are the same for 11" and 19" racks.

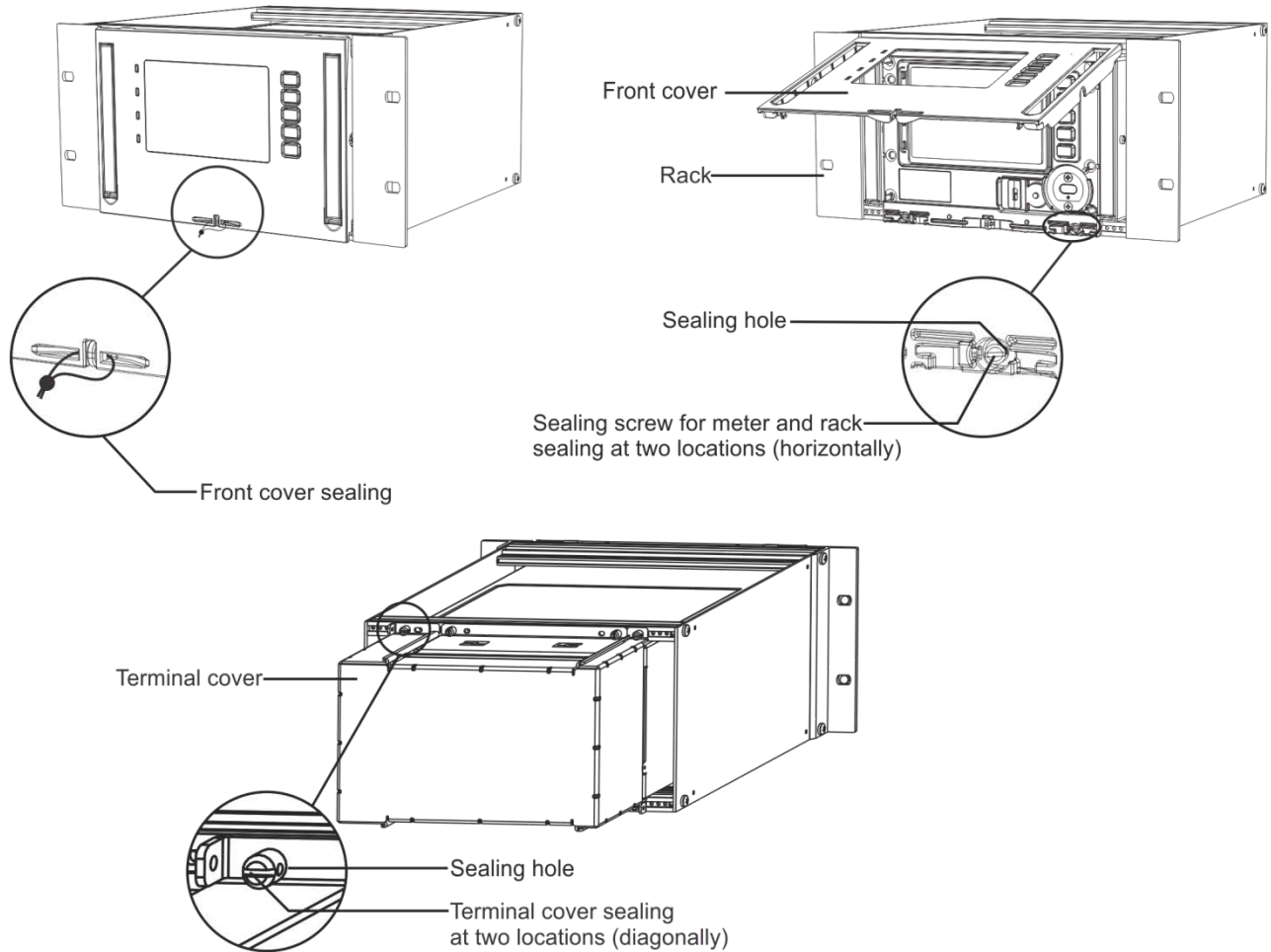


Figure 12: Front and rear sealing points – 11" rack installation

5 Using the meter

This section explains how to use the meter for various purposes.

5.1 Using the display

This section describes how the ProQ 100 display can be used to read measurement values and also to control certain functions in the meter.

ProQ 100 has 4.3 inch graphical colour display. The meter display is legible up to a distance of 0.75 m and viewing angle up to six o' clock excluding information being displayed in graphs, waveform and table.

Display parameters such as instantaneous parameters, energy TOD and demand; power quality parameters, waveforms, alarms, configuration, trends, billing parameters, vector diagram and harmonics are arranged into groups for easier navigation. Waveform for power quality events shown on meter display will be as per 128 samples per cycle. Online graphical view such as RMS values will be updated smoothly on display.

The setup menu is used to set-up and enable features such as display delays, MODBUS configuration and display language. They are also used to set-up communications and network settings.

The meter display can be set to following languages - English, Swedish, German, French, Italian, Russian and Arabic.

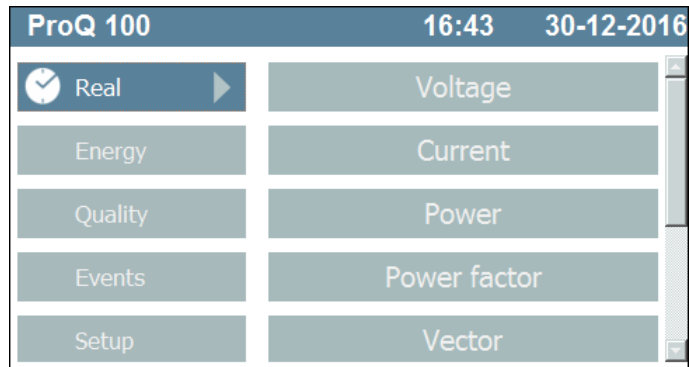
The communication settings for all the ports and status of auxiliary supply can be viewed on display.

There are two types of display mode: Auto-cycle and Manual.

Auto-cycle is the default display mode. The display delays can be configured in the field using ConfigView or by the display buttons. Once the display button is pressed, the auto-cycle mode will be interrupted and will switch to manual mode. If no button is pressed in manual mode, the display will time out and revert to auto-cycle mode. The display backlight remains ON in auto-cycle mode as per the configuration done by the user.

Display parameters are grouped in to a number of sequences: Real, Energy, Quality, Events and Setup. Each sequence parameters can be individually selected.

On pressing  button, the following display appears.



A display sequence/setup menu can be selected by pressing  button. A navigation screen will appear showing all the available options. You can then choose an option using  and  buttons. Press  button to select your choice.

Once you have selected a target display sequence/setup menu, you can then use  and  buttons to scroll through that selected display sequence/setup menu. Parameters are cyclically displayed in the selected display sequence/setup menu, i.e. after the last parameter in the list is displayed, the display will return to the first in the list, and so on.

Press  button to return to the immediate parent menu.

Scroll lock

Locking of individual parameter in display sequences (manual displays) –

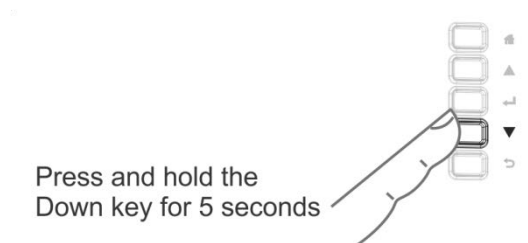


Figure 13: Locking the manual display parameter

The screen can be locked to show a desired parameter. To screen lock a parameter, select the parameter using the menu buttons. Press  button for 5 seconds. During this process the display will temporarily move to the next parameter, then after 5 seconds will display your selection.

To unlock the screen (i.e. revert to auto-cycle mode) press  button for 5 seconds.

The Setup menu is used to set-up and enable features such as the calibration LEDs, display delays, calibration LED constant, MODBUS configuration and display language.

Favourite sequence

This sequence is used for your selection of display parameters.

Press and hold the Up key for 5 seconds

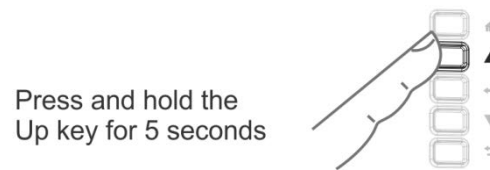


Figure 14: Adding parameter to favourite sequence

To add a parameter, go to the display containing the parameter that you require. Once the required display is selected, press ▲ button for 5 seconds, the selected parameter will now be added to your favourite sequence. When the favourite sequence is full, you will need to delete the display parameter in this sequence to make space for the new one, so be sure before selecting parameters as maximum 30 parameters can be selected in favourite display sequence.

To remove a display parameter from the Favourite sequence, go to the display layout under Favourite sequence which is to be removed and press ▲ button for 5 seconds.

Displaying OBIS code

The OBIS codes for the display parameters can be shown on the display.

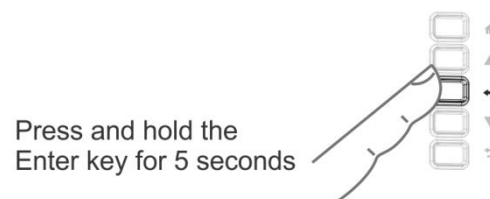


Figure 15: Showing OBIS codes on display

To show the OBIS codes, press ◀ button for 5 seconds. During this process the display will temporarily move to the next parameter, then after 5 seconds will show the OBIS codes for the display parameters.

To change the display mode to default (i.e. showing parameter names) press ◀ button for 5 seconds.

Default displays

The following display layouts will be shown in the auto-cycle mode, if the auto sequence is configured as Default display sequence.

Phase voltage10:23:4616-11-2017

L119185.032 v

L219105.974 v

L319162.131 v

N-E0.136 v

1/12

Line voltage10:23:4616-11-2017

L1233022.394 v

L2333013.076 v

L3133082.243 v

2/12

Line current10:23:4616-11-2017

L17.812 A

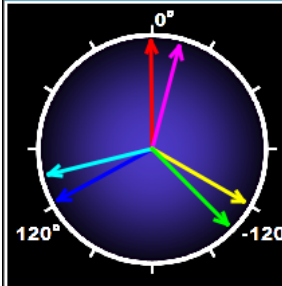
L27.998 A

L37.884 A

N0.024 A

3/12

Vector diagram10:23:4616-11-2017



Phase	Volts(V)	Angle(°)
L1	19185.031	0.000
L2	19105.974	-120.096
L3	19162.130	119.124

Phase	Amps(A)	Angle(°)
L1	7.811	-15.324
L2	7.998	-135.442
L3	7.883	104.120

4/12

System info10:23:4616-11-2017

L1

L2

L3

V

19185.03

19105.97

19162.13

A

7.812

7.998

7.814

PF

1.000

1.000

1.000

Hz

49.982

5/12

Active energy10:23:4616-11-2017

Active import total1103072.78 kWh

Active export total10655.71 kWh

Active import fund.1103089.03 kWh

Active export fund.10654.53 kWh

6/12

Reactive energy Q-wise10:23:4616-11-2017

Quadrant 139159.426 kvarh

Quadrant 2140.482 kvarh

Quadrant 31715.105 kvarh

Quadrant 49634.618 kvarh

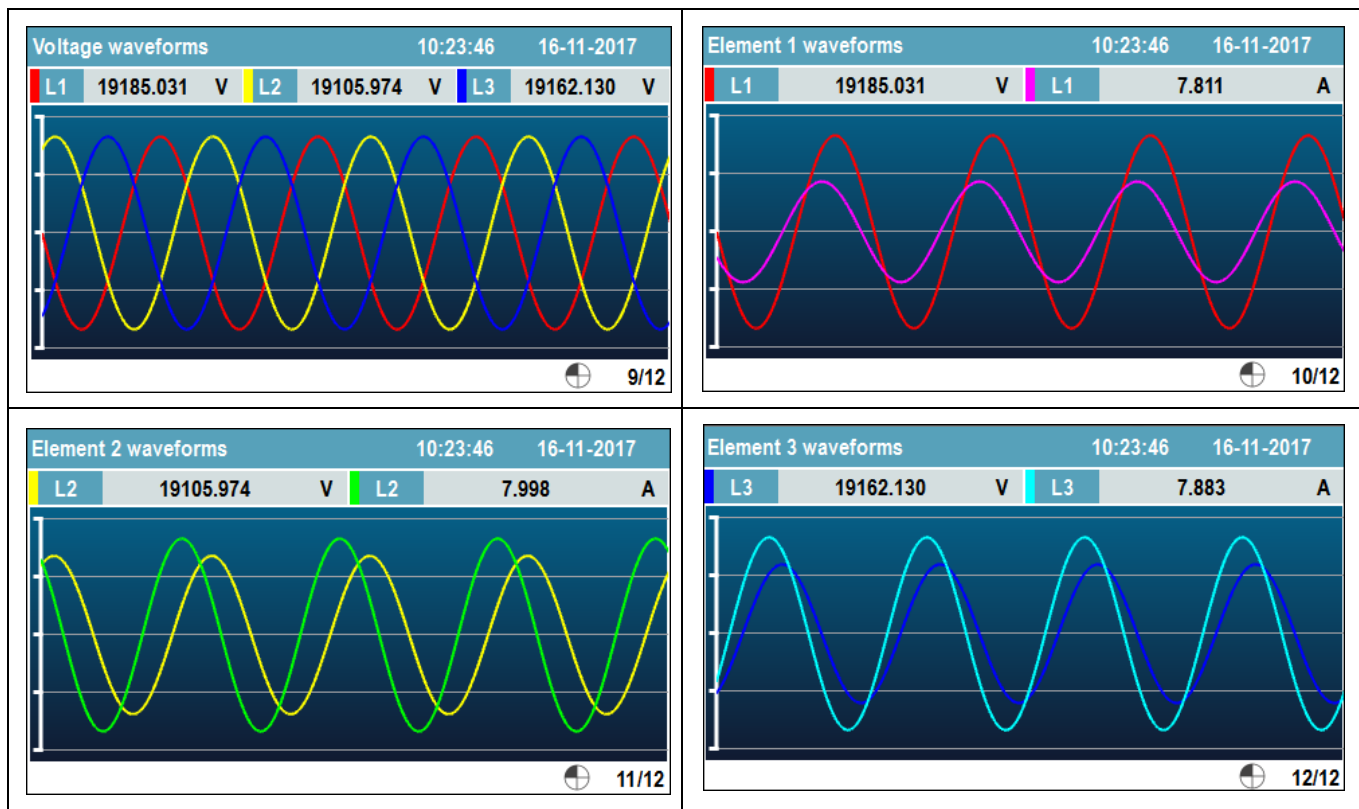
7/12

Apparent energy10:23:4616-11-2017

Apparent import1107757.372 kVAh

Apparent export11055.654 kVAh

8/12



Configuring meter using set-up menu

The setup menu is used to set up and enable features such as the display delays, network settings, communication settings, brightness control and language on display. They are also used to manage your favourite selections.

The setup menu is password protected which can be accessed only by users authorised to change the above configurations.

At the password prompt enter the 6-digit password (default password is '000000') using Enter, Up and Down buttons. Use the  button to enter a digit and use  and  buttons to enter a value for that digit and press  button to move the cursor to the right while entering a password. After entering the last digit of the password, use the  button to move to the Ok or Clear buttons on the password entry screen.

Using  button you can navigate through the password entry screen.

Once the password is entered, move to the Ok button and press  button to confirm. Correct password grants access to the setup menu. An incorrect password will display 'Access denied' message.

ProQ 100 10:23:46 16-11-2017	
Real	Change settings
Energy	Communication settings
Quality	Network settings
Events	I/O settings
Setup	Favourite pages



Password entry 10:23:46 16-11-2017	
Please enter password	
* * * * *	
OK	CLEAR

The setup menu is shown below.

ProQ 100 10:23:46 16-11-2017	
Real	Change settings
Energy	Communication settings
Quality	Network settings
Events	I/O settings
Setup	Favourite pages

Display delays 10:23:46 16-11-2017	
Auto cycling delay	0 0 5 Sec
Return to auto cycling	0 3 0 Sec
Display off duration	0 2 0 Sec
Auto sequence	Default
SAVE CANCEL	

The display delays can be configured in the field using M-Cubed 100 (ConfigView) or by the display keys.

Auto cycling delay - Auto-cycle displays advance sequentially to the next display in every 5 to 120 seconds (as configured in the meter).

Return to auto cycling - If no button is pressed in manual mode for 10 to 240 seconds (as configured in the meter) the display will time out and revert to automatic display cycling sequence.

Display off duration - After completing one full automatic display cycling sequence, there will be a delay of 0 to 240 seconds (as configured in the meter) before the display resumes from the beginning.

Auto sequence – Auto display sequence can be configured as Default display sequence or Favourite display sequence. The auto display sequence can be disabled by selecting Disable from the drop-down list.

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="background-color: #0070C0; color: white;">Ethernet SFP (Eth0)</th> <th style="text-align: right;">10:23:46</th> <th style="text-align: right;">16-11-2017</th> </tr> <tr> <td style="padding: 5px;">Static IP</td> <td colspan="3" style="text-align: right; padding: 5px;">1 7 2 . 0 1 6 . 0 1 3 . 1 6 4</td> </tr> <tr> <td style="padding: 5px;">Subnet mask</td> <td colspan="3" style="text-align: right; padding: 5px;">2 5 5 . 2 5 5 . 2 4 8 . 0 0 0</td> </tr> <tr> <td style="padding: 5px;">Gateway IP</td> <td colspan="3" style="text-align: right; padding: 5px;">1 7 2 . 0 1 6 . 0 1 5 . 2 3 8</td> </tr> <tr> <td colspan="4" style="text-align: right; padding: 10px;"> SAVE CANCEL 2/8 </td> </tr> </table>	Ethernet SFP (Eth0)		10:23:46	16-11-2017	Static IP	1 7 2 . 0 1 6 . 0 1 3 . 1 6 4			Subnet mask	2 5 5 . 2 5 5 . 2 4 8 . 0 0 0			Gateway IP	1 7 2 . 0 1 6 . 0 1 5 . 2 3 8			SAVE CANCEL 2/8				<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="background-color: #0070C0; color: white;">Ethernet RJ45 (Eth1)</th> <th style="text-align: right;">10:23:46</th> <th style="text-align: right;">16-11-2017</th> </tr> <tr> <td style="padding: 5px;">Static IP</td> <td colspan="3" style="text-align: right; padding: 5px;">1 7 2 . 0 1 6 . 0 2 8 . 1 6 5</td> </tr> <tr> <td style="padding: 5px;">Subnet mask</td> <td colspan="3" style="text-align: right; padding: 5px;">2 5 5 . 2 5 5 . 2 5 5 . 0 0 0</td> </tr> <tr> <td style="padding: 5px;">Gateway IP</td> <td colspan="3" style="text-align: right; padding: 5px;">1 7 2 . 0 1 6 . 0 2 8 . 0 0 1</td> </tr> <tr> <td colspan="4" style="text-align: right; padding: 10px;"> SAVE CANCEL 3/8 </td> </tr> </table>	Ethernet RJ45 (Eth1)		10:23:46	16-11-2017	Static IP	1 7 2 . 0 1 6 . 0 2 8 . 1 6 5			Subnet mask	2 5 5 . 2 5 5 . 2 5 5 . 0 0 0			Gateway IP	1 7 2 . 0 1 6 . 0 2 8 . 0 0 1			SAVE CANCEL 3/8			
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Protocol addresses		10:23:46	16-11-2017																																						
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5.2 Using metrology LEDs

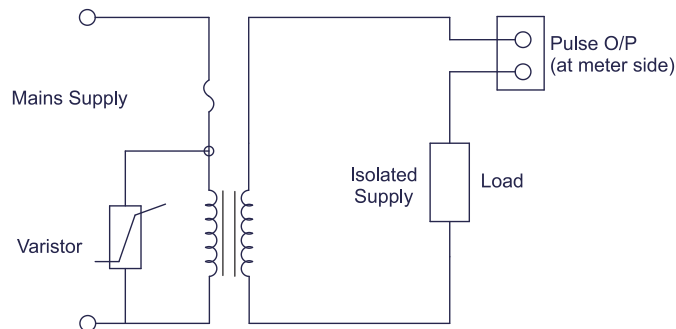
The meter has two calibration LEDs for Active (total/fundamental) and Reactive/Apparent energy which can be configured for visual indication of energy consumption. The calibration LED constant depends on the CT/VT ratio configured in the meter and can be selected from the available options through display or ConfigView.

5.3 Using pulse input/output

The pulse outputs can be linked to two LEDs indication as available on front side of meter so that user can have a visualisation sort of feature by physically seeing the LEDs. The pulse outputs 3 and 4 (refer to Figure 11 for details) are linked to the upper and lower output LEDs.

The LEDs can be configured through ConfigView either at factory or in field.

It is recommended to use conditioned power supply (isolated from Mains) for driving loads through pulse output of product so that any malfunction in the load or related circuit will not affect the metering. A tentative scenario for reference is shown in below diagram.



6 ProQ 100 and ConfigView BCS

This section describes the various operations that can be performed using the ConfigView BCS with ProQ 100 meter.

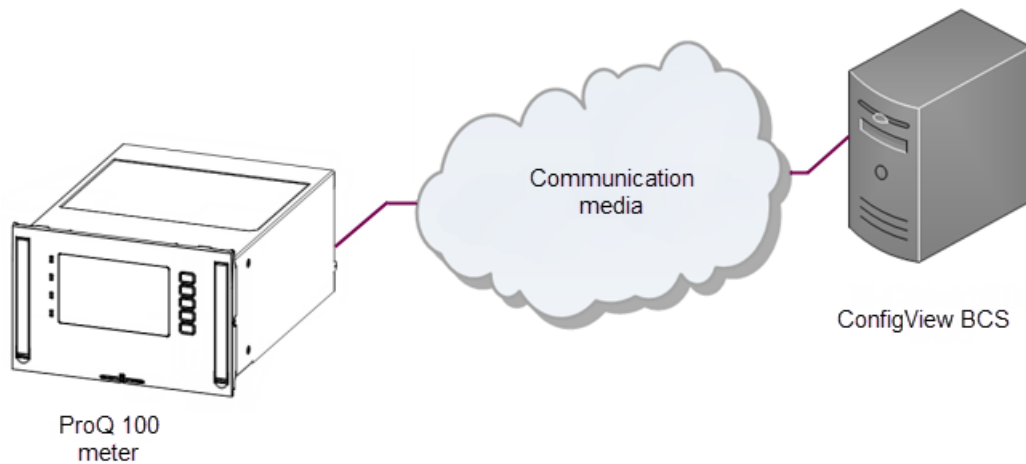


Figure 16: ProQ 100 and ConfigView BCS

ConfigView is an application which is used to configure and read data from meter. It also enables you to set time of the meter and upgrade firmware.

ConfigView can be used for:

- Configuration
- Reading
- Actions

Refer to ConfigView help for detailed description of all these functions.

6.1 Configuring the meter

ProQ 100 can be configured using ConfigView.

Once the application is installed in your computer, you can access it from the 'ConfigView' shortcut icon on the desktop. Alternatively, click  and look for 'ConfigView' under *All Programs*.

Before configuring ProQ 100 with the help of ConfigView, you should first add the product to the application. To add products select **File > Add Product** from the Menu bar. Select ProQ 100 from the supported product list, it will appear in the tree view list on the left-hand pane of the ConfigView window.

Right-click ProQ 100 in the tree view list on the left-hand pane and select **Add meter**.

The **General Settings** screen will be displayed.

The screenshot shows the 'General Settings' dialog box with 'Online Mode' selected. The 'Connect Using' dropdown is set to 'Serial (RS232)'. Under the 'Serial' section, 'Com Port' is 'COM1' and 'Baud Rate' is '9600'. Under the 'TCP/IP' section, 'Meter IP Address' is '127.0.0.1' and 'Port Number' is '4059'. The 'Use Access Level' checkbox is checked. The 'Product Details' section is collapsed. At the bottom are 'Ok' and 'Cancel' buttons.

Online mode

The screenshot shows the 'General Settings' dialog box with 'Offline Mode' selected. The 'Connect Using' dropdown is set to 'Serial (RS232)'. Under the 'Serial' section, 'Com Port' is 'COM1' and 'Baud Rate' is '9600'. Under the 'TCP/IP' section, 'Meter IP Address' is '127.0.0.1' and 'Port Number' is '4059'. The 'Use Access Level' checkbox is unchecked. The 'Product Details' section is expanded, showing a 'Program Name' dropdown set to '0.26.x'. At the bottom are 'Load Configuration', 'Ok', and 'Cancel' buttons.

Offline mode

Two types of configuration modes are available – Online and Offline. Online mode enables you to configure the meter online. Offline mode enables you to prepare configuration for further use.

In case of offline mode, select the Program Name of the meter to be configured and click Ok to add the grid meter node in the left-hand pane.

Note: The Program Name is the firmware version of the meter which can be viewed on the meter display (on **Meter Info** page under **Setup** menu).

Click Load Configuration to open an existing configuration file.

In case of online mode, connect the meter using serial or TCP/IP communication and select the Use Access Level for specifying the password level and custom password depending on the requirement.

Two types of communication modes are available- Serial communication and TCP/IP communication. TCP/IP communication enables all reading and configuration to be performed through Ethernet.

Before communicating with a meter using this application, ensure that,

- o The baud rate of the meter is known to you for Serial communication; and the IP address of the meter is known to you for TCP/IP communication.
- o The communication port of the PC is connected with the RS232 port of the meter for Serial communication; and the PC is connected to the meter either using Ethernet crossover cable or through TCP/IP network for TCP/IP communication.

Connect using: select the communication mode to be used when communicating with the meter. The available options are – Serial (RS232), Optical (1107 Sign On) and TCP/IP.

Serial Communication: On selecting communication mode as Serial, the **Serial Communication** group will be enabled. Enter the following information:

- o **Com Port:** select the serial communication port of the PC to which RS232 end of the connector cable is connected.
- o **Baud Rate:** From the list, select the communication speed (baud rate) that is set in the meter you are connecting to.

Note: The meter's optical port always starts with a baud rate of 300 bps, regardless of what is configured, before shifting over to the specified communication speed. This means that software that communicates with the meter via the optical port does not need to know the speed that the meter's optical port is set to.

Incorrect selection of com port and/or mismatch of baud rate will result in failure to establish the communication link.

TCP/IP Communication: On selecting communication mode as TCP/IP, the **TCP/IP Communication** group will be enabled. Enter the following information:

- o **IP Address:** specify the IP address of the meter you are connecting to. This should match with the IP address configured in the meter.
- o **TCP/IP Port:** Specify the TCP/IP communication port of the PC to which TCP/IP network is connected. By default, it is set as 4059.

Incorrect selection of TCP/IP port and/or mismatch of IP address will result in failure to establish the communication link.

When you have entered the communication settings for the selected mode, select the password level.

Use Access Level: Select Use Access Level to select the password level. You can specify the custom password for the selected password level by selecting Use Custom Password.

Note: Use Custom Password will be disabled if the password level is selected as Automatic.

You can see the program name of the connected meter by clicking the product details.

On clicking **Ok**, it reads all configurations from the meter, with on-screen messages indicating progress.

On successful connection, the communication settings, access level and the serial number of the connected meter will be displayed on the status bar.

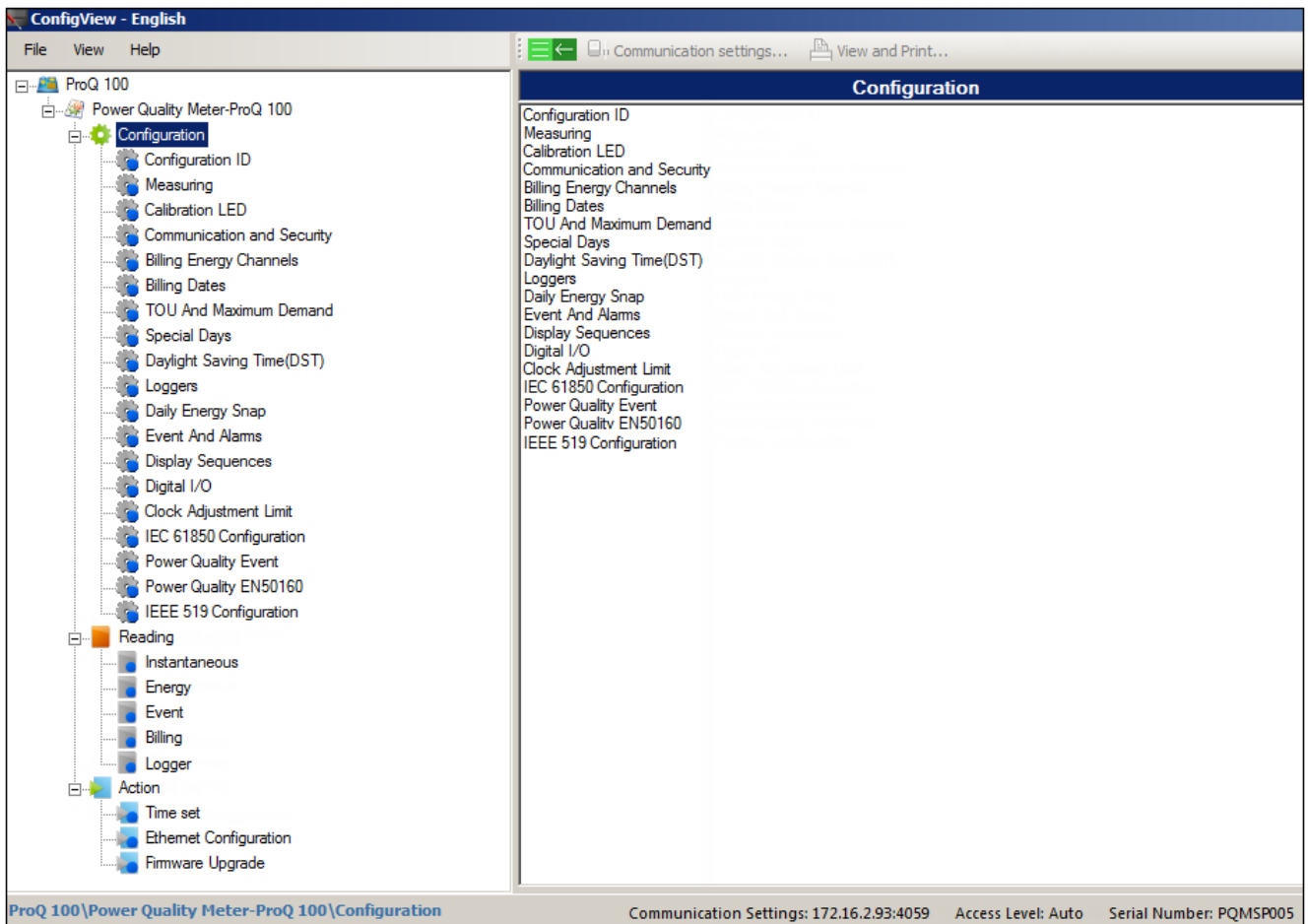
A Grid Meter node will now be added to the left-hand pane. Click  or  to expand or contract the tree view. When expanded, all the available features of the selected meter can be seen on the left pane.

This section details about all the features possible to configure with ConfigView.

All ProQ 100 meter variants are preconfigured at the factory. However, you can use ConfigView to customise certain configurations as per your requirements. Configurable features in ConfigView are product and variant specific. The ConfigView window will display only the relevant features of a selected product and variant.

You can refer to the help relevant to the presently opened page by clicking  icon present on the top right-hand corner of each page.

Depending on the features available in the meter variant added in ConfigView, you can configure the meter as described in the following section.



The configuration options are:

- o Configuration ID
- o Measuring
- o Calibration LED
- o Communication and Security
- o Billing Energy Channels
- o Billing Dates
- o TOU and Maximum Demand
- o Special Days
- o Daylight Saving Time (DST)
- o Loggers
- o Daily Energy Snap
- o Event and Alarms

- o Display Sequences
- o Digital I/O
- o Clock Adjustment Limit
- o IEC 61850 Configuration
- o Power Quality Event
- o Power Quality EN 50160
- o IEEE 519 Configuration

6.1.1 Setting configuration ID

Configuration ID is used to trace the existing configuration in meter. Upon selection it is available on meter display as well as in meter reading.

To open the **Configuration ID** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Configuration ID** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Click **Read configuration** to view the current ID in use.

Enter the Configuration ID. It can be a combination of alphanumeric and underscore characters and must be eight characters long.

Select the activation time as immediate or delayed. In case of delayed activation, select the date at which the activation will take place.

Click **Apply** to update the configuration in the meter.

6.1.2 Configuring measuring parameters

The **Measuring** screen allows you to configure the CT/VT ratio (scaling); CT/VT error compensation; and power transformer loss compensation.

To open the **Measuring** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Measuring** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Measuring

Configuration of measuring parameters

Check Supported Sections

☒ CT/VT Ratio ☐ Disable VT Adjustment ☒ Disable VT Harmonics

☒ CT/VT Error Compensation ☐ Disable Nonlinear CT ☐ Disable Transformation Loss

☒ Transformer Loss Compensation

CT/VT Ratio | CT/VT Error Compensation | Transformer Loss Compensation

Meter Wire Type: HV (3P4W) Nominal Frequency: 50

Primary Secondary

Line to Line Voltage: 132000 V 110 V

Current: 800 A 1 A

Basic Current: 1 A Max Current Percentage: 200 2.0 A

Nominal Current: 800 A Nominal Voltage: 132000 V

Notes

Percentage value of Max Current after read configuration may or may not be equal to the applied percentage, As this value is considered as up to one decimal point. If meter is self powered then LV meter type configuration is not applicable.

Read configuration Apply

This screen has a multi tab format. The default opening screen is with the CT/VT Ratio option selected.

Note: The CT/VT Ratio, CT/VT Error Compensation or Power Transformer Loss Compensation options must be selected to make the adjustments active, otherwise all the associated settings will appear dimmed and will not be available.

CT/VT Ratio Tab

Click **CT/VT Ratio** tab.

It allows you to configure meter wire type, nominal frequency, maximum current; primary and secondary values for current and voltage.

Click **Read configuration** button to download the existing configuration from the meter.

Note:

- For HV meter type, the primary value (for voltage and current) should not be less than secondary value.
- Maximum possible primary voltage is 2000000 V and primary current is 99999 A, whereas power should be less than 14,400,000,000 VA.
- The secondary current can be configured to any value ranging from 1 to 10 A.
- The maximum current can be configured to any value ranging from 1 to 10 A.
- Secondary and maximum current values are configurable with resolution of one decimal point.
- Software application allows valid CT/VT ratio only.

CT/VT Error Compensation Tab

Select CT/VT Error Compensation option. The following tabs are displayed:

- Linear VT error
- CT Error
- VT Harmonics Error

Linear VT error

Click **CT/VT Error Compensation** tab.

The Linear VT error section will be displayed.

Measuring

Configuration of measuring parameters

Check Supported Sections

- ☒ CT/VT Ratio
- ☒ CT/VT Error Compensation
- ☒ Transformer Loss
- ☐ Disable VT Adjustment
- ☐ Disable VT Harmonics
- ☐ Disable Nonlinear CT
- ☐ Disable Transformer Loss

CT/VT Ratio | **CT/VT Error Compensation** | Transformer Loss Compensation

Linear VT Error | CT Error | VT Harmonics Error

Present Values

	Phase1		Phase2		Phase3	
	Ratio(%)	Phase(Min)	Ratio(%)	Phase(Min)	Ratio(%)	Phase(Min)
PT	0	0	0	0	0	0

☒ Edit Values

	Phase1		Phase2		Phase3	
	Ratio(%)	Phase(Min)	Ratio(%)	Phase(Min)	Ratio(%)	Phase(Min)
PT	0.5000	10.00	-0.2500	-7.00	0.7500	12.00

Read configuration Apply

Click **Read configuration** button to download the existing configuration from the meter; this will appear in the top section of the screen, titled **Present Values**.

The bottom section of the screen is used to enter your input values.

Select **Edit Values** to make the adjustments active, otherwise all the associated settings will appear dimmed.

Enter the linear VT phase and ratio adjustment which you want to apply to the meter. Refer to the VT name plate for actual VT error.

A positive VT error adjustment will decrease the magnitude of the voltage.

CT Error

Click **CT/VT Error Compensation** tab and select CT Error tab.

The CT Adjustment section will be displayed.

Measuring

Configuration of measuring parameters

Check Supported Sections

- ☒ CT/VT Ratio
- ☒ CT/VT Error Compensation
- ☒ Transformer Loss
- ☐ Disable VT Adjustment
- ☐ Disable VT Harmonics
- ☐ Disable Nonlinear CT
- ☐ Disable Transformer Loss

CT/VT Ratio | CT/VT Error Compensation | Transformer Loss Compensation

Linear VT Error | **CT Error** | VT Harmonics Error

Non Linear CT Adjustment

	Load(%basic)	Load (Amp)	R-Ratio(%)	R- Phase(min)	Y-Ratio(%)	Y- Phase(min)	B-Ratio(%)	B- Phase(min)
	10	100.0000	0.75	10	0.50	12	-0.25	-7
	50	500.0000	0.6	8	0.4	10	-0.15	-5
	75	750.0000	0.5	6	.30	8	0.1	-3
▶	100	1,000.0000	0.3	4	0.2	6	0.05	-2
*								

Atleast 1 load point must be there for CT non linear correction.

CT Primary Current 2000

Read configuration Apply

Click **Read configuration** button to download the existing configuration from the meter; this will appear in the top section of the screen, titled **Non Linear CT Adjustment**.

The bottom section of the screen is used to enter your **New Non Linear CT Adjustment**.

Enter the non linear CT phase and ratio adjustment which you want to apply to the meter. At least one point must be defined.

A positive CT phase adjustment will decrease the lag of the current.

A positive CT ratio adjustment will decrease the magnitude of the current. Enter the CT ratio adjustment same as mentioned in the CT specification.

Note: Be sure to use the scroll bars to view the complete screen.

VT Harmonics Error

Click **CT/VT Error Compensation** tab and select VT harmonics error tab.

The VT Harmonics Adjustment section will be displayed.

Measuring

Configuration of measuring parameters

Check Supported Sections

- ☒ CT/VT Ratio
- ☒ CT/VT Error Compensation
- ☒ Transformer Loss
- ☐ Disable VT Adjustment
- ☐ Disable VT Harmonics
- ☐ Disable Nonlinear CT
- ☐ Disable Transformer Loss

CT/VT Ratio | CT/VT Error Compensation | Transformer Loss Compensation

Linear VT Error | CT Error | VT Harmonics Error

Non Linear VT Harmonics Adjustment

New Non Linear VT Harmonics Adjustment

Frequency	R-Ratio(%)	Y-Ratio(%)	B-Ratio(%)
100	0	0	0
500	0.5	0.5	0.5
1000	0.6	0.65	0.7
2000	0.7	0.75	0.8
▶▶			

Atleast 2 load point must be there for VT non linear correction.

Maximum Frequency 2500

Read configuration Apply

Click **Read configuration** button to download the existing configuration from the meter; this will appear in the top section of the screen, titled **Non Linear VT Harmonics Adjustment**.

The bottom section of the screen is used to enter your **New Non Linear VT Harmonics Adjustment**.

Enter the non linear VT harmonics ratio adjustment which you want to apply to the meter. At least two points must be defined and first point should be 100 Hz with 0% value.

Transformer Loss Compensation Tab

Click **Transformer Error Compensation** tab

The screen shown below will appear:

The screenshot shows a software interface titled "Measuring" with a subtitle "Configuration of measuring parameters". It features a "Check Supported Sections" area with three checked options: "CT/VT Ratio", "CT/VT Error Compensation", and "Transformer Loss". There are also four unchecked options: "Disable VT Adjustment", "Disable VT Harmonics", "Disable Nonlinear CT", and "Disable Transformer Loss". Below this is a tabbed interface with three tabs: "CT/VT Ratio", "CT/VT Error Compensation", and "Transformer Loss Compensation", which is currently selected. The "Transformer Loss Compensation" tab contains two sections: "Copper Loss" and "Iron Loss". Each section has two input fields for "ActivePower(%)" and "ReactivePower(%)". The "Copper Loss" values are 0.750 and 0.500, while the "Iron Loss" values are 0.500 and 0.500. At the bottom right, there are two buttons: "Read configuration" and "Apply".

It allows you to configure the transformer compensation for Copper Loss and Iron Loss.

Use the **Read configuration** button to download the existing configuration from the meter.

Note:

- Due to the variation in installations, advanced knowledge of power systems and connection methods is required before transformer loss compensation can be properly implemented.
- Data parameters for CT/VT Error Compensation and Transformer Loss Compensation calculations should only be programmed by qualified personnel with appropriate training and experience.

Click **Apply** to update the configuration in the meter.

6.1.3 Configuring calibration LEDs

The **Calibration LED** screen allows you to configure the calibration LEDs for Active, Reactive and Apparent energy. Active total and Active fundamental options are available for LED L1; and Reactive and Apparent energy are available for LED L2.

To open the **Calibration LED** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Calibration LED** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Calibration LED			
Calibration LED Configuration ?			
Calibration LED (L1)	Active total		
Calibration LED (L2)	Reactive		
Meter Constant Type	Secondary		
Meter Constant Value	40000	Imp/	kilo
Allowed Range according to select unit is 945 to 1889510			
Nominal Pulse Frequency(Hz)	4.234	Pulse Length(ms)	118.094
Notes 1. Pulse Constant is dependent on configuration parameters (CT/VT Ratio) available in meter. To configure this, please connect to meter and read configuration. 2. Nominal pulse rate is based on nominal power. Pulse rate would proportionally increase as the load goes higher. 3. Allowed Range for frequency is 0.1 to 200 Hz.			
			Read configuration Apply

Click the **Read configuration** button to download the existing configuration from the meter.

Select **As configured in meter for LED L1** or **Active total** or **Active fundamental (without harmonics)** for LED L1.

Select **As configured in meter for LED L2** or **Reactive** or **Apparent** for LED L2.

Select **Primary** or **Secondary** for the Meter Constant type.

The pulse constant inside the meter is derived from the CT/VT ratio of the meter and you have to connect to the meter and read configuration to configure the pulse constant in the meter. Then, enter the Meter Constant Value (in the allowed range) to apply for the purpose of on-site testing with respect to load running in meter. Nominal Pulse Frequency (Hz) and Pulse Length (ms) will be displayed.

Note:

- Nominal pulse rate is based on nominal power. Pulse rate would proportionally increase as the load goes higher.
- Allowed range for pulse frequency is 0.1 to 200 Hz.

Click **Apply** to update the configuration in the meter.

6.1.4 Configuring communication and security

The **Communication and Security** screen allows you to configure communication settings for all the channels, time synchronisation settings and hardware security.

To open the **Communication and Security** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Communication and Security** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Communication and Security			
Communication and Security section configuration			
Communication Port			
Optical Port			
Baud Rate:	Protocol:		
300	DLMS Sign On Mode		
Serial Port 1 : RS232			
Baud Rate:	Protocol:	Bus Address:	
9600	DLMS Mode	16	
Serial Port 2 : RS485			
Baud Rate:	Protocol:	Modbus ID:	
9600	Modbus Mode	16	
Time-Server Setting			
Network Time Sync		SNTP Server IP Address	Sync Interval (in minutes)
☒ Enable ☐ Disable		172.16.2.111	60
		UTC Time Zone Offset	
		☒ Configure UTC +01:00	
Notes			
1. Perform read configuration to view available communication details. 2. Modbus mode can be configured either on serial port1 or serial port2. 3. SNTP is for network time sync configuration. Please make sure that meter is in defined time zone before making SNTP configuration.			
Security			
☐ Permit measuring configuration only with hardware security unlock			
Access levels protected by hardware security:			
Not used		Hardware security unlock is required for selected levels before applying software password for configuration.	
Note:			
1. CT/VT ratio, Linear CT/VT error compensation, Transformer loss compensation and change configuration are available at level 3. 2. Non linear CT/VT correction configuration is available at level 4. 3. Security feature will be configured at level 4.			
		Read configuration	Apply

Click the **Read configuration** button to download the existing configuration from the meter.

Select the baud rate, protocol, bus address and Modbus ID.

A bus address can be defined for any serial communication port in the meter and shall have a value of 16 or higher. This setting is only used for the DLMS/COSEM protocol.

A Modbus ID can be defined for any serial communication port in the meter and shall have a value of 1 to 247. This setting is only used for the Modbus protocol.

You can enable network time synchronisation and configure SNTP time synchronisation settings. Enter the SNTP Server IP Address and select the Time Sync Interval (in hours) to specify the frequency with which the meter synchronises over SNTP. Select the Configure checkbox and select the UTC Time Zone Offset from the drop-down list to configure the time format in the meter.

Note: Ensure that the meter is in defined time zone before configuring time synchronisation settings.

Authorisation levels 3 to 5 can be protected by passwords and hardware security. In addition, measuring configuration can also be protected by hardware security. Hardware security settings can be configured if the meter is connected with authorisation level 4. By default, it is not used.

Select the access levels and/or measuring configuration to be protected by hardware security.

Note: Hardware security should be unlocked for the configured levels before applying passwords.

Click **Apply** to update the configuration in the meter.

6.1.5 Configuring billing energy channels

The **Billing Energy Channels** screen allows you to configure the energy channels for billing.

To open the **Billing Energy Channels** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Billing Energy Channels** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Billing Energy Channels

To save energy section, at least one energy channel for billing needs to be selected

Energy Channel for Billing
☒ Active Import Total (Q1+Q4)
☒ Active Export Total (Q2+Q3)
☒ Active Import Fundamental (Without Harmonics) (Q1+Q4)
☒ Active Export Fundamental (Without Harmonics) (Q2+Q3)
☒ Reactive Import While Active Import - Q1
☒ Reactive Export While Active Import - Q4
☒ Reactive Import While Active Export - Q2
☒ Reactive Export While Active Export - Q3
☒ Apparent - While Active Import
☒ Apparent - While Active Export
☒ Reactive Import (Q1+Q2)
☒ Reactive Export (Q3+Q4)
☐ Reactive High Import
☐ Reactive High Export
☐ Reactive Low Import
☐ Reactive Low Export
☐ Reactive Inductive (Q1+Q3)
☐ Reactive Capacitive (Q2+Q4)
☐ Active Import Total (Q1+Q4) - Phase 1
☐ Active Import Total (Q1+Q4) - Phase 2
☐ Active Import Total (Q1+Q4) - Phase 3

Apparent energy definition: Lag + Lead in all quadrant

Active energy for apparent calculation: Total

☒ Energy Limit Definition

Reactive High Voltage Limit: 103 % of V Nominal

Low Voltage Limit: 60 % of V Nominal

Reactive Low Voltage Limit: 97 % of V Nominal

Hysteresis: 3 %

Read configuration Apply

Click the **Read configuration** button to download the existing configuration from the meter.

Select the energy channels you wish to include for billing along with the desired definitions of Apparent and Active energy from the dropdown list.

Note: At least one energy channel for billing must be selected for saving the configuration.

Reactive high and reactive low energies are special registers, which can increment based on voltage and reactive load conditions. You can define the energy limits by selecting the Reactive High Voltage Limit, Reactive Low Voltage Limit, Low Voltage Limit and Hysteresis from the dropdown list.

Note: Ensure that the Energy Limit Definition is selected to enable the selection of limits.

The reactive high and reactive low registers increment only when certain voltage conditions are met and based on these, one or none of these may increment at any particular point of time. The voltage conditions are two average voltage levels Reactive Low Voltage Limit and Reactive High Voltage Limit. If average voltage falls

below Reactive Low Voltage Limit, then reactive low register is incremented. Similarly if average voltage is above Reactive High Voltage Limit, then reactive high register is incremented. If average voltage is between Reactive Low Voltage Limit and Reactive High Voltage Limit, then none of reactive high or reactive low register is incremented. By default the average voltage levels are set to 97% for Reactive Low Voltage Limit and 103% for Reactive High Voltage Limit.

If low voltage is detected, then none of reactive high or reactive low register is incremented. By default the low voltage limit is set to 60% and hysteresis for low voltage is set to 3%.

Hysteresis means that the limit for a state and the limit for when it is restored are different. This is to avoid several states being registered when the voltage level varies around a limit. The hysteresis limit is always midway between the low limit and nominal voltage.

For example, if the low voltage limit is 60% and hysteresis is 3% then the low voltage event occurs when any phase voltage falls below 60% and restores when the phase voltage becomes 63%.

Click **Apply** to update the configuration in the meter.

6.1.6 Configuring billing dates

The **Billing Dates** screen allows you to enter the values for a billing period, such as the start dates and the period.

If billing dates are not required, select **Disable Billing Dates**. By default, **Disable Billing Dates** is selected.

To open the **Billing Dates** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Billing Dates** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Billing Dates

Billing dates configuration ?

Billing date definition

Billing date 8/ 1/2016

Apply to Every year

Billing start On exact date

☐ Disable Billing Dates

Add
Delete
For Every Month

Selected billing dates

No.	Billing Date	Apply	Billing Start
1	01-January	Every year	On exact date
2	01-February	Every year	On exact date
3	01-March	Every year	On exact date
4	01-April	Every year	On exact date
5	01-May	Every year	On exact date
6	01-June	Every year	On exact date
7	01-July	Every year	On exact date
8	01-August	Every year	On exact date
9	01-September	Every year	On exact date
10	01-October	Every year	On exact date
11	01-November	Every year	On exact date
12	01-December	Every year	On exact date

Maximum number of billing dates: 53
Selected number of billing dates: 12

Read configuration
Apply

Click the **Read configuration** button to download the existing configuration from the meter.

Complete the **Billing date definition** details.

Click **Add** to enter details into the **Selected billing dates** pane.

Click **Apply** to update the configuration in the meter.

6.1.7 Configuring TOU and maximum demand

The **TOU and Maximum Demand** screen allows you to configure demand, tariff structure, day type and season dates. Defining a Time of Use is a skilled and detailed operation. It is important to plan a definition and have all the necessary information at hand before you commence a definition.

To open the **TOU and Maximum Demand** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **TOU and Maximum Demand** from the menu tree. A similar screen shown below will appear in the right-hand pane:

TOU and Maximum Demand

To save this section, at least one season date and minimum one parameter for demand register and rate register need to be selected

General | Tariff Structure | Season Dates

Maximum Demand

Demand Type: Fixed Demand

Monitoring Interval (minutes): 30

Parameters

What to record for Demand Register

- ☒ Active Import Total (Q1+Q4)
- ☒ Active Export Total (Q2+Q3)
- ☒ Active Import Fundamental (Without Harmonics) (Q1+Q4)
- ☒ Active Export Fundamental (Without Harmonics) (Q2+Q3)
- ☒ Reactive Import While Active Import – Q1
- ☒ Reactive Export While Active Import – Q4
- ☒ Reactive Import While Active Export – Q2
- ☒ Reactive Export While Active Export – Q3
- ☒ Apparent – While Active Import
- ☐ Apparent – While Active Export
- ☐ Reactive Import (Q1+Q2)
- ☐ Reactive Export (Q3+Q4)
- ☐ Reactive Inductive (Q1+Q3)
- ☐ Reactive Capacitive (Q2+Q4)

What to accumulate for TOU Register

- ☒ Active Import Total (Q1+Q4)
- ☒ Active Export Total (Q2+Q3)
- ☒ Active Import Fundamental (Without Harmonics) (Q1+Q4)
- ☒ Active Export Fundamental (Without Harmonics) (Q2+Q3)
- ☒ Reactive Import While Active Import – Q1
- ☒ Reactive Export While Active Import – Q4
- ☒ Reactive Import While Active Export – Q2
- ☒ Reactive Export While Active Export – Q3
- ☒ Apparent – While Active Import
- ☐ Apparent – While Active Export
- ☐ Reactive Import (Q1+Q2)
- ☐ Reactive Export (Q3+Q4)
- ☐ Reactive Inductive (Q1+Q3)
- ☐ Reactive Capacitive (Q2+Q4)

Read configuration Apply

This screen has a multi tab format.

General Tab

The **TOU and Maximum Demand** screen normally opens in the **General** tab screen, if not, click the **General** tab.

It allows you to configure demand type (Fixed or sliding), demand integration period and parameters to be logged for demand and Time of Use (TOU) registers.

Click **Read configuration** button to download the existing configuration from the meter.

Tariff Structure Tab

Click the **Tariff Structure** tab.

The following section will be displayed.

TOU And Maximum Demand

To save this section, at least one season date and minimum one parameter for demand register and rate register need to be selected

General

Tariff Structure

Season Dates

Day Type Selection

Day Type

2

Start Time (hh:mm)

00

:

00

End Time (hh:mm)

24

:

00

Rate Register

1

MD Register

☒ Register 1

☐ Register 2

☐ Register 3

☐ Register 4

☐ Register 5

☐ Register 6

☐ Register 7

Update

Delete

No.	Day Type	Start Time	End Time	Rate Register	MD Register
1	1	00:00	06:00	1	1
2	1	06:00	08:00	2	2
3	1	08:00	20:00	3	3
4	1	20:00	24:00	4	4
5	2	00:00	24:00	1	1

Note

1. Time zone should not be less than 30 minutes duration.

2. Time zone must be greater than the demand monitoring interval.

Read configuration

Apply

It allows you to configure day type, time zone, rate register and demand register.

Click **Read configuration** button to download the existing configuration from the meter.

Season Dates Tab

Click the **Season Dates** tab.

The following section will be displayed.

TOU and Maximum Demand

To save this section, at least one season date and minimum one parameter for demand register and rate register need to be selected ?

General | Tariff Structure | **Season Dates**

Season Start Date

Season Start Date: 4/ 1/2016

Season Start: On exact date

Day Type: 2

Select day for day type: ☐ Mon ☐ Tue ☐ Wed ☐ Thu ☐ Fri ☒ Sat ☒ Sun

Update Delete

Selected season list

Season No.	Season Start Date	Day Of Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	1-April	On exact date	1	1	1	1	1	2	2

Read configuration Apply

It allows you to configure season start dates and linking with day type and day of weeks.

Click **Read configuration** button to download the existing configuration from the meter.

At least one season date, one demand register and one TOU register must be selected before saving the configuration.

Click **Apply** to update the configuration in the meter.

6.1.8 Configuring special days

The **Special Days** screen allows you to define special days. Days that change rate according to a pattern that is not covered by linking day types to seasons (such as holidays) are called special days. A special date specifies the day type that applies on a certain date. Special dates can be configured to apply every year on the same date or for a single year. A maximum of 50 special days can be configured.

To open the **Special Days** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Special Days** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Special Days

If no special date is added then special day record will be set as null

Special definition

Special Date	12/25/2016
Day Type	2
Apply to	Every year
Special Day Start	On exact date

Add
Delete

Selected special dates

S.No	Date	Day Type	Apply to	Special Day Start
1	25-December	2	Every year	On exact date

Maximum number of dates: 50

Selected number of dates: 1

Read configuration
Apply

Click **Read configuration** button to download the existing configuration from the meter.

Complete the **Special definition** details.

Click **Add** to enter details into the **Selected special dates** pane.

Click **Apply** to update the configuration in the meter.

6.1.9 Setting Daylight Saving Time (DST)

The meter offers the alternative of letting the meter clock follow daylight savings time. At a specified date, the meter clock is adjusted forward, and at another, adjusted back to normal time. The meter can store a maximum of 25 DST dates.

If DST is not required, select **Disable DST**. By default, **Disable DST** is selected.

To open the **Daylight Saving Time (DST)** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Daylight Saving Time (DST)** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Daylight Saving Time(DST)

To save DST section, at least one DST date range needs to be selected

Daylight Saving Time Definition
 Start Date:
 Start Time (hh:mm): :

End Date (given in DST):
 End Time (hh:mm): :
 Adjust normal time with (hh:mm):

☐ **DisableDST**

Selected DST dates

No.	Begin Date & Time	End Date & Time (given in DST)	Adjust normal time with (hh:mm)
1	25-Mar-2018 02:00	28-Oct-2018 02:00	+01:00

Notes
 1. Maximum number of DST date range allowed: 25
 2. Daylight saving time must have a starting month that precedes the ending month.

Click the **Read configuration** button to download the existing configuration from the meter.

Complete the **Daylight Saving Time Definition** details.

Click **Add** to enter details into the **Selected DST dates** pane.

Click **Apply** to update the configuration in the meter.

6.1.10 Configuring loggers

A meter has two identical, parallel and individually configurable loggers, which is described in this section and applies to both logger 1 and logger 2.

The **Loggers** screen allows you to define the logger by configuring integration period for delta values, parameters to log and logger enable/disable.

You can define integration period as 1,2,3,4,5,10,15,20,30 and 60 min. A logger in a meter can log values for instant quantities, energy registers, external registers and individual harmonic parameters. Some quantities can be logged both by phase and as total values for all three phases, others only as total values.

Maximum 150 parameters can be selected including both logger 1 and logger 2.

Energy is logged as consumption (delta value). Instantaneous values can be logged as average, maximum, minimum and instant value during the logging interval or as the instantaneous value at the end of the logging interval. Harmonics and inter harmonics can be logged for current and voltage.

Available status flags are: Low voltage, Power loss, VT miss, DST applied, Current reversal, Load survey parameters changed, Alarm on, SIP incomplete, Time adjust and Data invalid.

To open the **Loggers** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Loggers** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Click the **Read configuration** button to download the existing configuration from the meter.

Select the parameters you wish to include for logging. The maximum number of logging days will be displayed.

In case of program 0.25.x, the logger supports the following logging days depending on the logging interval.

Integration period (in minutes)	Number of days (irrespective of number of parameters selected)
1	10
2	20
3	30
4	40
5	50
10	100
15	150
20	200
30	300
60	600

In case of program 0.26.x and onwards, the logger supports the following logging days depending on the logging interval and number of parameters.

Parameters	Integration period (in minutes)										
	1	2	3	4	5	10	15	20	30	60	
	≤ 25	30	60	90	120	150	300	450	600	900	1000
	26 to 50	20	40	60	80	100	200	300	400	600	800
	51 to 100	10	20	30	40	50	100	150	200	300	600

Click **Apply** to update the configuration in the meter.

6.1.11 Configuring daily energy snapshot

Energy snapshot feature saves the value of a particular energy register at a particular time in a day. The meter stores a snapshot of different energy registers on a daily basis at predefined time (capture time) as selected from tariff configuration (generally it is set at midnight). Snapshots can be stored for a maximum of 65 days as configured at factory. The updating of energy snapshot records is done in a rollover fashion, i.e. each day a new energy snapshot is stored in the memory and the earliest record is deleted. So at any time a meter will have energy snapshot records for the last 65 days.

To open the **Daily Energy Snap** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Daily Energy Snap** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Daily Energy Snap

Daily Energy Snap parameters configuration

Energy Channels

☒ What to log

☐ Active Import Total (Q1+Q4)

☐ Active Export Total (Q2+Q3)

☐ Active Import Fundamental (Without Harmonics) (Q1+Q4)

☐ Active Export Fundamental (Without Harmonics) (Q2+Q3)

☐ Reactive Import While Active Import - Q1

☐ Reactive Export While Active Import - Q4

☐ Reactive Import While Active Export - Q2

☐ Reactive Export While Active Export - Q3

☐ Apparent - While Active Import

☐ Apparent - While Active Export

☐ Reactive Import (Q1+Q2)

☐ Reactive Export (Q3+Q4)

☐ Reactive High Import

☐ Reactive High Export

☐ Reactive Low Import

☐ Reactive Low Export

☐ Reactive Inductive (Q1+Q3)

☐ Reactive Capacitive (Q2+Q4)

☐ Active Import Total (Q1+Q4) - Phase 1

☐ Active Import Total (Q1+Q4) - Phase 2

☐ Active Import Total (Q1+Q4) - Phase 3

☐ Active Export Total (Q2+Q3) - Phase 1

☐ Active Export Total (Q2+Q3) - Phase 2

☐ Active Export Total (Q2+Q3) - Phase 3

Daily Energy snap capture time

Capture time (hh:mm) 00:00

Read configuration Apply

Click the **Read configuration** button to download the existing configuration from the meter.

Select the energy channels and daily energy snap capture time.

Click **Apply** to update the configuration in the meter.

6.1.12 Configuring event and alarms

The **Event and Alarms** screen allows you to configure events for logging, pulse output and alarm LEDs.

A meter has a number of defined events (to monitor different conditions as voltage related, current related, power quality related and others). For logging purpose, event has to be selected and configured in meter. Select Events checkbox to enable logging of events.

The threshold limits, delays, digital output and alarm LEDs are configurable for the respective event as applicable.

The occurrence and restoration limits are expressed as percentages of configured nominal voltage.

Events are logged if the condition for the detection of an event persists for a specified duration, known as the delay. Events can have a different delay for occurrence and restoration as applicable. The delay for an occurrence as well as for restoration is configurable for respective event as applicable. However some events like power on/off will not have any restoration time because of the nature and type of the event. Similarly some events can have the same condition of event detection as per the nature and type of the event in a given circumstances.

The delay for occurrence and restoration can be set from the drop down list.

At least one event must be selected before saving the configuration.

To open the **Event and Alarms** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Event and Alarms** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Event And Alarms

Event and Alarms Configuration
?

Conditions:	Limit:		Delay (MM:SS):		Digital Output:	Events:	Alarm:	
	Occurrence	Restoration	Occurrence	Restoration			LED1	LED2
Select Condition % %	%	%	00	00		☐	☐	☐
Add/Update		Delete						

Selected Configuration

Condition	Occurence Limit	Restoration Limit	Occurence Delay ...	Restoration Delay...	Digital Output	Event	Alarm LED1	Alarm LED2
Event / Alarm Output								
Missing Voltage phase wise	5 %	10 %	300	300	Config Out...	Yes	Yes	No
Phase wise THD Current	10 %	7 %	300	--	Fixed Outpu...	Yes	No	No
Alarm Output								
Auxiliary Supply Fail	--	--	--	--	--	--	No	Yes
High Active Power	115 %	110 %	300	--	Config Out...	--	No	No
High Harmonic Current	10 %	10 %	300	--	Config Out...	--	No	No
Event								
Current missing phase wise	1 %	10 %	300	300	--	Yes	--	--
Current Open	--	--	300	300	--	Yes	--	--
Current terminal shorting	--	--	300	300	--	Yes	--	--
Feeder Fail(All phases missing)	--	--	300	300	--	Yes	--	--
Invalid Phase Association	--	--	300	300	--	Yes	--	--
Invalid Voltage	60 %	--	300	300	--	Yes	--	--
Power Failure	--	--	300	--	--	Yes	--	--

Notes

If digital outputs is used this must also be configured in the Digital I/O dialog.

Read configuration

Apply

Click the **Read configuration** button to download the existing configuration from the meter.

Select the conditions you wish to include for logging. You can also configure the conditions for digital output and alarm LEDs.

Note:

- Ensure that the Disable I/O Configuration checkbox present on the Digital I/O screen is not selected to configure the digital outputs.
- If digital output and Alarm LEDs are configured, then they must also be configured in the Digital I/O section.

Complete the screen as per your requirements.

Click **Add/Update** to update the selected configuration.

To clear an item from the list, select the item and click **Delete**.

When you have completed event and alarms configuration, click **Apply** to update the configuration in the meter.

6.1.13 Configuring display controls

The **Display Sequences** screen allows you to configure or customise the meter display.

To open the **Display Sequences** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Display Sequences** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Display Sequences

Display section will only be saved if at least one display is added in auto and manual list. Manual display sequences must be configured sequentially.

Display Controls

Configurable Time Delay

Delay for auto return from manual to automatic display cycling sequence 10 (in seconds)

Delay for automatic display cycling sequence 5 (in seconds)

Backlight off duration at end of Automatic display cycling sequence 20 (in seconds)

Display Configuration

Meter Display Language English

Password of "Configuration Menu" at meter display ***** ☐ Show 6 digits (numeric only)

Import/Export With +/- Sign

☐ Enable ☒ Disable

Vector View

☒ 3'o clock ☐ 12'o clock

Read configuration Apply

The Display Sequences screen has a **Display Controls** tab.

It allows you to configure display delays, meter display language, password for Configuration Menu at meter display, +/- sign configuration for import/export and vector view.

Click **Read configuration** button to download the existing configuration from the meter.

Select display delays, meter display language from the drop-down list. Specify six-digit numeric password for configuration menu. Select Show checkbox to see the password.

Select Import/Export with +/- sign as Enable or Disable.

Select Vector View as 3'o clock or 12'o clock.

Click **Apply** to update the configuration in the meter.

6.1.14 Configuring digital I/O

The **Digital I/O** screen allows you to configure pulse input, pulse output and alarm LEDs

If digital I/O configuration is not required, select **Disable I/O Configuration**. By default, **Disable I/O Configuration** is selected.

To open the **Digital I/O** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Digital I/O** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Digital I/O

Input and Output Pin Configuration

Input Output Configuration

I/O Options: 4 Output and 4 Configurable

I/O Type: ☐ Fixed Output ☐ Fixed Input ☐ Configurable Input Output ☒ Alarm LED

Alarm LED: 2

I/O Functions

Function Name: Alarm

Sub Function Name:

Multiplier:

Pulse Length (ms):

Inverted Pulse:

Select Alarm Conditions

If Alarm LED is used this must also be configured in the Event and Alarms section.

Update Clear ☐ Disable I/O Configuration

Selected I/O Configuration

No.	I/O Type	Function	Sub Function	Pulse Length	Inverted
1	Fixed Output	Energy Pulse	ENERGY TYPE :Active Import Total (Q1+Q4), PULSE CONSTANT :2952359 giga	20 ms	No
2	Fixed Output	---	---	---	---
3	Fixed Output	Alarm Outputs	---	---	No
4	Fixed Output	---	---	---	---
1	Configurable Output	Alarm Outputs	---	---	No
2	Configurable Output	Alarm Outputs	---	---	No
3	Configurable Output	Alarm Outputs	---	---	No
4	Configurable	---	---	---	---
1	Alarm LED	Alarm	---	---	---
2	Alarm LED	Alarm	---	---	---

Note

The Outputs are of the solid-state type and when the meter is turned off, they are open.

Read configuration Apply

Click the **Read configuration** button to download the existing configuration from the meter.

Select the I/O Option from the dropdown list.

Note: Refer to the meter rating plate or ordering information for the meter to be configured.

Select the I/O Type as Fixed Output, Configurable Input Output or Alarm LED for input, output and alarm configuration.

Complete the screen as per your requirements.

Note: If Alarm LED is configured, then it must also be configured in the Event and Alarms section.

Click **Update** to update the selected configuration.

To clear an item from the list, select the item and click **Clear**.

When you have completed input and output configuration, click **Apply** to update the configuration in the meter.

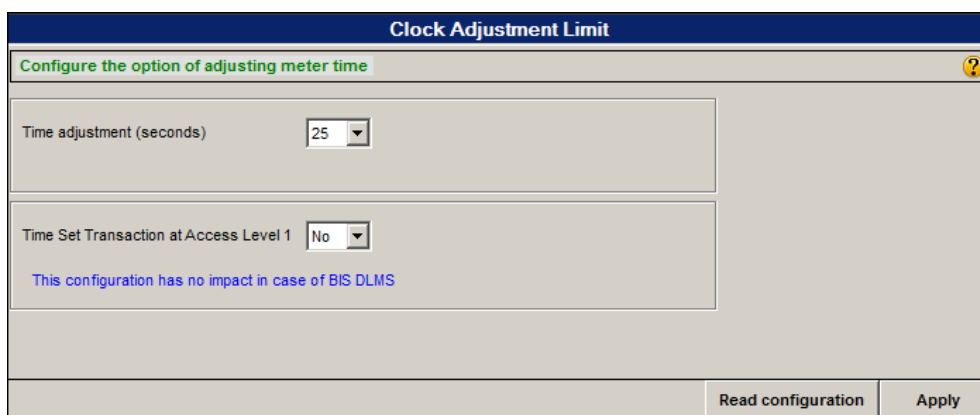
6.1.15 Configuring clock adjustment limit

The **Clock Adjustment Limit** screen allows you to configure time adjustment limit for time sync operation. It also allows you to permit time set transaction at access level 1.

Meter will not sync the time if the time difference is more than the time adjustment limit configured in the meter. The time adjustment limit can be configured as any value between 0 to 30 seconds.

To open the **Clock Adjustment Limit** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Clock Adjustment Limit** from the menu tree. A similar screen shown below will appear in the right-hand pane:



The screenshot shows a web-based configuration interface titled "Clock Adjustment Limit". Below the title bar is a subtitle "Configure the option of adjusting meter time" with a help icon. The main area contains two configuration sections. The first section, "Time adjustment (seconds)", has a dropdown menu currently set to "25". The second section, "Time Set Transaction at Access Level 1", has a dropdown menu currently set to "No". Below this second section is a blue text note: "This configuration has no impact in case of BIS DLMS". At the bottom right of the form are two buttons: "Read configuration" and "Apply".

Click the **Read configuration** button to download the existing configuration from the meter.

Select the time adjustment from the dropdown list.

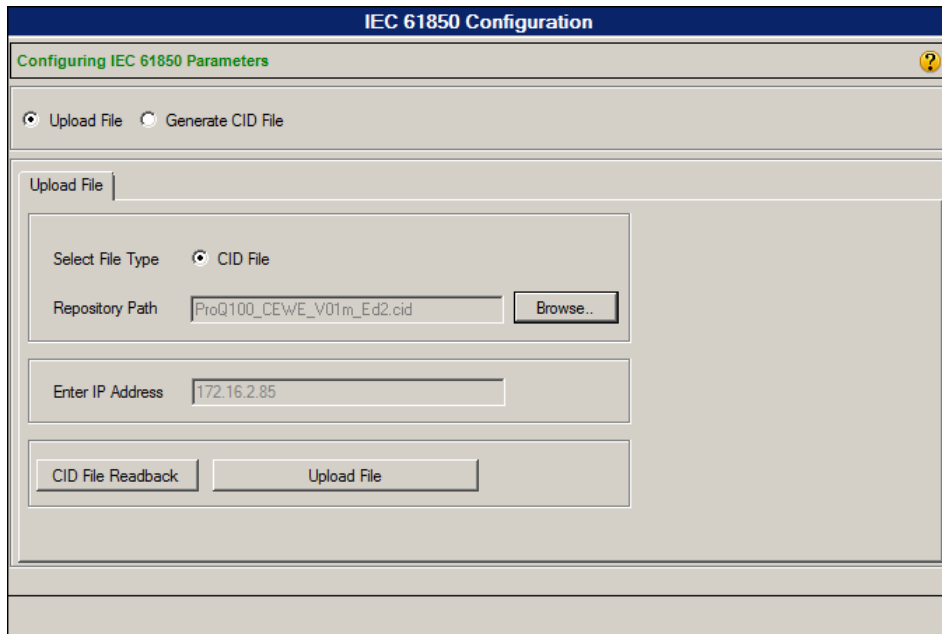
Click **Apply** to update the configuration in the meter.

6.1.16 Configuring IEC 61850

The **IEC 61850 Configuration** screen allows you to upload the CID (Configured IED Description) file for IEC 61850 communication into the meter variants supporting IEC 61850 communication. It also allows you to generate the CID file for IEC 61850 communication.

To open the **IEC 61850 Configuration** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **IEC 61850 Configuration** from the menu tree. A similar screen shown below will appear in the right-hand pane:



The default opening screen is with Upload File option selected.

Select one of the following options:

- Upload File
- Generate CID File

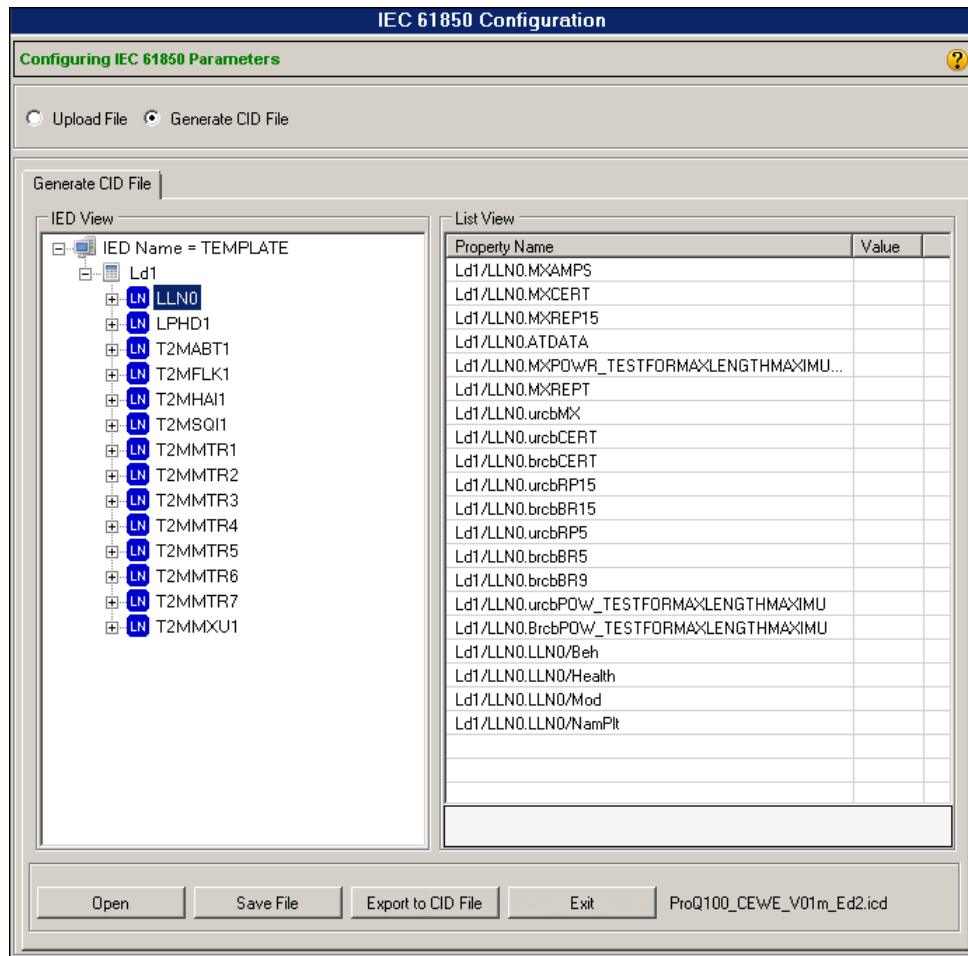
Upload File

Select the File Type and browse the file to be uploaded. You can upload the CID (Configured IED Description) file having '.cid' extension for IEC 61850 communication.

Enter the IP address for IEC 61850 communication and click **Upload File** to upload the file into the meter variant supporting IEC 61850.

Click **CID File Readback** to read the CID file from the meter.

Generate CID File



This option enables you to generate the CID file.

Click **Open** to open the CID or ICD file.

On opening the ICD file, click **Export to CID File** to generate the CID file from the ICD file.

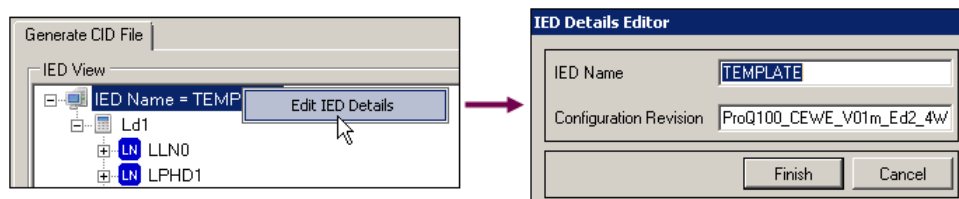
Click **Exit** to go back and open the CID/ICD file.

You can modify the IED details, datasets and reports.

Editing IED details

Select the IED Name in IED View. The details will be displayed in the List View.

Right click the IED Name and click **Edit IED Details** to edit the IED details. The **IED Details Editor** window will appear.



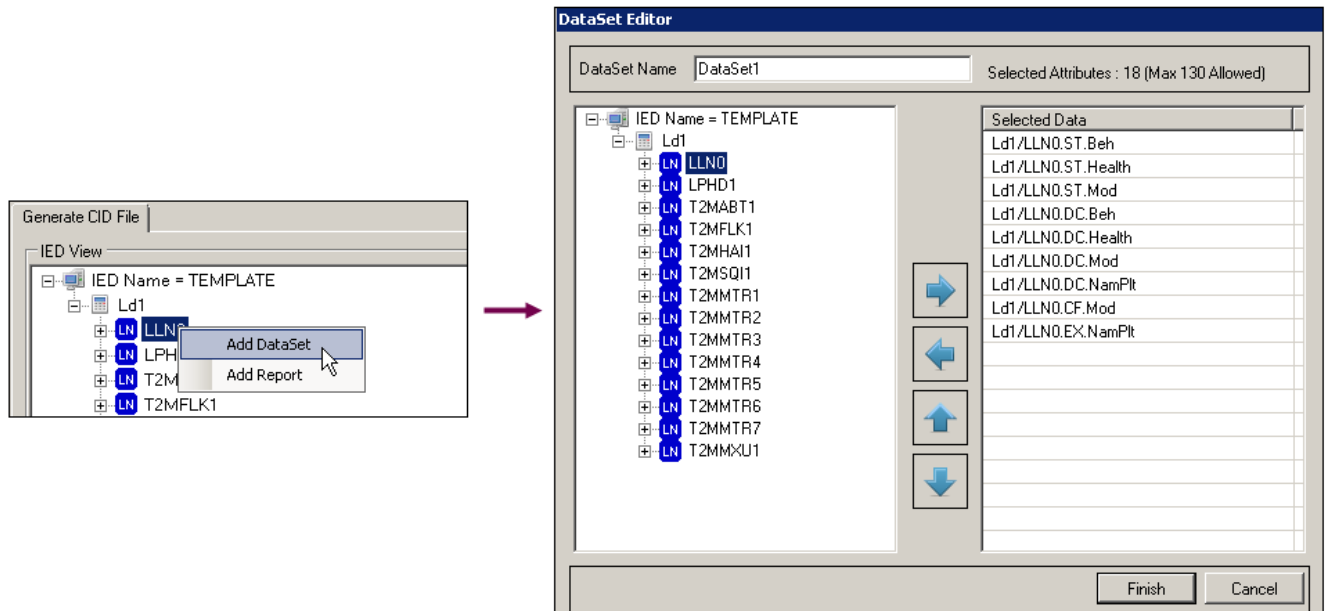
Enter the IED name and configuration revision, and click **Finish** to modify the IED details.

Managing DataSets

You can add, edit or delete a dataset.

To **add a dataset** to a LN node, select the LN node in IED View that you wish to modify. The details of the selected node will be displayed in the List View.

Right click the LN node and click **Add Dataset**. The **DataSet Editor** window will appear.



Enter the DataSet Name and select the attributes from the left-hand pane.

To view attributes in each group, click to expand the tree structure. Select required attributes from left-hand pane and add to the selected data list in the right-hand pane by clicking button.

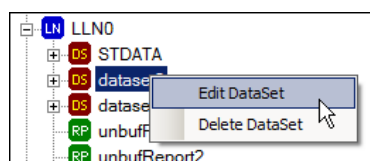
To remove an attribute from the selected data list, select the one you wish to remove and then click button.

You can rearrange the attributes in the selected data list by using or button. To rearrange, select an attribute and then click or button.

You can select a maximum of 136 attributes. Click **Finish** to add a dataset.

To **edit a dataset**, select the dataset in IED View that you wish to modify. The details of the selected node will be displayed in the List View.

Right click the dataset and click **Edit DataSet** to edit the dataset. The **DataSet Editor** window will appear.



Modify the dataset name and attributes. Click **Finish** to modify the dataset.

To **delete a dataset**, select the dataset in IED View that you wish to delete. The details of the selected node will be displayed in the List View.

Note: The dataset associated with a report cannot be deleted.

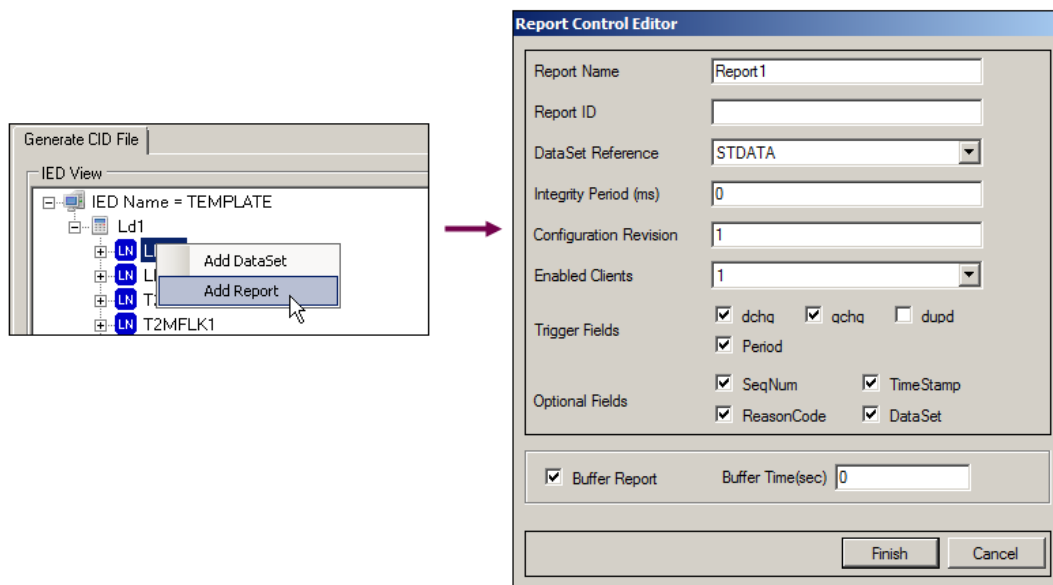
Right click the dataset and click **Delete DataSet** to delete the dataset.

Managing Reports

You can add, edit or delete a report.

To **add a report** to a LN node, select the LN node in IED View that you wish to modify. The details of the selected node will be displayed in the List View.

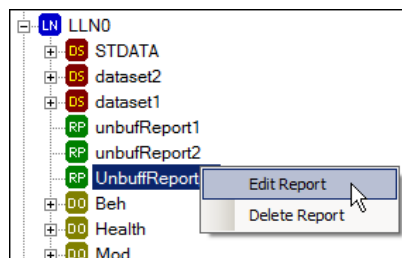
Right click the LN node and click **Add Report**. The **Report Control Editor** window will appear.



Enter the report name, ID, dataset reference, integrity period and configuration revision. Select the trigger and optional fields and buffer report. Click **Finish** to add a report.

To **edit a report**, select the report in IED View that you wish to modify. The details of the selected report will be displayed in the List View.

Right click the report and click **Edit Report** to edit the report. The **Report Control Editor** window will appear.



Modify the report details and click **Finish** to edit the report.

To **delete a report**, select the report in IED View that you wish to delete. The details of the selected report will be displayed in the List View.

Right click the report and click **Delete Report** to delete the report.

Click **Save File** to save the modifications made to the CID/ICD file.

6.1.17 Configuring power quality events

The **Power Quality Event** screen allows you to configure power quality events for logging.

If power quality events are not required, select **Disable PQ Event**.

A meter has a number of defined power quality events to monitor different conditions such as voltage sag, voltage swell, voltage interruption and rapid voltage change. Select Event RMS logger and Event Waveform Logger to enable RMS and waveform logging of power quality events.

The threshold limits and hysteresis are configurable for the respective event as applicable. The occurrence limits are expressed as percentages of configured nominal voltage.

At least one event must be selected before saving the configuration.

To open the **Power Quality Event** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Power Quality Event** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Conditions:	Occurrence Limit Upper	Occurrence Limit Lower	Hysteresis
Rapid voltage change	105.0 %	95.0 %	2.5 %

Sr. No.	Condition	Upper Occurrence...	Lower Occurrence...	Hysteresis Limit
1	Voltage sag, any phase	90	NA	2
2	Voltage swell, any phase	110	NA	2
3	Voltage interruption, any phase	10	NA	2
4	Rapid voltage change	105	95	2.5

Click the **Read configuration** button to download the existing configuration from the meter.

Select the Main Signal Frequency (Hz).

Select the conditions you wish to include for logging.

Note:

- The sum of voltage interruption occurrence limit and hysteresis must be less than the voltage sag occurrence limit.

- Voltage sag and swell event must be configured before configuring the rapid voltage change event.

Complete the screen as per your requirements.

Click **Add/Update** to update the selected configuration.

To clear an item from the list, select the item and click **Delete**.

Select Event RMS Logger to enable RMS logging of power quality events.

Select Event Waveform logger to enable waveform logging of power quality events.

Note:

- At least one event must be selected to enable the Event RMS and Event Waveform logging.

When you have completed power quality event configuration, click **Apply** to update the configuration in the meter.

6.1.18 Configuring power quality EN50160

The **Power Quality EN50160** screen allows you to configure power quality EN50160 reports to meet specific jurisdictional or regional requirements. You can select EN50160 standard for HV, MV and LV; and can also define custom compliance thresholds.

To open the **Power Quality EN50160** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **Power Quality EN50160** from the menu tree. A similar screen shown below will appear in the right-hand pane:

Power Quality EN50160

Power Quality EN50160 section configuration

☒ PQ Report
 Report Selection
 Report Type: EN50160HV Week Start Day: Monday
 Report Name: EN50160Report

	Monitoring Period	Min	Max		Measuring Period	Acceptance	
Frequency Condition1	Of Year	-1	1 %		10 sec	99.5	% of Time
Frequency Condition2	Of Time	-6	4 %		10 sec	100	% of Time
Voltage Condition1	Of Week	-10	10 %		10 min	99	% of Time
Voltage Condition2	Of Week	-15	15 %		10 min	100	% of Time
Flicker	Of Week		1 %		120 min	95	% of Time
Voltage Unbalance	Of Week		2 %		10 min	95	% of Time
Voltage THD	Of Week		8 %		10 min	95	% of Time
Main Signaling Voltage	1 Day		9 %		3 sec	99	% of Time

Individual Harmonic Configuration
 Select Harmonic Order:

	Harmonic Order	Relative Amplitude In %
▶	2	1.9
	3	3
	4	1
	5	5
	6	0.5
	7	4
	8	0.5
	9	1.3
	10	0.5
	11	3
	12	0.5
	13	2.5
	14	0.5
	15	0.5
	16	0.5
	17	2

Notes
 1. To save configuration of this section, user must have to select week start day.
 2. Default value will be save in case of blanked in editable control when user want to save configuration.

Read configuration Apply

Click the **Read configuration** button to download the existing configuration from the meter.

Select the PQ Report, Report Type, Report Name and Week Start Day. Week Start Day must be selected before saving the configuration.

You can set the thresholds for power quality events and individual harmonic configuration for custom report.

You can set only the Main Signaling Voltage threshold for EN50160LV, EN50160MV and EN50160HV reports.

Note: While saving the configuration, the blank fields will be set as default values.

When you have completed power quality EN50160 configuration, click **Apply** to update the configuration in the meter.

6.1.19 Configuring IEEE 519

The **IEEE 519 Configuration** screen allows you to configure IEEE 519 report to meet specific requirements for harmonic control in electrical power system.

If IEEE 519 configuration is not required, select **Disable IEEE 519 in meter**.

To open the **IEEE 519 Configuration** screen,

On the left-hand pane, expand the menu structure (if necessary) and select **IEEE 519 Configuration** from the menu tree. A similar screen shown below will appear in the right-hand pane:

IEEE 519 Configuration

☐ Disable IEEE 519 in meter

☐ IEEE 519 Configuration

Week Start Day: Monday

Max Short Circuit Current (ISC): 100 Amps

Max Demand Load Current (IL): 100 Amps

Method of Max Demand Load Current (IL) Computation: Calculated from last 12 billings

Energy Flow Direction for Compliance: Import

Notes:

1. Meter will use user defined IL value for first billing period irrespective of selected IL computation method.
2. Second billing onwards, meter will use IL value based on selected IL computation method.
3. If energy flow direction configured here differs from energy flow direction of meter, then compliance calculation will be ignored for that duration.

Read configuration Apply

Click the **Read configuration** button to download the existing configuration from the meter.

Select Week Start Day to configure the start day of the week.

Enter Max Short Circuit Current at point of common coupling (ISC) and Max Demand Load Current (IL) in Ampere.

Select the Method of Maximum Demand Load Current (IL) Computation from the drop-down list. The available methods are 'Calculated from last 12 billings' and 'User defined IL'.

Note:

- Meter will use user-defined IL value for first billing period irrespective of selected IL computation method.
- Second billing onwards, meter will use IL value based on selected IL computation method.
- For first 12 billing periods, average of available months' IL will be considered for IL computation.

Select Energy Flow Direction for Compliance as Import or Export.

Note: In case energy flow direction configured in the meter for IEEE 519 differs from actual energy flow direction in the system, the compliance calculation will be ignored for that duration.

When you have completed IEEE 519 configuration, click **Apply** to update the configuration in the meter.

7 Functions

This section provides an overview of the functions available in ProQ 100. All functions in the meter can be both configured and read in ConfigView. In many cases, ConfigView can also export data to a file or print out data.

7.1 Meter clock

The ProQ 100 has an integrated real-time clock for time-dependent functions. Information about time adjustment and daylight saving time status is recorded with tags on the logged values (refer to the section Loggers on page 78). Time set is also noted as an event in the event log; see *the section* Display of events (pg. 85).

One battery with life of 15 years (including 5 years shelf life) is provided as a backup source for the RTC, inside the meter.

7.1.1 Time set

The meter's date and time can be set to an absolute point in time. Instantaneous adjustment of the meter's time can influence logged values. For this reason, instantaneous adjustment of the meter clock is primarily intended for use at initial configuration of the meter.

7.1.2 Daylight saving time

ProQ 100 offers the alternative of letting the meter clock follow daylight savings time. At a specified date, the meter clock is adjusted forward, and at another, adjusted back to normal time. The meter can store a maximum of 25 DST dates.

Example: On 28 March the clock is to be adjusted forward, from 02:00 to 03:00. The adjustment back to standard time is to occur on 31 October at 3:00 (daylight savings time) when the clock is to be set back to 02:00. The following is set in the meter: Begin March, 28, 02:00. End October, 31, 03:00 and the standard time is to be adjusted by 60 minutes.

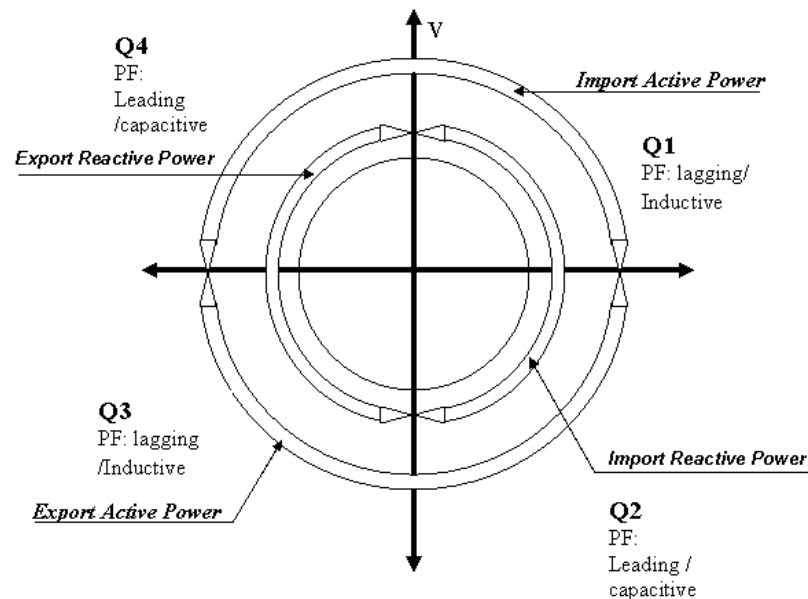
7.1.3 External synchronisation

ProQ 100 supports time sync through SNTP (Ethernet communication) protocol. Time sync through SNTP is considered most suitable method in revenue as well as power quality application.

You can enable network time synchronisation and configure SNTP time synchronisation settings using ConfigView by specifying the SNTP Server IP Address and selecting the Time Sync Interval (in hours) to specify the frequency with which the meter synchronises over SNTP.

7.2 Support for different types of energy

ProQ 100 meter is used for feeder based applications where energy may flow in both the directions. ProQ 100 is an Import Export type meter; its metering unit is capable of logging energy in both directions.



Quadrants	Phase angle	Current relative to voltage
I	0 to 90°	Lagging
II	90 to 180°	Leading
III	-180 to -90° or 180 to 270°	Lagging
IV	-90 to 0° or 270 to 360°	Leading

ProQ 100 supports different tariff structures and number of Energy types (refer to Table 2). Any combination of energy types can be provided as per the specification agreed at the time of order.

The energy channel registers are shown below:

S. No.	Parameters	Instantaneous	Billing	TOD MD / UMD	TOD Rate	Daily Energy	Logger 1	Logger 2
1	Active Import Total (Q1+Q4)	Y	Y	Y	Y	Y	Y	Y
2	Active Export Total (Q2+Q3)	Y	Y	Y	Y	Y	Y	Y
3	Active Import Fundamental (without harmonics) (Q1+Q4)	Y	Y	Y	Y	Y	Y	Y
4	Active Export Fundamental (without harmonics) (Q2+Q3)	Y	Y	Y	Y	Y	Y	Y

5	Reactive Import while Active Import – Q1	Y	Y	Y	Y	Y	Y	Y
6	Reactive Import while Active Export – Q2	Y	Y	Y	Y	Y	Y	Y
7	Reactive Export while Active Export – Q3	Y	Y	Y	Y	Y	Y	Y
8	Reactive Export while Active Import – Q4	Y	Y	Y	Y	Y	Y	Y
9	Apparent – While Active Import (See Note 2)	Y	Y	Y	Y	Y	Y	Y
10	Apparent – While Active Export (See Note 2)	Y	Y	Y	Y	Y	Y	Y
11	Reactive Import (Q1+Q2)	Y	Y	Y	Y	Y	Y	Y
12	Reactive Export (Q3+Q4)	Y	Y	Y	Y	Y	Y	Y
13	Reactive Inductive (Q1+Q3)	Y	Y	Y	Y	Y	Y	Y
14	Reactive Capacitive (Q2+Q4)	Y	Y	Y	Y	Y	Y	Y
15	Net Active (Imp – Exp) *	Y	Y	N	N	Y	Y	Y
16	Net Reactive (Q1+Q2-Q3-Q4) *	Y	Y	N	N	Y	Y	Y
17	Net reactive High*	Y	Y	N	N	Y	Y	Y
18	Net reactive Low*	Y	Y	N	N	Y	Y	Y
19	Reactive High Import	Y	Y	N	N	Y	Y	Y
20	Reactive Low Import	Y	Y	N	N	Y	Y	Y
21	Reactive High Export	Y	Y	N	N	Y	Y	Y
22	Reactive Low Export	Y	Y	N	N	Y	Y	Y
23	Active Import Total (Q1+Q4) - Phase 1	Y	Y	N	N	Y	Y	Y
24	Active Import Total (Q1+Q4) - Phase 2	Y	Y	N	N	Y	Y	Y

25	Active Import Total (Q1+Q4) - Phase 3	Y	Y	N	N	Y	Y	Y
26	Active Export Total (Q2+Q3) - Phase 1	Y	Y	N	N	Y	Y	Y
27	Active Export Total (Q2+Q3) - Phase 2	Y	Y	N	N	Y	Y	Y
28	Active Export Total (Q2+Q3) - Phase 3	Y	Y	N	N	Y	Y	Y

Table 2: Energy channel registers

The pre-defined energy channels can be configured for display, billing, TOU, MD, logger and daily energy in line with purchase order requirements at the time of order.

Notes:

- 1) All the bi-directional energy registers (* marked) will have sign indication ('-' sign will be available for negative value and no sign for positive value). The sign indication for import/export can be configured using Setup page on the meter display.
- 2) In 'Apparent' and 'Net Active' energy calculation, 'Active' energy can be either 'fundamental' or 'total'. This can be configured through ConfigView. Both energies need to be of same type.
- 3) Single phase measurements (23-28) are supported by the 4 wire configuration.
- 4) Apparent energy while active import and Apparent energy while active export can be configured as Lag only or Lag + Lead.

For energy types 1-16:

These registers are continuously increased depending on the selected energy.

Example: Main Energy Register kWh (I) will show the total imported active energy logged till date.

Recording of all supported energy types is possible but only those energy types are logged into the memory which is specified by the configuration file. An individual register is provided for all selected energy types. These registers are called Main Energy Registers. Whenever an individual energy type is generated / consumed, its value is updated in the corresponding main energy register. These registers can be reset by unlocking the meter at level 5.

For energy types 17-22:

Reactive high and reactive low energies are mainly used for Availability Based Tariff (ABT) application for maintaining the grid frequency discipline.

Reactive high and reactive low energies are special registers, which can increment based on voltage and reactive load conditions.

The reactive high and reactive low registers increment only when certain voltage conditions are met and based on these, one or none of these may increment at any particular point of time. The voltage conditions are two

average voltage levels V_{lowthres} (low threshold voltage) and $V_{\text{highthres}}$ (high threshold voltage). If average voltage falls below V_{lowthres} , then reactive low register is incremented. Similarly if average voltage is above $V_{\text{highthres}}$, then reactive high register is incremented. If average voltage is between V_{lowthres} and $V_{\text{highthres}}$, then none of reactive high or reactive low register is incremented. By default the average voltage levels are set to 97% for V_{lowthres} and 103% for $V_{\text{highthres}}$.

If low voltage is detected, then none of reactive high or reactive low register is incremented. By default the low voltage limit is set to 60% and hysteresis for low voltage is set to 3%.

Hysteresis means that the limit for a state and the limit for when it is restored are different. This is to avoid several states being registered when the voltage level varies around a limit. The hysteresis limit is always midway between the low limit and nominal voltage.

For example, if the low voltage limit is 60% and hysteresis is 3% then the low voltage event occurs when any phase voltage falls below 60% and restores when the phase voltage becomes 63%.

Recording of all supported energy types is possible but only those energy types are logged into the memory which is specified by the tariff file. An individual register is provided for all selected energy types. These registers are called Main Energy Registers. Whenever an individual energy type is generated / consumed, its value is updated in the corresponding main energy register.

7.3 Instant values

Besides energy, the ProQ 100 can also measure instant values. Instant values are constantly changing values such as current, voltage, power and harmonics. The instant values are updated every second. The formulas and definitions used to calculate the values are presented in Appendix E: Calculation Principles on page 103.

7.3.1 Overview

This table provides an overview of the instant values that can be read on the meter. Readings can be viewed with ConfigView, on the display and with other software that has implemented ProQ 100's communication protocol. Most instant values can be logged; for more information, see section Loggers on page 78.

Instant value	Available on 3-element, wire type (3P4W) meter	Available on 2-element, wire type (3P3W) meter
Real Time Clock – Date and Time	Yes	Yes
Phase Voltage	Yes (L1, L2, L3, Average)	No
Line Voltage (L12, L23, L31, Average)	Yes	Yes
Line Current	Yes (L1, L2, L3, Average)	Yes (L1, L3, Average)
Phase angle (L12, L23, L31)	Yes	Yes
Current Phase angle	Yes (L1, L2, L3)	Yes (L1, L3)
Active power total	Yes	Yes
Active power per phase	Yes	Yes (L1, L3)

Reactive power total	Yes	Yes
Reactive power per phase	Yes	Yes (L1, L3)
Apparent power total	Yes	Yes
Apparent power per phase	Yes	Yes (L1, L3)
Power factor total	Yes	Yes
Power factor per phase	Yes	No
Frequency	Yes	Yes
THD voltage per phase	Yes	No
THD current per phase	Yes	No
Phase voltage RMS	Yes (L1, L2, L3, Average)	No
Line voltage RMS (L12, L23, L31, Average)	Yes	Yes
Line current RMS	Yes (L1, L2, L3, Average)	Yes (L1, L3, Average)
Flicker Pst	Yes (L1, L2, L3)	Yes (L12, L23)
Flicker Plt	Yes (L1, L2, L3)	Yes (L12, L23)
Voltage under deviation	Yes (L1, L2, L3)	Yes (L12, L23)
Voltage over deviation	Yes (L1, L2, L3)	Yes (L12, L23)
Main signalling voltage	Yes (L1, L2, L3)	Yes (L12, L23)
PQ voltage unbalance	Yes	Yes
Voltage harmonics	Yes (L1, L2, L3)	Yes (L12, L23)
Current harmonics	Yes (L1, L2, L3)	Yes (L12, L23)
Voltage inter harmonics	Yes (L1, L2, L3)	Yes (L12, L23)
Current inter harmonics	Yes (L1, L2, L3)	Yes (L12, L23)

7.3.2 Prefix for units in the display

The presentation for units and the number of decimals depends on the CT/VT ratio (primary current and voltage value).

7.4 Daily energy snapshot

Energy Snapshot feature saves the value of a particular energy register at a particular time. ProQ 100 stores a snapshot of different energy registers (can be up to 28 energies) on a daily basis at predefined time as selected from tariff configuration (generally it is set at midnight). Snap shots can be stored for a maximum of 65 days. The updating of Energy Snap shot records is done in a rollover fashion, i.e. each day a new energy snapshot is stored in the memory and the earliest record is deleted. So at any time a meter will have energy snapshot records for the last 65 days.

7.5 Digital inputs and outputs

The ProQ 100 has several inputs and outputs that can be configured to perform various tasks. Both inputs and outputs are protected against overvoltages by varistors. They also have an isolated interface between the electronics and the surroundings to ensure personal safety. For electrical data on the meter's inputs and outputs, see Appendix F: Connection and general details (page 112).

7.5.1 Inputs

The inputs can be configured as follows:

- **Not used**

The input is not used.

- **Pulse input**

To register pulses from pulse-producing units such as energy meters or water meters, pulse inputs are used. Incoming pulses are accumulated in registers called external registers. There is an external register connected to each input on the meter.

7.5.1.1 Registration of pulses

A pulse must be at least 200 ms long to be guaranteed of being detected by the meter. In absence of power supply, the input pulses will not be detected.

7.5.2 Outputs

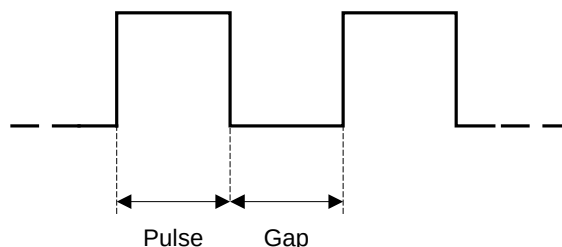
The outputs can be configured as follows:

- **Not used**

The output is not used.

- **Energy pulse**

The output is used to pulse an energy type that the meter is measuring. A multiplier is specified for the output as pulses/unit and the pulse length at the supply frequency is specified for all pulse outputs. The pulse length at the supply frequency (50 Hz or 60 Hz) can be configured between 20 ms and 1000 ms.



Maximum pulse frequency at outputs is limited so that the gap is at least as long as the pulse length.

- **Long pulse**

The output is used to generate long pulse whose length is between 2 seconds and 15 seconds. By default, the pulse length is set as 10 seconds. The long pulse output is used for the following functions:

- o End of MD period

On switching the MD registers, the output generates a long pulse.

- o End of rate period

On switching the Rate registers, the output generates a long pulse.

- o Billing action start

On performing billing action, the output generates a long pulse.

- o Demand integration period start

At the start of a set demand integration period, the output will go active for the configured pulse length before returning to the inactive state. See the section Maximum demand (pg. 86).

- o Logger 1 integration period start

At the start of a set logger 1 integration period, the output will go active for the configured pulse length before returning to the inactive state.

- **Remote control**

With this function, the output can be made active or inactive by sending commands to the meter via the DLMS protocol. This function can be used to control anything that can be controlled with a digital relay output.

- **State output**

- o MD register

With this function, the output remains active or inactive for the time zones during which the selected MD registers are activated.

- o Rate register

With this function, the output remains active or inactive for the time zones during which the selected Rate registers are activated.

- o Alarm output

When an output is set to function as an alarm output, one of the user-defined alarms can be chosen to indicate at the output. When an alarm occurs, the output switches to active, and when the alarm state ceases, the output returns to inactive. In the section Alarms (pg. 82), user-defined alarms are described and how they can be configured.

Pulse output used for system status alarm will have certain life expectancy as it will be used in inverted logic.

Note that the outputs are inverted via firmware. If the meter loses its auxiliary power, the relay will open, regardless of it is inverted or not.

7.5.2.1 Output states

An active output means a closed relay when the output is not inverted. When the output is inverted, the active relay is open. The ProQ 100 outputs are of the solid-state type and **when the meter is turned off, they are open.**

7.6 Communications and security

ProQ 100 have optical port, RS232, RS485, two Ethernet ports and USB port (micro B connector) for communication.

Communication channel	Default / Max supported baud rate	Supported protocol	Usage
Optical port (common port for IEC 1107 and ANSI)	300 / 9600 bps	DLMS Sign ON	Local meter reading and configuration
RS485 (RJ-45 in & out)	9600 / 57600 bps	DLMS, Modbus RTU	Meter reading, online monitoring, third party interface
RS232	9600 / 57600 bps	DLMS	Remote meter reading through external modem and configuration
Ethernet port	10 / 100 Mbps	Modbus TCP (port no.: 502) DLMS TCP (port no.: 4059)	Meter reading, configuration, online monitoring, third party interface Both the Ethernet ports can be used for IEC 61850 (if supported) network.
Ethernet port (User selectable SFP module)	Depends on module (e.g. 10/100/1000 Mbps)	Modbus TCP (port no.: 502) DLMS TCP (port no.: 4059)	Meter reading, online monitoring, third party interface Both the Ethernet ports can be used for IEC 61850 (if supported) network.
USB (micro B connector)	Not applicable	DLMS	Local meter reading and configuration

Note:

- For more information on protocol support, refer to the ProQ 100 technical reference guides for DLMS, Modbus and IEC 61850.
- Both the Ethernet ports must be connected on different subnet.

7.6.1 Communication speed

The meter's optical port always starts with a baud rate of 300 bps, regardless of what is configured, before shifting over to the specified communication speed. This means that software (for example, ConfigView) that communicates with the meter via the optical port does not need to know the speed that the meter's optical port is set to. RS232 and RS485 communication ports differ in this respect. They start at the specified baud rate from the beginning, which means that connected software must be aware of the speed to be able to communicate. The configured protocol and baud rate for the communication ports can be viewed on the meter display under page Setup -> 'Communication settings'.

7.6.1.1 Embedded web server

The built-in web pages display energy and power quality information.

7.6.1.2 FTP for IEC 61850

The meter can function as an FTP server, supporting IEC 61850 communication.

7.6.2 Security

The meter has five authorisation levels that can limit access to the meter during communication via any of the meter's communication ports. Authorisation levels are password-protected.

Authorisation levels

- 1 Provides access to reading.
- 2 Provides access to everything in level 1 plus access to set the clock and reset maximum demand values.
- 3 Provides access to everything in level 2 plus access to configure the meter, CT/VT ratio and linear transformer correction; and change password for levels 1, 2 and 3
- 4 Provides access to everything in level 3 plus access to non-linear transformer correction, calibrate the meter, change password for levels 3 and 4. upgrade application firmware in the meter

Refer to ConfigView help for information on upgrading application firmware.
- 5 Provides access to reset passwords for levels 1 to 4. By default, Level 5 password is not provided to user due to security reasons and is provided on demand (contact technical support team for level 5 password for meter, if required). Level 5 password is linked to the customer ID and meter serial number and is in form of an encrypted file known as Key Data File (KDF).

7.6.2.1 Limitation of total access attempts

The meter limits the total number of access attempts to seven when incorrect passwords are entered. At the eighth attempt, the meter blocks access whether the password is correct or not. The block is in effect until the next hour shift. After that, new password attempts may be made. This is in line with Code of Practice (Balancing and settlement code).

7.6.2.2 Passwords

A password must be 16 characters long.

If the setting 'Is COP5 Enabled' is activated, a new password can be a combination of alphanumeric and underscore characters. The password can have a minimum of 6 characters and a maximum of 12 characters.

7.6.2.3 Access restriction for measurement configuration

Generally the meter allows to be reconfigured at access level 3. This function requires level 4 for measuring configuration.

7.7 Loggers

The ProQ 100 has two identical, parallel and individually configurable time based loggers; and one logger for daily energy snapshot.

7.7.1 Overview

A logger in a ProQ 100 can log values for instant quantities, energy registers, external registers and individual harmonic parameters. Some quantities can be logged both by phase and as total values for all three phases, others only as total values. The below table provides an overview of quantities that can be logged. Certain instant values in the table are not available in 2-element, wire type (3P3W) meters and thus cannot be logged; see the section Instant values (pg. 72). Logger Parameters can be read as profile data and SIP wise.

Quantity	Computation Method
Real Time Clock – Date and Time	Instant
Active Import Total (Q1+Q4)	Consumption
Active Export Total (Q2+Q3)	Consumption
Active Import Fundamental (Q1+Q4)	Consumption
Active Export Fundamental (Q2+Q3)	Consumption
Reactive Import while Active Import – Q1	Consumption
Reactive Import while Active Export – Q2	Consumption
Reactive Export while Active Export – Q3	Consumption
Reactive Export while Active Import – Q4	Consumption
Apparent – While Active Import	Consumption
Apparent – While Active Export	Consumption

Reactive Import (Q1+Q2)	Consumption
Reactive Export (Q3+Q4)	Consumption
Reactive Inductive (Q1+Q3)	Consumption
Reactive Capacitive (Q2+Q4)	Consumption
Net Active (Imp – Exp)*	Consumption
Net Reactive (Q1+Q2-Q3-Q4)*	Consumption
Reactive High Import	Consumption
Reactive Low Import	Consumption
Reactive High Export	Consumption
Reactive Low Export	Consumption
Net Reactive High	Consumption
Net Reactive Low	Consumption
Active Import Total (Q1+Q4) - Phase 1	Consumption
Active Import Total (Q1+Q4) - Phase 2	Consumption
Active Import Total (Q1+Q4) - Phase 3	Consumption
Active Export Total (Q2+Q3) - Phase 1	Consumption
Active Export Total (Q2+Q3) - Phase 2	Consumption
Active Export Total (Q2+Q3) - Phase 3	Consumption
Phase Voltage - Phase wise, All phases	Min / Max / Avg / Instant
Line Voltage - Phase wise, All phases	Min / Max / Avg / Instant
Line Current - Phase wise, All phases	Min / Max / Avg / Instant
Active Power Total - Phase wise, All phases	Min / Max / Instant
Reactive Power - Phase wise, All phases	Min / Max / Instant
Apparent Power - Phase wise, All phases	Min / Max / Instant
Power Factor - Phase wise, All phases	Min / Max / Instant
THD Voltage (%) - Phase wise, All phases	Min / Max / Avg / Instant
THD Current (%) - Phase wise, All phases	Min / Max / Avg / Instant
THD Power (%) - Phase wise, All phases	Min / Max / Avg / Instant
Frequency	Min / Max / Avg / Instant
Voltage Phase Angle	Min / Max / Avg / Instant
Current Phase Angle (Voltage Current Angle)	Min / Max / Avg / Instant
Voltage Harmonics - Phase wise, All phases (up to 50 th order)	Min / Max / Avg / Instant
Voltage Inter Harmonics - Phase wise, All phases (up to 50 th order)	Min / Max / Avg / Instant

Current Harmonics - Phase wise, All phases (up to 50 th order)	Min / Max / Avg / Instant
Current Inter Harmonics - Phase wise, All phases (up to 50 th order)	Min / Max / Avg / Instant
Pulse Input Counter (1 to 4)	Instant
Status Flag (Low voltage, Power loss, VT miss, DST applied, Current reversal, Load survey parameters changed, Alarm on, SIP incomplete, Time adjust and Data invalid)	Flag

Energy is logged as consumption (Delta value). Instantaneous values can be logged as average, maximum, minimum and instant value during the logging interval or as the instantaneous value at the end of the logging interval. Maximums and minimums are detected based on interval snapshots, and average is calculated based on interval snapshots. The meter can measure up to 50th harmonics.

Notes:

- Maximum 150 parameters can be selected including both logger 1 and logger 2.
- Pulse input must be configured through ConfigView.
- In case of bidirectional parameter, the Min/Max is calculated based on arithmetic logic.

7.7.2 Logging interval and total channels

A logger can store data in 1 to 100 channels. The logging interval is common for all channels in a logger and it can be configured from one minute up to one hour. The maximum number of logging days will be displayed. When the logger is full, the oldest values will be written over. The below tables show the capacity in number of days before the oldest value is written over.

In case of program 0.25.x, the logger supports the following logging days depending on the logging interval.

Integration period (in minutes)	Number of days (irrespective of number of parameters selected)
1	10
2	20
3	30
4	40
5	50
10	100
15	150
20	200
30	300
60	600

In case of program 0.26.x and onwards, the logger supports the following logging days depending on the logging interval and number of parameters.

Parameters	Integration period (in minutes)										
	1	2	3	4	5	10	15	20	30	60	
	≤ 25	30	60	90	120	150	300	450	600	900	1000
	26 to 50	20	40	60	80	100	200	300	400	600	800
	51 to 100	10	20	30	40	50	100	150	200	300	600

Notes:

- Survey Integration Period (SIP) for Instantaneous and energy parameters can be configured as 1, 2, 3, 4, 5, 10, 15, 20, 30 or 60 minutes.

7.7.3 Storage of logged values

Logged values are saved with time stamps and flags that indicate events that have occurred during the logging interval.

- The time stamp indicates the end-time. If the logging interval is configured to one hour, a value with the time stamp 15:00 refers to the period 14:00 to 15:00.
- To indicate events or states during an interval, a logged value can be stored with one or more flags.

S.No.	Event or state	Explanation
1	Incomplete SIP	The past interval is incomplete. For example, an interval shortened by the meter being without auxiliary power or if the logging memory has been reset. The first value after the logging memory having been configured will thus always be indicated with 'Faulty value' (the logging memory is reset in conjunction with reconfiguration).
2	Time adjust	During the past interval, the meter clock has been adjusted by performing time set.
3	Daylight savings time applied	Daylight saving time has been in effect during the past interval.
4	Invalid data	Missing SIP
5	Alarm ON	In conjunction with user-defined alarms being configured, it may be specified that an alarm will also be indicated with logged values. When a user-defined alarm has triggered during the past interval, this is indicated with the flag 'Alarm'.
6	Load survey parameter changed	Changes in logger's parameter or CT/VT ratio
7	Current reversal	During the past interval measuring current direction detected as reverse (if configured as event)
8	VT miss	During the past interval VT missing is detected (if configured as event)

9	Power loss	During the past interval, the meter has been powered off (irrespective of event configured)
10	Low voltage	During the past interval measuring voltage has been low (if configured as event)

For several of the flags, additional information can be viewed in the event log. A more exact time for events is specified in the log.

7.8 Alarms

The ProQ 100 is equipped with alarms to be able to indicate when measured quantities are over or under a threshold limit value. The meter enters the alarm state when the limit value is reached. An alarm is generated only after the alarm state has continued for a configurable time (delay). Alarms are configurable by the user using ConfigView and are therefore called user-defined alarms.

Note: For more information, see the section Display of events (pg. 85).

7.8.1 Overview

For most user-defined alarms, the limit value is specified as a percentage of the nominal value, which is the configured, nominal primary value (current, voltage or power). For 3-element wire type 3P4W meters, the limit value corresponds to phase voltage, and for 2-element wire type 3P3W meters, phase to phase voltage. The following table provides an overview of available alarms.

Alarm/Event	Description and occurrence condition
Alarm output	
Auxiliary supply fail	Any auxiliary supply fails
High active power	System active power is above limit value. High active power is detected if 3-phase system active power value exceeds the configured limit (percentage of nominal power).
High harmonic current	Any phase current individual harmonics value (2 nd to 50 th) exceeds the configured limit (percentage of I_{basic}). The meter will scan 2 nd to 50 th harmonic values at every second.
High harmonic voltage	Any phase voltage individual harmonics value (2 nd to 50 th) is above the configured limit (percentage of $V_{nominal}$) value. The meter will scan 2 nd to 50 th harmonic values at every second.
High THD power	High THD power is detected if any THD power value exceeds the configured threshold (% THD power). Average value of THD for all power phases exceeds the limit value.

Low active power	System active power is below limit value. Low active power is detected if 3-phase system active power value is below the configured limit (percentage of nominal power).
Event	
Current missing phase wise	Current missing is detected if the current is below a specified threshold (it is set as 1% of I_{basic} for occurrence and 10% of I_{basic} for restoration). Precondition is that the phase voltage should be above specified threshold (5% of $V_{nominal}$) in case of occurrence.
Current open	If current is applied to the load but current terminal inside the meter body is disconnected then, meter will detect and log 'Current open' in meter's memory. For this condition voltages and current reverse condition shall be healthy. This is supported only for HV4 meter.
Current terminal shorting	Meter will detect and log shorting on each current if bypass current is greater than the defined threshold (neutral current). For this condition voltages and current reverse condition shall be healthy. This is supported only for HV4 meter.
Feeder fail (all phases missing)	This event will be logged when feeder supply, i.e. all the voltages goes below certain threshold. By default thresholds are 20% of $V_{nominal}$. Event will be restored when any of the voltages goes above certain threshold. By default this threshold is 50% of $V_{nominal}$. No snapshot will be logged with this event.
Invalid phase association	Meter will detect invalid phase association when the phase sequence of current and voltage is not same. Voltage angle with respect to locked phase is calculated. And current angle is calculated with respect to the phase at which the voltage is locked. Invalid Phase Association is locked when sequence does not match. This is supported only for HV4 meter.
Invalid voltage	Meter will detect invalid voltage provided the voltage is above a specified threshold (60% of $V_{nominal}$). The voltage angles between any two phases at that stage should $0^\circ \pm 10^\circ$. The angle between any two voltages will be used to detect an invalid voltage.
Power failure	Meter will detect power failure if both the auxiliary supply fails. The event shall be recorded on the next power up. At the same time power on event will be recorded. No snapshot shall be logged with this event. Power failure shall be logged based on occurrence delay and power on shall be logged immediately after power on.

Event/Alarm output	
Current unbalance	Current unbalance is detected if current deviation exceeds the configured limit (by default, it is set as percentage of I_{basic} and can be configured as percentage of $I_{average}$ depending on the requirement). Current deviation is the difference between any line current and basic current (I_{basic}). Precondition is that current open, current terminal shorting, missing voltage phase wise and invalid voltage should not persists in meter. Alarm can be configured for current unbalance event. Occurred condition is treated as alarm condition.
Low power factor	System power factor is below limit value. Low power factor is detected if 3-phase average power factor value falls to the configured limit.
Missing voltage phase wise or Any phase VT miss or Current without voltage	Missing voltage phase wise is detected if any phase voltage value is below the configured threshold (percentage of $V_{nominal}$). Precondition is that respective line current should be above predefined limits (default limit is 10% of I_{basic}). Alarm can be configured for VT miss event (any phase). Occurred condition (any phase) is treated as alarm condition.
Over voltage	Over Voltage is detected if any phase voltage value exceeds the configured limit (percentage of $V_{nominal}$). Alarm can be configured for over voltage event. Occurred condition is treated as alarm condition.
Phase wise THD current (High THD current)	High THD current is detected if any THD current value exceeds the configured threshold (% THD current). Alarm can be configured for current THD event. Occurred condition is treated as alarm condition.
Phase wise THD voltage (High THD voltage)	High THD voltage is detected if any phase THD voltage value exceeds the configured threshold (% THD voltage). Alarm can be configured for voltage THD event. Occurred condition is treated as alarm condition.
Reverse current direction	Reverse current is detected if current direction is reversed or the phase angle for a phase deviates by more than 90 degrees from another phase. Precondition is that respective phase voltage should be healthy. Alarm can be configured for CT reverse event (any phase). Occurred condition (any phase) is treated as alarm condition.

Under voltage	Under voltage is detected if any phase voltage value is below the configured limit (percentage of V_{nominal}). Precondition is that missing voltage phase wise should not persists in meter. Alarm can be configured for under voltage event. Occurred condition is treated as alarm condition.
Voltage unbalance	Voltage unbalance is detected if voltage deviation exceeds the configured limit (percentage of V_{nominal}). Voltage deviation is the difference between any phase voltage and average voltage. Alarm can be configured for voltage unbalance event. Occurred condition is treated as alarm condition.

Note:

- Two LEDs are available for alarm information.
- Multiple alarms can be selected on single LED.
- Events selected only for alarm, shall not log event. For logging purpose event has to be selected in event log section. Refer to Appendix G for details.

7.8.2 Indication

Alarms can be configured to indicate in one or more of the following ways:

- Alarm LED on meter front
- Changed digital output level
- Indication of a logged value with a flag

The alarm LED stops blinking and the digital output returns to inactive low after the alarm state passes.

7.8.3 Display of events

The events status can be viewed on the meter's display if the tamper information displays are configured to be included in one of the meter's display sequences. A more detailed description of the meter's events can be viewed in ConfigView. Via ConfigView, the event log can also be printed out or saved to a file.

Reno	Fixed Compartment	Events	Maximum number of events per compartment	Snapshot
1	1	Missing Voltage phase wise	100	Y
2		Over Voltage		
3		Under Voltage		
4		Voltage Unbalance		

5	2	Reverse Current direction phase wise	100	Y
6		Current Circuit Open phase wise		
7		Current terminal shorting		
8		Current Unbalance		
9	3	Power Failure / Power On-Off	100	N
10	4	Time Set Transactions	100	Y
		Profile capture period transaction (for logger 1 and logger 2)		
11	5	Low power factor	100	Y
12	7	Feeder supply fail	100	N
13	8	Current Missing phase wise	100	Y
14		Invalid Phase Association		
15		Invalid Voltage		
16	10	Phase wise voltage THD (%)	100	Y
17	11	Phase wise current THD (%)	100	Y

For snapshot refer to Appendix G

7.9 Maximum demand

Maximum Demand (MD) plays a crucial role in current scenario of electricity conditions. According to maximum demand conditions it is easy to monitor variation in the load condition and trend of load according to the time zone.

The ProQ 100 meter has the capability of logging Maximum Demand for all the selected energy types (except Net Active and Net Reactive). The Maximum Demand is computed for a fixed block of time which is called Demand Integration Period (DIP). DIP can be set to 15, 30 or 60 minutes. The demand window period can be set as 1 or 5 minutes.

Maximum Demand registers are provided for each individual energy type. A separate register is available to record the Maximum Demand during the entire day (i.e. 00-24 hours). This is not configurable through the tariff.

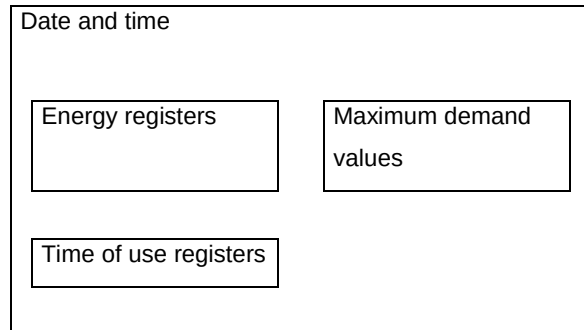
The rules for logging Maximum Demand in these individual register may be set on the following basis:

As per Time Zone: In this case the individual MD registers are assigned to a specific time zone of a day. A particular MD is active in the assigned Time Zone only. In such case the MD register are called **TOU MD register**.

Please note that the Maximum Demand in any MD register is for the current billing period and is always reset to zero whenever a billing cycle is finished.

7.10 Historical registers

Historical registers are used by the ProQ 100 to store current register values at defined points so as to be able to read them later. Stored in historical registers are all maximum demand values, TOU registers and energy registers, with the exception of energy registers by phase. The historical registers are time stamped to indicate when storage occurred. The ProQ 100 can store up to 24 historical registers.



7.10.1.1 Finish billing period

By performing billing, the current registers values are stored in historical registers and the maximum demand values are reset. When a billing period is finished, an event is stored in the meter's event log. Periods can be finished in various ways:

- Via ConfigView The billing period is finished when a command is given from ConfigView.
- At any configured billing date The billing period is finished when the meter clock reaches the configured billing date

7.11 Time of use

Time of use is a function that enables energy to be divided up into various registers depending on the rate that applied when the energy was measured. In the ProQ 100, tariff structure can be stored that switch rates at predetermined times according to a configurable pattern. A tariff structure consists of seasons, day types and special days. The maximum number of rates is eight.

- Day types specify how rates change during a 24-hour day.
- Seasons specify the day types that apply during the days of the week, Monday to Sunday.
- Special day specify the day type that applies on a certain date.

7.11.1 Day type

ProQ 100 supports up to 16 day types. A day type specifies which rate, from a maximum of eight, should apply when during the day. A day can have up to 16 changing points. A day type can be connected to a day of the week in a season or to a special day.

7.11.2 Season

A season refers to a period. During this period, the season defines the day types that will apply during the days of the week. ProQ 100 supports up to 16 separate seasons. The seasons are arranged in a sequence where one season replaces the previous at a predetermined date.

7.11.3 Special days

Days that change rates according to a pattern but is not covered by linking day types to seasons are called special days. A special day specifies the day type that applies on a certain date. Special days can be configured to apply every year on the same date or for a single year. In the ProQ 100, up to 50 special days can be configured.

7.11.4 TOU registers

An energy register that is chosen to be divided into the rates is a TOU register. There are 16 TOU registers and each TOU register has separate registers for eight rates.

7.12 Billing cycle support

The concept of energy metering essentially consists of billing cycles. ProQ 100 has an inbuilt support for billing cycle.

7.12.1 Billing cycle

The ProQ 100 provides following ways to perform a billing action. Performing a billing action finish current billing cycle and starts a new billing cycle.

- According to billing dates specified in tariff file. A billing action from a billing date is done at the start of the day on the nominated date file
- At the time of tariff activation i.e. whenever a new tariff is activated. Downloading of new tariff having change in energy channels, CT/VT ratio (scaling) and TOU.
- Authenticated command for MD Reset from ConfigView.

7.12.2 History of energy, rate and MD register

Following values are stored in the meter memory each time a billing cycle completes i.e. a billing action is performed.

1. Value of all main energy registers at the time of a billing action. This is maintained in a rollover fashion which may have a maximum of 24 histories .i.e. all last 24 historical values will be available to you.
2. Value of all rate registers. This is maintained in a rollover fashion which may have a maximum 24 histories .i.e. all last 24 historical values will be available to you.
3. Value for all MD registers along with date and time of MD occurrence. This is also maintained in a rollover fashion which may have a maximum 24 histories .i.e. all last 24 historical values will be available to you.

7.12.3 History for the cause of billing register

The cause of billing is available in the meter for last 24 billing actions along with date and time of billing. Meter display parameters also available for last billing actions along with date and time.

7.12.4 Cumulative maximum demand registers

A special register is also provided for energy type selected for maximum demand which stores cumulative Maximum Demand for all MD register whenever a billing action takes place. Each time billing action takes place, the cumulative register shall increase by the value of their source register.

The purpose of this register is to limit the scope of tampering with Maximum Demand by performing a billing action repeatedly.

7.13 Meter reading

The ProQ 100 uses DLMS for meter reading. In DLMS protocol the BCS is considered the client and the meter is the server. On request by the BCS, the meter will send all its supported OBIS codes and expected queries. All DLMS meters will communicate data only after 'getting associated' with the BCS client. Meter reading is divided into the following sessions:

Single parameter sessions

Profile sessions

1. Instantaneous profile reading
2. Daily energy profile reading
3. Data loggers profile reading
4. Log wise events profile reading

7.14 Transactions

ProQ 100 supports the following transactions:

- MD reset (only through communication)
- Configuration download
- Configuration upload (read back)
- Firmware upgradation
- Time set
- Event reset
- User triggered PQ event
- Profile capture period transaction
- Device ID change
- Password change
- AES key change

- Immediate tariff download
- Scaling tariff download

7.15 Transformer compensation

Transformer compensation is a function for compensating for measurement errors in instrument transformers and for losses in power transformers. The function enables the ProQ 100 to present measurement values for which errors and losses have been compensated. The formulas used in the meter are presented in Appendix E: Calculation Principles (pg. 103).

7.15.1 Overview

The tables present an overview of the transformer compensations in ProQ 100.

Instrument transformer compensations

Name	Value to be entered
Voltage error L1, L2, L3	Ratio error as percent
	Phase angle in minutes
Current error L1, L2, L3	Ratio error as percent
	Phase angle in minutes

Power transformer compensations

Name	Value to be entered
Copper losses, Total values	Active loss as percent of nominal power
	Reactive loss as percent of nominal power
Iron losses, Total values	Active loss as percent of nominal power
	Reactive loss as percent of nominal power

7.15.2 Instrument transformer compensations

To compensate for errors in instrument transformers, their amplitude error in percent and phase angle error in minutes are configured in the meter. One minute is equal to the angle $1^\circ/60$. The errors can be specified separately for all voltages and currents. When instrument transformer compensations are used, current and voltage are affected, as well as all quantities that arise from these: power, energy, etc.

7.15.2.1 2-element meter

When voltage errors are compensated on a 2-element meter, this is done on phase to phase voltages L12, L23 and L31 instead of on phase voltages. Only L12 and L23 are included in the calculation of power and energy. Compensation of L31 has no significance in this respect. In compensation of current errors for 2-element meters, only L1 and L3 can be compensated for because they are the only currents measured.

7.15.3 Power transformer losses

Power transformer losses consist of copper and iron losses. They are expressed as percentages of nominal power. One value is specified for active loss and one for reactive. When compensation of losses is configured, power, energy, power factor, etc. are affected but not current and voltage.

When copper losses are added per phase, the resulting copper loss is the average of the value.

Calculating loss values

Based on the nominal total power and the measured loss value in watts, a loss value can be calculated as a percentage of nominal power. It is the loss value that is configured in the meter. Nominal power is calculated with configured nominal current and voltage.

$$\text{Nominal power: } Power_{nom} = Current_{nom} \cdot Line\ voltage_{nom} \cdot \sqrt{3}$$

$$\text{Loss value: } Loss\ value = Loss / Power_{nom} \cdot 100$$

7.16 Power quality

This section explains the power quality parameters and how to configure meter's power quality functionality.

7.16.1 Power quality parameters

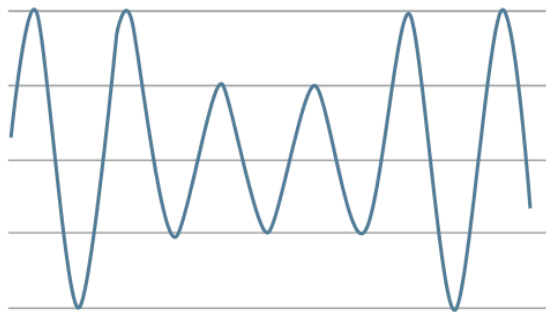
The meter records the following power quality parameters:

Flicker

Random or repetitive variations in the RMS voltage that occur in the range of 90% to 110% of nominal voltage can produce a phenomenon known as "flicker" in lighting equipment. Flicker is rapid visible change in brightness of light. It defines the characteristics of voltage fluctuations that produce objectionable light.

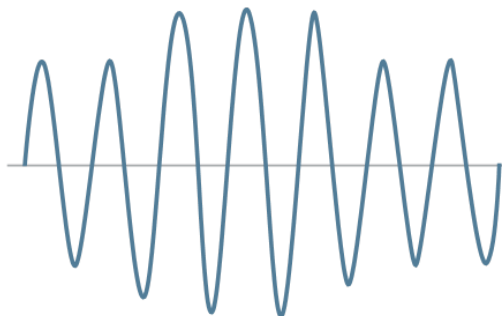
Supply voltage dips

A "dip" occurs when the RMS voltage is below the nominal voltage by 10% to 90% (configurable).



Supply voltage swells

When the RMS voltage exceeds the nominal voltage by 10% (configurable), the event is called a "swell".



Voltage interruptions

Interruptions are complete loss of voltages (drop less than 10% (configurable) of nominal voltage) in one or more phases.

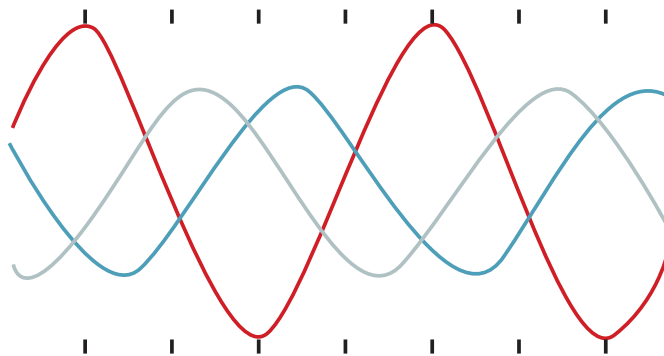
Momentary: 0.5 cycle to 3 seconds

Temporary: 3 sec to 1 minute

Long duration: more than 1 minute

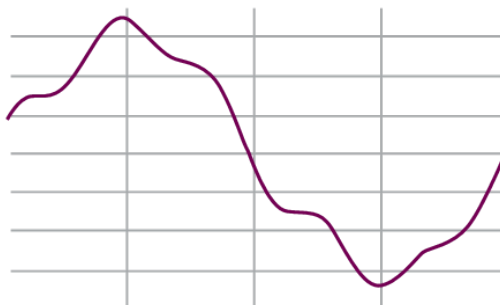
Supply voltage unbalance

Condition in a poly-phase system in which the RMS values of the line voltages (fundamental component) and/or the phase angles between consecutive line voltages are not equal. Voltage unbalance is the deviation of each phase from the average voltage of all three phases.



Voltage harmonics

Harmonics are integral multiples of the fundamental frequency of the sine wave.



Voltage inter harmonics

Inter harmonics are non integral multiples of the fundamental frequency of the sine wave.

Mains signaling voltage on the supply voltage

Mains signaling voltage, called ripple control signal in certain applications, is a burst of signals often applied at a non harmonic frequency, that remotely control industrial equipment, revenue meters and other devices.

Rapid voltage changes

A rapid voltage change is a quick transition in RMS voltage between two steady state conditions. The voltage during a rapid voltage change shall not exceed the voltage dip and/or voltage swell threshold as it would otherwise be considered as a voltage dip or swell.

Under deviation and over deviation

Under deviation: The absolute value of the difference between the measured value and the nominal value of a parameter, only when the value of the parameter is lower than the nominal value.

Over deviation: The absolute value of the difference between the measured value and the nominal value of a parameter, only when the value of the parameter is greater than the nominal value.

7.17 Using the IEC 61850 protocol

IEC 61850 is an Ethernet-based protocol designed for electrical substations. It is a standardised method of communications, developed to support integrated systems composed of multi-vendor, self-describing IEDs (intelligent electronic devices) that are networked together to perform monitoring, metering and real-time non-critical protection and control.

ProQ 100 can be integrated into an IEC 61850 system as an IED (or server), supporting a minimum of two IEC 61850 client connections and a FTP connection (used for transferring data or configuration files).

You must load a valid IEC 61850 configuration (CID) file into the meter in order to activate the IEC 61850 features in the meter.

You can upload the firmware and configuration files for IEC 61850 communication through ConfigView.

Appendix A: Abbreviations

The following are commonly occurring abbreviations used throughout this manual.

APS	:	Auxiliary Power Supply
BCS	:	Base Computer Software
CID	:	Configured IED Description
CT	:	Current Transformer
DIP	:	Demand Integration Period
DLMS	:	Device Language Message Specification
DPM	:	Direct Part Marking
DST	:	Daylight Saving Time
ETBC	:	Extended Terminal Block Cover
FTP	:	File Transfer Protocol
IED	:	Intelligent Electronic Device
KDF	:	Key Data File
MD	:	Maximum Demand
PC FR	:	Polycarbonate Fire retardant
PPE	:	Personal Protective Equipment
PQDIF	:	Power Quality Data Interchange Format
RMS	:	Root Mean Square
RTC	:	Real Time Clock
RTU	:	Remote Terminal Unit
SCADA	:	Supervisory Control and Data Acquisition
SFP	:	Small Form-factor Pluggable
SIP	:	Survey Integration Period

SNTP : Simple Network Time Protocol

THD : Total Harmonic Distortion

TOU : Time of use

VT : Voltage Transformer

Appendix B: Material declaration

The material declaration for the ProQ 100 is shown below:

Rack	Stainless steel with Aluminium
Meter enclosure	Metal housing with plastic front fascia
Meter back plate	Stainless steel
Meter current and voltage terminals	Brass with gold and silver plating
Handle	Aluminium
Screws	M3 for sealing meter with rack and M4 elsewhere
Front cover	Polycarbonate

Rack carries the female part of Essailec connector and meter carries the male part of Essailec connector with all the back side communication ports in the form of RJ-45 connector.

Appendix C: Communication ports

The ProQ 100 can come as fitted with the following ports (see the variant supplied as per order):

1. Optical 1107 port
2. RS232 port
3. RS485 IN and OUT
4. Ethernet
5. Ethernet (OFC)
6. USB (micro B connector)

Optical Communication Port (common port for IEC 1107 and ANSI) to be updated

In ProQ 100, the optical 1107 port is protected by the front cover without any additional sealing provision.

Communication through the 1107 infrared optical communications port is performed through PC with suitable communication cable. Care has to be taken to align the optical head so the IR transmitters and receivers are in the best position to exchange signals. Usually this means attaching the optical head with the connecting wire hanging straight down. Ambient visible light (daylight, incandescent or in particular fluorescent light) may disturb the exchange of IR signals if strong enough and cause the communication to fail. To ensure reliable communications, avoid strong ambient light positions when installing the ProQ 100.

RS232 Serial Communication Port

The RS232 communication port is used for connecting to communication equipment such as computers and modems through a serial cable. The meter side connector is an RJ-45 type. The user should ensure that the other side is fitted with a suitable connector before connecting an external device with the meter. See Figure 17 for pin description.

RS485 Serial Communication Port

The RS485 serial half duplex communication ports are intended to be used to connect the ProQ 100 to a network for multi-drop communications. The RS485 network is looped through the input connector to the output connector. See Figure 4 for pin description. If for example three meters needed to be "*daisy chained*", then simply connect the "RS485 Out" on the first meter to the "RS485 In" on the next meter and so on. The pin connection for both ports is identical, so the same type of cable can be used through-out and is not polarity conscious.

Ethernet Port

The Ethernet serial communication port is used for connecting directly to an internal Ethernet network. Each meter needs to be provided with an IP addressed static to internal LAN for communicating the data over TCP/IP network. See Figure 17 for pin description.

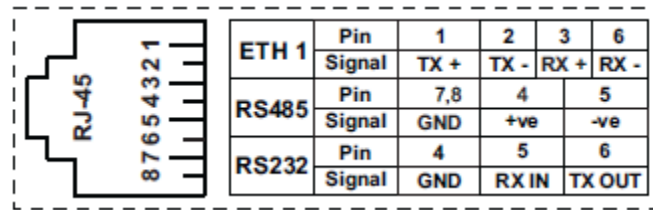


Figure 17: Pin Description for RJ-45 Ports

Ethernet (OFC) Port

The Ethernet port for optical communication through SFP bay with cap on it, is available so that you can choose SFP connector according to the cable length, wavelength and core of optical fibre network and connect it in SFP bay. It is also possible to connect SFP copper or SFP optical connector.

It is recommended to use the following SFP modules:

SFP module fixed GB copper	
Manufacturer	Part no.
Cisco	30-1410-03
FINISAR	FCLF8522P2BTL
Deltaco	SFP-DL001

USB port

The USB (micro B connector) peripheral port is protected by the front cover without any additional sealing provision. It is used for reading or configuring the meter through laptop or tablet.

Note- Recommended cable to use with all the above mentioned ports (RJ-45) is CAT6 type and shall be crimped with standard tools used in LAN connection to PC/ Laptop. The other end of the cable should be as desired by customer for its intended application like connecting to Modem or PC or LAN switch etc. In general, all the communication ports in meter are optically isolated with each other and can be configured by ConfigView for data settings, TCP/IP settings etc. as desired by user. The Ethernet cable is normally connected between the meter and the main switch, although local IP installations may differ.

The Ethernet port has a 1-minute inactivity time-out period. If no activity is detected the Ethernet port will disconnect after 1 minute.

Appendix D: How to read meter through Ethernet port

This section discusses reading a ProQ 100 meter through Ethernet port (TCP/IP connection).

Prerequisites:

- Take static IP address, Subnet Mask and Gateway from network
- ConfigView
- Install the ConfigView on PC
- Connect meter with PC using RS232 port

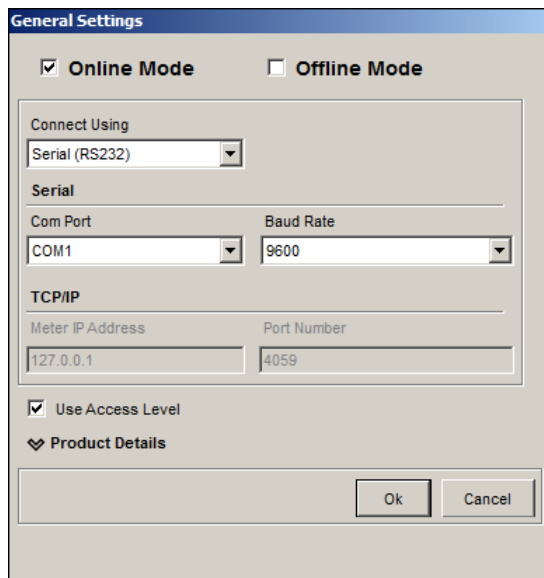
Configuring the static IP address, Subnet Mask and Gateway

The static IP address, subnet mask and gateway can be configured using the network settings page under setup menu on the meter display (refer to setup menu for details) or ConfigView.

To configure the static IP address, subnet mask and gateway IP using ConfigView, do the following:

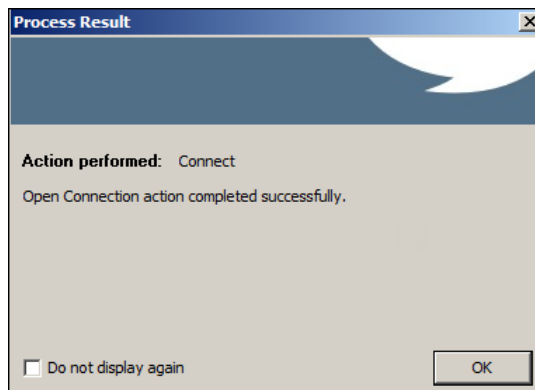
Connect ProQ 100 meter with PC on RS232 port

Select connection media, comport and baud rate. Click **OK**.



The 'General Settings' dialog box is shown. It has two tabs: 'Online Mode' (selected) and 'Offline Mode'. Under 'Connect Using', 'Serial (RS232)' is selected. The 'Serial' section has 'Com Port' set to 'COM1' and 'Baud Rate' set to '9600'. The 'TCP/IP' section has 'Meter IP Address' set to '127.0.0.1' and 'Port Number' set to '4059'. There is a checkbox for 'Use Access Level' which is checked. Below this is a section for 'Product Details' with a collapsed arrow icon. At the bottom right are 'Ok' and 'Cancel' buttons.

The following message will be displayed on successful connection.

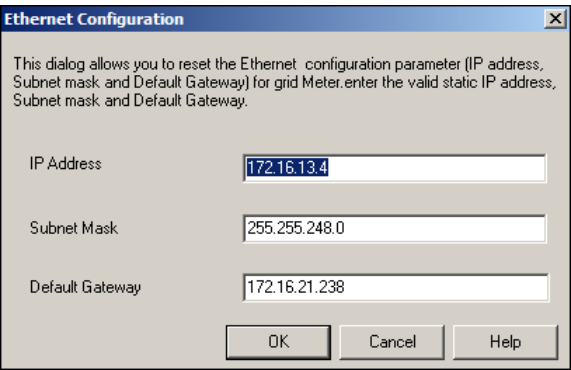


The 'Process Result' dialog box is shown. It has a title bar with a close button. The main area contains the text: 'Action performed: Connect' and 'Open Connection action completed successfully.' At the bottom left is a checkbox for 'Do not display again' which is unchecked. At the bottom right is an 'OK' button.

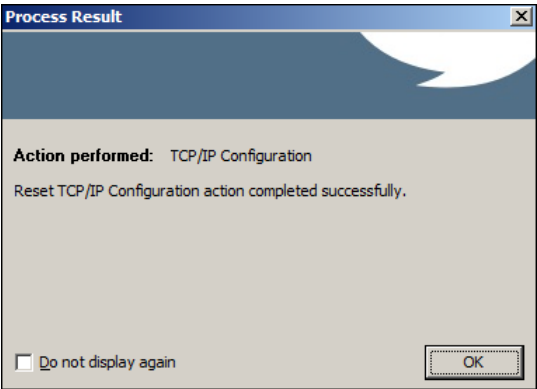
Click **Actions** and then click **Ethernet Configuration**.

Enter the IP address, Subnet Mask and Gateway information to be configured in meter.

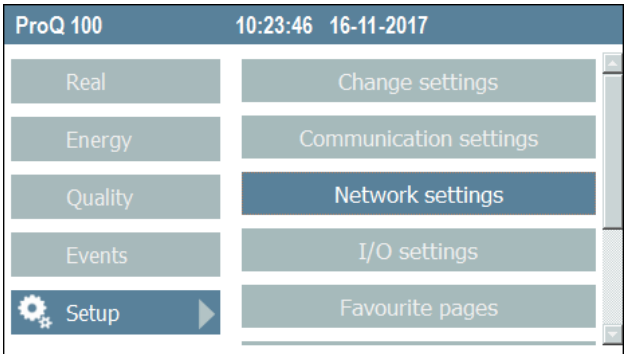
Click **OK**



The following message will be displayed on successful TCP/IP configuration.



You can verify on the meter display.
Go to the **Network Settings** page
under **Setup** menu.



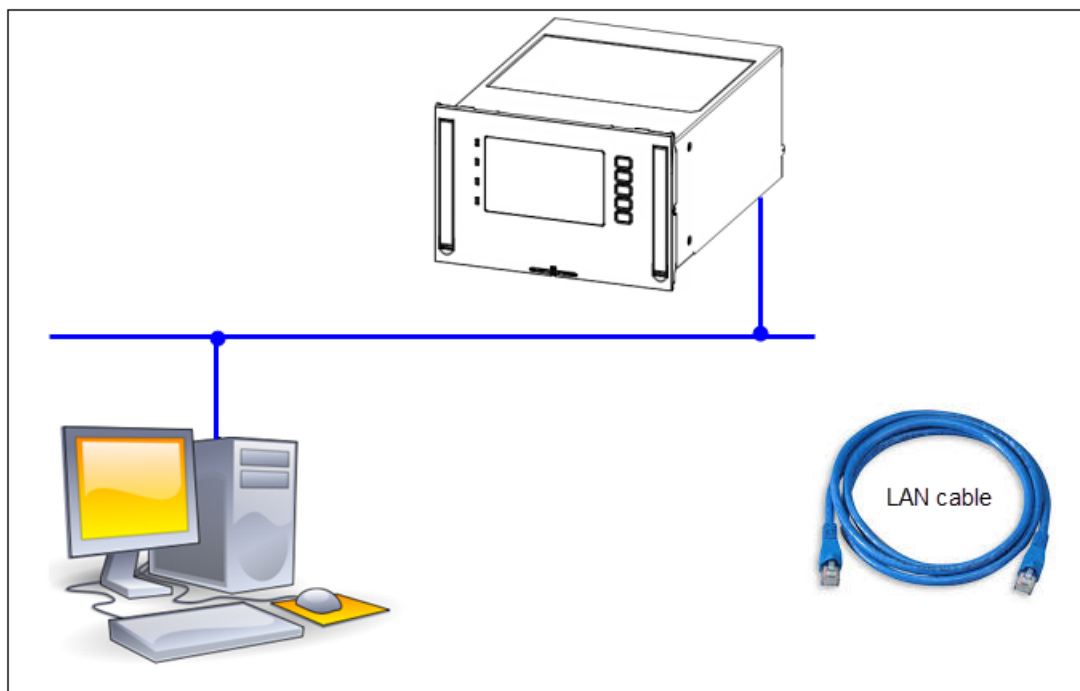
Scroll down to view the Ethernet configuration information

Ethernet RJ45 (Eth1)		10:23:46	16-11-2017
IP address	172.16.10.59		
Subnet mask	255.255.255.0		
Gateway address	192.168.0.11		
MAC address	54.4A.16.A2.5E.23		
			3/3

Reading the ProQ 100 meter on the Ethernet Port

Connect the meter with the LAN network using the LAN cable.

Confirm that the LAN cable is firmly connected to both the meter and PC Ethernet ports.



In General settings screen, select connection media as TCP/IP.

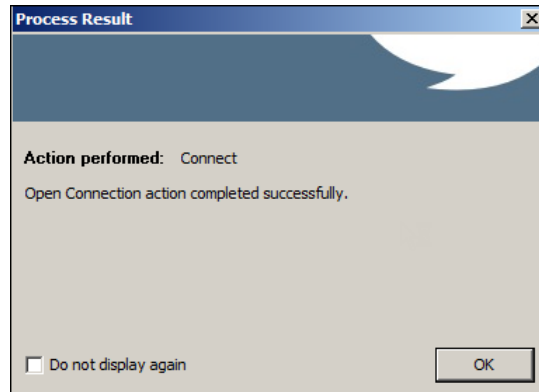
Enter the meter static IP information and port number.

Click **OK**.

Static IP is 172.16.13.4

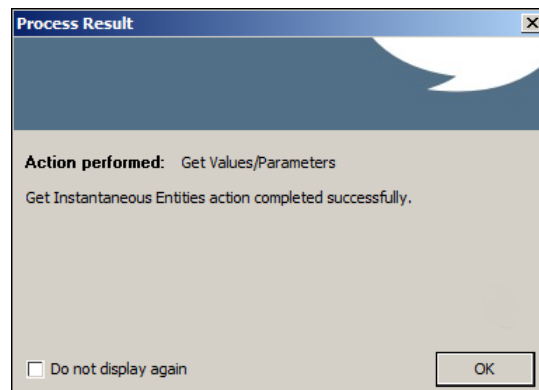
Service port is 4059. It is fixed for DLMS

The following message appears indicating that the meter is connected successfully with the ConfigView.



To read instant data, click **Reading > Instantaneous**

Action completed successfully will be displayed.



Appendix E: Calculation Principles

Current and voltage

Current and voltage are calculated as RMS of frequencies up to 3 kHz. There are also fundamental components calculated of current and voltage.

$I_{1,i}$ Current L1 spectral component i as RMS value ($Peak / \sqrt{2}$) Spectral component 0 is DC and excluded. Spectral component 10 (12)

I_1 Current L1 RMS value

$I_{1,f}$ Current L1 fundamental component (one of available spectral components)

$$I_1 = \sqrt{\sum_{i=1}^n I_{1,i}^2}$$

Calculated phase to phase voltage

Phase to phase voltages are calculated from the phase voltages including frequencies up to 3 kHz. This calculation is only made in the 3-element meter; in the 2-element meter, the phase to phase voltages are measured, except for U31 which is calculated from U12 and U23.

$U_{1,i}$ Voltage L1 spectral component i as RMS value ($Peak / \sqrt{2}$)

$\phi U_{1,i}$ Voltage L1 spectral component i as angle (not power phase angle!)

$$U_{12,i} = \sqrt{U_{1,i}^2 + U_{2,i}^2 - 2 \cdot U_{1,i} \cdot U_{2,i} \cdot \cos(\phi U_{1,i} - \phi U_{2,i})}$$

Power

Active power

$P_{1,i}$ Power element that includes current L1, spectral component i

$\phi_{1,i}$ Power phase angle for $P_{1,i}$

P_1 Sum of all spectral components of $P_{1,i}$

$P_{1,f}$ Fundamental component of $P_{1,i}$

Fundamental power is also calculated

3-element meter:

$$P_{1,i} = U_{1,i} \cdot I_{1,i} \cdot \cos(\varphi_{1,i})$$

$$P_{2,i} = U_{2,i} \cdot I_{2,i} \cdot \cos(\varphi_{2,i})$$

$$P_{3,i} = U_{3,i} \cdot I_{3,i} \cdot \cos(\varphi_{3,i})$$

$$P_1 = \sum_{i=1}^n P_{1,i}$$

$$P = P_1 + P_2 + P_3$$

2-element meter:

$$P_{1,i} = U_{12,i} \cdot I_{1,i} \cdot \cos(\varphi_{1,i})$$

$$P_{3,i} = U_{32,i} \cdot I_{3,i} \cdot \cos(\varphi_{3,i})$$

$$P_1 = \sum_{i=1}^n P_{1,i}$$

$$P = P_1 + P_3$$

Reactive Power

Q_1 Power element that includes current L1, fundamental component

3-element meter:

$$Q_1 = U_1 \cdot I_1 \cdot \sin(\varphi_1)$$

$$Q_2 = U_2 \cdot I_2 \cdot \sin(\varphi_2)$$

$$Q_3 = U_3 \cdot I_3 \cdot \sin(\varphi_3)$$

$$Q = Q_1 + Q_2 + Q_3$$

2-element meter:

$$Q_1 = U_{12} \cdot I_1 \cdot \sin(\varphi_1)$$

$$Q_3 = U_{31} \cdot I_3 \cdot \sin(\varphi_3)$$

$$Q = Q_1 + Q_3$$

Apparent Power

S_1 Apparent power element that includes current L1, all spectral components

$S_{1,f}$ Apparent power element that includes current L1, fundamental component

3-element meter, apparent based on power:

$$S_1 = \sqrt{P_1^2 + Q_1^2} \quad S_{1,f} = \sqrt{P_{1,f}^2 + Q_1^2}$$

$$S_2 = \sqrt{P_2^2 + Q_2^2} \quad S_{2,f} = \sqrt{P_{2,f}^2 + Q_2^2}$$

$$S_3 = \sqrt{P_3^2 + Q_3^2} \quad S_{3,f} = \sqrt{P_{3,f}^2 + Q_3^2}$$

$$S = \sqrt{P^2 + Q^2} \quad S_f = \sqrt{P_f^2 + Q^2}$$

2-element meter, apparent based on power:

$$S_1 = \sqrt{P_1^2 + Q_1^2} \quad S_{1,f} = \sqrt{P_{1,f}^2 + Q_1^2}$$

$$S_3 = \sqrt{P_3^2 + Q_3^2} \quad S_{3,f} = \sqrt{P_{3,f}^2 + Q_3^2}$$

$$S = \sqrt{P^2 + Q^2} \quad S_f = \sqrt{P_f^2 + Q^2}$$

Direction of Power / Energy

Definition of quadrants

The term phase angle is described under its own heading below.

Quadrant I: phase angle 0–90°

Quadrant II: phase angle 90–180°

Quadrant III: phase angle -180–(-90)° or 180–270°

Quadrant IV: phase angle (-90)–0° or 270–360°

Name and sign of active power / energy

For active power and active energy the name of direction and sign of direction is configurable.

Quadrant I + IV configuration	Name of direction	Sign of direction
Normal	Import	+
Reverse sign	Import	-
Reverse imp/exp	Export	+
Reversed	Export	-

Energy

Energy is calculated by integrating power (P, Q and S) over time. Transformer compensation is included, if configured.

Calibration LED corresponds to energy (including transformer compensation).

Energy registers

Nr.	P/Q/S	Direction	Qualifier	Description
1	Active	Import		Acc. ABS(P*t) for $P > 0$ (QI+QIV)
2	Active	Export		Acc. ABS(P*t) for $P < 0$ (QII+QIII)
3	Active	Import	Fundamental	Acc. ABS(P*t) for $P > 0$ (QI+QIV)
4	Active	Export	Fundamental	Acc. ABS(P*t) for $P < 0$ (QII+QIII)
5	Reactive	Q1		Acc. ABS(Q*t) for $P > 0$ and $Q > 0$ (QI)
6	Reactive	Q2		Acc. ABS(Q*t) for $P < 0$ and $Q > 0$ (QII)
7	Reactive	Q3		Acc. ABS(Q*t) for $P < 0$ and $Q < 0$ (QIII)
8	Reactive	Q4		Acc. ABS(Q*t) for $P < 0$ and $Q < 0$ (QIII)
9	Apparent	Import		Acc. ABS(S*t) for $P > 0$ and $Q > 0$ (QI) or Acc. ABS(S*t) for $P > 0$ (QI+Q4)
10	Apparent	Export		Acc. ABS(S*t) for $P < 0$ and $Q < 0$ (QIII) or Acc. ABS(S*t) for $P < 0$ (QII+QIII)
11	Reactive	Import		Acc. ABS(Q*t) $Q > 0$ (QI+QII)
12	Reactive	Export		Acc. ABS(Q*t) $Q < 0$ (QIII+QIV)
13	Reactive	Ind.		Acc. ABS(Q*t) (QI+QIII)
14	Reactive	Cap.		Acc. ABS(Q*t) (QII+QIV)
15	Active	Net		Acc. P*t (QI+QII+QIII+QIV) or Acc. P*t (QI+QII+QIII+QIV) fundamental
16	Reactive	Net		Acc. Q*t (QI+QII+QIII+QIV)
17	Reactive	Import	High	Acc. ABS(Q*t) $Q > 0$ (QI+QII) when $U > \text{highlim}$
18	Reactive	Import	Low	Acc. ABS(Q*t) $Q > 0$ (QI+QII) when $U < \text{lowlim}$
19	Reactive	Export	High	Acc. ABS(Q*t) $Q < 0$ (QIII+QIV) when $U > \text{highlim}$
20	Reactive	Export	Low	Acc. ABS(Q*t) $Q < 0$ (QIII+QIV) when $U < \text{lowlim}$
21	Reactive	Net	High	Acc. Q*t (QI+QII+QIII+QIV) when $U > \text{highlim}$
22	Reactive	Net	Low	Acc. Q*t (QI+QII+QIII+QIV) when $U < \text{lowlim}$
23	Active	Import	Element 1	Acc. ABS(P*t) for $P > 0$ (QI+QIV) Element 1
24	Active	Export	Element 1	Acc. ABS(P*t) for $P < 0$ (QII+QIII) Element 1
25	Active	Import	Element 2	Acc. ABS(P*t) for $P > 0$ (QI+QIV) Element 2
26	Active	Export	Element 2	Acc. ABS(P*t) for $P < 0$ (QII+QIII) Element 2
27	Active	Import	Element 3	Acc. ABS(P*t) for $P > 0$ (QI+QIV) Element 3
28	Active	Export	Element 3	Acc. ABS(P*t) for $P < 0$ (QII+QIII) Element 3

N.B.

Config.	Applies to	Effect
Lag only	9,10	Selects active power instead of apparent power in export direction
Fund only	9,10,15	Selects fundamental power (apparent or active as per register)
High Lim	17,29,21	Accumulation has a constraint on voltage level.
Low Lim	18,20,22	Accumulation has a constraint on voltage level.

Power factor and phase angle

$\cos(\varphi_1)$ Power factor for element that includes current L1, all spectral components

φ_1 Power phase angle for element that includes current L1, all spectral components in radians

$\cos(\varphi)$ Power factor, all spectral components

φ Power phase angle, all spectral components in radians

$$\cos(\varphi_1) = \frac{P_1}{S_1}$$

$$\cos(\varphi) = \frac{P}{S}$$

The power factor sign is as per active power sign, negative in export direction. Fundamental power factor is available synonymously.

$$\varphi = \cos^{-1}\left(\frac{P}{S}\right) \cdot \text{sign}(Q)$$

Power phase angle is as per below table

Quadrant	P	Q	$\cos(\varphi)$	φ [radians]	φ [degrees]
QI	+	+	$0 \leq \cos(\varphi) \leq 1$	$0 \leq \varphi \leq \frac{\pi}{2}$	$0 \leq \varphi \leq 90$
QII	-	+	$-1 \leq \cos(\varphi) \leq 0$	$\frac{\pi}{2} \leq \varphi \leq \pi$	$90 \leq \varphi \leq 180$
QIII	-	-	$0 \leq \cos(\varphi) \leq 1$	$-\pi \leq \varphi \leq -\frac{\pi}{2}$	$-180 \leq \varphi \leq -90$
QIV	+	-	$-1 \leq \cos(\varphi) \leq 0$	$-\frac{\pi}{2} \leq \varphi \leq 0$	$-90 \leq \varphi \leq 0$

THDS (Total Harmonic Distortion Subgroup)

Definition used is from IEC 61000-4-7 Amend. 1, IEC 2008 Paragraph 3.3.3 THDS

$U_{sg,h}$ Harmonic subgroup h

U_{h-10} Spectral bin index for harmonic h (12 for 60 Hz)

$$THDS = \sqrt{\sum_{h=2}^{50} \left(\frac{U_{sg,h}}{U_{sg,1}} \right)^2}$$

$$U_{sg,h} = \sqrt{U_{h-10-1}^2 + U_{h-10}^2 + U_{h-10+1}^2}$$

Similar for current THDS as well as power THDS

THD (Total Harmonic Distortion)

U_h Harmonic h

U_1 Fundamental (corresponds to 50 or 60 Hz)

$$THD = \sqrt{\sum_{h=2}^{50} \left(\frac{U_h}{U_1} \right)^2}$$

Similar for current THD

TDD (Total Demand Distortion) (only current)

I_h Harmonic h

I_{din} Declared (nominal) input current

$$TDD = \sqrt{\sum_{h=1}^{50} \left(\frac{I_h}{I_{din}} \right)^2}$$

K Factor (only current)

$$KFactor = \frac{\sum_{h=1}^{50} (I_h \cdot h)^2}{\sum_{h=1}^{50} I_h^2}$$

Interharmonic centered subgroup

Definition used is from IEC 61000-4-7 Amend. 1, IEC 2008 Paragraph 3.4.4

$U_{isg,h}$ Harmonic subgroup h

$U_{h \cdot 10}$ Spectral bin index for harmonic h (12 for 60 Hz)

$$U_{isg,h} = \sqrt{U_{h \cdot 10 + 2}^2 + U_{h \cdot 10 + 3}^2 + \dots + U_{h \cdot 10 + 8}^2}$$

Similar for current

Transformer compensations

Instrument transformer compensations

Instrument transformer compensations are specified as error in percent for amplitude, and as error in minutes (one-sixtieth of a degree) for voltage phase angle or current phase angle. These errors can be specified separately for all voltages and currents.

U_{corr} Voltage ratio correction as percent

ϕU_{corr} Voltage phase angle correction in minutes

U_{meas} Measured voltage

U Compensated voltage

Amplitude compensation

$$U = U_{meas} \{1/(1 + U_{corr}/100)\}$$

$$I = I_{meas} \{1/(1 + I_{corr}/100)\}$$

Phase angle compensation

$$\phi U = \phi U_{meas} - \phi U_{corr}/60$$

$$\phi I = \phi I_{meas} - \phi I_{corr}/60$$

For current there is a tabular entry of different corrections as a function of primary current amplitude.

In 3-element meters, phase voltages are compensated and in 2-element meters, phase to phase voltages. The same calculation is used for all currents and voltages.

Voltage transformer frequency compensations

The normal instrument transformer compensation includes compensations for fundamental frequency. When measuring any quantity that depends on higher frequency components, accuracy is limited by voltage transformer. To increase accuracy a tabular entry of ratio correction as function of frequency is added.

Amplitude compensation

$$U = U_{meas} (1 + U_{corr} / 100)$$

Note that the correction used is a function of frequency, so different spectral components will have different corrections applied.

Power transformer losses

Transformer losses are commonly categorized into Iron losses (no load losses) and Copper losses (load losses). These are handled differently and applies to both active and reactive power.

There are more losses like unbalance and harmonics, but these are not compensated for.

P_{meas} Measured active power

P_{nom} Nominal active power

U_{avg} Average voltage (system voltage)

Q Reactive power

$FeLoss$ Iron loss, expressed as percentages of nominal power (active or reactive)

$CuLoss$ Copper loss, expressed as percentages of nominal power (active or reactive)

Iron losses / No load losses

$$P = P_{meas} + \frac{FeLossP}{100} \cdot P_{nom} \cdot \left(\frac{U_{avg}}{U_{din}}\right)^2$$
$$Q = Q_{meas} + \frac{FeLossQ}{100} \cdot P_{nom} \cdot \left(\frac{U_{avg}}{U_{din}}\right)^4$$

Copper losses / Load losses

$$P = P_{meas} + \frac{CuLossP}{100} \cdot P_{nom} \cdot \left(\frac{I_{avg}}{I_{din}}\right)^2$$
$$Q = Q_{meas} + \frac{CuLossQ}{100} \cdot P_{nom} \cdot \left(\frac{I_{avg}}{I_{din}}\right)^2$$

Definition of phase order

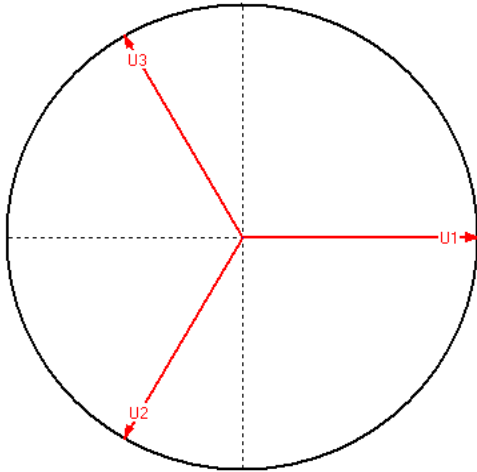
Correct phase order (123) corresponds to phase position:

$\phi U_1 = 0^\circ$ Voltage L1 fundamental phase angle (not power phase angle!)

$\phi U_2 = -120^\circ$ Voltage L2 fundamental phase angle (not power phase angle!)

$\phi U_3 = 120^\circ$ Voltage L3 fundamental phase angle (not power phase angle!)

The same system is represented graphically below. The vectors rotate in an anti-clockwise direction.



Aggregation

Calculations are made from spectral components with 5 Hz resolution (200 ms sampling window). All instantaneous values are based on this, except sags/swells which are updated on every half cycle.

1 s aggregation (definition unclear)

150 cycle aggregation (based on 150/180 cycles for 50/60 Hz systems)

10 min aggregation (based on UTC synchronization, includes 10 cycle value crossing synch limit)

Appendix F: Connection and general details

Electrical	
Connection type	HV3/HV4/LV4
Wiring configuration	3-phase 3-wire, 3-phase 4-wire
Voltage range	3 x 57.7/100 to 240/415 V (3P4W) 2 x 100 to 120 V (3P3W) (-30% to +20%)
Current range	I_{basic} : 1 to 5 A (configurable) I_{max} : up to 10 A (configurable)
Accuracy	class 0.2S, class 0.5S
Parameter accuracy	Accuracy of electrical parameters for average of 1 second is: - RMS current (1 A to 5 A) and voltage (57.7 V to 288 V): 0.1% reading - Power (real and apparent from power factor 0.5 lag to 0.8 lead, bi-directional): 0.2% reading - Power (reactive, zero power factor, bi-directional): 0.2% reading - Frequency measurement accuracy: ± 0.010 Hz
Frequency	Reference frequency: 50/60 Hz $\pm 5\%$ Operating range as per IEC 61000-4-30: (42.5 Hz to 57.5 Hz) or (51 Hz to 69 Hz)
Auxiliary power supply	50-230 V AC/DC $\pm 20\%$, 50/60 Hz, 25 VA/ 15 W max.
Burden	If power drawn from Aux supply – Current circuit: <0.1 VA per phase (for I_{basic}) Voltage circuit: <0.5 VA per phase with Aux. powered @ 230 V Aux. power supply: 25 VA/15 W max. If power drawn from VT i.e. self powered (optional) – Voltage circuit: <5 W and 5 VA per phase (approx.) @ 63.5 V
STOC	$7 \times I_{\text{max}}$ for 10 seconds, $10 \times I_{\text{max}}$ for 3 seconds, $20 \times I_{\text{max}}$ for 1 second
Measurement category	CAT III ≤ 300 V AC (versus earth)
Rated impulse voltage	4 kV

Insulation AC voltage test	2.2 kV AC/50 Hz/5s • Front cover versus protective earth. • All voltage and current inputs connected together versus protective earth. • All auxiliary inputs versus protective earth.
SFP module	Voltage range: 3.3 V $\pm$ 5%, Max. load: 600 mA
Compliance	
Standards	IEC 62052-11, IEC 62053-22, IEC 62053-24, IEC 62056-52, IEC 61010-1, EN 50160, IEEE 519, CE, IEC 61000-4-30 (class A), IEC 62586-2, DLMS UA (IEC 62056), IEC 60297, DIN 43862, COP-1 and 2, IEEE 1159.3 (PQDIF) format compliance
Mechanical	
Dimensions (L X W X D)	Meter – 201.4 mm (L) x 132.3 mm (W) x 294.8 mm (D)
	11" rack (with connectors and terminal cover) – 279.4 mm (L) x 132.5 mm (W) x 331 mm (D)
	19" rack (with connectors and terminal cover) – 482.6 mm (L) x 132.5 mm (W) x 331 mm (D)
Enclosure	Opaque polycarbonate cover (with clear transparent window for display) and overall steel body
Sealing	Sealable screws on the front and back fascia of meter, sealing provision for optical port, USB port and special function button
Weight	Meter – 3.6 kg approx. ($\pm$ 0.1 kg)
	11" rack (with connectors and terminal cover) – 1.8 kg ($\pm$ 0.1 kg)
	19" rack (with connectors and terminal cover) – 3.5 kg ($\pm$ 0.1 kg)
Ingress Protection (IP)	IP54 on front fascia and IP20 on back side
Impact rating	IK08

Environmental		
Temperature	Operating range	-20 °C to +60 °C (Essailec connectors' working temperature range: -10°C to +55°C, display's operating range: -10°C to +60°C)
	Limit range of operation	-40 °C to +70 °C (display's operating range: -10°C to 60°C, also PC plastic is generally not designed for temperature less than -25°C)
	Limit range for storage	-40 °C to +70 °C (Essailec connectors' storage temperature range: -25°C to +70°C)
	Limit range for transportation	-25 °C to +70 °C
	Display operating range	-10 °C to + 70 °C
Operating humidity	Up to 95% non-condensing	
Altitude level	Up to 2000 m	
Pollution degree	Type 2	
Over voltage category	CATIII (rated voltage 300 V for measuring circuits and auxiliary inputs)	
Use	Rack-mounted, indoor use only	
Protection class	Basic insulation – Protective class I	

Appendix G: Events

Description	Logging as event	Alarm LED	Pulse Output
Under voltage	✓	✓	✓
Over voltage	✓	✓	✓
Voltage unbalance	✓	✓	✓
Current unbalance	✓	✓	✓
High THD power		✓	✓
Auxiliary supply fail		✓	✓
Low power factor	✓	✓	✓
Low active power		✓	✓
High active power		✓	✓
High harmonic voltage		✓	✓
High harmonic current		✓	✓
Health status		✓	✓
Voltage sag Power quality	✓		
Voltage swell Power quality	✓		
Voltage interruption Power quality	✓		
Rapid voltage change	✓		
Energy pulse on channels			✓
Logger 1 Integration Period start			✓
Demand Integration Period start			✓
Billing Action Start			✓
End of Rate Period			✓
End of MD Period			✓
Rate register selection			✓
MD register selection			✓
Remote Control	✓		✓
Missing voltage phase wise	✓	✓	✓
Phase wise Reverse Energy Direction	✓	✓	✓

Phase wise Current Circuit Open (HV 3P4W meter only)	✓		
Current Terminal Shorting (HV 3P4W meter only)	✓		
Power Failure / Power On-Off	✓		
Time Set Transactions	✓		
Profile capture period transaction for logger 1	✓		
Profile capture period transaction for logger 2	✓		
Device ID Change (Bus Address)	✓		
Password Change (level 1)	✓		
High level Security Keys Change (passwords for levels 2, 3 and 4)	✓		
Tariff Download	✓		
Feeder Supply Fail (All phase missing)	✓		
Event Log Reset	✓		
Current Missing phase wise	✓		
Invalid Phase Association	✓		
Invalid Voltage	✓		
Phase wise THD Voltage (%)	✓	✓	✓
Phase wise THD Current (%)	✓	✓	✓

List of Profile Parameters (DLMS)		
Section : Event Log 1 to 9 Snapshot Profile		
S.No.	Profile	Parameter
1	Instantaneous	Real Time Clock – Date and Time
2	Instantaneous	Cumulative Energy – Active Import
3	Instantaneous	Cumulative Energy – Active Export
4	Instantaneous	Voltage – VRN for 3Φ4W / VRY for 3Φ3W
5	Instantaneous	Voltage – VYN for 3Φ4W
6	Instantaneous	Voltage – VBN for 3Φ4W / VBY for 3Φ3W
7	Instantaneous	Line Current – L1
8	Instantaneous	Line Current – L2
9	Instantaneous	Line Current – L3
10	Instantaneous	Active Current – L1
11	Instantaneous	Active Current – L2
12	Instantaneous	Active Current – L3
13	Instantaneous	Power Factor – L1 phase
14	Instantaneous	Power Factor – L2 phase
15	Instantaneous	Power Factor – L3 phase
16	Instantaneous	Voltage angle – Angle between L1 and L2 phase
17	Instantaneous	Voltage angle – Angle between L2 and L3 phase
18	Instantaneous	Voltage angle – Angle between L3 and L1 phase

List of Profile Parameters (DLMS)		
Section : Event Log 10 Snapshot Profile		
S.No.	Profile	Parameter
1	Instantaneous	Real Time Clock – Date and Time
2	Instantaneous	Cumulative Energy – Active Import
3	Instantaneous	Cumulative Energy – Active Export
4	Instantaneous	Voltage THD % - Phase 1
5	Instantaneous	3rd Harmonic Voltage - Phase 1
6	Instantaneous	5th Harmonic Voltage - Phase 1
7	Instantaneous	7th Harmonic Voltage - Phase 1
8	Instantaneous	9th Harmonic Voltage - Phase 1
9	Instantaneous	Voltage THD % - Phase 2
10	Instantaneous	3rd Harmonic Voltage - Phase 2
11	Instantaneous	5th Harmonic Voltage - Phase 2
12	Instantaneous	7th Harmonic Voltage - Phase 2
13	Instantaneous	9th Harmonic Voltage - Phase 2
14	Instantaneous	Voltage THD % - Phase 3

15	Instantaneous	3rd Harmonic Voltage - Phase 3
16	Instantaneous	5th Harmonic Voltage - Phase 3
17	Instantaneous	7th Harmonic Voltage - Phase 3
18	Instantaneous	9th Harmonic Voltage - Phase 3

List of Profile Parameters (DLMS)		
Section : Event Log 11 Snapshot Profile		
S.No.	Profile	Parameter
1	Instantaneous	Real Time Clock – Date and Time
2	Instantaneous	Cumulative Energy – Active Import
3	Instantaneous	Cumulative Energy – Active Export
4	Instantaneous	Current THD % - Phase 1
5	Instantaneous	3rd Harmonic Current - Phase 1
6	Instantaneous	5th Harmonic Current - Phase 1
7	Instantaneous	7th Harmonic Current - Phase 1
8	Instantaneous	9th Harmonic Current - Phase 1
9	Instantaneous	Current THD % - Phase 2
10	Instantaneous	3rd Harmonic Current - Phase 2
11	Instantaneous	5th Harmonic Current - Phase 2
12	Instantaneous	7th Harmonic Current - Phase 2
13	Instantaneous	9th Harmonic Current - Phase 2
14	Instantaneous	Current THD % - Phase 3
15	Instantaneous	3rd Harmonic Current - Phase 3
16	Instantaneous	5th Harmonic Current - Phase 3
17	Instantaneous	7th Harmonic Current - Phase 3
18	Instantaneous	9th Harmonic Current - Phase 3

Appendix H: Hardware security

The meter has five authorisation levels that can limit access to the meter during communication via any of the meter's communication ports. Authorisation levels 1 and 2 are password-protected. Authorisation levels 3 to 5 can be protected by passwords and hardware security. In addition, measuring configuration can also be protected by hardware security. Hardware security settings can be configured using ConfigView if the meter is connected with authorisation level 4. By default, it is not used.

Note: Hardware security should be unlocked for the configured levels before applying passwords.

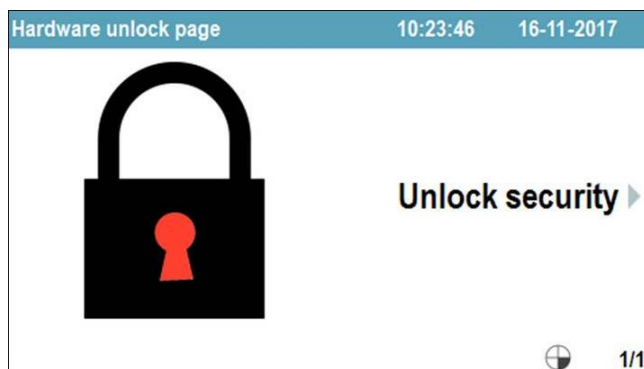
Authorisation levels

- 1 Provides access to reading.
- 2 Provides access to everything in level 1 plus access to set the clock and reset maximum demand values.
- 3 Provides access to everything in level 2 plus access to configure the meter, CT/VT ratio and linear transformer correction; reset events and change password for levels 1, 2 and 3
- 4 Provides access to everything in level 3 plus access to non-linear transformer correction, change password for levels 3 and 4.
- 5 Provides access to reset passwords and energy registers; and upgrade application firmware in the meter

Unlocking hardware security

To access the functions which are protected by hardware security, you need to unlock the hardware security. The procedure to unlock hardware security is as follows:

1. Swing-up the front cover by removing the seals and loosening the screws to access the special function button.
2. Press the special function button continuously for 5 seconds (long push). The following display screen appears. Select Unlock security and press  button.



An event will be logged every time hardware security is unlocked.

After performing required operations, press the special function button again for 5 seconds (long push) to enable hardware security lock.

Frequently asked questions (FAQs)

The message 'Not configured' is shown on the ProQ 100 display.

The message 'Not configured' is displayed when the parameters are not configured in the meter.

For e.g. Bar Graph of Energy parameter for the logger will be available on meter display if user configures logger energy in meter. Similarly Rate Registers and Demand Registers will be available if user configures TOU energy in meter.

Are the harmonics data up to 50th order available on meter display?

The voltage and current harmonics data up to 50th order is not available on meter display and can be accessed using ConfigView and via the communication protocol.

Which information is not available on the ProQ 100's display for 3-phase 3-wire?

On configuring Phase 2 displays for 3-phase 3-wire, the Phase 2 parameters such as energy, voltage, current, Power, P.F, harmonics, L1-L2 voltage phase angle, L2-L3 voltage phase angle and current symmetry data will be displayed as ".....".

Which events are not applicable for 3-phase 3-wire?

Phase 2 current reversal, Phase 2 current miss, Current circuit open, Current terminal shorting, neutral disturbance and invalid phase association are not applicable for 3-phase 3-wire.

Will the existing meter data reset on changing configuration?

The existing meter data will be reset on configuring/changing existing energy channels, logger parameters or CT/VT ratio (scaling information) in meter.

How the histories are affected by changes in time zone?

The histories will be retained even if number of time zones is changed.

What happens if a new successive DST adjustment is made when one is already underway?

The current adjustment will be stopped and the new begun.

When summer time starts, the clock jumps one hour. What happens if the user sets the meter to a DST time within that hour?

The meter will ignore the new time because that hour “does not exist”.

Is logger’s data affected by daylight saving time change? What data is affected by daylight saving time change?

The daylight saving time is applicable for logger’s data, TOU rate registers, TOU demand data and billing data.

Can user set meter clock via Modbus communication protocol?

Time set transaction as per base time or DST time will be provided via DLMS communication protocol.

Only time synchronisation as per base time or DST time will be provided via Modbus communication protocol.

Meter will reject the time sync request if it is above time adjustment limit.

What is the maximum time adjustment limit and how it works?

Time synchronisation as per base time or DST time will be provided via Modbus communication protocol only.

Meter will not sync the time if the time difference is more than the time adjustment limit configured in the meter. By default, the time adjustment limit is set as 25 seconds. The time adjustment limit can be configured as any value between 0 to 30 seconds using ConfigView.

So, if user wants to set the meter time, above time adjustment limit then time set transaction has to be performed via DLMS communication protocol.

How the logged values affected by the daylight saving time change?

Logged values during daylight saving time are labelled with the flag “Yes”. “Yes” means that the DST offset is applied in the meter.

What are the possible consequences of adjusting forward the meter clock?

If the clock is adjusted forward over one or more integration period, there will be empty spaces filled by zero value in the logging memory.

What are the possible consequences of adjusting backward the meter clock?

If the clock is adjusted backward over one or more interval limits, one or more values will exist with the duplicate day and same time stamps. Empty spaces will be filled by zero value in duplicate day. In the worst event, this can result in data read from the meter not matching the expected period. Previous integration period and rising demand data will be reset.

What are the possible consequences of adjusting backward or forward the meter clock within time adjustment limit?

Integration period will be compressed for forward time sync and stretched for backward time sync. Data will be logged as per integration period.

What is power quality?

Power quality is a measure of how well a system supports reliable operation of its loads. A power disturbance or event can involve voltage, current, or frequency. Power disturbances can originate in consumer power systems, consumer loads, or the utility.

What is power disturbance?

Power disturbances are defined in terms of magnitude and duration. Disturbances range from transients that last for microseconds to outages that continue for hours. When a power disturbance falls outside operating limits, equipment may be disrupted or damaged.

How the costs of poor power quality can be significant?

Production loss: Each time production is interrupted, your business loses profit on product that is not manufactured and sold.

Damaged product: Interruptions can damage a partially complete product, causing the material to be re-run or scrapped.

Energy cost: Electric utilities may charge penalties on poor power factor or high peak demands.

What are power quality loggers?

Power quality loggers are used for characterising power quality, conducting load studies and capturing hard-to-find voltage events over a user-defined period of time.

What are power quality recorders?

Advanced power quality recorders are used for capturing comprehensive details of power disturbances, trend analysis and Class-A 'quality-of-service' compliance testing over a user-defined period of time.

What are harmonic numbers?

The harmonic number indicates the harmonic frequency: the first harmonic is the fundamental frequency (60 or 50 Hz), the second harmonic is the component with two times the fundamental frequency (120 or 100 Hz), and so on. The harmonics sequence can be positive (+), zero (0), or negative (-).

Harmonic Frequencies and Sequences

Order	1st	2nd	3rd	4th	5th	6th
Frequency	60 Hz	120 Hz	180 Hz	240 Hz	300 Hz	360 Hz
	50 Hz	100 Hz	150 Hz	200 Hz	250 Hz	300 Hz
Sequence	+	-	0	+	-	0

As you can see, the sequence is + - 0 + -

Positive sequence harmonics try to make a motor run faster than the fundamental; negative sequence harmonics try to make the motor run slower than the fundamental. In both cases the motor loses torque and heats up. Harmonics can also cause transformers to overheat. Even harmonics will disappear if waveforms are symmetrical, i.e. as equally positive and negative. Zero sequence current harmonics add in Neutral conductors. This can cause these conductors to overheat.

What is current distortion?

Current distortion is expected in a system with non-linear loads like all semi-conductor devices. When the current distortion starts to cause voltage distortion (THD) of more than 5%, this signals a potential problem.

K-factor indicates the amount of harmonic currents and can help in selecting transformers. Use K-factor along with apparent power (kVA) to select a replacement transformer to handle non-linear, harmonics-rich loads. K-factor is a mathematically derived value that takes into account the effects of harmonics on transformer loading and losses. A K-rated transformer is one that is specifically designed to handle the effects associated with higher levels of harmonics.

What are inrush currents?

Inrush is the large spike most commonly caused by a motor load coming on-line. As it first energises, the motor utilises a higher amount of current than when runs at a constant speed. This large current draw frequently causes a large enough voltage dip to send other equipment off-line or cause the lights to blink.

If the inrush exceeds the breaker setting, it will trip. Measuring inrush current can help set appropriate breaker trip levels.

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