Energy Meter 610/610-PB

Manual

Weidmüller

Table of contents

General information

This manual applies to the products:

Energy Meter 610-24	2540920000
Energy Meter 610-230	2540850000
Energy Meter 610-PB-24	2540860000
Energy Meter 610-PB-230	2540870000

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Disclaimer

Weidmüller accepts no responsibility for errors or deficiencies within this manual, and makes no commitment to keep the contents of this functional description up to date.

Comments on the manual

We welcome your comments. If anything in this manual seems unclear, please let us know by sending an e-mail to: info@weidmueller.com

Meaning of symbols

This manual uses the following pictograms:

Dangerous voltage!
Risk to life or serious injury. Before commencing work on the system and the device, they must first be de-energised.

Please note!
Please pay attention to the documentation. This symbol is intended to warn you of potential dangers, which could occur during installation, commissioning and use.

Note!

Application notes

Please read these operating instructions and all other publications that must be consulted in order to work with this product (particularly for installation, operation or maintenance).

Please observe all safety regulations and warnings. Non-compliance with the instructions can lead to personal injury and/or damage to the product.

Any unauthorised alteration or use of this device which exceeds the specified mechanical, electrical or other operational limits can cause personal injury and/or damage to the product.

Any such unauthorised alterations are grounds for “abuse” and/or “negligence” in terms of the product’s guarantee and thus excludes the warranty for covering any possible resulting damages.

This device must only be operated and maintained by qualified personnel.

Qualified personnel are persons who, due to their respective training and experience, are able to recognise risks and avoid potential hazards that can be caused by operation or maintenance of the device.
When using the device, the legal and safety regulations required for the respective application must also be observed.

Safety is no longer guaranteed and the device may be dangerous if the device is not operated according to the operating instructions.

All signals connected with the device’s SELV circuit must also conform with the SELV provisions.

Conductors consisting of single wires must be provided with ferrules.

Only screw terminals with the same number of poles and the same type may be plugged together.

About these operating instructions

These operating instructions are part of the product.
- Read the operating instructions prior to using the device.
- Keep the operating instructions at hand throughout the entire service life of the product and keep ready for referencing.
- Hand over the operating instructions to each subsequent owner or user of the product.

Incoming goods inspection

The proper and safe operation of this device requires appropriate transport, proper storage, installation and assembly as well as careful operation and aintenance. When it is assumed that safe operation is no longer possible, the device must immediately be taken out of operation and secured against accidental start-up.
Unpacking and packing must be carried out with the usual care, without the use of force and only with the use of suitable tools. The devices must be visually inspected for proper mechanical condition.
It can be assumed that safe operation is no longer possible if the device, e.g.

- shows visible damage,
- does not work despite intact power supply,
- and was exposed to unfavourable conditions (e.g. storage outside of the permissible climatic limits without adaptation to the ambient climate, condensation, etc.) or transport stresses (e.g. falling from a great height even without exterior visible damage, etc.) for prolonged periods.
- Please check that the delivery is complete before you begin with installation of the device.

All supplied screw terminals are attached to the device.

Scope of delivery Energy Meter 610 or 610-PB

Quantity	Designation
1	Energy Meter 610 or 610-PB
2	Mounting brackets
1	Quick guide
1	Screw terminal, pluggable, 2-pin (auxiliary energy)
1	Screw terminal, pluggable, 4-pin (voltage measurement)
1	Screw terminal, pluggable, 6-pin (current measurement)
1	Screw terminal, pluggable, 2-pole (current measurement I4)
1	Screw terminal, pluggable, 2-pin (RS 485)
1	Screw terminal, pluggable, 10-pole (digital inputs/outputs)
1	Screw terminal, pluggable, 3-pin (digital/pulse output)

Product description

Proper use

The Energy Meter 610/610-PB is intended for the measurement and calculation of electrical parameters such as voltage, current, power, energy, harmonics etc. in building installations, on distribution units, circuit breakers and busbar trunking systems.
The Energy Meter 610/610-PB is suitable for integration into fixed and weatherproof switch panels. Conductive switch panels must be earthed. Can be installed in any attitude.

Measured voltage and measured current must derive from the same network.
The measurement results can be displayed and can be read out and further processed via the interfaces.

The voltage measurement inputs are designed for measurements in low voltage networks, in which rated voltages of up to 300 V relative to earth and surges in overvoltage category III can occur.
The current measurement inputs of the Energy Meter 610/610-PB are connected via external ../1A or ../5A current transformers.
The measurement in medium and high voltage networks is implemented in principle via current and voltage transformers. The Energy Meter 610/610-PB can be employed both domestically and in industry.

Device characteristics

- Supply voltage
  Option 230 V: 90 to 277 V (50/60 Hz) or DC 90 to 250 V; 300 V CATIII
  Option 24 V: 24 to 90 V AC/DC; 150V CATIII
- Frequency range: 45 to 65 Hz

Device functions

	Energy Meter	
	610-PB	610
3 voltage measurements, 300 V	✓	✓
4 current measurements (via current transformer)	✓	✓
RS 485 interface (Modbus RTU)	✓	✓
Profibus	✓	–
USB	✓	✓
2 + 4 digital outputs	✓	✓
4 digital inputs	✓	✓
Clock, memory	✓	✓

Features of the Energy Meter 610/610-PB

General

- Front panel-mounted with the dimensions 96x96 mm
- Connection via screw-type terminals
- LC display with backlighting.
- Operation via 2 buttons
- 3 voltage measurements inputs (300 V CAT III)
- 4 current measurement inputs for current transformer
- RS485 interface (Modbus RTU, slave, to 115 kbps)
- 6 digital outputs and 4 digital inputs
- USB interface
- Only Energy Meter 610-PB variant: Profibus interface (Profibus DP V0)
- Working temperature range -10 to +55 °C
- Storage of minimum and maximum values (with time stamp)
- 5 MB flash memory
- Clock and battery (with battery monitoring function)
- Configurable records, can be read out via RS485 and USB

Measurement uncertainty

- Active energy, measuring uncertainty class 0.5 for ../5 A transformer
- Active energy, measuring uncertainty class 1 for ../1 A transformer
- Reactive energy, class 2

Measurement

- Measurement in IT, TN and TT networks
- Measurement in networks with nominal voltages up to L-L 480 V and L-N 277 V
- Current metering range 0 to 5 Aeff
- True root mean square measurement (TRMS)
- Continuous scanning of voltage and current measurement inputs
- Frequency range of the mains frequency 45 to 65 Hz
- Measurement of harmonics 1 to 40 for ULN and I
- Uln, I, P (import/delivery), Q (ind./cap.).
- Fourier analyses 1 to 40. Harmonic for U and I.
- 7 power meter for
  Active energy (import), Active energy (export), Active energy (without a backstop), Reactive energy (ind.), Reactive energy (capacitive), Reactive energy (without a backstop), Apparent energy, each for L1, L2, L3 and total.
- 8 tariffs (switching via Modbus)

Measuring method

The Energy Meter 610/610-PB measures uninterrupted and calculates all root mean squares over a 10/12-period interval. The Energy Meter 610/610-PB measures the true root mean square (TRMS) of the voltages and currents applied to the measuring inputs.

Operating concept

There are several ways to program the Energy Meter 610/610-PB and retrieve measured values.

- Directly on the device using two buttons
- Via the programming software of the ecoExplorer go
- Through the device‘s homepage
- Via the RS485 interface with the Modbus protocol. Data can be changed and retrieved with the help of the Modbus address list.

These operating instructions only describe the operation of the Energy Meter 610/610-PB using the 2 buttons.
The programming software of the ecoExplorer go has its own documentation.

Additional components that are not included in the scope of deliverables will be required for parameterisation via the RS485 interface.

ecoExplorer go network analysis software

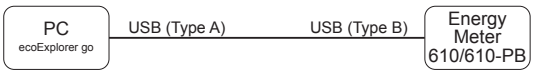
The Energy Meter 610/610-PB can be programmed and read out using the ecoExplorer go network analysis software. A PC must be connected via a serial interface to the USB or RS485 interface of the Energy Meter 610/610-PB for this (see connection variants).

ecoExplorer go software features

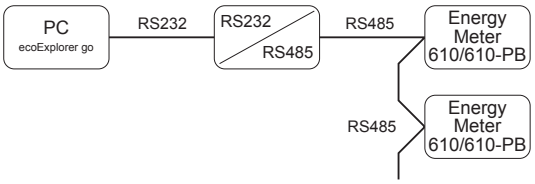
- Programming the Energy Meter 610/610-PB
- Graphical representation of measured values

Connection variants

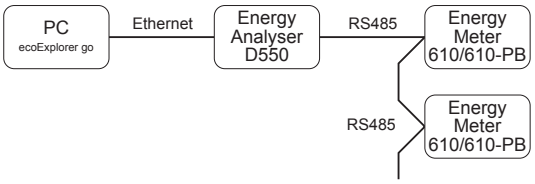
Connecting a Energy Meter 610 or 610-PB to a PC via the USB interface:



Connecting a Energy Meter 610 or 610-PB to a PC via an interface converter:



Connecting a Energy Meter 610 or 610-PB via a Energy Analyser D550 as gateway:



Assembly

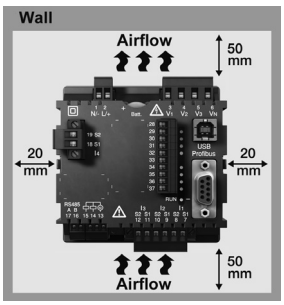
Installation location

The Energy Meter 610/610-PB is suitable for installation in permanent, weatherproof switchboards. Conducting switchboards must be earthed.

Installation position

The Energy Meter 610/610-PB must be installed vertically in order to achieve sufficient ventilation. The clearance to the top and bottom must be at least 50 mm and 20 mm at the sides.

Front panel cutout



Cutout dimensions:
$92^{+0,8}$ x $92^{+0,8}$ mm.

Fig.: Energy Meter 610/610-PB installation location (rear view)

⚠	Failure to comply with the minimum spacing can destroy the Energy Meter 610/610-PB at high ambient temperatures!

Mounting

The Energy Meter 610/610-PB is fixed using the mounting clips found on the side of the switch panel. Before inserting the device, they should be moved out of the way in a horizontal lever using a screwdriver, for example.

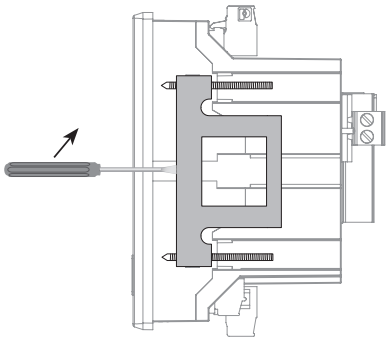
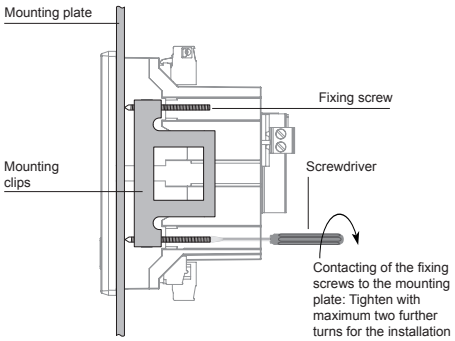


Fig.: Side view Energy Meter 610/610-PB with mounting clips. Loosening the clips is done using a screwdriver and a horizontal lever effect.

The fastening is then done when the device is pushed in an the clamps lock in place when the screws are tightened.

- Please tight the fixing screws until they contact the mounting plate easily.
- Tighten with two further turns, the clamping screws (are the screws tightened too much, the mounting bracket will be destroyed)



Installation

Supply voltage

A supply voltage is required to operate the Energy Meter 610/610-PB. The voltage supply is connected via plug-in terminals on the back of the device.

Before applying the supply voltage, ensure that the voltage and frequency correspond with the details on the nameplate!

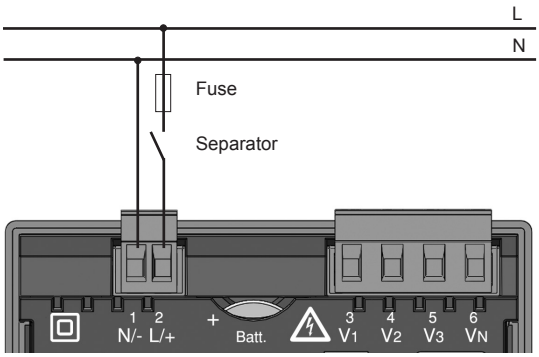


Fig.: Connection example of the supply voltage to the Energy Meter 610/610-PB

⚠	• The supply voltage must be connected through a fuse according to the technical data. • In building installations, the supply voltage must be provided with a disconnect switch or circuit breaker. • The disconnect switch must be attached near the device and must be easily accessible by the user. • The switch must be labelled as a separator for this device. • Voltages that exceed the permissible voltage range can destroy the device.

Voltage metering

The Energy Meter 610/610-PB can be used for voltage measurement in TN, TT and IT systems.
Voltage measurement in the Energy Meter 610/610-PB is designed for the 300 V overvoltage category CAT III (4 kV rated pulse voltage).

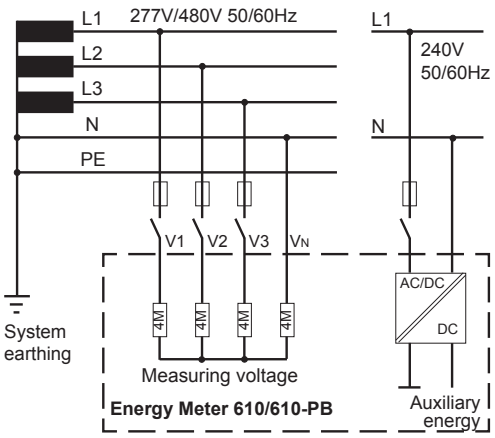


Fig.: Principle circuit diagram - Measurement in three-phase 4-wire systems.

In systems without a neutral, measured values that require a neutral refer to a calculated neutral.

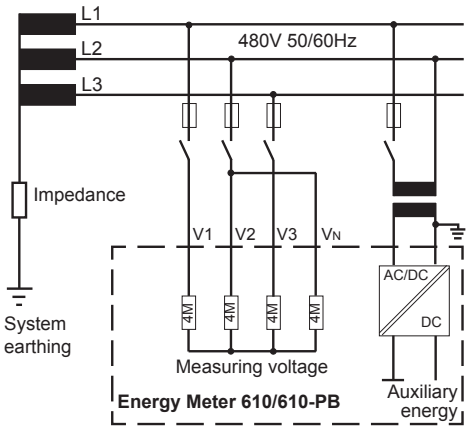


Fig.: Principle circuit diagram - Measurement in three-phase 3-wire systems.

Rated mains voltage

Lists of the networks and their rated mains voltage in which the Energy Meter 610/610-PB can be used.

Three-phase 4-wire systems with earthed neutral conductor.

U_{L-N} / U_{L-L}	
66V / 115V	
120V / 208V	
127V / 220V	
220V / 380V	
230V / 400V	
240V / 415V	
260V / 440V	
277V / 480V	Maximum rated voltage of the network

Fig.: Table of the rated mains voltages suitable for the voltage measuring inputs according to EN 60664-1:2003.

Unearthed three-phase, 3-wire systems.

U_{L-L}	
66V	
120V	
127V	
220V	
230V	
240V	
260V	
277V	
347V	
380V	
400V	
415V	
440V	
480V	Maximum rated voltage of the network

Fig.: Table of the rated mains voltages suitable for the voltage measuring inputs according to EN 60664-1:2003.

Voltage measurement inputs

The Energy Meter 610/610-PB has three voltage measurement inputs (V1, V2, V3).

Overvoltage
The voltage measurement inputs are suitable for measurement in networks in which overvoltages of overvoltage category 300 V CAT III (4 kV rated pulse voltage) can occur.

Frequency
The Energy Meter 610/610-PB requires the mains frequency for the measurement and calculation of measured values.
The Energy Meter 610/610-PB is suitable for measurements in the frequency range of 45 to 65 Hz.

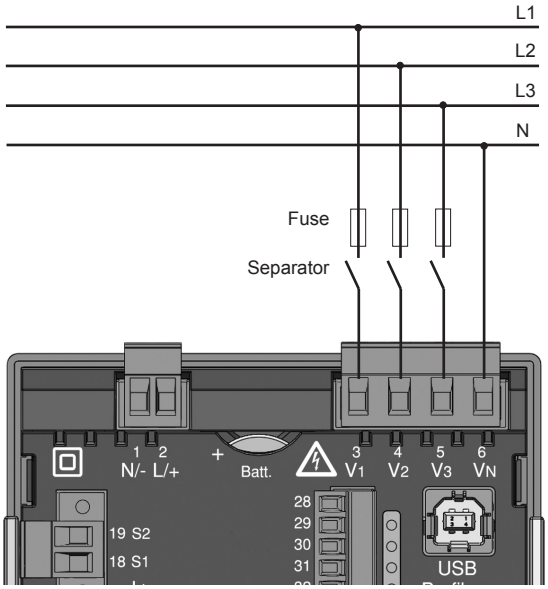


Fig.: Connection example for the voltage measurement

When connecting the voltage measurement, the following must be observed:

Isolation device
- A suitable circuit breaker must be fitted to disconnect and de-energise the Energy Meter 610/610-PB.
- The circuit breaker must be placed in the vicinity of the Energy Meter 610/610-PB, be marked for the user and easily accessible.
- The circuit breaker must be UL/IEC certified.

Overcurrent protection device
- An overcurrent protection device must be used for line protection.
- For line protection, we recommend an overcurrent protection device as per the technical specifications.
- The overcurrent protection device must be suitable for the line cross section used.
- The overcurrent protection device must be UL/IEC certified.
- A circuit breaker can be used as an isolating and line protection device. The circuit breaker must be UL/IEC certified.
- Measured voltages and measured currents must derive from the same network.

Attention!
Voltages that exceed the permitted ratedmains voltages must be connected via voltage transformers.

Attention!
The Energy Meter 610/610-PB is not suitable for the measurement of DC voltages.

Attention!
The voltage measurement inputs on the Energy Meter 610/610-PB are dangerous to touch!

Connection diagram, voltage measurement

- 3p 4w (addr. 509= 0), factory setting

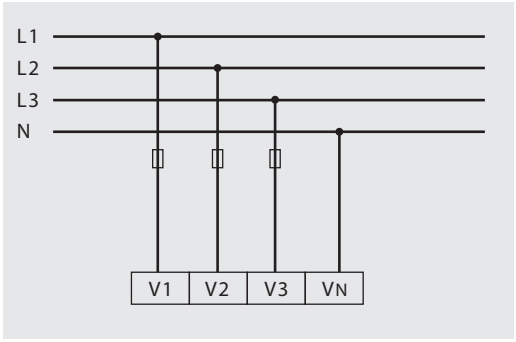


Fig.: System with three-phase conductors and a neutral conductor.

- 3p 2u (addr. 509 = 5)

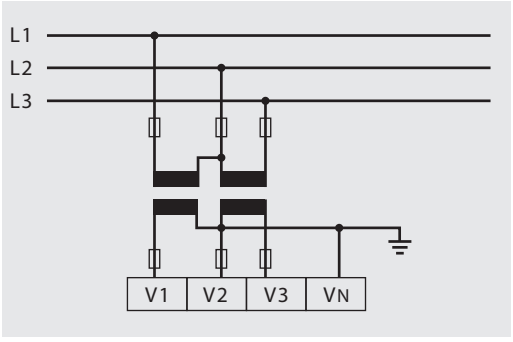


Fig.: System with three-phase conductors and no neutral conductor. Measurement via voltage transformer. Measured values that require a neutral refer to a calculated neutral.

- 3p 4u (addr. 509 = 2)

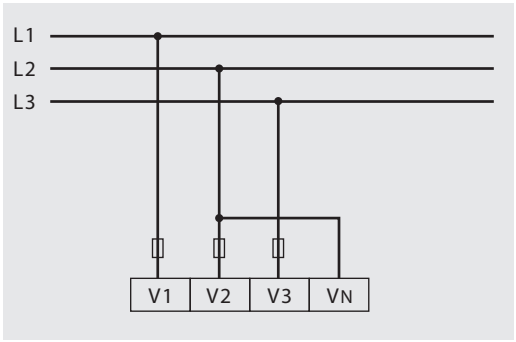


Fig.: System with three-phase conductors and no neutral conductor. Measured values that require a neutral refer to a calculated neutral.

- 1p 2w1 (addr. 509 = 4)

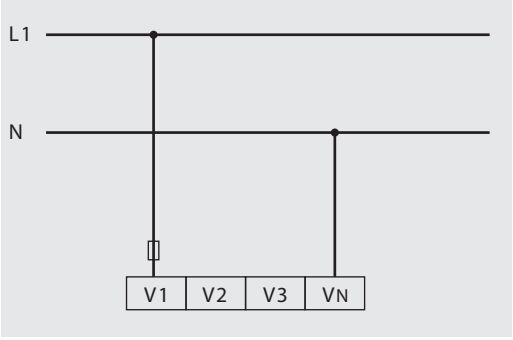


Fig.: Measured values derived from the V2 and V3 voltage measurement inputs are assumed to be zero and not calculated.

- 3p 4wu (addr. 509 = 1)

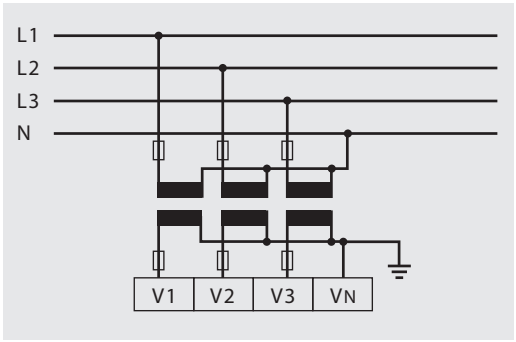


Fig.: System with three-phase conductors and a neutral conductor. Measurement via voltage transformer.

- 1p 2w (addr. 509 = 6)

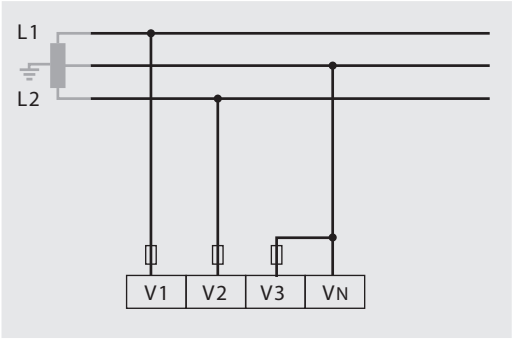


Fig.: TN-C system with single-phase, three-wire connection. Measured values derived from the V3 voltage measurement input Zero are assumed to be zero and not calculated.

- 2p 4w (addr. 509 = 3)

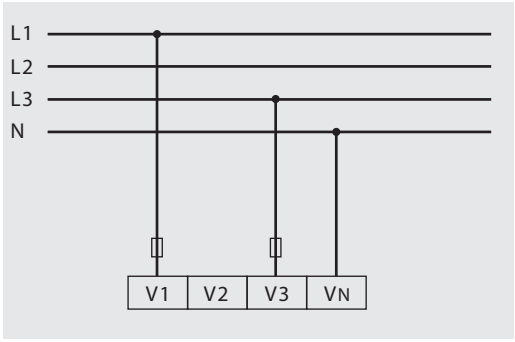


Fig.: System with uniform phase loading. The measured values for the V2 voltage measurement input are calculated.

- 3p 1w (addr. 509 = 7)

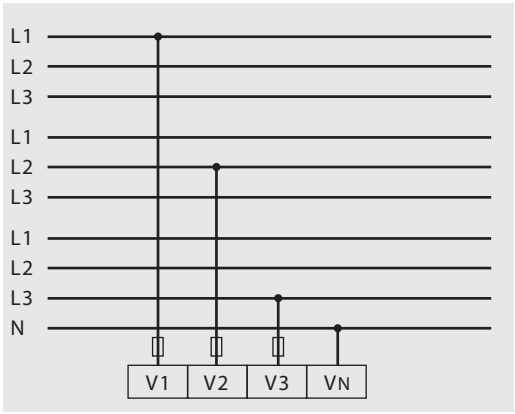


Fig.: Three systems with uniform phase loading. The measurement values L2/L3 resp. L1/L3 resp.L1/L2 of the respective system are calculated.

Current measurement via I1 to I4

The Energy Meter 610/610-PB is designed to have current transformers with secondary currents from ../1A and ../5A attached cia terminals I1-I4. The factory default for the current transformer ratio is 5/5A and must be adapted to the current transformer employed if necessary.
Direct measurement without a current transformer is not possible using the Energy Meter 610/610-PB.
Only AC currents can be measured - DC currents cannot.

Via the **current measurement input I4** only an apparent current measurement is carried out thanks to the lack of a multiplier. Power measurements are therefore not possible using the I4 input.

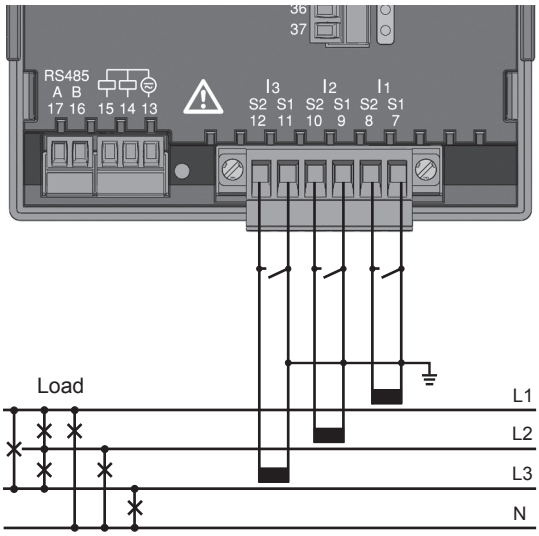


Fig.: Current measurement (I1-I3) via current transformers (connection example)

	Caution! The test leads must be designed for an operating temperature of at least 80 °C.

	Caution! The current measurement inputs are dangerous to touch.

	The attached screw terminal has to be fixed sufficiently with two screws on the device!

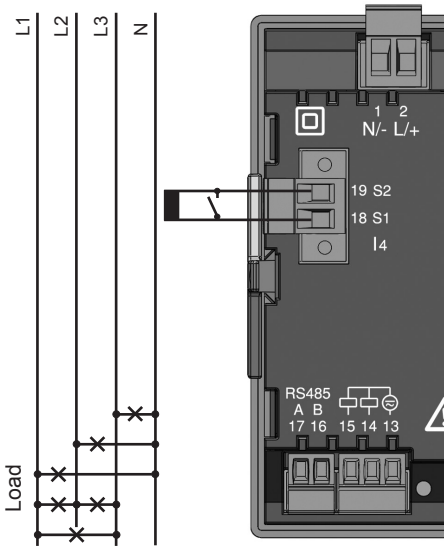


Fig.: Current measurement (I4) via current transformer (connection example)

	Earthing of current transformers! If a connection is provided for the earthing of secondary windings then this must be connected to the earth.
	Caution! The Energy Meter 610/610-PB is not suitable for measuring DC voltages.
	It is not necessary to configure a connection schematic for the I4 measurement input.

Direction of the current

The current direction can be individually corrected on the device or via the serial interfaces for each phase.

In the case of incorrect connection, the current transformer does not need to be subsequently reconnected.

	Caution! The Energy Meter 610/610-PB is only approved for a current measurement using the current transformer.
	Current transformer connections! The secondary connection of the current transformer must be short-circuited on this before the current feed to the Energy Meter 610/610-PB is disconnected! If a test switch, which automatically short-circuits the secondary wires of the current transformer, is available then it is sufficient to set this to the “Test” position insofar as the short-circuiting device has been checked beforehand.
	Open-circuit current transformers! High voltage spikes that are dangerous to touch can occur on current transformers that are driven with open-circuit secondary windings! With “safe open-circuit current transformers” the winding insulation is rated such that the current transformer can be driven open. However, even these current transformers are dangerous to touch when they are driven open-circuit.

Connection diagram, current measurement

- 3p 4w (addr. 510= 0), factory setting

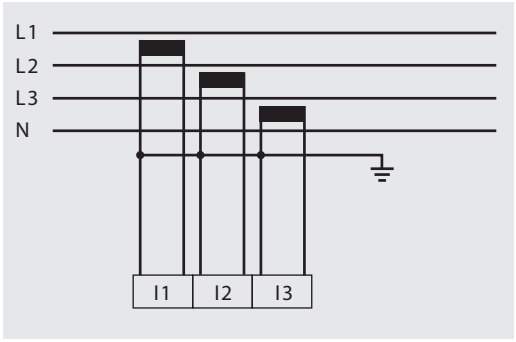


Fig.: Measurement in a three-phase net-work with an unbalanced load.

- 3p 3w3 (addr. 510 = 3)

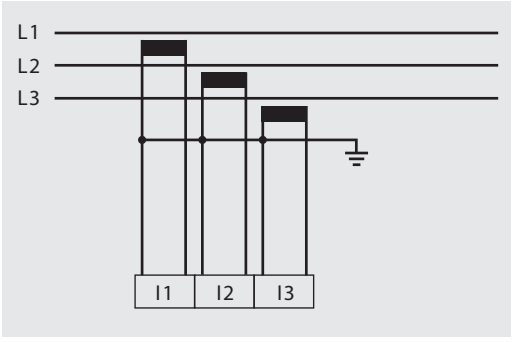


Fig.: Measurement in a three-phase net-work with an unbalanced load.

- 3p 2i0 (addr. 510 = 2)

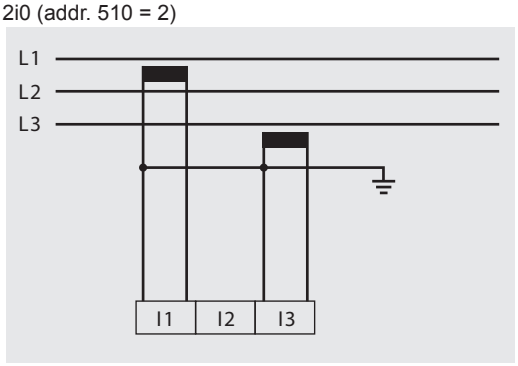


Fig.: The measured values for the I2 current measurementinput are calculated.

- 3p 3w (addr. 510 = 4)

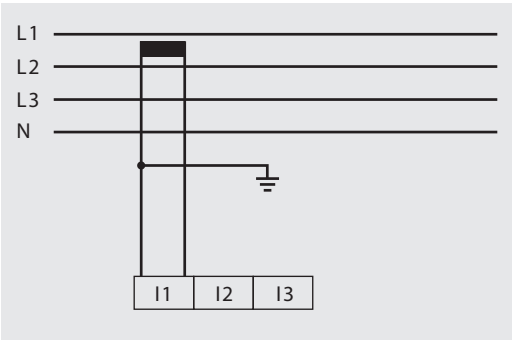


Fig.: System with uniform phase loading. The measured values for the I2 and I3 current measurement inputs are calculated.

- 3p 2i (addr. 510 = 1)

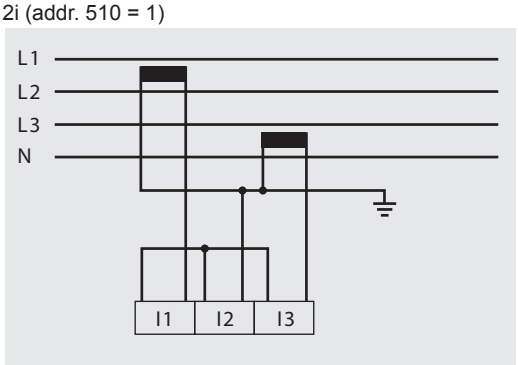


Fig.: System with uniform phase loading. The measured values for the I2 current measurement input are measured.

- 1p 2i (addr. 510 = 6)

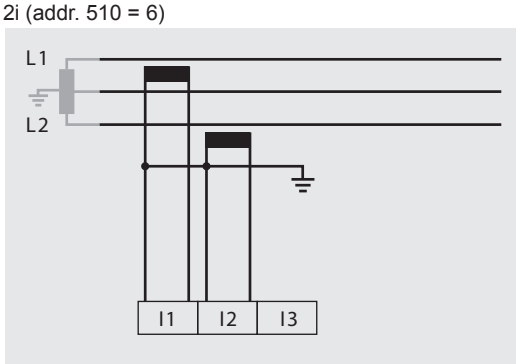


Fig.: Measured values derived from the I3 current measurement input are assumed to be zero and not calculated.

- 2p 4w (addr. 510 = 5)

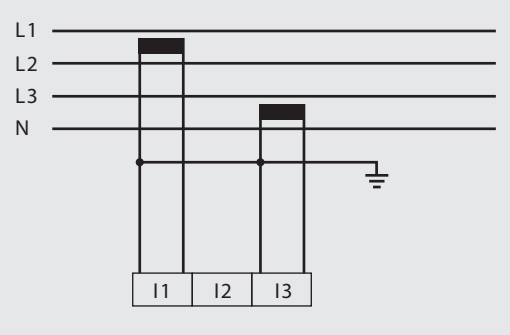


Fig.: System with uniform phase loading. The measured values for the I2 current measurement input are calculated.

- 1p 2w (addr. 510 = 7)

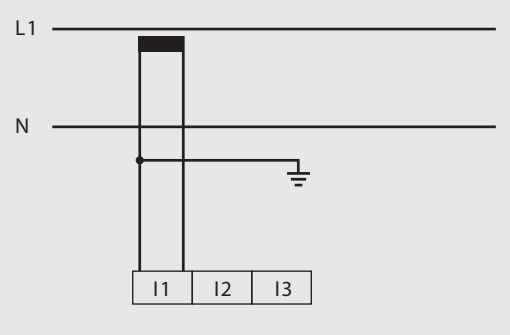


Fig.: Measured values derived from the I2 and I3 current measurement inputs are assumed to be zero and not calculated.

- 3p 1w (addr. 510 = 8)

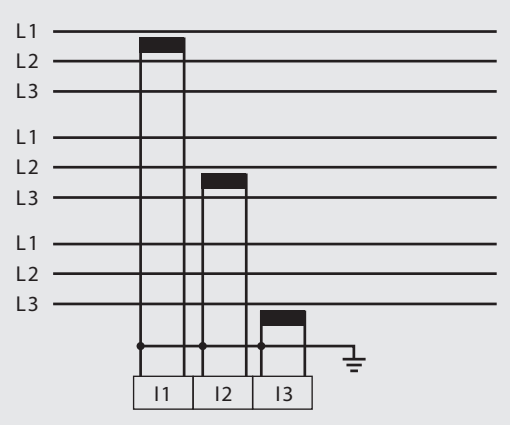


Fig.: Three systems with uniform phase loading. The current measurement values of the phases of the respective system where are no CTs connected are calculated (I2/I3 resp. I1/I3 resp. I1/I2).

Total current measurement

If the current measurement takes place via two current transformers, the total transformer ratio of the current transformer must be programmed in the Energy Meter 610/610-PB.

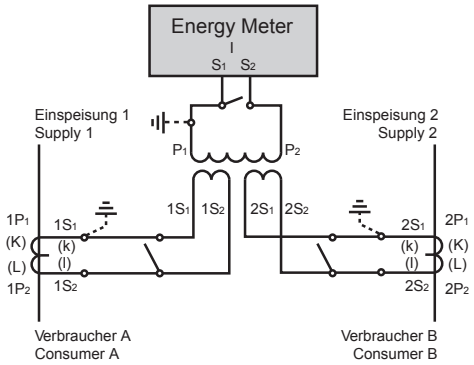


Fig.: Current measurement via a total current transformer (example).

Example:
The current measurement takes place via two current transformers. Both current transformers have a transformer ratio of 1000/5 A. The total measurement is performed with a 5+5/5 A total current transformer.

The Energy Meter 610/610-PB must then be set as follows:

Primary current:	1.000 A + 1.000 A = 2.000 A
Secondary current:	5 A

Ammeter

If you want to measure the current not only with the Energy Meter 610/610-PB but also with the ammeter, the ammeter must be connected in series with the Energy Meter 610/610-PB.

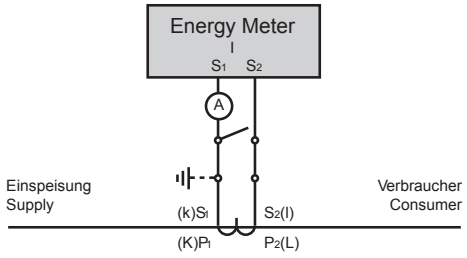


Fig.: Current measurement with an additional ammeter (example).

RS485 interface

The RS485 interface is designed with the Energy Meter 610/610-PB as a 2-pole plug contact and communicates via the Modbus RTU protocol (also see programming parameters).

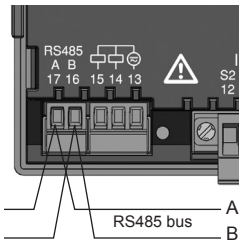


Fig.: RS485 interface, 2-pole plug contact

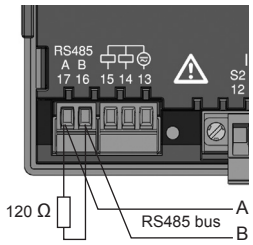
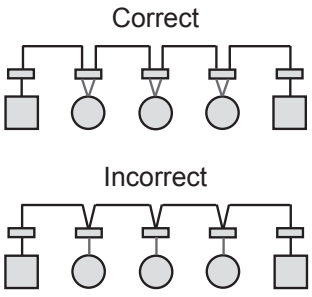


Fig.: RS485 interface, 2-pole plug contact with terminating resistor

Terminating resistors

The cable is terminated with resistors (120 ohm 1/4 W) at the beginning and end of a segment.

The Energy Meter 610/610-PB has no terminating resistors.



Terminal block in the switch cabinet.

Device with RS485 interface.
(without a terminating resistor)

Device with RS485 interface.
(with terminating resistor on the device)

Shielding

A twisted and shielded cable must be provided for connections via the RS485 interface.

- Ground the shields of all cables that run into the cabinet at the cabinet entry.
- Connect the shield so it has a large contact area and conductively with a low-noise earth.
- Mechanically trap the cable above the earthing clamp in order to avoid damage from cable movement.
- Use the appropriate cable inlets, e.g. PG screw joints, to insert the cable into the switch cabinet.

Cable type

The cable used must be suitable for an ambient temperature of at least 80 °C.

Recommended cable types:
Unitronic Li2YCY(TP) 2x2x0.22 (Lapp cable)
Unitronic BUS L2/FIP 1x2x0.64 (Lapp cable)

Maximum cable length

1200 m with a baud rate of 38.4 k.

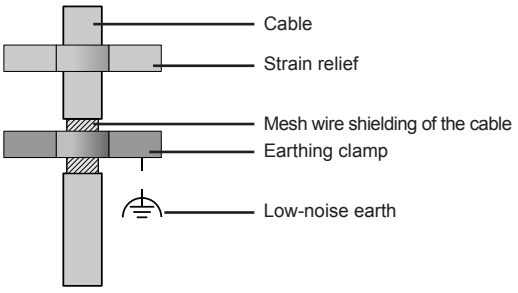


Fig.: Shielding design for cabinet entry.

For the wiring of the Modbus connection, CAT cables are not suitable. Please use the recommended cables.

Bus structure

- All devices are connected in a bus structure (line) and each device has its own address within the bus (also see programming parameters).
- Up to 32 stations can be interconnected in one segment.
- The cable is terminated with resistors (bus termination, 120 ohm 1/4 W) at the beginning and end of a segment.
- If there are more than 32 stations, repeaters (line amplifiers) must be used in order to connect the individual segments.
- Devices with activated bus termination must be supplied with power.
- It is recommended to set the master at the end of a segment.
- The bus is inoperative if the master is replaced with an activated bus termination.
- The bus can become unstable if the slave is replaced with an activated bus termination or is dead.
- Devices that are not involved in the bus termination can be exchanged without making the bus unstable.
- The shield has to be installed continuously and needs to be broadly and well conducting connected to an external low voltage (or potential) ground at the end.

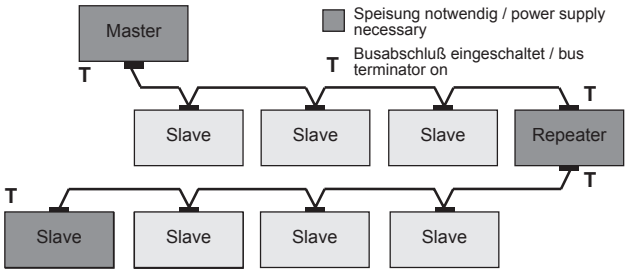
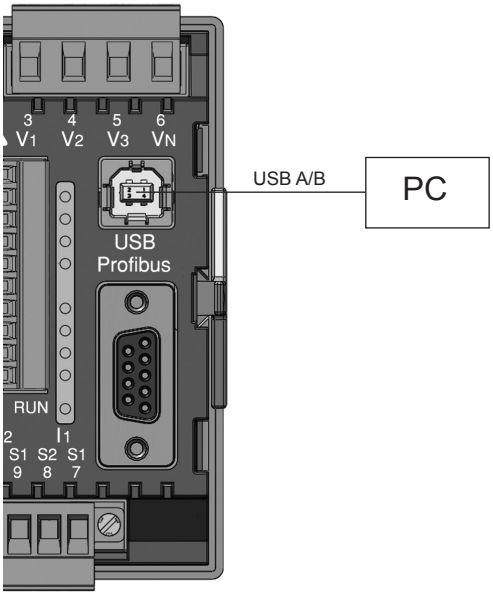


Fig.: Diagram of bus structure

USB interface

The Universal Serial Bus (USB) enables a rapid and uncomplicated connection between the device and a computer. After the installation of the USB driver the device data can be read out via the ecoExplorer go software and firmware updates can be installed.

The USB2.0 connection cable with A/B connectors included in the scope of deliverables is required for the USB connection of the device to the USB interface of the computer.



	The cable length of the USB connection should not exceed 5 m.

Profibus interface (only Energy Meter 610-PB)

This 9-pin D-sub receptacle RS485 interface supports the Profibus DP V0 slave protocol.

For the simple connection of inbound and outbound bus wiring these should be connected to the Energy Meter 610-PB via a Profibus connector.

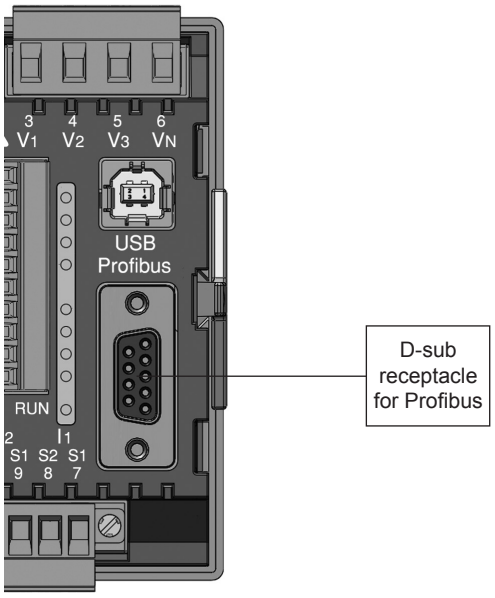


Fig.: Energy Meter 610-PB with D-sub receptacle for Profibus (View on rear).

	The device address can be configured by using the parameter 000 if the device is used in a Profibus-System. The baud rate in a Profibus system is detected automatically and must NOT be set via the address 001!

Connection of the bus wiring

The inbound bus wiring is connected to terminals 1A and 1B of the Profibus connector. The continuing bus wiring for the next device in line should be connected to terminals 2A and 2B.

If there are no subsequent devices in the line then the bus wiring must be terminated with a resistor (switch to ON).

With the switch set to ON terminals 2A and 2B are switched off for further continuing bus wiring.

Transfer speeds in Kbit/s	max. segment length
9.6 / 19.2 / 45.45 / 93.75	1200 m
187.5	1000 m
500	400 m
1500	200 m
3000 / 6000 / 12000	100 m

Tab.: Segment lengths per Profibus specification.

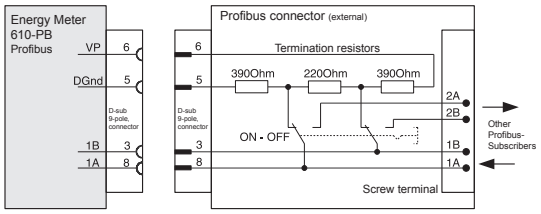
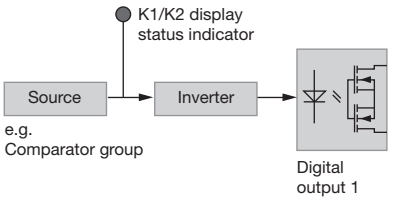


Fig.: Profibus connector with termination resistors.

Digital outputs

The Energy Meter 610 and Energy Meter 610-PB have 6 digital outputs, whereby these are split into two groups of 2 and 4 outputs.

Digital outputs, Group 1
- The status indicator appears on the display at K1 or K2
- The status indicator on the display is not dependent on an inversion being activated (NC / NO)



Digital outputs, Group 2
- The status of the inputs and outputs in Group 2 is indicated by the associated LED (cf. chapter LED status bar).

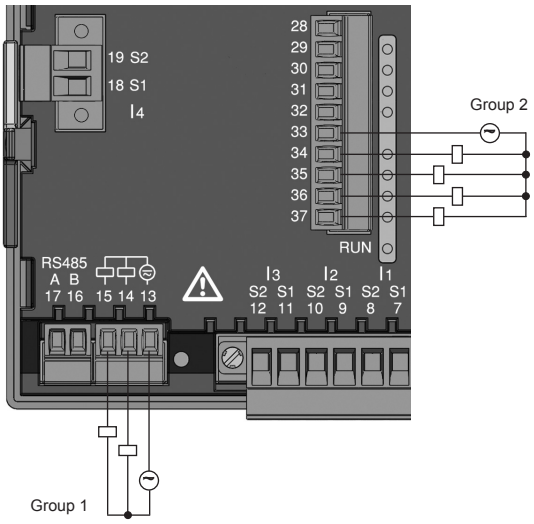


Fig.: Connection digital/pulse outputs

These outputs are electrically isolated from the evaluation electronics by optocouplers. The digital outputs have a common reference.

- The digital outputs can switch DC and AC loads.
- The digital outputs are not short circuit protected.
- Connected cables longer than 30 m must be shielded.
- An external auxiliary voltage is required.
- The digital outputs can be used as pulse outputs.
- The digital outputs can be controlled via the Modbus.
- The digital outputs can output results from comparators

	When using the digital outputs as pulse outputs the auxiliary voltage (DC) must have a max. residual ripple of 5 %.

	Functions for the digital outputs can be adjusted clearly in the ecoExplorer go software. A connection between the Energy Meter 610/610-PB and the PC via an interface is required for the use of the ecoExplorer go software.

DC connection example

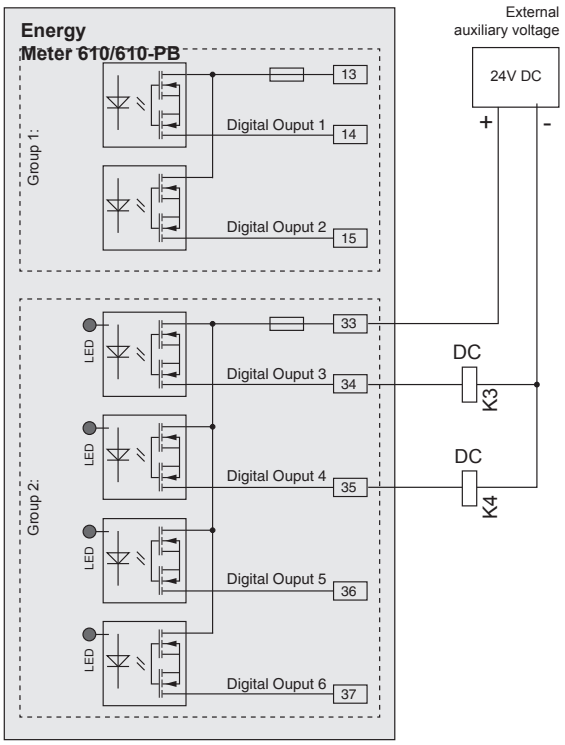


Fig.: Example for two relays connected to the digital outputs

Digital inputs

The Energy Meter 610-PB and Energy Meter 610 have 4 digital inputs, each of which can have a signal transducer connected.

On a digital input an input signal is detected if a voltage of at least 10 V and maximum 28 V is applied and where a current of at least 1 mA and maximum 6 mA flows at the same time. Wiring longer than 30 m must be screened.

Note the correct polarity of the supply voltage!

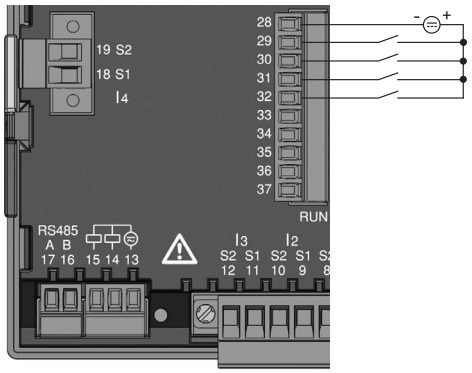


Fig.: Connection example for digital inputs.

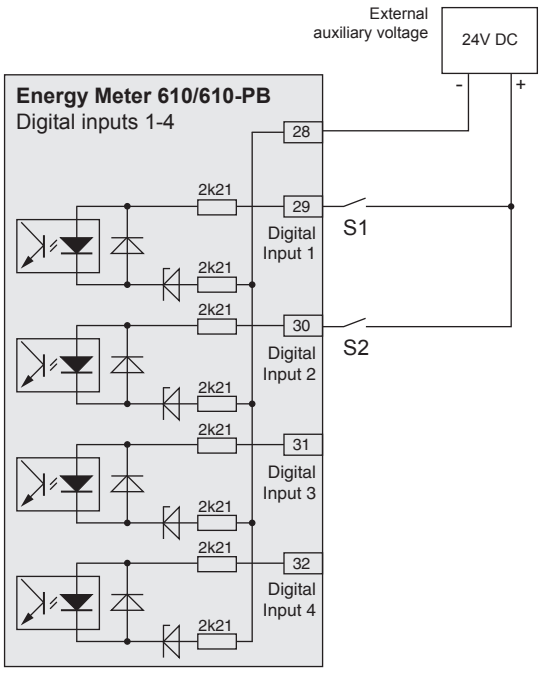


Fig.: Example for the connection of external switch contacts S1 and S2 to digital inputs 1 and 2.

S0 pulse input

You can connect an S0 pulse transducer per DIN EN 62053-31 to any digital input.

This requires an auxiliary voltage with an output voltage in the range 20 to 28 V DC and a resistor of 1.5 kOhm.

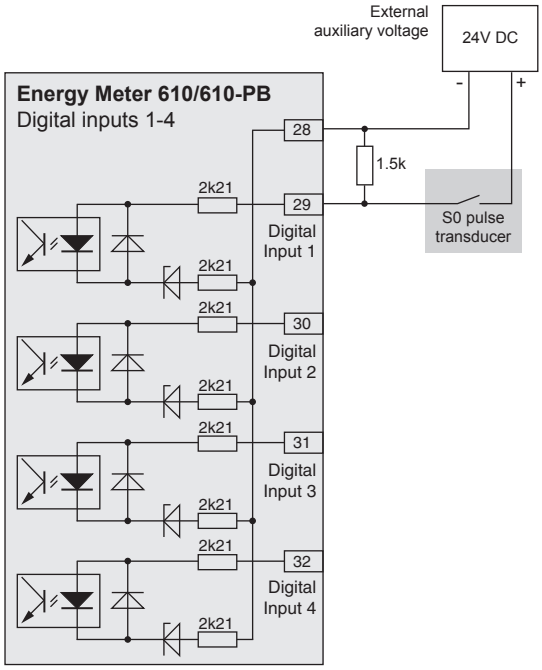


Fig.: Example for the connection of an S0 pulse transducer to digital input 1.

LED status bar

The different statuses of the inputs and outputs are displayed via the LED status bar on the rear of the device.

Digital inputs
The LED associated with the respective input illuminates green if there is a signal of at least 1 mA flowing through the interface.

Digital outputs
The LED associated with the respective output illuminates green if the output is active - independent of whether there is a connection on the interface.

Profibus (only Energy Meter 610-PB variant)
The LED associated with the Profibus provides comprehensive information by means of a red or green illumination and a flashing frequency, according to the table below.

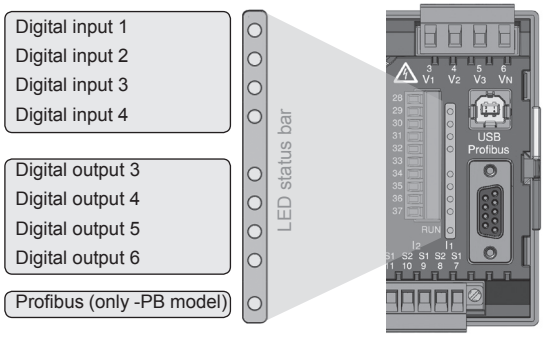


Fig.: LED status bar for inputs and outputs

Profibus status LED			
Flashing frequency	**Red**	**Green**	**Status**
Illuminates steadily	x	–	Still no contact with PLC
Slowly (approx. 1x per second)	x	–	Fault in the configuration data
Very slowly (approx. 1x per 2 second)	x	–	Fault with data exchange
Illuminates steadily	–	x	Data exchange with the PLC
Quickly (approx. 3x per second)	–	x	Energy Meter waiting on parameterising data
Slowly (approx. 1x per second)	–	x	Energy Meter waiting on configuration data

x = active – = passive

Tab.: LED status bar for inputs and outputs

The status “Energy Meter waiting on configuration data” occurs if there is no PLC connected

Operation

The Energy Meter 610/610-PB is operated using buttons 1 and 2. Measured values and programming data appears on a liquid crystal display.

A distinction is made between display mode and programming mode. The accidental changing of programming data is prevented by the entry of a password.

Display mode

In the display mode, you can scroll between the programmed measured value displays using buttons 1 and 2. All factory-set measured value displays listed in section 1 can be called up. Up to three measured values are displayed per measured value display. The measured value relaying allows select measured value displays to be shown alternately after a settable changeover time.

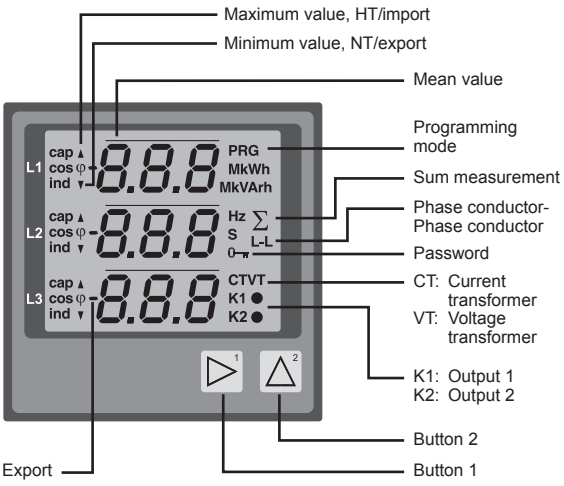
Programming mode

In the programming mode, the settings required for operating the Energy Meter 610/610-PB can be displayed and changed. Pressing buttons 1 and 2 simultaneously for about one second calls up the programming mode after the password prompt. If no user password was programmed, the user arrives directly in the first programming menu. Programming mode is indicated by the text “PRG” on the display.

Button 2 can now be used to switch between the following programming menus:

- current transformer,
- voltage transformer,
- parameter list.

If the device is in programming mode and no button has been pressed for approximately 60 seconds or if buttons 1 and 2 are pressed simultaneously for approx. one second, the Energy Meter 610/610-PB returns to display mode.



Parameters and measured values

All parameters necessary for operating the Energy Meter 610/610-PB, e.g. the current transformer data, and a selection of frequently required measured values are stored in the table. The contents of most addresses can be accessed via the serial interface and the buttons on the Energy Meter 610/610-PB.

Only the first 3 significant digits of a value can be entered on the device. Values with more digits can be entered using ecoExplorer go software.
The device always only displays the first 3 significant digits of a value.

Selected measured values are summarised in measured value display profiles and can be shown in display mode using buttons 1 and 2.

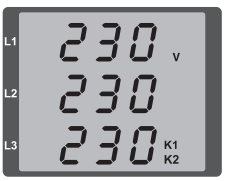
The current measured value display profile and the current display change profile can only be read and changed via the RS485 interface.

Example of the parameter display

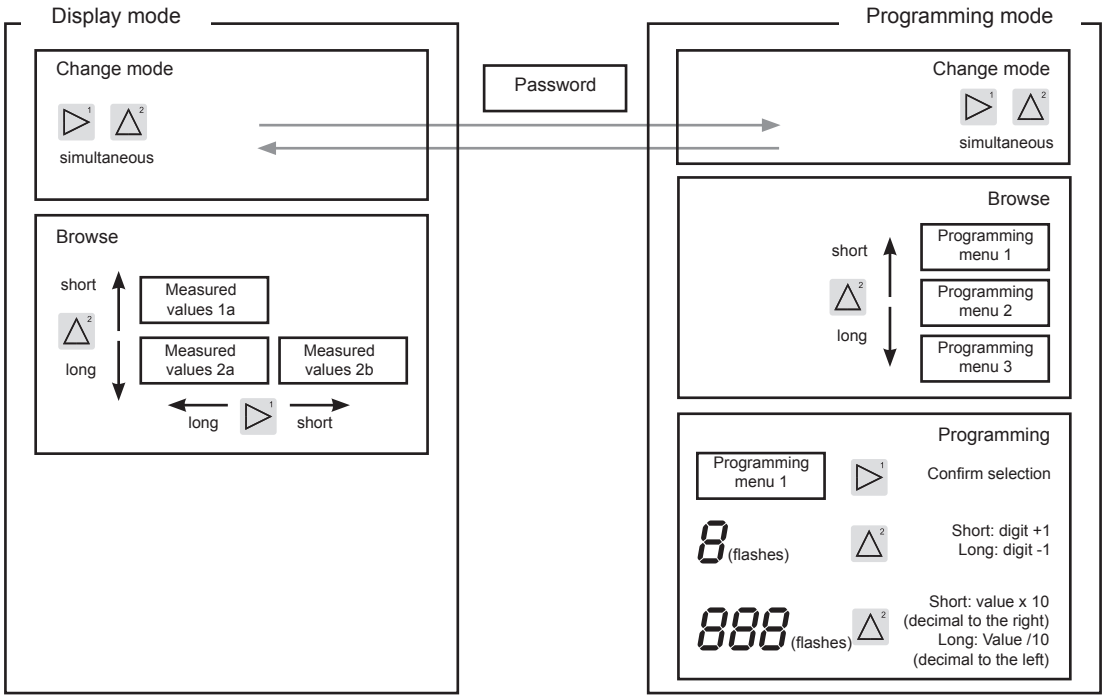
On the Energy Meter 610/610-PB display the value “001” is shown as the content of address “000”. This parameter reflects the device address (here “001”) of the Energy Meter 610/610-PB on a bus in list form.

Example of the measured value display

In this example, the Energy Meter 610/610-PB display shows the voltages L to N with 230 V each.
The K1 and K2 transistor outputs are conductive and current can flow.



Button functions



Configuration

Applying the supply voltage

To configure the Energy Meter 610/610-PB, the supply voltage must be connected.

The level of supply voltage for the Energy Meter 610/610-PB can be found on the nameplate.

If no display appears, check the operating voltage to determine whether it is within the rated voltage range.

Current and voltage transformers

A current transformer is set to 5/5 A in the factory. The pre-programmed voltage transformer ratio only needs to be changed if voltage transformers are connected.

When connecting voltage transformers, the measurement voltage on the Energy Meter 610/610-PB nameplate must be observed!

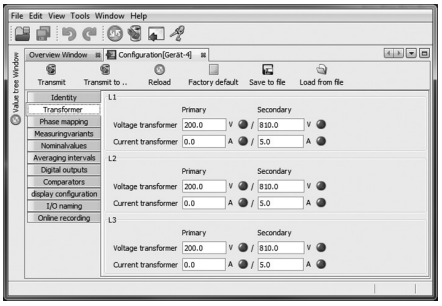


Fig.: Display for configuring the current and voltage transformers in the ecoExplorer go software.

	Attention! Supply voltages that do not correspond to the nameplate information can lead to device malfunction or destruction.
	The adjustable value 0 for the primary current transformer does not produce any useful energy values and must not be used.
	Devices, which are programmed to automatic frequency detection, need approximately 20 seconds to detect grid frequency. During this period, the measured values do not keep the confirmed measuring accuracy.
	Prior to commissioning potential production dependant contents of the energy counter, min/max values and records have to be deleted.
	Current and voltage transformers The transformer ratios for each of the three current and voltage measurement inputs can be individually programmed in the ecoExplorer go software. Only the transformer ratio of the respective group of current measurement inputs or voltage measurement inputs is adjustable on the device.

Programming current transformers

Switching to programming mode
- Simultaneously press buttons 1 and 2 in order to switch to programming mode. If a user password was programmed, the password request will appear with “000”. The first digit of the user password flashes and can be changed with button 2. The next digit is selected by pressing button 1 and will begin flashing. If the correct combination was entered or if no user password was programmed, the device will enter programming mode.
- The symbols for the programming mode (PRG) and for the current transformer (CT) appear.
- Confirm the selection with button 1.
- The first digit of the input area for the primary current starts flashing.

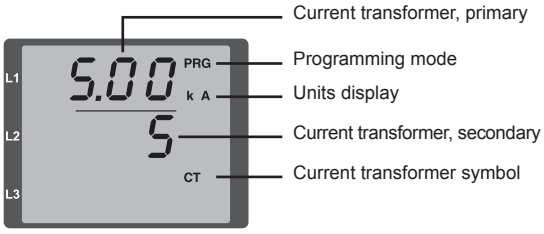
Current transformer primary current input
- Change the flashing digit with button 2.
- Select the next digit to be changed with button 1. The selected digit to be changed starts flashing. If the entire number is flashing, the decimal point can be moved with button 2.

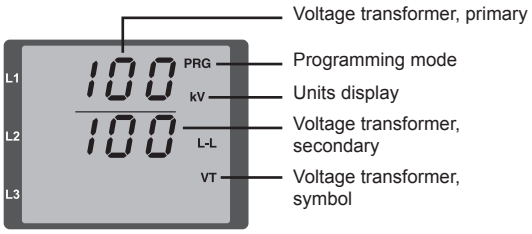
Current transformer secondary current input
- Only 1 A or 5 A can be set as the secondary current.
- Select the secondary current with button 1.
- Change the flashing digit with button 2.

Leaving programming mode
- Simultaneously press buttons 1 and 2 to exit the programming mode.

Programming voltage transformers

- Switch to the programming mode as described. The symbols for the programming mode (PRG) and for the current transformer (CT) appear.
- Use button 2 to switch to the voltage transformer setting.
- Confirm the selection with button 1.
- The first digit of the input area for the primary current starts flashing. The ratio of primary to secondary voltage of the voltage transformer can be set in the same way as the assignment of the current transformer ratio of primary to secondary current.





Programming parameters

Switching to programming mode
- Switch to the programming mode as described. The symbols for the programming mode (PRG) and for the current transformer (CT) appear.
- Use button 2 to switch to the voltage transformer setting. The first parameter of the parameter list is shown by repeatedly pressing button 2.

Changing parameters
- Confirm the selection with button 1.
- The most recently selected address is displayed with the associated value.
- The first digit of the address flashes and can be changed using button 2. Button 1 provides a selection of digits that, in turn, can be changed with button 2.

Changing the value
- Once the desired address is set, a digit of the value is selected with button 1 and changed with button 2.

Leaving programming mode
- Simultaneously press buttons 1 and 2 to exit the programming mode.

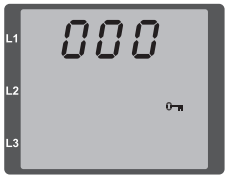


Fig.: Password request:
If a password was set, it can be entered using buttons 1 and 2.

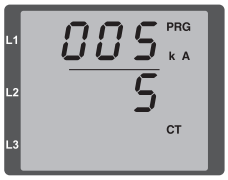


Fig.: Current transformer programming mode:
The primary and secondary currents can be changed using buttons 1 and 2.

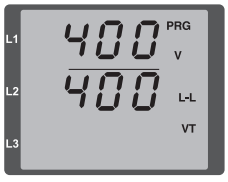


Fig.: Programming mode voltage transformer:
The primary and secondary currents can be changed using buttons 1 and 2.

Fig.: Programming mode parameter display:
The individual parameters can be changed using buttons 1 and 2.

Device address (addr. 000)

If several devices are connected to one another via the RS485 interface, a master device can only differentiate between these devices by means of their device addresses. Therefore, each device in a network must have a different device address. Addresses can be set in the range from 1 to 247.

	The adjustable range of the device address is between 0 and 255. The values 0 and 248 to 255 are reserved and may not be used.

Baud rate (addr. 001)

A common baud rate is adjustable for the RS485 interfaces. The baud rate must be chosen to be a uniform value in the network. On address 003 the quantity of stop bits can be set (0 = 1 bit, 1 = 2 bits). Data bits (8) are permanently set.

Setting	Baud rate
0	9.6 kbps
1	19.2 kbps
2	38.4 kbps
3	57.6 kbps
4	115.2 kbps (factory setting)

Mean value

Mean values are formed over an adjustable period for the current, voltage and power measured values. The mean values are identified with a bar above the measured value.
The averaging time can be selected from a list of nine fixed averaging times.

Current averaging time (addr. 040)
Power averaging time (addr. 041)
Voltage averaging time (addr. 042)

Setting	Averaging time/second
0	5
1	10
2	15
3	30
4	60
5	300
6	480 (factory setting)
7	600
8	900

Averaging method

After the set averaging time, the exponential averaging method used achieves at least 95% of the measured value.

Minimum and maximum values

All measured values are measured and calculated every 10/12 periods. Minimum and maximum values are determined for most of the measured values.
The minimum value is the smallest measured value that has been determined since the last reset. The maximum value is the largest measured value that has been determined since the last clearance. All minimum and maximum values are compared with the corresponding measured values and are overwritten if they are undercut or exceeded.
The minimum and maximum values are stored in an EEPROM every 5 minutes, without the date and time. This means that if the operating voltage fails, only the minimum and maximum values of the last 5 minutes are lost.

Clearing minimum and maximum values (addr. 506)

If “001” is written to the address 506, all minimum and maximum values are simultaneously cleared.

Mains frequency (addr. 034)

For automatic ascertainment of the mains frequency, an L1-N voltage larger than 10 Veff must be applied to the voltage measurement input V1.

The mains frequency is then used to calculate the sampling rate for the current and voltage inputs.

If there is no measurement voltage, the mains frequency cannot be determined and thus no sampling rate can be calculated. The acknowledgeable error message “500” appears.
The voltage, current and all other resulting values are calculated based on the previous frequency measurement and possible cable-connecting sockets and continue to be displayed. However, these derived measured values are no longer subject to the specified accuracy.

If it is possible to re-measure the frequency, then the error message will disappear automatically after a period of approx. 5 seconds once the voltage has been restored.

The error is not displayed if a fixed frequency has been configured.

Adjustment range: 0 or 45 to 65
0 = automatic frequency determination
The mains frequency is determined from the measurement voltage.
45 to 65 = fixed frequency
The mains frequency is preselected.

Energy meter

The Energy Meter 610/610-PB has energy meters for active energy, reactive energy and apparent energy.

Reading the active energy

Total active energy

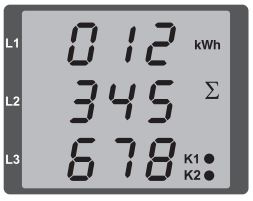


Fig.: The active energy in this example is: 12 345 678 kWh

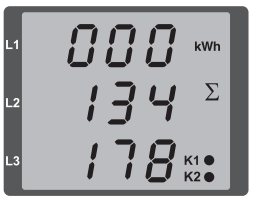


Fig.: The active energy in this example is: 134 178 kWh

Harmonics

Harmonics are the integer multiple of a mains frequency.
The voltage mains frequency for the Energy Meter 610/610-PB must be in the range between 45 and 65 Hz. The calculated voltage and current harmonics refer to this mains frequency.
Harmonics up to 40x the mains frequency are recorded.

The harmonics for currents are given in amperes and the harmonics for voltages are given in volts.

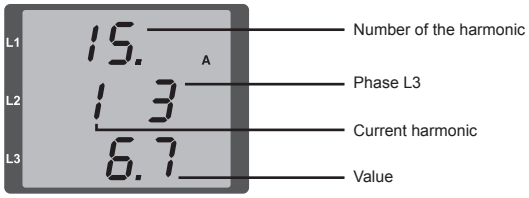


Fig.: Display of the 15th harmonic of the current in the L3 phase (example).

	Harmonics are not displayed in the factory default setting.

Total Harmonic Distortion (THD)

THD is the ratio of the root mean square value of harmonics to the root mean square value of the mains frequency.

Total Harmonic Distortion of the current (THDI):

$$THD_I = \frac{1}{|I_{fund}|}\sqrt{\sum_{n=2}^{M}|I_{n.Harm}|^2}$$

Total Harmonic Distortion of the voltage (THDU):

$$THD_U = \frac{1}{|U_{fund}|}\sqrt{\sum_{n=2}^{M}|U_{n.Harm}|^2}$$

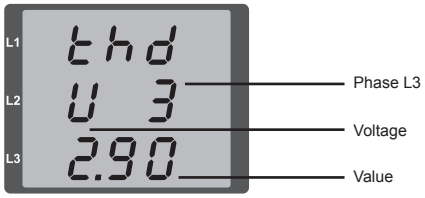


Fig.: Display of the total harmonic distortion of the voltage from the L3 phase (example).

Measured value relay

All measured values are calculated every 10/12 periods and can be recalled once per second on the measured value displays. Two methods are available for retrieving the measured value displays:

- The automatically changing display of selected measured values, referred to here as measured value relaying.
- Selection of a measured value display using buttons 1 and 2 from a preselected display profile.

Both methods are simultaneously available. Measured value relaying is active if at least one measured value display is programmed with a changeover time greater than 0 seconds.
If a button is pressed, the measured value displays of the selected display profile can be browsed. If no button is pressed for about 60 seconds, the device switches to the measured value relay and the measured values from the selected display change profile of the programmed measured value displays are shown one after the other.

Changeover time (addr. 039)

Adjustment range: 0 to 60 seconds
If 0 seconds are set, no changeover takes place between the measured value displays selected for the measured value relay.
The changeover time applies for all display change profiles.

Display change profile (addr. 038)

Adjustment range: 0 to 3
0 - Display changeover profile 1, by default.
1 - Display changeover profile 2, by default.
2 - Display changeover profile 3, by default.
3 - Customised display changeover profile.

Measured value displays

After return of the power supply, the Energy Meter 610/610-PB shows the first measured value panel from the current display profile. In order to keep the selection of measured values to be displayed arranged in a clear manner, only one part of the available measured values is pre-programmed for recall in the measured value display by default. A different display profile can be selected if other measured values are required to be shown on the Energy Meter 610/610-PB display

Display profile (addr. 037)

Adjustment range: 0 to 3
0 - Display profile 1, default setting.
1 - Display profile 2, default setting
2 - Display profile 3, default setting
3 - Customised display profile.

Profile settings
The profiles (display change profile and display profile) are clearly shown in the ecoExplorer go software. The profiles can be adjusted in the software via the device configuration; customised display profiles can also be programmed.
A connection between the Energy Meter 610/610-PB and the PC via the serial interface (RS485) is required for using the ecoExplorer go software.

The customised profiles (display change profile and display profile) can only be programmed via the ecoExplorer go software.

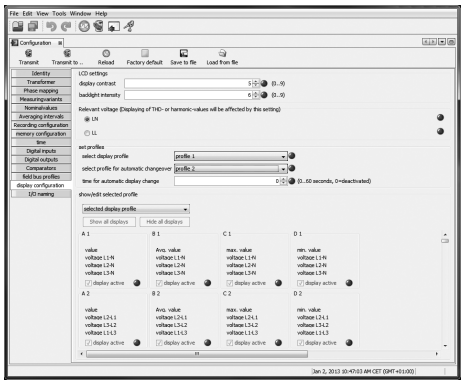


Fig.: Display of the profile setting in the ecoExplorer go software.

User password (addr. 050)

A user password can be programmed in order to impede any accidental change to programming data. A switch to the next programming menu can only be made after entering the correct user password.
No user password is specified in the factory. In this case, the password menu is skipped and the current transformer menu is reached directly.

If a user password was programmed, the password menu will appear with the display “000”.
The first digit of the user password flashes and can be changed with button 2. The next digit is selected by pressing button 1 and will begin flashing.
The programming menu for the current transformer can only be accessed after entering the correct number combination.

Forgotten password

If you have forgotten the password, the password can only be cleared by using the ecoExplorer go PC software.
To do this, connect the Energy Meter 610/610-PB to the PC via a suitable interface. More information can be found in the help section of ecoExplorer go software.

Clear energy meter (addr. 507)

The active, apparent and reactive energy meters can only be cleared together.

Address 507 must be written with “001” in order to clear the contents of the energy meters.

Prior to commissioning potential production dependant contents of the energy counter, min/max values and records have to be deleted.

Clearing the energy meters means this data in the device is gone.
In order to avoid possible data loss, read and save the measured values with the ecoExplorer go software before clearing.

Rotation field direction

The rotation field direction of the voltages and the frequency of phase L1 are shown on the display.
The rotation field direction indicates the phase sequence in three-phase systems. Usually there is a “clockwise spinning rotation field”.
The phase sequence at the voltage measurement inputs is checked and displayed in the Energy Meter 610/610-PB. A movement of the character string in the clockwise direction means a “right rotation” and a counter-clockwise movement indicates a “left rotation”.
The rotation field direction is determined only if the measurement and operating voltage inputs are fully connected. If one phase is missing or two of the same phases are connected, the rotation field direction will not be determined and the character string does not appear on the display.

Fig.: Display of the mains frequency (50.0) and the rotation field direction

Fig.: No rotation field direction detectable.

LCD contrast (addr. 035)

The preferred direction of viewing for the LCD is from “below”. The user can adjust the LCD contrast of the LCD screen. It is possible to set the contrast in the range from 0 to 9 in steps of 1.

0 = characters are very light
9 = characters are very dark

Factory default setting: 5

Backlight

The LCD backlight allows the display to be read easily even in poor light. The brightness can be controlled by the user in stages from 0 to 9.

The Energy Meter 610/610-PB has two different types of backlight:
- the operation backlight
- the standby backlight

Operation backlight (addr. 036)
The operation backlight is activated by pushing the appropriate button, or with a restart.

Standby backlight (addr. 747)
This backlight is activated after an adjustable period of time (addr. 746). If no button is pressed within this period, then the device switches to the standby backlight.
If buttons 1 to 3 are pressed, the device switches to the operation backlight and the defined period of time begins again.

If the brightness settings for the two backlights are set to the same value, then no change is discernible between the operation and standby backlights.

Address	Description	Setting range	Default setting
036	Brightness for operation backlight	0 to 9	6
746	Period of time after which the backlight will switch to standby	60 to 9999 s	900 s
747	Brightness for standby backlight	0 to 9	0

Time recording

The Energy Meter 610/610-PB records the operating hours and the total running time of each comparator

- where the time of operating hours is measured with a resolution of 0.1 h and is displayed in hours or
- the total running time of the comparator is represented in seconds (when 999999 seconds is reached, the display changes to hours).

For the querying of measured value displays, the times are marked with the numbers 1 to 6:

none = operating hours meter
1 = total running time, comparator 1A
2 = total running time, comparator 2A
3 = total running time, comparator 1B
4 = total running time, comparator 2B
5 = total running time, comparator 1C
6 = total running time, comparator 2C

A maximum of 99999.9 h (= 11.4 years) can be shown on the measured value display.

Operating hours meter

The operating hours meter measures the time for which the Energy Meter 610/610-PB records and displays measured values.
The time of operating hours is measured with a resolution of 0.1 h and is displayed in hours. The operating hours meter cannot be reset.

Total running time of the comparator

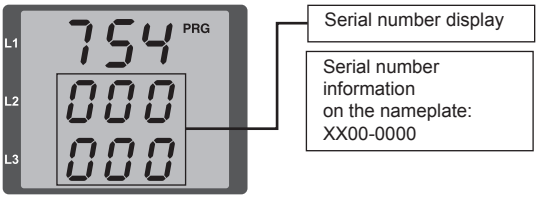
The total running time of a comparator is the sum of all time for which there is a limit value violation in the comparator result.
The total running time of the comparator can only be reset via the ecoExplorer go software. The reset is carried out for all total running times.

Fig.: Operating hours meter of the measured value display

The Energy Meter 610/610-PB shows the number 140.8 h in the operating hours meter. This corresponds to 140 hours and 80 industrial minutes. 100 industrial minutes correspond to 60 minutes. In this example, 80 industrial minutes therefore represent 48 minutes.

Serial number (addr. 754)

The serial number shown by Energy Meter 610/610-PB has 6 digits and is part of the serial number displayed on the nameplate. The serial number cannot be changed.



Software release (addr. 750)

The software for Energy Meter 610/610-PB is continuously improved and expanded. The software version in the device is marked with a 3-digit number, the software release. The user cannot change the software release.

“Drag indicator”
Max. value of the mean value over n minutes

The “drag indicator” describes a maximum mean value of a measured value over a defined period.

The period duration is set via a parameter, via the ecoExplorer go software or via the digital input 1.

In the process, synchronisation is triggered via the internal clock (which can be set via parameter 206 or to a full hour) or optionally via digital input 1. If synchronisation via the digital input is selected, the capture time must be set!

The thee highest values of 15 variables with time stamp are saved. The maximum values of the variables can also be viewed in the device display.

Variables:
- Current in the single phases L1...L3
- Effective power (consumption/export) in the single phases L1... L3
- Effective power (consumption/export), total.
- Apparent power the single phases L1...L3
- Apparent power, total

	Please note that even **before averaging**, the values are divided between positive and negative ones! During totalisation, first the totals for the single phases are calculated, **then** divided into positive and negative values!

The maximum values are reset via the “Delete min./max. values” function with the ecoExplorer go program, via Modbus or on the display by setting the corresponding parameters (parameter 506: set from 0 to 1).

Addr.	Description	Setting range	Presetting
206	Period duration	300 to 3600 s	900
207	Capture time	1 to 20 s	10 s
208	Configuration digital input 1 0 = internal synchronisation 1 = external synchronisation (NO) 2 = external synchronisation (NC)	0 to 2	0
506	Resetting	0, 1	0

Recordings

2 recordings are preconfigured in the default factory setting of the Energy Meter 610 and Energy Meter 610-PB. Recordings are adjusted and extended via the software “ecoExplorer go”.

- The smallest time base for records is 1 minute.
- A maximum of 4 recordings, each with 100 values are possible.

Recording 1:
The following measured values are recorded with the time base of 15 minutes:
- Voltage effective L1
- Voltage effective L2
- Voltage effective L3
- Current effective L1
- Current effective L2
- Current effective L3
- Current effective Sum L1-L3
- Active Power L1
- Active Power L2
- Active Power L3
- Active Power Sum L1-L3
- Apparent Power L1
- Apparent Power L2
- Apparent Power L3
- Apparent Power Sum L1-L3
- cos phi(math.) L1
- cos phi(math.) L2
- cos phi(math.) L3
- cos phi(math.) Sum L1-L3
- Reactive power fundamental L1
- Reactive power fundamental L2
- Reactive power fundamental L3
- Reactive power fundamental Sum L1-L3

The mean value, minimum value and maximum value are also recorded for each measured value.

Recording 2:
The following measured values are recorded with the time base of 1 hour:
- Active Energy Sum L1-L3
- Inductive Reactive Energy Sum L1-L3

Commissioning

Applying the supply voltage

- The level of supply voltage for the Energy Meter 610/610-PB can be found on the nameplate.
- After applying the supply voltage, the Energy Meter 610/610-PB switches to the first measured value display.
- If no display appears, the supply voltage must be checked to determine whether it is in the rated voltage range.

Applying the measured voltage

- Voltage measurements in networks with rated voltages above 300 V AC to ground must be connected to a voltage transformer.
- After the measured voltages are connected, the measured values for the L-N and L-L voltages displayed by the Energy Meter 610/610-PB must match those at the voltage measurement input.

	**Attention!** Voltages and currents outside the permissible metering range can result in personal injury and damage to the device.

Applying the measured current

The Energy Meter 610/610-PB is designed for connecting ../1A and ../5A current transformers.
Only AC currents and not DC currents can be measured via the current measurement inputs.
Short circuit all current transformer outputs except for one. Compare the currents displayed on the Energy Meter 610/610-PB with the applied current.
The current displayed by the Energy Meter 610/610-PB must match the input current, taking the current transformer ratio into consideration.
In the short circuit current measurement inputs, the Energy Meter 610/610-PB must show approx. zero amperes.

The factory-set current transformer ratio is 5/5A and may need to be adapted to the current transformer used.

	**Attention!** Supply voltages that do not correspond to the nameplate information can lead to device malfunction or destruction.

	**Attention!** The Energy Meter 610/610-PB is not suitable for the measurement of DC voltages.

Rotation field direction

Check the direction of the voltage rotation field on the measured value display of the Energy Meter 610/610-PB.
Usually there is a “clockwise” spinning rotation field.

Checking the phase assignment

The assignment of the phase conductor to the current transformer is correct if a current transformer is short circuited at the secondary terminals and the current shown by the Energy Meter 610/610-PB in the corresponding phase sinks to 0 A.

Checking the power measurement

Short circuit all current transformer outputs except for one and check the displayed power. The Energy Meter 610/610-PB must only show one rating in the phase with the non-short-circuited current transformer input. If this does not apply, check the measured voltage connection and the measured current connection.

If the magnitude of the real power is correct but the sign of the real power is negative, this can be due to two causes:
- The connections S1(k) and S2(l) on the current transformer are inverted.
- Active energy is being returned to the network.

Checking the measurement

If all voltage and current measurement inputs are correctly connected, the individual and sum power ratings are accurately calculated and displayed.

Checking the individual power ratings

If the current transformer is assigned to the wrong phase conductor, the associated power rating will be incorrectly measured and displayed.
The assignment of the phase conductor to the current transformer on the Energy Meter 610/610-PB is correct if there is no voltage between the phase conductor and the associated current transformer (primary).
In order to ensure that a phase conductor on the voltage measurement input is assigned to the correct current transformer, the respective current transformer can be short-circuited at the secondary terminals. The apparent power shown by the Energy Meter 610/610-PB must then be zero in this phase.

If the apparent power is correctly displayed but the real power is shown with a “-” sign, the current transformer terminals are inverted or power is being fed to the power company.

Check the sum power ratings

If all voltages, currents and power ratings for the respective phase conductor are correctly displayed, the sum power ratings measured by the Energy Meter 610/610-PB must also be correct. For confirmation, the sum power ratings measured by the Energy Meter 610/610-PB should be compared with the energy of the active and reactive power meters at the power feed.

RS485 interface

The data from the parameter and measured value list can be accessed via the Modbus RTU protocol with CRC check to the RS485 interface.

Address range:	1 to 247
Factory default setting:	1

The device address is set to 1 and the baud rate is set to 115.2 kbps by default.

Modbus Functions (Slave)
04 Read Input Registers
06 Preset Single Register
16 (10Hex) Preset Multiple Registers
23 (17Hex) Read/Write 4X Registers

The sequence of bytes is high before low byte (Motorola format).

Transmission parameters:		
Data bits:		8
Parity:		keine
Stop bits (Energy Meter 610/610-PB):		2
External stop bits:		1 oder 2
Number formats:	short	16 bit (-2^{15} to 2^{15} - 1)
	float	32 bit (IEEE 754)

	The system does not support broadcast (addr. 0).

	The message length must not exceed 256 bytes.

Example: Reading the L1-N voltage
The L1-N voltage is stored in the measured value list under the address 19000. The L1-N voltage is stored in FLOAT format.
The Energy Meter 610/610-PB device address with the address = 01 is adopted here.

The “query message” then appears as follows:

Description	Hex	Note
Device address	01	Energy Meter 610/610-PB, address = 1
Function	03	“Read Holding Reg.”
Start address Hi	4A	19000dez = 4A38hex
Start address Lo	38	
Disp. values Hi	00	2dez = 0002hex
Disp. values Lo	02	
Error Check	-	

The “response” from the Energy Meter 610/610-PB can then appear as follows:

Description	Hex	Note
Device address	01	Energy Meter 610/610-PB, address = 1
Function	03	
Byte meter	06	
Data	00	00hex = 00dez
Data	E6	E6hex = 230dez
Error Check (CRC)	-	

The L1-N voltage read back from address 19000 is 230 V.

Installation of USB driver

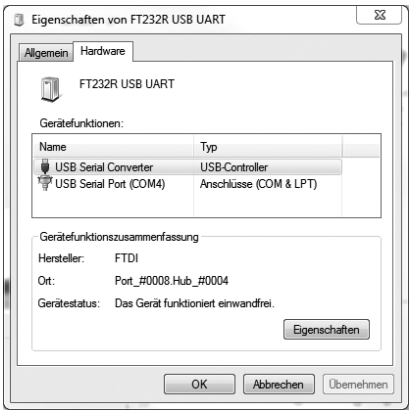
With internet access or authorisation for automatic updates of the driver library:

With all current operating systems (e.g. Windows 7) the required drivers are automatically installed the first time the device is connected to the USB interface of the computer.

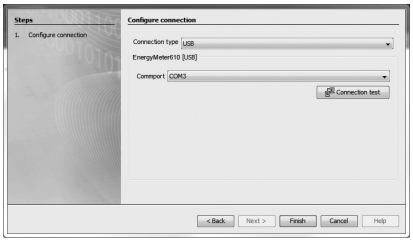
- Connect the power supply voltage for the Energy Meter 610/610-PB, as a minimum.
- Connect the Energy Meter 610/610-PB to a suitable USB interface on the computer with a USB cable.
- The installation of the system drivers required starts and runs automatically.
- After successful installation the device can be used.

Checking the USB installation

- Open the Devices and printers window in Windows 7 via the control panel, for example.
- Open the Properties of the device FT232 USB UART by double-clicking. Further information about the device can be found in the General and Hardware tabs.
- Change to Hardware. Under device functions a USB Serial Converter and a USB Serial Port (COMx) should be shown after a successful installation, whereby x reflects the virtual COM port.
- In Windows XP this information can be found in the hardware area of the device manager under USB Universal Controller.



- Start the ecoExplorer go software and integrate the Energy Meter 610/610-PB with the assistant (New file...). After selecting the connection type (USB) and the interface of the COM port (COMx, see above) the USB connection can be used.



Profibus interface (only Energy Meter 610-PB)

Profibus profiles

A Profibus profile contains the data to be exchanged between a Energy Meter 610-PB and a PLC. It is possible to read out measurement values and statuses via eight user-defined and four factory pre-configured Profibus profiles.

A Profibus profile can:
- Retrieve measurement values from the Energy Meter 610-PB.
- Set the digital outputs in the Energy Meter 610-PB.
- Query the status of the digital inputs in the Energy Meter 610-PB.

Each Profibus profile can hold a maximum of 127 bytes of data. If more data has to be transferred, simply create additional Profibus profiles.

- Every Profibus profile has a profile number. The profile number is sent by the PLC to the Energy Meter 610-PB.
- The 8 user-defined Profibus profiles (profile numbers 0 to 7) can be edited with the ecoExplorer go software.
- Factory pre-configured Profibus profiles (profile numbers 8 to 11) cannot be changed.

Activate outputs/tariffs via Profibus

To set the outputs or the tariffs an appropriate profile must be selected. Alongside the 1st byte used for the profile selection three further bytes can be used to:

- Switch outputs
- Control tariffs and energy meters

Profile number selection (1st byte):
Byte 1 enables the selection of the Profibus profile number 0 to 11. The output range of the PLC must contain this byte as a minimum. Within the byte, bits 0 to 3 describe the profile number, bits 4 to 7 are unused.

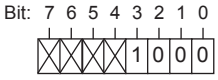


Fig.: Example: Profile number 8 selected (Binary representation)

Switching digital outputs (2nd byte):
Setting or clearing the bits in byte 2 (“Profibus remote” type) enables the setting of the digital outputs 1 to 6. Bits 6 and 7 are not used.

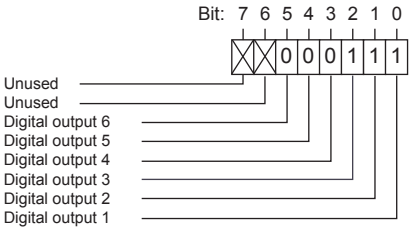


Fig.: Example: Output 1-3 set

Control tariffs (3rd byte):
Setting or clearing the bits enables the selection of tariffs 1 to 7. Bit 7 is not used. **If several tariffs are set in the byte then the tariff with the least significant bit is selected.** If byte 3 is used, then byte 4 should be set!

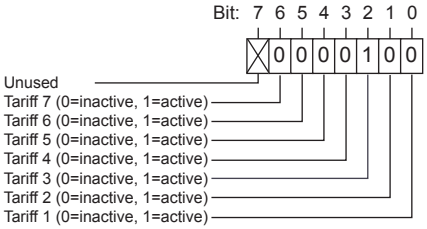


Fig.: Example: Tariff 3 selected

Control tariffs (4th byte):
Setting or clearing bits 0 to 6 of byte 4 enables a selection of energy meters for the tariff set. Each tariff can have up to 7 energy meters allocated to it.

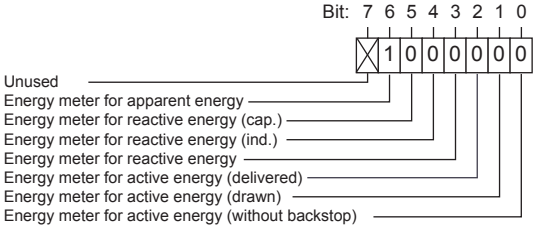


Fig.: Example: Apparent energy selected

Deactivate energy meters / tariffs via Profibus

If energy meters are assigned to a tariff then these can be deactivated via byte 3 and byte 4 (cf. activate tariffs via Profibus). Here the selection of the desired tariff is implemented in byte 3 and the clearing of the associated bits in byte 4 deactivates the energy meter.

Example:
If the energy meter for active energy (drawn) is set under tariff 3, the deactivation of the energy meter is implemented as follows:

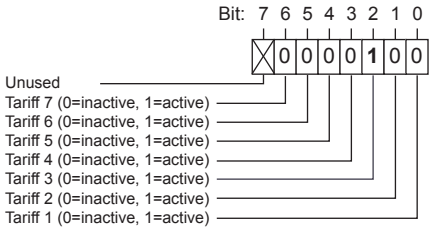


Fig.: Byte 3: Tariff 3 selected

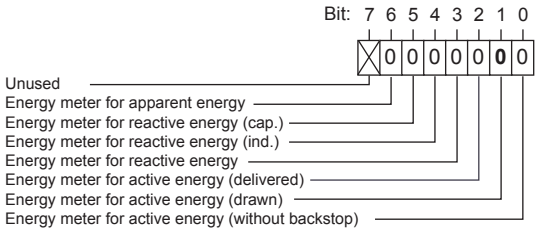


Fig.: Byte 4: Deactivating energy meters

The energy meter is deleted by selecting the tariff (byte 3) and clearing the bits in byte 4 associated with the energy meter.

If the meter is deleted then a new energy meter can be assigned to the tariff.

If the deactivation of a tariff is desired then the energy meters assigned should be deleted first via bytes 3 and 4 and then the tariff should be deactivated via byte 3.

Reading out measurement values via the Profibus

Selected measurement values can be read out via 4 factory-set profiles and an additional 8 user-defined profiles. Here each profile has a unique profile number with which a PLC can read out the configured measurement values of a profile.

Example:
Reading out of measurement values from the factory-preconfigured Profibus profile number 8.

The 1st byte should be set to the profile number 8 (dec.) and sent to the Energy Meter 610-PB.
The Energy Meter 610-PB then delivers the profile number 8 and the measured values set in profile 8 back.

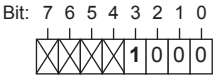


Fig.: Byte 1: Profile number 8 selection

	The device address can be configured by using the parameter 000 if the device is used in a Profibus-System. The baud rate in a Profibus system is detected automatically and must NOT be set via the address 001!

Example: Using Profibus to retrieve measurement values

At least one Profibus profile must be set up with ecoExplorer go software and transferred to the Energy Meter 610-PB.

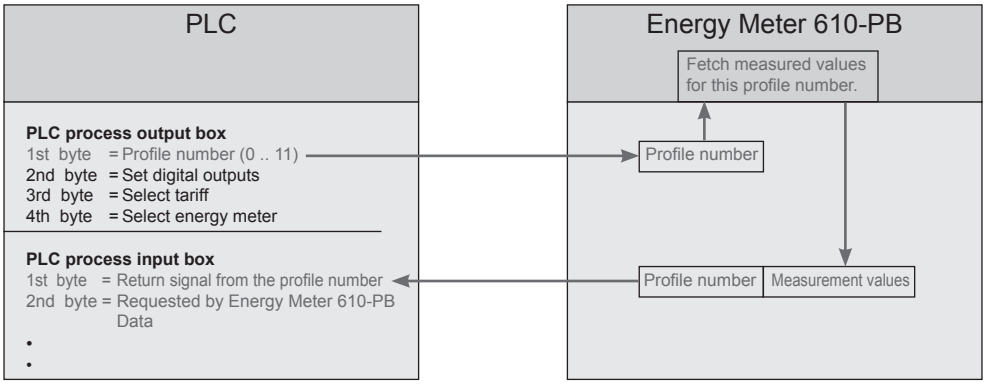


Fig.: Block diagram for data exchange between PLC and Energy Meter 610-PB.

Device master file

The device master file, or GSD file, describes the Profibus characteristics of the Energy Meter 610-PB. The GSD file is required by the configuration program of the PLC.

System variables

Various system variables (measured values) are available in the formats Float and Integer (byte order: Big and Little Endian).

These variables are clearly defined and listed in the Modbus address list. A customized scaling and conversion to other formats are not possible. In case that a different data type of a variable is required, an alternative representation of the variable (value) must exist (see Modbus address list).

Profile formats

The measuring values in the Profibus profile number 8 till 11 have the format „high byte before low byte“.

For measurements values in the format „low byte before high byte“ must be added to the Profibus profile number 128!

Factory pre-configured profiles

Profibus profile number 8

	Byte index	Value type	Value format	Scaling
1	1	Effective voltage L1	Float	1
2	5	Effective voltage L2	Float	1
3	9	Effective voltage L3	Float	1
4	13	Effective voltage L1-L2	Float	1
5	17	Effective voltage L2-L3	Float	1
6	21	Effective voltage L3-L1	Float	1
7	25	Effective current L1	Float	1
8	29	Effective current L2	Float	1
9	33	Effective current L3	Float	1
10	37	Effective current L4	Float	1
11	41	Effective current sum L1..L3	Float	1
12	45	Effective power L1	Float	1
13	49	Effective power L2	Float	1
14	53	Effective power L3	Float	1
15	57	Cos phi (math.) L1	Float	1
16	61	Cos phi (math.) L2	Float	1
17	65	Cos phi (math.) L3	Float	1
18	69	Frequency	Float	1
19	73	Effective power sum L1..L3	Float	1
20	77	Reactive power fundamental oscillation harmonic sum L1..L3	Float	1
21	81	THD voltage L1	Float	1
22	85	THD voltage L2	Float	1
23	89	THD voltage L3	Float	1
24	93	THD current L1	Float	1
25	97	THD current L2	Float	1
26	101	THD current L3	Float	1
27	105	THD current L4	Float	1

Profibus profile number 9

	Byte index	Value type	Value format	Scaling
1	1	Effective energy sum L1..L3	Float	1
2	5	Effective energy sum L1..L3 drawn	Float	1
3	9	Effective energy sum L1..L3 delivered	Float	1
4	13	Reactive energy sum L1..L3	Float	1
5	17	Ind. reactive energy sum L1..L3	Float	1
6	21	Cap. reactive energy sum L1..L3	Float	1
7	25	Apparent energy sum L1..L3	Float	1
8	29	Effective energy L1	Float	1
9	33	Effective energy L2	Float	1
10	37	Effective energy L3	Float	1
11	41	Inductive reactive energy L1	Float	1
12	45	Inductive reactive energy L2	Float	1
13	49	Inductive reactive energy L3	Float	1

The configuration/programming is implemented via the ecoExplorer go software. A connection between the Energy Meter 610-PB and the PC via an interface is required for the use of the ecoExplorer go software.

Profibus profile number 10

	Byte index	Value type	Value format	Scaling
1	1	Effective power L1	Float	1
2	5	Effective power L2	Float	1
3	9	Effective power L3	Float	1
4	13	Effective power sum L1..L3	Float	1
5	17	Effective current L1	Float	1
6	21	Effective current L2	Float	1
7	25	Effective current L3	Float	1
8	29	Effective current L4	Float	1
9	33	Effective current sum L1..L3	Float	1
10	37	Effective energy sum L1..L3	Float	1
11	41	Cos phi (math.) L1	Float	1
12	45	Cos phi (math.) L2	Float	1
13	49	Cos phi (math.) L3	Float	1
14	53	Cos phi (math.) sum L1..L3	Float	1
15	57	Reactive power fundamental oscillation harmonic L1	Float	1
16	61	Reactive power fundamental oscillation harmonic L2	Float	1
17	65	Reactive power fundamental oscillation harmonic L3	Float	1
18	69	Reactive power fundamental oscillation harmonic sum L1..L3	Float	1
19	73	Apparent power L1	Float	1
20	77	Apparent power L2	Float	1
21	81	Apparent power L3	Float	1
22	85	Apparent power sum L1..L3	Float	1

Profibus profile number 11

	Byte index	Value type	Value format	Scaling
1	1	Effective voltage L1	Float	1
2	5	Effective voltage L2	Float	1
3	9	Effective voltage L3	Float	1
4	13	Effective current L1	Float	1
5	17	Effective current L2	Float	1
6	21	Effective current L3	Float	1
7	25	Effective current L4	Float	1
8	29	Effective power L1	Float	1
9	33	Effective power L2	Float	1
10	37	Effective power L3	Float	1
11	41	Effective power sum L1..L3	Float	1
12	45	Counter status digital input 1	Integer (4 Byte)	1
13	49	Counter status digital input 2	Integer (4 Byte)	1
14	53	Counter status digital input 3	Integer (4 Byte)	1
15	57	Counter status digital input 4	Integer (4 Byte)	1
16	61	Status digital output 1	Integer (2 Byte)	1
17	63	Status digital output 2	Integer (2 Byte)	1
18	65	Status digital output 3	Integer (2 Byte)	1
19	67	Status digital output 4	Integer (2 Byte)	1
20	69	Status digital output 5	Integer (2 Byte)	1
21	71	Status digital output 6	Integer (2 Byte)	1

Measured values in **integer format** do not respect the transformer ratio. Measured values in **floating point format** contain the transformer ratio:
value in the Energy Meter 610-PB display =
transformer ratio x value PLC x solution

Digital outputs

The Energy Meter 610/610-PB have 6 digital outputs, whereby these are split into two groups of 2 and 4 outputs (see illustration below).

The User can allocate different functions to the digital outputs.

The functions can be programmed by using the configuration menu of the ecoExplorer go software.

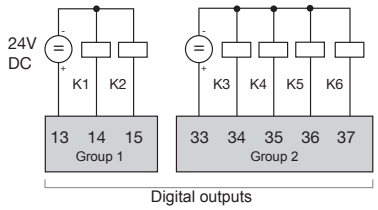


Fig.: Digital outputs of group 1 and group 2

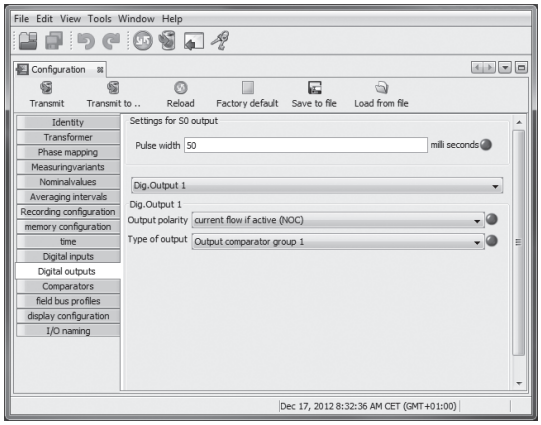
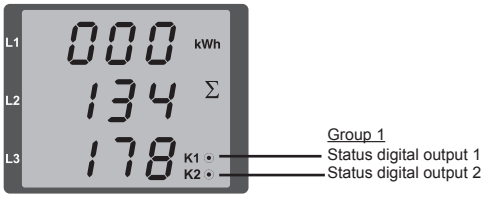


Fig.: Software ecoExplorer go, configuration menu

Digital outputs 1 and 2 — Status displays

The status of the switching outputs of group 1 is indicated by circular symbols in the display of the Energy Meter 610/610-PB.



Digital output stati

- ○ The current flow can be < 1 mA.
  Digital output 1: Addr. 608 = 0
  Digital output 2: Addr. 609 = 0

- ◉ The current flow can up to 50 mA.
  Digital output 1: Addr. 608 = 1
  Digital output 2: Addr. 609 = 1

	Since the indication is updated once per second, faster status changes of the outputs can not be displayed.

Impulse output

The digital outputs can be used for the output of pulses for the computation of power consumption. For this purpose, a pulse of defined length is applied on the output after reaching a certain, adjustable amount of power.

You need to make various adjustments in the software ecoExplorer go (configuration menu) to use a digital output as a pulse one.

- Digital output,
- Selection of source,
- Selection of measured value,
- Pulse length,
- Pulse value.

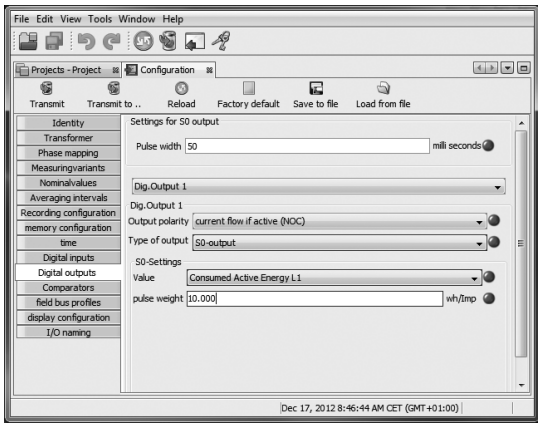


Fig.: Software ecoExplorer go, configuration menu

Pulse length (addr. 106)

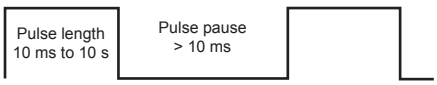
The pulse length applies for both pulse outputs and is permanently fixed via parameter address 106.

Adjustment range: 1 to 1000 1 = 10 ms
Default: 5 = 50 ms

The typical pulse length for S0 pulses is 30 ms.

Pulse pause

The pulse pause is at least as long as the selected pulse length. The pulse pause depends on the measured energy, for example, and can be hours or days.



Pulse spacing
The pulse spacing is proportional to the power within the selected setting.

Due to the minimum pulse length and minimum pulse pause, the values in the table are for the maximum number of pulses per hour.

Examples for the maximum possible number of pulses per hour.

Pulse length	Pulse pause	Maximum pulses/hour
10 ms	10 ms	180,000 pulses/hour
30 ms	30 ms	60,000 pulses/hour
50 ms	50 ms	36,000 pulses/hour
100 ms	100 ms	18,000 pulses/hour
500 ms	500 ms	3,600 pulses/hour
1 s	1 s	1,800 pulses/hour
10 s	10 s	180 pulses/hour

Measured value selection
When programming with ecoExplorer go software, a selection of energy values that are derived from the power values is received.

Pulse value (addr. 102, 104)

The pulse value specifies how much energy (Wh or varh) should correspond to a pulse.
The pulse value is determined by the maximum connected load and the maximum number of pulses per hour.

If the pulse value is specified with a positive sign, pulses will only be issued if the measured value also has a positive sign.

If the pulse value is specified with a negative sign, pulses will only be issued if the measured value also has a negative sign.

$$\text{Pulse value} = \frac{\text{maximum connection power}}{\text{maximum number of pulses per hour}}$$

	Since the active energy meter works with a return stop, pulses are only issued during import of electrical energy.

	Since the reactive energy meter works with a return stop, pulses are only issued under inductive load.

Determining the pulse value

Setting the pulse length
Set the pulse length according to the requirements of the connected pulse receiver.
For a pulse length of 30 ms, for example, the Energy Meter 610/610-PB can issue a maximum number of 60,000 pulses (see Table “Maximum Pulse Number”) per hour.

Determining the maximum connected load
Example:

Current transformer	= 150/5 A
L-N voltage	= max. 300 V
Power per phase	= 150 A x 300 V = 45 kW
Power for 3 phases	= 45 kW x 3
Maximum connected load	= 135 kW

Calculating the pulse value

$$\text{Pulse value} = \frac{\text{maximum connection power}}{\text{maximum number of pulses per hour}}$$

Pulse value = 135 kW / 60000 pulses/h
Pulse value = 0.00225 kWh/pulses
Pulse value = 2.25 Wh/pulses

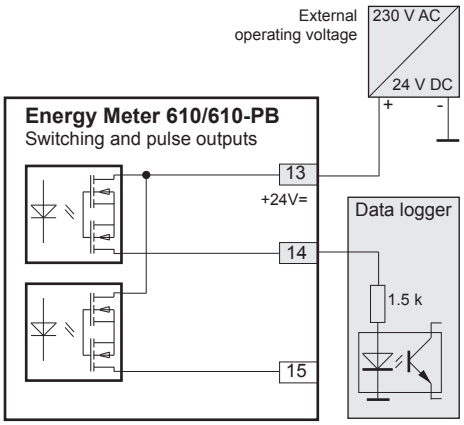


Fig.: Connection example for wiring the pulse output.

	When using the digital outputs as a pulse output, the auxiliary voltage (DC) must only have a maximum residual ripple of 5 %.

Comparators and monitoring threshold values

Six comparator groups (1 to 6) and three comparators per group (A to C) can be selected in order to monitor/control the thresholds. The results of the comparators A to J can be linked with AND or OR operators.

The result of the AND and OR operator can be allocated to the respective digital output.

The function “display blinking” can be additionally assigned to every comparator group. The effect is the change of the display backlight between maximum and minimum brightness when the comparator output is active.

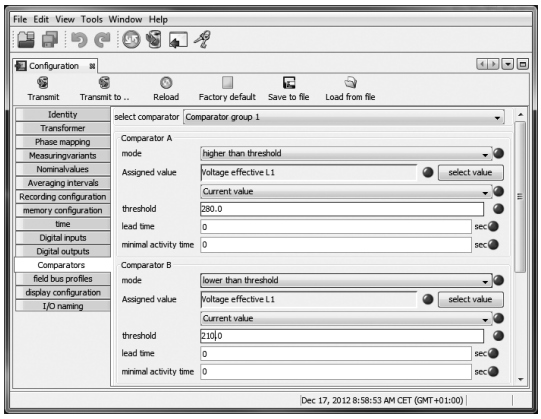


Fig.: Software ecoExplorer go, configuration menu

Service and maintenance

The device is subjected to several different safety tests before leaving the factory and is labelled with a seal. If a device is opened then the safety checks must be repeated. Warranty claims will only be accepted if the device is unopened.

Repair and calibration

Repair work and calibration can be carried out by the manufacturer only.

Front film

The front film can be cleaned with a soft cloth and standard household cleaning agent. Do not use acids and products containing acid for cleaning.

Disposal

The Energy Meter 610/610-PB can be reused or recycled as electronic scrap in accordance with the legal provisions. The permanently installed lithium battery must be disposed of separately.

Service

Should questions arise, which are not described in this manual, please contact the manufacturer directly.

We will need the following information from you to answer any questions:

- Device name (see rating plate),
- Serial number (see rating plate),
- Software release (see measured value display),
- Measuring-circuit voltage and power supply voltage,
- Precise description of the error.

Device calibration

The devices are calibrated by the manufacturer at the factory – it is not necessary to recalibrate the device providing that the environmental conditions are complied with.

Calibration intervals

It is recommended to have a new calibration carried out by the manufacturer or an accredited laboratory every 5 years approximately.

Firmware update

If the device is connected to a computer via Ethernet, then the device firmware can be updated via the ecoExplorer go software.

Select a suitable update file (menu Extras / Update device) and the device and the new firmware will be transferred.

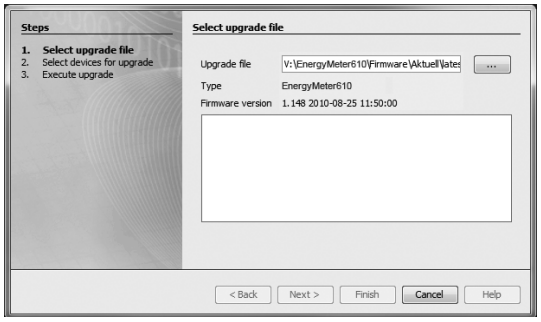


Fig.: Software ecoExplorer go firmware update assistent

Battery

The internal clock is fed from the supply voltage. If the supply voltage fails then the clock is powered by the battery. The clock provides date and time information, for the records, min. and max. values and results, for example.

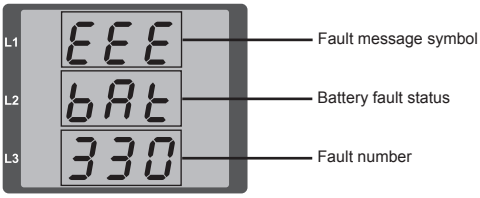
The life expectancy of the battery is at least 5 years with a storage temperature of +45 °C. The typical life expectancy of the battery is 8 to 10 years.

The battery is replaced via the battery insert provided on the rear of the device. Make sure that the correct type of battery is used and correct polarity is observed when inserting the battery (positive pole faces the rear of the device; negative pole faces the front).

See chapter “Changing the battery” for more information.

Battery monitoring function

The device indicates the condition of the battery via the “EEE” symbol followed by “bAt” and the status number. Depending on the status number a confirmation of the information by the operator may be required. It is recommended that the battery be replaced.



Status	Status description
EEE bAt 321	• Battery capacity is < 85 % • Operator confirmation required • Message appears weekly after confirmation • Battery should be replaced
EEE bAt 322	• Battery capacity is < 75 % • Battery capacity is too low • Can only be detected after resumption of mains power • Battery should be replaced
EEE bAt 330	• Battery capacity OK • Clock is stopped and must be set
EEE bAt 331	• Battery capacity is < 85 % • Clock is stopped and must be set • Operator confirmation required • Message appears weekly after confirmation • Battery should be replaced
EEE bAt 332	• Battery capacity is < 75 % • Clock is stopped and must be set • Operator confirmation required • Message appears daily after confirmation • Battery should be replaced

Replacing the battery

If the battery capacity is shown as < 75 %, we recommend that the battery be replaced.

Procedure

1. Disconnect system and device from power supply before beginning work.
2. Discharge any electrostatic charge in your body, e.g. by touching an earthed cabinet or metal part (radiator) connected to the earth of the building.
3. Remove the battery from the battery compartment, – e.g. using long-nose pliers –. **The device does not need to be opened to do this as the battery compartment can be accessed from the outside (see figure below).**
4. Make sure that the polarity is as shown on the insertion opening of the battery compartment and slide the replacement battery into the battery compartment. For this, use a battery compliant with the description in the technical data. The battery must fulfil the safety requirements of UL 1642. Otherwise, there is a risk of combustion or explosion.
5. Dispose of the old battery according to the legal regulations.
6. Start up the system and the device again and check the functionality of the Energy Meter 610/610-PB. Set the date and time.

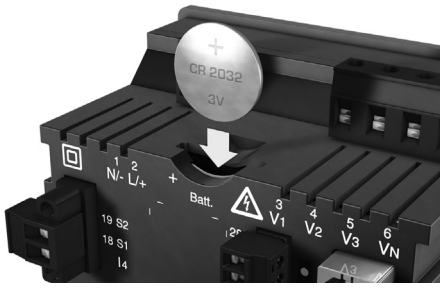


Fig.: Battery insertion on the rear

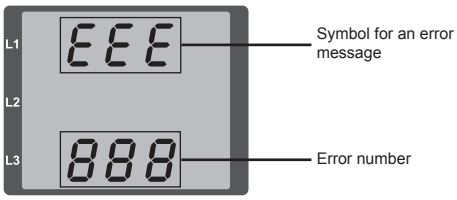
	Grease or dirt on the contact surfaces form a transfer resistance that will shorten the life of the battery. Only touch the battery at the edges.
	Dangerous voltage! Danger to life or risk of serious injury. Disconnect system and device from power supply before beginning work.
	Make sure that the correct type of battery is used and observe correct polarity when changing it.

Error messages

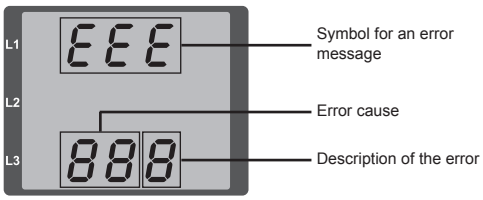
The Energy Meter 610/610-PB shows three different error messages on the display:

- warnings,
- clock/battery errors,
- serious error and
- metering range exceedances.

If there are warnings and serious errors, the error message is indicated by the symbol “EEE” followed by an error number.



The three-digit error number is composed of the error description and (if detectable by the Energy Meter 610/610-PB) one or more error causes.



Example of error message 911:

The error number is composed of serious error 910 and internal error cause 0x01.

In this example, an error occurred when reading the calibration from the EEPROM. The device must be sent to the manufacturer for inspection.

Warnings

Warnings are less serious errors and can be acknowledged with buttons 1 or 2. The measured values continue to be recorded and displayed. This error is re-displayed after each voltage recovery.

Error	Description of the error
EEE 500	The mains frequency could not be determined. Possible causes: The voltage at L1 is too small. The mains frequency does not range between 45 and 65 Hz. Remedy: Check the mains frequency. Select fixed frequency on the device.

Serious errors

The device must be sent to the manufacturer for inspection.

Error	Description of the error
EEE 910	Error when reading the calibration.

Internal causes of the error

The Energy Meter 610/610-PB can usually determine the cause of an internal error and then report it with the following error code. The device must be sent to the manufacturer for inspection.

Error	Description of the error
0x01	EEPROM does not answer.
0x02	Address range exceeded.
0x04	Checksum error.
0x08	Error in the internal I2C bus.

Clock/battery errors

Clock or battery errors are displayed together with the “EEE“ symbol followed by “bAt“ and a status number. For a more detailed description please refer to “Battery control function” and “Replacing the battery“.

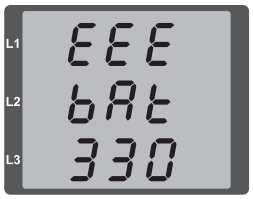


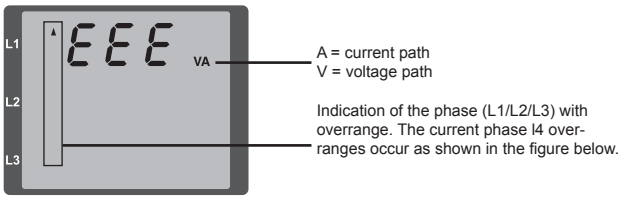
Fig.: Clock/battery error number 330 (clock does not run and has to be set).

Overranges

Overranges are displayed as long as they exist and cannot be acknowledged. An overrange exists if at least one of the voltage or current measurement inputs lies outside their specified measuring range.

The “upwards” arrow indicates the phase where the overrrange occured. The appropriate error message for current path I4 is generated as shown below.
The “V” and “A” symbols indicate whether the overrange occurred in the current or in the voltage path.

Overrange limits:
I = 7 Aeff
U_{L-N} = 300 V_{rms}



Examples

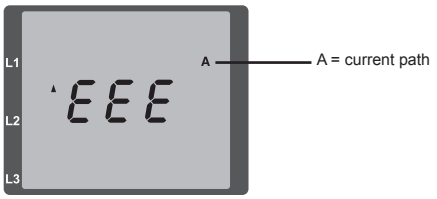


Fig.: Indication of the overrange in the current path of phase 2 (I2).

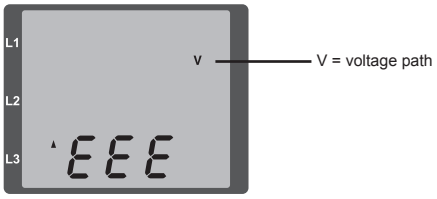


Fig.: Indication of the overrange in voltage path L3.

Fig.: Indication of the overrange in current path I4.

Parameter overrange

A detailed description of the error is coded in the parameter overrange (Addr. 600) in the following format:

0x	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**
Phase 1:		1		1				
Phase 2:		2		2				
Phase 3:		4		4				
		Current		U_{L-N}				

Example:
Error in phase 2 in the current path
0x**F2FFFFFF**

Example:
Error in phase 3 in the voltage path UL-N
0x**FFF4FFFF**

Procedure in the event of faults

Possible fault	Cause	Remedy
No display	External fusing for the power supply voltage has tripped.	Replace fuse.
No current display	Measurement voltage is not connected.	Connect the measuring-circuit voltage.
	Measurement current is not connected.	Connect measuring-circuit current.
Current displayed is too large or too small.	Current measurement in the wrong phase.	Check connection and correct if necessary.
	Current transformer factor is incorrectly programmed.	Read out and program the current transformer transformation ratio at the current transformer.
	The current peak value at the measurement input was exceeded by harmonic components.	Install current transformer with a larger transformation ratio.
	The current at the measurement input fell short of.	Install current transformer with a suitable transformation ratio.
Voltage displayed is too large or too small.	Measurement in the wrong phase.	Check connection and correct if necessary.
	Voltage transformer incorrectly programmed.	Read out and program the voltage transformer transformation ratio at the voltage transformer.
Voltage displayed is too small.	Overrange.	Install voltage transformers.
	The peak voltage value at the measurement input has been exceeded by harmonic components.	**Caution!** Ensure the measurement inputs are not overloaded.
Phase shift ind/cap.	A current path is assigned to the wrong voltage path.	Check connection and correct if necessary.
Effective power, consumption/supply reversed.	At least one current transformer connection is mixed up/reversed.	Check connection and correct if necessary.
	A current path is assigned to the wrong voltage path.	Check connection and correct if necessary.
Effective power too large or too small.	The programmed current transformer transformation ratio is incorrect.	Read out and program the current transformer transformation ratio at the current transformer.
	The current path is assigned to the wrong voltage path.	Check connection and correct if necessary.
	The programmed voltage transformer transformation ratio is incorrect.	Read out and program the voltage transformer transformation ratio at the voltage transformer.
An output is not responding.	The output was incorrectly programmed.	Check the settings and correct if necessary.
	The output was incorrectly connected.	Check connection and correct if necessary.
EEE in the display	See error messages.	
EEE bAt in the display	Battery capacity is too low	See "Battery control function" and "Replacing the battery"
No connection with the device.	RS485 - Device address is incorrect. - Different bus speeds (Baud rate). - Wrong protocol. - Termination missing.	 - Adjust the device address. - Adjust speed (baud rate). - Select the correct protocol. - Close bus with termination resistor.
	USB - Driver fault	 - Disconnect USB interface briefly - Use another USB port - Reinstall Driver
Device still does not work despite the above measures.	Device defective.	Send the device to the manufacturer for inspection and testing along with an accurate fault description.

Technical Data

General	
Net weight (with attached connectors)	approx. 358g
Packaging weight (including accessories)	approx. 790g
Battery	Lithium battery CR2032, 3 V (approval i.a.w. UL 1642)
Service life of the backlight	40000 h (after this period of time the background lighting efficiency will reduce by approx. 50 %)

Transport and storage The following information applies for devices that are transported or stored in their original packaging.	
Free fall	1 m
Temperature	K55 (-25 to +70 °C)
Relative humidity	0 to 90 % RH

Ambient conditions during operation	
The Energy Meter 610/610-PB is intended for use in weather-protected, fixed locations. Protection class II according to IEC 60563 (VDE 0106, part 1).	
Rated temperature range	K55 (-10 to +55 °C)
Relative humidity	0 to 75 % RH
Operational altitude	0 to 2000 m above sea level
Degree of pollution	2
Installation position	vertical
Ventilation	Forced ventilation is not required.
Foreign body and water protection - Front - Back - Front with seal	 IP40 according to EN 60529 IP20 according to EN 60529 IP54 according to EN 60529

Power supply voltage	
Option 230V: - Nominal range - Power consumption	 90 to 277 V (50/60 Hz) or DC 90 to 250 V; 300 V CAT III Type 610: 3 W / 6 VA Type 610-PB: max. 4 W / 7,5 VA
Option 24V: - Nominal range - Power consumption	 24 to 90 V AC/DC; 150 V CAT III Type 610: 3 W / 5 VA Type 610-PB: max. 5 W / 6,5 VA
Operating range	+-10 % of nominal range
Internal fuse, not replaceable	Type T1A / 250V/277V according IEC 60127
Recommended overcurrent protection device for line protection (certified under UL)	Option 230 V: 6 to 16 A (Char. B) Option 24 V: 1 to 6 A (Char. B)

Recommendation for a maximum number of devices on a circuit breaker:

- Option 230 V:	Circuit breaker B6A:	max. 4 devices
	Circuit breaker B16A:	max. 11 devices
- Option 24 V:	Circuit breaker B6A:	max. 3 devices
	Circuit breaker B16A:	max. 9 devices

Connection capacity of the terminals (power supply) Connectable conductor. Only one conductor may be connected per contact point!	
Single-wire, multi-wire, finely stranded conductor	0.2 to 2.5.mm², AWG 26 to 12
Pin terminals, ferrules	0.2 to 2.5.mm²
Tightening torque	0.4 to 0.5.Nm
Stripping length	7 mm

Digital outputs 6 digital outputs, semi-conductor relay, not short circuit protected.	
Switching voltage	max. 33 V AC, 60 V DC
Switching current	max. 50 mAeff AC/DC
Reaction time	10/12 periods + 10 ms *
Pulse output (energy pulses)	max. 50 Hz

* Reaction time at 50 Hz, for example: 200 ms + 10 ms = 210 ms

Digital inputs 4 optional digital outputs, semiconductor relays, not short-circuit proof.	
Maximum counter frequency	20 Hz
Input signal present	18 to 28 V DC (typical 4 mA)
Input signal not present	0 to 5 V DC, current less than 0.5 mA

Cable length (digital inputs and outputs)	
Cable lengths	- up to 30 m unshielded - from 30 m shielded

Connection capacity of the terminals (digital in-/outputs)	
Rigid/flexible	0.1 to 1.5 mm², AWG 28 to 16
Flexible with ferrules without plastic sleeve	0.,20 to 1.5 mm²
Flexible with ferrules with plastic sleeve	0.,20 to 1.5 mm²
Tightening torque	0.20 to 0.25 Nm
Stripping length	7 mm

Serial interfaces	
RS485 - Modbus RTU/slave	9.6 kbps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps
Stripping length	7 mm
USB (receptacle)	USB 2.0, type B, max. transfer rate 921.6 kbps
Profibus (only Energy Meter 610-PB) - Profibus DP/V0 - Receptacle	 - 9,6 kbps to 12 Mbps - D-sub, 9-pole

Connection capacity of the terminals (RS485)	
Single-wire, multi-wire, finely stranded conductor	0.20 to 1.5 mm²
Pin terminals, ferrules	0.20 to 1.5 mm²
Tightening torque	0.20 to 0.25 Nm
Stripping length	7 mm

Voltage metering	
Three-phase, 4-wire systems with nominal voltages up to	277 V / 480 V (+-10 %)
Three-phase, 3-wire systems, un-earthed, with nominal voltages up to	IT 480 V (+-10 %)
Overvoltage category	300 V CAT III
Rated surge voltage	4 kV
Metering range L-N	0[1)] to 300 Vrms (max. overvoltage 520 Vrms)
Metering range L-L	0[1)] to 520 Vrms (max. overvoltage 900 Vrms)
Resolution	0.01 V
Crest factor	2.45 (relative to the metering range)
Impedance	4 MOhm/phase
Power consumption	approx. 0.1 VA
Sampling rate	21.33 kHz (50 Hz), 25.6 kHz (60 Hz) per measuring channel
Mains frequency Resolution	45 to 65 Hz 0.01 Hz

1) The Energy Meter 610/610-PB can only detect measurements when a voltage L1-N greater than 20 Veff (4-wire measurement) at voltage input V1 or a voltage L1-L2 greater than 34 Veff (3-wire measurement) is applied.

Connection capacity of the terminals (voltage measurement) Connectable conductor. Only one conductor may be connected per contact point!	
Single-wire, multi-wire, finely stranded conductor	0.08 to 4 mm², AWG 28 to 12
Pin terminals, ferrules	0.2 to 2.5 mm²
Tightening torque	0.4 to 0.5 Nm
Stripping length	7 mm

Current measurement I1 - I4	
Rated current	5 A
Measurement range	0 to 6 Arms
Crest factor	1.98
Resolution	0.1 mA (Display 0.01 A)
Overvoltage category	300 V CAT II
Measurement surge voltage	2 kV
Power consumption	ca. 0.2 VA (Ri = 5 mOhm)
Overload for 1 second	120 A (sinusoidal)
Sampling frequency	21.33 kHz (50 Hz), 25.6 kHz (60 Hz) per measurement channel

Connection capacity of the terminals (current measurement) Connectable conductor. Only one conductor may be connected per contact point!	
Single-wire, multi-wire, finely stranded conductor	0.2 to 2.5 mm², AWG 26 to 12
Pin terminals, ferrules	0.2 to 2.5 mm²
Tightening torque	0.4 to 0.5 Nm
Stripping length	7 mm

Parameters of functions

Function	Symbol	Accuracy class	Metering range	Display range
Total real power	P	0.5 [5] (IEC 61557-12)	0 to 5.4 kW	0 W to 999 GW *
Total reactive power	*QA, Qv*	1 (IEC 61557-12)	0 to 5.4 kvar	0 varh to 999 Gvar *
Total apparent power	*SA, Sv*	0.5 [5] (IEC 61557-12)	0 to 5.4 kVA	0 VA to 999 GVA *
Total active energy	Ea	0.5S [5] [6] (IEC 61557-12)	0 to 5.4 kWh	0 Wh to 999 GWh *
Total reactive energy	*ErA, ErV*	1 (IEC 61557-12)	0 to 5.4 kvarh	0 varh to 999 Gvarh *
Total apparent energy	*EapA, EapV*	0.5 [5] (IEC 61557-12)	0 to 5.4 kVAh	0 VAh to 999 GVAh *
Frequency	f	0.05 (IEC 61557-12)	45 to 65 Hz	45.00 Hz to 65.00 Hz
Phase current	I	0.2 (IEC 61557-12)	0 to 6 Arms	0 A to 999 kA
Measured neutral conductor current	IN	1 (IEC 61557-12)	0 to 6 Arms	0 A to 999 kA
Calculated neutral conductor current	INc	1 (IEC 61557-12)	0.03 to 25 A	0.03 A to 999 kA
Voltage	U L-N	0.2 (IEC 61557-12)	10 to 300 Vrms	0 V to 999 kV
Voltage	U L-L	0.2 (IEC 61557-12)	18 to 520 Vrms	0 V to 999 kV
Displacement factor	PFA, PFV	0.5 (IEC 61557-12)	0.00 to 1.00	0.00 to 1.00
Short-term flicker, long-term flicker	Pst, Plt	-	-	-
Voltage dips (L-N)	Udip	-	-	-
Voltage surges (L-N)	Uswl	-	-	-
Transient overvoltages	Utr	-	-	-
Voltage interruptions	Uint	-	-	-
Voltage unbalance (L-N) [1]	Unba	-	-	-
Voltage unbalance (L-N) [2]	Unb	-	-	-
Voltage harmonics	Uh	Class 1 (IEC 61000-4-7)	up to 2.5 kHz	0 V to 999 kV
THD of the voltage [3]	THDu	1.0 (IEC 61557-12)	up to 2.5 kHz	0 % to 999 %
THD of the voltage [4]	THD-Ru	-	-	-
Current harmonics	Ih	Class 1 (IEC 61000-4-7)	up to 2.5 kHz	0 A to 999 kA
THD of the current [3]	THDi	1.0 (IEC 61557-12)	up to 2.5 kHz	0 % to 999 %
THD of the current [4]	THD-Ri	-	-	-
Mains signal voltage	MSV	-	-	-

1) Referred to amplitude.
2) Referred to phase and amplitude.
3) Referred to mains frequency.
4) Referred to root mean square value.
5) Accuracy class 0.5 with ../5A transformer.
   Accuracy class 1 with ../1A transformer.
6) Accuracy class 0.5S according IEC 62053-22.

* The display returns to 0 W when the maximum total energy values are reached.

Parameter and Modbus address list

The following excerpt from the parameter list contains settings that are necessary for proper operation of the Energy Meter 610/610-PB, such as current transformers and device addresses. The values in the parameter list can be written and read.
In the excerpt, the measured value list files the measured and calculated measured values, output status data and recorded values so that they can be read.

Table 1 - Parameter list

Address	Format	RD/WR	Unit	Note	Adjustment Range	Default
0	SHORT	RD/WR	-	Device address (Modbus/Profibus)	0 to 255 [1)]	1
1	SHORT	RD/WR	kbps	Baud rate for Modbus (0 = 9.6 kbps, 1 = 19.2 kbps, 2 = 38.4 kbps, 3 = 57.6 kbps, 4 = 115.2 kbps)	0 to 7 (5 to 7 only for internal use)	4
2	SHORT	RD/WR	-	Modbus Master 0 = Slave	0, 1	0
3	SHORT	RD/WR	-	Stopbits 0 = 1 Bit, none parity 1 = 2 Bits, none parity 2 = 1 Bit, even parity 3 = 1 Bit, uneven parity	0 to 3	0
10	FLOAT	RD/WR	A	Current transformer I1, primary	0 to 1000000 [2)]	5
12	FLOAT	RD/WR	A	Current transformer I1, secondary	1 to 5	5
14	FLOAT	RD/WR	V	Voltage transformer V1, primary	0 to 1000000 [2)]	400
16	FLOAT	RD/WR	V	Voltage transformer V1, secondary	100, 400	400
18	FLOAT	RD/WR	A	Current transformer I2, primary	0 to 1000000 [2)]	5
20	FLOAT	RD/WR	A	Current transformer I2, secondary	1 to 5	5
22	FLOAT	RD/WR	V	Voltage transformer V2, primary	0 to 1000000	400
24	FLOAT	RD/WR	V	Voltage transformer V2, secondary	100, 400	400
26	FLOAT	RD/WR	A	Current transformer I3, primary	0 to 1000000	5
28	FLOAT	RD/WR	A	Current transformer I3, secondary	1 to 5	5
30	FLOAT	RD/WR	V	Voltage transformer V3, primary	0 to 1000000	400
32	FLOAT	RD/WR	V	Voltage transformer V3, secondary	100, 400	400
34	SHORT	RD/WR	Hz	Frequency determination 0 = Auto, 45 to 65 = Hz	0, 45 to 65	0
35	SHORT	RD/WR	-	Display contrast 0 (low), 9 (high)	0 to 9	5
36	SHORT	RD/WR	-	Backlight 0 (dark), 9 (light)	0 to 9	6
37	SHORT	RD/WR	-	Display profile 0 = default display profile 1 = default display profile 2 = vdefault display profile 3 = freely selectable display profile	0 to 3	0
38	SHORT	RD/WR	-	Display change profile 0 to 2 = default display change profiles 3 = freely selectable display change profile	0 to 3	0
39	SHORT	RD/WR	s	Changeover time	0 to 60	0
40	SHORT	RD/WR	-	Averaging time, I	0 to 8 *	6
41	SHORT	RD/WR	-	Averaging time, P	0 to 8 *	6
42	SHORT	RD/WR	-	Averaging time, U	0 to 8 *	6
45	USHORT	RD/WR	mA	Response threshold of current measuring I1 to I3	0 to 200	5
50	SHORT	RD/WR	-	Password	0 to 999	0 (Kein Passwort)
100	SHORT	RD/WR	-	Address of the measured value, Digital output 1	0 to 32000	874
101	SHORT	RD/WR	-	Address of the measured value, Digital output 2	0 to 32000	882
102	FLOAT	RD/WR	Wh	Pulse value, Digital output 1	-1000000 to +1000000	1000
104	FLOAT	RD/WR	Wh	Pulse value, Digital output 2	-1000000 to +1000000	1000
106	SHORT	RD/WR	10ms	Minimum pulse length (1 = 10 ms) Digital output 1/2	1 to 1000	5 (= 50 ms)

206	SHORT	RD/WR	s	“Drag indicator” period duration	300 to 3600	900
207	SHORT	RD/WR	s	“Drag indicator” capture time	1 to 20	10
208	SHORT	RD/WR	-	Config. Digital input 1 0 = internal synchronisation 1 = external synchronisation (NO) 2 = external synchronisation (NC)	0 to 2	0
500	SHORT	RD/WR	-	Terminal assignment, I L1	-3...0...+3 1)	+1
501	SHORT	RD/WR	-	Terminal assignment, I L2	-3...0...+3 1)	+2
502	SHORT	RD/WR	-	Terminal assignment, I L3	-3...0...+3 1)	+3
503	SHORT	RD/WR	-	Terminal assignment, U L1	0 to 3 1)	1
504	SHORT	RD/WR	-	Terminal assignment, U L2	0 to 3 1)	2
505	SHORT	RD/WR	-	Terminal assignment, U L3	0 to 3 1)	3
506	SHORT	RD/WR	-	Clear min. and max. values	0 to 1	0
507	SHORT	RD/WR	-	Clear energy meter	0 to 1	0
508	SHORT	RD/WR	-	Force write EEPROM	0 to 1	0
Note: Energy values and minimum and maximum values are written to the EEPROM every 5 minutes.						
509	SHORT	RD/WR	-	Voltage connection diagram	0 to 8 2)	0
510	SHORT	RD/WR	-	Current connection diagram	0 to 8	0
511	SHORT	RD/WR	-	Relative voltage for THD and FFT	0, 1	0
The voltages for THD and FFT can be shown on the display as L-N or L-L values. 0 = LN, 1 = LL						
512	SHORT	RD/WR	-	Year	0 to 99	
513	SHORT	RD/WR	-	Month	0 to 12	
514	SHORT	RD/WR	-	Day	0 to 31	
515	SHORT	RD/WR	-	Hour	0 to 24	
516	SHORT	RD/WR	-	Minute	0 to 59	
517	SHORT	RD/WR	-	Second	0 to 59	
600	UINT	RD/WR	-	Metering range exceedance	0 to 0xFFFFFFFF	
746	SHORT	RD/WR	s	Period of time after which the backlight will switch to standby	60 to 9999	900
747	SHORT	RD/WR	s	Brightness of the standby backlight	0 to 9	0
750	SHORT	RD	-	Software release		
754	SERNR	RD	-	Serial number		
756	SERNR	RD	-	Production number		

(*1) Values 0 and 248 through 255 are reserved and may not be used.
(*2) The adjustable value of 0 does not produce any useful work values and must not be used.
* 0 = 5 seconds; 1 = 10 seconds.; 2 = 15 seconds; 3 = 30 seconds; 4 = 1 minute; 5 = 5 minutes; 6 = 8 minutes; 7 = 10 minutes; 8 = 15 minutes
1) 0 = No measurement of the current or voltage path.
2) The setting 8 is equal setting 0.

A complete overview of the parameters and measured values as well as explanations regarding the selected measured values is filed in the document “Modbus Address List” in the Internet on the product pages.

The addresses contained in the description can be adjusted directly on the device in the range from 0 to 800. The address range above 1000 can only be processed via modbus!

Only the first three positions (###) of a value are shown on the display. Values larger than 1,000 are marked with “k”. Example: 003k = 3000

Table 2 - Modbus address list
(frequently used measured values)

Modbus address	Address above display	Format	RD/WR	Unit	Note
19000	808	float	RD	V	Voltage L1-N
19002	810	float	RD	V	Voltage L2-N
19004	812	float	RD	V	Voltage L3-N
19006	814	float	RD	V	Voltage L1-L2
19008	816	float	RD	V	Voltage L2-L3
19010	818	float	RD	V	Voltage L3-L1
19012	860	float	RD	A	Current, L1
19014	862	float	RD	A	Current, L2
19016	864	float	RD	A	Current, L3
19018	866	float	RD	A	Vektor sum; IN = I1 + I2 + I3
19020	868	float	RD	W	Real power L1
19022	870	float	RD	W	Real power L2
19024	872	float	RD	W	Real power L3
19026	874	float	RD	W	Sum; Psum3=P1+P2+P3
19028	884	float	RD	VA	Apparent powerS L1
19030	886	float	RD	VA	Apparent powerS L2
19032	888	float	RD	VA	Apparent powerS L3
19034	890	float	RD	VA	Sum; Ssum3 = S1 + S2 + S3
19036	876	float	RD	var	Fund. reactive power (mains frequency) Q L1
19038	878	float	RD	var	Fund. reactive power (mains frequency) Q L2
19040	880	float	RD	var	Fund. reactive power (mains frequency) Q L3
19042	882	float	RD	var	Sum; Qsum3 = Q1 + Q2 + Q3
19044	820	float	RD	-	Fund. power factor, CosPhi; U L1-N IL1
19046	822	float	RD	-	Fund. power factor, CosPhi; U L2-N IL2
19048	824	float	RD	-	Fund. power factor, CosPhi; U L3-N IL3
19050	800	float	RD	Hz	Measured frequency
19052	-	float	RD	-	Rotation field; 1 = right, 0 = none, -1 = left
19054	-	float	RD	Wh	Real energy L1
19056	-	float	RD	Wh	Real energy L2
19058	-	float	RD	Wh	Real energy L3
19060	-	float	RD	Wh	Real energy L1..L3
19062	-	float	RD	Wh	Real energy L1, consumed
19064	-	float	RD	Wh	Real energy L2, consumed
19066	-	float	RD	Wh	Real energy L3, consumed
19068	-	float	RD	Wh	Real energy L1..L3, consumed, rate 1
19070	-	float	RD	Wh	Real energy L1, delivered
19072	-	float	RD	Wh	Real energy L2, delivered
19074	-	float	RD	Wh	Real energy L3, delivered
19076	-	float	RD	Wh	Real energy L1..L3, delivered
19078	-	float	RD	VAh	Apparent energy L1
19080	-	float	RD	VAh	Apparent energy L2
19082	-	float	RD	VAh	Apparent energy L3
19084	-	float	RD	VAh	Apparent energy L1..L3
19086	-	float	RD	varh	Reaktive energy L1

19088	-	float	RD	varh	Reaktive energy L2
19090	-	float	RD	varh	Reaktive energy L3
19092	-	float	RD	varh	Reaktive energy L1..L3
19094	-	float	RD	varh	Reaktive energy, inductive, L1
19096	-	float	RD	varh	Reaktive energy, inductive, L2
19098	-	float	RD	varh	Reaktive energy, inductive, L3
19100	-	float	RD	varh	Reaktive energy, L1..L3, inductive
19102	-	float	RD	varh	Reactive energy, capacitive, L1
19104	-	float	RD	varh	Reactive energy, capacitive, L2
19106	-	float	RD	varh	Reactive energy, capacitive, L3
19108	-	float	RD	varh	Reactive energy, L1..L3, capacitive
19110	836	float	RD	%	Harmonic, THD, U L1-N
19112	838	float	RD	%	Harmonic, THD, U L2-N
19114	840	float	RD	%	Harmonic, THD, U L3-N
19116	908	float	RD	%	Harmonic, THD, I L1
19118	910	float	RD	%	Harmonic, THD, I L2
19120	912	float	RD	%	Harmonic, THD, I L3

Modbus address	Address above display	Format	RD/WR	Unit	Note	Adjustment range	Default
20022	-	float	RD/WR	A	Current transformer I4, primary	0 to 1000000	5
20024	-	float	RD/WR	A	Current transformer I4, secondary	1 to 5	5

The addresses contained in the description can be adjusted directly on the device in the range from 0 to 800.
The address range 800 to 999 is available for programming comparators on the device. The addresses above 1000 can only be processed via modbus!

A complete overview of the parameters and measured values as well as explanations regarding the selected measured values is filed in the document “Modbus Address List” in the Internet on the product pages.

Number formats

Type	Size	Minimum	Maximum
short	16 bit	-2^{15}	$2^{15} - 1$
ushort	16 bit	0	$2^{16} -1$
int	32 bit	-2^{31}	$2^{31} - 1$
uint	32 bit	0	$2^{32} - 1$
float	32 bit	IEEE 754	IEEE 754

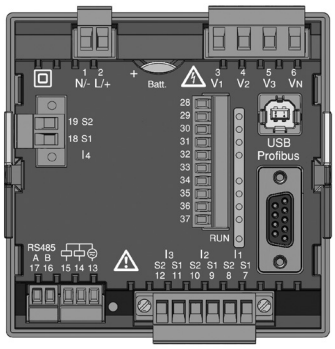
Notes on saving measurement values and configuration data:

- The following measurement values are saved at least every 5 minutes:
  - Comparator timer
  - S0 meter readings
  - Minimum / maximum / mean values
  - Energy values
- Configuration data is saved immediately!

Dimension diagrams

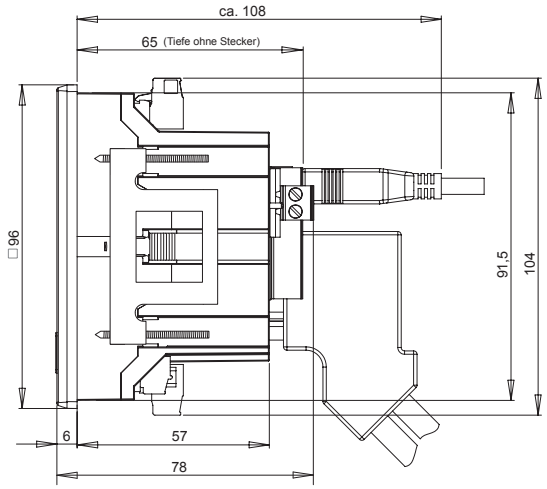
All dimensions in mm.

Rear view of Energy Meter 610-PB

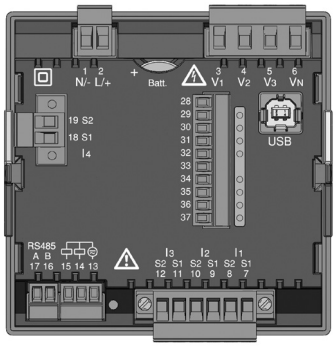


Side view of Energy Meter 610-PB

with USB and Profibus connectors inserted

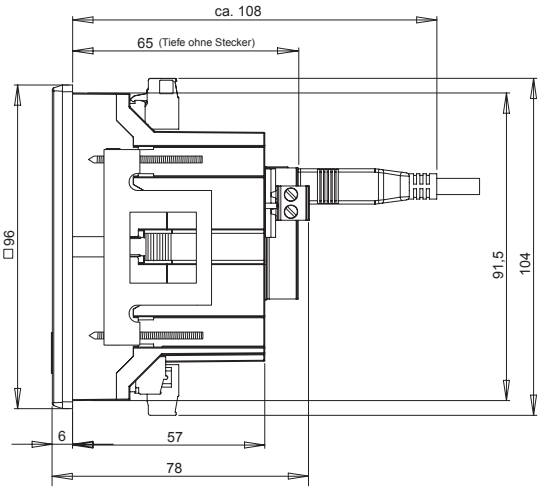


Rear view of Energy Meter 610

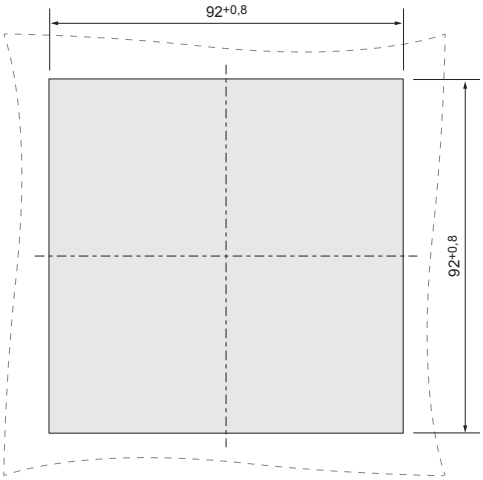


Side view of Energy Meter 610

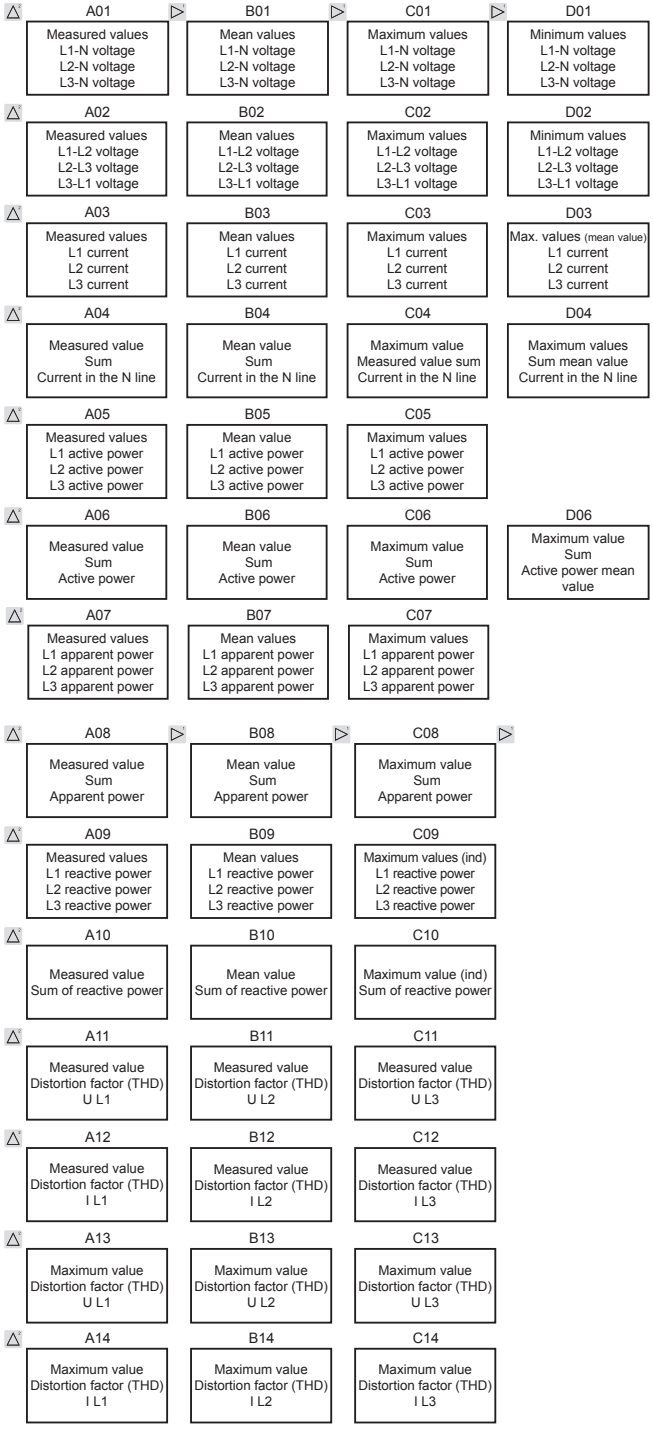
with USB connector inserted

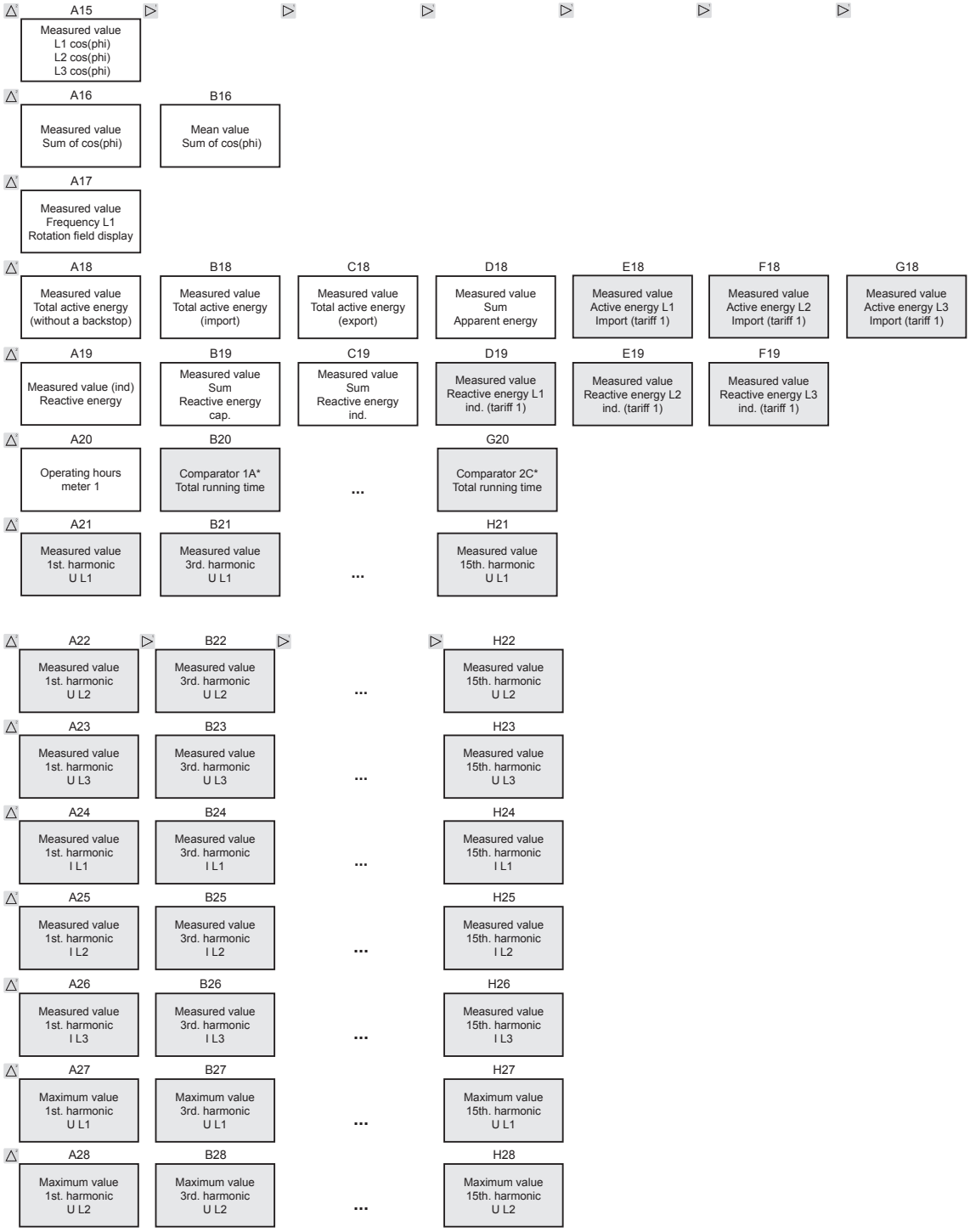


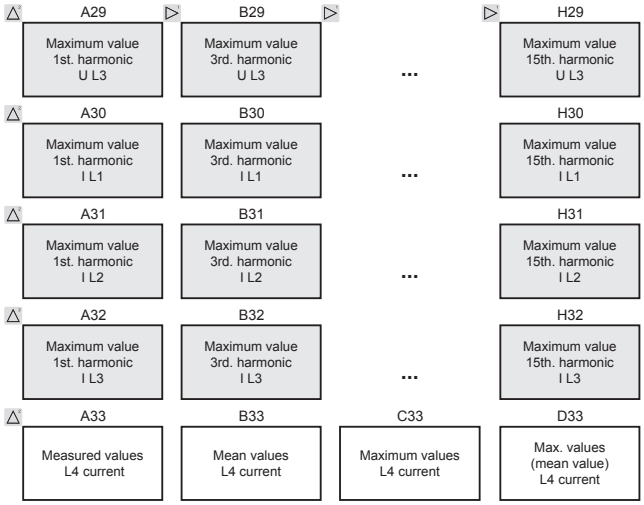
Cutout dimensions



Overview of measured value displays



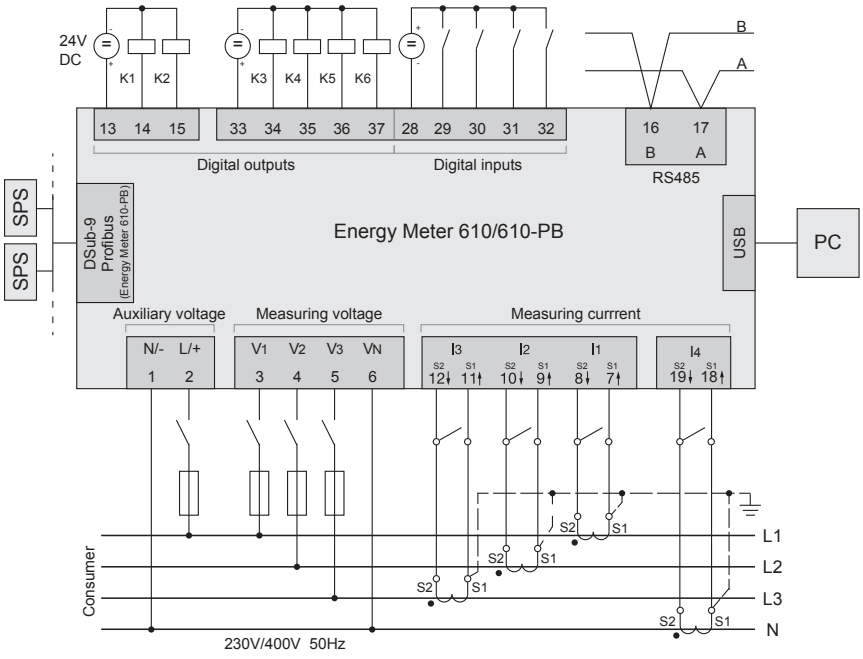

A15
Measured value
L1 cos(phi)
L2 cos(phi)
L3 cos(phi)
A16
Measured value
Sum of cos(phi)
B16
Mean value
Sum of cos(phi)
A17
Measured value
Frequency L1
Rotation field display
A18
Measured value
Total active energy
(without a backstop)
B18
Measured value
Total active energy
(import)
C18
Measured value
Total active energy
(export)
D18
Measured value
Sum
Apparent energy
E18
Measured value
Active energy L1
Import (tariff 1)
F18
Measured value
Active energy L2
Import (tariff 1)
G18
Measured value
Active energy L3
Import (tariff 1)
A19
Measured value (ind)
Reactive energy
B19
Measured value
Sum
Reactive energy
cap.
C19
Measured value
Sum
Reactive energy
ind.
D19
Measured value
Reactive energy L1
ind. (tariff 1)
E19
Measured value
Reactive energy L2
ind. (tariff 1)
F19
Measured value
Reactive energy L3
ind. (tariff 1)
A20
Operating hours
meter 1
B20
Comparator 1A*
Total running time
...
G20
Comparator 2C*
Total running time
A21
Measured value
1st. harmonic
U L1
B21
Measured value
3rd. harmonic
U L1
...
H21
Measured value
15th. harmonic
U L1
A22
Measured value
1st. harmonic
U L2
B22
Measured value
3rd. harmonic
U L2
...
H22
Measured value
15th. harmonic
U L2
A23
Measured value
1st. harmonic
U L3
B23
Measured value
3rd. harmonic
U L3
...
H23
Measured value
15th. harmonic
U L3
A24
Measured value
1st. harmonic
I L1
B24
Measured value
3rd. harmonic
I L1
...
H24
Measured value
15th. harmonic
I L1
A25
Measured value
1st. harmonic
I L2
B25
Measured value
3rd. harmonic
I L2
...
H25
Measured value
15th. harmonic
I L2
A26
Measured value
1st. harmonic
I L3
B26
Measured value
3rd. harmonic
I L3
...
H26
Measured value
15th. harmonic
I L3
A27
Maximum value
1st. harmonic
U L1
B27
Maximum value
3rd. harmonic
U L1
...
H27
Maximum value
15th. harmonic
U L1
A28
Maximum value
1st. harmonic
U L2
B28
Maximum value
3rd. harmonic
U L2
...
H28
Maximum value
15th. harmonic
U L2



* Only the first 6 comparators are shown.
Marked menus are not displayed in the factory presetting.

Even and **odd** harmonics up to the **40th order** can be called up via the ecoExplorer go software and can be viewed in the software.

Connection example



1) UL/IEC approved overcurrent protection system (6 A Char. B)
2) UL/IEC approved overcurrent protection system (10 A Class CC / Char. C)
3) Jumpers (external)

Basic functions quick guide

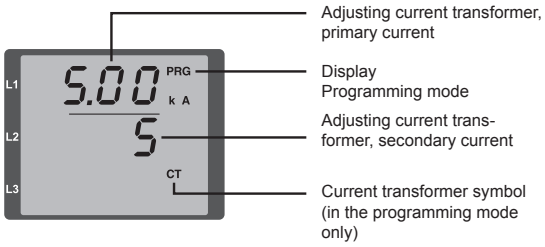
Adjusting the current transformer

Switch to the programming mode:
- Press button 1 and 2 simultaneously for around 1 second to switch to the programming mode. The symbols for the programming mode PRG and the current transformer mode CT appear on the display.
- Press button 1 to confirm the selection.
- The first digit of the input field for the primary current is flashing.

Adjusting the primary current
- Press button 2 to change the flashing digit.
- Press button 1 to select the next digit to be changed. The selected digit to be changed is flashing. If the entire number is flashing, press button 2 to move the decimal point.

Adjusting the secondary current
- Only 1A or 5A can be set as secondary current.
- Press button 1 to select the secondary current.
- Press button 2 to change the flashing digit.
-

Exit programming mode
- Press button 1 and 2 simultaneously for around 1 second to switch to the display mode.



View measured values

Switch to the display mode:
- If you are still in the programming mode (PRG and CT icons displayed on the screen), press button 1 and 2 simultaneously for around 1 second to switch to the display mode.
- A measured value display (e.g. voltage) appears

Button controls
- Press button 2 to change the measured value display for current, voltage, power, etc.
- Press button 1 to change the mean values, max. values etc. associated with the measured value.

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