

Energy Analyser 750

Manual

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General information

This manual applies to the products:

Energy Analyser 750-230

Energy Analyser 750-24

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2534160000

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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!



Ground wire connection



Inductive

The current lags behind the voltage.



Capacitive

The voltage lags behind the current.

Instructions on use

Please read this operation manual as well as all other publications that must be consulted for working with this product (in particular, for the installation, operation or maintenance).

Observe all safety instructions and warnings. Failure to comply with the instructions can result in personal injuries and/or damage to the product.

Any unauthorised changes or use of this device, which go beyond the mechanical, electrical or otherwise stated operating limitations, can result in bodily injury or/and damage to the product.

Any such unauthorised change constitutes "misuse" and/or "negligence" according to the warranty for the product and thus excludes the warranty for covering possible damage resulting from this.

This device must only be operated and repaired by specialised personnel.

Specialised personnel are persons, that based on their respective training and experience, are qualified to recognise risks and prevent potential dangers that can be caused by the operation or maintenance of the device.

Additional legal and safety regulations required for the respective application are to be followed during the use of the device.



If the device is not operated according to the operation manual, protection is no longer ensured and hazards can be presented by the device.



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



Single core conductor must be provided with sleeves.



Only pluggable screw terminals with the same number of poles and the same type of construction are permitted to be connected together.

Inspection on receipt

The prerequisites of faultless, safe operation of this device are proper transport and proper storage, set-up and installation, as well as careful operation and maintenance. If it can be assumed that risk-free operation is no longer possible, the device must be immediately put out of operation and secured against being put back into operation again.

Packing and unpacking must be carried out with customary care without the use of force and only using suitable tools. The devices should be visually checked for flawless mechanical condition.

It can be assumed that risk-free operation is no longer possible if the device, for example,

- has visible damage
- no longer works despite the mains power supply being intact
- has been exposed to prolonged adverse conditions (e.g. storage outside the permissible climate limits without being adapted to the room climate, condensation, etc.) or rough handling during transportation (e.g. falling from a height, even if there is no visible external damage, etc.)
- please check the delivered items for completeness before you start installing the device.



All screw-type terminals included in the scope of delivery are attached to the device.



All supplied options and versions are described on the delivery note.

Concerning this operation manual

This operation manual is part of the product.

- Read the operation manual before using the device.
- Keep the operation manual instructions throughout the entire service life of the product and have them readily available for reference.
- Pass the operation manual on to each subsequent owner or user of the product.

Scope of delivery Energy Analyser 750

Quantity	Description
1	Energy Analyser 750
1	Quick guide
1	Screw-type terminal, pluggable, 2-pole (auxilliary power)
1	Screw-type terminal, pluggable, 5-pole (voltage measurement 1-4)
1	Screw-type terminal, pluggable, 8-pole (current measurement 1-4)
1	Screw-type terminal, pluggable, 6-pole (digital inputs/outputs)
1	Screw-type terminal, pluggable, 7-pole (RCM, thermistor input)
1	Screw-type terminal, pluggable, 3-pole (RS 485)
1	Mounting clips

Product description

Proper use

The Energy Analyser 750 is intended for measurement in accordance with EN 61000-4-30 in building installations, on distribution units, circuit breakers and busbar trunking systems.

Measured voltages and measured currents must derive from the same network.

The Energy Analyser 750 is suitable for integration into fixed and weatherproof switch panels. Conductive switch panels must be earthed.

The Energy Analyser 750 can be used in 2, 3 and 4-conductor networks and in TN and TT networks.

The current measurement inputs 1–4 of the Energy Analyser 750 are connected via external $\dots/1A$ or $\dots/5A$ current transformers.

Measurements in medium and high-voltage networks are always performed via current and voltage transformers.

The measurement results can be displayed, saved and read out and further processed via the interfaces (Ethernet, Modbus, Profibus).

The Energy Analyser 750 can be used in industrial and domestic settings.

By continuously monitoring the residual currents (RCM) of an electrical system via the inputs I5 and I6, warning pulses can be triggered if a response threshold is exceeded. Using these, the system operator can be alarmed before a protective equipment reacts. The Energy Analyser 750 does not provide protection against electric shock!

The residual current monitoring is performed via the current measurement inputs I5 and I6 via an external residual current transformer with a rated current of 30 mA.



Residual current monitoring monitors residual currents via external current transformers and can trigger a warning impulse when a response threshold is exceeded. The device is thus **not** an independent protective device!

Energy Analyser 750 features

General information

- Front panel integration device with dimensions 144 x 144 mm
- Connection via pluggable screw terminals
- Colour graphic display 320 x 240, 256 colours
- Operation via 6 buttons
- 4 Voltage and 4 current measurement inputs
- 2 Residual current inputs with failure monitoring
- 1 Thermistor input
- 2 digital outputs and 2 digital inputs
- 16-bit A/D converter, memory 256 Mbyte Flash, SDRAM 32 Mbyte
- RS485 interface (Modbus RTU, slave, up to 115 kbps)
- Profibus DP/V0
- Ethernet (web server, e-mail)
- Capturing more than 2000 measured values
- Clock and battery (with battery monitoring function)
- Working temperature range -10 to +55 °C

Measurement

- Measurement in TN and TT networks
- Continuous sampling of the voltage and current measurement inputs at 25.6 kHz
- Frequency range of the fundamental oscillation 15 to 440 Hz
- Acquisition of transients > 39 µs and storage of up to approx. 330,000 sampling points
- Metering range current 0.001 to 7 Aeff.
- True RMS (TRMS)
- Continuous sampling of the voltage and current measurement inputs
- Continuous monitoring of residual currents with failure monitoring
- Temperature measurement
- Measurement of the power quality in accordance with DIN EN 61000-4-30, Class A
- Flicker measurement in accordance with DIN EN 61000-4-15:2011, Class F1
- Working measurement, measurement uncertainty in accordance to DIN EN 50470-3:
 - Class C for .../5A converter,
 - Class B for .../1A converter,
- Measurement of the harmonics 1st to 63rd in accordance with DIN EN 61000-4-7 class 1 for
 - Ull, Uln, I, P (cons./del.) and
 - Q (ind./cap.)
- Measurement of the interharmonics 1st to 63rd in accordance with DIN EN 61000-4-7 class1 for
 - Ull, Uln, I

Measuring process

The Energy Analyser 750 measures continuously and calculates all effective values over a 200 ms interval. The device measures the real effective value (TRMS) of the voltages and currents connected to the measurement inputs.

Operating concept

You can program and call up the measured values via many routes using the Energy Analyser 750.

- **Directly** on the device via 6 buttons and the display
- Using the **ecoExplorer go** programming software.
- Using the device **homepage**
- Using the Modbus **protocol**.
You can modify and call up the data using the Modbus address list. The list can be called up via the device's home page.

This operation manual only describes how to operate the Energy Analyser 750 using the six buttons.

The ecoExplorer go programming software has its own documentation.

ecoExplorer go network analysis software

The Energy Analyser 750 can be programmed and read out using the ecoExplorer go network analysis software available online. For this, a PC must be connected to the Energy Analyser 750 via a serial interface (RS485/Ethernet).

ecoExplorer go features

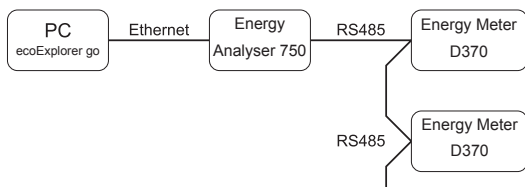
- Programming the Energy Analyser 750
- Configuring recordings
- Analysing the read out data according to EN 61000-2-4.
- Reading out recordings
- Saving data to a database
- Graphical representation of measured values
- Programming customer-specific applications

Connection variants

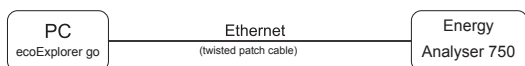
Connection of a Energy Analyser 750 to a PC via an interface converter:



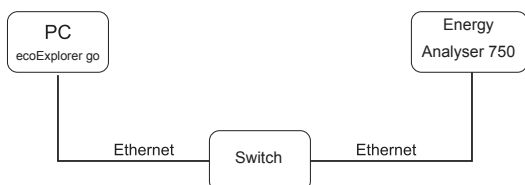
Connection of a Energy Meter D370 via a Energy Analyser 750 as a gateway



Direct connection of a Energy Analyser 750 to a PC via Ethernet.



Connection of a Energy Analyser 750 to a PC via Ethernet.



Installation

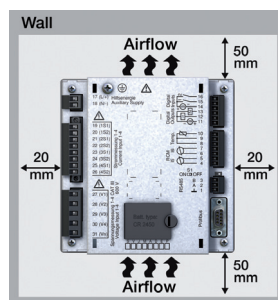
Position of installation

The Energy Analyser 750 is suitable for integration into fixed and weatherproof switch panels. Conductive switch panels must be earthed.

Mounting position

To ensure adequate ventilation, the Energy Analyser 750 must be installed vertically. There should be separation above and below of at least 50 mm with 20 mm space to the sides.

Front panel section



Cut-out size:
 $138^{+0.8} \times 138^{+0.8} \text{ mm}$

Fig.: Mounting position Energy Analyser 750 (View from rear)



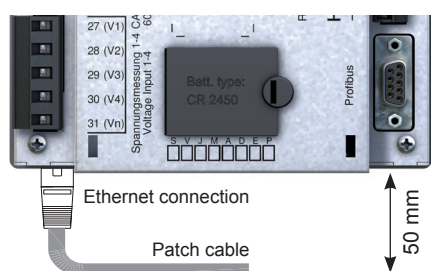
Failure to meet the minimum clearances can destroy the Energy Analyser 750 at high ambient temperatures!

Ethernet

The Ethernet connection of the Energy Analyser 750 is on the bottom of the housing.

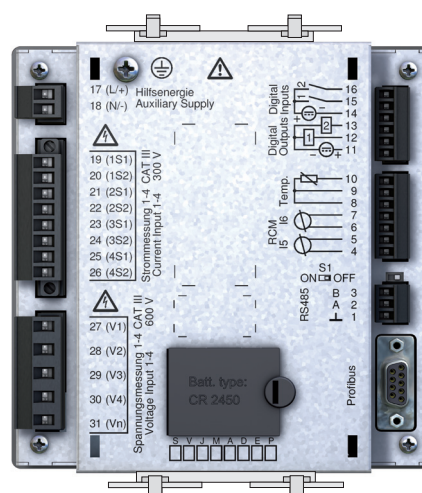
Depending on the bending radius of the Ethernet cable and connector type, you must install a connection area below the Energy Analyser 750.

The connection area below the Energy Analyser 750 should not be smaller than 50 mm.



Mounting

The Energy Analyser 750 is mounted in the switchboard with two mounting clips that are installed at the top and bottom of the device.



Installation

Ground wire connection

Use a ring cable lug for connecting the protective conductor to the Energy Analyser 750.

Supply voltage

The Energy Analyser 750 needs supply voltage to operate. The type and amount of the supply voltage required is specified on the rating plate. The supply voltage is connected on the rear side of the device via terminal blocks.

Before connecting the supply voltage, ensure that the voltage and frequency correspond to the details on the rating plate!

The supply voltage must be connected through a UL/IEC approved fuse (6 A type C).

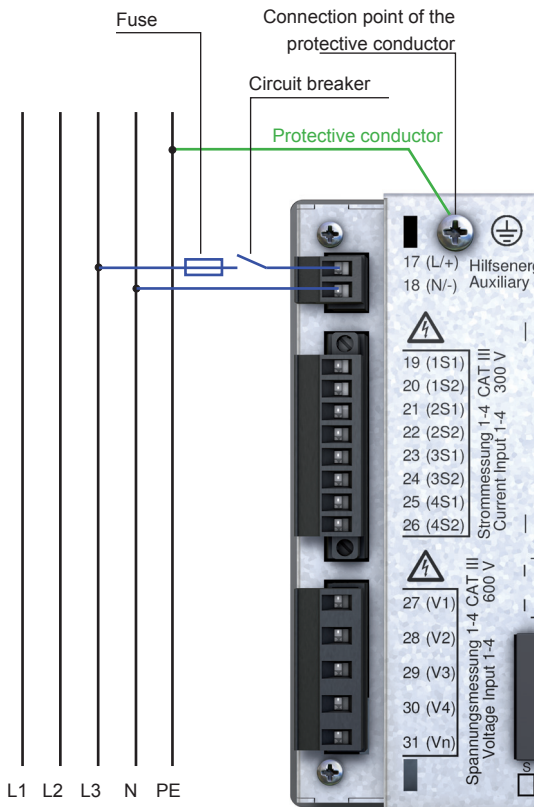


Fig.: Connection example of the supply voltage to a Energy Analyser 750.



Caution: Risk to life!

The ground wire connection on the device must be connected with the system earthing.



Please note!

The inputs for the supply voltage are hazardous if touched!



Please note!

Make sure to observe the specifications for the supply voltage that are provided on the rating plate of the Energy Analyser 750.



- If installed in a building, a disconnect or circuit breaker must be provided for the supply voltage.
- The disconnect must be installed near the device and easily accessible to the user.
- The switch must be marked as the circuit breaker for this device.
- Voltages which are over the permitted voltage range can destroy the device.

Voltage measurement

Three-phase 4-conductor systems

The Energy Analyser 750 can be used in three-phase 4-conductor systems (TN, TT networks) with an earthed neutral conductor. The bodies of the electrical system are earthed.

The voltage measurement in the Energy Analyser 750 is designed for the overvoltage category 600 V CAT III (measurement voltage surge 6 kV).

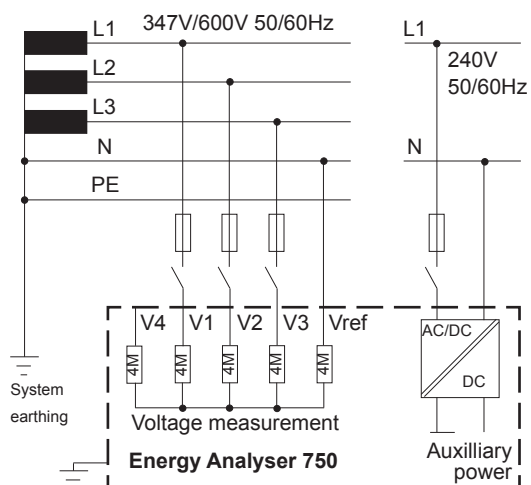


Fig.: Schematic diagram, Energy Analyser 750 in a **TN network**.

Three-phase 3-conductor systems

The Energy Analyser 750 is only suitable to a limited extent for use in IT networks, since the measured voltage relative to the housing potential is measured and the input impedance of the device creates residual current against the earth. The residual current can trigger the insulation monitoring in IT networks.

The connection variants with voltage transformers are suitable for unlimited use in IT networks.

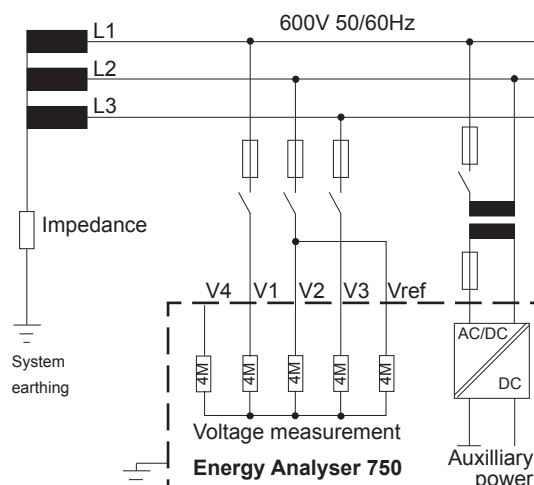


Fig.: Schematic diagram, Energy Analyser 750 in an **IT network** without N.

Rated voltages

Lists of networks and their nominal network voltages in which the Energy Analyser 750 can be used.

Three-phase 4-conductor 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	
347V / 600V	Maximum system rated voltage according to UL
400V / 690V	
417V / 720V	Maximum system rated voltage

Fig.: Table for network rated voltages i.a.w. EN 60664-1:2003 suitable for the voltage measurement inputs.

Three-phase 3-conductor systems, unearthed.

U_{L-L}	
66V	
115V	
120V	
127V	
200V	
220V	
230V	
240V	
260V	
277V	
347V	
380V	
400V	
415V	
440V	
480V	
500V	
577V	
600V	Maximum system rated voltage


Fig.: Table for network rated voltages i.a.w. EN 60664-1:2003 suitable for the voltage measurement inputs.


Voltage measurement inputs

The Energy Analyser 750 has four voltage measurement inputs (V1, V2, V3, V4).

Voltage swell

The voltage measurement inputs are suitable for measurements in networks where overvoltages of overvoltage category 600 V CAT III can occur.

 For measurement with the supporting measurement (V4), a voltage must be connected to the baseline measurement for frequency determination.

 If the baseline measurement (inputs V1-V3) is connected to a three-phase 3-conductor network, the supporting measurement (input V4) can no longer be used as a measurement input.

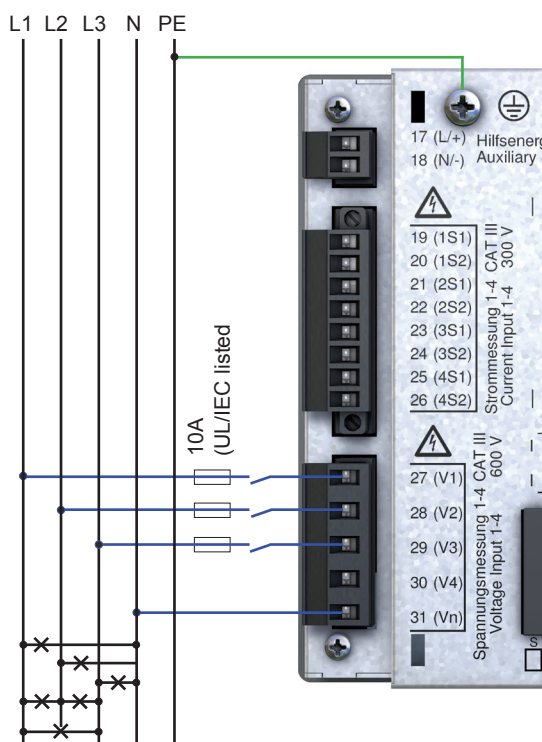





Fig.: Example connection for measuring voltage.


When connecting the voltage to be measured, the following must be observed:

- A suitable circuit breaker must be fitted to disconnect and de-energise the Energy Analyser 750.
- The circuit breaker must be placed in the vicinity of the Energy Analyser 750, be marked for the user and easily accessible.
- Use a UL/IEC approved circuit breaker 10 A (Type C) for the overcurrent protection and disconnect.
- The overcurrent protection must have a rated value, which is suitable for the short circuit current at the connection point.
- Measured voltages and measured currents must derive from the same network.

 **Please note!**
Voltages that exceed the allow nominal network voltages must be connected via a voltage transformer.

 **Please note!**
The Energy Analyser 750 is not suitable for measuring DC voltages.

 **Please note!**
The voltage measurement inputs on the Energy Analyser 750 are dangerous if touched!

 **Please note!**
The voltage measurement inputs may not be used for voltage measurement in SELV circuits (safe extra low voltage).

Baseline measurement, digital inputs 1-3

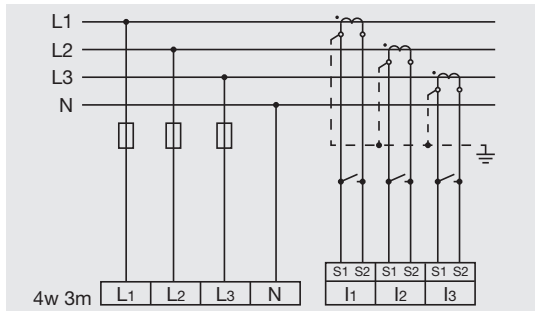


Fig.: Measurement in a three-phase 4-conductor network with asymmetric loading.

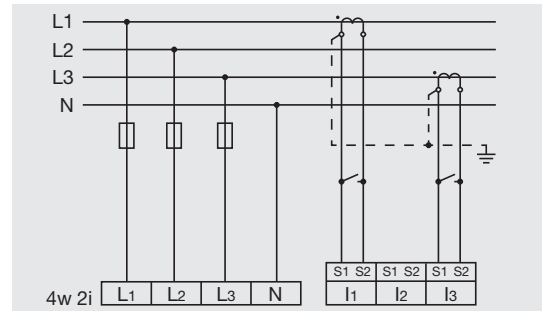


Fig.: Measurement via 2 voltage transformers in a three-phase 3-conductor network with symmetric loading.

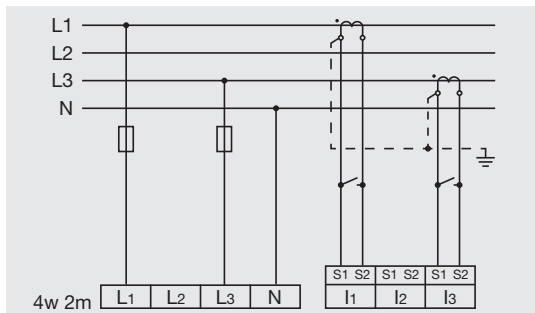


Fig.: Measurement in a three-phase 4-conductor network with symmetric loading.

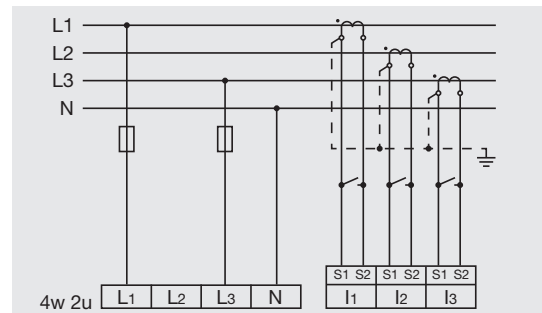


Fig.: Measurement in a three-phase 4-conductor network with asymmetric loading.

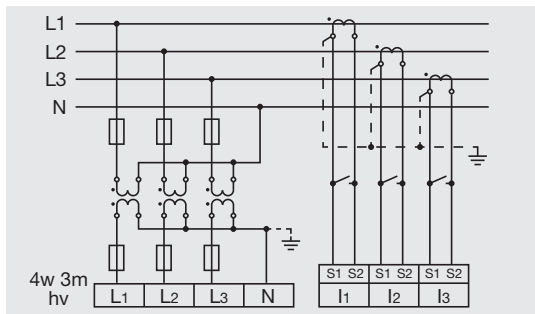


Fig.: Measurement via 3 voltage transformers in a threephase 4-conductor network with asymmetric loading.

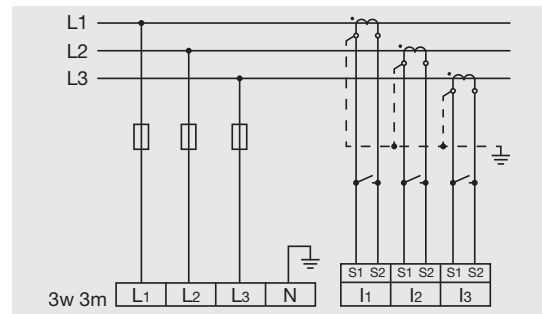


Fig.: Measurement in a three-phase 3-conductor network with asymmetric loading.

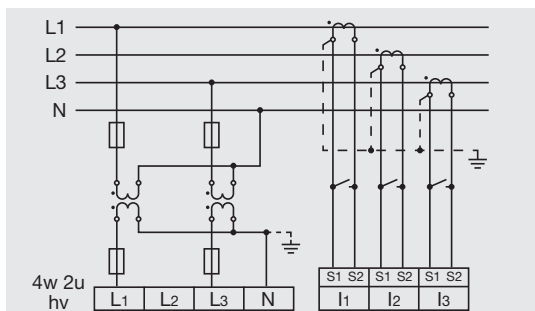


Fig.: Measurement via 2 voltage transformers in a three-phase 4-conductor network with asymmetric loading.

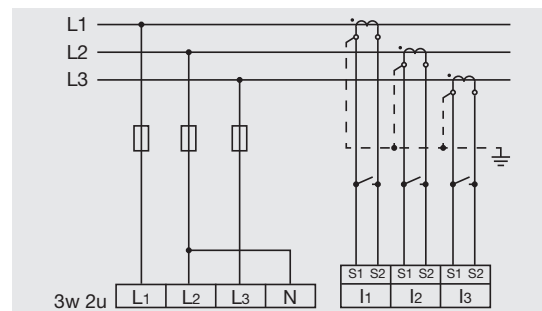


Fig.: Measurement in a three-phase 3-conductor network with asymmetric loading.

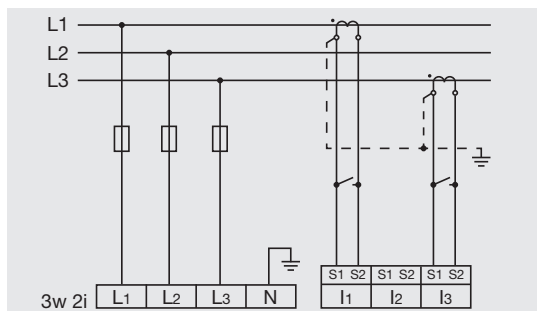


Fig.: Measurement in a three-phase 3-conductor network with asymmetric loading.

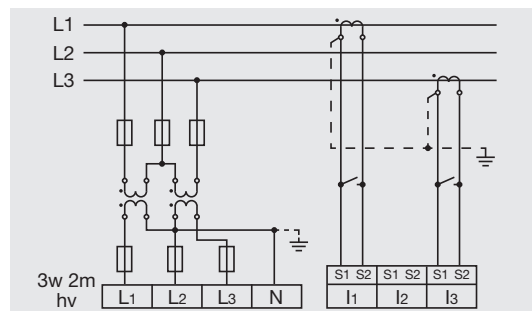


Fig.: Measurement in a three-phase 3-conductor network with asymmetric loading.

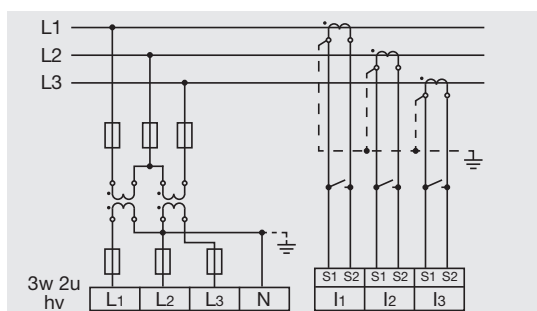


Fig.: Measurement in a three-phase 3-conductor network with asymmetric loading.

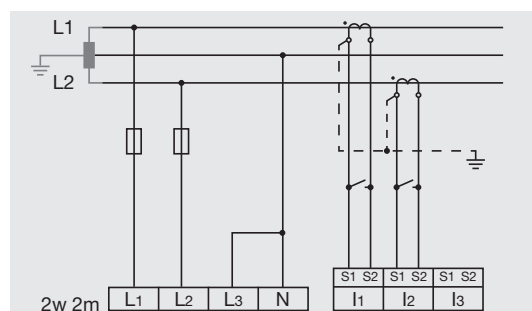


Fig.: Measurement in single-phase 3-conductor network. I3 and U3 are not calculated and set to zero.

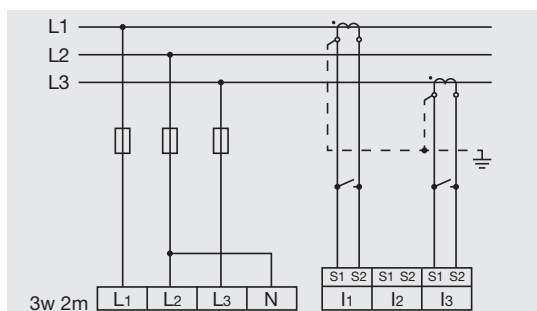


Fig.: Measurement in a three-phase 3-conductor network with asymmetric loading.

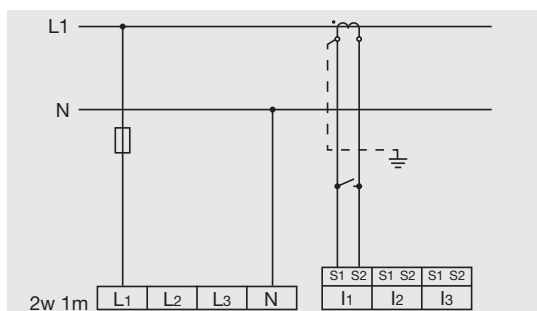


Fig.: Measurement of one phase in a three-phase 4-conductor network.

Supporting measurement, input V4

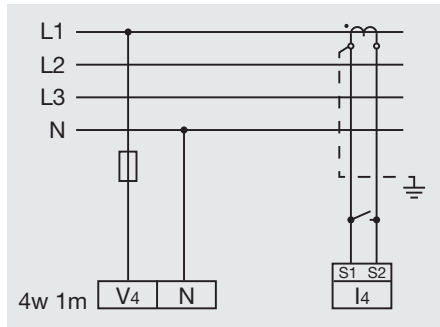


Fig.: Measurement in a three-phase 4-conductor network with symmetric loading.

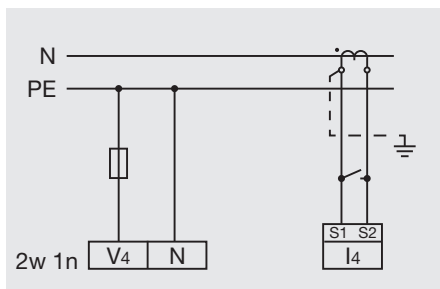


Fig.: Measurement of the voltage between N and PE. Measurement of the current in the neutral conductor.

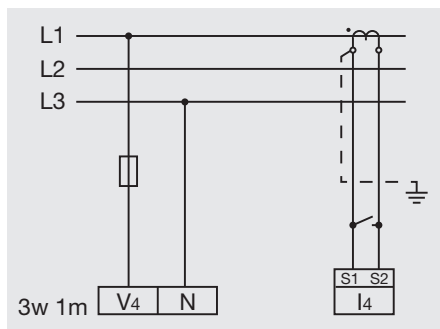


Fig.: Measurement in a three-phase 3-conductor network with symmetric loading.

Frequency

The Energy Analyser 750 is suitable for measurements in networks in which the fundamental oscillation of the voltage is in the range 15 Hz to 440 Hz.

To automatically determine (wide range) the mains frequency, a voltage L1-N of greater than 10 V_{eff} must be applied to voltage measurement input V1.

The mains frequency is only measured on the measurement inputs of the baseline measurement (V1, V2, V3).



Measured voltages and measured currents must derive from the same network.



If the baseline measurement (inputs V1-V3) is connected to a three-phase 3-conductor network, the supporting measurement (input V4) can no longer be used as a measurement input.



For measurement with the supporting measurement (V4), a voltage must be connected to the baseline measurement for frequency determination.

Current measurement

The Energy Analyser 750 is intended for the connection of current transformers with secondary currents of $\dots/1\text{A}$ and $\dots/5\text{A}$. The factory default for the current transformer ratio is $5/5\text{A}$ and must be adapted to the current transformer employed if necessary.

Only AC currents can be measured - DC currents cannot.

Any of the current measurement inputs can be loaded with 120 A for 1 second.

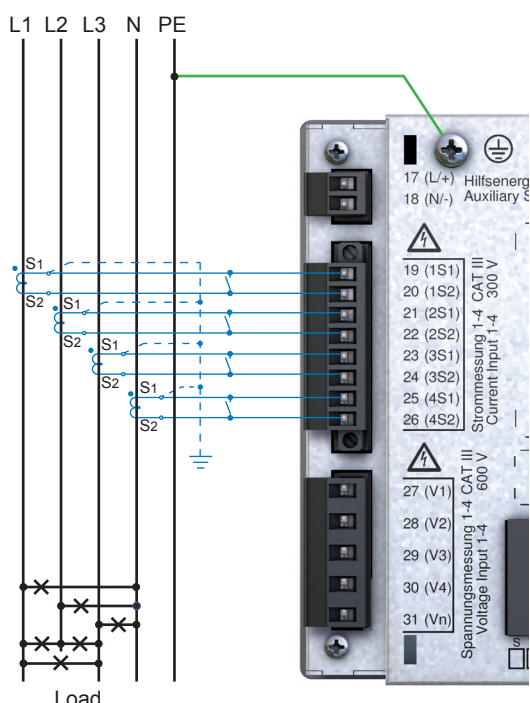


Fig.: Current measurement (I1-I3) via current transformers (connection example)

Current direction

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

If incorrectly connected, a subsequent re-connection of the current transformer is not required.



Current transformer connections!

The secondary connection of the current transformer must be short circuited on this before the current feed to the Energy Analyser 750 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.



Please note!

Residual current monitoring is performed using the terminals I5 and I6. There is no directional sensitivity of the residual currents of the network or load sides (not directionally sensitive).



Earthing of current transformers!

If a connection is provided for the earthing of secondary windings, then it must be connected to the earth.



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.



Attention!

The current transformer must have basic insulation per IEC 61010-1:2010, as a minimum, for the nominal voltage of the circuit to be measured.



Please note!

The measurement lines must be suitable for an operating temperature of at least $80\text{ }^{\circ}\text{C}$!



Please note!

The Energy Analyser 750 is not suitable for measuring DC voltages.



The attached screw-type terminal must be fixed using the two screws on the device!

Total current measurement

If the current measurement is done via two current transformers, the overall transformation ratio of the current transformers must be programmed into the Energy Analyser 750.

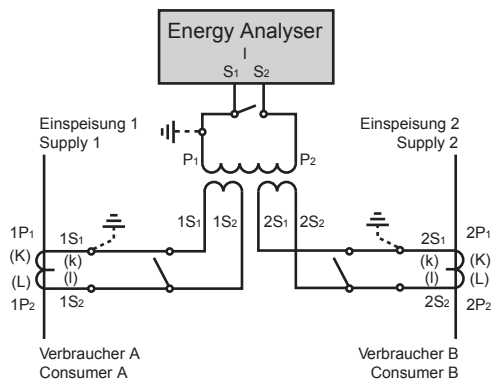


Fig.: Example, current measurement via a total current transformer

Example:

The current is measured via two current transformers. Both current transformers have a transformation ratio of 1000/5A. The summation measurement is performed using a total current transformer 5+5/5A.

The Energy Analyser 750 must then be setup as follows:

Primary current:	$1000\text{ A} + 1000\text{ A} = 2000\text{ A}$
Secondary current:	5 A

Direct measurement

You can use the Energy Analyser 750 to measure currents up to 5A directly without current transformers.

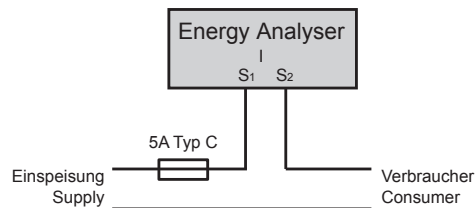
In this case, it must be taken into consideration that the direct measurement of the current can only be performed in three-phase 4-conductor systems with nominal network voltages up to

- 127V/220V (300V CAT III) according to UL
- 277V/480V (300V CAT III)

and three-phase 3-conductor systems with nominal network voltages up to

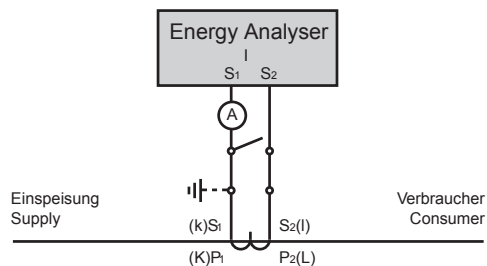
- 277V (300V CAT III) according to UL
- 480V (300V CAT III)

Since the Energy Analyser 750 does not feature any integrated protection for the current measurement, this protection must be provided in the installation.




Ammeter

If you wish to measure the current not just using the Energy Analyser 750, rather also with an ammeter, the ammeter must be connected to the Energy Analyser 750 in series.



Residual current measurement inputs (RCM)

The Energy Analyser 750 is suitable for use as a residual current monitoring device (RCM) as well as for monitoring AC, pulsing DC, and DC.

The Energy Analyser 750 can measure type A residual currents in accordance with IEC/TR 60755 (2008-01) .

The connection of suitable external residual current transformers with a rated current of 30 mA is performed via the residual current transformer inputs I5 (terminals 4/5) and I6 (terminals 6/7).

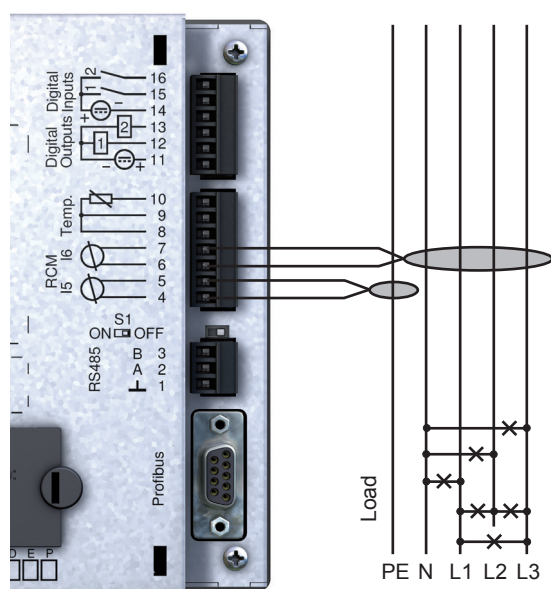




Fig.: Connection example of residual current monitoring via current transformers

	Residual current transformer ratio The ecoExplorer go software included in the scope of the delivery can be used to individually program the residual current transformer inputs' transformer ratios.
	It is not necessary to configure a connection schematic for measurement inputs I5 and I6.



Please note!

Operating equipment connected to the analogue inputs must feature reinforced or double insulation to the mains supply circuits!

Example - temperature sensor:

A temperature sensor in close proximity to non-isolated mains cables should measure within a 300 V CAT III network.

Remedy:

The temperature sensor must be equipped with reinforced or double insulation for 300 V CAT III. This equates to a test voltage for the temperature sensor of 3000 V AC (duration 1 min.).

Example - residual current transformer:

A residual current transformer should measure on isolated mains cables within a 300 V CAT III network.

Remedy:

The insulation of the mains cables and the insulation of the residual current transformer must fulfil the basic insulation requirements for 300 V CAT III. This equates to a test voltage of 1500 V AC (duration 1 min.) for the insulated mains cables and a test voltage of 1500 V AC (duration 1 min.) for the residual current transformer.

Failure monitoring

The Energy Analyser 750 monitors the ohmic resistance at the residual current measurement inputs.

If the ohmic resistance is greater than 300 Ohm, there is a failure (e.g. cable breakage) with the residual current monitoring.

Connection example, residual current monitoring

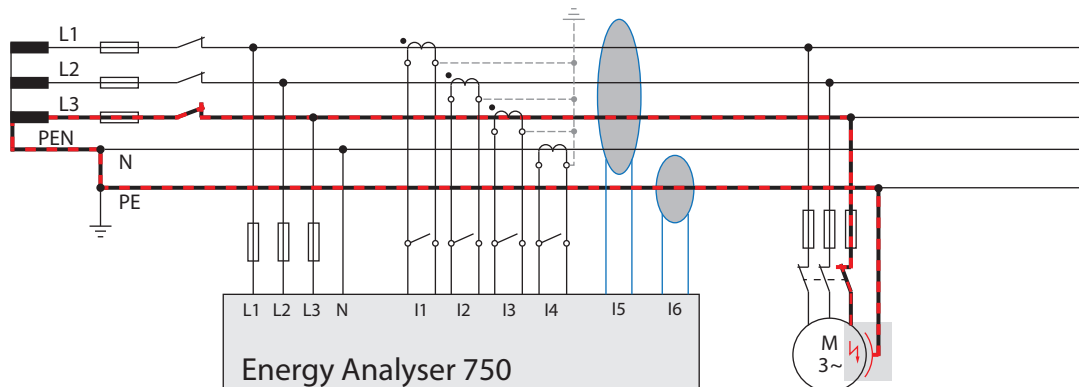
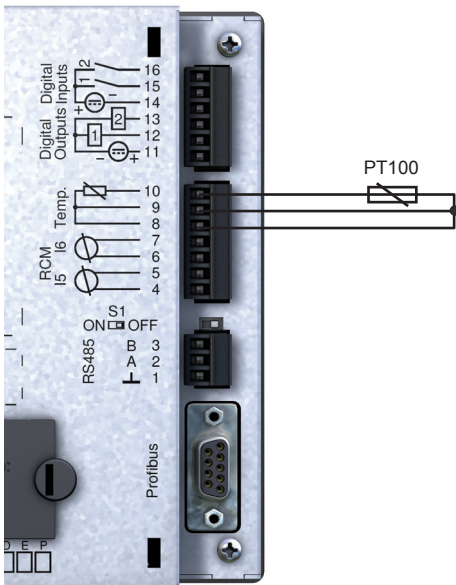
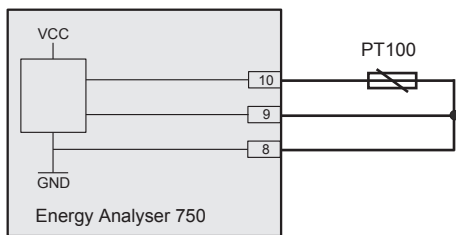


Fig.: Example Energy Analyser 750 with residual current monitoring via measuring inputs I5/I6.

Thermistor input

The Energy Analyser 750 has one thermistor input. The temperature is measured here via terminals 8 through 10.

Do not exceed the total resistance load (sensor + cable) of 4 kOhm.



RS485 interface

In the Energy Analyser 750, the RS485 interface is designed as a 3-pin plug contact, which communicates via the Modbus RTU protocol.

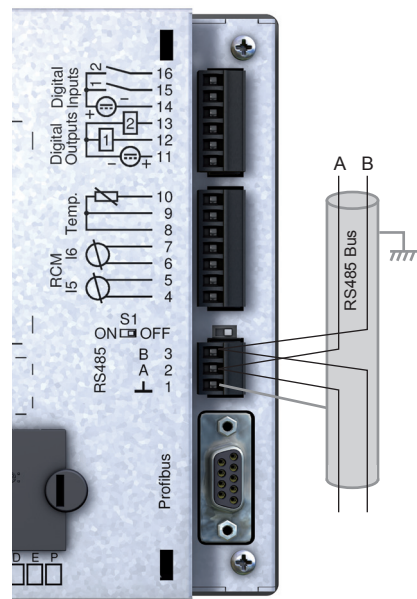


Fig.: Example, temperature measurement with a PT100

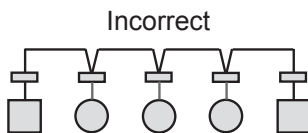
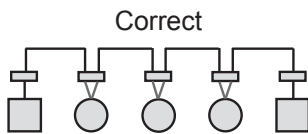
Please note!
Profibus, RS485 and the thermistor input are not galvanically separated from each other.




Use a shielded cable to connect the temperature sensor.

Termination resistors

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

Termination within the device is possible via the S1 DIP switch of the Energy Analyser 750.



-  Terminal strip in the cabinet.
-  Device with RS485 interface.
(without termination resistor)
-  Device with RS485 interface.
(with termination resistor on the device)

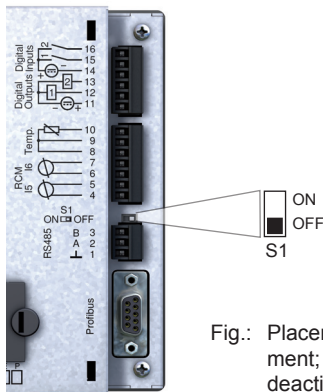


Fig.: Placement in the middle of the segment; termination via S1 DIP switch deactivated (OFF)

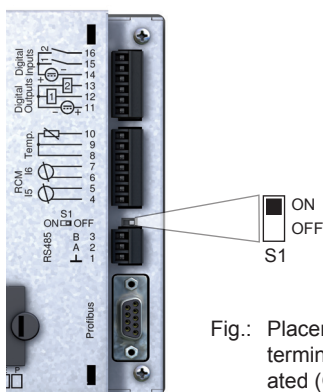


Fig.: Placement at the end of the segment; termination via S1 DIP switch activated (ON)

Screening

Twisted screened cable should be used for connections via the RS485 interface.

- Earth the screens of all cables that lead to the cabinet and at the cabinet entry.
- Connect the screens over a generous area and in a manner that will conduct well, to a low-noise earth.
- Gather the cables mechanically above the earthing clamp in order to avoid damage due to cable movements.
- Use suitable cable glands to feed the cables into the cabinet, for example, armoured conduit couplings.

Cable type

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

Recommended cable types:

Unitronic Li2YCY(TP) 2x2x0.22 (from Lapp Kabel)

Unitronic BUS L2/FIP 1x2x0.64 (from Lapp Kabel)

Maximum cable length

1200 m at a baud rate of 38.4 k.

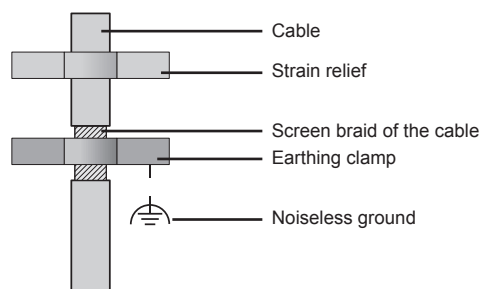


Fig.: Screening procedure at cabinet entry.



If the bus line is laid in the switch cabinet, the screen must be connected to functional earth (PE). When laying bus lines in the switch cabinet it is normally sufficient if the screen of the bus line is connected at least once to the functional earth (PE). If there are more significant sources of interference, such as a frequency converter, installed in the switch cabinet, the screen must be connected to the functional earth (PE) as close as possible to the device.



CAT cables are not suitable for bus wiring. Use the recommended cable types for this.

Bus structure

- All devices are connected in a bus structure (line) and each device has its own address within the bus (see also Parameter programming).
- Up to 32 subscribers can be connected together in a single segment.
- The cable is terminated with resistors (bus termination 120 Ohm, 1/4 W) at the beginning and at the end of a segment.
- With more than 32 subscribers, repeaters (amplifiers) must be used to connect the individual segments.
- Devices for which the bus connection is switched on must be under current.
- It is recommended that the master be placed at the end of a segment.
- If the master is replaced with a bus connection, the bus must be switched off.
- Replacing a slave with a bus connection that is either switched on or de-energised can destabilise the bus.
- Devices that are not connected to the bus can be replaced without destabilising the bus.

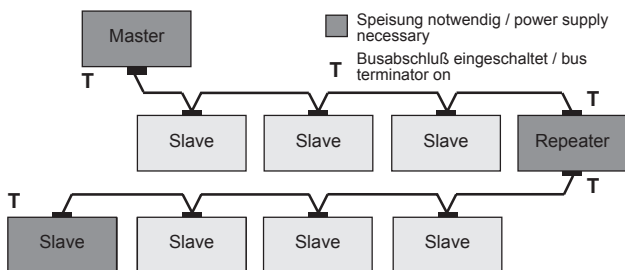


Fig.: Bus structure

Profibus interface

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

For the simple connection of inbound and outbound bus wiring, it should be connected to the Energy Analyser 750 via a Profibus connector.

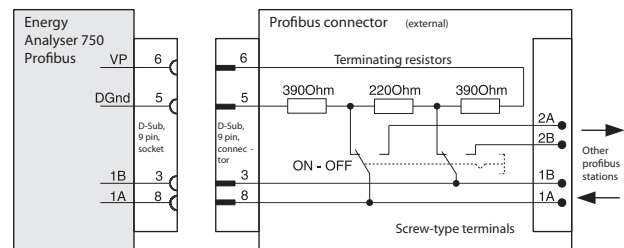


Fig.: Profibus connector with termination resistors.

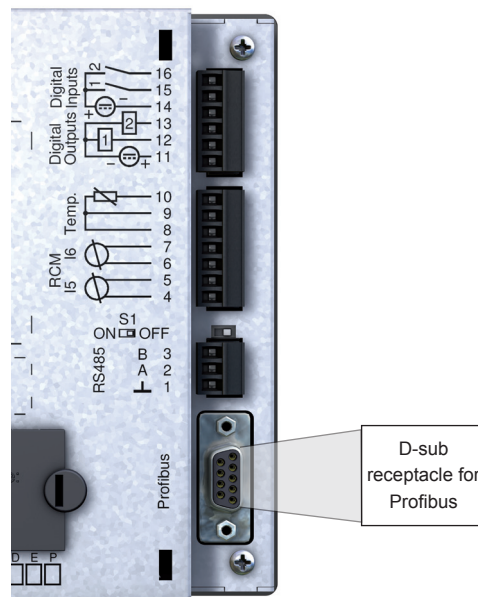


Fig.: Energy Analyser 750 with D-sub receptacle for Profibus (View from rear).



When using the device in a Profibus system, the device address must be set using the configuration menu.

Current measurement

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.

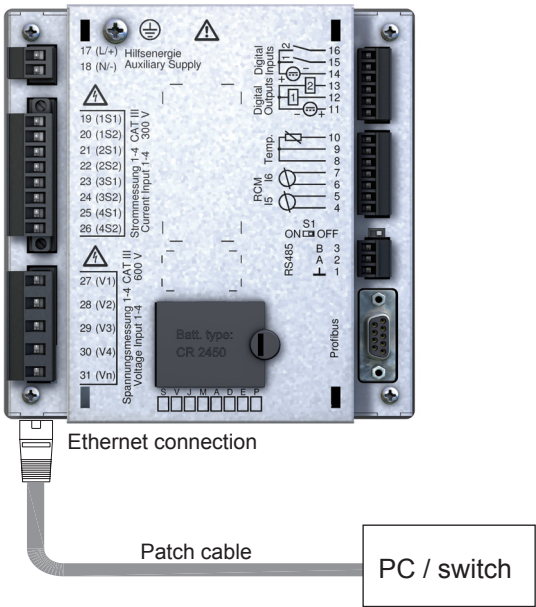
Transfer speeds in Kbit/s	Max. segment length
9.6 / 19.2 / 45.45 / 93.75	1200 m
187.5	1000 m
500	400 m
1500	200 m
3000 / 6000 / 12000	100 m

Table Segment lengths per Profibus specification.

Ethernet interface

The Ethernet network settings should be specified by the network administrator and set on the Energy Analyser 750 accordingly.

If the network settings are not known, the Energy Analyser 750 may not be integrated into the network through the patch cable.



Please note!

Connection of the Energy Analyser 750 to the Ethernet may only be carried out after consulting the network administrator!

Please note!

The Energy Analyser 750 is factory-set for the dynamic IP address assignment (**DHCP mode**). Settings can be changed as described in "TCP/IP Configuration" or, for example, via an appropriate Ethernet connection by means of ecoExplorer go software.

Digital outputs

The Energy Analyser 750 has two digital outputs. These outputs are galvanically separated from the analysis electronics using optocouplers. The digital outputs have a joint reference.

- The digital outputs can switch DC loads.
- The digital outputs are **not** short-circuit proof.
- Connected cables that are longer than 30 m must be shielded when laid.
- An external auxiliary voltage is required.
- The digital outputs can be used as impulse outputs.

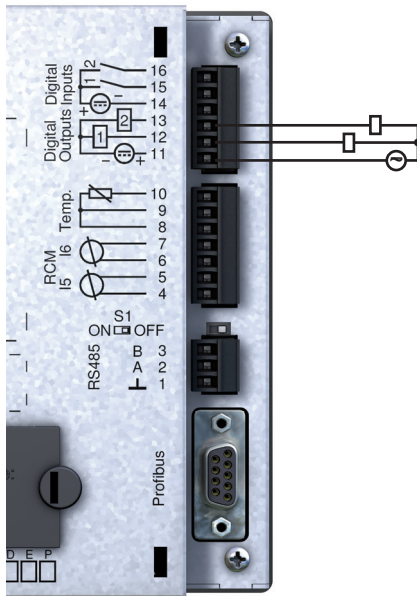


Fig.: Connection of digital outputs

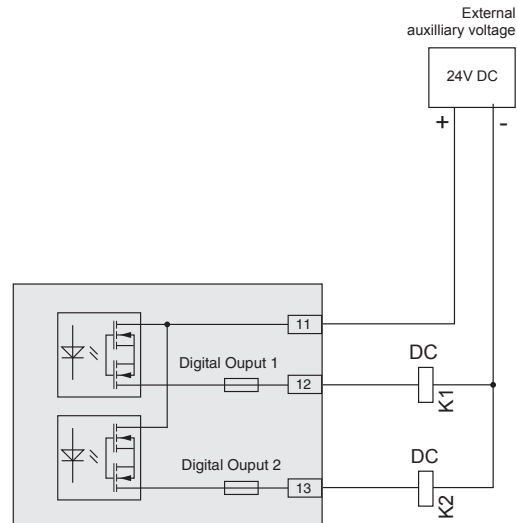


Fig.: Example for two relays connected to the digital outputs



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 provided in the scope of delivery. A connection between the Energy Analyser 750 and the PC via an interface is required to use the ecoExplorer go software.



Please note!

Digital outputs are not short-circuit proof!

Current measurement

Digital inputs

The Energy Analyser 750 has two digital inputs. An input signal is detected on a digital input if a voltage of at least 18 V and maximum 28 V DC (typically at 4 mA) is applied. There is no input signal for a voltage of 0 to 5 V and a current less than 0.5 mA.

Wiring longer than 30 m must be screened.

Note the correct polarity of the supply voltage!

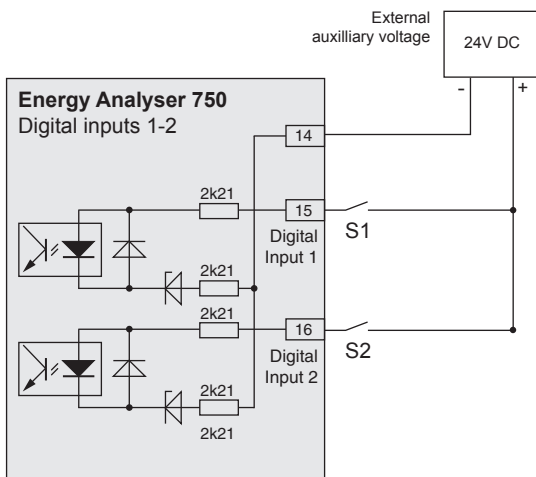


Fig.: Example for the connection of external switch contacts S1 and S2 to digital inputs 1 and 2.

S0 pulse input

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

This requires an external auxiliary voltage with an output voltage in the range 18 to 28 V DC and a resistor of 1.5 kOhm.

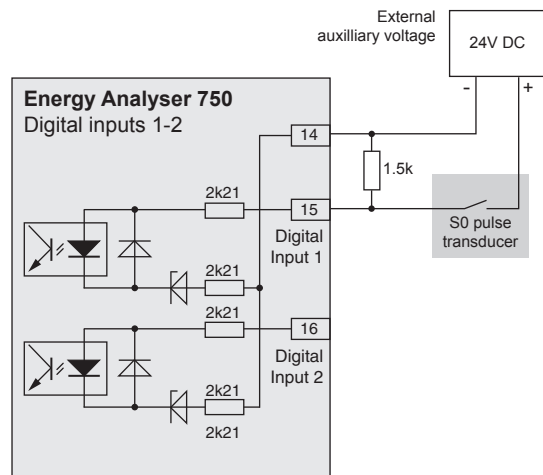


Fig.: Example for the connection of an S0 pulse transducer to digital input 1

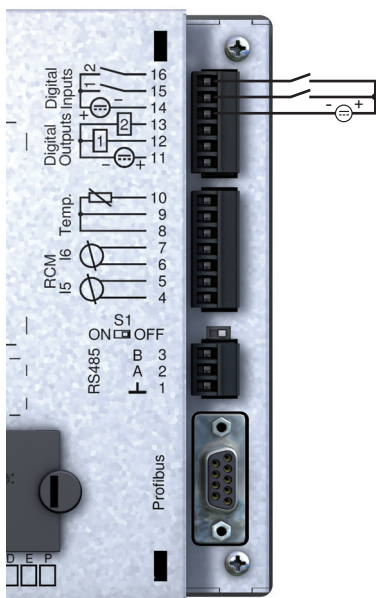


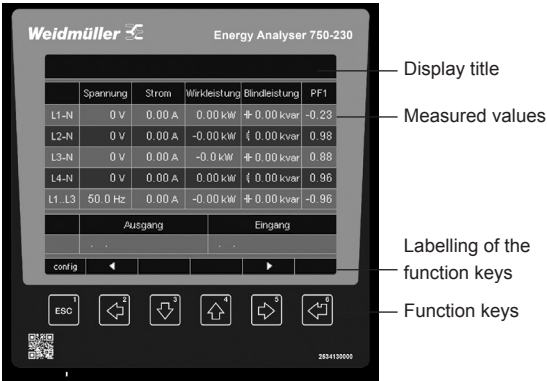
Fig.: Connection of digital inputs

Operation







The Energy Analyser 750 is operated by six function keys.

Depending on the context, the six keys are assigned with different functions:

- Selecting measured value displays.
- Navigation within the menus.
- Editing device settings.



Meaning of the keys

Key	Function
	<ul style="list-style-type: none">• Returns to the first screen (home)• Exits selection menu
	<ul style="list-style-type: none">• Selects number• Selects main values (U, I, P ...)
	<ul style="list-style-type: none">• Changes (number -1)• By-values (select)• Selects menu item
	<ul style="list-style-type: none">• Changes (number +1)• By-values (select)• Selects menu item
	<ul style="list-style-type: none">• Selects number• Selects main values (U, I, P ...)
	<ul style="list-style-type: none">• Opens selection menu• Confirm selection

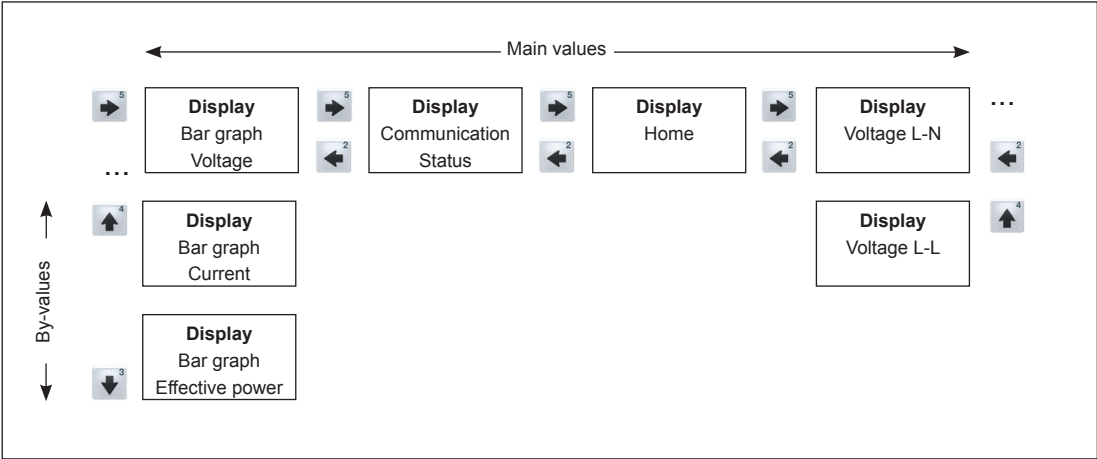
Measured value display

Main values

Using the 2 and 5 keys, you can scroll between the main values of the measured value displays.

By-values

Using the 3 and 4 keys, you can select the by-values of a measured value display.

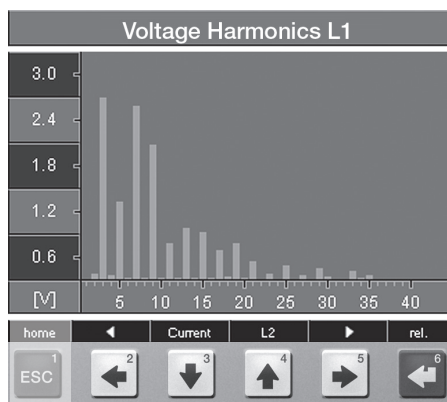


“Home” measured value display

After the power returns, the Energy Analyser 750 starts with the “Home” measured value display.

This measured value display contains the device names and an overview of important measured values. In its delivery condition, the unit name consists of the device type and the serial number of the device.

	Voltage	Current	Real Power	Reactive Pw.	PF
L1-N	223 V	25.8 A	5.3 kW	± 0.5 kvar	0.99
L2-N	223 V	28.0 A	5.9 kW	± 1.2 kvar	0.98
L3-N	223 V	13.8 A	2.7 kW	± 0.7 kvar	0.97
L4-N	0 V	0.00 A	0.00 kW	± 0.00 kvar	0.32
L1..L3	50.0 Hz	23.96 A	13.9 kW	± 2.4 kvar	0.99
Output			Input		
...			...		
config	←			→	



Using the “Home - key 1”, you navigate directly to the first “Home” measured value display from the measured value displays for the main values.

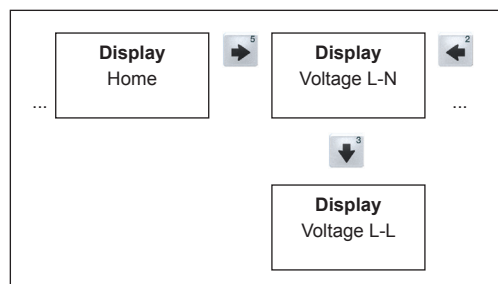
Selecting a measured value display

You would like to switch to a measured value display with main values.

- Using the 2 and 5 function keys, you can scroll between the measured value displays of the main values.
- Using the 1 (home) function key, you always navigate to the first measured value display.

You would like to switch to a measured value display with by-values.

- Select the measured value display with the main values.
- Using the 3 and 4 function keys, select the measured value display for the by-values.



Example: Selecting the voltage by-values.

Voltage L-N			
	Value	Min Value	Max Value
L1-N	225.5 V	217.0 V	228.7 V
L2-N	225.5 V	217.1 V	233.9 V
L3-N	225.4 V	216.9 V	233.8 V
L4-N	225.4 V	216.9 V	233.8 V

home	←	L-L	→	select
ESC 1	2	3	4	5

Voltage L-L			
	Value	Min Value	Max Value
L1-L2	384.1 V	217.1 V	404.4 V
L2-L3	383.4 V	216.9 V	403.4 V
L3-L1	383.5 V	217.7 V	404.4 V
L4-N	0.4 V	0.2 V	1.6 V

home	←	L-N	→	select
------	---	-----	---	--------

View additional information

- Using the 2 and 5 keys, scroll to the desired measured value display.
- Activate the measured value selection using the 6 key (select).
- The background colours for the measured value switches from grey to green. The additional information is displayed in blue window.
- Using the 2 and 5 keys, select the desired measured value.
- End the procedure using the 1 key (ESC) or select another measured value with the 2 to 5 keys.

Voltage L-N			
	Value	Min Value	Max Value
L1-N	225.5 V	217.0 V	228.7 V
L2-N	225.5 V	217.1 V	233.9 V
L3-N	225.4 V	216.9 V	233.8 V
L4-N	225.4 V	216.9 V	233.8 V
<div> <div>home</div> <div>←</div> <div>L-L</div> <div>→</div> <div>select</div> </div> <div> <div>1 ESC</div> <div>2 ←</div> <div>3 ↓</div> <div>4 ↑</div> <div>5 →</div> <div>6 ←</div> </div>			

Voltage L-N			
	Value	Min Value	Max Value
L1-N	225.3 V	217.0 V	228.7 V
L2-N	<div> <div>THD 2.3 %</div> <div>Power Factor 1.00</div> <div>Frequency 50.00 Hz</div> </div>	17.1 V	233.9 V
L3-N	225.2 V	216.9 V	233.8 V
L4-N	225.2 V	216.9 V	233.8 V
<div>esc ← ↓ ↑ →</div>			

Deleting min./max. values individually

- Using the 2 and 5 keys, scroll to the desired measured value display.
- Activate the measured value selection using the 6 key (select).
- The background colours for the measured value switches from grey to green. The additional information is displayed in blue window.
- Using the 2 and 5 keys, select the desired minimum or maximum value.
- The time along with the date and time of the occurrence are displayed as additional information.
- Using the 6 key (reset), you can delete the selected minimum or maximum value.
- End the procedure using the 1 key (ESC) or select another minimum or maximum value with the 2 to 5 keys.



The date and time for the minimum/maximum values are specified displayed in UTC time (Coordinated Universal Time).

Voltage L-N			
	Value	Min Value	Max Value
L1-N	225.5 V	217.0 V	228.7 V
L2-N	225.5 V	217.1 V	233.9 V
L3-N	225.4 V	216.9 V	233.8 V
L4-N	225.4 V	216.9 V	233.8 V
<div> <div>home</div> <div>←</div> <div>L-L</div> <div>→</div> <div>select</div> </div> <div> <div>1 ESC</div> <div>2 ←</div> <div>3 ↓</div> <div>4 ↑</div> <div>5 →</div> <div>6 ←</div> </div>			

Voltage L-N			
	Value	Min Value	Max Value
L1-N	225.1 V	223.4 V	225.9 V
L2-N	225.1 V	217.1 V	233.9 V
L3-N	225.0 V	216.9 V	233.8 V
L4-N	225.0 V	216.9 V	233.8 V
<div> <div>esc</div> <div>←</div> <div>↓</div> <div>↑</div> <div>→</div> <div>reset</div> </div>			

Transients list

The detected transients are listed in the transients list.

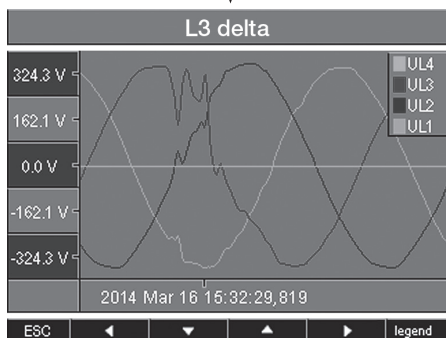
- The transients list consists of 2 pages.
- On page 1, the transients 1 through 8 are listed and on page 2, the transients 9 through 16 are listed.

Displaying transients

- Using the 2 and 5 keys, scroll to the "Transient" main value display.
- Select the desired page using the 4 key.
- Navigate to the transients list using key 6 (select) and select a transient using the 3 or 4 keys.
- Using the 6 key (select), have a transient displayed in a graph.
- Show or hide the legend using the 6 key (select).
- You can exit the transient graph display using the 1 key (ESC).

Transient voltages are fast impulse transient effects in electrical networks. The time when transient voltages occur cannot be predicted and they have a limited duration. Transient voltages are caused by lightning strikes, switching operations or by tripped fuses.

Transients (1..8)		
Phase	Reason	Date/Time
L1	delta	2011 Mar 16 15:33:07,122
L4	delta	2011 Mar 16 15:32:29,826
L3	delta	2011 Mar 16 15:32:29,819
L2	delta	2011 Mar 16 15:32:29,813
L2	delta	2011 Mar 16 15:32:29,806
L1	delta	2011 Mar 16 15:32:29,799
L4	delta	2011 Mar 16 15:32:29,793
L3	delta	2011 Mar 16 15:32:29,786



Event list

Detected events are listed in the event list.

- The event list consists of 2 pages.
- On page 1, the events 1 through 8 are listed and on page 2, the events 9 through 16 are listed.

Displaying events

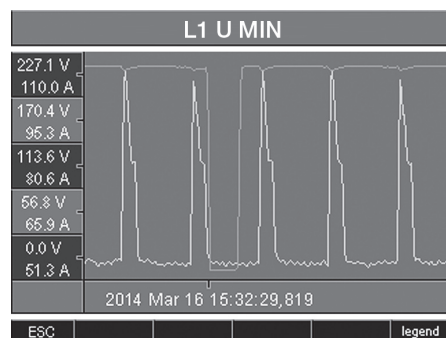
- Using the 2 and 5 keys, scroll to the "Event" main value display.
- Select the desired page using the 4 key.
- Navigate to the event list using key 6 (select) and select an event using the 3 or 4 keys.
- Using the 6 key (select), have an event displayed in a graph.
- Show or hide the legend using the 6 key (select).
- You can exit the result graph display using the 1 key (ESC).

Events are threshold value violations of effective current and voltage values.

Events (1..8)		
Phase	Reason	Date/Time
L4	U MAX	2011 Mar 16 15:32:29,950
L2	U MAX	2011 Mar 16 15:32:29,950
L3	U MAX	2011 Mar 16 15:32:29,950
L1	U MAX	2011 Mar 16 15:32:29,950
L4	U MAX	2011 Mar 16 15:32:29,867
L3	U MAX	2011 Mar 16 15:32:29,867
L2	U MAX	2011 Mar 16 15:32:29,867
L1	U MAX	2011 Mar 16 15:32:29,867

home 9..16 select

ESC 1 2 3 4 5 6



Configuration

The supply voltage must be connected for the configuration of the Energy Analyser 750.

Connecting the supply voltage

- The supply voltage level for the Energy Analyser 750 is specified on the rating plate.
- After connecting the supply voltage, a start display appears. Approximately ten seconds later, the Energy Analyser 750 switches to the first “Home” measured value display.
- If no display appears, check whether the applied supply voltage is within the rated voltage range.



Please note!

If the supply voltage does not correspond to the voltage indicated on the rating plate, this may lead to malfunctions and severe damage to the device.

	Voltage	Current	Real Power	Reactive Pw.	PF
L1-N	223 V	25.8 A	6.3 kW	± 0.5 kvar	0.99
L2-N	223 V	28.0 A	5.9 kW	± 1.2 kvar	0.98
L3-N	223 V	13.8 A	2.7 kW	± 0.7 kvar	0.97
L4-N	0 V	0.00 A	0.00 kW	± 0.00 kvar	0.32
L1..L3	50.0 Hz	23.96 A	13.9 kW	± 2.4 kvar	0.99
Output			Input		
...			...		
config	←			→	

Fig.: Example of the “Home” measured value display

Configuration menu

After the power returns, the device starts on the “Home” measured value display.

- Open the Configuration menu using the 1 button.

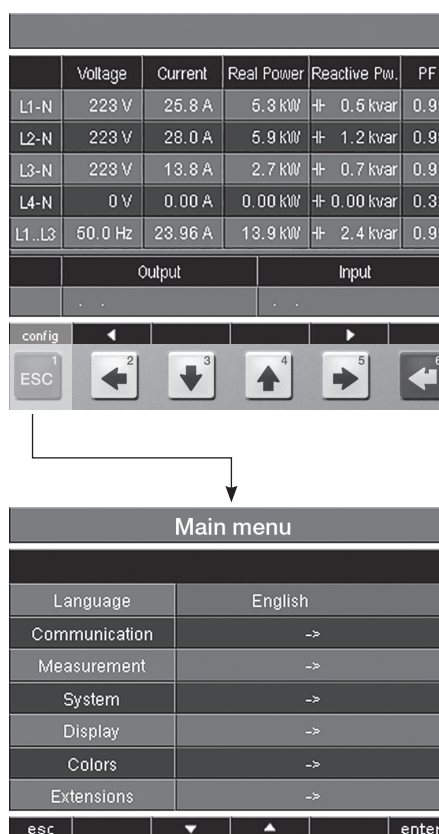
If you are in a measured value display for main values, you can navigate directly to the “Home” measured value display using the 1 button (home). Pressing the 1 key again opens the Configuration menu. Using the 3 or 4 keys, you select the desired submenu that can be activated using the 6 key (enter).

Language

You can set the language for the measured value displays and menus directly in the “Configuration” menu.

There are different languages available for selection. The factory default setting for the language is “English”.

If the language field is marked green, then the desired language can be selected by pressing the key 6 (enter) and the keys 3 or 4. Pressing the key 6 (enter) again confirms the selection and changes the language.



Communication

The Energy Analyser 750 has an Ethernet and a RS485 interface.

Ethernet (TCP/IP)

Select the type of the address assignment for the Ethernet interface here.

DHCP mode

- **Off** - The IP address, netmask and gateway are defined by the user and set directly on the Energy Analyser 750. Select this mode for straightforward networks without DHCP servers.
- **BOOTP** - BootP enables the fully automatic integration of a Energy Analyser 750 into an existing network. However, BootP is an older protocol and does not provide the scope of functions provided by DHCP.
- **DHCP** - When started, the Energy Analyser 750 automatically obtains the IP address, the network mask and the gateway from a DHCP server.

Factory default setting: **DHCP**



Connection of the Energy Analyser 750 to the Ethernet may only be carried out after consulting the network administrator!

Main menu	
Language	English
Communication	->
Measurement	->
System	->
Display	->
Colors	->
Extensions	->
esc	enter
ESC	enter

Communication	
Ethernet (TCP/IP)	
DHCP	DHCP
Address	192.168. 3.177
Netmask	255.255.255. 0
Gateway	192.168. 3. 4
Field Bus	
RS485	Modbus Slave
Device	1
Speed	115200
esc	enter

RS485

You can specify the protocol, device address and baud rate for operation with the RS485 interface. The device address must be uniquely assigned within the bus structure; the baud rate specification must be selected uniformly.

The corresponding field can be selected via the keys 3 or 4 (green marking). Key 6 (enter) provides you with access the selection options, which can then be selected with key 3 or 4. Pressing the 6 key (enter) again confirms the selection.

Protocol

Selection options

- Modbus slave
- Modbus master/gateway (default setting)
- Profibus DP V0 (option)

Device address

Setting range: 0 to 255

Factory default setting: 1

Baud rate

Setting range: 9600 kbps / 19200 kbps / 38400 kbps / 57600 kbps / 115200 kbps (default setting) / 921600 kbps

Communication	
Ethernet (TCP/IP)	
DHCP	DHCP
Address	192.168. 3.177
Netmask	255.255.255. 0
Gateway	192.168. 3. 4
Field Bus	
RS485	Modbus Slave
Device	1
Speed	115200
esc	enter
ESC	enter

Communication	
Ethernet (TCP/IP)	
DHCP	DHCP
Address	192.168. 3.177
Netmask	255.255.255. 0
Gateway	192.168. 3. 4
Field Bus	
RS485	Modbus Slave
Device	1
Speed	115200
esc	enter

Measurement

Measurement	
Transformer	->
Transients	->
Events	->
Voltage mode	L-N
Rated Freq.	50 Hz (fixed frequency)
Flicker	230V/50Hz
Temperature	PT100
esc	enter

Configure the following here:

- The measuring transducer for the current and voltage measurement
- Recording transients
- Recording events
- The relevant voltage
- The mains frequency
- The flicker settings

The Energy Analyser 750 has 4 measurement channels used to measure the current (I1...I4) and 4 measurement channels used to measure the voltage (V1...V4 against Vref).

Measured voltage and measured current for the measurement channels 1-4 must derive from the same network.

Baseline measurement

The baseline measurement uses the measurement channels 1-3. Use the measurement channels 1-3 in three-phase systems.

Supporting measurement

The supporting measurement only uses measurement channel 4. Use measurement channel 4 when measuring in single-phase systems or in three-phase systems with symmetrical loads. The frequency setting and the setting for the relevant voltage are pulled automatically from the baseline measurement settings.

Measuring transducer**Current transformer**

You can assign current transformer ratios to the baseline measurement and the supporting measurement. Select the 5/5A setting when measuring currents directly.

Setting range:

Primary	1 to 1000000
Secondary	1 to 5

Factory default setting:

Primary	5
Secondary	5

Transformer MAIN		
	primary	secondary
Current Transf.	5A	5A
Voltage Transf.	400V	400V
Rated Current	5A	
Rated Voltage	230V	
Apply to AUX	No	
Connection	4w3m	
esc	enter	

Rated current

The rated current defines the value to which

- Overcurrent
- Current transients
- K-factor and the
- Automatic scaling of graphics refer.

Setting range: 0 to 100000

Transformer MAIN		
	primary	secondary
Current Transf.	5A	5A
Voltage Transf.	400V	400V
Rated Current	5A	
Rated Voltage	230V	
Apply to AUX	No	
Connection	4w3m	
esc	enter	

Configuration

Residual current transformer

When using residual current inputs I5 and I6, the corresponding transformer ratios of the used residual current transformer must be set.

Setting range:

Primary 1 to 1000000
Secondary 1

Factory default setting:

Primary 127
Secondary 1

Residual current transformer		
	primary	secondary
Current Transf. I5	600	1
Monitoring I5	active	
Current Transf. I6	127	1
Monitoring I6	inactive	
esc		enter

Voltage transformer

You can assign voltage transformer ratios to the baseline measurement and the supporting measurement. Select the 400/400V setting when measuring without a voltage transformer.

Setting range:

Primary 1 to 1000000
Secondary 1 to 999

Factory default setting:

Primary 400V
Secondary 400V

Transformer MAIN		
	primary	secondary
Current Transf.	5A	5A
Voltage Transf.	400V	400V
Rated Current	5A	
Rated Voltage	230V	
Apply to AUX	No	
Connection	4w3m	
esc		enter

Monitoring

Activates or deactivates the failure monitoring of the corresponding residual current inputs.

- **Activated** - Switches on the failure monitoring for residual current monitoring.
- **Deactivated** - Switches off the failure monitoring for residual current monitoring.

Residual current transformer		
	primary	secondary
Current Transf. I5	600	1
Monitoring I5	active	
Current Transf. I6	127	1
Monitoring I6	inactive	
esc		enter

Rated voltage

The rated voltage corresponding to the "arranged input voltage U_{din}" according to EN 61000-4-30. The rated voltage defines the value to which

- Upward deviation (EN 61000-4-30),
- Downward deviation (EN 61000-4-30),
- Transients,
- Events and the
- Automatic scaling of graphics relate.

Setting range: 0 to 1000000

Factory default setting:

Nominal voltage 230 V

Transformer MAIN		
	primary	secondary
Current Transf.	5A	5A
Voltage Transf.	400V	400V
Rated Current	5A	
Rated Voltage	230V	
Apply to AUX	No	
Connection	4w3m	
esc		enter

Übernehmen AUX / MAIN

Die Messwandlereinstellung ist für die Haupt- und Hilfsmessung einstellbar. Sie können die Einstellungen der Messwandler jeweils aus der Hilfs- bzw. Hauptmessung übernehmen.

- **Nein** - Die Einstellungen aus der Hilfs- bzw. Hauptmessung werden nicht übernommen.
- **Ja** - Die Einstellungen aus der Hilfs- bzw. Hauptmessung werden übernommen.

Transformer MAIN		
	primary	secondary
Current Transf.	5A	5A
Voltage Transf.	400V	400V
Rated Current	5A	
Rated Voltage	230V	
Apply to AUX	No	
Connection	4w3m	
esc	▼	▲
		enter

Anschluss

Für die Spannungs- und Strommessung können Sie über die Auswahl „Anschluss“ zwischen unterschiedlichen Anschlussschemas wählen.

Werksseitige Voreinstellung: 4w3m

Transformer MAIN		
Current	L1	primary
Voltage	L2	5A
Rated	L3	400V
Rated	N	5A
Apply	4w3m	4w3m
Connection	4w3m	
esc	▼	▲
		enter

Abb.: Beispiel für die Messung in einem Dreiphasen-4-Leiternetz mit unsymmetrischer Belastung

Transients

Transient voltages are fast impulse transient effects in electrical networks. The time when transient voltages occur cannot be predicted and they have a limited duration.

Transient voltages are caused by lightning strikes, switching operations or by tripped fuses.

- The Energy Analyser 750 detects transients that are longer than 39 μ s.
- The Energy Analyser 750 monitors the measurement inputs for transients.
- There are two independent criteria by which transients are detected.
- If a transient has been detected, the wave form will be saved to a transient record.
- If a transient has been detected, the threshold value increases by 20 V, both in automatic and in manual mode. This automatic increase of the threshold value switches off within 10 minutes.
- If a further transient is detected within the next 60 seconds, it will be recorded with 512 points.
- The ecoExplorer go software event browser can display recorded transients.

Measurement	
Transformer	->
Transients	->
Events	->
Voltage mode	L-N
Rated Freq.	50 Hz (fixed frequency)
Flicker	230V/50Hz
Temperature	PT100
esc	▼
	▲
	enter

Mode (absolute)

If a sampled value exceeds the set threshold value, a transient is detected.

- **Off** - Transient monitoring has been switched off.
- **Automatic** - Factory default setting. The threshold value is calculated automatically and is 110 % of the current 200 ms effective value.
- **Manual** - The transient monitoring uses the configurable threshold values under "Peak".

Mode (delta)

If the difference between two neighbouring sampled points exceeds the set threshold value, a transient is detected.

- **Off** - Transient monitoring has been switched off.
- **Automatic** - Factory default setting. The threshold value is calculated automatically and is 0.2175 times the current 200 ms effective value.
- **Manual** - The transient monitoring uses the configurable threshold values under "Trns U".

Mode (envelop)

If a sampled value exceeds the envelope range, a transient is detected.

- **Off** - Transient monitoring has been switched off.
- **Automatic** - Factory default setting. The envelop is automatically calculated and is ± 5 % of the rated voltage.
- **Manual** - The transient monitoring uses the configurable envelop.

Accepting AUX / MAIN

The transient monitoring can be configured for the baseline measurement and supporting measurement. You can accept the settings from the supporting or baseline measurement.

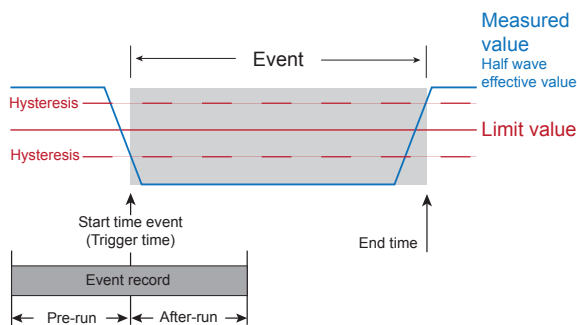
- **No** - The settings from the supporting and baseline measurement are not accepted.
- **Yes** - The settings from the supporting measurement and baseline measurement are accepted.

Allocations MAIN					
Transients					
Mode (abs)	automatically				
Peak U	0%				(0.0V)
Mode (delta)	automatically				
Trns U	0%				(0.0V)
Modus (abs I)	automatically				
Peak I	0%				(0.0A)
Modus (envelop)	automatically				
Envelop U	0%				(0.0V)
Apply to AUX	No				
esc		▼	▲		enter

Events

Events are threshold value violations of set threshold values for current and voltage.

Here, threshold values are compared with the half wave effective values for current and voltage from the measurement channels. The event record consists of a mean value, a minimum or maximum value, a start time and an end time.



- An event describes a fault due to undervoltages/overvoltages, voltage loss, overcurrent, overfrequency/underfrequency and rapid frequency changes
- Monitoring of the threshold values can be switched off (Off/Manual).
- Threshold values and hysteresis must be set as a percentage of the nominal value.
- Threshold values can be set for excess voltage, undervoltage, voltage interruption and overcurrent.
- If an event has occurred, the corresponding measured value is recorded with the set pre-run and after-run periods (respectively 0..1000 half waves).
- Event records are configured with the ecoExplorer go software and displayed with the event browser.

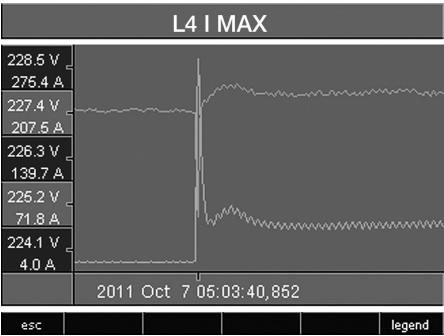


Fig.: Shows the half wave effective values for an event.

Voltage

Drop

A voltage drop is set in % of the rated voltage.

Voltage swell

The voltage swell is set in % of the rated voltage.

Current

Overcurrent

The rapid increase of current is set in % of the nominal current.

Accepting AUX / MAIN

The event monitoring can be configured for the baseline measurement and supporting measurement. You can accept the settings from the supporting or baseline measurement.

- **No** - The settings from the supporting and baseline measurement are not accepted.
- **Yes** - The settings from the supporting measurement and baseline measurement are accepted.

Allocations MAIN		
Voltage		
Sag	90%	(292.7V)
Swell	110%	(357.8V)
Current		
Inrush	110%	(7.8A)
Apply to AUX	No	
esc	▼	▲
		enter

Lead time

You can only set the lead time with ecoExplorer go software.
Factory default setting: 0

After-run

You can only set the after-run with ecoExplorer go software.
Factory default setting: 0

Relevant voltage

Depending on the application, the voltage between the outer conductors (L) or the voltage between the outer conductor (L) and the neutral conductor (N) is relevant for analysing the power quality.

We recommend the "L-N" setting for measuring the power quality in low voltage networks. You should select the "L-L" setting in medium voltage networks.

Measurement	
Transformer	->
Transients	->
Events	->
Voltage mode	L-N
Rated Freq.	50 Hz (fixed frequency)
Flicker	230V/50Hz
Temperature	PT100
esc	▼ ▲ enter

Nominal frequency

The Energy Analyser 750 determines the mains frequency from the voltage applied to L1 and uses this for the additional calculations.

The nominal frequency is required as a reference for measurement of the voltage quality.

Configure the nominal frequency for the mains on the Energy Analyser 750 prior to starting the measurement.

Select the mains frequency 50 Hz or 60 Hz for measuring the power quality in accordance with EN 61000-4-30 and EN 50160.

Setting range of the nominal frequency:

- 50 Hz (factory default setting)
- 60 Hz
- 15 to 440 Hz (wide range)

Set the nominal frequency to "Wide range" for measurements in networks with other nominal frequencies e.g. 16⅔ Hz or 400 Hz.

Measurement	
Transformer	->
Transients	->
Events	->
Voltage mode	L-N
Rated Freq.	50 Hz (fixed frequency)
Flicker	230V/50Hz
Temperature	PT100
esc	▼ ▲ enter




In order to determine the mains frequency, a voltage L1-N of greater than 10 Veff must be applied to voltage measurement input V1.

Flicker

The Energy Analyser 750 requires the mains base values in order to provide voltage and frequency-independent measurement and calculation of the flicker values (flicker measurement as per DIN EN 61000-4-15:2011). These values are to be specified by the user and can be selected from a predefined list:

- 230V/50Hz (factory default setting)
- 120V/50Hz
- 230V/60Hz
- 120V/60Hz

Measurement	
Transformer	->
Transients	->
Events	->
Voltage mode	L-N
Rated Freq.	50 Hz (fixed frequency)
Flicker	230V/50Hz
Temperature	PT100
esc	▼ ▲ enter



Flicker values can only be determined if the relevant voltage L-N is given.

Temperature

When using a temperature measurement, the corresponding sensor type must be selected from a predefined list.

- PT100
- PT1000
- KTY83
- KTY84

Measurement	
Transformer	->
Transients	->
Events	->
Voltage mode	L-N
Rated Freq.	50 Hz (fixed frequency)
Flicker	230V/50Hz
Temperature	PT100
esc	▼ ▲ enter

System

Display of the device-specific system settings with:

Firmware version

Serial number of the device

Fixed MAC address of the device

Set IP address


Set gateway address

Date and time

Set password

Reset settings

System	
Version	2.052
Serial	51104018
MAC	00:0E:6B:03:22:8C
Address	192.168. 3. 177
Gateway	192.168. 3. 4
Date/Time	01.01.1970 01:37:06
Password	0
Re-initialization	->
esc	▼ ▲ enter



You cannot configure the date and time directly on the device.
You can carry out the settings for the time synchronisation and date and time with the ecoExplorer go software.

Password

The user can block access to the configuration with a password. The configuration can then only be changed directly on the device by entering the password.

The password consists of a 6-digit code.

Setting range: 1 to 999999 = with password
 000000 = without password

Password (000000) is not factory-programmed.

- To change a password that has already been set, you must know the current password.
- Note down the changed password.
- When selecting the "Password" (green marking), the password can be changed using the 6 key (enter) and keys 2 to 5. Pressing the 6 key again confirms the entry.
- If you no longer want a password prompt, enter the password "000000".

System	
Version	2.052
Serial	51104018
MAC	00:0E:6B:03:22:8C
Address	192.168. 3. 177
Gateway	192.168. 3. 4
Date/Time	01.01.1970 01:37:06
Password	0
Re-initialization	->
esc	▼ ▲ enter



Forgot my password

If you no longer remember your password, you can only delete it using the "ecoExplorer go" PC software. In order to do so, connect the Energy Analyser 750 to the PC with a suitable interface. More information can be found in the ecoExplorer go software assistant.

Reset

Clearing energy meters

You can clear all energy meters in the Energy Analyser 750 at the same time using the "Reset" key. Some specific energy meters cannot be selected.

- Highlight the "Clear energy" button (green marking) and enable the deletion process using the key 6 (enter).

Re-initialization	
Reset energy	No
Clear min/max	No
Delivery status	No
Reset	No
esc	▼ ▲ enter

- Select "Yes" with the 4 key.
- Confirm the selection using the 6 key.
- The "Carried out" message appears in the line, all energy meters have been cleared.

Re-initialization	
Reset energy	No
Clear min/max	No
Delivery status	No
Reset	No
esc	▼ ▲ enter

Deleting min. and max. values

You can delete all min. and max. values in the Energy Analyser 750 at the same time using the "Reset" key.

The "Deleting minimum/maximum values individually" section describes how you can individually delete min. and max. values.

- Highlight the "Min/max values" item (green marking) and enable the clear process using the key 6 (enter).

Re-initialization	
Reset energy	No
Clear min/max	No
Delivery status	No
Reset	No
esc	enter

- Select "Yes" with the 4 key.
- Confirm the selection using the 6 key.
- The "Carried out" message appears in the line, all minimum and maximum values have been cleared.

Re-initialization	
Reset energy	No
Clear min/max	No
Delivery status	No
Reset	No
esc	enter

➔ Before commissioning, any content that may be present in the energy meters, min/max value or recordings that may be present due to production process should be deleted!*

Delivery status

All settings, such as the configuration and the recorded data, are restored to the factory default settings or deleted. Entered activation codes are not deleted.

- Select "Yes" with the 4 key.
- Confirm using the 6 key.
- The "Carried out" message appears in the line, the delivery status is restored.

Re-initialization	
Reset energy	No
Clear min/max	No
Delivery status	No
Reset	No
esc	enter

Re-initialisation

The Energy Analyser 750 is started again.

- Select "Yes" with the 4 key.
- Confirm using the 6 key.
- The device starts again within approx. 10 seconds

Re-initialization	
Reset energy	No
Clear min/max	No
Delivery status	No
Reset	No
esc	enter

Display

Brightness

The backlight brightness can be configured. The brightness set here is used when the Energy Analyser 750 is operated.

Setting range: 0 to 100 %
 Factory default setting: 70 %
 (0 % = dark, 100 % = very bright)

Standby

Time after which the brightness switches to the "Standby brightness".

Setting range: 60 to 9999 Seconds
 Factory default setting: 900 Seconds

Standby brightness)

Brightness level the system switches to after the standby time expires. The standby time is restarted by using keys 1-6.

Setting range: 0 to 60 %
 Factory default setting: 40 %

Screen Saver

The screen saver prevents a screen image that is not changed for a longer time period from "burning into" the LCD.

Setting range: Yes, No
 Factory default setting: Yes

Screen Update

Here, you can define the speed at which the new measured values appear in the measured value displays.

Setting range: Fast (200 ms), slow (1 second)
 Factory default setting: Fast

Rotate

The measured value displays are automatically shown one after the other. This does not affect the displays of the configuration.

Setting range: Yes, No
 Factory default setting: No

Rotation interval

Here, you can set the time after which the screen automatically switches to the next measured value display.

Setting range: 0 to 255 Seconds
 Factory default setting: 0 Seconds



The service life of the backlight is extended if the brightness of the backlight is lower.

Display	
Brightness	70%
Standby	900s
Brightness(standby)	40%
Screen Saver	Yes
Screen Update	fast
Rotate	No
Rotation interval	0s
esc	enter

Colours

Selection of the colours for displaying the current and voltage in the graphic representations.

Main menu	
Language	English
Communication	->
Measurement	->
System	->
Display	->
Colors	->
Extensions	->
esc	enter

- Using the keys 3 or 4, select the desired coloured field.
- Confirm the selection using the 6 key.
- Using the keys 3 or 4, select the desired colour.
- Confirm the selection using the 6 key.

Colors		
	Voltage	Current
L1		
L2		
L3		
L4		
esc	enter	

Extensions

Under "Extensions", you can subsequently activate functions that are subject to purchase (activation) and display the status of the Jasic programs (Jasic status).

Main menu	
Language	English
Communication	->
Measurement	->
System	->
Display	->
Colors	->
Extensions	->
esc	enter

Activation

The Energy Analyser 750 contains functions that are subject to purchase and can be subsequently activated.
List of the functions that can be activated:

- BACnet

You receive the activation codes from the manufacturer. The manufacturer requires the serial number of the device and the name of the function to be activated.

To activate the function, enter the 6-digit activation code in the corresponding line.

Make sure that the activation code is only valid for one device.

Extensions	
Activation	->
Jasic-state	->
esc	enter

Jasic status

Up to 7 customer-specific Jasic programs (1-7) and a recording can run in the Energy Analyser 750.

The Jasic programs can have the following statuses:

- Stopped
- Running

You cannot change the status of the Jasic programs on the device.

Extensions	
Activation	->
Jasic-state	->
esc	enter

Extensions	
Jasic-state	
Jasic-state 1	stopped
Jasic-state 2	stopped
Jasic-state 3	stopped
Jasic-state 4	stopped
Jasic-state 5	stopped
Jasic-state 6	stopped
Jasic-state 7	stopped
Records	running
esc	enter

Commissioning the unit

Connecting the supply voltage

- The supply voltage level for the Energy Analyser 750 is specified on the rating plate.
- After connecting the supply voltage, a display appears. Approximately 15 seconds later, the Energy Analyser 750 switches to the first measured value display.
- If no display appears, check whether the power supply voltage is within the rated voltage range.



Please note!

If the supply voltage does not correspond to the voltage indicated on the rating plate, this may lead to malfunctions and severe damage to the device.



Please note!

The Energy Analyser 750 is only suitable for use in networks where overvoltages of overvoltage category 600 V CAT III can occur.

Connecting the measured voltage

- Measurement of voltages in networks with over 500 VAC to earth must be connected via voltage transformers.
- After connecting the measured voltages, the measured values displayed by the Energy Analyser 750 for the L-N and L-L voltages must correspond to those at the voltage measurement input.
- If a voltage transformer factor is programmed, it must be taken into consideration for the comparison.



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



Please note!

The Energy Analyser 750 is not suitable for measuring DC voltages.

Frequency measurement

The Energy Analyser 750 requires the mains frequency for the measurement. The mains frequency can be defined by the user or automatically determined by the device.

- For the Energy Analyser 750 to automatically determine the frequency, a voltage L1-N of greater than 10 V_{eff} must be applied to voltage measurement input V1.
- The mains frequency must be in the range from 15 Hz to 440 Hz.
- If there is no sufficiently high measured voltage available, the Energy Analyser 750 cannot determine the mains frequency and thus cannot perform any measurements.

Direction of the rotating field

Check the direction of the rotating field voltage in the measured value display of the Energy Analyser 750.

A "right" rotation field usually exists.

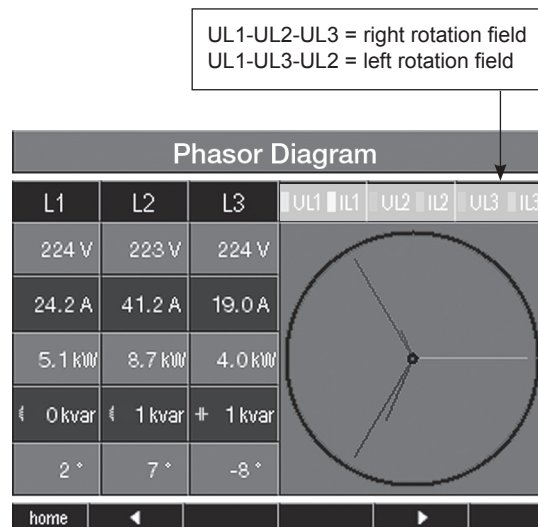


Fig.: Presentation of the phase sequence according to the direction of the rotating field.

Applying the measuring-circuit voltage

The Energy Analyser 750 is designed for the connection of .. /1A and .. /5A current transformers.
Only AC currents can be measured via the current measurement inputs - DC currents cannot.

Short circuit all current transformer outputs except for one. Compare the currents displayed by the Energy Analyser 750 with the applied current.

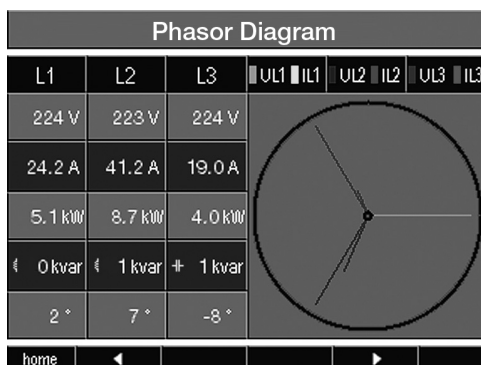
Bearing in mind the current transformer conversion ratio, the current displayed by the Energy Analyser 750 must correspond with the input current.

The Energy Analyser 750 must display approx. zero amperes in the short circuited current measurement inputs.

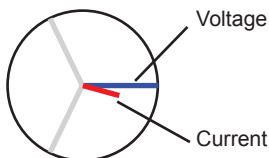
The current transformer ratio is factory-set to 5/5A and must be adapted to the current transformer used if necessary.

Phase shift angle sign prefix (U/I):

- Positive (+) for capacitive load
- Negative (-) for inductive load



In the Phasor diagram, the voltages are displayed with long pointers and the currents with short pointers.

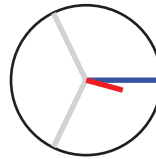


Please note!

Voltages and currents that are outside the permissible measuring range can damage the device.

Phasor diagram, example 1

Predominantly ohmic load.

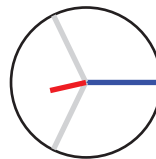


Voltage and current only have a minor deviation in the phase length.

- The current measurement input is assigned to the correct voltage measurement input.

Phasor diagram, example 2

Predominantly ohmic load.



Voltage and current only have a deviation of about 180° in the phase position.

- The current measurement input is assigned to the correct voltage measurement input.
- In the current measurement considered here, the **k and l connections are reversed** or there is a return feed in the mains power supply.

Applying the residual current

Connect residual current transformer only to the I5 and I6 inputs with a rated current of 30 mA! Both residual current inputs can measure AC currents, pulsing direct currents and DC currents.

Bearing in mind the current transformer ratio, the residual current displayed by the Energy Analyser 750 must correspond with the input current.

The current transformer ratio is factory-set to 5/5A and must be adapted to the residual current transformer used if necessary.

➔ The Energy Analyser 750 requires the mains frequency for residual current monitoring. For this purpose, the measured voltage should be applied or a fixed frequency should be set.

➔ It is not necessary to configure a connection schematic for residual current inputs I5 and I6.

Failure monitoring (RCM) for I5, I6

The Energy Analyser 750 enables continuous monitoring of the connection to the residual current transformer on inputs I5 and I6.

Activation of failure monitoring is performed using the corresponding menu item or by setting address 13793 for the residual-current measurement input I5 and 13795 for I6.

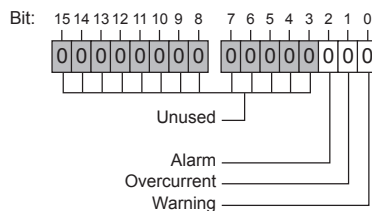
If there is an interruption in the connection to the current transformer, this state is recorded in certain registers or indicated in the ecoExplorer go software.

Modbus address	Value / Function
13793 (I5) 13795 (I6)	Failure monitoring for I5 / I6 0 = Deactivate monitoring 1 = Activate monitoring

Modbus address	Value / Function
13805 (I5) 13806 (I6)	0 = Connection to the residual current transformer on to I5 or I6 error-free 1 = Error in the current transformer connection to I5 or I6

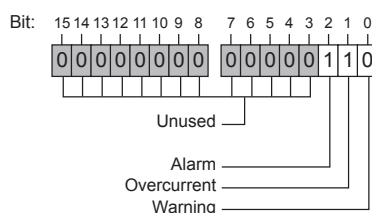
Alarm status for I5, I6

Using bit-by-bit coding inside the alarm register (addr. 13921 for I5, 13922 for I6), it is possible to read out different alarm statuses:



Example:

The measurement range has been exceeded. The alarm bit is also set and must be acknowledged!



Warning:	The residual current has exceeded the set warning limit value.
Overcurrent:	The measurement range has been exceeded.
Alarm:	Alarm bit is set for: warning, overcurrent or connection error to the transformer. The alarm bit must be reset or acknowledged manually.

Checking the power measurement

Short-circuit all current transformer outputs except for one and check the displayed power outputs.

The Energy Analyser 750 may only display one power output in the phase with a non-short-circuited current transformer input. If this is not the case, check the connection of the measured voltage and the measuring-circuit current.

If the effective power amount is correct but the sign of the power output is negative,

- S1(k) and S2(l) could be inverted at the current transformer
- or they supply effective power back into the network.

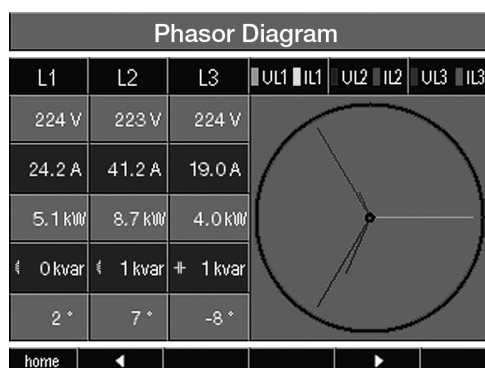


Fig.: In the Phasor diagram, the voltages are displayed with long pointers and the currents with short pointers.

Checking the communication

The Energy Analyser 750 counts all received (RX), all transmitted (TX) and all faulty data packages.

Ideally, the number of the error displayed in the Error column is zero.

Reset:

You can reset the meters for the data package with the 6 key. The start time for the new counting process is reset.

Communication State			
	RX	TX	Error
Ethernet	625363	5728	4
RS485	0 n	0 n	0 n
NTP	0	0	0
DHCP	642	956	0
DNS	0	0	0
E-Mail	-	0	0
Start Time	07-04-2014 15:19:48		
home	◀		▶ reset

Measurement range exceeded (overload)

If the measurement range is exceeded, it is displayed as long as this persists and cannot be acknowledged. The measurement range is exceeded if at least one of the four voltage or current measurement inputs lies outside their specified measuring range.

Threshold values for exceeding the measurement range (200 ms effective values):

$$I = 7 \text{ A}_{\text{rms}}$$

$$U_{\text{L-N}} = 600 \text{ V}_{\text{rms}}$$

Error - Overload		
	Voltage	Current
L1	225.5 V	0.0 A
L2	EEEE	0.0 A
L3	225.4 V	0.0 A
L4	0.5 V	EEEE

Fig.: Indication of values exceeding the measurement range in voltage circuit L2 and in current path I4

RS485 interface

Über das Modbus RTU Protokoll mit CRC-Check an der RS485-Schnittstelle kann auf die Daten aus der Parameter- und der Messwertliste zugegriffen werden (vgl. RS485-Konfiguration).

Modbus functions (master)

- 01 Read coil status
- 02 Read input status
- 03 Read holding registers
- 04 Read input registers
- 05 Force single coil
- 06 Preset single register
- 15 (0F Hex) Force multiple coils
- 16 (10Hex) Preset multiple registers
- 23 (17Hex) Read/write 4X registers

Modbus functions (slave)

- 03 Read holding registers
- 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: None
 Stop bits (Energy Analyser 750): 2
 External stop bits: 1 or 2

Number format: short 16 bit (-2^{15} to $2^{15}-1$)
 float 32 bit (IEEE 754)

Example: Reading the L1-N voltage

The L1-N voltage is saved in the measured value list at address 19000. The L1-N voltage is available in the FLOAT format. Address = 01 is approved as the Energy Analyser 750 device address.


The Query Message appears as follows:


Name	Hex	Note
Device address	01	Energy Analyser 750, address = 1
Function	03	"Read Holding Reg."
Start Addr. Hi	4A	19000dez = 4A38hex
Start Addr. Lo	38	
Ind. Value Hi	00	2dez = 0002hex
Ind. Value Lo	02	
Error Check	-	

The "Response" of the Energy Analyser 750 can appear as follows:

Name	Hex	Note
Device address	01	Energy Analyser 750, address = 1
Function	03	
Byte meter	06	
Data	00	00hex = 00dez
Data	E6	E6hex = 230dez
Error Check (CRC)	-	

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


 Broadcast (address 0) is not supported by the device.


 The message length must not exceed 256 bytes.

Profibus

Profibus profiles

A Profibus profile contains the data to be exchanged between a Energy Analyser 750 and a PLC. Four Profibus profiles are pre-configured at the factory.

A Profibus profile can:

- Retrieve measured values from the Energy Analyser 750,
- Set the digital outputs in the Energy Analyser 750,
- Query the status of the digital inputs in the Energy Analyser 750.

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 Analyser 750.
- Using ecoExplorer go software, 16 Profibus profiles (profile numbers 0 to 15) can be edited.
- Additional Profibus profiles (profile numbers 16 to 255) can be created using Jasic programs.
- Factory pre-configured Profibus profiles cannot be subsequently changed.

Device master file

The device master file, abbreviated as GSD file, describes the Profibus characteristics of the Energy Analyser 750. The GSD file is required by the configuration program of the PLC.

Variable definition

All system variables and global variables¹⁾ can be individually scaled and converted into one of the following formats:

- 8, 16, 32 bit integer with and without sign prefix.
- 32 or 64 bit float format.
- Big or little endian
 - Big endian* = High byte before low byte
 - Little endian* = Low byte before high byte

Example

Using Profibus to retrieve measured values

At least one Profibus profile must be set up with ecoExplorer go software and transferred to the Energy Analyser 750. A Jasic program is not required.

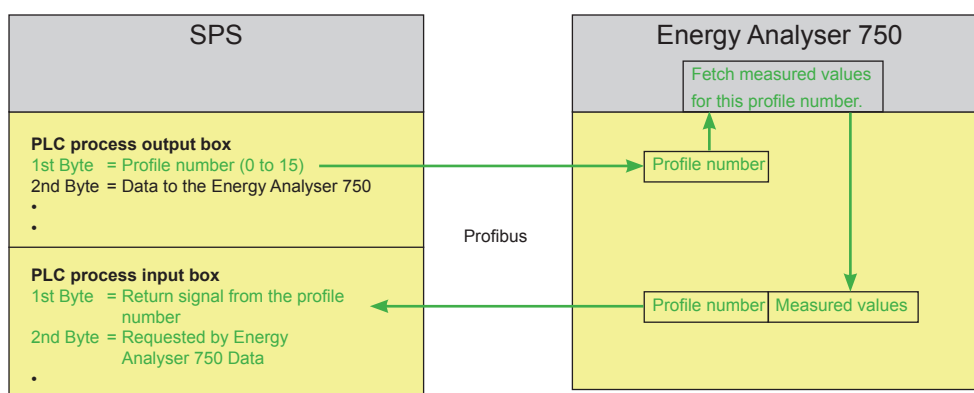


Fig.: Block diagram for data exchange between PLC and Energy Analyser 750.

¹⁾ Global variables are variables that are defined by the user in Jasic and are available to each interface in the Energy Analyser 750.

Commissioning the unit

Factory pre-configured profiles

Profibus profile number 0

	Byte index	Value type	Value format	Scaling
1	1	Voltage L1-N	Float	1
2	5	Voltage L2-N	Float	1
3	9	Voltage L3-N	Float	1
4	13	Voltage L4-N	Float	1
5	17	Voltage L2-L1	Float	1
6	21	Voltage L3-L2	Float	1
7	25	Voltage L1-L3	Float	1
8	29	Current L1	Float	1
9	33	Current L2	Float	1
10	37	Current L3	Float	1
11	41	Current L4	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	Effective power L4	Float	1
16	61	Cos phi (math.) L1	Float	1
17	65	Cos phi (math.) L2	Float	1
18	69	Cos phi (math.) L3	Float	1
19	73	Cos phi (math.) L4	Float	1
20	77	Frequency	Float	1
21	81	Effective power sum L1-L4	Float	1
22	85	Reactive power sum L1-L4	Float	1
23	89	Apparent power sum L1-L4	Float	1
24	93	Cos phi (math.) sum L1-L4	Float	1
25	97	Effective current sum L1-L4	Float	1
26	101	Active energy sum L1-L4	Float	1
27	105	Ind. Reactive energy sum L1-L4	Float	1
28	109	THD voltage L1	Float	1
29	113	THD voltage L2	Float	1
30	117	THD voltage L3	Float	1

Profibus profile number 1

	Byte index	Value type	Value format	Scaling
1	1	Voltage L1-N	Float	1
2	5	Voltage L2-N	Float	1
3	9	Voltage L3-N	Float	1
4	13	Voltage L2-L1	Float	1
5	17	Voltage L3-L2	Float	1
6	21	Voltage L1-L3	Float	1
7	25	Current L1	Float	1
8	29	Current L2	Float	1
9	33	Current L3	Float	1
10	37	Effective power L1	Float	1
11	41	Effective power L2	Float	1
12	45	Effective power L3	Float	1
13	49	Cos phi (math.) L1	Float	1
14	53	Cos phi (math.) L2	Float	1
15	57	Cos phi (math.) L3	Float	1
16	61	Frequency	Float	1
17	65	Effective power sum L1-L3	Float	1
18	69	Reactive power sum L1-L3	Float	1
19	73	Apparent power sum L1-L3	Float	1
20	77	Cos phi (math.) sum L1-L3	Float	1
21	81	Effective current sum L1-L3	Float	1
22	85	Active energy sum L1-L3	Float	1
23	89	Ind. Reactive energy sum L1-L3	Float	1
24	93	THD voltage L1	Float	1
25	97	THD voltage L2	Float	1
26	101	THD voltage L3	Float	1
27	105	THD current L1	Float	1
28	109	THD current L2	Float	1
29	113	THD current L3	Float	1

Profibus profile number 2

	Byte index	Value type	Value format	Scaling
1	1	Active energy sum L1-L3	Float	1
2	5	Rel. Active energy sum L1-L3	Float	1
3	9	Deliv. Active energy sum L1-L3	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	Active energy L1	Float	1
9	33	Active energy L2	Float	1
10	37	Active 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

Profibus profile number 3

	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	Current L1	Float	1
6	21	Current L2	Float	1
7	25	Current L3	Float	1
8	29	Current sum L1-L3	Float	1
9	33	Active energy sum L1-L3	Float	1
10	37	Cos phi (math.) L1	Float	1
11	41	Cos phi (math.) L2	Float	1
12	45	Cos phi (math.) L3	Float	1
13	49	Cos phi (math.) sum L1-L3	Float	1
14	53	Reactive power L1	Float	1
15	57	Reactive power L2	Float	1
16	61	Reactive power L3	Float	1
17	65	Reactive power sum L1-L3	Float	1
18	69	Apparent power L1	Float	1
19	73	Apparent power L2	Float	1
20	77	Apparent power L3	Float	1
21	81	Apparent power sum L1-L3	Float	1

Digital in-/outputs

The Energy Analyser 750 has two digital outputs and two digital inputs. The inputs and outputs can be configured using the ecoExplorer go software.

The settings of the functions in the configuration menu must be made using the ecoExplorer go software.

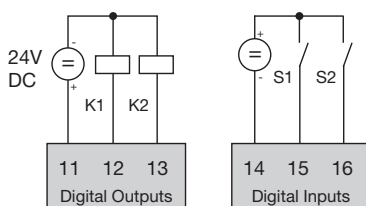


Fig.: Digital inputs and outputs

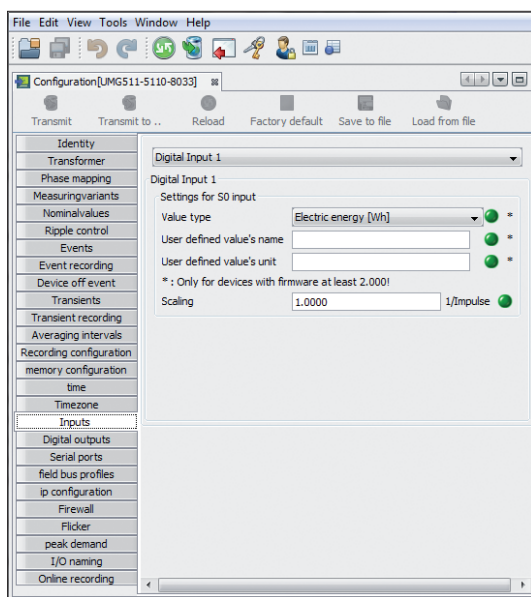


Fig.: ecoExplorer go software, configuration menu

Pulse 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 configuration menu using the ecoExplorer go software to use a digital output as a pulse out.

- Digital output,
- Measured value selection,
- Pulse length,
- Pulse value.

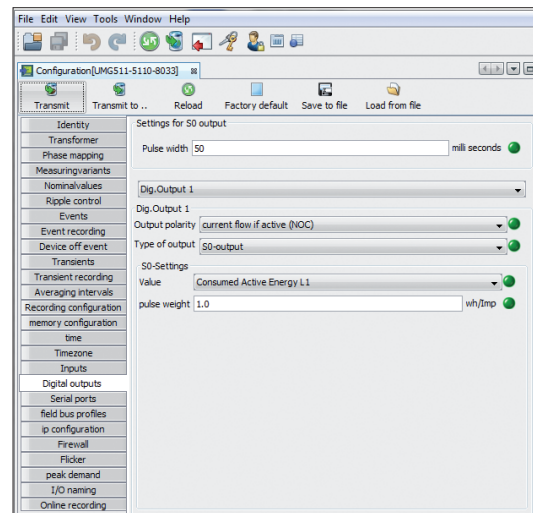


Fig.: ecoExplorer go software, configuration menu

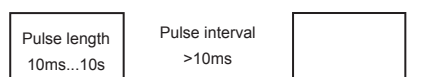
Pulse length


The pulse length applies to both pulse outputs and is set using the ecoExplorer go software.

The typical pulse length of S0 pulse is 30 ms.

Pulse interval

The pulse interval is at least as large as the selected pulse length. The pulse interval depends on the measured power, for example, and can take hours or days.




 **Pulse interval**
The pulse interval is proportional to the power output within the selected settings.

The values in the table are based on the minimum pulse length and the minimum pulse interval for the maximum number of pulses per hour.

Pulse length	Pulse interval	Max. pulse/h
10 ms	10 ms	180 000 pulses/h
30 ms	30 ms	60 000 pulses/h
50 ms	50 ms	36 000 pulses/h
100 ms	100 ms	18 000 pulses/h
500 ms	500 ms	3 600 pulses/h
1 s	1 s	1 800 pulses/h
10 s	10 s	180 pulses/h

Examples of the maximum possible number of pulses per hour.

 **Measured value selection**
When programming with the ecoExplorer go software you have a selection of work values which are derived from the power output values.

Pulse value


The pulse value is used to indicate how much power (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 you check the pulse value with a positive sign, the pulses will only be emitted when the measured value has a positive sign.

If you check the pulse value with a negative sign, the pulses will only be produced when the measured value has a negative sign.

$$\text{Pulse value} = \frac{\text{max. connected load}}{\text{max. number of pulses/h}}$$

 Since the effective power meter operates with a back-stop, pulses will only be generated when drawing electricity.

 Since the reactive power meter operates with a back-stop, pulses will only be generated with inductive load applied.

Determine the pulse value

Set the pulse length

Set the pulse length in accordance with the requirements of the connected pulse receiver.

At a pulse length of 30 ms, for example, the Energy Analyser 750 generates a maximum number of 60,000 pulses (see Table "maximum number of pulses" per hour.

Determining the maximum connected load

Example:

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

Calculating the pulse value

$$\text{Pulse value} = \frac{\text{max. connected load}}{\text{max. number of pulses/h}}$$

Pulse value = 135 kW / 60,000 pulses/h

Pulse value = 0.00225 kWh/pulses

Pulse value = 2.25 Wh/pulses

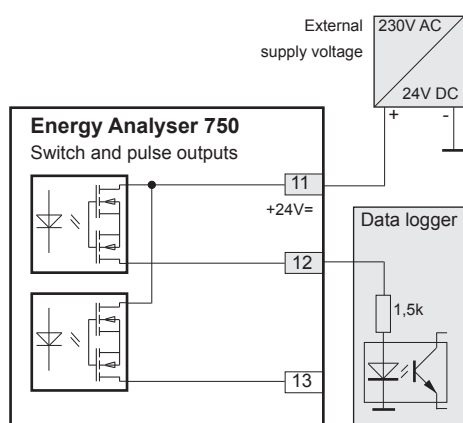


Fig.: Connection example for the circuit as pulse output.

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

Service and maintenance

The device underwent various safety checks before delivery and is marked with a seal. If a device is open, 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 Analyser 750 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),
- Measured 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

We recommend having the device recalibrated 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.

The new firmware is transferred by selecting a suitable update menu (Tools/Upgrade Devices menu) and the device.

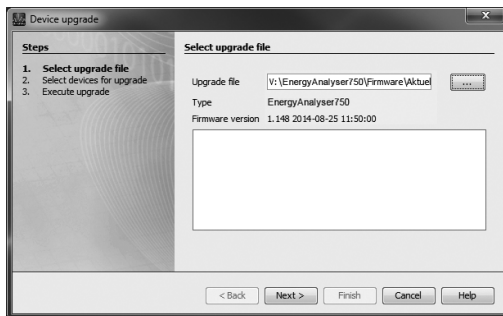


Fig.: ecoExplorer go software firmware update assistant



Firmware may NOT be updated via the RS485 interface.

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 events, 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 (type CR2450 / 3 V) can be replaced by the user.

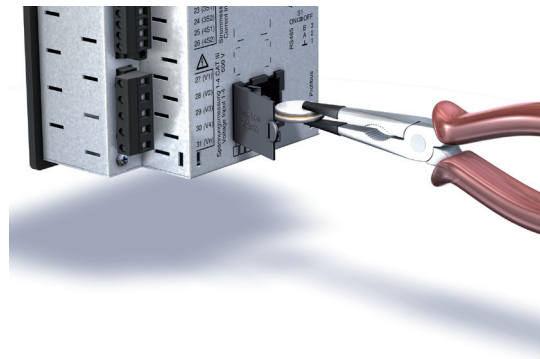


Fig.: Replacing the battery using long-nose pliers

Procedure in the event of faults

Possible fault	Cause	Remedy
No display	External fuse for the power supply voltage has tripped.	Replace fuse.
No current display	Measured voltage is not connected.	Connect the measured 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 CT ratio at the current transformer.
	The current peak value at the measurement input was exceeded by harmonic components.	Install current transformer with a larger CT ratio.
	The current at the measurement input fell short of.	Install current transformer with a smaller current transformer 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 ratio at the voltage transformer.
Voltage displayed is too small.	Measurement range exceeded.	Use voltage transformers.
	The peak voltage value at the measurement input has been exceeded by the harmonics.	Please note! Ensure the measurement inputs are not overloaded.
Phase shift ind/cap.	A current path is assigned to the wrong voltage circuit.	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 circuit.	Check connection and correct if necessary.
Effective power too large or too small.	The programmed CT ratio is incorrect.	Read out and program the CT ratio at the current transformer
	The current path is assigned to the wrong voltage circuit.	Check connection and correct if necessary.
	The programmed voltage transformer ratio is incorrect.	Read out and program the voltage transformer 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.
Measurement range exceeded display (overload)	Voltage and current measurement input outside the measurement range (See section Measurement range exceeded)	Check connection and correct if necessary.
		Use suitable voltage and current transformers.
		Read out and program the voltage or current transformer ratio at the transformer.
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. - Terminate bus with termination resistor.
	Ethernet - IP Device address is incorrect. - Incorrect addressing mode	- Adjust IP device address. - Adjust the IP address assignment mode
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

Technical data

General	
Net weight (with attached connectors)	approx. 1080g
Device dimensions	approx. l = 144 mm, w = 144 mm, h = 75 mm
Battery	Type Li-Mn CR2450, 3 V (approval i.a.w. UL 1642)
Clock (in temperature range -40°C to 85°C)	+5 ppm (corresponding to approx. 3 minutes p.a.)

Transport and storage	
The following information applies to devices which are transported or stored in the original packaging.	
Free fall	1 m
Temperature	-25 °C to +70 °C

Ambient conditions during operation	
The Energy Analyser 750 is intended for weather-protected, stationary use. The Energy Analyser 750 must be connected to the protective current connection! Protection class I in acc. with IEC 60536 (VDE 0106, Part 1).	
Working temperature range	-10 °C to +55 °C
Relative humidity	5 to 95 % RH (at 25°C without condensation)
Operating altitude	0 to 2000 m above sea level
Pollution degree	2
Mounting position	vertical
Ventilation	Forced ventilation is not required.
Protection against ingress of solid foreign bodies and water	
- Front side	IP40 in acc. with EN 60529
- Rear side	IP20 in acc. with EN 60529

Supply voltage	
Installations of overvoltage category	III
Protection of the supply voltage (fuse)	6 A, type C (approved i.a.w. UL/IEC)
230 V option:	
- Nominal range	95 V to 240 V (45 to 65 Hz) or DC 80 to 300 V
- Operating range	+10 % of nominal range
- Power consumption	max. 7 W / 14 VA
24 V option:	
- Nominal range	48 to 110 V (50/60 Hz) or DC 24 to 150 V
- Operating range	±10 % of nominal range
- Power consumption	max. 9 W / 13 VA


Terminal connection capacity (supply voltage)	
Connectable conductors. Only one conductor can be connected per terminal!	
Single core, multi-core, fine-stranded	0.2 to 2.5 mm ² , AWG24-12
Terminal pins, core end sheath	0.25 to 2.5 mm ²
Tightening torque	0.5 to 0.6 Nm
Stripping length	7 mm

Current measurement	
Rated current	5 A
Resolution	0.1 mA
Metering range	0.001 to 7 Arms
Measurement range exceeded (overload)	From 7 Arms
Crest factor	1.41
Overvoltage category	230 V option: 300 V CAT III 24 V option: 300 V CAT II
Measurement surge voltage	4 kV
Power consumption	approx. 0.2 VA (Ri = 5 mOhm)
Overload for 1 sec.	120 A (sinusoidal)
Sampling rate	25.6 kHz / phase

Voltage measurement	
The voltage measurement inputs are suitable for measurements in the following power supply systems:	
Three-phase 4-conductor systems with rated voltages up to	417 V / 720 V (+10 %)
Three-phase 3-conductor systems with rated voltages up to	600 V (+10 %)
From a safety and reliability perspective, the voltage measurement inputs are designed as follows:	
Overvoltage category	600 V CAT III
Measurement surge voltage	6 kV
Metering range L-N	0 ¹⁾ to 600 Vrms
Metering range L-L	0 ¹⁾ to 1000 Vrms
Resolution	0.01 V
Crest factor	1.6 (related to 600 Vrms)
Impedance	4 MOhm/phase
Power consumption	approx. 0.1 VA
Sampling rate	25.6 kHz / phase
Transients	> 39 µs
U _{din} ²⁾ i.a.w. EN 61000-4-30	100 to 250 V
Flicker range (dU/U)	27.5 %
Frequency range of the fundamental oscillation	15 to 440 Hz
- Resolution	0.001 Hz

- ¹⁾ The Energy Analyser 750 can only determine measured values, if at least a voltage L-N greater than 10 V_{eff} or a voltage L-L of greater than 18 V_{eff} is present at one voltage measurement input.
- ²⁾ The U_{din} = arranged input voltage according to DIN EN 61000-4-30

Terminal connection capacity (voltage and current measurement)	
Connectable conductors. Only one conductor can be connected per terminal!	
Single core, multi-core, fine-stranded	0.2 to 2.5 mm ² , AWG24-12
Terminal pins, core end sheath	0.25 to 2.5 mm ²
Tightening torque	0.5 to 0.6 Nm
Stripping length	7 mm

Residual current monitoring (RCM)	
Rated current	30 mArms
Metering range	0 to 40 mArms
Triggering current	100 µA
Resolution	1 µA
Crest factor	1.414 (related to 40 mA)
Burden	4 Ohm
Overload for 1 sec.	5 A
Sustained overload	1 A
Overload for 20 ms	50 A
Residual current monitoring	i.a.w. IEC/TR 60755 (2008-01), type A 
Maximum external burden	300 Ohm (for cable break detection)

Terminal connection capacity (residual current monitoring)	
Connectable conductors. Only one conductor can be connected per terminal!	
Rigid/flexible	0.14 to 1.5 mm², AWG28-16
Flexible with core end sheath without plastic sleeve	0.20 to 1.5 mm²
Flexible with core end sheath with plastic sleeve	0.20 to 1.5 mm²
Stripping length	7 mm
Tightening torque	0.20 to 0.25 Nm
Cable length	- up to 30 m unshielded - from 30 m shielded

Thermistor input	
3-wire measurement	
Update time	1 second
Connectable sensors	PT100, PT1000, KTY83, KTY84
Total burden (sensor + cable)	max. 4 kOhm
Cable length	- up to 30 m unshielded - from 30 m shielded

Sensor type	Temperature range	Resistor range	Measurement uncertainty
KTY83	-55 to +175 °C	500 to 2600 Ohm	±1.5 % rng
KTY84	-40 to +300 °C	350 to 2600 Ohm	±1.5 % rng
PT100	-99 to +500 °C	60 to 180 Ohm	±1.5 % rng
PT1000	-99 to +500 °C	600 to 1800 Ohm	±1.5 % rng

Terminal connection capacity (thermistor input)	
Connectable conductors. Only one conductor can be connected per terminal!	
Single core, multi-core, fine-stranded	0.08 to 1.5 mm²
Terminal pins, core end sheath	1 mm²

Digital inputs	
2 Digital inputs with a joint earth	
Maximum counter frequency	20 Hz
Response time (Jasic program)	200 ms
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	- up to 30 m unshielded - from 30 m shielded

Digital outputs	
2 Digital outputs with a joint earth; opto-coupler, not short-circuit proof	
Supply voltage	20 to 30 V DC (SELV- or PELV supply)
Switching voltage	max. 60 V DC
Switching current	max. 50 mAeff AC/DC
Response time (Jasic program)	200 ms
Pulse output (energy pulse)	max. 20 Hz
Cable length	- up to 30 m unshielded - from 30 m shielded

Terminal connection capacity (digital inputs and outputs)	
Rigid/flexible	0.14 to 1.5 mm², AWG28-16
Flexible with core end sheath without plastic sleeve	0.25 to 1.5 mm²
Flexible with core end sheath with plastic sleeve	0.25 to 0.5 mm²
Tightening torque	0.22 to 0.25 Nm
Stripping length	7 mm

RS485 interface	
3-wire connection with GND, A, B	
Protocol	Modbus RTU/slave, Modbus RTU/master, Modbus RTU /Gateway
Transmission rate	9.6 kbps / 19.2 kbps / 38.4 kbps / 57.6 kbps / 115.2 kbps / 921.6 kbps
Termination resistor	Can be activated by micro switch

Profibus interface	
Connection	SUB D 9-pole
Protocol	Profibus DP/V0 as per EN 50170
Transmission rate	9.6 kBaud to 12 MBaud

Ethernet interface	
Connection	RJ45
Function	Modbus gateway, embedded web server (HTTP)
Protocols	CP/IP, EMAIL (SMTP), DHCP client (BootP), Modbus/TCP, Modbus RTU over Ethernet, FTP, ICMP (Ping), NTP, TFTP, BACnet (option), SNMP

Technical data

Function parameters

- Measurement via current transformer ..5A
- Measurements with 50/60 Hz

Function	Symbol	Precision class	Metering range	Display range
Total effective power	P	0.2 ⁵⁾ (IEC 61557-12)	0 to 15.3 kW	0 W to 9999 GW *
Total reactive power	QA ⁶⁾ , Qv ⁶⁾	1 (IEC 61557-12)	0 to 15.3 kvar	0 varh to 9999 Gvar *
Total apparent power	SA, Sv ⁶⁾	0.2 ⁵⁾ (IEC 61557-12)	0 to 15.3 kVA	0 VA to 9999 GVA *
Total effective energy	Ea	0.2S ^{5) 7)} (IEC 61557-12)	0 to 15.3 kWh	0 Wh to 9999 GWh *
Total reactive energy	ErA ⁶⁾ , ErV ⁶⁾	1 (IEC 61557-12)	0 to 15.3 kvarh	0 varh to 9999 Gvarh *
Total apparent energy	EapA, EapV ⁶⁾	0.2 ⁵⁾ (IEC 61557-12)	0 to 15.3 kVAh	0 VAh to 9999 GVAh *
Frequency	f	0.05 (IEC 61557-12)	40 to 70 Hz	40 Hz to 70 Hz
Phase current	I	0.1 (IEC 61557-12)	0.001 to 8.5 Arms	0 A to 9999 kA
Measured neutral conductor current	IN	0.1 (IEC 61557-12)	0.001 to 8.5 Arms	0 A to 9999 kA
Residual currents I5, I6	IDIFF	1 (IEC 61557-12)	0 to 40 mArms	0 A to 9999 kA
Computed neutral conductor current	INc	0.5 (IEC 61557-12)	0.001 to 25.5 A	0 A to 9999 kA
Voltage	U L-N	0.1 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage	U L-L	0.1 (IEC 61557-12)	18 to 1000 Vrms	0 V to 9999 kV
Power factor	PFA, PFV	0.5 (IEC 61557-12)	0.00 to 1.00	0 to 1
Short-term flicker, long-term flicker	Pst, Plt	Cl. A (IEC61000-4-15)	0.4 to 10,0 Pst	0 to 10
Voltage drops	Udip	0.2 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage increases	Uswl	0.2 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Transient overvoltages	Utr	0.2 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage interruptions	Uint	Duration ±1 Cycle	-	-
Voltage unbalance ¹⁾	Unba	0.2 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage unbalance ²⁾	Unb	0.2 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage harmonics	Uh	Cl. 1 (IEC61000-4-7)	up to 2.5 kHz	0 V to 9999 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	1.0 (IEC 61557-12)	up to 2.5 kHz	0 % to 999 %
Current harmonics	Ih	Cl. 1 (IEC61000-4-7)	up to 2.5 kHz	0 A to 9999 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	1.0 (IEC 61557-12)	up to 2.5 kHz	0 % to 999 %
Mains signal voltage (interharmonics voltage)	MSV	IEC 61000-4-7 Class 1	10 to 200 % of IEC 61000-2-4 Class 3	0 V to 9999 kV

- Measurements in the range 15 to 440 Hz

Function	Symbol	Precision class	Metering range	Display range
Total effective power	P	2 (IEC 61557-12)	0 to 15.3 kW	0 W to 9999 GW *
Total reactive power	QA ⁶⁾ , Qv ⁶⁾	2 (IEC 61557-12)	0 to 15.3 kvar	0 varh to 9999 Gvarh *
Total apparent power	SA, Sv ⁶⁾	1 (IEC 61557-12)	0 to 15.3 kVA	0 VA to 9999 GVA *
Total effective energy	Ea	2 (IEC 61557-12)	0 to 15.3 kWh	0 Wh to 9999 GWh *
Total reactive energy	ErA ⁶⁾ , ErV ⁶⁾	2 (IEC 61557-12)	0 to 15.3 kvarh	0 varh to 9999 Gvarh *
Total apparent energy	EapA, EapV ⁶⁾	1 (IEC 61557-12)	0 to 15.3 kVAh	0 VAh to 9999 GVAh *
Frequency	f	0.05 (IEC 61557-12)	40 to 440 Hz	40 Hz to 440 Hz
Phase current	I	0.5 (IEC 61557-12)	0.001 to 8.5 Arms	0 A to 9999 kA
Measured neutral conductor current	IN	0.5 (IEC 61557-12)	0.001 to 8.5 Arms	0 A to 9999 kA
Residual currents I5, I6	IDIFF	1 (IEC 61557-12)	0 to 40 mArms	0 A to 9999 kA
Computed neutral conductor current	INc	1.5 (IEC 61557-12)	0.001 to 25.5 A	0 A to 9999 kA
Voltage	U L-N	0.5 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage	U L-L	0.5 (IEC 61557-12)	18 to 1000 Vrms	0 V to 9999 kV
Power factor	PFA, PFV	2 (IEC 61557-12)	0.00 to 1.00	0 to 1
Short-term flicker, long-term flicker	Pst, Plt	-	-	-
Voltage drops	Udip	0.5 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage increases	Uswl	0.5 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Transient overvoltages	Utr	0.5 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage interruptions	Uint	Duration ±1 Cycle	-	-
Voltage unbalance ¹⁾	Unba	0.5 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage unbalance ²⁾	Unb	0.5 (IEC 61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage harmonics	Uh	Cl. 2 (IEC61000-4-7)	up to 2.5 kHz	0 V to 9999 kV
THD of the voltage ³⁾	THDu	2.0 (IEC 61557-12)	up to 2.5 kHz	0 % to 999 %

Declaration

- 1) In relation to the amplitude.
- 2) In relation to phase and amplitude.
- 3) In relation to fundamental oscillation.
- 4) In relation to effective value.
- 5) Precision class 0.2 with to / 5A converter.
Precision class 0.5 with to / 1A converter.
- * The display returns to 0 W once the max. total working value range has been reached.
- 6) Calculation from fundamental oscillation.
- 7) Precision class 0.2 S per IEC 62053-22

Specifications as per IEC 61000-4-30

Characteristic	Uncertainty	Metering range
5.1 Frequency	± 10 mHz	42.5 to 57.5 Hz / 51 to 69 Hz
5.2 Supply voltage level	$\pm 0,1$ % of U_{din}	10 to 150 % von U_{din}
5.3 Flicker	± 5 % of measured value	0.2 to 10 Pst
5.4 Drops and excessive increases	Amplitude: $\pm 0,2$ % of U_{din} Duration: ± 1 period	N/A
5.5 Voltage interruptions	Duration: ± 1 period	N/A
5.7 Unbalance	$\pm 0,15$ %	0.5 to 5 % u_2 0.5 to 5 % u_0
5.8 Harmonics	IEC 61000-4-7 class 1	10 to 200 % for Class 3 acc. to IEC 61000-2-4
5.9 Interharmonics	IEC 61000-4-7 Class 1	10 to 200 % for Class 3 acc. to IEC 61000-2-4
5.10 Mains signal voltage	In the range 3 to 15 % of U_{din} : ± 5 % of U_{din} In the range 1 to 3 % of U_{din} : $\pm 0,15$ % of U_{din} There are no uncertainty requirements for values < 1 % of U_{din} .	0 to 15% von U_{din}
5.12 Downward/upward deviation	$\pm 0,1$ % of U_{din}	10 to 150 % von U_{din}

The Energy Analyser 750 meets the requirements according to IEC 61000-4-30 class A for:

- compensation, time uncertainty, marking concept, transient influence quantities.

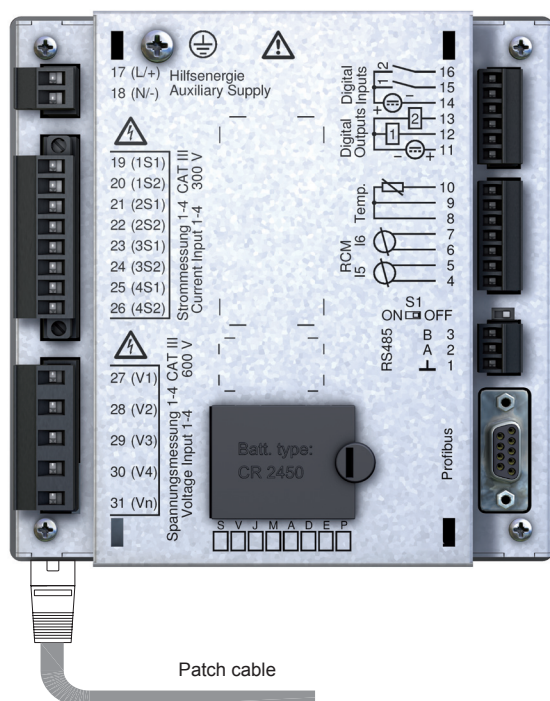


To ensure that two measurement devices achieve the same measurement results in a 10 minute compensation interval, we recommend synchronising time measurement in the Energy Analyser 750 using an external time signal.

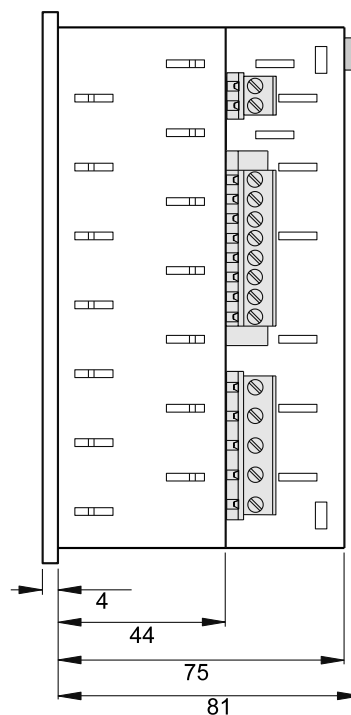
Dimension diagrams

Cut-out size: $138^{+0,8} \times 138^{+0,8}$ mm

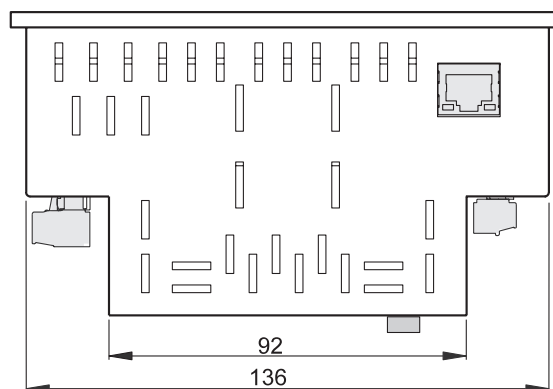
Rear side



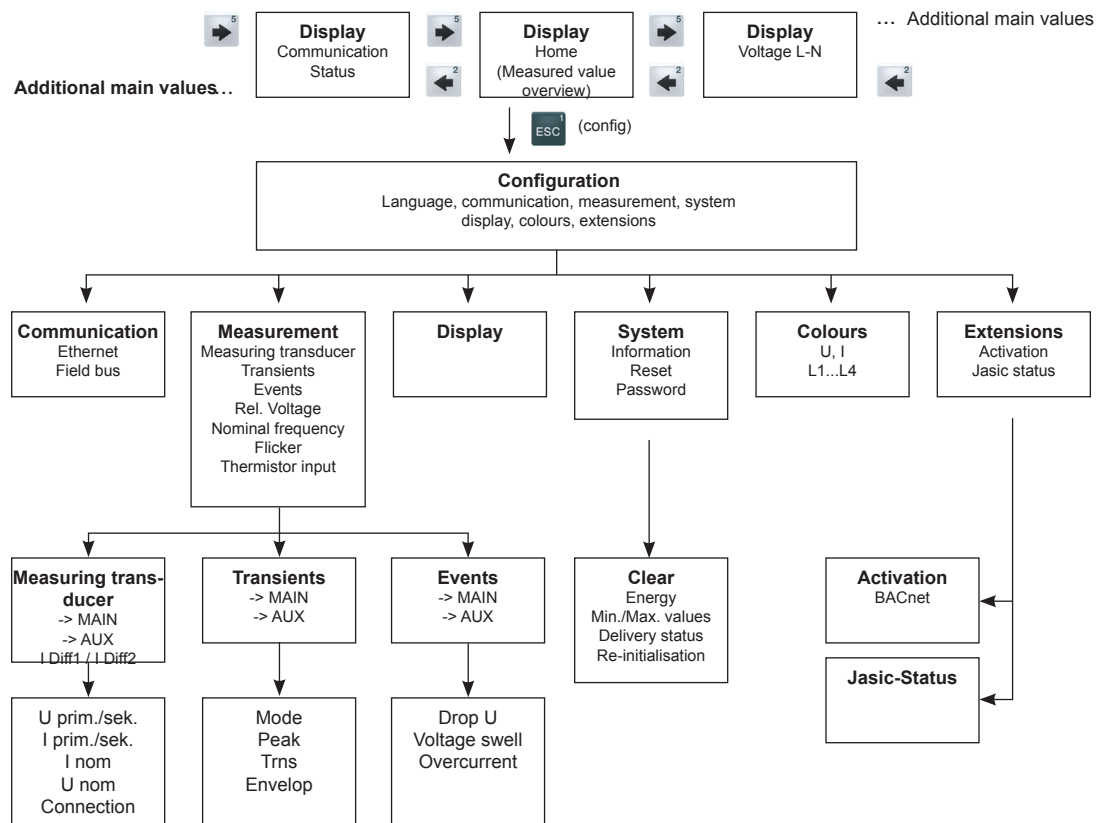
Side view



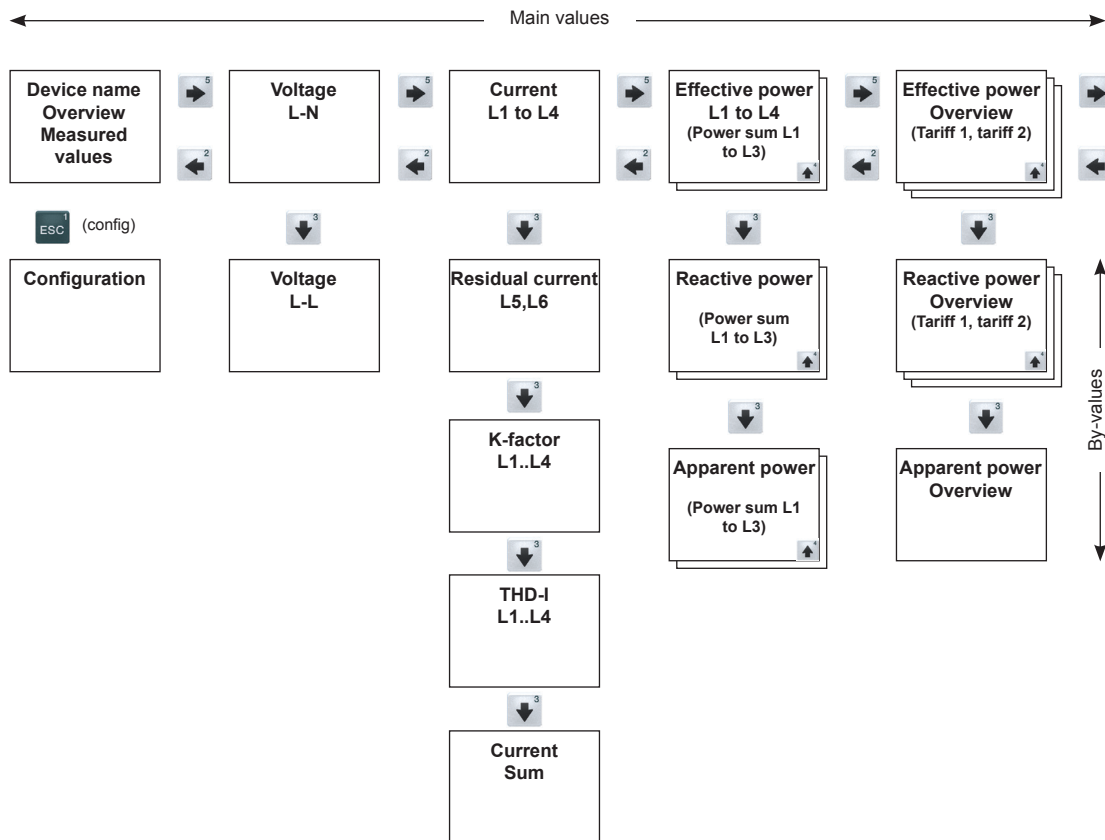
View from below

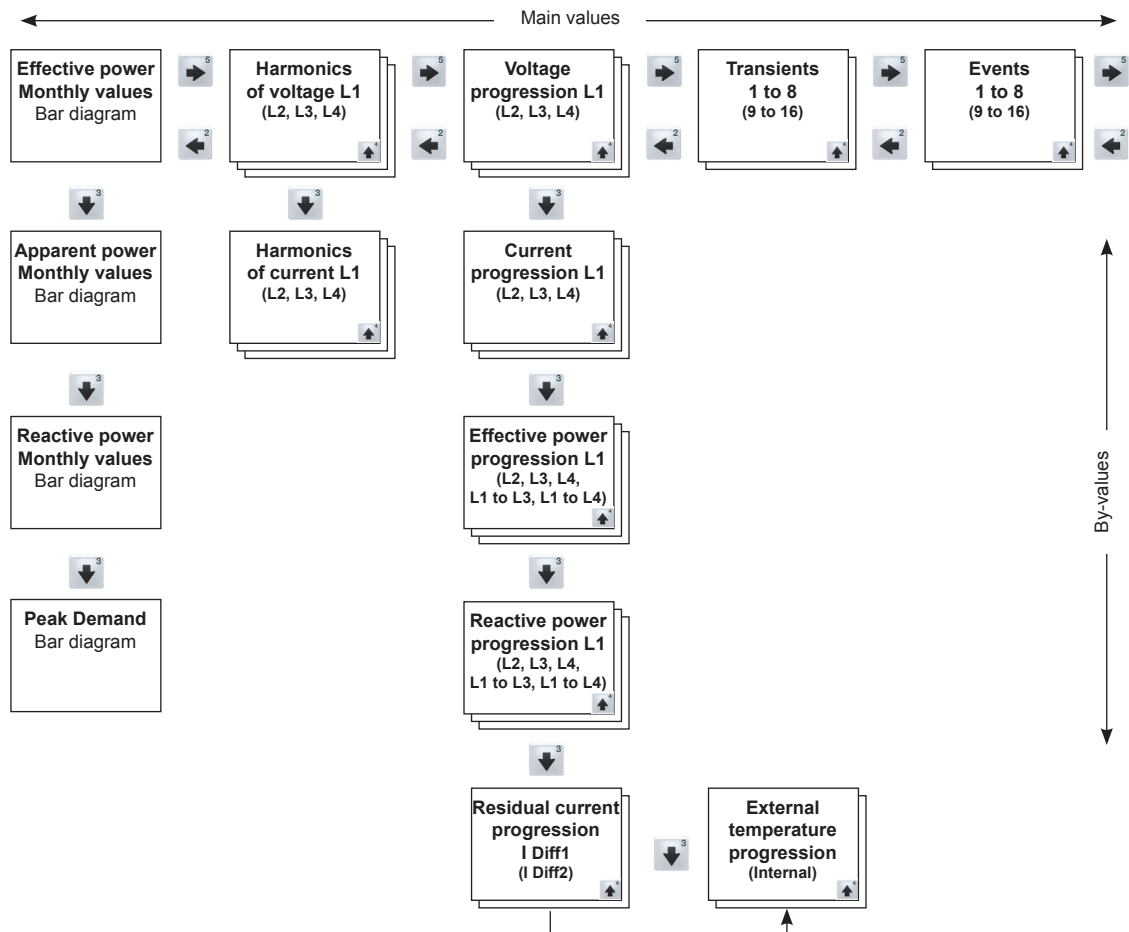


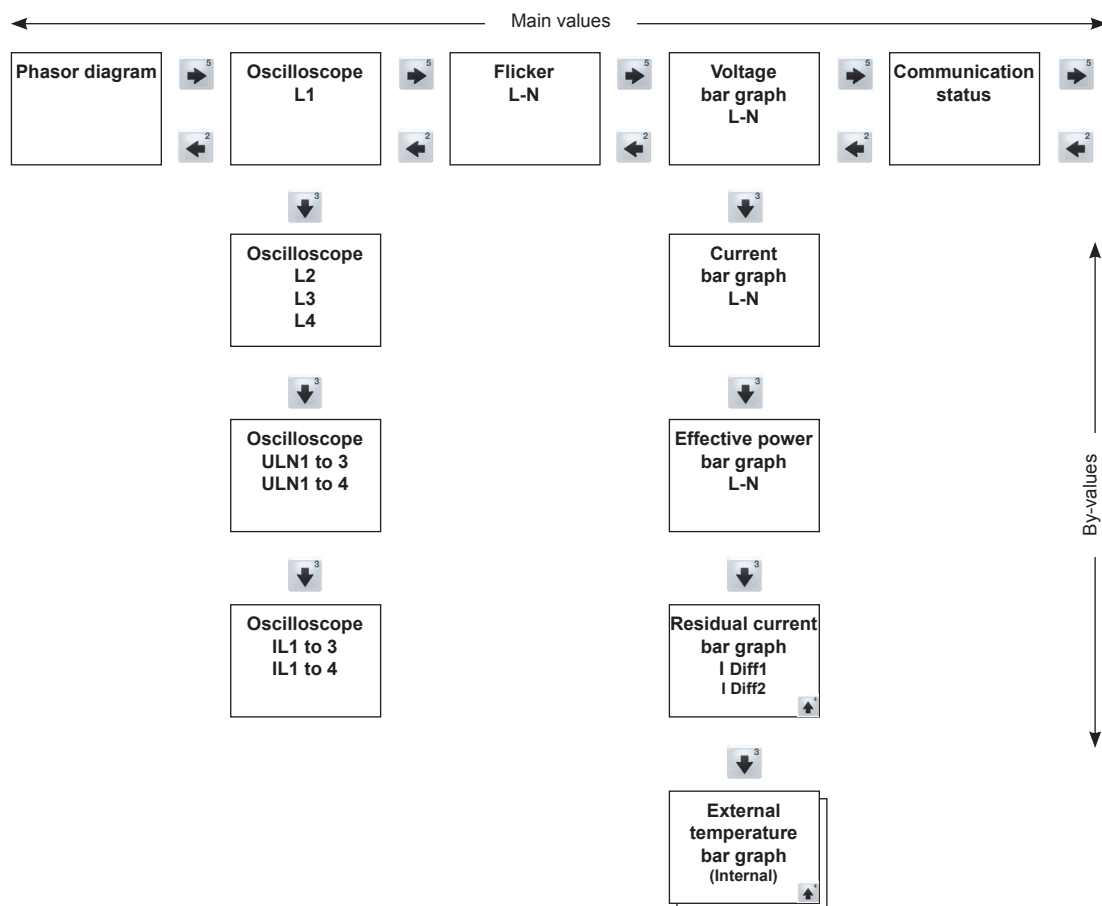
Configuration menu overview

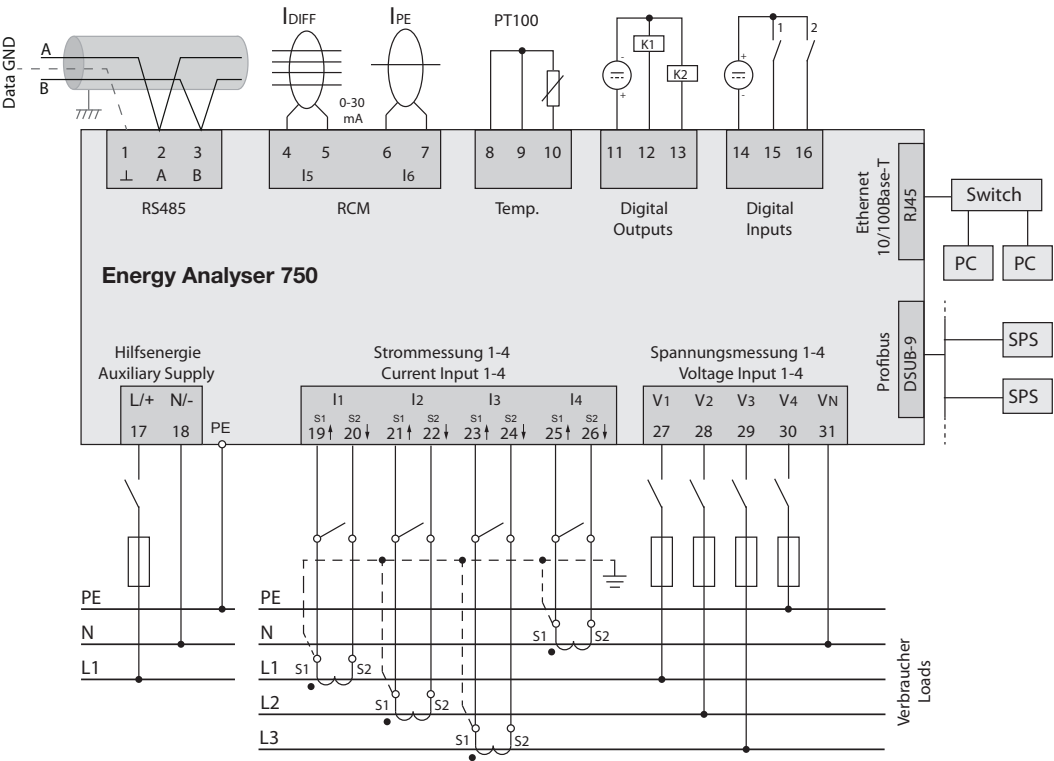


Measured value displays overview









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