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# Power Quality Analyser UMG 509

Operation manual and  
technical data



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## General information

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### 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@janitza.de](mailto:info@janitza.de)

### Trademarks

All trademarks and the resulting rights are the property of their respective owners.

### Disclaimer

Janitza electronics GmbH 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.

## 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.



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.

## 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.



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.

## 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.

**Scope of delivery UMG 509**

Number	Part no.	Label
1	52.26.xxx <sup>1)</sup>	UMG 509
1	33.03.194	Operation manual
1	51.00.116	CD with following content - GridVis programming software - GridVis functional description - UMG 509, GSD file "U5090F15.GSD"
1	10.01.855	Screw-type terminal, pluggable, 2-pole (auxilliary power)
1	10.01.847	Screw-type terminal, pluggable, 5-pole (voltage measurement 1-4)
1	10.01.853	Screw-type terminal, pluggable, 8-pole (current measurement 1-4)
1	10.01.873	Screw-type terminal, pluggable, 6-pole (digital inputs/outputs)
1	10.01.888	Screw-type terminal, pluggable, 7-pole (RCM, thermistor input)
1	10.01.859	Screw-type terminal, pluggable, 3-pole (RS 485)
1	08.01.505	Patch cable 2 m, twisted, grey (connection UMG PC/switch)
1	52.19.301	Mounting clips

<sup>1)</sup> For the item number, see delivery note

**Available accessories**

Part no.	Label
21.01.102	Lithium battery CR2450, 3V (approval according to i.a.w. UL 1642)
13.10.539	Profibus connector, 9-pole, D-SUB
13.10.543	Profibus connector, 9-pole, D-SUB, angled
29.01.903	Seal, 144 x 144

## Product description

### Proper use

The UMG 509 is intended for measurement in accordance with EN61000-4-30 in building installations, on distribution units, circuit breakers and busbar trunking systems.

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

The UMG 509 is suitable for integration into fixed and weatherproof switch panels. Conductive switch panels must be earthed.

The UMG 509 can be used in 2, 3 and 4-conductor networks and in TN and TT networks.

The current measurement inputs 1–4 of the UMG 509 are connected via external ..1A or ..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 UMG 509 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 UMG 509 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!

## UMG 509 features

### General information

- Front panel integration device with dimensions 144 x 144 mm
- Connection via pluggable screw terminals
- Colour graphic display 320x240, 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°C .. +55°C

### Measurement

- Measurement in TN and TT networks
- Continuous sampling of the voltage and current measurement inputs at 20 kHz
- Acquisition of transients >50 µs and storage of up to approx. 330,000 sampling points
- Metering range current 0.001 to 7Arms.
- True RMS (TRMS)
- Continuous sampling of the voltage and current measurement inputs

- Continuous monitoring of residual currents with failure monitoring
- Temperature measurement
- Working measurement, measurement uncertainty in accordance with DIN EN50470-3:
  - Class C for ..5A converter,
  - Class B for ..1A converter,
- Measurement of the 1st to 63rd harmonics, for
  - UI, Uln, I, P (cons./del.) and
  - Q (ind./cap.),
- Analysis and evaluation in accordance with DIN EN50160 with the GridVis programming software included in the scope of delivery
- Programming separate applications in Jasic

## Measuring process

The UMG 509 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 UMG 509.

- **Directly** on the device via 6 buttons and the display
- Using the **GridVis** 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 and can be found on the enclosed CD.

This operation manual only describes how to operate the UMG 509 using the buttons.

The GridVis programming software has its own "online help" system.

## GridVis network analysis software

The UMG 509 can be programmed and read out using the GridVis network analysis software included in the scope of the delivery. For this, a PC must be connected to the UMG 509 via a serial interface (RS485/Ethernet).

## GridVis features

- Programming the UMG 509
- 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 UMG 509 to a PC via an interface converter:

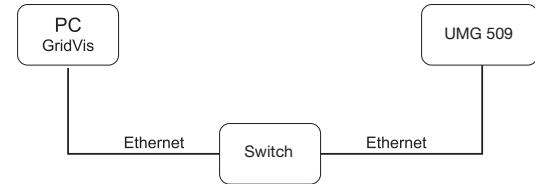
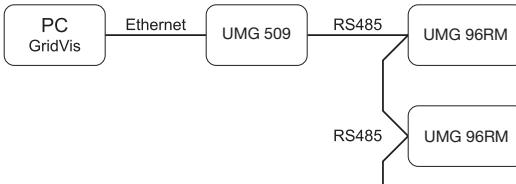


Direct connection of a UMG 509 to a PC via Ethernet.



Connection of a UMG 96RM via a UMG 509 as a gateway

Connection of a UMG 509 to a PC via Ethernet.



## Installation

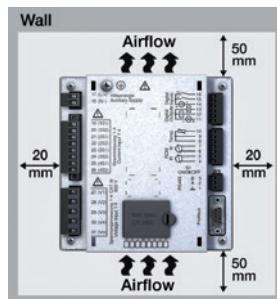
### Position of installation

The UMG 509 is suitable for integration into fixed and weatherproof switch panels. Conductive switch panels must be earthed.

### Mounting position

To ensure adequate ventilation, the UMG 509 must be installed vertically. There should be separation above and below of at least 50mm with 20mm space to the sides.

### Front panel section



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

*Fig. mounting  
position UMG 509  
(View from rear)*



Failure to meet the minimum clearances can destroy the UMG 509 at high ambient temperatures!

## Ethernet

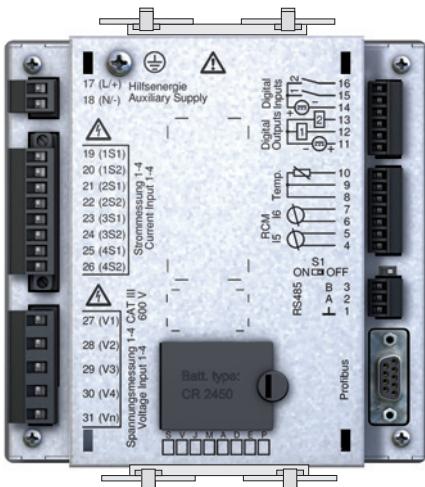
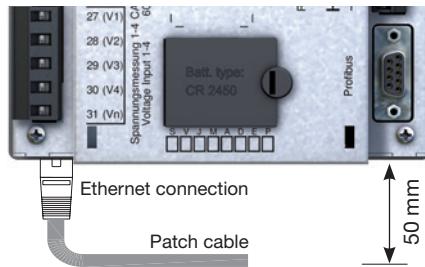
The Ethernet connection of the UMG 509 is on the bottom of the housing.

Depending on the bending radius of the Ethernet cable and connector type, you must install a connection area below the UMG 509.

The connection area below the UMG 509 should not be smaller than 50 mm.

## Mounting

The UMG 509 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 UMG 509.

### Supply voltage

The UMG 509 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.

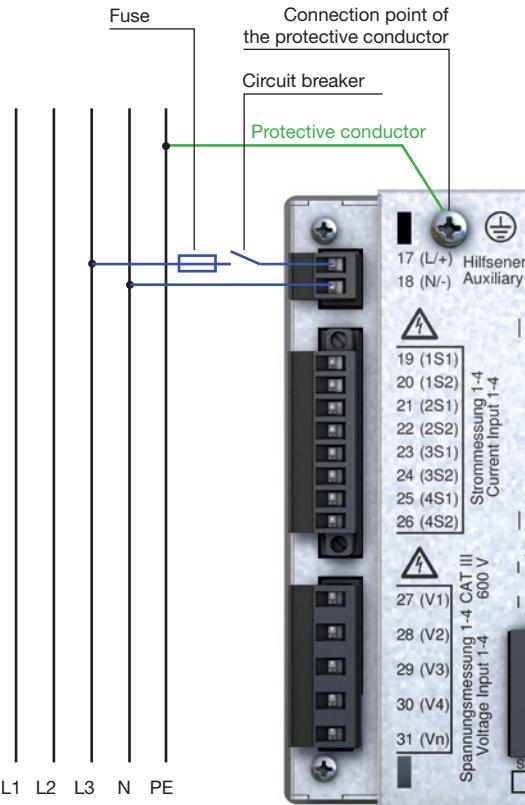
Before connecting the supply voltage, ensure that the voltage and frequency correspond to the details on the rating plate!

The supply voltage must be connected through a UL/IEC approved fuse.



#### Caution: Risk to life!

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



*Fig. connection example of the supply voltage to a UMG 509.*

**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 UMG 509.



- If installed in a building, a disconnector or circuit breaker must be provided for the supply voltage.
- The disconnector 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 UMG 509 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 UMG 509 is designed for the overvoltage category 600V CAT III (measurement voltage surge 6kV).

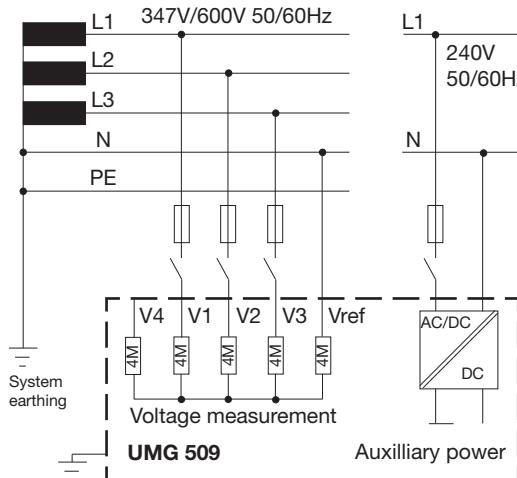


Fig. Schematic diagram, UMG 509 in a TN network.

### Three-phase 3-conductor systems

The UMG 509 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.

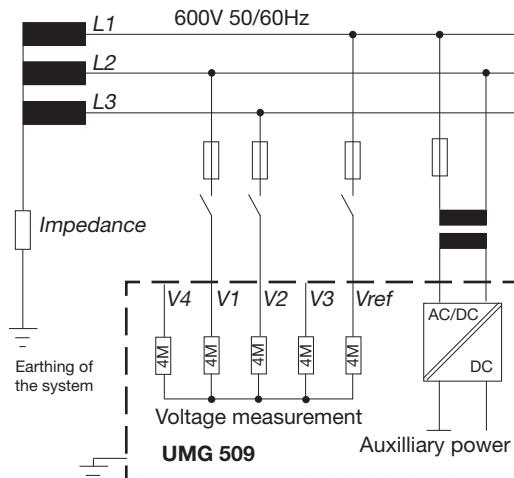


Fig. Schematic diagram, UMG 509 in an IT network without N.

**Rated voltages**

Lists of networks and their nominal network voltages in which the UMG 509 can be used.

**Three-phase 3-conductor systems, unearthinged.****Three-phase 4-conductor systems with earthed neutral conductor.**

$U_{L-N} / U_{L-L}$	$U_{L-L}$
66V / 115V	66V
120V / 208V	115V
127V / 220V	120V
220V / 380V	127V
230V / 400V	200V
240V / 415V	220V
260V / 440V	230V
277V / 480V	240V
347V / 600V	260V
400V / 690V	277V
417V / 720V	347V
	380V
	400V
	415V
	440V
	480V
	500V
	577V
	600V
	Maximum system rated voltage according to UL
	Maximum system rated voltage
	Maximum system rated voltage

Fig. Table for network rated voltages i.a.w. EN60664-1:2003 suitable for the voltage measurement inputs.

Fig. Table for network rated voltages i.a.w. EN60664-1:2003 suitable for the voltage measurement inputs.

## Voltage measurement inputs

The UMG 509 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 600V CATIII can occur.

### Frequency

The UMG 509 requires the mains frequency for the measurement and calculation of measured values. The UMG 509 is suitable for measurements in networks whose mains frequency is in the range 40Hz to 70Hz.



It is not necessary to configure a connection schematic for measurement inputs V4 and I4.



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

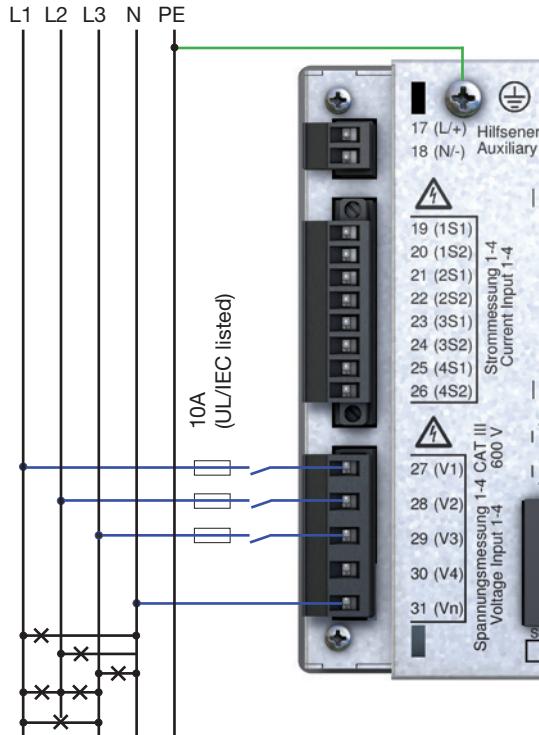


Fig. Example connection for measuring voltage.

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 UMG 509.
- The circuit breaker must be placed in the vicinity of the UMG 509, be marked for the user and easily accessible.
- Use a UL/IEC approved circuit breaker for the overcurrent protection and disconnector.
- 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 UMG 509 is not suitable for measuring DC voltages.



**Please note!**

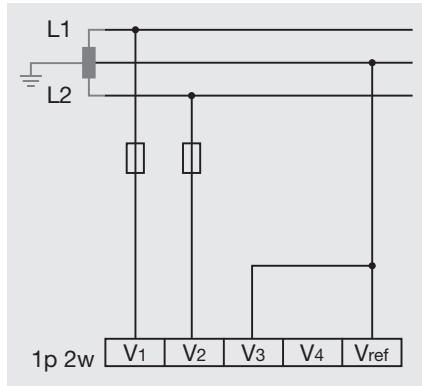
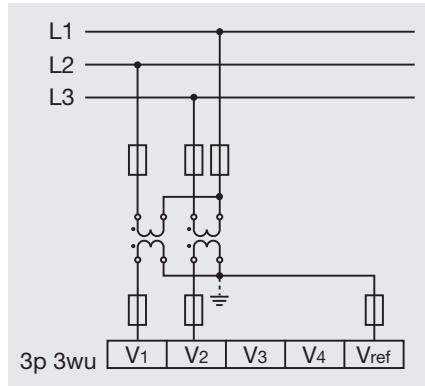
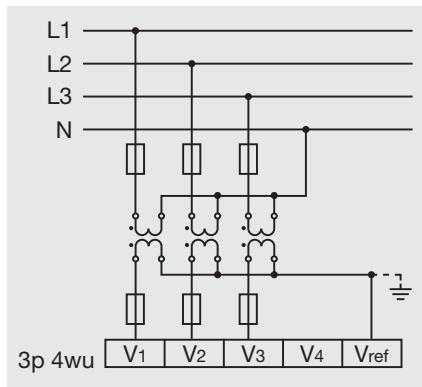
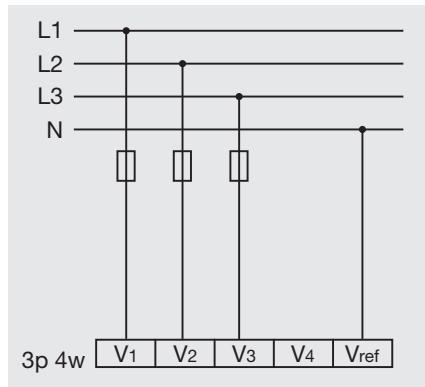
The voltage measurement inputs on the UMG 509 are dangerous if touched!

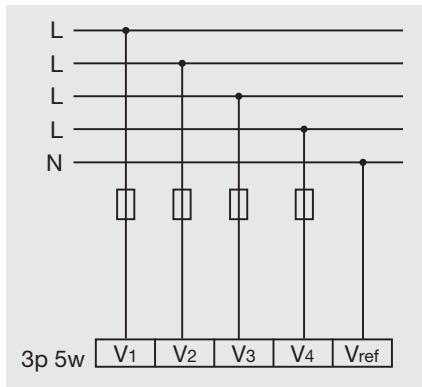
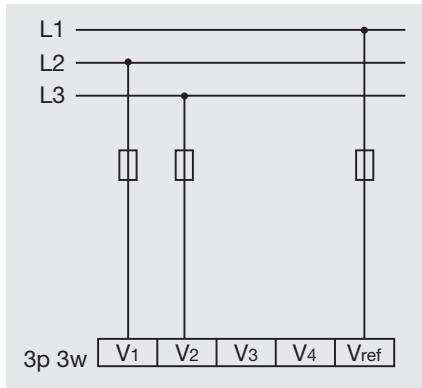


**Please note!**

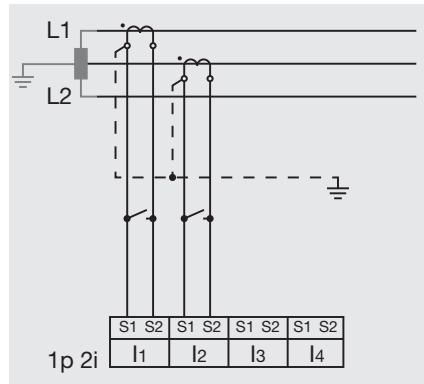
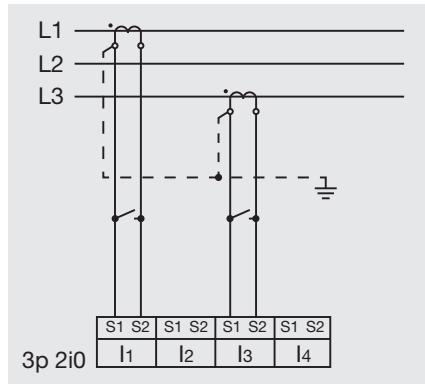
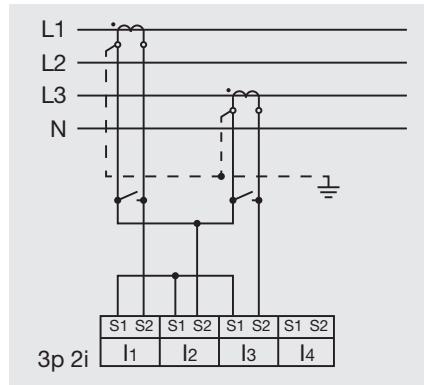
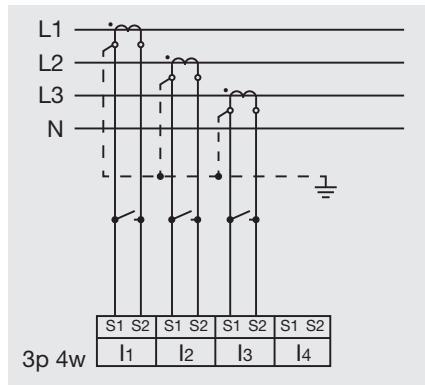
The voltage measurement inputs may not be used for voltage measurement in SELV circuits (safe extra low voltage).

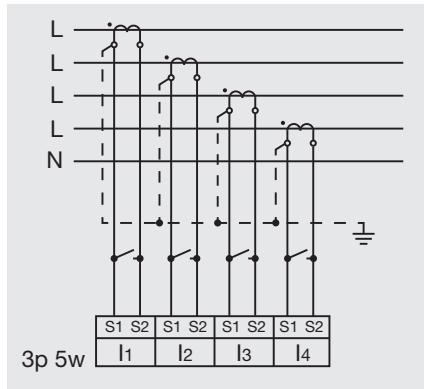
## Connection schematics, voltage measurement





## Connection schematics, current measurement





### Supporting measurement, input V4

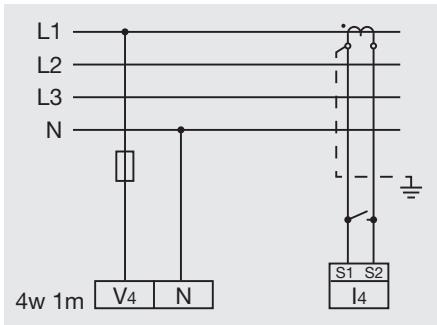


Fig. Measurement in a three-phase 4-conductor network with symmetric loading.

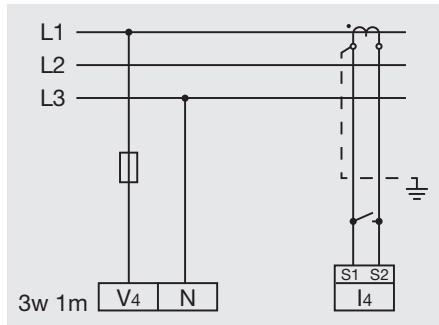


Fig. Measurement in a three-phase 3-conductor network with symmetric loading.

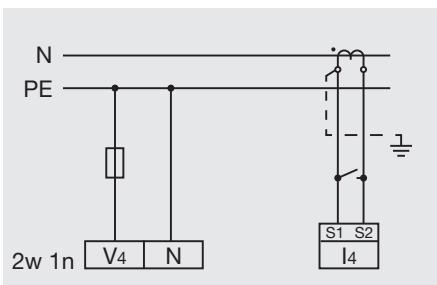


Fig. Measurement of the voltage between N and PE.  
Measurement of the current in the neutral conductor.



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.



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



## Current measurement

The UMG 509 is intended for the connection of current transformers with secondary currents of ..1A and ..5A. The factory default for the current transformer ratio is 5/5A 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 120A for 1 second.



### 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°C!

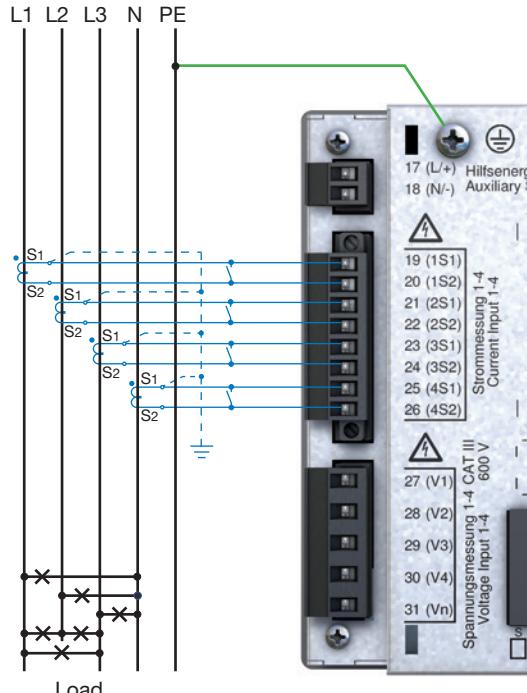


### Please note!

The UMG 509 is not suitable for measuring DC voltages.



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



*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.



### 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.



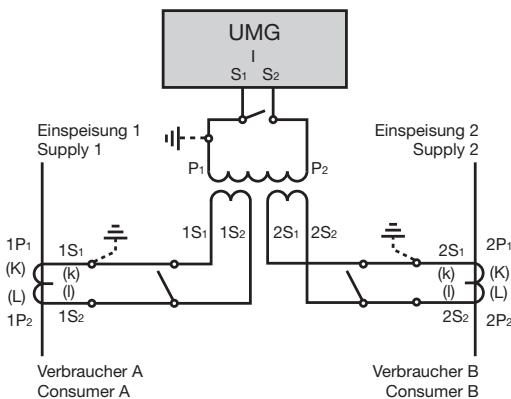
### Current transformer connections!

The secondary connection of the current transformer must be short circuited on this before the current feed to the UMG 509 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.

## 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 UMG 509.



*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.

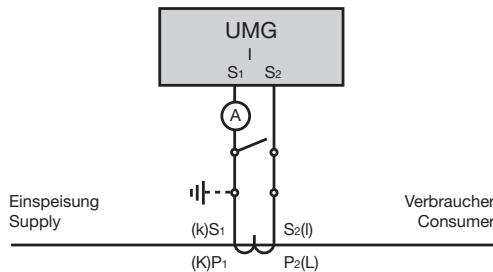
The UMG 509 must then be setup as follows:

Primary current: 1000A + 1000A = 2000A

Secondary current: 5A

## Ammeter

If you wish to measure the current not only with the UMG 509 but rather with an ammeter too, the ammeter must be connected to the UMG 509 in series.

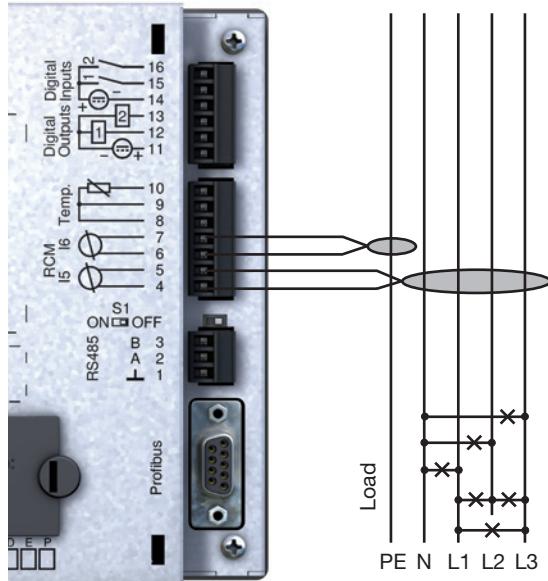


## Residual current measurement inputs (RCM)

The UMG 509 is suitable for use as a residual current monitoring device (RCM) as well as for monitoring AC, pulsing DC, and DC.

The UMG 509 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 GridVis 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!

**Failure monitoring**

The UMG 509 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.

*Example - temperature sensor:*

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

**Remedy:**

The temperature sensor must be equipped with reinforced or double insulation for 300V CAT III.

*Example - residual current transformer:*

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

## Connection example, residual current monitoring

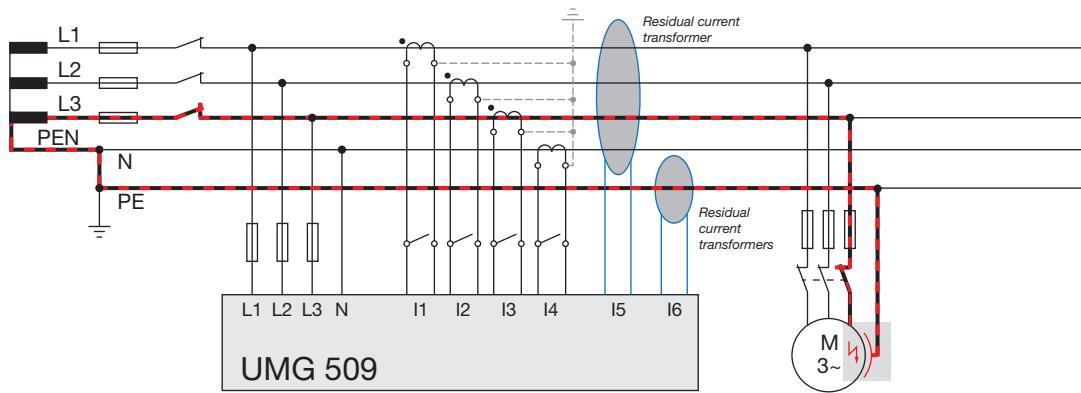
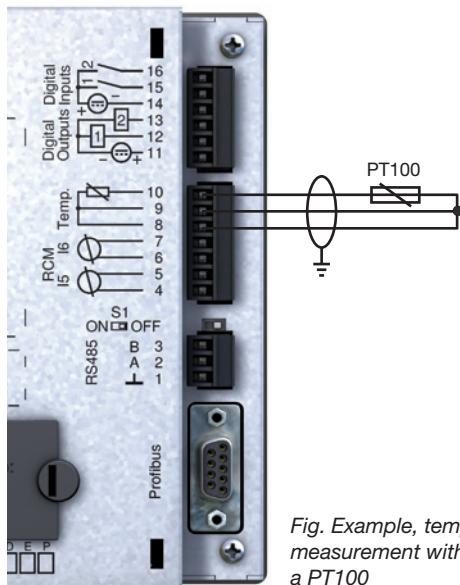
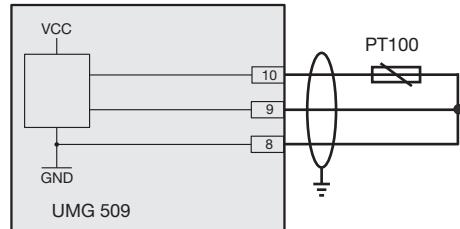


Fig. Example UMG 509 with residual current monitoring via measuring inputs I5/I6.

## Thermistor input

The UMG 509 has one thermistor input. The temperature is measured here via terminals 8 through 10.

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



*Fig. Example, temperature measurement with a PT100*



### Please note!

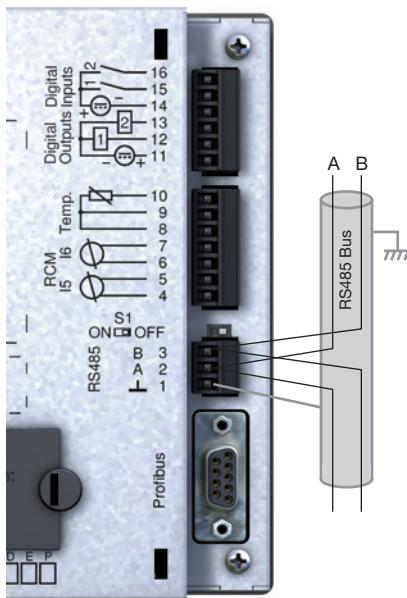
Profibus, RS485 and the thermistor input are not galvanically separated from each other.



Use a shielded cable to connect the temperature sensor.

## RS485 interface

In the UMG 509, the RS485 interface is designed as a 3-pin plug contact, which communicates via the Modbus RTU protocol.

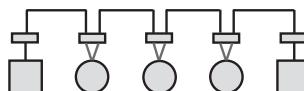


## Termination resistors

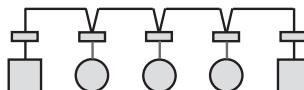
The cable is terminated with resistors (120Ohm, 1/4W) at the beginning and at the end of a segment.

Termination within the device is possible via the S1 DIP switch of the UMG 509.

### Correct



### Incorrect



— Terminal strip in the cabinet.

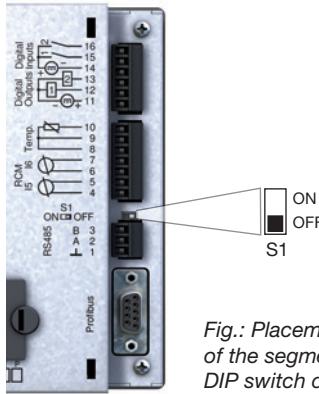
○ Device with RS485 interface.  
(without termination resistor)

■ Device with RS485 interface.  
(with termination resistor on the device)

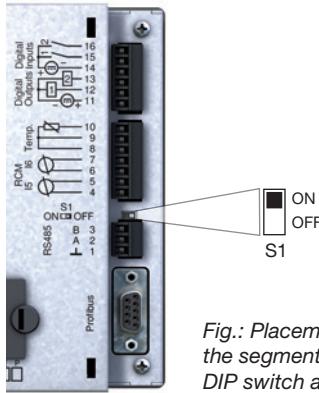
## Screening

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.



*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)*

## Cable type

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



If the bus line is laid in the switch cabinet, the screen must be connected to functional earth (PE).

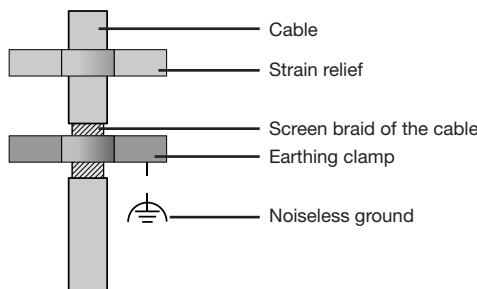
Recommended cable types:

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

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

## Maximum cable length

1200m at a baud rate of 38.4k.



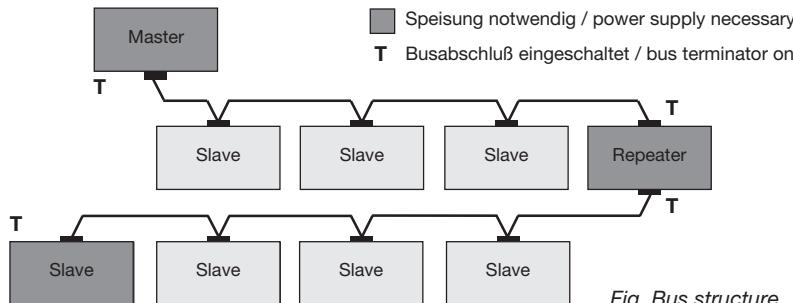
*Fig. Screening procedure at cabinet entry.*



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, 1/4W) 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 UMG 509 via a Profibus connector.

For the connection, we recommend a 9-pole Profibus connector, e.g. type "SUBCON-Plus-ProfiB/AX/SC" from Phoenix, item number 2744380. (Janitza item no: 13.10.539)

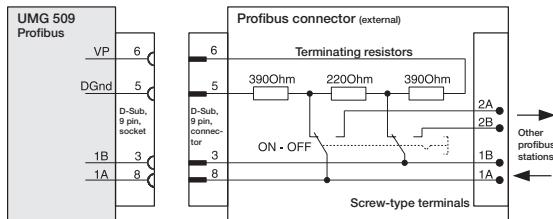


Fig. Profibus connector with termination resistors.



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

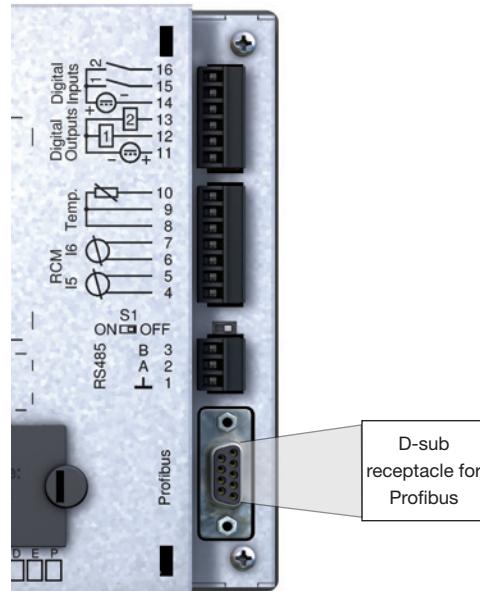


Fig. UMG 509 with D-sub receptacle for Profibus (View from rear).

## 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.

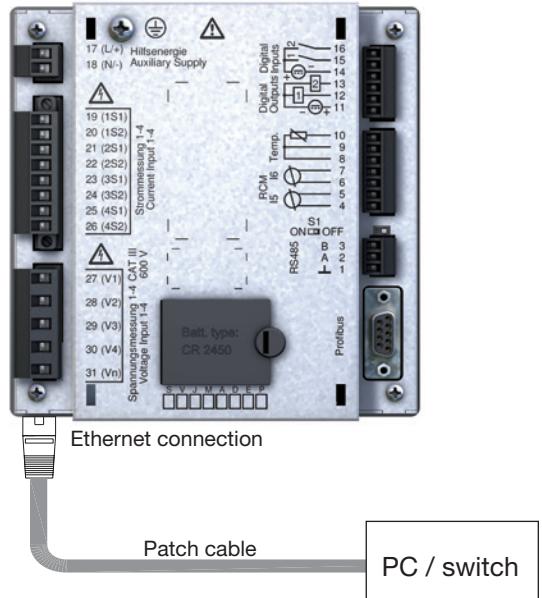
Transferspeeds in Kbit/s	Max. segment length
9.6, 19.2, 45.45, 93.75	1200m
187.5	1000m
500	400m
1500	200m
3000, 6000, 12000	100m

*Table Segment lengths per Profibus specification.*

## Ethernet interface

The Ethernet network settings should be specified by the network administrator and set on the UMG 509 accordingly.

If the network settings are not known, the UMG 509 may not be integrated into the network through the patch cable.



### Please note!

Connection of the UMG 509 to the Ethernet may only be carried out after consulting the network administrator!



### Please note!

The UMG 509 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 GridVis software.

## Digital outputs

The UMG 509 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 30m must be shielded when laid.
- An external auxilliary voltage is required.
- The digital outputs can be used as impulse outputs.

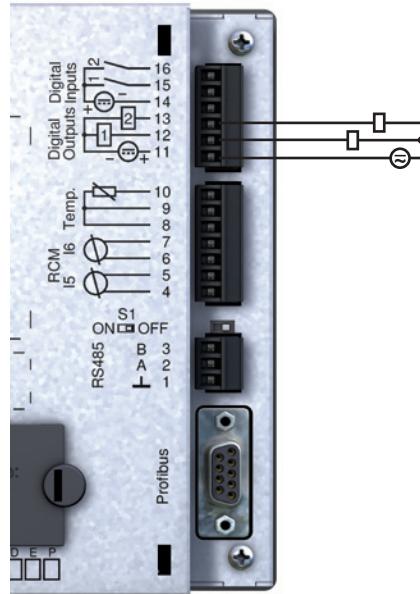
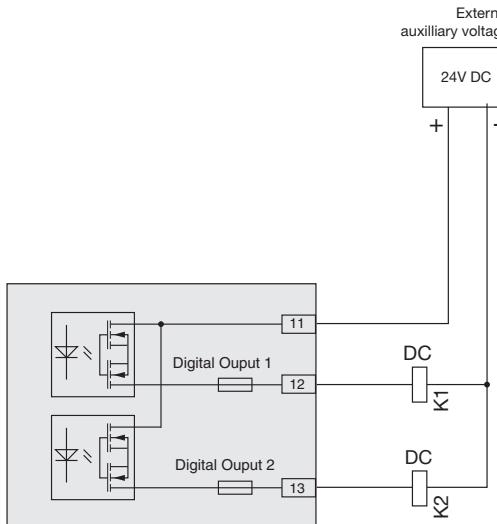


Fig. Connection of digital outputs



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



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



Functions for the digital outputs can be adjusted clearly in the GridVis software provided in the scope of delivery. A connection between the UMG 509 and the PC via an interface is required to use the GridVis software.



**Please note!**

Digital outputs are not short-circuit proof!

## Digital inputs

The UMG 509 has two digital inputs. An input signal is detected on a digital input if a voltage of at least 18V and maximum 28V DC (typically at 4mA) is applied. There is no input signal for a voltage of 0 to 5V and a current less than 0.5 mA.

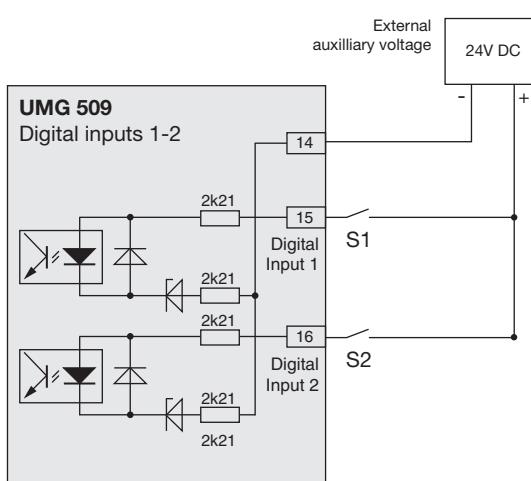


Fig. Example for the connection of external switch contacts S1 and S2 to digital inputs 1 and 2.

Wiring longer than 30m must be screened.

Note the correct polarity of the supply voltage!

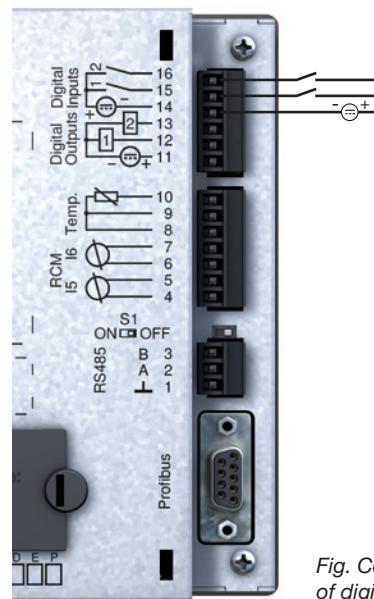


Fig. Connection of digital outputs

## S0 pulse input

You can connect an S0 pulse transducer per DIN EN62053-31 to any digital input.

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

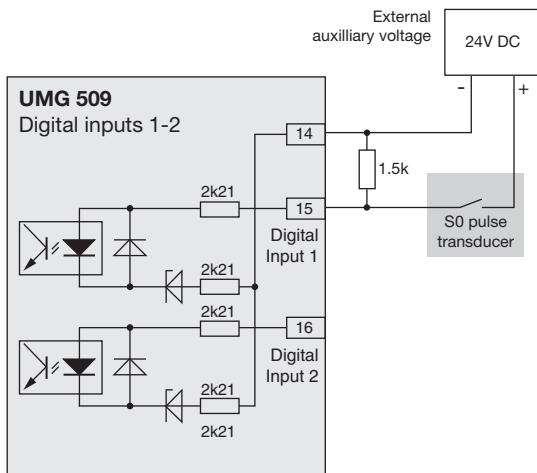


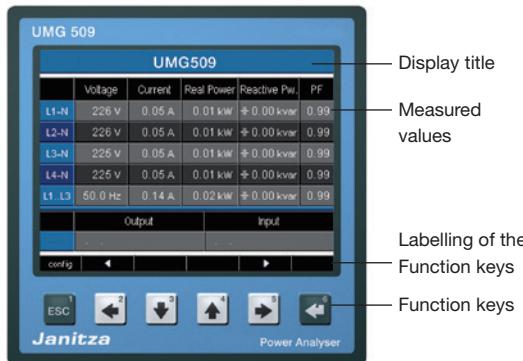
Fig. Example for the connection of an S0 pulse transducer to digital input 1

## Operation

The UMG 509 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
1 ESC	<ul style="list-style-type: none"> <li>• Returns to the first screen (home)</li> <li>• Exits selection menu</li> </ul>
2	<ul style="list-style-type: none"> <li>• Selects number</li> <li>• Selects main values (U, I, P ...)</li> </ul>
3	<ul style="list-style-type: none"> <li>• Changes (number -1)</li> <li>• By-values (select)</li> <li>• Selects menu item</li> </ul>
4	<ul style="list-style-type: none"> <li>• Changes (number +1)</li> <li>• By-values (select)</li> <li>• Selects menu item</li> </ul>
5	<ul style="list-style-type: none"> <li>• Selects number</li> <li>• Selects main values (U, I, P ...)</li> </ul>
6	<ul style="list-style-type: none"> <li>• Opens selection menu</li> <li>• Confirm selection</li> </ul>

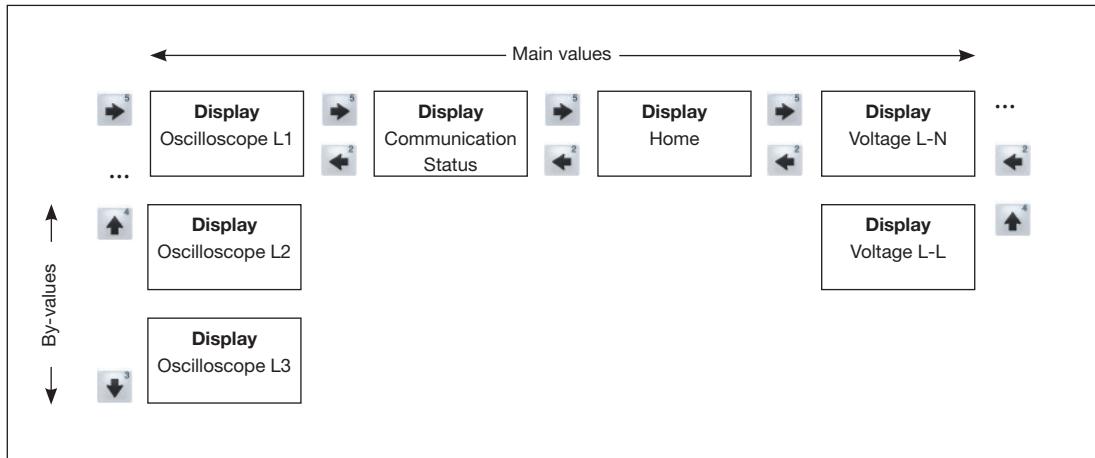
## Measured value display

### Main values

Using the 2 and 5 keys, you can scroll between the main values of the measured value displays (see page 120-123).

### By-values

Using the 3 and 4 keys, you can select the by-values of a measured value display (see page 120-123).



## "Home" measured value display

After the power returns, the UMG 509 starts with the "Home" measured value display.

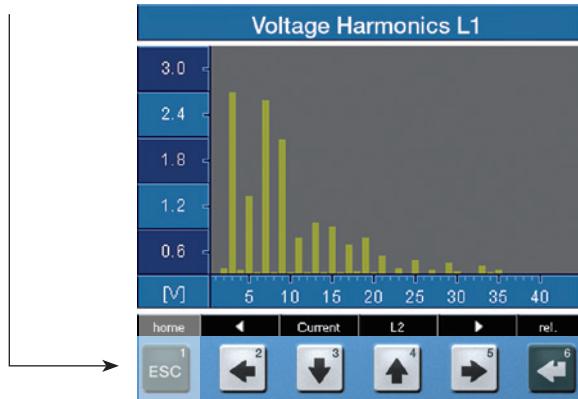
This measured value display contains the device names and an overview of important measured values. In its delivery condition, the unit name consists of the device type and the serial number of the device.

UMG509 - 51201480						
	Voltage	Current	Real Power	Reactive Pow.	PF	
L1-N	223 V	25.8 A	5.3 kW	+ 0.6 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	...	...	...	...	...	...

home

ESC

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



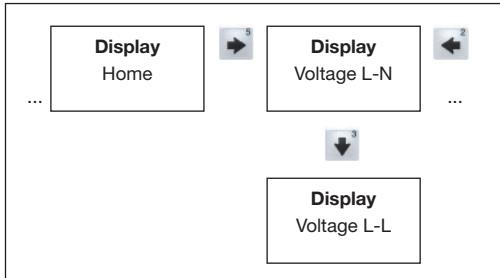
## Selecting a measured value display

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	

Below the table is a control panel with the following layout:

- Buttons: home, back, forward, select
- Function keys: 1 (ESC), 2 (left arrow), 3 (down arrow), 4 (up arrow), 5 (right arrow), 6 (left arrow)

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	

Below the table is a control panel with the following layout:

- Buttons: home, back, forward, 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	

home   ◀   L-L   ▶   select

1   2   3   4   5   6

ESC   ◀   ▼   ▲   ▶



Voltage L-N				
	Value	Min Value	Max Value	
L1-N	225.3 V	217.0 V	228.7 V	
L2-N	THD 2.3 %	Power Factor 1.00	17.1 V	233.9 V
	Frequency 50.00 Hz			
L3-N	225.2 V	216.9 V	233.8 V	
L4-N	225.2 V	216.9 V	233.8 V	

esc   ◀   ▼   ▲   ▶

## 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.

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

Voltage L-N				
	Value	Min Value	Max Value	
L1-N	225.1 V	223.4 V	225.9 V	
		06-04-2011 07:47:08		
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	

esc   ◀   ▼   ▲   ▶   reset



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

## 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.

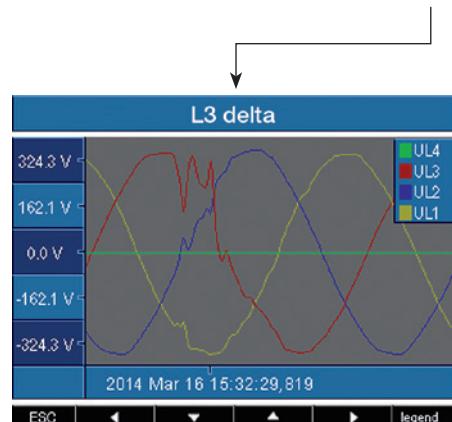
The time when transient voltages occur cannot be predicted and they have a limited duration.

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 15:32:29,788

esc ▾ ▲ enter

1 ESC 2 3 4 5 6 ←



## 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.

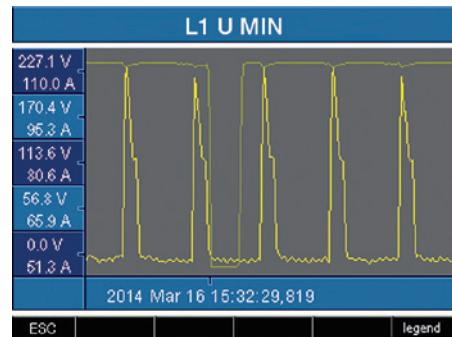
## Displaying events

- 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 15:32:29,960
L2	U MAX	2011 Mar 16 15:32:29,960
L3	U MAX	2011 Mar 16 15:32:29,960
L1	U MAX	2011 Mar 16 15:32:29,960
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



## Configuration

The supply voltage must be connected for the configuration of the UMG 509.

### Connecting the supply voltage

- The supply voltage level for the UMG 509 is specified on the rating plate.
- After connecting the supply voltage, a start display appears. Approximately ten seconds later, the UMG 509 switches to the first "Home" measured value display.
- If no display appears, check whether the applied supply voltage is within the rated voltage range.

UMG509 - 51201480					
	Voltage	Current	Real Power	Reactive Pow.	PF
L1-N	223 V	25.8 A	5.3 kW	+ 0.6 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



#### Please note!

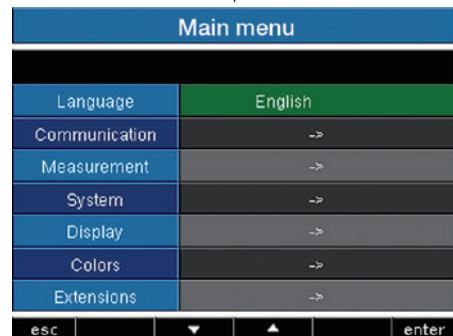
If the supply voltage does not correspond to the voltage indicated on the rating plate, this may lead to malfunctions and severe damage to the device.

## 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 UMG 509 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 UMG 509. Select this mode for straightforward networks without DHCP servers.
- BOOTP** - BootP enables the fully automatic integration of a UMG 509 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 UMG 509 automatically obtains the IP address, the network mask and the gateway from a DHCP server.

Factory default setting: **DHCP**



Connection of the UMG 509 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
1 ESC	2
3	4
5	6

↓

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 to 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)

### Device address

Setting range: 0 - 255

Factory default setting: 1

### Baud rate

Setting range: 9600, 19200, 38400, 57600,  
115200 (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
1 ESC	2 ↙ 3 ↘ 4 ↑ 5 ↓ 6 ↛

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	- >
Rated Freq.	50 Hz (fixed frequency)
Temperature	PT100
esc	▼ ▲ enter

Configure the following here:

- The measuring transducer for the current and voltage measurement
- Recording transients
- Recording events
- The mains frequency
- Temperature sensor

## 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 999999
Secondary	1 to 5

Factory default setting:

Primary	5
Secondary	5

Transformer L1		
	primary	secondary
Current Transf.	100A	5A
Voltage Transf.	400V	400V
Rated Current	5000A	
Rated Voltage	230V	
Apply to L2-L4	no	
Voltage con.	3 phase - 4 line, 3VT	
Current con.	3 phase - 4 line, 2CT	
esc		▼
		▲
		enter

### Rated current

The rated current defines the value to which

- Overcurrent
- Current transients
- Automatic scaling of graphics refer.

Setting range: 0 to 999999A



You can set the nominal value for the measurement of the K-factor and TDD only via the GridVis.

Transformer L1		
	primary	secondary
Current Transf.	100A	5A
Voltage Transf.	400V	400V
Rated Current	5000A	
Rated Voltage	230V	
Apply to L2-L4	no	
Voltage con.	3 phase - 4 line, 3VT	
Current con.	3 phase - 4 line, 2CT	
esc		▼
		▲
		enter

## Connection schematic, current measurement

The following connection schematics can be selected for the current measurement:

- 3p4w - 3 phases, 4 conductors, 3 current transformers
- 3p5w - 3 phases, 4 conductors, 4 current transformers  
The fourth current transformer can be used for the measurement in the neutral conductor for example.
- 3p2i - 3 phases, 4 conductors, 2 current transformers  
For networks with symmetrical loading.
- 3p2i0 - 3 phases, 3 conductors, 2 current transformers  
Aron circuit for networks without neutral conductor. The third current will be calculated
- 1p2i - 1 phase, 2 conductors, 2 current transformers

Factory default setting: 3p4w



It is not necessary to configure a connection schematic for measurement inputs V4 and I4.

Transformer L1		
	primary	secondary
Current Transf.	100A	5A
Voltage Transf.	400V	400V
Rated Current	5000A	
Rated Voltage	230V	
Apply to L2-L4	no	
Voltage con.	3 phase - 4 line, 3VT	
Current con.	3 phase - 4 line, 2CT	

Transformer L1		
	primary	secondary
Current Tra	L1	5A
Voltage Tra	L2	400V
Rated Cur	L3	
Rated Volt	N	
Apply to L		
Voltage co		
Current con.	I1 I2 I3 I4	3 phase - 4 line, 3CT

## Voltage transformer

You can assign voltage transformer ratios to the baseline measurement and the supporting measurement.

Select the 400 V / 400 V setting when measuring without a voltage transformer.

Setting range:

Primary	1 to 999,999 V
Secondary	1 to 999 V

Factory default setting:

Primary	400 V
Secondary	400 V

Transformer L1		
	primary	secondary
Current Transf.	100A	5A
Voltage Transf.	400V	400V
Rated Current	5000A	
Rated Voltage	230V	
Apply to L2-L4	no	
Voltage con.	3 phase - 4 line, 3VT	
Current con.	3 phase - 4 line, 2CT	
esc	▼	▲
		enter

## Rated voltage

The rated voltage defines the value to which

- Transients,
- Events and the
- Automatic scaling of graphics relate.

Setting range: 0 to 1,000,000 V

Factory default setting:

Nominal voltage	230 V
-----------------	-------

You can also select the primary voltage as the nominal voltage for example.

Transformer L1		
	primary	secondary
Current Transf.	100A	5A
Voltage Transf.	400V	400V
Rated Current	5000A	
Rated Voltage	230V	
Apply to L2-L4	no	
Voltage con.	3 phase - 4 line, 3VT	
Current con.	3 phase - 4 line, 2CT	
esc	▼	▲
		enter

## Connection schematic, voltage measurement

- 3p4w    - 3 phases, 4 conductors
- 3p4wu    - 3 phases, 4 conductors
- 3p3w    - 3 phases, 4 conductors  
For networks without neutral conductor with symmetrical loading.
- 3p3wu    - 3 phases, 3 conductors  
For networks without neutral conductor with symmetrical loading.
- 3p5w    - 3 phases, 4 conductors  
Measurement at an additional outlet.
- 1p2w    - 1 phase, 2 conductors (180°)

Factory default setting: 3p4w

Transformer L1		
	primary	secondary
Current Transf.	100A	5A
Voltage Transf.	400V	400V
Rated Current	5000A	
Rated Voltage	230V	
Apply to L2-L4	no	
Voltage con.	3 phase - 4 line, 3VT	
Current con.	3 phase - 4 line, 2CT	

Transformer L1				
L1	L2	L3	N	secondary
Current Tra				5A
Voltage Tra				400V
Rated Cur				
Rated Volt				
Apply to L2				
Voltage con.	3 phase - 4 line, 3VT			
Current con.	3 phase - 4 line, 2CT			



It is not necessary to configure a connection schematic for measurement inputs V4 and I4.

## Adopt L2-L4

The settings for voltage and current transformers as well as nominal current and voltage can be set for each phase. You can adopt these settings from phase L1 and apply them to phases L2, L3 and L4 with this function.

- **No** - The settings from phase L1 will not be applied to phases L1 to L4
- **Yes** - The settings from phase L1 will be applied to phases L1 to L4

Transformer L1		
	primary	secondary
Current Transf.	150A	5A
Voltage Transf.	400V	400V
Rated Current	5000A	
Rated Voltage	230V	
Apply to L2-L4	no	
Voltage con.	3 phase - 4 line, 3VT	
Current con.	3 phase - 4 line, 2CT	
esc	▼	▲
		enter

Transformer L1		
	primary	secondary
Current Transf.	150A	5A
Voltage Transf.	400V	400V
Rated Current	5000A	
Rated Voltage	230V	
Apply to L2-L4	yes	
Voltage con.	3 phase - 4 line, 3VT	
Current con.	3 phase - 4 line, 2CT	
esc	▼	▲
		enter

## 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 I5	inactive	
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 I5	inactive	
esc	▼	▲
		enter

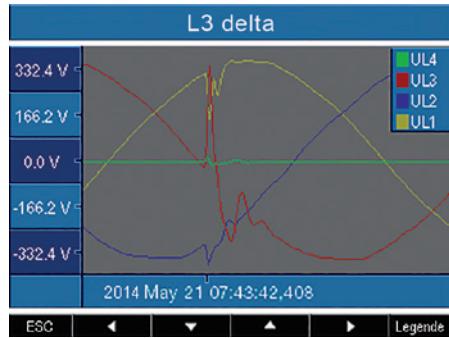
## Transients

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 UMG 509 detects transients that are longer than 50µs.
- The UMG 509 monitors the voltage measurement inputs for transients.
- The transient monitoring can be adjusted for each phase.
- 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 20V, 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 509 points.
- The GridVis event browser can display recorded transients.

Measurement	
Transients	
Phase L1	->
Phase L2	->
Phase L3	->
Phase L4	->
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 U".

Transients L1		
Voltage		
Mode (abs)	manually	
Peak U	150%	(487.9V)
Mode (delta)	manually	
Trns U	150%	(487.9V)
Apply to L2-L4	no	
esc	▼	▲
		enter

## 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 200ms effective value.
- **Manual** - The transient monitoring uses the configurable threshold values under "Trns U".

## Adopt L2-L4

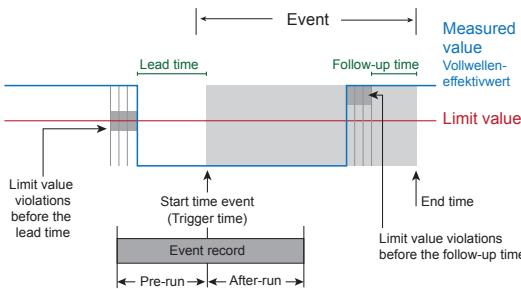
The transient monitoring can be adjusted for each phase. You can adopt these settings from phase L1 and apply them to phases L2, L3 and L4.

- **No** - The settings from phase L1 will not be applied to phases L2, L3 and L4
- **Yes** - The settings from phase L1 will be applied to phases L2, L3 and L4

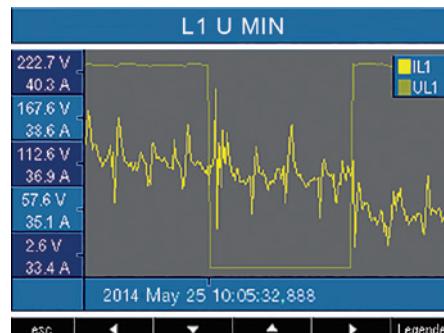
## Events

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

Here, threshold values are compared with the full-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.



- Monitoring of the threshold values can be switched off (Off/Manual).
- Threshold values must be set as a percentage of the nominal value.
- Threshold values can be set for excess voltage, undervoltage 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 full waves).
- Event records are configured with the GridVis and displayed with the event browser.



*Fig. Shows the full 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.

**Adopt L2-L4**

The monitoring of events can be adjusted for each phase. You can adopt these settings from phase L1 and apply them to phases L2, L3 and L4.

- **No** - The settings from phase L1 will not be applied to phases L2, L3 and L4
- **Yes** - The settings from phase L1 will be applied to phases L2, L3 and L4

Events L1		
Voltage		
Sag	85%	(195.5V)
Swell	110%	(253.0V)
Current		
Inrush	110%	(5500.0A)
Apply to L2-L4	no	
esc	▼	▲
		enter

**Lead time**

You can only set the lead time with GridVis.

Factory default setting: 0

**After-run**

You can only set the after-run with GridVis.

Factory default setting: 0

## Mains frequency

The UMG 509 requires the mains frequency for the measurement and calculation of measured values.

The UMG 509 is suitable for measurements in networks whose mains frequency is in the range 40Hz to 70Hz.

The mains frequency can be stipulated by the user or automatically determined by the device.

- **Auto** - Factory default setting. The mains frequency will be measured.
- **50Hz** - The mains frequency is fixed at 50Hz. The mains frequency will not be measured.
- **60Hz** - The mains frequency is fixed at 60Hz. The mains frequency will not be measured.

Measurement	
Transformer	->
Transients	->
Events	->
Rated Freq.	50 Hz (fixed frequency)
Temperature	PT100
esc	▼ ▲ enter

## Automatic frequency determination

For the UMG 509 to automatically determine the frequency, a voltage ( $V-V_{ref}$ ) greater than 10V<sub>eff</sub> must be applied to at least one of the voltage measurement inputs.

If there is no sufficiently high measured voltage available, the UMG 509 cannot determine the mains frequency and thus cannot perform any measurements.

## 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	->
Rated Freq.	50 Hz (fixed frequency)
Temperature	PT100
esc	
	▼
	▲
	enter

## System

Display of the device-specific system settings with:

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 GridVis.

## 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:  
1-999999 = 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 password

If you no longer remember your password, you can only delete it using the "GridVis" PC software.

In order to do so, connect the UMG 509 to the PC with a suitable interface. More information can be found in the GridVis assistant.

## Reset

### Clearing energy meters

You can clear all energy meters in the UMG 509 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 UMG 509 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).

- 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.



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!\*

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

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

## 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 UMG 509 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 UMG 509 is operated.

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

### Standby after

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

Setting range: 60 to 9999 sec.  
 Factory default setting: 900 sec.

### Brightness (standby)

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

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

## Screen Update

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

Setting range: fast (200ms), slow (1 sec.)

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.

## 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	[Yellow]	[Yellow]
L2	[Blue]	[Blue]
L3	[Red]	[Red]
L4	[Green]	[Green]

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).

### Activation

The UMG 509 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.

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

Extensions		
Activation		->
Jasic-state		->
esc	▼	▲
		enter

## Jasic status

Up to 7 customer-specific Jasic programs (1-7) and a recording can run in the UMG 509.

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 UMG 509 is specified on the rating plate.
- After connecting the supply voltage, a display appears. Approximately 15 seconds later, the UMG 509 switches to the first measured value display.
- If no display appears, check whether the power supply voltage is within the rated voltage range.

### Connecting the measured voltage

- Voltage measurements above the nominal mains voltages listed must be excluded by means of a voltage transformer!
- After connecting the measured voltages, the measured values displayed by the UMG 509 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.



#### 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 UMG 509 is only suitable for use in networks where overvoltages of overvoltage category 600V CATIII can occur.



#### Please note!

The UMG 509 is not suitable for measuring DC voltages.

## Frequency measurement

The UMG 509 requires the mains frequency for the measurement. The mains frequency can be defined by the user or automatically determined by the device.

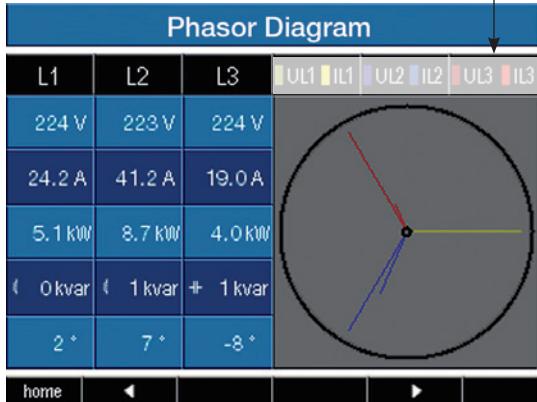
- For the UMG 509 to automatically determine the frequency, a voltage ( $V-V_{ref}$ ) greater than  $10V_{eff}$  must be applied to at least one of the voltage measurement inputs.
- The mains frequency must be in the range from 40Hz to 70Hz.
- If there is no sufficiently high measured voltage available, the UMG 509 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 UMG 509.

A “right” rotation field usually exists.

UL1-UL2-UL3 = right rotation field  
UL1-UL3-UL2 = left rotation field



*Presentation of the phase sequence according to the direction of the rotating field.*

## Applying the measuring-circuit voltage

The UMG 509 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 UMG 509 with the applied current.

Bearing in mind the current transformer conversion ratio, the current displayed by the UMG 509 must correspond with the input current.

The UMG 509 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.

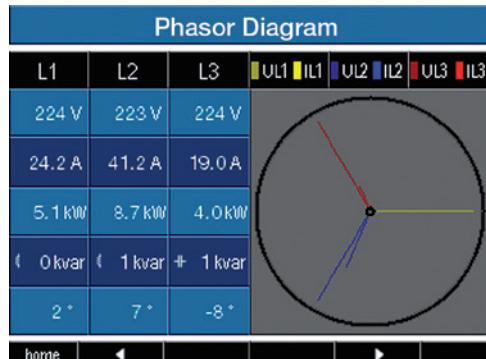
Phase shift angle sign prefix (U/I):

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

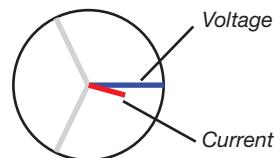


### Please note!

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

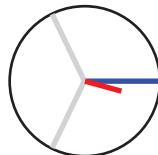


In the Phasor diagram, the voltages are displayed with long pointers and the currents with short pointers.



### Phasor diagram, example 1

Predominantly ohmic load.

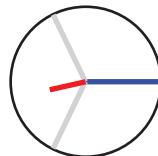


Voltage and current only have a minor deviation in the phase length.

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

### Phasor diagram, example 2

Predominantly ohmic load.



Voltage and current 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 I 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 30mA! Both residual current inputs can measure AC currents, pulsing direct currents and DC currents.



The UMG 509 requires the mains frequency for residual current monitoring. For this purpose, the measured voltage should be applied or a fixed frequency should be set.

Bearing in mind the current transformer ratio, the residual current displayed by the UMG 509 must correspond with the input current.



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

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

## Failure monitoring (RCM) for I5, I6

The UMG 509 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 18895 for the residual-current measurement input I5 and 18897 for I6.

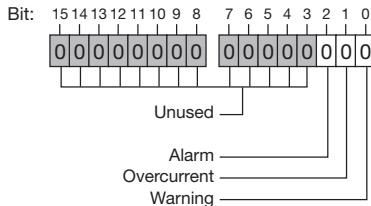
If there is an interruption in the connection to the current transformer, this state is recorded in certain registers or indicated in the GridVis software:

Modbus addr.	Value / Function (int32)
18895 (I5) 18897 (I6)	Failure monitoring for I5 / I6 0 = Deactivate monitoring 1 = Activate monitoring

Modbus addr.	Value / Function (short16)
18907 (I5) 18908 (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

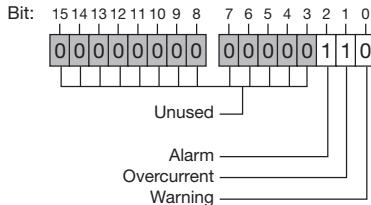
Using bit-by-bit coding inside the alarm register (addr. 19224 for I5, 19225 for I6), it is possible to read out different alarm statuses:



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.

### Example:

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



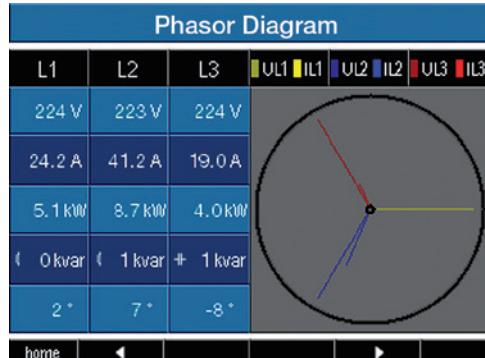
## Checking the power measurement

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

The UMG 509 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.



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

## Checking the communication

The UMG 509 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	6728	4
RS485	0 n	0 n	0 n
NTP	0	0	0
DHCP	642	966	0
DNS	0	0	0
EMail	-	0	0
Start Time	07-04-2014 15:19:48		

### 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):

$$\begin{array}{lcl} I & = & 7 \text{ Arms} \\ U_{L-N} & = & 600 \text{ Vrms} \end{array}$$

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

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

## RS485 interface

The MODBUS RTU protocol with CRC check on the RS485 interface can be used to access the data from the parameter and the measured value lists (see RS485 configuration).

Transmission parameters:

Data bits:	8
Parity:	None
Stop bits (UMG 509):	2
External stop bits:	1 or 2

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

### 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).



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



The message length must not exceed 256 bytes.

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 UMG 509 device address.

The Query Message appears as follows:

Name	Hex	Note
Device address	01	UMG 509, 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 UMG 509 can appear as follows:

Name	Hex	Note
Device address	01	UMG 509, 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 230V.

## Profibus

### Profibus profiles

A Profibus profile contains the data to be exchanged between a UMG and a PLC. Four Profibus profiles are preconfigured at the factory.

A Profibus profile can:

- retrieve measured values from the UMG,
- set the digital outputs in the UMG,
- query the status of the digital inputs in the UMG.

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 UMG.
- Using GridVis, 16 Profibus profiles (profile numbers 0..15) can be edited.
- Additional Profibus profiles (profile numbers 16..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 UMG 509. The GSD file is required by the configuration program of the PLC.

The device master file for the UMG 509 has the file name "U5090F15.GSD" and is included on the data carrier as part of the scope of the delivery.

### Variable definition

All system variables and global variables<sup>1)</sup> 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.

<sup>1)</sup> Global variables are variables that are defined by the user in Jasic and are available to each interface in the UMG 509.

## Example

### Using Profibus to retrieve measured values

At least one Profibus profile must be set up with GridVis software and transferred to the UMG 509.

A Jasic program is not required.

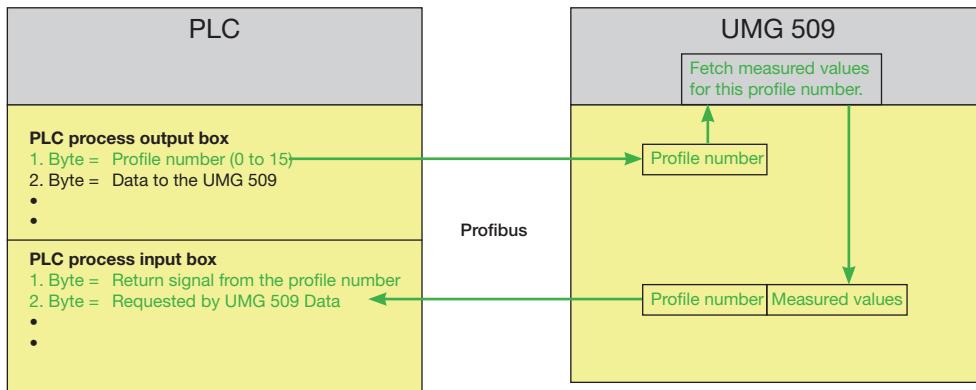


Fig. Block diagram for data exchange between PLC and UMG 509.

## Factory pre-configured profiles

### Profibus profile number 0

Byte index	Value type	Value format	Scaling
1	Voltage L1-N	Float	1
2	Voltage L2-N	Float	1
3	Voltage L3-N	Float	1
4	Voltage L4-N	Float	1
5	Voltage L2-L1	Float	1
6	Voltage L3-L2	Float	1
7	Voltage L1-L3	Float	1
8	Current L1	Float	1
9	Current L2	Float	1
10	Current L3	Float	1
11	Current L4	Float	1
12	Effective power L1	Float	1
13	Effective power L2	Float	1
14	Effective power L3	Float	1
15	Effective power L4	Float	1
16	Cos phi (math.) L1	Float	1
17	Cos phi (math.) L2	Float	1
18	Cos phi (math.) L3	Float	1
19	Cos phi (math.) L4	Float	1
20	Frequency	Float	1
21	Effective power sum L1-L4	Float	1
22	Reactive power sum L1-L4	Float	1
23	Apparent power sum L1-L4	Float	1
24	Cos phi (math.) sum L1-L4	Float	1
25	Effective current sum L1-L4	Float	1
26	Active energy sum L1-L4	Float	1
27	Ind. Reactive energy sum L1-L4	Float	1
28	THD voltage L1	Float	1
29	THD voltage L2	Float	1
30	THD voltage L3	Float	1

### Profibus profile number 1

Byte index	Value type	Value format	Scaling
1	Voltage L1-N	Float	1
2	Voltage L2-N	Float	1
3	Voltage L3-N	Float	1
4	Voltage L2-L1	Float	1
5	Voltage L3-L2	Float	1
6	Voltage L1-L3	Float	1
7	Current L1	Float	1
8	Current L2	Float	1
9	Current L3	Float	1
10	Effective power L1	Float	1
11	Effective power L2	Float	1
12	Effective power L3	Float	1
13	Cos phi (math.) L1	Float	1
14	Cos phi (math.) L2	Float	1
15	Cos phi (math.) L3	Float	1
16	Frequency	Float	1
17	Effective power sum L1-L3	Float	1
18	Reactive power sum L1-L3	Float	1
19	Apparent power sum L1-L3	Float	1
20	Cos phi (math.) sum L1-L3	Float	1
21	Effective current sum L1-L3	Float	1
22	Active energy sum L1-L3	Float	1
23	Ind. Reactive energy sum L1-L3	Float	1
24	THD voltage L1	Float	1
25	THD voltage L2	Float	1
26	THD voltage L3	Float	1
27	THD current L1	Float	1
28	THD current L2	Float	1
29	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

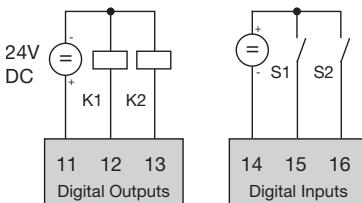
**Profibus profile number 3**

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

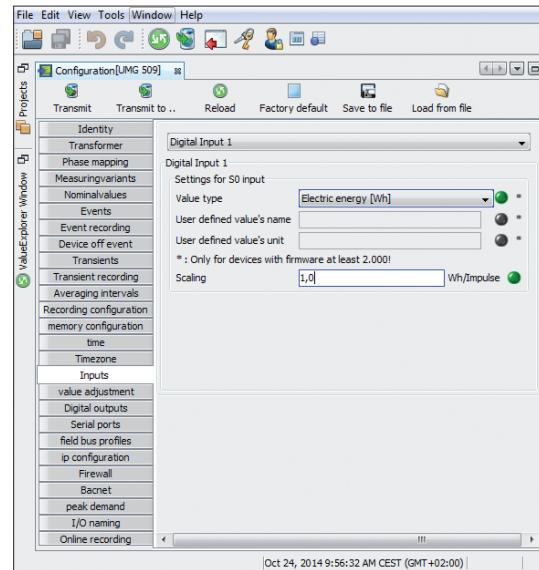
## Digital in-/outputs

The UMG 509 has two digital outputs and two digital inputs. The inputs and outputs can be configured using the GridVis software (included in the scope of delivery).

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



*Fig.: Digital inputs and outputs*



*Fig.: GridVis 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 GridVis software to use a digital output as a pulse out.

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

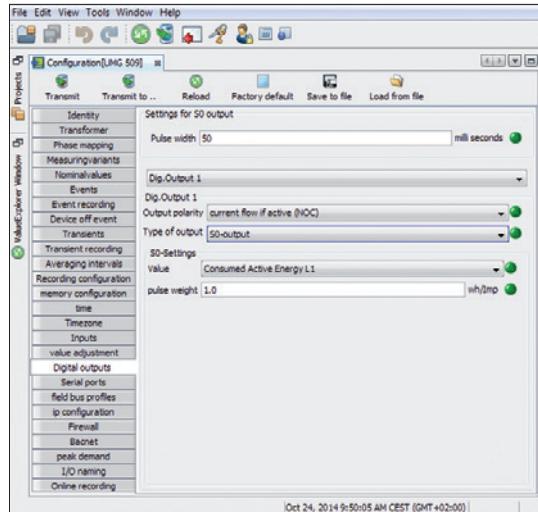


Fig.: GridVis software, configuration menu

## Pulse length

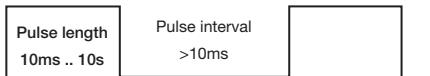
The pulse length applies to both pulse outputs and is set using the GridVis software.

The typical pulse length of S0 pulse is 30ms.

## 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.



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	3600 pulses/h
1 s	1 s	1800 pulses/h
10 s	10 s	180 pulses/h

Examples of the maximum possible number of pulses per hour.



### Pulse interval

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



### Measured value selection

When programming with GridVis 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.

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



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



Since the reactive power meter operates with a backstop, 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 UMG 509 generates a maximum number of 60,000 pulses (see Table "maximum number of pulses" per hour).

Determining the maximum connected load

Example:

<i>Current transformer</i>	= 150/5A
<i>Voltage L-N</i>	= max. 300 V
<i>Power per phase</i>	= $150 \text{ A} \times 300 \text{ V}$
	= 45 kW
<i>Power at 3 phases</i>	= $45 \text{ kW} \times 3$
<i>Max. connected load</i>	= 135kW

Calculating the pulse value

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

$$\begin{aligned}\text{Pulse value} &= 135\text{kW} / 60,000 \text{ Imp/h} \\ \text{Pulse value} &= 0.00225 \text{ pulse/kWh} \\ \text{Pulse value} &= 2.25 \text{ pulses/Wh}\end{aligned}$$

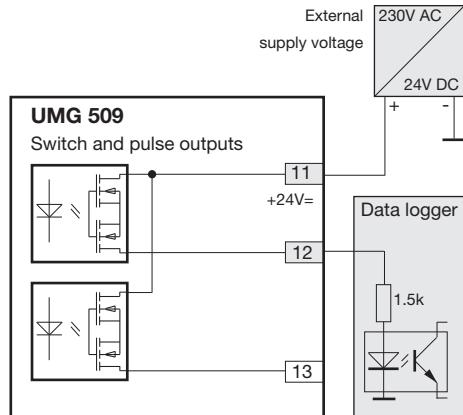


Fig.: Connection example for the circuit as pulse output.



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 UMG 509 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 GridVis software.

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

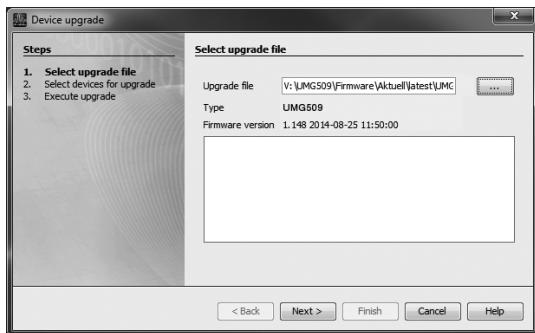


Fig. GridVis firmware update assistant



**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 / 3V) can be replaced by the user.

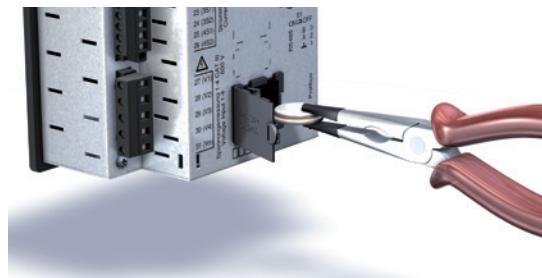


Fig. Replacing the battery using long-nose pliers

## 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.
	Measurement in the wrong phase.	Check connection and correct if necessary.
Voltage displayed is too large or too small.	Voltage transformer incorrectly programmed.	Read out and program the voltage transformer ratio at the voltage transformer.
	Measurement range exceeded.	Use voltage transformers.
Voltage displayed is too small.	The peak voltage value at the measurement input has been exceeded by the harmonics.	<b>Please note!</b> Ensure the measurement inputs are not overloaded.
	A current path is assigned to the wrong voltage circuit.	Check connection and correct if necessary.
	At least one current transformer connection is mixed up/reversed.	Check connection and correct if necessary.
Phase shift ind/cap.	A current path is assigned to the wrong voltage circuit.	Check connection and correct if necessary.

Possible fault	Cause	Remedy
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.
	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

<b>General</b>	
Net weight (with attached connectors)	approx. 1080g
Device dimensions	Approx. l = 144mm, w = 144mm, h = 75mm
Battery	Type Li-Mn CR2450, 3V (approval i.a.w. UL 1642)
Clock (in temperature range -40°C to 85°C)	+5ppm (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	1m
Temperature	-25°C to +70°C

### Ambient conditions during operation

The UMG 509 is intended for weather-protected, stationary use.

The UMG 509 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 .. +55°C
Relative humidity	5 to 95% RH (at 25°C without condensation)
Operating altitude	0 to 2000m 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 - Rear side	IP40 in acc. with EN60529 IP20 in acc. with EN60529

<b>Supply voltage</b>	
Installations of overvoltage category	300V CAT III
Protection of the supply voltage (fuse)	6A Char. B (approved i.a.w. UL/IEC)
230V option:	<ul style="list-style-type: none"> <li>- Nominal range</li> <li>- Operating range</li> <li>- Power consumption</li> </ul>
	95V .. 240V (50/60 Hz) or DC 80V .. 300V +-10% of nominal range max. 7W / 14VA
24V option:	<ul style="list-style-type: none"> <li>- Nominal range</li> <li>- Operating range</li> <li>- Power consumption</li> </ul>
	48V .. 110V (50/60 Hz) oder DC 24V .. 150V +-10% vom Nennbereich max. 9W / 13VA

<b>Terminal connection capacity (supply voltage)</b>	
Connectable conductors. Only one conductor can be connected per terminal!	
Single core, multi-core, fine-stranded	0.2 - 2.5mm <sup>2</sup> , AWG 24 - 12
Terminal pins, core end sheath	0.25 - 2.5mm <sup>2</sup>
Tightening torque	0.5 - 0.6Nm
Stripping length	7mm

<b>Current measurement</b>	
Rated current	5A
Resolution	0.1mA
Metering range	0.001 to 7 Arms
Measurement range exceeded (overload)	From 7 Arms
Crest factor	2.4
Overvoltage category	230V option: 300V CAT III      24V option: 300V CAT II
Measurement surge voltage	4kV
Power consumption	approx. 0.2 VA (R <sub>i</sub> =5mOhm)
Overload for 1 sec.	120A (sinusoidal)
Sampling rate	20kHz / phase

<b>Voltage measurement</b>	
The voltage measurement inputs are suitable for measurements in the following power supply systems:	
Three-phase 4-conductor systems with rated voltages up to	417V/720V 347V/600V UL listed
Three-phase 3-conductor systems with rated voltages up to	600V
From a safety and reliability perspective, the voltage measurement inputs are designed as follows:	
Overvoltage category	600V CAT III
Measurement surge voltage	6kV
Fuse protection for voltage measurement	1-10 A
Metering range L-N	0 <sup>0</sup> ) to 600Vrms
Metering range L-L	0 <sup>0</sup> ) to 1000Vrms
Resolution	0.01V
Crest factor	1.6 (related to 600Vrms)
Impedance	4MΩ/phase
Power consumption	approx. 0.1VA
Sampling rate	20kHz / phase
Transients	> 50µs
Frequency range of the fundamental oscillation	40Hz to 70Hz
- Resolution	0.001Hz

- <sup>0</sup>) The UMG 509 can only determine measured values, if at least a voltage L-N greater than 10Veff or a voltage L-L of greater than 18Veff is present at one voltage measurement input.

<b>Terminal connection capacity (voltage and current measurement)</b>	
Connectable conductors. Only one conductor can be connected per terminal!	
Single core, multi-core, fine-stranded	0.2 - 2.5mm <sup>2</sup> , AWG 24-12
Terminal pins, core end sheath	0.25 - 2.5mm <sup>2</sup>
Tightening torque	0.5 - 0.6Nm
Stripping length	7mm

<b>Residual current monitoring (RCM)</b>	
Rated current	30mA rms
Metering range	0 to 40mA rms
Triggering current	100µA
Resolution	1µA
Crest factor	1.414 (related to 40mA)
Burden	4 Ohm
Overload for 1 sec.	5A
Sustained overload	1A
Overload for 20 ms	50A
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 - 1.5mm <sup>2</sup> , AWG 28-16
Flexible with core end sheath without plastic sleeve	0.20 - 1.5mm <sup>2</sup>
Flexible with core end sheath with plastic sleeve	0.20 - 1.5mm <sup>2</sup>
Stripping length	7mm
Tightening torque	0.20 - 0.25Nm
Cable length	up to 30m unshielded, from 30m shielded

#### **Potential separation and electrical safety**

- The RCM measurement inputs are double-insulated from the current and voltage measurement inputs as well as the supply voltage.
- There is no insulation from the thermistor input.
- There is only a functional insulation from the Ethernet, Profibus and RS485 interfaces and the digital I/Os.
- The residual current transformer connected and the lines to be measured must each have at least one additional or a basic insulation per IEC61010-1:2010 for the mains voltage present.

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

Sensor type	Temperature range	Resistor range	Measurement uncertainty
KTY83	-55°C to +175°C	500Ohm to 2.6kOhm	± 1.5% rng
KTY84	-40°C to +300°C	350Ohm to 2.6kOhm	± 1.5% rng
PT100	-99°C to +500°C	60Ohm to 180Ohm	± 1.5% rng
PT1000	-99°C to +500°C	600Ohm to 1.8kOhm	± 1.5% rng

<b>Terminal connection capacity (thermistor input)</b>	
Connectable conductors. Only one conductor can be connected per terminal!	
Single core, multi-core, fine-stranded	0.08 - 1.5mm <sup>2</sup>
Terminal pins, core end sheath	1mm <sup>2</sup>
<b>Potential separation and electrical safety</b>	
<ul style="list-style-type: none"> <li>- The thermistor input is double-insulated from the current and voltage measurement inputs as well as the supply voltage.</li> <li>- There is no insulation from the RCM measurement input.</li> <li>- There is only a functional insulation from the Ethernet, Profibus and RS485 interfaces and the digital I/Os.</li> <li>- The external temperature sensor must be double insulated from the system parts that carry voltages that are dangerous to the touch (per IEC61010-1:2010).</li> </ul>	

<b>Digital inputs</b> 2 Digital inputs with a joint earth	
Maximum counter frequency	20Hz
Response time (Jasic program)	200ms
Input signal present	18V to 28V DC (typical 4mA)
Input signal not present	0 to 5V DC, current less than 0.5mA
Cable length	up to 30m unshielded, from 30m shielded
<b>Digital outputs</b> 2 Digital outputs with a joint earth; semiconductor relay, not short-circuit proof	
Supply voltage	20V - 30V DC (SELV or PELV supply)
Switching voltage	max. 60V DC, 30V AC
Switching current	max. 50mAeff AC/DC
Response time (Jasic program)	200ms
Output of voltage dips	20ms
Output of voltage exceedance events	20ms
Pulse output (energy pulse)	max. 20Hz
Cable length	up to 30m unshielded, from 30m shielded
<b>Terminal connection capacity (digital inputs and outputs)</b>	
Rigid/flexible	0.14 - 1.5mm <sup>2</sup> , AWG 28-16
Flexible with core end sheath without plastic sleeve	0.25 - 1.5mm <sup>2</sup>
Flexible with core end sheath with plastic sleeve	0.25 - 0.5mm <sup>2</sup>
Tightening torque	0.22 - 0.25Nm
Stripping length	7mm
<b>Potential separation and electrical safety</b>	
<ul style="list-style-type: none"> <li>- The digital inputs and outputs are double-insulated from the current and voltage measurement inputs as well as the supply voltage.</li> <li>- There is only a functional insulation from the Ethernet, Profibus and RS485 interfaces and the digital I/Os, and from one another.</li> <li>- The external auxiliary voltage to be connected must be compliant with SELV or PELV.</li> </ul>	

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

<b>Profibus interface</b>	
Connection	SUB D 9-pole
Protocol	Profibus DP/V0 as per EN 50170
Transmission rate	9.6k baud to 12 MBaud

<b>Ethernet interface</b>	
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

<b>Potential separation and electrical safety for the interfaces</b>	
- The Ethernet, Profibus and RS485 interfaces are double-insulated from the current and voltage measurement inputs as well as the supply voltage.	

- There is only a functional insulation from the RCM measurement inputs and thermistor inputs as well as from the digital I/Os, and from one another.

- The interfaces of the externally connected equipment must have double or reinforced insulation against mains voltages (acc. to IEC 61010-1:2010).

**Function parameters**

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

<b>Function</b>	<b>Symbol</b>	<b>Precision class</b>	<b>Metering range</b>	<b>Display range</b>
Total effective power	P	0.2 <sup>5)</sup> (IEC61557-12)	0 to 15.3kW	0 W to 9999 GW *
Total reactive power	QA <sup>6)</sup> , Qv <sup>6)</sup>	1 (IEC61557-12)	0 to 15.3 kvar	0 varh .. 9999 Gvar *
Total apparent power	SA, Sv <sup>6)</sup>	0.2 <sup>5)</sup> (IEC61557-12)	0 to 15.3 kVA	0 VA to 9999 GVA *
Total effective energy	Ea	0.2S <sup>5)7)</sup> (IEC61557-12)	0 to 15.3 kWh	0 Wh to 9999 GWh *
Total reactive energy	ErA <sup>6)</sup> , ErV <sup>6)</sup>	1 (IEC61557-12)	0 to 15.3 kvarh	0 varh .. 9999 Gvarh *
Total apparent energy	EapA,EapV <sup>6)</sup>	0.2 <sup>5)</sup> (IEC61557-12)	0 to 15.3 kVAh	0 VAh to 9999 GVAh *
Frequency	f	0.05 (IEC61557-12)	40 to 70 Hz	40 Hz to 70 Hz
Phase current	I	0.2 (IEC61557-12)	0.001 to 7 Arms	0 A to 9999 kA
Measured neutral conductor current	IN	0.2 (IEC61557-12)	0.001 to 7 Arms	0 A to 9999 kA
Residual currents I5, I6	IDIFF	1 (IEC61557-12)	0 to 40 mAmps	0 A to 9999 kA
Computed neutral conductor current	INc	0.5 (IEC61557-12)	0.001 to 22.2 A	0 A to 9999 kA
Voltage	U L-N	0.1 (IEC61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage	U L-L	0.1 (IEC61557-12)	18 to 1000 Vrms	0 V to 9999 kV
Power factor	PFA, PFV	0.5 (IEC61557-12)	0.00 to 1.00	0 to 1
Short-term flicker, long-term flicker	Pst, Plt	- -	-	-
Voltage drops	Udip	0.2 (IEC61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage increases	Uswi	0.2 (IEC61557-12)	10 to 600 Vrms	0 V to 9999 kV
Transient overvoltages	Utr	0.2 (IEC61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage interruptions	Uint	- -	-	-
Voltage unbalance <sup>1)</sup>	Unba	0.2 (IEC61557-12)	10 to 600 Vrms	0 V to 9999 kV
Voltage unbalance <sup>2)</sup>	Unb	0.2 (IEC61557-12)	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 <sup>3)</sup>	THDu	1.0 (IEC61557-12)	up to 2.5 kHz	0% to 999 %
THD of the voltage <sup>4)</sup>	THD-Ru	1.0 (IEC61557-12)	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 <sup>3)</sup>	THDi	1.0 (IEC61557-12)	up to 2.5 kHz	0% to 999 %
THD of the current <sup>4)</sup>	THD-Ri	1.0 (IEC61557-12)	up to 2.5 kHz	0% to 999 %
Mains signal voltage (interharmonics voltage)	MSV	- -	-	-

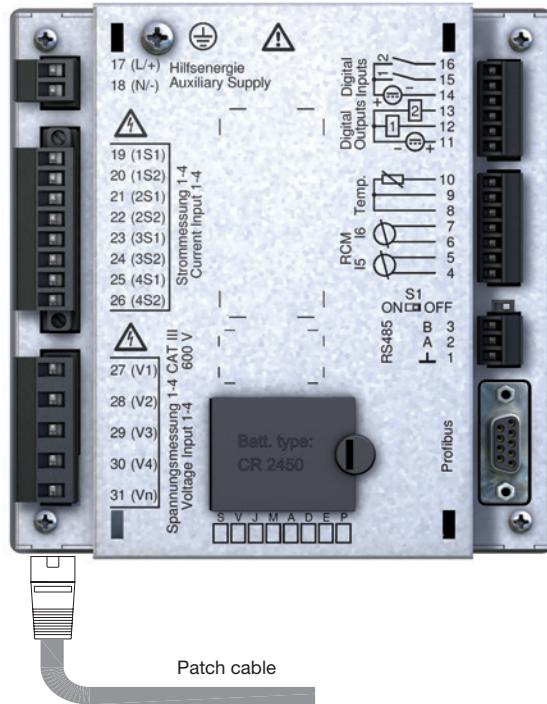
#### Declarations

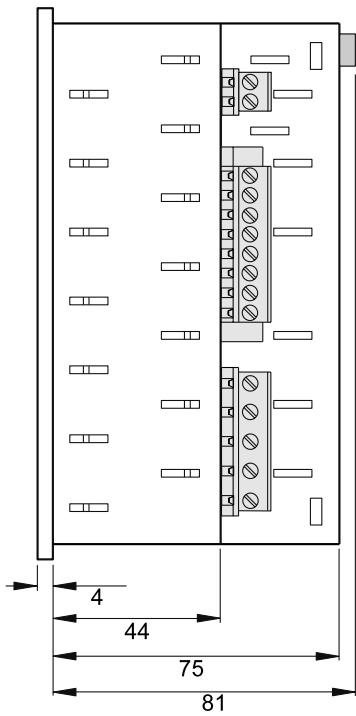
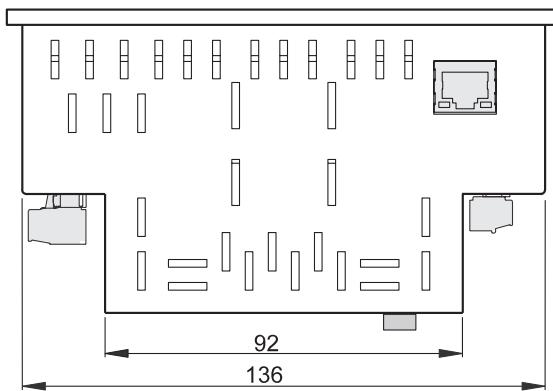
- 1) In relation to the amplitude.
- 2) In relation to phase and amplitude.
- 3) In relation to fundamental oscillation.
- 4) In relation to effective value.
- 5) Precision class 0.2 with.../ 5A converter.  
Precision class 0.5 with.../ 1A converter.
- \* The display returns to 0 W once the max. total working value range has been reached.
- 6) Calculation from fundamental oscillation.
- 7) Precision class 0.2S per IEC62053-22

## Dimension diagrams

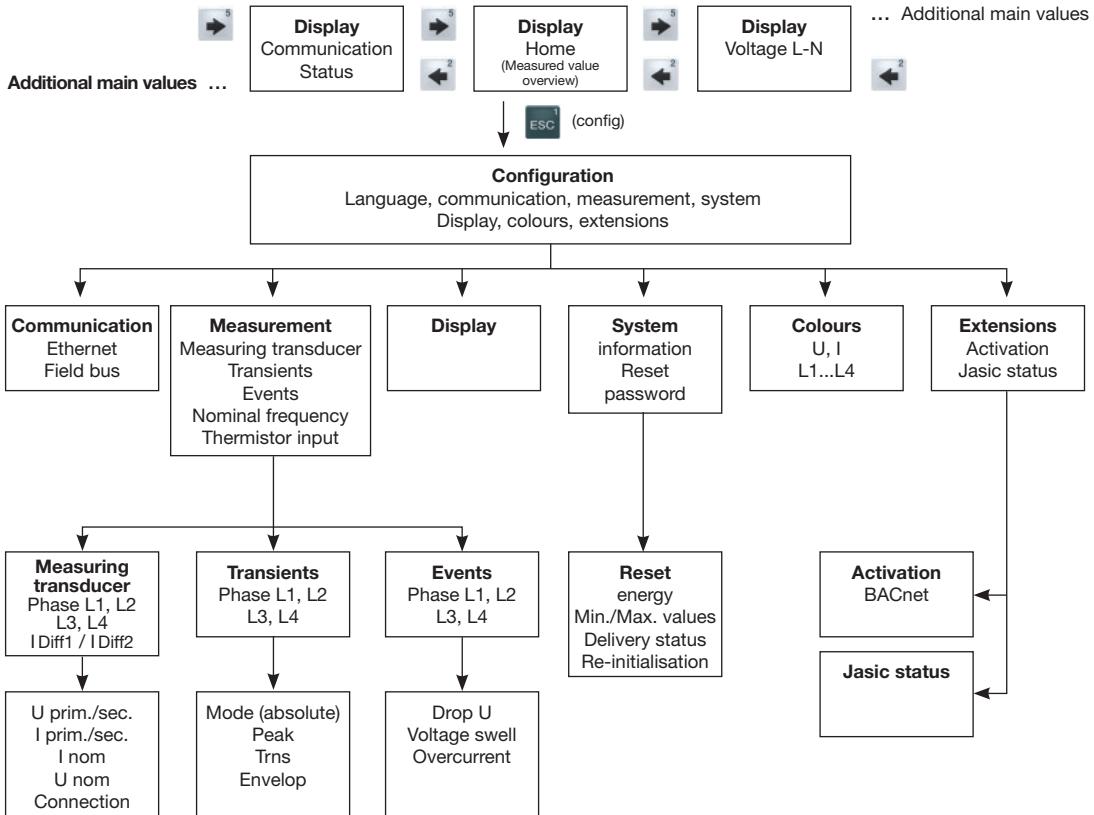
Cut-out size:  $138^{+0.8} \times 138^{+0.8}$  mm

## Rear side

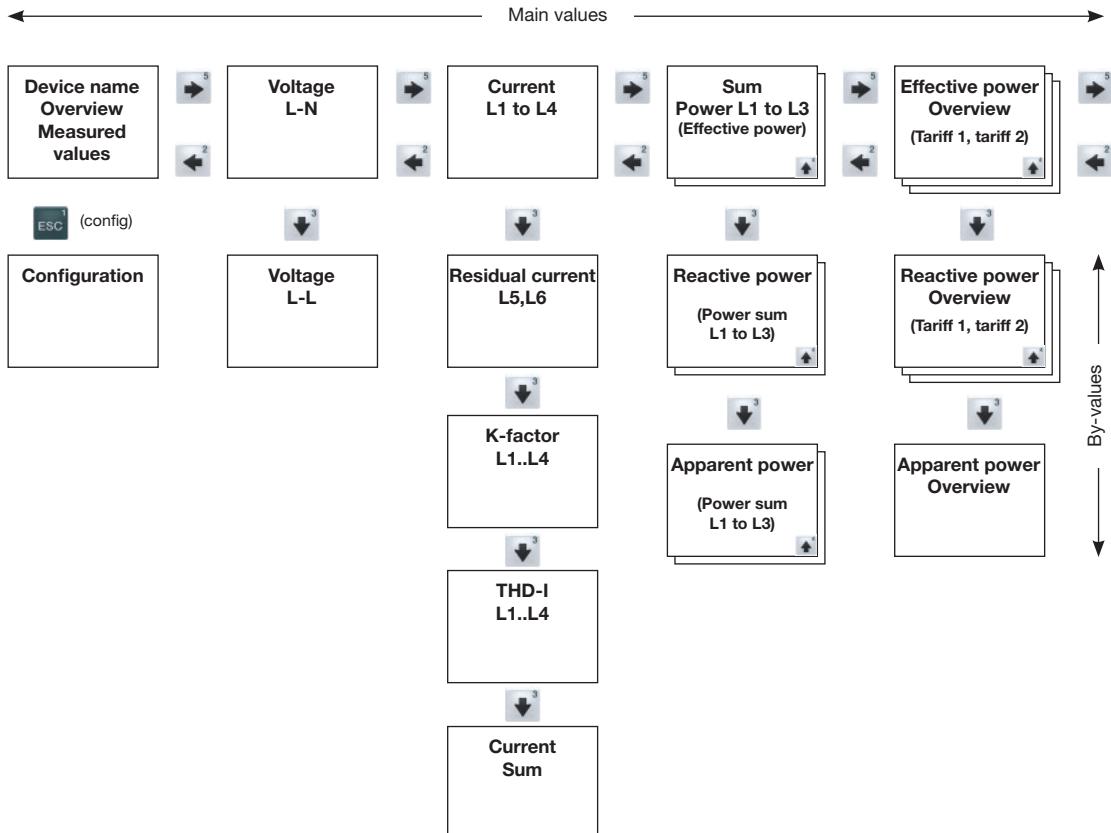


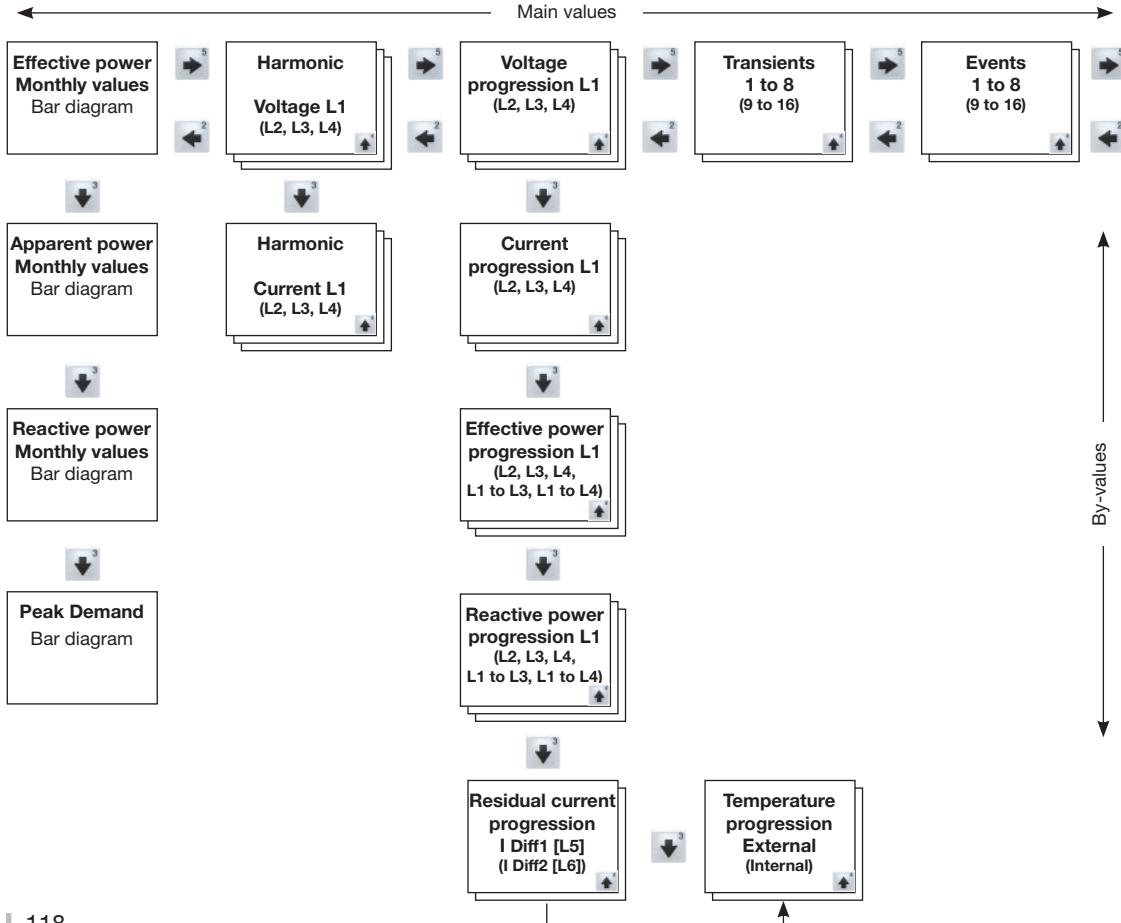
**Side view****View from below**

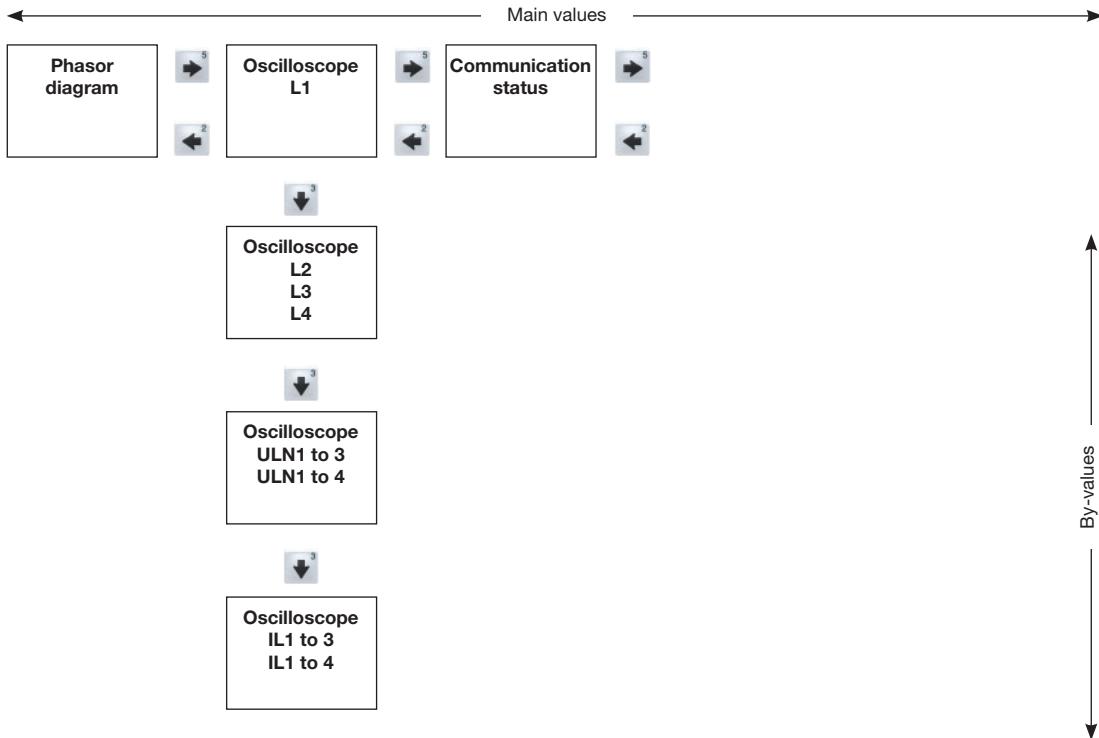
## Configuration menu overview



## Measured value displays overview







## Connection example

