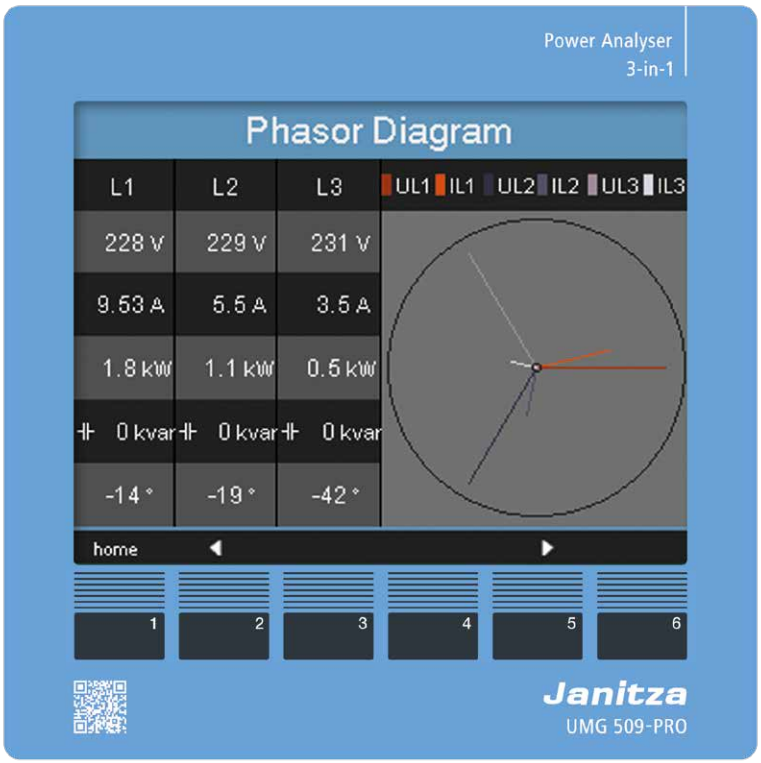
Part no. 3303217

www.janitza.com

Power Quality Analyzer

UMG 509-PRO

User manual and technical data



Doc. no.: 2.059.011.3.a 12/2025

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Janitza®

UMG 509-PRO
Power Quality Analyzer

Doc. no.: 2.059.011.3.a
12/2025
The German version is the original edition of the documentation.

Subject to technical alterations.

The contents of our documentation have been compiled with great care and reflect the current state of the information available to us. Nonetheless, we wish to point out that updates of this document are not always possible at the same time as technical refinements are implemented in our products. Please see our website under www.janitza.com for the current version.

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Table of contents

1. General

1.1 Disclaimer

Compliance with the informational products for the device is a prerequisite for safe operation and attaining the stated performance characteristics and product features.

Janitza electronics GmbH assumes no liability for bodily injury, material damage or financial losses which result from disregard of the informational products.

Ensure that your informational products are readily accessible in a legible form.

1.2 Copyright notice

1.3 Technical changes

- Make sure that your device matches the user manual.
- This user manual applies to the UMG 509-PRO. Separate validities and distinctions are marked.
- First read and understand the documents associated with the product.
- Keep the documents associated with the product available for the entire service life and pass them on to any possible subsequent users.
- Find out about device revisions and the associated modifications of the documentation associated with your product at www.janitza.com.

1.4 About this user manual

If you have questions, suggestions or ideas for improvement of the user manual, please let us know via email at: info@janitza.com.

INFORMATION

This user manual describes the UMG 509-PRO and provides information on operating the device.
Also consult the additional documentation relevant for this user manual, such as:
- Installation instructions.
- Data sheet.
- Safety information.
- As applicable, documents for expansion modules.
- Online help for the network visualization software GridVis.

1.5 Meaning of the symbols

The following pictograms are used in this manual:

	Ground wire connection.
	**Inductive.** The current lags behind the voltage.
	**Capacitive.** The voltage lags behind the current.

1.6 Defective device/disposal

Before sending **defective devices, modules or components** back to the manufacturer for testing:
· Contact the manufacturer's Support department.
· Send devices, modules or components complete with all accessories.
· When doing so, please bear the terms for transportation in mind.

INFORMATION

Please return defective or damaged devices to Janitza electronics GmbH in accordance with the shipping instructions for air or road freight (complete with accessories).
Observe special regulations for devices with built-in batteries or rechargeable batteries!

Do not attempt to open or repair the device (the component) on your own because otherwise all warranty claims become invalid!

For the **Disposal** of the device please observe national regulations! Dispose of individual parts, as applicable, depending on their composition and existing country-specific regulations, e.g. as
· Electronic waste,
· Batteries and rechargeable batteries.
· Plastics.
· Metals.

Engage a certified disposal company to handle scrapping as needed.

Information on service and maintenance of your device can be found in chapter „14. Service and maintenance“ on page 98.

2. Safety

The chapter on Safety contains information which must be observed to ensure your personal safety and avoid material damage.

2.1 Display of warning notices and safety information

The warning notices shown below
· are found throughout all of the documentation,
· can be found on the devices themselves.
· indicate potential risks and hazards,
· underscore aspects of the information provided that clarifies or simplifies procedures.

The additional symbol on the device itself indicates an electrical danger that can result in serious injuries or death.

This general warning symbol draws attention to a possible risk of injury. Be certain to observe all of the information listed under this symbol in order to avoid possible injury or even death.

2.2 Hazard levels

Warning and safety information is marked by a warning symbol, and the hazard levels are shown as follows, depending on the degree of hazard:

⚠ DANGER

Warns of an imminent danger which, if not avoided, results in serious or fatal injury.

⚠ WARNING

Warns of a potentially hazardous situation which, if not avoided, could result in serious injury or death.

⚠ CAUTION

Warns of an immediately hazardous situation which, if not avoided, can result in minor or moderate injury.

ATTENTION

Warns of an immediately hazardous situation which, if not avoided, can result in material or environmental damage.

INFORMATION

Indicates procedures in which there is **no** hazard of personal injury or material damage.

2.3 Product safety

The device reflects current engineering practice and accepted safety standards, but hazards can arise nonetheless.

Observe the safety regulations and warning notices. If notices are disregarded, this can lead to personal injury and/or damage to the product.

Every type of tampering with or use of this device,
· which goes beyond the mechanical, electrical or other operating limits can lead to personal injury and/or damage to the product;
· constitutes “misuse” and/or “negligence” under the product’s warranty and thus voids the warranty for any possible resulting damage.

Read and understand the user manual before installing, operating, maintaining and using the device.

Only operate the device when it is in perfect condition and in compliance with this user manual and the associated, included documents. Send defective devices back to the manufacturer in compliance with proper transport conditions. Retain the user manual throughout the service life of the device and keep it at hand for consultation.

When using the device, also observe the legal and safety regulations for your system that are applicable for the respective use case.

2.4 Dangers when handling the device

When operating electric devices, it is unavoidable for certain parts of these devices to conduct hazardous voltage. Consequently, severe bodily injury or material damage can occur if they are not handled properly.
Therefore, when handling our devices, always observe the following:

- do not exceed the limit values specified in the user manual and on the rating plate! This must also be observed during testing and commissioning!
- Safety and warning notices in all documents that belong to the devices!

⚠ WARNING

Disregarding the connection conditions of the Janitza measurement devices or their components can lead to injuries and even death or to material damage!

- Do not use Janitza measurement devices or components for critical switching, control or protection applications where the safety of persons and property depends on this function.
- Do not carry out switching operations with the Janitza measurement devices or components without prior inspection by your plant manager with specialist knowledge! In particular, the safety of persons, material assets and the applicable standards must be taken into account!

⚠ WARNING

Risk of injury due to electrical voltage!
Severe bodily injury or death can result! Therefore please abide by the following:

- **Switch off your installation before commencing work! Secure it against being switched on! Check to be sure it is de-energized! Ground and short circuit! Cover or block off adjacent live parts!**
- **During operation and troubleshooting (especially for DIN rail devices), check your system for dangerous voltages and switch these off if necessary!**
- **Wear protective clothing and protective equipment in accordance with applicable guidelines when working on electrical systems!**
- **Before making connections to the device/the component, ground the device by means of the ground wire connection, if present.**
- **Do not touching bare or stripped leads that are energized! Equip stranded conductors with wire ferrules!**
- **Hazardous voltages can be present in all circuitry parts that are connected to the power supply.**
- **Protect wires, cables and devices with a suitable line circuit breaker/fuse!**
- **Never switch off, remove or tamper with safety devices!**
- **There can still be hazardous voltages present in the device or in the component even after it has been disconnected from the supply voltage (capacitor storage).**
- **Do not operate equipment with current transformer circuits when open.**
- **Only connect screw terminals with the same number of poles and design!**
- **Do not exceed the limit values specified in the user manual and on the rating plate! This must also be observed during testing and commissioning.**
- **Take note of the safety and warning notices in the documents that belong to the device!**

2.5 Electrically qualified personnel

To avoid bodily injury and material damage, only electrically qualified personnel are permitted to work on the devices and their components, modules, assemblies, systems and current circuits who have knowledge of:

- The national and international accident prevention regulations.
- Safety technology standards.
- Installation, commissioning, operation, disconnection, grounding and marking of electrical equipment.
- the requirements concerning personal protective equipment.

Electrically qualified persons within the scope of the technical safety information of all documents associated with the device and its components are persons who can furnish proof of qualification as an electrically skilled person.

⚠ WARNING

Warning against unauthorized manipulation or improper use of the device or its components!
Opening, dismantling or unauthorized manipulation of the device and its components which goes beyond the mechanical, electrical or other operating limits indicated can lead to material damage or injury, up to and including death.

- **Only electrically qualified personnel are permitted to work on the devices and their components, assemblies, systems and current circuits.**
- **Always use your device or component only in the manner described in the associated documentation.**
- **If there is discernible damage, send the device or the component back to the manufacturer!**

2.6 Warranty in the event of damage

Any unauthorized tampering with or use of the device constitutes "misuse" and/or "negligence" under the product's warranty and thus voids the warranty of any possible resulting damage. In this regard, please take note of section „3.3 Intended use“ on page 16.

2.7 Safety information for handling current transformers and measurement devices with residual current measurement

⚠ WARNING

Risk of injury due to large currents and high electrical voltage on the current transformers!
Current transformers operated while open on the secondary side (high voltage peaks pose a hazard when touched) can result in severe bodily injury or death.

- **Avoid operating the current transformers while open; short circuit the unloaded transformers!**
- **Before interrupting the current supply, short circuit the secondary connections of the current transformers. Switch any test switches that automatically short circuit the secondary lines of the current transformers to the "Test" status (Check the test switch/ short circuiting connection beforehand)!**
- **Only use current transformers with basic insulation to IEC 61010-1:2010!**
- **Caution, even current transformers rated as safe for open operation can pose a hazard when touched during operation while open!**
- **Make sure that screw terminals for the current transformer connection on the device are adequately tightened!**
- **Comply with the information and provisions in the documentation of your current transformers!**

⚠ CAUTION

Risk of injury or damage to the meter due to high measurement currents at the connections of the current transformers!
High measurement currents can cause temperatures of up to 80 °C (176 °F) on the connections of the current transformers

- **Use wiring that is designed for an operating temperature of at least 80 °C (176 °F)!**
- **The current transformers can be hot even after the power supply has been switched off. Allow the connections of the current transformers and the connecting cables to cool down before touching them!**

⚠ WARNING

Risk of injury or damage to the meter due to improper use!
Meters with residual current measurement can trigger warning pulses if limit values are exceeded, and these are used exclusively for monitoring residual currents or failure monitoring. Use of the warning pulses as a stand-alone protective device against electrical shock can lead to injury and even death!

- **Do not use devices with residual current measurement as a stand-alone protective device. Employ suitable protective devices for your system!**

⚠ CAUTION

Risk of injury or damage to the meter/your system due to short circuit!
Inadequate insulation of the operating equipment at the residual current measuring input with respect to the supply circuits can cause voltages at the measuring input which represent a hazard when touched or damage to your device or system.

- **Ensure reinforced or double insulation with respect to the supply circuits!**
- **Ensure galvanic isolation of the residual current measuring inputs from each other!**

2.8 Handling batteries/accumulators

The following apply for the battery used in the device:

⚠ CAUTION

Risk of injury due to fire or burns!
The battery used in the device may cause fire or burns if used improperly.

- **Only replace the battery with the same type or types recommended by Janitza!**
- **Observe the polarity when installing the battery!**
- **Remove batteries only with non-conductive tools (e.g. plastic tweezers)!**
- **Do not recharge, disassemble, burn or heat batteries above 100 °C (212 °F)!**
- **Do not dispose of batteries with household waste! Follow the disposal instructions in the respective device documentation!**
- **Keep batteries away from children and animals!**
- **In case of damage, return devices with a soldered battery to the manufacturer, observing proper transport conditions!**

3. Product description

3.1 Device description

The device is:

· Intended for measurements in building installations, on distribution boards, circuit breakers and busbar trunking systems.
· Suitable for installation in fixed and weather-protected switchboards.
· Can be used in 2, 3 and 4-conductor networks and in TN and TT networks.
· Intended for current measurement via external ../1 A or ../5 A current transformers.
· Suitable for measurements in medium and high voltage networks only via current and voltage transformers.
· Suitable for use in residential and industrial areas.
· Suitable for a residual current measurement (RCM) via external residual current transformers with a nominal current of 30 mA.
· Suitable for measured voltages and currents from the same network.

The measurement results can be displayed and stored as well as read out and further processed via the interfaces of the device.

This operating manual only describes the operation of the device via the 6 buttons. The GridVis® network analysis software has its own "online help".

⚠ CAUTION

Malfunction and damage of the device or risk of injury due to improper connection.
Improperly connected devices can deliver incorrect measured values, damage the device or pose a risk of injury to persons.
Observe the following:
· **That measured voltages and currents come from the same network.**
· **Do not use the device for measuring direct current!**
· **Ground current-conducting switchboards!**

⚠ CAUTION

The residual current measurement monitors residual currents via external current transformers and can trigger a warning pulse if a limit value is exceeded.
The device is therefore not an independent protective device against electric shock.

3.2 Incoming goods inspection

The prerequisites for trouble-free and safe operation of this device include proper transport, storage, setup and assembly, as well as proper operation and maintenance.

Exercise due caution when unpacking and packing the device, do not use force and only use suitable tools.

Check the devices for flawless mechanical condition by visual inspection.

Please check the scope of delivery for completeness before you start installing the device.

If it can be assumed that safe operation is no longer possible, the device must be taken out of operation immediately and secured against unintentional start-up. It can be assumed that safe operation is no longer possible if the device, for example:

· has visible damages,
· no longer functions despite an intact power supply,
· was subjected to extended periods of unfavorable conditions (e.g. storage outside of the permissible climate thresholds without adjustment to the room climate, condensation, etc.) or transport stress (e.g. falling from an elevated position, even without visible external damage, etc.).

3.3 Intended use

The device is:
· Only for use in the industrial sector.
· Intended for installation in switchboard cabinets and small distribution boards.
· Not intended for installation in vehicles! Use of the device in non-stationary equipment constitutes an exceptional environmental condition and is only permissible by special agreement.
· Not intended for installation in environments with harmful oils, acids, gases, vapors, dusts, radiation, etc.
· Designed as an interior meter.

Safe and trouble-free operation of the device requires proper transport, storage, assembly, installation, operation and maintenance.

3.4 Performance characteristics

General

· Front panel installation device with dimensions of (144 x 144) mm
· Connection via screw terminals
· Color graphic display of 320x240, 256 colors
· Operation via 6 buttons
· 4 voltage and 4 current measurement inputs
· 2 residual current inputs with failure monitoring
· 1 temperature measurement input
· 2 digital outputs and 2 digital inputs
· 16-bit A/D converter, data memory of 256 MByte Flash, SDRAM of 32 Mbyte
· RS-485 interface (Modbus RTU, slave, up to 921 kbps)
· Profibus DP/V0
· Ethernet (web server, email)
· Acquisition of more than 2000 measured values
· Clock and battery
· Working temperature range -10 °C .. +55 °C

Measurement

· Measurement in TN and TT networks
· Continuous sampling of voltage and current measurement inputs at 20 kHz
· Acquisition of transients >50 µs and storage with up to approx. 330,000 sampling points
· Current measuring range 0.001 ..7 Arms
· True effective value measurement (TRMS)
· Continuous sampling of the voltage and current measurement inputs
· Continuous monitoring of residual currents with failure monitoring
· Temperature measurement
· Working measurement, measurement uncertainty according to DIN EN50470-3:
  - Class C for ../5 A transformers
  - Class B for ../1 A transformers
· Measurement of 1st to 63rd harmonics for:
  - Ull, Uln, I, P (cons./del.) and Q (ind./cap.)
· Analysis and evaluation according to DIN EN 50160 with the GridVis® programming software included in the scope of delivery
· Programming your own applications in Jasic

INFORMATION

All supplied options and design variants are described on the delivery note.

3.5 EU conformity declaration

Please see the EU declaration of conformity posted at www.janitza.com for the laws, standards and directives applied by Janitza electronics GmbH for the devices. The CE conformity marking requirements for the device arise from the EU conformity declaration and the laws, standards and directives mentioned therein.

3.6 FCC Declaration of Conformity

The device:
· complies with Part 15 of the FCC Rules for Class B digital devices (limits to protect against harmful interference in a residential installation).
· generates, uses and can radiate high-frequency energy
· can cause harmful interference to radio communications if not installed and used properly. There is no guarantee that interference will not occur in a particular installation.

If there is radio or television reception interference, which can be determined by turning the device on and off, proceed as follows:
· Align or reposition the receiving antenna.
· Increase the distance between the device and the radio/television receiver.
· Connect the device and the radio/television receiver in different circuits.
· if necessary, contact Janitza support or a radio/television technician.

Code of Federal Regulations, Title 47, Part 15, Subpart B - Unintentional Radiators.

3.7 Scope of delivery

Quantity	Part. no.	Designation
1	52 26 xxx [1)]	UMG 509-PRO
1	33 03 320	Installation instructions
1	33 03 348	“GridVis Software” Quick Guide
1	33 03 342	Safety instructions
1	52 26 251	Accessories pack UMG 509-PRO

[1)] For part number see delivery note

3.8 Accessories

Part. no.	Designation
21 01 102	Battery type, Lithium CR2450, 3 V, (approval according to UL 1642)
13 10 539	Profibus connector, 9-pin DSUB
13 10 543	Profibus connector, 9-pin DSUB, uncoiled
29 01 903	Seal, 144 x 144

3.9 Measuring method

The device:

· Measures without gaps and calculates all RMS values over a 200 ms interval.
· Measures the true RMS value (TRMS) of the voltages and currents applied to the measurement inputs.

3.10 Operating concept

You can program the device and retrieve measured values in several ways:

· **Directly on the device** using 6 button and the display.
· Using the **GridVis programming software.**
· Using the **device homepage.**
· The **Modbus protocol** can be used to change and retrieve data with the help of the Modbus address list. This list is available via the device homepage.

3.11 GridVis network analysis software

You can program the device and read out data using the GridVis network analysis software available at www.janitza.com. To do so requires that a PC be connected to the device via a serial interface (RS-485 / Ethernet).

The GridVis network analysis software allows you to:

· Program the device.
· Configure and read out recordings.
· Analyze the data that has been read according to EN 61000-2-4.
· Save data to a database.
· Display measured values graphically.
· Program customer-specific applications.

4. Structure of the device

4.1 Front panel and display

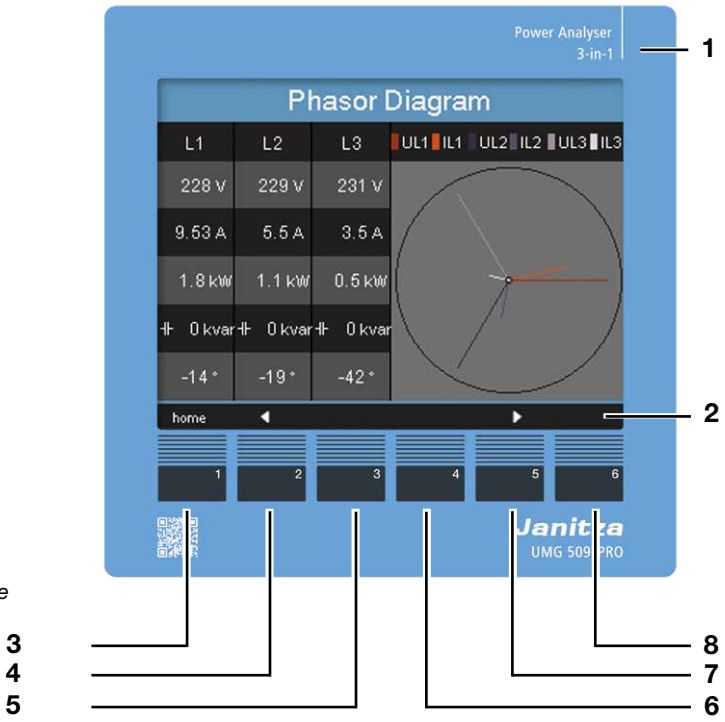


Fig. Front view of device

1 Device type
2 Description of the function buttons
3 Button 1: Configuration menu, Back
4 Button 2: Select digit, switch between the main values
5 Button 3: Decrement digit by 1, select by-values, select menu item
6 Button 4**:** Increment digit by 1, select by-values, select menu item
7 Button 5: Select digit, switch between the main values
8 Button 6: Activate input, confirm selection

4.2 Rear view

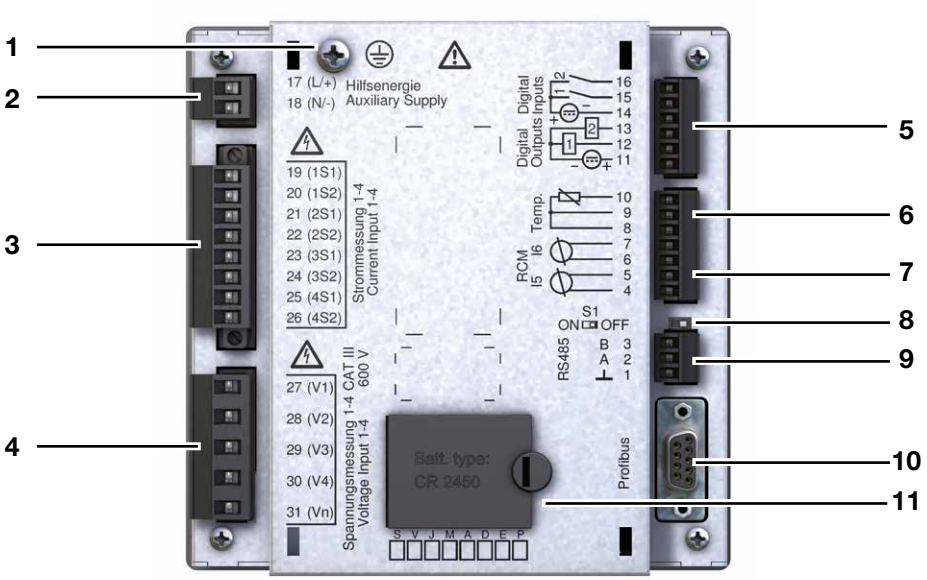


Fig. Rear view of device

1 Ground wire connection
2 Supply voltage
3 Current measurement inputs I1 to I4
4 Voltage measurement inputs V1 - V4 and Vn
5 Digital inputs/outputs
6 Temperature measurement inputs
7 Residual current measurement inputs I5 and I6
8 DIP switch S1
9 RS-485 interface
10 Profibus interface
11 Battery compartment

5. Mounting

5.1 Installation location

The device is suitable for installation in stationary and weatherproof switchboards indoors.

Provide grounding for conductive switchboards.

ATTENTION

Material damage due to disregard of the installation instructions!
Disregard of the installation instructions can damage or destroy your device.
Observe the information on the mounting orientation in sections „5. Mounting“ and „15. Technical data“.

5.2 Mounting orientation

The cut-out dimension in the switchboard is $138^{+0.8}$ mm x $138^{+0.8}$ mm.

Follow these instructions to achieve adequate ventilation:
· Install the device vertically.
· Maintain a minimum clearance of 50 mm upwards and downwards.
· Maintain a minimum clearance of 20 mm to the sides.

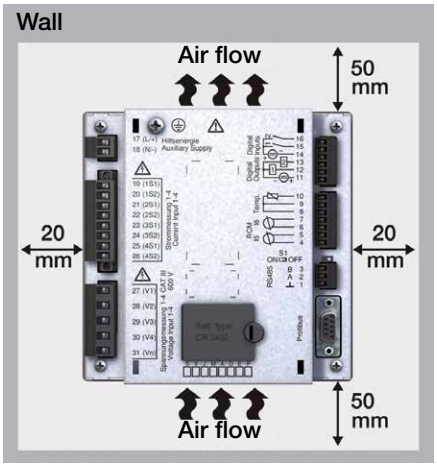


Fig. Rear view of the mounting orientation of the device

5.3 Securing

The device is fastened to the switchboard by two fastening clips, one at the bottom and one at the top. The fastening clips must be hooked onto the device beforehand.

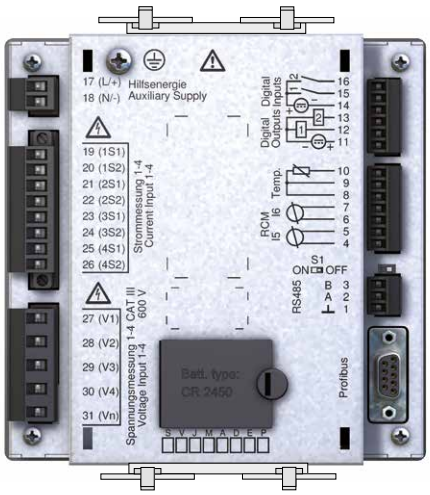


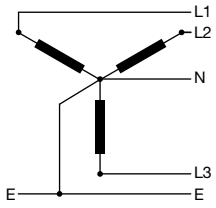
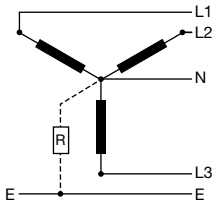
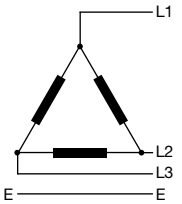
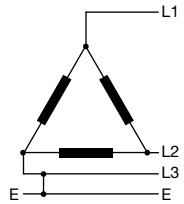
Fig. Arrangement of the fastening clips on the device

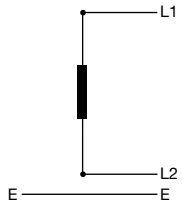
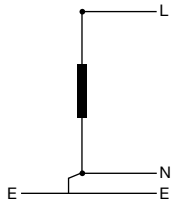
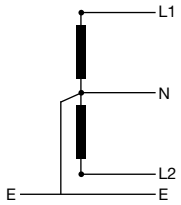
⚠DANGER

Danger of electric shock!
Electric shocks lead to serious injuries, including death.
· Disconnect your system from the power supply before mounting and connecting the device!
· Secure it against being switched on!
· Check to be sure it is de-energized!
· Ground and short circuit!
· Cover or block off adjacent live parts!
· The installation must only be carried out by qualified personnel with electrical training!

6. Grid systems

Grid systems and maximum rated voltages according to DIN EN 61010-1/A1:

Three-phase 4-conductor systems with grounded neutral conductor		**Three-phase 4-conductor systems** with non-grounded neutral conductor (IT networks)	**Three-phase 3-conductor systems** ungrounded	**Three-phase 3-conductor systems** with grounded phase
				
IEC	U_{L-N} / U_{L-L}: 417 VLN / 720 VLL	Only suitable to a limited extent in ungrounded networks		U_{L-L} 600 VLL
UL	U_{L-N} / U_{L-L}: 347 VLN / 600 VLL			

Two-phase two-conductor systems ungrounded		**Single-phase 2-conductor systems** with grounded neutral conductor		**Split single-phase 3-conductor system** with grounded neutral conductor	
					
Only suitable to a limited extent in ungrounded networks	IEC	U_{L-N} 480 VLN	IEC	U_{L-N} / U_{L-L}: 400 VLN / 690 VLL	
	UL	U_{L-N} 480 VLN	UL	U_{L-N} / U_{L-L}: 347 VLN / 600 VLL	

Application areas for the device

- 2, 3 and 4-conductor networks (TN and TT networks).
- Residential and industrial areas.

⚠ WARNING

Risk of injury due to electrical voltage!
Rated surge voltages above the permitted overvoltage category can damage the insulation in the device. This impairs the safety of the device. This can result in serious injury or death.

- **Only use the device in environments which comply with the permissible rated surge voltage.**
- **Observe the limit values specified in the user manual and on the rating plate.**

6.1 Three-phase 3-conductor systems

The device is only suitable to a limited extent for use in IT networks since the measured voltage is measured against the housing potential and the input impedance of the device causes a leakage current to ground. The leakage current can cause the insulation monitoring in IT networks to be triggered.

The connection variants with voltage transformers are suitable without restriction for IT networks.

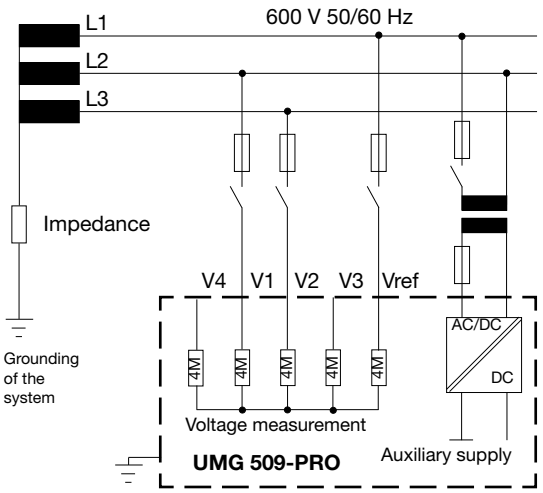


Fig. Schematic diagram, UMG 509-PRO in an **IT network** *without N*

6.2 Three-phase 4-conductor systems

The device can be used in three-phase 4-conductor systems (TN, TT network) with a grounded neutral conductor. The components of the electrical system are grounded.

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

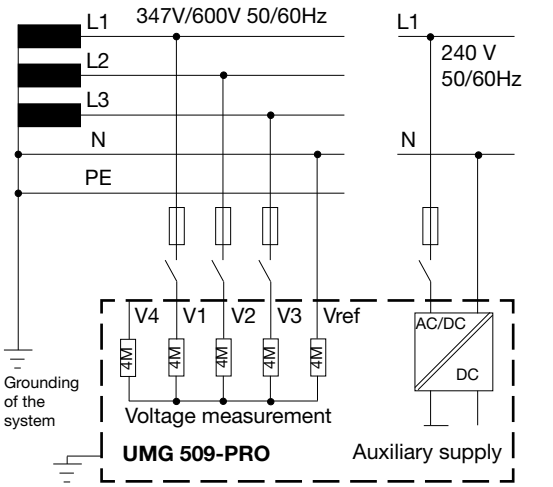


Fig. Schematic diagram, UMG 509-PRO in a **TN network**

6.3 Nominal voltages

The following figures show lists of the networks and associated nominal network voltages in which the device can be used.

U_{L-N} / U_{L-L}	
66 V / 115 V	
120V / 208V	
127V / 220V	
220V / 380V	
230V / 400V	
240V / 415V	
260V / 440V	
277V / 480V	
347V / 600V	Maximum nominal voltage of the network as per UL
400V / 690V	
417V / 720V	Maximum nominal voltage of the network

Fig. Nominal network voltages suitable for measurement inputs in a **three-phase 4-conductor network with grounded neutral conductor** *according to EN 60664-1:2003*

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

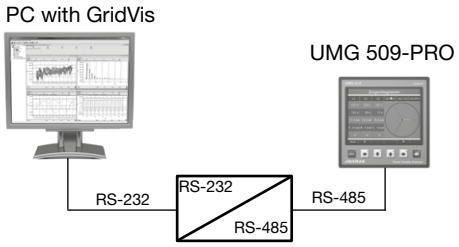
Fig. Nominal network voltages suitable for measurement inputs in an ungrounded **three-phase 3-conductor network** *according to EN 60664-1:2003*

7. Installation

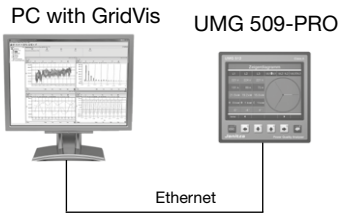
7.1 Connection to a PC

When connecting the device to a PC, there are several possibilities:

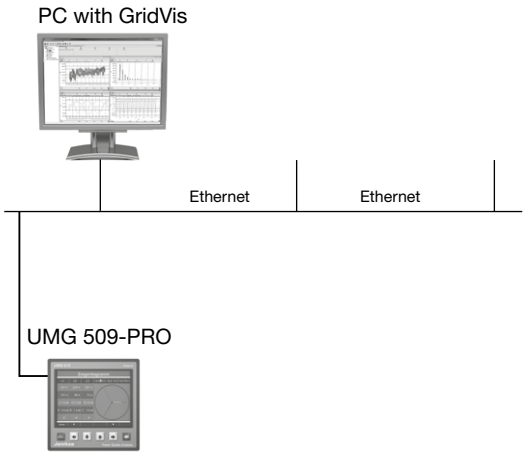
1. Connection via an interface converter:



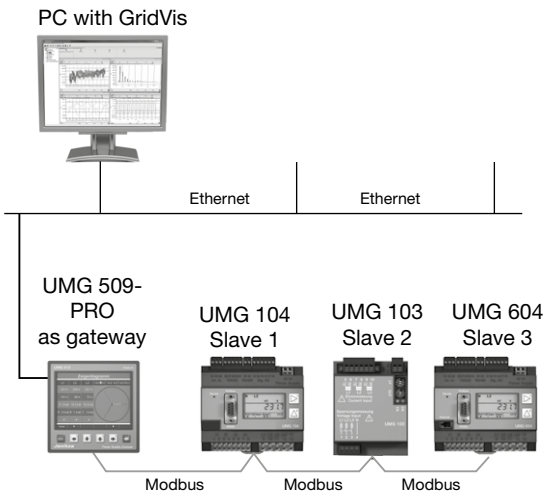
2. Direct connection via Ethernet:



3. Connection via the network:



4. Using the UMG 509-PRO as a gateway for further UMGs



7.2 Ground wire connection

Use a ring cable lug to connect the protective conductor to the device.

7.3 Circuit breaker

Provide a suitable circuit breaker in a building installation to disconnect the device from the power supply.

· Install the circuit breaker near the device and within easy reach of the user.
· Mark the switch as an isolation device.

7.4 Supply voltage

⚠ WARNING

Risk of injury due to electrical voltage!
Severe bodily injury or death can result from:
· Touching bare or stripped leads that are energized.
· Device inputs that pose a hazard when touched.
· Disconnect your system from the power supply before mounting and connecting the device!
· Secure it against being switched on!
· Check to be sure it is de-energized!
· Ground and short circuit!
· Cover or block off adjacent live parts!

A supply voltage is required to operate the device. The level of the supply voltage for your device can be found on the rating plate.

Before applying the supply voltage, make sure that the voltage and frequency match the specifications on the rating plate.

The supply voltage is connected via the plug-in terminals on the rear of the device.

Connect the supply voltage via a UL/IEC approved fuse.

ⓘ *INFORMATION*

The fuse is a line protection - it is not a device protection!

ATTENTION

Material damage due to disregard of the connection instructions!
Disregard of the connection instructions or exceeding the permissible voltage range can damage or destroy your device.
Before connecting the device to the supply voltage, please note:
· Voltage and frequency must correspond to the specifications on the rating plate!
· Observe the limit values as described (see section „15. Technical data“ on page 100)!
· In the building installation, secure the supply voltage with a UL/IEC listed line circuit breaker/ fuse!
· Observe the following for the isolation device:
  - Install it close to the device and easily accessible for the user.
  - Mark it for the respective device.
· Do not tap the supply voltage from the voltage transformers.
· Provide a fuse for the neutral conductor if the neutral conductor terminal of the source is not grounded.

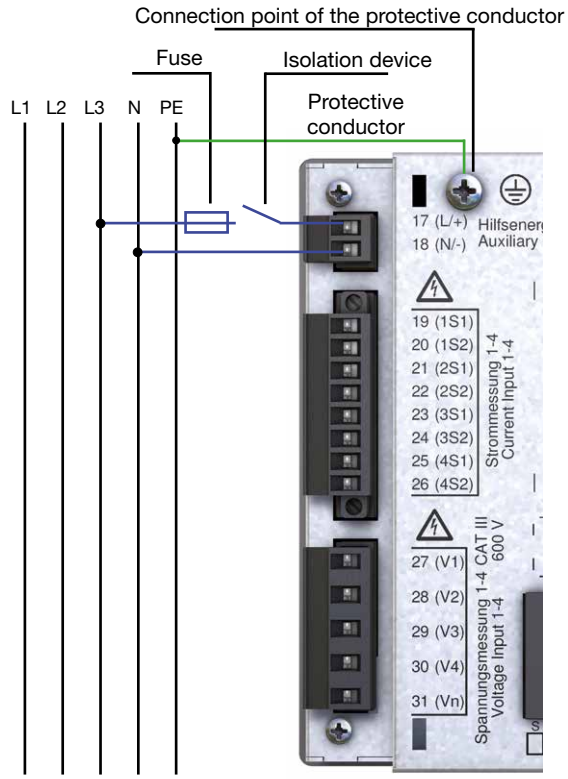


Fig. Connection example for the supply voltage

7.5 Measured voltage

The device has 4 voltage measurement inputs (V1 to V4) located on the back of the device.

· V1 to V3 are for the main measurement.
· V4 is for the auxiliary input

In the following, the connections are referred to as the auxiliary and main measurement.

7.5.1 Overvoltage

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

7.5.2 Frequency

The device:

· Is suitable for measurement in networks in which the fundamental oscillation of the voltage is in the range from 40 Hz to 70 Hz.
· Measures the frequency only at the measurement inputs V1, V2 and V3.

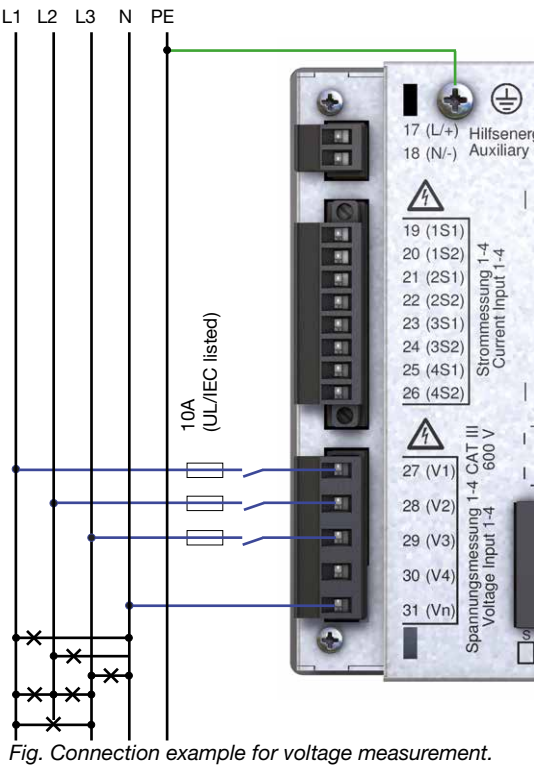


Fig. Connection example for voltage measurement.

⚠ WARNING

Risk of injury or damage to the device due to electrical voltage and improper connection!
Failure to comply with the connection conditions for the voltage measurement inputs can result in damage to the device or serious injury, including death.
Therefore, please observe the following:
· **Switch off your installation before commencing work! Secure it against being switched on! Check to be sure it is de-energized! Ground and short circuit! Cover or block off adjacent live parts!**
· **Do not apply a DC voltage**
  - **to the voltage measurement inputs.**
  - **Equip the voltage measurement inputs with a suitable, marked fuse and isolation device (alternatively: line circuit breaker) located nearby.**
  - **The voltage measurement inputs are dangerous to touch.**
· **Connect voltages that exceed the permissible nominal network voltages via a voltage transformer.**
· **Measured voltages and currents must originate from the same network.**

ⓘ *INFORMATION*

As an alternative to the fuse and isolation device, you can use a line circuit breaker.

ⓘ *INFORMATION*

For the measurement inputs V4 and I4, no connection diagram has to be configured.

ⓘ *INFORMATION*

For measurement with the auxiliary measurement, a voltage must be connected to the main measurement to determine the frequency.

7.6 Current measurement

The device:

- Is designed for the connection of current transformers with secondary currents of ../1 A and ../5 A.
- Does not measure DC currents.
- Has current measurement inputs which can be loaded at 120 A for 1 second.

The factory-set current transformer ratio is 5/5 A and must be adapted to the current transformers used as needed.

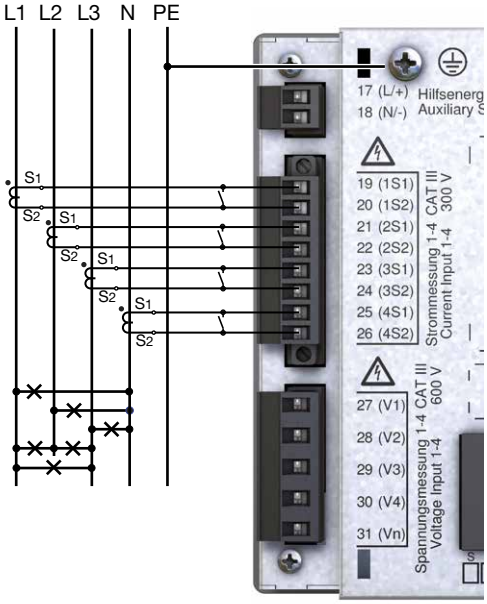


Fig. Connection example, "Current measurement via current transformer".

⚠ WARNING

Risk of injury or damage to the device due to electrical voltage and improper connection!
High measured currents can cause temperatures of up to 80 °C (176 °F) at the connections.
Use wiring designed for an operating temperature of up to 80 °C (176 °F)!

⚠ WARNING

Risk of injury due to electrical voltage at current transformers!
Current transformers which are operated exposed on the secondary side can carry hazardous live high voltage peaks which can lead to serious bodily injury or death.
Therefore please abide by the following:
- **Switch off your installation before commencing work! Secure it against being switched on! Check to be sure it is de-energized! Ground and short circuit! Cover or block off adjacent live parts!**
- **Avoid exposed operation of the current transformers.**
- **Short-circuit unloaded current transformers.**
- **Before interrupting the current supply, short circuit the secondary connections of the current transformers.**
- **If there is a test switch which automatically short-circuits the secondary current transformer lines, it is sufficient to set it to the "Test" position, provided that the short-circuiters have been checked beforehand.**
- **Only use current transformers with basic insulation according to IEC 61010-1:2010.**
- **Fix the attached screw terminal to the device with the two screws.**
- **Even current transformers rated as safe for exposed operation are dangerous to touch if they are operated exposed.**

⚠ WARNING

Risk of injury due to high currents and high electrical voltages!
Severe bodily injury or death can result from:
- Touching bare or stripped leads that are energized.
- Dangerous live current measurement inputs of the device and at the current transformers.

Therefore, please note for your system:
- **Disconnect the supply of power before starting work!**
- **Secure it against being switched on!**
- **Check to be sure it is de-energized!**
- **Ground and short circuit! Use the ground connection points with the ground symbol for grounding!**
- **Cover or block off adjacent live parts!**

7.6.1 Current direction

You can correct the current direction for each phase individually on the device or via the serial interfaces provided. This means that in the case of incorrect connection, no subsequent reconnection of the current transformers is necessary.

7.6.2 Summation current measurement

For a summation current measurement via two current transformers, first set their total ratio on the device. How to set the current transformer ratios is described in „11.3.1 Transformers“.

Example:
The current is measured via two current transformers. Both current transformers have a ratio of 1000/5 A. The summation measurement is carried out with a summation current transformer of 5+5/5 A.

The device must then be adjusted as follows:

Primary current: 1000 A + 1000 A = 2000 A
Secondary current: 5 A

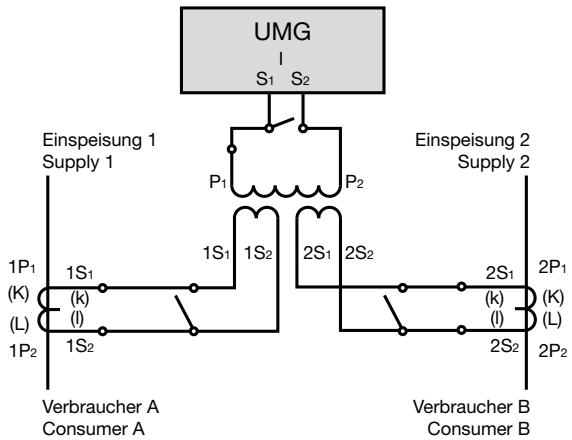


Fig. Example for current measurement via a summation current transformer

⚠ WARNING

Disregard of the connection conditions of the transformers to Janitza measurement devices or their components can lead to injuries or even death or to material damage!

- Do not use Janitza measurement devices or components for critical switching, control or protection applications (protective relays)! It is not permitted to use measured values or measurement device outputs for critical applications!
- For Janitza measurement devices and their components use **only “Transformers for measurement purposes”** which are suitable for the energy monitoring of your system. Do **not use “Transformers for protection purposes”**!
- Observe the information, regulations and limit values in the usage information on **"Transformers for measuring purposes"**, including during testing and commissioning of the Janitza measurement device, the Janitza component and your system. Voltages above the permissible voltage range can destroy the device.

7.6.3 Ammeter

If you want to measure the current not only with the UMG, but also with an ammeter, connect the ammeter to the UMG in series.

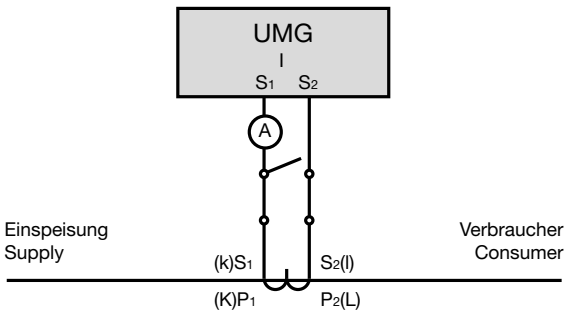


Fig. Circuit diagram with additional ammeter connected in series

7.7 Measuring variants

7.7.1 Voltage measurement

Here are some circuit diagrams of the most common connection methods for voltage measurement.

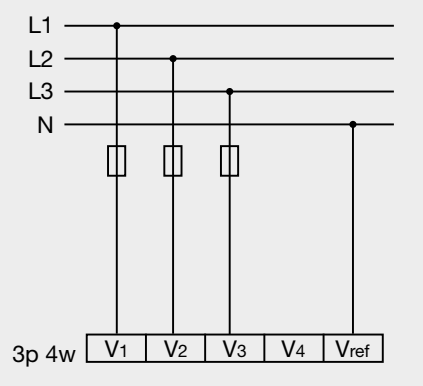


Fig. Measurement in a three-phase 4-conductor network

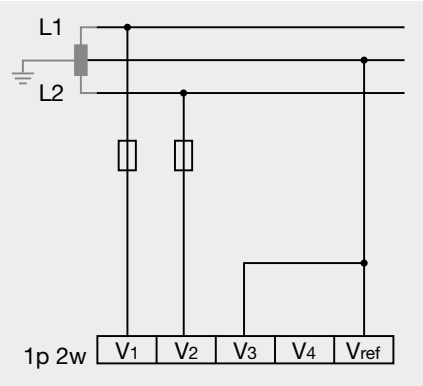


Fig. Measurement in a single-phase 2-conductor network

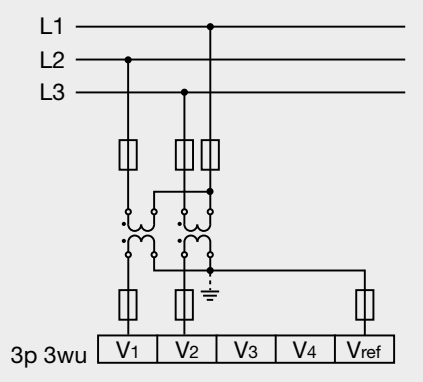


Fig. Measurement in a three-phase 3-conductor network without neutral conductor

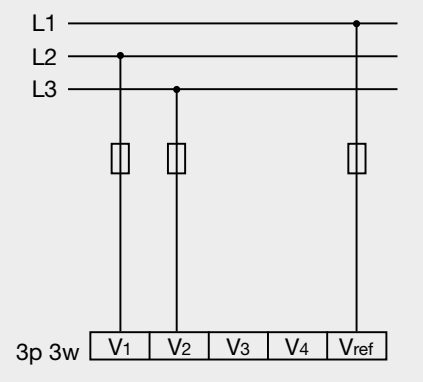


Fig. Measurement in a three-phase 3-conductor network

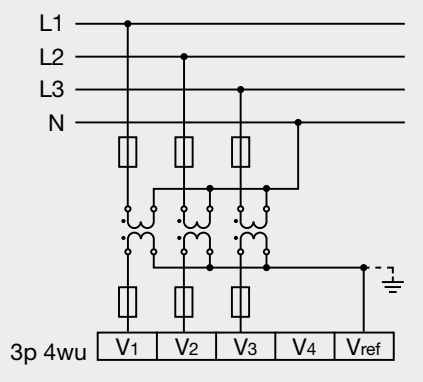


Fig. Measurement in a three-phase 4-conductor network

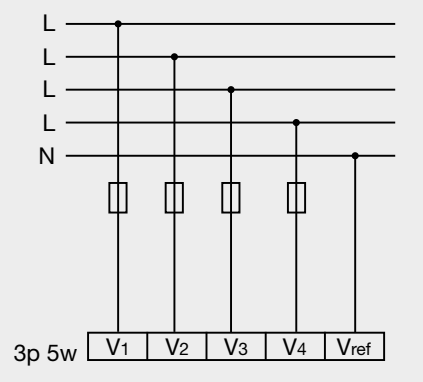


Fig. Measurement in a three-phase 4-conductor network with an additional conductor

7.7.2 Current measurement

Here are some circuit diagrams of the most common connection methods for current measurement.

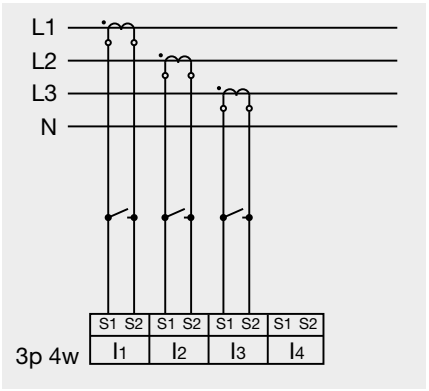


Fig. Measurement in a three-phase 4-conductor network via three current transformers

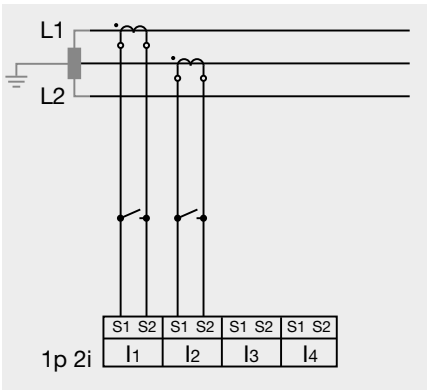


Fig. Measurement in a single-phase 2-conductor network via 2 current transformers

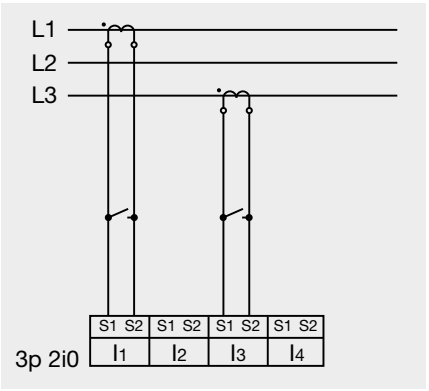


Fig. Measurement in a three-phase 3-conductor network via two current transformers

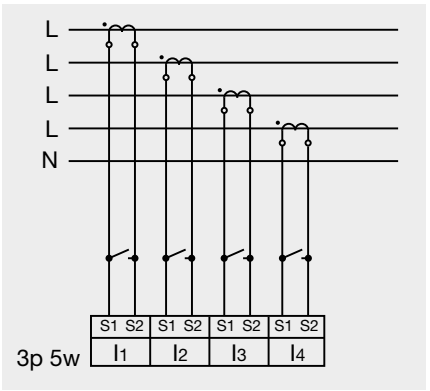


Fig. Measurement in a three-phase 4-conductor network via four current transformers

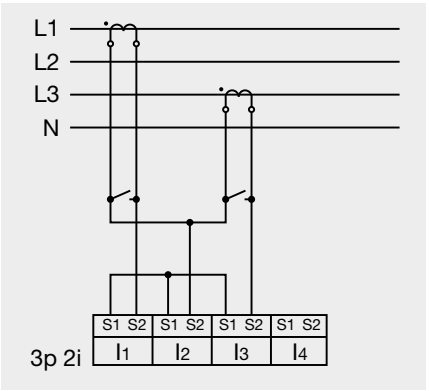


*Fig. Measurement in a three-phase 4-conductor network **with a symmetrical load** via two current transformers*

7.7.3 Connection variants for V4 measurement

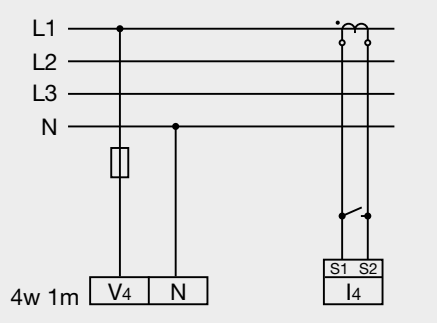


Fig. Measurement in a three-phase 4-conductor network with a symmetrical load

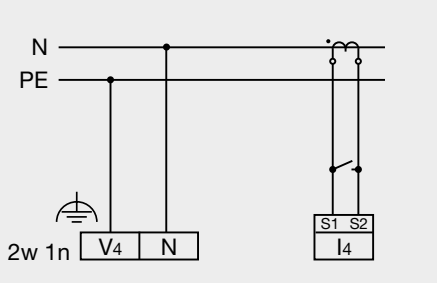


Fig. Measurement of voltage between N and PE. Measurement of the current in the neutral conductor

INFORMATION

If the main measurement is connected to a three-phase 3-conductor network, measurement input V4 can no longer be used.

INFORMATION

The use of measurement input V4 requires that a voltage be applied to the main measurement to determine the frequency.

INFORMATION

Measured voltages and currents must originate from the same network.

7.8 Residual current detection

The device:

- Is suitable for use as a residual current monitor (RCM) for monitoring AC currents and pulsating DC currents.
- Can measure residual currents according to IEC/TR 60755 (2008-01) ⎓ of type A.

Connection of suitable external residual current transformers with a nominal current of 30 mA can be made on residual current transformer inputs I5 (terminals 4/5) and I6 (terminals 6/7).

7.8.1 Failure monitoring

The device monitors the ohmic resistance at the residual current measurement inputs.

If this is greater than 300 ohms, this indicates a failure of the residual current measurement. This can occur, for example, due to a cable break.

For more information on failure monitoring, see the section „12.7 Failure monitoring (RCM)“ on page 76.

⚠ CAUTION

Risk of injury or damage to the meter/your system due to short circuit!
Inadequate insulation of the operating equipment at the residual current measuring input with respect to the supply circuits can cause voltages at the measuring input which represent a hazard when touched or damage to your device or system.

- **Ensure reinforced or double insulation with respect to the supply circuits.**
- **Isolate residual current measurement inputs galvanically from each other and galvanically from the supply voltage!**

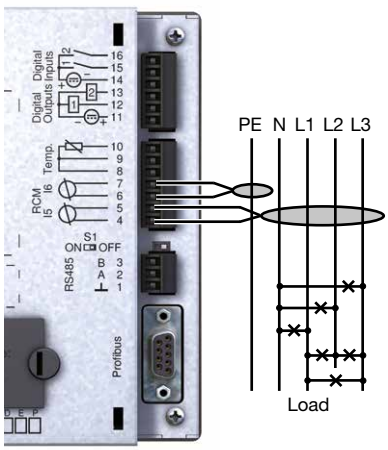


Fig. "Residual current measurement via current transformer" connection variant

INFORMATION

- The ratios for the residual current transformer inputs via can be configured using the GridVis power grid monitoring software.
- For the measurement inputs I5 and I6, no connection diagram has to be configured.

7.8.2 Example: Insulation of the residual current transformers

A residual current transformer is used to measure on insulated mains wiring in a 300 V CAT III network.

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

ATTENTION

Transmission error and material damage due to electrical malfunction.
With a cable length of more than 30 m, there is an increased probability of transmission errors and damage to the device due to atmospheric discharge!
Use a shielded cable for the connection to the residual current transformer inputs.

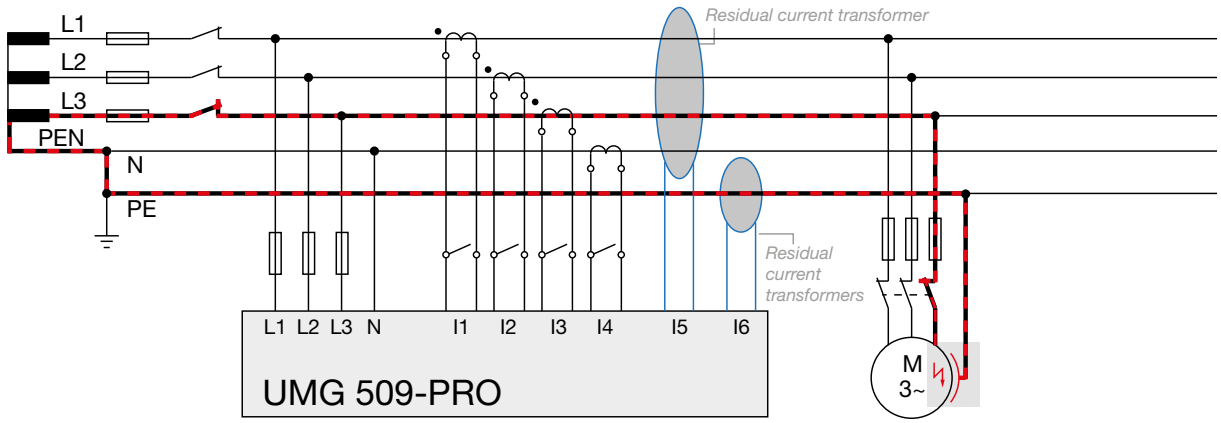


Fig. Example of UMG with residual current monitoring via measurement inputs I5/I6.

⚠ WARNING

Risk of injury due to electrical voltage!
The Profibus, RS-485, temperature measurement input and residual current measurement input are not galvanically isolated from each other.
Consequently, it is essential to note that dangerous voltages at these inputs can have an effect on the other respective connections.

7.8.3 Temperature measurement

The device has a temperature measurement input designed for a maximum total load of 4 kOhms.

This refers to the sensor and the wire.

The temperature is measured via terminals 8 to 10.

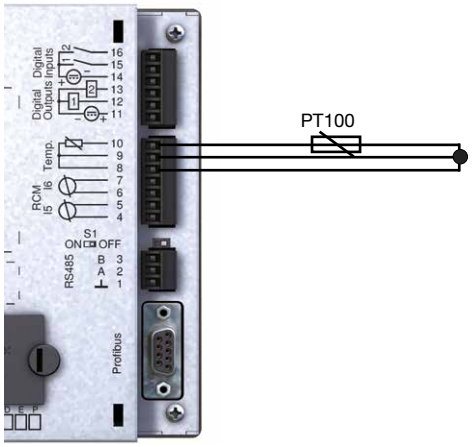


Fig. Connection example for temperature measurement via a PT100

ATTENTION

Transmission error and material damage due to electrical malfunction.
With a cable length of more than 30 m, there is an increased probability of transmission errors and damage to the device due to atmospheric discharge!
Use a shielded cable for the connection of the temperature sensor.

⚠ WARNING

Risk of injury due to electrical voltage!
The Profibus, RS-485, temperature measurement input and residual current measurement input are not galvanically isolated from each other.
Consequently, it is essential to note that dangerous voltages at these inputs can have an effect on the other respective connections.

7.8.4 Example insulation of the temperature sensor

A temperature sensor is used for measurement in the proximity of
non-insulated mains wiring in a 300 V
CAT III network.

The temperature sensor must use reinforced or double insulation for 300 V CAT III.

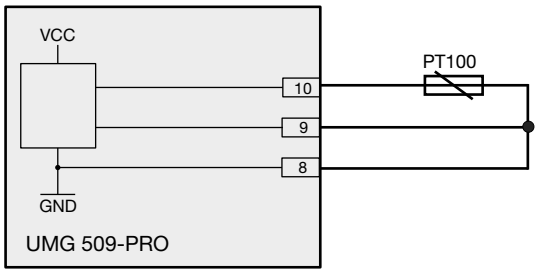


Fig. Schematic representation of the connection example

⚠ CAUTION

Risk of injury or damage to the meter/your system due to short circuit!
Insufficient insulation of the equipment at the analog inputs (temperature measurement and residual current measurement) with respect to the supply circuits can lead to voltages at the measurement input that are dangerous to touch or can damage your device/system.
Ensure reinforced or double insulation with respect to the supply circuits.

8. Interfaces

The device has the following interfaces through which it can be connected to other devices:
· RS-485
· Profibus
· Ethernet

8.1 Shielding

Provide a twisted and shielded cable for connections via the interfaces and observe the following points for shielding:

· Ground the shields of all cables leading into the cabinet at the cabinet entrance.
· Connect the shield to a noiseless ground and ensure a large surface area with good conductivity.
· Mechanically restrain the cables before the grounding clamp to prevent damage from cable movement.
· Use suitable cable glands, for example PG glands, to lead the cable into the switchboard cabinet.

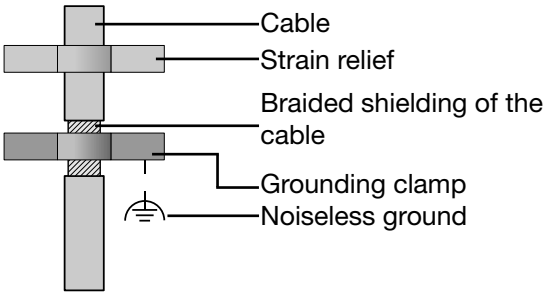


Fig. Shielding design at the cabinet entry.

⚠ WARNING

Risk of injury due to high currents and high electrical voltages!
Atmospheric discharge can cause transmission errors and dangerous voltages on the device. Therefore please abide by the following:
· **Connect the cable shielding to functional earth (PE) at least once.**
· **For larger sources of interference or frequency converters in the switchboard cabinet, connect the shielding to functional earth (PE) as close to the device as possible.**
· **Comply with the maximum cable length of 1,200 m at a baud rate of 38.4 kbps.**
· **Use shielded cables.**
· **Route interface cables spatially separated or additionally insulated from mains voltage-carrying system components.**

8.2 RS-485 interface

The RS-485 interface of this device is designed as a 3-pole plug contact and communicates using the Modbus RTU protocol.

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

Recommended cable type:

· Unitronic Li2YCY(TP) 2x2x0.22 (Lapp cable)

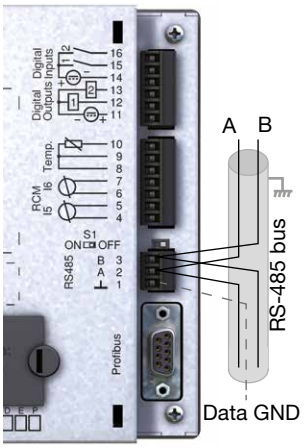


Fig. RS-485 connection example

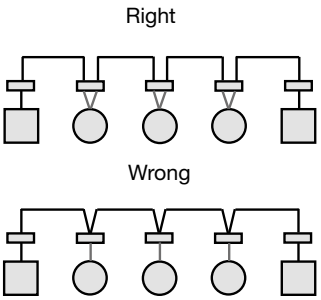
⚠ WARNING

Risk of injury due to electrical voltage!
The Profibus, RS-485, temperature measurement input and residual current measurement input are not galvanically isolated from each other.
Consequently, it is essential to note that dangerous voltages at these inputs can have an effect on the other respective connections.

8.2.1 Termination resistors

At the beginning and end of a segment, the cable is to be terminated with resistors (120 ohms, 1/4 W).

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



▭	Terminal strip in the switchboard cabinet.
○	Device with RS-485 interface. (Without termination resistor)
□	Device with RS-485 interface. (With termination resistor on the device)

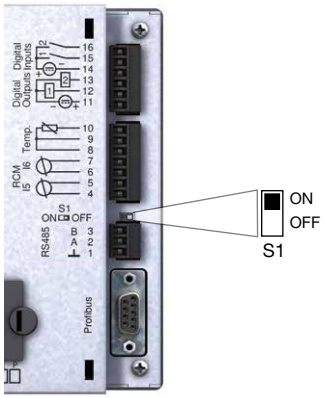


Fig. Termination activated via DIP switch (ON).

8.3 Profibus interface

This RS-485 interface, designed as a 9-pin DSub socket, supports the Profibus DP V0 slave protocol.

For easy connection of incoming and outgoing bus lines, use a Profibus connector to connect them to the device.

For the connection, we recommend a 9-pin Profibus connector, e.g. from Phoenix of the type "SUBCON-Plus-ProfiB/AX/SC" with part number 2744380.
(Janitza Part. No: 13.10.539)

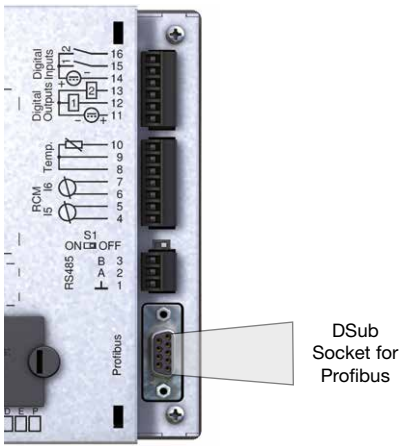


Fig. Rear view of UMG with DSub socket for Profibus

INFORMATION

When using the device in a Profibus system, set the device address via the configuration menu as described in „11.2.2 Fieldbus“ on page 55.

8.3.1 Connecting the bus lines

1. Connect the incoming bus line to terminals 1A and 1B of the Profibus connector.
2. Connect the continuing bus line for the next device in the line to terminals 2A and 2B.
3. If no device follows within the line, terminate the bus line with resistors by setting the switch on the Profibus connector to ON.

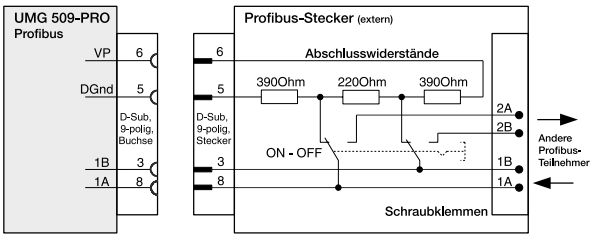


Fig. Profibus connector with termination resistors

Transmission speeds in kBit/s	max. Segment length
9.6, 19.2, 45.45, 93.75	1200 m
187.5	1000 m
500	400 m
1500	200 m
3000; 6000; 12000	100 m

Tab. Segment lengths according to the Profibus specification.

WARNING

Risk of injury due to electrical voltage!
The Profibus, RS-485, temperature measurement input and residual current measurement input are not galvanically isolated from each other.
Consequently, it is essential to note that dangerous voltages at these inputs can have an effect on the other respective connections.

8.4 Bus structure

- All devices are connected in a bus structure (line).
- Each device has its own address within the bus (see also Programming parameters).
- Up to 32 nodes can be connected together in one segment.
- At the beginning and end of a segment, the cable is to be terminated with resistors (bus termination, 120 ohms, 1/4 W).
- If there are more than 32 nodes, repeaters (line amplifiers) must be used to connect the individual segments.
- Devices with bus termination switched on must be powered.
- It is recommended that the master be placed at the end of a segment.
- If the master is replaced with the bus termination switched on, the bus is out of operation.
- The bus can become unstable if a slave with bus termination switched on is replaced or is de-energized.
- Devices that are not involved in the bus termination can be replaced without the bus becoming unstable.

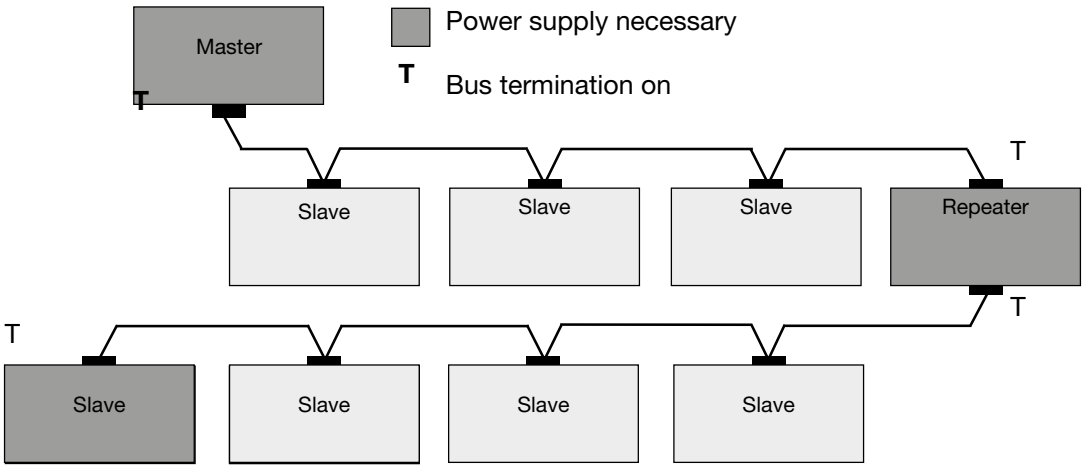


Fig. Bus structure

INFORMATION

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

8.5 Ethernet interface

The Ethernet interface is located on the bottom of the device. When connecting, make sure to provide a sufficient connection area to accommodate the bending radius and connector type of the Ethernet cable.

This connection area should not be smaller than 50 mm.

ATTENTION

Material damage due to incorrect network settings.
Incorrect network settings can cause faults in the IT network!
Consult your network administrator for the correct network settings for your device.

ATTENTION

Material damage due to security vulnerabilities in programs, IT networks and protocols.
Security vulnerabilities can lead to data misuse and faults and even the standstill of your IT infrastructure.
To protect your IT system, network, data communications and measurement devices:
- **Inform your network administrator and/or IT representative.**
- **Always keep the meter firmware up to date and protect the communication to the meter with an external firewall. Close unused ports.**
- **Take protective measures against viruses and cyber attacks from the Internet, e.g. through firewall solutions, security updates and virus protection programs.**
- **Eliminate security vulnerabilities and update or renew existing protection for your IT infrastructure.**

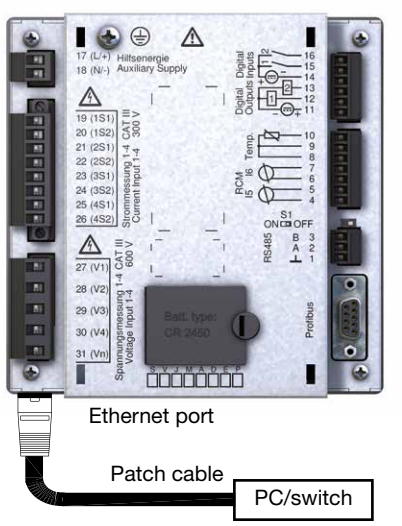


Fig. Rear view of UMG 509-PRO with patch cable

INFORMATION

The device is set to dynamic IP address assignment at the factory **(DHCP mode)**. These settings can be changed as described in „11.2.1 Ethernet (TCP/IP)“ or via the GridVis software (see www.janitza.com).

INFORMATION

We recommend using at least CAT5 cable for connection.

Meaning of the LEDs of the Ethernet interface:

LED	Function
Yellow	Blinks during network activity.
Green	Is illuminated when there is a connection (link).

9. Digital inputs and outputs

ATTENTION

Transmission error and material damage due to electrical malfunction.
With a cable length of more than 30 m, there is an increased probability of transmission errors and damage to the device due to atmospheric discharge!
Use shielded cables for the connections to the digital inputs and outputs!

9.1 Digital inputs

The device has two digital inputs.

An input signal is detected at a digital input when a voltage of at least 18 V and at most 28 V DC (typically at 4 mA) is present.

For a voltage from 0 to 5 V and a current of less than 0.5 mA there is no input signal.

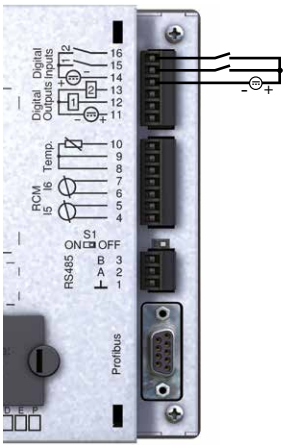


Fig. Connection of digital inputs

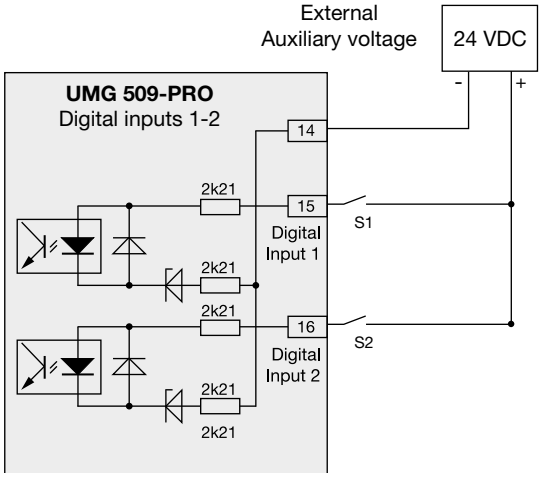


Fig. Example of connection of external contacts S1 and S2 to digital inputs 1 and 2

INFORMATION

Observe the polarity of the supply voltage.

9.1.1 S0 - Pulse input

You can connect an S0 pulse generator according to DIN EN62053-31 to each digital input.

You need an external auxiliary voltage with an output voltage in the range of 18 .. 28 VDC and a resistor of 1.5 kohms.

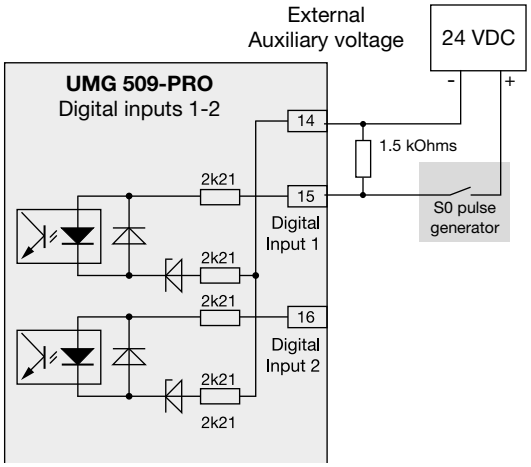


Fig. Connection example for an S0 pulse generator to digital input 1

9.2 Digital outputs

The device has two digital outputs that:

- Are electrically isolated from the evaluation electronics via optocouplers.
- Have a common reference.
- Require an external auxiliary voltage.
- Can be used as impulse outputs.

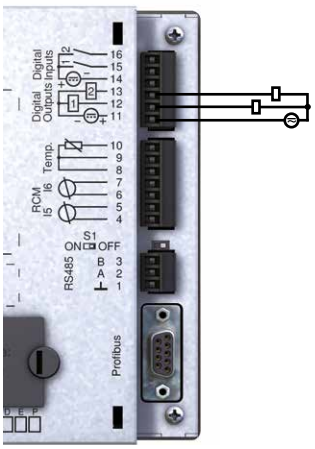


Fig. Connection of digital outputs

INFORMATION

Functions for the digital outputs can be set with a good overview using the GridVis software (see www.janitza.com).

INFORMATION

When using the digital outputs as pulse outputs, measurement errors can occur due to residual ripple. For the supply voltage (DC) of the digital inputs and outputs, use power supplies whose residual ripple is less than 5% of the supply voltage.

ATTENTION

Connection errors can damage the device and cause material damage.
The digital outputs are not short-circuit proof! Connection errors can therefore lead to damage to the connections.
Make sure that the wiring is correct when connecting the outputs.

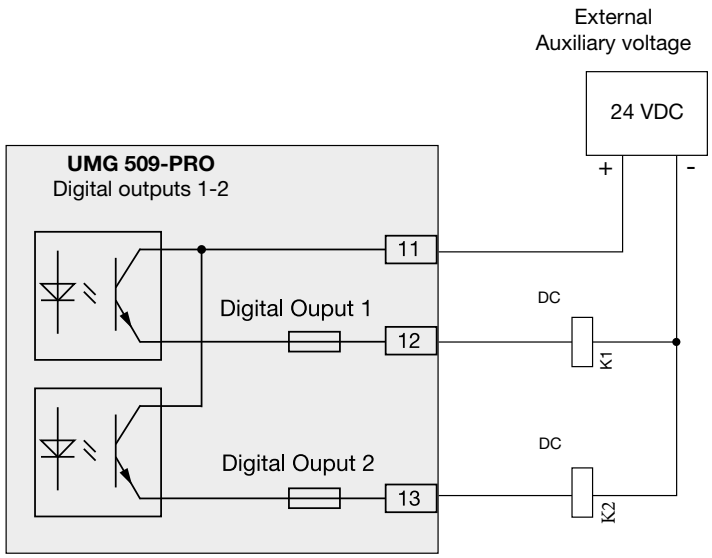


Fig. Connection example for 2 relays to digital outputs 1 and 2

10. Operation

The device is operated via six function buttons, which are assigned different functions depending on the context:

· Selecting measuring displays.
· Navigation within the menus.
· Editing device settings.

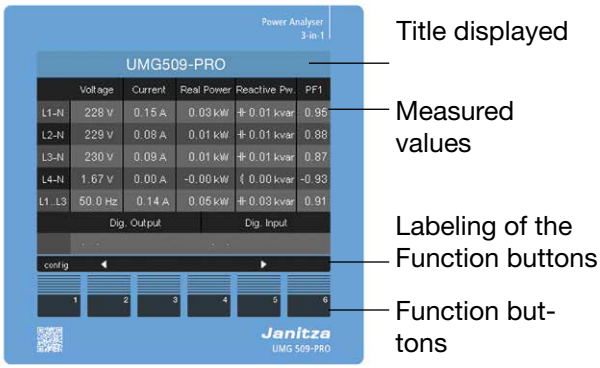


Fig. UMG measuring display "Home"

10.1 Button assignment

Button	Function
1	· Return to first screen (Home) · Exit selection menu
2	· Select digit · Select main values (U, I, P ...)
3	· Change (digit -1) · By-values (select) · Select menu item
4	· Change (digit +1) · By-values (select) · Select menu item
5	· Select digit · Select main values (U, I, P ...)
6	· Open selection menu · Confirm selection

10.2 Measuring display "Home"

After restoration of network power, the device starts with the measuring display "Home".

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

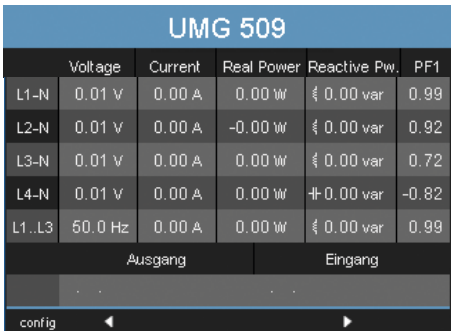


Fig. Relevant voltage V LN in a three-phase 4-conductor network

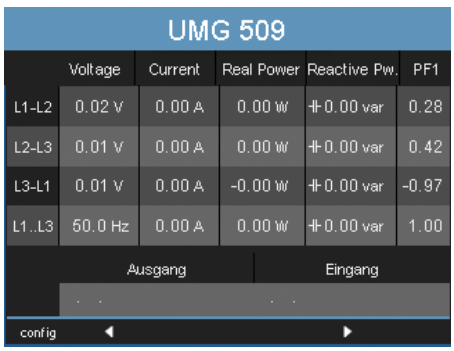


Fig. Relevant voltage V LL in a three-phase 3-conductor network

INFORMATION

The value PF1 on the display shows the value of cos phi.

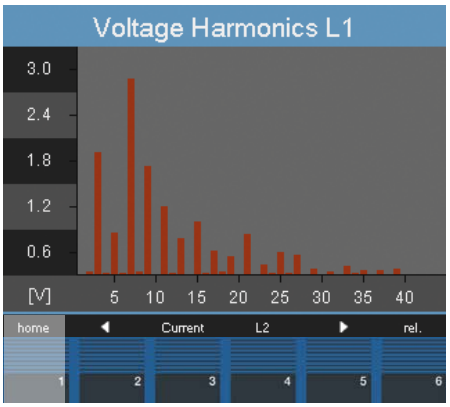


Fig. Harmonics voltage L1

The "Home - Button 1" takes you from the measuring displays for the main values directly to the first "Home" measuring display

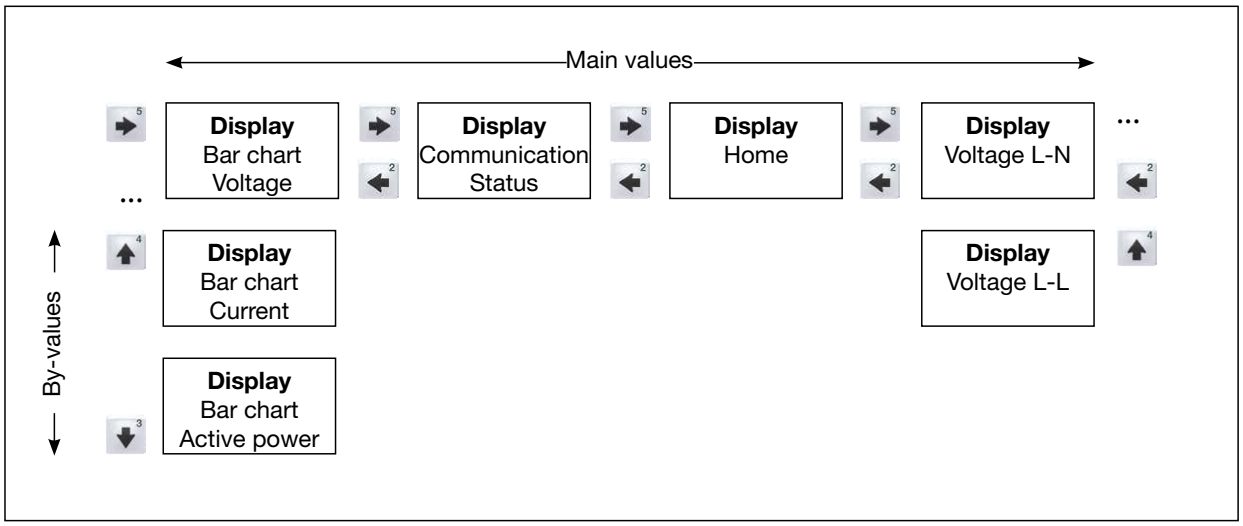
10.3 Measuring display

10.3.1 Main values

Use buttons 2 and 5 to scroll between the main values of the measuring displays. An overview of the measuring displays can be found in the section „17.2 Overview of measuring displays“.

10.3.2 By-values

The by-values of a measuring display can be selected with buttons 3 and 4. You can also find these in the overview in the section „17.2 Overview of measuring displays“.



10.4 Selecting a measuring display

To go to a measuring display with main values, use function buttons 2 to 5 to select the desired measuring displays with main values.
Function button 1 (Home) always takes you to the first measuring display.

Proceed as follows to go to a measuring display with by-values:

1. Select the measuring display with the main values.
2. Use function buttons 3 or 4 to select the measuring display for the desired by-values.

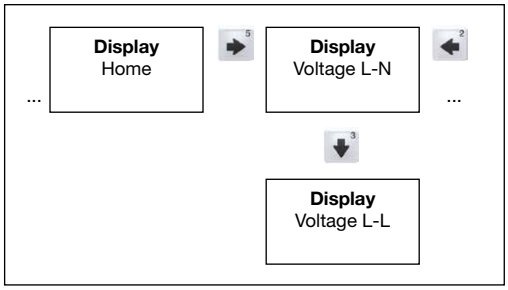


Fig. Example: Selection of by-values for voltage.

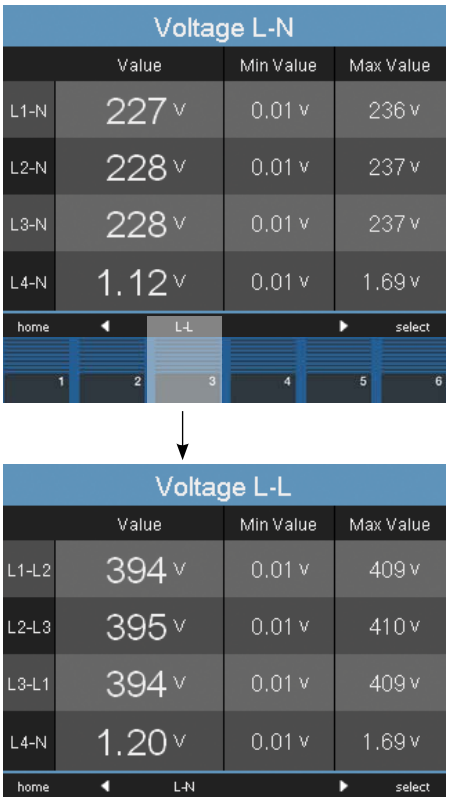


Fig. Selecting a measuring display

10.5 Retrieving additional information

Proceed as follows to retrieve additional information, such as power factor and frequency:

1.Scroll to the desired measuring display using buttons 2 to 5.
2.Activate the measured value selection with button 6 (selection).
· The background color for the measured value changes from gray to blue. The additional information is displayed in a separate window.
3.Select the desired measured value with buttons 2 to 5.
4.End the process with button 1 (ESC) or select another measured value with buttons 2 to 5.

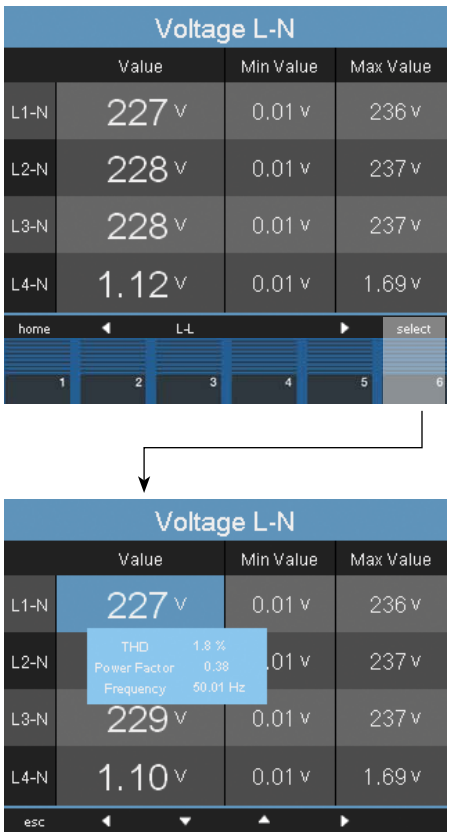


Fig. Additional information on voltage L1-N

10.6 Deleting values

To delete individual minimum and maximum values, proceed as follows:

1.Scroll to the desired measuring display using buttons 2 to 5.
2.Activate the measured value selection with button 6 (selection).
· The background color for the measured value changes from gray to blue. The additional information is displayed in a separate window.
3.Use buttons 2 to 5 to select the desired min. or max. value.
· The time instant with date and time of occurrence is displayed as additional information.
4.Use button 6 (Reset) to delete the selected min. or max. value.
5.End the process with button 1 (ESC) or select another min. or max. value with buttons 2 to 5.

INFORMATION

The date and time for the min./max. values are given in UTC time.

10.7 Transient list

Transient voltages:

· Are fast, pulse-like transient events in electrical networks.
· Are not predictable in terms of timing and are of limited duration.
· Are caused by lightning, by switching operations or by fuses blowing.

The transient list of the device lists a total of 16 detected transients on 2 pages.

Proceed as follows to display a specific transient voltage:

1.Scroll to the "Transients" main value display using buttons 2 or 5
2.Select the desired page using button 4.
3.Go to the transient list with button 6 (Select).
· The background color for date/time changes from gray to blue.
4. Select a transient with buttons 3 or 4.
5. Use button 6 (selection) to display a transient graphically.
6. Show or hide the legend by pressing button 6 (Legend) again.
7. Use button 1 (Esc) to leave the graphical display of the transient.

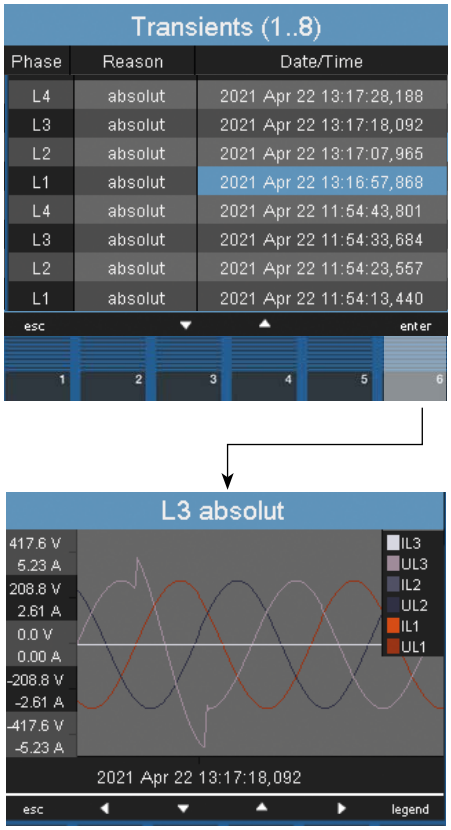


Fig. Display of a transient (V_{LN} reference)

Fig. Display of a transient (V_{LL} reference)

10.8 Event list

Events are limit violations of current and voltage RMS values.

The event list of your device lists a total of 16 detected events on two pages.

Proceed as follows to display a specific event:

1. Scroll to the main "Events" display using buttons 2 or 5.
2. Select the desired page using button 4.
3. Go to the event list with button 6 (selection).
· The background color for date/time changes from gray to blue.
4. Select an event with buttons 3 or 4.
5. Use button 6 (Enter) to display the event graphically.
6. Show or hide the legend by pressing button 6 (Legend) again.
7. Use button 1 (Esc) to leave the graphical display of the event.

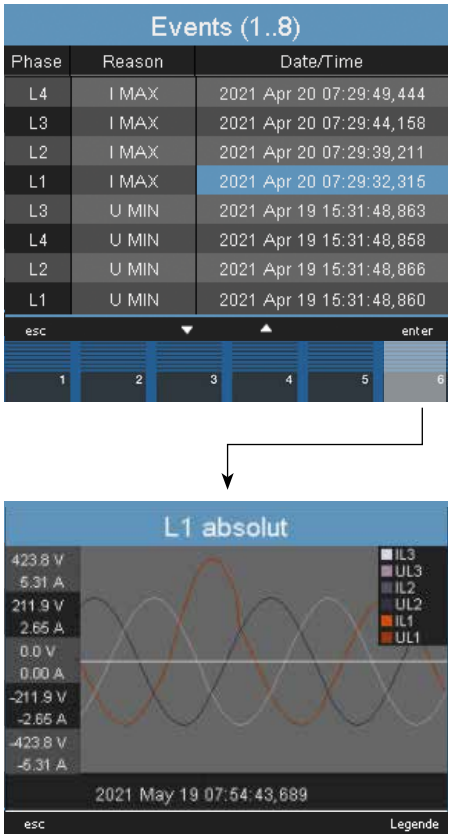


Fig. Display of an event

11. Configuration

The supply voltage must be connected to be able to configure the device. To do so, proceed as described in „12.1 Supply voltage“:

Press button 1 from the "Home" measuring display to open the configuration menu.

11.1 Languages

You can set the language for the measuring displays and menus directly in the "Configuration" menu.

There are several languages to choose from. The factory default setting for the language is "English".

Proceed as follows to change the system language:

1.Open the Configuration menu.
2.Press buttons 3 or 4 until the language field is highlighted.
3.Open the language selection with button 6 (Enter).
4.Use buttons 3 or 4 to select the desired language.
5.Confirm your selection by pressing button 6 (Enter) again.

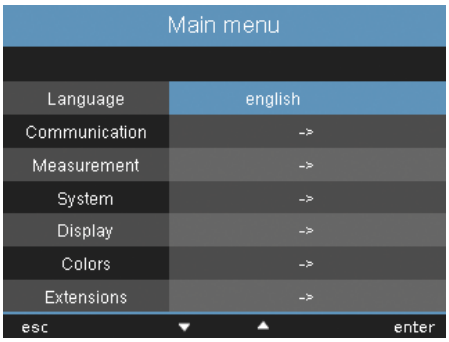


Fig. "Configuration" menu

11.2 Communication

The Ethernet and RS-485 interfaces of your device can be configured in the Communication menu.

Proceed as follows to enter the Communication menu:

1.Open the Configuration menu. Press button 1 in the "Home" menu to do so.
2.Press buttons 3 or 4 until the communication field is highlighted.
3.Open the "Communication" menu by pressing button 6.

11.2.1 Ethernet (TCP/IP)

In this section, select the address assignment mode and, if necessary, the IP address, netmask and gateway. The latter are assigned automatically in the BOOTP and DHCP assignment modes.

The device has three types of address assignment:

· **Off** - IP address, netmask and gateway are defined by you and set directly on the device. Select this mode for simple networks with no DHCP server.

· **BOOTP** - BootP allows fully automatic integration of a device into an existing network. BootP is an older protocol and does not have the functionality of DHCP.

· **DHCP** - At startup, the device automatically obtains the IP address, netmask and gateway from a DHCP server. DHCP is preset at the factory.

Proceed as follows to set the IP address, netmask and gateway:

1.Press buttons 3 or 4 until the corresponding field is highlighted.
2.Activate the input by pressing button 6.
· The font changes to red and a cursor appears.
3.Now set the desired digit with buttons 3 or 4.
4.Go to the next digit with button 5.
5.Repeat steps 3 and 4 until you have completed the desired input.
6.Confirm your entry with button 6.

11.2.2 Fieldbus

If you connect the device via the RS-485 interface, configure the following settings in this section:

· **Modbus protocol -** Here you select whether the device acts as slave or master/gateway in the bus structure.

· **Device address -** Select a device address for the device here with which the device can be addressed in the bus. This address must be between 0 and 255 and must be unique in the bus structure.

· **Baud rate -** Select a uniform baud rate for all devices in a bus structure. Possible settings are 9600, 19200, 38400, 57600, 115200, 921600 kbps.
The standard factory setting is 115200 kbps.

Proceed as follows to make the settings:

1.Press buttons 3 or 4 until the corresponding field is highlighted.
2.Press button 6 (Enter) to open the selection options.
3.Use buttons 3 or 4 to select the corresponding value.
4.Confirm your selection with button 6.

ATTENTION

Material damage due to incorrect network settings.
Incorrect network settings can cause faults in the IT network!
Consult your network administrator for the correct network settings for your device.

11.3 Measurement

In the Measurement menu, configure the following:

· The transformers for current and voltage measurement.
· The recording of transients.
· The recording of events.
· The mains frequency.
· The temperature sensor.

The device has:

· 4 measurement channels for current measurement (I1..I4)
· 4 measurement channels for voltage measurement (V1..V4 against Vref).

The measured voltages and measured currents for measurement channels 1-4 must come from the same network.

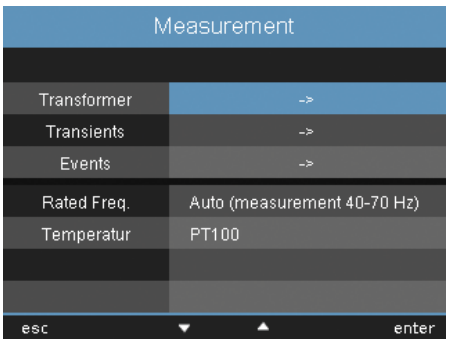


Fig. "Measurements" menu

11.3.1 Transformers

The following settings for main and auxiliary measurements can be made here:

· Current transformer
· Voltage transformer
· Nominal current
· Nominal voltage
· Apply AUX / Main
  - nominal voltage L-N, L-L
· Connection

As well as make settings for the ratios and monitoring for residual current transformers.

Current transformers
You can assign current transformer ratios to the main measurement and the auxiliary measurement respectively.

For direct measurement of currents, select the 5/5 A setting.

Setting range:	
Primary	1 .. 1000000
Secondary	1 .. 5

Factory default setting:	
Primary	5
Secondary	5

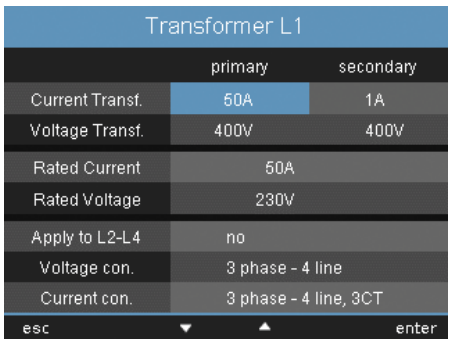


Fig. "Measurements" menu

Nominal current
The nominal current sets the reference point for:

· Overcurrent
· Current transients
· Automatic scaling of graphics

Setting range: 0 .. 1000000 A

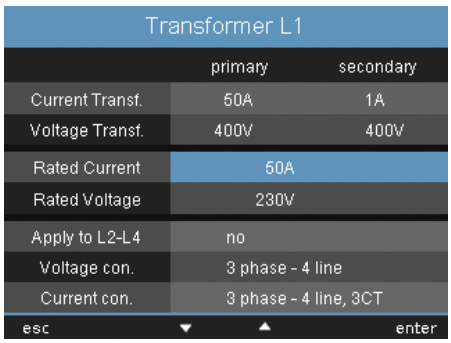


Fig. Configuring current transformer ratios

Voltage transformer
You can assign voltage transformer ratios to the main measurement and the auxiliary measurement respectively.
For measurements without a voltage transformer, select the 400/400 V setting.

Setting range:

Primary	1 .. 1000000
Secondary	1 .. 999

Factory default setting:

Primary	400
Secondary	400

INFORMATION

NOTE!
For Janitza measurement devices and components, use **only** current transformers intended for measuring purposes (“transformers”)!

“Transformers”, unlike “protection transformers”, go into saturation at high current peaks. “Protection transformers” do not have this saturation behavior and can therefore significantly exceed the rated values in the secondary circuit. This can overload the current measurement inputs of the measurement devices!

Furthermore, please note that Janitza measurement devices and components are **not** to be used for critical switching, control or protection applications (protective relays)! Observe the safety and warning information in the chapters „7. Installation“ and „2. Safety“!

INFORMATION

You can set the nominal values for measuring the K-factor and TDD via the GridVis software (see www.janitza.com).

Nominal voltage
The nominal voltage corresponds to the "Agreed input voltage Udin" according to EN 61000-4-30. The nominal voltage defines the reference point for:
· Overdeviation (EN 61000-4-30)
· Underdeviation (EN 61000-4-30)
· Transients
· Events
· Automatic scaling of graphics.
· When the nominal voltage U_{LN} is entered, the nominal voltage U_{LL} is calculated automatically. Formula: $U_{LL} = U_{LN} \cdot \sqrt{3}$
· When the nominal voltage U_{LL} is entered, the nominal voltage U_{LN} is calculated automatically. Formula: $U_{LN} = \frac{U_{LL}}{\sqrt{3}}$

Setting range, U_{LN}: 0 .. 999999 V
Setting range, U_{LL}: 0 .. 999999 V
Factory default setting: 230 V (U_{LN}), 398 V (U_{LL})
You can also select the primary voltage as the nominal voltage.

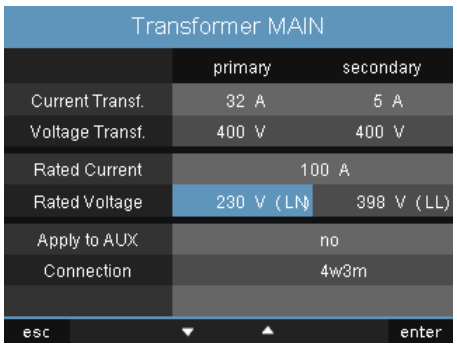


Fig. Transformer, main measurement

Apply L2 - L4
These settings are configurable per phase.

Under the menu item "Apply L2 - L4" you can apply the settings from phase L1 to phases L2, L3 and L4 respectively, so that you do not have to enter everything again.

· **No** - The settings from phase L1 are not adopted for phases L1 to L4.
· **Yes** - The settings from phase L1 are adopted for phases L1-L4.

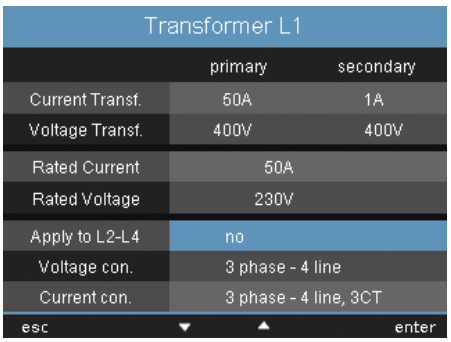


Fig. "Apply settings" disabled.

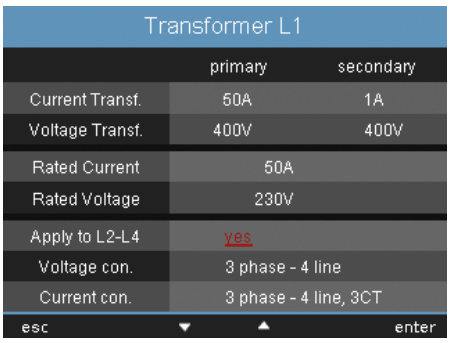


Fig. Apply settings for L2 - L4

Voltage measurement connection diagram
For voltage measurement you can choose between the following connection schemes:

3p4w	3 phases 4 conductors
3p4wu	3 phases 4 conductors
3p3w	3 phases 3 conductors For networks with no neutral conductor with a balanced load
3p3wu	3 phases 3 conductors For networks with no neutral conductor with a balanced load
3p5w	3 phases 4 conductors Measurement on an additional conductor
1p2w	1 phase 2 conductor (180°)

Factory default setting: 3p4w

INFORMATION

For the measurement inputs V4 and I4, no connection diagram has to be configured.

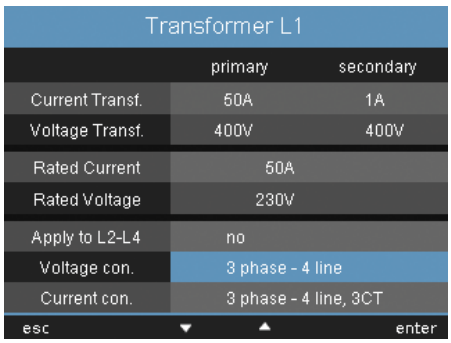


Fig. Connection diagram configuration for voltage

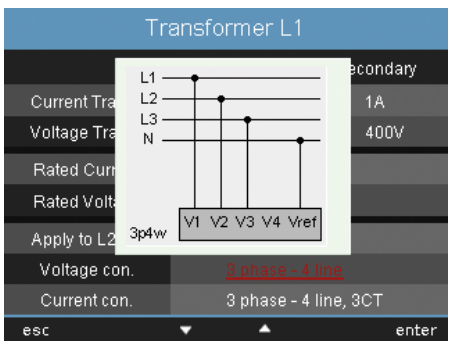


Fig. Connection diagram for voltage measurement

Current measurement connection diagram
For current measurement, you can choose between the following connection schemes:

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 of the neutral conductor, for example.
3p2i	3 phases 4 conductors, 2 current transformers For networks with a symmetrical load.
3p2i0	3 phases 3 conductors, 2 current transformers Aron circuit for networks with no neutral conductor. The third current is calculated
1p2i	1 phase 2 conductor, 2 current transformers

Factory default setting: 3p4w

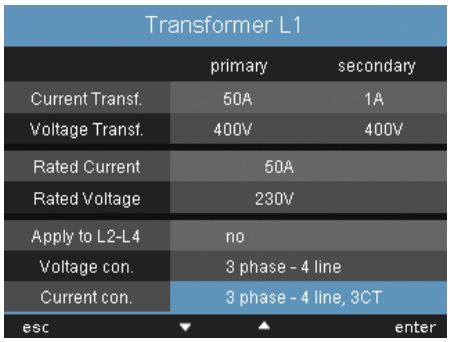


Fig. Connection diagram configuration for current

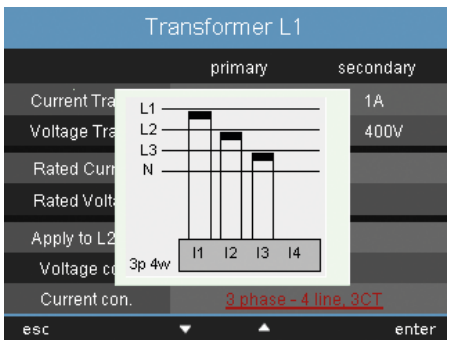


Fig. Connection diagram for current measurement

Lock transformer ratios
Locking/unlocking of the current and voltage transformer ratios can be done via the display. The status can be read out via an internal device address:

- If the entry "Lock all transformers" contains the value "no", the registers are not locked (neither current transformer (CT) nor voltage transformer (VT) ratios).
- If the entry "Lock all converters" contains the value "yes", the registers are locked (CT and VT ratios).

Modbus addr.	Value / Function
19716	Lock transformer ratios 0 = not locked 1 = locked

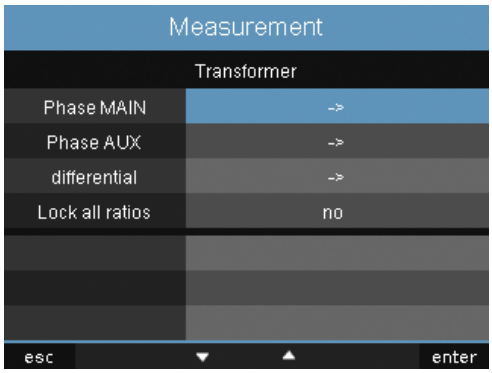


Fig. Lock transformer ratios

INFORMATION

- **A Modbus address list for your device can be found in the download area at www.janitza.com.**

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

Setting range:

Primary	1 .. 1000000
Secondary	1

Factory default setting:

Primary	127
Secondary	1

This menu is also used to set the failure monitoring of the corresponding residual current inputs:

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

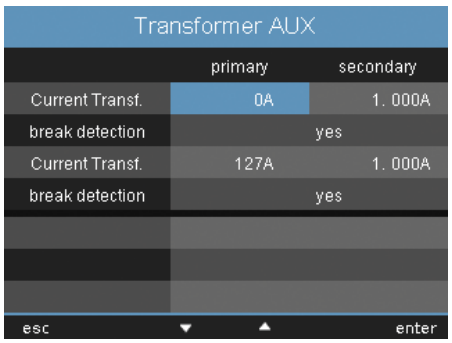


Fig. Configuration of residual current transformer

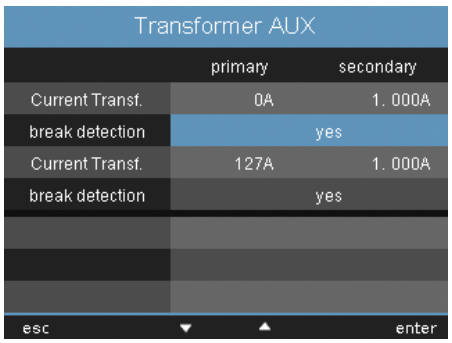


Fig. Configuring residual current measurement monitoring

11.3.2 Transients

The device:

· Monitors the voltage measurement inputs for transients.
· Detects transients that are longer than 50 µs.
· Can detect transients according to two independent criteria.
· Can receive different monitoring settings for each phase.

The addition of an "(LN)" or "(LL)" indicates the dependence of the calculated voltage values for the transient setting.

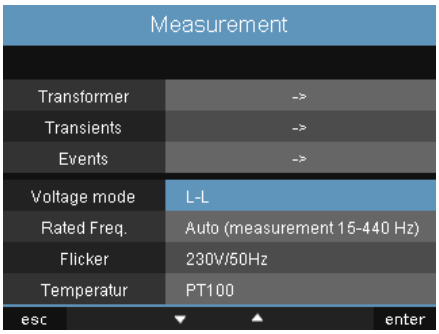


Fig. Example "Relevant voltage" ULL

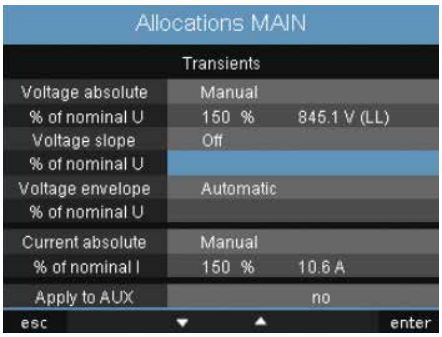


Fig. Setting MAIN "Transients" ULL

When a transient is detected:

· The waveform is stored in a transient recording.
· The limit value, both in automatic and manual mode, is automatically increased by 20 V for the next 10 minutes.
· For a period of 60 seconds each further transient is recorded with 512 points.

You can display recorded transients using the GridVis event browser.

The following modes are available for recording transients:

· **absolute**
· **delta**

Mode (absolute)
If a sample value exceeds the set limit value, a transient is detected:

· **off** - The transient monitoring is switched off
· **automatically** - Factory default. The limit value is calculated automatically and is 150% of the momentary 200 ms RMS value.
· **manually** - The transient monitoring uses the configurable limit values under "Peak".

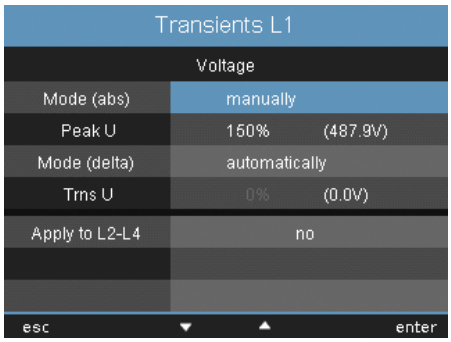


Fig. Configuring the transient recording mode

INFORMATION

Automatic determination of the mains frequency requires that a voltage L1-N of greater than 10 Vrms be present at voltage measurement input V1.

Mode (delta)
If the difference between two adjacent sample points exceeds the set limit value, a transient is detected:

· **off** - The transient monitoring is switched off.
· **automatically** - Factory default. The limit value is calculated automatically and is 0.2175 times the momentary 200 ms RMS value.
· **manually** - The transient monitoring uses the configurable limit values under "Trns U".

Apply L2-L4
· Transient monitoring can be configured per phase. You can apply the settings from phase L1 to phases L2, L3 and L4.

· **No** - The settings from phase L1 are not applied to phases L2, L3 and L4.
· **Yes** - The settings from phase L1 are applied to phases L2, L3 and L4.

Monitoring of the transients can be switched off (Off/Manual).
If a transient is switched off and on again, the value is first initialized according to its defaults. Either 85%, 110% or 150% depending on the setting.

11.3.3 Events

Events are limit violations of set limit values for current and voltage.

For this purpose, the limit values are compared with the full-wave RMS values of current and voltage from the measurement channels.
The event recording includes:

An average value.
A minimum or maximum value.
A start time and an end time.

An event describes disturbances due to:

· Over-/undervoltage
· Overcurrent
· Over/under frequency
· Fast frequency changes

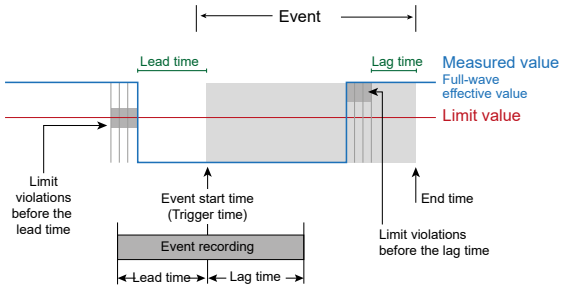
Monitoring of the events can be switched off (Off/Manual).

· If you switch an event off and on again, the value is first initialized according to its defaults. Either 85%, 110% or 150% depending on the setting.
· An event is triggered if there is a limit violation that remains uninterrupted throughout the lead time.
· The event is terminated if there is no limit violation within the lag time.

Limit values and hysteresis are set in percent of the nominal value. Limit values are configurable for:

· Overvoltage and undervoltage
· Overcurrent.

If an event has occurred, the associated measured value is recorded with the set lead and lag time (0..1000 full waves each).



INFORMATION

Event recording can be set with a good overview using the GridVis software (see www.janitza.com).

INFORMATION

The lead and lag time can be set with a good overview using the GridVis software (see www.janitza.com).
Factory default setting: 0

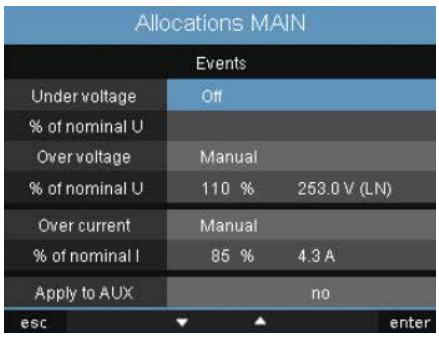


Fig. Configuring an event

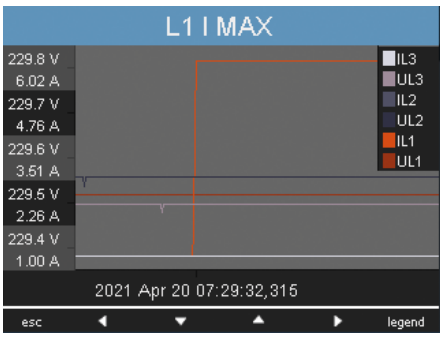


Fig. Display of an overcurrent for an event

Voltage dip
A voltage dip is set in % of the nominal voltage ULN.

Overvoltage
The overvoltage is set in % of the nominal voltage ULN.

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

Apply L2-L4
Monitoring of the events can be configured per phase. You can apply the settings from phase L1 to phases L2, L3 and L4.

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

11.3.4 Mains frequency

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

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

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

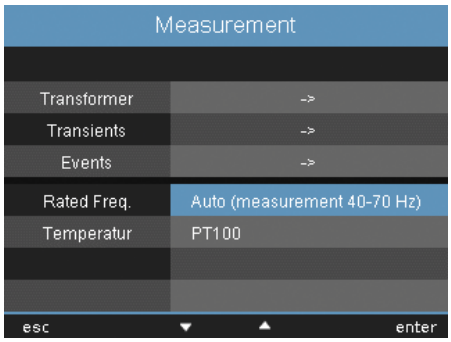


Fig. Setting the nominal mains frequency

Automatic frequency determination
For automatic determination of the frequency by the device, a voltage (V-Vref) of greater than 10 Vrms must be present on at least one of the voltage measurement inputs.

If the measured voltage is not sufficiently high, the device cannot determine the mains frequency and therefore cannot carry out a measurement.

11.3.5 Temperature

When using a temperature measurement, select the appropriate sensor type from a predefined list:

- PT100
- PT1000
- KTY83
- KTY84

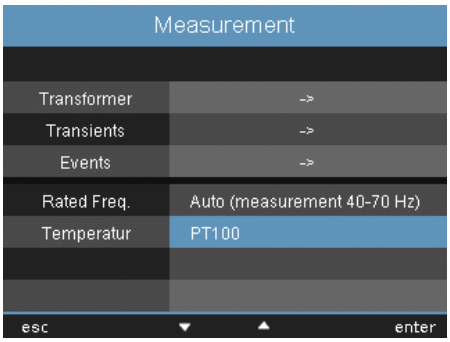


Fig. Selection of the temperature sensor

11.4 System

Here you can access the system settings and, as far as permissible, change them.

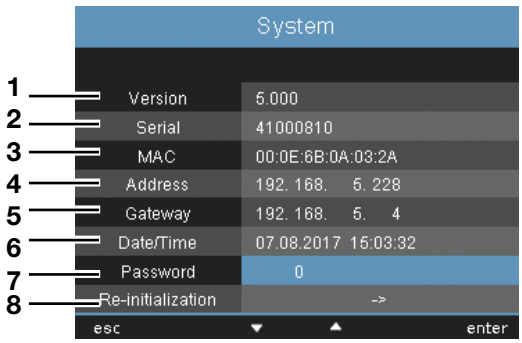


Fig. System settings

1 Firmware version
2 Serial number of the device
3 Fixed MAC address of the device
4 IP address that is set
5 Gateway address that is set
6 Date and time
7 Password that is set
8 Reset settings

INFORMATION

You can change the settings for time synchronization, date and time via the GridVis software (see www.janitza.com).

11.4.1 Password

A user can block access to the configuration by using a password. Changing the configuration directly on the device is then only possible after entering the password.

The password consists of a 6-digit number.

Setting range:

1-999999 = with password
0 = without password

No password (0) is programmed at the factory.

To change an already set password, you must know the current password. Remember a changed password.

Proceed as follows to set a password:

1.Open the System menu
2.Navigate to the Password setting using buttons 3 or 4.
3.Open the output by pressing button 6.
4.Enter the desired password using buttons 2 to 5.
5.Confirm your entry by pressing button 6 again.
· If you no longer wish to be prompted for a password, enter "0" as the password.

INFORMATION

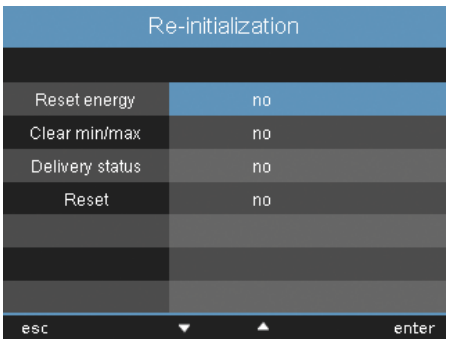
If you no longer know the password, you can only change it using the GridVis software (see www.janitza.com).

11.4.2 Reset

In this area you can reset the settings that you have made to the factory defaults.

Reset energy
You can delete all energy meters in the device simultaneously. It is not possible to select specific energy meters.

1.Open the Reset menu.
2.Use buttons 3 or 4 to highlight the "Reset energy" item.
3.Activate the input by pressing button 6.
· The font color changes to red and a cursor appears.
4.Change the value to "Yes" by pressing button 4.
5.Confirm your entry with button 6.



· The message "Executed" appears in the line - all energy meters have been cleared.

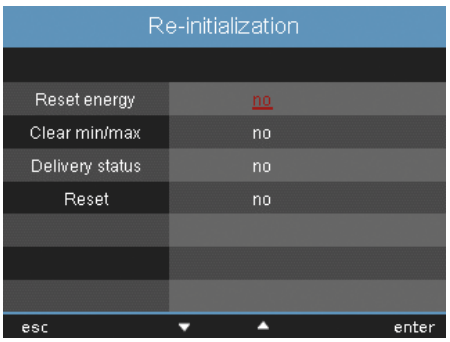


Fig. Energy reset

Deleting min. / max. values
You can delete all min. and max. values in the device at the same time.
You can find out how to delete individual min. and max. values in „10.6 Deleting values“.

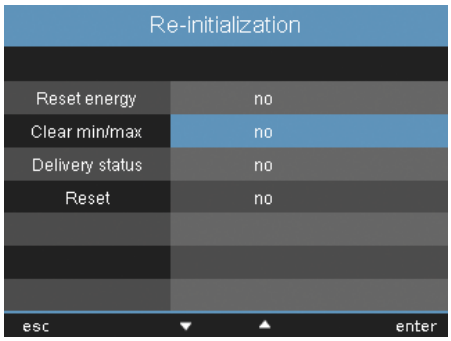


Fig. Clearing min. / max. values

1.Open the Reset menu.
2.Use buttons 3 or 4 to highlight the "Min/Max values" item (green marking)
3.Activate the input by pressing button 6.
· The font color changes to red and a cursor appears.
4.Change the value to "Yes" by pressing button 4.
5.Confirm your entry with button 6.
· The message "Executed" appears in the line - all min. and max. values have been cleared.

INFORMATION

Before commissioning, delete any possible production-related contents of the energy meters, min. / max. values and recordings.

Delivery condition
This is used to reset all settings, such as configurations and recorded data, to the factory default settings. Registered activation codes will not be deleted.

1.Open the Reset menu.
2.Use buttons 3 or 4 to highlight the "Delivery condition" item (green marking)
3.Activate the input by pressing button 6.
· The font color changes to red and a cursor appears.
4.Change the value to "Yes" by pressing button 4.
5.Confirm your entry with button 6.
· The message "Executed" appears in the line - the delivery condition has been restored.

Restart
Proceed as follows to restart the device manually:

1.Open the Reset menu.
2.Use buttons 3 or 4 to highlight the "Restart" item (green marking)
3.Activate the input by pressing button 6.
· The font color changes to red and a cursor appears.
4.Change the value to "Yes" by pressing button 4.
5.Confirm your entry with button 6.
· The device restarts within approx. 10 seconds.

11.5 Display

Here you can adapt the display settings of your device.

Brightness
You can set the display brightness of the device here. Proceed according to the pattern described in the previous sections.

Setting range:	0 .. 100%
Factory default setting:	100%

· 0% = dark
· 100% = very bright

INFORMATION

The backlight service life is extended when the backlight brightness is lower.

Standby
Here you can set the time after which the display brightness switches to the standby brightness that has been set.

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

Brightness (standby)
Here you can set the display brightness to be switched to after the standby time has elapsed. The standby time is restarted by using the buttons 1-6.

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

Screen saver
You can activate or deactivate the screen saver here.

INFORMATION

If the display shows an unchanging image over a longer period of time, this can damage the display.
Using a screen saver prevents this and thus prolongs the service life of the display.

Setting range:	Yes, No
Factory default setting:	Yes

Representation
Here you can set the speed at which new measured values appear in the measuring displays.

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

Factory default: fast

Rotate
Here you can activate or deactivate automatic rotation between the different measuring displays.

Setting range:	Yes, No
Factory default setting:	No

Change time
Here you can set the time after which the display automatically switches to the next measuring display.

Setting range:	0 .. 255 seconds
Factory default setting:	0 seconds

11.6 Colors

Here you can select the colors for the display of current and voltage in the graphical visualizations.

1. Press buttons 3 or 4 until the color field is highlighted in green.
2. Open the Colors menu with button 6
3. Use buttons 3 or 4 to select the desired color field.
4. Confirm your selection with button 6.
5. Use buttons 3 or 4 to select the desired color.
6. Confirm your selection by pressing button 6.

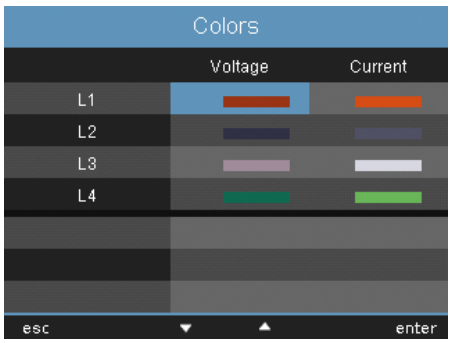


Fig. Colors setting menu

11.7 Enhancements

Here you can:
· Unlock functions later on that are subject to a charge.
· Retrieve the status of the Jasic programs.

Activation
The device contains the following functions subject to a charge that you can activate later on:

· BACnet

You will receive the activation code from the manufacturer. The manufacturer requires the serial number of the device and the name of the function to be enabled.
To unlock the function, enter the 6-digit activation code in the corresponding line.

Note that the activation code is only valid for one device.

Jasic status
Up to 7 customer-specific Jasic programs (1-7) and one recording can run in the device.

The Jasic programs can assume the following states:

· Stopped
· Running

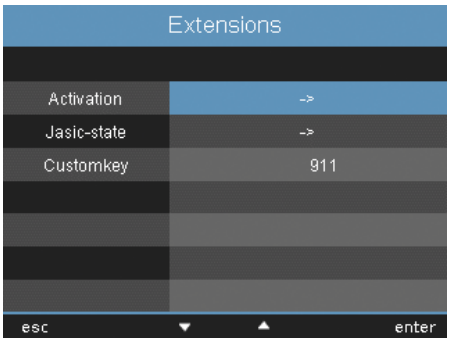


Fig. Enhancements setting menu

INFORMATION

You can only change the status of Jasic programs through the software.

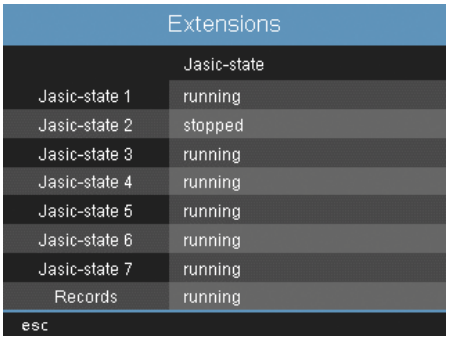


Fig. Jasic status setting menu

11.8 PTP configuration

The device supports the **Precision Time Protocol (PTP**) in accordance with the Standard Annex J IEEE 1588-2008 **PTP Default Profile.**

The PTP protocol is executed in a logical area known as the domain. The time specified by the protocol in one domain is independent of the times in other domains.

The PTP protocol enables precise time synchronization in the network from the time server (master) to the clients (slaves). The prerequisite for this is the PTP capability of the client. The reference time for the system is determined by what is known as the Grandmaster Clock (see section „Example: PTP timing according to IEEE 1588-2008 and clock types“).

Time synchronization in a network is achieved by the exchange of PTP time control messages. Clients use the time control information in the PTP messages to set their time to that of the time server (master) in their part of the hierarchy.

While NTP uses the client-server model – each client must be configured with a name or the IP address – the system configures itself according to the default PTP profile.

For the **Device** (as of firmware version 5.017), activate PTP (or NTP):
· In the GridVis software (device configuration).
· Via the parameter **_MODE_NTP** (the Modbus address can be found in the Modbus address list of your device at www.janitza.com).

11.8.1 Important Modbus parameters for the PTP configuration of the device

Meanings of the Modbus parameters:

Parameter name	Data type	Permission	Entry (range)
_MODE_NTP (cf. section „11.8.2 PTP parameter _MODE_NTP“)	int	RD/WR	NTP/PTP activation
_PTP_DOMAIN [1)]	byte	RD/WR	Default = 0 (0 - 127)
_PTP_ANNOUNCE_RECEIPT_TIMEOUT [2)]	byte	RD/WR	Default = 3 (2 - 10)
_PTP_MANAGEMENT_INTERFACE [3)]	short	RD/WR	Default = 0 (0 - 1)

1. Domain number (default domain = 0). A PTP domain is a range of PTP clocks (devices) which synchronize themselves with each other using the PTP protocol.
2. Selects the PTP Announce Receipt Timeout. This parameter specifies the number of intervals that are allowed to elapse without receipt of an announce message (default = 3).
3. 0 (default) – Device supports PTP configuration via the Modbus.
   1 - Alternative method of configuration (enables a comprehensive configuration via the interface).

11.8.2 PTP parameter _MODE_NTP

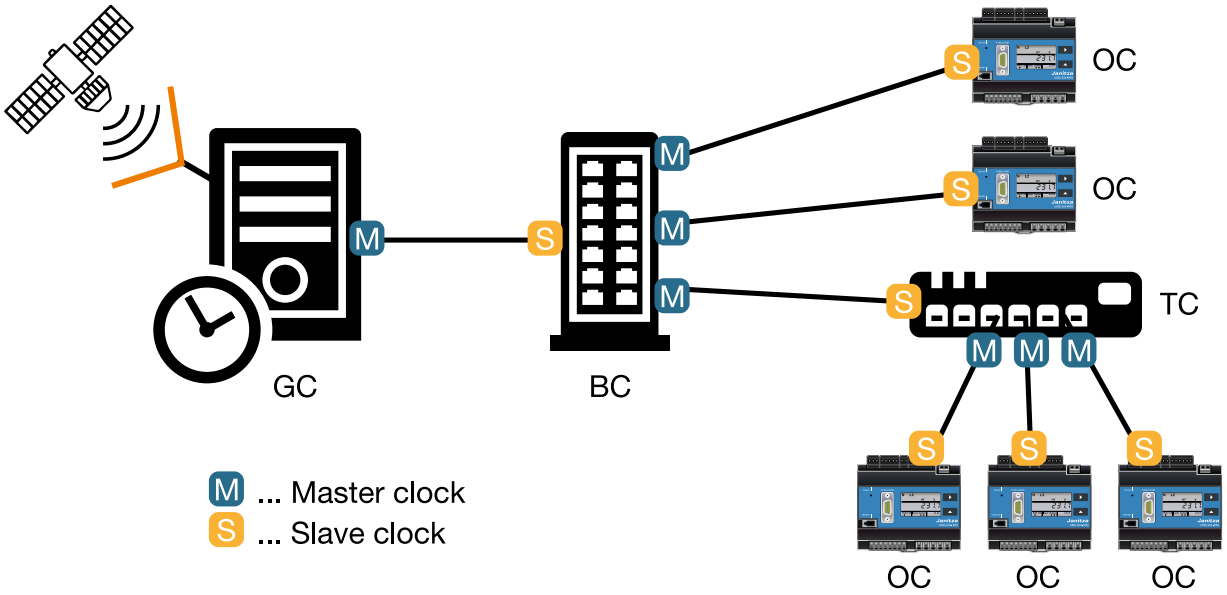
In this context, the entries have the following functions:

Parameter _MODE_NTP	Entry	Description
TIME_PROTOCOL_NONE	= 0	No time protocol is active. Manual time configuration.
TIME_PROTOCOL_NTP_BROADCAST	= 1	NTP mode “Listen”, PTP deactivated.
TIME_PROTOCOL_NTP_ACTIVE	= 2	NTP mode “Active”, PTP deactivated.
TIME_PROTOCOL_PTP	= 3	PTP mode is activated, NTP deactivated.

INFORMATION

- **A Modbus address list including all the PTP parameters of your device can be found in the download area at www.janitza.com.**
- **Specifications for PTP (Precision Time Protocol) can be found in IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems (IEEE Std. 1588-2008).**
- **The device supports PTP according to the default PTP profile Annex J IEEE 1588-2008 with the profile ID 00-1B-19-00-01-00.**

11.8.3 Example: PTP timing according to IEEE 1588-2008 and clock types



Ordinary clock (OC)	Simple clock (one port, measures one client) that is connected with a master as the slave and synchronizes its time with the master.
Boundary clock (BC)	Clock that contains several “ordinary clocks” (several ports) and, as the master, synchronizes several slaves with its time and transports this beyond a network boundary. The “boundary clock” can also be connected to a master as a slave and synchronize its time with the master.
Transparent clock (TC)	Clock that does not actively intervene in the time synchronization; it is more a hardware item that transmits time synchronization data packets (e.g. a network switch). “Transparent clocks” can also correct the time stamp within the data packet by the dwell time within the hardware, if needed.
Grandmaster clock (GC)	The grandmaster clock is an “ordinary clock” that has access to GPS or another very accurate time and provides this time for all subordinate nodes.

12. Commissioning

This section presents everything you need to know about the initial commissioning of your device

12.1 Supply voltage

Proceed as follows when applying the supply voltage:

1. Connect the supply voltage with a terminal on the back of the device.
2. After connecting the supply voltage, the first measuring display, Home, appears on the display.
3. If no display appears, check whether the supply voltage is within the nominal voltage range.

⚠ WARNING

Material damage due to disregard of the connection instructions!
Voltages and currents outside the permissible measuring range can destroy the device.
- **Comply with the measuring range specifications from the technical data.**
- **Do not use the device for measuring DC voltage.**

INFORMATION

Before commissioning, delete any possible production-related contents of the energy meters, minimum and maximum values and recordings.

12.2 Measured voltage

Proceed as follows when connecting the measured voltage:

1. Connect the measured voltage with a terminal on the back of the device.
2. After connecting the measured voltage, the measured values displayed by the device for the voltages L-N and L-L must match those at the measurement input.
3. Take into account any voltage transformer factors that may be set.

⚠ WARNING

Risk of injury due to electrical voltage!
If the device is exposed to surge voltages above the permissible overvoltage category, safety-relevant areas of insulation in the device can be damaged. This means that the safety of the product can no longer be guaranteed.
Only use the device in environments in which the permissible overvoltage category is not exceeded.

12.3 Frequency measurement

For the measurement, the device requires the mains frequency, which can either be specified by the user or determined automatically by the device.

- For automatic determination of the frequency, a voltage (V-Vref) greater than 10 Vrms must be present on at least one of the voltage measurement inputs.
- The mains frequency must be in the range from 40 Hz to 70 Hz.
- If the measured voltage is not sufficiently high, the device cannot determine the mains frequency and therefore cannot carry out a measurement.

12.4 Direction of rotary field

Check the direction of the voltage rotating field in the measuring display of the device.
Usually it is a "right" rotating field.

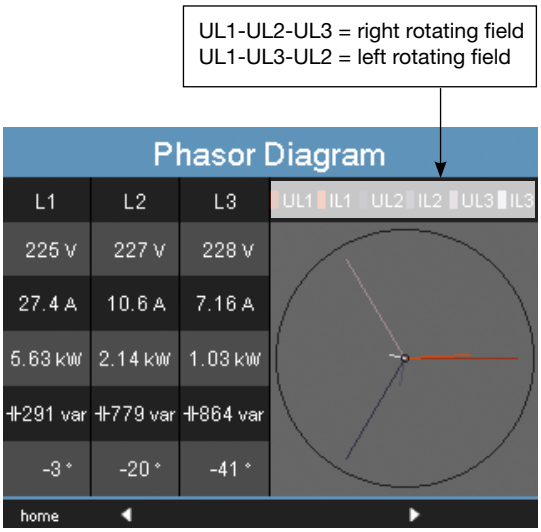


Fig. Illustration of the phase sequence according to the direction of the rotating field.

12.5 Measured current

The device:

· Is designed for the connection of current transformers with secondary currents of ../1 A and ../5 A.
· Does not measure DC currents.
· Has current measurement inputs which can be loaded at 120 A for 1 second.

The factory-set current transformer ratio is 5/5 A and must be adapted to the current transformers used as needed.

Proceed as follows when connecting the measured current:

1.Short-circuit all current transformer outputs except one.
2.Connect the measured current via the terminal on the back of the device and secure it sufficiently with the two screws.
3.Compare the current displayed on the device with the applied input current.
· The currents must match, taking into account the current transformer ratio.
· In the short-circuited current measurement inputs, the device must indicate approx. zero amperes.

Sign of phase shift angle (U/I):
· Positive (+) with capacitive load
· Negative (-) with inductive load

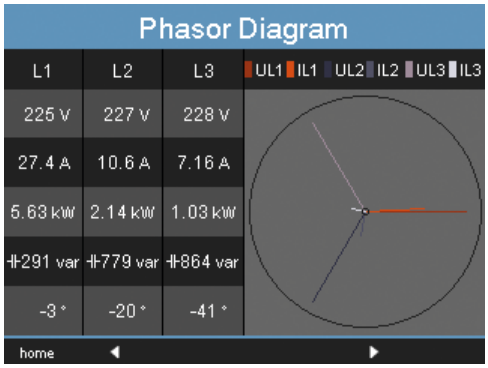
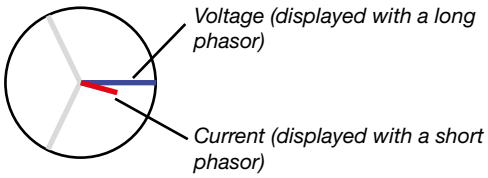


Fig. Phasor diagram



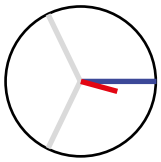
WARNING

Material damage due to disregard of the connection instructions!
Voltages and currents outside the permissible measuring range can destroy the device.
Comply with the measuring range specifications from the technical data.

12.5.1 Phasor diagram examples

Here you can see two examples of a display of measured current and measured voltage in the phasor diagram:

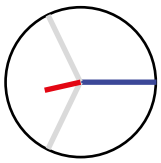
Example 1
Primarily ohmic load.



Voltage and current have only a small deviation in the phase position.

· The current measurement input is assigned to the correct voltage measurement input

Example 2
Primarily ohmic load.



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

· The measured current input is assigned to the correct voltage measurement input.
· In the current measurement under consideration, the connections k and l are reversed or there is a feedback into the supply network.

12.6 Residual current

Only connect residual current transformers with a nominal current of 30 mA to inputs I5 and I6!

Both residual current inputs can measure AC currents and pulsating DC currents.

The residual current displayed by the device must match the input current, taking into account the current transformer ratio.

The current transformer ratio is set to 127/1 A at the factory and must be adapted to the residual current transformers used if necessary.

INFORMATION

· For the measurement inputs I5 and I6, no connection diagram has to be configured.

INFORMATION

The device requires the mains frequency for the measurement of residual currents. For this purpose, apply the measured voltage or set a fixed frequency.

12.7 Failure monitoring (RCM)

The device enables continuous monitoring of the connection to the residual current transformer for inputs I5 and I6.

The failure monitoring can be activated via:

- The corresponding menu item, as described in the section „11.3.1 Transformers“.
- Or by setting the addresses 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 status is recorded in specific registers or displayed in the GridVis software.

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

Modbus addr.	Value / Function
18907 (I5) 18908 (I6)	0 = Connection to residual current transformer at I5 or I6 is fault-free 1 = Error in the current transformer connection at I5 or I6

12.7.1 Alarm status

The bitwise coding within the alarm registers (addr. 19224 for I5, 19225 for I6) makes it possible to read out different alarm states:
Example:

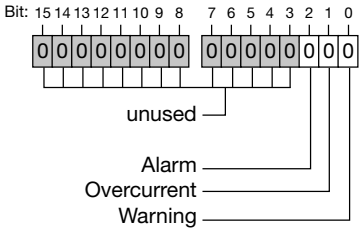


Fig. Alarm register

An overcurrent was measured. The alarm bit is set as well and must be acknowledged!

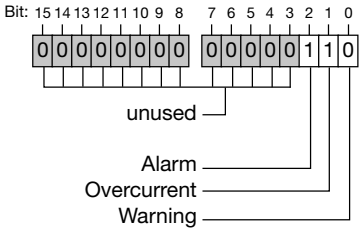


Fig. Example alarm register in the event of measured overcurrent.

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

12.8 Overrange

The overrange message is displayed as long as the condition is present and it cannot be acknowledged. The measuring range is exceeded if at least one of the four voltage or current measurement inputs lies outside its specified measuring range.

Limit values for overrange (200 ms effective values):

I	=	7.5 Arms
UL-N	=	600 Vrms

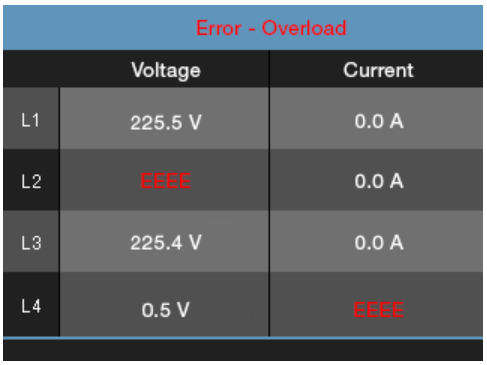


Fig. Display of overrange in voltage circuit L2 and current path I4

12.9 Control of the power measurement

1.Short-circuit all current transformer outputs except one.
2.Check the displayed powers.
· The device must only show power in the phase with the current transformer input that is not short-circuited.
· If this is not the case, check the connection of the measured voltage and measured current.

If the amount of active power is correct, but the sign of the active power is negative, this can have two causes:

1.The connections S1(k) and S2(l) on the current transformer are reversed.
2.Active energy is returned to the grid.

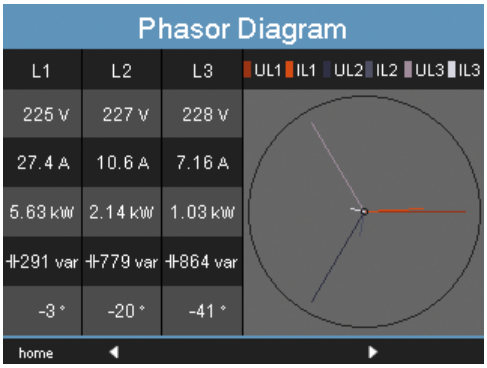


Fig. In the phasor diagram, voltages are shown with long phasors and currents with shorter phasors.

12.10 Control of the communication

The device counts all received (RX), all sent (TX) and all faulty data packets.

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

Pressing button 6 resets the counters for the data packets to 0. The start time for the new count is automatically reset.

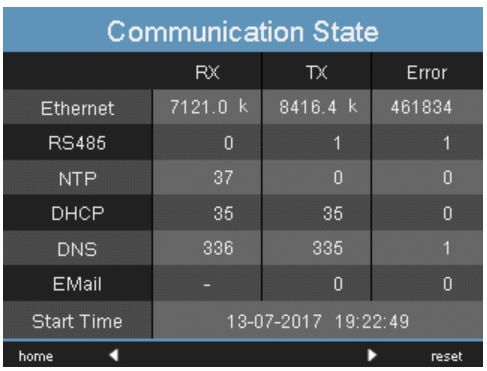


Fig. Communication status

12.11 Communication in the bus system

12.11.1 RS-485

The data from the parameter and measurement list can be accessed via the MODBUS RTU protocol with CRC check at the RS-485 interface (cf. „11.2.2 Fieldbus“).

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 order of the bytes is high before low byte (Motorola format).

Transmission parameters

Data bits:	8
Parity:	none
Stop bits (UMG 509-PRO):	2
Stop bits, external:	1 or 2

Number formats

short	16 bit (-215 ... 215 -1)
Float	32 bit (IEEE 754)

INFORMATION

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

INFORMATION

The telegram length must not exceed 256 bytes.

Example: Reading the voltage L1-N
The voltage L1-N is stored in the measurement list under the address 19000. The voltage L1-N is in the FLOAT format.
In this example 01 is assumed as the device address.

The "Query Message" then looks as follows:

Designation	Hex	Comment
Device address	01	Address=1
Function	03	“Read Holding Reg”
Start address Hi	4A	19000dec = 4A38hex
Start address Lo	38	
No. of values Hi	00	2dec = 0002hex
No. of values Lo	02	
Error check (CRC)	-	

The "response" of the device can then look as follows:

Designation	Hex	Comment
Device address	01	Address=1
Function	03	
Byte counter	06	
Data	00	00hex=00dec
Data	E6	E6hex=230dec
Error check (CRC)	-	

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

12.11.2 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.

Using a Profibus profile you 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 contain a maximum of 127 bytes of data. If more data has to be transferred, you may create further Profibus profiles. Each Profibus profile has a profile number. The profile number is sent from the PLC to the UMG.

The GridVis software allows you to directly edit 16 Profibus profiles (profile numbers 0..15).
With Jasic programs you may create additional Profibus profiles (profile numbers 16..255).

Factory preconfigured Profibus profiles can be changed later on.

Device master file
The device master file, abbreviated GSD file, describes the Profibus properties of the UMG. The GSD file is required by the configuration program of the PLC.
The device master file for your device has the file name "U5090F15.GSD" and is available on the Janitza homepage.

Variable definition
All system variables and global variables[1)] can be scaled individually and converted to one of the following formats:

· 8, 16, 32-bit signed and unsigned integer.
· 32 or 64-bit float format.
· Big endian = High byte before low byte.
· Little endian = Low byte before high byte.

[1)] Global variables are defined by the user in Jasic and are available to any interface in the device.

Example: Retrieving measured values via Profibus

You must define at least one Profibus profile with the GridVis software and transfer it to the device.

No Jasic program is required.

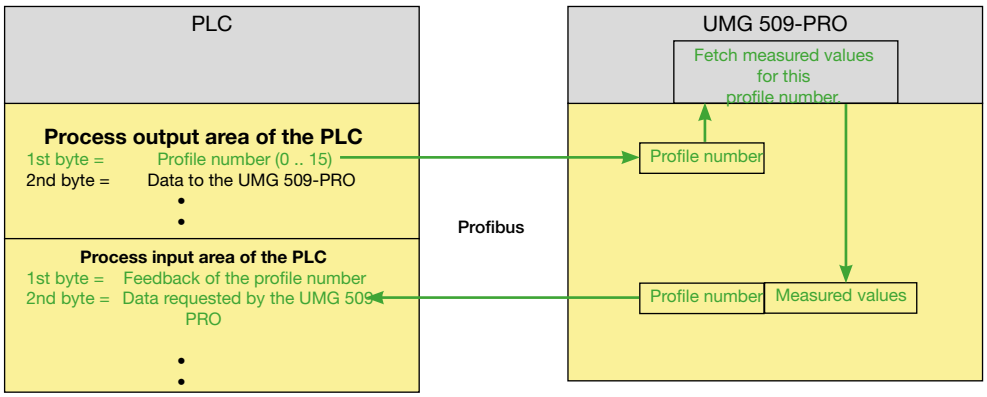


Fig. Block diagram for data exchange between PLC and UMG.

Factory preconfigured profiles
This section presents a tabular representation of the preconfigured Profibus profiles.

· **Profibus profile number 0**

	Byte index	Value type	Values format	Scaling
1	1	Voltage L1-N	Float	1
2	5	Voltage L2-N	Float	1
3	9	Voltage L3-N	Float	1
4	13	Voltage L4-N	Float	1
5	17	Voltage L2-L1	Float	1
6	21	Voltage L3-L2	Float	1
7	25	Voltage L1-L3	Float	1
8	29	Current L1	Float	1
9	33	Current L2	Float	1
10	37	Current L3	Float	1
11	41	Current L4	Float	1
12	45	Active power L1	Float	1
13	49	Active power L2	Float	1
14	53	Active power L3	Float	1
15	57	Active power L4	Float	1
16	61	Cos phi (math.) L1	Float	1
17	65	Cos phi (math.) L2	Float	1
18	69	Cos phi (math.) L3	Float	1
19	73	Cos phi (math.) L4	Float	1
20	77	Frequency	Float	1
21	81	Active power sum L1-L4	Float	1
22	85	Reactive power sum L1-L4	Float	1
23	89	Apparent power sum L1-L4	Float	1
24	93	Cos phi (math.) Sum L1-L4	Float	1
25	97	RMS current sum L1-L4	Float	1
26	101	Active energy sum L1-L4	Float	1
27	105	Ind. reactive energy sum L1-L4	Float	1
28	109	THD voltage L1	Float	1
29	113	THD voltage L2	Float	1
30	117	THD voltage L3	Float	1

Profibus profile number 1

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

Profibus profile number 2

	Byte index	Value type	Values format	Scaling
1	1	Active energy sum L1-L3	Float	1
2	5	Consumed active energy sum L1-L3	Float	1
3	9	Delivered 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	Values format	Scaling
1	1	Active power L1	Float	1
2	5	Active power L2	Float	1
3	9	Active power L3	Float	1
4	13	Active 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

12.12 Recording configuration

Two recording profiles are preconfigured in the factory default setting of the device.

Adaptation and expansion of recordings can be done using the GridVis software.

Profile	Measured value	Time base	Type
1	RMS voltage L1, L2, L3, L4, L1-L2, L2-L3, L3-L1	15 min.	average value (arithmetic), Min./max. values
1	RMS current L1, L2, L3, L4	15 min.	average value (arithmetic), Min./max. values
1	Active power L1, L2, L3, L4	15 min.	average value (arithmetic), Min./max. values
1	Active power, sum L1..L3, L1..L4	15 min.	average value (arithmetic), Min./max. values
1	Reactive power, fundamental L1, L2, L3, L4	15 min.	average value (arithmetic), Min./max. values
1	Reactive power, fundamental, sum L1..L3, L1.. L4	15 min.	average value (arithmetic), Min./max. values
2	Consumed active energy L1, L2, L3, L4	1 hr.	Sample
2	Consumed active energy, sum L1..L3, L1..L4	1 hr.	Sample
2	Inductive reactive energy L1, L2, L3, L4	1 hr.	Sample
2	Inductive reactive energy sum L1..L3, L1..L4	1 hr.	Sample

12.13 Digital inputs/outputs

Your device has two digital outputs and two digital inputs.

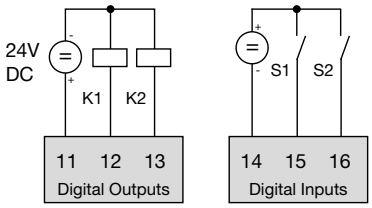


Fig: Digital outputs and inputs

The inputs and outputs can be configured using the GridVis software included in the scope of delivery.

12.13.1 Digital inputs

The digital inputs give you the option of having information from other devices that have a digital output sent directly to your device.

You can use the configuration window of the GridVis software in the Inputs area to define the following for both digital inputs:

· Which value type the incoming signal has.
· Which scaling factor should be used for the value.

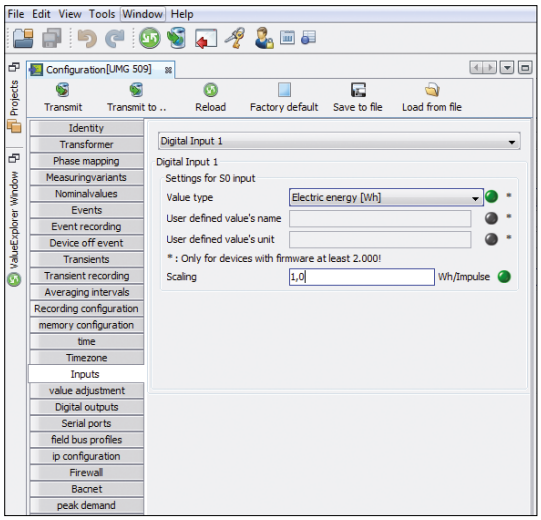


Fig. Configuring inputs of the UMG via GridVis

12.13.2 Pulse output

The digital outputs can also be used to output pulses for counting energy consumption. To do so, a pulse of defined length is applied to the output after a certain, configurable amount of energy has been reached.

To use a digital output as a pulse output requires that various settings be made within the configuration menu via the GridVis software:

· Pulse width
· Digital output to be configured
· Output type (event message or S0 output)
· The measured value to be transmitted
· Pulse valency

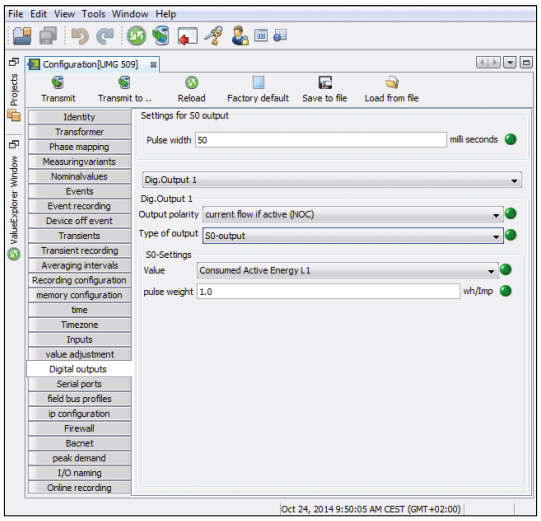


Fig. Configuring digital outputs of the UMG via GridVis

Pulse length
The pulse length applies for both pulse outputs and is set via the GridVis software.
The typical pulse length for S0 pulses is 30 ms.

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

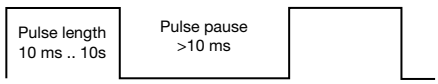


Fig. Schematic representation of a digital pulse

The maximum number of pulses per hour is calculated based on the minimum pulse duration and the minimum pulse pause, resulting in the values in the table.

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

Tab. Examples of the maximum possible number of pulses per hour

INFORMATION

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

INFORMATION

When programming with the GridVis software, you are given a selection of work values that are derived from the power values (see www.janitza.com).

Pulse valency
Use the pulse valency to specify how much energy (Wh or varh) should correspond to one pulse.

The pulse valency is determined by the maximum connected load and the maximum number of pulses per hour.

If you indicate the pulse valency with:

- With a positive sign, pulses are only output if the measured value also has a positive sign.
- With a negative sign, pulses are only output if the measured value also has a negative sign.

INFORMATION

Since the active energy meter operates with a reverse running stop, pulses are only output when electrical energy is consumed.

INFORMATION

Since the reactive energy meter operates with a reverse running stop, pulses are only output when there is an inductive load.

Determining pulse valency

1.Set the pulse length according to the requirements of the connected pulse receiver. With a pulse length of 30 ms, for example, the device can emit a maximum of 60,000 pulses (see table “Maximum number of pulses”) per hour.

2.Determine the maximum connected load.

Example:
Current transformer = 150/5 A
Voltage L-N = max. 300 V

Power per phase = 150 A x 300 V
= 45 kW

Power with 3 phases = 45 kW x 3
Max. connected load = 135 kW

3.Calculate the pulse valency:

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

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

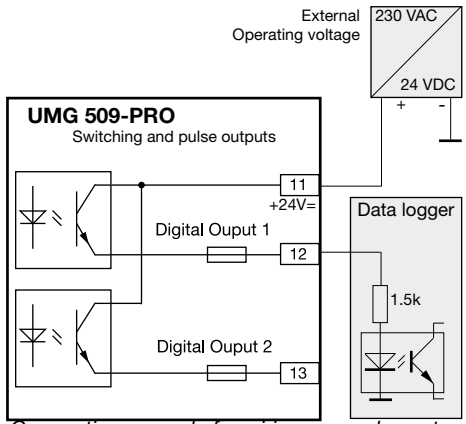


Fig.: Connection example for wiring as a pulse output.

INFORMATION

When using the digital outputs as pulse outputs, measurement errors can occur due to residual ripple. **For the supply voltage (DC) of the digital inputs and outputs, use power supplies whose residual ripple is less than 5% of the supply voltage.**

13. Device homepage

Your meter has a built-in web server that has a standalone homepage. You can access your measurement device via this device homepage from any terminal device using a conventional web browser. You can reach the homepage of your device by entering the IP address of the device into a web browser on your terminal device. Connecting the device to the Internet is described in the section „11.2.1 Ethernet (TCP/IP)“.

No prior software installation is required here to:
- Retrieve historical as well as current measured values.
- Retrieve the power quality status in an easy-to-understand display.
- Remotely control your device.
- Access installed apps.

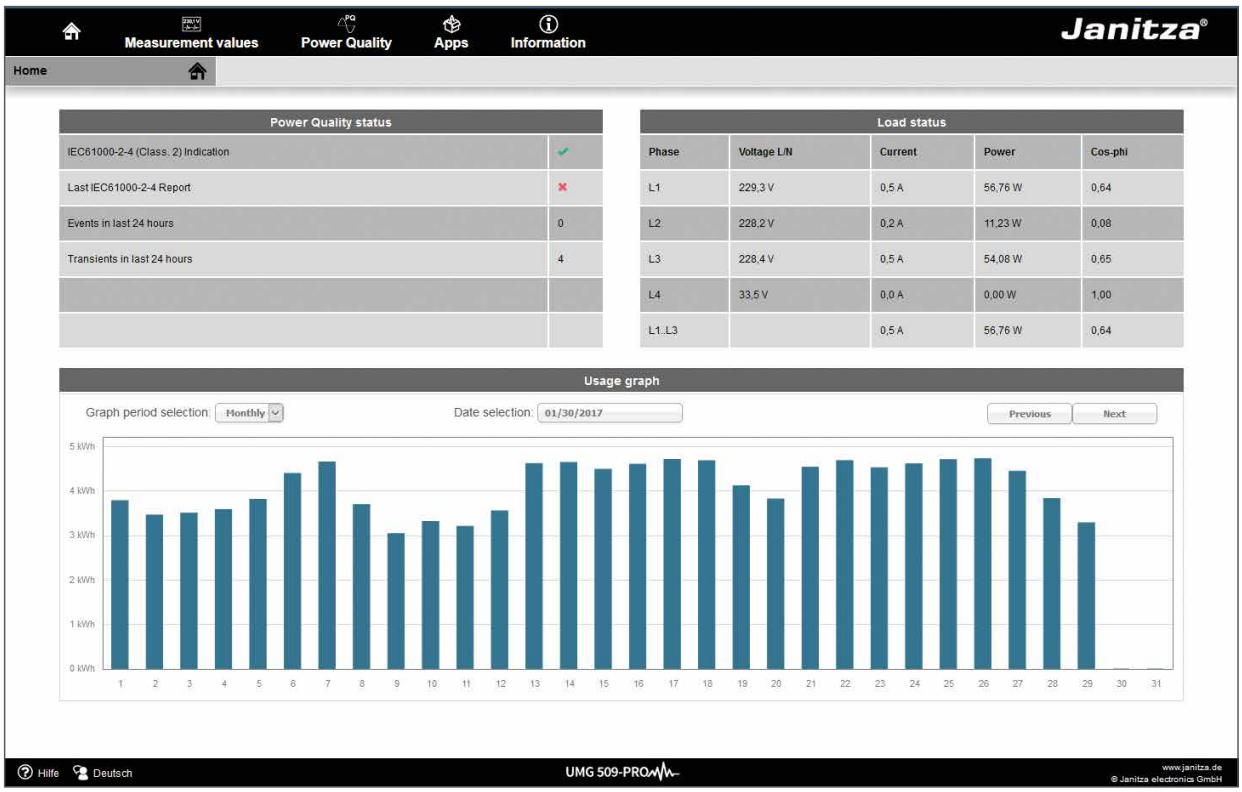


Fig. Device homepage overview

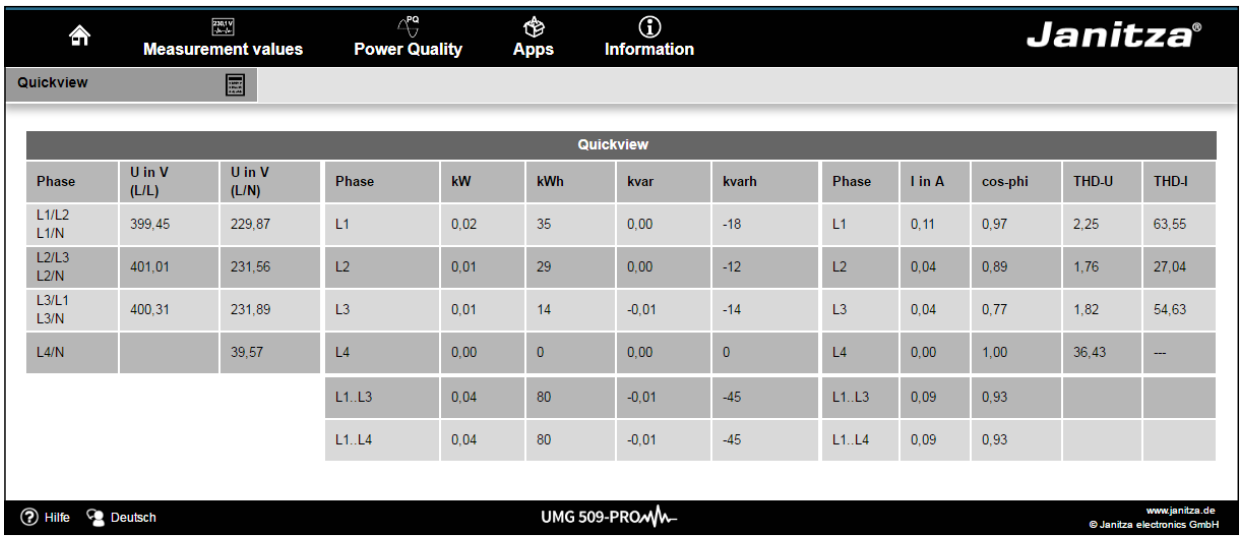
13.1 Measured values

The menu item "Measured values" allows you to call up both simple and detailed views of measured values and visualize individual measured values. The following menu items are available:

· Brief overview
· Detailed measured values
· Charts
· RCM - residual current measurement
· Events
· Transients

13.1.1 Brief overview

The brief overview shows the most important measured values for each phase, such as momentary voltage values, power values and current strength.



Quickview

Phase	U in V (L/L)	U in V (L/N)	Phase	kW	kWh	kvar	kvarh	Phase	I in A	cos-phi	THD-U	THD-I
L1/L2 L1/N	399,45	229,87	L1	0,02	35	0,00	-18	L1	0,11	0,97	2,25	63,55
L2/L3 L2/N	401,01	231,56	L2	0,01	29	0,00	-12	L2	0,04	0,89	1,76	27,04
L3/L1 L3/N	400,31	231,89	L3	0,01	14	-0,01	-14	L3	0,04	0,77	1,82	54,63
L4/N		39,57	L4	0,00	0	0,00	0	L4	0,00	1,00	36,43	---
			L1..L3	0,04	80	-0,01	-45	L1..L3	0,09	0,93		
			L1..L4	0,04	80	-0,01	-45	L1..L4	0,09	0,93		

Fig. Brief overview of measured values

13.1.2 Detailed measured values

The overview gives you access to extensive information on the following points:

· Voltage
· Current
· Power
· Harmonic oscillations
· Work
· Peripherals (digital inputs/outputs, temperature measurements)

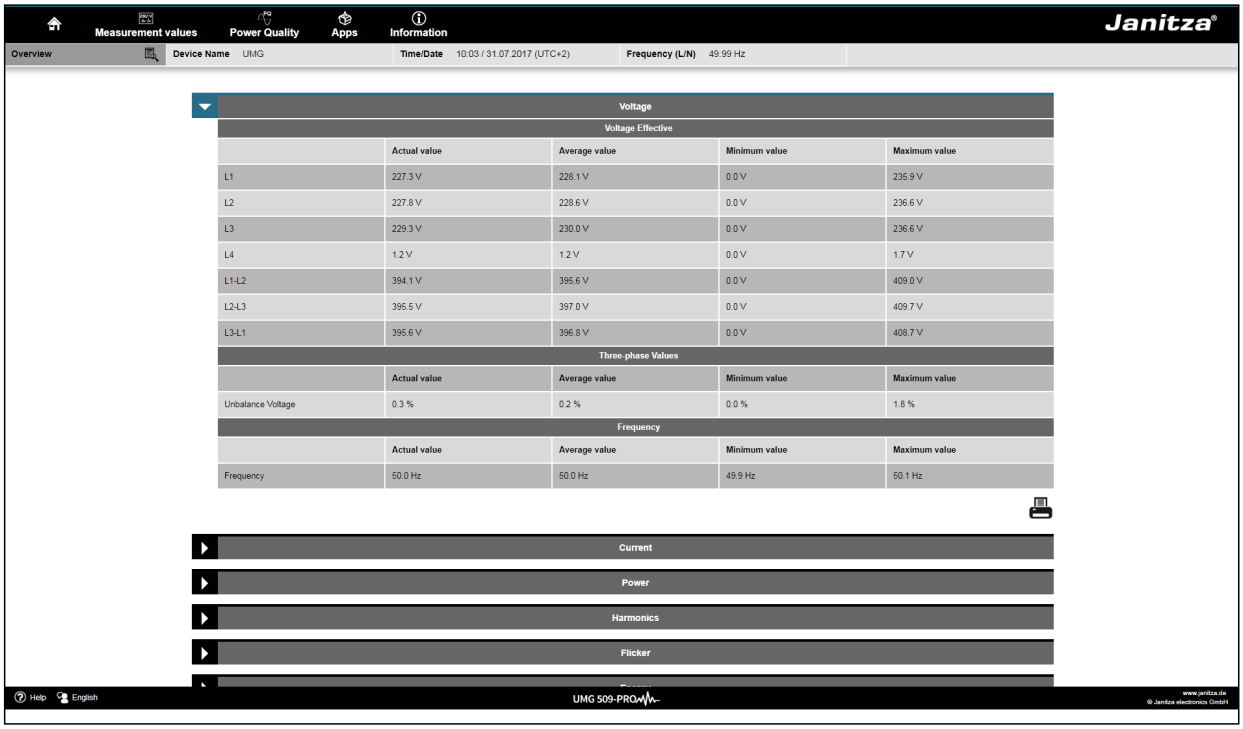


Fig. Detailed overview of measured values

13.1.3 Charts

You can access the measured value monitor via the "Charts" item. The measured value monitor is a configurable display of current and historical measured values with automatic scaling. To display a graph of the measured values, drag the desired values from the list on the left side of the screen into the field in the center of the screen.

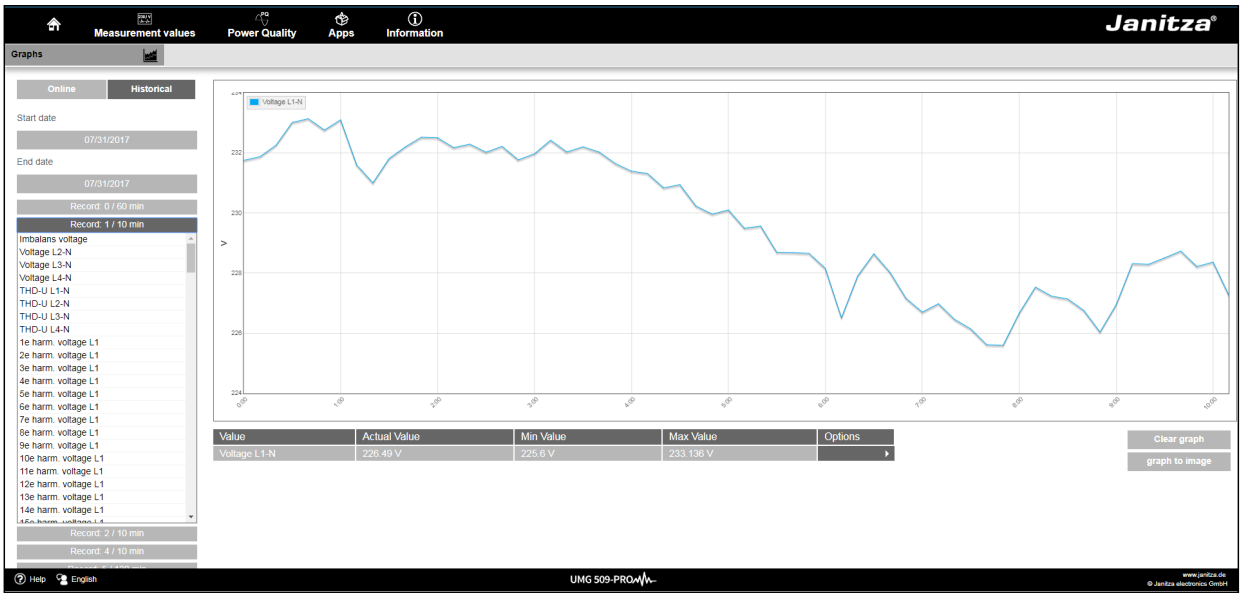


Fig. Device home page event recordings

13.1.4 RCM - residual current measurement

The "RCM" item shows you the instantaneous values and absolute limit values of the RCM channels. For more information on residual current measurement, refer to the section 7.8 on page 36.

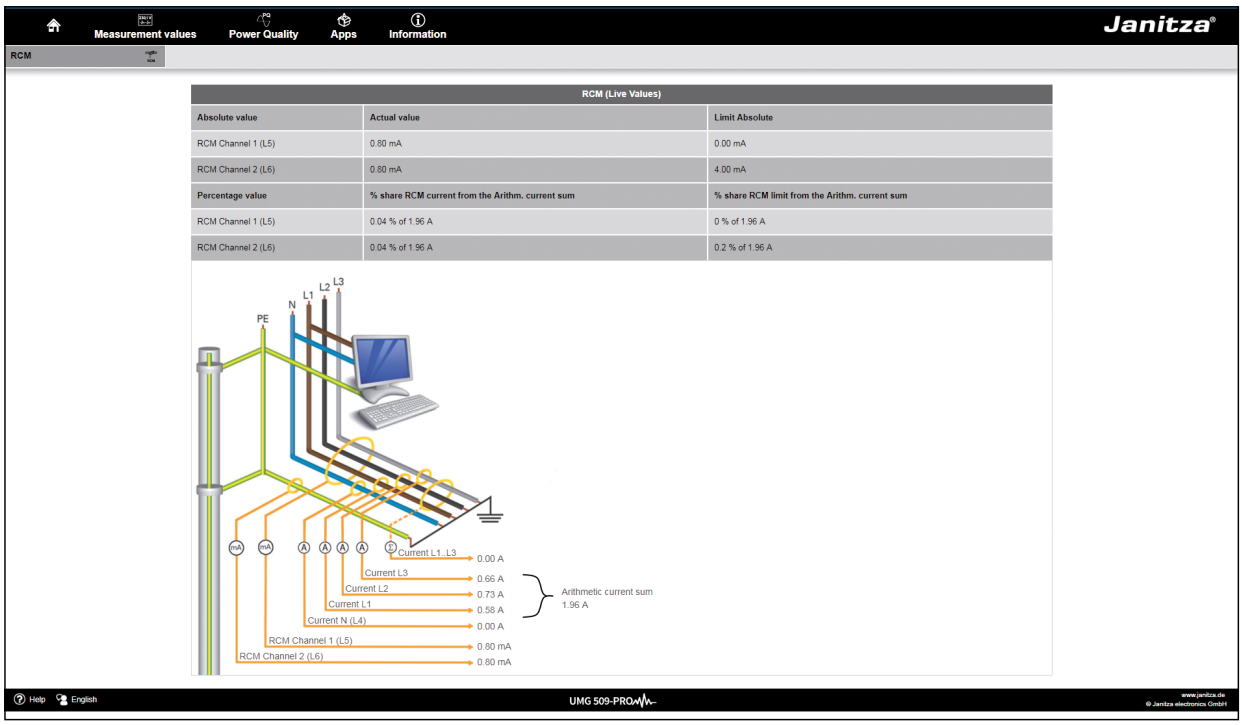


Fig. RCM device homepage

13.1.5 Events

The "Events" item allows you to open a graphical representation of recorded events, such as overcurrent or undervoltage. More information on event recording can be found under „11.3.3 Events“.

Fig. Event recording

13.1.6 Transients

The "Transients" area shows the graphical representation of transients within a date list. For more details on the transient list and transients, see sections 10.7 on page 52 and 11.3.2 on page 61.

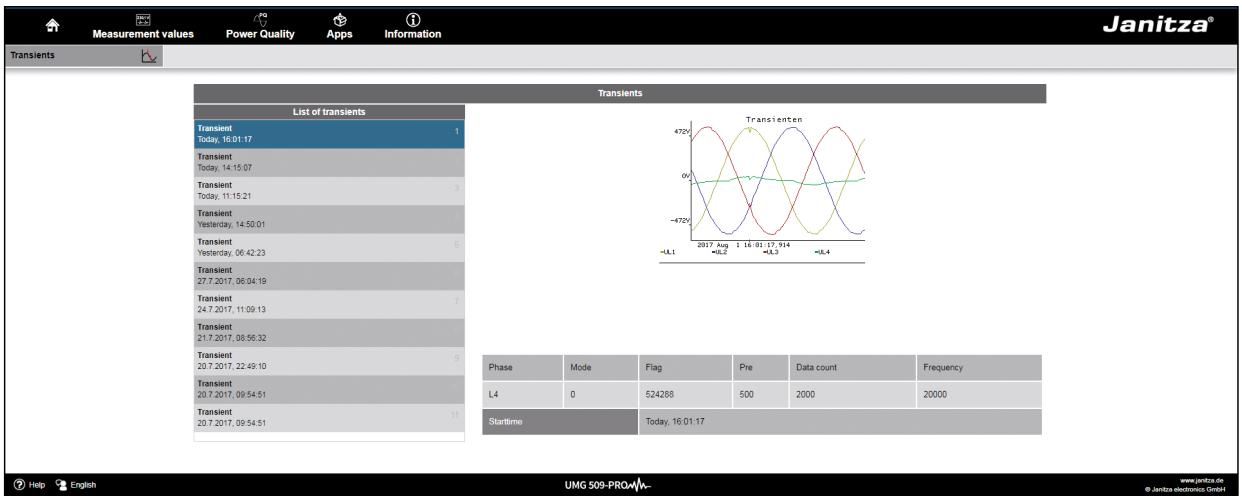


Fig. Transients

13.2 Power quality

The "Power Quality" (PQ) area gives you the option of retrieving the PQ status with a clear overview according to common standards. Here you have access to continuous monitoring of the power quality according to:

· **IEC 61000-2-4** PQ for customer-supplied power grids

The evaluation takes place via indicator (quick evaluation), as well as within the Watchdog App (temporal evaluation). The class of IEC 61000-2-4 can be temporarily changed within the indicator settings. However, this has no lasting effect.

A change of the class is reset to class 2 ("compatibility level as in the public network") after leaving the page.

If you have installed further apps for the power quality, there are additional menu items in the "Power quality" menu:

For the app "IEC 61000-2-4 Watchdog":
· **IEC 61000-2-4 Settings**
· **IEC 61000-2-4 Watchdog**

Changing the IEC 61000-2-4 class in the watchdog settings changes the class permanently in the watchdog, as well as in the indicator.

The display using the traffic light principle allows events that do not comply with the respective quality agreements to be identified without in-depth knowledge.

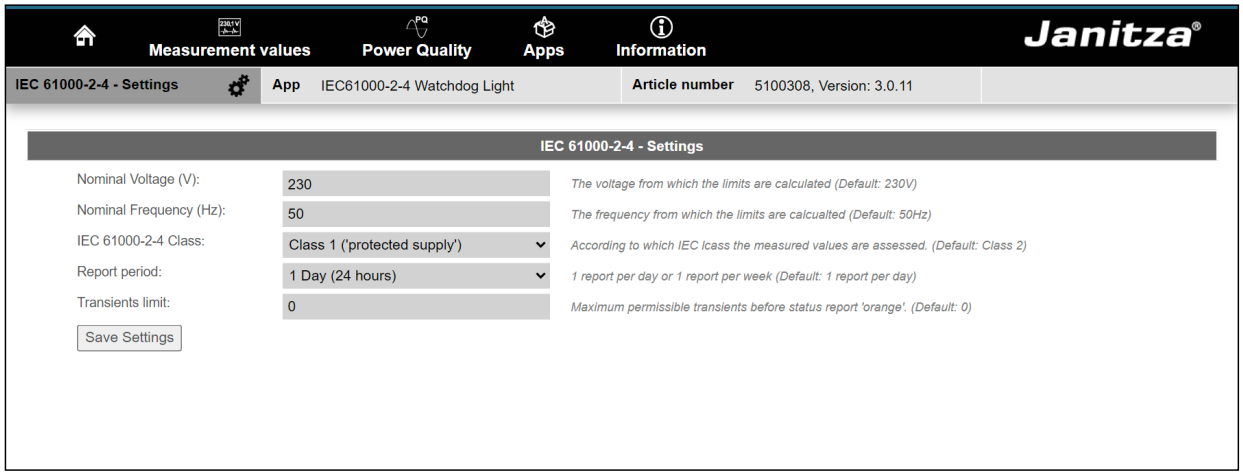


Fig. IEC61000-2-4 Watchdog settings for the report

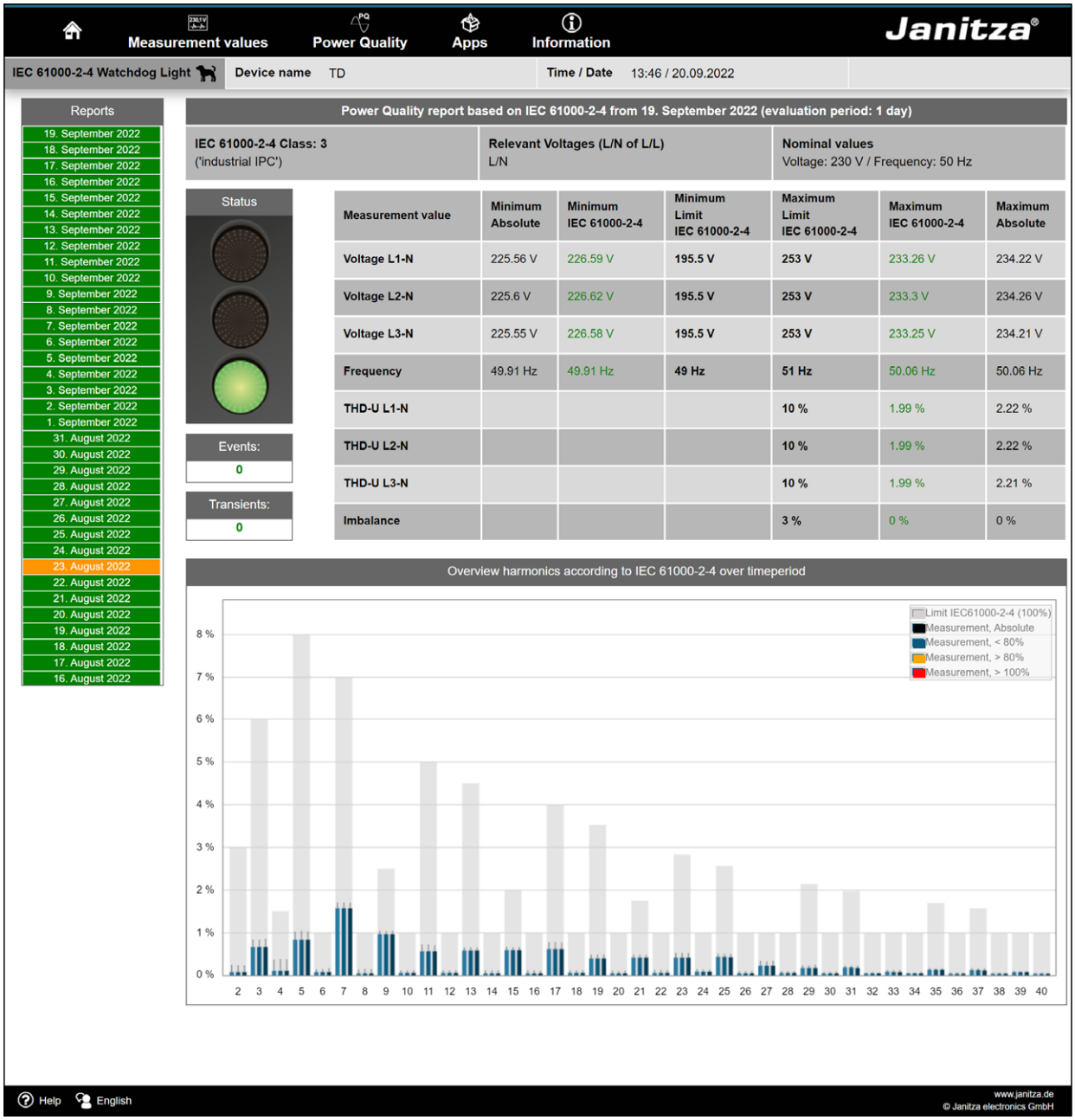


Fig. IEC 61000-2-4 Watchdog parameters with traffic light principle - report

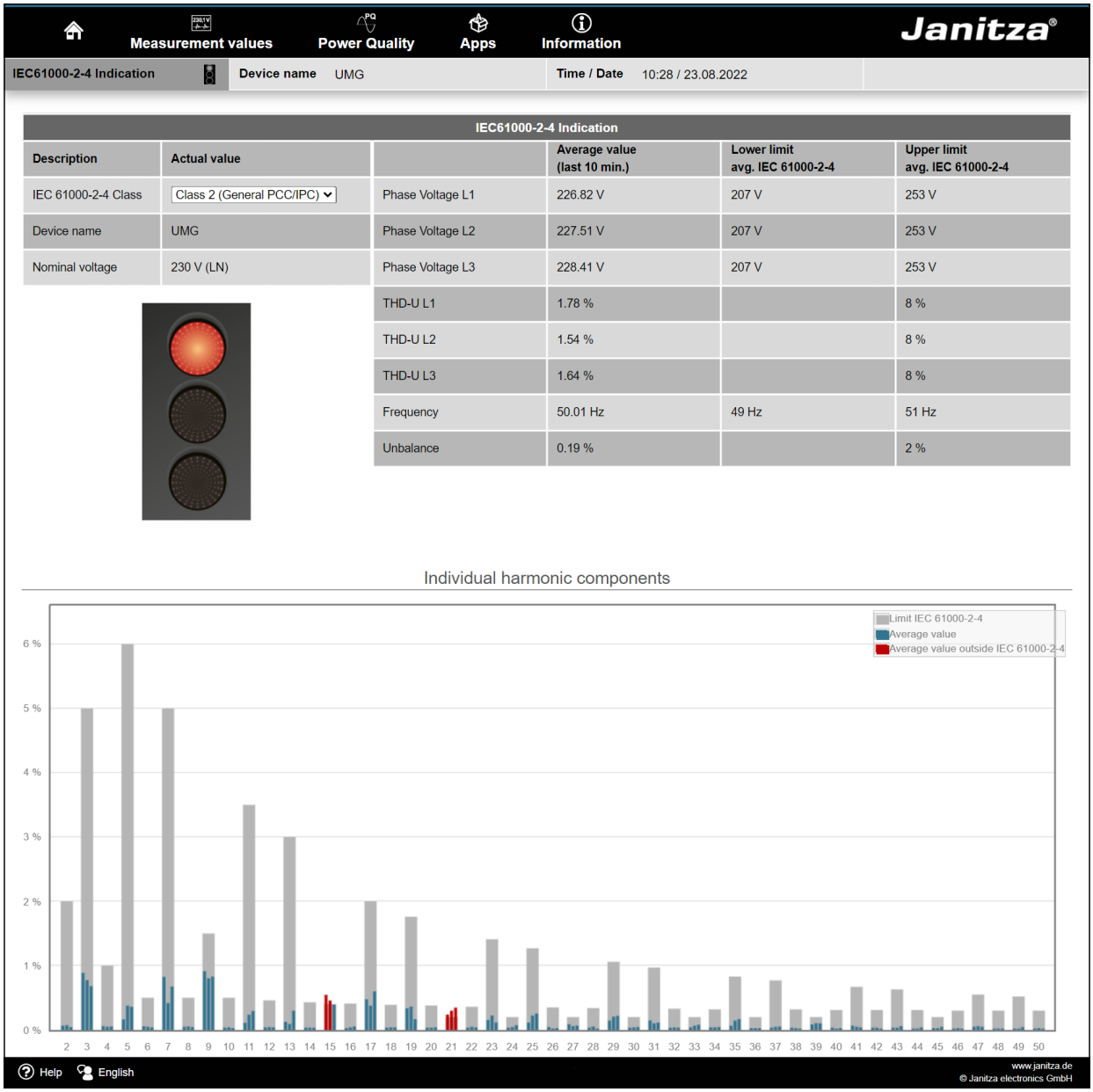


Fig. IEC61000-2-4 PQ indicator parameters with traffic light principle - snapshot

13.3 Apps

You can enhance the functionality of your device later on by installing additional apps.

13.3.1 Push Service

An example of an installable app is the Push Service. With the Push Service, measured values are sent directly from the device to a cloud or portal solution of your choice - such as the Janitza Energy Portal.

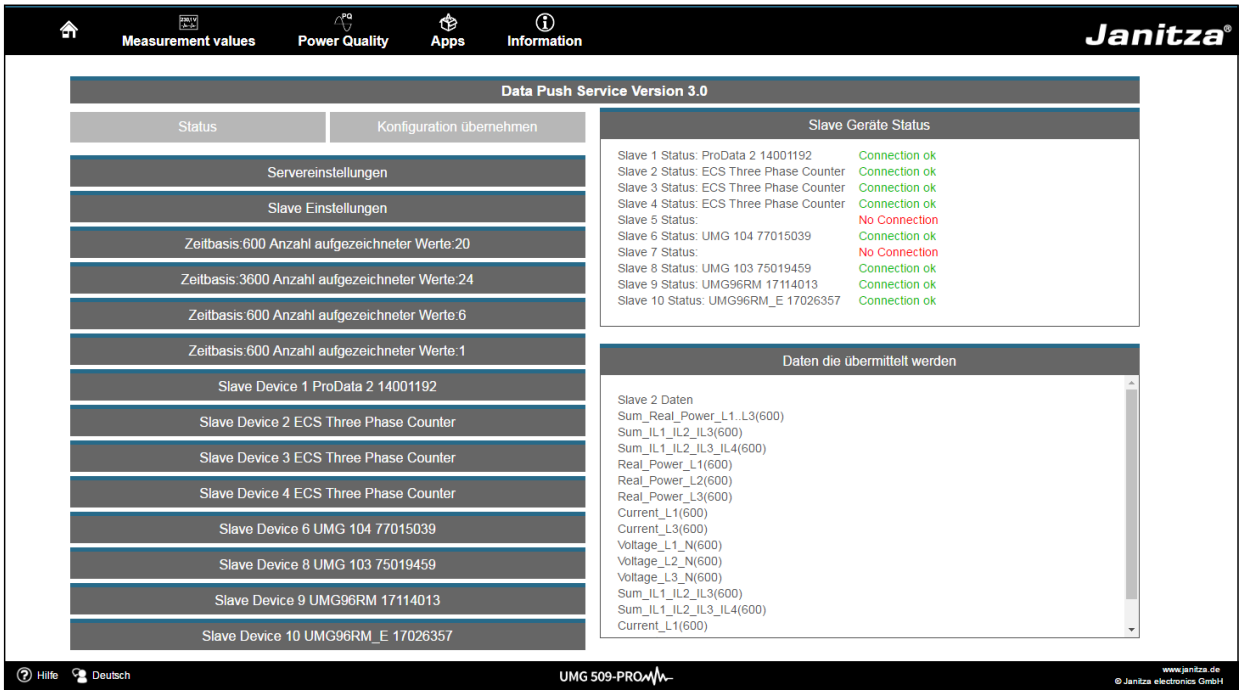


Fig. Push Service

13.4 Information

13.4.1 Device information

Under the menu item "Device information" you will find all the information as well as settings that you can change on the device.

13.4.2 Display

Under the item "Display" you will find the display of the device, which reflects the actual display.

You can remotely control the device here by pressing the control buttons with the mouse.

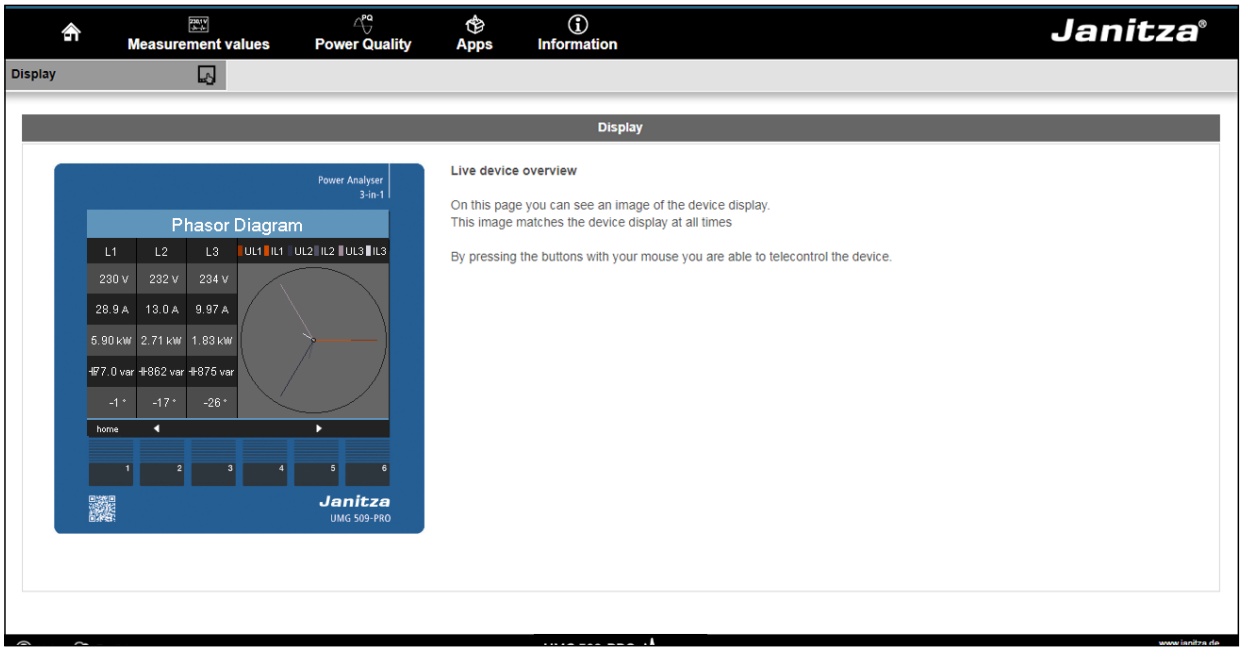


Fig. Operation of the UMG 509-PRO via the device homepage

13.4.3 Downloads

Click on "Downloads" to access the download area of the Janitza homepage. Here you are able to download catalogs and operating manuals.

14. Service and maintenance

Prior to outbound delivery, the device is subjected to various safety tests and is marked with a seal. If a device is opened, the safety tests must be repeated. A warranty is only assumed for unopened devices.

14.1 Repairs and calibration

Repairs and calibration can only be carried out by the manufacturer.

14.2 Front panel foil

The front panel foil can be cleaned with a soft cloth and standard household cleaning agents. Acids and acidic agents must not be used for cleaning.

14.3 Disposal

Please abide by national regulations! Dispose of individual parts, as applicable, depending on their composition and existing country-specific regulations, e.g. as:
· Electronic waste
· Plastics
· Metals
or engage a certified disposal company to handle scrapping.

14.4 Service

If questions arise that are not described in this manual, please contact the manufacturer directly. The following information is essential for us to be able to answer any questions you may have:
· Device designation (see rating plate)
· Serial number (see rating plate)
· Software release (see measuring display)
· Measured voltage and supply voltage
· An exact error description.

14.5 Device adjustment

The devices are adjusted by the manufacturer prior to outbound delivery. No readjustment is necessary if the environmental conditions are complied with.

14.6 Calibration intervals

A recalibration by the manufacturer or an accredited laboratory is recommended after about 5 years.

14.7 Firmware update

To perform a firmware update, connect the device to a computer via Ethernet and access it using the GridVis software.

Open the firmware update wizard by clicking on "Update device" in the "Extras" menu.

Select an appropriate update file and perform the update.

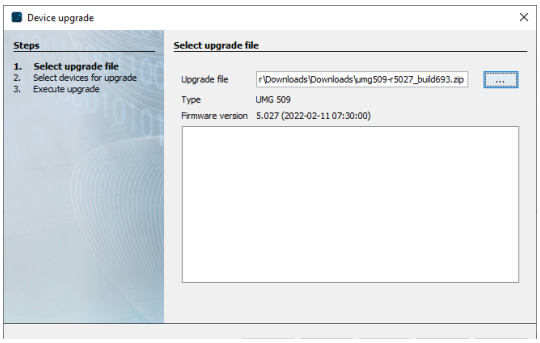


Fig. Firmware update wizard of the GridVis® software

INFORMATION

A firmware update is **not** possible via the RS-485 interface.

14.8 Battery

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

The life expectancy of the battery is at least 5 years at 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.

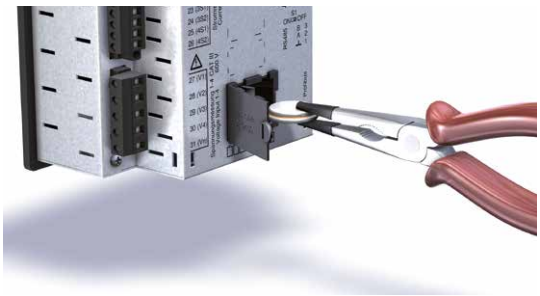


Fig. Battery replacement with needle-nose pliers

15. Technical data

General	
Net weight (with attached plug-in connectors)	approx. 1080 g
Device dimensions	approx. w = 144 mm, h = 144 mm, d = 75 mm
Battery	Type Li-Mn CR2450, 3 V (UL 1642 approval)
Clock (in the temperature range of -40°C to 85°C)	+-5 ppm (equivalent to 3 minutes per year)

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

Environmental conditions during operation	
The device is intended for weather-protected, stationary use. The device's ground wire connection must be connected! Protection class I according to IEC 60536 (VDE 0106, part 1).	
Working temperature range	-10 °C .. +55 °C
Relative humidity	5 to 95% (at 25 °C) without condensation
Operating elevation	0 .. 2000 m above sea level
Pollution degree	2
Mounting orientation	vertical
Ventilation	forced ventilation is not required
Protection against foreign matter and water · Front · Rear	 IP40 according to EN60529 IP20 according to EN60529

15.1 Supply voltage

Supply voltage	
Installation overvoltage category	300 V CAT III
Fuse protection of the supply voltage (fuse)	6 A, type B (approved according to UL/IEC)
Option 230 V: - Nominal range - Operating range - Power consumption	 95 V .. 240 V (50/60 Hz) / DC 80 V .. 300 V +-10% of nominal range max. 7 W / 14 VA
Option 24 V: · Nominal range · Operating range · Power consumption	 48 V .. 110 V (50/60 Hz) or DC 24 .. 150 V +-10% of nominal range max. 9 W / 13 VA

Connection capacity of the terminals (supply voltage) Connectible conductors. Only one conductor may be connected per terminal point!	
Single core, multi-core, fine-stranded	0.2 - 2.5 mm², AWG 24 - 12
Terminal pins, wire end ferrules	0.25 - 2.5 mm²
Tightening torque	0.5 - 0.6 Nm
Strip length	7 mm

15.2 Voltage and current measurement

Current measurement	
Nominal current	5 A
Resolution	0.1 mA
Measuring range	0.005 .. 7 Arms
Overrange (overload)	from 7.5 Arms
Crest factor	2.4
Overvoltage category	Option 230 V: 300 V CAT III Option 24 V: 300 V CAT II
Rated surge voltage	4 kV
Power consumption	approx. 0.2 VA (Ri=5 mOhms)
Overload for 1 s	120 A (sinusoidal)
Sampling frequency	20 kHz/phase

Voltage measurement	
The voltage measurement inputs are suitable for measurement in the following power supply systems:	
Three-phase 4-conductor systems with rated voltages up to	417 V / 720 V 347 V / 600 V UL listed
Three-phase 3-conductor systems with rated voltages up to	600 V
The voltage measurement inputs are designed as follows from the point of view of safety and reliability:	
Overvoltage category	600 V CAT III
Rated surge voltage	6 kV
Protection of the voltage measurement	1 - 10 A
Measuring range L-N	0[1)] .. 600 Vrms
Measuring range L-L	0[1)] .. 1000 Vrms
Resolution	0.01 V
Crest factor	1.6 (referred to 600 Vrms)
Impedance	4 MOhms/phase
Power consumption	approx. 0.1 VA
Sampling frequency	20 kHz/phase
Transients	> 50 µs
Frequency of the fundamental oscillation - Resolution	40 Hz .. 70 Hz 0.001 Hz

1) The device can only determine measured values if a voltage L-N greater than 10 Vrms or a voltage L-L greater than 18 Vrms is present on at least one voltage measurement input.

Phase angle measuring accuracy	0.075°

Connection capacity of the terminal points (voltage and current measurement) Connectible conductors. Only one conductor may be connected per terminal point!	
Single core, multi-core, fine-stranded	0.2 - 2.5 mm², AWG 24-12
Terminal pins, wire end ferrules	0.25 - 2.5 mm²
Tightening torque	0.5 - 0.6 Nm
Strip length	7 mm

15.3 Residual current detection

Residual current measurement (RCM)	
Nominal current	30 mArms
Measuring range	0 .. 40 mArms
Operating current	100 µA
Resolution	1 µA
Crest factor	1.414 (relative to 40 mA)
Load	4 ohms
Overload for 1 s	5 A
Constant overloaded	1 A
Overload 20 ms	50 A
Measurement of residual currents	according to IEC/TR 60755 (2008-01) Type A
Maximum external load	300 ohms (for cable break detection)

Connection capacity of the terminal points (residual current measurement) Connectible conductors. Only one conductor may be connected per terminal point!	
Rigid/flexible	0.14 - 1.5 mm², AWG 28-16
Flexible with wire ferrules without plastic sleeve	0.20 - 1.5 mm²
Flexible with wire ferrules with plastic sleeve	0.20 - 1.5 mm²
Strip length	7 mm
Tightening torque	0.20 - 0.25 Nm
Cable length	up to 30 m not shielded; greater than 30 m shielded

Potential isolation and electrical safety of the residual current measurement inputs
· The RCM measurement inputs are double insulated relative to the current and voltage measurement inputs as well as to the supply voltage. · There is no insulation relative to the temperature measurement input. · There is only a functional insulation relative to the Ethernet, Profibus, RS-485 and digital I/O interfaces. · The connected residual current transformers and the wires to be measured must each have at least an additional or basic insulation in accordance with IEC61010-1:2010 for the mains voltage applied.

15.4 Temperature measurement input

Temperature measurement input 3-wire measurement	
Update time	1 second
Connectable sensors	PT100, PT1000, KTY83, KTY84
Total load (sensor and cable)	max. 4 kOhms
Cable length	up to 30 m not shielded; greater than 30 m shielded

Sensor type	Temperature range	Resistance range	Measurement uncertainty
KTY83	-55 °C ... +175 °C	500 ohms ... 2.6 kOhms	±1.5% rng
KTY84	-40 °C ... +300 °C	350 ohms ... 2.6 kOhms	±1.5% rng
PT100	-99 °C ... +500 °C	60 ohms ... 280 ohms	±1.5% rng
PT1000	-99 °C ... +500 °C	600 ohms ... 2.8 kOhms	±1.5% rng

Connection capacity of the terminal points (temperature measurement input) Connectible conductors. Only one conductor may be connected per terminal point!	
Single core, multi-core, fine-stranded	0.08 - 1.5 mm^2
Terminal pins, wire end ferrules	1 mm^2

Potential isolation and electrical safety of the temperature measurement inputs

- The temperature measurement input is double insulated relative to the current and voltage measurement inputs as well as to the supply voltage.
- There is no insulation to the RCM measurement input.
- There is only a functional insulation relative to the Ethernet, Profibus, RS-485 and digital I/O interfaces.
- The external temperature sensor must be double insulated relative to hazardous contact voltage (according to IEC61010-1:2010).

15.5 Digital inputs and outputs

Digital inputs 2 digital inputs with a common ground	
Maximum counter frequency	20 Hz
Response time (Jasic program)	200 ms
Input signal applied	18 V .. 28 V DC (typically 4 mA)
Input signal not applied	0 .. 5 V DC, current less than 0.5 mA
Cable length	up to 30 m not shielded; greater than 30 m shielded

Digital outputs 2 digital outputs with a common ground; optocoupler, not short-circuit proof	
Operating voltage	20 V - 30 V DC (SELV or PELV supply)
Switching voltage	max. 60 V DC, 30 V AC
Switching current	max. 50 mAeff AC/DC
Response time (Jasic program)	200 ms
Output of voltage dips	20 ms
Output of voltage exceedances	20 ms
Switching frequency	max. 20 Hz
Cable length	up to 30 m not shielded; greater than 30 m shielded

Connection capacity of the terminal points (digital inputs and outputs)	
Rigid/flexible	0.14 - 1.5 mm^2, AWG 28-16
Flexible with wire ferrules without plastic sleeve	0.25 - 1.5 mm^2
Flexible with wire ferrules with plastic sleeve	0.25 - 0.5 mm^2
Tightening torque	0.22 - 0.25 Nm
Strip length	7 mm

Potential isolation and electrical safety of the digital inputs and outputs

- The digital inputs and outputs are double insulated relative to the current and voltage measurement inputs as well as to the supply voltage.
- There is only functional isolation from each other and from the Ethernet, Profibus, RS-485 and digital I/O interfaces.
- The auxiliary voltage to be connected externally must be realized with SELV or PELV.

15.6 Interfaces

RS-485 interface 3-wire connection with GND, A, B	
Protocol	Modbus RTU/Slave, Modbus RTU/Master, Modbus RTU /Gateway
Transmission rate	9.6 kbps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps, 921.6 kbps
Termination resistor	can be activated via microswitch

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

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

Potential isolation and electrical safety of the interfaces
· The RS-485, Profibus and Ethernet interfaces are double insulated relative to the current and voltage measurement inputs and the supply voltage. · There is only a functional insulation from each other and from the RCM and temperature measurement inputs as well as from the digital I/Os. · The interfaces of the devices connected here must have double or reinforced insulation against mains voltages (according to IEC 61010-1: 2010).

15.7 Performance characteristics of functions

The measurements are made via current transformers ../5 A with a frequency of 50 / 60 Hz.

Function	Symbol	Accuracy class	Measuring range	Display range
Total active power	P	0.2 [5] (IEC61557-12)	0 .. 15.3 kW	0 W .. 9999 GW *
Total reactive power	QA [6], Qv [6]	1 (IEC61557-12)	0 .. 15.3 kvar	0 varh .. 9999 Gvar *
Total apparent power	SA, Sv [6]	0.2 [5] (IEC61557-12)	0 .. 15.3 kVA	0 VA .. 9999 GVA *
Total active energy	Ea	0.2 [5] (IEC61557-12) 0.2S [5] (IEC62053-22) 0.5 (ANSI C12.20)	0 .. 15.3 kWh	0 Wh .. 9999 GWh *
Total reactive energy	ErA [6], ErV [6]	1 (IEC61557-12)	0 .. 15.3 kvarh	0 varh .. 9999 Gvarh *
Total apparent energy	EapA,EapV [6]	0.2 [5] (IEC61557-12)	0 .. 15.3 kVAh	0 VAh .. 9999 GVAh *
Frequency	f	0.05 (IEC61557-12)	40 .. 70 Hz	40 Hz .. 70 Hz
Phase current	I	0.2 (IEC61557-12)	0.005 .. 7 Arms	0 A .. 9999 kA
Neutral conductor current measured	IN	0.2 (IEC61557-12)	0.005 .. 7 Arms	0 A .. 9999 kA
Residual currents I5, I6	IDIFF	1 (IEC61557-12)	0 .. 40 mArms	0 A .. 9999 kA
Neutral conductor current calculated	INc	0.5 (IEC61557-12)	0.005 .. 21 A	0 A .. 9999 kA
Voltage	U L-N	0.1 (IEC61557-12)	10 .. 600 Vrms	0 V .. 9999 kV
Voltage	U L-L	0.1 (IEC61557-12)	18 .. 1000 Vrms	0 V .. 9999 kV
Power factor	PFA, PFV	0.5 (IEC61557-12)	0.00 .. 1.00	0 .. 1
Short-term flicker, long-term flicker	Pst, Plt	-	-	-
Voltage dips	Udip	0.2 (IEC61557-12)	10 .. 600 Vrms	0 V .. 9999 kV
Voltage swells	Uswl	0.2 (IEC61557-12)	10 .. 600 Vrms	0 V .. 9999 kV
Transient overvoltages	Utr	0.2 (IEC61557-12)	10 .. 600 Vrms	0 V .. 9999 kV
Voltage interruptions	Uint	-	-	-
Voltage unbalance [1]	Unba	0.2 (IEC61557-12)	10 .. 600 Vrms	0 V .. 9999 kV
Voltage unbalance [2]	Unb	0.2 (IEC61557-12)	10 .. 600 Vrms	0 V .. 9999 kV
Voltage harmonics	Uh	Cl. 1 (IEC61000-4-7)	Up to 2.5 kHz	0 V .. 9999 kV
THD of voltage [3]	THDu	1.0 (IEC61557-12)	Up to 2.5 kHz	0% .. 999%
THD of voltage [4]	THD-Ru	1.0 (IEC61557-12)	Up to 2.5 kHz	0% .. 999%
Current harmonics	Ih	Cl. 1 (IEC61000-4-7)	Up to 2.5 kHz	0 A .. 9999 kA
THD of current [3]	THDi	1.0 (IEC61557-12)	Up to 2.5 kHz	0% .. 999%
THD of current [4]	THD-Ri	1.0 (IEC61557-12)	Up to 2.5 kHz	0% .. 999%
Mains signal voltage (interharmonic voltage)	MSV	-	-	-

1) Referenced to amplitude.
2) Referenced to phase and to amplitude.
3) Referenced to the fundamental oscillation.
4) Referenced to the RMS value.
5) Accuracy class 0.2/0.2S with ../5 A transformer.
Accuracy class 0.5/0.5S with ../1A transformer.
6) Calculation from the fundamental oscillation.

* When the max. total work values are reached, the display jumps back to 0 W.

INFORMATION

Note on saving measured values and configuration data:
Since the following measured values are stored in a non-volatile memory every 5 minutes, an **operating voltage failure** can result in an interruption of the recording of max. 5 minutes:

- **Comparator timer**
- **S0 meter readings**
- **Min. / max. / average values (without date and time)**
- **Energy values**

Configuration data is saved immediately.

A detailed Modbus address and parameter list can be found at www.janitza.com.

15.8 Dimensional drawings

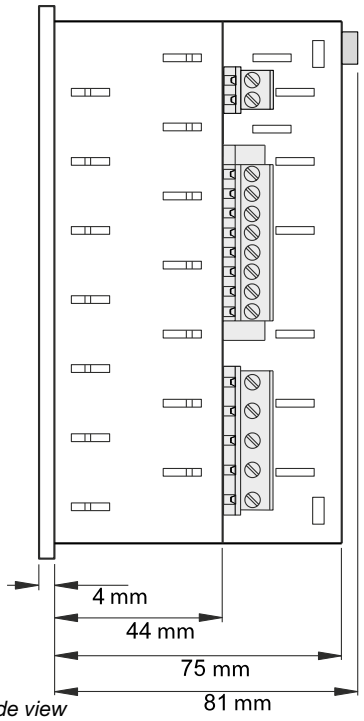


Fig. Side view

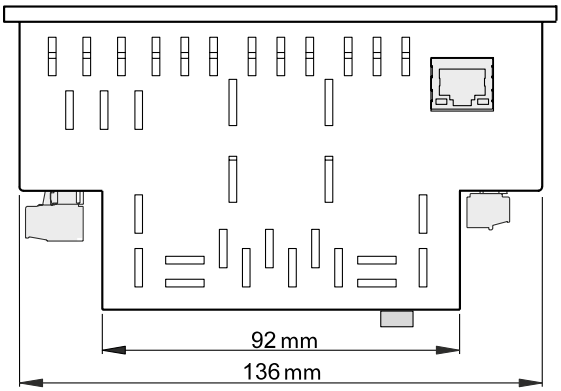


Fig. Bottom view

16. Procedure in the event of a malfunction

Failure mode	Cause	Remedy
No display	External fuse for the supply voltage has tripped.	Replace fuse.
No current display.	No measured voltage connected.	Connect measured voltage.
	No measured current connected.	Connect measured current.
Displayed current istoo great or too small.	Current measurement on the wrong phase.	Check connection and correct if necessary.
	Current transformer factor incorrectly programmed.	Read and program the current transformer ratio on the current transformer.
	The peak current value at the measuring input was exceeded by current harmonics.	Install current transformers with a higher current transformer ratio.
	The current at the measuring input is too low.	Install current transformers with a lower current transformer ratio.
Displayed voltage is too low or too high.	Measurement on the wrong phase.	Check connection and correct if necessary.
	Voltage transformer programmed incorrectly.	Read the voltage transformer ratio on the voltage transformer and program.
Displayed voltageis too low.	Overrange.	Use a voltage transformer.
	The voltage peak value at the measuring input was exceeded due to harmonics current.	**Attention!** Make sure that the measuring inputs are not overloaded.
Phase shift, ind./cap.	Current path is assigned to the wrong voltage circuit.	Check connection and correct if necessary.
Active power consumed / delivered is interchanged.	At least one current transformer connection is reversed.	Check connection and correct if necessary.
	A current path is assigned to the wrong voltage circuit.	Check connection and correct if necessary.

Failure mode	Cause	Remedy
Active power too small or too great.	The programmed current transformer ratio is incorrect.	Read and program the current transformer ratio on 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 the voltage transformer ratio on the voltage transformer and program.
One output is not responding.	The output has been programmed incorrectly.	Check programming and correct if necessary.
	The output has been connected incorrectly.	Check connection and correct if necessary.
Display of measuring range exceeded (overload)	Voltage or current measurement input outside the measuring range (see the section Overrange)	Check connection and correct if necessary.
		Use suitable voltage or current transformers.
		Read and program the voltage or current transformer ratio on the transformer.
No connection to the device.	RS-485 - Incorrect device address. - Different bus speeds (Baud rate). - Incorrect protocol. - No termination.	- Correct the device address. - Correct the speed (baud rate). - Correct the protocol. - Terminate bus with termination resistor.
	Ethernet - Incorrect device IP address - Incorrect addressing mode	- Correct the IP device address. - Correct the mode for assigning the IP address
Despite the above measures, the device does not function.	Device defective.	Send the device to the manufacturer for inspection with an exact description of the fault.

17. Menu navigation overview

17.1 Configuration menu overview

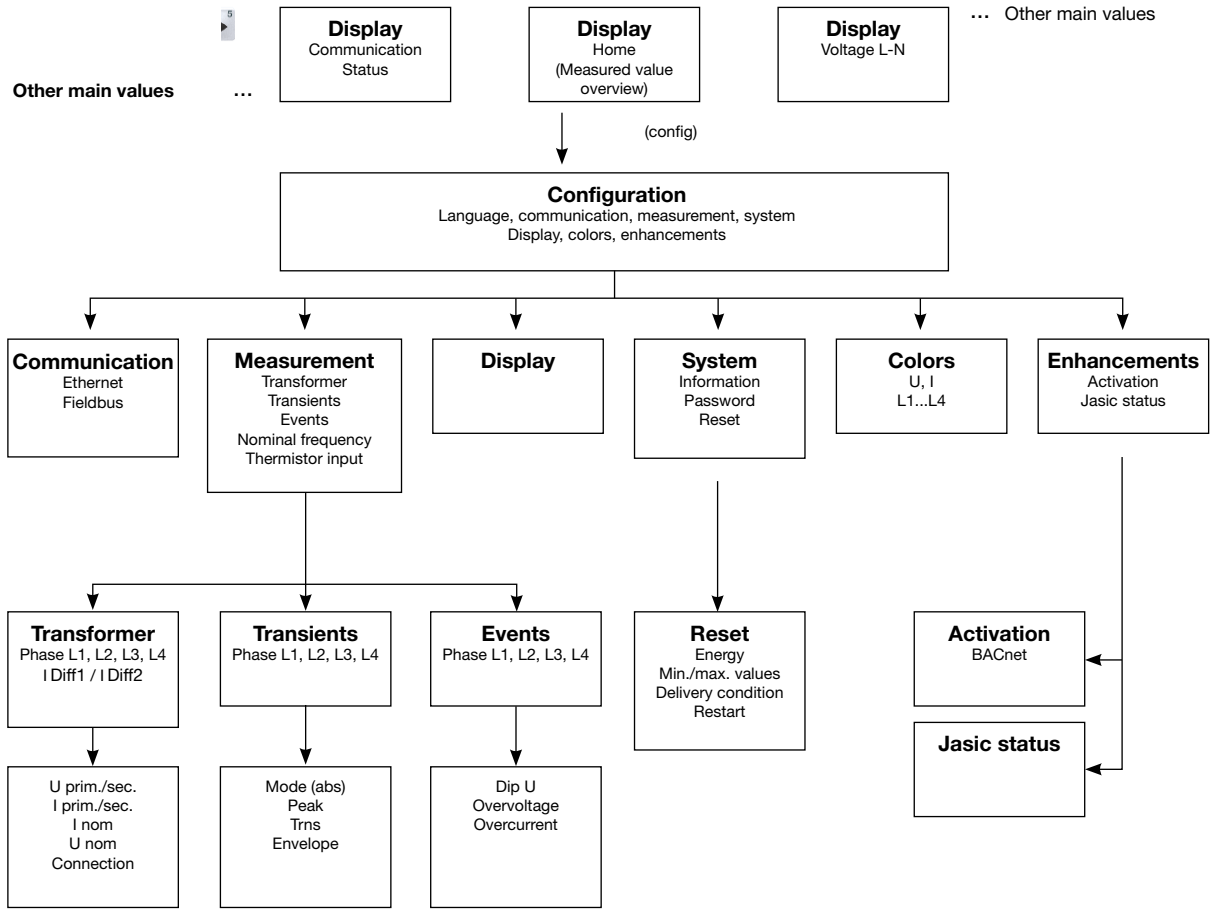


Fig. Schematic representation of the configuration menu navigation

17.2 Overview of measuring displays

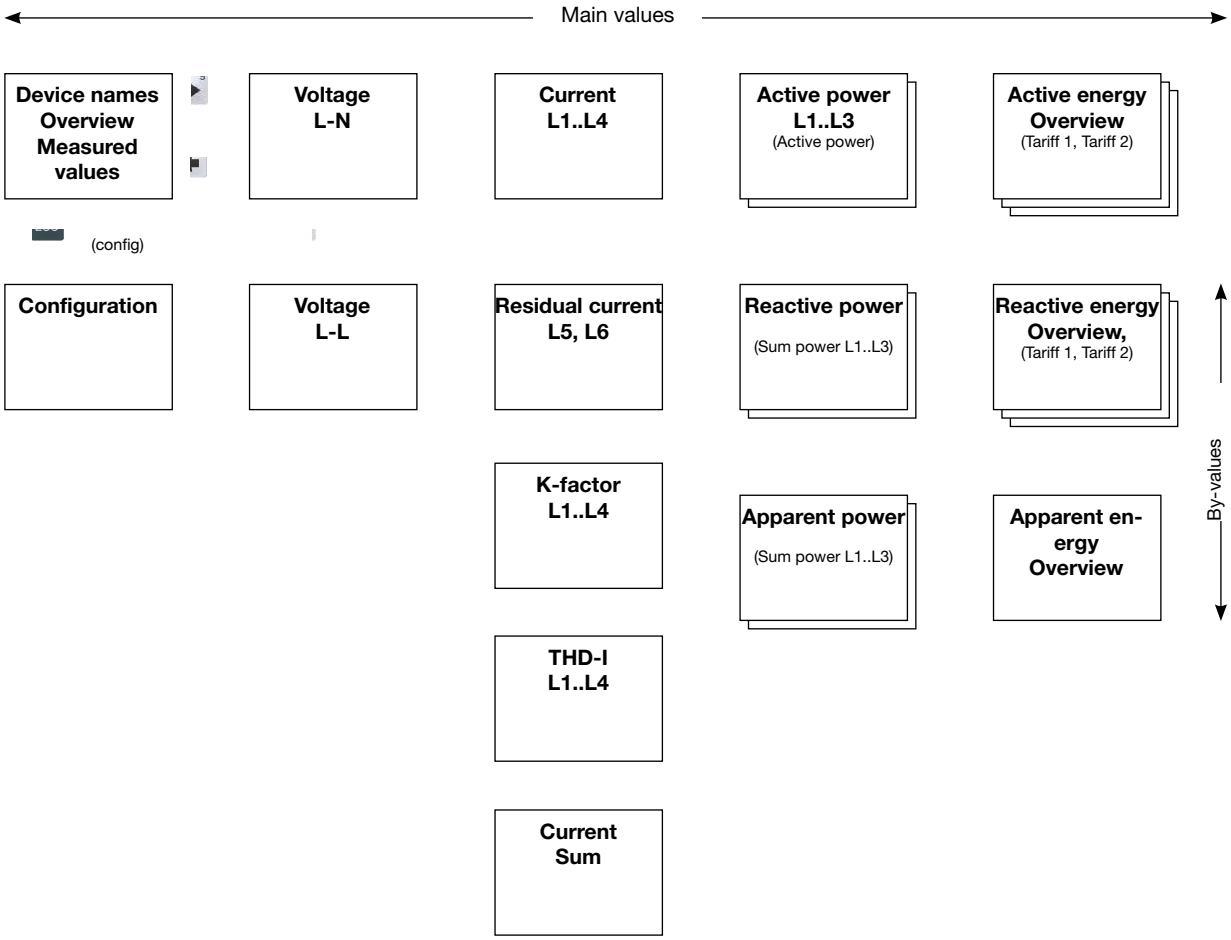


Fig. Schematic representation of the menu navigation for the measuring displays, part 1

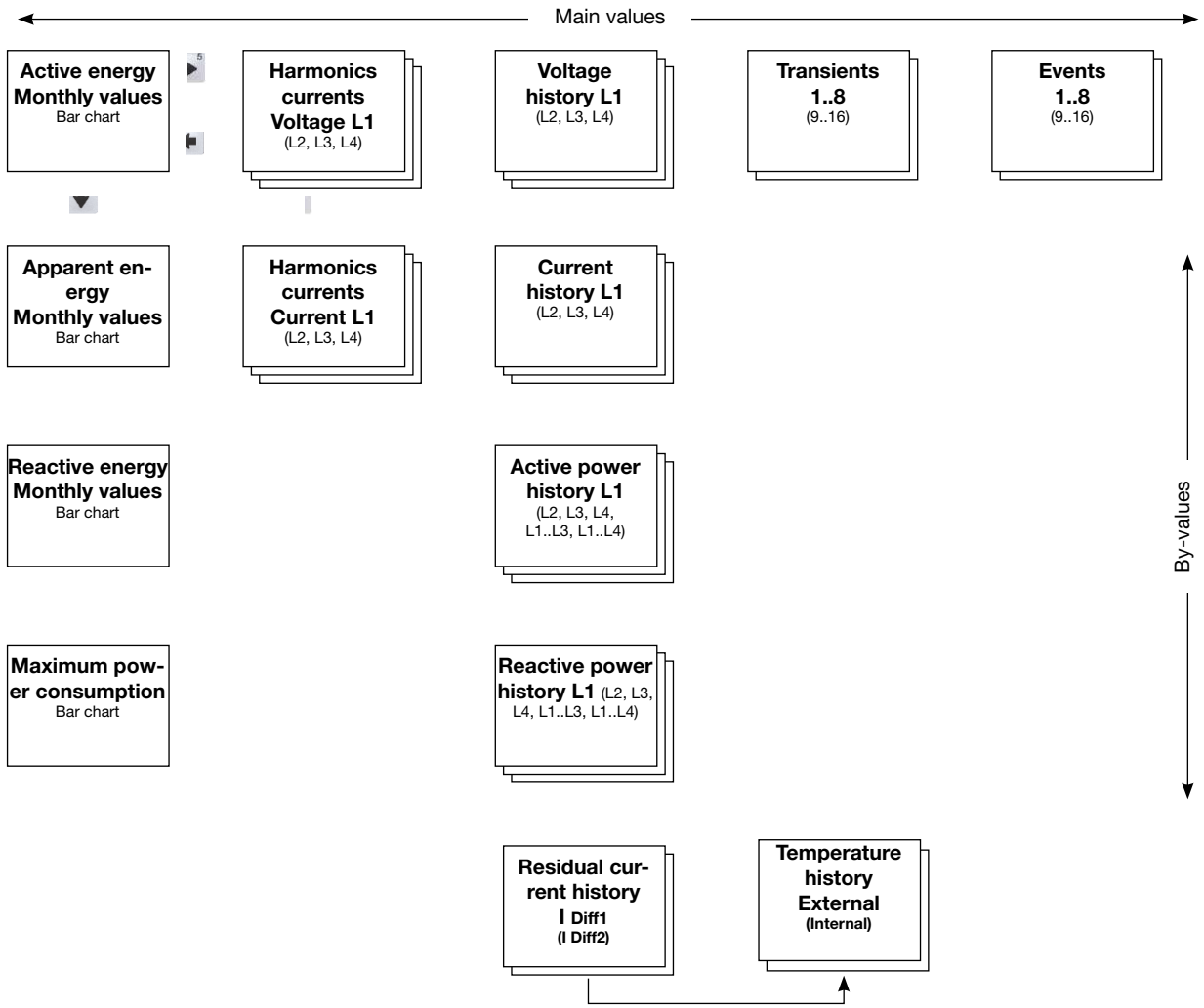


Fig. Schematic representation of the menu navigation for the measuring displays, part 2

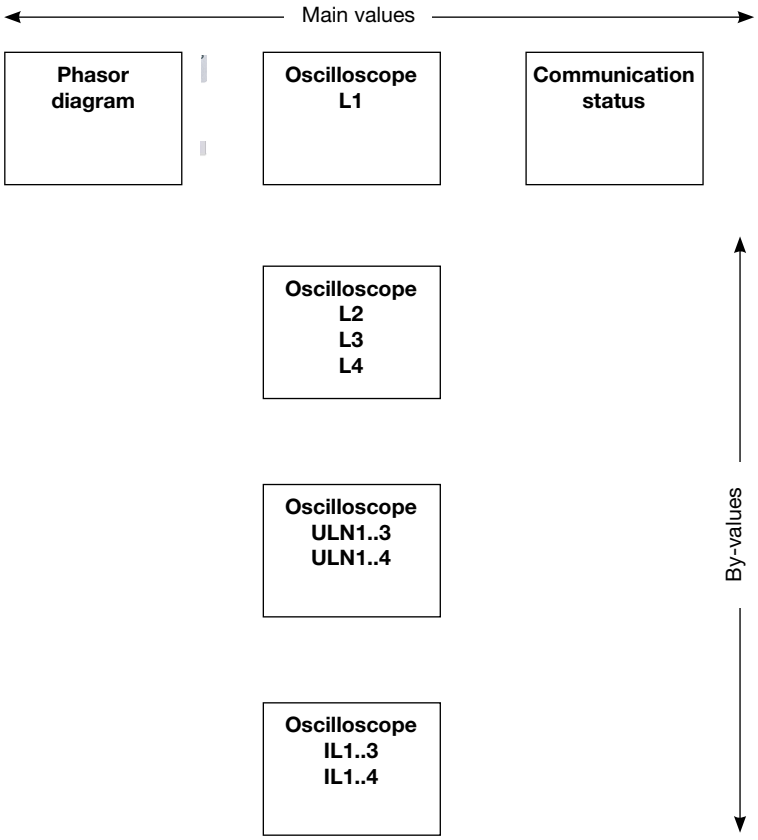


Fig. Schematic representation of the menu navigation for the measuring displays, part 3

18. Connection example

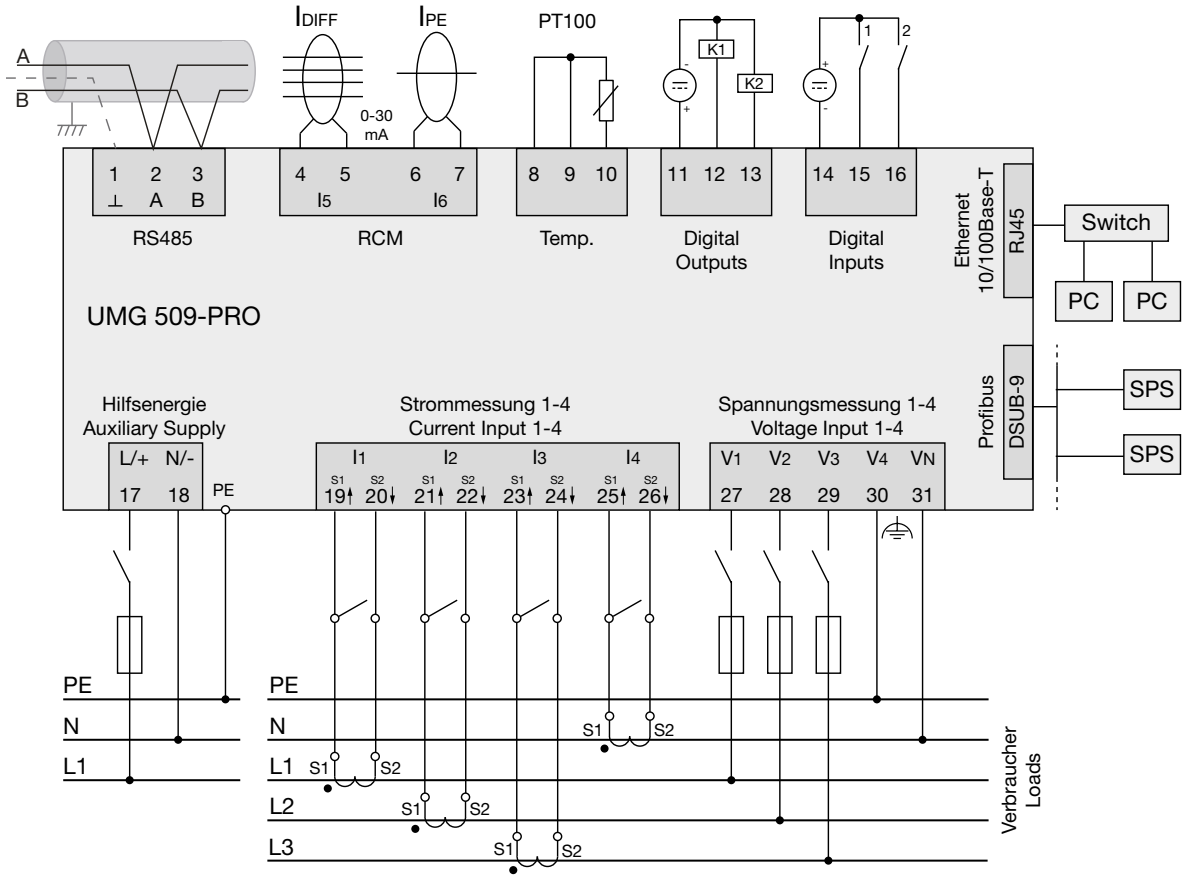


Fig. Connection example schematic drawing for the UMG 509-PRO

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