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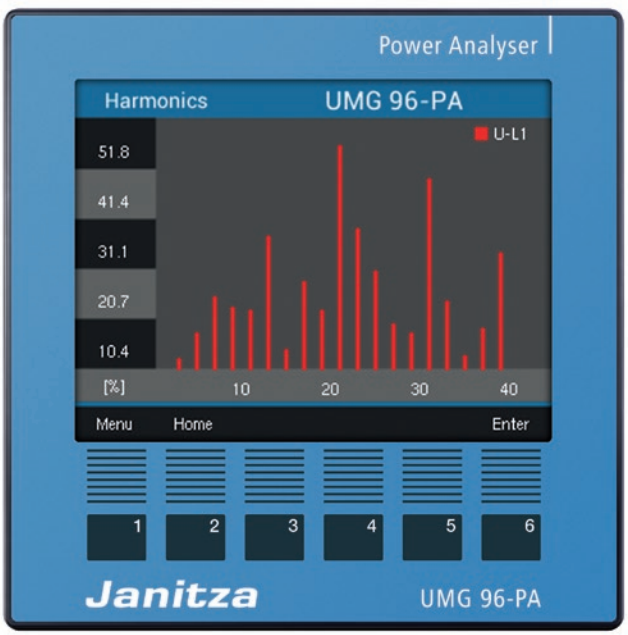
Power Analyzer

UMG 96-PA

(Firmware 2.0 and higher)

User Manual and Technical Data



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Janitza®

UMG 96-PA (Firmware 2.0 and higher)
Measurement device for recording energy measured values

Doc. no.: 2.061.039.0b
Status: 04/2019
The German version is the
original version of the documentation

Subject to technical changes.

The content of our documentation has been compiled with the utmost care and is based on the latest information available to us. Nevertheless, we would like to point out that the updating of this document cannot always be performed simultaneously with the further technical development of our products. Information and specifications can be changed at any time.
Please consult *www.janitza.com* for information on the current version.

TABLE OF CONTENTS

1. Notes on the device and user manual 8
1. 1 Disclaimer 8
1. 2 Copyright notice 8
1. 3 Technical changes 8
1. 4 About this user manual 8
1. 5 Defective device/disposal 9

2. Safety 10
2. 1 Presentation of warning notices and safety instructions 10
2. 2 Danger levels 10
2. 3 Safety measures 11
2. 4 Qualified personnel 11
2. 5 Warranty in the event of damage 11

3. Product description 12
3. 1 Incoming goods inspection 12
3. 2 EC declaration of conformity 12
3. 3 Intended use 12
3. 4 Scope of delivery 13
3. 5 Available accessories 13
3. 6 Device description 14
3. 7 Measurement method 14
3. 8 Operating concept 14
3. 9 GridVis® network analysis software 14
3. 10 Performance features 15

4. Design of the device 16
4. 1 Front view - display 16
4. 2 Rear view - location of the connections 17
4. 3 Rating plate 18

5. Assembly 19
5. 1 Installation location 19
5. 2 Installation position 19
5. 3 Mounting 19

6. Network systems 20

7. Installation 20

7. 1 Rated voltages 20

7. 1. 1 Three-phase 4-conductor network with grounded neutral conductor 20

7. 2 Disconnectors 21

7. 3 Supply voltage 21

7. 4 Voltage measurement 22

7. 4. 1 Overvoltage 22

7. 4. 2 Frequency 22

7. 4. 3 Voltage measurement connection versions 23

7. 5 Current measurement 24

7. 5. 1 Current direction 25

7. 5. 2 Summation current measurement 25

7. 5. 3 Ammeter 25

7. 5. 4 Current measurement connection versions 25

8. Connection and PC connections 26

8. 1 Connection variants 26

8. 2 RS485 interface 26

8. 3 Shielding 27

8. 4 Termination resistors 27

8. 5 Bus structure 28

9. Digital inputs and outputs 30

9. 1 Digital inputs 30

9. 1. 1 S0 pulse input 30

9. 2 Digital outputs 31

9. 3 LED status bar 31

10. Analog output 32

11. Operation 33

11. 1 Key assignment 33

11. 2 “Home” measured value indication 33

11. 3 Menu 33

11. 4 Overview of menu displays 34

12. Configuration 36
12. 1 The Configuration window 36
12. 2 Language 36
12. 3 Communication 37
12. 4 Measurement 37
12. 4. 1 Rated current 38
12. 4. 2 Rated frequency 38
12. 4. 3 Current transformer and voltage transformer 39
12. 5 Display 40
12. 5. 1 Brightness 40
12. 5. 2 Standby after 40
12. 5. 3 Brightness (standby) 40
12. 5. 4 Colors 40
12. 6 System 41
12. 6. 1 Firmware/serial number 41
12. 6. 2 Date/time 41
12. 6. 3 Password 41
12. 6. 4 Reset 42
12. 7 Modbus editor 44

13. Commissioning 46
13. 1 Connecting the supply voltage 46
13. 2 Measured voltage 46
13. 3 Measured current 46
13. 4 Frequency 47
13. 5 Phase sequence 47
13. 5. 1 Phasor diagram basics 48
13. 6 Checking the voltage and current inputs using a phasor diagram 49
13. 7 Exceeding the measurement range 49
13. 8 Checking the power measurement 50
13. 9 Checking the communication 50
13. 10 Delete min./max. values 51
13. 11 Harmonics 52
13. 12 Communication in the bus system 53
13. 12. 1 RS485 53

13. 13 Digital inputs and outputs 54
13. 13. 1 Digital inputs 54
13. 13. 2 Digital outputs 56
13. 14 Analog output configuration 60
13. 15 “Drag pointer” function 61
13. 15. 1 Internal synchronization 61
13. 15. 2 External synchronization 62
13. 15. 3 Synchronization priority 64
13. 16 Recordings 65
13. 17 Tariff changeover 66

14. Overview of measured value indications 68

15. Overview of configuration displays 72

16. Service and maintenance 74
16. 1 Repair and calibration 74
16. 2 Front film and display 74
16. 3 Service 74
16. 4 Device adjustment 74
16. 5 Firmware update 74
16. 6 Clock/battery 75

17. Procedure in the event of errors 76

18. Technical data 77

19. Function characteristics 80
19. 1 Modbus address list of frequently used measured values 82
19. 2 Number formats 83
19. 3 Dimensional drawings 84
19. 4 Connection example 1 85

1. Notes on the device and user manual

1.1 Disclaimer

It is essential that the information products for the devices are observed to ensure safe operation and achieve the specified performance characteristics and product features.

Janitza electronics GmbH assumes no liability for personal injuries, property damage and financial losses resulting from the failure to observe the information products.

Make sure that your information products are legible and accessible.

1.2 Copyright notice

1.3 Technical changes

- Make sure that the user manual matches your device.
- This user manual is valid for the UMG 96-PA (F**irmware 2.0 and higher**).
- First, make sure you have read and understood the document accompanying the product.
- Keep the documents accompanying the product accessible through its service life and hand them over to the subsequent owner where applicable.
- Refer to www.janitza.de for information concerning device revisions and the associated adjustments to the documentation accompanying the product.

1.4 About this user manual

Please send us any questions, comments or suggestions for improvement about the user manual via e-mail to info@janitza.de.

NOTE

This user manual describes the UMG 96-PA devices (**Firmware 2.0 and higher**) and provides information on the operation of the devices.

For this user manual, refer to the additional documentation for your device, such as:
- Installation instructions.
- Quick start “GridVis®” software.
- “Safety instructions” supplement.

If necessary, also observe the documentation for the expansion modules as well as
- user manuals and
- installation instructions.

The **GridVis®** software features “online help”.

1.5 Defective device/disposal

Please contact the manufacturer's support department before sending **defective devices (components)** back to the manufacturer for testing (complete with accessories). Take the transport conditions into consideration.

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

Do not attempt to independently open or repair the device since the warranty claim will otherwise expire.

Please observe national regulations when **disposing** of the device (component). Dispose of individual parts, where necessary, depending on the properties and existing country-specific regulations, e.g. as:
· Electronic waste,
· Batteries and accumulators,
· Plastics or
· Metals.
If necessary, commission a certified disposal company with the scrapping.

Further information about the operation and maintenance of your device can be found in chapter „16. Service and maintenance“ on page 74.

2. Safety

Please read the present user manual and all other publications that are applicable for working with this product. This applies in particular for installation, operation and maintenance.

In the process, observe all safety requirements and warning notices. Failure to observe the notices can result in personal injury and/or damage to the product.

Any impermissible modification or use of this device exceeding the specified mechanical, electrical or other operating limits can result in personal injury and/or property damage.

Read the user manual before using the device and keep it in a safe place for the entire service life of the product and have it readily available for reference.

Also observe the applicable legal and safety requirements for the respective application when using the device.

2.1 Presentation of warning notices and safety instructions

The warning notices listed below
· are used in the complete documentation.
· can be found on the devices themselves.
· point out potential risks and dangers.
· confirm information which clarifies or simplifies procedures.

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

The general warning symbol calls attention to possible risks of injury. Observe all the instructions listed under this symbol in order to prevent injuries or even death.

2.2 Danger levels

Warning notices and safety instructions are highlighted by a warning symbol and the danger levels are presented as follows depending on the level of risk:

DANGER
Indicates an imminently dangerous situation that will result in serious or fatal injuries in the event of noncompliance.

WARNING
Indicates an imminently dangerous situation that can result in serious or fatal injuries in the event of noncompliance.

CAUTION
Indicates an imminently dangerous situation that can result in minor injuries in the event of noncompliance.

ATTENTION
Indicates an imminently dangerous situation that can result in property damage or environmental damage in the event of noncompliance.

NOTE
Points out procedures during which a danger of injuries or property damage does **not** exist.

2.3 Safety measures

When operating electrical devices, specific parts of these devices inevitably carry dangerous voltage. As a result, serious bodily harm or property damage can occur if they are not handled correctly:

⚠ WARNING

Risk of injury due to electric voltage!
Serious personal injuries or death may occur!
Therefore, please observe the following:

- **Before starting work on your system, disconnect the system from the power supply! Secure it against being switched back on! Verify disconnection from power! Ground and short-circuit! Cover or block off neighboring parts that are under voltage!**
- **Also make sure to check the surrounding area for dangerous voltage and switch it off if necessary during the operation and troubleshooting (especially with top hat rail devices)!**
- **For work on electrical systems, wear protective clothing and safety equipment according to applicable directives!**
- **Before connection, ground the device/ components at the ground wire connection, if available!**
- **Do not touch exposed or stripped cores that are under voltage! Fit wire end ferrules on the conductors made of individual wires!**
- **Dangerous voltages may be present in all circuit parts connected to the voltage supply.**
- **Secure the supply voltage with a suitable circuit breaker/fuse.**
- **Never switch off, dismantle or manipulate safety devices.**
- **There may still be dangerous voltages present in the device or in the components even after disconnection of the supply voltage (capacitor storage).**
- **Do not operate equipment with open current transformer circuits.**
- **Only connect screw-type terminals with the same numbers of poles and same type!**
- **Do not exceed the threshold values stated in the user manual and on the rating plate; this must also be observed during inspection and commissioning.**
- **Safety instructions and warning notices in the documents that accompany the devices and their components!**

2.4 Qualified personnel

To prevent personal injuries and property damage, only electrically qualified personnel may work on the devices and their components, modules, assemblies, systems and circuits. They must also have knowledge

- of the national and international accident prevention regulations.
- of safety technology standards.
- in installation, commissioning, operation, enabling, grounding and labeling of electrical equipment.
- of the requirements for personal protective equipment.

Electrically qualified personnel, in terms of the safety-related notes in all documents accompanying the device and its components, are persons who can prove a professional qualification as an electrician.

⚠ WARNING

Warning against impermissible manipulations or improper use of the device or its components.
Opening, dismantling or impermissible manipulation of the device and its components, which exceeds the specified mechanical, electrical or other operating limits, can result in property damage or injuries up to death.

- **Only electrically qualified personnel may work on the devices and their components, assemblies, systems and circuits!**
- **Always use your device or components as described in the associated documentation.**
- **Send the device or components back to the manufacturer in the event of visible damage.**

2.5 Warranty in the event of damage

Any impermissible manipulation or use of the device applies as "misuse" and/or "negligence" with respect to the product warranty and thus voids the warranty for coverage of potentially resulting damages. Observe chapter „3.3 Intended use“ on page 12 for this.

3. Product description

3.1 Incoming goods inspection

The prerequisites for smooth and safe operation of this device and its components include proper transport, storage, setup and assembly, operation and maintenance, as well as observance of the safety instructions and warning notices.

Exercise caution when unpacking and packing the device, without using force and only using suitable tools.

Perform a visual inspection of the device to ensure the fault-free mechanical condition.

Please check the scope of delivery for completeness before beginning with the installation of the device.

If you assume that safe operation is no longer possible, the device must be shut down immediately and prevented from unintended re-commissioning. It can be assumed that safe operation is no longer possible, when, for example, the device:

· has visible damage,
· 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.).

3.2 EC declaration of conformity

The laws, standards and directives applied for the devices by Janitza electronics GmbH can be found in the EC declaration of conformity at www.janitza.de.

3.3 Intended use

The device is:
· intended for installation in switching cabinets and small installation distributors.
· not intended for installation in vehicles! Using the device in mobile equipment is considered an unusual environmental condition and is only permissible by special agreement.
· not intended for installation in areas exposed to harmful oils, acids, gases, vapors, dust and radiation, etc.
· designed as an indoor meter.

NOTE

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

NOTE

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

The following applies to the battery used in the device:

⚠ CAUTION

Risk of injury due to fire or chemical burns.
The battery used in the device may cause fire or burns if used incorrectly.
· **Only replace the battery with the same type or types recommended by Janitza.**
· **Observe the polarity when installing the battery.**
· **Only remove batteries with non-conductive tools (e.g. plastic tweezers).**
· **Do not recharge, destroy, heat up over 100°C (212°F) or burn batteries.**
· **Do not dispose of batteries with household waste. Observe the disposal requirements in the respective device documentation.**
· **Keep batteries away from children and animals!**
· **Send devices with soldered batteries back to the manufacturer taking into consideration the transport conditions in the event of damage.**

3.5 Scope of delivery

Number	Item no.	Designation
1	52.32.xxx [1)]	UMG 96-PA
1	33.03.360	Installation instructions
1	33.03.342	“Safety instructions” supplement.
1	33.03.361	Quick start “GridVis” software.
1	10.01.896	Screw-type terminal, pluggable, 3-pole (auxiliary supply)
1	10.01.849	Screw-type terminal, pluggable, 4-pole (voltage measurement)
1	10.01.871	Screw-type terminal, pluggable, 6-pole (current measurement)
1	10.01.909	Screw-type terminal, pluggable, 3-pole (RS 485)
1	10.01.865	Screw-type terminal, pluggable, 10-pole (digital inputs and outputs, analog output)
1	52.22.251	Fastener set

1) For the item number, see the delivery note

3.4 Available accessories

Number	Item no.	Designation
1	21.01.058	Battery type lithium CR2032, 3 V (Approval according to UL 1642)
1	29.01.065	Seal, 96 x 96
1	15.06.015	Interface converter RS485 <-> RS232
1	15.06.025	Interface converter RS485 <-> USB

3.6 Device description

The device is suitable for
· measurements and calculations of electric values, such as voltage, current, power, energy, harmonics in the building installation, on distributors, circuit breakers and busbar trunking systems.
· measurements of voltages and currents which originate from the same network.
· measurements in low-voltage networks in which rated voltages of up to 417 V conductor to ground and surge voltages of overvoltage category III occur.
· measurements in medium and high-voltage networks with current and voltage transformers. Measurements in medium and high-voltage networks generally take place via current and voltage transformers.
· Current measurement via external ../1 A or ../5 A current transformer.
· Installation in permanently installed switch cabinets or small installation distributors in any installation position.
· Use in residential and industrial sectors.

Measurement results are displayed by the measurement device and transmitted via the interface for readout and further processing.

ATTENTION

Malfunction or damage to the device due to improper connection.
Improperly connected devices can deliver incorrect measured values or damage the device.
Please observe the following:
· **The measured voltages and measured currents originate from the same network.**
· **Do not use the device to measure DC current!**
· **Ground conductive switchboards.**

3.7 Measurement method

The device measures
· seamlessly and calculates all effective values in a 200 ms interval.
· the true effective value (TRMS) of the voltages and currents generated at the measurement inputs.

3.8 Operating concept

The operating concept of the measurement device is based on the following methods:
· **6 function keys with display** for configuring and acquiring data.
· A **Modbus editor.**
· The **Modbus protocol and the Modbus address list** for configuring and reading out data. The Modbus address list is available at www.janitza.de.
· The **GridVis®** network analysis and programming software for programming and analyzing data**.**

This user manual describes the operation of the measurement device using the 6 function keys and the Modbus editor. The GridVis® network analysis software has its own “Online help” and e-learning modules.

3.9 GridVis® network analysis software

You can use the GridVis® network analysis software, which is available at www.janitza.de, to program your measurement device and read out data for analysis. To do this, connect a PC, e.g. via the serial interface (RS485) or a gateway (e.g. UMG 512-PRO), to your measurement device.

With the GridVis® network analysis software, you can:
· Program devices.
· Configure and read out recordings.
· Analyze the read out data.
· Saving data in a databases.
· Display measured values in a graph.
· Program the customer-specific applications.

3.10 Performance features

General information
- Integrated front panel unit with the dimensions 96 x 96 mm
- Extension through module technology
- Connection via pluggable screw-type terminals
- Color graphic display 320 x 240 px
- Operation via 6 keys
- 3 voltage measurement inputs (600 V, CAT III)
- 3 current measurement inputs (via current transformer)
- 3 digital outputs
- 3 digital inputs
  (configured as pulse counter with simultaneous power calculation)
- 1 analog output (0 - 20 mA)
- 4 MByte Flash data memory
- RS485 interface (Modbus RTU, slave, up to 115 kbps)
- Recording of more than 2000 measured values
- Clock and battery
- Operating temperature range -10°C .. +55°C

Measurement uncertainty
- Active energy, measurement uncertainty class 0.5S for ../5A transformer
- Active energy, measurement uncertainty class 1 for ../1A transformer
- Reactive energy, class 1

Measurement
- Recording of more than 800 measured values
- Measurement in TN and TT networks
- Measurement in networks with rated voltages up to L-L 720 V_{rms} and L-N 417 V_{rms} (according to IEC)
- Current measurement range 0.005 .. 6 A_{rms}
- True effective value measurement (TRMS)
- Continuous scanning of the voltage and current measurement inputs
- Frequency range of the power frequency 45 Hz .. 65 Hz
- Measurement of harmonics up to the 40th for U_{LN} and I
- U_{LN}, U_{LL}, I, P (consumption/export), Q (ind./cap.)
- 2 rates (switchover via Modbus or digital input 1)

4. Design of the device

4.1 Front view - display

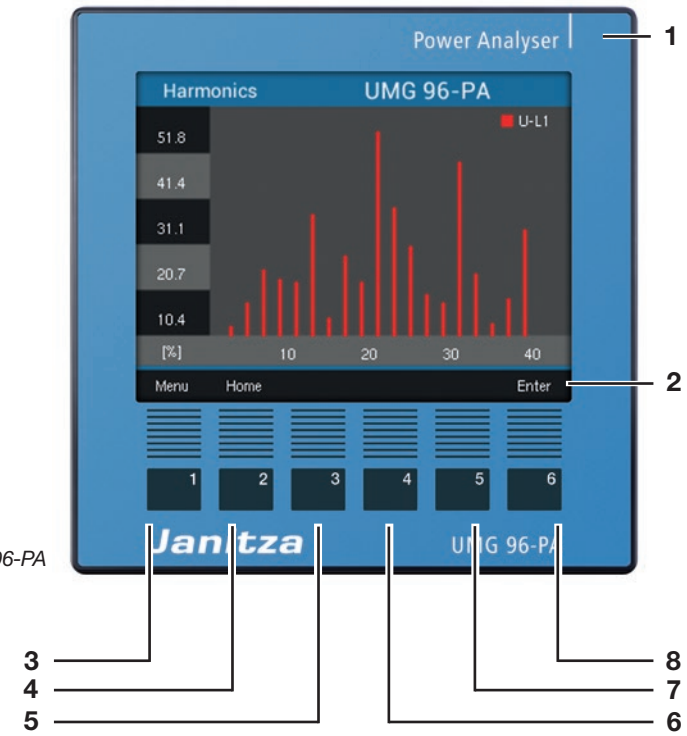


Fig. Front view of the UMG 96-PA

1 Device type
2 Description of the function keys
3 Key 1: Configuration menu, back (*ESC*)
4 Key 2: Select number, set selection field (◀)
5 Key 3: Lower number by 1, select menu item (▼), set selection field (▼)
6 Key 4**:** Increase number by 1, select menu item (▲), set selection field (▲)
7 Key 5: Select number, set selection field (▶)
8 Key 6: Open selection menu, activate input, confirm selection (*Enter*)

4.2 Rear view - location of the connections

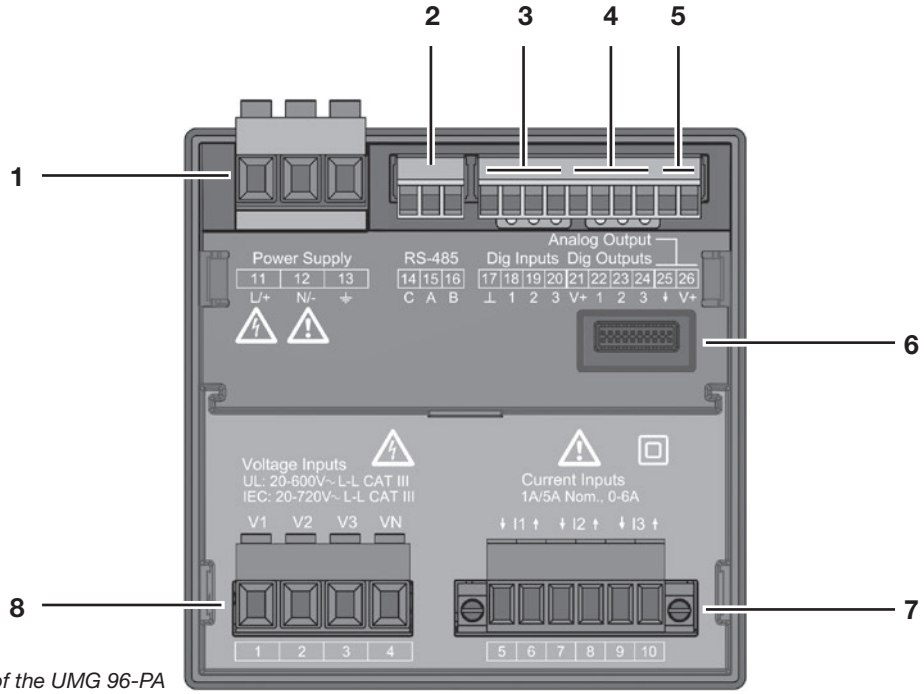
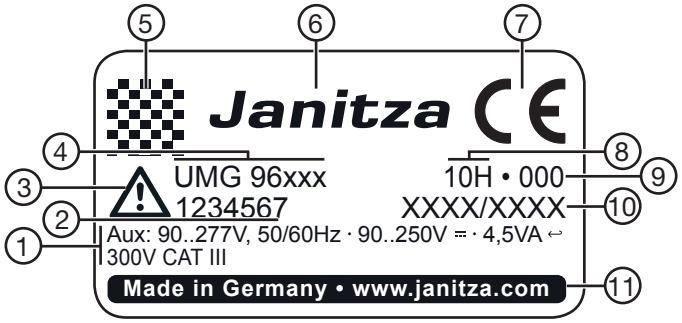


Fig. Rear view of the UMG 96-PA

1 Supply voltage
2 RS485 interface
3 Digital inputs
4 Digital outputs
5 Analog output
6 Module connector
7 Current measurement inputs I1 to I3
8 Voltage measurement inputs V1 to V3

4.3 Rating plate

UMG 96-PA



Pos.	Designation	Description
1	Operating data	· AC supply voltage in V · Rated frequency in Hz · DC supply voltage in V · Power consumption in VA · Overvoltage category
2	Item number	Item number of the manufacturer
3	“Danger sign” symbol	General danger symbol. Observe the warning notices depicted on the device and listed in the documents in order to prevent injuries or even death.
4	Device type	Device designation
5	QR code	Coded manufacturer data
6	Manufacturer logo	Logo of the device manufacturer
7	CE mark	See chap. „3.2 EC declaration of conformity“ on page 12.
8	Manufacturer-specific data	Coded manufacturer data
9	Hardware version	Hardware version of your device
10	Type/serial number	Number for identifying the device
11	Designation of origin/web address	Country of origin and web address of the manufacturer

5. Assembly

5.1 Installation location

The device is suitable for indoor installation in stationary and weather-protected switchboards.

Ground conductive switchboards.

ATTENTION

Property damage due to noncompliance with the assembly instructions!
Noncompliance with the assembly instructions may damage or destroy your device.
- **Observe the information for the installation location in the "Assembly" and "Technical data" sections.**
- **Ensure sufficient air circulation in your installation environment and, where applicable, sufficient cooling with high temperatures!**

5.2 Installation position

The cut-out size in the switchboard is $92^{+0.8}$ mm x $92^{+0.8}$ mm.

Minimum clearances for adequate ventilation:

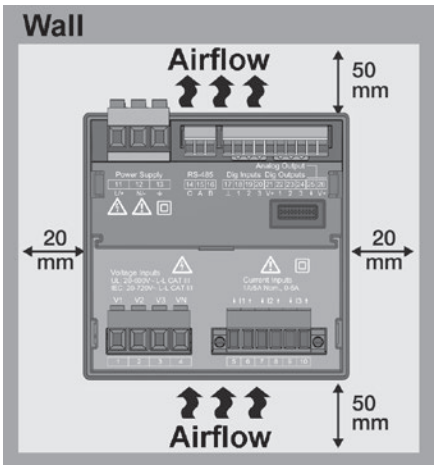


Fig. Rear view of the UMG 96-PA mounting position

5.3 Mounting

Fasten the device with the side mounting brackets inside the switchboard (mounting plate). To do this, proceed as follows:
- Before inserting the device, remove the mounting brackets (e.g. with a screwdriver) by moving the lever horizontally.

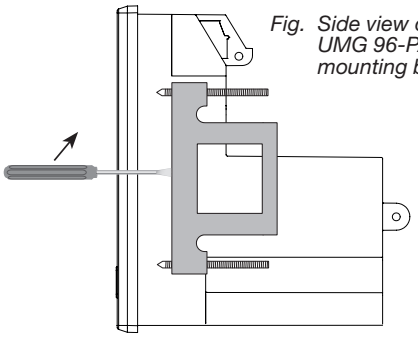
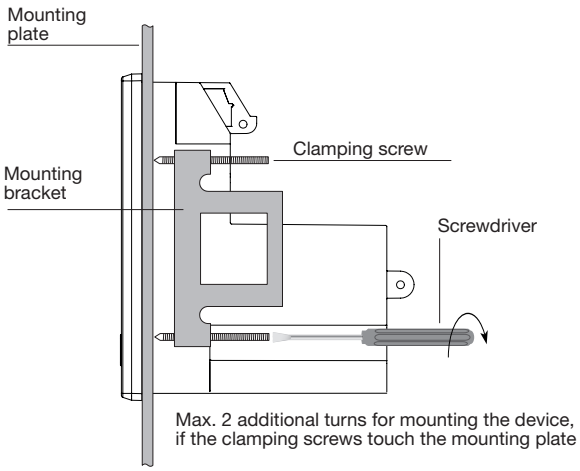


Fig. Side view of the UMG 96-PA with mounting bracket.

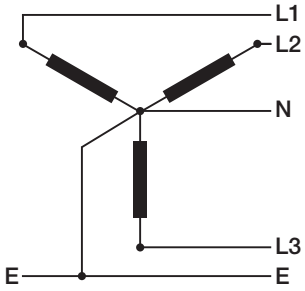
- Guide your device from the front through the switchboard (mounting plate).
- Attach the brackets to the side of the device by pushing them in and snapping them into place.
- Screw in the clamping screws until they touch the mounting plate.
- Then tighten the clamping screws with two additional turns each. **Clamping screws that are too tight can destroy the mounting brackets.**



6. Network systems

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

Three-phase 4-conductor systems
with grounded neutral conductor



IEC	U_{L-N} / U_{L-L}: 417 V_{LN} / 720 V_{LL}
UL	U_{L-N} / U_{L-L}: 347 V_{LN} / 600 V_{LL}

The device can be used in
· TN and TT networks
· residential and industrial sectors.

WARNING

Risk of injury due to electric voltage!
Measurement voltage surges over the approved overvoltage category can damage insulation in and on the device. The safety of the device will be impaired. This can result in serious personal injuries or death.
· **Only use the device in environments in which the permissible measurement voltage surge can be observed.**

7. Installation

The device is suitable for the voltage measurement in TN and TT systems.
The voltage measurement of the device has the overvoltage category 600V CATIIII (measurement voltage surge 6 kV).

WARNING

Risk of injury due to electric voltage!
Do not short circuit the secondary-side connections of voltage transformers. This can result in serious personal injuries or death.
· **Connect voltage transformers according to their documentation.**
· **Check your installation.**

7.1 Rated voltages

7.1.1 Three-phase 4-conductor network with grounded neutral conductor

Suitable networks and rated voltages for your device:

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

Fig. Suitable network rated voltages for measurement inputs according to EN 60664-1:2003

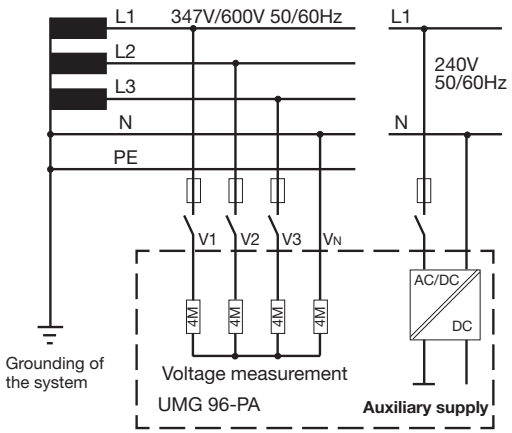


Fig. Schematic diagram - measurement in three-phase 4-conductor systems.

7.2 Disconnectors

Install a suitable disconnector for the supply voltage in the building installation in order to de-energize the device from current and voltage.
· Install the disconnector near the device in a location that is easily reachable for the user.
· Mark the disconnector as a disconnecting device for this device.

7.3 Supply voltage

Device operation requires a supply voltage. The type and level of the supply voltage for your device can be found on the rating plate. Please continue observing the following:
· Before connecting the supply voltage, ensure that the voltage and frequency correspond to the specifications on the rating plate.
· Connect the supply voltage via a UL/IEC-approved fuse to the plug-type terminals on the rear of the device.
· After connecting the supply voltage, the display appears. If no display appears, check whether the supply voltage is within the rated voltage range.

⚠ WARNING

Risk of injury due to electric voltage!
Serious personal injuries or death can occur due to:
· Touching live exposed or stripped cores.
· Device inputs that are dangerous to touch.
Before starting work, disconnect your system from the power supply! Secure it against being switched back on! Verify disconnection from power! Ground and short-circuit! Cover or block off neighboring parts that are under voltage!

⚠ CAUTION

Property damage due to noncompliance with the connection conditions.
Noncompliance of the connection conditions may damage or destroy your device.
Therefore, please observe the following:
· **Observe information on voltage and frequency on the rating plate.**
· **Connect the supply voltage via a fuse in accordance with the technical data.**
· **Do not tap the supply voltage at the voltage transformers.**
· **Provide a fuse for the neutral conductor if the neutral conductor connection is not grounded to the source.**

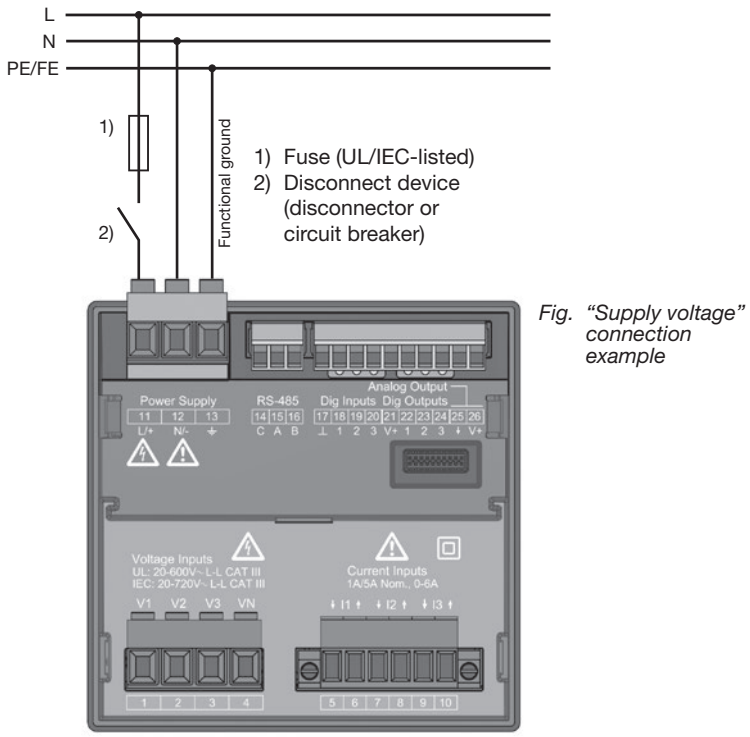


Fig. "Supply voltage" connection example

NOTE

Without functional ground, the device shows that no residual voltage is present.

Overcurrent protection device for the line protection of the supply voltage

Recommendation for the overcurrent protection device of the supply voltage line protection (depending on the device variants):
· Option 230 V --> 6 - 16 A (char. B)
· Option 24 V --> 1 - 6 A (char. B)

Recommendation for the maximum number of devices on one circuit breaker, depending on the variants:
· 230 V option:
  With a circuit breaker B6A: maximum 4 devices.
  With a circuit breaker B16A: maximum 11 devices.
· 24 V option:
  With a circuit breaker B6A: maximum 3 devices.
  With a circuit breaker B16A: maximum 9 devices.

NOTE
The fuse is a line protection. It **does not** protect the device.

7.4 Voltage measurement

There are 3 voltage measurement inputs (V1 to V3) on the back of the device.

7.4.1 Overvoltage

The voltage measurement inputs are suitable for measurement in networks in which overvoltages of category 600 V CAT III (measurement voltage surge 6 kV) may occur.

7.4.2 Frequency

The device:
· requires the mains frequency for the measurement and calculation of measured values.
· is suitable for measurement in networks in which the fundamental oscillation of the voltage is in the range of 45 Hz to 65 Hz.

The power frequency is determined from the measured voltage of phase L1. The sampling rate of the voltage and current measurement inputs results from the power frequency.

For measurements with strongly distorted voltages, the frequency of the fundamental voltage oscillation can no longer be determined exactly. This means that for measuring voltages with strong distortions, the corresponding power frequency should be fixed. Voltage distortions occur, for example, during measurements on loads that are operated with phase angle control. Distortions of the current do not influence the frequency determination.

You can find more information in chapter „12.4.1 Rated frequency“ on page 38

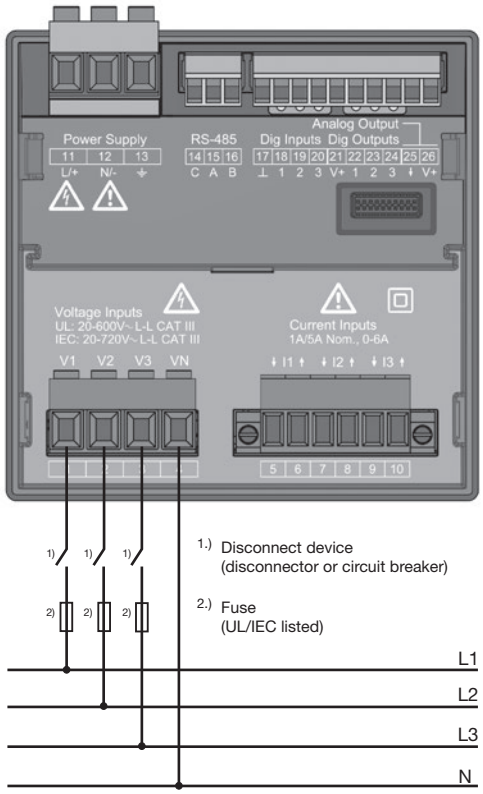


Fig. Connection example for the voltage measurement.

⚠ WARNING

Risk of injury due to electric voltage!
Serious personal injury or death may result if the connection conditions for the voltage measurement inputs are not observed.
Therefore, please observe the following:
- **Before starting work, disconnect your system from the power supply! Verify that there is no current!**
- **Connect voltages above the permitted network rated voltages via voltage transformers.**
- **The voltage measurement inputs on the device are dangerous to touch.**
- **Install a circuit breaker as described in section 7.2 on page 21.**
- **Use a UL/IEC-approved overcurrent protection device with a rated value rated for short-circuit current at the connection point.**

⚠ CAUTION

Malfunction due to improper connection.
Incorrect connection of the device may result in incorrect measured values.
Therefore, please observe the following:
- **Measured voltages and currents originate from the same network.**
- **The device is not suitable for measuring DC voltage.**

NOTES

- The device only determines the measured values if voltage L1-N is greater than 20 V_{eff} (4-conductor measurement) or voltage L1-L2 is greater than 34 V_{eff} (3-conductor measurement) at voltage measurement input V1.
- Use a line protection with IEC/UL approval as an overcurrent protection device for voltage measurement.

7.4.3 Voltage measurement connection versions

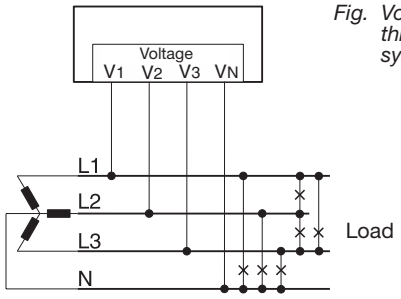


Fig. Voltage measurement in the three-phase 4-conductor system

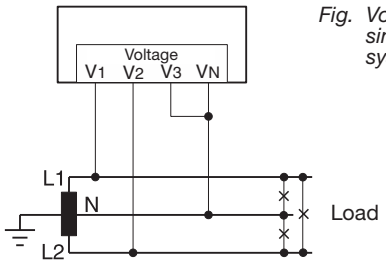


Fig. Voltage measurement in the single-phase 3-conductor system

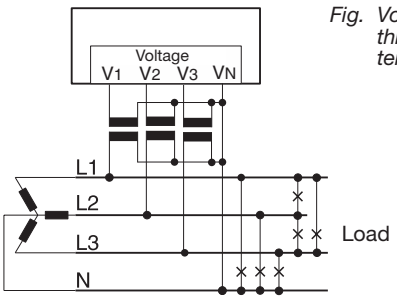


Fig. Voltage measurement in the three-phase 4-conductor system via voltage transformers

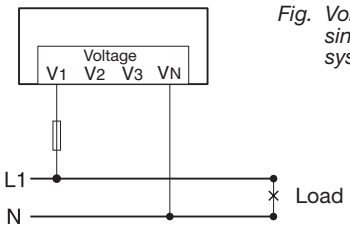


Fig. Voltage measurement in the single-phase 2-conductor system

NOTE

The device only permits setting **one voltage transformer ratio** for **all phases**!
You can easily configure the **voltage transformer ratios** via
- the device menu.
- the GridVis® software.

For information on the voltage transformer configuration, see chapter „12.4.3 Current transformer and voltage transformer“ on page 39.
For information on exceeding the measurement range, see chapter „13.7 Exceeding the measurement range“ on page 49.

7.5 Current measurement

The device:
· is designed for the connection of current transformers with secondary currents of ../1 A to ../5 A.
· is only approved for a current measurement using the current transformer.
· does not measure DC currents.

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

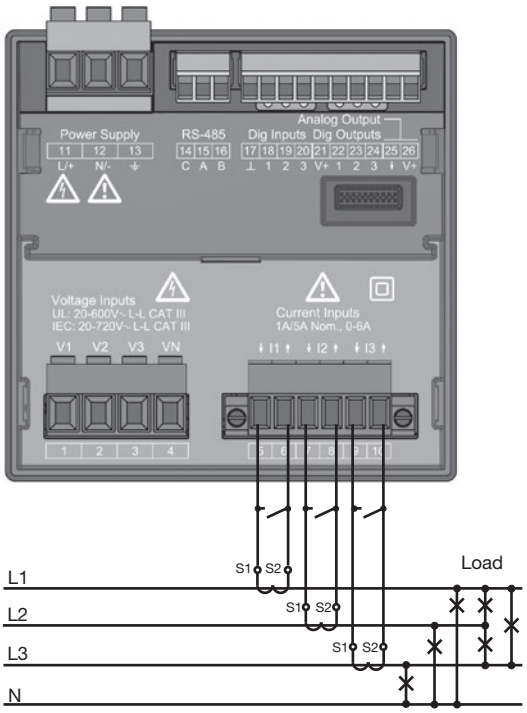


Fig. "Current measurement via current transformer" connection example

⚠ WARNING

Risk of injury due to electric voltage!
Serious personal injuries or death can occur due to:
· Touching live exposed or stripped cores.
· Device inputs that are dangerous to touch.
De-energize your system before beginning to work! Check that there is no voltage!
Ground the system!
Use the ground connection point with the ground symbol for this.

⚠ WARNING

Risk of injury due to electric voltage on current transformers!
High voltage spikes that are dangerous to touch can occur on current transformers that are operated open on the secondary side, which may result in serious injuries or even death.
Therefore, please observe the following:
· **Before starting work, disconnect your system from the power supply! Verify that there is no current!**
· **Avoid open operation of the current transformer.**
· **Short-circuit unloaded current transformers.**
· **Before interrupting the power supply, make sure to short circuit the secondary connections of the current transformer.**
· **If a test switch is present that automatically short circuits the secondary lines of the current transformer, it is sufficient to put it in the "test" position provided that the short-circuit units have been checked beforehand.**
· **Only use current transformers that have a basic insulation according to IEC 61010-1:2010.**
· **Fasten the attached screw-type terminal to the device with the two screws.**
· **Even safe open current transformers are dangerous to touch if they are operated open.**
· **Observe the documentation for the current transformers.**

⚠ WARNING

Risk of injury due to electric voltage!
During high measured currents, temperatures up to 80°C can arise at the connections.
Use lines which are designed for an operating temperature of at least 80 C.

NOTE

The device only permits setting **one current transformer ratio** for **all phases.**
You can easily configure the **current transformer ratios** via
· the device menu.
· the GridVis® software.
For information on the current configuration, see chapter „12.4.3 Current transformer and voltage transformer“ on page 39.

7.5.1 Current direction

You can correct the current direction individually for each phase via the existing serial interfaces. In case of an incorrect connection, the current transformers do not need to be subsequently reconnected.

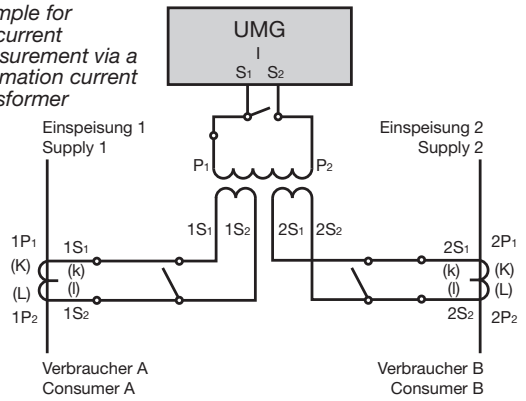
7.5.2 Summation current measurement

For a summation current measurement via two current transformers, first set their total transformation ratio on the device. The procedure for setting the current transformer ratios is described in chapter 12.4.3 on page 39.

Example:
The current measurement occurs via two current transformers. Both current transformers have a transformation ratio of 1000/5 A.
The summation measurement is performed with a summation current transformer 5+5/5 A.

The device must then be set as follows:
Primary current: 1000 A + 1000 A = 2000 A
Secondary current: 5 A

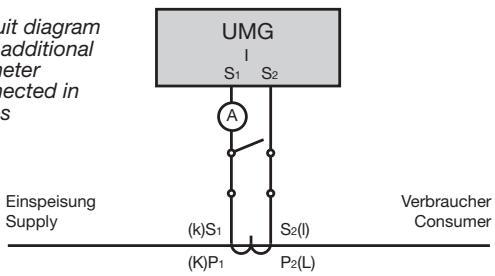
Fig. Example for the current measurement via a summation current transformer



7.5.3 Ammeter

If you want to measure the current with the UMG as well as an ammeter, connect the ammeter in series to the UMG.

Fig. Circuit diagram with additional ammeter connected in series



7.5.4 Current measurement connection versions

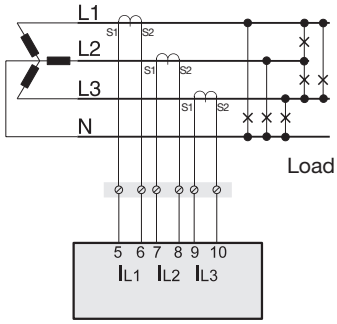


Fig. Current measurement via the current transformer in the three-phase 4-conductor system

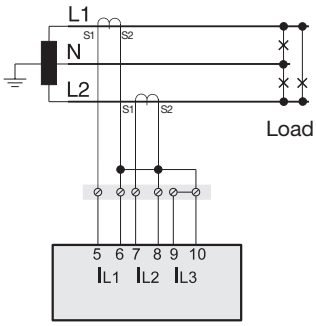


Fig. Current measurement in the single-phase 3-conductor system

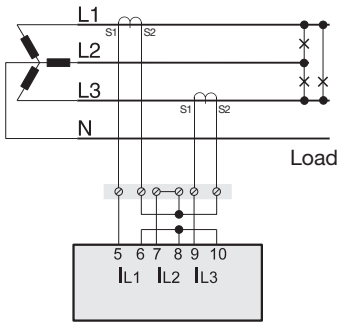


Fig. Current measurement via 2 current transformers in the three-phase 4-conductor system

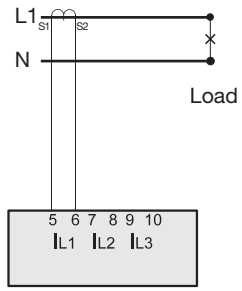


Fig. Current measurement in the single-phase 2-conductor system

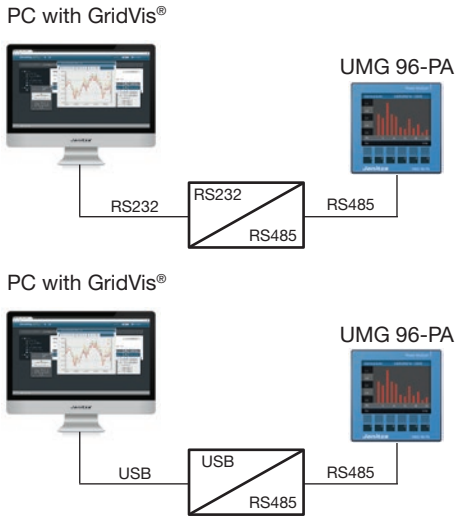
NOTE

If the measuring range is exceeded, the device display shows the warning notice ***Measuring range exceeded and specifies the current and voltage path.***
For information on exceeding the measurement range, see chapter „13.7 Exceeding the measurement range“ on page 49.

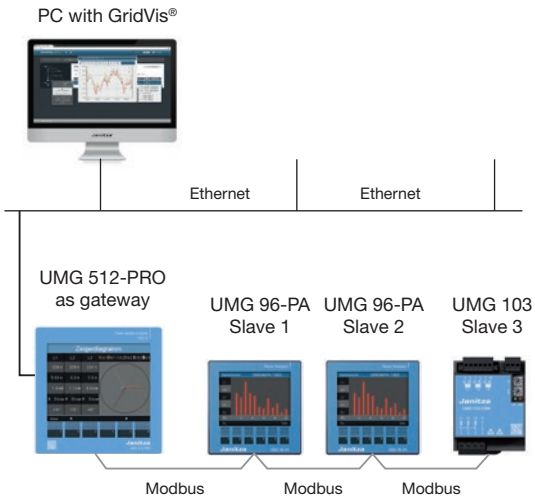
8. Connection and PC connections

8.1 Connection variants

There are several ways to connect the device to a PC:
1. Connection via an interface converter:



2. Using the UMG 96-PA (slave) via a UMG (master) with gateway functionality (e.g. UMG 512):



CAUTION

Property 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.

8.2 RS485 interface

The device communicates with the Modbus RTU protocol via an RS485 interface (3-pole plug contact).

Recommended cable type:
· ***Unitronic Li2YCY(TP) 2x2x0.22 (Lapp cable)***

Connection capacity of the terminal:
· 0.2 - 1.5 mm²
(see chapter "*Technical data*")

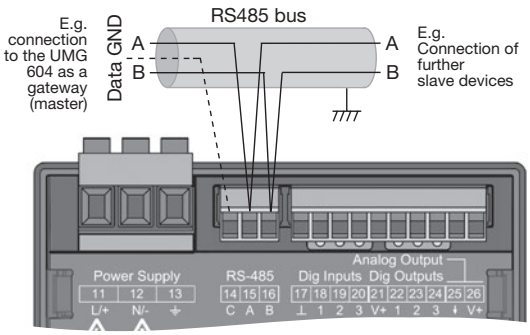


Fig. RS485 interface, 3-pole plug contact

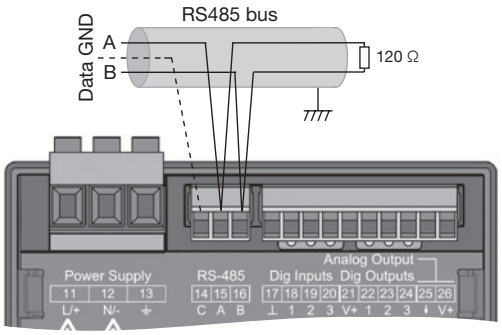


Fig. RS485 interface, 3-pole plug contact with termination resistor (item no. 52.00.008)

NOTES

· CAT cables are not suitable for the bus wiring. Use the recommended cable types for this (see above).
· A segment of an RS485 bus structure contains up to 32 participants/devices. Connect more than 32 participants/devices with repeaters.
· The device does not contain an integrated termination resistor (see chap. „8.4 Termination resistors“ on page 27).
· In an RS485 bus structure, observe the address settings for your master and slave device in the respective documentation.

8.3 Shielding

For connections via the interfaces, provide a twisted and shielded cable and observe the follow points for the shielding:

- Ground the shields of all cables that lead into the cabinet at the cabinet entrance.
- Connect the shield over a large area and with good conductivity to a noiseless ground.
- Do **NOT** connect the shield to terminal C (GND).
- Mechanically trap the cable above the grounding clamp in order to prevent damage due to movements of the cable.
- Use appropriate cable entries for guiding the cable into the switching cabinet, for example, PG glands.

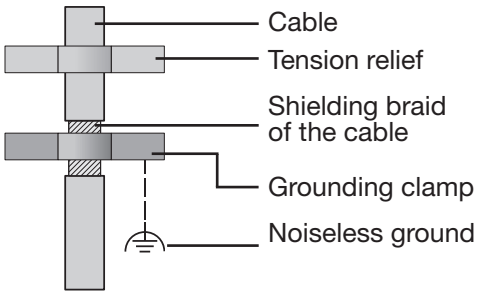


Fig. Shielding design at cabinet entrance.

⚠ WARNING

Transmission errors and risk of injury due to electrical disturbances!
Due to atmospheric discharge, errors in the transmission and dangerous voltages on the device can arise.

Therefore, please observe the following:

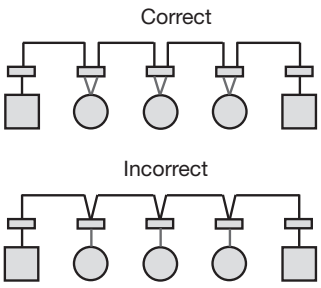
- **Place the shielding at least once on functional ground (PE).**
- **In case of larger interference sources and frequency inverters in the switching cabinet, place the shielding as close as possible to the device on functional ground (PE).**
- **Observe the maximum cable length of 12000 m at a baud rate of 38.4 k.**
- **Use shielded cables.**
- **Lay interface lines spatially separated or additionally insulated from the system parts carrying network voltage.**

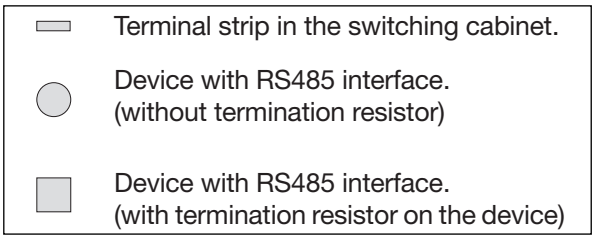
8.4 Termination resistors

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

NOTE

The device does not contain an integrated termination resistor.

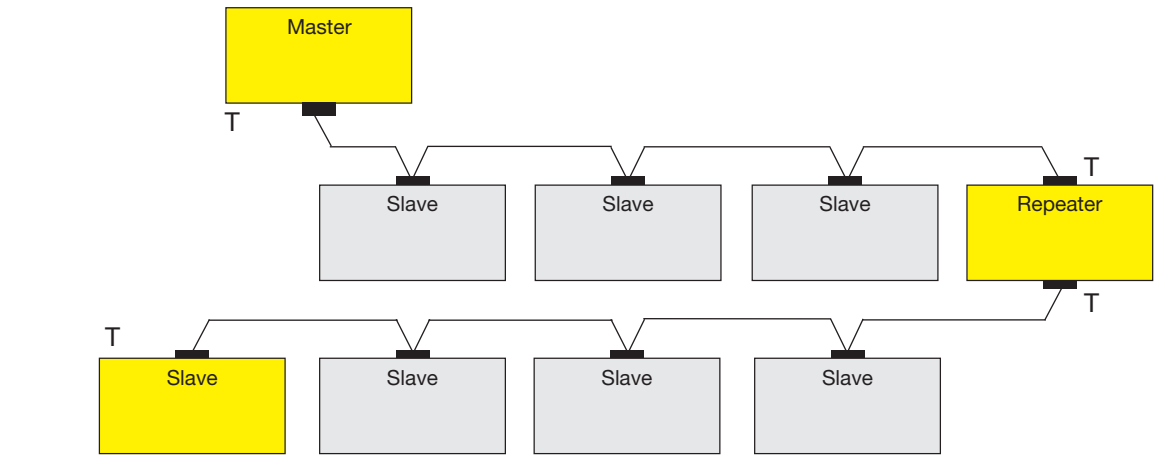




8.5 Bus structure

In a bus structure
· all devices are connected in line.
· each device has its own address.
· up to 32 participants/devices can be interconnected in a segment. The cable is terminated with resistors (bus terminator, 120 Ohm, 1/4 W) at the start and end of a segment.
· repeaters (line amplifiers) are used for more than 32 participants to connect the segments.
· devices with an activated bus terminator must be supplied with power.
· placing the master at the end of a segment is recommended. If the master is replaced with an activated bus terminator, the bus is deactivated.
· the bus can become unstable if a slave is replaced with an activated bus terminator or is de-energized.
· devices, which do not participate in the bus terminator, can be replaced without making the bus unstable.

Fig. Representation of a bus structure



Speisung notwendig / power supply necessary

T Busabschluss eingeschaltet / bus terminator on

Master - e.g. UMG 604-PRO

Slave - UMG 96PA

9. Digital inputs and outputs

The device features
· **3 digital inputs** and
· **3 digital outputs.**

9.1 Digital inputs

The device features three digital inputs, for connecting one signal transmitter each, for example. If a signal is present, the corresponding LED lights up green.

The device recognizes an input signal at the digital input if
· a voltage of at least 18 V and at most 28 V DC (typically at 4 mA) is present.
· a current of at least 0.5 mA and at most 6 mA flows.

NOTE

Observe the polarity of the supply voltage.

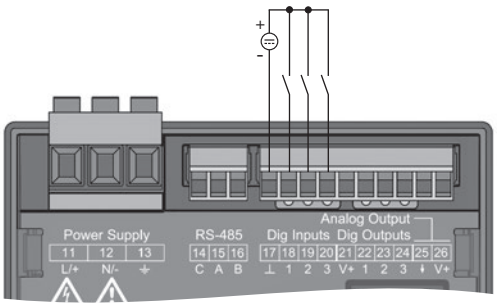


Fig. Connection of digital inputs

⚠ CAUTION

Transmission errors and property damage due to electrical disturbances.
With a line length greater than 30 m, there is an increased probability of transmission errors and damage to the device due to atmospheric discharge.
Use shielded lines for the connection to the digital inputs and outputs.

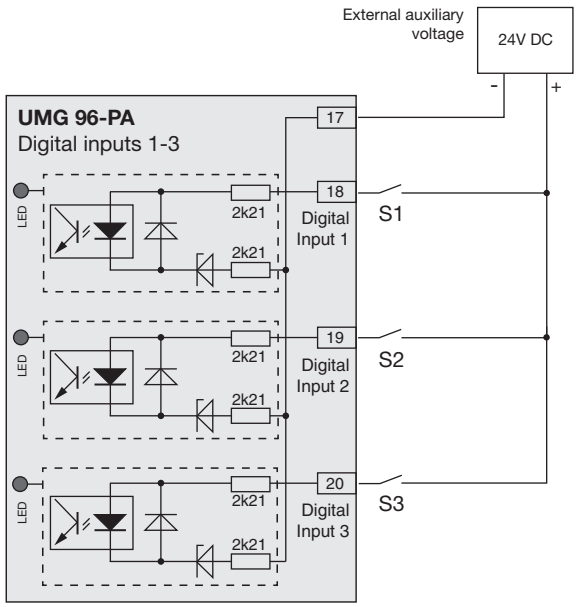


Fig. Example for connecting the external switching contacts S1-S3 to the digital inputs 1, 2 and 3.

9.1.1 S0 pulse input

Each digital input is designed for the connection of an S0 pulse generator according to DIN EN62053-31.

You need an external auxiliary voltage with an output voltage in the range 18 ... 28 V DC and a resistor with 1.5 kOhm.

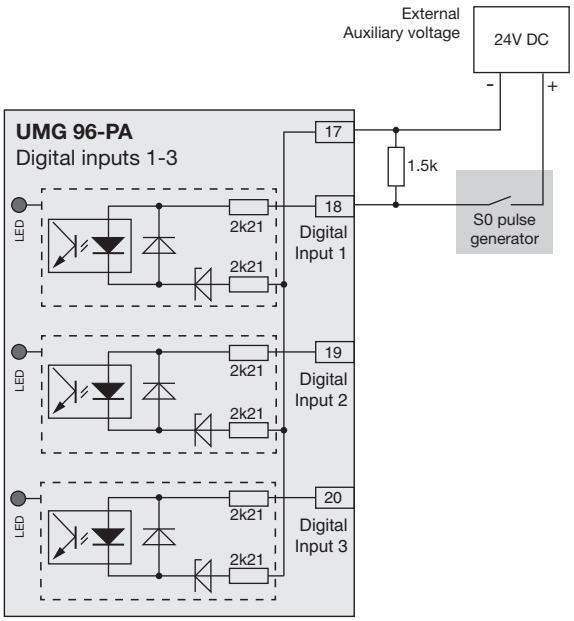


Fig. Example for connecting an S0 pulse generator the digital input 1.

9.2 Digital outputs

The device features 3 digital outputs that
· are electrically isolated from the evaluation electronics via optocouplers.
· have a common reference.
· are **not** short-circuit proof.
· require external auxiliary voltage.
· can be used as impulse outputs.
· can switch DC and AC loads.
· can be controlled via Modbus.
· can output the results of comparators.

⚠ CAUTION

Property damage due to connection errors.
The digital and outputs are not short-circuit proof. Connection errors can damage the connections.
Make sure that the wiring is correct when connecting the outputs.

NOTES

· Functions for the digital outputs can be easily and clearly configured in the GridVis® software (see www.janitza.de).
· In order to use the GridVis® software, there must be a connection between the device and the PC via an interface.

⚠ CAUTION

Measurement error when used as a pulse output.
If the digital outputs are used as pulse outputs, measurement errors may occur due to residual ripple.
Use a power supply whose ripple is less than 5% of the supply voltage for the supply voltage (DC) of the digital inputs and outputs.

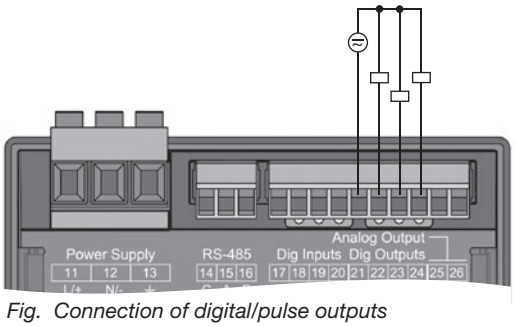


Fig. Connection of digital/pulse outputs

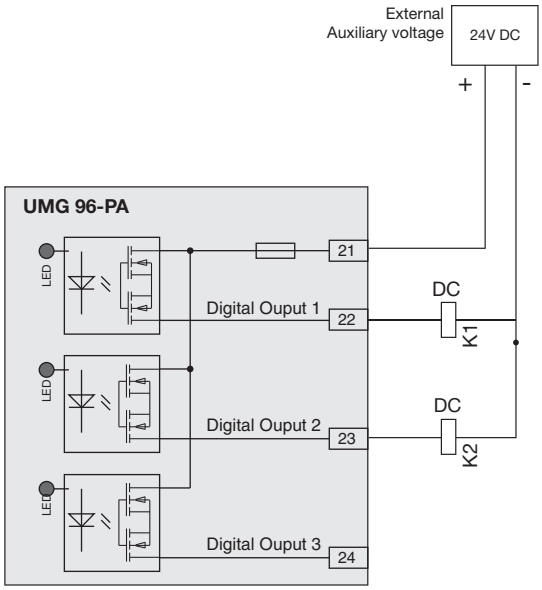


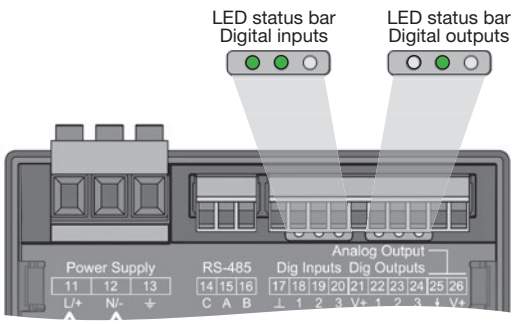
Fig. Connection example of two relays to the digital outputs

9.3 LED status bar

The LED status bar on the back of the device shows the different states of the inputs and outputs.

Digital inputs
The LED assigned to the input lights up green when a signal of at least 4 mA flows at this interface.

Digital outputs
The LED assigned to the output lights up green when the output is set as active - independent of any further connection to this interface.



10. Analog output

The device features 1 passive analog output, which can output a current of 0 - 20 mA.
An external power supply unit (24 V DC) is required for operation.

The connectable load must not exceed a resistance of 300 Ohm.
If the analog output is loaded with a larger resistor, the output range (20 mA) is limited.

The measured value assigned to the analog output, the start and end values and the output range *4 - 20 mA* or *0 - 20 mA* must be set via the GridVis® software (for further information, see chapter „13.14 Analog output configuration“ on page 60)

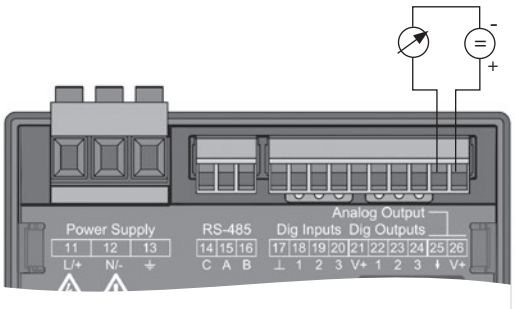
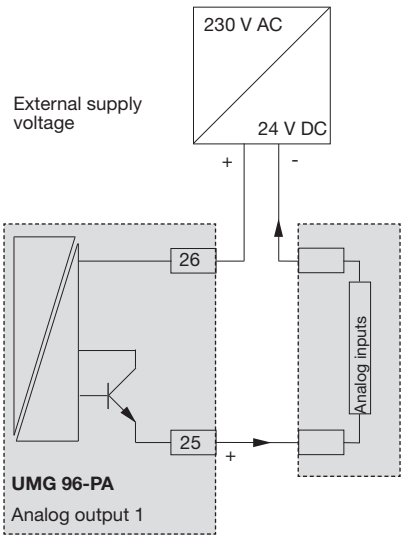


Fig. Analog output connection



11. Operation

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

· Selecting displayed measured values.
· Navigation within the menus.
· Editing device settings.

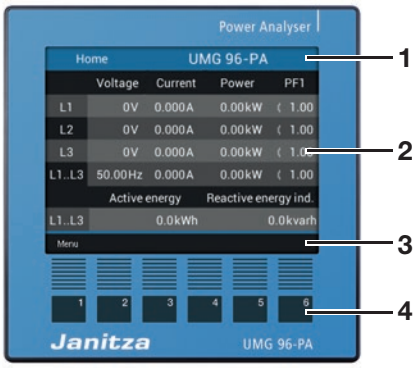


Fig. 96-PA "Home" measured value indication

1 Display title
2 Measured values
3 Function key label
4 Function keys

11.1 Key assignment

Key	Function
1	· Display menu · Exit menu · Cancel action (*ESC*)
2	· Switch to *Home* display. · Select position (to the left " ◂ ")
3	· Select menu item or position (down " ▾ ") · Change (selection, number -1)
4	· Select menu item or position (up " ▴ ") · Change (selection, number +1)
5	· Select position (to the right " ▸ ")
6	· Confirm selection (*Enter*)

11.2 "Home" measured value indication

UMG 96-PA start screen:
After the power returns, the **UMG 96-PA** starts with the *Home* measured value indication.

This measured value indication contains the device name and an overview of important measured values. In the delivery state, the device name consists of the type and serial number of the measurement device.

You return from each display back to the "*Home*" measured value indication by pressing button 2 ("*Home*").

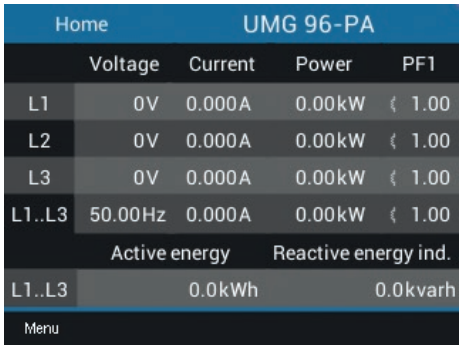


Fig. "Home" measured value indication

11.3 Menu

Press button 1 to open the menu of your measurement device:

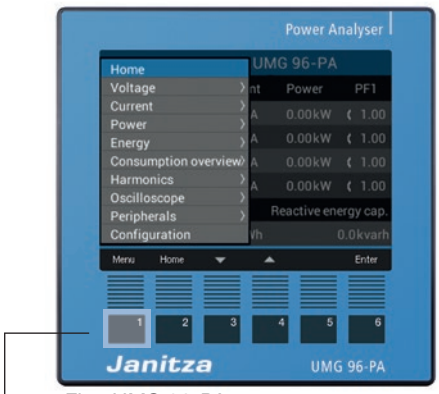


Fig. UMG 96-PA menu

11.4 Overview of menu displays

- **Menu**
  - **Home(UMG 96-PA start screen)**
  - **Voltage**
    - Voltage L-N
    - Voltage L-L
    - Curve
    - Phasor diagram
  - **Current**
    - Current
    - THD-I
    - Curve
  - **Power**
    - Total power
    - Active power
    - Reactive power
    - Apparent power
    - Curve of active power
    - Curve of reactive power
    - Curve of apparent power
  - **Energy**
    - Active energy
    - Reactive energy
    - Apparent energy
    - Tariff
  - **Consumption overview**
    - Active energy/month
    - Reactive energy/month
    - Apparent energy/month
    - Active energy/day
    - Reactive energy/day
    - Apparent energy/day
  - **Harmonics**
    - Voltage L1
    - Voltage L2
    - Voltage L3
    - Current L1
    - Current L2
    - Current L3
  - **Oscilloscope**
    - Voltage L1
    - Voltage L2
    - Voltage L3
    - Voltage L1-3
    - Current L1
    - Current L2
    - Current L3
    - Current L1-3
  - **Peripherals**
    - Overview of COM ports
    - Comparator 1
    - Comparator 2
  - **Configuration**
    - Language
      - German
      - English
    - Communication/field bus
      - Device address
      - Baud rate
      - Data frame
    - Measurement
      - Measuring transducer
      - Rated current
      - Rated frequency
    - Display
      - Brightness
      - Standby after
      - Brightness (standby)
      - Colors
    - System
      - Version *
      - Serial number *
      - Time
      - Password
      - Reset
    - Modbus editor
      - Address
      - Value
      - Minimum *
      - Maximum *
      - Type *
      - Access *

* ... not configurable

Selecting a menu item:
· Use *keys 3* (▼) and *4* (▲) to select the menu item.
· Confirm it using *key 6 (Enter)*.
· Use *key 1* (*Esc*) to exit the selection.
· Use *key 2 (Home)* to access the start screen.

12. Configuration

12.1 The Configuration window

The *Configuration* menu of the device contains all the parameters in which you can make settings. The device requires the supply voltage for configuration. To do this, proceed as described in 13.1 on page 46.

· If you are **not** in the *Home* measured value indication, press button 2 *(Home*) to switch to this view.
· Open the menu using key 1 (*Menu*).
· Use the keys 3 (▼) and 4 (▲) to select the "*Configuration*" menu item and confirm it with key 6 (*Enter*).

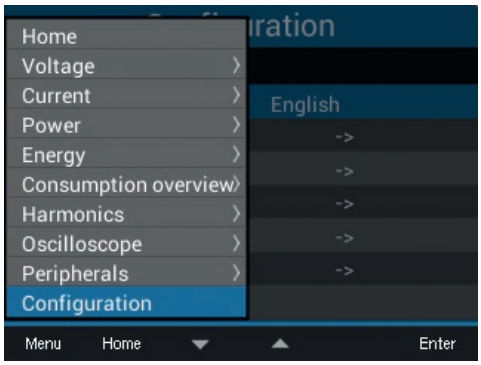


Fig. "Configuration" menu entry

· The *Configuration* window appears.

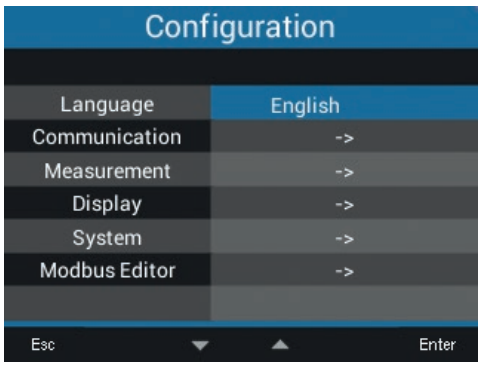


Fig. Configuration window with the language entry activated.

NOTE

Password-protected devices require a password to be entered before configuration. If your device is password-protected, enter your password to access the *Configuration* window (see chapter "12.8.3 Password" on page 34).

12.2 Language

In the *Language* entry of the *Configuration* window, you can configure the language for the user interface of the device:

· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *Language* entry and confirm with key 6 (*Enter*).
· The *Language* entry appears in yellow letters.

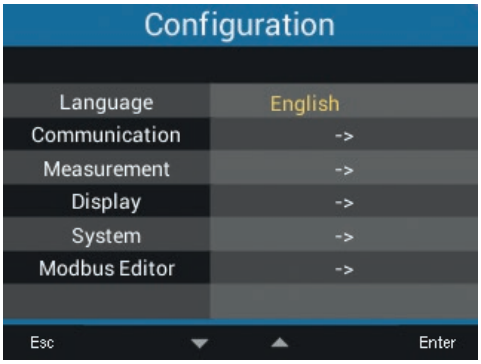


Fig. Language configuration window

· Use keys 3 (▼) and 4 (▲) to select the (*German* or *English*) language and confirm with key 6 (*Enter*).
· The user interface entries change to the selected language.
· Use key 1 (*Esc*) to return to the menu.
· Then, press key 2 *Home* to access the *Home* measured value indication.

12.3 Communication

In the *Communication* entry of the *Configuration* window, you can configure the parameters for the RS485 interface of your device.

· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *Communication* entry and confirm with key 6 (*Enter*).
· The *Communication* window appears with the parameters
  - Device address.
  - Baud rate.
  - Data frame.

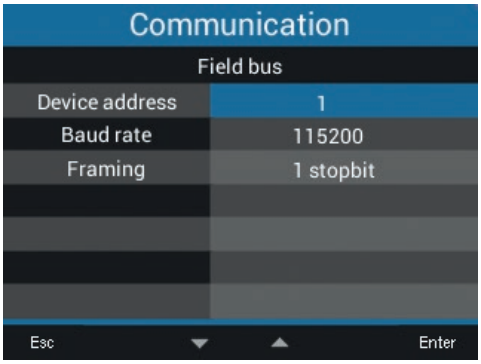


Fig. Communication window of the field bus parameter (RS485 interface)

· In the *Communication* window, configure the parameters for the field bus (RS485 interface), such as ***device address***, ***baud rate*** and ***data frame***, by selecting the respective entry and confirming with key 6 (*Enter*).
· Depending on the selected parameter, the corresponding entry appears in "yellow".
· Use keys 2 (◀) and 5 (▶) to change the position of the number to be set and keys 3 (▼) and 4 (▲) to change the number (-1/+1) for each entry.
· Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
· In order to return to the *Home* measured value indication, press key 1 (*Esc*) 2 times and then key 2 (*Home*).

Settings:
· ***Device address***:
Select a device address for the device with which the device is addressed in the bus structure. Each device address exists only once in a bus structure.
Setting range: *1 - 250*
Default setting: *1*

· ***Baud rate:***
Select a uniform baud rate for all devices in the bus structure.
Setting range: *Auto, 9600, 19200, 38400, 57600, 115200 kbps*
Default setting: *Auto*

· ***Data frame:***
Select a uniform data frame for all devices in the bus structure.
Setting range:
  · "*odd*" (parity *odd* , with 1 stop bit)
  · "*even*" (parity *even*, with 1 stop bit)
  · "*1 stop bit*" (parity *none*, with 1 stop bit).
  · "*2 stop bits*" (parity *none*, with 2 stop bits).
  · Default setting: *1 stop bit* (no parity).

⚠ CAUTION

Property 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.

12.4 Measurement

In the "*Measurement"* menu, you can configure the ratio of the current and voltage transformers (primary to secondary side), the rated current and the rated frequency.

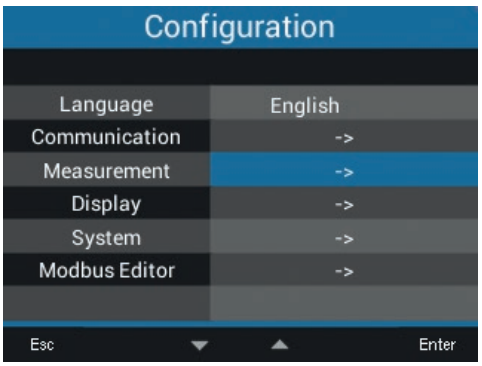


Fig. Configuration window with the measurement entry activated.

12.4.1 Rated frequency

The device requires the power frequency for measuring and calculating measured values. The device is suitable for measurements in networks with the frequency range 45 - 65 Hz.

· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *Measurement* entry and confirm with key 6 (*Enter*).
· The *Measurement* window appears with the entries
  - Measuring transducer.
  - Rated current.
  - Rated frequency.

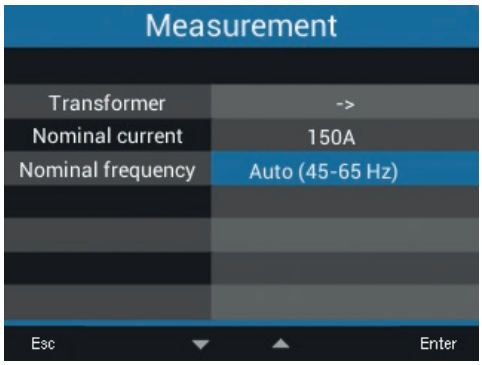


Fig. Configuration window with the rated frequency entry activated.

· Use keys 3 (▼) and 4 (▲) to select the *Rated frequency* entry and confirm with key 6 (*Enter*).
· The entry for the *Rated frequency* appears in "yellow".
· Use keys 3 (▼) and 4 (▲) to select your frequency range.
· Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
· In order to return to the *Home* measured value indication, press key 1 (*Esc*) 2 times and then key 2 (*Home*).

Rated frequency setting ranges:
· ***Auto*** (45-65 Hz) - **Default setting**
· ***60 Hz*** (const. frequency)
· ***50 Hz*** (const. frequency)

NOTE

Devices with the ***Auto*** setting need about 5 seconds to determine the power frequency. During this time, the measured values do **not** comply with the guaranteed measurement uncertainty.

To determine the power frequency, the device requires a voltage > 20 Veff (4-conductor measurement) or a voltage L1-L2 > 34 Veff (3-conductor measurement) at the voltage measurement input V1.

NOTE

If the power frequency is outside the range 45-65 Hz,
· there is no error or warning message.
· the corresponding setting is used when a constant frequency (*50/60 Hz*) is specified.
· the last determined frequency in the range of 45-65 Hz is used when automatic frequency detection *(Auto)* is selected.

The frequency is determined over a period of 10 seconds. The frequency **does not** represent a 200 ms measured value.

12.4.2 Rated current

For defined device operation, you need the rated current in addition to the settings of the current and voltage transformer ratios.

· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *Measurement* entry and confirm with key 6 (*Enter*).
· The *Measurement* window appears.
· Use keys 3 (▼) and 4 (▲) to select the *Rated current* entry and confirm with key 6 (*Enter*).
· The entry for the *Rated current* appears in "yellow".

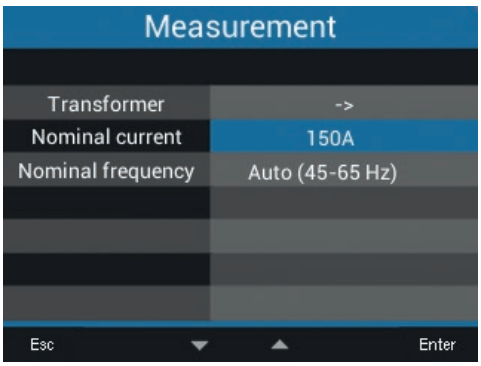


Fig. Measurement window with the rated current entry activated.

· Use keys 2 (◀) and 5 (▶) to change the position of the number to be set and keys 3 (▼) and 4 (▲) to change the number (-1/+1) for each entry.
· Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).

· In order to return to the *Home* measured value indication, press key 1 (*Esc*) 2 times and then key 2 (*Home*).

Rated current settings:
Setting range: *0 - 999999 A*
Default setting: *150 A*

12.4.3 Current transformer and voltage transformer

NOTE

Before configuring the current and voltage transformer ratios, observe the instructions on the device rating plate and the technical data for connecting the measuring transducers.

· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *Measurement* entry and confirm with key 6 (*Enter*).
· The *Measurement* window appears.
· Use keys 3 (▼) and 4 (▲) to select the *Measuring transducer* entry and confirm with key 6 (*Enter*).

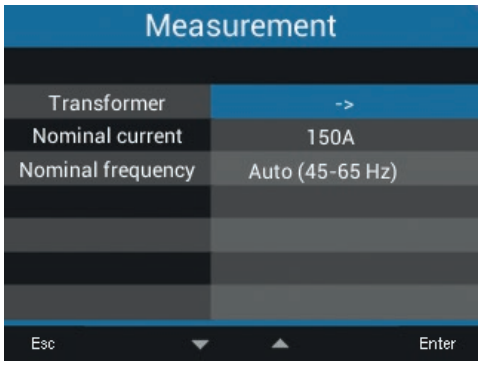


Fig. Measurement window with the measuring transducer entry activated.

· The *Measurement* window appears with the settings for the current and voltage transformers (primary and secondary).

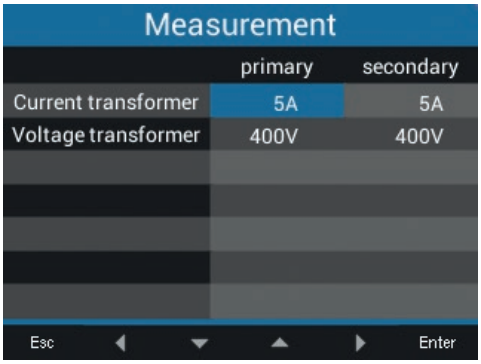


Fig. Measurement window with the entries for the measuring transducer

· Use keys 2 (◀), 3 (▼), 4 (▲) and 5 (▶) to select the entry for the measuring transducer on the primary or secondary side to be set and confirm with key 6 (*Enter*).
· The selected entry appears in “yellow”.
· Use keys 2 (◀) and 5 (▶) to change the position of the number to be set and keys 3 (▼) and 4 (▲) to change the number (-1/+1) for each entry.
· Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
· In order to return to the *Home* measured value indication, press key 1 (*Esc*) 3 times and then key 2 (*Home*).

Measuring transducer settings:
· Current transformer (primary):
Setting range: *0 - 32000 A*
Default setting: *5 A*
· Current transformer (secondary):
Setting range: *0 - 5 A*
Default setting: *5 A*
· Voltage transformer (primary):
Setting range: *0 - 32000 V*
Default setting: *400 V*
· Voltage transformer (secondary):
Setting range: *0 - 999 V*
Default setting: *400 V*

NOTE

Do not use the value 0 for the primary current transformers. The **value 0** does not result in meaningful energy values.

12.5 Display

You can configure the following display settings using the *Display* entry of the measurement device:
· Brightness,
· Standby after,
· Brightness (standby) and
· Colors.

· Open the *Configuration* window as described above.

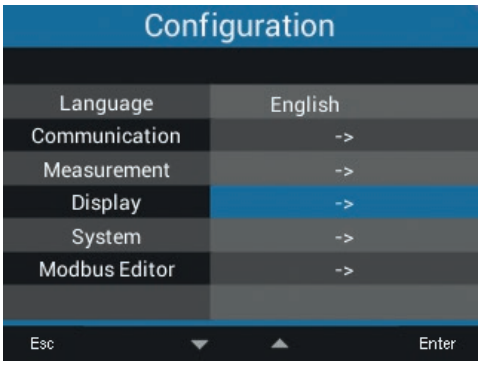


Fig. Configuration window with the display entry activated.

· Use keys 3 (▼) and 4 (▲) to select the *Display* entry and confirm with key 6 (*Enter*).
· The *Display* window appears.

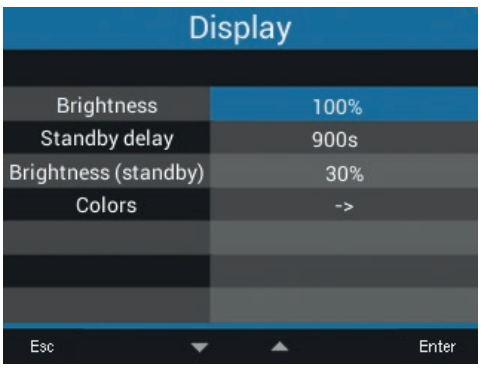


Fig. Display window

· Use keys 3 (▼) and 4 (▲) to select the corresponding entry of the *Display* window and confirm with key 6 (*Enter*).
· The entries for ***Brightness***, ***Standby after*** and ***Brightness (standby)*** appear in "yellow" and the ***Colors*** window appears for the *Color* entry.
· Use keys 2 (◀) and 5 (▶) to change the position of the number to be set and keys 3 (▼) and 4 (▲) to change the number (-1/+1) for each entry.
· Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
· In order to return to the *Home* measured value indication, press key 1 (*Esc*) 2 times and then key 2 (*Home*).

12.5.1 Brightness

Display brightness of the measurement device.

· Setting range: *30% - 100%*
Default setting: *70%*

With 30% = dark
100% = very bright

12.5.2 Standby after

Time in seconds after which the display brightness switches to the set *brightness (standby)*.

· Setting range: *60 s - 3600 s*
Default setting: *900 s*

12.5.3 Brightness (standby)

Display brightness to which the measurement device switches after the standby time has elapsed.

· Setting range: *20% - 60%*
Default setting: *30%*

With 20 % = dark
60 % = very bright

12.5.4 Colors

Colors for the representation of current and voltage in the graphic representations.

· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *Display* entry and confirm with key 6 (*Enter*).
· The *Display* window appears.
· Use keys 3 (▼) and 4 (▲) to select the *Colors* entry and confirm with key 6 (*Enter*).
· The *Colors* window appears.

Fig. Colors window

· Use keys 2 (◂), 3 (▾), 4 (▴) and 5 (▸) to select the color for voltage and current of the phase to be set and confirm with key 6 (*Enter*).
· The selected color appears with a blue border.
· Use keys 3 (▾) and 4 (▴) to select the desired color and confirm with key 6 (*Enter*) or cancel the action using key 1 (*Esc*).
· In order to return to the *Home* measured value indication, press key 1 (*Esc*) 3 times and then key 2 (*Home*).

12.6 System

In the *System* window, the measurement device user can
· view device-specific system settings.
· configure a password.
· delete or reset measured values and device parameters.

· Open the *Configuration* window as described above.
· Use keys 3 (▾) and 4 (▴) to select the *System* entry and confirm with key 6 (*Enter*).

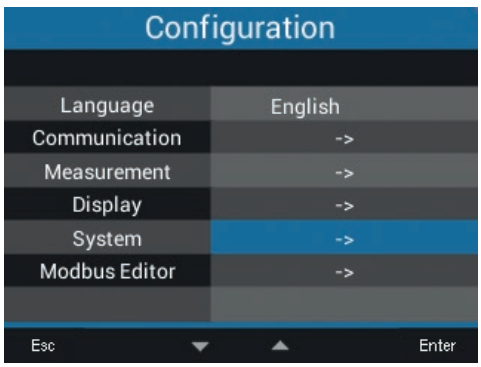


Fig. Configuration window with the system entry activated.

· The *System* window appears.

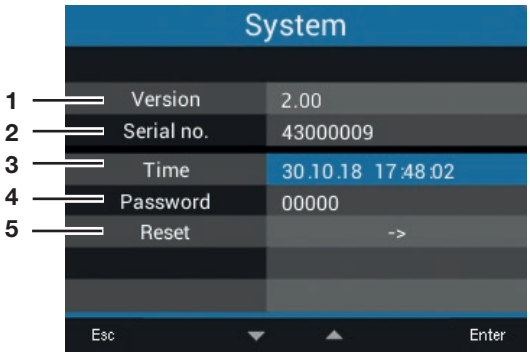


Fig. System window

1 Firmware version
2 Serial number of the measurement device
3 Date/time
4 Password function
5 Reset function

12.6.1 Firmware/serial number

The firmware and serial number of the measurement device are required for support requests or registration on the homepage (www.janitza.de).

12.6.2 Date/time

The date and time setting. You can change the settings for time synchronization, date and time zones using
· the GridVis® software or
· the Modbus addresses.

12.6.3 Password

You can use a password to block access to the configuration. The device is only configured after entering the password.

The password consists of a number combination of up to 5 digits.

Setting ranges:
· *1-99999 = With password*
· *00000 = No password*
Default setting:
· *00000 = No password*

The UMG 96-PA is configured ex works with the password 00000 (no password).

To change the password, you need the current password.

NOTE

- The measurement device locks the device configuration for 15 minutes after the password is entered incorrectly four times.
- Note your password and keep it in a safe place!
- You cannot configure your device without a password. If the password is lost, notify the support department of the device manufacturer.

Setting the password:

- Open the *Configuration* window as described above.
- Use keys 3 (▼) and 4 (▲) to select the *System* entry and confirm with key 6 (*Enter*).
- The *System* window appears.
- Use the keys 3 (▼) and 4 (▲) to select the *Password* entry and confirm it with key 6 (*Enter*).
- The entry for the *Password* appears in “yellow”.

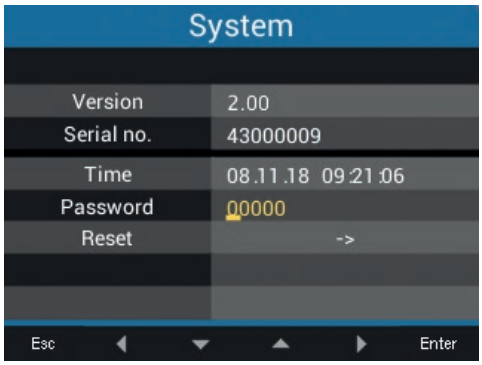


Fig. System window with the password entry activated

- Use keys 2 (◀) and 5 (▶) to change the position of the number to be set and keys 3 (▼) and 4 (▲) to change the number (-1/+1) for each entry.
- Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
- In order to return to the *Home* measured value indication, press key 1 (*Esc*) 2 times and then key 2 (*Home*).

12.6.4 Reset

You can use this function to delete and reset measured values and device parameters.

Energy

You can delete all energy meters in the device at the same time. Certain energy meters cannot be selected.

- Open the *Configuration* window as described above.
- Use keys 3 (▼) and 4 (▲) to select the *System* entry and confirm with key 6 (*Enter*).
- The *System* window appears.
- Use keys 3 (▼) and 4 (▲) to select the *Reset* entry and confirm with key 6 (*Enter*).
- The *Reset* window appears.
- Use keys 3 (▼) and 4 (▲) to select the *Energy* entry and confirm with key 6 (*Enter*).

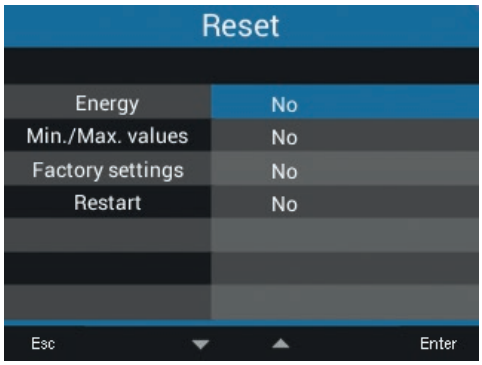


Fig. Reset window, reset the energy meters

- The entry for the *Entry* appears in “yellow”.
- Use keys 3 (▼) and 4 (▲) “*Yes*” or “*No*”.
- Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
- In order to return to the *Home* measured value indication, press key 1 (*Esc*) 3 times and then key 2 (*Home*).

Minimum and maximum values

The device user can use this function to delete all min. and max. values in the device simultaneously. Certain energy meters cannot be selected.

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

· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *System* entry and confirm with key 6 (*Enter*).
· The *System* window appears.
· Use keys 3 (▼) and 4 (▲) to select the *Reset* entry and confirm with key 6 (*Enter*).
· The *Reset* window appears.

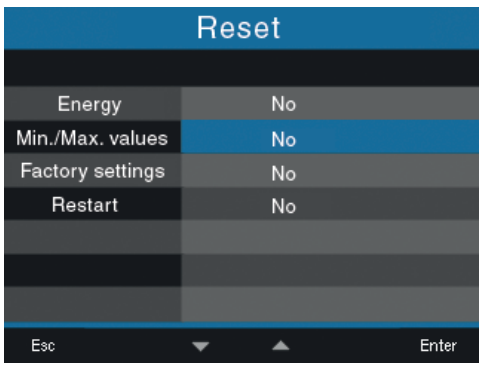


Fig. Reset window, delete min./max. values

· Use keys 3 (▼) and 4 (▲) to select the *Min./Max. values* entry and confirm with key 6 (*Enter*).
· The entry for the *Min./Max. values* appears in "yellow".
· Use keys 3 (▼) and 4 (▲) "*Yes*" or "*No*".
· Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
· In order to return to the *Home* measured value indication, press key 1 (*Esc*) 3 times and then key 2 (*Home*).

Factory settings

This function resets all settings, such as configurations and recorded data, to the factory settings.

· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *System* entry and confirm with key 6 (*Enter*).
· The *System* window appears.
· Use keys 3 (▼) and 4 (▲) to select the *Reset* entry and confirm with key 6 (*Enter*).
· The *Reset* window appears.
· Use keys 3 (▼) and 4 (▲) to select the *Factory setting* entry and confirm with key 6 (*Enter*).

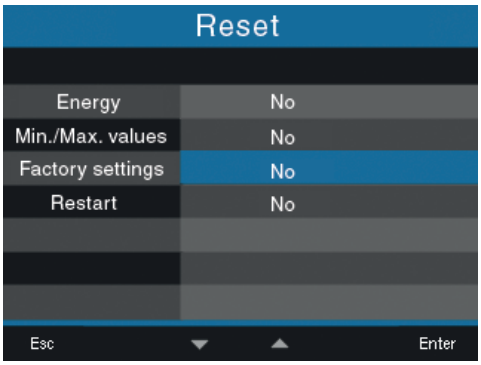


Fig. Reset window, factory setting

· The *Factory setting* entry appears in "yellow".
· Use keys 3 (▼) and 4 (▲) "*Yes*" or "*No*".
· Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
· Confirm the warning using key 6 (*Enter*) or cancel the action with key 1 (*menu*).
· Press key 6 (*Enter*) to reset the device to factory settings.

Restart

This function restarts the measurement device.

· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *System* entry and confirm with key 6 (*Enter*).
· The *System* window appears.
· Use keys 3 (▼) and 4 (▲) to select the *Reset* entry and confirm with key 6 (*Enter*).
· The *Reset* window appears.

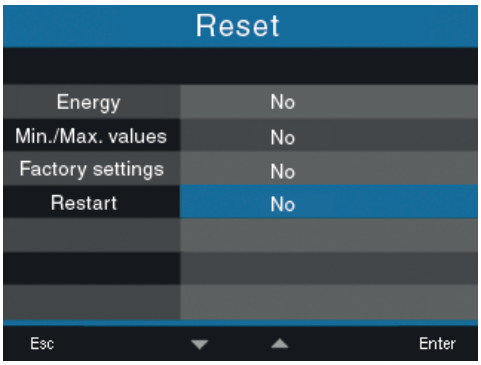


Fig. Reset window, restart the device

· Use keys 3 (▼) and 4 (▲) to select the *Restart* entry and confirm with key 6 (*Enter*).
· The entry for the *Restart* appears in "yellow".
· Use keys 3 (▼) and 4 (▲) "*Yes*" or "*No*".
· Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
· Press key 6 (*Enter*) to restart the device.

12.7 Modbus editor

You can use the ***Modbus editor*** function to configure Modbus addresses directly on the measurement device. Your measurement device does not require a network connection for this. You can use the Modbus address and parameter list, which are available for download on our website, to configure the **analog output** of the measurement device directly via the device keyboard.

Example of configuring the measured value for the analog output:

To assign a measured value to the analog output of your measurement device, write the Modbus address of the measured value (see table of frequently used measured values) to the

Modbus address 30001

To configure a start value for your measured value, write the start value to the

Modbus address 30002

You enter a final value of your measured value in

Modbus address 30004

To assign the output ranges to the analog output of a device, write to the

Modbus address 30006

· a **0** for the output range **0-20 mA.**
· a **1** for the output range **4-20 mA.**

NOTES

More information on the analog outputs can be found in chapter „10. Analog output" on page 32 and chapter „13.14 Analog output configuration" on page 60.

Table of frequently used measured values

Frequently used measured values and their Modbus addresses for the output on the ***analog output (Modbus address 30001)***:

Modbus address	Measured value
19026	Active power sum L1-L3, instantaneous value
19042	Reactive power sum L1-L3, instantaneous value
19012	Current L1, instantaneous value
19014	Current L2, instantaneous value
19016	Current L3, instantaneous value
1050	Cos phi sum L1-L3, instantaneous value
For measurement devices with RCM module	
20053	Neutral conductor current I4, instantaneous value
20055	Residual current RCM 1 (I5), instantaneous value
20057	Residual current RCM 2 (I6), instantaneous value
20061	Temperature sensor, instantaneous value

You can access the Modbus editor as follows:
· Open the *Configuration* window as described above.
· Use keys 3 (▼) and 4 (▲) to select the *Modbus Editor* entry and confirm with key 6 (*Enter*).

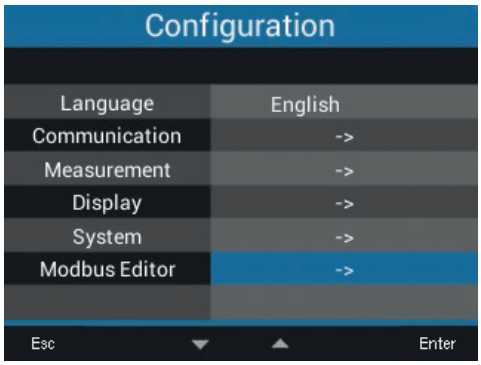


Fig. Configuration window, Modbus editor

· The *Communication* window appears with the *Modbus editor.*

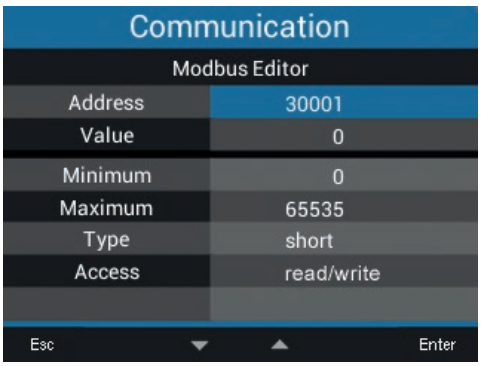


Fig. Configuration window, Modbus editor

· Use keys 3 (▼) and 4 (▲) to select the *Address* or *Value* entry and confirm with key 6 (*Enter*).
· The selected entry appears in “yellow”.
· Use keys 2 (◀) and 5 (▶) to change the position of the number to be set and keys 3 (▼) and 4 (▲) to change the number (-1/+1) for each entry.
· Confirm your entries with key 6 (*Enter*) or cancel the action with key 1 (*Esc*).
· In order to return to the *Home* measured value indication, press key 1 (*Esc*) 2 times and then key 2 (*Home*).

Example for the *active power* measured value:

· In the *Configuration* window, select the *Modbus editor* entry and confirm using key 6 (*Enter*).
· The *Communication/Modbus editor* window appears with the *address* and *value* entries.
· Select the *address* entry and confirm with key 6 (*Enter*).
· The *address* entry appears in “yellow”.
· Use keys 2 (◀), 5 (▶), 3 (▼) and 4 (▲) to configure the number ***30001*.**
· Confirm the entry with key 6 (*Enter*).
· Then select the *Value* entry and confirm with key 6 (*Enter*).
· The *value* entry appears in “yellow”.
· Use keys 2 (◀), 5 (▶), 3 (▼) and 4 (▲) to configure the number ***19026*** for the ***active power sum L1-L3*** **measured value.**
· Then configure the *start* and *end value* of the active power in addresses ***30002*** and ***30004***. E.g. start value 500 W and end value 1000 W. Note that you must always enter the measured values in the base unit (e.g. W, A, V).

More information on this example can be found in chapter „13.14 Analog output configuration“ on page 60.

NOTES

· You can easily and clearly configure measured values and Modbus addresses for the analog outputs in the GridVis ® software (see www.janitza.de).
· To use the GridVis® software, you need a connection between the measurement device and a PC (server) running the GridVis® software (see chapter „8. Connection and PC connections“ on page 26).
· Also observe the documentation for the RCM modules.

13. Commissioning

13.1 Connecting the supply voltage

1. Connect the supply voltage to a terminal on the rear of the device.
2. After connecting the supply voltage, the *Home* measured value indication appears on the display of your measurement device.
3. If no display appears, check whether the supply voltage is within the rated voltage range.

⚠ CAUTION

Property damage due to noncompliance with the connection conditions.
Noncompliance of the connection conditions may damage or destroy your device.
Please observe the following:
· **Observe the information on voltage and frequency on the rating plate.**
· **Do not use the device for measuring DC voltage.**

NOTE

Before commissioning, delete any production-related contents of the energy meters, min/max values and records (see chapter „Minimum and maximum values“ on page 43).

13.2 Measured voltage

NOTE

Connect the voltage measurement inputs in networks with rated voltages that exceed the specified rated voltages via voltage transformers (see chapter „7.1 Rated voltages“ on page 20).

Connecting the measured voltage:
1. Connect the measured voltage to the terminals of the voltage measurement inputs on the rear of the device.
2. After connecting the measured voltage, check the measured values for the voltages L-N and L-L displayed by the device.
   Take into consideration any voltage transformer factors that may have been set.

⚠ WARNING

Risk of injury due to electric voltage!
If the device is exposed to surge voltages above the permissible overvoltage category, safety-relevant insulations 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.

13.3 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 with 60 A (sinusoidal) for 1 second.

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

1. Short-circuit all current transformer outputs except one.
2. Compare the current displayed on the device with the applied current input.
   - The currents must match taking into account the current transformer ratio.
   - The device must display approx. 0 amperes in the short circuited current measurement inputs.

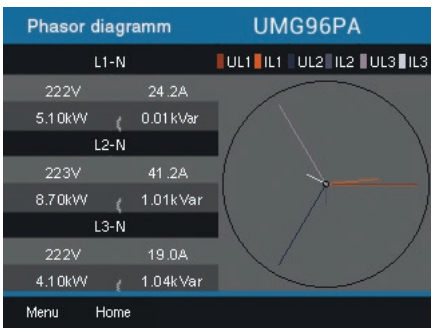


Fig. Phasor diagram

13.4 Frequency

The device requires the rated frequency or power frequency for measuring and calculating measured values. The power frequency can either be specified by the user or determined automatically by the device.

- To determine the power frequency, a voltage greater than 20 Veff (4-conductor measurement) or a voltage L1-L2 greater than 34 Veff (3-conductor measurement) must be applied to the voltage measurement input V1.
- The power frequency must be in the range between 45 Hz and 65 Hz.
- If the measured voltage is not sufficiently high, the device cannot determine the power frequency and therefore cannot perform a measurement.

You can find more information in chapter „12.4.1 Rated frequency“ on page 38.

13.5 Phase sequence

Check the direction of the rotating field voltage in the measured value indication of the device.

- Normally a “right rotation field” exists.

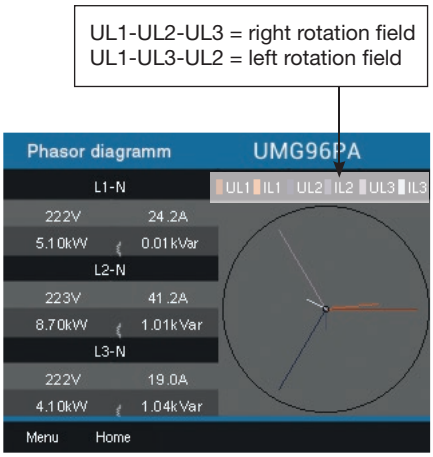


Fig. Phasor diagram window showing the phase sequence according to the rotation field direction.

Open the “*Phasor diagram*” menu display to check the rotating field voltage:

- If you are **not** in the *Home* measured value indication, press button 2 *(Home*) to switch to this view.
- Open the menu using key 1 (*Menu*).

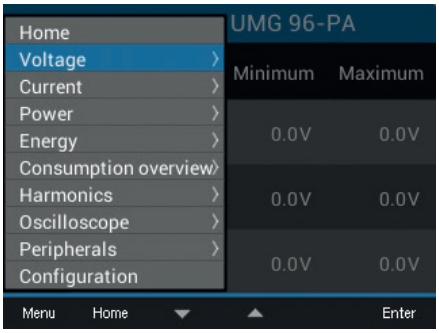


Fig. Voltage menu entry

- Use keys 3 (▼) and 4 (▲) to select the *Voltage* entry and confirm with key 6 (*Enter*).
- The submenu appears with the *phasor diagram* entry.

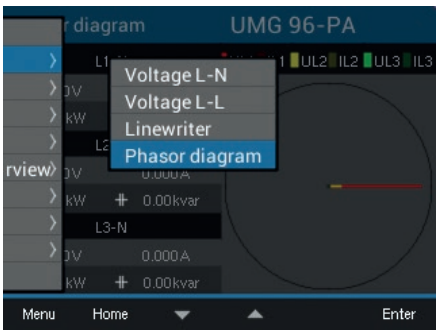


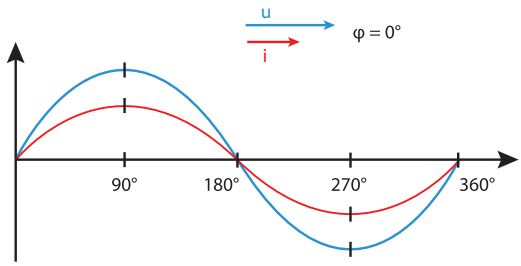
Fig. Phasor diagram submenu entry

- Use keys 3 (▼) and 4 (▲) to select the *Phasor diagram* entry and confirm with key 6 (*Enter*).
- The *Phasor diagram* window appears.

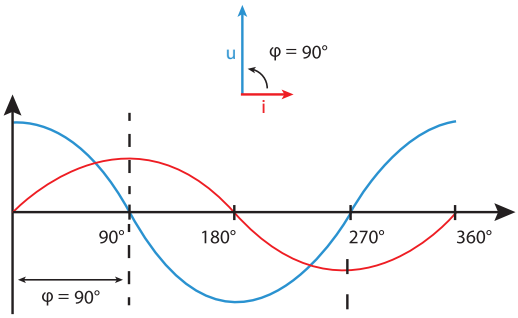
13.5.1 Phasor diagram basics

The phasor diagram graphically describes the phase shift or phase angle between voltage and current. The pointers rotate at a constant angular velocity - proportional to the frequency of voltage and current - around an origin. The phasor diagram thus shows the current state of the variables in an AC circuit.

Representation of ohmic resistance:
· Voltage and current are both in phase

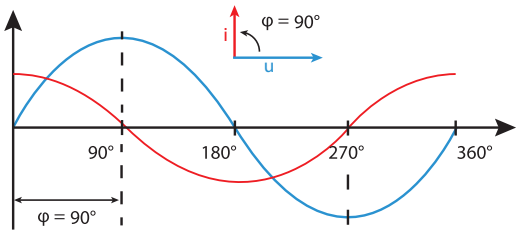


Inductance representation:
· The voltage rushes ahead of the current
· The phase shift for an "ideal coil" is 90°

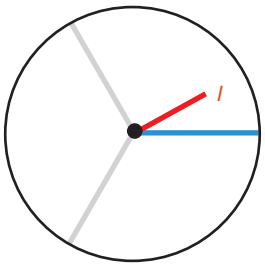


Capacity representation:

· The current rushes ahead of the voltage
· The phase shift of an "ideal capacitor" is 90°.

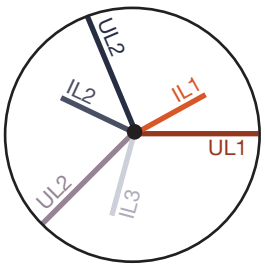


With a combination of the states, the phase angle "current to voltage" can assume values between -90° and +90°.



Current: *Representation with short pointers*
Voltage: *Representation with long pointers*

Example of phasor diagram (3 phases)

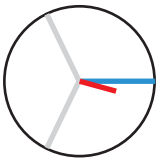


Current and voltage are shifted against each other. The current rushes ahead of the voltage, i.e. the network is capacitively loaded.

13.6 Checking the voltage and current inputs using a phasor diagram

The phasor diagram can be used to check incorrect connections at the voltage and current inputs.

Example 1
Predominantly 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
Predominantly ohmic load.

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

· 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 feed-back into the supply network.

⚠ WARNING

Property damage due to noncompliance with the connection conditions.
Voltages and currents outside the permissible measurement range may destroy the device.
Observe the measurement range specifications provided in the technical data.

13.7 Exceeding the measurement range

If the measurement range is exceeded, the "*overvoltage*" warning appears in the device display, e.g. for the voltage, indicating the voltage circuit.

If the measurement range is exceeded, it is displayed as long is occurs. Alarms must be acknowledged with key 5 *Alarms*. The measurement range is exceeded when at least one of the voltage or current measurement inputs is outside its specified measurement range.

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

I	=	6 A_{rms}
U_{L-N}	=	600 V_{rms}

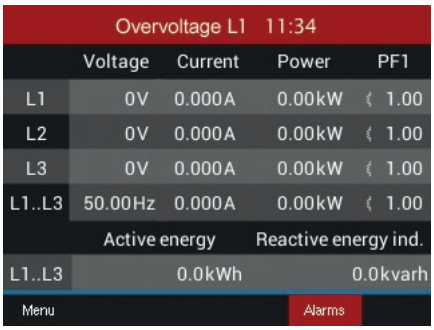


Fig. Example warning for overvoltage in phase L1.

NOTE

If the measurement range is exceeded, please check your installation and connections. Observe the connection conditions specified in the technical data.

13.8 Checking the power measurement

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

· The device may only display 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 the measured current.

If the amount of the 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 delivered back into the network.

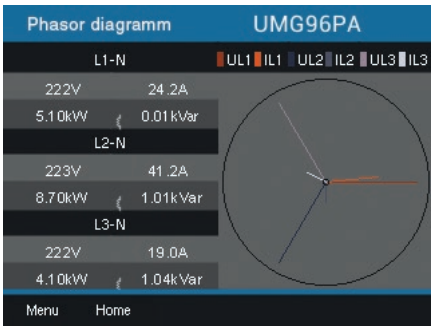


Fig. The phasor diagram shows voltages with long pointers and currents with short pointers.

Call up the phasor diagram with information on power:
· If you are **not** in the *Home* measured value indication, press button 2 *(Home*) to switch to this view.
· Open the menu using key 1 (*Menu*).
· Use keys 3 (▼) and 4 (▲) to select the *Voltage* entry and confirm with key 6 (*Enter*).
· The submenu appears with the *phasor diagram* entry.
· Use keys 3 (▼) and 4 (▲) to select the *Phasor diagram* entry and confirm with key 6 (*Enter*).
· The *Phasor diagram* window appears.

13.9 Checking the communication

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

Ideally, the number of errors in the Error column should be "0" (see figure below, *COM ports overview* window).

· If you are **not** in the *Home* measured value indication, press button 2 *(Home*) to switch to this view.
· Open the menu using key 1 (*Menu*).
· Use keys 3 (▼) and 4 (▲) to select the Peripherals entry and confirm with key 6 (*Enter*).
· The submenu appears with the *COM ports overview* entry.

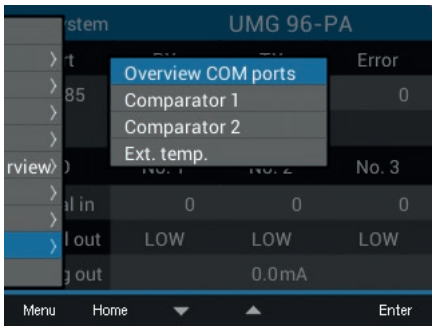


Fig. COM ports overview submenu entry

· Use keys 3 (▼) and 4 (▲) to select the *COM ports overview* entry and confirm with key 6 (*Enter*).
· The COM ports overview window appears.

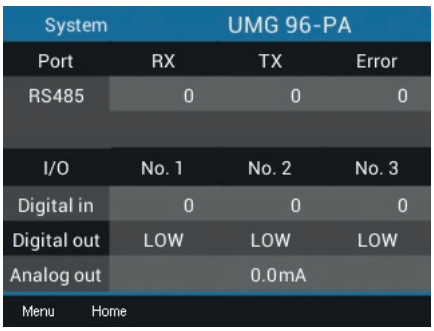


Fig. COM ports overview window with the view of the communication parameters (Com. view)

· In order to return to the *Home* measured value indication, press key 2 (*Home*).

13.10 Delete min./max. values

In the measured value indications for voltage, current and power, the device function is deleting *min./max. values* via key 6 (*Enter*). The *min/max values* can be deleted for the following measured values*:*

In the ***Voltage*** submenu:
· Voltage L-N
· Voltage L-L

In the ***current*** window:
· Current
· THD-I (Total harmonic distortion - current)

In the ***Power*** window:
· Total power
· Active power
· Reactive power
· Apparent power

· If you are **not** in the *Home* measured value indication, press button 2 *(Home*) to switch to this view.
· Open the menu using key 1 (*Menu*).
· Use keys 3 (▼) and 4 (▲) to select the *Voltage, Current and Power* entry and confirm with key 6 (*Enter*).

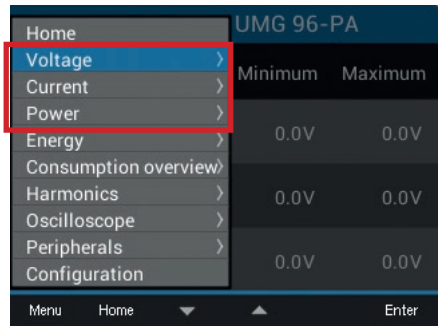


Fig. Voltage, current and power menus

The following description explains the *Delete min/max values* function using the *voltage L-N* measured value indication as an example. Deleting the *Min. /Max. Values* for current and power requires the same procedure.

· The submenu for the *voltage* appears.
· In the submenu, select the *Voltage L-N* submenu using keys 3 (▼) and 4 (▲) and confirm with key 6 (*Enter*).
· The voltage measured value indication appears with the measured values L1-N, L2-N and L3-N.
· To delete the *Min./Max. values*, press key 6 (*Enter*).
· The *Min./Max. values* submenu appears.
· In the *Min./Max. values* submenu, use keys 3 (▼) and 4 (▲) to select the *Delete* entry or cancel the action with the *Cancel* entry.
· Confirm your action by pressing key 6 (*Enter*).

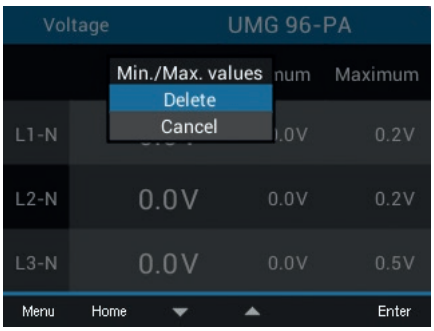


Fig. Voltage L-N measured value indication with delete/cancel Min./Max. values menu

13.11 Harmonics

Harmonics are caused, for example, by equipment with non-linear characteristics. These additional frequencies represent the integer multiple of a power frequency and show how the equipment affects the equipment on the power network. Possible effects of harmonics are e.g:

· additional heating of equipment.
· an additional current on the neutral conductor.
· overloading and reduced service life of electrical consumers.

Harmonic loads are the main cause of invisible voltage quality problems with enormous costs for repair and investments in replacing defective equipment.

The device measures the power frequency of the voltage in the range 45 - 65 Hz. The calculated harmonics of the voltages and currents relate to this power frequency.

The device calculates harmonics up to 40 times the power frequency.

· If you are **not** in the *Home* measured value indication, press button 2 *(Home*) to switch to this view.
· Open the menu using key 1 (*Menu*).
· Use keys 3 (▼) and 4 (▲) to select the *Harmonics* entry and confirm with key 6 (*Enter*).
· A selection list appears with voltages and currents for displaying the harmonics.

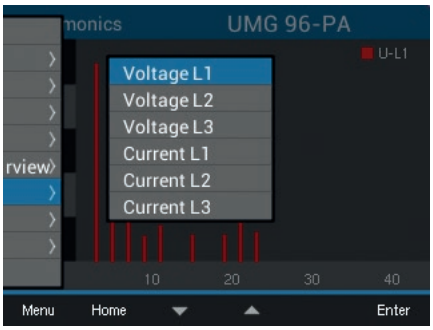


Fig. Selection list with voltages and currents for displaying the harmonics.

· Use keys 3 (▼) and 4 (▲) to select the corresponding voltage or the corresponding current and confirm with key 6 (*Enter*).

· The *Harmonics* of the selected measured value window appears.

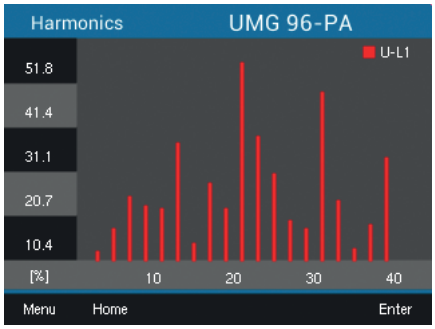


Fig. Harmonics measured value indication (e.g. voltage L1)

13.12 Communication in the bus system

13.12.1 RS485

The device sends and receives data via the RS485 interface. For example, the device receives data from the parameter and measured value list via a MODBUS RTU protocol with CRC check.

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 byte before low byte (Motorola format).

Transmission parameters

Data bits:	8
Parity:	odd
	even
	none (1 stop bit)
	none (2 stop bits)
Stop bits (UMG 96-PA):	1 / 2
Stop bits, external:	1 / 2

Number formats

Short	16 bit (-2^{15} .. 2^{15} -1)
Float	32 bit (IEEE 754)

For further information on configuring the RS485 interface on the device, see chapter „12.3 Communication“ on page 37. For information on the interface, see chapter „8.2 RS485 interface“ on page 26.

Example: Reading out the voltage L1-N
The voltage L1-N is saved in the parameter and measured value list at address 19000 in FLOAT format.
In this example, 01 is assumed as the device address.

The “Query message” then appears as follows:

Designation	Hex	Remark
Device address	01	Address=1
Function	03	“Read Holding Reg”
Start address Hi	4A	19000dec = 4A38hex
Start address Lo	38	
Number of Hi values	00	2dec = 0002hex
Number of Lo values	02	
Error check (CRC)	-	

The “Response” of the device can then appear as follows:

Designation	Hex	Remark
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 sent from address 19000 is 230 V.

13.13 Digital inputs and outputs

Your device has three digital outputs and three digital inputs.

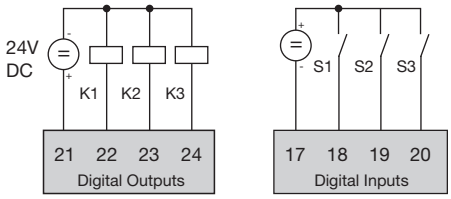


Fig. Digital inputs and outputs

· You can configure the digital inputs and outputs using the GridVis® software
· The GridVis® software is available on our web site (www.janitza.de) as a download.

13.13.1 Digital inputs

You send information from other devices with a digital output to your device (pulse counter) via the digital inputs.
There is also the option of configuring digital inputs as function inputs (function mode).
As a function input, each digital input has its own function. A function input **cannot** be configured as a pulse counter.

Use the GridVis® software to configure the digital inputs in the "*Peripherals"* area:

Function mode (on/off mode)
· The function assigned to the digital input.

Pulse counters
· Value type of the incoming signal (e.g. electrical energy, gas/water consumption, CO_2 ...)
· Pulse value for measured or power values.
· Duration of the averaging time.

The states of the digital inputs each have their own Modbus address.
For each digital input, the last 16 switching actions (events) are logged with a time stamp.

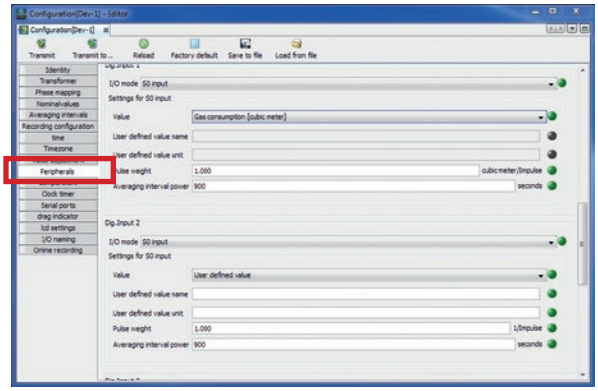


Fig. Configuration of the digital inputs via the GridVis® software

Function mode (on/off mode)
Each digital input can be assigned its own function:
· Digital input 1:
Configuration as a tariff changeover (HT/NT).
· Digital input 2:
Configuration for a synchronization of the device clock with the selection of minute or hour synchronization.
Synchronization is also possible via a Modbus address.
· Digital input 3:
Configuration as reset input for the synchronous values of the drag pointer function. The drag pointer can also be synchronized via a Modbus address.

Pulse counters
All digital inputs can be operated with a frequency of 25 Hz. The pulse duration (pulse width) and the pulse pause must be greater than 20 ms.
The typical pulse length for S0 pulses is 30 ms.

The maximum number of pulses per hour is calculated based on the minimum pulse duration and the minimum pulse pause:

Pulse length (Pulse duration)	Pulse pause (pause)	Max. pulses/h
20 ms	20 ms	90 000 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

Fig. Examples for the maximum number of pulses per hour.

The pulse counters can be configured with simultaneous measured value or power calculation. The pulses are counted as 64-bit numbers and overflow after approximately 1.17×10^{10} years of continuous operation (25 Hz).

Pulse value
A pulse value can be assigned to each digital input. With the pulse value, you specify which measured value or power value (e.g. energy) is to correspond to a pulse.

NOTE

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

Measurement value calculation:

Measured value = pulse x pulse value

Power value calculation:

$$\text{Power value} = \frac{\text{pulse x pulse value}}{\text{Time [s]}}$$

Since the pulse distance can become very large, a continuous calculation of the measured or power values is not possible. For this reason, only mean values are calculated. The calculation of the mean values for the measured value calculation results from the number of pulses per period multiplied by the pulse value. This value must be divided by an adjustable time value for calculating the mean power values.

The period is assigned to the digital input and can be set between 1 and 60 minutes. At the end of the period, the value can be called up via Modbus.

For each digital input an external synchronization can be connected. A synchronization pulse closes a period and starts a new one. A fixed capture time of 30 seconds is preset for the external synchronization. If no synchronous pulse is present after the period has expired, the system waits for a maximum of 30 seconds and it is then synchronized by the software. All further periods are then synchronized by the software.

The factory setting is a period of 15 minutes.

The calculation result of the S0 power value is only available at the end of the period.

NOTE

During the programming with the GridVis® software, you will receive a selection of energy values which are, however, derived from the power values.

13.13.2 Digital outputs

Different functions can be assigned to the three digital outputs:

· Digital output 1[1)]
  - Pulse output for active energy
  - Output for timer
  - Modbus remote output
· Digital output 2
  - Pulse output for reactive energy
  - Output for comparator group 1
  - Output for timer
  - Modbus remote output
· Digital output 3
  - Output for comparator group 2
  - Output for timer
  - Modbus remote output

You can use the configuration window of the GridVis® software to configure the digital inputs in the *"Peripherals"* area:

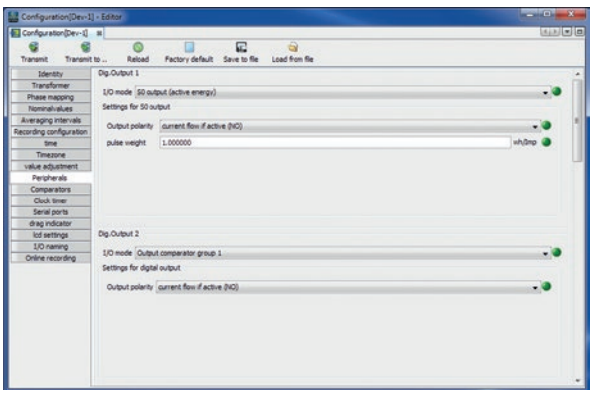


Fig. Configuration of the digital outputs via the GridVis® software

Pulse output
Digital output 1 and 2 can be used to output pulses for counting active energy and reactive energy. For this purpose, a pulse is applied to the output after a certain adjustable amount of energy has been reached.

To use a digital output as a pulse output, you must configure various settings via the GridVis® software within the configuration menu:
· Pulse width
· Mode for the digital input: S0 output
· Output polarity: Normally open, normally closed
· Pulse value

Pulse value
The pulse value indicates how much energy (Wh or varh) corresponds to a pulse.

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

If you specify the pulse value with a:
positive sign, pulses are then only output if the measured value also has a positive sign.
· negative sign, pulses are then only output if the measured value also has a negative sign.

NOTE

Since the **active energy meter** works with anon-return device, the device only sends pulses during consumption of electrical energy.

Since the **reactive energy meter** works with a non-return device, the device only sends pulses during an inductive load.

Determining the pulse value
1. Establish the pulse length according to the requirements of the connected pulse receiver. With a pulse length of e.g. 30 ms, the device can emit a maximum number of 60,000 pulses per hour (see table “maximum number of pulses”).

2. Determining the maximum connected load:

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

3. Calculating the pulse value:

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

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

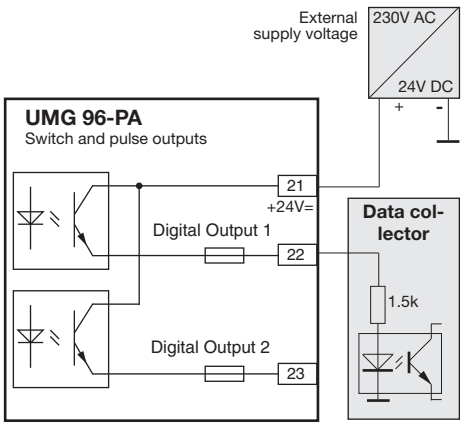


Fig. Connection example for switching as a pulse output.

⚠ CAUTION

Measurement error when used as a pulse output.
If the digital outputs are used as pulse outputs, measurement errors may occur due to residual ripple.
Use a power supply whose ripple is less than 5% of the supply voltage for the supply voltage of the digital inputs and outputs.

Timer output
64 independent weekly timers can be configured in the device with:
· a resolution of 1 minute.
· a definable active period within one day.
The active day within the week can be selected.

Example:
Time 9:25 to 11:45 a.m. on Sunday, Monday and Friday.
The weekly timers can be configured as a
· Tariff changeover (1 and 2)
· Setting the digital outputs 1 to 3
· as "non-functional".
The status can be called up via Modbus.
The states of the timer at the digital output are linked "OR".

The weekly timers are configured using the GridVis® software in the "*Timer*" configuration area)

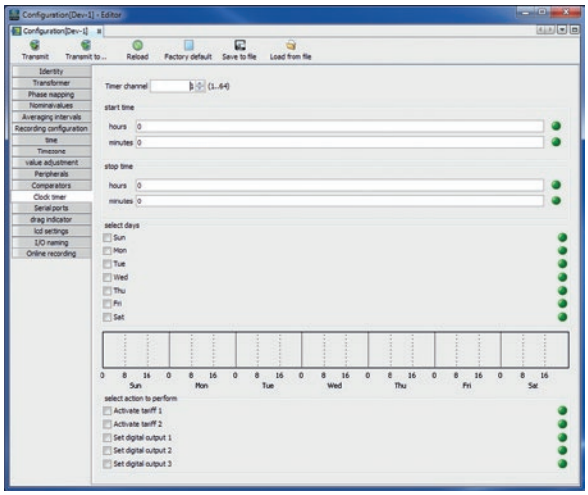


Fig. Configuration of the weekly timer (GridVis® software)

Output for Modbus remote
Enables switching of the outputs via a Modbus address.

This function is configured via the GridVis GridVis® software:
· In GridVis®, open the device configuration.
· Set the mode of the digital outputs under "*Peripherals*" to "*Modbus remote output*".
· Determine the output polarity with:
- Current flow active (normally open contact)
- Current inactive (normally closed contact)

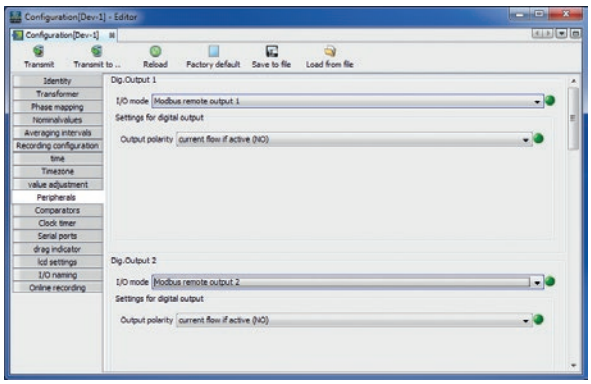


Fig. Configuration of the digital outputs as a "Modbus remote" in GridVis® software

Output for the comparator group
Two comparator groups (comparator 1 and 2) with 3 comparators each (A - C) are available for monitoring threshold values.

The results of the comparators A to C can be linked "*AND*" or "*OR*".

The logic result of comparator group 1 can be assigned to digital output 2 and the logic result of comparator group 2 can be assigned to digital output 3.

The comparator is only configured using the GridVis® software in the "*Comparator*" configuration area.

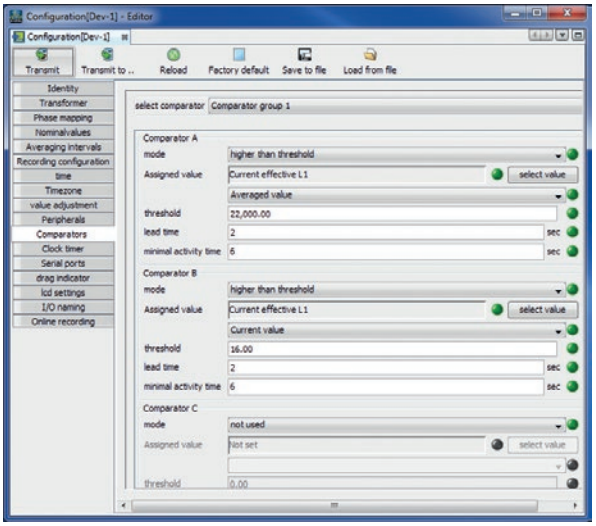


Fig. Configuration of the comparator in the GridVis® software

Reading out comparator settings on the device:
· Open the menu using key 1.
· Use keys 3 (▼) and 4 (▲) to select the *Peripherals* entry.
· Confirm using key 6 (*Enter*).
· The submenu appears.
· Use keys 3 (▼) and 4 (▲) to select the *comparator 1* entry for comparator 1 and *comparator 2* for comparator group 2.
· Confirm using key 6 (*Enter*).

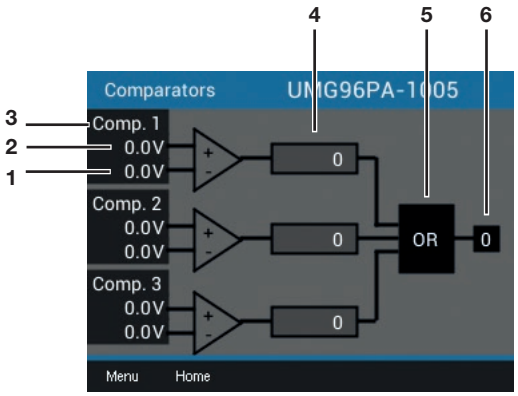
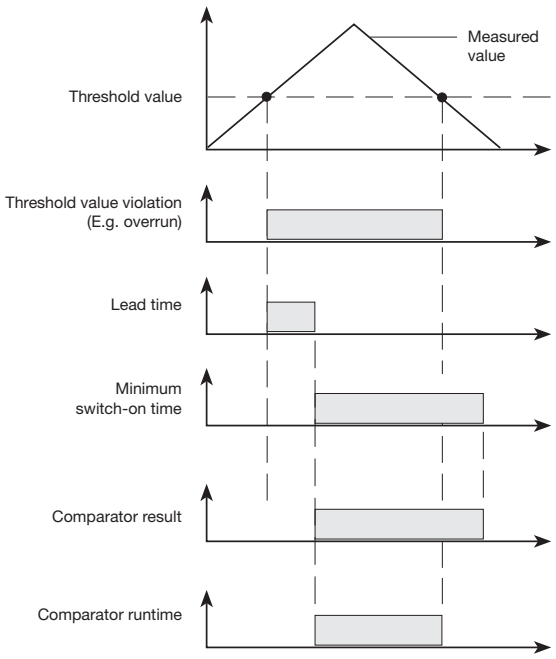


Fig. "Comparators" in the "Peripherals / Comparators" menu

1 Actual value
2 Threshold value
3 Comparator
4 Comparator runtime
5 Logic
6 Status

Comparator runtime
Comparator runtimes are time counters that add up when a comparator output is set. This means that if the condition of the comparator is fulfilled and the lead time has elapsed, the counter increases by the corresponding amount of time - the minimum switch-on time is not taken into account.

Comparator with set threshold value violation
· The set threshold value is compared with the measured value.
· If a threshold value violation occurs for at least the duration of the lead time, the comparison result is changed.
· The result is retained at least for the duration of the minimum switch-on time and at most for the duration of the threshold value violation. If a threshold value violation no longer occurs and the minimum switch-on time has elapsed, the result is reset.



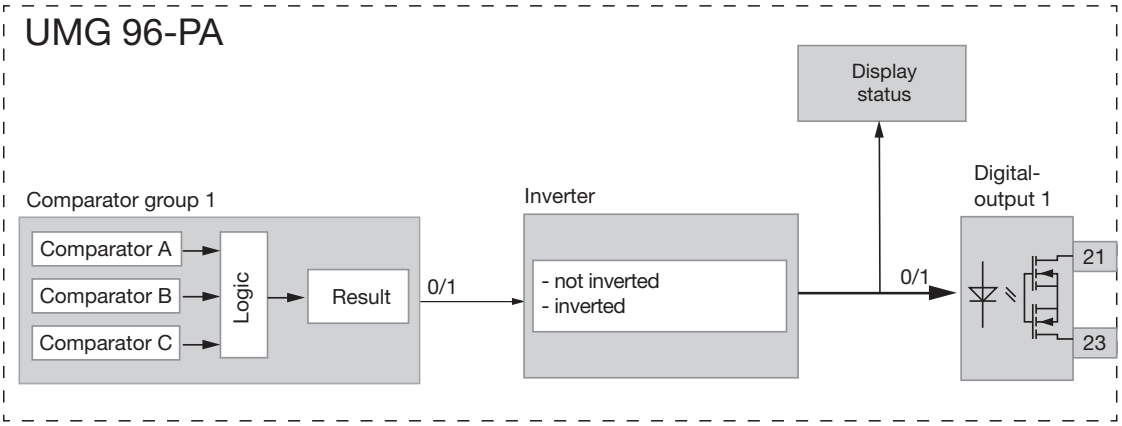


Fig. Block diagram "Use of digital output 2 for threshold value monitoring".

13.14 Analog output configuration

The device features an analog output, which can output a maximum current of 20 mA.
An external 24 V DC power supply unit is required for operation.

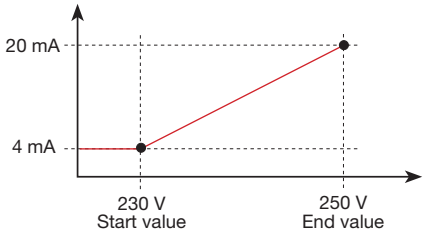


Fig. Analog output principle with voltage monitoring

The configuration of the analog output can be conveniently set via the GridVis® software. To do this, enter the assigned measured value, the start and end value and the output range under "*Peripherals*" in the device configuration.

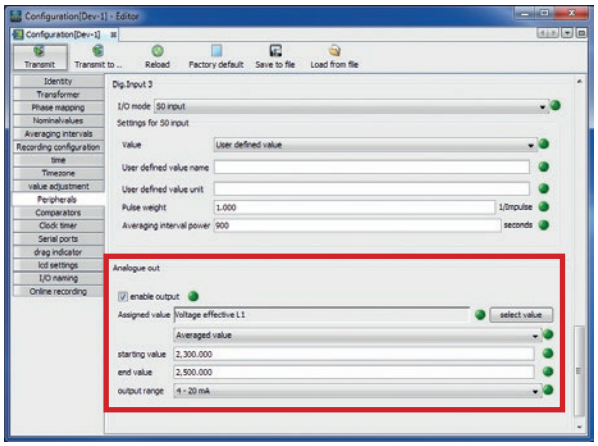
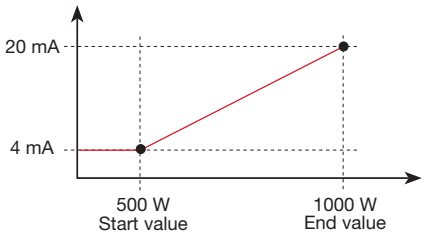


Fig. Configuration of the analog output in the GridVis® software

NOTE

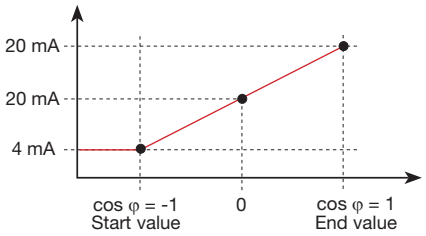
Information on configuring the analog output via the device keyboard can be found in chapter „12.7 Modbus editor“ on page 44.

Examples:
Assignment of active power L1 (output range 4 - 20 mA)



· With an active power of 500 W, the current at the analog output is 4 mA and with an active power of 1000 W --> 20 mA.
The measured active power is proportional to the current at the analog output.

Assignment of the calculated active power factor cos φ (math.) (output range 4 - 20 mA).



· Monitoring of the active power factor cos φ (math.) with:
cos φ (math.) > 0 active power, consumed.
cos φ (math.) < 0 active power, supplied.

13.15 “Drag pointer” function

The "drag pointer" function describes the three highest mean values of value types over a defined period of time (time base).

· The determined mean values can be called up via the GridVis® software and a parameter with time stamp.
· Period duration (time base), synchronization and capture time can be set in the GridVis® software or by setting the corresponding parameters.
· The mean value is calculated from the measured values of the following value types:
  - Current L1
  - Current L2
  - Current L3
  - Active power L1
  - Active power L2
  - Active power L3
  - Active power sum (L1...L3)
  - Apparent power L1
  - Apparent power L2
  - Apparent power L3
  - Apparent power sum (L1...L3)

Period duration (time base):
Individually adjustable period duration in seconds for calculating the mean values over this period (duration of the measured value recording). If internal synchronization is selected, the mean values are recalculated after the set time period has elapsed.

Synchronization mode:
A synchronization operation determines a start time for the calculation periods of the mean values. Synchronization is performed
· via the internal clock *(internal synchronization)*,
· by setting a parameter (*via Modbus*) or
· optionally via digital input 3 *(external synchronization)*.

Capture time:
The individually adjustable *capture time* describes a time slot in which an incoming pulse synchronizes the time. If the device receives apulse outside the capture time, the calculated mean values are deleted and the time is reset.
Note: The setting of the capture time - e.g. in the software GridVis®- describes half the time slot of the total capture time.

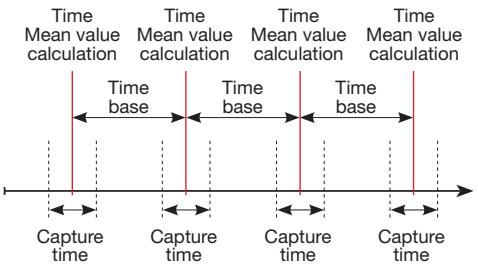


Fig. Synchronization principle

13.15.1 Internal synchronization

The mean values are calculated after the adjustable period elapses (time base).
The internal synchronization takes place at the full minute, if this describes a multiple of the time base.

Time base [min]	Sync 1 (Time)	Sync 2 (Time)	Sync 3 (Time)	Sync 4 (Time)
2	09:00:00	09:02:00	09:04:00	09:06:00
5	09:00:00	09:05:00	09:10:00	09:15:00
15	09:00:00	09:15:00	09:30:00	09:45:00

Fig. Examples of internal synchronization with different time bases

NOTE

To perform an *internal synchronization*, the options *Synchronization via Modbus* **AND** *Synchronization via digital output 3* must be deactivated.

13.15.2 External synchronization

An external synchronization for calculating the 3 highest mean values takes place
· via digital input 3 (e.g. via a pulse generator) or
· via a Modbus command

External synchronization scenarios:

"No pulse despite setting."
If there is no pulse via digital input 3 or a Modbus command, the measured values are saved similar to the internal synchronization function - but not only at the full minute.

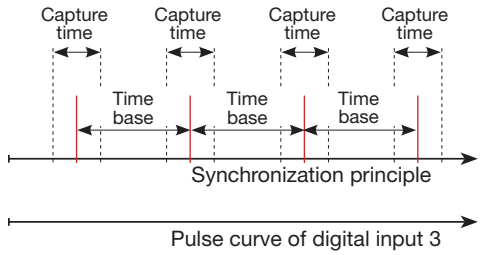


Fig. Synchronization principle with "no pulse despite setting"

Example	Maximum value	Value	Time stamp
Effective current L1	Drag pointer 1	3.51 A	09:13:07
Effective current L1	Drag pointer 2	2.52 A	09:08:07
Effective current L1	Drag pointer 3	1.52 A	09:03:07

Fig. Example of drag pointer storage with time stamp (with set time base of 5 min)

"A pulse"
If the device receives a pulse or a Modbus command once outside the capture time, the measured values summed up to that time for calculating the mean value and the time are reset. The time is redefined as the relative zero point and a new calculation is performed.

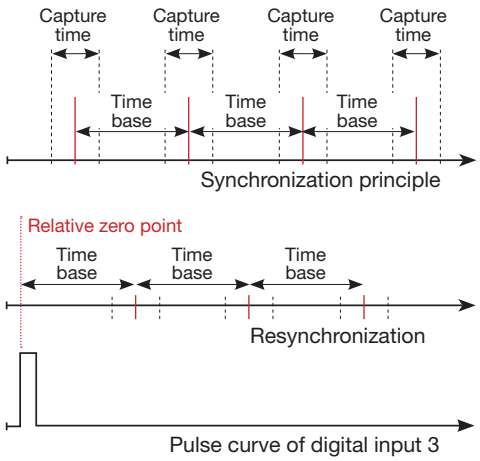


Fig. Synchronization principle with "a pulse outside the capture time"

Example:

Example	Maximum value	Value	Time stamp
Active power L1	Drag pointer consumption 1	396.73 W	09:18:47
Active power L1	Drag pointer Consumption 2	207.34 W	09:13:47
Active power L1	Drag pointer Consumption 3	80.59 W	09:08:47

Fig. Example of drag pointer storage with time stamp (with set time base of 5 min)

The power increases with time. The values are reset to 0 by the pulse (09:06:47) outside the capture time. From this point on, the intermediate values are totaled again. Since no additional pulse arrives, the mean value is calculated according to the set time (time base).

“Periodic pulses”
If the device receives periodic pulses via digital input 3 or periodic Modbus commands, there are different scenarios.

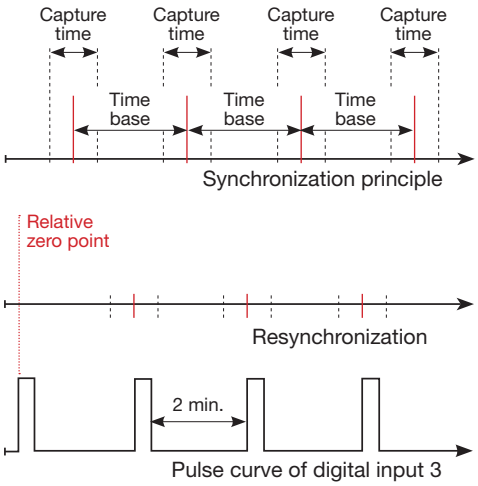
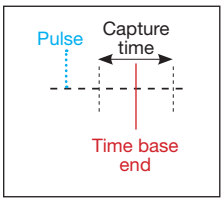
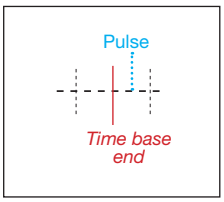


Fig. Synchronization principle with “periodic pulses” on digital input 3

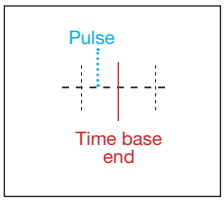
Scenario "pulse outside the capture time":
· Totaled intermediate values are set to 0.
· The time is set to 0 (new relative zero point).
· No value is calculated.



Scenario "impulse after the time base, but within the capture time":
· Totaled intermediate values are set to 0.
· The time is set to 0 (new relative zero point).
· No value is calculated.



Scenario "impulse before the time base, but within the capture time":
· Now calculate the value.
· The time is set to 0 (new relative zero point).
· Delete accumulated intermediate values.



NOTE

With the periodic synchronization, the time is synchronized with each pulse.

13.15.3 Synchronization priority

An external synchronization takes place according to different priorities:

· *Priority 1: Modbus synchronization*
Set the "Enable flag" via the Modbus tool (addr.: 822) or select the "Synchronization via Modbus" option in the GridVis® software in the configuration area for the drag pointer.

· *Priority 2: Synchronization via digital input 3*
To do this, set the Modbus parameter "FUNC_SYNC_RECORD" (addr. 30048 to the value 4) or select the "Synchronization drag pointer" in the GridVis® software in the configuration area for the peripherals (digital input 3).
Note: Do **NOT** select the "Synchronization via Modbus" option in the drag pointer configuration.

· Priority 3: Internal synchronization

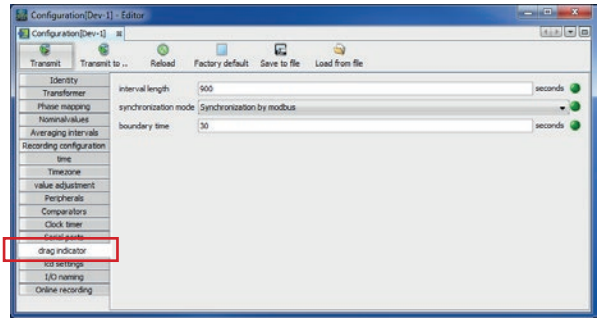


Fig. Drag pointer in the GridVis® software

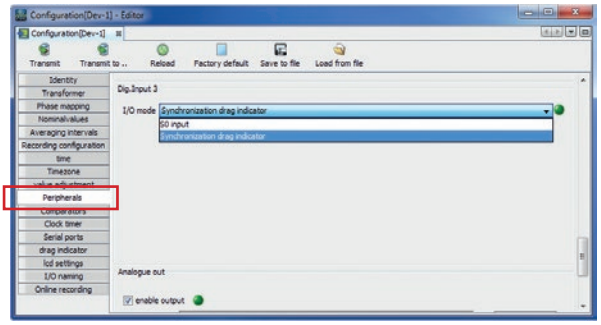


Fig. Configuration "synchronization via digital input 3" in the GridVis® software

Modbus address	Function	Setting range
820	Set trigger flag for drag pointer synchronization	0 .. 1
821	Time base in seconds	60 .. 65535
822	Enable flag of the Modbus trigger	0 .. 1
823	Capture time in seconds	0 .. 255
30048	Configuration of the inputs	0 .. 4*

** 0 = FUNC_NONE;*
1 = FUNC_TARIF;
2 = FUNC_SYNC_CLOCK_MIN;
3 = FUNC_SYNC_CLOCK_H;
4 = FUNC_SYNC_RECORD

Fig. Table of Modbus addresses for a synchronization

13.16 Recordings

Two recording profiles are preconfigured in the factory default setting of the device. The GridVis® software is used to adapt and extend recordings.

- The smallest time base for recordings is 1 minute.
- A maximum of 4 recordings with 29 measured values are possible. If minimum and maximum values are also defined, the number is reduced to 19 or 14 values respectively.
- Within the recording configuration, measured values are defined according to the types *mean value*, *sample, maximum or minimum* over a time base.
  - Type *mean value*: Arithmetic mean value of the measured values over a fixed period of time.
  - Type *maximum* and *minimum*: Maximum or minimum values of a defined period of time.
  - Type *sample*: Measured value at the end of the specified time period.

  Note: Working values are only recorded with the type *sample*.

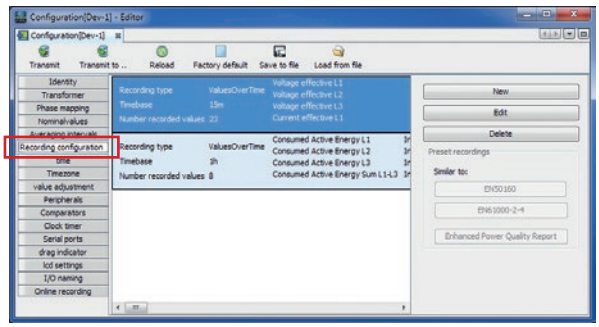


Fig. Recording configuration in the GridVis® software

Recording 1
The following measured values are recorded with a time base of 15 minutes:

- Effective voltage L1
- Effective voltage L2
- Effective voltage L3
- Effective current L1
- Effective current L2
- Effective current L3
- Effective current sum L1..L3
- Active power L1
- Active power L2
- Active power L3
- Active power sum L1..L3
- Apparent power L1
- Apparent power L2
- Apparent power L3
- Apparent power sum L1..L3
- cos phi(math.) L1
- cos phi(math.) L2
- cos phi(math.) L3
- cos phi(math.) sum L1..L3
- Reactive power of power frequency L1
- Reactive power of power frequency L2
- Reactive power of power frequency L3
- Reactive power of power frequency sum L1..L3

Recording 2
The following measured values are recorded with a time base of 1 hour:

- Active energy consumption L1
- Active energy consumption L2
- Active energy consumption L3
- Active energy consumption sum L1..L3
- Inductive reactive energy L1
- Inductive reactive energy L2
- Inductive reactive energy L3
- Inductive reactive energy sum L1..L3

13.17 Tariff changeover

Electrical energy values (active, reactive and apparent energy) are recorded via internal counters for two tariffs each.

Switching between the tariffs (HT/NT) is supported by:
· Modbus,
· digital input 1
(see chapter "*Digital inputs*") or
· the weekly timer
(see chapter "*Timer output*")

Tariff	UMG96PA-1005		
Tariff	Active E. [kWh]	Reactive E. [kVArh]	Apparent E. [kVAh]
1	0	0	0
2	0	10	10
1 + 2	0	10	10
Menu	Home		

Fig. Device display of the sum (L1..L3) of the active, reactive and apparent energy according to tariffs

NOTE

Configure the tariff changeover via the GridVis® software.

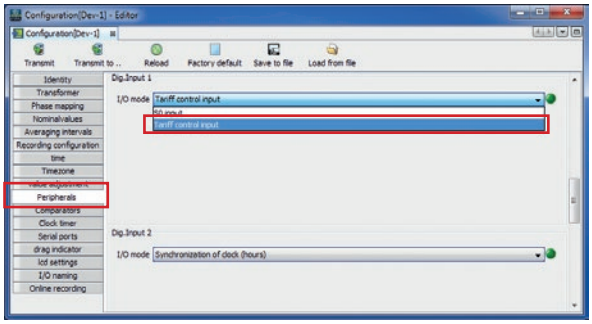


Fig. Configuration of digital input 1 as the tariff changeover input in the GridVis® software

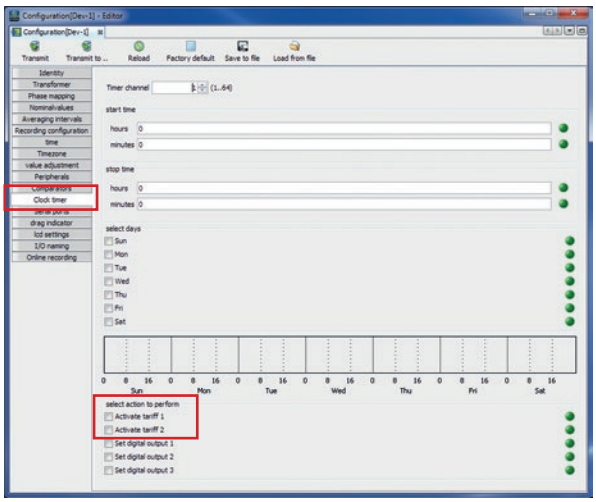
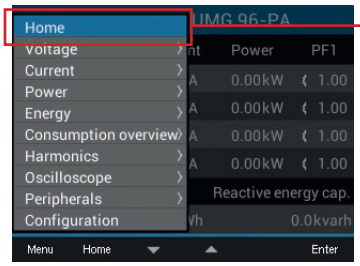


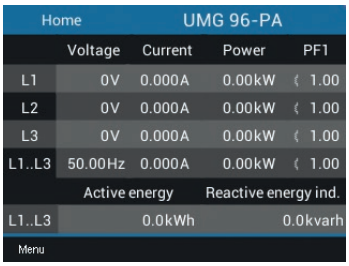
Fig. Timer configuration in the GridVis® software

14. Overview of measured value indications

Menu (Home)

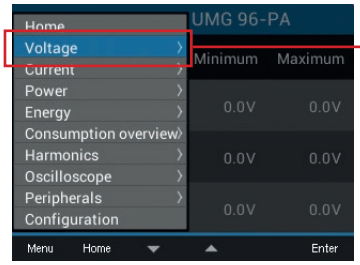


Network analysis (start screen)

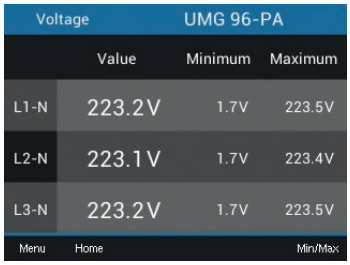


Display of voltage L1, L2, L3; current L1, L2, L3; power L1, L2, L3; power factor; active and reactive energy L1-L3

Menu (voltage)

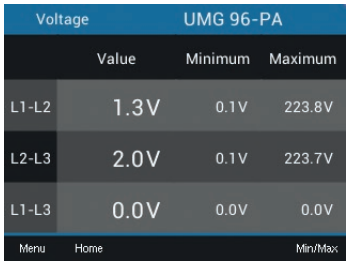


Voltage L-N



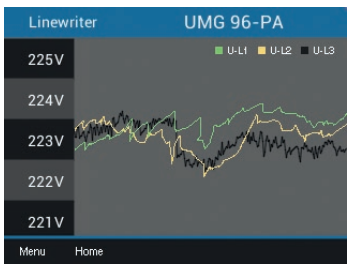
Display of voltage L1-N, L2-N, L3-N and their min. / max. values

Voltage L-L



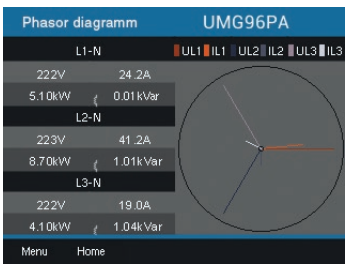
Display of voltage L1-L2, L2-L3, L1-L3 and their min. / max. values

Curve



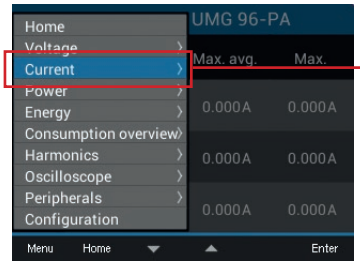
Display of voltage curve of L1-N, L2-N, L3-N

Phasor diagram

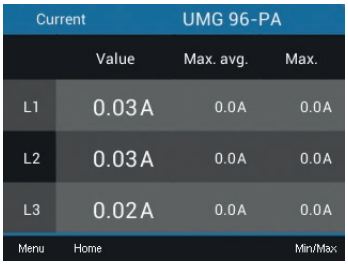


Display of voltage curve of L1-N, L2-N, L3-N

Menu (current)

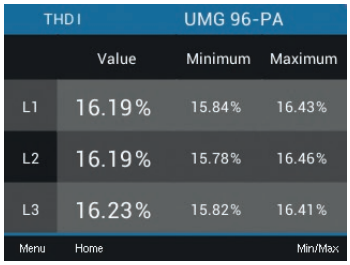


Current



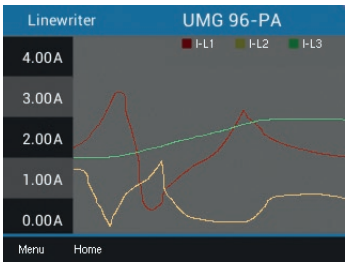
Display of current L1, L2, L3 and their min. / max. values

THD-I



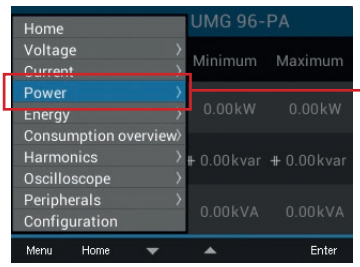
Display of the THD factors for the current (THD-I) L1, L2, L3 and their max. / max. values

Curve

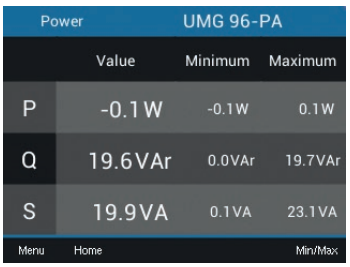


Display of current curve of L1, L2, L3

Menu (power)

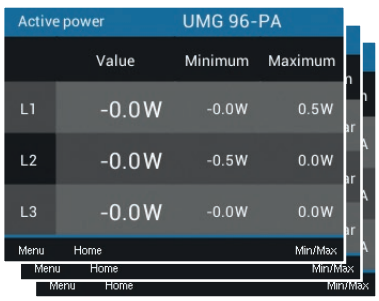


Power sum



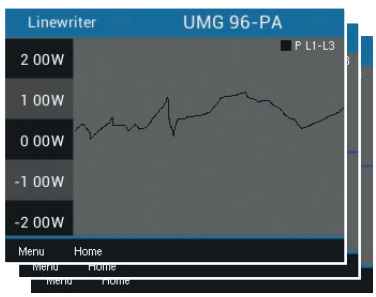
Display of sum (L1..L3) of active, reactive and apparent power and their min. / max. values

Active / reactive / apparent power



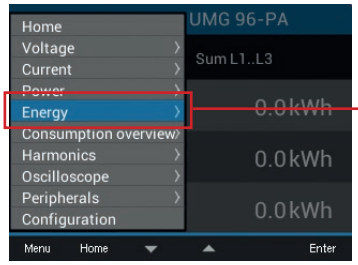
Display of power values (active, reactive or apparent power) L1-N, L2-N, L3-N and their min. / max. values

Curve of active/ reactive / apparent power

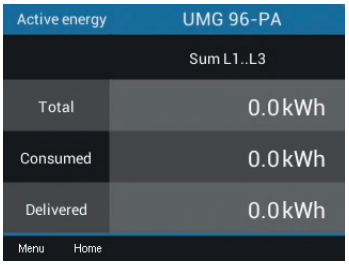


Display of the active, reactive or apparent power curve (sum L1..L3)

Menu (energy)

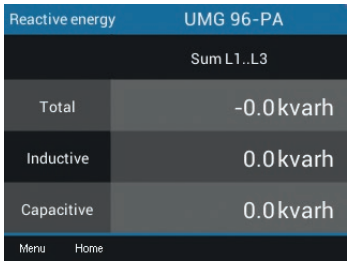


Active energy



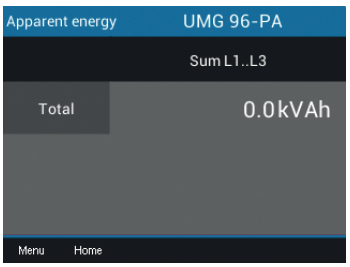
Display of sum (L1..L3) of the active energy (total/consumed/supplied)

Reactive energy



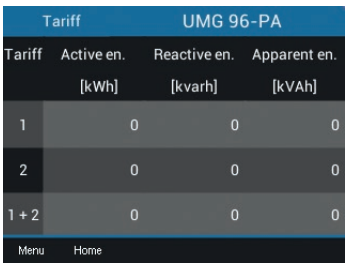
Display of sum (L1..L3) of the reactive energy (total/inductive/supplied)

Apparent energy



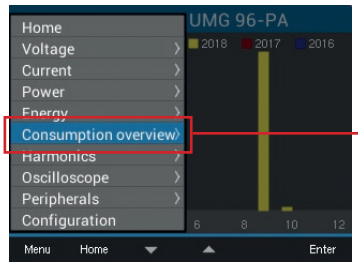
Display sum (L1..L3) of the apparent energy

Tariff

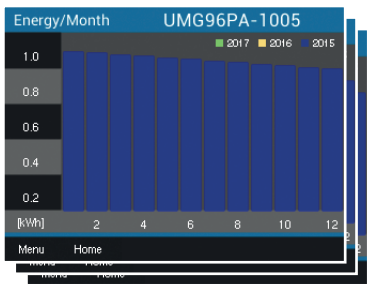


Display of the sum (L1..L3) of the active, reactive and apparent energy according to tariffs

Menu (consumption overview)

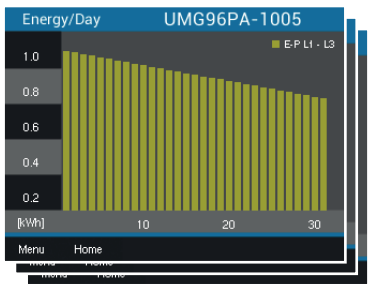


Active, reactive, apparent energy / month



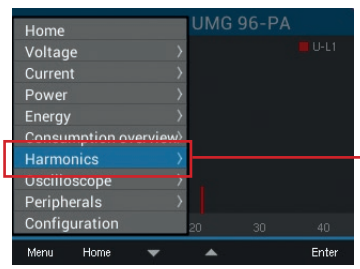
Display of active, reactive or apparent energy per month (of the last three years)

Active, reactive, apparent energy / day

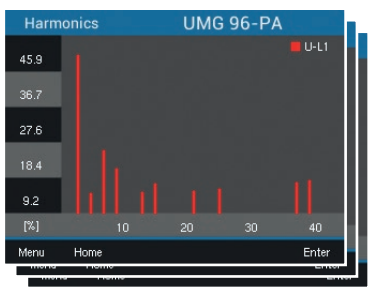


Display of active, reactive or apparent energy per day (of the current month)

Menu (harmonics)

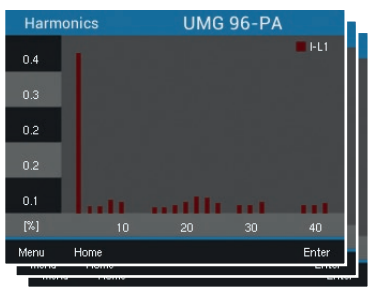


Voltage L1 / L2 / L3



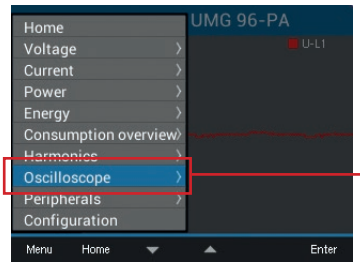
Display of harmonics up to the 40th harmonic. (Voltage L1, L2, L3)

Current L1 / L2 / L3

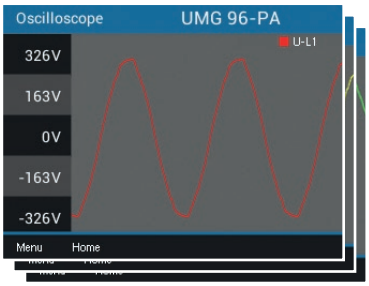


Display of harmonics up to the 40th harmonic. (Current L1, L2, L3)

Menu (oscilloscope)

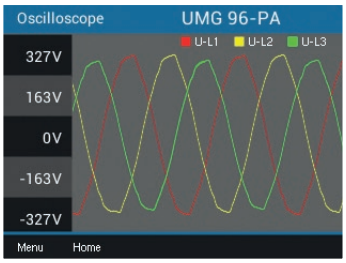


Voltage L1 / L2 / L3



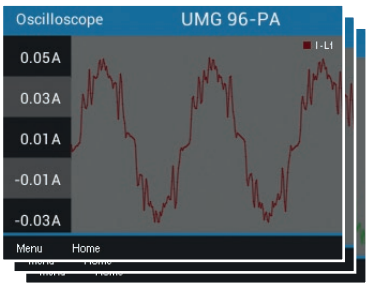
Display of the voltage L1, L2 or L3 oscillogram

Voltage L1..L3



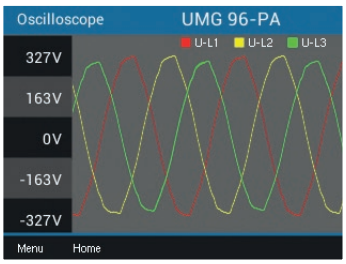
Display of the voltage L1, L2 and L3 oscillogram

Current L1 / L2 / L3



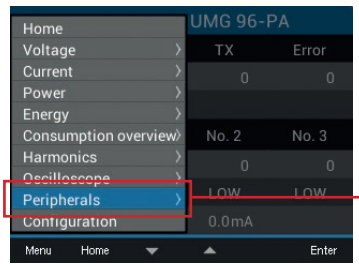
Display of current L1, L2, L3 oscillogram

Current L1..L3



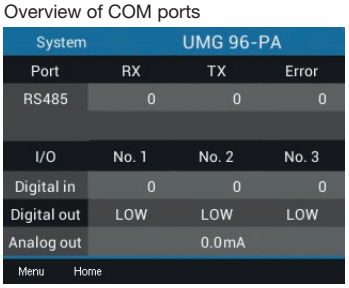
Display of current L1, L2 and L3 oscillogram

Menu (peripherals)



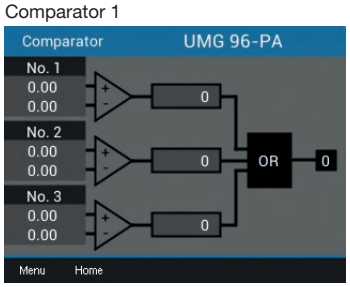
***Note:** You can find more information in chapter "**Operation**" and "**Configuration**".*

Overview of COM ports



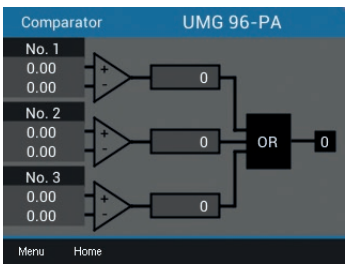
Display of received (RX), transmitted (TX) and faulty data packets; switching current analog output

Comparator 1



Display of threshold value, actual value, comparator runtime, logic and status

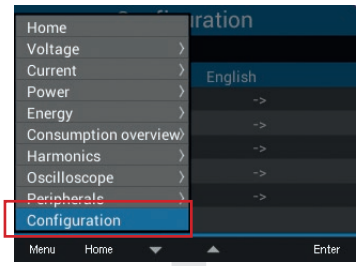
Comparator 2



Display of threshold value, actual value, comparator runtime, logic and status

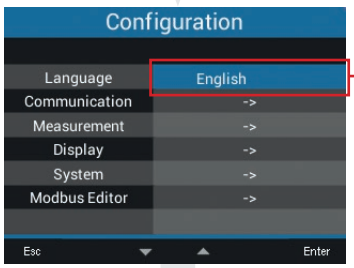
15. Overview of configuration displays

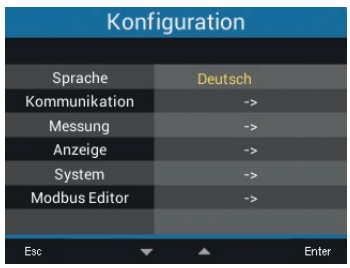
Menu (configuration)



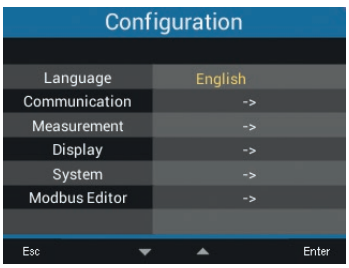
For information on the entries in the configuration window, see chapter „12. Configuration“ on page 36.

Language



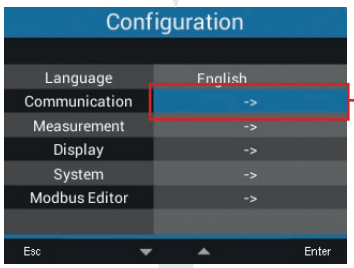


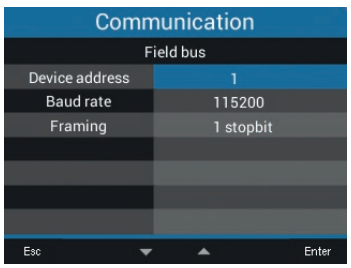
German language setting.



English language setting.

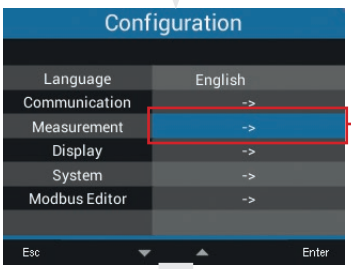
Communication

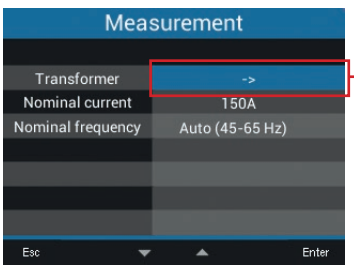




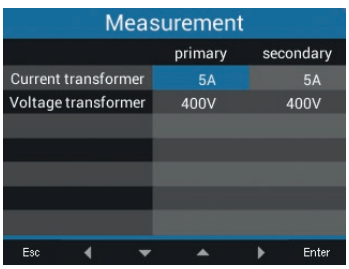
Field bus settings, device address, baud rate and data frame.

Measurement



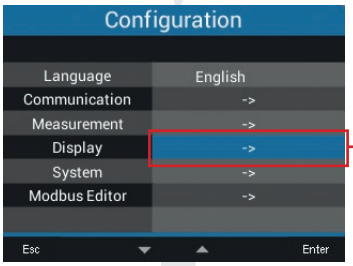


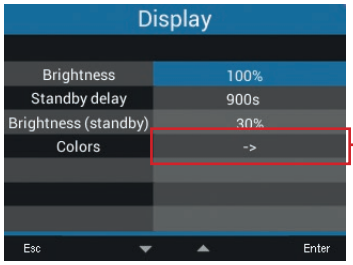
Measuring transducer, rated current and rated frequency settings.



Current and voltage transformers (primary and secondary) setting.

Display

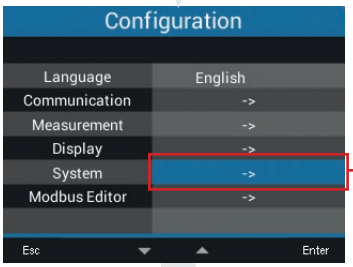


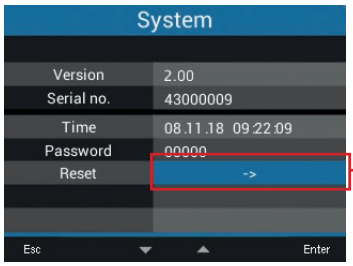


Settings for brightness, standby time after, brightness (standby) and the display colors for voltage and current (L1, L2, L3).

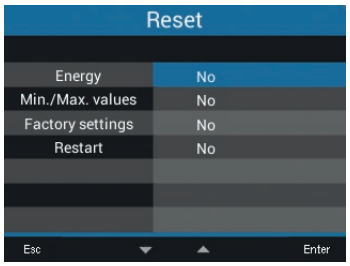
Settings for the display colors of voltage and current (L1, L2, L3).

System



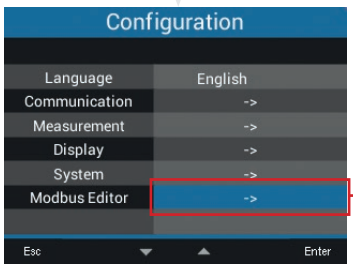


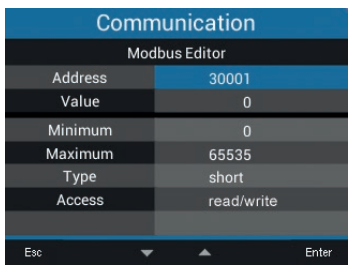
Version of the firmware, serial number. Setting for time, the password and resetting measured values.



Resetting of energy measured values, min. and max. values. Resetting to factory settings or restart the measurement device.

Modbus-editor





Settings for the Modbus addresses (address, value).

16. Service and maintenance

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

16.1 Repair and calibration

The device must only be repaired and calibrated by the manufacturer or an accredited laboratory. The manufacturer recommends calibrating the device every 5 years.

⚠ WARNING

Warning against impermissible manipulations or improper use of the device.
Opening, dismantling or impermissible manipulation of the device, which exceeds the specified mechanical, electrical or other operating limits, can result in property damage or injuries up to death.

- **Only electrically qualified personnel may work on the devices and their components, assemblies, systems and circuits!**
- **Always use your device or components as described in the associated documentation.**
- **Send the device back to the manufacturer in the event of visible damage, and also for repair and calibration!**

16.2 Front film and display

Observe the following during the care and cleaning of the front film and display:

NOTE

Property damage due to incorrect care and cleaning of the device.
The use of water or other solvents, such as e.g. denatured alcohol, acids, acidic agents, for the front film or the display can damage or destroy the device during the cleaning. Water can e.g. penetrate the device housing and destroy the device.

- **Clean the device, front film or the display with a soft cloth.**
- **For severe soiling, use a cloth moistened with clear water.**
- **Clean the front foil and the display,**
- **e.g. fingerprints, with a special LCD cleaner and a lint-free cloth.**
- **Do not use any acids or acidic agents to clean the devices.**

16.3 Service

Please contact the manufacture for any questions that were not answered or described in this manual. Please make sure to have the following information readily available for answering questions:

- Device designation (see rating plate)
- Serial number (see rating plate)
- Software release (see system display)
- Measured voltage and supply voltage
- Exact error description.

16.4 Device adjustment

The manufacturer adjusts the devices before delivery. When adhering to the ambient conditions, a readjustment is not necessary.

16.5 Firmware update

To update your device firmware, connect your device to a computer and access it via the **GridVis®** software:

- Open the Firmware Update Assistant by clicking "Update Device" in the "Tools" menu.

- Select your update file and perform the update.

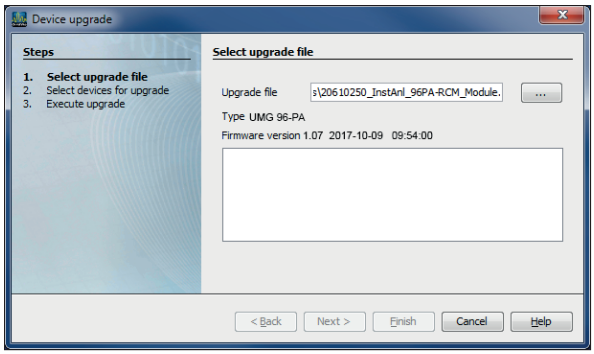


Fig. Update the device firmware in the GridVis® software

16.6 Clock/battery

The supply voltage supplies the internal clock of the measurement device. If the supply voltage fails, the battery supplies power to the clock. The clock supplies date and time information for e.g. records and min. and max. values.

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

A battery change is carried out via the battery compartment on the bottom of the device. **When changing the battery, make sure that the battery type and polarity are correct** (positive terminal points to the rear of the unit; negative terminal points to the front of the unit).

Observe the following when changing the battery:

⚠ WARNING

Risk of injury due to electric voltage!
Serious personal injuries or death can occur due to:
· Touching live exposed or stripped cores.
· Device inputs that are dangerous to touch.
When handling your device and when changing the battery, observe the following before starting work:
· **Disconnect the system/device from the power supply.**
· **Secure it against being switched back on!**
· **Verify disconnection from power!**
· **Ground and short-circuit!**
· **Cover or block off neighboring parts that are under voltage!**

NOTE

Grease or dirt on the contact surfaces creates transmission resistance which decreases the service life of the battery. Only hold the battery on the edges.

17. Procedure in the event of errors

Possible error	Cause	Remedy
No display	External fuse for the power supply voltage has tripped.	Replace fuse.
No current display	Measured voltage is not connected.	Connect the measured voltage.
	Measurement current is not connected.	Connect measurement current.
Current displayed is too large or too small.	Current measurement in the wrong phase.	Check connection and correct if necessary.
	Current transformer factor is incorrectly programmed.	Read out and program the current transformer transformation ratio at the current transformer.
	The current harmonics exceeded the current peak value at the measuring input.	Install current transformer with a larger CT ratio.
	The current at the measurement input was not achieved.	Install current transformer with a smaller current transformer ratio.
Voltage displayed is too low or too high.	Measurement in the wrong phase.	Check connection and correct if necessary.
	Voltage transformer incorrectly programmed.	Read out and program the voltage transformer ratio at the voltage transformer.
Voltage displayed is too small.	Measurement range exceeded.	Install voltage transformers.
	The peak voltage value at the measurement input has been exceeded by harmonic components.	Attention! Ensure the measurement 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 consumption/ export is reversed.	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.
Active power displayed is too low or too high.	The programmed current transformer ratio is incorrect	Read out and program the current transformer transformation ratio at the current transformer
	The current path is assigned to the wrong voltage circuit.	Check connection and correct if necessary.
	The programmed voltage transformer ratio is incorrect.	Read out and program the voltage transformer ratio at the voltage transformer.
An input/output is not responding.	The input/output has been programmed incorrectly.	Check the programming and correct if necessary.
	The input/output was connected incorrectly.	Check connection and correct if necessary.
Display “Measurement range exceeded”	The measuring range has been exceeded	Check connection and correct if necessary. Correct current/voltage transformer translation ratio.
No connection to the device.	RS485 - Incorrect device address. - Different bus speeds (baud rate) and / or data frame - Incorrect protocol. - Termination missing.	- Correct device address. - Correct speed (baud rate). Correct data frame. - Correct protocol. - Connect bus with termination resistor.
Device still does not work despite the above measures.	Device defective.	Send the device to the manufacturer for inspection and testing.

18. Technical data

General information	
Net weight (with attached connectors)	Approx. 250 g
Packaging weight (including accessories)	Approx. 500 g
Battery	Type Lithium CR2032, 3 V (approval according to UL 1642)
Service life of the backlight	40000 h (Backlight is reduced to approx. 50% over this period)

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

Ambient conditions during operation	
Use in a weather-protected, stationary application. Protection class II in accordance with IEC 60536 (VDE 0106, Part 1).	
Operating temperature range	-10°C .. +55°C
Relative humidity (non-condensing)	0 to 75% RH
Operating altitude	0 .. 2000 m above sea level
Pollution degree	2
Installation position	discretionary
Ventilation	No external ventilation required.
Protection against foreign bodies and water - Front - Rear - Front side with sealing	 IP40 i.a.w. EN60529 IP20 i.a.w. EN60529 IP54 i.a.w. EN60529

Supply voltage		
230 V option	Rated range	AC 90 V - 277 V (50/60 Hz) or DC 90 V - 250 V, 300 V CATIII
	Power consumption	Max. 4.5 VA / 2 W
24 V option	Rated range	AC 24 V - 90 V (50/60Hz) or DC 24 V - 90 V, 150 V CATIII
	Power consumption	Max. 4.5 VA / 2 W
Operating range	+-10% of nominal range	
Internal fuse, not interchangeable	Type T1A / 250 VDC / 277 VAC according to IEC 60127	
Recommended overcurrent protection device for the line protection (approval according to UL)		230 V option: 6 - 16 A (char. B) 24 V option: 1 - 6 A (char. B)

Recommendation for the maximum number of devices on one circuit breaker:
230 V option: With a circuit breaker B6A: maximum 4 devices / with a circuit breaker B16A: maximum 11 devices
24 V option: With a circuit breaker B6A: maximum 3 devices / with a circuit breaker B16A: maximum 9 devices

Voltage measurement	
Three-phase 4-conductor systems with rated voltages up to	417 V / 720 V (+-10%) according to IEC 347 V / 600 V (+-10%) according to UL
Single-phase 2-conductor systems with rated voltages up to	480 V (+-10%)
Overvoltage category	600 V CAT III
Measurement voltage surge	6 kV
Fuse for the voltage measurement	1 - 10 A (with IEC/UL approval)
Measuring range L-N	0[1)] .. 600 V_{rms} (max. overvoltage 800 V_{rms})
Measuring range L-L	0[1)] .. 1040 V_{rms} (max. overvoltage 1350 V_{rms})
Resolution	0.01 V
Crest factor	2.45 (related to the measurement range)
Impedance	3 MΩ/phase
Power consumption	Approx. 0.1 VA
Sampling frequency	8.33 kHz
Frequency of the power frequency - Resolution	45 Hz .. 65 Hz 0.01 Hz

1) The device only determines the measured values if voltage L1-N is greater than 20 Veff (4-conductor measurement) or voltage L1-L2 is greater than 34 Veff (3-conductor measurement) at voltage measurement input V1.

Current measurement	
Rated current	5 A
Measuring range	0.005 .. 6 A_{rms}
Crest factor (based on the rated current)	2 (based on 6 A_{rms})
Overvoltage category	300 V CAT II
Measurement voltage surge	2 kV
Power consumption	Approx. 0.2 VA (Ri=5 mΩ)
Overload for 1 sec.	60 A (sinusoidal)
Resolution	0.1 mA (display 0.01 A)
Sampling frequency	8.33 kHz

Serial interface	
RS485 - Modbus RTU/slave	9.6 kbps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps

Digital outputs 3 digital outputs, semiconductor relays, not short-circuit proof.	
Switching voltage	Max. 33 V AC, 40 V DC
Switching current	Max. 50 mA_{eff} AC/DC
Response time	Approx. 200 ms
Pulse output	Max. 50 Hz (energy pulse)

Digital inputs 3 digital inputs, semiconductor relays, not short-circuit proof.	
Maximum counter frequency	20 Hz
Input signal present	18 V .. 28 V DC (typical 4 mA)
Input signal not present	0 .. 5 V DC, current less than 0.5 mA

Line length (digital inputs/outputs)	
Up to 30 m	Unshielded
Greater than 30 m	Shielded

Analog output	
External power supply	Max. 33 V
Current	0 .. 20 mA
Update time	1 s
Load	Max. 300 Ω
Resolution	10 Bit

Terminal connection capacity (supply voltage) Connectable conductors. Only one conductor can be connected per terminal.	
Single core, multi-core, fine-stranded	0.08 - 4.0 mm², AWG 28-12
Terminal pins, core end sheath	0.2 - 2.5 mm²
Tightening torque	0.4 - 0.5 Nm
Stripping length	7 mm

Terminal connection capacity (voltage measurement) Connectable conductors. Only one conductor can be connected per terminal.	
Single core, multi-core, fine-stranded	0.08 - 4.0 mm², AWG 28-12
Terminal pins, core end sheath	0.2 - 2.5 mm²
Tightening torque	0.4 - 0.5 Nm
Stripping length	7 mm

Terminal connection capacity (current measurement) Connectable conductors. Only one conductor can be connected per terminal.	
Single core, multi-core, fine-stranded	0.2 - 2.5 mm², AWG 26-12
Terminal pins, core end sheath	0.2 - 2.5 mm²
Tightening torque	0.4 - 0.5 Nm
Stripping length	7 mm

Terminal connection capacity (serial interface)	
Single core, multi-core, fine-stranded	0.2 - 1.5 mm², AWG 28-16
Terminal pins, core end sheath	0.2 - 1.5 mm²
Tightening torque	0.2 - 0.25 Nm
Stripping length	7 mm

Terminal connection capacity (digital inputs and outputs, analog output)	
Single core, multi-core, fine-stranded	0.2 - 1.5 mm², AWG 28-16
Terminal pins, core end sheath	0.2 - 1.5 mm²
Tightening torque	0.2 - 0.25 Nm
Stripping length	7 mm

19. Function characteristics

Function	Symbol	Accuracy class	Measuring range	Display range
Total active power	P	0.5[5] (IEC61557-12)	0 W .. 12.6 kW	0 W .. 999 GW *
Total reactive power	QA, Qv	1 (IEC61557-12)	0 var .. 16.6 kvar	0 var .. 999 Gvar *
Total apparent power	SA, Sv	0.5[5] (IEC61557-12)	0 VA .. 12.6 kVA	0 VA .. 999 GVA *
Total active energy	Ea	0.2[5] (IEC61557-12) 0.2 S[5] (IEC62053-22)	0 Wh .. 999 GWh	0 Wh .. 999 GWh *
Total reactive energy	ErA, ErV	1 (IEC61557-12)	0 varh .. 999 Gvarh	0 varh .. 999 Gvarh *
Total apparent energy	EapA, EapV	0.5[5] (IEC61557-12)	0 VAh .. 999 GVAh	0 VAh .. 999 GVAh *
Frequency	f	0.05 (IEC61557-12)	45 Hz .. 65 Hz	45.00 Hz .. 65.00 Hz
Phase current	I	0.2 (IEC61557-12)	0 Arms.. 7 Arms	0 A .. 999 kA
Calculated neutral conductor current	INc	1.0 (IEC61557-12)	0.03 A.. 25 A	0.03 A .. 999 kA
Voltage	U L-N	0.2 (IEC61557-12)	10 Vrms.. 600 Vrms	0 V .. 999 kV
Voltage	U L-L	0.2 (IEC61557-12)	18 Vrms .. 1040 Vrms	0 V .. 999 kV
Power factor	PFA, PFV	0.5 (IEC61557-12)	0.00 .. 1.00	0.00 .. 1.00
Short-term flicker, long-term flicker	Pst, Plt	-	-	-
Voltage dips (L-N)	Udip	-	-	-
Voltage swells (L-N)	Uswl	-	-	-
Transient voltage swells	Utr	-	-	-
Voltage interruptions	Uint	-	-	-
Voltage unbalance (L-N) [1]	Unba	-	-	-
Voltage unbalance (L-N) [2]	Unb	-	-	-
Voltage harmonics	Uh	Cl. 1 (IEC61000-4-7)	1 .. 40	0 V .. 999 kV
THD of the voltage [3]	THDu	1.0 (IEC61557-12)	0% .. 999%	0% .. 999%
THD of the voltage [4]	THD-Ru	-	-	-
Current harmonics	Ih	Cl. 1 (IEC61000-4-7)	1 .. 40	0 A .. 999 kA
THD of the current [3]	THDi	1.0 (IEC61557-12)	0% .. 999%	0% .. 999%
THD of the current [4]	THD-Ri	-	-	-
Mains signal voltage	MSV	-	-	-

1) In relation to the amplitude.
2) In relation to the phase and amplitude.
3) In relation to the power frequency.
4) In relation to the effective value.
5) Accuracy class 0.2/0.2S with ../5A transformer. Accuracy class 0.5/0.5S with ../1A transformer.
* When the max. total energy values are reached, the display returns to 0 W.

19.1 Modbus address list of frequently used measured values

Address	Format	RD/WR	Variable	Unit	Remark
19000	float	RD	_ULN[0]	V	Voltage L1-N
19002	float	RD	_ULN[1]	V	Voltage L2-N
19004	float	RD	_ULN[2]	V	Voltage L3-N
19006	float	RD	_ULL[0]	V	Voltage L1-L2
19008	float	RD	_ULL[1]	V	Voltage L2-L3
19010	float	RD	_ULL[2]	V	Voltage L3-L1
19012	float	RD	_ILN[0]	A	Apparent current, L1
19014	float	RD	_ILN[1]	A	Apparent current, L2
19016	float	RD	_ILN[2]	A	Apparent current, L3
19018	float	RD	_I_SUM3	A	Total; IN=I1+I2+I3
19020	float	RD	_PLN[0]	W	Active power L1
19022	float	RD	_PLN[1]	W	Active power L2
19024	float	RD	_PLN[2]	W	Active power L3
19026	float	RD	_P_SUM3	W	Total; Psum3=P1+P2+P3
19028	float	RD	_SLN[0]	VA	Apparent power L1
19030	float	RD	_SLN[1]	VA	Apparent power L2
19032	float	RD	_SLN[2]	VA	Apparent power L3
19034	float	RD	_S_SUM3	VA	Total; Ssum3=S1+S2+S3
19036	float	RD	_QLN[0]	var	Reactive power (power frequency) L1
19038	float	RD	_QLN[1]	var	Reactive power (power frequency) L2
19040	float	RD	_QLN[2]	var	Reactive power (power frequency) L3
19042	float	RD	_Q_SUM3	var	Total; Qsum3=Q1+Q2+Q3
19044	float	RD	_COS_PHI[0]		Fund. power factor, CosPhi; UL1 IL1
19046	float	RD	_COS_PHI[1]		Fund. power factor, CosPhi; UL2 IL2
19048	float	RD	_COS_PHI[2]		Fund. power factor, CosPhi; UL3 IL3
19050	float	RD	_FREQ	Hz	Frequency
19052	float	RD	_PHASE_SEQ		Rotation field; 1=right, 0=none, -1=left
19054*	float	RD	_WH_V[0]	Wh	Active energy L1, obtained
19056*	float	RD	_WH_V[1]	Wh	Active energy L2, obtained
19058*	float	RD	_WH_V[2]	Wh	Active energy L3, obtained
19060	float	RD	_WH_V_HT_SUML13	Wh	Active energy L1..L3
19062	float	RD	_WH_V[0]	Wh	Active energy L1, obtained
19064	float	RD	_WH_V[1]	Wh	Active energy L2, obtained
19066	float	RD	_WH_V[2]	Wh	Active energy L3, obtained
19068	float	RD	_WH_V_HT_SUML13	Wh	Active energy L1..L3, consumed, tariff 1
19070	float	RD	_WH_Z[0]	Wh	Active energy L1, supplied
19072	float	RD	_WH_Z[1]	Wh	Active energy L2, supplied
19074	float	RD	_WH_Z[2]	Wh	Active energy L3, supplied
19076	float	RD	_WH_Z_SUML13	Wh	Active energy L1..L3, supplied
19078	float	RD	_WH_S[0]	VAh	Apparent energy L1
19080	float	RD	_WH_S[1]	VAh	Apparent energy L2
19082	float	RD	_WH_S[2]	VAh	Apparent energy L3
19084	float	RD	_WH_S_SUML13	VAh	Apparent energy L1..L3
19086*	float	RD	_IQH[0]	varh	Reactive energy, inductive, L1
19088*	float	RD	_IQH[1]	varh	Reactive energy, inductive, L2
19090*	float	RD	_IQH[2]	varh	Reactive energy, inductive, L3
19092	float	RD	_IQH_SUML13	varh	Reactive energy L1..L3
19094	float	RD	_IQH[0]	varh	Reactive energy, inductive, L1

* The assignment of the marked device addresses does not correspond to the assignment of other devices of the UMG series.

Address	Format	RD/WR	Variable	Unit	Remark
19096	float	RD	_IQH[1]	varh	Reactive energy, inductive, L2
19098	float	RD	_IQH[2]	varh	Reactive energy, inductive, L3
19100	float	RD	_IQH_SUML13	varh	Reactive energy L1..L3, ind.
19102	float	RD	_CQH[0]	varh	Reactive energy, capacitive, L1
19104	float	RD	_CQH[1]	varh	Reactive energy, capacitive, L2
19106	float	RD	_CQH[2]	varh	Reactive energy, capacitive, L3
19108	float	RD	_CQH_SUML13	varh	Reactive energy L1..L3, cap.
19110	float	RD	_THD_ULN[0]	%	Harmonic, THD, U L1-N
19112	float	RD	_THD_ULN[1]	%	Harmonic, THD, U L2-N
19114	float	RD	_THD_ULN[2]	%	Harmonic, THD, U L3-N
19116	float	RD	_THD_ILN[0]	%	Harmonic, THD, I L1
19118	float	RD	_THD_ILN[1]	%	Harmonic, THD, I L2
19120	float	RD	_THD_ILN[2]	%	Harmonic, THD, I L3

19.2 Number formats

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

NOTE

Note on saving measured values and configuration data:
Since the following measured values are saved in a non-volatile memory every 5 minutes, the recording may **be interrupted for a** maximum of 5 minutes in case the operating voltage fails:
· Comparator timer
· S0 counter statuses
· Min. / Max. / mean values (without the date and time)
· Energy values

Configuration data is saved immediately.

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

19.3 Dimensional drawings

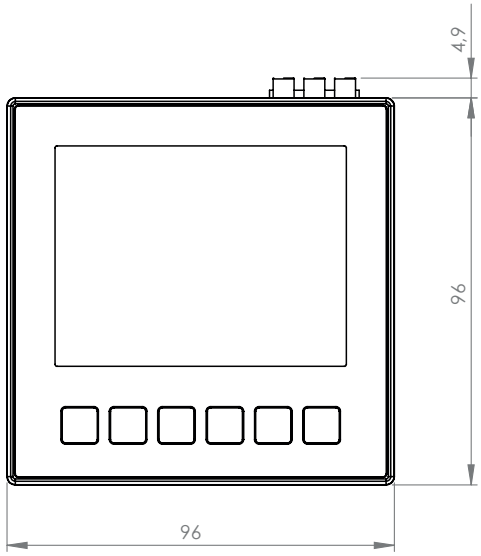
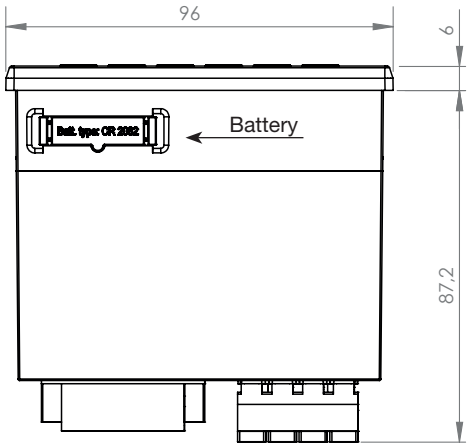


Fig. Front view



1) View from below

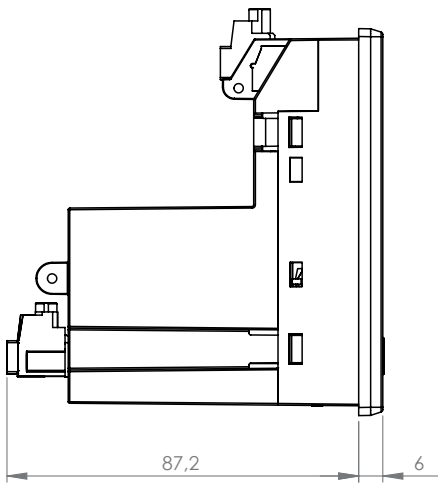


Fig. Side view

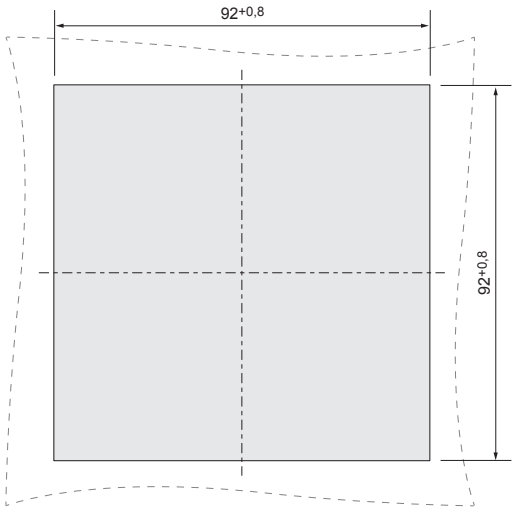
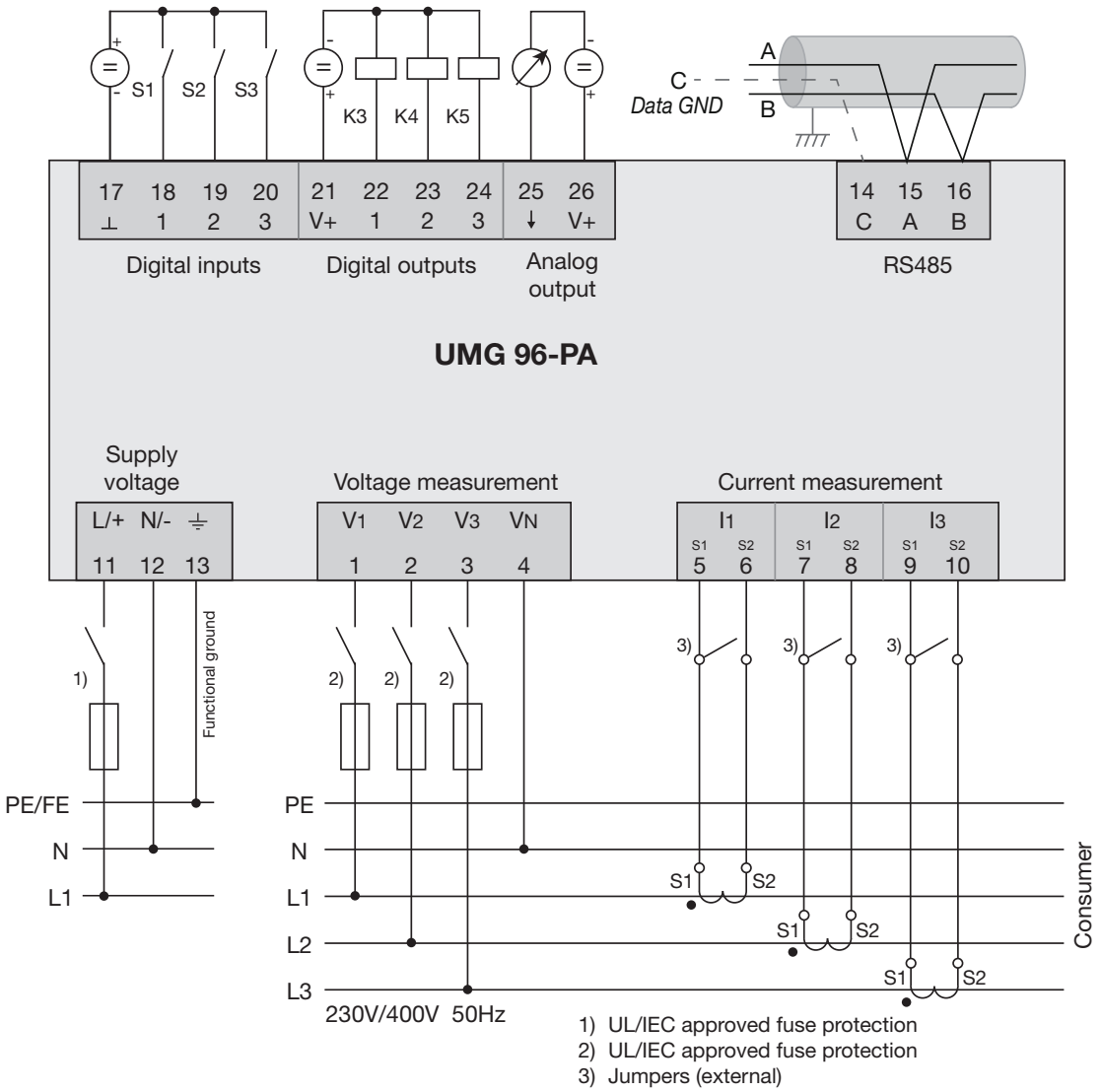


Fig. Cut-out size

19.4 Connection example 1



1) UL/IEC approved fuse protection
2) UL/IEC approved fuse protection
3) Jumpers (external)

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