

MID Energy Meter EMD 485-P3

User manual



The device front may deviate!



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Characteristics

The device can measure and display:

- Grid voltage and THD% (total harmonic distortion) of all phases
- Grid frequency
- Current, current demand and current THD% of all phases
- Power, maximum power demand, and power factor
- Active and reactive energy (imported and exported)

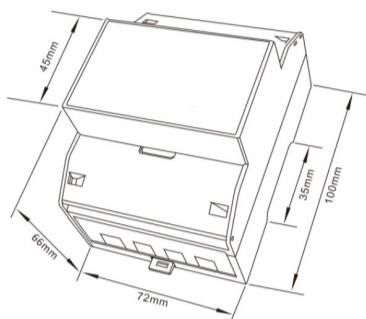
The password-protected setup menu allows to:

- Select the grid system: 3p4w, 3p3w, 1p2w, 1p3w
- Configure the device, e.g., Modbus parameters, display settings, demand interval time
- Reset the max. demand and the digital input counters
- Change the password

Features

- Certified according to the Measuring Instruments Directive (MID) 2014/32/EU.
- Up to 100 A alternating current measurement
- Bidirectional energy measurement IMP & EXP
- Two digital inputs as counters
- RS485 Modbus RTU for remote monitoring and setup
- Din rail mounting 35 mm (DIN EN 60715)
- Accuracy class C active energy

Dimensions



Introduction

This document provides instructions for installation, operation, and maintenance.

Device description

The energy meter (device) measures and displays important electrical parameters in three-phase four-wire (3p4w), three-phase three-wire (3p3w), single-phase two-wire (1p2w), and single-phase three-wire (1p3w) grid systems. The energy measurement is bidirectional, i.e. imported and exported energy are measured separately, so that, for example, the solar gain of a PV system can also be recorded.

The maximum demand of current and power can be measured over preset periods of up to 60 minutes.

The device has measurement inputs for voltages and currents. It supports direct measurement up to 100 A. The direct connection results in a cost-saving solution, eliminating the need for wiring the current transformers.

The device provides an RS485 serial port with Modbus RTU protocol for communication and to enable remote monitoring and control of the device.

Intended use

The MID-certified device is intended for the following uses:

- Measurement of power and cumulative energy in accordance with class B EN 50470-3/ ANSI C12-20:2010 in the specified grid systems.
- Installation in weather-protected switchboard cabinets and small distribution boards in industrial and residential environments. The installation position is arbitrary.
- For indoor use only.
- Use in accordance with national specifications.

Improper use:

The following is considered improper use:

- Operation outside the specifications, e.g., regarding operating/measuring voltage or current, environmental specifications, etc.
- Too high or wrong external back-up fuse (fig. 5).
- Installation in vehicles! Use of the device in non-stationary equipment constitutes an exceptional environmental condition and is only permissible by special agreement.
- Installation in environments with harmful oils, acids, gases, vapors, dusts, radiation, etc.

Safety precautions



- During normal operation, life-threatening voltages may be present at some terminals of this device. Installation, operation, and maintenance must only be carried out by qualified and trained personnel in compliance with local regulations. Ensure that all power supplies are de-energized before connecting the device or performing any other work.
- After installation, the terminals must not be accessible to the user. The external installation precautions must be sufficient to prevent hazards under fault conditions.
- This device is not intended to function as part of a system that serves as the sole means of protection against faults – good engineering practice requires that each critical function is protected by at least two independent and different means.
- The device does not have an internal fuse. Upstream fuses for line protection are required in all phases. If the circuit is faulty or abnormal, the fuse will blow quickly for line protection and safety.
- Install and operate the device according to the Technical Data specified in this manual.
- If this device is manipulated or used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

Installation

⚠ WARNING

Risk of injury from electrical voltage!
Touching live wires or exposed conductors and touching dangerous device inputs can cause severe physical harm or death.

- **Switch off your installation before starting any work! Secure the equipment against being switched on!**
- **Verify that it is disconnected from power! Ground and short-circuit!**
- **Cover or block any nearby live parts!**

Observe all safety precautions before installation!

- Mount the device on a 35 mm mounting rail in a switchboard cabinet or small distribution board.
- Connect the line inputs to the terminals as shown. The terminals 1-8 have 25 mm² connecting capacity.

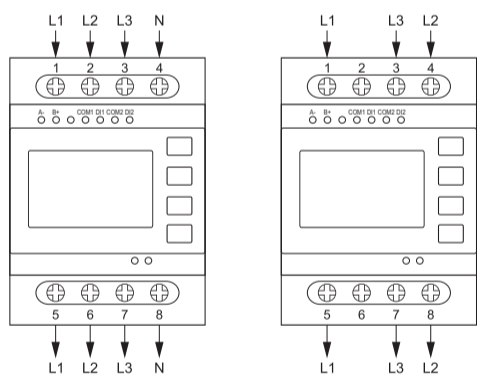


Figure 1. Left: Three-phase four-wire (3p4w) Right: Three-phase three-wire (3p3w)

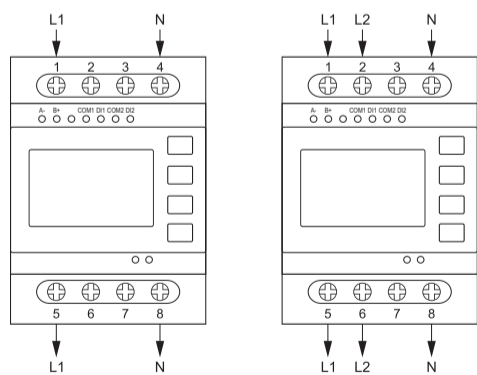


Figure 2. Left: Single-phase two-wire (1p2w) Right: Single-phase (split-phase) three-wire (1p3w). Note: The 1p3w grid system is not covered by the MID directive.

- Connect RS485 and/or digital inputs if required.

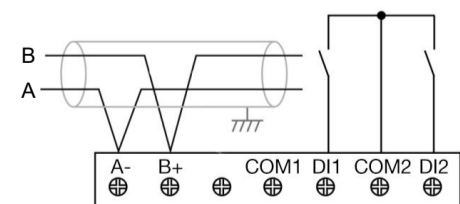
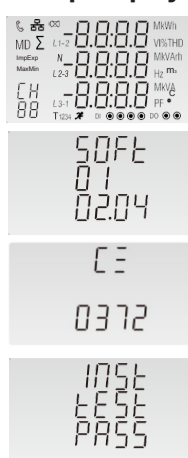


Figure 3. Connection of RS485 and digital inputs

Start-up displays



*After a short delay, the display shows the measurement display for active energy.

Button functions

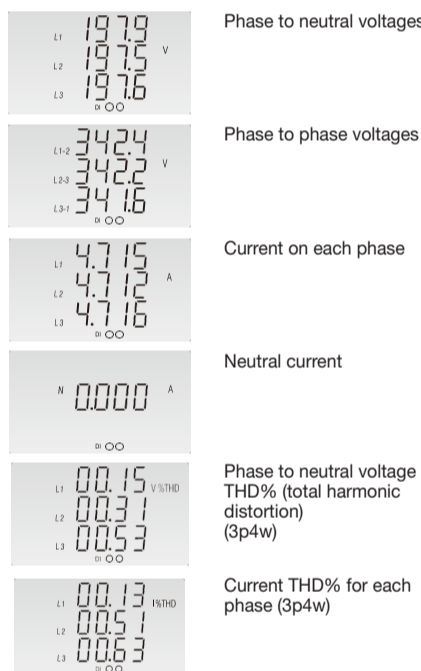
The buttons operate as follows:

- V/A ESC**: Selects the **Voltage** and **Current** displays. In the setup menu, this is the "Left" or "Back" button.
- MD PF Hz**: Selects the **Frequency** and **Power factor** displays. In the setup menu, this is the "Up" button.
- P**: Selects the **Power** displays. In the setup menu, this is the "Down" button.
- E**: Selects the **Energy** displays. In the setup menu, this is the "Enter" or "Right" button.

Measured value displays

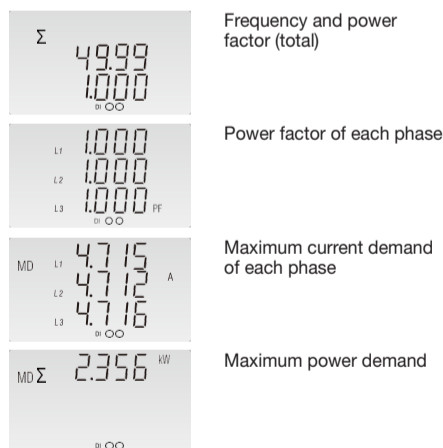
Voltage and current

Each time you press the **V/A** button, the next display is shown:



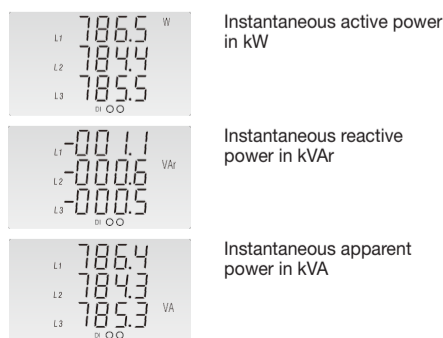
Frequency, power factor, max. demand

Each time you press the **MD** button, the next display is shown:



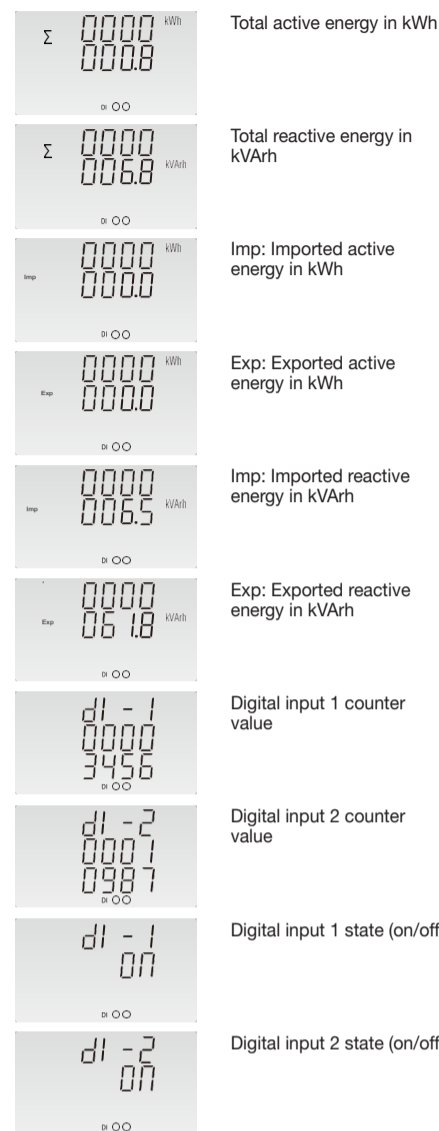
Power

Each time you press the **P** button, the next display is shown:



Energy

Each time you press the **E** button, the next display is shown:

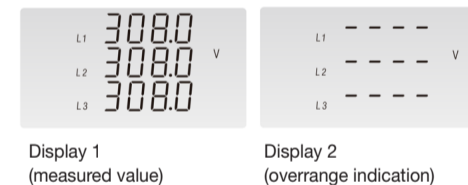


Underrange and overrange

Indication on the display

On the voltage, current, and power displays, etc., when the measured values are below the measurement range, the display shows "0". When the measured values are above the measurement range, two displays alternate. One shows the actual measured value and the other shows "—" symbols.

Example: If the voltage is exceeded, the display alternates at short intervals between the following two displays:



Defined thresholds

	Underrange	Overrange
Voltage	< 100 V (for L-N / L-L)	> 480 V (for L-N / L-L)
Current	< 0.04 A (for L-N / L-L)	> 100 A (for L-N / L-L)
Power	< 8 W (VAr)(VA) (for L-N / L-L)	> 48000 W(VAr)(VA) (for L-N / L-L)

Note: The threshold values of underrange and overrange are the secondary values of the meter.

Setting-up the device

The setup menu is password-protected. To enter the setup menu, press the **[E_{SET}]** button for 3 seconds until the password display appears:

PASS
0000

Enter the password (default '1000'). Use the **[MD]** and **[P]** buttons to set the flashing digit. When the password is entered, press the **[E_{SET}]** button for 3 seconds.

PASS
ERR

If an incorrect password is entered, the display shows: PASS Err

To exit the setup menu, press the **[VIA]** button repeatedly until the measurement display is shown.

Input methods for setting up

Some menu items, such as the password, require the entry of four-digit number (A), while others, such as grid system, require a selection from a list of options (B).

(A) Entering numbers

When setting up the device, some displays require to enter a number. In particular, on entry to the setting up section, a password must be entered. Digits are set individually from left to right. The procedure is as follows:

- 1) The current digit to be set flashes. Use the **[MD]** and **[P]** buttons to set the currently flashing digit.
- 2) Press the **[E_{SET}]** button to confirm setting of each digit.
- 3) Press the **[E_{SET}]** button for 3 seconds to confirm an entry.
- 4) After setting, press **[VIA]** to exit the setting routine.

(B) Selecting an option

- 1) Use the **[MD]** and **[P]** buttons to select the required option from the menu. The selection does not scroll between the bottom and top of the list.
- 2) Press the **[E_{SET}]** button to confirm your selection.
- 3) If an item flashes, use the **[MD]** and **[P]** buttons to select the desired option. If not, there may be a further layer.
- 4) After completing a setting, press the **[VIA]** button to return to a higher menu level.

Confirming and exiting setup mode

To save a setting and to return the main setup menu, press and hold the **[E_{SET}]** button for 3 seconds.

To cancel a setting without changing it, press the **[VIA]** button. The setup menu is displayed.

To exit the setup menu, press the **[VIA]** button repeatedly until the measurement display is shown.

RS485 parameters

The device provides an RS485 serial port with Modbus RTU protocol for communication and to enable remote monitoring and control of the device. Set up the Modbus parameters using the described procedures.

Note: You can use the PC software GridVis® for remote monitoring, analysis and visualization of the measured data. The device must be connected to the PC via an Ethernet Modbus gateway (RS485 Modbus RTU to TCP) or via an USB to RS485 converter.

Modbus address

SEt
ADDId
001

From the setup menu, use the **[MD]** and **[P]** buttons to select the Address ID. The range is from 001 to 247.

SEt
ADDId
001

Press **[E_{SET}]** button to enter the selection routine. The current setting flashes.

SEt
ADDId
001

Use the **[MD]** and **[P]** buttons to choose Modbus address (001 to 247).

Baud rate

SEt
BAUD
96

From the setup menu, use the **[MD]** and **[P]** buttons to select the baud rate option.

SEt
BAUD
96

Press **[E_{SET}]** to enter the selection routine. The current setting flashes.

SEt
BAUD
96

Use **[MD]** and **[P]** buttons to choose the baud rate (2.4k, 4.8k, 9.6k, 19.2k, 38.4k, 115.2k).

Parity

SEt
PARId
NONE

From the setup menu, use the **[MD]** and **[P]** buttons to select the Parity option.

SEt
PARId
NONE

Press **[E_{SET}]** to enter the selection routine. The current setting flashes.

SEt
PARId
NONE

Use the **[MD]** and **[P]** buttons to choose parity (EVEN / ODD/ NONE). Default is NONE.

Stop bits

Note: Default is 1, and only when the parity is NONE the stop bit can be changed to 2.

SEt
SEtOP
1

From the setup menu, use the **[MD]** and **[P]** buttons to select the Stop bit option.

SEt
SEtOP
1

Press **[E_{SET}]** to enter the selection routine. The current setting flashes.

SEt
SEtOP
1

Use the **[MD]** and **[P]** buttons to choose Stop Bit (2 or 1).

Demand integration time (DIT)

The device continuously records the highest current and power values for the set interval. The peak value of the last interval is compared with the stored peak value; only the overall highest value is stored until the demand values are reset. The options are: 0, 5, 8, 10, 15, 20, 30, 60 minutes (0= real time update).

SEt
dIT
60

From the setup menu, use the **[MD]** and **[P]** buttons to select the DIT option. The display shows the currently selected integration time.

SEt
dIT
60

Press **[E_{SET}]** to enter the selection routine. The currently set interval flashes (unit: minutes).

SEt
dIT
10

Use the **[MD]** and **[P]** buttons to select the interval required.

SEt
dIT
10

Press **[E_{SET}]** to confirm the selection.

Press **[VIA]** to exit the DIT selection and to return to the main setup menu.

Backlight lasting period (LP)

You can set the lasting period of the blue backlight after the last button press. Note: If you set LP to "on" or "off", the backlight is permanently on or off, respectively.

SEt
LP
60

The default lasting period is 60 minutes. For example, if LP is set to 5, the backlight turns off 5 minutes after the last operation on the meter.

SEt
LP
60

Press **[E_{SET}]** to enter the selection routine. The current setting flashes. The options are: on, 5, 10, 30, 60, 120 minutes, off.

Use the **[MD]** and **[P]** buttons to select the backlight lasting period. Then press **[E_{SET}]** to confirm the setting.

Grid system (SYS)

Select the grid system being monitored.

SEt
SYS
3P4

From the setup menu, use the **[MD]** and **[P]** buttons to select the SYS option. The display shows the currently selected grid system.

SEt
SYS
3P4

Press **[E_{SET}]** to enter the selection routine. The current selection flashes.

SEt
SYS
1P2

Use the **[MD]** and **[P]** buttons to select the grid system: 1P2(W), 3P3(W), 3P4(W). For 1p3w grid systems, also select 3P4.

SEt
SYS
1P2

Press **[E_{SET}]** to confirm the selection.

Clear max. demands (CLR)

This option allows to reset the maximum demands of current and power.

CLR

From the setup menu, use the **[MD]** and **[P]** buttons to select the reset option.

MD CLR

Press **[E_{SET}]** until "MD" flashes. Press **[E_{SET}]** again ("MD" is still flashing) until "GOOD" is displayed.

Set Password (PASS)

SEt
PASS
1000

Use the **[MD]** and **[P]** buttons to select the PASS option.

SEt
PASS
1000

Press **[E_{SET}]** to enter the password changing routine. The new password display appears with the first digit flashing.

SEt
PASS
1000

Use the **[MD]** and **[P]** buttons to set the first digit. Press **[E_{SET}]** to confirm your selection. The next digit flashes.

SEt
PASS
1100

Repeat the procedure for the remaining three digits.

SEt
PASS
1100

After setting the last digit, SET is displayed.

Filter time of digital inputs (FLTR)

The meter only counts pulses whose duration is longer than the set filter time in milliseconds.

SEt
dI
FLTR

From the setup menu, use the **[MD]** and **[P]** buttons to select the filtering time setting.

dI
FLTR
100

Press **[E_{SET}]** to enter the filtering time setting routine. The first digit flashes.

dI
FLTR
100

Press **[MD]** or **[P]** to set the first digit and press **[E_{SET}]** to confirm your selection. The next digit flashes.

dI
FLTR
100

Repeat the procedure for the remaining digit. After setting the last digit, press **[E_{SET}]** to confirm the setting.

Technical data

General	
Net weight	approx. 325 g (0.71 lbs)
Total weight (incl. packaging)	approx. 395 g (0.87 lbs)
Width in horizontal pitches	4 HP (1 HP = 18 mm)
Power consumption	approx. 1 W
Fuse, external	100 A fast
Warm-up time	5 s
Backlight service life	10 years (50% of the start brightness)
Digital inputs	2 counters
Optical pulse output LED for total active energy	400 imp/kWh
Material	self-extinguishing UI94 V-0

Environmental conditions	
Install the device in a weather-protected and stationary location.	
Protection class II according to IEC 60536 (VDE 0106, Part 1).	
Rated temperature range (operation and storage)	-40 °C (-40 °F) .. +70 °C (158 °F)
Relative air humidity	0 .. 90%, no condensation
Operating altitude	0 .. 2000 m (6562 ft) above sea level
Pollution degree	2
Mounting orientation	Any
Ventilation	No forced ventilation required.
Protection rating: Front panel / other areas	IP20 on terminal blocks without protective housing and IP51 in protective housing, in accordance with IEC 60529
Vibration	10 .. 50 Hz, IEC 60068-2-6, 2g
Shock	up to 30 kg of shock to the front, back and sides

Voltage and current measurement	
Nominal voltage	230 / 400 V AC
Measuring range L-N	100 .. 277 V AC
Measuring range L-L (3p3w)	172 .. 480 V AC
Supported grid systems	3p3w, 3p4w, 1p2w, 1p3w
Measurement category (IEC 61010-1)	300 V CAT III
AC withstand voltage;	4 kV for 1 minute;
Pulse withstand voltage	6 kV-1.2 uS waveform
Harmonics	1 .. 31.
Measuring range	0.3 .. 10 (100) A _{eff}
Maximum current	100 A
Nominal current	10 A
Minimum current	0.3 A
Starting current	0.04 A
Crest factor (relative to maximum current)	10
Overload for 0.01 s	3000 A
Resolution	1 mA
Overvoltage category	III
Rated surge voltage	4 kV

Power factor, frequency and max. demand	
Frequency	50 / 60 Hz (±10 %)
Instantaneous values:	
- Active power	0 .. 3600 MW
- Reactive power	0 .. 3600 MVar
- Apparent power	0 .. 3600 MVA
Maximum demanded power since last demand reset	
Maximum neutral demand current since the last demand reset (3p4w only)	
Power factor range	-1.0 .. 1.0

Energy Measurements	
Imported/exported active energy	0 .. 9999999.9 kWh
Imported/exported reactive energy	0 .. 9999999.9 kVarh
Total active energy	0 .. 9999999.9 kWh
Total reactive energy	0 .. 9999999.9 kVarh

Accuracy	
Accuracy class	MID Class C
Voltage	0.5 % of the maximum range
Current	0.5 % of the nominal current
Frequency	0.2 % of the mid frequency
Power factor	1 % of the unit (0.01)
Active power (W)	±1 % of the maximum range
Reactive power (VAr)	±1 % of the maximum range
Apparent power (VA)	±1 % of the maximum range
Active energy (Wh)	Class 0.5 - IEC 62053-21 Class C - EN 50470-3
Reactive energy (VARh)	Class 2 - IEC 62053-23
Total harmonic distortion	1 % up to 31st harmonic
Response time to digital input	100 ms, typical, to > 99 % of final reading, at 50 Hz

Connection capacity and torques of the clamping points	
Connectible conductors. Only connect one conductor per terminal point!	
Single core, multi-core, fine-stranded, wire ferrules	
Voltage/current measurement	4 .. 25 mm ² (AWG4)
	2.5 - 3 Nm (22.13 - 26.55 lbf in)
Other terminals	0.5 .. 2.5 mm ² (AWG14)
	0,2-0,4 Nm (1.77 - 3.54 lbf in)

Reference conditions of influencing quantities	
Influencing quantities are variables that affect measurement errors to a minor degree. Accuracy is verified under nominal value (within the specified tolerance) of these conditions.	
Ambient temperature	23 °C ±1 °C
Input frequency	50 Hz (MID) 45 .. 65 Hz (non-MID)
Input waveform	Sinusoidal (distortion factor < 0.005)
Magnetic field of external origin	Terrestrial flux

RS485 port for Modbus RTU	
The following RS485 communication parameters can be configured from the setup menu:	
Baud rate (bps)	2400, 4800, 9600, 19200, 38.4k, 115.2k (default: 115.2k)
Parity	none (default)/odd/even
Stop bits	1 or 2
RS485 network address	3-digit number, 001 .. 247
The byte order is high byte/low byte ("big-endian", not configurable).	

Troubleshooting

Failure	Cause	Remedy
No display	External fuse for the supply voltage has tripped.	Replace fuse.
No current display.	No measured voltage connected. No measured current connected.	Connect measured voltage. Connect measured current.
Displayed current is too great or too small.	Current measurement on the wrong phase.	Check connection and correct if necessary.
	Current transformer factor incorrectly programmed.	Read and program the current transformer ratio on the current transformer.
	Current harmonic exceeds current peak value at measuring input.	Install current transformers with a higher current transformer ratio.
Displayed voltage is too high or too low.	The current at the measuring input is too low.	Install current transformers with a lower current transformer ratio.
	Measurement on the wrong phase.	Check connection and correct if necessary.
Displayed voltage is too high or too low.	Voltage transformer programmed incorrectly.	Read the voltage transformer ratio on the voltage transformer and program.
	Overrange.	Use a voltage transformer.
Despite the above measures, the device does not function.	The voltage peak value at the measuring input was exceeded due to harmonics current.	Attention! Make sure that the measuring inputs are not overloaded.
	Device defective.	Send the device and error description to the manufacturer for inspection.

Maintenance and service

Use a dry, soft cloth to clean the device and the display. Do not use water or other solvents for cleaning as this may damage the device.

Repair and calibration of the device must only be carried out by the manufacturer or an accredited laboratory! The manufacturer recommends calibrating the device every 5 years!

For questions or in case of failures not described above, please contact the manufacturer. A warranty is only assumed for unopened devices with intact safety seal.

Disposal

Please abide by national regulations! Dispose of individual parts, as applicable, depending on their composition and existing country-specific regulations (e.g. as electronic waste, plastics, metals) or engage a certified disposal company to handle scrapping.



Additional documentation, e.g., the Modbus address list, can be found on our website www.janitza.com under Downloads.