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MID Energy Meter
EMD 485-CT3-A

User manual



The device front may deviate!

Janitza

Janitza electronics GmbH
Vor dem Polstück 6
D-35633 Lahnau | Germany
Support +49 6441 9642-22
info@janitza.com | www.janitza.com

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. External current transformers (CT) are required for current measurement. A wide range of CTs is available, giving the device a wide range of applications. Use calibrated transformers if the MID-certified device is used for billing purposes!

The device can be supplied by a separate auxiliary voltage (AC or DC). Alternatively, it can also be supplied from the monitored grid system, where appropriate.

Intended use

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

- Measurement of power and cumulative energy in the specified grid systems.
- Installation in wheather-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. An external 1 A/300 V AC fast-blow fuse at terminal 5 (Fig. 5) is required. If the circuit is faulty or abnormal, the fuse will blow quickly for line protection and safety.
- Never operate current transformers (CTs) open on the secondary side, as dangerously high voltages can occur. Short-circuit the secondary connections of the CTs if you disconnect the secondary circuits.
- The CTs connected to this device must meet double insulation requirements. The secondary connection can be grounded depending on the CT (refer to the CT documentation).
- 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.

Characteristics

The device can measure and display:

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

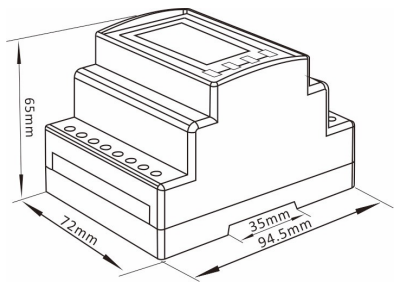
The password-protected setup menu allows to:

- Select the grid system: 1p2w, 3p3w, 3p4w
- Configure the device, e.g., Modbus parameters, display settings, demand interval time
- Reset the maximum demand values (power/current)
- Change the password

Features

- Certified according to the Measuring Instruments Directive (MID) 2014/32/EU.
- Bidirectional measurement IMP & EXP
- Two digital inputs as counters
- RS485 Modbus RTU for remote monitoring and setup
- Din rail mounting 35 mm (DIN EN 60715)
- ..1/..5A current transformer (CT) connection
- Accuracy class 0.5 active energy

Dimensions



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 voltage inputs to terminals 1-4 and the external CTs to the three current inputs (fig. 1 to 4). The terminals have 2.5 mm² connecting capacity.

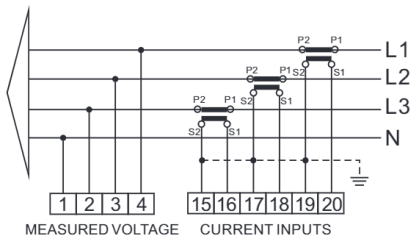


Figure 1. Three-phase four-wire (3p4w)

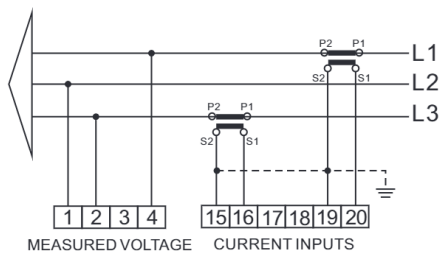


Figure 2. Three-phase three-wire (3p3w)

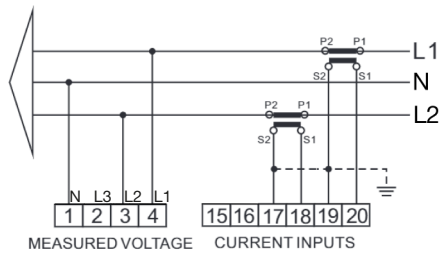


Figure 3. Single-phase (split-phase) three-wire (1p3w).
Note: This grid system is not covered by MID directive.

Set the grid system to 3p4w.

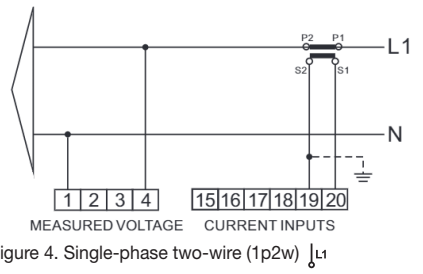


Figure 4. Single-phase two-wire (1p2w)

- Connect the auxiliary supply via an external fuse (fig. 5, terminal has 2.5 mm² connecting capacity).

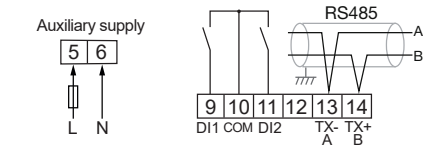


Figure 5. Supply and communication connections

Start-up displays



The first display lights up all display segments and can be used as a display check.



The second display indicates the firmware installed in the device and its build number.



The next display indicates an additional internal version number.



The device performs a self-test and indicates the result if the test passes.

*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 ESC button, the next display is shown:



Phase to neutral voltages



Phase to phase voltages



Current on each phase



Neutral current



Phase to neutral voltage THD% (total harmonic distortion)



Current THD% for each phase

Frequency, power factor, max. demand

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



Frequency and power factor (total)



Power factor of each phase



Maximum current demand of each phase



Maximum power demand

Power

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



Instantaneous active power in kW



Instantaneous reactive power in kVAr



Instantaneous apparent power in kVA



Total kW, kVAr, kVA

Energy

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



Total active energy in kWh



Total reactive energy in kVArh



Imp: Imported active energy in kWh



Exp: Exported active energy in kWh



Imp: Imported reactive energy in kVArh



Exp: Exported reactive energy in kVArh



Digital input 1 counter value



Digital input 2 counter value



Digital input 1 state (on/off)



Digital input 2 state (on/off)

Energy values can only be reset via modbus.

Underrange and overrange

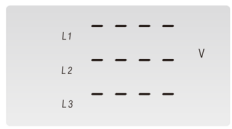
Indication on the display

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:



Display 1
(measured value)



Display 2
(overrange indication)

Defined thresholds

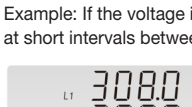
	Underrange	Overrange
Voltage	< 30 V (for L-N / L-L)	> 317 V (for L-N) > 550 V (for L-L)
Current	< 0.004 A (for L-N / L-L)	> 6 A (for L-N / L-L)
Power	< 1 W (VAr)(VA) (for L-N / L-L)	> 1830 W(VAr)(VA) (for L-N) > 3180 W(VAr)(VA) (for L-L

Note: The threshold values of underrange and overrange are the secondary values of the meter. CT and PT ratios are not included.

For example: If the CT ratio is 10, it is underrange when the current is less than 0.04 A (= 0.004*10). It is overrange when the current is over 60 A (= 6*10).

Setting-up the device

The setup menu is password-protected. To enter the setup menu, press the E button for 3 seconds until the password display appears:



Enter the password (default ‘1000’). Use the MD PF Hz and P buttons to set the flashing digit.
When the password is entered, press the E button for 3 seconds.

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

To exit the setup menu, press the V/A ESC button repeatedly until the measurement display is shown.

Input methods for setting up

Some menu items, such as password and CT, 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 PF Hz and P buttons to set the currently flashing digit.
2) Press the E button to confirm setting of each digit.
3) Press the E button for 3 seconds to confirm an entry.
4) After setting, press V/A ESC to exit the setting routine.

(B) Selecting an option

1) Use the MD/PF Hz 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 button to confirm your selection.
3) If an item flashes, use the MD/PF Hz and P buttons to select the desired option. If not, there maybe a further layer.
4) After completing a setting, press the V/A/esc 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 button for 3 seconds.

To cancel a setting without changing it, press the V/A/esc button. The setup menu is displayed.

To exit the setup menu, press the V/A/esc 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



From the setup menu, use the MD/PF Hz and P buttons to select the Address ID. The range is from 001 to 247.



Press E button to enter the selection routine. The current setting flashes.



Use the MD/PF Hz and P buttons to choose Modbus address (001 to 247).

Baud rate



From the setup menu, use the MD/PF Hz and P buttons to select the baud rate option.



Press E to enter the selection routine. The current setting flashes.



Use MD/PF Hz and P buttons to choose the baud rate (2.4k, 4.8k, 9.6k, 19.2k, 38.4k, 115.2k).

Parity



From the setup menu, use the MD/PF Hz and P buttons to select the Parity option.



Press E to enter the selection routine. The current setting flashes.



Use the MD/PF Hz 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.

From the setup menu, use the MD/PF Hz and P buttons to select the Stop bit option.



Press E to enter the selection routine. The current setting flashes.



Use the MD/PF Hz and P buttons to choose Stop Bit (2 or 1).

Current transformer (CT)

Enter the correct current transformer ratio.

Note: Due to MID certification, you can only change the current transformer ratio once during initial commissioning. Subsequent changes are not possible.



From the setup menu, use the MD/PF Hz and P buttons to select the CT2 option.



Press E to enter the secondary current of the CT (5 A or1 A) as the nominal input current for the meter.



Press E to enter the primary current of the CT. The range is from 0001 to 9999 A.

Voltage transformer (PT)

If voltage transformers are used, enter the transformer ratio.

Note: Due to MID certification, you can only change the voltage transformer ratio once during initial commissioning. Subsequent changes are not possible.



From the setup menu, use the MD/PF Hz and P buttons to select the PT2 option. The PT2 display shows the secondary voltage value. The default value is 400 V.



Press E to enter the secondary voltage of the PT. The range is from 100 to 500 V.



Press E to enter the primary voltage of the PT. The range is from 0001 to 9999 V.

Note: It is not necessary that the PT1 and PT2 values correspond to the real voltages. The ratio PT1/PT2 must only correspond to the transformer ratio.

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).



From the setup menu, use the MD/PF Hz and P buttons to select the DIT option. The display shows the currently selected integration time.



Press E to enter the selection routine. The currently set interval flashes (unit: minutes).



Use the MD/PF Hz and P buttons to select the interval required.



Press E to confirm the selection.

Press V/A/esc 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.



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.



Press E to enter the selection routine. The current setting flashes.
The options are: on, 5, 10, 30, 60, 120 minutes, off.

Use the MD/PF Hz and P buttons to select the backlight lasting period. Then press E to confirm the setting.

Grid system (SYS)

Select the grid system being monitored.



From the setup menu, use the MD/PF Hz and P buttons to select the SYS option. The display shows the currently selected grid system.



Press E to enter the selection routine. The current selection flashes.

Use the MD/PF Hz and P buttons to select the grid system: 1P2(W), 3P3(W), 3P4(W), 1P3(W).



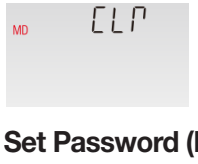
Press E to confirm the selection.

Clear max. demands (CLR)

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



From the setup menu, use the MD/PF Hz and P buttons to select the reset option.



Press E until “MD” flashes.
Press E again (“MD” is still flashing) until “GOOD” is displayed.

Set Password (PASS)



Use the MD/PF Hz and P buttons to select the PASS option.



Press E to enter the password changing routine. The new password display appears with the first digit flashing.



Use the MD/PF Hz and P buttons to set the first digit.
Press E to confirm your selection. The next digit flashes.



Repeat the procedure for the remaining three digits.



After setting the last digit, SET is displayed.

Correction of reversely connected current inputs



Use the MD/PF Hz and P buttons to select the SYS CONT option.



Press E to enter phase A (L1). The default is forward (Frd). If the current direction is reversed at the CTs, choose REv (reverse).



Use the MD/PF Hz and P buttons to access the settings for phase B (L2) and C (L3).

Filter time of digital inputs (FLTR)

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



From the setup menu, use the MD/PF Hz and P buttons to select the filtering time setting.



Press E to enter the filtering time setting routine.
The first digit flashes.



Press MD/PF Hz or P to set the first digit and press E to confirm your selection. The next digit flashes.



Repeat the procedure for the remaining digit. After setting the last digit, press E to confirm the setting.

Technical data

General	
Net weight	approx. 246 g (0.54 lbs)
Total weight (incl. packaging)	approx. 315 g (0.69 lbs)
Width in horizontal pitches	4 HP (1 HP = 18 mm)
Warm-up time	1 min
Backlight service life	10 years (50% of the start brightness)
Digital inputs	2 counters
Optical pulse output LED for total active energy	3200 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

Auxiliary supply	
Nominal range	AC 100 V .. 277 V (50/60 Hz) or DC 120 V .. 424 V
Power consumption	approx. 1 W
Fuse, external	1 A / 300 V AC fast

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; Pulse withstand voltage	4 kV for 1 minute; 6 kV-1.2 uS waveform
Harmonics	1. .. 31.
Measuring range	0.05 .. 5 (6) A_{rms}
Maximum current	6 A
Nominal current	5 A
Minimum current	0.05 A
Nominal current of CT	5 A or 1 A
Crest factor (relative to maximum current)	1.2
Overload for 0.01 s	20 times the maximum current
Resolution	0.1 mA
Overvoltage category	III
Rated surge voltage	4 kV

Power factor, frequency and max. demand	
Frequency	50 / 60 Hz (±10 %)
Instantaneous values: - Active power - Reactive power - Apparent power	 0 .. 3600 MW 0 .. 3600 MVAr 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 Class 0.5S - IEC 62053-22
Reactive energy (VARh)	Class 2 - IEC 62053-23
Total harmonic distortion	3 % up to 31st harmonic
Response time to digital input	1 s, typical, to > 99 % of final reading, at 50 Hz

Connecting capacity of the terminals	
Connectible conductors (105°C, 600V recommended). Only connect one conductor per terminal point!	
Single core or fine-stranded with wire ferrules	
Voltage/current measurement	0.5 .. 2.5 mm² (AWG14) 0,2-0,4 Nm (1.77 - 3.54 lbf in)
Other terminals	0.5 .. 2.5 mm² (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 or 60 Hz ±2 %
Input waveform	Sinusoidal (distortion factor < 0.005)
Auxiliary supply voltage	Nominal ±1 %
Auxiliary supply frequency	Nominal ±1 %
Auxiliary supply waveform (if AC)	Sinusoidal (distortion factor < 0.05)
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 current connected.	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.
	The current at the measuring input is too low.	Install current transformers with a lower current transformer ratio.
Displayed voltage is too high or too low.	Measurement on the wrong phase.	Check connection and correct if necessary.
	Voltage transformer programmed incorrectly.	Read the voltage transformer ratio on the voltage transformer and program.
Displayed voltage is too low.	Overrange.	Use a voltage transformer.
	The voltage peak value at the measuring input was exceeded due to harmonics current.	Attention! Make sure that the measuring inputs are not overloaded.
Despite the above measures, the device does not function.	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.

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