GOSSEN METRAWATT
GMC-INSTRUMENTS GROUP

OPERATING INSTRUCTIONS

3/11.24
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ENERGYMID

MULTIFUNCTIONAL ENERGY METERS

EM2281, EM2289 – DIRECT CONNECTION
EM2381, EM 2387, EM2389 – TRANSFORMER CONNECTION

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1 SAFETY INSTRUCTIONS

Read and follow these instructions carefully and completely in order to ensure safe and proper use.

Keep for future reference.

General

- The instrument may only be used by qualified electricians in the commercial field.
- The instrument may only be used for the measurements described in the documentation for the instrument.

Work Performed on the Instrument

- Work performed on the instrument may only be carried out by a qualified electrician.
- Wear suitable and appropriate personal protective equipment (PPE) whenever working with the instrument.
- Observe and comply with all safety regulations which are applicable for your work environment.
- The respective system, as well as all connection cables and leads, must be voltage-free before any work is performed on the instrument.
- Observe the five safety rules in accordance with DIN VDE 0105-100, Operation of electrical installations – Part 100: General requirements.
  (1. Shut down entirely. 2. Secure against restart. 3. Assure absence of voltage at all poles. 4. Ground and short circuit. 5. Cover neighboring live components, or make them inaccessible.)

Operation

- Only operate the instrument if it's in good working order.
  Inspect the instrument at regular intervals. Pay particular attention to damage.
- Connection cables and leads must be damage-free.
  Inspect connection cables and leads at regular intervals. Pay particular attention to damage, interrupted insulation or kinked cables.
- Use the accessories in undamaged condition only.
  Inspect the accessories before use. Pay particular attention to damage.
- If the device or accessories are damaged during use, permanently remove the device/accessories from operation and secure them against inadvertent use.
- If there are any signs of interior damage to the device or accessories (e.g. loose parts in the housing), permanently remove the device/accessories from operation and secure them against inadvertent use.
- Equipment and accessories from Gossen Metrawatt GmbH are designed to function ideally with products from Gossen Metrawatt GmbH which are specifically intended for this purpose. Unless expressly confirmed otherwise in writing by Gossen Metrawatt GmbH, they are not intended or suitable for use with other products.
- If the instrument or its accessories don't function flawlessly, permanently remove the instrument/accessories from operation and secure them against inadvertent use.
- Do not use the device and its accessories after long periods of storage under unfavorable conditions (e.g. humidity, dust or extreme temperature).
- Do not use the device and its accessories after extraordinary stressing due to transport.
- Do not expose the instrument to direct sunlight.
- Only use the instrument and its accessories within the limits of the specified technical data and conditions (ambient conditions, IP protection code, measuring category etc.).
- Do not use the instrument in potentially explosive atmospheres. Danger of explosion!
- Do not use the instrument in areas subject to the risk of fire. Danger of fire!

Emissions (feature W8 LPWAN only)

- This instrument is equipped with a radio interface supporting the LoRaWAN® protocol. Determine whether or not use of the implemented ISM frequency band of 868 MHz is permissible in your country.

Data communication (feature W8 LPWAN only)

- The LoRaWAN® protocol permits configuration of the terminal device via the remote station. Ensure that the device is not operated with parameters that could lead to a violation of applicable directives and/or regulations.

Calibration

- Comply with national calibration regulations and laws.

Data Security and Protection

- The instrument determines values with relevance for billing. Observe and comply with currently valid regulations for data security and protection.
- Protect the instrument against unauthorized tampering. Use the functions provided by the instrument (e.g. sealing) as well as other appropriate measures (e.g. restricting physical access to the instrument).

2 APPLICATIONS

Please read this important information!

2.1 INTENDED USE / USE FOR INTENDED PURPOSE

ENERGYMID EM2281, EM2289, EM2381, EM2387 and EM2389 instruments are multifunctional energy meters (certified in accordance with MID – Measuring Instruments Directive 2014/32/EC).

They're used for the acquisition and billing of active energy, e.g. in industrial, household, commercial and building management applications. Integrated 4-quadrant measurement permits measurement of energy import and export. 4 tariffs (hardware-controlled as standard feature) and, depending on model or version, 4 additional tariffs (software-controlled) can be selected.

Thanks to MID certification, acquired data (display) can also be used for the purpose of billing energy costs to third parties.

- EM2281 (article no. U2281): for 2 wire system, 230 V, direct connection, 5(80) A
- EM2289 (article no. U2289): for 4-wire system, any load, direct connection, 5(80) A
- EM2381 (article no. U2381): for 2 wire system, 230 V, transformer connection 1(6) A (including 5(6) A)
- EM2387 (article no. U2387): for 3-wire system, any load, transformer connection, 1(6) A (including 5(6) A)
- EM2389 (article no. U2389): for 4-wire system, any load, transformer connection, 1(6) A (including 5(6) A)

Technical properties and other functions are defined via configurable features (e.g. pulse output, type of bus connection and meter reading profile). This results in individualized, device-specific variants when placing orders. Refer to the data sheet and your order for your instrument variant and its features.

All instruments include measures for protection against tampering (tamper-proof cover and configuration disabling).

Values are also forwarded to superordinate management systems via feature-dependent communication interfaces, e.g. for acquisition and optimization, as well as for building automation and control technology).
ENERGYMID energy meters are ideally suited for use with other components included in GOSSEN METRAWATT's Energy Control System (ECS) for the implementation of comprehensive systems for energy data collection: data from ENERGYMID energy meters can be retrieved by means of summators and data loggers, e.g. the SU1604 or SMARTCONTROL, and can be consolidated in energy management software, e.g. EMC 5.x. All relevant consumption data can then be archived, displayed, analyzed and billed.[1]

Safety of the operator, as well as that of the tester, is only assured when it's used for its intended purpose.

2.2 USE FOR OTHER THAN INTENDED PURPOSE

Using the instrument for any purposes other than those described in the condensed operating instructions or these instrument operating instructions is contrary to use for intended purpose. Use for other than the intended purpose may lead to unforeseeable damage!

2.3 LIABILITY AND GUARANTEE

The liability and warranty provided by Gossen Metrawatt GmbH are governed by the applicable contractual and mandatory statutory provisions.

1. Refer to https://www.gmc-instruments.de for information concerning additionally available components.

3 DOCUMENTATION

3.1 INFORMATION CONCERNING THESE INSTRUCTIONS

Read these instructions carefully and attentively. They contain all necessary information for safe use of the instrument. Comply with them in order to protect yourself and others from injury, and to avoid damaging the instrument.

The latest version of these instructions is available on our website:

https://www.gmc-instruments.de/en/services/download-center/

Descriptions of Instrument Variants

This documentation describes the following instruments and their variants: ENERGYMID EM2281, EM2289, EM2381, EM2387 und EM2389.

As a result, features and functions may be described which do not apply to your instrument. Furthermore, images may differ from your instrument or represent only one of several possible variants. Illustrations must therefore be regarded as representative examples.

Errors and Suggestions for Improvement

These instructions have been prepared with utmost care in order to ensure correctness and completeness. Unfortunately, errors can never be entirely avoided. Continuous improvement is part of our quality goal, so we always appreciate your comments and suggestions.

Gender Equality

For better readability, only the masculine form is used in these instructions in a grammatically impartial sense. The female and diverse forms are of course always implied as well.

Trademark Law

Product designations used in this document may be subject to trademark law, brand law and patent law. They are the property of their respective owners.

Copyright

3.2 IDENTIFICATION OF WARNINGS

Instructions for your safety and for the protection of the instrument and its environment are provided as warnings and notes at certain points within these instructions. They're laid out as shown below and are graded in terms of the severity of the respective hazard. They also describe the nature and cause of the hazard and what must be done to avoid it.

DANGER

Death or serious injury is almost certain.

WARNING

Death or serious injury is possible.

CAUTION

Minor or moderate injury is possible.

ATTENTION

Damage to the product or the environment is possible.

Note

Important information

Tip

Useful additional information or application tip

3.3 IDENTIFIERS

The following identifiers are used in this documentation:

Identifier/Symbol	Meaning
Control element	Keys, buttons, menus and other controls
✓ Prerequisite	A condition etc. which must be fulfilled before a given action can be taken
▶ **Procedure**	Beginning of a procedural instruction
1. Procedural step	Steps of a procedure which must be completed in the specified order
↳ Result	Result of a procedural step
■ Enumeration ■ Enumeration	Bullet lists
Abb. 1: Caption	Description of the content of a figure
Tab. 1: Table 1:	Description of the content of a table
Footnote	Comment

3.4 ICONS IN THE DOCUMENTATION

The following icons are used in this documentation:

Icon	Meaning
	Read and adhere to the product documentation.
	General warning symbol
	Warning regarding electrical voltage

Table 2: Icons used in this document

3.5 DEFINITION OF TERMS

Instrument	Energy meters ENERGYMID EM2281, EM2289, EM2381, EM2387 und EM2389.
Feature	Product feature (e.g. bus connection type, pulse output, measurement of reactive energy) – used to configure the instrument variant and is specified when the order is placed Overview ⇨ "Appendix" 🗎68
Meter reading profile	A series of meter readings taken at regular intervals with a discrete time interval and a time-stamp Feature Z1: Adjustable time interval Feature Z2: Fixed time interval, every 15 minutes (in accordance with PTB-A 50.7 and PTB-A 50.7-1) – with operating logbook and calibration logbook (recorded for 4 years)

4 GETTING STARTED

This chapter provides an overview of the initial steps for working with the instrument.

1. Read and adhere to the product documentation. In particular, observe all safety information in the documentation, on the instrument and on the packaging.
   - Safety Instructions ➪🗎5
   - Applications ➪🗎7
   - Documentation ➪🗎8
2. Familiarize yourself with the instrument and its features ➪🗎11.
3. Start up the instrument ➪🗎22.
4. Familiarize yourself with the display and instrument operation ➪🗎33.
5. Configuration and operation ➪🗎37:
   - Display of active and reactive energy, as well as active and reactive power ➪🗎38
   - Switching amongst tariffs ➪🗎39
   - Power displays (feature M2/M3 only) ➪🗎43
   - Mains monitor (only with feature M1/M3) ➪🗎45
   - S0 pulse output (only with feature W0) ➪🗎48
   - Transformation ratio (EM2381, EM2387 and EM2389 only) ➪🗎51
   - Bus connections (features W1, W2, W4, W7, W8) ➪🗎52
   - Meter reading profile ➪🗎53
   - Firmware version ➪🗎55
   - Display test ➪🗎55
   - Calibration display ➪🗎56

Further topics of interest: Maintenance ➪🗎58

5 THE INSTRUMENT

5.1 SCOPE OF DELIVERY

Please check for completeness.

1	Energy Meter
1	Condensed operating instructions
1	SMA adapter, socket to socket (only with feature W8 LPWAN)
1	Supplement (only with feature W8 LPWAN)

5.2 OPTIONAL ACCESSORIES

U270B	Door mounting kit for energy meter, 4 or 7 standard width units
Z309A	Antenna cable, SMA plug to SMA socket
Z309B	ISM stub antenna (868 MHz)
Z309C	External magnetic antenna (868 MHz)

5.3 INSTRUMENT OVERVIEW

5.3.1 FRONT

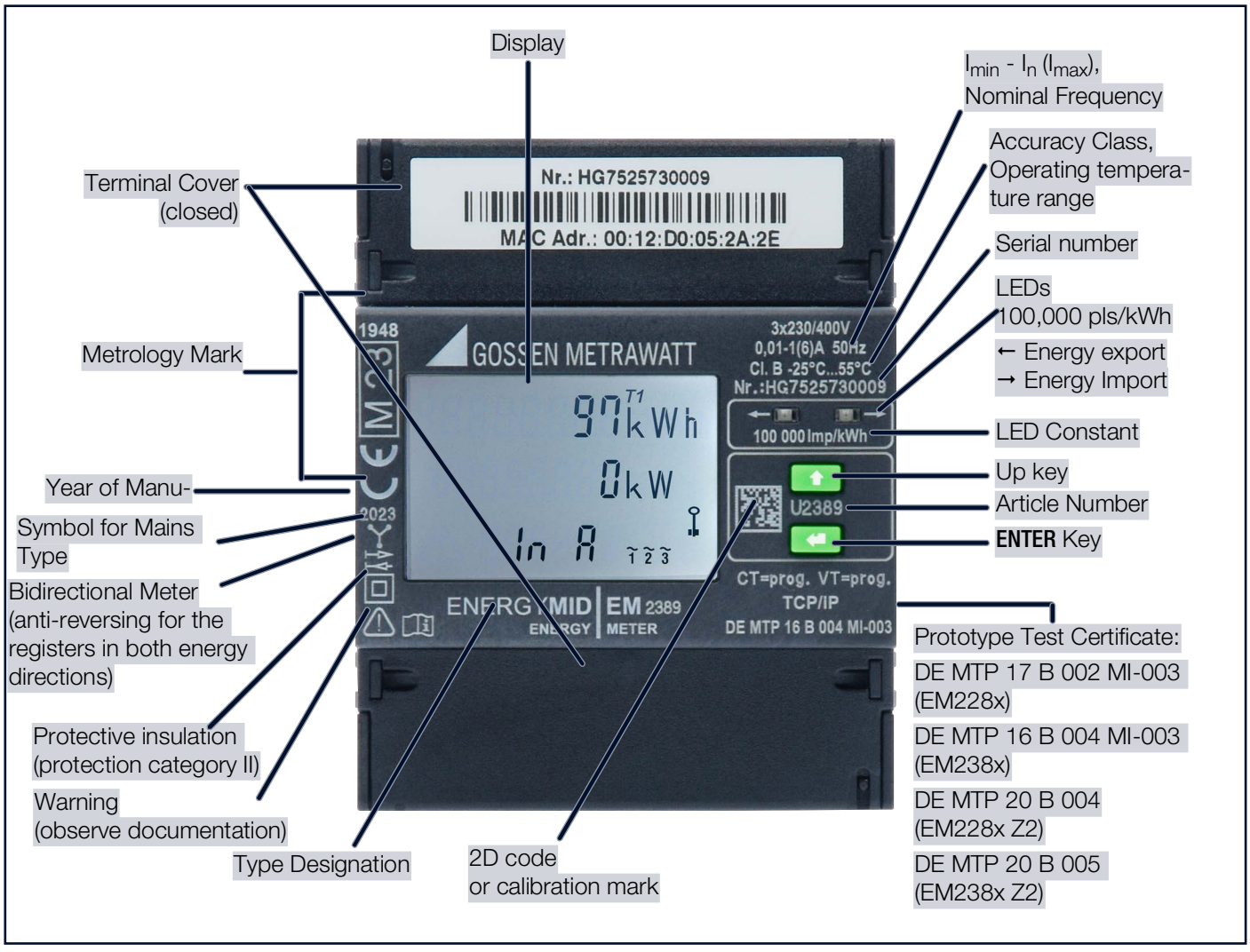


Fig. 2: Front Panel

5.3.2 SIDE VIEW

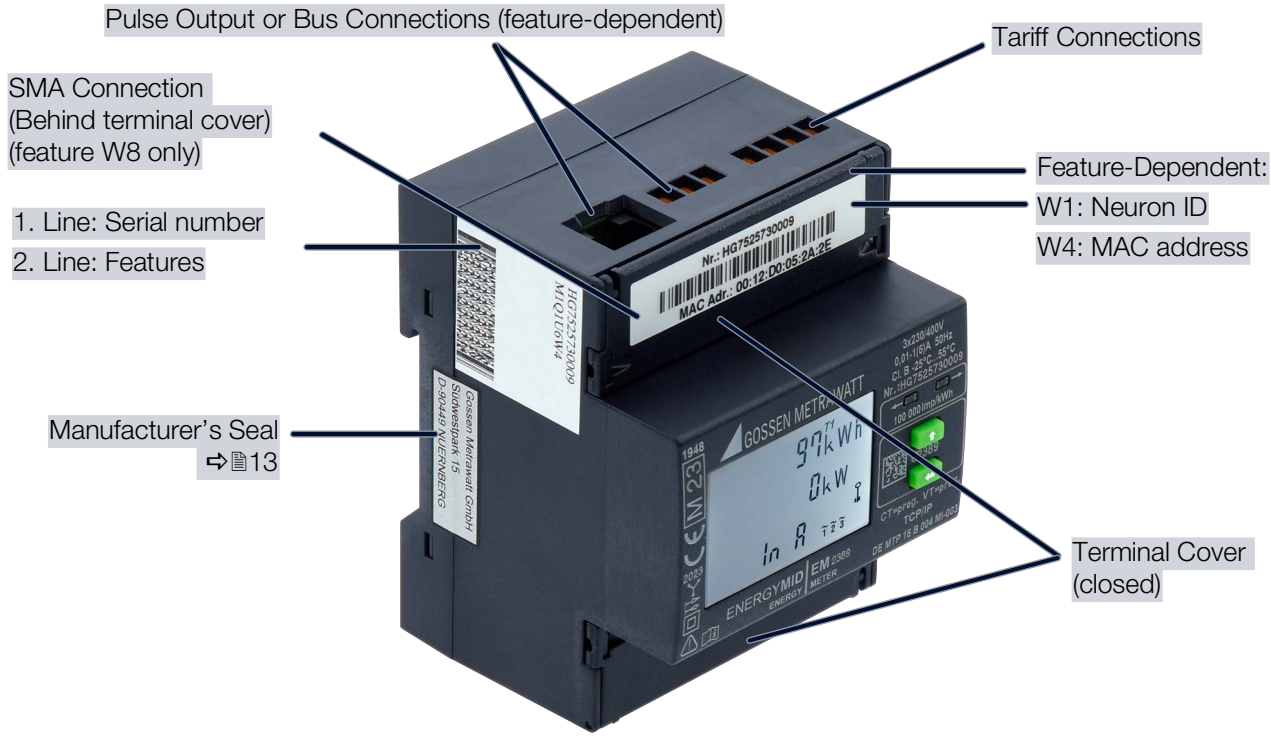
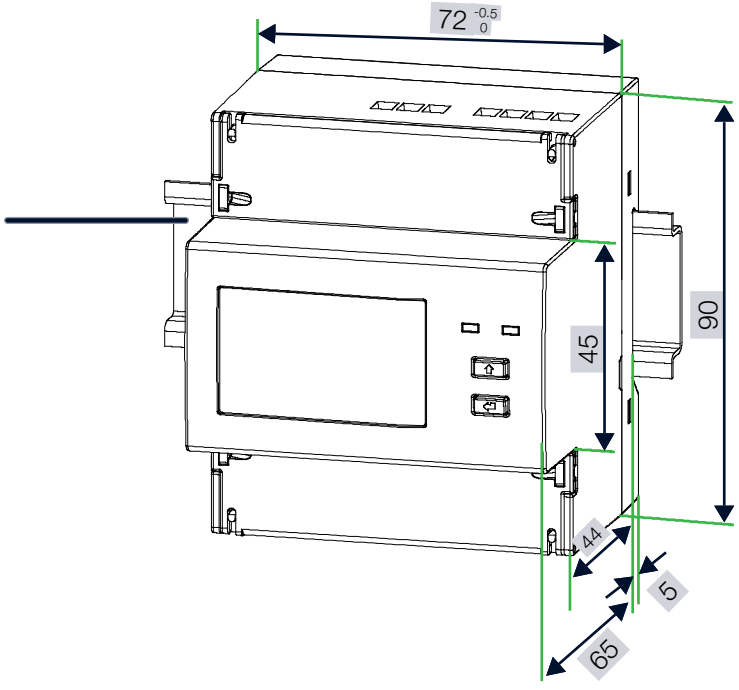


Fig. 3: Instrument, Side View

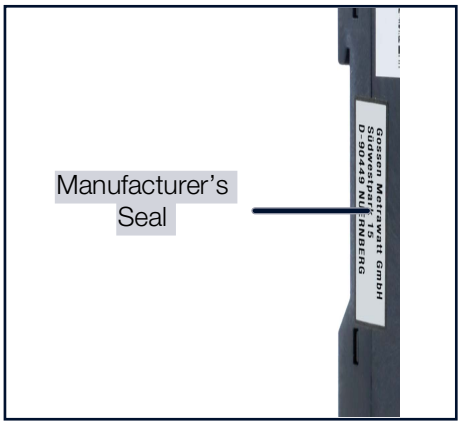
5.4 DIMENSIONAL DRAWING



5.5 TAMPER-PROOF SEALING

The instrument is provided with various seals in order to protect it against unauthorized modifications.

One manufacturer's seal on the side:



The manufacturer's seal serves as the instrument's calibration and guarantee seal.

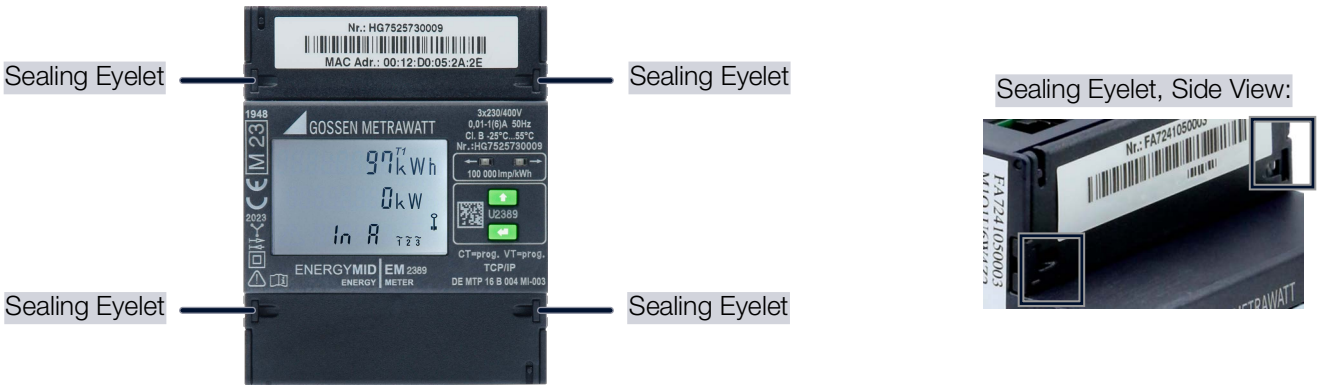
ATTENTION

Violation of Calibration Law

An instrument with a broken manufacturer's seal may not be used for billing purposes.

Never break or damage the manufacturer's seal.

Four tamper-proof seals for the terminal cover (can be mounted to the left and right of each terminal cover):



5.6 CONNECTIONS

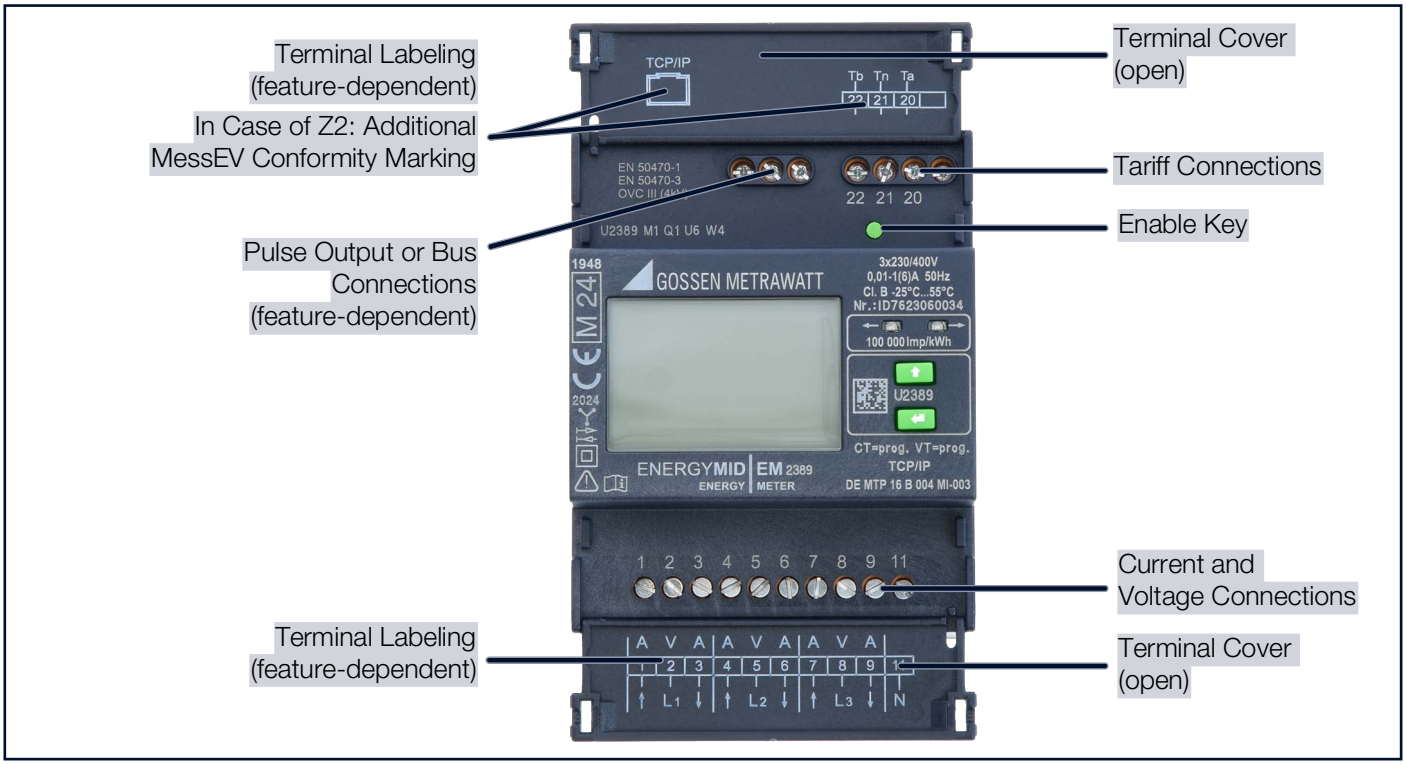


Fig. 4: Instrument – Connections

5.7 SYMBOLS ON THE INSTRUMENT AND THE INCLUDED ACCESSORIES

EBY 8 22	Marking with stamp of the federally approved test laboratory (for calibration only)
CE M22 1948	CE and metrology mark with indication of year (M22) and registration number of the notified body for module D, country-specific calibration validity period
DE-M 22 1948	Metrological symbol for national approval in Germany (DE = Germany, M = Metrology) with indication of year (22) and registration number of the notified body
DE MTP XX B XXX DE MTP XX B XXX MI-XXX	Prototype Test Certificate: DE MTP 17 B 002 MI-003 = EM2281, EM2289 DE MTP 16 B 004 MI-003 = EM2381, EM2387, EM2389 DE MTP 20 B 004 = EM2281, EM2289 each with Z2 DE MTP 20 B 005 = EM2381, EM2387, EM2389 each with Z2
	Meter type: Bidirectional Meter Energy received at the measuring point (i.e. import) Energy supplied at the measuring point (i.e. export)
	Anti-reversing
	Mains type: 3-wire energy meter
	Mains type: 2-wire energy meter
	Double insulation (protection category II)
	Warning concerning a point of danger (attention, observe documentation!)
	Read documentation!
	European conformity marking
	The instrument may not be disposed of with household trash ⇨ "Disposal and Environmental Protection" 🗎65.

5.8 RELEVANT STANDARDS, REGULATIONS AND DIRECTIVES

The instrument has been manufactured and tested in accordance with the following safety regulations.

ATTENTION

The design of the device does not release the user from the obligation to comply with legal regulations.

Violation of legal regulations.

Always comply with all relevant legal regulations.

For example, the German weights and measures act (MessEG) and the German measuring and verification act (MessEV).

Note

Unless a certain revision level is indicated, the currently valid version of the respective standard always applies.

Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments (revision) text with EEA relevance	
DIN 43856	Electricity meters, tariff time switches and ripple control receivers; connection diagrams, terminal marking, circuit diagrams
DIN 43880	Built-in equipment for electrical installations; overall dimensions and related mounting dimensions
DIN 46200	Current carrying connection bolts up to 1 600A; design and assignment of current intensities
EN 50470-1	Electricity metering equipment (a.c.) – Part 1: General requirements, tests and test conditions – Metering equipment (class indexes A, B and C)
EN 50470-3	Electricity metering equipment (a.c.) – Part 3: Particular requirements – Static meters for active energy (class indexes A, B and C)
EN 55022	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
EN 60529	Test instruments and test procedures – Degrees of protection provided by enclosures (IP code)
EN 61326-1	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements
EN 62052-1	Electricity metering equipment – General requirements, tests and test conditions – Part 11: Metering equipment
EN 62053-23	Electricity metering equipment (a.c.) - Particular requirements – Part 23: Static meters for reactive energy (classes 2 and 3)
EN 62053-31	Electricity metering equipment (a.c.) – Particular requirements – Pulse output devices for electromechanical and electronic meters (two wires only)
EN 62056-61	Electricity metering – Data exchange for meter reading, tariff and load control – Part 61: Object identification system (OBIS)
PTB-A 50.7	Requirements for electronic and software-controlled measuring instruments and ancillary equipment for electricity, gas, water and heat
PTB-A 50.7-1	Software requirements for measuring instruments and ancillary equipment according to PTB-A 50.7 equipment class 1: Simple instrument

5.9 TECHNICAL DATA

Some of the technical data are model and feature-dependent: You selected the device type and (optional) features when you placed your order. All options are listed with corresponding identification in the following table. The features included with your instrument can be found on the label on its side (⇨🗎11), the information uder the top terminal cover (⇨🗎11) or in your order documents. A breakdown of the features can be found in the appendix ⇨🗎68.

Table 3: Technical Data

Connection	EM2281, EM2289: Direct EM2381, EM2387, EM2389: Via transformer	
Measurement type	4-quadrant measurement	
Multifunctional version	Optional: U, I, P, Q, S, PF, f, THD, I_N (M1) / reactive energy (M2) / U, I, P, Q, S, PF, f, THD, I_N THD, I_N, reactive energy (M3) [a]	
Meter reading profile	Optional: meter reading profile (Z1) / certified meter reading profile PTB-A 50.7 (Z2)	
Approval	MID (conformity assessment procedure modules B and D)	
Accuracy class	B for industrial and commercial use, as well as for household use with highly demanding requirements	
Mains type	EM2281, EM2381: 2-wire system EM2289, EM2389: 4-wire system EM2387: 3-wire system	
Current and voltage ranges	Input voltage (reference voltage U_n AC):	EM2281: 230 V L–N (U5) EM2289: 400 V L–L (U6) EM2381: 230 V L–N (U5) EM2387: 100 … 110 V L–L (U3) / 400 V L–L (U6) EM2389: 100 … 110 V L–L (U3) / 400 V L–L (U6)
	Nominal current (current limit value):	EM2281, EM2289: 5 (80) A EM2381, EM2387, EM2389: 1(6) A (including 5(6) A)
Power consumption	Total:	Single-phase: < 2 W (at nominal voltage) 3-phase: < 2 W (at nominal voltage) (where line frequency = 45 … 65 Hz)
	Internal power supply:	From measuring voltage U: 80 … 115 % U_r 3.3 V / 100 mA For W4: 3.3 V / 200 mA (plus 100 mA for Ethernet)
	Per voltage path (including supply):	< 2 VA
	Per current path:	At I_{max}: < 1 VA for direct meter / < 0.2 VA for transformer meter At I_{ref}: < 0.02 VA for direct meter / < 0.005 VA for transformer meter
	Starting current:	Direct meter: approx. 17 mA at 0.1… 5(80) A Transformer meter:approx. 1.5 mA at 0.01… 1(6) A
Ambient Conditions	Operating temperatures:	-25 ... +55 °C
	Storage temperatures:	-25 ... +70 °C
	Relative atmospheric humidity:	Max. 95%, no condensation allowed Max. 75% annual average and non-condensing
	Elevation:	Max. 2000 m
Place of use	Indoors	

a. Not approved in Switzerland

Continued on next page.

Electrical Safety	Pollution degree:	2
	Protection category:	II
	Insulating group:	II
	Utilization category (electrical switchgear):	(only for meters with direct connection) UC-2 (per EN 60947)
	Nominal insulation voltage:	Inputs: 300 V_{AC} Output: 50 V_{DC} (bus/S0) with V0 / V1 / V2 / V7 / V8 / V9 230 V_{AC} (pulse) with V3 / V4
	Insulation test voltage:	Input ↔ output/housing: 4 kV_{AC} Output ↔ housing: 500 V (bus/S0) with V0 / V1 / V2 / V7 / V8 / V9 4 kV (pulse) with V3 / V4
	Overload capacity:	All meters: continuous 1.15 U_r and I_{max} Direct connection: 5 × 3 s, U_r and 100 A (5 min. interval) Direct connection: 1 × 1 s, U_r and 250 A, 10 ms 2400 A Current transformer connection: 0.5 s and 20 × I_{max}
	Overvoltage category:	III (per EN 62052-31) for Feature U3: 63.5 (110) V_{AC} Feature U5 / U6: 230 (400) V_{AC}
	Rated impulse voltage:	4 kV with basic insulation and 6 kV with reinforced insulation
Electromagnetic Compatibility (EMC)	Interference emission:	EN 55022, class B
	Interference immunity:	EN 61326-1
	Electromagnetic classification	E2
Wireless Transmission Characteristics (W8)	Interface:	LPWAN supporting the LoRaWAN® protocol
	Frequency range:	868 MHz ISM
	Channel bandwidth:	125 kHz
	Transmission intensity:	14 dBm at max. permissible antenna gain of 2 dBi
Mechanical Design	Mechanical classification:	M1
	Protection:	Front (panel-mount instrument): IP 51 (protection against ingress of solid foreign objects: protected against harmful amounts of dust ; protection against ingress of water: protection against dripping water) Terminals: IP 20 (protection against ingress of solid foreign objects: ≥ 12.5 mm dia., ∅; protection against ingress of water: not protected) (per EN 60529 / IEC 60529)
	Housing (W × H × D):	4 standard width units, approx. 72 × ≤ 90 × ≤ 70 mm
	Housing material:	Lexan polycarbonate per UL94 V0
	Weight:	< 0.3 kg
	Mounting:	Top-hat rail per EN 50022 or snap-on rail with c profile, dimensions each: 35 × 15 mm or 35 × 7.5 mm
	Screw terminals:	Slotted screw, 16 mm^2 cross-section
	Display:	LCD, approx. 28 × 42 mm, 7-segment characters (0 … 99999999 digits) 1 main display: max. 8-place, height: 5.6 mm, 2 auxiliary displays: 8-place, height: 5 mm Refresh: approx. 6 times per second
	Protection against tampering:	Tamper-proof cover, configuration disabling

Continued on next page.

<table>
<tr><td rowspan="5">Interfaces</td><td colspan="2">The energy meters are equipped with two pulse outputs or one bus output as a standard feature.</td></tr>
<tr><td>Pulse output:</td><td>Model and feature-dependent, as well as optional:
■ S0 standard, 1000 pls/kWh (V1) /
■ S0 Programmable, 1… 1000 pls/kWh Secondary, (V2 at EM2281 / EM2289) /
■ S0 Programmable, 1… 50000 pls/kWh Secondary, (V2 at EM2381 / EM2387 / EM2389) /
■ Switching output up to 230 V, 1000 pls/kWh (V3)/
■ Switching output up to 230 V, programmable, 1 … 1000 pls/kWh (V4 with EM2281 / EM2289) /
■ Switching output up to 230 V, programmable, 1 … 50,000 pls/kWh (V4 with EM2381 / EM2387 / EM2389) /
■ S0 130 ms, 100 pulses/kWh (V7 at EM2281 / EM2289) /
■ S0 130 ms,100 pls/kWh, in combination with Q9 depending on CT × VT (V7 at EM2381 / EM2387 / EM2389) /
■ S0 130 ms,1000 pls/kWh (V8) /
■ Customer-specific S0 (V9)

See ⇨ "Pulse Outputs" 🗎19 for further information.</td></tr>
<tr><td>Bus connection:</td><td>Optional:
■ LON (W1) /
■ M-Bus (W2) /
■ Modbus RTU (W7) /
■ TCP/IP (BACnet / Modbus / TCP / HTTP) (W4) /
■ Wireless interface LPWAN supporting the LoRaWAN® protocol (W8)

See ⇨ "Bus Interfaces" 🗎20 for further information.</td></tr>
<tr><td>Antenna connection:</td><td>Optional:
SMA at LPWAN (W8)
See ⇨ "Bus Interfaces" 🗎20 for further information.</td></tr>
<tr><td>Tariff interface:</td><td>4 tariffs (hardware controlled) and 4 additional tariffs with bus feature W1 / W2 / W4 / W7 [a]
Power utility pulse:</td></tr>
<tr><td>Transformer ratio</td><td colspan="2">EM2381/ EM2387 and EM2389 only:
default: CT = VT = 1, main display for secondary (Q0)
Feature-dependent alternative: CT and VT programmable, auxiliary display for secondary, permitted for billing purposes (Q1) / fixed CT and VT, main display for primary (Q9)</td></tr>
</table>

a. The 4 additional tariffs via bus are not included in the scope of MID approval.

5.10 CHARACTERISTIC VALUES

5.10.1 MEASURING RANGES

Voltage	Reference voltage U_n AC:	U3:	100 … 110 V L–L
		U5	230 V L–N
		U6:	400 V L–L
	Allowable deviation:	-20% … +15%	
Current	I_{ref}	Direct connection:	5 A
		Transformer connection:	1 A
	Starting current	Direct connection:	20 mA
		Transformer connection:	2 mA
	I_{min}	Direct connection:	0.1 A
		Transformer connection:	0.01 A
	I_{max}	Direct connection:	80 A
		Transformer connection:	6 A
Frequency range	Nominal frequency:	50 Hz	
	Cutoff frequency:	45 Hz … 65 Hz	
Accuracy	Active energy:	Class B per EN 50470-3	
	Reactive energy:	Class 2 per EN 62053-23	
Sampling rate	Continuous, 32 per period		

5.10.2 INPUTS, OUTPUTS AND INTERFACES

The energy meters are equipped with two pulse outputs or one bus output depending on model and variant.

Note

Circuit diagrams, terminal assignments etc. can be found under chapter "Initial Startup" ➪🗎22.

5.10.3 TARIFF INPUTS

All instruments are equipped with 4 hardware-controlled tariff inputs. The tariffs are controlled via these tariff inputs by applying a certain voltage level:

- Level 0 = < 12 V_{AC}
- Level 1 = 45 … 265 V_{AC}

Depending on the combination of levels 0 and 1, the values measured at the instrument are recorded in the corresponding tariff. Recording is thus possible in a daytime and a nighttime tariff, for example.

Instruments with bus (features W1, W2, W4, W7) have 4 additional software-controlled tariffs (not included in the scope of MID approval). Further information can be found in the respective interface description. See chapter "Bus Connections (features W1 / W2 / W4 / W7 / W8)" ➪🗎52.

The active tariff appears at the display ➪🗎33.

5.10.4 PULSE OUTPUTS

Pulses are transmitted via the pulse outputs (pulses per kWh). One of 4 pulse sources can be selected for each output: active energy import, active energy export, reactive energy import or reactive energy export. Pulse frequency and duration can also be adjusted on some models and variants.

Direct connection: Pulse frequency is proportional to measured energy.

Transformer connection: The permitted energy values are transmitted. In the case of feature Q0 and Q1, these are the secondary energy values. However, in the case of feature Q9, the primary energy values in consideration of the CT and VT value are transmitted.

The pulse outputs are electrically isolated from the measuring circuit by means of an optocoupler.

Electrical Values

Pulse frequency:	With direct connection:	1000 pls/kWh (adjustable with V2 / V4)
	With transformer connection:	1000 pls/kWh (adjustable with V2 / V4)
Pulse duration:	30 ms (adjustable up to 3 s with V2 / V4)	
Interpulse period:	> 30 ms	
U_{ext}:	Max. 40 V (375 V with V3/ V4)	
Switching current:	Max. 27 mA (100 mA with V3/ V4)	

Feature Q1

Only the auxiliary display is approved. As a result, only the secondary values (menu selection) can be used for billing purposes.

Feature Q9

Pulse rates are specified in relation to the primary side.

	In combination with V1/ V3	In combination with V7	In combination with V2/ V4
CT x VT	Fixed	Fixed	Programmable
2 to 10	1000 pulses per kWh	100	1 … 1000 pls/kWh
11 to 100	100 pulses per kWh	10	0.1 … 100 pls/kWh
101 to 1000	10 pulses per kWh	1	0.01 … 10 pls/kWh
1001 … 10,000	1000 pulses per MWh	100	1 … 1000 pls/MWh
10,001 … 100,000	100 pulses per MWh	10	0.1 … 100 pls/MWh
100,001 … 1,000,000	10 pulses per MWh	1	

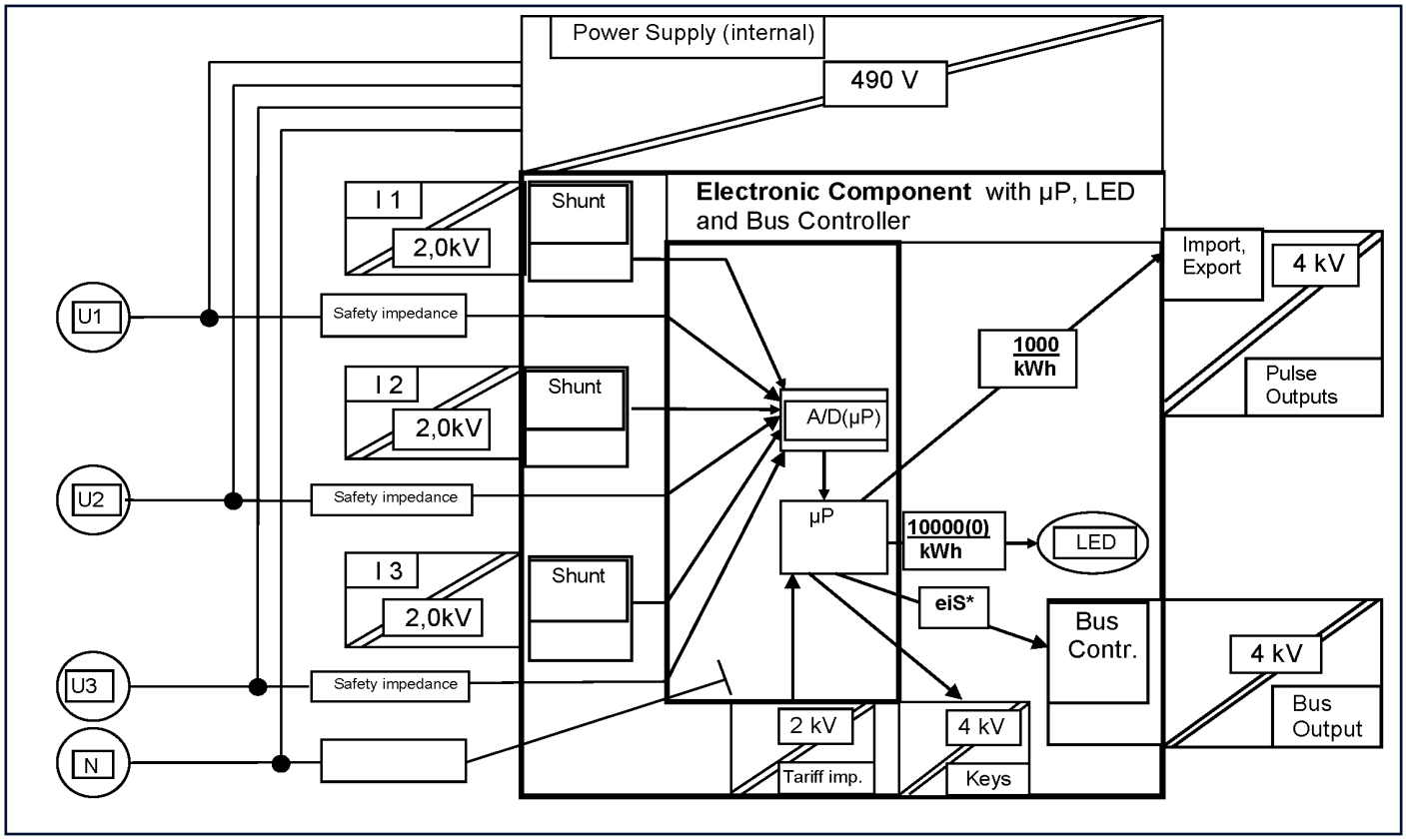
5.10.5 BUS INTERFACES

Interface	Feature	Note
LON-Bus	W1	
M-Bus	W2	The standard M-Bus secondary address consists of the last 8 digits of the serial number.
TCP/IP (BACnet, Modbus TCP, HTTP)	W4	
Modbus RTU	W7	
Wireless interface LPWAN supporting the LoRaWAN® protocol	W8	Antenna connection (SMA)

Interface descriptions can be found at

https://www.gmc-instruments.de/en/services/download-center/

5.10.6 BLOCK DIAGRAM FOR SAFETY SPECIFICATION



* Uniform internal interface

5.11 OBIS FIGURES

Table 4: OBIS Figures (object identification system) per EN 62056-61

Measured quantity		OBIS Figure	Measured quantity		OBIS Figure
Active energy – import	Total	1.8.0	Active energy – export	Total:	2.8.0
	Tariff 1:	1.8.1		Tariff 1:	2.8.1
	Tariff 2:	1.8.2		Tariff 2:	2.8.2
	Tariff 3:	1.8.3		Tariff 3:	2.8.3
	Tariff 4:	1.8.4		Tariff 4:	2.8.4
	Tariff 5:	1.8.5		Tariff 5:	2.8.5
	Tariff 6:	1.8.6		Tariff 6:	2.8.6
	Tariff 7:	1.8.7		Tariff 7:	2.8.7
	Tariff 8:	1.8.8		Tariff 8:	2.8.8
Reactive energy (M2 / M3) – import	Total:	3.8.0	Reactive energy (M2 / M3) – export	Total:	4.8.0
	Tariff 1:	3.8.1		Tariff 1:	4.8.1
	Tariff 2:	3.8.2		Tariff 2:	4.8.2
	Tariff 3:	3.8.3		Tariff 3:	4.8.3
	Tariff 4:	3.8.4		Tariff 4:	4.8.4
	Tariff 5:	3.8.5		Tariff 5:	4.8.5
	Tariff 6:	3.8.6		Tariff 6:	4.8.6
	Tariff 7:	3.8.7		Tariff 7:	4.8.7
	Tariff 8:	3.8.8		Tariff 8:	4.8.8

6 INITIAL STARTUP

Initial instrument startup includes installation at the place of use as well as connection to your equipment:

- ⇨ "Unpacking" 🗎22
- ⇨ "Installation" 🗎22
- ⇨ "Connection to Your Equipment (interfaces)" 🗎31

Note

This document only describes technical startup of the instrument.

Inform yourself about further measures that may have to be taken into account during initial startup, for example, documentation (installation verifications, meter numbers, meter readings etc.) or other administrative requirements (photos, inspections etc.).

6.1 UNPACKING

Check the entire scope of delivery for transport damage, in particular the instrument.

Note

We recommend keeping the packaging and using it when sending the instrument in for recalibration, as well as for storage if the instrument is not going to be used for a lengthy period of time. See chapter "Transport and Storage" ⇨🗎63.

6.2 INSTALLATION

Installation is broken down into individual steps that have to be carried out in a specific order. They're explained in the following sections:

1. Mounting of the instrument onto a top-hat rail or snap-on rail with C-profile, e.g. in the control cabinet ⇨ "Mounting" 🗎23
2. Connecting the instrument to supply power and for data communication ⇨ "Connection" 🗎24
3. As soon as the instrument is supplied with power, any connection errors are detected automatically. Instructions on how to interpret and rectify such errors are provided in chapter "Display of Connection Errors and Troubleshooting" ⇨🗎30.
4. At this point, the device must first be configured. Corresponding information can be found under chapter "Configuration and Operation" ⇨🗎37.
5. Attaching seals to the instrument ⇨ "Sealing" 🗎31

DANGER

Danger of Injury

Installation involves risks which may not be recognized as such by inadequately trained persons (e.g. electric shock and arcing).

(Death or serious injury is almost certain).

- Installation may only be performed by a qualified electrician.
- Observe and comply with all safety regulations which are applicable for your work environment.
- Wear suitable and appropriate personal protective equipment (PPE) whenever working with the instrument.

6.2.1 MOUNTING

The instrument may only be installed inside an external housing, e.g. switch or meter cabinet. The housing must provide at least IP 51 protection and may only be located indoors. Only in this case is protection against dust and water ingress guaranteed in accordance with the EN50470-1.

The instrument is mounted on a top-hat rail in accordance with EN 50022 or on a snap-on rail with C-profile. The rail must measure 35 × 15 mm or 35 × 7.5 mm.

If no corresponding rail is available, a door mounting kit (U270B) is required.

Dimensions with relevance for mounting can be found in the dimensional drawing ➪🗎12.

DANGER

Electric shock due to live components!

Life endangering due to electric arcs!

Touching voltage conducting components is life endangering!

During installation, the installation environment must be voltage-free.

When disconnecting, observe the five safety rules in accordance with DIN VDE 0105-100, Operation of electrical installations – Part 100: General requirements:

1. Shut down entirely.
2. Secure against restart.
3. Assure absence of voltage at all poles.
4. Ground and short circuit.
5. Cover neighboring live components, or make them inaccessible.

ATTENTION

Incorrect Installation Site

Faulty installation can cause damage to the product due to environmental influences – either immediately or in the long term.

Your system can also be damaged by faulty installation.

- Install the instrument only in environments that meet the specified conditions (temperature etc.) ➪ "Technical Data" 🗎16.
- Do not install the instrument in locations where it may be exposed to direct sunlight.
- Do not install the instrument in potentially explosive atmospheres.

ATTENTION

Damaged Instrument

A faulty instrument can damage your system.

Moreover, it cannot be used for billing purposes.

- Only install the device if it's in good working order.
  Inspect the instrument before installation. Pay particular attention to damage.
- Do not install the instrument after long periods of storage under unfavorable conditions (e.g. humidity, dust or extreme temperature).
- Do not install the instrument after extraordinary stressing due to transport.

Rail Mounting

Required tool: small slotted screwdriver

✓ The installation location is an enclosure with IP 51 protection located indoors.
✓ A top-hat rail in accordance with EN 50022 or a snap-on rail with C-profile (dimensions: 35 × 15 mm or 35 × 7.5 mm) is available at the installation site.
✓ All cables have been removed from the instrument.

1. Position the instrument at the desired location on the top-hat rail or snap-on rail with C-profile. Hook the two protruding hooks on the back of the housing into the top of the rail to this end.
2. Use the slotted screwdriver to pull down the snap connector on the bottom of the unit at the back, and hold it there. Push the slotted screwdriver into the slot and pull down to this end.
3. Push the instrument down onto the rail with your other hand and allow the snap connector to slide up. The locking mechanism latches into place.

↳ The instrument is firmly mounted on the top-hat rail or snap-on rail with C-profile.
You can now proceed with connection ⇨ "Connection" 🗎24.

Door Mounting Kit (U270B)

Required tool: small slotted screwdriver

✓ A door mounting kit (U270B) is available.
✓ All cables have been removed from the instrument.

Observe and follow the instructions in the product documentation for the door mounting kit (U270B). To mount the device on the respective rail, follow the instructions provided above under ⇨ "Rail Mounting" 🗎24.

6.2.2 CONNECTION

First of all, familiarize yourself with the connections and all associated information: all necessary information can be found in the tables and figures included below. Instructions for the procedure are provided at the end of the section.

Wire Gauge and Torque

Connection	Direct Meter (EM2281 / EM2289)	Transformer Meter (EM2381 / EM2387 / EM2389)
Current input	Fine wire: 6 to 16 mm² Solid wire: 6 to 25 mm² With wire end ferrule: 6 to 16 mm² Torque: 3 Nm	Fine wire: 0.5 to 4 mm² Solid wire: 0.5 to 6 mm² With wire end ferrule: 0.5 to 2.5 mm² Torque: 0.5 Nm
Voltage input	–	Fine wire: 0.5 to 4 mm² Solid wire: 0.5 to 6 mm² With wire end ferrule: 0.5 to 2.5 mm² Torque: 0.5 Nm
S0 pulse output Bus output Tariff input (power utility pulse)	Fine wire: 0.2 to 2.5 mm² Solid wire: 0.2 to 2.5 mm² With wire end ferrules: 0.25 to 1.5 mm² Torque: 0.4 Nm	
LON (W1) [a]	Twisted pair copper cable, recommended: JY (ST) Y 2 × 2 × 0.8 mm with twisted wire pairs (where 0.8 mm = wire diameter, wire cross-section = 0.5 mm²), maximum cable length of 900 m with bus topology (bus terminator at both ends), 500 m with free topology (bus terminator at one end) or 320 m from device to device	
M-Bus (W2) [a]	2-wire twisted-pair	
TCP/IP (W4) [a]	RJ-45 (8P8C)	
Modbus (W7) [a]	2-wire twisted-pair, shielded if possible, maximum length of 1000 m (depending on cable thickness and transmission speed), cross-section of at least 0.22 mm², wave impedance approx. 100 to 150 Ω, terminating resistors at both ends (the following applies: resistance value = line impedance)	
LPWAN (W8) [a]	Antenna connection (SMA connector); SMA adapter torque: 57 Ncm	

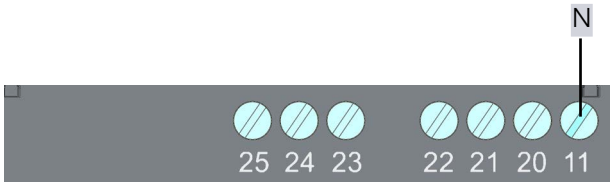
a. For more detailed information refer to the instrument's interface description. It can be found at:
https://www.gmc-instruments.de/en/services/download-center/

Terminal Assignments

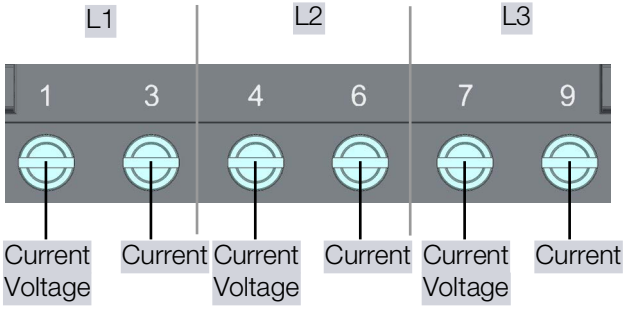
All connection components are laid out as self-locking screw terminals, except for the TCP/IP interface which is equipped with an RJ-45 connector and the LPWAN interface which has an SMA antenna connector.

EM2281, EM2289 – Direct Connection

Top terminals:

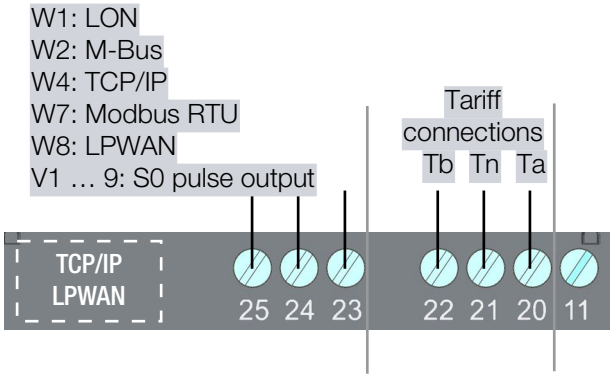


Bottom terminals:

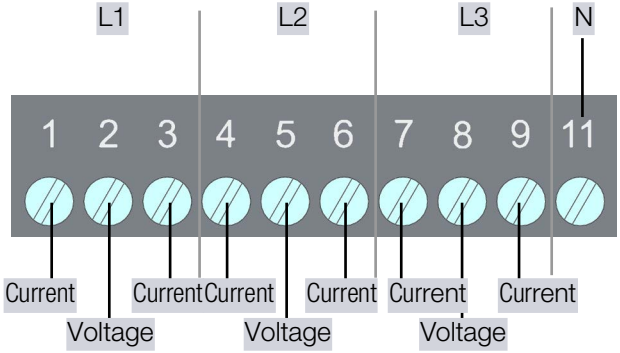


EM2381, EM2387, EM2389– Transformer Connection

Top terminals:



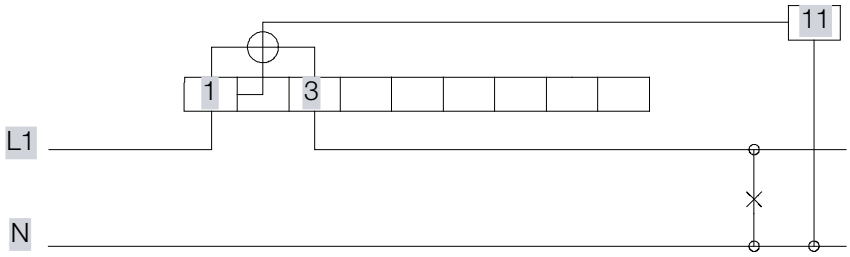
Bottom terminals:



Wiring Diagrams – Current and Voltage

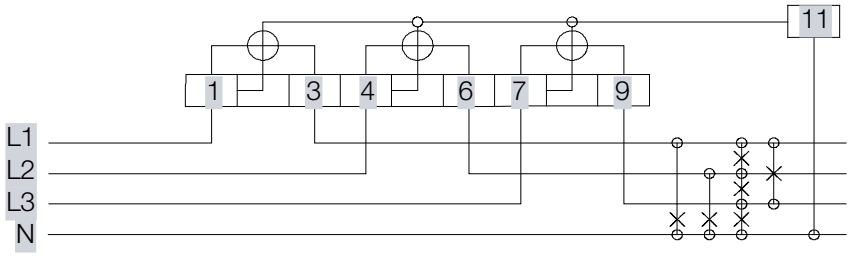
EM2281 – Direct Connection

2-Wire AC System, Any Load



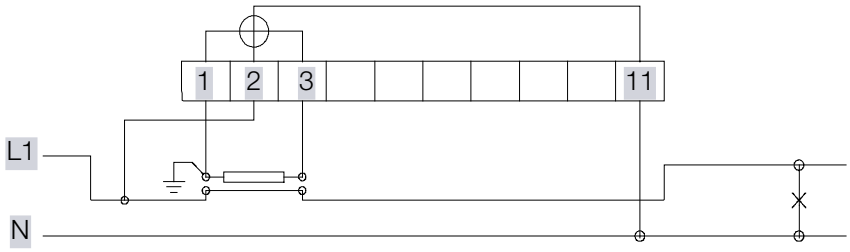
EM2289 – Direct Connection

4-Wire AC System, Any Load



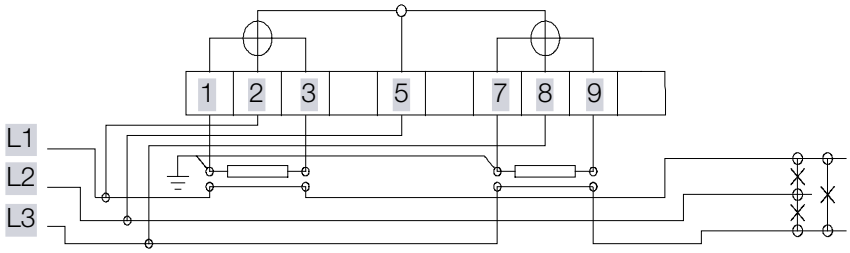
EM2381 – Transformer Connection

2-Wire AC System, Any Load



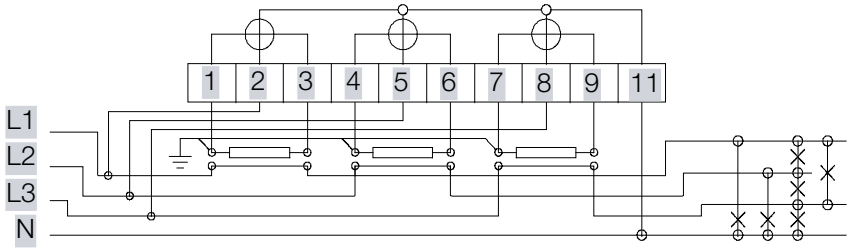
EM2387 – Transformer Connection

3-Wire AC System, Any Load



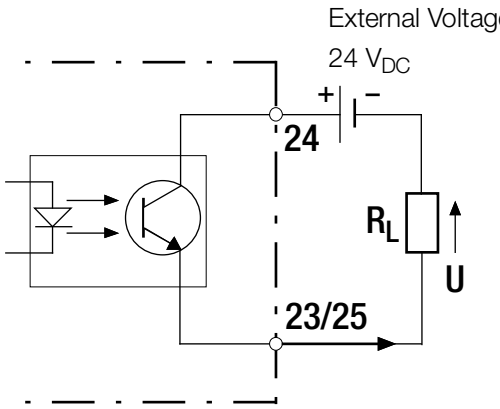
EM2389 – Transformer Connection

4-Wire AC System, Any Load



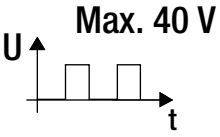
Wiring Diagrams – Pulse Output

Feature V1 / V2 / V7 / V8 / V9:



I = max. 27 mA

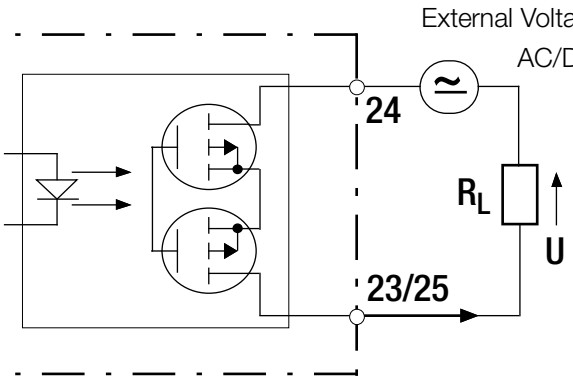
Energy type*
(can be selected with feature V2/ V4)



Standard pulse duration: 30 ms + 5%, interpulse period: > 30 ms
V7/V8 pulse duration: 130 ms + 5%, interpulse period: > 130 ms

Default setting: Active energy
Terminal 23 (S01): import, terminal 25 (S02): export

Feature V3 / V4:



I = max. 100 mA

Energy type*
(can be selected with feature V2/ V4)

Standard pulse duration: 30 ms + 5%, interpulse period: > 30 ms
V7/V8 pulse duration: 130 ms + 5%, interpulse period: > 130 ms

Default setting: Active energy
Terminal 23 (S01): import and terminal 25 (S02): export

Tariff Connections

For the hardware-controlled tariff connections, tariff inputs Ta and Tb are each connected with reference to Tn.

Tariff Inputs	Tb	Ta
Tariff 1	0	0
Tariff 2	0	1
Tariff 3	1	0
Tariff 4	1	1

Level 0: < 12 V_{AC}
Level 1: 45 … 265 V_{AC}

Procedure

Required tool: small slotted screwdriver

Required materials: Connecting cables or leads;
SMA accessories, if applicable: Z309A antenna cable SMA socket to SMA plug or Z309B stubby antenna for ISM (868 MHz) or Z309C external magnetic antenna (868 MHz)

✓ The instrument is mounted on the top-hat rail or snap-on rail ⇨ "Connection" 🗎24.
✓ You have examined the terminal assignments and connection diagrams and are familiar with the wiring required for your instrument.

First of all, connect the instrument to the S0 pulse outputs or bus connections. Then supply the instrument with electrical power. This is described below. Skip the steps which do not apply to your instrument.

DANGER

Electric shock due to live components!

Life endangering due to electric arcs!

Touching voltage conducting components is life endangering!

- During installation, all lines connected to the meter must be voltage-free.
  When disconnecting, observe the five safety rules in accordance with DIN VDE 0105-100, Operation of electrical installations – Part 100: General requirements:
  1.Shut down entirely.
  2.Secure against restart.
  3.Assure absence of voltage at all poles.
  4.Ground and short circuit.
  5.Cover neighboring live components, or make them inaccessible.
- Observe all regulations and standards which apply to your installation and operating environment.

ATTENTION

Incorrect Installation

Incorrect installation may result in property damage to the product and/or the respective system.

Risk of operational malfunctions.

- Observe the specified technical data and characteristic values (nominal voltage, maximum pulse output voltage etc.). See ⇨ "Technical Data" 🗎16 and ⇨ "Characteristic Values" 🗎19.
- Comply with the respectively permissible torque value (see above). Excessive torque damages the terminals and/or connection cables or leads.
- Connection cables must be selected appropriately with regard to type, conductor cross-section, voltage, ambient conditions and maximum load.
- Connection cables must be voltage-free when wiring the instrument.
- Low-resistance contact must be ensured when connecting measuring current.

Transformer Connection

- The secondary side of the current and voltage transformers must be grounded.

Note

The installation technician is responsible for:

- Coordination of the rated values and the characteristic values of the overcurrent protection devices on the supply side, including maximum current rating values.
- The rated utilization category of the metering equipment in case of directly connected meters.

1. Open both terminal covers by flipping them up or down respectively.
2. Connect the connection cables or leads to the S0 pulse output or bus output.
   - Loosen one screw terminal.
   - Insert the respective connection cable or lead into the corresponding terminal.
   - Retighten the screw terminals.

- Repeat this procedure for all other necessary connection cables and/or leads.
- With TCP/IP Interface: Plug the RJ-45 cable into the RJ-45 socket.
- With the antenna interface: Screw the SMA cable onto the SMA plug. Use the included socket to socket SMA adapter and observe the appropriate torque (⇨ "Wire Gauge and Torque" 🗎24).
  - Z309A antenna cable, SMA plug to SMA socket: Screw the SMA cable onto the SMA plug.
  - Z309B stub antenna for ISM (868 MHz): Screw the stub antenna onto the SMA socket of the device.
  - Z309C external magnetic antenna (868 MHz): Screw the antenna cable onto the SMA plug of the device. Place the antenna in a suitable location.

3. Connect the connection cables or leads to the tariff connections.
   - Loosen one screw terminal.
   - Insert the respective connection cables or leads into the corresponding terminals.
   - Retighten the screw terminals.
   - Repeat this procedure for all other necessary connection cables and/or leads.
4. Connect the connection cables or leads to the current and voltage terminals.
   - Loosen one screw terminal.
   - Insert the respective connection cables or leads into the corresponding terminals.
   - Retighten the screw terminals.
   - Repeat this procedure for all other necessary connection cables and/or leads.
5. Make sure that all connecting cables or leads are correctly connected: phase connections, neutral conductor, current flow direction etc. (model and feature-dependent).
6. Install conductor protection if necessary.

Close the two terminal covers in order to provide effective protection for the terminals in accordance with IP 20.

Note

Do not attach the seals until later.

You'll need access to the components under the terminal covers for configuration (⇨🗎31) and, if necessary, for correcting installation errors (⇨🗎30).

7. Supply the instrument with electrical power.
   The instrument is switched on automatically.
8. Check the installation and eliminate any possible errors:
   - One of the two LEDs (⇨🗎11) must blink.
   - Any possible connection error is displayed. Display and troubleshooting is explained in the next section ⇨ "Display of Connection Errors and Troubleshooting" 🗎30.
     Measured power can also be checked. The existing power factor cos(ϕ) must be known to this end:
     measure current and calculate power taking applied voltage into consideration. Compare the theoretically determined value with power indicated at the display (⇨🗎33).

↳ The instrument is ready for operation.
You can reverse the disconnection measures.
Familiarize with ⇨ "Display and Operation" 🗎33 and configure the instrument ⇨🗎37. The instrument must be sealed after configuration in order to protect it from unauthorized changes or tampering ⇨🗎31.

6.2.3 DISPLAY OF CONNECTION ERRORS AND TROUBLESHOOTING

In the event of a connection error, this is automatically detected and indicated by the display. Depending on the respective meaning, check your connections and correct any wiring errors. Observe and follow the instructions and safety information included in chapter "Connection" ⇨🗎24.

Display Performance	Meaning
Cyclical blinking of 1 and 2 and 3, display blinks red.	Incorrect phase sequence (rotating field direction)
1 and/or 2 and/or 3 are not displayed, display blinks red.	Phase failure or U < 75%
1 and/or 2 and/or 3 blinks, display blinks red.	Negative power Reversed current transformer polarity at the respective phase (current transformer is incorrectly connected or defective)

6.2.4 SEALING

In order to protect the device against inadvertent changes or tampering, the instrument's terminal covers must be closed and sealed.

Note

Do not seal the device until after it has been configured! See chapter "Configuration and Operation" ➪🗎37.

Otherwise the seals will have to be removed and replaced.

Required tools: Sealing pliers

Required materials: Sealing wire (< 1.7 mm), seals (plastic, metal)

1. Close both terminal covers.
2. Attach seals to all 4 sealing eyelets. See chapter "Tamper-Proof Sealing" ➪🗎13.
   Observe the product documentation for the sealing tool and materials, as well as your own work instructions and procedures.

↳ The instrument is protected.

6.3 CONNECTION TO YOUR EQUIPMENT (INTERFACES)

Connection to your equipment is established via (feature-dependent) interfaces. A description of the respective interface can be found in the following subsections.

Observe and follow the associated product documentation for connection to other components. For example, instructions for interaction with other components from the product range of Gossen Metrawatt GmbH – e.g. SMARTCONTROL and SU1604 summators or EMC 5.x energy management software – can be found in the respective product documentation.

6.3.1 LON INSTALLATION (FEATURE W1)

The LON interface has been electrically connected during installation (➪🗎22). In order to commission the interface, the instrument can be integrated into a LON network either manually or via an installer. All information and files required to this end can be found in the download section for your instrument. Your instrument can be accessed via:

https://www.gmc-instruments.de/en/services/download-center/

6.3.2 M-BUS INSTALLATION (FEATURE W2)

The M-Bus interface has been electrically connected during installation (➪🗎22). The EnergyMID software tool provides assistance when starting up the interface. All information and files required to this end can be found in the download section for your instrument. Your instrument can be accessed via:

https://www.gmc-instruments.de/en/services/download-center/

6.3.3 TCP/IP – BACNET, MODBUS TCP, HTTP (FEATURE W4)

The RJ-45 interface has been connected during installation ➪🗎22.

The instrument is equipped with an integrated web server. Further information on initial startup can be found in the download section for your instrument. Your instrument can be accessed via:

https://www.gmc-instruments.de/en/services/download-center/

6.3.4 MODBUS RTU (FEATURE W7)

The Modbus interface has been electrically connected during installation (➪🗎22). All information and files required for initial startup of the interface can be found in the download section for your instrument. Your instrument can be accessed via:

https://www.gmc-instruments.de/en/services/download-center/

6.3.5 LPWAN (FEATURE W8)

The SMA interface has been connected during installation (➪🗎22). All information and files required for initial startup of the interface can be found in the download section for your instrument. Your instrument can be accessed via:

https://www.gmc-instruments.de/en/services/download-center/

7 DISPLAY AND OPERATION

7.1 DISPLAY

The instrument shows measured variables (e.g. active energy) and information (e.g. active tariff) at the display. Depending on the type of multifunctional variant, the instrument is capable of acquiring reactive power and indicating up to 33 additional measured quantities directly at the display.

This makes it possible to view information at any time concerning voltage levels, loads placed on individual phases, reactive power component and the functioning of compensation systems.

Significance of Symbols

Lock symbols (keys) for parameter settings:

with features Q1 and V2, V4:

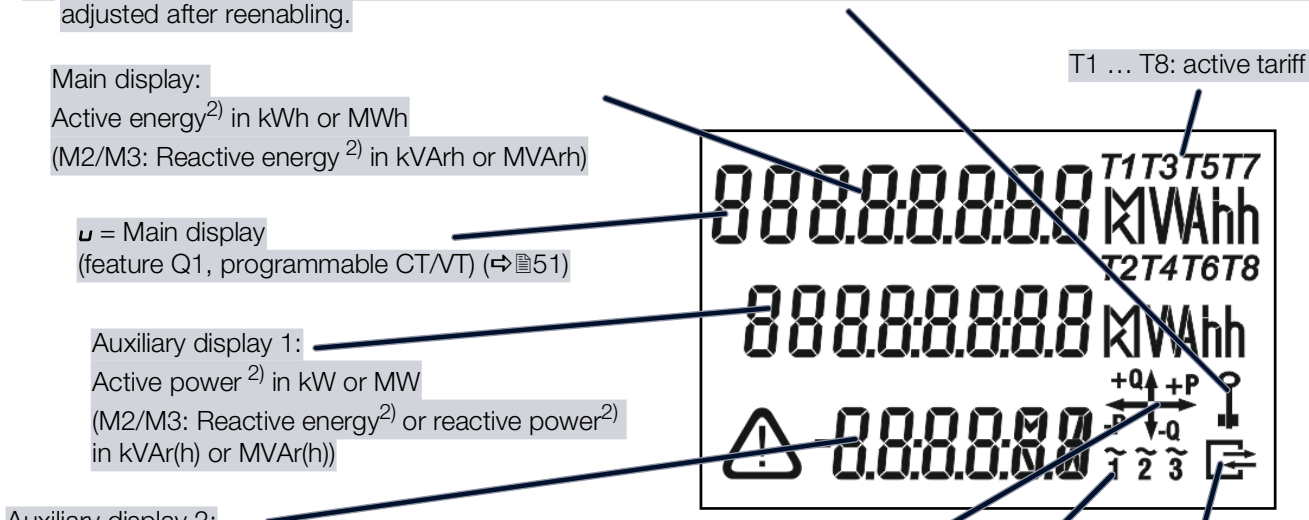
CT, VT and S0 parameters can be changed depending on features.

CT, VT and S0 parameters disabled.

All other feature combinations:

Permitted CT, VT or S0 parameters are preset at the factory [1], and can be queried in the display mode, other values can be adjusted.

Permitted parameters are preset at the factory[1]; other parameters are disabled with the enable key and can be adjusted after reenabling.



1) Values which are preset at the factory are printed additionally on the rating plate.
2) Transformer meter EM238x: CT and VT are taken into account / power: negative sign for export

Fig. 5: Significance of Display Elements

Background Illumination

The display is illuminated. Background illumination is activated whenever a key is pressed. It goes out if no keys are pressed for a duration of 2 minutes.

Colors indicate various display menus:

Table 5: Meanings of Background Illumination Colors

Color	Meaning
White	Retrieval menus for viewing values (⇨ "Configuration and Operation" 🗎37)
Pink	Parameter display and setting menus (⇨ "Configuration and Operation" 🗎37)
Red	Firmware version display (⇨🗎55)
Blinking red:	Error (see below)

Error Display

The display blinks red in the event of an error. An error code is also displayed, which consists of a triangle icon and text. Complete information concerning the individual codes and error elimination can be found in chapter "Fault Conditions and Troubleshooting" ⇨🗎57.

Main Display Resolution (first display line) – Energy Import

Internally, metering is executed with increased resolution. As a result, the last place in the overall register may be a few digits higher than the sum of the individual registers if multiple tariffs are used.

Table 6: Main Display Resolution

Pulse Rates	V1/V3, fixed	V7	V8	V9, fixed	V2/V4, programmable
	[pls/kWh]				
Direct Meter	**EM2281, EM2289**				
	1000	100	—	—	1 … 1000 pls/kWh
Transformer Meter	**EM2381, EM 2387, EM2389**				
	f (secondary)				
				100 …	
CT×VT = 1 (Q0)	1000	100	1000	50000	1...<u>1000</u>...10000 pls/kWh
CT × V T= 1 (Q0) U6	1000	100	1000	20000	1...<u>1000</u>...10000 pls/kWh
CT × VT = 1 (Q0) U3	1000	100	1000	50000	1...<u>1000</u>...10000 pls/kWh
CT, VT, progr. (Q1)	1000	100	1000	50000	1...<u>1000</u>...50000 pls/kWh
CT, VT, progr. (Q1) U6	1000	100	1000	20000	1...<u>1000</u>...50000 pls/kWh
CT, VT, progr. (Q1) U3	1000	100	1000	50000	1...<u>1000</u>...50000 pls/kWh
CT × VT; CT, VT fix (Q9)	**f (primary)**				**f (primary)**
2 … 10	1000	100	—	—	1 … <u>1000</u> pls/kWh
11 … 100	100	10	—	—	0.1 … <u>100</u> pls/kWh
101 … 1000	10	1	—	—	0.01 … <u>10</u> pls/kWh
1001 … 10000	1	100	—	—	1 … <u>1000</u> pls/MWh
10001 … 100000	0.1	10	—	—	0.1 … <u>100</u> pls/MWh
100001..1000000	0.01	1	—	—	0.01 … <u>10</u> pls/MWh

Underlined values are default values.

Standard Display and Calibration Display Resolution

Table 7: Standard Display and Calibration Display

Meter / Feature		CT × VT min.	CT × VT max.	Standard Display	Calibration Display [a]	Unit of Measure
Direct Meter EM2281, EM2289		—	—	123456.78	23456.789	kWh
Transformer Meter EM2381, EM 2387, EM2389	**Q0**	1	1	12345.678	2345.6789	kWh
	Q9	2	4	12345.678	2345.6789	kWh
		5	40	123456.78	3456.7890	kWh
		41	400	1234567.8	34567.890	kWh
		401	4000	12345678	345678.90	kWh
		4001	40000	123456.78	3456.7890	MWh
		40001	400000	1234567.8	34567.890	MWh
		400001	1000000	12345678	345678.90	MWh
	Q1 [b]	1	4	u12345.67	b	kWh
		5	40	u123456.7	b	kWh
		41	400	u1234567	b	kWh
		401	4000	u12345.67	b	MWh
		4001	40000	u123456.7	b	MWh
		40001	100000	u1234567	b	MWh

a. The calibration display includes an additional place to the right of the decimal point in the case of a main display which is permitted for billing (Q0 or Q9). The leading digit is therefore eliminated in the case of an 8-place display.

b. For Q1, the secondary display is permitted for billing. for which reason display overflow is based on the secondary display. The normal display is shifted one place to the left if necessary.

7.2 TEST LEDS

The test LEDs are located above the control keys. The left LED indicates energy export and the right LED indicates energy import. Blinking frequency accelerates as the measured power value increases. If all currents are smaller than starting current, both LEDs light up continuously.

LED Constant

Direct meters EM2281, EM2289:	10,000 pulses per kWh
Transformer meters EM2381, EM2387, EM2389:	100,000 pulses per kWh

7.3 KEYS

This chapter only describes the general functions of the various keys as required for basic understanding. Detailed procedures can be found in chapter "Configuration and Operation" ➪🗎37.

7.3.1 UP AND ENTER

The **UP** and **ENTER** keys can be used to switch back and forth amongst the various displays (e.g. view of momentary values and selected parameter settings). The keys are pressed only briefly for this purpose. If neither of the keys is pressed for a period of 1 minute, the meter is returned automatically to its standard display.

Depending on the instrument and its features, the two keys can also be used to adjust parameters. To this end, press and hold the ENTER key in order to access the setting menu. Subsequently, select the requested parameter via the UP key and release it for modification with the enable key (➪🗎36).

7.3.2 ENABLE KEY

The enable key makes it possible to enable or disable parameter changes.

It's located behind the top terminal cover between terminals 21 and 22. See chapter "Instrument Overview" ⇨🗎11.

The enable key can be activated with a pointed object (e.g. an ESD safe screwdriver).

DANGER

Slipping and touching the screw terminals.

Electric shock due to live components!

Life endangering due to electric arcs!

Touching voltage conducting components is life endangering!

- The terminal cover must be closed.
- Use an ESD safe screwdriver, another insulated tool or a non-conductive object.

ATTENTION

Damage caused by pointed objects

Pointed objects may damage the key.

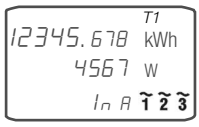
Be careful when pressing the enable key with a pointed object.

Enable	Pressing the enable key activates the "change parameters" operating mode:	→ (key off)
Disable	Pressing the enable key again disables the "change parameters" operating mode:	→ (key on)

If no keys are pressed for a period of about 2 minutes, the "change parameters" operating mode is exited automatically and disabled (key on).

8 CONFIGURATION AND OPERATION

The standard display (active energy and active power import) appears by default:



Accuracy of active energy EP_1 … EP_8, EP_{tot} (kWh): ± 1%

Accuracy of active power P_1, P_2, P_3, P_{tot} (kW): 1% ± 1 d

The **ENTER** and **UP** keys (⇨🗎35) can be used to switch from the standard display to other displays or menus. The following assumes that the standard display is active and describes how to “cycle through” the display from there.

Note

The displays and menus are dependent on the included features and may therefore not be available on your instrument.

Feature-dependent displays and menus are identified in this section with a light gray color and the feature designation.

Display (viewing values)

Different values can be displayed. Which values are displayed is feature-dependent.

Measuring Function / Measured Quantity		Accuracy (ref. cond.)	Display (feature) M0	M1	M2 [a]	M3 [b]
Active energy (kWh) [c]	EP_1 … EP_8, EP_{tot}	±1%	•	•	•	•
Reactive energy (kVArh) [d]	EQ_{tot}	±2%	—	—	•	•
Star voltage (V)	U_{1N}, U_{2N}, U_{3N}	0.5% ±1 d	—	•	—	•
Delta voltage (V)	U_{12}, U_{23}, U_{13}	0.5% ±1 d	—	•	—	•
Current per phase (A)	I_1, I_2, I_3	0.5% ±1 d	—	•	—	•
Neutral conductor current (A)	I_N [e]	1% ± 1 d, typical	—	•	—	•
Active power (kW)	P_1, P_2, P_3, P_{tot}	1% ±1 d	—	•	—	•
Reactive power (kVAr)	Q1, Q2, Q3, Q_{tot}	1% ±1 d	—	•	—	•
Apparent power (kVA)	S_1, S_2, S_3, S_{tot}	1% ±1 d	—	•	—	•
Power factor cos(ϕ)	PF_1, PF_2, PF_3, PF_{tot}	1% ±1 d	—	•	—	•
Frequency (Hz)	f	0.05% ±1 d	—	•	—	•
RMS distortion value	THD U_1, U_2, U_3		—	•	—	•
	THD I_1, I_2, I_3		—	•	—	•

a. Not approved for billing purposes in Switzerland
b. Not approved for billing purposes in Switzerland
c. Total power (kW/kVAr) appears at auxiliary display 2 with plus or minus sign
d. Total power (kW/kVAr) appears at auxiliary display 2 with plus or minus sign
e. The greatest current value per phase is used as a reference value for accuracy.

When displaying values, the display is backlit in white (exception: red when displaying firmware version) ⇨ "Display" 🗎33.

Settings

The following parameters can be changed:

- All instruments with feature V2 / V4: S0 - Pulse Rate
- EM2381 / EM2387 / EM2389 with feature Q1: CT and VT
- Further parameters in accordance with the instrument’s interface (model and feature-dependent).

The display is backlit in pink in menus to which settings can be entered ⇨ "Display" 🗎33.

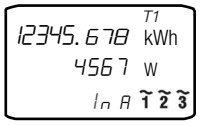
Which values do you want to display or which parameters do you want to adjust?

- ⇨ "Display of Active and Reactive Energy, as well as Active and Reactive Power" 🗎38
- ⇨ "Switching Amongst Tariffs" 🗎39
- ⇨ "Power Displays (feature M1 / M3 only)" 🗎43
- ⇨ "Mains Monitor (only with feature M1 / M3)" 🗎45
- ⇨ "S0 Pulse Output (only with feature W0)" 🗎48
- ⇨ "Transformation Ratio (EM2381 / EM2387 and EM2389 only)" 🗎51
- ⇨ "Bus Connections (features W1 / W2 / W4 / W7 / W8)" 🗎52
- ⇨ "Meter Reading Profile" 🗎53
- ⇨ "Display Test" 🗎55
- ⇨ "Firmware Version and Checksum(s)" 🗎55
- ⇨ "Calibration Display" 🗎56

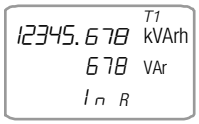
8.1 DISPLAY OF ACTIVE AND REACTIVE ENERGY, AS WELL AS ACTIVE AND REACTIVE POWER

The various values are shown in successive displays. As a result, you may have to cycle through multiple displays.

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



The standard display is the starting point.



8.1.1 DISPLAYING INDUCTIVE REACTIVE ENERGY AND REACTIVE POWER (ONLY WITH FEATURE M2 / M3)

For the currently selected tariff.

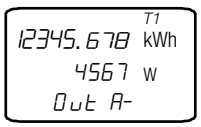
Accuracy of reactive energy EQ_1 … EQ_8, EQ_{tot} (kVArh): ± 2%

Accuracy of reactive power Q_1, Q_2, Q_3, Q_{tot} (kVAr): 1% ± 1 d

▶ **Procedure**

1. Briefly press the **UP** key.

↳ Inductive reactive energy and inductive reactive power are displayed.



8.1.2 DISPLAYING ACTIVE ENERGY AND ACTIVE POWER EXPORT

For the currently selected tariff.

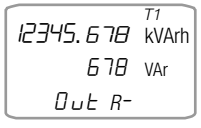
Accuracy of active energy EP_1 … EP_8, EP_{tot} (kWh): ± 1%

Accuracy of active power P_1, P_2, P_3, P_{tot} (kW): 1% ± 1 d

▶ **Procedure**

1. Briefly press the **UP** key.
   For instruments with feature M2/M3: Briefly press the **UP** key 2 times in succession at short intervals.

↳ Active energy and active power export are displayed.



8.1.3 DISPLAYING CAPACITIVE REACTIVE ENERGY AND REACTIVE POWER (ONLY WITH FEATURE M2 / M3)

For the currently selected tariff.

Accuracy of reactive energy EQ_1 … EQ_8, EQ_{tot} (kVArh): ± 2%

Accuracy of reactive power Q_1, Q_2, Q_3, Q_{tot} (kVAr): 1% ± 1 d

▶ **Procedure**

1. Briefly press the **UP** key 3 times in succession at short intervals.

↳ Capacitive reactive energy and reactive power export are displayed.

Continued on next page.

8.1.4 DISPLAYING TOTAL ACTIVE ENERGY IMPORT (ALL) AND REACTIVE ENERGY IMPORT (ONLY WITH FEATURE M2/M3)

For all tariffs.

Accuracy of active energy EP_1 … EP_8, EP_{tot} (kWh): ± 1%

Accuracy of reactive energy EQ_1 … EQ_8, EQ_{tot} (kVArh): ± 2%

Procedure

1. Briefly press the **UP** key 2 times in succession at short intervals.
   For instruments with feature M2/M3: Briefly press the **UP** key 4 times in succession at short intervals.

↳ Total active energy import is displayed.
In the case of instruments with feature M2/M3, total reactive energy import is also displayed.

8.1.5 DISPLAYING TOTAL ACTIVE ENERGY EXPORT (ALL) AND REACTIVE ENERGY IMPORT (ONLY WITH FEATURE M2/M3)

For all tariffs.

Accuracy of active energy EP_1 … EP_8, EP_{tot} (kWh): ± 1%

Accuracy of reactive energy EQ_1 … EQ_8, EQ_{tot} (kVArh): ± 2%

Procedure

1. Briefly press the **UP** key 3 times in succession at short intervals.
   For instruments with feature M2/M3: Briefly press the **UP** key 5 times in succession at short intervals.

↳ Total active energy export is displayed.
In the case of instruments with feature M2/M3, total reactive energy export is also displayed.

Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

8.2 SWITCHING AMONGST TARIFFS

All instruments are equipped with 4 hardware-controlled tariff inputs. Instruments with bus (features W1, W2, W4, W7) have 4 additional software-controlled tariffs (not included in the scope of MID approval).

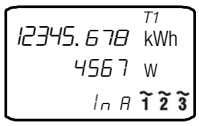
8.2.1 DISPLAYING ACTIVE ENERGY AND REACTIVE ENERGY (ONLY WITH FEATURE M2 / M3)

The various tariffs are shown in successive displays. As a result, you may have to cycle through multiple displays. Active energy is displayed for each tariff, and reactive energy is also displayed for instruments with feature M2 or M3.

Accuracy of active energy EP_1 … EP_8, EP_{tot} (kWh): ± 1%

Accuracy of reactive energy EQ_1 … EQ_8, EQ_{tot} (kVArh): ± 2%

The linear path is described at the left on the next page. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



The standard display is the starting point.

Tariff 1 (T1) – Import

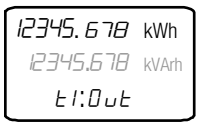
1. Briefly press the **ENTER** key.

↳ Active energy import is displayed for tariff 1.
In the case of feature M2/M3, reactive energy import is also displayed for tariff 1.

Tariff 1 (T1) – Export

1. Briefly press the **ENTER** key.
2. Briefly press the **UP** key.

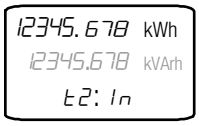
↳ Active energy export is displayed for tariff 1.
In the case of feature M2/M3, reactive energy export is also displayed for tariff 1.



Tariff 2 (T2) – Import

1. Briefly press the **ENTER** key.
2. Press the **UP** key 2 times in succession at short intervals.

↳ Active energy import is displayed for tariff 2.
In the case of feature M2/M3, reactive energy import is also displayed for tariff 2.



Tariff 2 (T2) – Export

1. Briefly press the **ENTER** key.
2. Press the **UP** key 3 times in succession at short intervals.

↳ Active energy export is displayed for tariff 2.
In the case of feature M2/M3, reactive energy export is also displayed for tariff 2.

Tariff 3 (T3) – Import

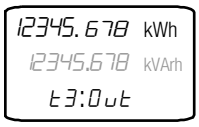
1. Briefly press the **ENTER** key.
2. Press the **UP** key 4 times in succession at short intervals.

↳ Active energy import is displayed for tariff 3.
In the case of feature M2/M3, reactive energy import is also displayed for tariff 3.

Tariff 3 (T3) – Export

1. Briefly press the **ENTER** key.
2. Press the **UP** key 5 times in succession at short intervals.

↳ Active energy export is displayed for tariff 3.
In the case of feature M2/M3, reactive energy export is also displayed for tariff 3.



Tariff 4 (T4) – Import

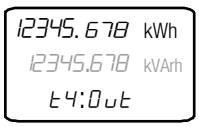
1. Briefly press the **ENTER** key.
2. Press the **UP** key 6 times in succession at short intervals.

↳ Active energy import is displayed for tariff 4.
In the case of feature M2/M3, reactive energy import is also displayed for tariff 4.

Tariff 4 (T4) – Export

1. Briefly press the **ENTER** key.
2. Press the **UP** key 7 times in succession at short intervals.

↳ Active energy export is displayed for tariff 4.
In the case of feature M2/M3, reactive energy export is also displayed for tariff 4.



Use the same procedure for tariffs 5, 6, 7 and 8.

Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

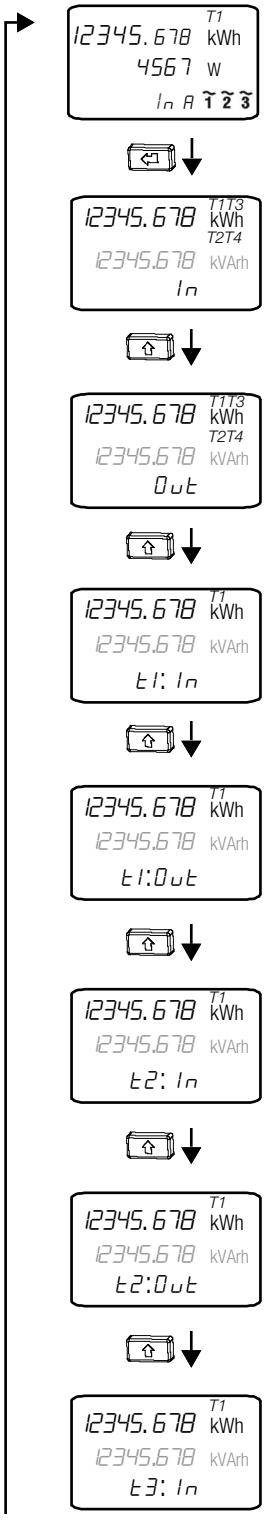
8.2.2 DISPLAYING TOTAL ACTIVE ENERGY AND TOTAL REACTIVE ENERGY IMPORT (ONLY WITH FEATURE M2 / M3)

The various tariffs are shown in successive displays. As a result, you may have to cycle through multiple displays. Total active energy import is displayed for each tariff, and total reactive energy import is also displayed for instruments with feature M2 or M3. In combination with feature Q1, this secondary display is permitted for billing.

Accuracy of active energy EP_1 … EP_8, EP_{tot} (kWh): ± 1%

Accuracy of reactive energy EQ_1 … EQ_8, EQ_{tot} (kVArh): ± 2%

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



The standard display is the starting point.

Total Import

1. Briefly press the **ENTER** key twice in succession at short intervals.
   Total active energy import is displayed.
   In the case of feature M2 / M3, total reactive energy import is also displayed.

Export, total

1. Briefly press the **ENTER** key 2 times in succession at short intervals.
2. Briefly press the **UP** key.

↳ Total active energy export is displayed.
In the case of feature M2/M3, total reactive energy export is also displayed.

Tariff 1 (T1) – Import

1. Briefly press the **ENTER** key twice in succession at short intervals.
2. Press the **UP** key 2 times in succession at short intervals.

↳ Active energy import is displayed for tariff 1.
In the case of feature M2/M3, reactive energy import is also displayed for tariff 1.

Tariff 1 (T1) – Export

1. Briefly press the **ENTER** key twice in succession at short intervals.
2. Press the **UP** key 3 times in succession at short intervals.

↳ Active energy export is displayed for tariff 1.
In the case of feature M2/M3, reactive energy export is also displayed for tariff 1.

Tariff 2 (T2) – Import

1. Briefly press the **ENTER** key twice in succession at short intervals.
2. Press the **UP** key 4 times in succession at short intervals.

↳ Active energy import is displayed for tariff 2.
In the case of feature M2/M3, reactive energy import is also displayed for tariff 2.

Tariff 2 (T2) – Export

1. Briefly press the **ENTER** key twice in succession at short intervals.
2. Press the **UP** key 5 times in succession at short intervals.

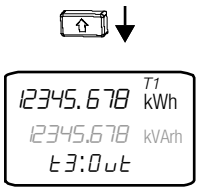
↳ Active energy export is displayed for tariff 2.
In the case of feature M2/M3, reactive energy export is also displayed for tariff 2.

Tariff 3 (T3) – Import

1. Briefly press the **ENTER** key twice in succession at short intervals.
2. Press the **UP** key 6 times in succession at short intervals.

↳ Active energy import is displayed for tariff 3.
In the case of feature M2/M3, reactive energy import is also displayed for tariff 3.

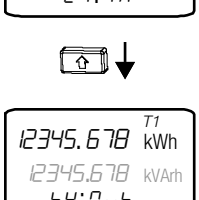
Continued on next page.



Tariff 3 (T3) – Export

1. Briefly press the **ENTER** key twice in succession at short intervals.
2. Press the **UP** key 7 times in succession at short intervals.

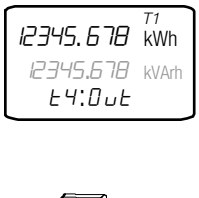
↳ Active energy export is displayed for tariff 3.
In the case of feature M2/M3, reactive energy export is also displayed for tariff 3.



Tariff 4 (T4) – Import

1. Briefly press the **ENTER** key twice in succession at short intervals.
2. Press the **UP** key 8 times in succession at short intervals.

↳ Active energy import is displayed for tariff 4.
In the case of feature M2/M3, reactive energy import is also displayed for tariff 4.



Tariff 4 (T4) – Export

1. Briefly press the **ENTER** key twice in succession at short intervals.
2. Press the **UP** key 8 times in succession at short intervals.

↳ Active energy export is displayed for tariff 4.
In the case of feature M2/M3, reactive energy export is also displayed for tariff 4.

Use the same procedure for tariffs 5, 6, 7 and 8.

Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

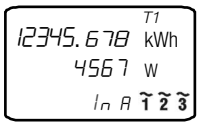
8.3 POWER DISPLAYS (FEATURE M1 / M3 ONLY)

Available displays differ according to the number of conductors.

8.3.1 4-WIRE DISPLAYS

The various values are shown in successive displays. As a result, you may have to cycle through multiple displays.

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



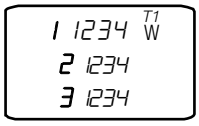
The standard display is the starting point.

Active power per phase

Accuracy of active power P_1, P_2, P_3, P_{tot} (kW): 1% ± 1 d

1. Briefly press the **ENTER** key 3 times in succession at short intervals.

↳ Active power per conductor is displayed.

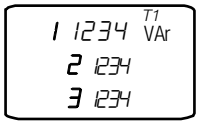


Reactive power per phase

Accuracy of reactive power Q_1, Q_2, Q_3, Q_{tot} (kVAr): 1% ± 1 d

1. Briefly press the **ENTER** key 3 times in succession at short intervals.
2. Briefly press the **UP** key.

↳ Reactive power per conductor is displayed.

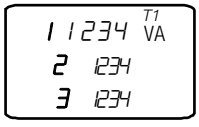


Apparent power per phase

Accuracy of apparent power S_1, S_2, S_3, S_{tot} (kVA): 1% ± 1 d

1. Briefly press the **ENTER** key 3 times in succession at short intervals.
2. Press the **UP** key 2 times in succession at short intervals.

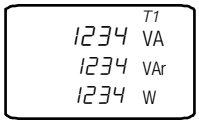
↳ Apparent power per conductor is displayed.



Total power

1. Briefly press the **ENTER** key 3 times in succession at short intervals.
2. Press the **UP** key 3 times in succession at short intervals.

↳ Total power is displayed.

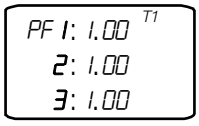


Power factor per phase

Power factor PF_1, PF_2, PF_3, PF_{tot} (cos(ϕ)): 1% ± 1 d

1. Briefly press the **ENTER** key 3 times in succession at short intervals.
2. Press the **UP** key 4 times in succession at short intervals.

↳ Power factor per conductor is displayed.

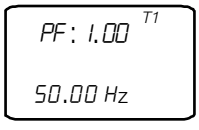


Power factor and line frequency

Power factor PF_1, PF_2, PF_3, PF_{tot} (cos(ϕ)): 1% ± 1 d

1. Briefly press the **ENTER** key 3 times in succession at short intervals.
2. Press the **UP** key 5 times in succession at short intervals.

↳ The power factor and frequency are displayed.

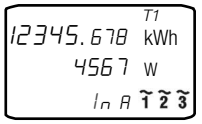


Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

8.3.2 3-WIRE DISPLAYS

The various values are shown in successive displays. As a result, you may have to cycle through multiple displays.

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.

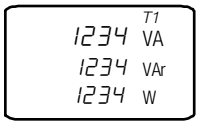


The standard display is the starting point.

▶ **Total power**

1. Briefly press the **ENTER** key 3 times in succession at short intervals.

↳ Total power is displayed.

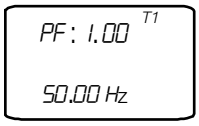


▶ **Power factor and line frequency**

Power factor PF_1, PF_2, PF_3, PF_{tot} (cos(ϕ)): 1% ± 1 d

1. Briefly press the **ENTER** key 3 times in succession at short intervals.
2. Press the **UP** key.

↳ The power factor and line frequency are displayed.

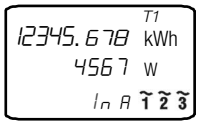


Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

8.3.3 2-WIRE DISPLAYS

The various values are shown in successive displays. As a result, you may have to cycle through multiple displays.

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



The standard display is the starting point.

▶ **Apparent, Reactive and Active Power**

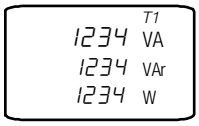
Accuracy of apparent power S_1, S_2, S_3, S_{tot} (kVA):1% ± 1 d

Accuracy of reactive power Q_1, Q_2, Q_3, Q_{tot} (kVAr): 1% ± 1 d

Accuracy of active power P_1, P_2, P_3, P_{tot} (kW): 1% ± 1 d

1. Briefly press the **ENTER** key 3 times in succession at short intervals.

↳ Apparent, reactive and active power are displayed.

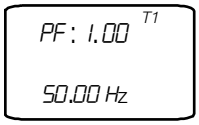


▶ **Power factor and line frequency**

Power factor PF_1, PF_2, PF_3, PF_{tot} (cos(ϕ)): 1% ± 1 d

1. Briefly press the **ENTER** key 3 times in succession at short intervals.
2. Press the **UP** key.

↳ The power factor and line frequency are displayed.



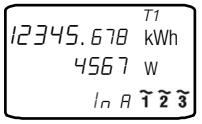
Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

8.4 MAINS MONITOR (ONLY WITH FEATURE M1 / M3)

8.4.1 4-WIRE DISPLAYS

The various values are shown in successive displays. As a result, you may have to cycle through multiple displays.

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.

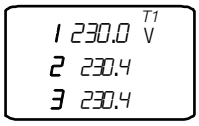


The standard display is the starting point.

Phase voltages

1. Briefly press the **ENTER** key 4 times in succession at short intervals.

↳ Phase voltages are displayed.

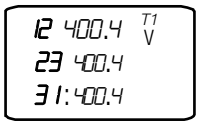


Delta Voltage (line-to-line voltage)

Accuracy of delta voltage U_{12}, U_{23}, U_{31} (V): 0.5% ± 1 d

1. Briefly press the **ENTER** key 4 times in succession at short intervals.
2. Briefly press the **UP** key.

↳ Line-to-line voltage is displayed.

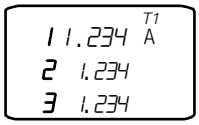


Current per Phase

Accuracy of current per phase I_1, I_2, I_3 (A): 0.5% ± 1 d

1. Briefly press the **ENTER** key 4 times in succession at short intervals.
2. Press the **UP** key 2 times in succession at short intervals.

↳ Phase currents are displayed.



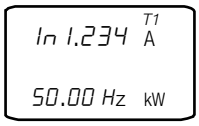
Neutral Conductor Current and Line Frequency

Accuracy of neutral conductor current I_N (A): 1% ± 1 d, typ.

Accuracy of frequency f (Hz): 0.05% ± 1 d

1. Briefly press the **ENTER** key 4 times in succession at short intervals.
2. Press the **UP** key 3 times in succession at short intervals.

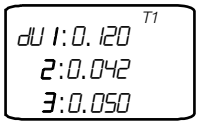
↳ Neutral conductor current and line frequency are displayed.



Voltage Distortion Component per Phase (THD of U_1, U_2 and U_3)

1. Briefly press the **ENTER** key 4 times in succession at short intervals.
2. Press the **UP** key 4 times in succession at short intervals.

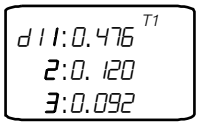
↳ The RMS values of distortion for U_1, U_2 and U_3 are displayed.



Current Distortion Component per Phase I_1, I_2 and I_3)

1. Briefly press the **ENTER** key 4 times in succession at short intervals.
2. Press the **UP** key 5 times in succession at short intervals.

↳ The RMS values of distortion for I_1, I_2 and I_3 are displayed.

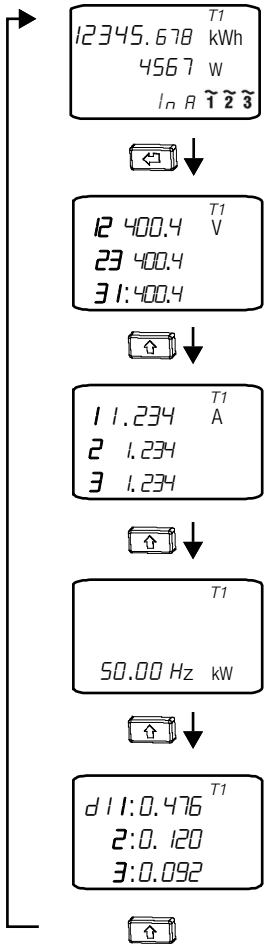


Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

8.4.2 3-WIRE DISPLAYS

The various values are shown in successive displays. As a result, you may have to cycle through multiple displays.

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



The standard display is the starting point.

▶ **Delta Voltage (line-to-line voltage)**

Accuracy of delta voltage U_{12}, U_{23}, U_{31} (V): 0.5% ± 1 d

1. Briefly press the **ENTER** key 4 times in succession at short intervals.

↳ Line-to-line voltage is displayed.

▶ **Current per Phase**

Accuracy of current per phase I_1, I_2, I_3 (A): 0.5% ± 1 d

1. Briefly press the **ENTER** key 4 times in succession at short intervals.
2. Briefly press the **UP** key once.

↳ Phase currents are displayed.

▶ **Line frequency**

Accuracy of frequency f (Hz): 0.05% ± 1 d

1. Briefly press the **ENTER** key 4 times in succession at short intervals.
2. Press the **UP** key 2 times in succession at short intervals.

↳ The line frequency is displayed.

▶ **Current Distortion Component per Phase I_1, I_2 and I_3)**

1. Briefly press the **ENTER** key 4 times in succession at short intervals.
2. Press the **UP** key 3 times in succession at short intervals.

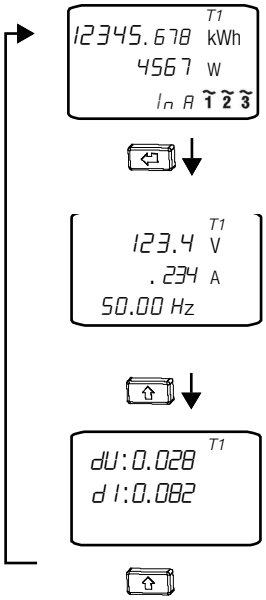
↳ The RMS values of distortion for I_1, I_2 and I_3 are displayed.

Briefly press the UP key or wait for one minute in order to switch to the standard display.

8.4.3 2-WIRE DISPLAYS

The various values are shown in successive displays. As a result, you may have to cycle through multiple displays.

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



The standard display is the starting point.

▶ **Voltage, current and frequency**

Accuracy of current (A): 0.5% ± 1 d

Accuracy of frequency f (Hz): 0.05% ± 1 d

Accuracy of voltage: 0.5% ±1 d

1. Briefly press the **ENTER** key 4 times in succession at short intervals.

↳ Voltage, current and frequency are displayed.

▶ **Current and Voltage Distortion Component (THD U and I)**

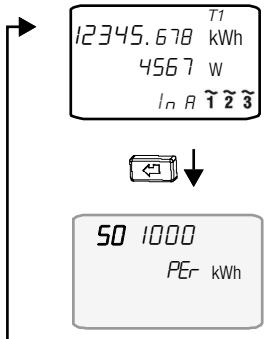
1. Briefly press the **ENTER** key 4 times in succession at short intervals.
2. Briefly press the **UP** key.

↳ The RMS values of distortion for voltage U and current I are displayed.

Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

8.5 S0 PULSE OUTPUT (ONLY WITH FEATURE W0)

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



The standard display is the starting point.

8.5.1 DISPLAYING PULSE FREQUENCY

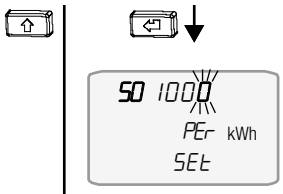
Pulse frequency is the number of pulses which are read out per kWh.

Default value for direct connection: 1000 pls/kWh / for transformer connection: 1000 pulses per kWh
(adjustable and possibly different with feature V2, V4)

Procedure

1. Press and hold the **ENTER** key.
2. Instruments with direct connection: Briefly press the **UP** key 3 times in succession at short intervals.
   Instruments with transformer connection: Briefly press the **UP** key 5 times in succession at short intervals.

↳ The pulse rate is displayed.



8.5.2 ADJUSTING PULSE FREQUENCY (ONLY WITH FEATURE V2 / V4)

Pulse frequency is the number of pulses which are read out per kWh.

The adjustable value (pls/kWh) is model and feature-dependent:
V2 / V4 – direct connection: 1 … 1000 pls/kWh
V2 / V4 – current transformer connection: 1 … 50,000 pls/kWh

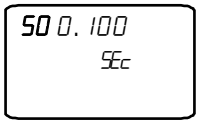
When selecting the value to be adjusted, consider the mutual dependence of pulse frequency and pulse duration.

Procedure

1. Press and hold the **ENTER** key.
2. Instruments with direct connection: Briefly press the **UP** key 3 times in succession at short intervals.
   Instruments with transformer connection: Briefly press the **UP** key 5 times in succession at short intervals.
   ↳ Pulse frequency is displayed.
3. Press the **Enable** key.
   ↳ The pulse frequency parameter is enabled: changes to . The blinking cursor which then appears marks the entry position.
4. Enter the new pulse frequency:
   Change the currently blinking number with the help of the **UP** key.
   Switch to the next entry position by pressing the **ENTER** key.
5. Acknowledge the last number by pressing the **ENTER key.**
   SAVinG appears briefly at auxiliary display 2. Pulse frequency has been changed.
6. Press the **Enable** key.
   ↳ The pulse frequency parameter is disabled: changes to .

↳ The edited pulse frequency is saved and the parameter is disabled.

Continued on next page.



8.5.3 DISPLAYING PULSE DURATION

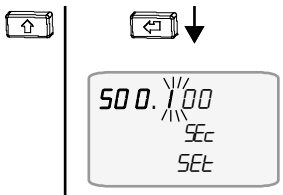
Pulse duration is the duration of the pulse for the ON state or HIGH value.

Default: 30 ms (adjustable and possibly different with feature V2, V4)

Procedure

1. Press and hold the **ENTER** key.
2. Instruments with direct connection: Briefly press the **UP** key 4 times in succession at short intervals.
   Instruments with transformer connection: Briefly press the **UP** key 6 times in succession at short intervals.

↳ Pulse duration is displayed.



8.5.4 ADJUSTING PULSE DURATION (ONLY WITH FEATURE V2 / V4)

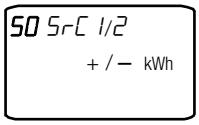
Pulse duration is the duration of the pulse for the ON state or HIGH value. Adjustable: 30 ms … 3 s (accuracy: ± 5%). Recommendation in case of processing problems: 70 ms.

When selecting the value to be adjusted, consider the mutual dependence of pulse frequency and pulse duration.

Procedure

1. Press and hold the **ENTER** key.
2. Instruments with direct connection: Briefly press the **UP** key 4 times in succession at short intervals.
   Instruments with transformer connection: Briefly press the **UP** key 6 times in succession at short intervals.
   ↳ Pulse duration is displayed.
3. Press the **Enable** key.
   ↳ The pulse duration parameter is enabled: changes to . The blinking cursor which then appears marks the entry position.
4. Enter the new pulse duration:
   Change the currently blinking number with the help of the **UP** key.
   Switch to the next entry position by pressing the **ENTER** key.
5. Acknowledge the last number by pressing the **ENTER** key.
   ↳ SAVE nO appears briefly at auxiliary display 2. Pulse duration has been changed.
6. Press the **Enable** key.
   ↳ The pulse duration parameter is disabled: changes to .

↳ The edited pulse duration is saved and the parameter is disabled.



8.5.5 DISPLAYING THE PULSE SOURCE

There are 4 pulse sources for pulse outputs S01 and S02:

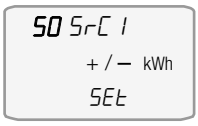
- Active energy import in kWh
- Active energy export in – kWh
- Reactive energy import in kVAr
- Reactive energy export in – kVAr

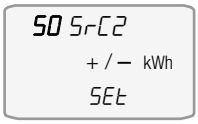
Procedure

1. Press and hold the **ENTER** key.
2. Instruments with direct connection: Briefly press the **UP** key 5 times in succession at short intervals.
   Instruments with transformer connection: Briefly press the **UP** key 7 times in succession at short intervals.>
   ↳ The pulse source for S01 is displayed.
3. Briefly press the **UP** key again.

↳ The pulse source for S02 is displayed.

Continued on next page.





8.5.6 ADJUSTING PULSE SOURCES (ONLY WITH FEATURE V2 / V4)

4 pulse sources for pulse outputs S01 and S02:

– Active energy import kWh or export – kWh

– Reactive energy import kVAr or export – kVAr

2 states: The S0 switch is either CLoSEd or OPEn (depending on the selected setting).

Procedure

First, pulse source 1 is set. Only then can pulse source 2 be set.

1. Press and hold the **ENTER** key.
2. Instruments with direct connection: Briefly press the **UP** key 5 times in succession at short intervals.
   Instruments with transformer connection: Briefly press the **UP** key 7 times in succession at short intervals.
   ↳ The pulse source is displayed.
3. Press the **Enable** key.
   ↳ The pulse source parameter is enabled:  changes to  .
4. Briefly press the **ENTER** key.
   ↳ The blinking cursor which then appears marks the entry position.
5. Enter the new pulse source:
   Change the currently blinking state with the help of the **UP** key.
6. Acknowledge the state by pressing the **ENTER** key.
   ↳ SAVinG appears briefly at auxiliary display 2. Pulse source 1 is changed.
7. Briefly press the **UP** key.
8. Briefly press the **ENTER** key.
   ↳ The blinking cursor which then appears marks the entry position.
9. Enter the new pulse source:
   Change the currently blinking state with the help of the **UP** key.
10. Acknowledge the state by pressing the **ENTER** key.
    ↳ SAVinG appears briefly at auxiliary display 2. Pulse source 2 is changed.
11. Press the **Enable** key.
    ↳ The pulse source parameter is disabled:  changes to  .

↳ The edited pulse source is saved and the parameter is disabled.

Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

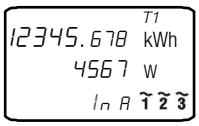
Lon  ⟶

⇨ "Firmware Version and Checksum(s)" 🗎55

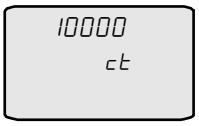
8.6 TRANSFORMATION RATIO (EM2381 / EM2387 AND EM2389 ONLY)

In the case of meters with transformer connection, the transformation ratios of the current transformer (CT) and the voltage transformer (VT) can be viewed.

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



The standard display is the starting point.



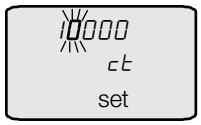
8.6.1 DISPLAYING THE CURRENT TRANSFORMATION RATIO (CT)

Default:
Q0: CT = VT = 1
Q1: adjustable (CT × VT ≤ 100,000)
Q9: fixed individually (default; QCT = 1…10000, QVT = 1…1000, CT × VT ≤ 1,000,000)

Procedure

1. Press and hold the **ENTER** key.
2. Briefly press the **UP** key 3 times in succession at short intervals.

↳ The CT value is displayed.



8.6.2 SETTING THE CURRENT TRANSFORMATION RATIO (CT) (ONLY WITH FEATURE Q1)

Adjustable: CT × VT ≤ 100,000

Procedure

1. Press and hold the **ENTER** key.
2. Briefly press the **UP** key 3 times in succession at short intervals.
   ↳ The CT value is displayed.
3. Press the **Enable** key.
   ↳ The CT parameter is enabled:  changes to  .
4. Briefly press the **ENTER** key.
   ↳ The blinking cursor which then appears marks the entry position.
5. Enter the new CT value:
   Change the currently blinking number with the help of the **UP** key.
   Switch to the next entry position by pressing the **ENTER** key.
6. Acknowledge the last number by pressing the **ENTER** key.
   ↳ SAVing appears briefly at auxiliary display 2. The CT value is changed.
7. Press the **Enable** key.
   ↳ The CT parameter is disabled:  changes to  .

↳ The edited CT value is saved and the parameter is disabled.

8.6.3 DISPLAYING THE VOLTAGE TRANSFORMATION RATIO (VT)

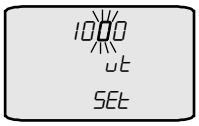
Default:
Q0: CT = VT = 1
Q1: adjustable (CT × VT ≤ 100,000)
Q9: fixed individually (default; QCT = 1…10000, QVT = 1…1000, CT × VT ≤ 1,000,000)

Procedure

1. Press and hold the **ENTER** key.
2. Briefly press the **UP** key 4 times in succession at short intervals.

↳ The VT value is displayed.

Continued on next page.



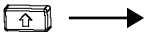
8.6.4 SETTING THE VOLTAGE TRANSFORMATION RATIO (VT) (ONLY WITH FEATURE Q1)

Adjustable: CT × VT ≤ 100,000

Procedure

1. Press and hold the **ENTER** key.
2. Briefly press the **UP** key 4 times in succession at short intervals.
   ↳ The VT value is displayed.
3. Press the **Enable** key.
   ↳ The VT parameter is enabled: changes to .
4. Briefly press the **ENTER** key.
   ↳ The blinking cursor which then appears marks the entry position.
5. Enter the new VT value:
   Change the currently blinking number with the help of the **UP** key.
   Switch to the next entry position by pressing the **ENTER** key.
6. Acknowledge the last number by pressing the **ENTER** key.
   ↳ SAVE no appears briefly at auxiliary display 2. The VT value is changed.
7. Press the **Enable** key.
   ↳ The VT parameter is disabled: changes to .

↳ The edited VT value is saved and the parameter is disabled.



⇨ "S0 Pulse Output (only with feature W0)" 🗎48

8.7 BUS CONNECTIONS (FEATURES W1 / W2 / W4 / W7 / W8)

There are separate menus and setting options for all bus connections. Their descriptions are comprehensive and are made available in separate documents, i.e. the interface descriptions:

- LON-Bus (W1): Document Number 3-349-908-01
- M-Bus (W2): Document Number 3-349-909-01
- Modbus RTU (W7): Document Number 3-349-910-01
- TCP/IP incl. BACnet / Modbus / TCP / HTTP (W4)
  - for Z1: Document Number 3-349-937-01
  - for Z2: Document Number 3-447-174-01
- LPWAN (W8): Document Number 3-447-248-01

These can be found at:

https://www.gmc-instruments.de/en/services/download-center/

8.8 METER READING PROFILE

Depending on the instrument variant, the meter is equipped with a meter reading profile (⇨ "Definition of Terms" 🗎9).

- Z1: Meter reading profile
- Z2: with certification per PTB-A 50.7

It stores the current meter readings of the active tariff for active and reactive power (both import and export but only active power with feature Z2) for each selected period. The consumption profile and a load profile can be determined from these data.

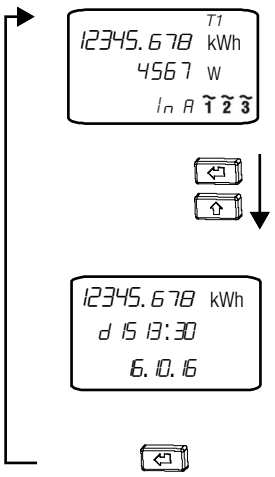
8.8.1 METER READING PROFILE Z1

This document only describes the display of meter reading profile Z1 and the increment setting. A detailed description and setting options can be found in the operating instructions "ENERGYMID|EM EM228X and EM238X Energy Meters with Meter Reading Profile Feature Z1" (document number 3-349-972-03). The document is available on the Internet at:

https://www.gmc-instruments.de/en/services/download-center/

Displaying Values (only with feature Z1 in combination with bus connection W1 / W2 / W4 / W7)

The following values are saved for one period: Meter reading (4 energy values) with the associated tariff, set period duration, time, date and status (cumulative view of events that occurred during the registration period).



The standard display is the starting point.

▶ **Procedure**

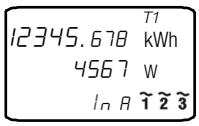
1. Briefly press the **ENTER** key 3 times in succession at short intervals.
   For instruments with feature M1/M3: Briefly press the **ENTER** key 5 times in succession at short intervals.
   ↳ The meter reading profile is displayed.
   (line 2: period duration as dt / time as hh:mm / line 3: date as DD.MM.YY)
2. Briefly press the **UP** key in order to display older meter readings with date and time.
   ↳ An additional value is displayed each time the key is pressed.

Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

Displaying and Setting Period Duration (only with feature Z1 in combination with bus connection W1 / W2 / W4 / W7)

Period duration is the time interval at which values are stored (also called the integrating period).

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.

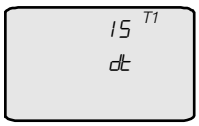


The standard display is the starting point.

Displaying Period Duration

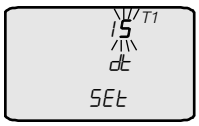
1. Briefly press the **ENTER** key 3 times in succession at short intervals.
   For instruments with feature M1/M3: Briefly press the **ENTER** key 5 times in succession at short intervals.
2. Press the **UP** key 2 times in succession at short intervals.

↳ Period duration dt of the meter reading profile is displayed.



Setting Duration

1. Press and hold the **ENTER** key.
2. Press the **UP** key 2 times in succession at short intervals.
   ↳ Period duration dt of the meter reading profile is displayed.
3. Briefly press the **Enable** key.
   ↳ The period duration parameter is enabled: changes to .
4. Briefly press the **ENTER** key.
   ↳ The blinking cursor which then appears marks the entry position.



5. Set period duration. Briefly press the **UP** key to this end.
   ↳ Each time the key is pressed, the next available value in minutes is selected.
   The following values are possible: 1, 2, 3, 4, 5, 10, 15, 30, 60 minutes. The default values is 15 minutes. Integration takes place synchronous to clock time.
6. Acknowledge the selected value with **ENTER.**
   ↳ SAVing appears briefly at auxiliary display 2.
7. Press the **Enable** key.
   ↳ The increment parameter is disabled: changes to .

↳ The edited period duration is saved and the parameter is disabled.

Briefly press the **UP** key or wait for one minute in order to switch to the standard display.

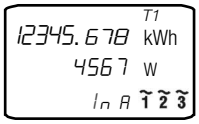
8.8.2 CERTIFIED METER READING PROFILE Z2 (ONLY IN COMBINATION WITH FEATURE W4)

In the case of certified meter reading profile Z2, meter reading profile values are recorded and processed in the meter in accordance with PTB-A 50.7 and PTB-A 50.7-1. Consequently, the values can also be used for billing and acquiring 3rd party quantities.

All information and settings for the certified meter reading profile Z2 (feature Z2) can be found in the Interface Description TCP/IP Z2 (document number 3-447-174-03). The document is available on the Internet at:

https://www.gmc-instruments.de/en/services/download-center/

8.9 FIRMWARE VERSION AND CHECKSUM(S)



The standard display is the starting point.

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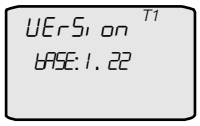
Display firmware version

1. Press and hold the **ENTER** key.

↳ The firmware version is displayed with a red background.



Display firmware checksum

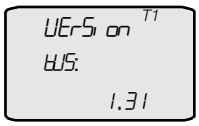
1. Press and hold the **ENTER** key.
   ↳ The firmware version is displayed with a red background.
2. Briefly press the **ENTER** key 2 times in succession at short intervals.

↳ The firmware checksum is displayed with a red background.

Display bus version

1. Press and hold the **ENTER** key.
   ↳ The firmware version is displayed with a red background.
2. Briefly press the **ENTER** key.

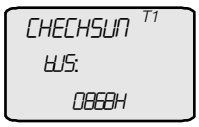
↳ The bus version is displayed with a red background.

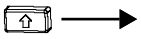


Display bus checksum (meter reading profile Z2 only)

1. Press and hold the **ENTER** key.
   ↳ The firmware version is displayed with a red background.
2. Briefly press the **ENTER** key 3 times in succession at short intervals.

↳ The bus checksum is displayed with a red background.



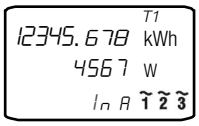


⇨ "Display Test" 🗎55

For information on possible firmware updates see chapter "Updates" ⇨🗎59.

8.10 DISPLAY TEST

You can check to determine whether or not the display is functioning correctly (all segment lines are displayed).

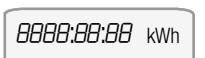


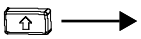
The standard display is the starting point.

Display Test Procedure

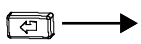
1. Press and hold the **ENTER** key.
   ↳ The firmware version is displayed.
2. Briefly press the **UP** key.
   ↳ The first test pattern is displayed.
3. Check to determine whether or not all segments are displayed.
4. Press the ENTER key briefly in order to display the second test pattern.
5. Check to determine whether or not all segments are displayed.
6. Press the ENTER key again briefly in order to display the second and third test patterns.
7. Check to determine whether or not all segments are displayed.

↳ The display test has been completed.





⇨ "Calibration Display" 🗎56



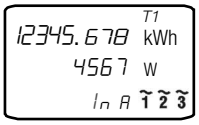
Press and hold the ENTER key to return to the standard display. Alternatively, you can wait 1 minute.

8.11 CALIBRATION DISPLAY

The calibration display includes an additional decimal place. Resolution is model and feature-dependent. See chapter "Standard Display and Calibration Display" ⇨🗎35.

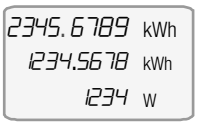
Example: normally 100,010.00 kWh and with calibration display 100,010.005 kWh.

The linear path is described on the left. In contrast, the absolute number of keys required from the starting point to the desired display is shown on the right in the various sections.



The standard display is the starting point.

8.11.1 ACTIVATING THE CALIBRATION DISPLAY



Procedure

1. Press and hold the **ENTER** key.
2. Briefly press the **UP** key twice in succession at short intervals.

↳ The calibration display is activated.

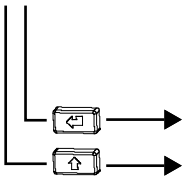
8.11.2 PINNED CALIBRATION DISPLAY / LIVE VALUES

Active energy import and export are displayed as live values.

Procedure

1. Press and hold the **ENTER** key.
2. Briefly press the **UP** key twice in succession at short intervals.
3. Briefly press the **ENTER** key.

↳ The calibration display is pinned and the values are displayed live.



Deactivates pinning.

⇨ "Setting the Current Transformation Ratio (CT) (only with feature Q1)" 🗎51

9 ERROR

9.1 POWER FAILURE

Meter parameters and meter readings are retained in internal memory (EEPROM) in the event of power failure.

9.2 FAULT CONDITIONS AND TROUBLESHOOTING

The instrument is equipped with an error display: if an error occurs, the display alternates between the respective error code and active energy or instantaneous power.

In the event of an error, read out the error code at the display and eliminate the error with the help of the following table:

Error Code	Meaning	Cause/Remedy
⚠ LOUoLt	All phase voltages < 75%	Check connection In the case of meters with feature U3 (100…110V L-L) including TCP/IP (W4) or Modbus RTU (W7) bus connections, background illumination and the bus connection are deactivated. Meter reading profile Z1 cannot be viewed as long as the error is pending. Meter functioning is otherwise unimpaired.
⚠ UH, 1	Maximum value for U_1 exceeded	Check connection
⚠ UH, 2	Maximum value for U_2 exceeded	Check connection
⚠ UH, 3	Maximum value for U_3 exceeded	Check connection
⚠ IH, 1	Maximum value for I_1 exceeded	Check connection
⚠ IH, 2	Maximum value for I_2 exceeded	Check connection
⚠ IH, 3	Maximum value for I_3 exceeded	Check connection
⚠ SYnc	Frequency measuring error	Meter connected to direct voltage
⚠ COM	Interface error	Check connection
⚠ EnErGY	Device is defective	Send meter for repair ⇨ "Contact, Support and Service" 🗎64
⚠ cAL, b	Erroneous measurement detected, balancing (calibration) required	Send meter for repair ⇨ "Contact, Support and Service" 🗎64
⚠ AnALoG	DC offset too high	Send meter for repair ⇨ "Contact, Support and Service" 🗎64
⚠ MEMErr	Memory error	Send meter for repair ⇨ "Contact, Support and Service" 🗎64
⚠ CErt	Calibration logbook	Replace meter

10 MAINTENANCE

The instrument is maintenance-free.

10.1 CLEANING

Keep outside surfaces clean. Clean the instrument with a dry cloth.

DANGER

Life Endangering due to Electric Shock!

Life endangering due to electric arcs!

Touching voltage conducting components is life endangering.

- Maintenance may only be carried out by trained personnel who are familiar with the dangers involved.
- The instrument and all connected conductors must be voltage-free before beginning, as well as during cleaning.

ATTENTION

Water and cleaning agents are unsuitable.

Damage to the instrument.

- Use a dry cloth for cleaning.
- Avoid the use of cleansers, abrasives or solvents!

10.2 CALIBRATION

The calibration period in Germany is 8 years.

ATTENTION

National Calibration Regulations

Violation of calibration law.

Comply with national calibration regulations and laws.

Calibration by our state-approved test laboratory (EBY-8) is possible at any time. Contact information ⇨ "Contact, Support and Service" 🗎64.

Information for the Test/Calibration Laboratory

The manufacturer's seal is located on the side of the instrument ⇨🗎13.

ATTENTION

Broken Manufacturer's Seal

Violation of calibration law.

Calibration is invalidated. The instrument may not be used for billing purposes.

The instrument must be calibrated. Send the instrument in for recalibration ⇨ "Contact, Support and Service" 🗎64.

ATTENTION

Removing the Seal

Violation of calibration law.

Seals may only be broken by authorized, qualified personnel.

- A calibration display can be activated for testing or calibration purposes, at which energy values are displayed with increased resolution ⇨ "Calibration Display" 🗎56.

- In the case of direct meters: current and voltage paths cannot be galvanically isolated.
- Transformer meters with nominal voltage 100 V … 110 V: Calibration testing at 100 V (L-L) is sufficient.
  The more critical power value, because roughly 9% smaller, is remeasured at all load points. Voltage influence was found to be negligible during type testing. Balancing is conducted at 60 V × $\sqrt[3]{}$. Start-up is controlled internally via the current measurement only, so that voltage changes are not relevant for no-load and start-up tests.
- Transformer meters with nominal voltage 100 V … 110 V: due to PTB requirements, the no-load test must be performed at 126.5 V for calibration purposes.

10.3 UPDATES

To guarantee a full scope of functions and in order to ensure that the most up-to-date safety measures are implemented, it is necessary to have the latest firmware installed for Modbus (W7) and LPWAN (W8) interfaces.

All the information required for updating can be found in the associated interface description which, in turn, is available in the download section for your instrument. Your instrument can be accessed via:

https://www.gmc-instruments.de/en/services/download-center/

Further updates are not required and/or possible.

11 REPAIR

If your instrument requires repair, please contact our service department ⇨ "Contact, Support and Service" 🗎64.

The instruments are guaranteed for a period of 3 years after shipment. The manufacturer's guarantee covers materials and workmanship. Damage resulting from use for any other than the intended purpose or operating errors, as well as any and all consequential damage, are excluded.

Note

Loss of Warranty and Guarantee Claims

Unauthorized modification of the instrument is prohibited. This also includes opening the meter.

If it can be ascertained that the tester has been opened by unauthorized personnel, no guarantee claims can be honored by the manufacturer with regard to personal safety, measuring accuracy, compliance with applicable safety measures or any consequential damages.

If the manufacturer's seal (⇨🗎13) is damaged or removed, all guarantee claims are rendered null and void.

- The device may only be repaired or opened by authorized, qualified personnel who are familiar with the associated dangers.
- Original replacement parts may only be installed by authorized, qualified personnel.
- Seals may only be broken or removed by authorized, qualified personnel.
- The device may not be placed back into operation until troubleshooting and repair have been performed, and recalibration and dielectric strength have been tested by an approved test laboratory (for example one of our test centers).

Note

Data Protection

Data can be stored in the instrument. Some of these data may be sensitive.

Back up your data before sending the instrument for repair.

Also, be aware of the owner's or end user's own responsibility with regard to protecting sensitive data in the instrument before sending it for repair.

12 REMOVAL FROM SERVICE AND DISMANTLING

The device cannot be switched off and must instead be disconnected from the power supply. It may only be dismantled after it has been disconnected from the power supply.

DANGER

Danger of Injury

Removal from service and dismantling involve risks which may not be recognized as such by inadequately trained persons (e.g. electric shock).

- Installation may only be performed by a qualified electrician.
- Observe and comply with all safety regulations which are applicable for your work environment.
- Wear suitable and appropriate personal protective equipment (PPE) whenever working with the instrument.

ATTENTION

Device Used for Billing Purposes

Incomplete billing or violation of legal regulations for billing energy. Property damage may also occur.

Do not remove the device from service or dismantle it until it can be assured that it's no longer being used for billing purposes. Consult with the operator/owner in this regard.

12.1 DISCONNECTION FROM THE POWER SUPPLY

Required tool: small slotted screwdriver, seal cutter

✓ You have familiarized yourself with the connections and all associated information ⇨ "Initial Startup" 🗎22.

DANGER

Electric shock due to live components!

Life endangering due to electric arcs!

Touching voltage conducting components is life endangering!

When removing the device from service, all lines connected to the meter must be voltage-free.
When disconnecting, observe the five safety rules in accordance with DIN VDE 0105-100, Operation of electrical installations – Part 100: General requirements:

1. Shut down entirely.
2. Secure against restart.
3. Assure absence of voltage at all poles.
4. Ground and short circuit.
5. Cover neighboring live components, or make them inaccessible.

ATTENTION

Tamper-Proof Sealing

Violation of calibration law.

Seals may only be broken by authorized, qualified personnel.

▶ **Disconnecting the device from the power supply**

✓ The meter is voltage-free (on the device side, i.e. all lines which are connected to the meter).

1. Remove the seals.
2. Open both terminal covers by flipping them up or down respectively.

3. Remove all connecting cables or lines.
   - Loosen one screw terminal.
   - Pull out the respective connecting cable or connecting line.
   - Retighten the screw terminals.
   - Repeat this procedure for all other necessary connection cables and/or leads.
   - With TCP/IP Interface: Remove the RJ-45 cable from the RJ-45 socket.
   - With LPWAN Interface: Remove the antenna cable from the SMA terminal.

↳ The device is removed from service.
If you want to remove it from the installation site, proceed with dismantling ➪🗎62.

12.2 DISMANTLING

Required tool: small slotted screwdriver

DANGER

Electric shock due to live components!

Life endangering due to electric arcs!

Touching voltage conducting components is life endangering!

The surrounding environment must be free of voltage when the device is removed from the installation site. When disconnecting, observe the five safety rules in accordance with DIN VDE 0105-100, Operation of electrical installations – Part 100: General requirements:

1. Shut down entirely.
2. Secure against restart.
3. Assure absence of voltage at all poles.
4. Ground and short circuit.
5. Cover neighboring live components, or make them inaccessible.

✓ The device is disconnected from the power supply and all connection cables or lines have been removed from the device ➪🗎61.

▶ **Removing the Device from the Installation Site**

1. Pull down the snap connector located on the bottom of the device. Push the slotted screwdriver into the slot and pull down to this end.
2. Tilt the device slightly in order to unhook it from the top-hat rail.
   ↳ Latching is released.
3. Remove the device from the rail.

↳ The device is removed.
You can store it for reuse in the future ➪🗎63.
Alternatively it can be disposed of ➪🗎65.

13 TRANSPORT AND STORAGE

If the instrument is (temporarily) removed from service, it can be stored. Please observe the notes in this section in this regard.

The same applies if the instrument is transported, e.g. to a storage location or another place of use.

ATTENTION

Improper Transport

Damage to the product and measuring error

- Transport the instrument only within the limits of permissible ambient conditions (temperature, humidity etc.) ⇨ "Technical Data" 🗎16.
- Use suitable packaging in order to ensure adequate protection against environmental influences and mechanical stress (e.g. impact, damage, contamination etc.).
  We recommend transporting the instrument in its original packaging for protection against damage.

ATTENTION

Improper Storage

Damage to the instrument and/or loss of measuring accuracy and compliance. This means that it cannot be reused.

- Store the instrument in a protected location and only within the limits of permissible ambient conditions. The respective ambient conditions (temperature, humidity etc.) can be found under ⇨ "Technical Data" 🗎16.
- Use suitable packaging in order to ensure adequate protection against environmental influences and mechanical stress (e.g. damage, contamination etc.).
  We recommend storing the instrument in its original packaging for protection against damage.

14 CONTACT, SUPPORT AND SERVICE

Gossen Metrawatt GmbH can be contacted directly and conveniently – we have a single number for everything! Whether you require support or training, or have an individual inquiry, we can answer all of your questions here:

+49 911 8602-0	Monday to Thursday:	08:00 am - 4:00 pm
	Friday:	08:00 am - 2:00 PM
Or contact us by e-mail at:	info@gossenmetrawatt.com	

Do you prefer support by e-mail?

Measuring and Test Technology:	support@gossenmetrawatt.com
Industrial Measuring Technology:	support.industrie@gossenmetrawatt.com

Enquiries concerning training and seminars can also be submitted by e-mail and online:

training@gossenmetrawatt.com

https://www.gmc-instruments.de/en/knowledge/webinars/

Please contact GMC-I Service GmbH for repairs, replacement parts and calibration[1]:

+49 911 817718-0
service@gossenmetrawatt.com
www.gmci-service.com/en/

Beuthener Str. 41
90471 Nürnberg
Germany

1. DAkkS calibration laboratory per DIN EN ISO/IEC 17025
accredited by the Deutsche Akkreditierungsstelle GmbH under reference number D-K-15080-01-01

15 DISPOSAL AND ENVIRONMENTAL PROTECTION

Proper disposal makes an important contribution to the protection of our environment and the conservation of natural resources.

ATTENTION

Environmental Damage

Improper disposal results in environmental damage.

Follow the instructions concerning return and disposal included in this section.

The following comments refer specifically to the legal situation in the Federal Republic of Germany. Owners or end users who are subject to other national regulations must comply with the respectively applicable national requirements and implement them correctly on site. Relevant information can be obtained, for example, from the responsible national authorities or national distributors.

Waste Electrical Equipment, Electrical or Electronic Accessories and Waste Batteries (including rechargeable batteries)

Electrical equipment and batteries (including rechargeable batteries) contain valuable raw materials that can be recycled, as well as hazardous substances which can cause serious harm to human health and the environment, and they must be recycled and disposed of correctly.

The symbol at the left depicting a crossed-out garbage can on wheels refers to the legal obligation of the owner or end user (German electrical and electronic equipment act ElektroG and German battery act BattG) not to dispose of used electrical equipment and batteries with unsorted municipal waste (“household trash”). Waste batteries must be removed from the old device (where possible) without destroying them and the old device and the waste batteries must be disposed of separately. The battery type and its chemical composition are indicated on the battery’s labelling. If the abbreviations “Pb” for lead, “Cd” for cadmium or “Hg” for mercury are included, the battery exceeds the limit value for the respective metal.

Please observe the owner’s or end user’s responsibility with regard to deleting personal data, as well as any other sensitive data, from old devices before disposal.

Old devices, electrical or electronic accessories and waste batteries (including rechargeable batteries) used in Germany can be returned free of charge to Gossen Metrawatt GmbH or the service provider responsible for their disposal in compliance with applicable regulations, in particular laws concerning packaging and hazardous goods. Further information regarding returns can be found on our website.

Packaging Materials

We recommend retaining the original packaging materials in case you might require servicing or calibration in the future.

WARNING

Danger of Asphyxiation Resulting from Foils and Other Packaging Materials

Children and other vulnerable persons may suffocate if they wrap themselves in packaging materials, or their components or foils, or if they pull them over their heads or swallow them.

Keep packaging materials, as well as their components and foils, out of the reach of babies, children and other vulnerable persons.

In accordance with German packaging law (VerpackG), the user is obligated to correctly dispose of packaging and its components separately, and not together with unsorted municipal waste (“household trash”).

Packaging which is not subject to so-called system participation is returned to the appointed service provider. Further information regarding returns can be found on our website.

16 CERTIFICATIONS

16.1 CE DECLARATION

The instrument fulfills all requirements of applicable EU directives and national regulations. We confirm this with the CE mark. This can be found on the Internet at:

https://www.gmc-instruments.de/en/services/download-center/

Gossen Metrawatt GmbH	Begleitende Formulare zum PEP EU-Konformitätserklärung / EU Declaration of Conformity	Form E0F34

Hersteller / Manufacturer: Anschrift / Address:	Gossen Metrawatt GmbH Südwestpark 15, 90449 Nürnberg
Produktbezeichnung/ Product name:	Mehrtarif-Energiezähler Multi Rate Energy Meter
Typ / Type:	EnergyMID
Artikel-Nr / Article No:	EM2281 / EM2289 (DE MTP 17 B 002 MI-003) EM2381 / EM2387 / EM2389 (DE MTP 16 B 004 MI-003)
Dokumente (NB)/ Documents (NB):	EU-Baumusterprüfbescheinigung Nr.: DE MTP 17 B 002 MI-003 EU-Baumusterprüfbescheinigung Nr.: DE MTP 16 B 004 MI-003 Modul D Zertifikat-Nr.: DE CSA 24 D 005

Der oben beschriebene Gegenstand der Erklärung erfüllt die einschlägigen Harmonisierungsvorschriften der Union: / The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

2014/32/EU	MID-Richtlinie (MI 003)	MID Directive (MI 003)

EN/Norm/Standard

EN 50470-1 : 2006 , EN 50470 : 2006 + A1 : 2018 , EN 50470-3 : 2006 , EN 50470-3 : 2006 + A1 : 2018

EN 62052-11 : 2003 + A1 : 2017 , EN 62053-21 : 2003 + A1 : 2017

2014/53/EU	Funkanlagenrichtlinie	Radio Equipment Directive (RED)

EN/Norm/Standard

EN 301 489-3 V2.3.2 : 2023 , EN 301 489-1 V2.2.3 : 2019

ETSI EN 300 220-1 V3.1.1 : 2017/02 , ETSI EN 300 220-2 V3.1.1 : 2017/02

2011/65/EU	RoHS – Richtlinie	RoHS Directive
(EU) 2015/863	Deligierte Richtlinie	Deligate Directive

EN/Norm/Standard

EN IEC 63000 : 2018

Nürnberg, 07.11.2024
Ort, Datum / Place, Date:

Joachim Czabanski, Geschäftsführer / Managing Director

Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller. Sie beinhaltet jedoch keine Zusicherung von Eigenschaften. Die Sicherheitshinweise der mitgelieferten Produktdokumentationen sind zu beachten.

This Declaration of Conformity is issued under the sole responsibility of the manufacturer but does not include a property assurance. The safety notes given in the product documentation which are part of the supply, must be observed.

Datei:	Ausgabe:	Erstellt:	Freigabe:
24-002-U228X-U238X-CE-Entwurf	15.01.2021	Eckl	Weiß

Fig. 6: CE Declaration

16.2 PROTOTYPE TEST CERTIFICATE

Prototype test certificates can be found on the Internet at:

https://www.gmc-instruments.de/en/services/download-center/

16.3 NATIONAL DECLARATION OF CONFORMITY

The instrument complies with the German measurement and calibration act and all legal ordinances based on this act. We confirm this by means of the national declaration of conformity. This can be found on the Internet at:

https://www.gmc-instruments.de/en/services/download-center/

G APPENDIX

Abbreviations and their Meanings:

Icon	Meaning
CT	Current transformation ratio
CT × VT	Product of CT times VT
EP_1 … EP_8, EP_{tot}	Active energy per tariff and total (across all phases)
EQ_1 … EQ_8, EQ_{tot}	Reactive energy per tariff and total (across all phases)
f	Frequency
I_1, I_2, I_3	Current per phase (TRMS value)
I_N	Neutral conductor current (calculated)
I_{max}	Limit current
I_{min}	Minimum current value
I_{ref}	Reference amperage
M0 (feature)	Without multifunctional variant
M1 (feature)	Multifunctional variant: measurement of U, I, P, Q, S, PF, f, THD, I_N
M2 (feature)	Multifunctional variant: measurement of reactive energy (not approved for billing purposes in Switzerland)
M3 (feature)	Multifunctional variant: measurement of U, I, P, Q, S, PF, f, THD, I_N, reactive energy (not approved for billing purposes in Switzerland)
P_1, P_2, P_3, P_{tot}	Active power, per phase and total
PF_1, PF_2, PF_3, PF_{tot}	Power factor (cos(ϕ)) , per phase and total
P0 (feature)	MID approval
Q_1, Q_2, Q_3, Q_{tot}	Reactive power, per phase and total
Q0 (feature)	Fixed current/voltage, CT = VT = 1
Q1 (feature)	Programmable transformation ratios
Q9 (feature)	Fixed transformation ratios
S_1, S_2, S_3, S_{tot}	Apparent power, per phase and total
S0	Pulse rate, S0 output
THD I_1, I_2, I_3	Current distortion component per phase (TRMS value), THD – total harmonic distortion
THD U_1, U_2, U_3	Voltage distortion component per phase (TRMS value), THD – total harmonic distortion
U_n	Reference voltage
U_{1N}, U_{2N}, U_{3N}	Star voltage (TRMS)
U_{12}, U_{23}, U_{13}	Delta voltage (TRMS)
U3 (feature)	Reference voltage: 100 … 110 V L–L
U5 (feature)	Reference voltage: 230 V L–N
U6 (feature)	Reference voltage: 400 V L–L
V0 (feature)	Without pulse output
V1 (feature)	Pulse output
V2/V4 (feature)	Programmable S0
V9 (feature)	Customer-specific S0 rate
VT	Voltage transformation ratio
W0 (feature)	Pulse output only (without bus connection)
W1 (feature)	LON-Bus
W2 (feature)	M-Bus
W4 (feature)	TCP/IP (BACnet, Modbus TCP, HTTP)

Icon	Meaning
W7 (feature)	MODBUS RTU
W8 (feature)	LPWAN supporting the LoRaWAN® protocol
Z0 (feature)	Without meter reading profile
Z1 (feature)	Meter reading profile (only possible with bus connection)
Z2 (feature)	Certified meter reading profile per PTB-A 50.7 (only in combination with W4, not possible in combination with U3)

GOSSEN METRAWATT
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