Product manual for the
Digital Industry Meter DIZ
Generation G

Installation I Device description I Operating

Contents page

1   About this product manual

This product manual is part of the documentation. It contains all information necessary for safe use. Read these instructions before starting up the device. Keep this product manual and all other supplied documentation safe so that they are available during the entire service life of the device.

The following documents, including this product manual, still belong to the product documentation:

- Data sheet
- Instructions for use

When operating the meter, also strictly observe all documents supplied with the other components.

1.1   Applied standards and conformity

The mentioned standards in chapter 7.1 on page 49 were applied to device.

> **i**   **All models and functions of the meter are described in this manual.**
> **Please note that models may differ in respect to configuration, data interfaces, inputs/outputs or other aspects of the design. It is possible that features are described that do not apply to the device you are using.**
>
> **The available configurations please refer to the chapter 3.3 Technical data on page 8.**

Illustrations in this product manual are meant to aid understanding and may deviate from the actual design of the device.

1.2   Target group

The product manual is intended for:

- technicians responsible for assembly, connection and maintenance of the devices
- for those parties, e.g. energy supply companies, responsible for professional and safe start-up and efficient operation of the product.

The device may be installed and set up exclusively by trained and qualified electricians in according with the generally accepted codes of practice and regulations for setting up telecommunications equipment and terminals.

Qualified electricians are those who can assess the tasks given to them and recognize potential hazards based on their expert training, knowledge and experience as well as on their knowledge of relevant standards.

Operators and users must be familiar with the operation of this device. Observe the legal requirements for its operation and use.

1.3　Warnings

Warnings in this product manual identify information that is relevant to safety. You will find warnings within procedural sequences in front of a step that poses a risk to persons or property.

Warnings consist of:

- The warning symbol (pictogram),
- A signal word to identify the danger level,
- Information on the danger, as well as
- Instructions on avoiding the danger.

Warnings are expressed in one of the following danger levels depending on the degree of risk:

⚠ **DANGER!**

Indicates an immediate danger that, if not avoided, will lead to serious injuries or death.

⚠ **WARNING!**

Indicates a possible danger that, if not avoided, may lead to serious injuries or death.

⚠ **CAUTION!**

Indicates a possible danger that, if not avoided, may lead to minor or moderate injuries.

ATTENTION!

Indicates a situation that, if not avoided, will lead to damage to property or the environment.

ℹ Indicates useful information within procedural sequences or descriptions.

1.4　Special markings and symbols

In the following chapters, the markings and symbols described here are used to emphasise procedural instructions, results and other elements:

- Text that is **emphasised in this way** designates names of menus, format names and other fixed designations.
- Action sequences are characterized by a consecutive numbering.
- ➢　Indicates the result of a previous action.

2 For your safety

This chapter contains information about handling the device responsibly and about general safety rules.

2.1 Basic safety instructions

Always follow the instructions below:

- Read all supplied instructions and information.
- Observe the warnings on the device and in the documents.
- Check the outside of the device prior to assembly for recognisable damage from transport or other kinds of damage.
- Observe the applicable local occupational health and safety regulations for electrical installations.
- Make sure that the installation and operating site of the device corresponds to the specifications of the technical data.
- Only use the device if it is in proper working order and only use it for its intended purpose.
- The meter may not be operated outside of the specified technical data ranges (see nameplate).
- Always work in a safety and hazard-conscious manner.
- During assembly, installation and removal of the meter, observe the applicable local occupational health and safety regulations for electrical installations.
- Select conductor cross-sections according to the maximum current load.
- Use flexible lines with ferrules.
- Observe the maintenance and the warranty information.

2.2 Intended use

The meter is to be exclusively used for measuring electrical energy and may not be operated outside of the specified technical data ranges (see nameplate).

2.3 Maintenance and warranty instructions

The meter is maintenance-free. In the event of damage (e.g. due to transport, storage), it is not permissible to perform repairs yourself. Opening the device will void the warranty. The same applies if a defect is due to external influences (e.g. lightning, water, fire, extreme temperatures or weather conditions) as well as improper or negligent use or handling.

2.4 Instructions for care

> ⚠ **DANGER!**
>
> **Contact of parts under voltage is extremely dangerous!**
>
> When cleaning the housing of the meter, the conductor to which the meter is connected must be de-energized.

Clean the housing of the meter with a dry cloth. Do not use chemical cleaning agents. Never use petrol, paint thinner or other solvents to clean the housing; otherwise, the surface can become damaged or discoloured.

2.5   Disposal

In accordance with the specifications of the Environmental Management Standard ISO 14001, most of the components used in the device are recyclable.

Specialised waste management and recycling companies carry out material separation, disposal and recycling.

The following table names the components and how they are to be handled at the end of their service life.

Table 1:   Disposal of the components of the device

Components	Waste collection and disposal
PCB's	Electronic waste: dispose in accordance with local regulations.
LEDs, LC display	Special waste: dispose in accordance with local regulations.
Metal parts	Scrap, recyclable: separate according to type and recycle.
Plastic parts	Separate according to type and recycle (re-granulate). Send for waste incineration if necessary (energy generation by thermal process).

3 Description of the device

3.1 Scope of delivery

Before beginning with installation and start-up, please check that the contents of the box are complete.

- 1 DIZ device of generation G
- 1 Instructions for use
- Accessory (optional):
    - Path separator

If the contents are not complete or damaged, please contact your supplier.

3.2 General description

This meter is a digital one, two or four tariff meter for measuring positive and negative active and reactive energy in 2-, 3- and 4-wire networks. Tariff switching can be realized via the internal real time clock (RTC) or via an external control input for 2 tariff types.

The application areas are mainly the energy data collection in the industrial and building technology, the switchgear engineering and the use in the energy supply sector.

Its design allows for space-saving installation (only 6 modules according to DIN 43880).

The meter in the converter design has an adjustable transformer ratio to capture the actual energy consumption. The converter ratio can be set directly on the meter using the call-up button. If the meter is used for billing purposes, the edit menu must be permanent lock. The transformer ratios are then no longer be changed.

The energy consumption values are presented on an 8-digit LC-display.

Furthermore, the energy consumption values can be issued via secondary or primary pulse outputs and/or via a two-wire electrical interface (M-Bus) or RS485 (M-Bus, Modbus-RTU®). The pulse constant and pulse length can be adjusted depending on the meter types.

The meter has the following accuracy classes:

- Active energy: accuracy class B or A according to EN 50470-1, -3
- Reactive energy: accuracy class 2 or 3 according to IEC 62053-23

3.3 Technical data

Table 2: Technical data

		Transformer connected meter 1(6) A or 5(6) A	Direct connected meter 0,25 - 5(65) A, 0,25 - 5(80) A or 0,5 - 10(65) A
Voltage	4-wire meter	3 x 58/100 V, 3 x 63/110 V, 3 x 230/400 V, 3 x 290/500 V	3 x 230/400 V, 3 x 254/440 V
	3-wire meter	3 x 100 V, 3 x 110 V, 3 x 230 V, 3 x 400 V, 3 x 500 V	3 x 230 V, 3 x 400 V, 3 x 500 V
	2-wire meter	100 V, 230 V	230 V
Starting current		2 mA	20 mA
Frequency		50 Hz, 60 Hz, 16,7 Hz	50 Hz, 60 Hz
Accuracy	active energy reactive energy	Cl. B or Cl. A according to EN 50470-1, -3 Cl. 2 or Cl. 3 according to IEC 62053-23	
Measuring types	active energy reactive energy	+A, -A +R, -R	
Meter constants	LED	10 000...100 000 Imp./kWh (depending on meter type)	1 000...2 000 Imp./kWh (depending on meter type)
	primary output	1...1 000 Imp./kWh (depending on meter type, pulse length 100 or 500 ms)	---
	secondary output	100...100 000 Imp./kWh (depending on meter type, pulse length 30, 50 or 100 ms)	1...1 000 Imp./kWh (depending on meter type, pulse length 30, 50, 100 or 500 ms)

	configuration ability
	  certified version
	  with Declaration of Conformity of MID
		fixed parameterisation
		settable via mechanical button (lockable for billing purposes)	

Energy registers	number	max. 4 tariff register + 1 tariffless register for energy direction +P and -P; max. 2 tariff register + 1 tariffless register for each energy direction (+P, -P, +Q and -Q)	
Load profile	number of channels typical memory depth at 1 channel registering period registering type	max. 4 12 000 entries 5, 10, 15, 30, 60 min state of energy register	
Real Time Clock	accuracy synchronisation running reserve Goldcap	within ± 5 ppm via data interface or line commutation max. 10 days (240 hours)	
Control input	number low voltage/system voltage	max. 1 for external tariff switching	
Data retention time		without voltage in the FLASH-ROM, at least 20 years	
Display	LC display digit size in the value range reading without power supply (optional)	8 digits 3,4 x 6,8 mm by buffer battery	
Operation	mechanical button	for operation of display	
Data interface (optional)	M-Bus RS485	according to EN 13757-2, -3 (300...9600 baud) protocols: M-Bus, or Modbus-RTU® (Remote Terminal Unit)	

		Transformer connected meter 1(6) A or 5(6) A	Direct connected meter 0,25 - 5(65) A, 0,25 - 5(80) A or 0,5 - 10(65) A
Outputs (optional)	number Opto-MOSFET S0-output	max. 2 max. 250 V AC/DC, 100 mA for impulse transmission (fulfils S0-specifications) max. 27 V DC, 27 mA (passive)	
Energy supply	switched-mode power supply	3-phase from the measuring voltage	
Power consumption per phase	voltage path current path	< 2,0 VA/1,0 W < 0,5 VA	< 2,0 VA/1,0 W < 2,5 VA
EMC-characteristics	isolation resistance surge voltage resistance against HF-fields	Isolation: 4 kV AC, 50 Hz, 1 min EMC: 4 kV, Impulse 1,2/50 µs, 2 Ω ISO: 6 kV, Impulse 1,2/50 µs, 500 Ω 10 V/m (under load)	
Temperature range	specified operating range limit range for operation, storage and transport	-25 °C...+55 °C -40 °C...+70 °C	
Relative humidity		max. 95 %, non-condensing, according to IEC 62052-11, EN 50470-1 and IEC 60068-2-30	
Housing	dimensions class of protection degree of protection housing degree of terminal block housing material fire characteristics	6 modules (according to DIN 43880) = 107,5 x 89,5 x 64,0 (W x H x D) mm II IP 20 IP 20 polycarbonate glass-fibre reinforced, without halogen, recyclable according to IEC 62052-11	
Environmental conditions	mechanical electromagnetic intended location	M1 according to Measuring Instruments Directive (2014/32/EU) E2 according to Measuring Instruments Directive (2014/32/EU) indoor according to EN 50470-1	
Weight		approx. 450 g	
Connection cross section	current or neutral terminals voltage or additional terminals	max. 4 mm² (max. 2,5 mm² according to IEC 60999-1) max. 2,5 mm²	max. 25 mm² (max. 16 mm² according to IEC 60999-1) max. 2,5 mm²
Further features	measuring of instantaneous values installation check buffer battery (optional)	powers, voltages, currents, neutral conductor current, frequency via instantaneous values (service data) possible integrated buffer battery for reading the display without power	

Product specifications are subject to change without notice!

* To insure the required protection against ingress of dust and water according standard (IP 51, EN 50470-1, pt. 5.9) the devices has to be used in a meter cabinet, which fulfil the class IP 51.

3.4 Function circuit diagram

3.4.1 Direct connected meter up to 80 A
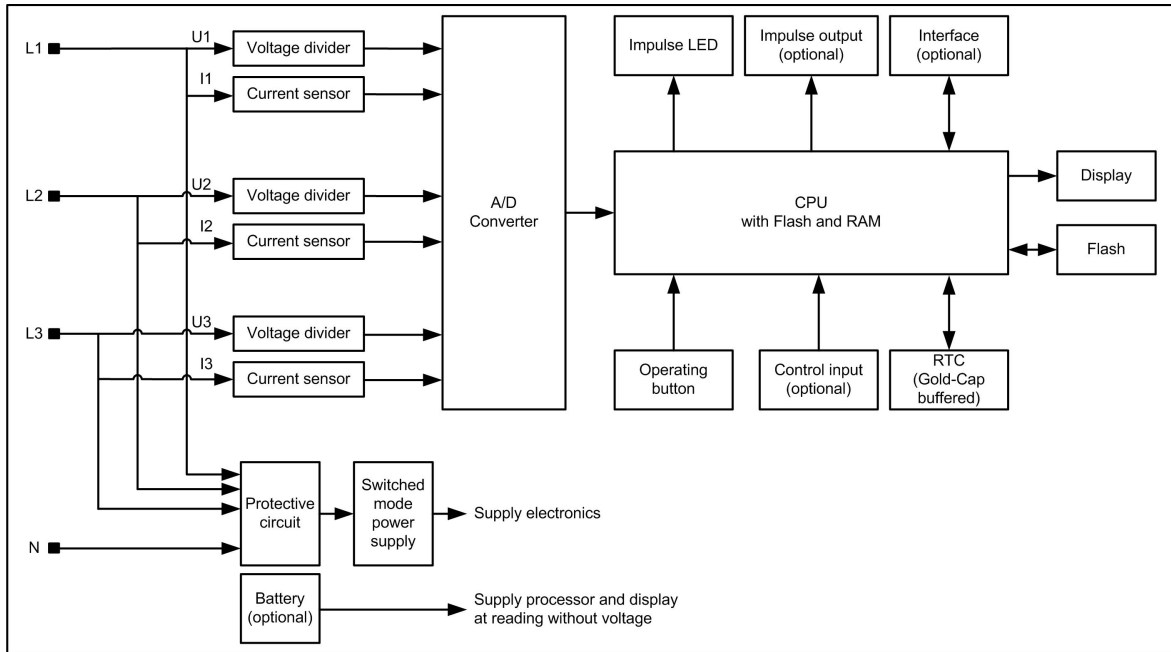
Illustration 1:   Function circuit diagram direct connected meter

3.4.2 Transformer operated meter up to 5 A
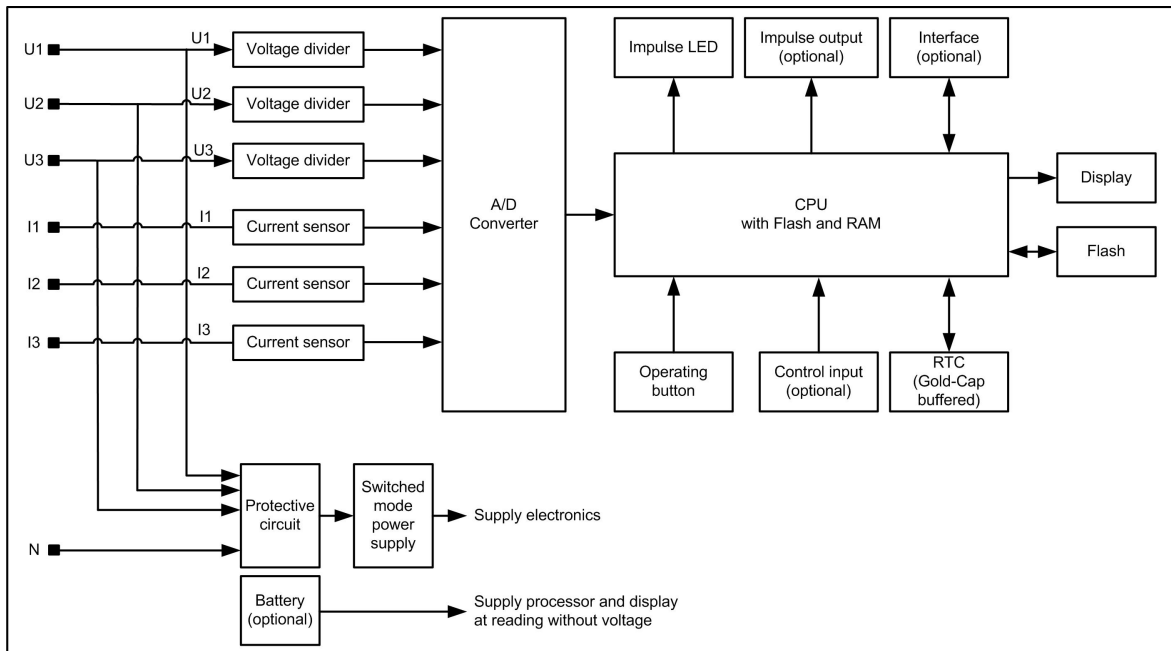
Illustration 2:   Function circuit diagram transformer operated meter

The meter can be operated as a secondary meter (measured energy from the secondary side of the transformer got to be multiplied with the transformer ratios (VT x CT)) or as a primary meter by setting the transformer ratios (real energy on the primary side of the transformer).

3.5 Housing, display and operating elements

3.5.1 Overview of housing, display and operating elements
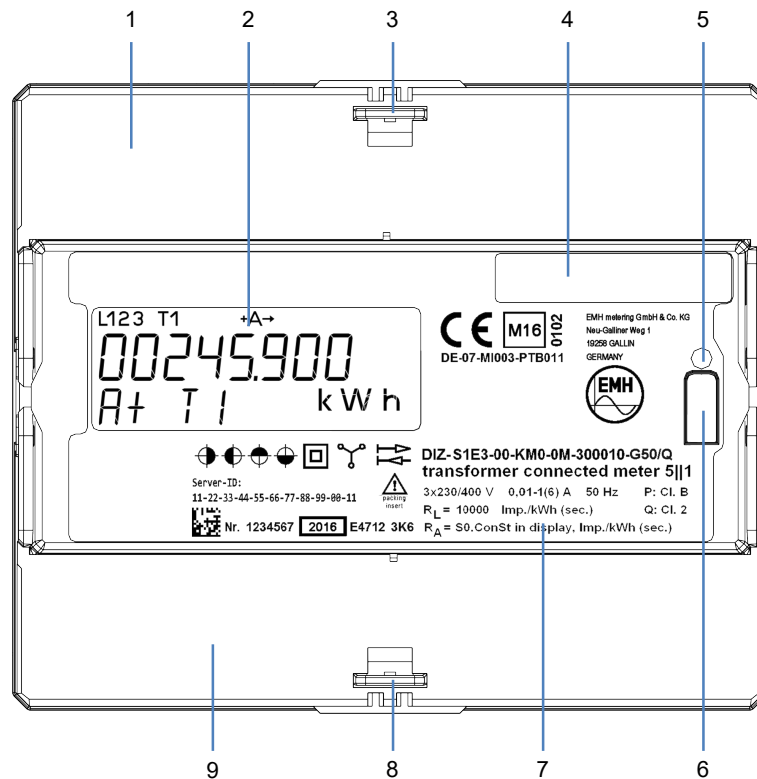
No.	Description
(1)	Folding terminal cover
(2)	Display
(3)	Seal eye
(4)	Compartment for transformer plate (only on transformer connected meters)
(5)	Test LED
(6)	Call-up button to operate the meter
(7)	Nameplate
(8)	Seal eye
(9)	Folding terminal cover

Illustration 3:   Housing, display and operating elements

3.5.2 Display

The meter is equipped with a Liquid Crystal Display (LCD) with following structure:

Illustration 4:   Structure of the display
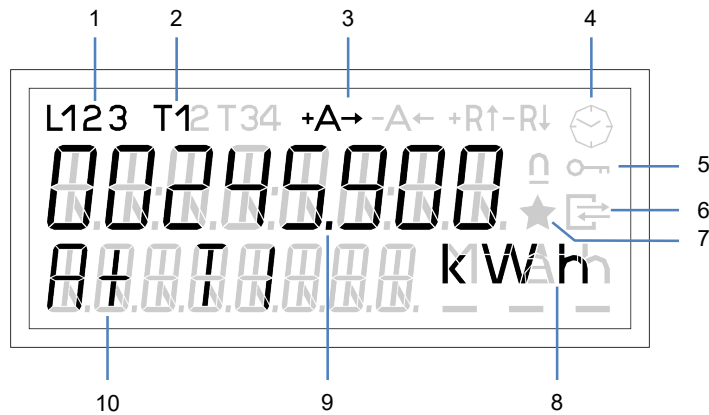
No.	Description
(1)	Phase display
(2)	Display of the active tariff
(3)	Energy direction display
(4)	Clock symbol
(5)	Lock symbol (key)
(6)	Communication symbol
(7)	Test mode symbol (star)
(8)	Display of the units
(9)	Value area
(10)	Information area

Phase display

L1, L2, L3 are continuously lit: Phase voltages are applied.

L1, L2, L3 are flashing: Phase sequence of the voltage is wrong.

Display of the active tariff

T1, 2, 3 or 4:   Tariff 1, 2, 3 or 4 is active

Energy direction display

+A is lit continuously: The meter has started up and registers positive active energy.

+R is lit continuously: The meter has started up and registers positive reactive energy.

-A is lit continuously: The meter has started up and registers negative active energy.

-R is lit continuously: The meter has started up and registers negative reactive energy.

+A/-A flash: Non-reverse ratchet is active, energy is not registered (+A: meter is only recording imported energy, flashing when energy is exported; -A meter is only recording exported energy, flashing when energy is imported).

Clock symbol

is lit continuously:	Tariff control is done via the tariff switching clock.
flashes:	Clock is defective or power is depleted.
off:	Tariff control deactivated or is done via an external signal (control input).

Lock symbol (key)

flashes:	Edit mode is active or was left without locking. The edit data can continue to be changed (not allowed for billing purposes).
off:	The edit mode is continuously locked and cannot be activated (allowed for billing purposes).

Communication symbol

Lights up during communication via the electric interface. The frame of the symbol flashes when the parametering status is active.

Test mode symbol (star)

is lit continuously:	Test mode active. Pulse output of active power to test LED with increased pulse valence.
flashes:	Test mode active. Output of reactive power to test LED with increased pulse valence.

Display of the units

Unit of the value displayed in the value area.

Value area

Display of the register content or action target during menu navigation.

Information area

Additional description of the displayed value.

Lighted display (optional)

Optionally the meter can be equipped with a backlight display.
The backlight will be activated by using the call-up button.
A further short push of the call-up button will start the call-up menu with the static list.

The lighting expires:

- when leaving the call-up menu the display goes back to the operating display
- if the call-up button is pushed longer (t ≥ 5 s). Automatically the display switches back to the operating display.
- if the call-up button is not used:
    - automatically after 30 s during the operating display.
    - automatically after 5 min during a menu are active.

i	During battery operation the backlight function of the display is not possible.

3.5.3 Nameplate

The nameplate contains data for the identification of the meter, the approval mark as well as technical specifications and details.

The nameplate may contain more specifications than are configured in your meter.
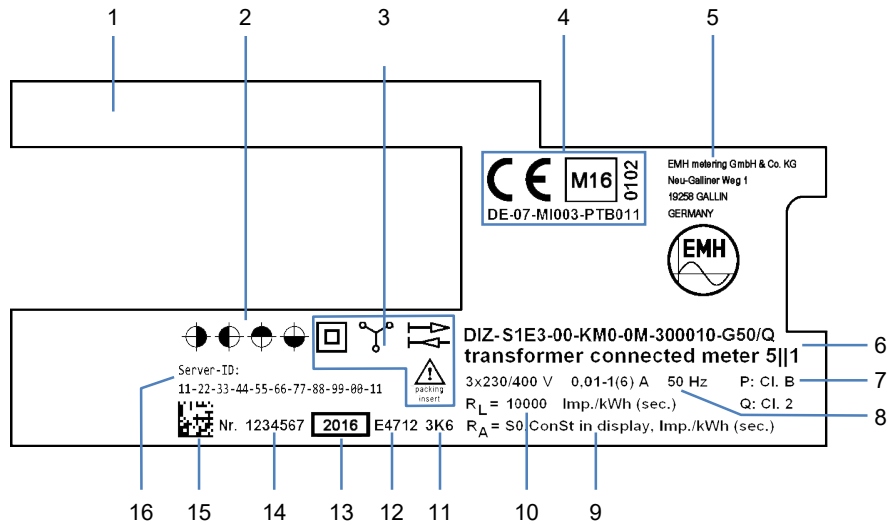
No.	Description
(1)	Space for ownership inscription
(2)	Registered quadrants
(3)	Safety and instruction notes
(4)	Conformity and approval mark
(5)	Manufacturer address
(6)	Type designation and type key
(7)	Accuracy classes
(8)	Voltage, current, frequency
(9)	Output impulse constant
(10)	LED impulse constant
(11)	Temperature class according to IEC 60721-3-3
(12)	Contact sequence number
(13)	Model year
(14)	Serial number
(15)	Bar code
(16)	Server ID or Neuron ID

Illustration 5:   Example of nameplate

3.6 Interfaces

3.6.1 M-Bus interface

The M-Bus interface is built according to DIN EN 13757-2, -3. The M-Bus interface which is galvanically separated from the meter is found at the auxiliary terminals 23 and 24.

The following parameter can be transferred via the M-Bus:

- Manufacturer identification
- Medium
- Primary and secondary addresses for M-Bus
- Energy values
- Instantaneous values:
    - power P for all phases
    - active power (P1, P2, P3)
    - currents
    - voltages (U1, U2, U3, U12, U23, U13)
    - reactive powers (Q)
    - apparent powers (S)
    - frequency
    - power factors (PF)
    - neutral conductor current
- Voltage (VT) and current (CT) transformer ratio (changes are only possible on devices with activated edit mode! see also chapter 5.9 on page 42)
- Error status
- Load profile

Further information and details can be found in the M-Bus description for this meter. It is possible that not all data can be read, this depends on the read tool. If this is the case, we recommend the industrial meter tool.

3.6.2 RS485 interface (M-Bus, Modbus-RTU®)

The electrical interface RS485 is a symmetrical two-wire interface (half-duplex) and is built according to TIA/EIA-485/ITU-T V.11.

The RS485 interface which is galvanically separated from the meter is located at the auxiliary terminals 14 and 16.

Used as data protocols are the M-Bus protocol (also see chapter 3.6.1 M-Bus interface), or Modbus-RTU® (Remote Terminal Unit).

Table 3: Specification of the RS485 interface

Characteristics		
Number of connected devices	up to 32	
Maximum cable length	up to 1000 m	
Data transmission rate	300...38400 baud, depending on the protocol	
Signal according to TIA/EIA-485/ITU-T V.11	logical "1" -0,3 V to -6 V	logical "0" +0,3 V to +6 V

RS485 standard bus

At an RS485 bus can be operated up to 31 meters and 1 modem (or master, e. g. i/o controller). The first and last device in bus system are terminated with a terminating resistor between line B and line A to eliminate line reflections. If a terminating resistor is already available as in the modem, a further resistor is not necessary at this side of the bus. Furthermore, this modem (master) must be installed at the beginning or at the end of the bus.

Bus structure:
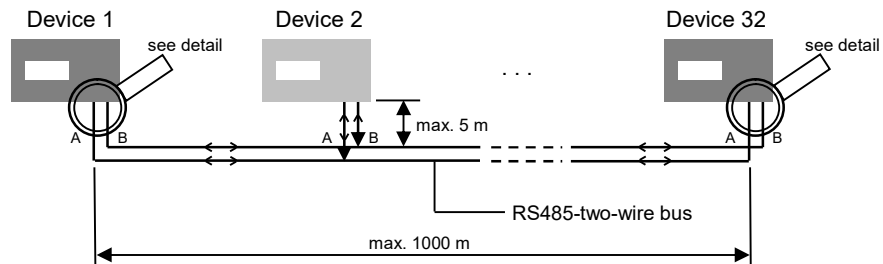
Illustration 6: System layout of an RS485 two-wire bus

Detail:
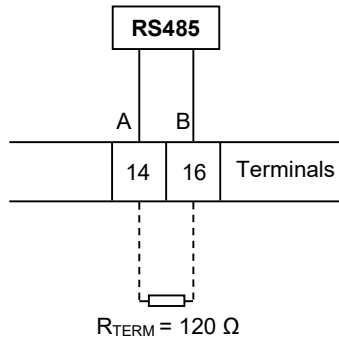
Illustration 7: Detailed drawing RS485 terminating resistor

Further features and details can be found in the protocol descriptions for this meter.

Modbus-RTU® (Remote Terminal Unit)

Depending on the respective meter design and meter configuration, the meter supports the protocol Modbus-RTU® (Remote Terminal Unit). Modbus-RTU® is an open master slave protocol, designed by Modicon (nowadays Schneider Electric).

The master sends a telegram via the bus, which is addressed to a certain slave or all slaves (broadcast). If the slave can process the telegram without conflicts, then it will issue, depending on the received telegram type, a special answer. Only the master is allowed to initiate a data exchange. There can only be one master in any network, however, up to 247 slaves can exist.

The settings for the serial interface are called transmission mode.

The following possibilities are available:

- 1 start, 8 data, 1 stop bit, even parity (8E1)

- 1 start, 8 data, 1 stop bit, uneven parity (8O1)

- 1 start, 8 data, 2 stop bit, no parity (8N2)

- 1 start, 8 data, 1 stop bit, no parity (8N1)

The transmission mode can be changed either via Modbus® or using the call-up button via the user menu.

The baud rates 1200, 2400, 4800, 9600 19200 and 38400 are supported.

3.7 Input and outputs

3.7.1 Input

The two tariff meter can be equipped with a control input (voltage system) for tariff switching.

Table 4:   Specification of the input

Specifications	
System voltage	58...230 V AC (standard)
Low voltage	5…40 V AC

3.7.2 Outputs

The meter has two potential-free S0 impulse outputs (according to IEC 62053-31) or two potential-free MOSFET impulse outputs (semiconductor relay).

The MOSFET outputs are designed as a make contact.

Table 5:   Specification of the outputs

Specifications	
Opto-MOSFET	max. 250 V AC/DC, 100 mA (standard)
S0	max. 27 V DC, 27 mA (passive)

Secondary pulse outputs

The pulse outputs are not affected by any possibly transformer ratios.

Depending on device configuration the pulse duration can be 30, 50, 100 or 500 ms.

The energy pulses (R_A) can be, depending on device configuration, 1, 10, 50, 100, 500, 1 000, 5 000, 10 000, 50 000 or 100 000 Imp./kWh or Imp./kvarh and are always based secondary.

Primary pulse outputs

The transformer ratios effect the pulse output.

Depending on device configuration and the transformer ratio, the pulse duration can be 100 or 500 ms.

The pulse valence can be set to 1, 10, 100 or 1 000 Imp./kWh or Imp./kvarh.

i	On meters with a configured primary pulse output, the functionality of the pulse output also depends on the set total transformer ratio.
	The transformer ratios must be selected by the user in a way that during maximum load of the meter a sufficiently high pulse pause in ensured.

Example:

Meter connection type: 4-wire

U_{Nom} = 3x230/400 V

I_{Max} = 6 A

Output pulse valence: 1 Imp./kWh with 500 ms pulse duration

Total transformer ratio = U-factor x I-factor = e.g. 1000

P_{Max} = U_{Nom} x 15 % x I_{Max}

P_{Max} = 3x230 V x 1,15 x 6 A = 4,761 kW

Pulse frequency = 1 hour x P_{Max} x pulse valence x transformer ratio / 3600 s

Pulse frequency = 1 h x 4,761 kW x 1 Imp./kWh x 1000 / 3600 s

Pulse frequency = 1,3225 Hz => every 756 ms a pulse

With a fixed pulse duration of 500 ms the pulse period is 256 ms (756 ms – 500 ms).

Configuration of the pulse outputs

The configuration of the impulse outputs will be fixed during the production process. It is not possible to change it later.

Table 6:   Configuration of the pulse outputs

Out 1	Out 2
|P|	none
|P|	|Q|
+P	none
+P	-P
+P	+Q

3.7.3   Test LED

Any possibly transformer ratios do not effect the test LED.

The LED constant (R_L) depends on the device model and is always related secondary.

3.8   Battery

⚠ **CAUTION!**

Danger of explosion due to improper handling of the exchangeable battery!

Only authorised personnel are permitted to insert or replace the battery. Batteries may leak or ignite.

- Do not short-circuit, damage, heat or open force batteries.

The meter can optionally be equipped with an internal battery, which allows the reading of the meters display in a de-energised state.

At least 250 readings with duration of 1 min each are possible. The readings can be done in a time period of 8 years, whereby the runtime of the battery changes through the respective user profile.

During battery operation the display extinguishes automatically 20 s after the last actuation of the call-up button.

The following is not provided during battery operation:

- Optical/electrical interface
- Measuring element
- Data storage
- Pulse counting
- Input
- Outputs
- Display lighting

During battery operation no symbols are shown in the display.

Next to the standard operating display the menu contains the listmenu as the only sub-menu. In the listmenu the measured values list is hidden.

In the scrolling list of standard operating display the energy values for the active tariff are shown.

---

i   The battery that is used in the meter is a lithium battery with slow self-discharge. If lithium batteries are stored or not used for a long time a protective film forms technology-related on the inner contacts that prevents self-discharge. If the battery is used again, this protective film must first be removed, so that the full power is available. Therefore, it may be necessary that the call-up button must be pressed for a longer time (≤ 30 s) so that the device can be operated again.

3.9   Real Time Clock

The quartz-run, capacitor buffered real time clock (RTC) is used for tariff switching and synchronization of the load profile.

The running accuracy of the real time clock is operating within ± 5 ppm.

After a charging time of the gold caps of at least 24 hours, the internal clock is running even during a power outage with a power reserve of at least 168 hours (7 days).

The time and date can be set via the data interface and the setmenu.

4 Installation and commissioning

⚠ **DANGER!**

Contact of parts under voltage is extremely dangerous!

When installing or changing the meter, the conductor to which the meter is connected must be de-energized.

- Remove the relevant back-up fuses, for two-sided supply on the mains side as well as on the generation side.
- Store the back-up fuses in such a way that other people cannot refit them unnoticed.
- If you use selective circuit breakers for disconnection from the mains, secure them against being switched on again unnoticed.
- Only use the dedicated screw terminals for installation and connection of the meter.

⚠ **DANGER!**

Risk of danger to life due to electric arc and electric shock!

The input and outputs are not secured internally.

- Secure the input with a back-up fuse of ≤ 0,5 A according to valid technical directives.
- Secure the outputs in compliance with the current value specified on the nameplate of the meter and the Opto-MOSFET output with a back-up fuse of 0,1 A according to valid technical directives.

⚠ **DANGER!**

Risk of danger to life due to electric arc and electric shock!

The voltage taps are not secured internally and directly connected to the mains potential.

- Secure external devices, which are operated via the voltage taps of the meter, with back-up fuses of ≤ 0,5 A according to valid technical directives.

i   The meter may not be operated outside of the specified technical data ranges. Ensure that a meter is installed, which is suitable for the intended use.

4.1   Mounting the meter

The meter is designed for the installation onto DIN rails TH 35-7.5 according to IEC 60715. The following figure shows the relevant dimensions for the mounting of the meter (in mm).
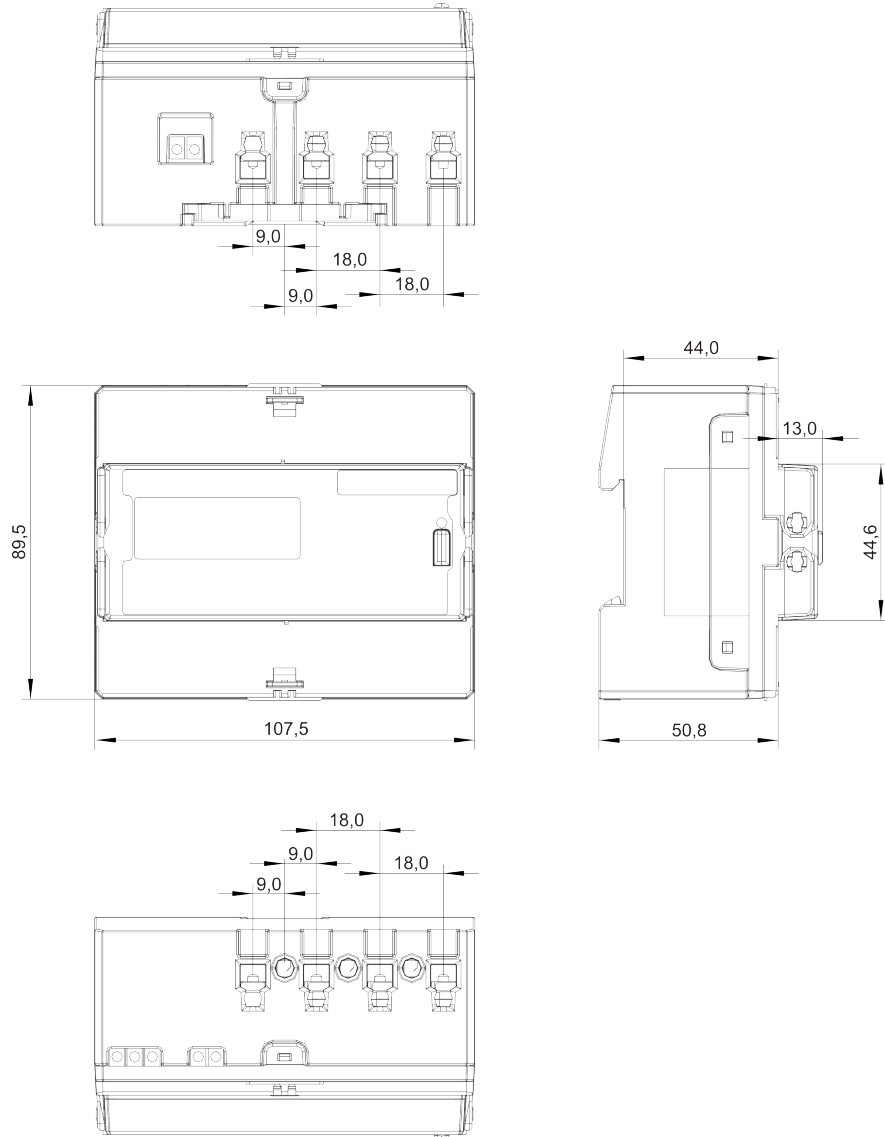
Illustration 8:   Housing dimensions (in mm)

4.2 Installation the meter

i

When connecting the meter, observe the appropriate wiring diagram, which you can find inside the terminal cover.

If the wiring diagram is missing, please contact the supplier.

4.2.1 Examples of wiring diagrams

⚠ **DANGER!**

Improper installation endangers life and health and carries the risk of malfunction and property damages!

- When connecting the meter make sure that the terminals for neutral conductor 10/11 and 12 are on the left side.

2-wire version, connected directly
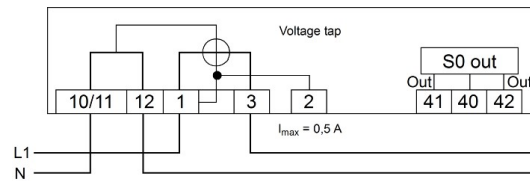
3-wire version, connected to the current and voltage transformer
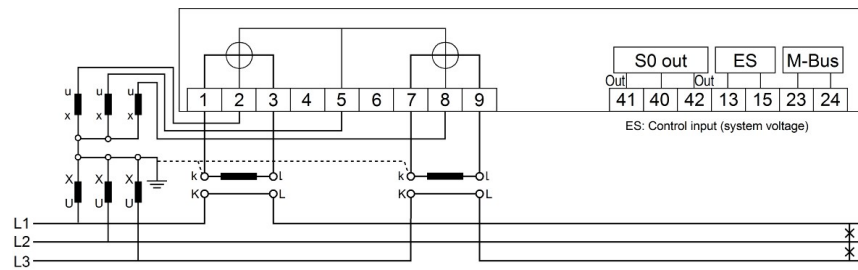
4-wire version, connected to the current transformer
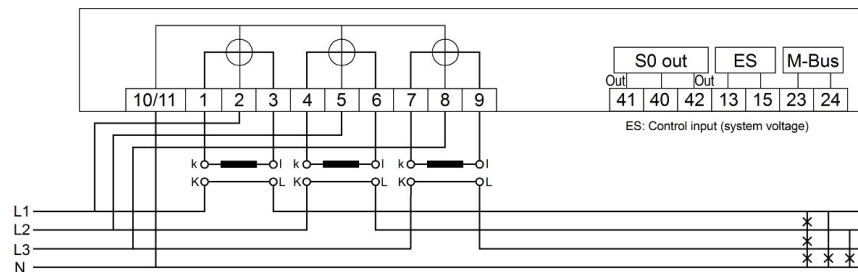
4-wire version, connected directly
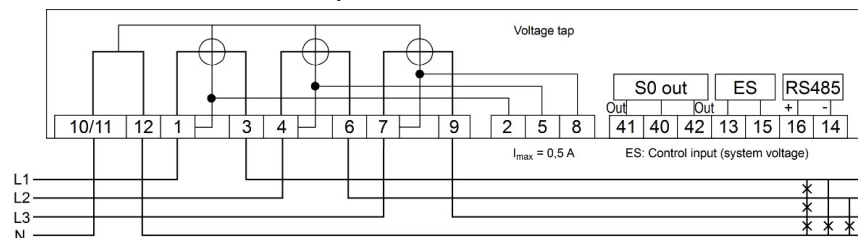
4-wire version, connected to the current and voltage transformer
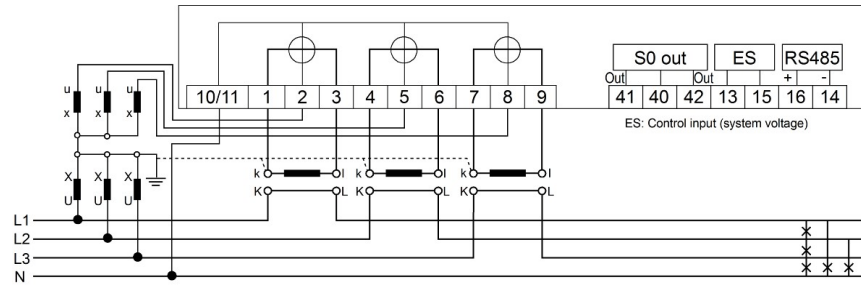
4-wire version connected to current and voltage transformers (3 voltage transformers)
(auxiliary circuit with 2 current transformers)
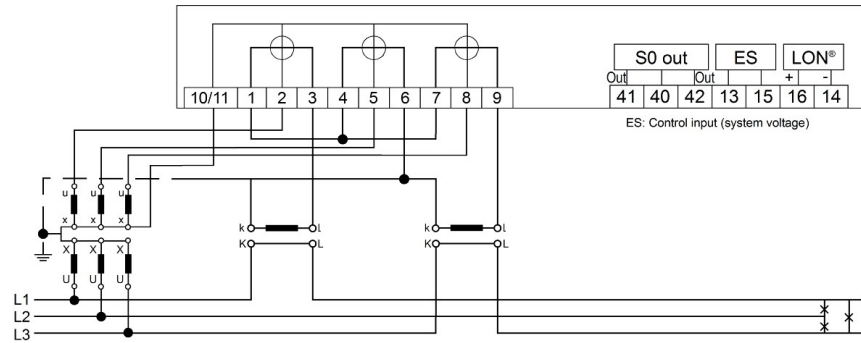
4-wire version, connected to the current and voltage transformer (auxiliary circuit with 2 current converters)
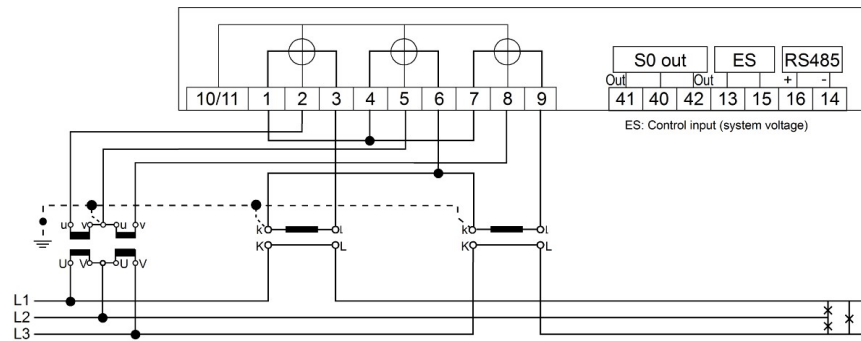
4.2.2   Terminal blocks

> **NOTICE!**
>
> **Damage of the terminals due to excessive torque!**
>
> The appropriate torque depends on the type of the connection line and on the maximum current.
> - Tighten the terminals with the required torque according to IEC 60999-1.

Transformer connected meter to 5 A

> ⚠ **DANGER!**
>
> **Contact of parts under voltage is extremely dangerous!**
> - Protect meters with a transformer connection in the voltage circuit with a back-up fuse of < 6 A according to valid technical directives.
> - Secure the current paths in compliance with the current value specified on the nameplate of the meter according to valid technical directives.

> ⚠ **DANGER!**
>
> **Risk of danger to life due to high voltage when current transformers are interrupted!**
>
> The high voltage on the interrupted current transformer at the transformer connected meter is extremely dangerous and destroys the current transformer.
> - Short-circuit the secondary circuits of the current transformer at the testing terminals before disconnecting the current path.

Meter up to 80 A

> ⚠ **DANGER!**
>
> **Improper installation endangers life and health and carries the risk of malfunction and property damages!**
> - Use a overcurrent protection for maximal 65 A or 80 A (e. g. a main circuit breaker) before the meter.
> - Secure the connection paths in compliance with the current value specified on the nameplate of the meter according to valid technical directives.

> **NOTICE!**
>
> **Damage of the meter in the absence of back-up fuse on the control input!**
> - Protect the control input by a back-up fuse of 0,5 A.

> **NOTICE!**
>
> **Damage of the meter in the absence of back-up fuse on the Opto-MOSFET output!**
> - Protect the Opto-MOSFET output by a back-up fuse of 0,1 A.

Table 7:   Terminal dimensions, connection cross sections and torques

	Current terminals/ N-terminal		Voltage terminals	Auxiliary terminals
	up to 80 A	up to 5 A	up to 80 A/ up to 5 A	
Terminal dimensions W x H or d (mm)	6,9 x 7,9	d = 3,1	d = 3,1	d = 2,5
Minimum connection cross section (mm²)	2,5	0,5 **	0,5 **	0,5 **
Maximum connection cross section (mm²)*	25,0 ***	4,0 ****	2,5	2,5
Maximum torques (Nm)	3,0	0,5	0,5	0,5
Screw type	Screw and washer assembly with cross recess, type PZ2 (Pozidriv)	Screw and washer assembly with cross recess, type PH1 (Phillips)	Screw and washer assembly with cross recess, type PH1 (Phillips)	Slotted screw, type SL 0,6 x 4
Thread size	M5	M3	M3	M3

*   Rated connection capacity according to IEC 60999-1
**   Rated connection capacity according to IEC 60999-1, maximum 0,5 mm² flexible
***   Rated connection capacity according to IEC 60999-1, maximum 16,0 mm² flexible
**** Rated connection capacity according to IEC 60999-1, maximum 2,5 mm² flexible

Terminal arrangement on top of the meter   **Terminal arrangement down on the meter**
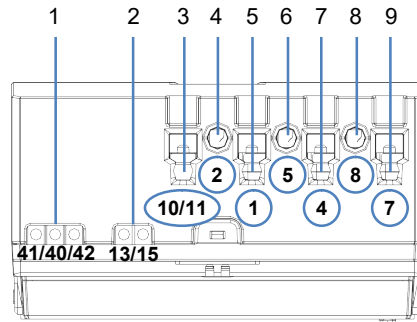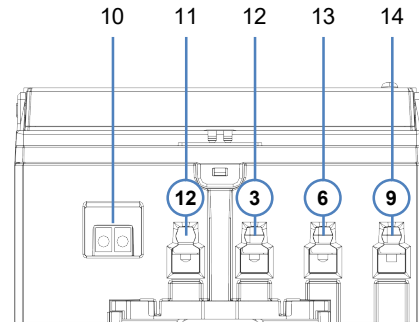
No.	Description
(1)	S0 outputs
(2)	Control input
(3)	Neutral conductor N
(4)	Voltage input U1
(5)	Current input I1
(6)	Voltage input U2
(7)	Current input I2
(8)	Voltage input U3
(9)	Current input I3

No.	Description
(10)	Electrical interface (optional), e. g. • Two-wire interface: • M-Bus (terminals 23 and 24) • RS485 interface: • M-Bus (terminals 14 and 16) or • Modbus-RTU® (terminals 14 and 16)
(11)	Neutral conductor N (terminal 12)
(12)	Current output I1 (terminal 3)
(13)	Current output I2 (terminal 6)
(14)	Current output I3 (terminal 9)

Illustration 9:   Connection of the meter

4.2.3   Path separator (accessory)

With a direct connected meter, it is possible to separate the voltage path from the current path for testing. Therefore, a special path separator is used, which is available as an accessory.

> ℹ️ Remove the path separator after testing the meter. Otherwise, the meter cannot be started up, as the voltage supply is interrupted.
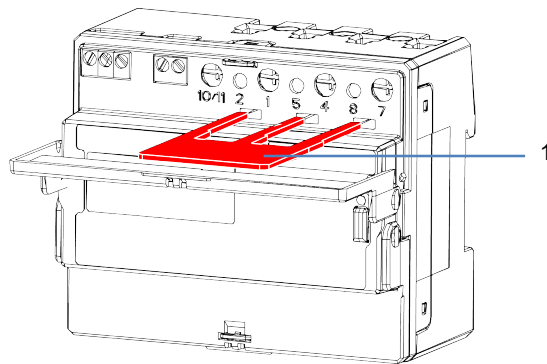
No.	Description
(1)	Path separator

Illustration 10:   Path separator

4.2.4   Terminal cover

To prevent unauthorized access to the terminals, the terminal covers are mounted with sealing screws on the sealing eyes (see chapter 3.5.1 Overview of housing, display and operating elements).

5 Functions and operation

To operate the meter via a connected PC, use the Industriezählertool.
The following chapters describe only the procedures using the mechanical button
(call-up button) on the device.

5.1 Display control

The following applies for operation of the meter via the call-up button:

- **Short operation (t < 2 s):**
    - switches to the next list value, menu item or setting value
    - activates the backlight, but only if the meter is equipped with this option
- **Long operation (2 s ≤ t < 5 s):**
    - activates the currently displayed menu item
    - confirms a setting change for the acceptance (switches only after 2 s and not when button has been released, however, the changed settings are only finally accepted when button has been released)
- **Longer operation (t ≥ 5 s):**
    - leads always back to the standard operating display (activates the selected menu item after 2 s, only after the expiry of 5 s the jump in the standard operating display occurs, setting changes that must be confirmed are not accepted)

5.2 Error codes

To ensure smooth operation of the meter, following checksums are permanently during operation:

- Checksum via the program code
- Checksum of the parameter data
- Checksum of the edit data
- Checksum of the calibration data

Should an error occur during the monitoring then an error code is displayed in the standard operating display in a hexadecimal form. For several errors the sum of the respective error code is shown:

Table 8: Error code description

Error code	Explanation
00000001	Program code faulty
00000002	Parameter data faulty
00000004	Edit data faulty
00000008	Data back-up faulty
00000010	Calibration data faulty

If an error is shown at the display it is not allowed to use the meter data for billing purposes. Because the meter could be negatively affected. The reset of an error massage can only be done in the manufacturer's factory. If the device shall be used for billing purpose again, it has to be repaired properly and afterwards the manufacturer has to declare the conformity according to the measurement directives and regulations.

5.3 Overview of the menu navigation

Start list

Standard operating display

Call-up menu with static list

- Positive active energy tariff 1 (A+ T1)
- Positive active energy tariff 2 (A+ T2)
- Negative active energy tariff 1 (A- T1)
- Negative active energy tariff 2 (A- T2)
- Voltage transformer ratio (U-Const)
- Current transformer ratio (I-Const)
- Active power (P)
- Total active power (P_{total})
- Active power L1 (P1)
- Active power L2 (P2)
- Active power L3 (P3)
- Voltage (U)
- Voltage L1 (U1)
- Voltage L2 (U2)
- Voltage L3 (U3)
- Current (I)
- Current L1 (I1)
- Current L2 (I2)
- Current L3 (I3)
- S0 impulse constant
- S0 impulse length
- M-Bus address 1
- M-Bus address 2
- M-Bus baud rate
- Modbus address
- Modbus baud rate

Listmenu	Test	Edit	Setmenu
Tarifflist	Testmode P	U-Const	Date
Meterlist	Testmode Q	I-Const	Time
Setlist		Scale	Clock Net Sync
		S0-Const	1.Address
		S0-Length	2.Address
		Lock Edit M.	Baud rate M-Bus
			Modbus®-Addr.
			Baud rate Modbus®
			Transmission mode Modbus®

Illustration 11:   Overview of the menu navigation

5.4   Start list

After start-up the firmware version and the firmware checksum appear for 5 s.

During this time the call-up button is not active yet.

After this time the standard operating display is activated.

5.5 Standard operating display

During normal operation the meter is in the standard mode.

If the meter is in a different mode, 5 min after the last operation of the button the display will automatically switch back to the standard display.

Here, depending on the configuration, the available energy registers for the active tariff are sequentially displayed (scrolling) every 5 s. If the meter has only 1 energy register, this register displayed for 10 s.
During battery operation, the available energy registers (depending on configuration) at the rates T0 and T1 are displayed at intervals of 5 s of each other (rolling).

---

i

With a short push of the call-up button during the operating display the backlight will be activated but only if the meter is equipped with this function. With another short push of the call-up button the call-up menu appears with the static list.

The lighting expires:
- If the call-up menu ends and the display goes back to the operating display.
- If the call-up button is pushed longer (t ≥ 5 s).
- If the call-up button is not used:
  - Automatically after 30 s during the operating display.
  - Automatically after 5 min during a menu are active.
- During battery operation the backlight function of the display is not possible.

S = short operation (t < 2 s)

L = long operation (2 s ≤ t < 5 s)

Table 9: Standard operating display

Menu item	Display	Button
Error display (only if an error is present, see also chapter 5.2)	L123 T1 +A→ `00000001` `Error`	Appears for 60 s if an error **S** or **L** Activate the call-up menu
Energy register for positive active energy at the active tariff (if configured)	L123 T1 +A→ `01123.625` `A+ T1    kWh`	Appears for 5 s* **S** or **L** Activate the call-up menu
Energy register for negative active energy at the active tariff (if configured)	L123 T1 +A→ `00570.200` `A- T1    kWh`	Appears for 5 s* **S** or **L** Activate the call-up menu
Energy register for positive reactive energy at the active tariff (if configured)	L123 T1 +A→ `00033.285` `R+ T1    kvarh`	Appears for 5 s* **S** or **L** Activate the call-up menu
Energy register for negative reactive energy at the active tariff (if configured)	L123 T1 +A→ `00060.834` `R- T1    kvarh`	Appears for 5 s* **S** or **L** Activate the call-up menu
Display test	L123 T12 T34 +A→ -A← +R↑-R↓ `8.8.8.8.8.8.8.8` `8.8.8.8.8.8.8.8 kWarh`	Appears for 5 s **S** or **L** Activate the call-up menu

* If the meter has only 1 energy register, this register displayed for 10 s.

5.6 Call-up menu „Menus"

The call-up menu is activated by pushing the call-up button during the standard operating display.

The menu starts with the listing (static list) of the most important values for standard applications. In this list are tariff information T1 and T2 (active energy) and values for an installation check.

Afterwards the following submenus can be activated:

- the list menu
  - tariff list (with additional tariff register)
  - measuring values (extended instantaneous values (measurement device function))
  - device setting (additional device settings)
- test menu (test modes for test purposes)
- edit menu (setup of device settings, which can be blocked against further changes)
- set menu (setup of device settings, which can be changed again).

| **i** | During battery operation only tariff register and transformer ratios are shown. Only access to the list menu is possible. |

$\boxed{S}$ = short operation (t < 2 s)

$\boxed{L}$ = long operation (2 s $\leq$ t < 5 s)

| **i** | The following illustrations are for a better understanding and can differ from the display of your meter. |

Table 10: Call-up menu „Menus"

Menu item	Display	Button	
Tariff 1, positive active energy (if configured)	L123 T1 +A→ 01123.625 A+ T1 kWh	$\boxed{S}$ $\boxed{L}$	To the next menu item Return to the standard operating display
Tariff 2, positive active energy (if configured)	L123 T1 +A→ 00210.374 A+ T2 kWh	$\boxed{S}$ $\boxed{L}$	To the next menu item Return to the standard operating display
Tariff 1, negative active energy (if configured)	L123 T1 +A→ 00570.200 A- T1 kWh	$\boxed{S}$ $\boxed{L}$	To the next menu item Return to the standard operating display
Tariff 2, negative active energy (if configured)	L123 T1 +A→ 00132.103 A- T2 kWh	$\boxed{S}$ $\boxed{L}$	To the next menu item Return to the standard operating display
Voltage transformer ratio	L123 T1 +A→ 001 U-ConSt	$\boxed{S}$ $\boxed{L}$	To the next menu item Return to the standard operating display
Current transformer ratio	L123 T1 +A→ 0001 I-ConSt	$\boxed{S}$ $\boxed{L}$	To the next menu item Return to the standard operating display

Menu item	Display	Button	
Active power (only on 2-wire-meters)	L1 T1 +A→ 1770.20 P W	**S**	To the next menu item
		L	Return to the standard operating display
Total active power	L123 T1 +A→ 2640.01 PtotAL W	**S**	To the next menu item
		L	Return to the standard operating display
Active power L1 (only on 4-wire-meters)	L123 T1 +A→ 880.01 P1 W	**S**	To the next menu item
		L	Return to the standard operating display
Active power L2 (only on 4-wire-meters)	L123 T1 +A→ 890.00 P2 W	**S**	To the next menu item
		L	Return to the standard operating display
Active power L3 (only on 4-wire-meters)	L123 T1 +A→ 870.00 P3 W	**S**	To the next menu item
		L	Return to the standard operating display
Voltage L1-N (only on 2-wire-meters)	L1 T1 +A→ 230.67 U V	**S**	To the next menu item
		L	Return to the standard operating display
Voltage L1-N (only on 4-wire-meters)	L123 T1 +A→ 230.67 U1 V	**S**	To the next menu item
		L	Return to the standard operating display
Voltage L2-N (only on 4-wire-meters)	L123 T1 +A→ 230.68 U2 V	**S**	To the next menu item
		L	Return to the standard operating display
Voltage L3-N (only on 4-wire-meters)	L123 T1 +A→ 230.69 U3 V	**S**	To the next menu item
		L	Return to the standard operating display
Current L1 (only on 2-wire-meters)	L1 T1 +A→ 2.35 I A	**S**	To the next menu item
		L	Return to the standard operating display
Current L1 (only on 3 or 4-wire-meters)	L123 T1 +A→ 2.35 I1 A	**S**	To the next menu item
		L	Return to the standard operating display
Current L2 (only on 4-wire-meters)	L123 T1 +A→ 2.38 I2 A	**S**	To the next menu item
		L	Return to the standard operating display
Current L3 (only on 3 or 4-wire-meters)	L123 T1 +A→ 2.40 I3 A	**S**	To the next menu item
		L	Return to the standard operating display
Pulse constant S0 outputs in Imp./kWh	L123 T1 +A→ 000010 S0-ConSt	**S**	To the next menu item
		L	Return to the standard operating display

Menu item	Display	Button	
Pulse length S0 outputs in milliseconds	L123 T1 →A→ **100 mSEc** **S0-LEnG**	**S**	To the next menu item
		L	Return to the standard operating display
Primary address (only for meter with M-Bus)	L123 T1 →A→ **123** **1. AddrES**	**S**	To the next menu item
		L	Return to the standard operating display
Secondary address (only for meter with M-Bus)	L123 T1 →A→ **45678901** **2. AddrES**	**S**	To the next menu item
		L	Return to the standard operating display
Baud rate M-Bus (only for meter with M-Bus)	L123 T1 →A→ **2400 bd** **bAudrAtE**	**S**	To the next menu item
		L	Return to the standard operating display
Address Modbus® (only for meter with Modbus®)	L123 T1 →A→ **001** **Modb.Addr.**	**S**	To the next menu item
		L	Return to the standard operating display
Baud rate Modbus® (only for meter with Modbus®)	L123 T1 →A→ **9600 bd** **bAudrAtE**	**S**	To the next menu item
		L	Return to the standard operating display
List menu	L123 T1 →A→ **-- Go --** **LISTMEnU**	**S**	To the next menu item
		L	Activate the list menu (see chapter 5.7)
Test menu	L123 T1 →A→ **-- Go --** **TEST**	**S**	To the next menu item
		L	Activate the test menu (see chapter 5.8)
Edit menu (only if the menu is not locked permanently)	L123 T1 →A→ **-- Go --** **Edit**	**S**	To the next menu item
		L	Activate the edit menu (see chapter 5.9)
Set menu (only on meters with communication interfaces and/or tariff switching clock)	L123 T1 →A→ **-- Go --** **SETMEnU**	**S**	To the next menu item
		L	Activate the set menu (see chapter 5.10)
Switch to the first entry of the menu or to the standard operating display	L123 T1 →A→ **-ESCAPE-** **MEnUS**	**S**	To the first entry of the menu
		L	Return to the standard operating display (scrolling)

ℹ️ When pressing the button longer (> 5 s) the display will jump from any point in the list menu back to the standard operating display (scrolling, unlit).

5.7   List menu „Listmenu"

Further sub-menus can be accessed via the list menu. The sub-menus contain the display values for the available energy register, measuring values and device settings.

| i | The sub-menu „Meterlist" is hidden during battery operation. |

S = short operation (t < 2 s)

L = long operation (2 s ≤ t < 5 s)

Table 11:   List menu „Listmenu"

Menu item	Display	Button	
Tarifflist	L123 T1 +A→ -- Go -- TARIFLST	S	To the next menu item
		L	Activate the tarifflist (see chapter 5.7.1)
Meterlist	L123 T1 +A→ -- Go -- METERLST	S	To the next menu item
		L	Activate the meterlist (see chapter 5.7.2)
Setlist	L123 T1 +A→ -- Go -- SETLIST	S	To the next menu item
		L	Activate the setlist (see chapter 5.7.3)
Switch to the first entry of the menu or the call-up menu	L123 T1 +A→ -ESCAPE- LISTMENU	S	To the first entry of the menu
		L	Return to the call-up menu

5.7.1 Tarifflist

The tariff list contains all energy registers, ones with and without tariff. They can be reached via the list menu. Following energy registers and amount of tariffs are possible:

Table 12: Energy registers and amount of tariffs

Meter type	Direction of energy	Energy register	Amount of tariffs
Unidirectional meter with reverse stop as consumption meter	+P	+A	maximum 4 (T0 - T4)
Unidirectional meter with reverse stop as consumption meter with measurement of reactive energy	+P +Q -Q	+A +R -R	maximum 2 (T0 - T2)
Unidirectional meter with reverse stop as exported energy meter with measurement of reactive energy	-P +Q -Q	-A +R -R	maximum 2 (T0 - T2)
Combi meter as import energy	+P +Q	+A +R	maximum 2 (T0 - T2)
Combi meter as exported energy meter	-P -Q	-A -R	maximum 2 (T0 - T2)
Bidirectional meter	+P -P	+A -A	maximum 4 (T0 - T4)
4-quadrant meter	+P -P +Q -Q	+A -A +R -R	maximum 2 (T0 - T2)

S = short operation (t < 2 s)

L = long operation (2 s ≤ t < 5 s)

Table 13: Tarifflist

Menu item	Display	Button
No tariff, positive active energy	L123 T1 +A→ 0141 0.423 A+ T0 kWh	S or L To the next menu item
Tariff 1, positive active energy (if configured)	L123 T1 +A→ 01123.625 A+ T1 kWh	S or L To the next menu item
Tariff 2, positive active energy (if configured)	L123 T1 +A→ 00210.374 A+ T2 kWh	S or L To the next menu item
Tariff 3, positive active energy (if configured)	L123 T1 +A→ ⊙ 00074.321 A+ T3 kWh	S or L To the next menu item
Tariff 4, positive active energy (if configured)	L123 T1 +A→ ⊙ 00002.103 A+ T4 kWh	S or L To the next menu item

Menu item	Display	Button
No tariff, negative active energy	L123 T1 +A→ 007652 15 A- T0 k W h	**S** or **L** To the next menu item
Tariff 1, negative active energy (if configured)	L123 T1 +A→ 0057 0.200 A- T1 k W h	**S** or **L** To the next menu item
Tariff 2, negative active energy (if configured)	L123 T1 +A→ 00 132.103 A- T2 k W h	**S** or **L** To the next menu item
Tariff 3, negative active energy (if configured)	L123 T1 +A→ �🕑 00047.338 A- T3 k W h	**S** or **L** To the next menu item
Tariff 4, negative active energy (if configured)	L123 T1 +A→ 🕑 000 15.574 A- T4 k W h	**S** or **L** To the next menu item
No tariff, positive reactive energy (if configured)	L123 T1 +A→ 00054.772 R+ T0 k v arh	**S** or **L** To the next menu item
Tariff 1, positive reactive energy (if configured)	L123 T1 +A→ 00033.285 R+ T1 k v arh	**S** or **L** To the next menu item
Tariff 2, positive reactive energy (if configured)	L123 T1 +A→ 0002 1.487 R+ T2 k v arh	**S** or **L** To the next menu item
No tariff, negative reactive energy (if configured)	L123 T1 +A→ 000 72.937 R- T0 k v arh	**S** or **L** To the next menu item
Tariff 1, negative reactive energy (if configured)	L123 T1 +A→ 00060.834 R- T1 k v arh	**S** or **L** To the next menu item
Tariff 2, negative reactive energy (if configured)	L123 T1 +A→ 000 12.103 R- T2 k v arh	**S** or **L** To the next menu item
Switch to the first entry of the menu or the call-up menu	L123 T1 +A→ -ESCAPE- TARIFLST	**S** To the first entry of the menu **L** Return to the call-up menu

5.7.2   Meterlist

The meter list contains the recorded instantaneous. If transformer ratios are set in the meter, then the instantaneous values are shown for the primary side. The meter list can be accessed via the list menu.

ℹ️   During battery operation the meterlist is hidden in the list menu.

S = short operation (t < 2 s)

L = long operation (2 s ≤ t < 5 s)

Table 14:   Meterlist

Menu item	Display	Button
Voltage L1-N (only on 2-wire-meters)	L1 T1 +A→ **230.67** U V	S or L To the next menu item
Voltage L1-N (only on 4-wire-meters)	L123 T1 +A→ **230.67** U1 V	S or L To the next menu item
Voltage L2-N (only on 4-wire-meters)	L123 T1 +A→ **230.68** U2 V	S or L To the next menu item
Voltage L3-N (only on 4-wire-meters)	L123 T1 +A→ **230.69** U3 V	S or L To the next menu item
Voltage L1-L2 (only on 3 or 4-wire-meters)	L123 T1 +A→ **400.36** U12 V	S or L To the next menu item
Voltage L2-L3 (only on 3 or 4-wire-meters)	L123 T1 +A→ **400.35** U23 V	S or L To the next menu item
Voltage L3-L1 (only on 3 or 4-wire-meters)	L123 T1 +A→ **400.39** U31 V	S or L To the next menu item
Current L1 (only on 2-wire-meters)	L1 T1 +A→ **2.35** I A	S or L To the next menu item
Current L1 (only on 3 or 4-wire-meters)	L123 T1 +A→ **2.35** I1 A	S or L To the next menu item
Current L2 (only on 4-wire-meters)	L123 T1 +A→ **2.38** I2 A	S or L To the next menu item

Menu item	Display	Button
Current L3 (only on 3 or 4-wire-meters)	L123 T1 +A→ 2.40 I3 A	S or L To the next menu item
Current N (calculated, only on 4-wire-meters)	L123 T1 +A→ 0.20 I_n A	S or L To the next menu item
Active power (only on 2-wire-meters)	L1 T1 +A→ 1770.20 P W	S or L To the next menu item
Total active power (only on 2-wire-meters)	L123 T1 +A→ 2640.01 PtotAL W	S or L To the next menu item
Active power L1 (only on 4-wire-meters)	L123 T1 +A→ 880.01 P1 W	S or L To the next menu item
Active power L2 (only on 4-wire-meters)	L123 T1 +A→ 890.00 P2 W	S or L To the next menu item
Active power L3 (only on 4-wire-meters)	L123 T1 +A→ 870.00 P3 W	S or L To the next menu item
Reactive power (only on 2-wire-meters)	L1 T1 +R↑ 159.27 Q var	S or L To the next menu item
Total reactive power (only on 2-wire-meters)	L123 T1 +R↑ 234.65 QtotAL var	S or L To the next menu item
Reactive power L1 (only on 4-wire-meters)	L123 T1 +R↑ 78.73 Q1 var	S or L To the next menu item
Reactive power L2 (only on 4-wire-meters)	L123 T1 +R↑ 80.54 Q2 var	S or L To the next menu item
Reactive power L3 (only on 4-wire-meters)	L123 T1 +R↑ 75.38 Q3 var	S or L To the next menu item
Apparent power (only on 2-wire-meters)	L1 T1 +A→ 1777.15 S VA	S or L To the next menu item
Total apparent power (only on 2-wire-meters)	L123 T1 +A→ 2650.41 StotAL VA	S or L To the next menu item

Menu item	Display	Button
Apparent power L1 (only on 4-wire-meters)	L123 T1 +A→ **883.51** S1 VA	**S** or **L** To the next menu item
Apparent power L2 (only on 4-wire-meters)	L123 T1 +A→ **893.64** S2 VA	**S** or **L** To the next menu item
Apparent power L3 (only on 4-wire-meters)	L123 T1 +A→ **873.26** S3 VA	**S** or **L** To the next menu item
Total power factor (only on meters with measure of reactive power)	L123 T1 +A→ +R↑ **0.95** PF	**S** or **L** To the next menu item
Power factor L1 (only on 4-wire-meters)	L123 T1 +A→ +R↑ **0.95** PF 1	**S** or **L** To the next menu item
Power factor L2 (only on 4-wire-meters)	L123 T1 +A→ +R↑ **0.94** PF 2	**S** or **L** To the next menu item
Power factor L3 (only on 4-wire-meters)	L123 T1 +A→ +R↑ **0.96** PF 3	**S** or **L** To the next menu item
Frequency	L123 T1 +A→ **50.02** FREQ HZ	**S** or **L** To the next menu item
Switch to the first entry of the menu or the call-up menu	L123 T1 +A→ −ESCAPE− METERLST	**S** To the first entry of the menu **L** Return to the call-up menu

5.7.3 Setlist

The settings for the meter can be seen in the device setting list. Some of the settings can be changed in the edit menu, if it's available and not locked.

The set list can be accessed via the list menu.

$\boxed{S}$ = short operation (t < 2 s)

$\boxed{L}$ = long operation (2 s ≤ t < 5 s)

Table 15: Setlist

Menu item	Display	Button
Mode of the device clock	L123 T1 →A→ ACTIVE CLOCK	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Source of the tariff control (possible displays: Intern, Remote or Off)	L123 T1 →A→ INTERN TARF.Ctrl	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Time switch program number	L123 T1 →A→ 06002200 TA.PROG.NR	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Amount of tariffs	L123 T1 →A→ 2 TARIFFS	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Channels of load profile	L123 T1 →A→ A+A-R+R- LP.CHAnnL	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Period length of load profile	L123 T1 →A→ 15 Min LP.LENG	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Measured energies	L123 T1 →A→ A+A-R+R- En.DIRECT	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Electrical interface (possible displays: MbuS SER, Modb SER (for Modbus), SER , if configured)	L123 T1 →A→ MbuS SER Int.FACE	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Pulse constant S0 outputs in Imp./kWh	L123 T1 →A→ 000010 S0-ConSt	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Pulse length S0 outputs in milliseconds	L123 T1 →A→ 100 mSEc S0-LENG	$\boxed{S}$ or $\boxed{L}$ To the next menu item
Configuration S0 output 1	L123 T1 →A→ P+ S0 1	$\boxed{S}$ or $\boxed{L}$ To the next menu item

Menu item	Display	Button
Configuration S0 output 2	L123 T1 +A→ *P -* *S0 2*	**S** or **L** To the next menu item
Voltage transformer ratio	L123 T1 +A→ *001* *U-ConSt*	**S** or **L** To the next menu item
Current transformer ratio	L123 T1 +A→ *0001* *I-ConSt*	**S** or **L** To the next menu item
Amount of pre and post decimal positions of the energy register representation	L123 T1 +A→ *55555.333* *SCALE*	**S** or **L** To the next menu item
Switch to the first entry of the menu or the call-up menu	L123 T1 +A→ *-ESCAPE-* *SETLIST*	**S** To the first entry of the menu **L** Return to the call-up menu

5.8 Test menu „Test"

The TEST symbol in the display indicates that the meter is in test mode. If the symbol appears permanently, then the test mode for the active power is active. If the test mode is activated for reactive power, the symbol flashes.

The representation of the energy values is done with increased resolution, i.e. the rates are displayed 8-digits with 2 additional decimal places (max. 5). Furthermore, the test LED flashes with a 10 times higher pulse frequency and a pulse length of 2 ms.

The test mode can be stopped using a command via the communication interface (RS485 or two-wire interface) or via deactivation in the test menu (see the following table). The test mode is automatically deactivated after 24 hours.

> **i** Only one test mode can be selected, either for active or reactive power. The test mode for the reactive power (Q), if previously selected, is deactivated, if the test mode for active power (P) has been activated.

S = short operation (t < 2 s)

L = long operation (2 s ≤ t < 5 s)

Table 16:   Test menu „Test"

Menu item	Display	Button
Test mode of active power (can be set to On or Off)	L123 +A→ ⊙ *OFF* *TEST P*	**S** To the next menu item **L** **Access in the test mode for the active power**
Adjusted value (value flashes)	L123 +A→ ⊙ *OFF* *TEST P*	**S** **Next value** **L** Accept value and return to test menu

Menu item	Display	Button	
Changed value	L123　　　　+A→　　　⊙ **ON**　　　　　★ *TEST P*	**S**	Next value
		L	**Accept value and return to test menu**
Test mode of reactive power (can be set to On or Off)	L123　　　　+A→　　　⊙ **OFF**　　　　　★ *TEST Q*	**S**	To the next menu item
		L	Access in the test mode for the reactive power
Switch to the first entry of the menu or the call-up menu	L123　　　　+A→　　　⊙ *-ESCAPE-*　★ *TEST*	**S**	To the first entry of the menu
		L	Return to the call-up menu

5.9 Edit menu „Edit"

The status of the edit menu is indicated by the lock symbol (key) in the display (see also chapter 3.5.2 Display).

i 　The meter must not be used for billing purpose while the edit menu is unlocked.

5.9.1 Changeable Parameter

If the meter is not used for billing, the edit menu can be available (flashing key symbol in the display).

The following parameters can be changed in this case:

- transformer ratios
- arity of the energy register
- settings of the pulse outputs

a) Change transformer ratios:

- voltage transformer ratio VT (on transformer-connected meters):
    - integer values from 1 to 999 (default value 1)
- current transformer ratio CT (on transformer-connected meters):
    - integer values from 1 to 9999 (default value 1)
- ➤ **The product of CT x VT can be max. 999999.**

If the transformer ratios are set, the measuring values (secondary side of the transformer) will be multiplied with the transformer ratios. In this case the meter operates as a primary meter.

i 　Should the transformer ratios be changed on a meter that has already registered energy, then the energy registers are reset to „Zero".

This can be done only if the meter is not used billing and the edit menu is be available.

In this case the resolution of the energy registers and pulse constants are reset to the standard values. Only after the changes the new transformer ratios are considered.

b) Arity of the energy register:

The resolution of energy register can be changed manually via the display control or via the data interface. Possible values are:

- direct connected meters:
  - 8.0 (default value), 7.1, 6.2, 5.3
- transformer connected meters:
  - secondary meters: 8.0, 7.1, 6.2, 5.3 (default value), 4.4
  - primary meters: 8.0, 7.1, 6.2, 5.3, 4.4

According to the MID (Measuring Instruments Directive) 4000 hours' operation at maximum load may not cause register overflow.

> **i**   If meter resolutions are selected, which do not guarantee this fact, the meter cannot be used anymore for billing purposes!

Example: Meter with 3 x 230/400 V, direct connected 80 A

P_{Max} = 3 x U_{Ref} x I_{Max}

      = 3x230 V x 80 A

      = 55,2 kW

registered energy after 4000 h = 220.800 kWh

➢ **There must be at least 6 digits before the decimal point.**

The meter resolution should therefore be selected with the following limitations:

- direct connected meters:
  - 8.0 (default value), 7.1, 6.2
- transformer connected meters:
  - secondary meters: 6.2, 5.3 (default value)
  - primary meters: The available arity and the unit are derived from the transformer ratio for voltage (VT) and current (CT). If in the meter the corresponding transformer ratios are set, the energy register displays the primary energy (primary meter).

    The following example shows the permissible solution of energy register of a primary meter with 3 x 230/400 V in accordance with MID:

Transformer ratio (VT x CT)	Meter resolution	Unit
1 - 5	8.0, 7.1, 6.2, 5.3	kWh/kvarh
6 - 49	8.0, 7.1, 6.2	kWh/kvarh
50 - 499	8.0, 7.1	kWh/kvarh
500 - 4 999	8.0, 7.1, 6.2, 5.3	MWh/Mvarh
5 000 - 49 999	8.0, 7.1, 6.2	MWh/Mvarh
50 000 - 499 999	8.0, 7.1	MWh/Mvarh
500 000 - 999 999	8.0	MWh/Mvarh

    Example of a primary meter with 3 x 290/500 V:

Transformer ratio (VT x CT)	Meter resolution	Unit
1 - 9	8.0, 7.1, 6.2	kWh/kvarh
10 - 99	8.0, 7.1	kWh/kvarh
100 - 999	8.0	kWh/kvarh
1 000 - 9 999	8.0, 7.1, 6.2	MWh/Mvarh
10 000 - 99 999	8.0, 7.1	MWh/Mvarh
100 000 - 999 999	8.0	MWh/Mvarh

    During an energy registers display overflow due to the set arity the leading numbers are cut respectively. The internal meter state stays.

c) Change the pulse outputs:

- pulse values for pulse outputs (see also chapter 3.7.2 on page 18)
    - secondary meters: 1, 10, 50, 100, 500, 1 000, 5 000, 10 000, 50 000 or 100 000 Imp./kWh resp. Imp./kvarh
    - primary meters:　　1, 10, 100 or 1 000 Imp./kWh resp. Imp./kvarh

- pulse duration for pulse outputs
    - secondary meters: 30, 50, 100 or 500 ms
    - primary meters:　　100 or 500 ms

Not every pulse length can be realized with appropriate pulse rate (impulse constant and registered energy per time). Therefore, some settings can't be possible.
Following messages are displayed, if the pulse lengths are not allowed:

- w.SETTInG:　　The pulse length must be adjusted.
- no.CHOICE:　　No valid setting possible. The pulse value must be adjusted new.

5.9.2　　Locking the edit mode permanently

The edit mode is permanently locked, if the menu item "Lock Edit M." is set to "On" when leaving the edit menu.

| **i** | Do not use the "Lock Edit M." if you like to open the edit menu again. |

During the permanently locked edit mode the locking symbol (key) is no longer visible in the display. The meter can be official calibrated.

| **i** | Should the meter be used for billing purposes, then the edit mode must be permanently locked. |

5.9.3　　Edit menu: Functional principle and operation

| S | = short operation (t < 2 s)
| L | = long operation (2 s ≤ t < 5 s)

Table 17:　　Edit menu „Edit"

Menu item	Display	Button	
Voltage transformer ratio	L123 T1　　+A→　　　　○⊣ 00 1 U-ConSt	S	To the next menu item
		L	Edit value
Current transformer ratio	L123 T1　　+A→　　　　○⊣ 000 1 I-ConSt	S	To the next menu item
		L	**Edit value**
Example: Changing the current transformer ratio			
Edit the first digit (digit flashes)	L123 T1　　+A→　　　　○⊣ 000 1 I-ConSt	S	Increase digit by 1
		L	**Edit next digit**

Menu item	Display	Button	
Edit the second digit (digit flashes)	L123 T1 +A→ 000 1 I-ConSt	**S**	**Increase digit by 1**
		L	Edit next digit
Edit the second digit (digit flashes)	L123 T1 +A→ 0 10 1 I-ConSt	**S**	Increase digit by 1
		L	**Edit next digit**
Edit the third digit (digit flashes)	L123 T1 +A→ 0 10 1 I-ConSt	**S**	Increase digit by 1
		L	**Edit next digit**
Edit the fourth digit (digit flashes)	L123 T1 +A→ 0 10 1 I-ConSt	**S**	**Increase digit by 1**
		L	Edit next digit
Edit the fourth digit (digit flashes)	L123 T1 +A→ 0 100 I-ConSt	**S**	Increase digit by 1
		L	**Transfer of values**
Take over value (all digit flash)	L123 T1 +A→ 0 100 I-ConSt	**S**	Edit the first digit
		L	**Take over the edited value, switch over to the next menu option**
Checking the transformer ratios			
Total transformer ratio too large: VT x CT > 999999	L123 T1 +A→ 1000000 rAtiotot	**S**	Overwriting the transformer ratios
		L	New input of transformer ratios, set values are discarded
Total transformer ratio is OK: VT x CT ≤ 999999	no display		Accepting the values, default values for meter solution is selected automatically
Example: Changing the meter arity			
Arity of the energy registers	L123 T1 +A→ 44444.4444 SCALE	**S**	To the next menu item
		L	**Edit value**
Set value (value flashes)	L123 T1 +A→ 4444.4444 SCALE	**S**	**Next value**
		L	Adopt value
New value	L123 T1 +A→ 55555.333 SCALE	**S**	Next value
		L	**Adopt value**
Output constant in Imp./kWh or Imp./kvarh	L123 T1 +A→ 000010 S0-ConSt	**S**	To the next menu item
		L	Edit value

Menu item	Display	Button	
Pulse length in milliseconds	L123 T1 +A→ 100 mSEc SO-LENG	**S**	To the next menu item
		L	Edit value
Leave edit menu without final lock ("Off" must be activated)	L123 T1 +A→ OFF LocKEdit	**S**	**To the next menu item**
		L	Edit value
Switch to the first entry of the menu or the call-up menu	L123 T1 +A→ -ESCAPE- Edit	**S**	To menu start
		L	**Return to the call-up menu**
Leave edit menu with final lock ("On" must be activated)	L123 T1 +A→ On LocKEdit	**S**	**To the next menu item**
		L	Edit value
Confirm lock	L123 T1 +A→ LocKEdit Edit	**S**	Return to the previous menu item
		L	**To the next menu item**
Permanent lock and leave edit mode (LocK.Edit flashes)	L123 T1 +A→ LocKEdit Edit	**S**	Return to the previous menu item
		L	**Leave edit mode and permanent lock, switch to the menu and acceptance of all values**

> **i** When pressing the button longer, the edit mode can be permanently locked, meaning data can no longer be edited.

5.10 Set menu „Setmenu"

The set menu can be reached via the call-up menu and is only available if the meter has an electric interface or a clock. This includes settings for system time, addresses as well as baud rates. The data in the set menu have no calibrated legal relevance.

S = short operation (t < 2 s)

L = long operation (2 s ≤ t < 5 s)

Table 18: Set menu „Setmenu"

Menu item	Display	Button	
Setting the date (Format: dd.mm.yyyy)	L123 T1 +A→ 19.06.2015 dd.mm.yyyy	**S**	To the next menu item
		L	Edit value
Setting time (Format: hh:mm:ss)	L123 T1 +A→ 23:59:59 TIME	**S**	To the next menu item
		L	Edit value

Menu item	Display	Button	
Line commutation is active	L123 T1 +A→ On CLOC.SYNC	**S**	To the next menu item
		L	Edit value
Primary address (adjustable 001-250; only for meter with M-Bus)	L123 T1 +A→ 123 1. AddrES	**S**	To the next menu item
		L	Edit value
Secondary address (adjustable 00000000-99999999; only for meter with M-Bus)	L123 T1 +A→ 45678901 2. AddrES	**S**	To the next menu item
		L	Edit value
Baud rate M-Bus (adjustable 0300, 2400 and 9600 bd; only for meter with M-Bus)	L123 T1 +A→ 2400 bd bAudrAtE	**S**	To the next menu item
		L	Edit value
Modbus® address (adjustable 001-247; only for meter with Modbus®)	L123 T1 +A→ 001 Modb.Addr.	**S**	To the next menu item
		L	Edit value
Baud rate Modbus® (adjustable 1200, 2400, 4800, 9600, 19200 and 38400 bd; only for meter with Modbus®)	L123 T1 +A→ 9600 bd bAudrAtE	**S**	To the next menu item
		L	Edit value
Transfer mode Modbus® (adjustable 8E1, 8O1, 8N1 and 8N2 - see also page 13; only for meter with Modbus®)	L123 T1 +A→ 8 n 1 COM	**S**	To the next menu item
		L	Edit value
Switch to the first entry of the menu or the call-up menu	L123 T1 +A→ -ESCAPE- SETMENU	**S**	To the first entry of the menu
		L	Return to the call-up menu

6   EU Declaration of Conformity

	The current EU Declaration of Conformity can be found in the download

7 Appendix

7.1 Standards and regulations

EN 13757-2, -3	Communication systems for and remote reading of meters
ISO/EN 14908-1, -2, -3, -4	Open Data Communication in Building Automation, Controls and Building Management - Control Network Protocol
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
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 (CISPR 22:2008, modified)
IEC 60068-2-30	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60715	Dimensions of low-voltage switchgear and controlgear - Standardized mounting on rails for mechanical support of electrical devices in switchgear and controlgear installations
IEC 60721-3-3	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; section 3: Stationary use at weatherprotected locations
IEC 60999-1	Connecting devices - Electrical copper conductors; Safety requirements for screw-type and screwless-type clamping units - Part 1: General requirements and particular requirements for clamping units for conductors 0,2 mm² up to 35 mm² (included)
IEC 61000-3-2, -4-2, -4-3, -4-4, -4-5, -4-6, -4-11, -6-2	Electromagnetic compatibility (EMC)
IEC 62052-11	Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC 62053-21	Electricity metering equipment (a.c.) - Particular Requirements - Part 21: Static meters for active energy (classes 1 and 2)
IEC 62053-23	Electricity metering equipment (a.c.) - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)
IEC 62053-31	Electricity metering equipment (a.c.) - Particular requirements - Part 31: Pulse output devices for electromechanical and electronic meters (two wires only)
IEC 62056-21	Electricity metering - Data exchange for meter reading, tariff and load control - Part 21: Direct local data exchange
IEC 62056-61	Electricity metering - Data exchange for meter reading, tariff and load control. Part 61: Object identification system (OBIS)
IEC 62056-62	Electricity metering - Data exchange for meter reading, tariff and load control. Part 62: Interface classes

ITU-T V.11	Electrical characteristics for balanced double-current inter-change circuits operating at data signalling rates up to 10 Mbit/s
TIA/EIA-485	Electrical characteristics of drivers and receivers for use in digital measuring systems

7.2 Abbreviations

A	Active energy
+A	Positive active energy (customer imports from utility)
-A	Negative active energy (customer exports to utility)
A/D Converter	Analog-to-Digital-Converter
Cl.	Accuracy class
CPU	Central Processor Unit
DIN	Deutsches Institut für Normung e.V. (German Institute for standards)
EMC	Electromagnetic Compatibility
EN	European standards
HF	High Frequency
I	Current
ID	Identification
IEC	International Electrotechnical Commission
IP	Ingress Protection
ISO	International Standard Organisation
L1, L2, L3	External conductors
LC	Liquid Crystal
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MID	Measurement Instruments Directive
N	Neutral conductor
OBIS	Object Identification System
P	Active power
+P	Positive active power (customer imports from utility)
-P	Negative active power (customer exports to utility)
|P|	Measuring of absolute value of P
PCB	Printed Circuit Board
Q	Reactive power
+Q	Positive reactive power
-Q	Negative reactive power
|Q|	Measuring of absolute value of Q
R	Reactive energy
+R	Positive reactive energy
-R	Negative reactive energy
ROM	Read Only Memory
RTC	Real Time Clock
RTU	Remote Terminal Unit
S0	Interface according to IEC 62053-31

t	Operating time
U	Voltage