



MT171

Three-Phase Electronic Meter

Technical Description

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Energy Measurement and Management

MT171 – Three-Phase Electronic Meter

The MT171 three-phase electronic meters are designed for measuring and registration of active energy in three-phase four-wire network for direct connection. Measuring and technical characteristics of the meter comply with the IEC 62052-11 and IEC 62053-21 (IEC 61036) international standards for electronic active energy meters, class 1 or 2.

The meters are designed and manufactured in compliance with the standards and ISO 9001 as well as more severe Iskraemeco standards.

Meter characteristics

- **Active energy meter**
 - accuracy class 1 or 2
- **Energy measuring and registration modes**
 - standard – as an induction meter
 - other options:
 - bi-directional
 - absolute (*always positive*)
 - three-phase, two-phase, single-phase
- **Connection to network:** a three-phase meter can also function as a single-phase or a two-phase meter.
- **One or multi-tariff registration (up to 4 tariffs):**
 - With external tariff changeover
- **LCD – two sizes:**
 - Standard (7 + 1 digit)
 - Large in compliance with VDEW specification (option)
- **Display modes on LCD:**
 - automatic data scroll
 - manual (triggerred with a key)
- **Data display on LCD in voltage-free state (option)**
- **Indications:**
 - LED: Imp / kWh
 - LCD: Presence of phase voltages. L1, L2, L3
Phase currents flow-direction
- **Inputs and outputs:**
 - up to two pulse outputs
 - up to two tariff inputs
- **Communications:**
 - IR optical port for local meter programming and data downloading
 - CS serial interface (20 mA current loop) for remote data readout
- **Detection of meter cover and terminal cover opening (option)**

- **Current terminals:** a universal clamping terminal with one screw enables the same reliability of the contact for all types and cross-sections of connection wires
- **Voltage terminals:**
 - internal or external connection
 - a sliding voltage link (for simple disconnection of a voltage circuit from a current circuit)
- **Quality:**
 - high accuracy as well as long-term stability of measurement
 - high reliability of operation and long lifetime (20 years)
- **High immunity to EMC disturbances**
- **Simple and fast mounting**
- **A compact plastic case,** made of high-quality self-extinguishing materials, assures high degree of protection against dust and water penetration (IP53).

1. Meter configuration

1. A measuring chip (R phase)
2. A measuring chip (S phase)
3. A measuring chip (T phase)
4. A meter power supply unit
5. A microprocessor
6. LCD
7. An impulse LED
8. A »Scroll« key
9. IR optical port
10. CS interface
11. Impulse output 1 (S0 or OPTOMOS relay)
12. Impulse output 2 (S0 or OPTOMOS relay)
13. Tariff input 1
14. Tariff input 2

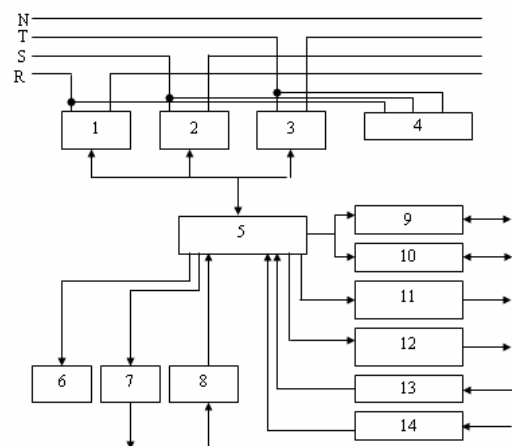


Fig. 1 - Meter block diagram

2. Measuring principle

The measuring element is based on Rogowski coil that measures changes on the induced voltage.

The measuring system is made of:

1. Current coil frame,
2. Current coil,
3. Two Rogowski coils,
4. PCB

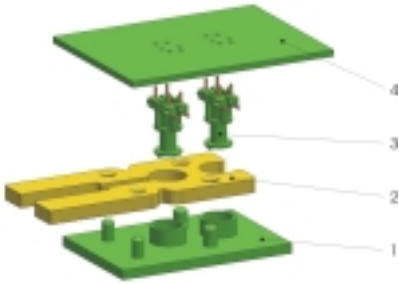


Fig. 2 – Measuring system

Through current coil flows the current. Inside the air coils (Rogovski coil) voltage is induced due to alternate magnetic field.

Measuring system measures induced voltage on measuring coils which is proportional to the current on input.

On each phase there are two Rogowski coils.

The first coil measures energy and the second one is compensation coil that measures outside disturbance. Compensation value is subtracted from measuring element.

Output signal from Rogowski coils is related to the input of the measuring integrated current. Signal is integrated, amplified and multiplied with measuring voltage and send to the microprocessor.

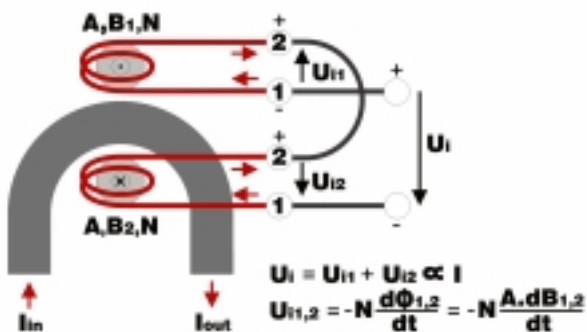


Fig. 3 – Measuring principle

3. Energy measurement and registration

The meter measures and registers electric energy:

- In a three-phase three-wire,
- Single-phase two-wire,
- Three-phase four-wire network:
 - by individual phases L1, L2, L3 (R, S, T) or
 - total ($\sum Li$)
 - only positive active energy
 - positive and negative active energy (A+, A-) separately
 - absolute active energy $|A|$

Measurement can be performed in max. four different tariffs.

4. Display

Display and indications:

The meter can be equipped with a standard or large LCD.

Standard display:



Fig. 4 – Standard display

Measuring data are displayed with seven 7-segment 8 mm high digits and with one 7-segment 6 mm high identification number.

Large display:

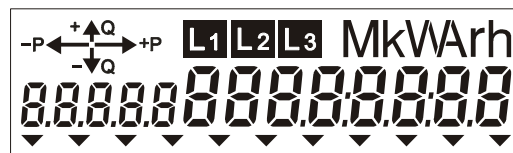


Fig. 5 – Large display

Measuring data are displayed with eight 7-segment 8 mm high digits. Displayed data are identified with five-digit EDIS code (DIN 43863-3), digits are 7-segment and 5 mm high.

Symbols indicating energy flow direction, a valid tariff as well as the meter statuses are also displayed on both displays.

4.1. Data display on LCD

Data that are defined in auto scroll and manual scroll sequences are displayed.

Data are reviewed with a key or they are cyclically displayed.

ID CODE / LCD		DESCRIPTION
Stand.	Large.	
U	C.1.0	Manufacturing number
A	0.0.0	Device number
0	1.8.0	Total positive active energy (A+)
0*	15.8.0	Total absolute active energy A
1	1.8.1	Positive active energy in first tariff (T1)
1*	15.8.1	Absolute active energy in first tariff T1
2	1.8.2	Positive active energy in second tariff (T2)
2*	15.8.2	Absolute active energy in second tariff T2
3	1.8.3	Positive active energy in third tariff (T3)
3*	15.8.3	Absolute active energy in third tariff T3
4	1.8.4	Positive active energy in fourth tariff (T4)
4*	15.8.4	Absolute active energy in fourth tariff T4
5	2.8.0	Total negative active energy (A-)
6	2.8.1	Negative active energy in first tariff (T1)
7	2.8.2	Negative active energy in second tariff (T2)
8	2.8.3	Negative active energy in third tariff (T3)
9	2.8.4	Negative active energy in fourth tariff (T4)
F	F.F	Fatal error

Table 1 - Display of register codes

Notes:

- (*)The same register code can be used for different data on a standard display. Register codes are described on the front plate. At the same meter type the given register code has only one meaning.
- A display of energy registers by individual phases is available at a large display as an option.

4.2. Scroll key

The meter is equipped with one mechanical key on the meter cover.

Key function:

- LCD test
- As an option data defined in auto scroll and manual scroll sequences can be displayed even when there is no voltage in the network or the meter is not connected.

5. Communication interface

5.1. IR optical port

The meter is provided with an optical port that enables meter parameter setting and data downloading.

The optical port complies with the IEC 62056-21 (IEC61107) standard; mode C protocol is employed; data transmission rate is 9600 bit/sec.

5.2. CS serial interface - option

CS-interface is intended for remote meter readout and parameter setting. The CS interface is 20-mA current loop that is made in compliance with the DIN 66348 standard. Maximal data transmission rate is 9600 bit/sec. Maximal data transmission distance is one km at twisted-pair (0.5 mm² wire cross-section is recommended). Up to six meters can be connected in one current-loop.

6. Inputs and outputs

6.1. Inputs

The meter is equipped with one (two-rate meters) or two (3- and 4-rate meters) tariff inputs that are used for external tariff changeover with a phase voltage.

6.2. Outputs

The meter is equipped with one or two impulse outputs. Two impulse outputs are used in case of bi-directional energy flow (an output for each energy flow direction).

Outputs can be an S0 (DIN 43864) or opto-MOS relay type.

7. Anti-fraud protection

Detection is performed by:

- Meter cover opening (option)
- Terminal cover opening (option)

Each detection of meter cover or terminal cover opening is stored as increment in a special register that can be readout by means of a MeterView or MeterRead service software.

A number of meter cover opening is stored in register.

A number of terminal cover opening is stored in register.

If the above stated detections function also in a voltage-free state, the meter should be equipped with a battery. It is not necessary to replace it during the meter lifetime.

8. Handling with the meter

Two sets of tools are available:

- For service programming and readout:**
 - MeterView (Iskraemeco software)
 - An optical probe
 - PC: a desk-top, a laptop

The tool is intended for the operators who service or reprogramme the meters in the laboratory or in a field.

- For billing readout and programming:**
 - MeterRead (Iskraemeco software) for all types of Palm-top PCs operating in the WinCE environment
 - An optical probe

The tool is intended for meter readers in the field.



Fig. 6 – Data downloading by means of a Palm top PC is shown

9. Maintenance

The meter is designed and manufactured in such a way that it does not need any maintenance interventions in the entire lifetime. Measuring stability assures that no recalibration is required. If battery is built into the meter, its capacity is sufficient to back up all functions for the entire meter lifetime.

10. Lifetime

The meter is designed for a 20-year lifetime at normal operating conditions.

11. Meter connection procedure

1. Place the meter to a connection position
2. Connect the meter to network
3. Check connection indication:
 - LED is lit (load current is less than starting current)
 - LED is blinking (proportional to load current strength)
4. Check connection – see LCD indications:
 - **Standard display:**
 - Presence of all three phases - ▼ is lit at 5th position
 - Failure of at least one phase - ▼ is not lit at 5th place
 - Reversed phase sequence - ▼ is blinking at the 5th place

- **Large display:**

- Presence of all three phases - L1 L2 L3; all symbols displayed,
- One phase failed – a symbol for the failed phase is not displayed
- Reversed phase sequence - L1 L2 L3 symbols of reverse connected phases are blinking

12. Meter case

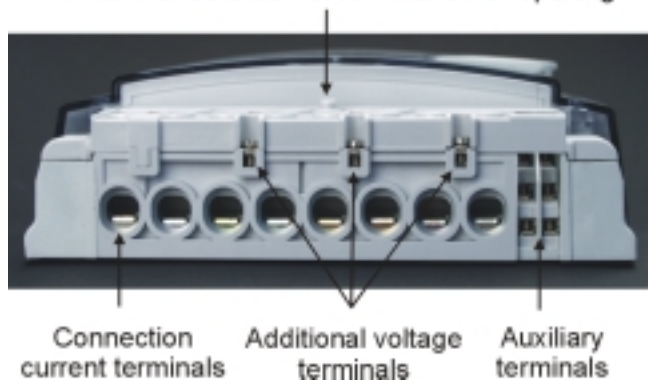
The meter case is made of self-extinguishing polycarbonate that can be recycled.



Fig. 7 – Meter constituent parts

1. An LCD
2. Meter technical data
3. A legend of data identification codes
4. A meter cover sealing screw
5. A terminal cover sealing screw
6. An IR optical port
7. A Scroll key
8. An impulse LED

A switch for detection of terminal cover opening



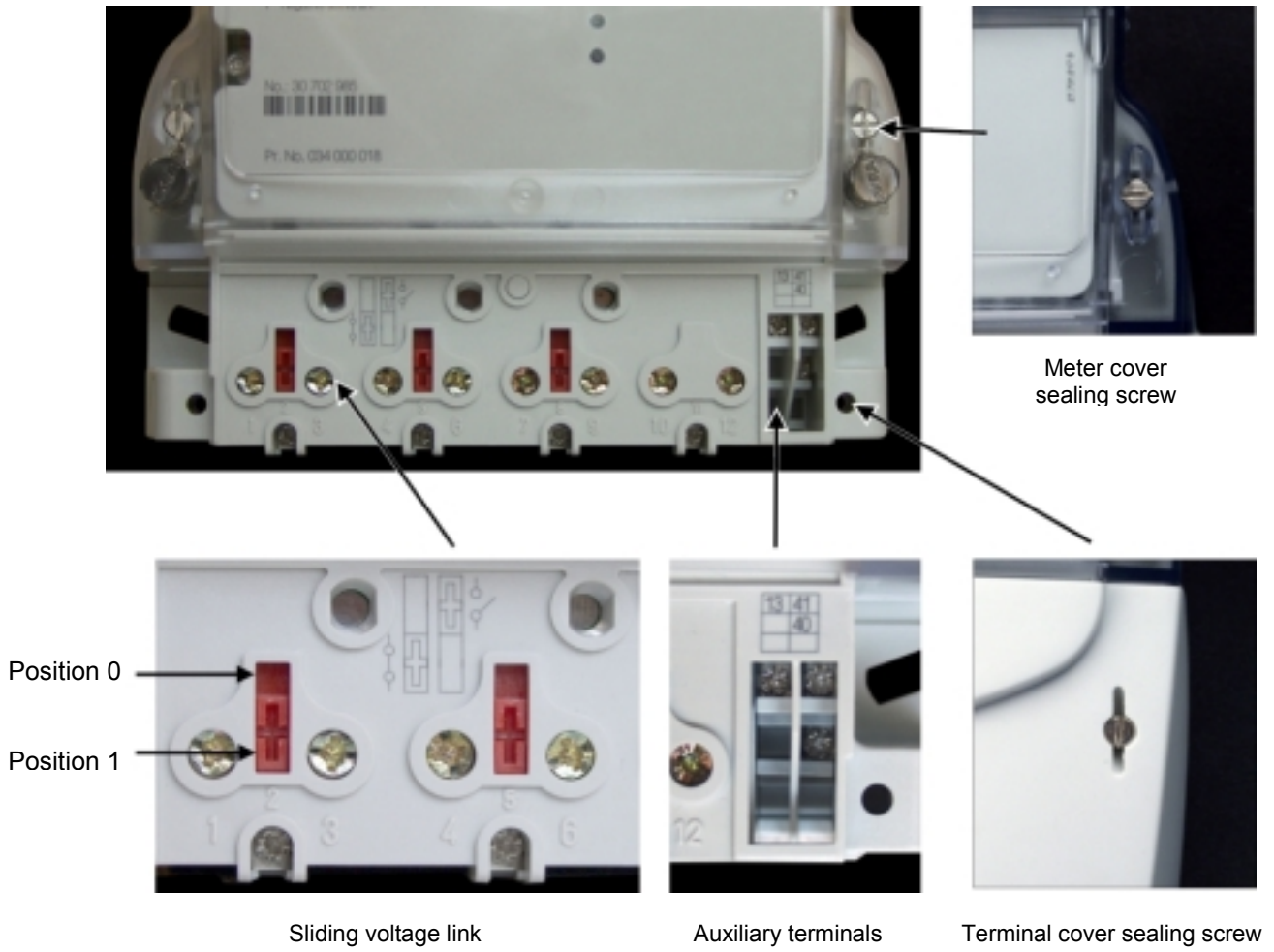


Fig. 8 – Terminal block constituent parts

12.1. Dimensions

Meter fixing dimensions comply with the DIN 43857 standard.

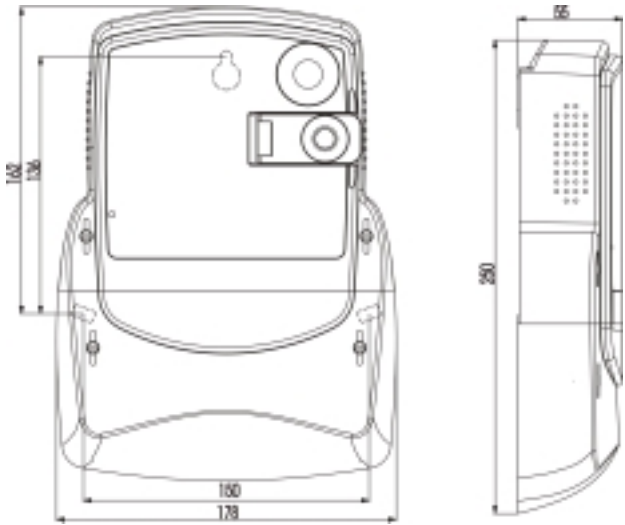


Fig. 9 – Meter fixing dimensions.

13. Terminal block

13.1.1. Terminal block

A terminal block complies with the BS 5685 standard. It is made of high quality polycarbonate assuring mechanical strength as well as resistance to high temperatures and voltage-breakdown.

13.1.2. Current terminals

Current terminals are made of zinc-plated iron and have only one screw. A universal clamping terminal assures the same reliability of the contact irrespective of the diameter and type of the connected conductor (a solid wire, a stranded wire). It also assures faster meter connection. Current terminal hole diameter is 9.5 mm.

13.1.3. Auxiliary voltage terminals

The meter can be equipped with max. four auxiliary voltage terminals 2 (L1), 5 (L2), 8 (L3), 11 (N). They enable simple connection of additional external devices.

13.1.4. Sliding voltage link

A sliding voltage link is intended for fast and simple separation of meter current and voltage circuit used for meter calibration or accuracy testing. A special slider is built in each phase of the connection terminal. It can be shifted up and down with a screwdriver. When a voltage bridge is in »0« position, it means that the voltage circuit is separated from the current circuit, while in position »1« the voltage circuit is connected to the current circuit.

14. Connection

The meter can be connected to network as a single-phase, two-phase or three-phase meter.

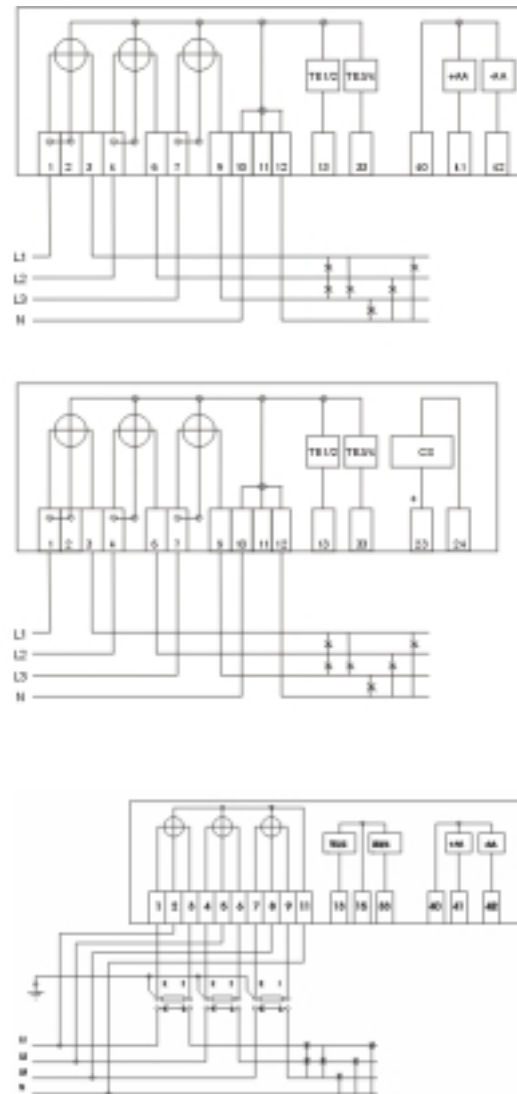


Fig. 10 – Connection diagrams

15. Technical data

Accuracy class	2 or 1
Basic current I _b	1A, 5, 10, 15, 40 A
Max. current I _{max}	6A, 40, 60, 85, 100, 125 A
Min. current	0.05 I _b
Starting current	0.004 I _b
Rated voltage U _n	3x230/400 V, 3x400 V
Voltage range	0.8 U _n ... 1.15 U _n
Rated frequency	50 Hz
Operating temperature range	-25°C ... +60°C
Extended operating temperature range	-40°C ... +60°C
Storing temperature	-40°C ... +85°C
Current circuit burden	<0.5 VA
Voltage circuit burden	<2 W / 10 VA
Dielectric strength	4 kV, 50 Hz, 1 min
Impulse voltage	6 kV, 1.2/50 μs
Short-circuit current	30 I _{max}
EMC: High frequency disturbances (IEC 1000-4-4)	6 kV
Flame class	V0 (Standard UL 94)
Dust and Water protection	IP53
Optical port	IEC62056-21 (IEC 61107)
Impulse outputs:	
S0	t _i = 40 ms (on request from 10 to 160 ms)
opto-MOS relay:	t _i = 40 ms (on request from 10 to 160 ms) Switching power: 25 VA (100 mA, 250 V)
Dimensions (h x w x d)	250 x 178 x 55 mm
Mass	1kg

Table 2 - Technical data
16. Meter type designation
MT171-D2A41-V22G22-K0

M	electronic meter
T	three-phase three-system meter
171	meter with LCD and external tariff changeover
T1	terminal block for indirect connection up to 6 A
D1	terminal block for direct connection up to 85 A
D2	terminal block for direct connection up to 120 A
A4	active energy measurement, accuracy class 1
A5	active energy measurement, accuracy class 2
1	energy measurement in one direction
2	energy measurement in two directions
4	absolute energy measurement
V 12	1 tariff input
V 22	2 tariff inputs
G12	1 impulse S0 output
G 22	2 impulse S0 outputs
L 11	1 OPTOMOS relay output
L 21	2 OPTOMOS relay outputs
K	communication interface
0	optical port in compliance with IEC 62056-21 (IEC 61107)
1	optional second communication interface – CS (20-mA loop)

Table 3 – Meter type designation

Owing to periodically improvements of our products the supplied products can differ in some details from data stated in this technical description.

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