ISKRAEMECO

Energy Measurement and Management

MT*851...*
MD*851...*

Multifunction meters
with load profile

The **MT851** / **MD851** electronic multifunction electricity meters are designed for metering of active energy in two directions, reactive energy in four quadrants, apparent energy, active and reactive demand as well as registration of load profile and electric energy quality parameters in polyphase 3-wire networks (MT851 / MD851) and 4- wire networks (MT851) at industrial customers and electric utilities. The meters can be connected directly, via CT or via CT and VT. They comply with the IEC 61036 (class 2 or 1) or IEC 60687 (class 0.5S) standard for active energy and IEC 61268 standard for reactive energy (class 3 or 2) as well as VDEW Requirements. The meters are manufactured in compliance with the ISO 9001 standard.

Metering system

The metering system is 3-element (MT851), or 2-element (MD851) with artificial connection employed at a kvarh-meter. The metering element is based on Iskraemeco SPS (Smart Power Sensor) technology. The Hall-effect sensor, analogue and digital circuits are integrated in a single silicon crystal. The metering elements are shielded against external magnetic fields and are protected against over-voltages and high frequency disturbances. Such a design of the metering element assures excellent and long-term stable metering feature, negligible effect of influence quantities and high meter reliability. Therefore, the meters do not require any calibration over their entire life span.

Meter housing

The meter housing is made of self-extinguishing polycarbonate and can be recycled at the end of the meter life. It assures double insulation and IP 53 protection level against dust and water penetration. Overall and fixing dimensions comply with the DIN 43857 standard.

Meter design

Each meter is a unique design and is made according to a customer's specification. This is performed by a powerful microcomputer, internal real-time clock, LCD, LED, communication interfaces and 3 pushbuttons as well as control inputs, control and pulse outputs according to a customer's specification.

Microcomputer

The microcomputer enables all functions specified by a customer, stores metering data and parameters in a non-volatile memory, stores metering data of previous billing periods (up to 50 last billing periods), calculates some quantities, enables load profile and time-of-use registration, definition of calendar and holidays, compensates errors of instrument transformers, logs events that have occurred, drives the LCD, enables some monitoring and control functions. The A/D converter enables metering of line voltages and harmonics (only MT851). The microcomputer is supervised by a watchdog circuitry.

Real-time clock

The internal real-time clock is either synchronised with 50 Hz network frequency or is controlled with a 32 kHz quartz crystal oscillator. The RTC that is controlled with a quartz crystal oscillator complies with the IEC 61038 standard. It is backed up with a super capacitor or a Li-battery and a super capacitor. The super capacitor permits 250-hour operation reserve; the Li-battery permits 2-year operation reserve. The microcomputer logs elapsed time of the RTC operated on the Li-battery.

The RTC enables metering periods for demand and load profile, definition of tariff change-over schedules, seasons registration, automatic change-over from standard time to day-light saving period and vice versa, and registration of day, date, hour and minute (time stamp) when events have occurred.

LCD

The MT851 and MD851 meters are equipped with an LCD specified by VDEW Recommendation. The LCD operates in two modes: basic and extended data list display. The meter user programs which data will be displayed in each of data display modes, data format and resolution as well as time of data being displayed. In case of transformer rated meters a user can program the metering data to be displayed as primary, semi-primary or secondary value. Displayed data is identified by EDIS identification codes (DIN 43863-3). Besides metering data the LCD displays events that have occurred, the meter status and alarms as well.

Indicators

LED indicators are used for testing and indication of kWh- and kvarh-meter operation. Meter constants depend on maximum current and voltage.

Communication interfaces

The meters are always equipped with an infrared optical port (IEC 61107) for meter programming and data down-loading. A 20 mA CS interface (DIN 66348), RS 232 and RS 485 interfaces are built into the meters on request. The meter can be equipped with a CS interface and either RS232 or RS 485 interface. The RS232 interface can be used for an external standard PSTN, ISDN or GSM modem. At meter programming and data down-loading the IEC 61107, Mode C protocol with a password is used.
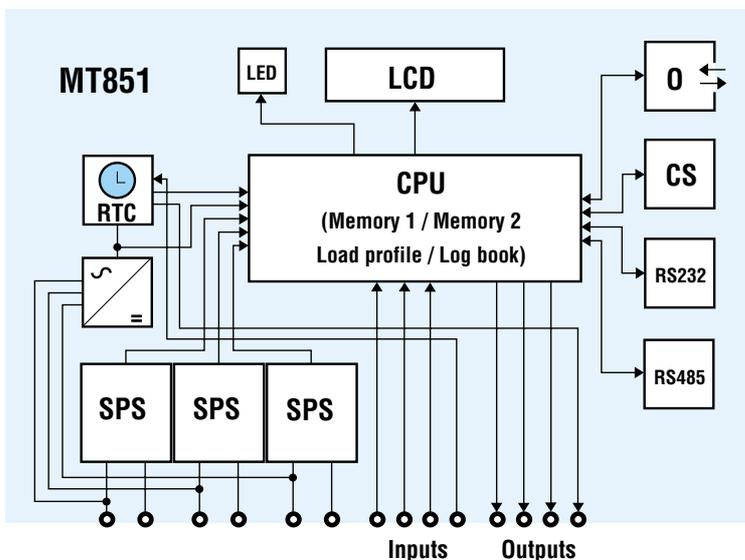
BLOCK DIAGRAM

Pushbuttons

The meters are equipped with 3 pushbuttons. The Data Scroll pushbutton is always accessible and is used for the extended data display mode. The Reset pushbutton can be locked with a padlock and is used for manual billing reset of the meter or together with the Data Scroll pushbutton for programming the meter in a field as well as setting some meter parameters. The Param pushbutton is placed under the meter cover and is used for setting the meter parameters in a workshop.

Inputs and outputs

The MT851 and MD851 meters can be equipped with up to 34 auxiliary terminals with which up to 10 inputs and 16 outputs can be realised. A customer can define in his order which inputs and outputs should be built-in.

The following inputs are available: tariff change-over inputs for energy and demand, for the RTC synchronisation, for timing demand period for billing reset and for disabling demand registration. The inputs are controlled with line-to-neutral voltage.

The meters are equipped with OPTOMOS relay outputs. The following outputs are available: pulse outputs for kWh- and kvarh-meter, output for changing-over tariff for energy and/or demand of an external meter, for starting demand period, for energy flow direction indication, for indication of disabled demand measurement, for 3-level control of demand, for indication of billing reset, different alarms and the meter status (e.g. line failure, line voltage out of limits, energy registered in a particular quadrant, load profile registration, etc.).

Load limiter

The meters can be equipped with auxiliary terminals for off/on switching or limiting the load. In the first case the microcomputer switches off the load when calculates that the permitted demand has been already achieved in a current demand period. At the end of demand period the microcomputer switches on the load. In the second case the microcomputer calculates the demand trend over the whole demand period and off/on switches parts of the load so that at the end of the demand period the limit demand is not exceeded.

Anti-fraud protection

The meters are protected against fraud in the following ways: meter and terminal covers are sealed separately, the Reset pushbutton can be locked with a padlock, the Param pushbutton is under the meter cover, execution of some commands and access to some registers are protected with passwords and code algorithms. All parameter modifications that affect the metered values are recorded in the log-book. All metering data are stored in a non-volatile memory at two locations as an original and its copy.

Time-of-use registration

The meters enable registration of energy and demand in different tariff changing-over schedules. The meters enable registration in 8 tariffs if each quantity has its own tariff changing-over schedule, otherwise 24 tariff registers are available. Times of changing-over tariffs are set with hour and minute with resolution 1 minute. It is possible to set up to 32 periods over a day in which one or more tariffs are valid. Up to 64 different daily tariff-change over schedules can be programmed. There are 8 different day types (7 days + a holiday) and it is possible to define up to 64 weekly tariff changing ower schedule. Up to 64 seasons a year defined by weekly tariff changing-over schedule that is valid in a particular season can be programmed. Besides the current tariff program up to three so called sleeping tariff programs can be programmed and are activated on programmed dates. It is possible to define up to 330 holidays a year, including holidays based on a lunar calendar (e.g. Eastern) or some other cyclic algorithm. The calendar is valid by the year 2090.

Maximum demand indicator

Maximum demand can be based either on fixed or rolling demand period. The demand period can be set in a range from 1 to 120 minutes with resolution 1 minute. It is possible to register maximum demand of active energy for two energy flow directions as well as of reactive energy in each of four quadrants. Maximum demands are registered in tariffs (up to 8) and cumulative. It is possible to disable maximum demand registration for a certain period that follows a period of power shortage.

Load profile

A 32-channel data logger is built into the meter. It enables load profile registration per line and polyphase of active energy demands in two energy flow directions and reactive energy demand in four quadrants or combination of them (i.e. Q1+Q2 and Q3+Q4). The load profile period can be set in a range from 1 minute to 60 minutes with 1-minute resolution. The data logger can also register line rms voltages, total harmonic distortion factors of line voltages (only MT851), events that have occurred (power shortages, manual meter resets, etc) and the meter status (energy flow direction, disabled demand registration, tripping of a load limiter, status of inputs and outputs, etc.).

Log-book

Events that have occurred as well as date and time of their occurrence are registered in a ring buffer by the microcomputer. The log-book has 255 registers. Data stored in the log-book can be downloaded with other data in the data down-load sequence. The following events can be stored in the log-book: power up, power down setting RTC, setting parameters via pushbuttons, parameterization of the meter via communication billing reset, previous values reset, Log-book reset, load profile reset, Watchdog reset, Master reset, CPU error.

Meter upgrading

The meters can be upgraded by an Iskraemeco P2C communicator, which can be mounted on the meter terminal block. The P2C is connected to the meter communication interface and is equiped with a standard PSTN, ISDN or GSM-modem. In such a case CALL-BACK function is possible.

Accessories

The MeterView software that enables the meter programming and data down-loading as well as an optical probe with a serial 9-pin connector are available on request.

TECHNICAL DATA

Accuracy	kWh-meter . . . . .class 1 (IEC 61036) or class 0.5S (IEC 60687)
	kvarh-meter . . . . .class 2 (IEC 61268) or class 2, calibrated to 1%

	direct connected	transformer operated
	class 2 or 1	class 1 or 0.5S (only MT851)
Basic current I_b	5 A	1 A
Maximum current I_{max}	120 A	6 A

Starting current	whole current meter . . . . .0.004 I_b
	transformer rated meter . . . . .0.002 I_b

Reference voltage U_r . . . . .3 x 220/380 V, 3 x 230/400 V, 3 x 240/415 V
3 x 58/100 V, 3 x 63/110 V, 3 x 100 V, 3 x 110 V

Voltage range . . . . .0.8 U_r to 1.15 U_r

Reference frequency . . . . .50 Hz ±5%

Accuracy of quartz controlled RTC (at 25 °C) . . . .≤±3 min/year (≤±6 ppm)

Memory capacity of load profile . . . . .84 days at 4 channels and 15-minute demand period

Number of auxiliary terminals . . . . .up to 34

Number of inputs . . . . .up to 10

Number of outputs . . . . .up to 16

Operating temperature range . . . .–25°C to +60°C

Storing temperature range . . . .–30°C to +70°C

Current circuit burden . . . .<0.1 VA / line

Voltage circuit burden . . . .<3 W / 4 VA

Relay ratings . . . . .25 VA (100 mA, 275 V)

Dielectric strength . . . . .4 kV, 50 Hz or 60 Hz, 1 min

Impulse voltage . . . . .6 kV, 1.2/50 μs

Short-circuit current . . . . .30 I_{max}

Burst test . . . . .4 kV (IEC 1000-4-4)

Dimensions . . . . .327 x 177 x 90 mm

Mass . . . . .1.8 kg approx.

Metered and calculated quantities

The meters measure all quantities per line and polyphase. The following electric quantities are metered or calculated:

– active energy in two energy flow directions

– reactive energy in four quadrants as well as in combined quadrants (i.e. Q1+Q2 and Q3+Q4)

– apparent energy (calculated quantity)

– demand of active energy in two energy flow directions

– demand of reactive energy in four quadrants as well as in combined quadrants (i.e. Q1+Q2 and Q3+Q4)

– cumulative maximum demands

– power factors per line

– line-to-neutral voltages

– content of harmonics in line-to-nautral voltages (up to 15th harmonic)

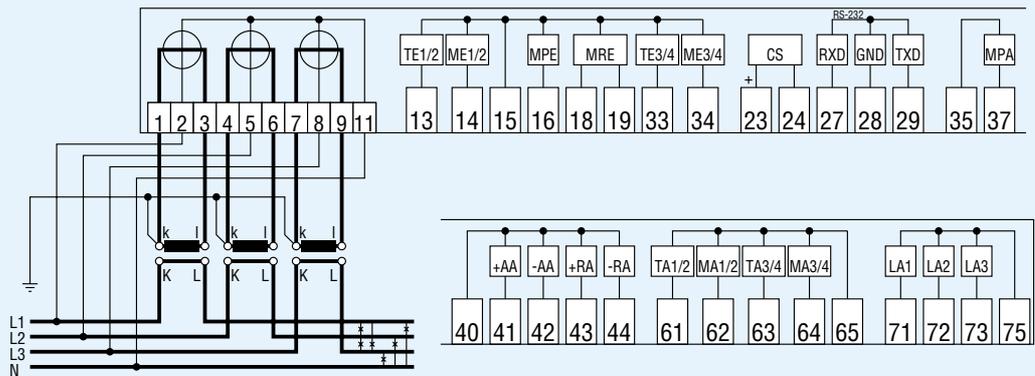– total harmonic distortion of line-to-neutral voltage (up to 15th harmonic)
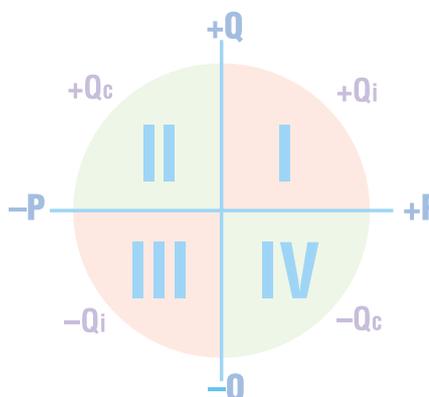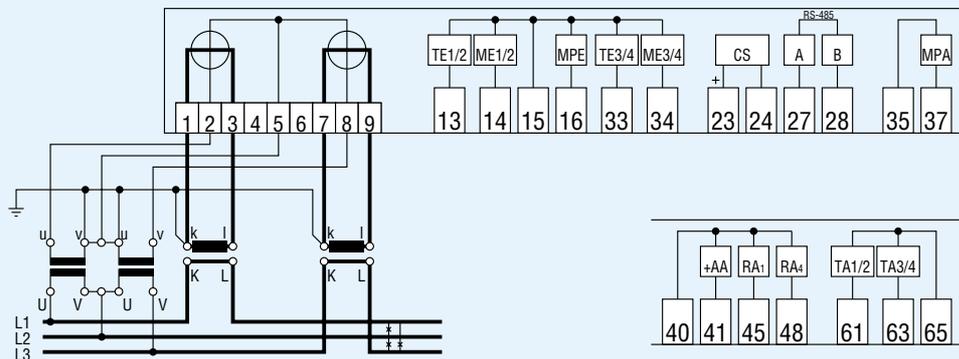
OVERALL AND FIXING DIMENSIONS
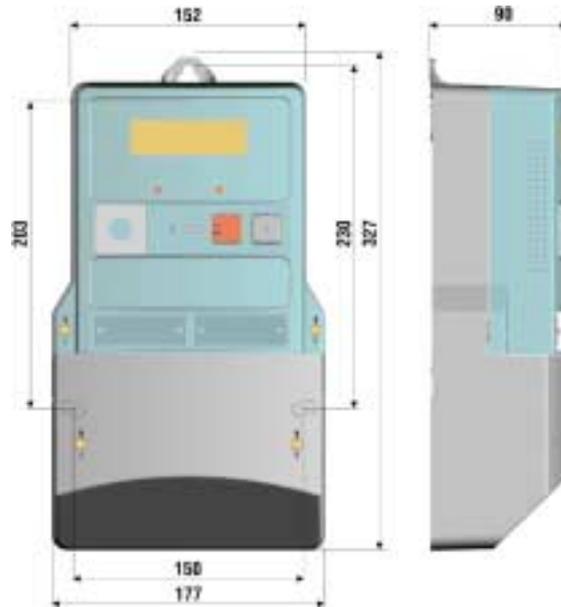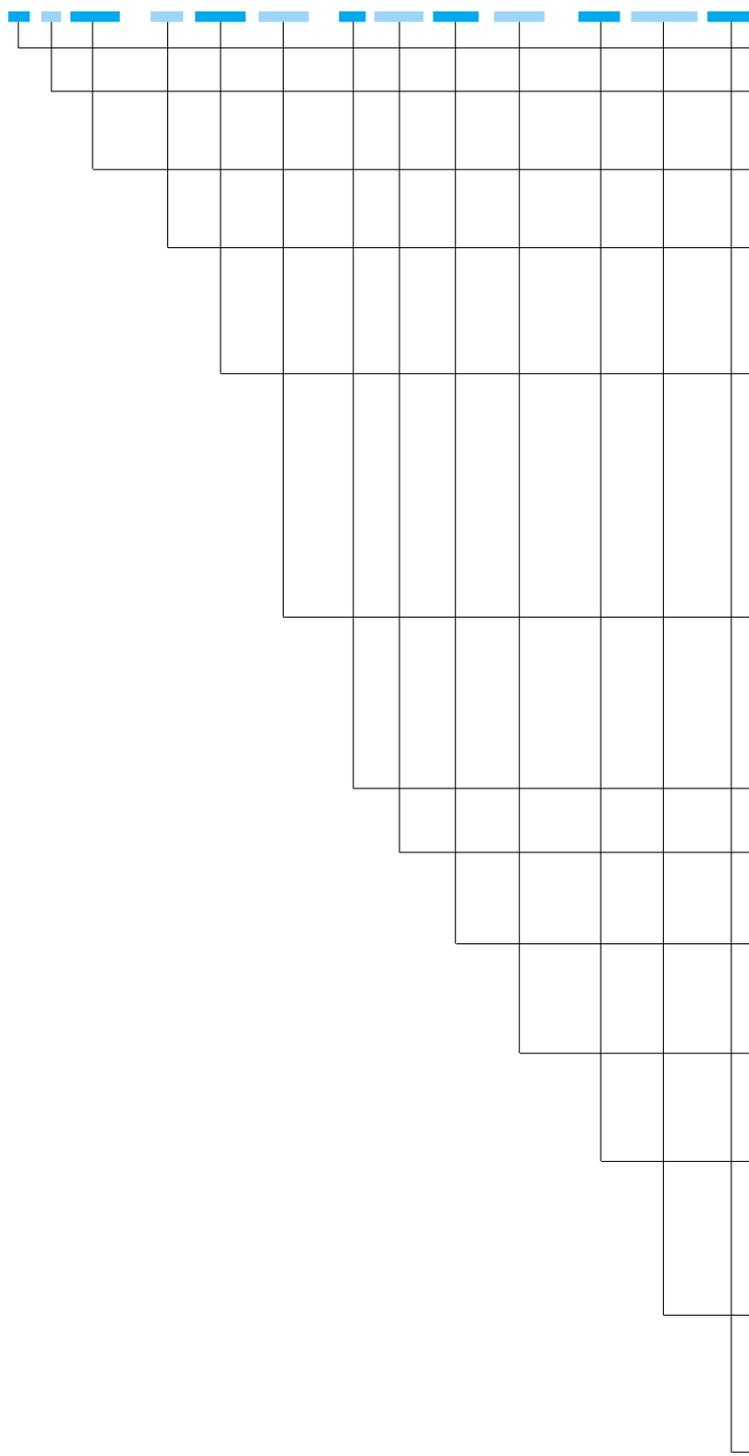

TYPICAL CONNECTION DIAGRAMS

MT851...

MD851...

ISKRAEMECO — MT*851...*, MD*851...*

METER TYPE DESIGNATION

M T 851 - T1 A42 R46 – E V62 L71 C22 – M3 K013 Z2

- **M** – static meter
- **T** – polyphase 3-element meter
- **D** – polyphase 2-element meter
- **8** – multifunction meter
- **5** – up to 34 auxiliary terminals
- **1** – LCD by VDEW Recommendation
- **D2** – whole current meter with terminal block for Imax = 120 A
- **T1** – transformer operated meter with terminal block for Imax = 6 A
- **A** – Active energy
  - **3** – kWh-meter class 0.5S (IEC 60687) - (only MT851)
  - **4** – kWh-meter class 1 (IEC 61036)
  - **5** – kWh-meter class 2 (IEC 61036)
    - **1** – one energy flow direction
    - **2** – two energy flow directions
- **R** – Reactive energy
  - **4** – kvarh-meter class 2 (IEC 61268), calibrated to 1% (only MT851)
  - **5** – kvarh-meter class 2 (IEC 61268)
  - **6** – kvarh-meter class 3 (IEC 61268)
    - **1** – one energy flow direction (Q+ = Q1+Q2)
    - **2** – two energy flow directions (Q+ = Q1+Q2 and Q-= Q3+Q4)
    - **3** – inductive energy import, capacitive energy export (Q1 and Q4)
    - **4** – inductive energy, two energy flow directions (Q1 and Q3)
    - **5** – four quadrant meter (Q1, Q2, Q3 and Q4)
    - **6** – four quadrants, reactive energy import and export (Q1, Q2, Q3, Q4, Q+ and Q-)
- **E** – external power supply
- **V** – control inputs
  - **n** – number of inputs (n =1, 2, …, 10)
  - **2** – line voltage to be applied to the inputs
- **L** – Photo-MOS relay outputs
  - **m** – number of outputs (m = 1, 2, …, 16)
  - **1** – make contact
- **C** – energy flow direction output
  - **1** – one output for energy flow direction
  - **2** – two outputs for energy flow direction
  - **2** – Photo-MOS relay
- **M** – additional device
  - **2** – RTC + super capacitor
  - **3** – RTC + Li-batery
- **K** – communication interfaces
  - **0** – 1st interface: IR optical port
    - **1** – 2nd interface: CS (20 mA) interface
    - **2** – 2nd interface: RS232 interface
    - **3** – 2nd interface: RS485 interface
      - **2** – 3rd interface (if the second interface is CS): RS232 interface
      - **3** – 3rd interface (if the second interface is CS): RS485 interface
- **Z** – load profile
  - **2** – load profile memory 128k SRAM

Owing to periodical improvements of our products the supplied products can differ in some details from the data stated in the prospectus material.