

POLY-PHASE STATIC ACTIVE ELECTRICITY METERS

ED 310, ED 310.I

DISPLAY, CONSUMPTION AND SUPPLY, 4 TARIFFS



Electricity meters ED 310 and ED 310.I (hereinafter referred to also as ED 310) are modern, electronic, programmable devices for monitoring consumption and supply of active electricity in the retail consumption area. During development and design, increased attention was paid to comply, with ample margin, with IEC, EN & DIN standards and communication protocol recommendations.

MEASURING SYSTEM

The ED 310 is a poly-phase, static, one- to four-tariff electricity meter of active energy of class A or B as per EN 50470-1 and 50470-3 designed for direct (ED 310) and indirect (ED 310.I) connection.

The technical solution basis is the microprocessor, which performs all major functions. It digitalizes analogue current and voltage signals; performs calculations, operates the display, senses tariff inputs, communicates via the opto-interface, generates IR and S0 impulses, logs selected values and data as well as adapts the ED 310 properties to customer requirements and needs. The measuring system also enables measurement in the occurrence of DC and harmonic components in the measured voltage and current circuit within the whole measuring range of the ED 310. Negative impact of the DC components is eliminated in each measuring period. Measuring system calibration is done electronically, the electricity meter has no mechanically set-up items. The measuring system ensures a high degree of accuracy even if connected to two phases or a single phase only. If connected to two phases, their phase shift can be 180°.

The ED 310 measures, logs (and displays if requested) basic values as follows:

- Consumption and supply for each of the 4 tariffs (i.e. 8 registers of energy)
- Operating time for each consumption or supply register (i.e. 8 registers of time)
- Total consumption and supply
- Maximum current (also per phase) and maximum power (also per phase)
- Operating time, number of drop outs, time elapsed after current and power maxima resetting.

The ED 310 measures, logs (and displays if requested) auxiliary values as follows:

- Instantaneous effective voltage
- Instantaneous effective current (also per phase)
- Instantaneous active power (also per phase).

CURRENT TRANSFORMER COUPLING

If a Current Transformer (CT) Factor is entered, the ED 310.I will calculate / display CT primary side consumption. The CT Factor can be any integer value between 1 and 400. The CT Factor multiplies energy, power, current and S0 output values. Multiplied values can be shown on the display, always together with the CT Factor entered. The red calibration LED uses non-multiplied values, i.e. displays CT secondary side consumption. CT Factor changing is password protected and can be entered by the manufacturer only.



RANGE OF CURRENT MEASUREMENT

The ED 310 measures from start-up current up to 63 A (ED 310.I up to 7.5 A), with ample margin, complying with applicable DC component & harmonics standards.

INPUTS

The ED 310 is equipped with up to three external inputs for switching of up to 4 tariffs. Tariff switching is done by applying voltage to ED 310 tariff terminals. The active tariff is shown on the display.

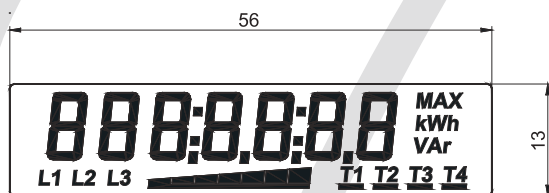
METER DESIGN

The ED 310 allows for simple DIN bar installation.

DISPLAY OF MEASURED QUANTITIES

Displaying is done by a Liquid Crystal Display (LCD). In addition to data on measured consumption (and / or supply) of active energy in kWh for tariffs T1 to T4, the display can also show, as per customer requirements, other values, e.g. effective current, effective voltage, instantaneous power (also per phase), maximum current (also per phase), maximum power (also per phase), power factor, number of drop-outs, operation time and CT factor. Further to that, the display indicates active tariff (in which the ED 310 logs consumption / supply) and instantaneous current direction (consumption / supply).

All data captured can be configured to be displayed and their display scrolling speed can be set as well.



Captured data are logged to registers that can always be accessed via the opto-interface. In addition, individual tariff register values can be added or subtracted and results shown (with up to 4 decimal points): consumption, supply, consumption + supply, consumption – supply. Values can be made absolute prior to or after calculation performed. For maximum values storage, the ED 310 enables a suitable filter to be configured for peak values capturing. To ensure better orientation, the ED 310 always indicates the instantaneous power gross size on the display in the form of a bar chart (if the current is below the start-up value, the bar chart is not shown). Symbols L1, L2 and L3 indicate the presence of individual phase voltages and their correct sequence. Supply value registers, shown on the display, are preceded with a “-“ sign for easier identification.

OUTPUTS AND COMMUNICATION

The ED 310 has a calibration (test) LED output; the constant for conversion of energy consumed to number of transmitted pulses is programmable.

The ED 310 is equipped with an S0 interface (as per EN 62053-31). The circuit has galvanic separation using an optron, the output of which is connected to a transistor with an open collector. It transmits impulses with a frequency corresponding to the energy consumed. Impulses number and their length are programmable.

The ED 310 is provided with an opto-interface as per EN 62056-21.

Further to that, the ED 310 can be equipped with either an RS 485 or M-Bus communication module. The RS 485 module is galvanically separated from ED 310 other parts and, therefore, requires a power supply from an external source. The M-Bus module, also galvanically separated as its RS 485 counterpart, is powered via its two-wire communication link.

Calibration LED

A red LED is used for calibration purposes. The diode transmits light impulses with frequency corresponding to energy measured in line with the programmable ED 310 constant, standard 10 000 imp./kWh.

Optical Communication

The opto-interface enables local reading as per EN 62056-21. The reading is done via an opto-head placed on the appropriate place of the ED 310 case. Its electrical input and/or output are via RS 232 or USB connected to a PC port or mobile terminal PDA connector. Communication speed can be changed.

As per standard above, the ED 310 has three modes implemented:

- Programming Mode for configuration / parametrization
- Manufacturer Specification Mode with service commands
- Electricity Meter Readouts.

Setting Up Communication

Communication setting up can be either addressed or non-addressed. An address, comprising up to eight digits (ASCII characters permitted) is logged to the electricity meter and can be set-up or changed by the ED 310 configuration. If the electricity meter address is empty, the ED 310 responds to all addresses.

A so called “Fast Identification” can be configured with responses shortened from 200 ms to 20 ms when swapping communication direction (response time is adjustable – this includes response after changing of communication speed). Although the communication setting up speed can be configured, it is usually set to a standard 300 Bd. Communication once set up, its speed can be changed from 300 Bd up to 9600 Bd (higher communication speeds need to be supported by the optical head used).

Programming Mode

In the Programming Mode during production, both configuration and parametrization of the ED 310 are performed (the HW is blocked by a jumper prior to handing over to customer). Programming Mode access has the strongest SW protection - compliant with “Access Level 3”. To access this mode, the password needs to be known (stored in the electricity meter configuration) as well as the encryption algorithm. To disable the algorithm from being detected during communication, a random number, generated by the electricity meter, is used for algorithm access.

In case of a standard set-up, (unless the customer requests otherwise), changes of all configuration parameters and resetting (change of the content) of selected registers are HW blocked.

Manufacturer Specification Mode

In the Manufacturer Specification Mode, two commands protected with individual independent passwords are implemented. One command is maxima deleting, the other command gives access to calibration mode commands.

Electricity Meter Readouts

Electricity meter readouts always return all readable registers with maximum accuracy. The register names (e.g. 1.8.1) are optional and any register can be omitted from the readout. All permissible register operations are fully programmable by the reading unit or depend on further processing by the master computer. A successful readout can be configured to be followed by deletion of a maxima register. Another possibility how to delete maxima registers is by a command in the Manufacturer Specification Mode.

RS 485 Communication

The ED 310 together with the RS 485 module can be used for remote data collection and industrial processes (e.g. automation, regulation, control of street lighting etc.).

The distance for communicating via the RS 485 module can reach up to 1200m, subject to quality wiring and correct termination. A repeater is required for long distances if more than 32 ED 310s are connected. This gives a more stable environment for communication.

The ED 310 that is equipped with a RS 485 module communicates and reads-out in a way similar to the opto-interface. The number of registers in the read-out, their format and read-out sequence, depend on the format specifics of the ED 310. The ED 310 is formatted during production as per customer's requirements.

The RS 485 module is galvanically separated from other parts of the ED 310 (4 kV / 50 Hz / 60 s) and, therefore, it requires an external power supply. Power supply requirements are specified in the technical data sheet on the following page.

If the RS 485 bus is actively engaged, the ED 310 opto-interface is disconnected automatically. In this mode, the ED 310 can be accessed via the RS 485 module only.

M-Bus Communication

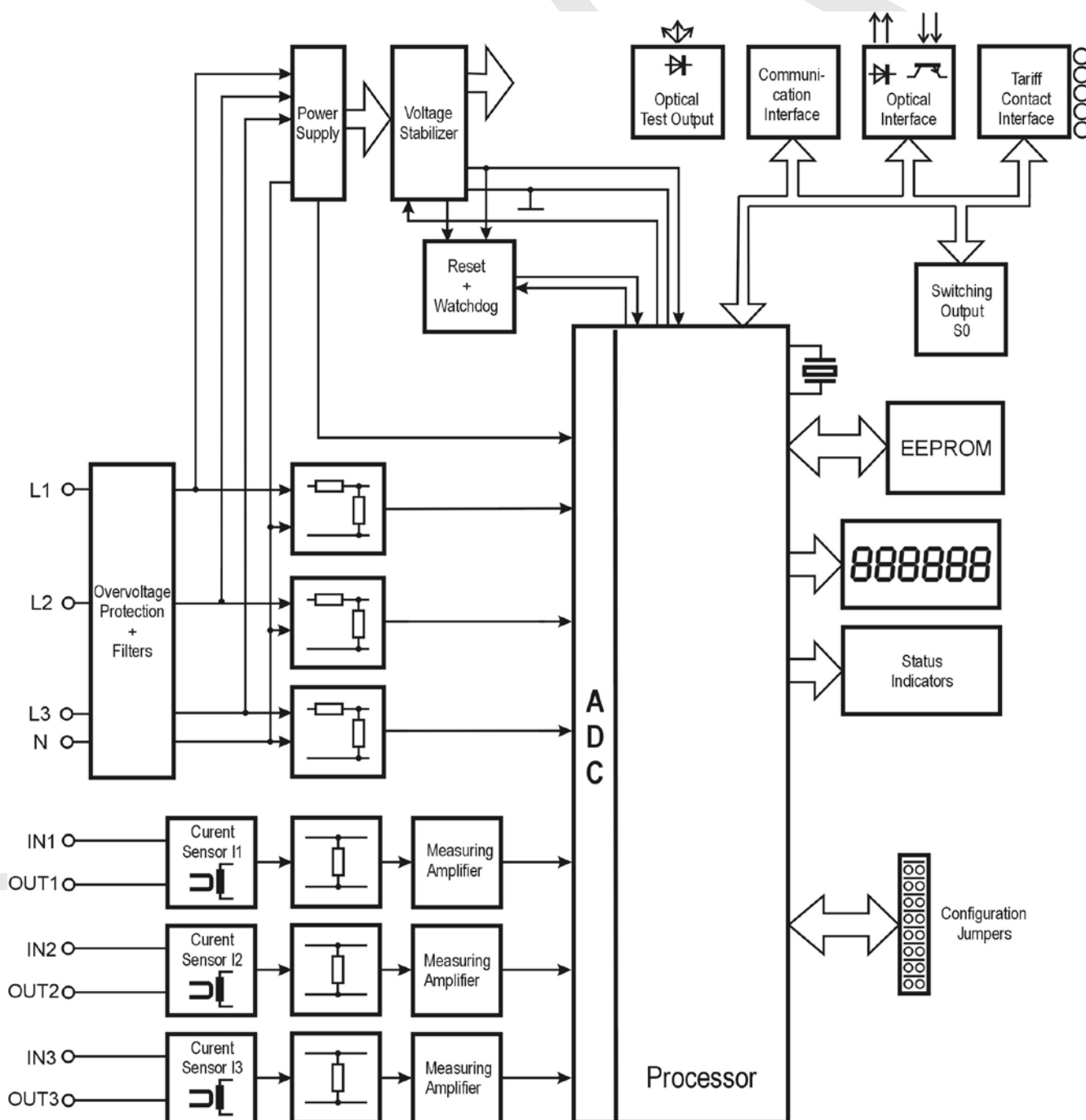
M-Bus communication is exercised via a two-wire link by changing the current flowing out from the M-Bus master. When idle, the M-Bus module takes 2.4 mA. This current corresponds to a logical "1". If a logical "0" is to be communicated, the current will rise to between 12 to 20 mA.

The distance for communicating via M-Bus can be between 350 m to 1000 m, subject to communication speed chosen.

The M-Bus module is powered via the two-wire communication link. Power supply requirements are specified in the technical data sheet on the following page.

ELECTRICITY METER BLOCK DIAGRAM

The block diagram shows current terminals as labelled on the ED 310.I, to be coupled to current transformers.



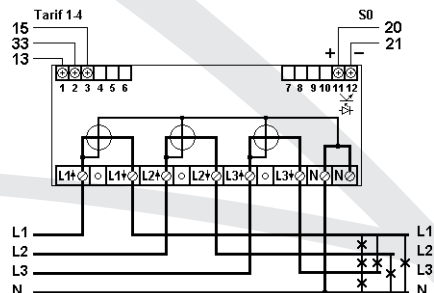


TECHNICAL DATA

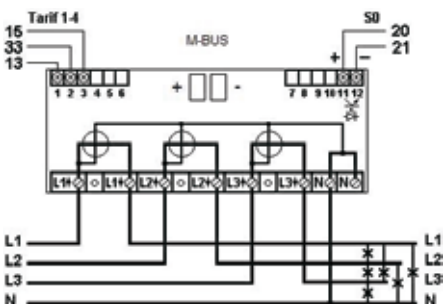
Basic Data	
Accuracy Class	A or B as per EN 50470-1, 50470-3
Electricity Meter Constant (test LED output)	Programmable, standard 10 000 imp. / 1 kWh
Connection	Direct four-wire / Indirect (via current transformers)
Reference Voltage U_n	3 x 230 / 400 V
Operation Voltage Range	0.75 U_n to 1.15 U_n
Own Consumption of Each Voltage Circuit (without inserted module)	maximum 0.7 W, maximum 8 VA cap.
Own Consumption of Each Current Circuit	maximum 0.01 VA
Nominal Frequency f_n / Operating Frequency Range	50 Hz / 45 to 55 Hz
Starting Current I_{st} (direct / indirect connection)	Below 15 mA / 5 mA
Minimum Current I_{min} (direct / indirect connection)	200 mA / 50 mA
Transitional Current I_t (direct / indirect connection)	500 mA / 250 mA
Reference Current I_{ref} (direct connection)	Configurable 5 A or 10 A
Rated Current I_n (indirect connection)	5 A
Maximum Current I_{max} (direct connection) permanently	Configurable in integer multiples of I_b from 40 A to 63 A
Maximum Current I_{max} (indirect connection)	Configurable 6 A or 7.5 A
Maximum Measurement Range (direct / indirect connection)	15 mA to 63 A / 5 mA to 7.5 A
Tariff Switching – External Terminals	
Switching Voltage U_t	230 V
Permitted Switching Voltage Range	0.75 U_t to 1.15 U_t
Maximum Consumption at $U_t = 230V$	1.5 mA
Outputs	
Test LED in S0	Class A as per EN 62053-31
• Output Connection	Direct, two-wire, open collector output type
• Impulse Number	Programmable from 0.15 to 10 000 imp. / 1 kWh
• Impulse Width	Programmable, standard 40 ms
• Supply Voltage Rated / Maximum	24 V DC / 30 V DC
• Current	5 to 15 mA DC
• Maximum Wiring Length	1000 m
Temperature Range	
Operating / Storage	-25°C to +55°C
Humidity	Without condensation
Ingress Protection	IP 20
Mechanical / Electromagnetic Environment	M1 / E2
Resistance to Voltage Impulses - Impulse Voltage // Impulse Shape	8 kV // 1.2 μ s / 50 μ s
Electromagnetic Compatibility	
Electrostatic Discharges	as per EN 50470-01
• Test Voltage	8 kV
• Discharges Number	10
High-frequency Electromagnetic Field	as per EN 50470-01
• Severity Grade 3, Vertical and Horizontal Polarization	
Fast Transient Phenomena (impulse groups)	as per EN 50470-01
• Length of Impulse Group / Period of Impulse Group	15 ms / 300 ms
• Test Length	60 s
• Test Voltage	4 kV
Radio Interference Suppression	as per EN 55022
• Interference Voltage Peak Phase within Zone	0,15 to 30 MHz
• Electromagnetic Field Peak Phase Intensity within Zone	30 to 2000 MHz
• Resistance to Interference Spread in Wiring as per EN 61000-4-6	0.15 to 80 MHz
RS 485 Communication Module	
Supply Voltage Range / Recommended	12 to 24 V DC or 12 to 18 V AC / 12 V DC
Own Consumption (idle / communication)	10 mA / 50 mA
M-Bus Communication Module	
Supply Voltage Range	24 to 36 V DC
Weight and Dimensions	
Weight without / with Module	ca 0.4 / 0.5 kg
Width x Height x Depth	107 x 91 x 71.5 mm
Installation / Operation Position	DIN Bar / Any
Connection of Wires	
Terminal Diameter	7.2 mm (direct) / 4 mm (indirect)
Wire Maximum Cross-section - Rope	25 mm ² (direct) / 6 mm ² (indirect)
Wire Maximum Cross-section - Strand	16 mm ² (direct) / 4 mm ² (indirect)
Connecting Screws	M5 (direct) / M3.5 (indirect)
• Cross Slot	Type Z, size 2
• Slot	1.2 mm
• Tightening Torque	2 to 3 Nm (direct) / 1 Nm (indirect)
Other technical parameters as per EN 50470-1, 50470-3	

TERMINAL BOARD WIRING DIAGRAM

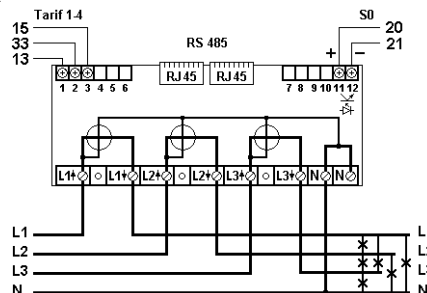
Direct Electricity Meter ED 310.D0



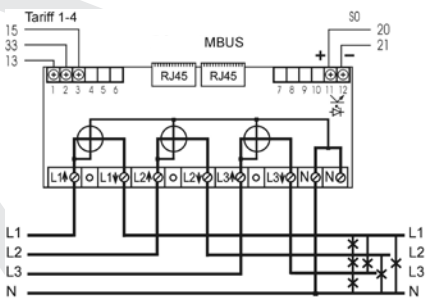
ED 310.DB



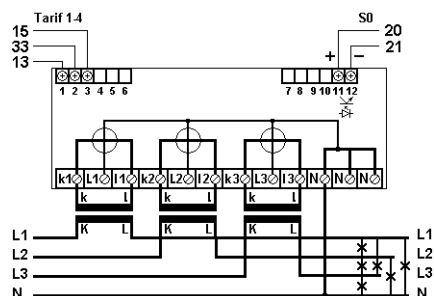
ED 310.DR



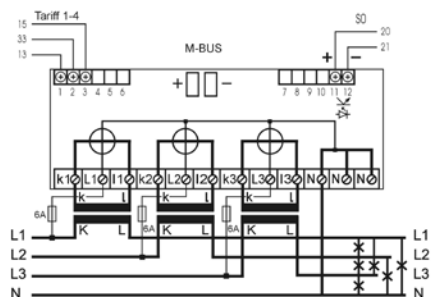
ED 310.DB



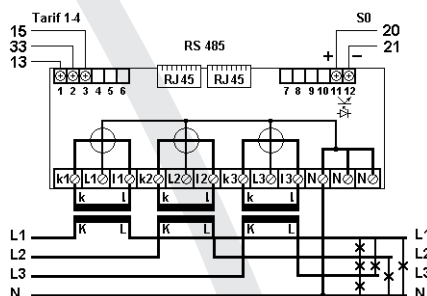
Indirect Electricity Meter ED 310.I.D0



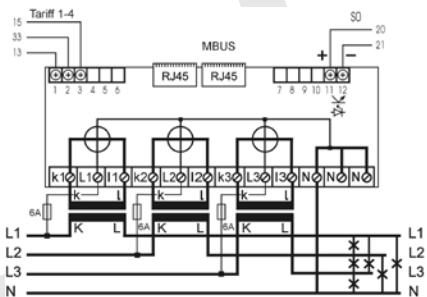
ED 310.I.DB



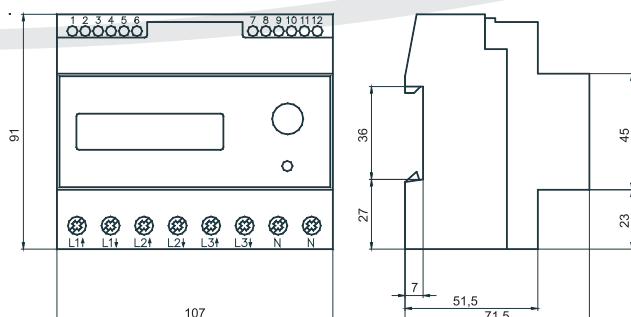
ED 310.I.DR



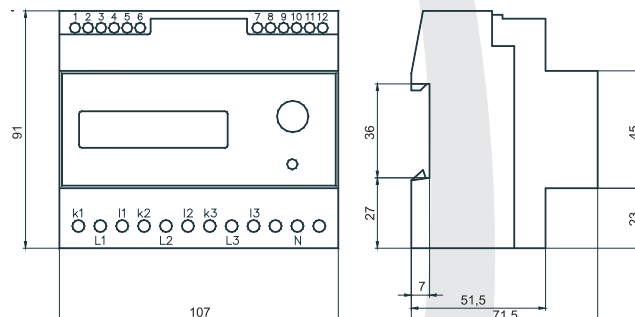
ED 310.I.DB



DIMENSIONAL SKETCH - Direct Electricity Meter



DIMENSIONAL SKETCH - Indirect Electricity Meter



TYPE DESIGNATION

(Direct / Indirect El. Meter) ED 310. D / ED 310.I.D #	#	#	#	#	#	#	#	-	#	#
With display, 1 to 4 tariffs	0									
With display, 1 to 4 tariffs, with RS 485 module	M									
With display, 1 to 4 tariffs, with M-Bus module (KNX or RJ45)	B									
<i>Without optical communication</i>	0									
With optical communication	1									
<i>Without control of tariffs</i>	0									
Free connection of tariffs	1									
<i>Without tariff switching</i>									X	
Tariff switching – Czech logics									C	
Tariff switching – European logics									E	
<i>Tariff switching – Customer logics</i>									Z	
FW Modification (firmware customer version)										00 - 99
<i>One-tariff with S0</i>										1
<i>Two-tariff with S0</i>										2
<i>Three-tariff with S0</i>										3
Four-tariff with S0										4
<i>One-tariff without S0</i>										5
<i>Two-tariff without S0</i>										6
<i>Three-tariff without S0</i>										7
<i>Four-tariff without S0</i>										8
HW Modification (hardware customer version)										00 - 99

Connector RJ45 Pin Wiring for RS 485

FCC plug A/B	
RS 485 Bus	
1	Terminals are coupled 1 st pole of power supply
2	
3	
4	Rx/Tx +
5	Rx/Tx -
6	Terminals are coupled 2 nd pole of power supply
7	
8	
Shielding	

Both RJ45 connectors are identical. Power supply terminals are indifferent to power voltage polarity. Rx/Tx + and Rx/Tx - Bus terminals must have correct polarity.

ED310 standard models are printed in bold letters. Customer models, modifications and production can be ordered subject to prior agreement with the manufacturer.

The direction of energy measured forms an integral part of the meter: **ODB** (can be specified otherwise) – consumption **ODB/DOD** (can be specified otherwise) - consumption and supply This direction symbol will be specified in the Customer Sheet, forming a part of the purchase contract.

PACKAGING MATERIALS AND DEFUNCT PRODUCT DISPOSAL

Packaging Materials and Defunct Product Disposal

The electricity meters at the end of their service life are to be handed over to specialized organizations, engaged in separation of used materials or their recycling. Unused devices are to be disposed of ecologically in compliance with the Waste Act.

MANUFACTURER'S WARNING

The device is capable of safe operation. The manufacturer issued a Declaration of Conformity as per Sect. 13 of the Act 22/97 Coll. However, despite the said above, the manufacturer warns of the risk of possible danger resulting from incorrect device handling or application:

- Installation and maintenance needs to be performed by a knowledgeable person with corresponding electrotechnical qualification, who shall inform the operator on conditions of safe operation
- The device may not be used for other purposes than those manufactured for
- The device may not be wilfully modified contrary to the type design
- The device may not be operated with different voltage, current and frequency than those it was manufactured or professionally modified for
- The device shall be located and secured so as to complicate or disable handling by persons with no electrotechnical qualification, especially children

Packaging Materials

Packing boxes are recyclable. Hand used boxes over to organizations as a source of secondary raw materials or energy.

Electricity Meter

Contains no radioactive, cancerogenic or other materials, harming human health/environment. All plastic materials used are recyclable.

- Before every putting into operation, e.g. after repair, maintenance etc., Ingress Protection is to be fully restored, all safety measures taken and revision done by a revision technician
- During operation, premises where the device is installed must be free from danger of fire or explosion in case of occurrence of gases, vapours of flammable liquids and occurrence of flammable dust
- The device may be handled by a knowledgeable person only, handling performed without voltage with the exception of measurement by measuring device with insulated tips
- The device may not be operated under the conditions or in an environment that does not ensure safe operation (e.g. location on a flammable base, cover from a flammable material, insufficient protection against penetration of foreign elements or water or other liquids)
- The device may not be operated with vibrations and oscillation exceeding those identified in the technical specification.

Should the user fail to respect any of the aforesaid warnings and should any defect occur as an incidental consequence of such a failure, the manufacturer shall not be liable for the defect.