

POLY-PHASE ELECTRONIC ACTIVE ELECTRICITY METERS

ED310, ED310.I

CONSUMPTION AND SUPPLY, 4 TARIFFS

Electricity meters ED310 and ED310.I (hereinafter referred to also as ED310) 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 ED310 is a poly-phase, electronic, four-tariff electricity meter of active energy of class A or B as per EN 50470-1 and 50470-3 designed for direct (ED310) and indirect (ED310.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 ED310 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 ED310. 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.

The ED310 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 ED310 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.





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 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 connection)	200 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} (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. / 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	IP20
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
RS485 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 Module RS485	ca 0.4
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	

F.F. the registry displays:

000000 - no error

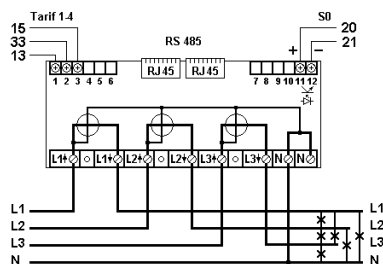
032768 - one or two phases are missing

016384 - wrong phase sequence

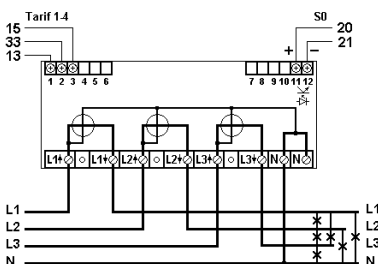
TERMINAL BOARD WIRING DIAGRAM

Direct Electricity Meter

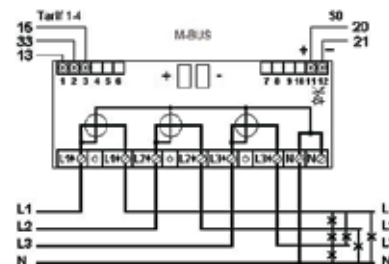
ED310.DR



ED310.D0

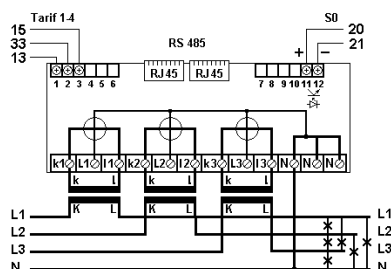


ED310.DB

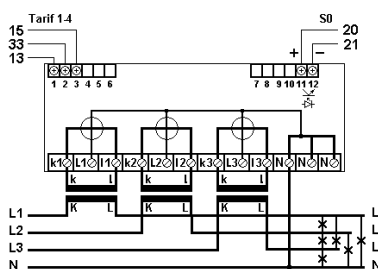


Indirect Electricity Meter

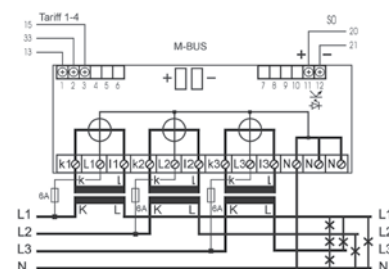
ED310.I.DR



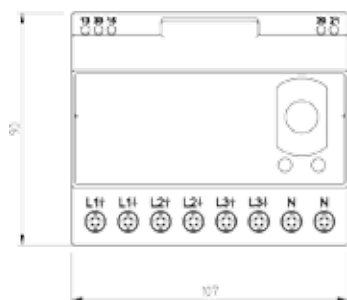
ED310.I.D0



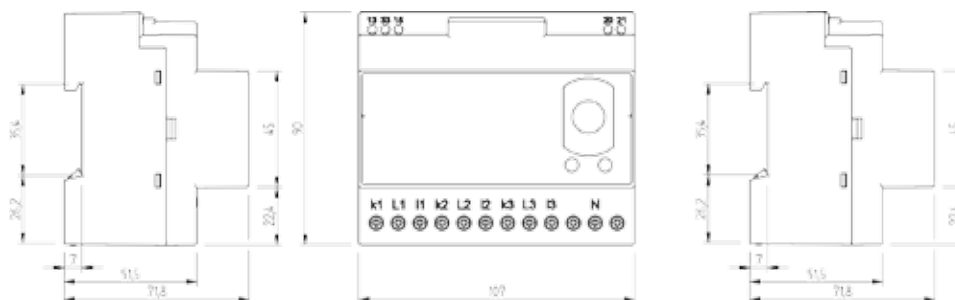
ED310.I.DB



DIMENSIONAL SKETCH - Direct Electricity Meter



DIMENSIONAL SKETCH - Indirect Electricity Meter



RANGE OF CURRENT MEASUREMENT

The ED310 measures from start-up current up to 63 A (ED310.I up to 7.5 A), with ample margin, complying with applicable DC component & harmonics standards.

INPUTS

The ED310 is equipped with up to three external inputs for switching of up to 4 tariffs. Tariff switching is done by applying voltage to ED310 tariff terminals. The active tariff is shown on the display.

OUTPUTS AND COMMUNICATION

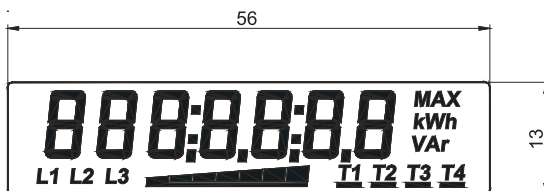
The ED310 has a calibration (test) LED output; the constant for conversion of energy consumed to number of transmitted pulses is programmable. The electricity meter is equipped with an S0 interface (as per EN 61393). The circuit has galvanic separation using an optron, the output of which is connected 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.

Further to that, the ED310 can be equipped with either an RS485 or M-Bus communication module. The RS485 module is galvanically separated from ED310 other parts and, therefore, requires a power supply from an external source. The M-Bus module, also galvanically separated as its RS485 counterpart, is powered via its two-wire communication link.

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 ED310 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.

Optical Communication

The optical interface enables local reading as per EN 62056-21. The reading is done via an opto-head placed on the appropriate place of the ED310 case. Its electrical input and/or output are via RS232 or USB connected to a PC port or mobile terminal PDA connector. Communication speed can be changed.

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 ED310 constant, standard 10 000 imp./kWh.

ED310 Design

The ED 310 allows for simple DIN bar installation.

Optical Communication

As per standard above, the ED310 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 ED310 responds to all addresses.

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 ED310 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

In electricity meter can be set registers with their 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. To delete maxima registers can be done by a command in the Manufacturer Specification Mode.

RS485 Communication

The ED310 together with the RS485 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 RS485 module can reach up to 1200m, subject to quality wiring and correct termination. A repeater is required for long distances if more than 32 ED310s are connected. This gives a more stable environment for communication.

The ED310 that is equipped with a RS485 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 ED310. The ED310 is formatted during production as per customer's requirements.

The RS485 module is galvanically separated from other parts of the ED310 (4 kV / 50 Hz / 60 s) and, therefore, it requires an external power supply. Power supply requirements are specified in the technical data. If the RS485 bus is actively engaged, the ED310 opto-interface is disconnected automatically. In this mode, the ED310 can be accessed via the RS485 module only.

TYPE DESIGNATION

Direct el. meter ED310.D #.	#	#	#	#	#	#	#	-	#	#
Indirect el. meter D310.I.D										
With display, 1 to 4 tariffs	0									
With display, 1 to 4 tariffs, with RS485 module	R									
With display, 1 to 4 tariffs, with M-Bus module (KNX or RJ45)	B									
Without optical communication	0									
With optical communication	1									
Without control of tariffs	0									
Tariff connection via terminal nr. 3 (15)	4									
Without tariff switching		X								
Tariff switching – Czech logics		C								
Tariff switching – European logics		E								
Tariff switching – Customer logics		Z								
FW Modification (firmware customer version)			00							99
One-tariff with S0										1
Two-tariff with S0										2
Three-tariff with S0										3
Four-tariff with S0										4
One-tariff without S0										5
Two-tariff without S0										6
Three-tariff without S0										7
Four-tariff without S0										8
HW Modification (hardware customer version)										00 - 99

Tariff control table

Two tariffs

Logics	EU	ČR
Tariff	E2	E1
1	0	1
2	1	0
Control via terminal	2 (33)	1 (13)

E1, E2 signals for tariff switching

1 means „active“ input, ie. that between tariff inputs is the voltage (eg. between active terminal 2 and the common terminal 3)

0 means input „inactive“

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.

Connector RJ45 Pin Wiring for RS485

FCC plug A/B	
RS485 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.

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.

Four tariffs

Logics	EU		CR	
	E1	E2	E1	E2
1	0	0	1	0
2	0	1	0	0
3	1	0	1	1
4	1	1	0	1
Control via terminal	1 (13)	2 (33)	1 (13)	2 (33)



MAINTENANCE AND STORAGE

Care And Maintenance

The device is a maintenance-free product with determined minimum operation service life of 15 years. For possible cleaning of the outside surface from dust and other impurities, the manufacturer does not recommend using organic solvents, aggressive chemicals and abrasive cleaning agents. Prescribed storage temperatures shall be complied with: failure to do so can result in shortening of electronic components service life. The product shall be protected against wet and humid conditions. It is designed for internal use, i.e. it may be used only in places providing additional protection against the effects of external environment (e.g. in a building or cabinet). Precipitation, humidity and liquids containing minerals can cause corrosion of electric circuits if the device becomes wet. The product shall not be placed on and dried by a source of heat or inserted into a source of heat (e.g. microwave oven, classic oven or radiator / heater) as it can overheat and some of its parts explode. It shall not be exposed to excessive heat as it can lead to deformation of case / cover. The device shall not be stored in cold premises, especially with subsequent warming-up (to nominal operation temperature). Humidity can condensate inside and damage electronic components or isolation properties of the product can deteriorate.

Service

Service shall be ensured by: ZPA Smart Energy a.s., Komenského 821, 541 01 Trutnov, Czech Republic, Trademark Smart Energy, Tel. + 420 499 907 111, E-mail zpa@zpa.cz, www.zpa.cz.

Battery Replacement

Battery can be replaced after opening of the terminal cover (breaking of terminal cover seals cannot be avoided).

Transport

The device shall be packed for transport either in the original package, in which it was delivered by the manufacturer, or in a package causing/ensuring no damage due to handling or transport.

SAFETY

Manufacturer Warnings

The product is capable of safe operation. The manufacturer has issued the EU Declaration of Conformity as per Act 90/2016 Coll.

Despite this fact, the manufacturer warns of the risk of possible danger resulting from incorrect handling or incorrect use of the product as follows:

- Installation and maintenance must be performed by a personnel with the corresponding electro-technical qualification and adequately trained, that shall inform the operator on conditions of safe operation;
- The product shall not be used for purposes other than those it was manufactured for;
- The product shall not be willfully modified contrary to the type design;
- The product shall not be operated with voltage, current or frequency other than those it was produced or professionally modified for;
- The product shall be located and secured so as to complicate or disable handling by persons with no electro-technical qualification, especially children;
- Before every new putting to operation, e.g. after repair, maintenance etc., Ingress Protection shall be restored in full, all safety measures taken and inspection done by a designated electrical inspector;
- During operation, premises where the device is installed, shall be free of danger of fire or explosion in case of development of gases, vapors of inflammable liquids and occurrence of inflammable dust,
- The product shall be handled by a qualified and adequately trained person only, and handling shall be performed without voltage with the exception of measurement by measuring meter with insulated tips;
- The product shall not be operated under conditions or in an environment not ensuring safe operation (e.g. location on flammable base, cover from inflammable material, insufficient protection from penetration of foreign elements, water or other liquids);
- The product shall be located and operated in an indoor environment, i.e. in places providing additional protection against effects of external environment (e.g. inside a building or cabinet).
- The product shall not be operated in an environment with major vibrations and oscillations or under such conditions.

Failure of the user to observe any of the aforesaid warnings renders the manufacturer not being liable for a defect occurring as an incidental consequence of this failure. Non-observance of storage and operation conditions recommended in article Care And Maintenance can have an adverse effect on the device service life.

Responsibility

The owner of the device is responsible for ensuring that all persons engaged in working and handling the product:

- Are knowledgeable and qualified as per national regulations;
- Have read and understood corresponding parts of this document;
- Strictly observe safety regulations and operation data stipulated in its individual articles.

The owner of the device is further responsible for:

- Protection of persons;
- Prevention of damage to material;
- Personnel training.

Safety Instructions

The following safety instructions shall be observed under all circumstances:

- Wires the device is connected to shall be powered neither during installation nor replacement. Powered contacts pose a life threat. For this reason, until the work is finished, the corresponding power supply fuses shall be removed and stored in a place, safeguarding against unnoticed reinstallation by a person holding no responsibility;
- Local safety regulations shall be observed. The device installation shall be executed solely by qualified and trained personnel;
- With no exception, prior to terminal cover opening, current transformer secondary circuits shall be short circuited. High voltage generated during current transformer circuit interruption poses a life threat and damages the transformer;
- Transformers in medium or high voltage systems shall be grounded on one side or in a neutral point on the secondary side. Non-observance can result in their being charged to a voltage exceeding product isolation strength and also posing a life threat;
- During installation, the product shall be firmly held or secured against falling and causing injury;
- Dropped device shall not be installed even if showing no visible signs of damage. It shall be returned for inspection either to designated repair office or directly to manufacturer. Internal damage can cause functional failures or a short circuit;
- The product shall by no means be cleaned under running water or by high-pressure equipment. Water penetration can cause a short circuit. It is necessary to respect ingress protection of the device.

DISPOSAL

As per certificate ISO 14001 data, the components used in the device are mostly separable and so can be disposed of or recycled accordingly. At the end of its service life, the device shall be handed over to specialized companies dealing in used material separation and consequent recycling. An unused device shall be disposed of ecologically as per the Waste Act.

The device contains no radioactive, carcinogenic or other materials having an adverse effect either on human health or the environment. All plastic materials can be recycled.

Packing is recyclable and at the end of its service life shall be handed over to specialized companies as a source of secondary raw materials or energy.

Liquidation and Legal Regulations Concerning the Environment Protection

The product disposal shall strictly observe local regulations for environment protection.

Components	Disposal
PCB, LCD, LED	Electronic waste. Dispose of as per local regulations.
Battery	Dangerous waste. Dispose of as per local regulations.
Metal parts	Separate and hand over to the waste collection center for disposal as per local regulations.
Plastic components	Separate and hand over for disposal or re-granulation as per local regulations