



RTU and special electronics

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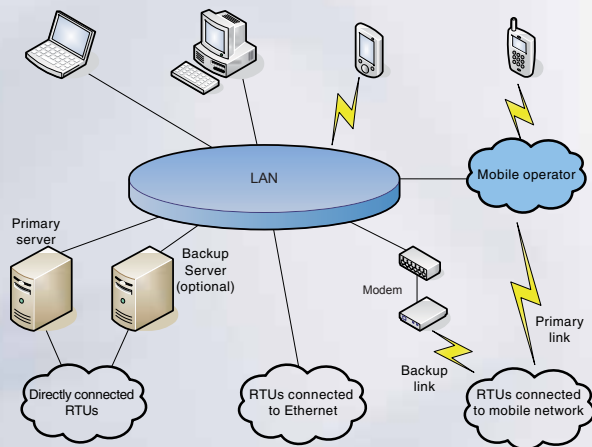
RTU units for control, protection, data acquisition and communication

RTU units for control, protection, data acquisition and communication

Our distributed input and output units product line is nowadays simply called as „RTU“ line, a general abbreviation for Remote Terminal Unit, originated by shortening the „GSM RTU“ mark, the original name of the first products of our brand remote I/O line. As evident from the name these first elements were used for communication through mobile GSM networks. With the replacement of the communication interface with Ethernet module 10/100Mb/s the modification indicated as “NET RTU” originated, however, when it later became clear that communication options can easily include many other communication interfaces, it was not possible to mark the planned modular units at the time of production according to the interface, because when the user replaced the module the marking of the product would change, so for new models an abbreviation was introduced with the general indication “RTU”. If you are seeking a suitable RTU for your application, our “RTU” is the best choice you can make.

Properties

The first versions of the RTU units were fitted with a restricted number of digital inputs and outputs, although with the option of perspective connection to further equipment through installed communication lines. These basic products integrated important properties such as the backup supply from the accumulator, measurement of supply voltages and indoor and outdoor temperatures.



The major property which made possible the implementation of these products in energy sector is consistent galvanic separation of inputs and outputs which, as a rule, achieves an electrical strength greater than 4kV. New unit models added further important properties in terms of measurement, communication and automatic evaluation of data.

The current RTU units are not only distributed inputs and outputs – they are intelligent measuring and communication points which manage in any manner to communicate with and between master systems and monitored equipment.

The versions fitted with inputs for direct measurement of

voltage and current in three-phase distribution systems are primarily stated for implementation and integrates sophisticated protection functions, reclosing and other automation procedures. The programmable communication modules ensure easy connection of any equipment fitted with communication lines for the purpose of remote monitoring and control or collection of data. In this case, the RTU unit becomes a stable and reliable communication concentrator.

Architecture

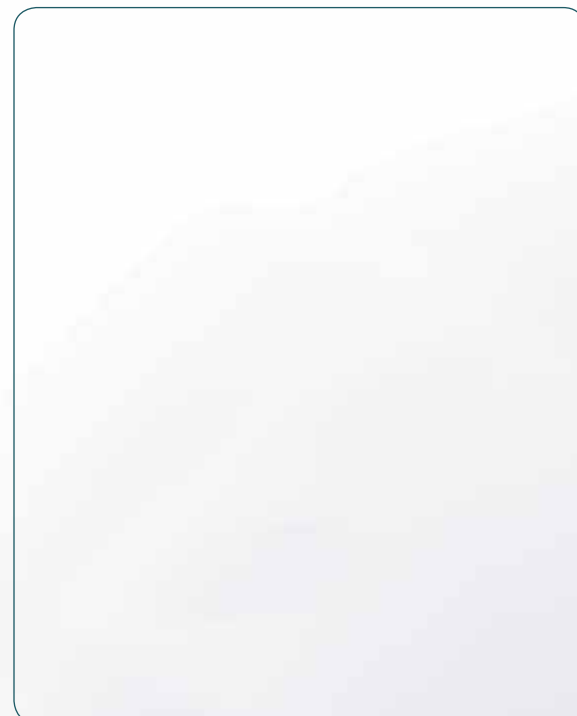
RTU units are based on a reliable platform of single-chip micro-controllers that with low consumption and thermal radiation provide a sufficient performance for this type of equipment. Compact units are classified into two parts, including a motherboard for servicing inputs and outputs and control of supply; the mounted communication module transfers data according to the type of interface into the other systems. To ensure maximum safety of the control, the switching of output relays is checked by the auxiliary processor and the action will only proceed with the consent of the evaluation of command in accordance with the main CPU. Modular units use a “semi-multiprocessor” solution where it is possible to find in the menu passive modules representing only an interface to IO ports on the main processor, as well as modules with their own processor which communicate with the rest of the unit through a data bus. This internal data bus is installed in the form of a RS-485 line to which external modules and slave RTU units (in the slave mode) can be connected. In terms of the application it

RTU units for control, protection, data acquisition and communication

is not important whether the function is provided by a module inserted into the bus or by an equivalent type of external module. Compact units support the same manner of expansion with the difference that this data bus is not used for the connection of internal peripherals. The mentioned mixed concept of modular units offers a price and technically effective solution for the wide scope of applications from small systems with a simple arrangement of IO up to comprehensive sub-networks for collection of data consisting of a dozen RTU units connected in tree architecture to the central unit which includes intelligent modules with its own computing performance in its positions.

Remote diagnostics and service

As previously mentioned, the first RTU units were used for remote wireless communication through GSM transmissions. This type of applications is specific either by the often difficult physical accessibility of the place of installation (long distance, not accessible terrain) together with a large number of occupied places. For these reasons high demands are placed on the reliability of such equipment – however, this reliability does not often mean that it is not necessary to visit the respective locality and to carry out service actions related to any reconfiguration of the system by improving its properties, etc. For these purposes the necessary property has the option of remote administration, diagnostics, reconfiguration and software upgrades. RTU fulfil all these requirements which make it possible to implement them in many critical applications with a wide territorial scope of activity.

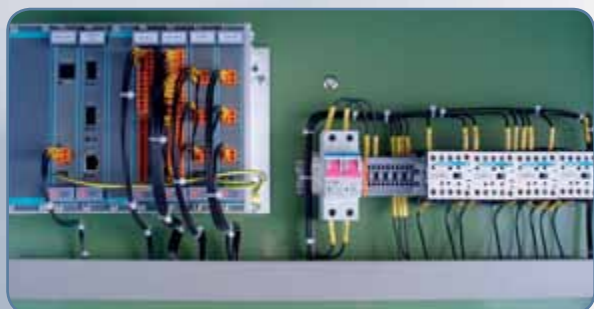


Areas of implementation

The general technical parameters of the units enable use in any area related to the monitoring, control and collection of data. Due to various specific properties and modules in selected fields they significantly exceed their utility value of a common unit for remote collection of data and control.

One of the most important areas is the energy sector and related industries where due to the three-phase measurement of voltage, current and derived values in relation to the integrated protection functions, reclosing and other capabilities, they offer an “all-in-one box” solution for monitoring and controlling distribution networks. Galvanic separation with high electrical strength, digital inputs with counting of impulses, measurement of their period and time filtration of flashes they enable easy and fast connection to consumption measuring devices (electricity meters, flow meters) not just in the energy sector, but also in the gas sector, water area, etc. Good communication abilities, integrated measurement of temperatures, backup supply and other standard RTU properties enable implementation in the role of the monitoring system and a communication gate for a wide range of equipment and technologies in the area of industry, transport and building automation.

Examples of implementation

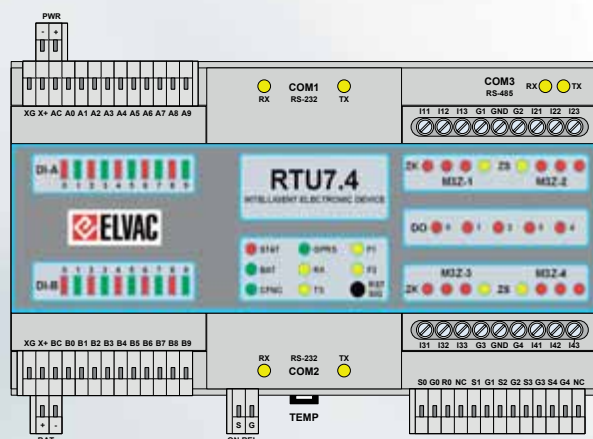


Compact RTU units

RTU7.4 – control and communication unit, 4 × IFC

Description of the unit

The RTU7.4 unit is a modern integrated tool for remote monitoring of energy objects; in particular distribution stations (DTS). It is derived from the well established series of RTU units from ELVAC IPC s.r.o. which have been successfully implemented for several years in applications for the control and monitoring of energy networks, as well as other areas with high demands on the reliability and robust character of systems. RTU7.4 units integrate, in addition to the basic operating and communication functions, digital inputs and outputs, particularly the 4 three-phase measurement of currents (alternatively voltage) with the function of the indication of short circuits and ground connections based on the well-established technology of independently delivered M3Z units. This integration provides the option for the transmission of fast records of signal waveforms on analogue inputs activated from failure events, which together with the variability of the communication interface offers a highly effective and price acceptable solution for many applications.



Basic properties

- 20x digital inputs, periodical evaluation and filtration of entering signal changes
- 4x measurement of currents in 3-phase system, analogue (AC) inputs are periodically read, including the processing of entered measurement values
- 5x relay outputs, automatic function, e.g. relay activation depending on the input parameters
- unit supply, necessary to use a stabilized source of DC voltage 10VDC to 40VDC. The value of the supply voltage must be minimally higher by 5V than the backup accumulator voltage
- controlled (kept) charging of backup accumulator 12 V or 24 V, including any correction of the value of the voltage depending on temperature, periodic testing of the status (capacity) of the backup accumulator
- analysis of the measured values in time with the option to store and send time records
- signalling of ground connection, over-current and short circuit, option for the selection of protective functions, e.g. disconnection
- time information into the unit delivered from the superior system or from GPS
- the unit can be connected through a RS-485 port, further modules and can expand the number of inputs and outputs. For example: modules ext10 (10x DI), M3Z (3x AI), ...
- if necessary, it is possible to connect with other types of modules, units and systems, with HMI terminals, etc.
- 3x independent communication, various communication interface (GPRS, Ethernet, series communication) – communication protocols – IEC 60870-5-101, IEC 60870-5-104 and HIOCom2

Ordering information

Ordering code	Type indication	Description
200418550008	RTU7.4	Remote monitoring of energy objects

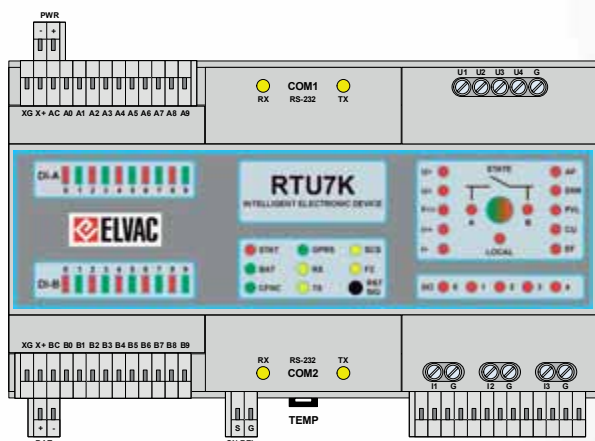
Technical specification

Current inputs	4 x (3 x 20mA AC/DC)
Digital inputs	20 x optoisolated (dry contact)
Digital outputs	5 x relay (switching)
Input supply voltage	10 VDC–40 VDC
Standby accumulator voltage	12 V / 24 V
Max. charging current of accumulator	1 A
Max. maintenance voltage of accumulator	13,7 V / 27,4 V
Disconnecting voltage (accumulator protection)	11 V / 22 V
Thermal sensor	The temperature range is -55°C to 125 °C, with a precision of ±0.5 °C within the range -10°C to 85 °C.
Temperature range	-20 °C to 50 °C
Storage temperature	-30 °C to 75 °C
Surrounding relative moisture	30 %–95 % RH not condensing
Coverage	IP20 IP21 with protective cover (delivered free of charge on request)

RTU7K – control and communication unit, 3V+3I

Description of the unit

RTU 7K unit is a modern integrated tool for remotely monitoring and controlling energy objects, in particular the section disconnecting switch fitted with an electrical drive. It is derived from the well established series of RTU units from ELVAC IPC, s.r.o. that have been successfully implemented for several years in applications for the control and monitoring of energy networks, as well as other areas with high demands on the reliability and the robust character of the systems. The RTU7K unit includes in addition to the basic operating and communication functions, digital inputs and outputs, particularly the 3-phase measurement of currents and voltages with the indication of short-circuits and ground connections based on well-established technology. This integration also provides the option for the transmission of fast signal waveform records on analogue inputs activated from failure events, which together with the variability of the communication interface offers a highly effective and price acceptable solution for many applications.



Basic properties

- 20x digital inputs, periodical evaluation of the filtration of signal input changes
- measurement of currents and voltages in a 3-phase system, analogue (AC) inputs are periodically read, including processing of data input for measurement
- 5x relay outputs, automatic function, e.g. relay activation depending on the input parameters
- unit supply, necessary to use stabilized source of DC voltage 10VDC to 40VDC. The value of the supply voltage must be minimally higher by 5V than the backup accumulator voltage
- controlled (kept) charging of the 12 V or 24 V backup accumulator, including correction of the voltage value depending on temperature, periodical testing of the status (capacity) of the backup accumulator
- analysis of measured values in time with the option to store and send time records
- signalling of ground connection, excess current, short circuit, under voltage, excess voltage and other, option for selecting protective functions, e.g. disconnection
- time information into the unit delivered from the superior system or received from GPS
- the unit can be interconnected through port RS-485 and the number of inputs and outputs expanded, e.g. it is possible to connect modules ext10 (10x DI), M3Z (3x AI), ...
- if necessary, it can connect with other types of modules, units and systems, with HMI terminals, etc.
- 3x independent communication, various communication reports (GPRS, Ethernet, series communication)

Ordering information

Ordering code	Type indication	Description
200418550009	RTU 7K	Control and communication unit

Technical specification

Voltage inputs	3 x 100V AC (DC) or capacitance sensor, 1 x 100V AC (DC)
Current inputs	3 x 1/5A or 20mA AC (DC)
Digital inputs	20 x optoisolated unit (dry contact)
Digital outputs	5 x relay (switching)
Input supply voltage	10 VDC–40 VDC
Standby accumulator voltage	12 V / 24 V
Max. charging current of accumulator	1 A
Max. maintenance voltage of accumulator	13,7 V / 27,4 V
Disconnecting voltage (accumulator protection)	11 V / 22 V
Thermal sensor	The temperature range is -55°C to 125°C, with a precision of ±0.5°C within the range -10 °C to 85°C.
Temperature range	-20 °C to 50 °C
Storage temperature	-30 °C to 75 °C
Surrounding relative moisture	30 %–95% RH not condensing
Coverage	IP20 IP21 with protective cover (delivered free of charge on request)

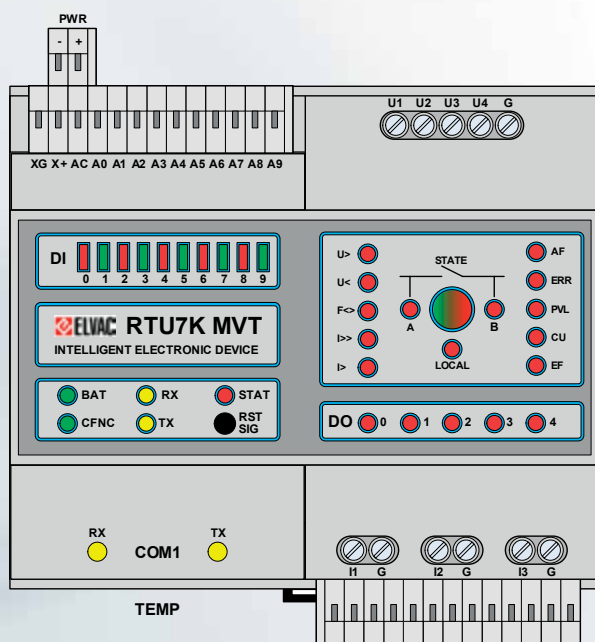
Compact RTU units

RTU7K MVT – unit for installation into high-voltage boxes in remotely controlled DTS (distribution transformer stations)

Description of the unit

This concerns a compact module delivered in the RTU unit product series containing measurement 3(+1)V+3I, evaluation of data, binary inputs and outputs for measurement and high voltage outlet control, including protective functions. The basic functionality and parameters are identical with the RTU7K unit so that the derived module is better adapted to the specific type of application, particularly in terms of the smaller dimensions and the lower price that was enabled by eliminating some of the parts that would not be used in the stated application.

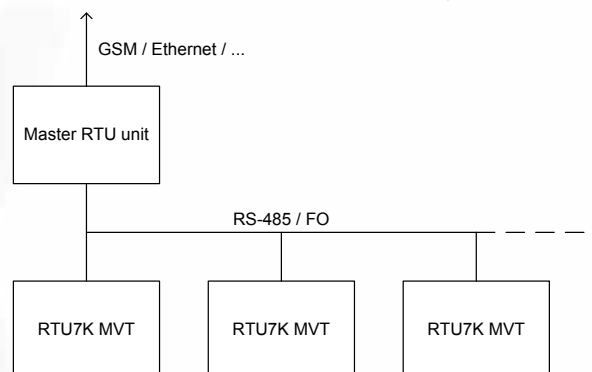
Similarly as the further compact RTU units, this version is delivered in a plastic box for assembly on the DIN rail. Compared with the RTU7K unit the box is narrower by one section (about 1/3 of the width). For the unit the number of digital inputs was reduced from 20 to 10 and on request, it is possible to mount only part of input circuits and to decrease the price. The number of digital outputs remains the same; however, it is possible to mount a lower number of relays to achieve savings. These modifications are accessible when ordering 50 or more units with the same configuration



The unit is not fitted with the output for the backup accumulator, so it does not contain a charger or battery tester. Operation is proposed from a central backup source within the object such as the battery charged by the master RTU working in the role of the concentrator.

The function of measurement, calculations, protection and control cover all the requirements of the remote control unit and automatic protection of a high-voltage outlet in DTS (ground directional protections, excess current, short circuit, overvoltage, under voltage, frequency protection). The firmware used is identical with units for reclosed or sectional switches with remote control, measurement and protection, including automated systems (reclosing, disconnection in the second voltage-free pause). The production of failure records with the option of remote downloading and consequent analysis of the failure action is a matter of course in our RTU series.

Despite that it is possible to equip the unit with its own communication modem; it is primarily designated for application as a slave unit connected to the master RTU, which ensures communication with the SCADA system.



Informace pro objednání

Ordering code	Type indication	Description
200418550011	RTU7K MVT	Compact module into high-voltage box in remotely controlled DTS

Technical specification

Voltage inputs	3 x 100V AC (DC) or capacitance sensor, 1 x 100V AC (DC)
Current inputs	3 x 1/5A or 20mA AC (DC)
Digital inputs	10 x optoisolated (dry contact)
Digital outputs	5 x relay (switching)
Measuring temperature	-55 to 125 °C
Signalling	LED on front panel
Communication	in the device is the position for the communication module (RS-485, RS-232, Ethernet, optics, GSM modem...)
Supply	9-36V, 18-72V DC
Dimensions	105 x 90 x 58 mm
Weight	approx 400g

RTU7K LVT – unit for measurement on low-voltage side of transformers

Description of the unit

This concerns the compact module delivered in the RTU unit product series, fitted with 3V+3I measurement, evaluation of data, basic binary inputs and outputs for measurement and possible control/protection/indication of failure statuses in the low-voltage part of the transformers. The basic parameters are identical with the RTU7K unit so that the derived module is adapted to the specific type of application, in particular from the viewpoint of software and smaller dimensions along with a lower price enabled by eliminating various parts that would not be used in the stated application.

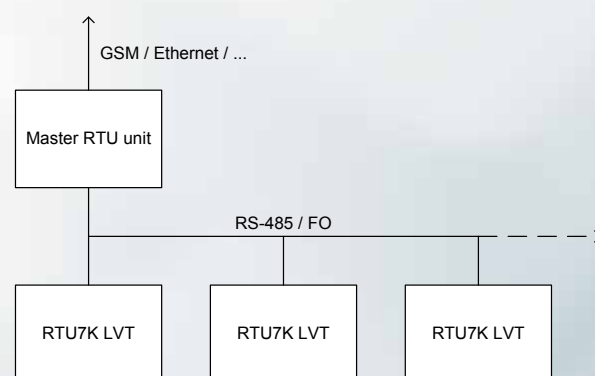
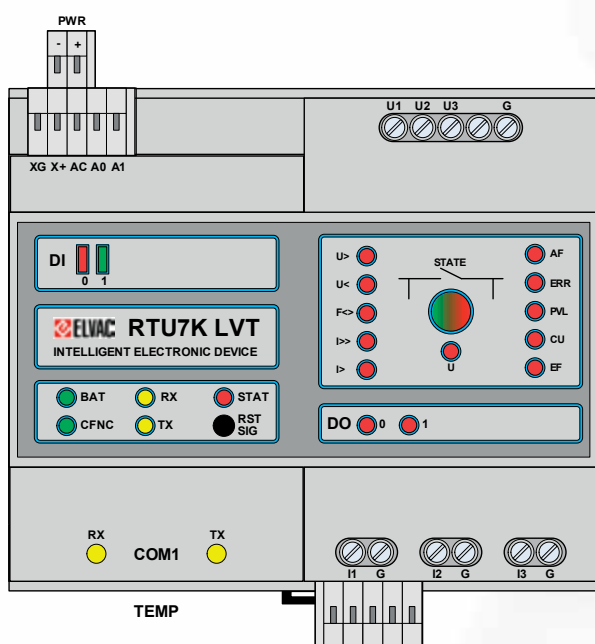
Similarly as the further compact RTU units, this version is delivered in a plastic box for assembly on the DIN rail. Compared with the RTU7K unit the box is narrower by one section (about 1/3 of the width). For the unit, it is possible to reduce the number of digital inputs from 20 to 2 (on request it is possible to mount up to 10 inputs) The number of digital outputs is also decreased to two (on request max 5). Modifications with a higher number of IO than standard

are available in the case of ordering 50 or more units in the same configuration.

The unit is not fitted with the output for the backup accumulator, so it does not contain a charger or battery tester. Operation is proposed from a central backup source within the object such as the battery charged by the master RTU working in the role of the concentrator.

The functions of measurement, calculations, indication of failures (or also protection) and control cover all requirements for the remote monitoring of the low-voltage part of the transformers. The firmware used is especially modified with respect to the requirements for the measurement and evaluation of specific data. The production of failure records with the option of remote downloading and consequent analysis of the failure action is a matter of course in our RTU series.

Despite that it is possible to equip the unit with its own communication modem, it is primarily designated for application as slave unit connected to the master RTU, which ensures communication with SCADA system.



Informace pro objednání

Ordering code	Type indication	Description
200418550015	RTU7K LVT	Measurement on low-voltage part of transformers

Technical specification

Voltage inputs	3 x 230/400V AC (DC)
Current inputs	3 x 1/5A or 20mA AC (DC)
Digital inputs	2 x optoisolated (dry contact)
Digital outputs	2 x relay (switching)
Měření teploty	-55 to 125 °C
Signalizace	LED on front panel
Komunikace	in the device is the position for the communication module (RS-485, RS-232, Ethernet, optics, GSM modem...)
Napájení	9-36V, 18-72V DC
Rozměry	105 x 90 x 58 mm
Hmotnost	approx 400 g

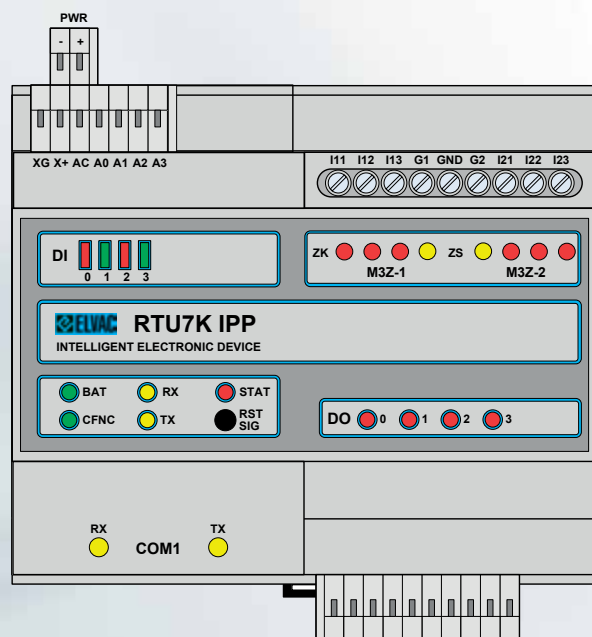
Compact RTU units

RTU7K IFC – Unit of failure current identifiers

Description of the unit

This concerns the compact module delivered in the RTU unit product series fitted with 2 x 3I measurement, evaluation of data, basic binary inputs and outputs for measurement and control/protection/indications of failure statuses on high-voltage outlets from DTS. Basic parameters and philosophy are identical with unit RTU7.4 so that the derived module is adapted for smaller applications, has smaller dimensions and a lower price was achieved which was enabled for example, by eliminating various parts (backup source, number of IO), which in many cases are not necessary.

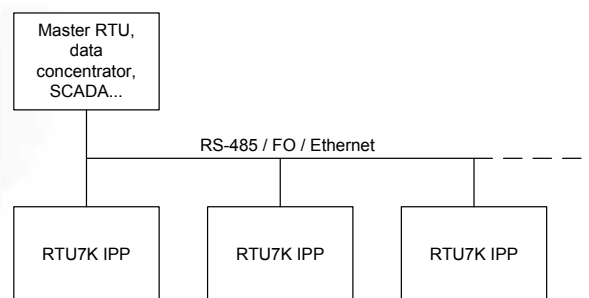
Similarly as the further compact RTU units, this version is delivered in a plastic box for assembly on the DIN rail. Compared with the RTU7.4 unit the box is narrower by one section (about 1/3 of the width). For this unit the number of digital inputs was reduced from 20 to 4. The number of digital outputs was decreased to four. For the purpose of further decreasing the price, in the case of ordering 50 or more units with the same configuration, a version without DIO can be selected.



The unit is not fitted with the output for the backup accumulator, so it does not contain a charger or battery tester. Operation is proposed from a central backup source within the object such as the battery charged by the master RTU working in the role of the concentrator.

The functions of measurement, calculations, indication of failures (excess current, short circuit, ground connection) and control cover all requirements for the remote monitoring of high-voltage DTS outputs. The production of failure records with the option of remote downloading and consequent analysis of the failure action is a matter of course in our RTU series.

Despite the fact that it is possible to equip the unit with its own communication modem, it is primarily designed for implementation as slave unit connected to the master RTU, which will ensure communication with the SCADA system or for direct communication with IEC 870-5-101/104 protocol with the concentrator or a third party SCADA system.



Ordering information

Ordering code	Type indication	Description
200418550017	RTU7K IFC	Unit of indicator of failure currents

Technical specification

Current inputs:	2 x (3 x 20mA AC/DC)
Digital inputs:	4 x optoisolated (dry contact)
Digital outputs:	4 x relay (switching)
Signalling:	LED on front panel
Communication:	in the device is the position for the communication module (RS-485, RS-232, Ethernet, optics, GSM modem...)
Supply:	9-36V, 18-72V DC
Dimensions:	105 x 90 x 58 mm
Weight:	approx 400 g

RTU M3Z – module for measurement and evaluation of 3-phase currents

Basic properties

- measurement of 3-phase currents in high-voltage networks
- range of measurement 0 to $I_n = 20\text{mA}$
- precision of measurement 0.5%
- overloading of inputs by 200% - permanently
- evaluation of ground connection in high-voltage networks
- evaluation of short-circuit currents in high-voltage networks up to the value $20 \times I_n$
- evaluation of over-currents in high-voltage networks up to the value $2 \times I_n$ - permanently
- inputs protected against over-current
- signalling LED for indication of the status of the unit

Technical specification

Module	RTU M3Z
Communication interface	RS-485 (isolation 2KV AC during 1min)
Supply voltage	4,5 to 5,5 VDC, isolated DC/DC converter on input
Power consumption	0,8 W
Temperature range	-20 °C to +55 °C
Storage temperature	-30 °C to +75 °C
Surrounding relative humidity	30 %-95% RH non-condensing
Coverage	IP20
Dimensions	71 × 90 × 58 mm
Mounting	on DIN 35

Description of the module

The RTU M3Z digital converter measures in a 3-phase electricity network the 50 Hz effective values of 3 currents. It samples and analyses their waveform and vector sum (i_0) with a period from 1 ms. It can evaluate and signal ground connection. During the ground connection, the yellow ZS diode is permanently lit, if the ground connection has expired, it will flash for a certain time. The converter regularly checks the stated limits of the measured currents. The measured and calculated values and readers are sent to the connected system through communication interface RS-485. It is possible to parameterise the converter through this communication interface. If necessary, it is possible to remotely replace FW in the measuring converter. It is possible to interconnect the converter with GSM RTU (GPRS), NET RTU (Ethernet) units and other monitoring or control systems. The green diode signals the presence of supply voltage in the converter. The red diode signals the status of the converter, including the status of communication through the RS-485 interface.

Ordering information

Ordering code	Type indication	Description
200404555002	RTU M3Z	Measurement and evaluation of 3-phase current

RTU ext10 – expansion module with 10 binary inputs

Basic properties

- 10 binary inputs (active / passive)
- galvanic isolation 4kV
- WAGO 250V/4kV/3 connectors, 12A, pin spacing 5.08 mm
- parameterisation option for time filter for reading inputs
- galvanically isolated supply
- signalling voltage for passive inputs within the range 20 to 30 V DC
- signalling voltage of active inputs 24V DC (2W)
- signalling LED for indication of the status of the unit

Technical specification

Module	RTU ext10
Communication interface	RS-485 (isolation 2KV AC during 1min)
Supply voltage	4,5 to 5,5 VDC, isolated DC/DC converter on input
Power consumption	2 W
Temperature range	-20 °C to +55 °C
Storage temperature	-30 °C to +75 °C
Surrounding relative moisture	30 %-95% RH non-condensing
Coverage	IP20
Dimensions	71 × 90 × 58 mm
Mounting	on DIN 35

Description of the module

The RTU ext10 unit for digital inputs has 10 binary galvanically isolated inputs which have a common terminal. Using serial port RS-485 it is possible to interconnect the unit with other modules and systems. The control processor processes the inputs and filters binary signals. Inputs are read and evaluated each 5 ms. Parameters and data can be stored in the EEPROM and FLASH memory. Parameterisation and FW (SW) update or upgrade can be performed remotely through port RS-485. The unit can be used, e.g. as an expanding module of the monitoring or control system, for signalling statuses. It is possible to interconnect the unit with GSM RTU (GPRS), NET RTU (Ethernet) units and other monitoring or control systems. The change of functionality which cannot be performed by parameterisation in the standard version of FW, or another type of communication can be performed by changing the FW unit for which the HW unit is equipped.

Ordering information

Ordering code	Type indication	Description
200404555005	RTU ext10	expansion module by 10 binary inputs

Compact RTU units

RTU7K ECDAC – compact data concentrator

Description of the unit

Generally usable data concentrator unit with compact dimensions. Primarily designed as a central communication node for slave RTU units, protection and control systems. It can find its application in large DTS, for photovoltaic and wind power plants and smaller sub-stations. Due to the support of protocols IEC 870-5-101, 103 and 104, DNP3 and MODBUS, its use is not only restricted to applications in relation to RTU ELVAC; the unit can be easily used in connection with any third party equipment supporting some of the mentioned protocols. We also offer the opportunity to add new protocols according to client requirements that will expand application options in the future.

Similarly as the further compact RTU units, this version is delivered in a plastic box for assembly on the DIN rail. The unit is not fitted with the output for the backup accumulator, so it does not contain a charger or battery tester. Operation from a central backup source is proposed, for example RTU7M PWR.

The unit has only one position for the optional communication module which can be, for example, a GSM modem. In such configuration it is possible to use the device as an intelligent modem in the whole series of devices which do not support the direct connection to the modem or with respect to the manner of data transfer they need pre-processing of data before sending (e.g. delta criteria for the transfer of the analogue value).

Technical specification

Signalling	LED on front panel
Communication	3 x RS-232/485, 1 x Ethernet 100Mb/s, 1 x position for communication module (RS-232/485, Ethernet, optics, GSM modem...)
Supply	9-36V, 18-72V DC
Dimensions	105 × 90 × 58 mm
Weight	approx 400 g
Analogue inputs*	2 x 4..20mA/DC
Digital inputs*	2 x optoisolated (dry contact)
Digital outputs*	2 x relay (switching)
Measuring of temperature*	-55 to 125 °C

*Option board

RTU7K PWR – independent backup supply source with diagnostics system

Description of the unit

Many ELVAC RTU units already contain an integrated backup supply source with a tester for accumulators and measuring voltage, however, there are also versions of units or types of applications where an independent source is required. In these cases, and not only in relation to our RTU units and modules, we offer an independent source module which keeps the functional advantages of the solution that can be used in sources integrated in RTU, with compact constructions for assembly on the DIN rail which provides a higher output than internal sources which allows to use the source for supplying further RTU units or other equipment.

The control and the diagnostics of the source is through a serial communication line (RS-232/485), which supports, in addition to the firm protocol HIOCom, standard protocol IEC 870-5-101, which allows easy linkage with standard products and third party SW.

For critical applications it is possible to use the options for the mutual connection of two sources and to ensure a redundant supply in the case of failure of one of them. This function can also be advantageously used during the supply of the system from two independent inputs.

The charging and keeping of the accumulator is controlled depending on the temperature of the auxiliary sensor. The accumulator is tested 1x per day by a set current during 1s and information about the status of the accumulator is provided according to the measurement result. The input voltage of the source and the voltage of accumulator are permanently measured.

Technical specification

Input voltage	50-140V, 90-260V AC / 12-60V DC
Output voltage	12V/24V DC
Accumulator	12V/24V
Charging current	max 5A / 2.5A
Permanent off-take	max 4A / 2A
Peak off-take	max 15A / 15A (with aku support)
Measuring of temperature	-55 to 125 °C
Accu testing current	max 10A
Signalling	LED on front panel
Communication	1 x RS-232/485
Dimensions	105 × 90 × 58 mm
Weight	approx 400 g

Modular RTU units

Modular RTU units

RTU7M – chassis, bus and CPU modules

Basic properties

- chassis with 5,8 or 10 slots
- keyed slots, protection against insertion of improper module into the position
- high-performance signal processor (unit core RTU7M)
- modularity, option of easy I/O expansion
- integrated internal thermal sensor
- 2 internal serial communication lines for communication with slave modules
- synchronization line
- RTC backup circuit
- mounting on a wall or into a panel
- EMC/EMI compatibility

Description of the unit

In the chassis is a 5, 8 or 10-slot bus with signal processor which represents the core of the RTU7M unit.

Some slots are universal, some allow to insert only one or several types of modules (plug-in cards). All slots and delivered modules have keyed connectors. Keying serves for protection against insertion of an improper module into the slot. Slots are numbered from the left by numbers from 1 to 5, 8 or 10. For the 5 slot version, position numbers 2, 4, 5, 9 and 10 are missing.



Mounted chassis RTU7M-5

Slots, reserved slots

The following table is the list of reserved slots in the RTU7M-5, RTU7M-8 and RTU7M-10 chassis:

RTU7M-5 Number of slot	RTU7M-8, RTU7M-10 Number of slot	module
1	1,2	supply module (according to the type of module)
2	3	communication module
3	4,5	direct digital outputs (according to FW)
3	6	direct digital inputs (according to FW)
4,5	7,8	direct analogue inputs

Any module with indirect digital inputs or outputs or a module with an indirect analogue input can be inserted into slots 3, 4, 5 for a 5-slot bus and into slots 1, 4, 5, 6, 7 and 8 for an 8-slot bus and 9 and 10 for a 10-slot bus.

Then these modules become independent slave units with their own processor and the independent RTU7M unit serves as a communication bridge with the master system.

The unit is fitted with a very exact, thermally compensated real time circuit with backup. The time synchronizing of the unit is possible from the server or through the module with GPS receiver. The time synchronising of the slave units is by means of the synchronizing line on the bus. The temperature of the chassis is measured by a thermal sensor. The range of temperatures is -55°C to 125°C, with a precision of $\pm 0.5^\circ\text{C}$ within the range -10°C to 85°C.

The unit is fitted with universal assembly clamps for installation on the wall of the switchboard, as well as into the assembly hole (front or rear assembly clamps).

Standards

The whole unit and components were tested according to the following technical standards (unless stated in the detailed technical specifications for individual modules otherwise):

EMC:

ČSN EN 61000-4-2, ČSN EN 61000-4-3 ed.3, ČSN EN 61000-4-4 ed.2, ČSN EN 61000-4-5, ČSN EN 61000-4-6, ČSN EN 61000-4-7 ed.2, ČSN EN 61000-4-8, ČSN EN 61000-4-9, ČSN EN 61000-4-10, ČSN EN 61000-4-11 ed.2, ČSN EN 61000-4-12 ed.2, ČSN EN 61000-4-18, ČSN EN 50130-4

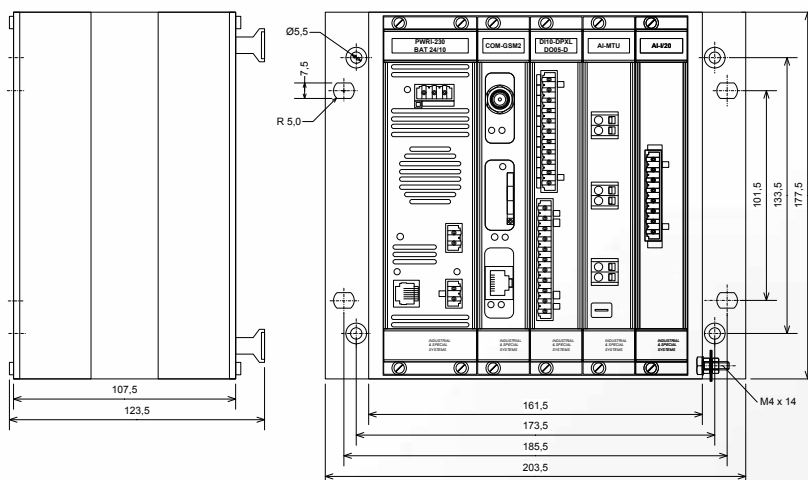
EMI:

ČSN EN 55022

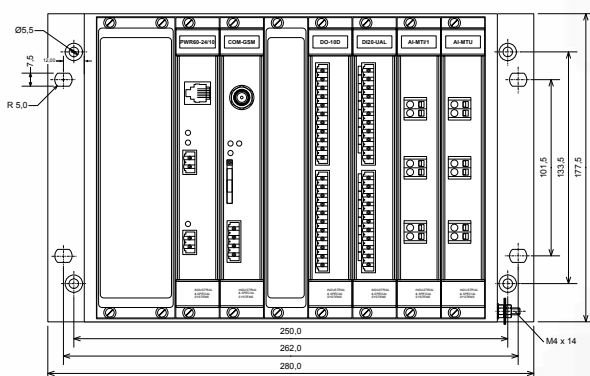
Electrical safety:

ČSN EN 60950-1 ed.2

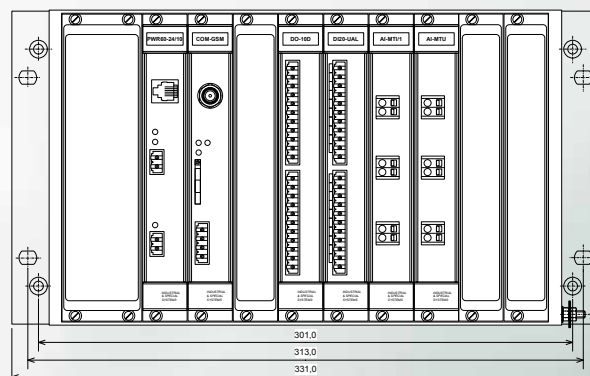
Individual modules of the RTU7M unit fulfil the abovementioned standard which are described below and the unit as a whole.



Dimensions of the RTU7M-5 tub



Dimensions of the RTU7M-8 tub



Dimensions of the RTU7M-10 tub

Ordering information

Ordering code	Type indication	Description
221304550007	RTU7M-5	Chassis of the RTU7M unit with bus, 5 slots
221304550004	RTU7M-8	Chassis of the RTU7M unit with bus, 8 slots
221304550005	RTU7M-10	Chassis of the RTU7M unit with bus, 10 slots
221307550009	CPU-02	CPU module with RTC

Technical specification:

	RTU7M-5	RTU7M-8	RTU7M-10
Marking on the tub	5	8	10
Number of slots	5	8	10
CPU	signal processor 16 bits, according to the type of CPU module		
Thermal sensor	The temperature range is -55°C to 125°C, with a precision of ±0.5°C within the range -10°C to 85°C.		
Dimensions (with assembly clamps)	203,5 x 177,5 (4U) x 107,5 mm (width x height x depth)	280 x 177,5 (4U) x 107,5 mm (width x height x depth)	331 x 177,5 (4U) x 107,5 mm (width x height x depth)
Temperature range	-20°C to +55°C		
Storage temperature	-30°C to +75°C		
Surrounding relative moisture	30% - 95%RH non-condensing		
Coverage	IP20		

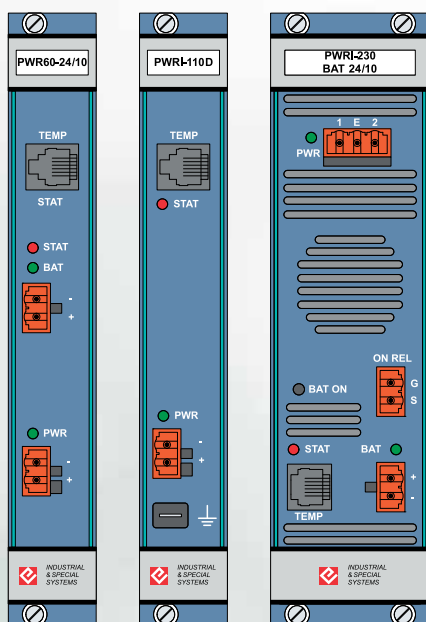
Modular RTU units

RTU7M – supply modules

Basic properties

The modules serve for the supply to the RTU7M unit, all modules and slave units in the bus. We deliver three principally different types of supply modules:

- DC, non-insulated module
- DC, galvanically separated module
- AC / DC, galvanically separated, backup module



Description of individual modules

DC, not insulated module

This supply module has an input range of 12-60VDC and is mostly used with pre-connected supply adapters. It has a width of just 25 mm.

It enables to connect the backup accumulator. Switching to the backup accumulator is automatic after breakdown of the input voltage. Both connecting inputs, primary, as well as accumulators, are protected by fuse and are fitted with over-voltage protection.

When operating from the backup accumulator, the voltage is changed and protection against full discharge is ensured. In the case of a decrease in the voltage of the accumulator below the minimum value, the unit is switched to the disconnecting mode for a period of 1 minute. Information regarding this status, plus information regarding the breakdown of the input supply voltage is transferred to the master system. After 1 minute, if there is no restoration of the input voltage supply, the unit is automatically disconnected.

Measurement of the input supply voltage and voltage of accumulator is a matter of course. The supply modules include an

integrated charger for 12V or 24V backup accumulators for various accumulator capacities.

The maximum charging current kept is 1A. The charging of accumulators is controlled by the unit processor depending on its temperature (if an external thermal sensor is connected). The capacity of the accumulator is periodically measured, its value and status is transferred to the master system. In the case of the use of the backup accumulator, the input supply voltage must be minimally higher by 5V than the value of the voltage of the accumulator.

The external thermal sensor is typically used for measurement of the temperature of the accumulator or the surrounding temperature of the unit (temperature in the switchboard). The range of temperatures is -55°C to +125°C, with the precision of $\pm 0.5^\circ\text{C}$ within the range -10°C to +85°C. On the module are two signalling LED diodes; the first diode signals the status of the communication unit, the second the status of the accumulator and charger.

DC, galvanically separated module

This module differs from the previous in that it has a galvanically separated input from output, has a wider range of supply voltage (according to the version of the module) and does not enable the backup accumulator to be connected. The width is again 25 mm and is mostly used for the supply from the battery backup with various voltage levels within the range according to the construction.

There are two connectors on the face of the module. The RJ-12 connector, as well as the previous type and PWR for the connection of supply voltage.

After agreement with the producer of the module it is possible to connect external insulated voltage AUX 5 V or 12 V 5W for further use.

AC / DC, galvanically separated, backup module

This module is different from the previous module in terms of construction, its width is 45 mm and it can be connected to DC, as well as AC voltage. It is produced with two input ranges and serves, for example, for the supply from a 230VAC/50Hz distribution network, although it can be connected to a DC supply voltage. The charger for the accumulator has identical parameters as in the case of the first version, only the tester for the accumulator loads the accumulator with a higher current for the 24 V accumulator that is 9 A and for 12 V accumulator it is 4.5 A. The unit is also fitted with the auxiliary contact – ON REL connector. This contact can be used for disconnecting the backup accumulator from the unit and other circuits in the switchboard when disconnecting the unit after the breakdown of the main supply in the case of discharging the backup accumulator. Compared with the previous module, there is one more BAT ON button. This button serves for activation of the unit only during operation from the backup accumulator. The module also measures the effective value of the primary supply voltage in the whole supply range.



Technical specification of modules

Module	PWR60-24/03	PWR60-24/10	PWR60-12/03	PWR60-12/10	PWRI-57 BAT24/10	PWRI-57 BAT12/10	PWRI-230 BAT24/10	PWRI-230 BAT12/10
Input supply voltage	12VDC - 60VDC (max. 70W)				50-140VAC/47-63Hz 70-200VDC		90-260VAC/47-63Hz 130-360VDC	
Maximum input current	2,5A DC				1,5A AC; 1,2A DC		1A AC; 0,8A DC	
Protection of input	3,2A polyswitch				Fuse T 4A			
External protection					In the case of connection to the IT system, the external two-pole protection is necessary			
Output voltage	+5VDC / 4A (20W) , -5VDC / 1,5A (7,5W)				+5VDC / 4A (20W) , -5VDC / 0,3A (1,5W)			
Insulation	-				Primary – secondary 3kVAC during 1 minute Primary – body 1.5kVAC during 1 minute Secondary – body 500VAC during 1 minute			
Voltage of accumulator	24V		12V		24V	12V	24V	12V
Max. charging current of the accumulator	0,3A		0,3A		1A (it is possible to optionally select a lower current)			
Max. voltage kept of the accumulator	27,4V		13,7V		27,4V	13,7V	27,4V	13,7V
Protection of accumulator	3,2A polyswitch							
Disconnecting voltage (protection of accumulator)	22V		11V		22V	11V	22V	11V
Tester for accumulator	Yes							
Testing current	1A				9A	4,5A	9A	4,5A
Auxiliary contact ON REL	NO				Switching contact 250VAC, 3A			
BAT ON (switching button)	NO				YES, serves for activation of the unit only during operation from the accumulator			
Temperature sensor	Measuring range is -55°C to +125°C, with a precision of ±0.5°C within the range -10°C to +85°C							
Connectors	2 x WAGO 231-302/026-000 part of delivery, RJ-12				2 x WAGO 231-302/026-000, 1 x WAGO 231-303/026-000 part of delivery, RJ-12			
Signalling LED	PWR, STAT, BAT							
Dimensions (with mounted face)	25 x 172 x 92 mm (width x height x depth)				45 x 172 x 92 mm (width x height x depth)			
Temperature range	-20°C to +55°C							
Storage temperature	-30°C to +75°C							
Ambient relative moisture	30% - 95%RH not condensing							
Coverage	IP20							
Position in 5/8 slot bus	1 / 1 2				1 / 1			

Module	PWRI-12D	PWRI-24D	PWRI-48D	PWRI-110D	PWRI-220D
Input supply voltage	9-18 VDC (max. 20 W)	18-36 VDC (max. 20 W)	36-75 VDC (max. 50 W)	70-150 VDC (max. 50 W)	180-370 VDC (max. 50 W)
Protection of input	Fuse 5x20 F 8 A	Fuse 5x20 F 8 A	Fuse 5x20 F 8 A	Fuse 5x20 F 5 A	Fuse 5x20 F 3,15 A
Input voltage	+5 VDC / 3 A (15 W) , -5 VDC / 0,3 A (1,5 W)				
Insulation	Input-Output 1,5 kV DC		Input-Output 3 KVAC, Input-Faston 1,5 KVAC, Output-Faston 500 VAC (The centre of the noise filter is connected to the faston and the exchanger cooler)		
Voltage of accumulator	Does not support backup accumulator				
AUX	According to the request of client, the module can be fitted with a separate output with the voltage 5/12 V (5 W) s insulation 1.5 K VDC				
Temperature sensor	Measuring range is -55°C to 125 °C, with a precision of ±0.5 °C within the range -10 °C to 85 °C				
Connectors	2× WAGO 231-302/026-000 part of delivery, FASTON, RJ-12				
Signalling LED	STAT, PWR				
Dimensions (with mounted face)	25 × 172 × 92mm (width × height × depth)				
Temperature range	-20 °C to 55 °C				
Storage temperature	-30 °C to 75 °C				
Ambient relative moisture	30 %-95% RH not condensing				
Coverage	P20				
Position in the bus	1 / 1 , 2				

Ordering information

Order code	Type of indication	Description
221310550121	PWRI-57 BAT24/10	Supply module, insulated 50-140V AC, charger 24V/1A
221310550120	PWRI-57 BAT12/10	Supply module, insulated 50-140V AC, charger 12V/1A
221310550124	PWRI-230 BAT24/10	Supply module, insulated 90-260V AC, charger 24V/1A
221310550123	PWRI-230 BAT12/10	Supply module, insulated 90-260V AC, charger 12V/1A
221310550117	PWR60- 24/10	Supply module, not insulated, max.60V DC, charger 24V/1A
221310550115	PWR60-12/10	Supply module, not insulated, max.60V DC, charger 12V/1A
221310550129	PWRI-12D	Supply module, insulated 9-18V DC
221310550131	PWRI-24D	Supply module, insulated 18-36V DC
221310550130	PWRI-48D	Supply module, insulated 36-75V DC
221310550133	PWRI-110D	Supply module, insulated 70-150V DC
221310550136	PWRI-220D	Supply module, insulated 180-370V DC

RTU7M – communication modules

Basic properties

- up to 4 communication interfaces on the card
- many versions of communication interfaces (GPRS, EDGE, Ethernet, RS-232, RS-485, Optical, CLO, Bluetooth, GPS)
- web server for setting
- serves at the communication bridge during communication with slave units
- wide range of supported communication protocols

Description of the module

CIOMOD communication interface

Communication interfaces are designed by means of small plug-in CIOMOD-xxx communication modules that can be mutually exchanged. In this manner the necessary interface can be selected on individual cards.

CIOMOD-NET – the module has an Ethernet interface. The communication parameters can be set remotely through the web interface or by means of PC utilities.

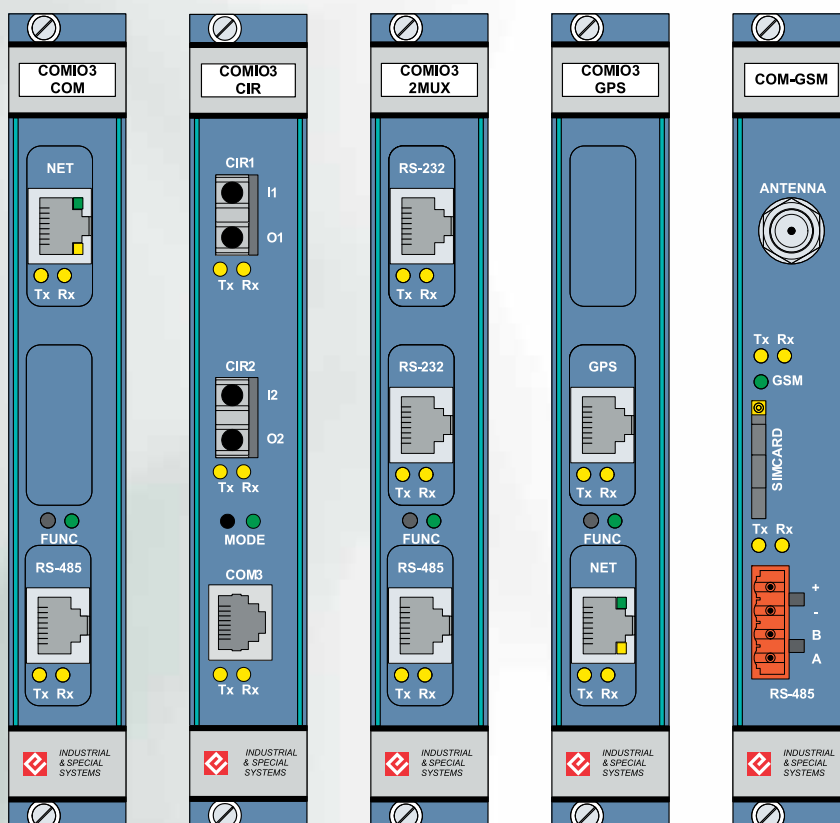
CIOMOD-GSM – on the module is a built-in modem for GSM 900/1800/1900 MHz networks. The parameters can be remotely configured by means of the UDP-API modem.

CIOMOD-GSM2 – compared with the previous type, this module can also communicate also through EDGE and, at the same time, can divide communication into two IP addresses. The module is larger in terms of dimensions and occupies the position of two communication modules. It can be fitted into a COMIO3 card.

CIOMOD-GSM3 – on the module is a built-in modem for GSM 900/1800/1900 MHz networks with the support of EDGE. This module is recommended for CONV7 universal converter and for COMIO4 and COMIO-PC cards.

CIOMOD-232 – contains galvanically separated line RS-232. The connection to other devices is through a shielded RJ-45 connector.

CIOMOD-485 – contains a galvanically separated RS-485 line. The connection to the other devices is through a shielded RJ-45 connector. On the module are switches for the connection of termination resistance and resistance for the definition of a steady line status.





CIOMOD-OPT – is equipped with an optical series communication interface for communication with plastic optical cable. Connection to other devices is through a HFBR-4516Z connector.

CIOMOD-CLO – contains a galvanically separated current loop. Connection is by a shielded RJ-45 connector. Production of this module is planned in the future. It is necessary to enquire availability at the producer.

CIOMOD-GPS – time synchronization module. Contains two galvanically separated RS-422 lines. Connection to GPS receiver through a shielded RJ-45 connector.

CIOMOD-BT – on the module is a Bluetooth interface.

COMIO3 card variants

COMIO3-COM

This card is a communication card for units in the RTU7M series. The first interface (COM1) connects the unit with the master system; any of the above-mentioned communication interfaces can be selected. The second interface (COM2) is unoccupied. On the third COM3 interface there is an internal line from the RTU unit, for example for the connection of external signalling and distinguishing modules. Any of the above-mentioned interfaces can be installed for this interface.

COM1 and COM3 interfaces must be specified in the order separately!

COMIO3-2MUX

A card with three interfaces. On interfaces COM1, COM2 two independent communication protocols are multiplexed on the RTU7M unit. For both these channels the unit can communicate with various set protocols according to requirements in various combinations (HioCOM2, IEC-608705-101, IEC608705-104), and according to the type of individual communication interface. The third COM3 port is the general communication port for connection of external equipment (slave RTU units, protection units, HMI, ...). For the COMIO3-2MUX card it is possible to use for COM1, COM2, COM3 any of the above-mentioned interfaces. COM1, COM2, COM3 interfaces must be specified in the order separately!

COMIO3-CIR

The card has two firmly mounted optical interfaces for the implementation of a double redundant circle (connectors of the type HFBR-4516Z, plastic optical cable HFBR-RUD). For the COMIO3-CIR card, any interface can be used for COM3.

The type of third interface must be specified in the order separately!

The type of functionality master / slave in the optical ring is set by the internal switch (setting is by the producer).

COMIO3-GPS

This card serves as a communication card for units from the RTU7M series with the option for the connection of the external GPS unit as a time standard. The first interface (COM1) is unoccupied, in the second interface (COM2) there is a module for the CIOMOD-GPS interface installed from the producer (RJ-45 connector). The GPS unit must be ordered separately. The third COM3 interface serves as a communication port for the RTU7M unit and can be used on any interface.

The type of third interface must be specified in the order separately!

COMIO-PC communication card

This concerns a communication card for the RTU7M modular unit with built-in PC with LINUX operating system. It is produced in several variants depending on the type of application for which it is designed. The card has four communication interfaces. One COM1 communication interface can be changed by means of plug-in modules from the CIOMOD-xxx series (RS-232, RS-485, GSM/(E)GPRS, optical interface, CLO and Ethernet interface). Three interfaces are firmly installed, the second from up COM2 is RS-232 (alternatively GPS), under it RS-485 with ADDC and fully down Ethernet 10/100Mbps. The function of the card depends on the SW. The main use is as built-in communication converter and concentrator which convert various communication protocols between various physical interfaces. In the function of the concentrator it gathers data from slave devices and transfers this data into the master system. Communication protocol for communication with a slave device can differ from the communication protocol for communication with the master system. The built-in communication converter and concentrator are operated under the operating system which, among others, enables the dynamic expansion of its functionality with the option for configuration, parameterisation and diagnostics. Within one device it is possible to implement the converter and concentrator functions at the same time. The list of supported communication protocols is as follows.

- IEC 60870-5-101 (hereinafter referred to as IEC 101)
- IEC 60870-5-104 (hereinafter referred to as IEC 104)
- HioCom2
- IEC 60870-5-103
- Modbus
- and others

According to the client's wishes, almost any communication protocol (standardized and proprietary) can be implemented.

Modular RTU units



For administration and parameterisation, the following protocols are used:

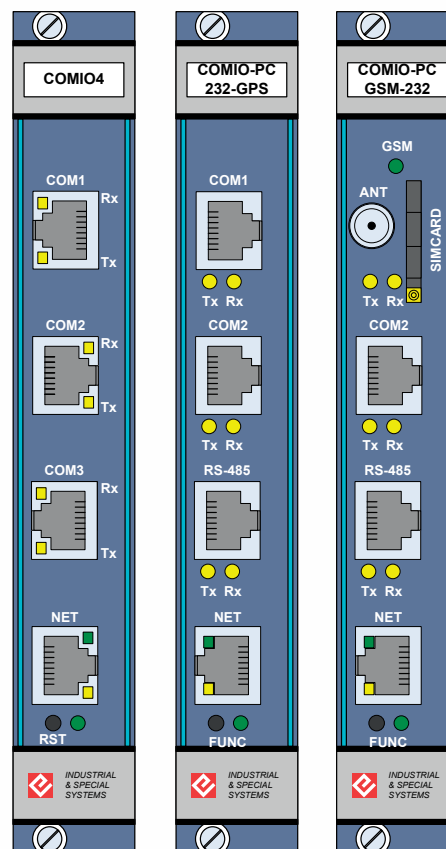
- Telnet
- FTP
- HTTP

COMIO4 communication card

This concerns a modular communication card in the RTU7M modular unit. This card can be used in all applications where it is possible to use the COMIO3 card; moreover, it is possible to use it in selected applications where the COMIO-PC card is used. Some of these applications are, for example, concentrators for RTU units or converters between communication protocols.

It is possible to mount on the card into the first and third interface any module CIOMOD-XXX, the second interface is switchable by DIP switch between RS-232 and RS-485, the last interface is always Ethernet 10/100Mbps. The card is universal; it is possible to mount it into any position on the bus. The configuration of the functionality is performed through the web interface or by means PC utilities. It is produced in several variants depending on the type of application for which it is designed. Interfaces are marked from up in the following order: COM1, COM2, COM3, Ethernet.

The type of COM1-3 interface must be specified in the order separately!



Technical specification of communication modules

Module	CIOMOD GSM	CIOMOD GSM2	CIOMOD GSM3	CIOMOD-NET	CIOMOD-OPT	CIOMOD-232	CIOMOD-485	CIOMOD-CLO	CIOMOD-BT
Communication interface with master system	GSM/GPRS module	GSM/GPRS/EDGE module	GSM/GPRS/EDGE module	Ethernet 10/100 Mbps	Optical interface	RS-232 (insulation 2KV AC during 1 min.)	RS-485 (insulation 2KV AC during 1 min.)	Current loop	Bluetooth
Connector	FME	FME	FME	RJ45	SC	RJ45	RJ45	RJ45	-
Protocols supported by the communication interface	PPP SMS, CSD, GPRS, UDP, IP, TCP	TCP, UDP, HTTP, FTP, SMTP, POP3, TCP/IP		UDP, IP, TCP, DHCP, Telnet, SNMP, HTTP, SMTP, ARP, SNTP, ICPMP					SPP
Consumption	1W			1,7W	1W				0,1W
Temperature range	-20°C až +55°C	-30°C až +85°C		0°C až +60°C	-20°C až +55°C				-30°C až +85°C
Storage temperature	-30°C až +75°C								
Surrounding relative moisture	30% - 95%RH non-condensing								
Possible to be mounted into cards	COMIO3, COMIO4, COMIO-PC	COMIO3	COMIO4, COMIO-PC	COMIO3, COMIO4, COMIO-PC					



Technical specification of COMIO3 modules

Module	COMIO3-COM	COMIO3-2MUX	COMIO3-CIR	COMIO3-GPS
Communication interface with master system	GSM/GPRS, GSM/EDGE, Ethernet, RS-232, RS-485, CLO, optics, Bluetooth	GSM/GPRS, Ethernet, RS-232, RS-485, CLO, optics, Bluetooth	Optical double redundant ring	GSM/GPRS, Ethernet, RS-232, RS-485, CLO, optics, Bluetooth
Other interface	GSM/GPRS, Ethernet, RS-232, RS-485, CLO, optics, Bluetooth			GPS
Consumption	0,5W		1W	0,5W
Temperature range	-20°C to +55°C			
Storage temperature	-30°C to +75°C			
Surrounding relative moisture	30% - 95%RH non-condensing			
Coverage	IP20			
Position in the bus 5/8 slot	2/3		2/3 verze SLAVE 2, 3, 4, 5 / 1, 3, 4, 5, 6, 7, 8 version MASTER	2/3

Technical specification of COMIO-PC and COMIO4 modules

Module	COMIO-PC	COMIO4
Firmly mounted communication interface	(from down) Ethernet 10/100Mbps, RS-485 (s ADDC), RS-232 (alternatively GPS), exchangeable module	(from down) Ethernet 10/100Mbps, exchangeable module, RS-232/RS-485 exchangeable module
Optional interface	GSM/(E)GPRS, Ethernet, RS-232, RS-485, CLO, optics, Bluetooth	
Consumption	3W	2W
Temperature range	-20°C to +55°C	-20°C to +85°C
Storage temperature	-30°C to +75°C	
Surrounding relative moisture	30% - 95%RH non-condensing	
Coverage	IP20	
Position in the bus 5/8 slot	2, 3, 4, 5/1, 4, 5, 6, 7, 8	

Ordering information

Ordering code	Type indication	Description
221312550254	CIOMOD-GSM	Communication module, interface GSM/GPRS
221312550255	CIOMOD-GSM2	Communication module, interface GSM/GPRS/ EDGE
221312550256	CIOMOD-GSM3	Communication module, interface GSM/GPRS/ EDGE
221312550257	CIOMOD-NET	Communication module, interface Ethernet 10/100 Mbps
221312550259	CIOMOD-OPT	Communication module, optical interface, SC connector
221312550253	CIOMOD-232	Communication module, interface RS-232
221312550251	CIOMOD-485	Communication module, interface RS-485
221312550265	CIOMOD-CLO	Communication module, current loop
221312550267	CIOMOD-BT	Communication module, interface Bluetooth
221312550225	COMIO3-COM	Communication module, 1 interface, master system, 1 inside line
221312550226	COMIO3-2MUX	Communication module, 2 interfaces, master system, 1 inside line
221312550227	COMIO3-CIR	Communication module, 2 interfaces, 1 inside line
221312550228	COMIO3-GPS	Communication module, 1 interface, master system, 1 GPS
221312550223	COMIO-PC	Communication module, Ethernet, RS-485, RS-232, CIOMOD-xxx
221312550310	COMIO4	Communication module, Ethernet, CIOMOD-xxx, RS-232/RS-485, CIOMOD-xxx

RTU7M – digital inputs (DI)

Basic properties

- 20 digital inputs
- insulation 3.75kV AC
- indication of input state
- adjustable SW time filter for both logical levels
- 2-bit signalling option (e.g. stating the semi-position of the power element)
- configurable maximum permitted number of changes on input with time interval
- sampling of inputs with period 5ms (1ms)
- pulse counting and period measurement with flash memory backup – for applications of energy consumption measurements

Description of the module

Digital input modules for RTU7M units are produced in several basic variants:

- direct DI, active
- direct DI, passive
- indirect DI, active
- indirect DI, passive

Direct DI

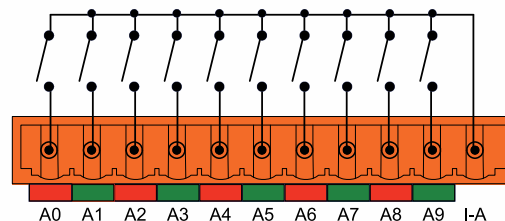
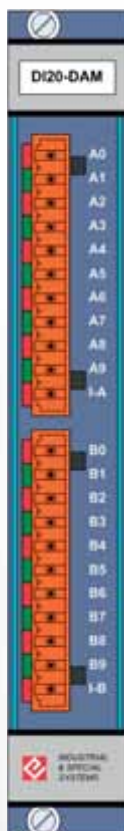
The card for direct inputs has HW inputs connected directly to the inputs of the main processor of the RTU7M unit. The processor then evaluates input signals, performs their filtration, etc. A maximum of two cards can be mounted into the frame of the RTU7M (according to FW, see the User Manual). The advantage is the support of the automatic functions, e.g. conditional control (switching relay on the basis of the input statuses on the direct DI card).

Indirect DI

The card for indirect digital inputs has its own processor which processes input signals (without the participation of the main processor of the RTU7M unit). The card behaves as a slave unit from the RTU7 series, data is transferred through the internal bus of the RTU7M unit, which serves as a communication bridge. The modules support IEC 60870-5-101 and HIOCom2 communication protocols. All the above-mentioned functions are supported, with the exception of the automated functions.

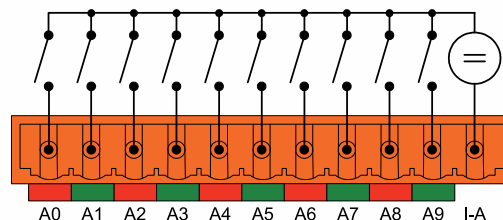
Active DI

The excitation takes place after connection of the respective input terminal by outside contact to the common terminal. On the card there is its own galvanic-separated source of voltage with the respective value according to the type of card.



Passive DI

These inputs do not have a source of exciting voltage. They are activated by connection of the outside voltage of the respective value according to the type of card.



Processing of digital input signals

Digital inputs are sampled for a period of 5 ms. The sampling interval can be decreased up to 1 ms. In the processing, the filtration of changes is sent to the master system, if required. In the case of each change, the exceeding of the set maximum number or changes per minute is monitored. If the maximum number of changes is exceeded, the value is transferred with a telemetric error. This prevents redundant transfer of oscillating values.

Ordering information

Direct inputs		
Ordering code	Type indication	Description
221315550020	DI 20-DAS	20xDI, Active, 12 V
221315550040	DI 20-DAM	20xDI, Active, 24 V
221315550060	DI 20-DAL	20xDI, Active, 48 V
221315550030	DI 20-DPS	20xDI, Passive, 12 V
221315550050	DI 20-DPM	20xDI, Passive, 24 V
221315550070	DI 20-DPL	20xDI, Passive, 48 V
221315550080	DI 20-DPX	20xDI, Passive, 110 V

Indirect inputs		
Ordering code	Type indication	Description
221316550020	DI 20-UAS	20xD, Active, 12 V
221316550040	DI 20-UAM	20xD, Active, 24 V
221316550060	DI 20-UAL	20xD, Active, 48 V
221316550030	DI 20-UPS	20xD, Passive, 12 V
221316550050	DI 20-UPM	20xD, Passive, 24 V
221316550070	DI 20-UPL	20xD, Passive, 48 V
221316550080	DI 20-UPX	20xD, Passive, 110 V



Technical specification

Module	DI20-DAS	DI20-DAM	DI20-DAL	DI20-DPS	DI20-DPM	DI20-DPL	DI20-DPX	DI20-DPXL
Number of inputs	20							
Types of inputs:	Active (switching by dry contact)			Passive (switching by external voltage, both polarities)				
Transfer of statuses	Direct connection of inputs statuses to the main processor							
Level H	ON	ON	ON	9-28V	20-70V	35-70V	75-150V	200-300V
Level L	OFF	OFF	OFF	0-4V	0-10V	0-17V	0-25V	0-60V
Current through input	3,6mA	2,4mA	2,4mA	1,3-7,5mA	1,3-7mA	1,3-3,5mA	2,7-15mA	2,7-5,3mA
SW filter for level H and L	0 – 327,675s, step 5ms							
Permitted number of changes in minute	0-255							
Insulating voltage	3,75kV AC during 1 minute							
Consumption	Max. 3 W			0,2W				
Connectors	2 x WAGO 231-311/026-000 part of delivery							
Temperature range	-20°C to +55°C							
Storage temperature	-30°C to +75°C							
Ambient relative moisture	30% - 95%RH not condensing							
Coverage	IP20							
Positions in 5 / 8 slot bus	3 / 6							

Module	DI20-UAS	DI20-UAM	DI20-UAL	DI20-UPS	DI20-UPM	DI20-UPL	DI20-UPX	DI20-UPXL
Number of inputs	20							
Types of inputs:	Active (switching by dry contact)			Passive (switching by external voltage, both polarities)				
Communication protocol	IEC 60870-5-104, IEC 60870-5-101, HIOCom2							
Level H	ON	ON	ON	9-28V	20-70V	35-70V	75-150V	200-300V
Level L	OFF	OFF	OFF	0-4V	0-10V	0-17V	0-25V	0-60V
Current through input	3,6mA	2,4mA	2,4mA	1,3-7,5mA	1,3-7mA	1,3-3,5mA	2,7-15mA	2,7-5,3mA
SW filter for level H and L	0 – 327,675s, step 5ms							
Permitted number of changes in minute	0-255							
Insulating voltage	3,75kV AC during 1 minute							
Consumption	Max. 3,5 W			0,5W				
Connectors	2 x WAGO 231-311/026-000 part of delivery							
Temperature range	-20°C to +55°C							
Storage temperature	-30°C to +75°C							
Ambient relative moisture	30% - 95%RH not condensing							
Coverage	IP20							
Positions in 5 / 8 slot bus	3, 4, 5 / 1, 4, 5, 6, 7, 8							

RTU7M – digital outputs (DO)

Basic properties

- 10 relay digital outputs
- 8A@250V AC, 8A@24V DC
- 8 x form A contact, 2 x form C contact
- HW and SW protection against accidental switching of output
- adjustable time for activation of relay
- treated spreading of interference to the connection circuit in the case of activation of relay contacts
- special function of some DO (thermostat control, protection functions)

Description of the module

Digital output modules for RTU7M units are produced in two variants:

- direct DO
- indirect DO

Direct DO

The card for direct digital outputs has HW outputs connected through power exciters directly to the digital inputs of the main processor of the RTU7M unit. A maximum of two cards can be mounted into the RTU7M tube (according to FW, see the User Manual). The advantage is the support of the automatic functions, e.g. conditional control (switching relay on the basis of the statuses of the inputs on the direct DI card).

Indirect DO

The card for indirect digital outputs has its own processor which through the drivers for the signals activates the relay according to the stated requirements. The card behaves as a slave unit from the RTU7 series, data is transferred through the internal bus of the RTU7M unit bus, which serves as a communication bridge.

Technical specification

Module	DO10-D	DO10-U
Number of outputs	8 switching and 2 switching/disconnecting relay contacts	
Adjustable time of switching	10ms to 655s, by step 10ms	
Communication protocol	-	IEC 60870-5-104, IEC 60870-5-101, HIOCom2
Dielectric strength contact – coil	5KV AC during 1 minute	
Dielectric strength between disconnecting contacts	1KV AC during 1 minute	
Loading capacity of contacts	8A@250V AC, 8A@24V DC	
Service life	2x10 ⁷ cycles	
Switching relay	Secured against accidental activation. Activation is controlled by digital signals directly from the main processor	Secured against accidental activation. Independent slave unit from RTU7 series
Consumption	2,3 W	3 W
Connectors	2 x WAGO 231-311/026-000 part of delivery	
Temperature range	-20°C to +55°C	
Storage temperature	-30°C to +75°C	
Ambient relative moisture	30% - 95%RH not condensing	
Coverage	IP20	
Positions in 5 / 8 slot bus	3 / 4,5	3,4,5 / 1,4,5,6,7,8

Technical specification

The modules support IEC 60870-5-101 and HIOCom2 communication protocols. The conditional control and automated functions are not implemented.

Connection of connectors

On the card are two 11-pole connectors. On each connector there are 4 form A contacts and 1 form C contact for output relay.

Securing digital outputs

Close attention is paid to protection against accidental activation of a digital output. In the RTU7series units this is resolved at the hardware and software level:

- at SW level a two-phase control for the activation of the relay is used. The unit must receive two identical commands for activation of the relay in the respective interval to execute the command.
- at HW level, each relay is controlled by two drivers. To activate the relay both drivers must be activated at the same time. Each driver is controlled by its own processor.

Special functions

Depending on the type of firmware, some digital outputs can have a reserved function. An example is the activation of the heater depending on the temperature measured by the external sensor (thermostat function, tempering of the switchboard), function for control of the power element with evaluation of the ground connection, short circuit or over-current, etc.

Ordering information

Ordering code	Type indication	Description
221315550520	DO 10-D	10x-DO, direct outputs
221316550520	DO 10-U	10x-DO, indirect outputs

RTU7M – combined digital inputs / outputs

Basic properties

The module provides 10 digital inputs, 5 relay outputs with 4 form A and 1 form C contact.

Digital inputs are galvanically separated from the unit but are not insulated between each other. Modules of digital inputs for RTU7M units are produced in two basic variants:

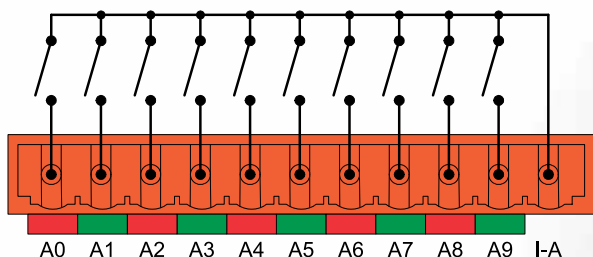
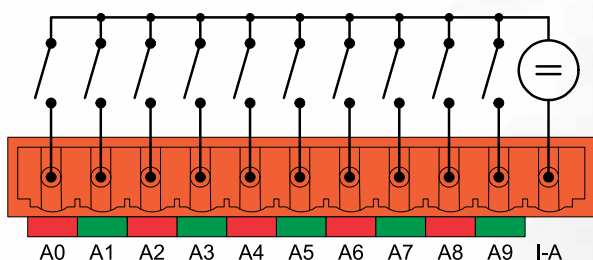
- direct DI, active
- direct DI, passive

Description of the module

Direct digital inputs of the module are HW connected to digital inputs of the main processor of the RTU7M unit. The processor then evaluates the input signals, filters them, etc. A maximum of one card can be installed into the RTU7M. The advantage of this is the automatic function support, e.g. conditional control (switching the relay on the basis of the input status on the direct DI card).

Active DI

Excitation takes place after connection of the respective input terminal by external contact to the common terminal. On the card is a galvanically separated source of voltage with the respective value according to the type of card.

**Passive DI**

These inputs do not have a source of exciting voltage. They are activated by the connection of the external voltage for the respective value according to the type of card.

**Digital inputs**

They are sampled with a period of 1ms. In the processing is the filtration of signal changes. A time filter can be set for both logical levels. If the change to the digital input lasts for the stated time then the respective logical level is declared valid and is sent to the master system, if required. In the case of each change, the exceeding of the set maximum number of changes per minute is monitored. If the maximum number of changes is exceeded, the value is transferred with a telemetric error. This prevents any redundant transfer of the oscillating values.

In addition to the use of these modules as simple digital inputs with one or two-bit signalling, it can be used for reading impulses and measuring the period with saving the status into the backup memory in applications for measuring energy and media consumption. This depends on the firmware used.



Digital outputs

On the combined card these are produced in the direct DO variant. Relays are excited through power exciters directly from the digital outputs of the main processor for the RTU7M unit. A maximum of one card can be installed into the RTU7M. The advantage is the automatic functional support and conditional control (switching relay on the basis of the input statuses).

Securing of digital outputs

Close attention is paid to protect against accidental activation of the digital output. This is resolved in the hardware and software in the RTU7M unit series:

- at the SW level a two-phase control for activation of relay is used. The unit must receive two identical commands for activating the relay in the respective interval to execute the command.
- At HW level each relay is controlled by two exciters. To activate the relay both exciters must be activated at the same time. Each exciter is controlled by its own processor.

Special functions

Depending on the type of firmware some digital outputs can have a reserved function. An example of this is the activation of the heating body depending on the temperature measured by an external sensor (thermostat function, switchboard tempering), function for controlling the power element with evaluation of the ground connection, short circuit or over-current, etc.

Technical specification

Module	DI10-DAS DO05-D	DI10-DAM DO05-D	DI10-DAL DO05-D	DI10-DPS DO05-D	DI10-DPM DO05-D	DI10-DPL DO05-D	DI10-DPX DO05-D	DI10-DPXL DO05-D
Number of inputs	10							
Types of inputs:	Active (switching by dry contact)			Passive (switching by external voltage, both polarities)				
Transfer of statuses	Direct connection of inputs statuses to the main processor							
Level H	ON	ON	ON	9-28V	20-70V	35-70V	75-150V	200-300V
Level L	OFF	OFF	OFF	0-4V	0-10V	0-17V	0-25V	0-60V
Current through input	3,6mA	2,4mA	2,4mA	1,3-7,5mA	1,3-7mA	1,3-3,5mA	2,7-15mA	2,7-5,3mA
SW filter for level H and L	0 – 327,675s, step 5ms							
Permitted number of changes in minute	0-255							
Insulating voltage	3,75kV AC during 1 minute							
Number of outputs	4 switching and 1 switching/disconnecting relay contacts							
Adjustable time of switching	10ms to 655s, by step 10ms							
Communication protocol	-							
Dielectric strength contact – coil	5KV AC during 1 minute							
Dielectric strength between disconnecting contacts	1KV AC during 1 minute							
Loading capacity of contacts	8A@250V AC, 8A@24V DC							
Service life	2x10 ⁷ cycles							
Switching relay	Secured against accidental activation. Activation is controlled by digital signals directly from the main processor							
Consumption	Max. 3,5W			Max. 1,3W				
Connectors	2 x WAGO 231-311/026-000 part of delivery							
Temperature range	-20°C to +55°C							
Storage temperature	-30°C to +75°C							
Ambient relative moisture	30% - 95%RH not condensing							
Coverage	IP20							
Positions in 5 / 8 slot bus	3 / -							

RTU7M – analogue inputs, direct measurement

Basic properties

- 3 channels for analogue inputs
- variant with current or voltage inputs
- measurement of AC or AC/DC according to the type of module
- wide scope of input ranges
- high over-loading of current measurements
- galvanic separation – according to the type of module
- over-voltage protection on inputs
- processing of measurement by high-performance signal processor
- sampling, filtration according to the FW used
- change of input ranges, on request

Description of the modules

These modules serve for modification of the measured signal to an inside unified voltage signal which is then processed by the main processor of the unit. After modification the signal is connected to the inputs of the ADC processor. In addition, the modules ensure galvanic separation and over-voltage protection of the analogue inputs of the unit. There can only be two modules for direct measurements in the RTU7M unit; the expansion of the number of analogue inputs is possible through the indirect measurement modules.

Input ranges are selected in such a manner that the unit can easily be incorporated into various monitoring and control applications in the industry and, in particular, in the energy sector. In addition to the types mentioned, after consulting with the producer, the other measurement ranges are possible.

A-MTI modules

These are modules for measurement of AC currents within ranges which are stated by the type of module. On the inputs are exact measuring transformers for the current. Some types of modules are fitted with two-range measurement for increasing the precision of measurement in the nominal range. The advantage is the high over-loading capacity which is necessary in energy applications during detection of failure statuses on lines (losses, over-currents, ground connections). The modules are also recommended for measurement in other, general and industrial applications.

AI-MTU modules

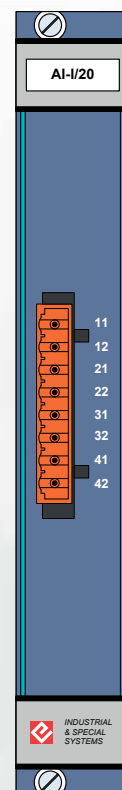
These are modules with measuring transformers of voltage for AC measurements: the basic range is 100V AC. The overloading capacity is $1.2U_n$ and fully fulfils industrial and energy applications.

AI-I/20 modules

These are modules used for measurement of AC or DC currents: the nominal measurement range is $\pm 20\text{mA DC}$ or 20mA AC , overloading capacity is $2I_n$. They are produced in variants with galvanic separation or without it.

AI-U-I modules

These are modules with galvanic separation for measurement of DC or AC voltages: for some modules the inputs are modified directly for use with resistance or capacity sensors for voltage. Typical applications are remote controlled section switches or Reclosers.

**Ordering information**

Ordering code	Type indication	Description
221318550210	AI-M TI/5	3× AI, 5 A AC, overloading 4× I_n , insulation
221318550200	AI-MTI/1	3× AI, 1 A AC, overloading 4× I_n , insulation
221318550024	AI-I/5-1	3× AI, 5 mA AC, insulation
221318550230	AI-MTU/100	3× AI, 100 VAC, overloading 1,2× U_n , insulation
221318550231	AI-MTU/400	3× AI, 400 VAC, overloading 1,2× U_n , insulation
221318550060	AI-I/20	3× AI, 20 mA AC, $\pm 20\text{ mA DC}$, overloading 2× I_n
221318550020	AI-I/5	3× AI, 5 mA AC, $\pm 5\text{ mA DC}$, overloading 2× I_n
221318550064	AI-I/20-I	3× AI, 20 mA AC, $\pm 20\text{ mA DC}$, overloading 2× I_n , insulation
221318550420	AI-UA/2-I	3× AI, 2 V AC, overloading 1,2× U_n , insulation
221318550044	AI-U/10-I	3× AU, 10 V AC, $\pm 10\text{ V DC}$, overloading 1,2× U_n , insulation

Modular RTU units



Technical specification

Module	AI-MTI/5	AI-MTI/1	AI-MTI/5-1	AI-MTU	AH/20	AH/20-I	AI-UA/2-I	AI-U/10-I
Measured value	Current			Voltage	Current		Voltage	
Number of inputs	3				3 (4 on request)			
Nominal range *	5 A AC	1 A AC	5 A AC	100 V AC	20 mA AC ±20 mA DC		2 V AC	10 V AC ±10 V DC
Overloading	20 A AC during 1 minute	4 A AC during 1 minute	5 A AC permanently	120 V AC permanently	40 mA AC trvale ±40 mA DC permanently		2,4 V AC permanently	12 V AC permanently ±12 V DC perm.
Types of inputs:	Insulated 4 kV			Insulated 3,7 kV	Not insulated	Insulated 4 kV		
Precision of measurement (of measuring range)	±0,5 %							
Precision of measurement (at overloading)	±1,5 %		-	±0,5 %	±1 %		±0,5 %	
Processing of signal	10bit A/D converter							
Sampling	According to used firmware							
Power consumption	+5 Van./0.1 W; -5 Van./0.1 W				+5 Van./0.1 W -5 Van./0.1 W		+5 Vdig./1 W +5 Van./0.1 W -5 Van./0.1 W	
Connectors	3 x connector WAGO; direct connection of conductor; max. 2.5 mm2				1 x WAGO 231-308/037-000, part of delivery			
Temperature range	-20°C to +55°C							
Storage temperature	-30°C to +75°C							
Ambient relative moisture	30% - 95%RH not condensing							
Coverage	P20							
Positions in 5 / 8 slot bus	8		7, 8		For 3 inputs position 7, 8 For 4 inputs position 8			

* input ranges for all modules can be modified, if necessary

RTU7M – analogue inputs, indirect measurement

Basic properties

- 3 or 6 channels for analogue inputs on the module
- up to 6 modules in the RTU7M bus (up to 36 analogue inputs)
- variant with current inputs
- AC/DC measurement
- high over-loading capacity of current measurements, protection against over-current
- galvanic separation – according to the type of module
- over-voltage protection on inputs
- processing of measurement by high-performance signal processor
- sampling, filtration according to the FW used
- independent units not loading main RTU7M processor
- LED indication for signalling earth faults and short circuits at three-phase measurements
- LED status for indication of the status of the unit and communication
- remote upgrade of firmware

Description of the modules

Modules for indirect measurements are fitted with their own high-performance signal processor for processing measured signals. The RTU7M unit serves in this case only as a communication bridge for the transfer of data. After consultation with the producer other variants of inputs are possible other than those mentioned.

Modules M3ZD

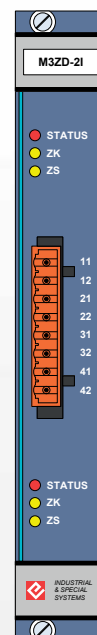
These are used as general current inputs $\pm$ 20mA DC or 20mA AC. The over-loading is 2xIn. They are produced as one or two independent units on one plug-in card. In the energy applications, the modules are used as indicators of short-circuits, over-currents and earth faults. In particular they are recommended for use in cable networks. In the case of 3-phase measurements, the effective value of the currents is continuously calculated in individual phases, then the effective value I₀ and mean value I_{mean}. In addition, the exceeding of the parameterised limits for particular phase currents and current I₀ is evaluated. After exceeding the limits during the defined time, the



earth fault is signalled, short circuit or over-current.
The modules support IEC 60870-5-101(104) and HIO-Com2 communication protocols.
All limits for the evaluation of error statuses on line, parameters for the automatic transfer of measurements and the automatic transfer of messages regarding failure are remotely parameterised as in the case of other units from the RTU7 series. At the same time, the units enable to remotely upgrade firmware.

Informace pro objednání

Ordering code	Type indication	Description
221320550010	M3ZD-1I	3× AI, 20 mA AC, ±20 mA DC, overloading 2× In, insulation, one unit on the module
221320550020	M3ZD-2I	3× AI, 20 mA AC, ±20 mA DC, overloading 2× In, insulation, two units on the module
221320550021	M3ZD-2IS	3× AI, 20 mA DC, two units on the module



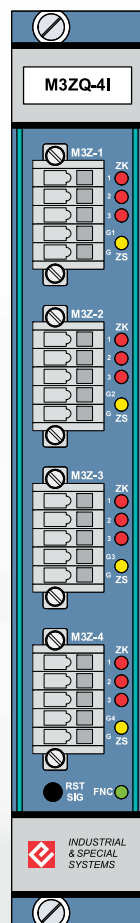
Technical specification

Module	M3ZD-1I	M3ZD-2I	M3ZD-1N	M3ZD-2IS
Number of inputs	3	2× 3	3	2 × 3
Types of inputs:	Insulation 2,5 kV during 1 min	Insulation 2,5 kV during 1 min (insulation input/output and mutual 2× 3 inputs)	Not insulated	Insulation 2,5 kV
Communication protocols	EC 60870-5-104, IEC 60870-5-101, HIOCom2			
Measurement of signals	own processor, 10bit A/D converter			
Measured value	Current			
Nominal range	20 mA AC ±20 mA DC			20 mA DC
Overload capacity	40 mA AC trvale ±40 mA DC permanently			–
Precision of measurement	±0,5%			±1%
Precision of measurement (at overloading)	±1%	±1%	±1%	–
Sampling	According to firmware used			
Consumption	1 W	2 W	+5Vdig./0,5W +5Van./0,1W -5Van./0,1W	2W
Connectors	1× WAGO 231-308/037-000, part of delivery			
Temperature range	-20°C to +55°C			
Storage temperature	-30°C to +75°C			
Ambient relative moisture	30% - 95%RH not condensing			
Coverage	P20			
Positions in 5 / 8 slot bus	1, 4, 5, 6, 7, 8		7 8	

RTU7M - analogue inputs, indirect measurement (M3ZQ)

Basic properties

- 6 or 12 analogue input channels on module
- up to 6 modules in the RTU7M bus (up to 72 analogue inputs)
- variant with current inputs
- differential amplifier on inputs eliminate the influence of ground loops for measurement
- AC/DC measurement
- high over-loading capacity of current measurements, protection against over-current
- galvanic separation (inputs from unit)
- over-voltage protection on inputs
- processing of measurement by high-performance signal processor
- sampling of filtration according to the FW used
- record of the waveform of measured values (failure records)
- records in the COMTRADE format or in binary file
- browser for records for MS Windows is available
- remote transfer of records
- independent units not loading main processor RTU7M
- LED indication for time signalling of ground connections and short circuits in individual phases of 3-phase measurements
- remote or local reset LED signalling
- LED status for indication of the unit status and communication
- remote upgrade of firmware



Description of M3ZQ modules

Modules for M3ZQ indirect measurements are fitted with their own high-performance signal processor for processing measured signals. In this case the RTU7M unit serves only as a communication bridge for data transfer. After consultation with the producer, another input variant is possible than that mentioned. It is also possible to configure inputs as voltage inputs.

M3ZQ modules can be used as general current inputs ± 20 mA DC or 20 mA AC. The overload capacity is $2 \times I_n$. They are produced with six or twelve channel variants on the card. The modules are used in energy applications and short-circuit indicators, over-currents and ground connections. They are particularly recommended for use in cable networks. In the case of 3-phase measurements, the effective value of currents is continuously calculated in individual phases, then effective value I_0 and mean value I_{stf} . In addition, there is the evaluation of exceeding the parameterized limits for individual phase currents and current 0. After exceeding the limits during the stated time, the ground connections, short circuit or over-current are signalled. The modules support IEC 60870-5-101, IEC 60870-5-104 and HIOCom2 communication protocols. All limits for the evaluation of failure statuses on the line, parameters for automatic transfer of measurements and automatic transfer of messaging about the failure are remotely parameterized as for the other RTU7 unit series. Similarly, the units enable the remote upgrade of firmware.

Ordering information

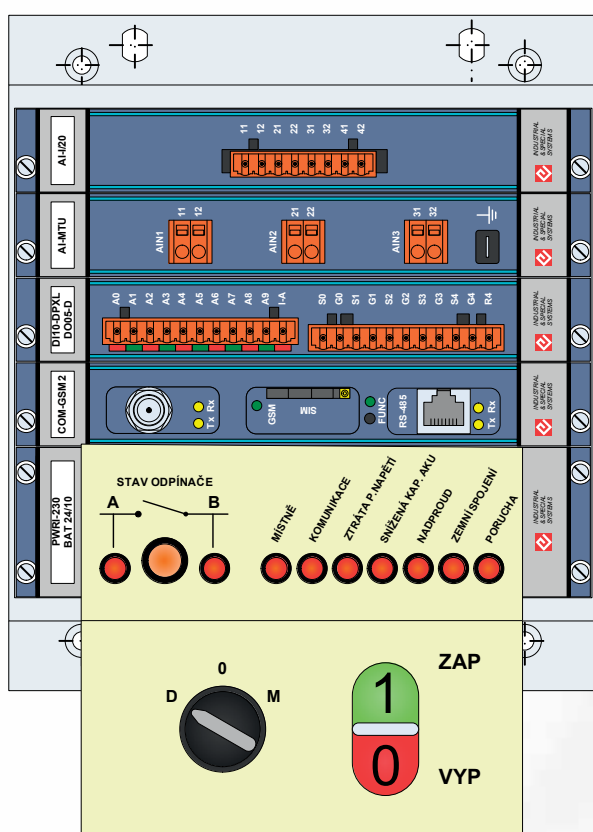
Ordering code	Type indication	Description
221320550030	M3ZQ-4I	Module for indirect analogue measurements

Technical specification

Module	M3ZQ-2I	M3ZQ-4I
Number of inputs	2 × 3	4 × 3
Types of inputs:	Differential inputs insulated 2.5 kV for 1 min.	Differential inputs insulated 2.5 kV for 1 min.
Communication protocols	EC 60870-5-104, IEC 60870-5-101, HIOCom2	
Measurement of signals	own processor, 10bit A/D converter	
Measured value	Current	
Nominal range	± 20 mA DC	
	20 mA AC	
Overloading capacity	± 40 mA DC permanently	
	40 mA AC permanently	
Precision of measurement	$\pm 0,5$ %	
Precision of measurement (at overloading)	± 1 %	
Sampling	According to firmware used	
Consumption	2 W	4 W
Connectors	WAGO	
Temperature range	-20°C to +55°C	
Storage temperature	-30°C to +75°C	
Ambient relative moisture	30% - 95%RH not condensing	
Coverage	P20	
Positions in 5 / 8 slot bus	3, 4, 5/1, 4, 5, 6, 7, 8	
Signalling	Signalizace poruchových stavů LED diodam	

Basic properties

- interface with indicating LED diodes
- external or internal variant
- signalling of the status of the power element
- signalling of the communication status
- signalling of errors, earth faults, short circuits and over currents
- signalling of the status of the accumulator
- for remote controlled section switches and reclosers



Description of the module

The signal module with the LED indicator is produced in two basic variants: internal or external. The main area of use is the energy application of the remote controlled section switches and Reclosers. There is the signalling of the disconnection status, error statuses on line, communication status and backup accumulator.

In the case of the internal variant, the RTU7M unit can be installed into the switchboard under the sub-panel, only the signal module is accessible by users.

The module in the external variant can be connected to the RTU7M unit of the communication module (line RS-485). The supply voltage for this module is on the connector of the communication line.

Ordering information

Ordering code	Type indication	Description
221322550722	SIG-D	Signal module, internal
221322550723	SIG-D-EXT05	Signal module, external

Technical specification

Number of LED	10
Consumption	1 W
Temperature range	-20 °C to +55 °C
Storage temperature	-30 °C to +75 °C
Ambient relative moisture	30% - 95%RH not condensing
Coverage	P20
Positions in bus	1

Notes:

Sample sets of modular units

Sample sets of modular units

RTU7MS – set for RCSS and Recloser

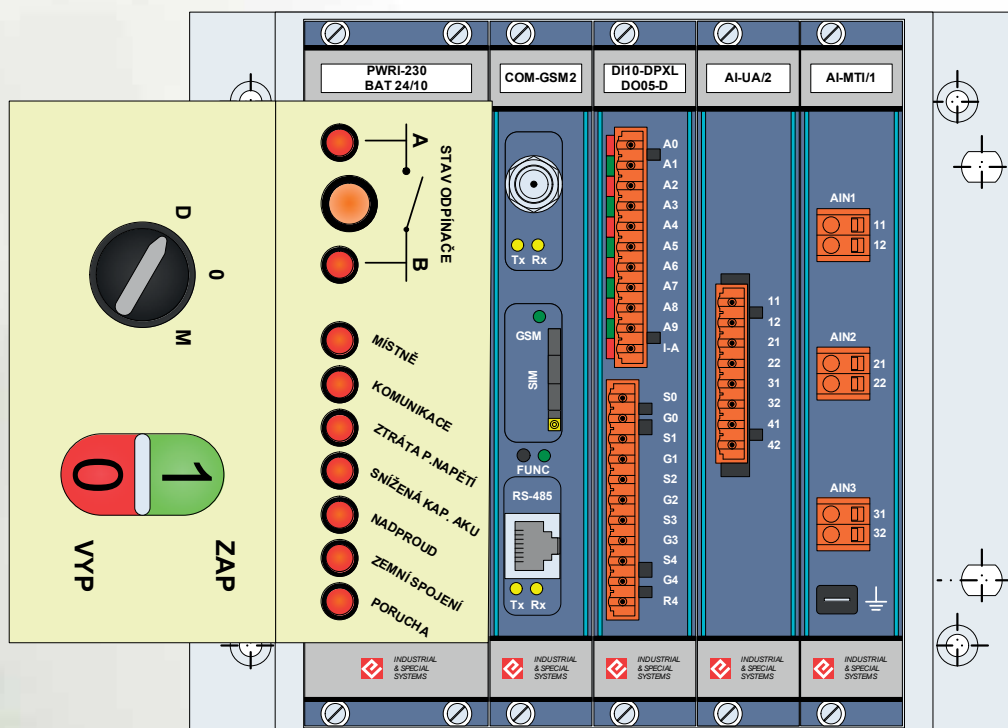
Remote controlled section switch in medium-voltage networks

A remote supply is required for this type of application, as well as the signalling of the input status and measurement, including the calculation and transfer of analogue values. There is also the function of signalling failures (excess current, short-circuit, ground connection), recording of the voltage waveform and the current during failure and remote transfer. Disconnection is required in the second voltage-free pause for automated functions.

Remote-controlled disconnecter in medium-voltage networks (Recloser)

Remote control is required, signalling the status of digital inputs and measurement, including the calculation and transfer of analogue values. Protection functions – disconnection and signalling of excess current and short circuits, signalling of ground connection (if required, disconnection of ground connection), recording of the waveform of measured voltages and currents with individual protection flags during failure and remote transfer. Re-switching is required for automated functions.

Properties of sets are stated by the Cards used.



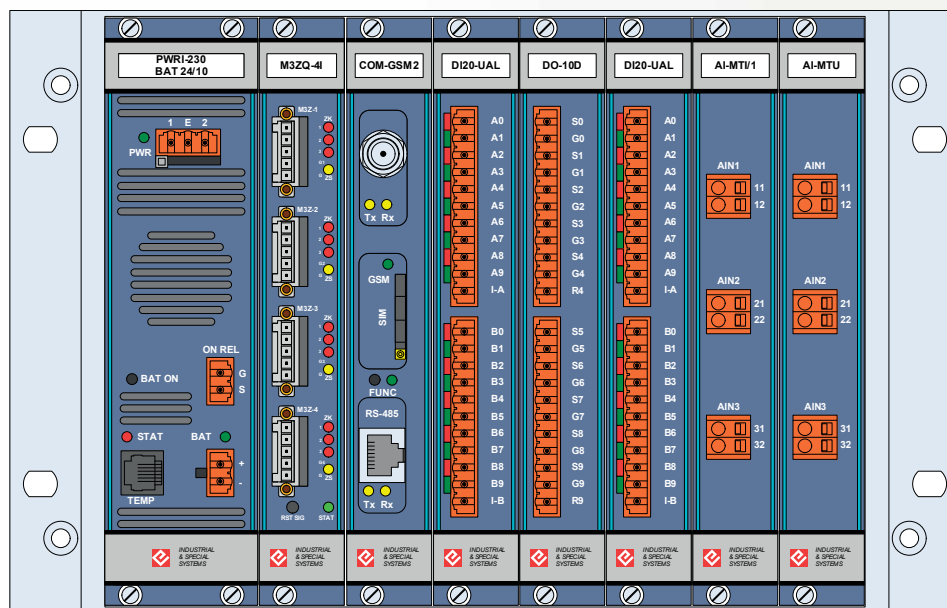
Typical configuration of the set:

1,00	Chassis of the unit	RTU7M CASE-5
1,00	Bus	RTU7M BUS-5
1,00	Processor module	RTU7M CPU-02
1,00	Source and charger of the accumulator	RTU7M PWRI-57 BAT-24/10
1,00	Communication card	RTU7M COMIO3-COM
1,00	GSM/GPRS module	RTU7M CIOMOD-GSM2
1,00	RS-485 module	RTU7M CIOMOD-485
1,00	Card for binary inputs and outputs	RTU7M DI10-DAL DO05-D
1,00	Card for measurement of voltage 3x 1V AC	RTU7M AI-UA/2
1,00	Card of measurement of currents 3x 1A AC	RTU7M AI-MTI/1
1,00	Firmware	RTU7M FW-DOUS (Recloser)
1,00	Signalling module	RTU7M SIG-D EXT
1,00	External aerial	GSM/GPRS GSM aerial 2dB FME
1,00	Thermal sensor	Digital thermal sensor; RJ; 0.50 m

These are used for monitoring and control of high-voltage distribution stations (DTS)

The units ensure remote control (blocked, conditional), signalling of the digital input status (status of power switches, control circuit breakers, fuses, remote/local control, etc.). In addition, there is the measurement of currents (voltage) and the calculation of other physical values. The measurement includes protective functions, such as signalling of short circuits, excess currents and group connections on each outlet. The time recording of values during failure statuses and the transfer into the master system is highly sought after.

Properties of sets are stated by the cards used.

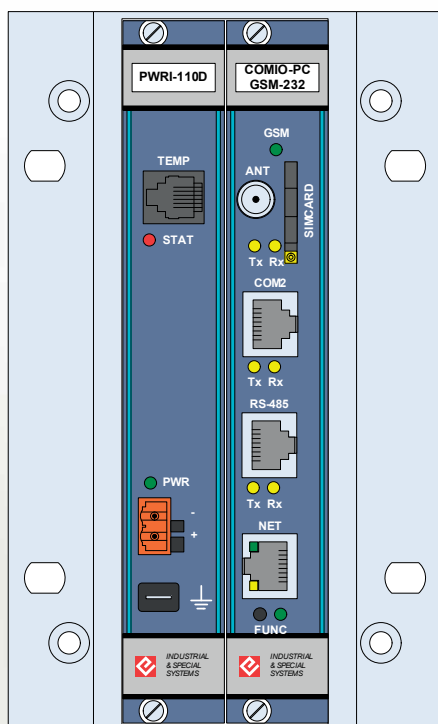


Typical configuration of the set:

1,00	Chassis of the unit	RTU7M CASE-8
1,00	Bus	RTU7M BUS-8
1,00	Processor module	RTU7M CPU-02
1,00	Source and charger of the accumulator	RTU7M PWRI-230 BAT-24/10
1,00	Card for measurement of currents 4x3f	RTU7M M3ZQ-4I
1,00	Communication card	RTU7M COMIO3-COM
1,00	GSM/GPRS module	RTU7M CIOMOD-GSM2
1,00	RS-485 module	RTU7M CIOMOD-485
1,00	Card 20x binary input	RTU7M DI20-UPM
1,00	Card 10x binary output	RTU7M DO10-D
1,00	Card 20x binary input	RTU7M DI20-DPM
1,00	Card for measurement of voltage 3x 100V AC	RTU7M AI-MTU
1,00	Card of measurement of currents 3x 5A AC	RTU7M AI-MTI/5
1,00	Firmware	RTU7M FW-RTU 7.2
1,00	Aerial	GSM/GPRS GSM aerial 5dB FME
1,00	Thermal sensor	Digital thermal sensor; RJ; 0.50 m

Sample sets of modular units

RTU 7MC – communication converter



Description of the converter

The RTU 7MC communication converter completes the portfolio for successful and well established RTU units from ELVAC IPC s.r.o., which have been implemented for several years in applications for the control and monitoring of electric stations and networks and in other areas with high requirements for the reliability and robust character of the delivered solution. The RTU 7MC communication converter is primarily designated as the converter between various communication protocols and various physical interfaces. It can find its application as a converter of protocols IEC 60870-5-101 and IEC 60870-5-103, which communicate through the serial interface (RS-232 or RS-485), to the protocol IEC 60870-5-104, which is used by transport protocol TCP for the transfer of data. Today the (E)GPRS network is often used for data transfer. In this area the communication converter RTU 7MC uses the extensive experience of ELVAC IPC s.r.o. with this type of network. The RTU 7MC can also be used in the role of communication and data concentrator. It is possible to perform the parameterization using the User center RTU application, or through the web interface. For advanced administration and configuration it is possible to use telnet, ftp

The RTU 7MC communication converter offers a highly effective and price acceptable solution into applications, not only in the energy sector.

Communication interface of converter

- 1x interface RS-232 galvanically separated,
- 1x interface RS-485 galvanically separated,
- 1x Ethernet,
- 1x exchangeable communication module (GSM/(E)GPRS, Bluetooth, RS-232, RS-485, optics).

Converter supply

The supply voltage is optional by selection of the integrated galvanic separated supply source within the range 9 VDC to 230 VDC.

Supported communication protocols

- IEC 60870-5-101,
- IEC 60870-5-104,
- IEC 60870-5-103,
- HioCom2,
- Modbus
- other protocols supported by clients.

Modification and expansion of unit (greater chassis)

- AC supply source with charging and testing of accumulator,
- cards for digital galvanically separated inputs and outputs,
- cards for galvanically separated measurements of DC and AC currents and voltages,
- GPS card for exact time synchronizing.

Typical configuration of the set:

1,00	Chassis of the unit	RTU7M CASE-2
1,00	Bus	RTU7M BUS-2
1,00	Supply source	RTU7M PWRI-24D
1,00	Communication card	RTU7M COMIO-PC / GSM-232

Accessories for RTU units

Accessories for RTU units

Aerials

GSM aerials



GSM aerial 900/1800 MHz, magnetic, 5 dB, cable 3 m RG174, connector FME (f)

Ordering code	Type indication	Description
182812100001	GSM aerial 5dB FME	GSM magnetic aerial



GSM aerial 900/1 800 MHz, magnetic, 5 dB, cable 3 m RG174, connector SMA (m).

Ordering code	Type indication	Description
182812100005	GSM aerial 5 dB SMA	GSM magnetic aerial



GSM aerial YAGI, 12 dB, cable RG58 10 m, connector FME (f).

Ordering code	Type indication	Description
182812100007	GSM aerial YAGI FME	GSM outdoor aerial



GSM external aerial 2 dB, cable RG58 4 m, connector FME (f).

Ordering code	Type indication	Description
182812100004	GSM aerial 2 dB FME	GSM outdoor aerial

Accumulators

Backup accumulators

AKU 12 V/1,3 Ah

- Lead accumulator, dimensions 97×43×53 mm

Ordering code	Type indication	Description
90932000001210	AKU 12 V/1,3 Ah	Lead accumulator

AKU 12 V/4,5 Ah

- Lead accumulator, dimensions 90 × 70 × 107 mm

Ordering code	Type indication	Description
90932000001213	AKU 12 V/4,5 Ah	Lead accumulator

AKU 12 V/7 Ah

- Lead accumulator, dimensions 100 × 65 × 150 mm

Ordering code	Type indication	Description
90932000001216	AKU 12 V/7 Ah	Lead accumulator

AKU 12 V/12 Ah

- Lead accumulator, dimensions 151×98×101 mm

Ordering code	Type indication	Description
90932000001220	AKU 12 V/12 Ah	Lead accumulator

Clamp AKU for DIN 35

- Holder for backup battery on DIN rail

Ordering code	Type indication	Description
90932000002010	Clamping unit AKU on DIN 35	- Holder for backup battery on DIN rail



Technical specification

Voltage source $U_{vst} = 230 \text{ V AC}$,
 $U_{vyst} = 48 \text{ V DC}/1,5 \text{ A}$, clamping on DIN 35

Ordering code	Type indication	Description
151505111025	DR-7548	Supply source

Technical specification

Voltage source $U_{vst} = 230 \text{ V AC}$,
 $U_{vyst} = 24 \text{ V DC}/2 \text{ A}$, clamping on DIN 35

Ordering code	Type indication	Description
151505111010	DR-4524	Supply source



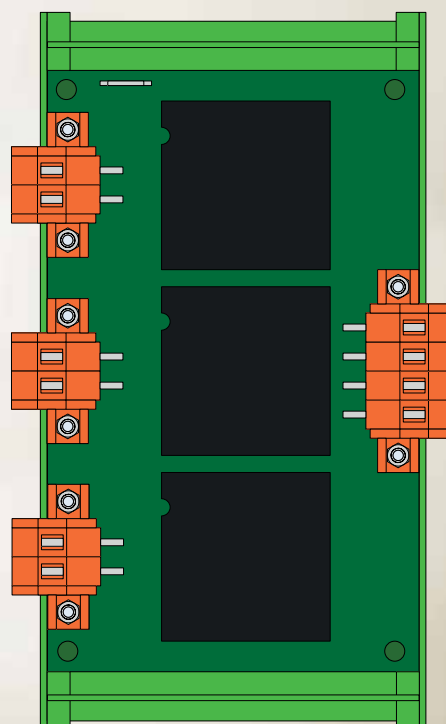
Measuring transformers

Measuring transformers for currents and voltage

Converters for the direct measurement of currents and voltage with output for measuring the inputs of RTU units.

Technical specification

Type indication	Description
EXT AI-MTI/1	3-phase measurement of currents: $I_{vst} = 1 \text{ A}$, $I_{vyst} = 10 \text{ mA}$
EXT AI-MTI/5	3-phase measurement of currents: $I_{vst} = 5 \text{ A}$, $I_{vyst} = 5 \text{ mA}$
EXT AI-MTI/100	1-phase measurement of currents: $I_{vst} = 100 \text{ A}$, $I_{vyst} = 20 \text{ mA}$
EXT AI-MTI/200	1-phase measurement of currents: $I_{vst} = 200 \text{ A}$, $I_{vyst} = 20 \text{ mA}$
EXT AI-MTI/300	1-phase measurement of currents: $I_{vst} = 300 \text{ A}$, $I_{vyst} = 20 \text{ mA}$
EXT AI-MTI/400	1-phase measurement of currents: $I_{vst} = 400 \text{ A}$, $I_{vyst} = 20 \text{ mA}$
EXT AI-MTI/500	1-phase measurement of currents: $I_{vst} = 500 \text{ A}$, $I_{vyst} = 20 \text{ mA}$
EXT AI-MTU/100	1-phase measurement of voltage: $U_{vst} = 100 \text{ V}$, $U_{vyst} = 1 \text{ V AC}$
EXT AI-MTU/400	1-phase measurement of voltage: $U_{vst} = 400 \text{ V}$, $U_{vyst} = 1 \text{ V AC}$



Accessories for RTU units

LCD display for RTU units

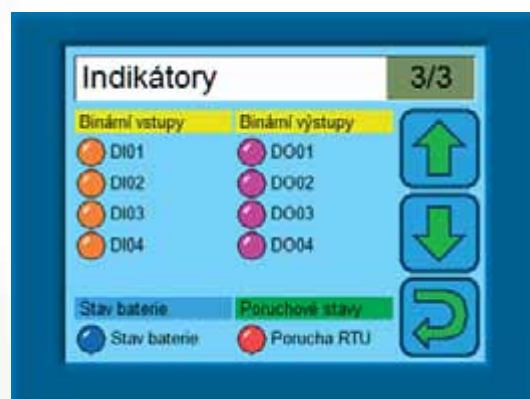
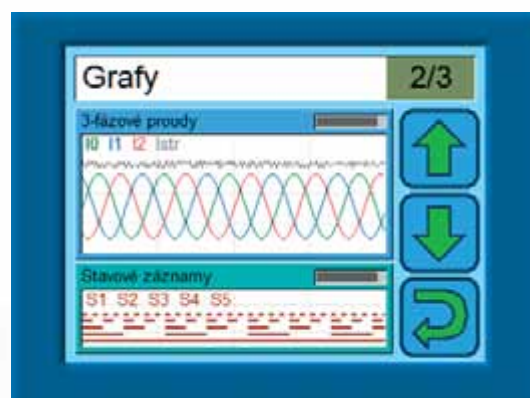
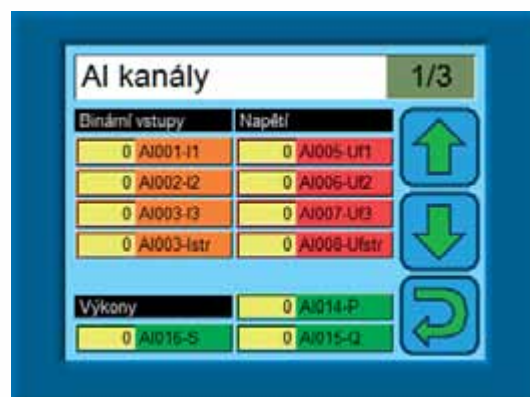
Basic properties

- LCD touch display (backlit)
- 1 button under the display
- direct communication with RTU unit
- display of numeric and graphic values
- control of statuses
- graphic user interface
- configuration by means of SW – User center
- update of firmware



Description of the module

The LCD display serves as a user interface for direct communication with RTU units. After connection to the unit by serial interface RS-485 it displays the actual status of individual measuring channels in the form of numeric value, graphic record or LED indication (ON/OFF). In addition, there is the option to control binary channels and to display error records. Due to the HW and SW variability of RTU units, it is necessary to configure the LCD display before using the specific unit. "LCD display editor" is used for this which is part of the RTU User center application. Using the graphic interface it is possible to easily create a specific appearance of individual displaying "pages". Each page defines the type and number of the channel, the manner of displaying the value and other data. Examples how such a set can look in reality are shown in the pictures. To save the created configuration and measured data, a built-in Flash type memory is used.



Ordering information

Ordering code	Type indication	Description
221322550800	ELT7	LCD touch display

Technical specification

LCD display	QVGA, TFT, 320x240 px, 262 thousand colours
Data interface	RS-485
Supply voltage	5 ±0,35V, DC
Accumulator	3.7V, 700mAh, Li-Ion, AA
Supply adapter	5V, max. 500mA, microUSB connector
Operating temperature	0 °C to +70 °C
Storage temperature	-30 °C to +80 °C

RTU unit firmware

Basic functions

Firmware for RTU7 units provides functions that are recommended for applications in the energy sector (3-phase measurement, integrated protection, signalling, control, ..., nevertheless, it can also be used in other general industrial applications for monitoring, control and automation where there is a requirement for high quality, reliability and a robust character of the delivered solution. RTU7 series units can measure with this firmware and also process analogue measurements, detect changes in digital signals, control digital outputs and other under mentioned functions. The firmware includes various standardized communication protocols for communication with the master system and with slave devices. It is possible to record this firmware into modular units as well as compact versions of RTU units from the RTU7 series.

Basic properties

- direct 3-phase voltage measurement (up to 6 channels) and currents (up to 12 channels)
- measurement of the supply voltage and accumulator voltage
- external accumulator tester
- digital filtration and measurement
- remote control for digital signals
- calculation of the effective values of measured signals
- calculation of further values (outputs, frequency, ...) from measured signals
- recording of the source of measured values
- support direct and indirect digital inputs, outputs and measurements
- support for communication protocols IEC 60870-5-104, IEC 60870-5-101, HioCom2 for communication with the master system
- support for communication protocol IEC 60870-5-103 (communication with external protections), Modbus, HioCom2 for communication with slave devices
- integrated protection: short circuit, excess current, ground directional, overvoltage, under voltage, frequency
- evaluation of current non-symmetry
- integrated automated systems: re-switching, disconnection in the case of unsuccessful reclosing
- remote setting of all parameters (communication, functional, protection, records, ...)
- option to connect external signalling or HMI (touch LCD panel)
- integrated interpretation of logical and relation expression
- option to record into modular and compact units
- typical applications in the energy sector: remote controlled section switches, reclosers, measurements in DTS (distribution transformer station), identification of failures in cable networks, photovoltaic and wind power plants and others

Description of firmware

Firmware processes measurements from input modules for direct measurements. The period of sampling and further

functions differ according to the modules used for measurement. If the module for measuring voltage and current is used, all protection functions and automated systems are used. The most frequently implemented current input is the two-range measurement with 8-multiple overloading. If only voltage inputs are used, only such protection is available which does not need to measure the current. If only modules with current inputs are used, protection is available which work with the values of the current. The input measurements are digitally filtered using the signal processor for the unit. In the case of 3-phase measurement of voltage and currents, the following values are deducted from phase voltage and currents: I1, I2, I3, I0, IS, U1, U2, U3, U0, U12, U23, U31, US, P, Q, S, $\cos \varphi$, $\cos \varphi_0$, f. According to the specific requirements of individual blocks of protection, the measurement values are taken from the whole spectrum or only from the first harmonic (usually the user can select the requested source of signal). The configuration will state which values and under which conditions they are transferred into the master (dispatch) system. The user can also select whether the changes are transferred with or without a time mark. For optimising the transfers it is possible to define a group transfer of selected measurements. Group transfer is also recommended if you want to know the values of selected measurements at the same time.

Digital signals are processed periodically according to set filters. In the case of the change of signal status, this status is transferred together with attributes into the master system (must be enabled in parameters). The support of one or two bit signals and the option for SW negation is a matter of course.

The control can be performed in one or two phases if higher security is required. In relation to HW units, security blocking of the control is also implemented (i.e. even in the case of failure of the main unit processor, there is no unwanted switching of output). The control of the power element from protection can be performed in a 2-pole manner (four digital outputs are used for control) or in a one and half pole manner (three digital outputs are used for the control).

The great advantage of the firmware for RTU7 unit series is that it is possible to record this firmware into modular as well as compact units. This ensures a higher quality of the delivered firmware and, moreover, provides clients with the option to select for them the most suitable HW solution and to keep SW functionality verified and tested on any type of the unit.

Protective functions

- over-current protection
- short circuit protection
- evaluation of current non-symmetry
- ground directional protection (option to combine more principles of detection)
- overvoltage protection
- under-voltage protection
- frequency protection (detection of low and high frequency in two stages)

IFC (fault current indicator) function, protection function

For each mentioned protection it is possible to separately define its parameters, such as the limits, permission for signalling of current, affection of protection (it is possible to define for each phase separately) and others. For signalling the impulse and affection, digital output can be defined. In addition, the signalling can be transferred into the master system. All protection can perform disconnections which must be enabled in parameters and also by means of a special signal for each protection (due to securing against unwanted disconnection). Automation functions can be implemented in the firmware.

- re-connection
- disconnection in the second voltage-free phase in the case of unsuccessful connection

It is possible to define in the parameters up to 6 various times for voltage connection. In the parameters for individual protection which enable re-connection, the maximum number of re-connection cycles is defined. The connection can also be modified by means of control when the dispatcher can select between any combination of fast and slow re-connection.

In addition to the standard protective functions mentioned above, the function of the second sectional switch is implemented. This function serves for disconnection of the second section switch in the case of the change in the power element of the first section switch without the intervention of operators. If defined changes in the power element occurs, the first US will automatically send the requested command to the section switch. In the case of a change in the power element, the controlled section switch sends this information to the control section switch. The section switch which controls, can control the compliance of the requested and the actual status of the second section switch and the result is signalled into the master system. For keeping the connection, the control section switch can send test messages in the set frequency. The functions for the control of the second section switch can be used, for example, to automatically control the renewable energy sources.

Indicator of failure currents

Units which are only fitted with measurement of currents can work in the mode for indicators of failure currents. Short-circuit, over-current and ground protection are implemented in the firmware along with the evaluation of the current non-symmetry. As in the case of all other firmware configurations, this configuration provides the option to produce measurement records for later analysis which will enable optimal setting of the protection parameters. All mentioned protection, if required, can disconnect the technology and can only signal the failure status. The signalling can be implemented through digital outputs and can also be transferred into the master system.

Records

Measured values of currents, voltage and flags P1 to P16 are recorded each second (indicating, for example an impulse or action from the selected protection). Records are stored in the external memory. The record is started by running

a flag (e.g. impulse from the ground directional protection), or it is possible to run the record by means of the signal. The manual running of the record is used with the advantage during commissioning of the unit when a short record provides exact information about the sequence order of the phase and any error in the connection. The length of records, as well as the running flags, is defined in the parameters of the records which can be set remotely (similarly as the other parameters of the unit). The memory with records can also be manually deleted, if necessary (by sending the respective signal).

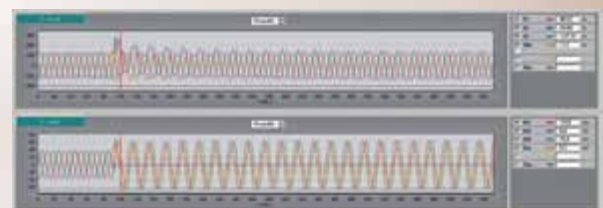
Expressions

It is possible to record user defined logical and relation expressions into the unit. In this manner it is possible to define into the unit new functionality without the necessity to modify firmware. Using a logical expression, it is possible to define permanent or impulse switching of digital outputs and the compounding of signals into general messages. The input in expressions can be a signal of measurement, including constants. It is possible to easily define expressions in the application User center. An example of the application of expressions in the RTU unit is the implementation of the regulation of the output for renewable energy sources.

Communication function

For the transfer into the master system it is possible to use standardized communication protocols IEC 60870-5-101 and IEC 60870-5-104, or company protocol HioCom2, which was especially developed for communication with RTU units in the GSM/GPRS network. In addition, implementation of DNP3 protocol is planned and possibly more if requested by clients. RTU7 series units are equipped with an external communication interface which the unit is able to communicate with the slave devices through protocols IEC 60870-5-103, Modbus and HioCom2. In addition, it is possible to connect to the unit signalling or the user terminal with the touch display.

An example of the use of communication with a slave device is communication with external protection by means of IEC 60870-5-103 protocol. The unit periodically reads data from the protection and maps it into its directory space. Measurement values which are periodically sent from the protection are filtered in the unit and transferred during the change, as well as the measured values that are transferred directly measured by the unit. In this manner it is possible to concert communication through protocol IEC 60870-5-103 to the communication with protocol IEC 60870-5-104. The firmware supports various protection from various producers.



Testing devices

Basic properties

- 3-channel current generator within the range 0 to 45mA AC and 0 to +/-60mA DC
- in expanded version 3-channel voltage generator within the range 0 to 7V AC and 0 to +/-10V DC
- protection of analogue outputs against overloading with indication
- 4xDI and in the expanded version 4xDO for testing of protection
- alpha-numeric LCD display with easy controlled rotary knob with integrated button
- supply from NiMH exchangeable accumulators or from external adapter
- integrated fast charger for accumulators
- USB 2.0 communication interface with galvanic separation
- wide range of user FW
- option of FW user upgrade according to the necessary functionality of the device
- higher FW version enables to generate failure waveforms gathered from protection (format COMTRADE, proprietary format of RTU units ,...)
- option to save generated courses directly in the internal memory of the device
- in specialized FW higher functions are available for testing protective functions
- SW toolkit for PC available

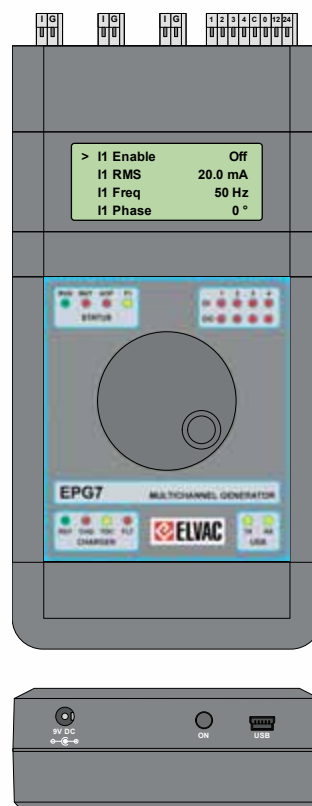
Description of EPG7

EPG7 is a compact generator of AC or DC 3-phase currents in the value of several tens of mA primarily designated for testing the correct function of the indicators of failure currents in M3Z and RTU units, or possibly other devices compatible through their parameters. It is possible to use the device as a simple process calibrator – the output current corresponds within the declared precision to the value shown on the display.

In the case of fitting with an expanding voltage card, the device enables to generate 3-phase AC or DC voltage in the value of several volts; 4 digital inputs and 4 digital outputs are available which can be used for advanced functions for testing protection.

All versions of the device are fitted with a 4-line LCD display and rotary knob with integrated control buttons. The USB interface serves for communication with user SW. Analogue outputs, digital outputs, digital inputs and USB interfaces are galvanically separated.

The device can be supplied from 4 NiMH AA accumulators or from an external adapter. During the supply from the accumulators the operating time is approximately 2 hours (valid for permanent generating 45mA AC currents on all outputs). Discharging of the accumulator is indicated by the LED diode. The internal fast charger is fitted with LED sig-



nalling of the charging process status. The time for charging the accumulator is approximately 2.5 hours.

Description of delivered HW variants

Basic

- 3 current AC/DC outputs
- 4 x DI
- FW basic
- without accumulators
- without adapter

Advanced

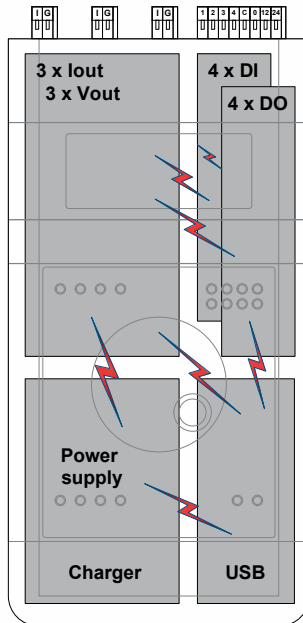
- 3 current AC/DC outputs
- 3 voltage AC/DC outputs
- 4 x DI
- 4 x DO
- FW basic
- accumulators are included in the delivery
- supply adapter is included in the delivery

Comfort

- as Advanced version
- portable box
- cables



Galvanic separation EPG7



Description of FW for device

Basic

The basic FW version enables to generate AC or DC currents. For AC waveforms a fixed frequency of 50Hz is set, the phase shift is 120°. The user only changes the amplitude of the generated signal – in the same manner in all phases. The option to control and read DI/DO. This SW module is always available.

Voltage generator

Generation of AC or DC currents and voltage. The functionality is the same as for basic FW. In addition, the option to control and read DI/DO is available.

Function generator

This enables to set independent amplitudes, frequencies and phase shifts on individual voltage and current outputs.

Record player

Option to play error records from protection (formats COMTRADE, RTU,...) – requires SW on PC.

IFC tester

FW provides functions for automatically testing indicators for failure currents.

Protection tester

Automatic testing of protection in RTU units.

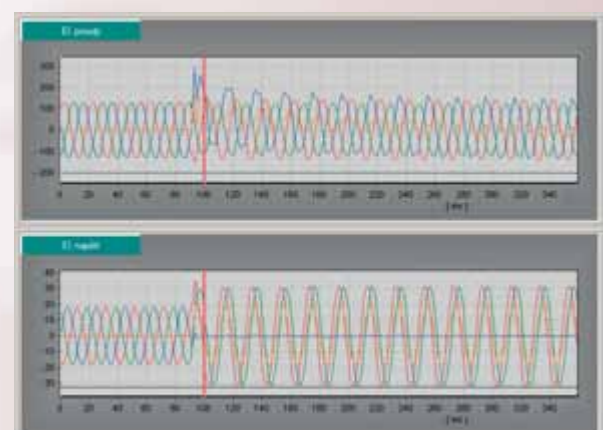
DI datalogger

Record of changes on digital inputs with time mark.

Individual modules can be mutually combined according to the requirements of the control user and to activate it is necessary to record into the device the respective licence linked with the serial number (if ordering the device together with the requested configuration of FW modules, the respective licences will be installed during the production).

User SW for EPG7

The EPG7 device is optionally delivered with user SW for PC (OS MS Windows). Some of the basic functions are updating firmware, implementation of the licence number for the FW module and the calibration of voltage and current channels. The number of functions accessible from the user interface corresponds to the options of the device according to the installed FW module licences. In addition to the comfortable control of all parameters (amplitude, frequency, phase ...), using the respective FW module licence, it is possible to read the error records generated by ELVAC RTU units, or any protection in the standard Comtrade format, to load them into the generator memory and then to generate it on its output. There is also the option to create your own waveforms of signals for specific testing purposes. It is possible to read the error statuses from the generator (diagnostics are available, as well as back checking of generated values) and time marks for digital input changes (DI generator). The user interface also enables to set digital outputs or parameters of routines for automatically testing RTU units (including simulation of the response of the power element). Bi-directional communication between the PC and the generator is ensured through HioCom2 communication protocol through the USB interface. For communication with the generator it is also possible to use the RTU-ComSuite SW package, which enables direct control of the generator from SCADA or the testing systems of third parties (through OPC, DDE, IEC 870-5-104...).



Testing devices



HW ordering information

Ordering code	Type indication	Description
802005550020	EPG7 BASIC	Generator EPG7 3xI 0-45mA AC, 4xDI, FW BASIC, without AKU
802005550030	EPG7 ADVANCED	Generator EPG7 3xI 0-45mA AC, 3xU 0-7V AC, 4xDI, 4xDO, FW BASIC, AKU, adapter
802005550040	EPG7 COMFORT	As Advanced version, in portable box, with connecting cables
802005550110	EPG7 U MODULE	Module with voltage outputs and DO
151502170050	GS40A09-P1J	Supply adapter
802005550120	EPG7 AKU	Accumulators NiMH for EPG7

FW ordering information

Objednáací kód	Typ. označení	Popis
Ordering code	Type indication	Description
802005550210	FWEPEG7-VG	FW for EPG7, generator voltage
802005550220	FWEPEG7-FG	FW for EPG7, functional generator
802005550230	FWEPEG7-RP	FW for EPG7, player of records
802005550240	FWEPEG7-IT	FW for EPG7, tester IPP
802005550250	FWEPEG7-PT	FW for EPG7, tester for protection
802005550260	FEPEG-DL	FW for EPG7, DI datalogger

EPG7 technical specification

Basic specification		
Display	LCD 16x4	
Control	Rotary knob with integrated button	
Supply voltage	9VDC	
Input protection	2.5A polyswitch	
Backup accumulator	4xNiMH AA, capacity 2100mAh max.	
Charging current for the accumulator	1.5A	
Protection for accumulator	2.5A polyswitch	
Dimensions	196 (207) x 100 x 40 mm	
Weight	1kg	
Temperature range	0°C to +50°C	
Storage temperature	-20°C to +75°C	
Surrounding relative moisture	30% - 95%RH non-condensing	
Coverage	IP20	
Current outputs		
Number of outputs	3	
Ranges of generated current	45mA AC / ± 60mA DC	
Precision of current generation	± 0.1% of the range	
Loading impedance	maximum 100Ω @ 45mA AC	
Range of frequency of generated current	40-350Hz	
Setting of the phase shift for individual outputs	0-360°	
Protection against disconnecting loop	Yes, indication of exceeding maximum loading impedance – LED AOF	
Processing of signal	16-ti bit D/A converter	
Connectors	2 x WAGO 734-102; pin spacing 3,5mm; part of delivery	
Cross section of the conductor	0.08-1.5mm2	
Digital inputs		
Number of inputs	4 digital inputs	
Signalling voltage	12V/24V	
Configuration of inputs	Active (switching by dry contact)	Passive (switching by outside voltage, both polarities)
Level H	Switched	11-40V
Level L	Disconnected	0-8V
Input current	6.6mA max.	2-6,6mA; 3.3mA@12V
Insulating voltage	1.5kV DC during 1 minute	
Connectors	2 x WAGO 734-108; pin spacing 3,5mm; part of delivery	
Cross section of the conductor	0.08-1.5mm2	
Communication interface		
Connector	Mini USB B, 5 pins	
Communication standard	USB 2.0	
Insulation	4 kV during 1 minute	



Technical specification expanding voltage cards for EPG7:

Voltage outputs	
Number of outputs	3
Ranges of generated voltage	7V AC / $\pm 10V$ DC
Precision of generation of voltage	$\pm 0.1\%$ of the range
Output current	maximum 30mA AC
Range of frequency of generated voltage	40-350Hz
Setting of the phase shift for individual outputs	0-360°
Protection against overloading	Yes, indication of the connection lower loading impedance than permitted – LED AOF
Processing of signal	16-bit D/A converter
Connectors	2 x WAGO 734-102; pin spacing 3,5mm; part of delivery
Cross section of the conductor	0.08-1.5mm ²
Digital outputs	
Output	DO1-DO4
Insulating voltage	3750 Vrms during 1 minute
Loading capacity of switches	1.75A@35V AC, 2.5A@50V DC
Resistance in switched status	0,1 Ω maximum
Connectors	1 x WAGO 734-108; pin spacing 3,5mm; part of delivery
Cross section of the conductor	0.08-1.5mm ²

EPG7 HP – prepared device

Basic properties

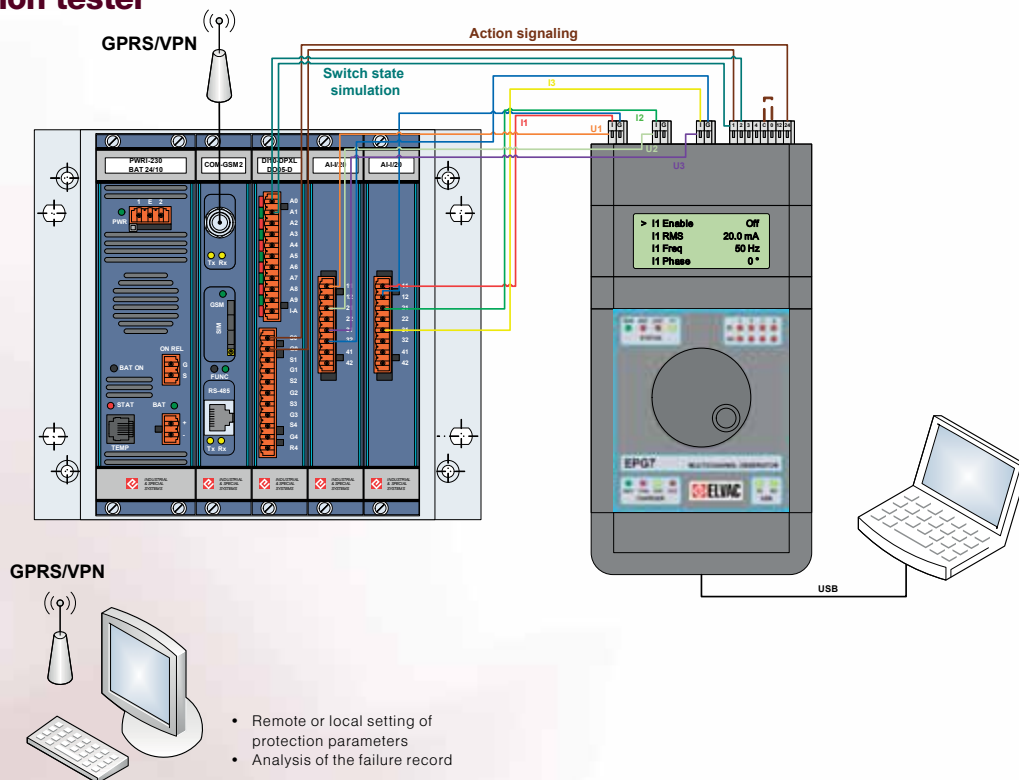
- output version of the EPG7 generator
- 3-channel current generator within the range 0 to 10A AC
- 3-channel voltage generator 0 to 150V AC
- frequency range on current and voltage channels 40-350Hz
- fluent setting of phase shifts between individual outputs
- protection of analogue outputs against overloading with indication
- 4xDI and in the expanded version 4xDO for testing of protection
- recommended for testing protection of RTU7 units with inputs 1A, 5A, 100V
- the device is located in the portable box
- alpha-numeric LCD display with easy controlled rotary knob with integrated button
- supply from internal accumulators or from 230V AC
- integrated charger for accumulators
- USB 2.0 communication interface with galvanic separation
- wide range of user FW
- option of FW user upgrade according to the necessary functionality of the device
- higher FW version enables to generate failure waveforms gathered from protection (format COMTRADE, proprietary format of RTU units ,...)
- option to save generated waveforms directly in the internal memory of the device
- in specialized FW higher functions are available for testing protective functions
- SW toolkit for PC available

Testing devices

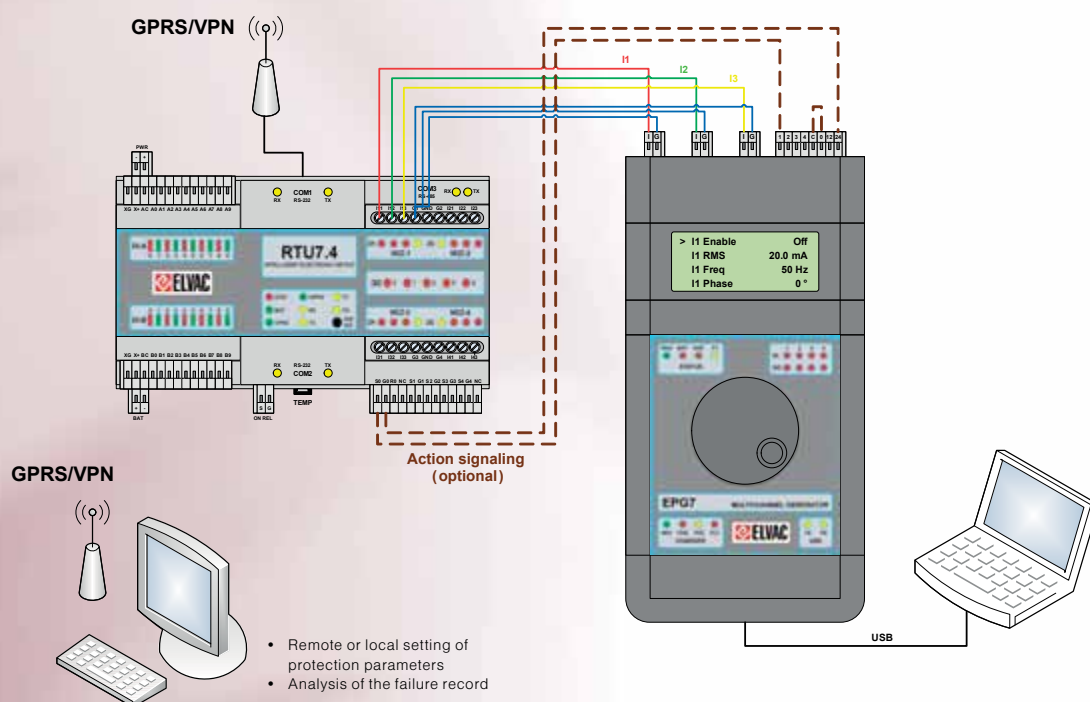


Examples of EPG7 generator use

Protection tester



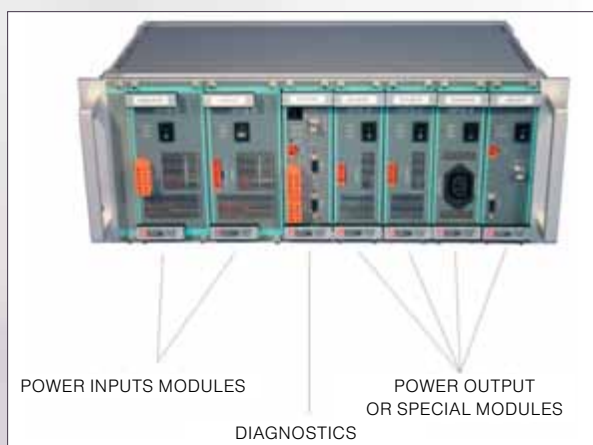
Tester for indicators of current failure



Redundant power supply RPSII

Redundant power supply RPSII

In many critical applications, the necessary prerequisite is ensuring permanent power to key devices regardless of any power grid blackout. Regularly, this requirement is solved using battery backup power sources (UPS), which however is not always the only possible and technically feasible solution. UPS ensures power supply only for a limited period provided by the capacity of the accumulators, while the accumulators are a frequent source of problems in the long run, because their capacity drops with time and it is necessary to ensure regular maintenance. In order to ensure a reliable power source for electronic control systems, the option for power from two independent electricity supplies: one primary supply and a centrally administered accumulator backup, seems to be a suitable alternative. For this purpose, the redundant power source of the RPS II series is a more powerful and sophisticated successor to the original RPS series.



The source is a fully modular concept with extensive diagnostic functions. Two input modules serve for connecting independent power supplies of various voltage levels, which allows to use two supplies of grid voltage 230 V AC or any combination of alternate or direct current input voltages (e.g. 230V AC and 24V DC). The input modules supply a constant voltage of 28V DC to the bus and in regular operation, they share the load evenly. Their task is also to ensure galvanic separation from individual supplies.

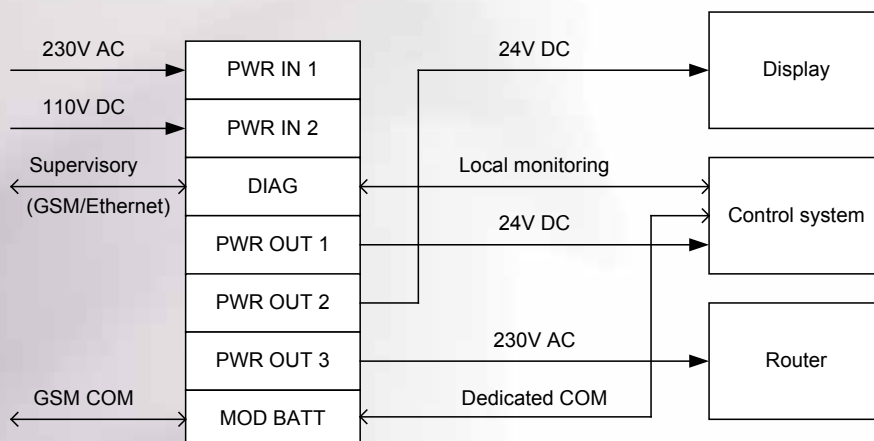
It is possible to fit up to 4 independent output modules that ensure both conversion to the required output voltage level and also overcurrent limitation, possibly also further galvanic separation for individual outputs into the output positions.

All input and output modules are replaceable in operation, which allows for replacement of a damaged module or exchange for a different type without the necessity of turning off the entire equipment. The unit is suitably complemented by a diagnostic module in the design with an Ethernet or GSM interface for remote supervision and control of the equipment. The diagnostics provide information about the current condition of individual modules, the voltage and supplied or consumed currents. Furthermore, the fans in the cabinet and the temperature at each module are checked.

The RPS II source is an ideal power centre for important technological equipment and instruments.

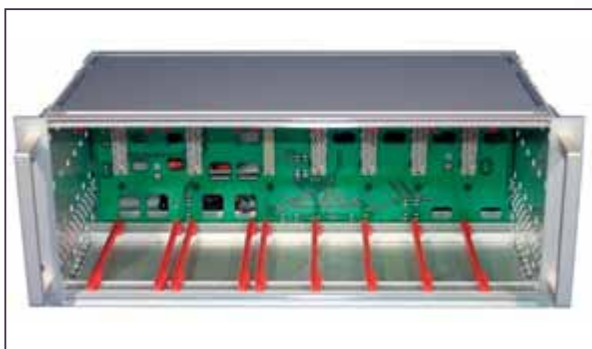
Typical areas of use – powering up

- control systems in energy production
- control systems for important technological lines and machines in industry
- telecommunication systems and industrial data network
- mobile measurement systems (vehicle installations, powering up from “on board” 12/24V DC or external lead 230V AC, switching between sources with no interruption to powered devices in operation)



Basic properties

- 2 positions for input supply modules
- 4 positions for output supply modules
- 1 position for diagnostic card
- width 19" (482.6mm)
- height 4U (177mm)
- internal and external dimensions are in accordance with IEC 60 297-3-101, 102, 103
- EMC/EMI compatibility



General description

The frame and metal sheets of the case are made of high quality aluminium alloy with surface treatment by eloxation. The case is characterized by high mechanical stability and is used for assembly into a 19" construction. In the case where it is fitted with a bus there is space for 7 modules. In positions 1 and 2 it is possible to mount input modules; position 3 is used for a diagnostic card and positions 4, 5, 6 and 7 are used for output modules. The bus ensures the merger of the outputs of both input modules, the division of outputs between these modules in common operation, separation of a disconnected or damaged module in the case of failure of one of the modules. From the merged 28.3V voltage, the auxiliary 12V voltage is stabilized which serves for the supply of thermally regulated fans and the control parts of the output modules. The stabilization of voltage for 12V is performed by two stabilizers in a redundant connection to increase the reliability (voltage 12V A, 12V B). If the diagnostic card is occupied, the values of voltage 28V, 12V A, 12V B are measured and transferred to the master system. The maximum total permanent output delivered by all output modules connected to the bus is 250W.

Ordering information

Ordering code	Type indication	Description
121013550003	RPS II-CASE	Frame with bus and fans

Technical specification

Module	RPS II-CASE
Internal and external dimensions	In accordance with IEC 60 297-3-101, 102, 103
Width	482,6 mm - 19" (84HP)
Height	177 mm - 4 U
Depth	245 mm
Power consumption	Max. 15 W
Temperature range	-20 °C to +60 °C
Storage temperature	-30 °C to +75 °C
Ambient relative moisture	30 %-95 % RH non-condensing
Coverage	P20
Shocks and vibrations	According to IEC 61587-1, EN 50 155

Redundant power supply RPSII

RPS II – input supply modules

Basic properties

- redundant mode
- Hot-Swap
- Isolation input/output 2 kV AC (during 1 minute)
- output 280W
- measurement of output voltage, current, temperature of module
- function of protection (over-current, short-circuit, over-voltage and under-voltage)
- signalling LED for indication of the status of the module
- remote control and monitoring (with diagnostic card)
- remote upgrade firmware (with diagnostic card)
- wide range of input supply voltage

General description

It is possible to fit the frame of the RPSII source with two input supply modules. These modules ensure the redundancy of the whole supply system. To keep full redundancy the total consumed output from these modules must not exceed 280 W. The proportional division of the delivered output is ensured from the input modules if they are both installed. The modules are designed as Hot-Swap, which means that they can be replaced during the operation of the supply source without the influence of the remaining modules. The modules are produced for a wide range of input voltages. Modules with various input voltages can be combined.

Input modules are fitted with DC/DC converters which transform the input voltage to 28.3V. In addition, the converters ensure galvanic separation between the input supply units and distribution of 28.3V voltage on the busbar.

This voltage serves for the supply of the power parts of the input modules and the diagnostic card. Input supply modules communicate with the other modules on the internal communication bus.

Each input supply module is equipped with its own measurement of the output current and voltage. This data is used for a built-in protection function (short-circuit, above-current, over-voltage and under-voltage). The short-current

protection cannot be parameterized; it is resolved on the module in two methods. The first method is the hardware solution, electronic current fuse.

The second method is the software solution during which the short-circuit from the measurement of the output current and the voltage is evaluated by the processor. The over-current, under-voltage and over-voltage protection is evaluated from the measured current and voltage by the processor and is parameterized from the master system; it is also possible to enable or disable these protections.

On the modules is a thermal sensor that evaluates the temperature near the power elements and transfers the measured values into the master system. The output modules communicate with the input modules, or with the diagnostic card on the internal bus.



Ordering information

Ordering code	Type indication	Description
121013550005	RPS IHN 230V AC/DC	Input supply module 230 V AC or DC
121013550008	RPS II IN 24 V DC	Input supply module 24 V DC
121013550007	RPS IHN 48 V DC	Input supply module 48 V DC
121013550006	RPS IHN 110 V DC	Input supply module 110 V DC

Technical specification

Module	RPS IHN 230V AC/DC	RPS IHN 24 V DC	RPS IHN 48 V DC	RPS IHN 110V DC
Input supply voltage	230 V/50 Hz AC (+/-10 %) 230 V DC (210 V-380 V DC)	24 V DC (20-30 V DC)	48 V DC (38 V-72 V DC)	110V DC (90 V-170 V)
Input current	1,3 A (max. 2 A)	12,5 A (při 24 V DC)	6,25 A (při 48 V DC)	2,8 A (při 110 V DC)
Protection of input	Fuse 5 A F	Fuse 25 A F	Fuse 20 A F	Fuse 10 A F
Output voltage	+28,3VDC (280W)			
Galvanic insulation	Galvanic isolation input/output 2kV AC (for 1min.)			
Connector	WAGO 231-306/026-000			
Temperature range	-20 °C to +60 °C			
Storage temperature	-30 °C to +75 °C			
Ambient relative moisture	30 %-95 % RH non-condensing			
Coverage	P20			
Possible position of insertion into bus	1,2			

RPS II - output supply modules

Basic properties

- Hot-Swap
- measurement of output voltage, current, module temperature
- function of protection (over-current, short-circuit, over-voltage and under-voltage)
- signalling LED for indication of the status of the module
- remote control and monitoring (with diagnostic card)
- remote upgrade firmware (with diagnostic card)

General description

The frame of the RPSII source can be fitted with up to 4 supply output modules (positions 4-7 in the frame). The total maximum output consumed from these modules is 250W while keeping full redundancy on the part of the input modules. The modules are designed as Hot-Swap. This means that they are replaceable under the operation of the source without the influence of the function of the remaining modules.

Each output supply module is fitted with its own measurement of current and voltage – this data is used for the built-in protection function (short circuit, over-current, under-voltage and under-voltage).

The short-current protection cannot be parameterized; it is resolved on the module in two methods. The first method is a hardware solution, electronic current fuse. The second method is a software solution during which the short-circuit from the measurement of the output current and the voltage is evaluated by the processor. The over-current, under-voltage and over-voltage protection serves for the protection of equipment connected to the output terminals of the module against the exceeding of parameters

which can occur in the case of failure of the module. This protection is evaluated from the measured current and voltage by the processor and is parameterized from the master system; it is also possible to enable or disable this protection. On the modules there is a thermal sensor which evaluates the temperature near the power elements and transfers the measured values into the master system. The output modules communicate with the input modules, or with the diagnostic card on the internal bus.



Ordering information

Ordering code	Type indication	Description
121013550011	RPS - OUT 12 V DC	Output supply module 12 V DC
121013550012	RPS - OU 24 V DC	Output supply module 24 V DC
121013550009	RPS - OUT 24 V DC/I	Output supply module 24 V DC insulated
121013550010	RPS - OUT 48 V DC/I	Output supply module 48 V DC insulated
121013550013	RPS - OUT 230 V AC	Output supply module 230 V DC

Technical specification

Module	RPS II-OUT 12 V DC	RPS II-OUT 24 V DC	RPS II-OUT 24 V DC/I	RPS II-OUT 48 V DC/I	RPS II-OUT 230 V AC
Input supply voltage	12 V DC	24 V DC		48 V DC	230 V AC/50 Hz (modified sine curve)
Output current	1,5 A (18 W)	5 A (120 W)	3,75 A (90 W)	1,9 A (90 W)	0,4A (90 W)
Tolerance	±3 %		±2 %		±5 %
Galvanic isolation	No isolation		2 kV AC (during 1 min.)		No isolation
Connector	WAGO 231-306/026-000				Coupler socket EURO
Temperature range	-20 °C to +60 °C				
Storage temperature	-30 °C to +75 °C				
Ambient relative moisture	30 %-95 % RH non-condensing				
Coverage	P20				
Possible positions of insertion into bus	4, 5, 6, 7				

Redundant power supply RPSII

RPS II - diagnostic card

Basic properties

- Hot-Swap
- interface GPRS/Ethernet
- 4 digital inputs
- 2 digital outputs
- internal and external thermal sensor
- 2 x series port, galvanic-isolated
- monitoring of voltage on the bus and revolutions of fans
- controls for charging the backup accumulator (12V)
- signalling LED for indication of the status of the module
- enables the master system to communicate with individual modules
- enables remote control and monitoring of modules
- remote firmware upgrade

General description

It is possible to equip the frame of the redundant RPSII supply source with a diagnostic card with many functions and built-in peripherals. In terms of the design, the card is derived from RTU units which are also produced by ELVAC IPC s.r.o. The card, similarly as the other modules, communicates with the surroundings via the HioCom2 protocol.

The function of the diagnostic card is to monitor the internal supply voltage on the bus of the RPSII frame, the revolutions of the fans in the frame, to control the charging of the backup accumulator (external or on the MOD BATT module). In addition, the diagnostic card enables the master system to communicate with the individual modules, enables remote monitoring and controls the module.

There are the following peripherals on the diagnostic card; 2 digital outputs (switching relay contact), 4 digital inputs (active, 24V, other configurations are possible), input for external thermal sensor, 2

series galvanic-separated ports.

Using these peripherals it is possible to control, monitor or communicate with other equipment within the technology. The supply of the module of the diagnostic card is backed up by means of the accumulator which can be external or located on the MOD BATT module directly in the frame of the RPSII supply source.

The diagnostic card enables mounting of various GPRS, Ethernet, or other communication interfaces according to the requirements of the client (RS-232, RS-485, CLO, optical).



Ordering information

Ordering code	Type indication	Description
121013550016	RPS II-DIAG GPRS	Communication with master system through GPRS
121013550015	RPS II-DIAG NET	Communication with master system through Ethernet

Note: It is possible to also deliver with other communication interfaces, see modules RTU7M (RS-232, RS-485, CLO, optical)

Technical specification

Module	RPS II-DIAG GPRS	RPS II-DIAG NET
Communication interface with master system	GSM/GPRS module	Ethernet module
Digital inputs	4 pcs, active (switching by dry contact), current input 5.9 mA, galvanic separation 3.75 kV AC (during 1 min.), signalling of excitation 4x LED	
Digital outputs	2 pcs, switching contact relay, max. switched voltage 30 VDC/250 VAC, max. switched current 5 A, galvanic separation 3.75 kV AC (during 1 min.), signalling of excitation 2x LED	
Series ports	2 pcs, RS-232 (TxD, RxD), connector Canon DB9/F, galvanic separation 1 kV AC (during 1 min.)	
Other interface	Connector for external thermal sensor	
Charger of backup accumulator	12 V/0.3 A (changes for max. voltage 13.8 V)	
B. Intermediate consumption	Max. 300 mA	
Connectors	FME, WAGO 231-302/026-000, 231-304/026-000, 231-305/026-000	RJ45, WAGO 231-302/026-000, 231-304/026-000, 231-305/026-000
Temperature range	-20 °C to +60 °C	
Storage temperature	-30 °C to +75 °C	
Ambient relative moisture	30 %-95 % RH non-condensing	
Coverage	P20	
Optional positions for insertion into the bus	3	

With the aim of meeting the requirements of the clients, ELVAC IPC s.r.o. is constantly expanding its product portfolio. One result of this is the expansion of the series of output modules for the frame of the RPSII source by special modules. This is specialized equipment which has another function other than supply and uses a redundant supply provided by input modules mounted into the RP-

SII frame and the compact character of the design of the whole frame. Another advantage is the option of remote control and monitoring if a diagnostic card is installed.

RPS II - MOD BATT

Basic properties

- Hot-Swap
- integrated GSM/GPRS modem with RS232 interface
- the accumulator for the diagnostic card is integrated on the card backup.
- internal thermal sensor
- signalling LED for indication of the status of the module
- remote control and monitoring (with diagnostic card)
- remote upgrade firmware (with diagnostic card)



General description

This concerns the special output module which integrates the GSM/GPRS modem with the RS-232 interface together with the backup accumulator which is used for the backup of the supply diagnostic card. The frame for the RPSII source can be fitted with one to four MOD BATT modules.

If the frame of the source is fitted with a diagnostic card, the RPSII-MOD BATT module provides the master system with information concerning the supply voltage of the GSM/ GPRS module, the temperature of the accumulator, status of the switch, status of the modem and the position of the module in the frame.

Ordering information

Ordering code	Type indication	Description
121013550020	RPS II-MOD BATT	Communication with master system through GPRS
121013550022	RPS II-MOD BATT2	Communication with master system through GPRS/ EDGE

Technical specification

Module	RPS II-MOD BATT
Modem	GSM/GPRS modem (Enfora Enabler II-G)
Serial ports	RS-232 (TxD, RxD, RTS, CTS, STR, DSR, RI, CD), connector Canon DB9/F, ESD protection on all 15kV lines
Charger for backup accumulator	Lead pressurized accumulator 12V/1.3Ah (WP 1.3-12)
Power consumption	Max. 150 mA
Connector	FME, WAGO 231-302/026-000
Temperature range	-20 °C to +60 °C
Storage temperature	-30 °C to +75 °C
Ambient relative moisture	30 %-95 % RH non-condensing
Coverage	P20
Possible positions of insertion into the bus	4, 5, 6, 7

Redundant power supply RPSII

RPS II – accessories

Ordering information

Ordering code	Type indication	Description
121013550031	RPS -OUT230 CAB	90cm cable for connection of the RPSII-OUT230VAC module with equipment supplied by 230V AC
121013550032	RPS -BATT CAB	60cm cable for connection of RPSII-DIAG and RPSII-MOD BATT modules
121013550033	RPS -COM CAB	2m communication cable (RS-232) for RPSII and PC interconnection
121013550034	RPS -CAB-24	1.4m cable for connection of the RPSII-OUT24VDC module and the supplied DC equipment
121013550035	RPS -MCS CAB	1m cable for connection of the RPSII-OUT24VDC module to the MCS system
121013550036	RPS -TEMP CAB	2m cable with thermal sensor for connection to RPSII-DIAG
182812100001	ANTENA	GSM due aerial, magnetic, 5dB, connector FME (f)

Special cards and modules

Special cards and modules

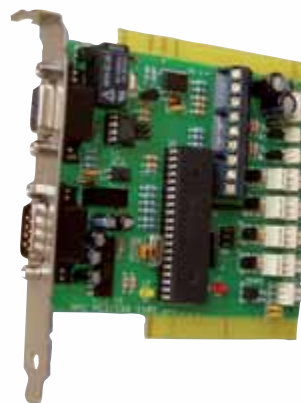
MPC cards – monitor cards for PC

Description of functions

The standard use of the MPC card is based on linkage with the extending SNMP agent for the Windows operating system (product ELVAC IPC, s.r.o.), which ensures comprehensive remote monitoring of the operation of a PC. As the central node for monitoring of an "unlimited" number of such an equipped PC, the RTUComCenter or GlobalWatchII monitoring system is used. On request it is possible to deliver the specification of the communication protocol of the MPC card for integration into the client SW. Parameters are stored in the EEPROM or FLASH memory of the processor. It is possible to set, e.g. the frequency of sending messages, for analogue inputs (voltage, revolutions, temperature) filtration and the max./min. limits and time of duration; for binary inputs the time filters for changes.

Basic properties

- measuring of temperatures
- measurement of ventilator revolutions
- 7x measurement of DC voltages from PC power supply
- signalling of status by LED
- galvanic-isolated binary inputs
- communication through RS-232 series interface
- four free I/O pins
- status output through switching relay contacts
- optical or acoustic signalling of statuses
- supply directly from PCI or ISA bus or from traditional PC connector



Ordering information

Ordering code	Type indication	Description
124040100004	MPC PCI/ISA	Monitoring card for PC
124040100010	MPC	Monitoring card for PC

Technical specification

Module	MPC PCI/ISA	MPCII
Communication with master system	RS-232, without galvanic isolation	
Supply voltage	5 a 12 V DC	
Power consumption	1,5 W	
Binary inputs	2× DI, galvanically isolated	
Measurement of voltage source	measurement +3,3 V, +5 V, +12 V, -5 V, -12 V	
Binary outputs	1× DO, contact relay	
Measurement of revolutions of ventilators	4x measurement of revolutions	7x measurement of revolutions
Thermal sensor	2× internal, 2× external measurements of temperature	
Connectors	CAN 9M, CAN 9F	CAN 9M, CAN 9F
Temperature range	-20 °C to +60 °C	
Storage temperature	-30 °C to +75 °C	
Ambient relative moisture	30 %-95 % RH non-condensing	
Mounting	PCI/ISA bus	screw mounting holes

Diagnostic cards MPC3

Basic properties

The MPC card can be used either in relation to the expanding SNMP agent for Windows systems (available free of charge), or it is possible to service it through the RTUComCenter communication server, which enables access to data by means of a standard interface for further user applications.

Description of functions

Measuring of temperature

The temperature is measured within the range from -55 to 125 °C, from -10 to 85 °C with the provision ± 0.5 °C. Up to 4 thermal readers can be connected.

Measurement of revolutions

The card is fitted with 8 connectors for connection of 3-conductor ventilators and for gathering information regarding the revolutions back to the motherboard. Four LED signal lamps serve for indicating the status



Measurement of voltage

Four inputs are available for measurement of positive voltage and two inputs for negative voltage (max. 15 V) The status of these two inputs is merged into one signalling LED.

Binary inputs

Two digital inputs are designed for reading the status of the redundant sources. Inputs are optically separated by means of optical units. For switching, a voltage of approximately 2 V of any polarity is necessary. The statuses of these inputs are indicated by means of LED8 and LED9.

Communication

The expanded version of the card is fitted with a communication module which provides data through series line, Ethernet or GSM modem

Technical specification

Diagnostic card	MPC3 (basic version)	MPC3 (expanded version)
Measurement of internal temperature	4× internal thermal sensor	
Range of measurement of internal temperatures	Range -40 °C to 125 °C precision $\pm 1,3^{\circ}\text{C}$ within the range 25 °C to 85 °C	
Measurement of external temperature	-	1× external thermal sensor
Range of measurement of external temperatures	Measuring range -55 to 125 °C, precision $\pm 0,5$ °C within the range -10 °C to 85 °C	
Measurement of ventilator revolutions	4× ventilator with the output OC	
Measurement of voltage	4× input for measurement of positive voltage and 2× input for measurement of negative voltage (max. voltage 15 V resp. -15 V)	
Checking the status of the redundant source	2× binary inputs PWR sensitivity 1.5 V-5 V (connection of info from redundant source)	
Digital input	-	1 digital input, passive, level L 0-4 V, level H 8-28 V (option to mount active inputs, or at other voltage)
	-	1× ALARM, 2× general switching contacts (contact relays 50 V/1 A AC/DC)
WDT functions	-	ANO, 1× contact for resetting the device
Communication with supervising system	-	optional interface Ethernet, RS-232, RS-485, GSM/GPRS
Optical signalling	10× two-colour LED (4× ventilators, 2× temperature, HDD, voltage, 2× redundant source)	
Sound signalling	1× buzzer (possible to disconnect)	
Supply	5 V and 12 V from PC (from external source)	
Consumption	1 W	3 W
Assembly	4× assembly hole, diameter 3.2 mm	PCI, PCI Express, ISA
Dimensions	168 mm × 82mm	109 mm × 100 mm
Other info	Speaker 40 × 40 mm 8 Ohm, 0.2 W	
Temperature range	-20°C to 55°C	
Storage temperature	-30°C to 75°C	
Surrounding relative moisture	30 %-95 % RH not condensing	
Coverage	P20	

GPSTime – PC time synchronization by GPS satellite system signal

Description of the system

GPS (Global Positioning System) is a network of satellites transmitting coded information enabling the exact specification of position and time (UTC, Coordinated Universal Time) anywhere on the surface of the Earth. For the exact specification of the mentioned values it is necessary to process signals from further satellites at the same time and, therefore, the receiver must be located in a place with the best view of the maximum area of the sky in order to be able to receive and uncode very weak signals. From a simplified viewpoint, the under mentioned system of time synchronization works as a clock with the distinguishing of milliseconds synchronized for UTC. The contribution for the computer control or recording system is the exact time value common for all computers irrespective of their geographic location.

PC card GPS-2BP (ISA)

The core of the card is the microcontroller generating the synchronized date and time. The implemented algorithm precisely identifies the validity of the GPS data of the receiver signalling connection to the UTC and after the fulfilment of a series of conditions it enables the synchronization of the internal time of the PC card. The circuit structure can be divided into two basic blocks. The detection block and the processing of signals received from GPS enables to mount a thermally stable oscillator ensuring the generation of time in a non-suspending status with a deviation lower than 5ms for nearly a 30-minute breakdown of the connection of the GPS receiver. The second part of the board is the block for data transmission simulating the function of the GPS receiver for further subordinated cards through the second RS-422 interface. Such a solution ensures with minimum cost, the mutual synchronization of the time of further computers with the connection to UTC. An important property of GPS-2 is the option of supply from a backup accumulator source. In the case of the temporary breakdown of the source of the host computer, the function of the system remains kept and subordinated GPS cards may work without interruption of the activity. In addition to the variant solution according to the stability of the oscillator, the GPS-2 card is alternatively delivered with an integrated supply source for the external converter and GPS receiver..

Ordering information

Ordering code	Type indication	Description
802002221040	GPS-2BP	PC card for ISA bus
802002221030	GPS-11BP	PC card for PCI bus
802002221010	GPS-31	Converter + GPS aerial

PC card GPS-11BP (PCI)

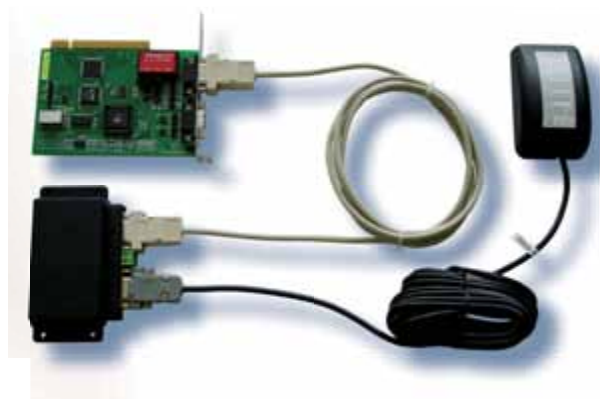
GPS-11 is an actual type of PC card used for installation into a PCI bus. It contains a driver fulfilling the requirements of PCI Bus rev. 2.2 variant 32 bits, 33 MHz, 5V. The card is functionally of analogue type GPS-2 and with the exception of the operation with an accumulator; it is delivered in variants according to the stability of the oscillator and the integrated supply source for the GPS-31 external converter.

GPS-31 converter + GPS aerial

The selected type of GPS aerial must be installed in a place where the aerial has a direct view of the GPS satellite system. For this reason the assortment has been expanded by a special converter of the signal from the GPS of the aerial for RS-422 enabling to locate the GPS aerial at a distance of tens up to hundreds of metres from the computer with the installed GPS card. It is necessary to add that both described GPS-2 and GPS-11 cards exclusively support the RS-422 interface and, therefore, require the presence of a GPS-31 converter.

SW support

The driver and DLL library are delivered together with supplied HW sets for reading the exact time, synchronization of PC time and configuration. The system also includes a small testing program and particularly the service for OS Windows which in regular intervals automatically synchronizes the PC system with world time. For the use of cards under another OS, the description of servicing is available. For ISA cards, examples in the Turbo Pascal programming language are available.



Basic properties

- converter for USB communication to various physical interfaces (changed by user)
- carrier for all replaceable modules of the CIOMOD-xyz series
- USB 2.0 Full Speed compatible
- galvanic separation 2kV AC (with CIOMOD-232 and CIOMOD-485 modules)
- ESD protection on the part of the USB interface
- ESD protection for replaceable CIOMOD modules
- transmission speed 300bps up to 1Mbps with CIOMOD-232 and CIOMOD-485 modules)
- with the CIOMOD-GSM module it is possible to use the converter as a USB (E)GPRS modem
- Virtual COM Port drivers available for series OS (Windows, Linux, Mac OS)



Description of the converter

Universal USB converter serves as carrier for communication modules for CIOMOD-xyz series. It converts USB communication to various physical interfaces. Communication is through Virtual COM port drivers. The installed communication interface (module CIOMOD) is mapped in OS as a serial line. Individual modules can be easily replaced by the user according to requirements for the respective type of physical communication interface. The CONV7 converter can be used as a service communication interface between the PC and User center and RTU-7/M series units.

The delivery includes 1m USB cable, CD with drivers, user manual and set of replaceable faces for various types of modules. For the CONV7-GSM converter with the CIOMODGSM module the delivery includes the aerial.

Individual modules in the CIOMOD series can be ordered separately

Support in OS

Virtual COM Port drivers are available for the following OS:

- Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows
- Server 2008 R2
- Windows Mobile 2003, Windows Mobile 2003 SE, Windows Mobile 5, Windows Mobile 6, Windows Mobile 6.1, Windows Mobile 6.5, Windows CE 6.0
- Mac OS X
- Linux (drivers are part of the core from version 2.6.31)

Ordering information

Ordering code	Type indication	Description
80200655100	CONV7-UNI	USB converter without CIOMOD module
80200655110	CONV7-232	USB converter with module CIOMOD-232
80200655120	CONV7-485	USB converter with module CIOMOD-485
80200655130	CONV7-GSM	USB converter with module CIOMOD-GSM ((E)GPRS modem)
80200655140	CONV7-OPT	USB converter with module CIOMOD-OPT
80200655150	CONV7-BT	USB converter with module CIOMOD-BT

Technical specification

USB interface	USB 2.0 Full Speed compatible
Connector	USB B
Off-take from USB port	Max. 500 mA (max. 1A when using the module COMIO-GSM)
Insulation	2kV AC during 1 minute (for modules CIOMOD-232 and CIOMOD-485)
Communication speed	300bps – 1Mbps (for modules COMIO-232 and COMIO-485)
Drivers	Windows, Linux, Mac OS (see text)
Temperature range	-20°C to +55°C
Storage temperature	-30°C to +75°C
Surrounding relative moisture	30% - 95%RH non-condensing
Coverage	IP20
Dimensions	94.5 x 63 x 28 mm
Weight	approx 0.1 kg

Notes:

SW support

RTU Communication Suite

Brief characteristics

- parameterization of RTU units and similar devices (redundant RPS II sources or MPC diagnostic cards)
- archiving of parameters in the database or XML files
- diagnostics of units and connected technologies
- regular display of actual status of units
- recording of communication with units into the file
- control of unit outputs
- mediation of communication of the control or visualization system with units
- record of communication with control and visualization system into the file
- support for DDE and OPC standards, support for IEC 60870-5-101 and IEC 60870-5-104 communication protocols
- various system technologies
- option for redundant installation in the mode of hot backup

Basic description

The RTU Communication Suite is a set of programs that enable complete and comfortable service of RTU units and similar devices. Using these programs it is possible to use the full potential of the mentioned devices. The communication suite consists of the following programs:

- RTU Communicator
- RTU User center

The RTU Communicator ensures own communication with serviced devices and with the master control and display (SCADA) system and the RTU User center provides the user of the Communication suite with a comfortable graphic user interface. The Communication suite includes the Microsoft SQL database server.

Communication suite installation topology

Programs of the Communication suite (including SQL server) can be installed on one computer or each on another computer or can be arbitrarily combined on their host computers. It is also possible to use multi-user installation during which the Communicator and SQL server are located on one or two central computers and the User center is installed on several client computers.

Redundancy

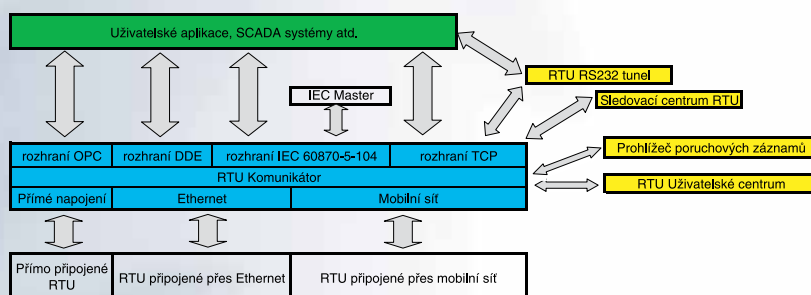
RTU Communicator can be doubled along with the options for redundant connection for such a pair. In this regime the connection and communication with RTU units is ensured by one Communicator of the pair and the second fulfils the hot backup function. In the case of failure of the first Communicator, its function is automatically taken by the second Communicator. Depending on the MS SQL server, the backup Communicator also provides services for the User center. If one MS SQL server is installed with each Communicator in the Express edition (standard communication set), the backup Communicator takes over its communication functions during the breakdown, so therefore maintains the linkage between the SCADA system and the units. It is not possible to connect to the backup Communicator by the User center. However, if the user provides their own MS SQL server with guaranteed accessibility or selects the variant of the set with the MS SQL server in the standard edition, the backup Communicator will takeover its functions during the breakdown, including the option to work in the User center.

Optional parts

The optional part of the Communication suite can be:

- Failure record browser
- RTU monitoring center
- RTU RS232 tunnel
- ECDAC
- IEC Master

The Browser for the failure records is suitable for adding to basic programs, if in the RTU units the function for recording failure statuses is used. The RTU monitoring center enables to monitor the time sequence of events coming from the specific unit. The RTU RS232 tunnel enables access to the serial ports of RTU units for other applications through virtual serial ports of the MS Windows XP operating system. ECDAC is an independent data concentrator working on IEC 60870-5-101 and IEC 60870-5-104 protocols. The IEC Master serves similarly as a monitoring center for the diagnostics – during the verification of communication with the units, with the ECDAC concentrator or with RTU Communicator simulates the master SCADA system.



RTU communicator

Brief characteristics

- server for communication with RTU units and similar devices (redundant RPS II sources or MPC diagnostic cards)
- gate or concentrator for mediation of communication between the control and visualization system and RTU units
- communication with RTU units over TCP/IP network through communication protocols TCP and UDP
- communication with RTU units through RS485 network or through RS232 line
- DDE and OPC standards, IEC 60870-5-101 and IEC 60870-5-104 communication protocols
- operation on the background as service of the operating system
- configuration in the database and/or XML file
- storage of records from RTU units into files
- recording of measurements into daily files
- recording of communication with units into the file
- record of communication with control and visualization system into the file
- recording of error and operating messages into the file
- option for redundant installation in the mode or hot backup

Basic description

The RTU Communicator is a server for communication with remote terminal devices which use HioCom or HioCom2 communication protocol (RTU units, RPS II redundant sources, MPC diagnostic cards), IEC 60870-5-101 or IEC 60870-5-104 communication protocol. It collects data from the connected terminal devices and enables to control these devices. It runs in the background of the operating system as its service. The Communicator does not have its own user interface; it is implemented by the independent RTU User center. However, this application pair must be completed with the Microsoft SQL database server.

External data interface

The Communicator can provide collected data for other applications through its external data interface. Applications can control terminal devices by means of these interfaces. The Communicator has four interfaces:

- DDE – this interface uses DDE standard.
- OPC – this interface uses OPC standard. The interface is implemented through the third party DLL library which works without the licence for only the first 30 minutes after starting the Communicator. For full operation it is necessary to purchase the Communicator with OPC licence.
- TCP – communicates through the ETP protocol (Elvac Tree Protocol), it works as a TCP server.
- IEC-104 – works according to the IEC 60870-5-104 standard, in the role of TCP server. The interface is implemented through the ECDAC concentrator in the DLL library version. The ECDAC concentrator is described in the independent chapter.

Installation of the communicator

The most frequent installation of the RTU Communicator is installation within the Communication suite (including SQL servers in the Express edition). In this installation the Communicator is used as a parametrizing tool, external interfaces are not active. The configuration of parameterized units is stored in the database or the XML file. The Communicator is not provided with any expanded licence, it is possible to communicate only with one RTU unit at one time. All programs in the Communication suite are installed for this use on one computer and the Communication suite is used for a single-user.

Another type of installation is the concentrator or communication gate. In this manner it is possible to implement the Communicator if the mediator is required between the control and the visualization (SCADA) system and the RTU unit and it is proposed that the set of end units is static. Then it is possible to install the Communicator independently without the User center and without the MS SQL server, and to set it so that the storage of the configuration of terminal units uses the XML file instead of the database with the use of its external data interface. In the case of this use, it is necessary to purchase the Communicator with an expanded licence for the respective number of terminal units. It is possible to double the communicator to achieve the requested redundancy.

If a mediator is requested between the SCADA system and the RTU units although it is proposed that the system will be expanded or minimized during the operation or that the configuration of units will be changed during the operation, it is recommended to install the whole Communication suite in the role of the concentrator or communication gate. Then the Communicator is installed on the central server and is set so that the storage area of the configuration was only a database. The SQL server is installed on the same computer as the Communicator or another central server. User center are installed on client computers. Such a Communication suite is a multi-user. It is necessary to purchase a communication suite with an expanded licence for the respective number of terminal units and for the respective number of settings of the User centre. By doubling the Communicator or MS SQL server it is possible to achieve redundant operation in the hot backup mode (it is possible to find a detailed description in the Chapter regarding the RTU Communication suite).

Ordering information

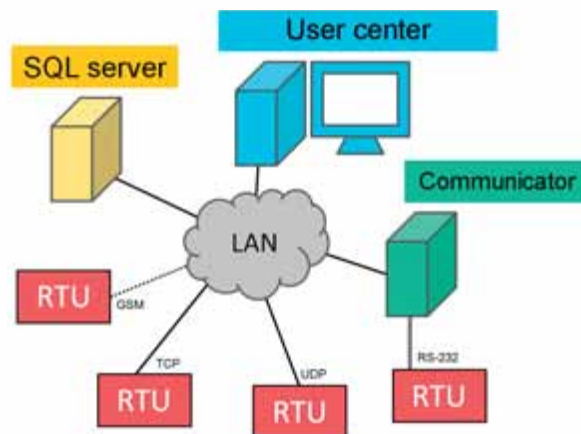
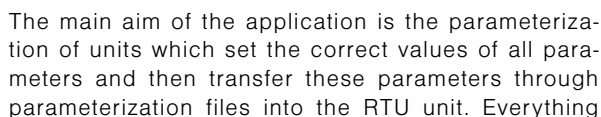
Ordering code	Type indication	Description
802012551050	SW-RTU-KOM	RTU communicator
802012551200	SW-RTU-KS	RTU communication suite
802012551100	SW-ECDAC	data concentrator
802012551060	SW-RTU-UC	RTU user center

Note: the price is derived from the scope of the licence.

Basic properties

- user interface for configuration of RTU units
- interface: RS-232, UDP, TCP client, TCP server, ECDAC
- option to connect hundreds of units
- protocol HioCom2, HTTP, FTP
- arrangement of data into a tree structure
- saving of tree structure into .XML file
- the data storage is the SQL server
- back compatibility with the Communication center

The User center application is the successor to the Communication center; it takes all of its original properties, adds new functions and simplifies control. However, it is only a user tier, it does not communicate with RTU units directly but through the Communication service. Both these applications use as a storage area the whole data structures of the SQL database which is an integral part of the whole configuration package with the name "RTU Communication Suite". All three parts communicate together through the Ethernet network (see diagram). The user interface is designed in such a manner that it enables more users to access units (User center clients). It is always valid that the RTU unit can be only configured for one user; the other users only have access rights for reading.

[illegible]

is maximally simplified. Parameters setting is simplified by the help for parameters with the indication of data types, range of values and units, option of group change for parameters for further nodes and various functions for searching for any setting conflicts. The process of transferring the parameters into the unit is reduced only to the selection of this function. Then there is a series of actions which remain hidden for users but their results are logged into the information window.

ECDAC – redundant data concentrator

Basic properties

ELVAC Data Concentrator is the application serving for the concentration of slave station data and transfer into the control station. At present the ECDAC concentrator has implemented standard protocols IEC 60870-5-101 and IEC 60870-5-104. In addition, it is planned to implement DNP3 protocol as the next protocol defined by clients. The data concentrator can work in the mode of an independent application or as a dynamic library for communication with systems and equipment. For transferring data a serial line is supported with TCP protocols (client and server) and UDP. The ECDAC data concentrator is also offered in a redundant variant.

Architecture

The basis of the ECDAC concentrator is the live database which due to the high throughput is stored in the RAM memory where the actual data is stored, attributes and times of all signals and measurements and control stations. Between the signals of the control and controlled stations there can be linkage that will ensure that during the changes in the status of some of the signals in the database, the status of the linked signals will be updated. The Concentrator is delivered in two versions. This is in the independent application version and then in the version of the dynamic library which can be configured into the user applications.

Independent application

In this version the data concentrator does not need any data application to run. It communicates with the slave devices by means of various implemented protocols and with the master system also by means of various offered protocols. For diagnostic application purposes it offers a web interface where it is possible to browse actual signal statuses and measurements, analyze communication logs, etc.. Parameterization is either through web interface (the respective parameterization file is loaded), or more comfortably using the RTU User Centre application.

Dynamic library

The ECDAC data concentrator in the version of dynamic library enables easy time and price effective integration of standard communication protocols into the user application. For example, in this manner the support of communication protocol IEC 60870-5-104 is integrated into the RTU Communicator service. In this version of the concentrator, a web interface is provided.

Addressing

The concentrator can work in two work regimes with the addresses of stations and signals. .

Compilation of addresses

This mode defines the table for the conversion (mapping) of individual signals from slave devices to the addresses of the virtual device which communicates with the master system. During this configuration the master system communicates only with one virtual device where all signals of all slave devices are defined.

Mode 1:1

In mode 1:1 the master system communicates with each slave device separately (on the basis of its address). During communication the concentrator does not compile these addresses. Data in this mode passes through the internal database of the ECDAC concentrator, which ensures the immediate response to the overall inquiry (the actual image of data in all devices is saved in the concentrator).

Communication on the line

ECDAC has in addition to the standard implementation of protocol IEC 60870-5-101, the implementation of an especially marked optimising algorithm for communication on the line. The line communication is optimized for the radio network with large latency where commands for the control station must be sent with priority over less critical data. During the command the respective communication channel is reserved only for control which will ensure the shortest way for the execution of the command and the achievement of back information regarding performance.

For communication on the line it is not necessary to perform any additional configuration. The ECDAC concentrator detects the manner of communication with slave devices on the basis of the presence of one or more devices under one communication interface.

Redundancy

Two ECDAC concentrators can work in a redundant regime so that one concentrator is always the main (communicates with slave units) and the second is backup. Between the main and the backup concentrator a connection is created using protocol IEC 60870-5-104. Concentrators exchange data in this manner so both concentrators have a permanently actual data image in the units. The master system can have TCP linkage with both concentrators although the data channel can be opened at the respective time only with one concentrator. The exact form of the redundant mode can be modified on the basis of specific client requirements.

Failure record browser

Basic properties

- browsing of records from series units of RTU7x family
- easy analysis of errors (short circuits, over-currents, ground connection)
- analysis of behaviour of protection and signalling
- automatic detection of the type of record (according to the type of the unit)
- display of waveforms of actual values of voltages and currents.
- calculation and display of the course of actual and effective values I_0 , V_0
- calculation and display of the course of actual and effective values of harmonic I_0 , V_0
- calculation and display of time course of angle ϕ_0
- change of scale on time axis, time marks (real time)
- export of records (CSV and Comtrade formats)

Product description

The browser for failure records serves for the display of time courses of measured values, calculated values and flags from protection, IFC and automatic systems generated by units of RTU7x series.

It enables fast analysis of failures, such as ground connections, short circuits and above-currents. This software can be used for the advantage of verifying the correct function of newly installed equipment, i.e. for checking the sequence of phases.

The main application window has three parts.

- the first and second panel contain waveforms of 3-phase measurements of voltage or currents (combinations 3V+3I, 6V, 6I according to the configuration of RTU)
- the third panel contains the time courses of individual protection flags, reasons for running records

In the first two panels it is possible to display waveforms of the actual values of three-phase measurements of voltages or currents.

In addition, it is possible to switch the display into the mode for the time courses of the effective values of three-phase measurements. Waveforms of actual and effective values of I_0 and V_0 and first harmonic I_0 and V_0 are calculated. It is possible to display the time course of the angle ϕ_0 which is also calculated.

The display of individual waveforms can be enabled or disabled through check boxes beside both panels. In this area all values are displayed depending on the position of the cursor in graphs.

In the third panel are protection flags, flags for signalling the start of protections, status of power element, etc. It is possible to

specify from these the reason for running the record and affecting of protection.

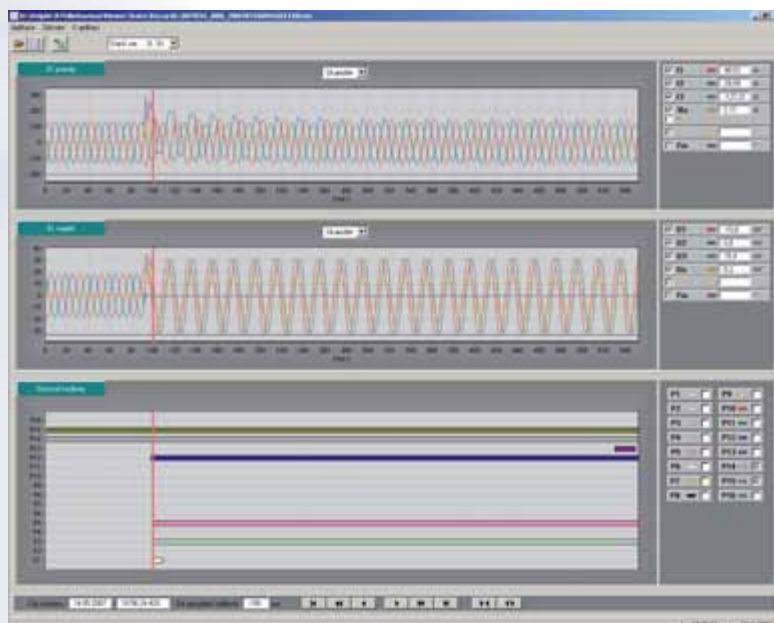
The meaning of individual flags is displayed by means of bubble help.

For units of RTU7x series there is also recording of waveforms typically 100 ms before starting event. The starting event is displayed on all three panels. Records also include time marks (real time). It is possible to change scale on the time axis, it is possible to browse records.

The browser of records enables to export data in several formats for the use in further applications – with respect to the possibility to analyze records produced by ELVAC RTU units in third parties software the Comtrade format is usually used.

Ordering information

Ordering code	Type indication	Description
802012551020	SW-RTU-PPZ	Failure record browser
802012551030	SW-RTU-CH	RTU monitoring center
802012551040	SW-RTU-ETP	RTU RS232 tunnel

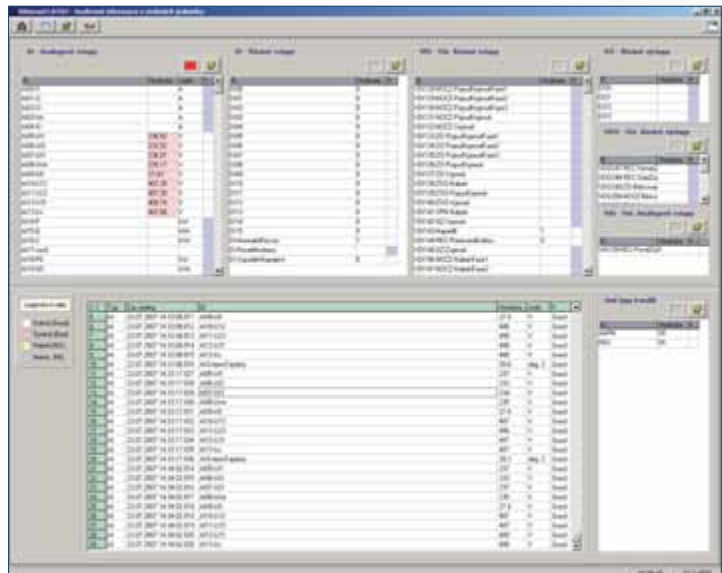


RTU monitoring center

Basic properties

- add-ons to the RTU communication suite
- easy-to-orientate graphic display of all RTU unit values on one screen
- colour highlighting of channels for which a change of the status took place
- chronological list of the change of values on the screen and on the file in the hard-disk.
- communication through TCP protocol
- option to display and filter changes only to selected channels
- the application is according to client requirements.

colour up to the time of „acknowledgement“. All changes are also recorded into the text file on the hard-disk and can be processed.



Product description

The RTU monitoring center enables to display on one screen in a easy-to-orientate form all values monitored by the RTU unit. Values are calculated from RTU Communicator via TCP protocol. All changes in the monitored values are recorded with a time mark received directly from the RTU unit. For better orientation the changed values are highlighted in a red

RTU RS232 tunnel

Basic properties

- adds-on to the RTU Communication Suite for PC serial ports emulation by the communication ports of RTU units
- operation in background (in the systray)
- indication of connection with the RTU Communicator
- data transfer indication
- recording of error and operating messages into the file
- recording of communication into the file

in the systray and also by animation in the control window. The program includes authorization mechanism using “locks” of series channels in the RTU communicator (RTU User center). In the case of the use of this mechanism, the attempt for tunnel connection to RTU unit serial port is indicated in the RTU User center and the administrator must explicitly enable the connection. The application is according to client requirements.

General description

The “RTU RS232 tunnel” program makes it possible to establish RS232/422/485 communication ports of RTU units as local serial ports (COM ports) of MS Windows 2000 / XP operating systems. It is plug-in for the RTU Communicator. For exchanging data between the Communicator and the RTU RS232 Tunnel the TCP external data interface and the ETP proprietary protocol (Elcom Tree Protocol) are used. Under normal circumstances the program runs in the background, it is accessible through the icon in the systray. The connection with the RTU communicator center is indicated either by the change in the icon in the systray, as well as by reporting in the application control window. The transfer of data through the tunnel is indicated by the change in the icon



Basic properties

- communication through protocols IEC 60870-5-101 and IEC 60870-5-104
- transfer of data through serial line, TCP (client and server) and UDP
- display of actual statuses of signals and measurement values
- generation of overall (general) inquiry, time synchronization, commands, ...
- recording and saving of running communication
- display of statistics
- easy configuration of application
- option of saving and reading configuration
- demo mode for testing

Product description

The IEC Master application serves primarily for testing and verifying slave devices which communicate with protocols IEC 60870-5-101 and IEC 60870-5-104. For the transfer of data it is possible to use a serial line, TCP protocols (client and server) and UDP. In the configuration of the application it is sufficient to set only a small number of communication parameters and the application is then ready for use. The database of signals and measurements is created dynamically, so it is not necessary to be defined in advance. The application provides statuses of signals and values of measurements (standardized values and decimal places), including quality attributes. It is possible to send to the slave device the overall (general) inquiry, time synchronization, test command, single-bit and two-bit command with as well as without the time. For diagnostic purposes the list of running communication is displayed. For automatic testing the application provides an interface for running the test scripts.

Communication log

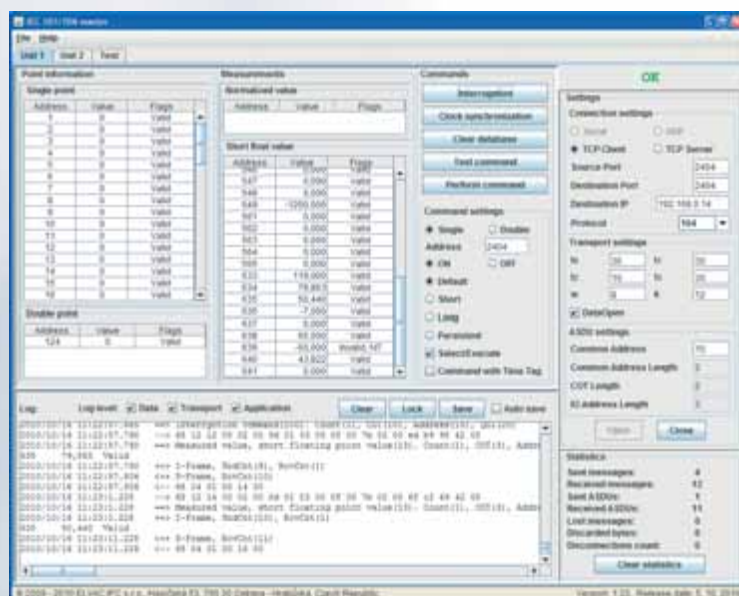
The running communication can be logged. The user can select the level of logging. In the first level, clear data is logged which is sent/is coming from/into the selected communication interface. In the second level the passing data is processed at the level of linkage/transport tier (establishment and keeping the linkage ...). The third level logs application data (values of signals, measurements ...). It is possible to save the communication log for later analysis for request by the client or automatically.

Interface testing

The IEC Master application enables to automatically test the outputs and inputs of the slave devices. It is possible to define a scenario with actions (control of outputs) and respond to them (requested statuses of signals). In addition, the time limit for the response is defined (the response must be within the previously defined time). The output of the test is a message which contains the list of changes to the monitored device, including information whether this change was or was not expected. After termination of the test, the statistics for the number of any erroneous (unexpected) statuses of signals is displayed. Incoming measurements calls only warning.

Ordering information

Order code	Type indication	Description
802012551070	SW-IEC-MASTER	IEC master



Application
IEC Master



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