Communication unit MEg202.3

User manual

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Communication unit MEg202.3

1/ CHARACTERISTICS

The communication unit MEg202.3 in its basic confi guration provides remote transmission of states or changes of binary inputs and commands by GSM/GPRS and GSM/UMTS/HSPA networks of mobile operators. The measured values are transferred through the serial communication line RS485 from connected measuring devices. It implements the standardized communication protocol according to IEN 60870-5-104 standard and enable the connected devices to be integrated in the SCADA system either directly or by means of data concentrators.

The MEg202.3 unit contains a processor that communicates with connected devices, optimizes and controls the data transmission, provided for pre-processing the data readout from the measuring devices, supervises the connected devices and in case of an event it conveys the information to the superior system.

The MEg202.3 unit can be used also in the function of a communication converter GPRS/UMTS/HSPA on RS485 bus when the data sent through the mobile operator network are re-sent in transparent mode to the programmed RS485 channel and conversely, the data from RS485 are sent back.

The basic setting of the unit‘s functions is performed in production. The appropriate change in setting is possible with the M202Param program.

2/ TECHNICAL PARAMETERS

Power supply: +12 V ± 10 % / max. 200 mA + 1.25 * (I_{CHAN1} + I_{CHAN2})
I_{CHAN1}, I_{CHAN2} are the currents feeding the devices in individual channels
Maximal current per channel is 165 mA.

Working temperature: -20 °C to +60 °C

Dimensions and weight, construction

Length × Width × Height: 55 × 75 × 110 mm

Weight : 0.2 kg

The unit is constructed for installation on the DIN rail, TC 35 type.

GSM communication

GSM / GPRS module:

Dual-band EGSM 900 / 1800 MHz
Optionally Quad-band 850 / 900 / 1800 / 1900 MHz
GPRS class 10

Module GSM / UMTS / HSPA:

Dual-band 900 / 1800 MHz (GPRS / EDGE)
Dual-band 900 / 2100 MHz (UMTS / HSPA)
Optionally Dual-band 850 / 1900 MHz (GPRS / EDGE and UMTS / HSPA)
GPRS / EDGE class 33
HSPA category 8 downlink, 6 uplink

Supported protocols:

UDP, TCP, ICMP, SMTP, MODBUS, IEC 60870-5-104

Antennas

GSM antenna Magnetic 50, Dual-band, 5 dB,
vertical polarization, radiation H - 360 °, V - 30 °,
antenna dimensions ø 40 mm × 300 mm,
supply cable length 3 m, connector SMA(m) ø 9 mm.

GSM antenna Magnetic 50, Dual-band, 9 dB,
vertical polarization, radiation H - 360 °, V - 30 °, antenna dimensions
ø 62 mm × 420 mm, supply cable length 3.5 m, connector SMA(m) ø 9 mm.
Where appropriate, it is possible to use a 10 m extension cable RG58.

GSM antenna YAGI120, Dual-band, 12 dB,
vertical polarization, radiation H - 250 °, V - 30 °, dimensions 300 × 200 × 26,4 mm,
co-axial cable length 10 m, connector SMA(m) ø 9 mm, weight 0.86 kg.

MEg202.3 communication with instruments

RS485 interface, max. Baud rate 115.2 kBd
Number of digital galvanically non-isolated inputs:
5 (12 V voltage from MEg202.3)
Number of outputs implemented by relay NO contact:
2 (max. 30 V_{DC}, 30 mA_{DC})

3/ CONSTRUCTION

The communication unit MEg202.3 according to Fig. 1 with the panel in Fig. 2 is built in a self-extinguishing plastic case made of ABS. It is constructed for installation on the DIN rail TC 35. The screw terminals are located in two rows and their denotation is in Tab. 1. Maximum cross-section of connected wires is 4 mm2. The communication between the communication unit MEg202.3 and the connected devices take its course through one of the two RS485 interfaces on terminals **1** to **8**.

Tab. 1: MEg202.3 terminal chart

Contact	Signal	Contact	Signal
1	Channel 1 (CHAN1), +12 V_1	11	Output OUT22
2	Channel 1 (CHAN1), $\perp_1$	12	Output OUT21
3	Channel 1 (CHAN1), RS485, A_1	13	Output OUT12
4	Channel 1 (CHAN1), RS485, B_1	14	Output OUT11
5	Channel 2 (CHAN2), +12 V_2	15	Input IN5
6	Channel 2 (CHAN2), $\perp_2$	16	Input IN4
7	Channel 2 (CHAN2), RS485, A_2	17	Input IN3
8	Channel 2 (CHAN2), RS485, B_2	18	Input IN2
9	Power MEg202.3, $\perp$, GND	19	Input IN1
10	Power MEg202.3, +12 V	20	Common input, $\perp$, GND

On the panel of the GPRS MEg202.3 unit, there is a circular co-axial connector of SMA(f) type, 6.4 mm diam., for antenna connection. For the communication unit MEg202.3, it is possible to use the internal magnetic GSM antenna 3 dB, 5 dB and 9 dB or the outdoor GSM YAGI120 antenna in locations with weak signal or intensive external interference.

The LED indicator **STAT** signals the internal state of the unit. Two states that alternate are distinguished. The first is related to the GSM network, the second to any of the connected devices. If everything is OK, the LED will shortly blink once. If an error occurred in connection with the GSM/GPRS or GSM/UMTS network (the module failed to register with the GSM network, activation of GPRS or UMTS failed, data transmission failed), the LED indicator blinks twice in succession. If the communication with any of the connected devices failed, the LED indicator blinks shortly three times in succession.

For example, if a poor signal is available and the unit cannot register with the network (and the communication with connected devices is in good order), blinking will appear as follows: 2×–1×–2×–1×… If, in addition, none of the connected devices communicates, blinking will appear as follows: 2×–3×–2×–3×…

If modification of communication interfaces is needed or when a problem is signalled, it is possible to find out more detailed data using the M202Param program after connection of the square service USB connector on the unit with a computer. This program is used also for setting the unit and other service actions (e.g. finding out the intensity and direction of the GSM network signal).

Warning!
If the GPRS unit MEg202.3 is used in ways other than originally intended, the protection provided by the device may be impaired.

4/ COMMUNICATION

4.1 Remote data transmission

The communication unit MEg202.3 mediates the transmission of data and events, the source of which are instruments and devices connected to it. The data transmission is ensured by the TCP/IP protocol by means of GPRS and UMTS technologies of mobile operators. Primarily, GSM/UMTS is used, if it is unavailable, GSM/GPRS is used. In co-ordination with the mobile operator, it is possible to configure the unit in such a way that it can be part of the customer‘s private Ethernet network or the data can be transmitted through the public Internet network.

The UDP or TCP can be selected as the communication protocol of the transport layer. When the TCP protocol is used, the unit can operate as a TCP client as well as a TCP server. The standardized protocol according to IEN 60870-5-104, MODBUS TCP, the proprietary protocol optimized for transmission of a large amount of data but also the transparent mode, mediating the direct communication with the connected device, can be chosen from the application protocols.

The communication unit makes it possible to create up to 4 communication IP channels, or it provides for communication with up to four user applications at the same time. The unit incorporates 1 SIM card but it can create connectivity via up to 4 APNs (Access Point Name) and may be assigned up to 4 different IP addresses. This feature enables you to configure the communication unit in such a way that it can send the important ope-

ration data and events, e.g. to control room, the important data related to invoicing are sent to the business department server, important measurements regarding monitoring and evaluation of the long-term parameters of a measuring point can be downloaded to a server in another department and service actions and configuration of the unit can be enabled e.g. from an external service organization.

4.2 Peripherals

Peripherals, i.e. devices operated externally, can be connected through the digital inputs and outputs (e.g. IZP1) or through one of the two standard RS485 interfaces. Any devices can be operated right in command mode where the communication unit MEg202.3 uses the commands for scanning the digital inputs, setting the state of outputs, transmitting the individual commands obtained via the set interface for the devices and for sending the individual responses of the devices back through the GSM communication. In transparent mode, the data received over the GSM channel are sent to the selected RS485 interface and the relevant responses from the devices are sent back.

In addition to direct control, the unit MEg202.3 can operate some devices by itself, scan data, select data, respond to events, etc. The activity must be specified for the given devices in advance and the relevant operations of the device must be programmed in MEgA, which is then incorporated in MEg202.3 firmware. For each operated device even of the same type, some parameters, specifying the type of device, interface or input to which the device is connected, device address, etc. must be user programmed. The user structure in the communication unit counts with connection and operation of up to 32 devices in all. The structure of the operated devices is programmed using the M202Param program.

At present, the MEg202.3 firmware supports monitoring of short-circuit current indicators, e.g. IZP1, a series of short-circuit and ground fault indicators MEg61 and in case of events, it sends a message to one ore more GSM communication channels. It also enables data transmission and actuation of the universal monitors MEg70, MEg71 and MEg44. It communicates with the MEg40 monitor through the control USB/RS485 converter.

4.2.1 IZP1 short-circuit current indicator operation

The MEg202.3 has 5 digital inputs and so it enables the operation of up to 5 short-circuit current indicators or other two-state information sources that must be equipped with a contact wired between the selected input of the MEg202.3 and the common terminal. The MEg202.3 program monitors all indicators in second intervals and when the state of the input is changed, it will send a message over the GSM communication channel. A message is also sent when power for MEg202.3 is interrupted and restored in the case that the indicator is in the state other than the programmed release state. It can be set in such a way that the indicator states are always sent after power restoration.

The message is one-bit information with time (type 30 information object) according to IEN 60870-5-104 where the address and the information object number identify which indicator sends the message; the message contains the time and the instantaneous state of IZP1.

The indicator is reset to zero by sending the "simple command", type 45, message.

IZP1 configuration structure has the following form:

Type – IZP1 internal code
Input – the number of input to which the IZP1 is connected
Address – IZP1 serial number
GSM channels – communication channels to which messages are to be sent automatically
Release state – the state of output while IZP1 is not signalling
Reset output – the output to which IZP1 reset is connected

4.2.2 MEg61 ground fault indicator operation

The MEg61 devices can be connected to either of the two RS485 interfaces. The program transmits inquiries about the state to individual programmed MEg 61 devices in second intervals through the relevant interface. After the response from the MEg61, it will evaluate the programmed bits and when the state is changed, it will send a message over the selected GSM communication channel. The message is one-bit information with time (type 30 information object) according to IEN 60870-5-104 where the address and the information object number identify which MEg61 indicator sends the message; the message contains the time and the instantaneous state.

MEg61 configuration structure has the following form:

Type – MEg61 internal code
Port – RS485 interface
Address – MEg61 serial number serving as the address in communication
GSM channels – communication channels to which messages are to be sent automatically
Release state – the state of MEg61 inputs
Input mask – specification of the MEg61 status bits the program should respond to.

4.2.3 Operation of MEg40 series monitors

The MEg40 series devices, i.e. MEg40, MEg40^{+} or MEg40^{+}/supra, hereinafter MEg40 only, can be connected to either of the two channels CHAN1, CHAN2 with RS485 interface. The MEg40 designed with RS485 can be connected directly, the MEg40 designed with USB and P202 protocol is connected through the USBhost/RS485 converter made by MEgA. The 12 V DC of relevant channel CHAN1 or CHAN2 in the MEg202.3 unit is intended for feeding the converter.

The measured voltage, current, active and reactive power and power factor values can be read out as information object of type 13 (M_ME_NC_1) according to I EN 60870-5-104.

An integrating deviation criterion can be programmed for each MEg40 as well. In such a case, the MEg202.3 reads the measured values from the MEg40 every second and evaluates the deviation from the value sent out last time. If the programmed deviation is reached (integrated) or the time interval from the last data transmission is reached, the instantaneous measured values are sent automatically to the programmed GSM channels.

MEg40 configuration structure has the following form:

Type – MEg40 internal code
Port – RS485 interface
Address – MEg40 serial number serving as its address in communication
GSM channels – communication channels to which the measured values are to be transmitted in case of the deviation criterion
Voltage deviation – voltage deviation value in tenths of per cent of the nominal value
Current deviation – current deviation value in tenths of per cent of the nominal value
Interval – Time interval for transmitting the values unless the programmed deviation is reached.
Values 1 to 127 are in seconds,
at a value > 128 the Value = Interval – 128 in minutes.

Note: At a value of interval or deviation = 0 this deviation or interval is not evaluated.

4.2.4 Operation of MEgA monitor types MEg70, MEg71 and MEg44

The MEg70, MEg71 and MEg44 monitors can be connected to either of the RS485 CHAN1 or CHAN2 interfaces and they can be fed directly from 12 V power for the relevant channel. Three MEg70 or one MEg71 can be fed from one channel. Larger number of MEg70 or MEg71 monitors as well as MEg44 must be fed from external power supply, e.g. MEg101.4 or MEg101.5.

The measured voltage, current, active and reactive power and power factor values can be read out as information object of type 13 (M_ME_NC_1) according to IEN 60870-5-104.

It is possible to program also the integrating deviation criteria for each MEg 70, MEg71 and MEg44 monitor. In such a case, the MEg202.3 reads the measured values every second and evaluates the deviation from the value sent out last time. If the programmed deviation is reached (integrated) or the time interval from the last data transmission is reached, the instantaneous measured values are sent automatically to the programmed GSM channels.

The configuration structure of MEg70, MEg71 or MEg44 monitors has the following form:

Type – internal code of the MEg70, MEg71 and MEg44 compact monitor
Port – RS485 interface
Address – MEgA monitor serial number serving as its address in communication
GSM channels – communication channels to which the measured values are to be transmitted in case of the deviation criterion
Voltage deviation – voltage deviation value in tenths of per cent of the nominal value
Current deviation – current deviation value in tenths of per cent of the nominal value
Interval – Time interval for transmitting the values unless the programmed deviation is reached.
Values 1 to 127 are in seconds,
at a value > 128 the Value = Interval – 128 in minutes.
Note: At a value of interval or deviation = 0 this deviation or interval is not evaluated.

5/ INSTALLATION

The MEg202.3 unit in Fig. 2 is intended for installation in the environment treated against action of water onto the DIN TC35 rail which is attached to the switchgear panel with two screws. The 12 V DC power is brought to terminals **9** and **10** on the MEg202.3, the negative pole is connected to terminal **9** and the positive pole to terminal **10**. The power terminal **9** of the unit is connected with the common terminal **20** for **IN1** to **IN5** input signals. **NO** and **NC** contacts of external devices, the states of which are to be transmitted, are connected to inputs **IN1** to **IN5** on terminals **19** to **15** in the MEg202.3 unit. The circuits of the collaborating devices are fed with 12 V DC from the communication unit MEg202.3. The two output signals **OUT1** a **OUT2** on terminals **14** to **11** on the unit MEg202.3, implemented by galvanically isolated relay switching contacts are used to control the external devices, e.g. for their resetting.

The external devices with RS485 communication are connected to one of the channels, CHAN1 or CHAN2. The signals **A** and **B** on terminals **3**, **4** and **7**, **8** are used for this purpose. If it is necessary to provide supply for the communication circuits of external devices such as the USB/RS485 protocol converter, when connecting the universal monitor MEg40 with USB2 communication, there are galvanically isolated 12 V DC supply voltages with a maximum current consumption of 150 mA for the individual channels available also from the MEg202.3 communication unit circuits. These voltages are brought to terminals **1**, **2** for CHAN1 and to terminals **5**, **6** for CHAN2. Then, one of the channels CHAN1 and CHAN2 can co-operate with the standardized protocol IEN 60870-5-101 and the other with the proprietary communication protocol.

The power for the communication unit MEg202.3 is usually implemented with uninterruptible power supplies, e.g. MEg101.4 or MEg101.5. However, it is possible to use another uninterruptible or interruptible 12 V DC power supply. However, the interruptible power supply does not enable communication when the supply voltage is interrupted in the place of communication. Wiring example is in Fig. 3.

The indoor omnidirectional rod antenna with magnetic attachment is usually put on a ferromagnetic pad so that the antenna is found in vertical position. The connector of the co-axial antenna cable is screwed in the mating connector SMA(f) on the panel of the MEg202.3 unit. The cable of the outdoor YAGI antenna is also connected to the circular GPRS connector. The length of the antenna cable for the outdoor antenna is 10 m. The YAGI antenna for outdoor installation is directional and so it is necessary to direct it to the nearest relay point of the mobile operator network used. This is made possible by the M202Param control program, the controls of which are in a separate description.

The SIM card installation according to Fig. 2 will be carried out by the manufacturer after receiving it from the customer. After agreement with the manufacturer, the customer may set up the MEg202.3 unit for his own SIM card using the M202Param application.

6/ MAINTENANCE REQUIREMENTS

The communication unit MEg202.3 does not require forced ventilation and except for the antenna connector and terminals, it has no moving parts. Except for common surface cleaning, it has no special requirements for maintenance. Use soft materials for surface cleaning.

The preventive inspection includes:

- checking the unit for mechanical integrity,
- checking the establishment of communication after power restoration.

It is recommended to perform preventive inspections after every 3 years of operation. Removing the cover from the installed or connected communication unit MEg202.3 is not allowed. The functionality of the unit may be impaired by removing its cover.

7/ CONTENTS OF THE SET

Basic set:

- Communication unit MEg202.3,
- User manual,
- CD with M202Param program and description how to use the program and parametrization of the communication unit MEg202.3.

Optional parts of the set:

- DIN rail l = 75 mm,
- Communication cable USB-PQ / 2 m / EMC,
- GSM antenna Magnetic 50, Dual-band, 5 dB,
- GSM antenna Magnetic 90, Dual-band, 9 dB,
- 10 m RG58 cable extension to Magnetic 90 antenna,
- GSM antenna YAGI 120, Dual-band, 12 dB,
- GSM YAGI 120 antenna attachment to HV power pole.

Note:

The customer may deliver his own SIM card that the manufacturer installs in the MEg202.3 unit to test the proper operation of the unit.

Based on agreement with the manufacturer, the customer himself can install the SIM card and perform the parametrization of the communication unit MEg202.3 according to description of the MEg202Param program implementation.

8/ DELIVERING, HANDLING AND TRANSPORTATION

The place of delivery of the communication unit MEg202.3, accessories and possibly the outdoor GSM YAGI120 antenna with antenna cable if not specified otherwise, is the manufacturer‘s place of business. The communication unit MEg202.3 with accessories and antenna is delivered in separate cardboard boxes. The boxes are recyclable. Based on the specification in the purchase order, it is possible to send the communication unit set by the transport service chosen by the customer. Due to the weight of the individual wrapped parts of the communication unit, no special measures are needed when handling the delivery. There is information on the contents on the boxes. The completion certificate and the warranty certificate with the date of purchase indicated are part of the delivery.

9/ WARRANTY

It is not permitted to open the communication unit MEg202.3 during the warranty period. The MEg202.3 unit is covered by a warranty for 2 years from the date of purchase. Defects originating during this period as a demonstrable result of defective design, manufacturing or using improper material will be repaired free of charge by the manufacturer whereas the place of fulfilment is the manufacturer‘s place of business. The warranty becomes null and void if the user breaks the lead seals or makes unauthorized modifications or alterations to the MEg202.3 unit or to its accessories, or the device is connected incorrectly or if the communication unit or its accessories were operated contrary to technical conditions. The defects on the MEg202.3 communication unit and its accessories originating during the warranty period shall be claimed by the user to the manufacturer of the communication unit. The complaint without the attached warranty certificate shall not be accepted. The manufacturer bears in any case no responsibility for subsequent damages caused by using the communication unit MEg202.3. No responsibility which would exceed the price of the MEg202.3 unit follows for the manufacturer from this guarantee.

10/ MANUFACTURER

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Fig. 1: Illustration of the communication unit MEg202.3

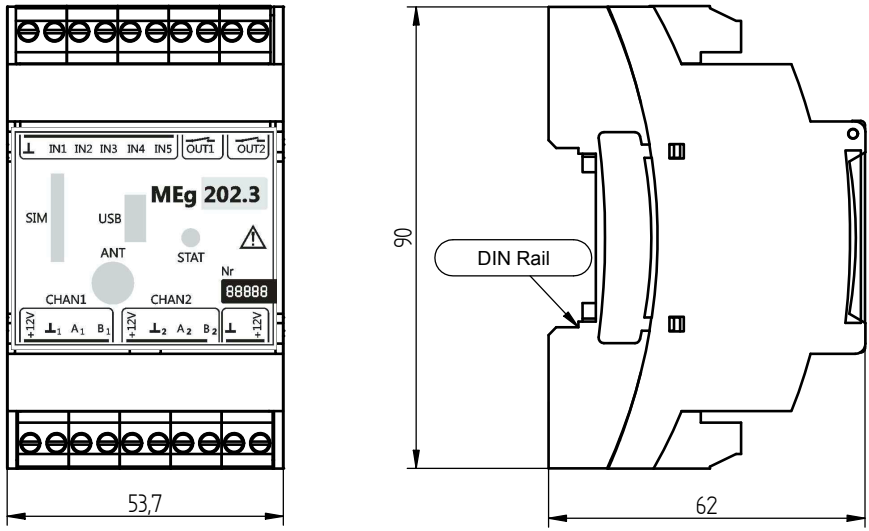


Fig. 2: Picture of the front panel and communication unit MEg202.3

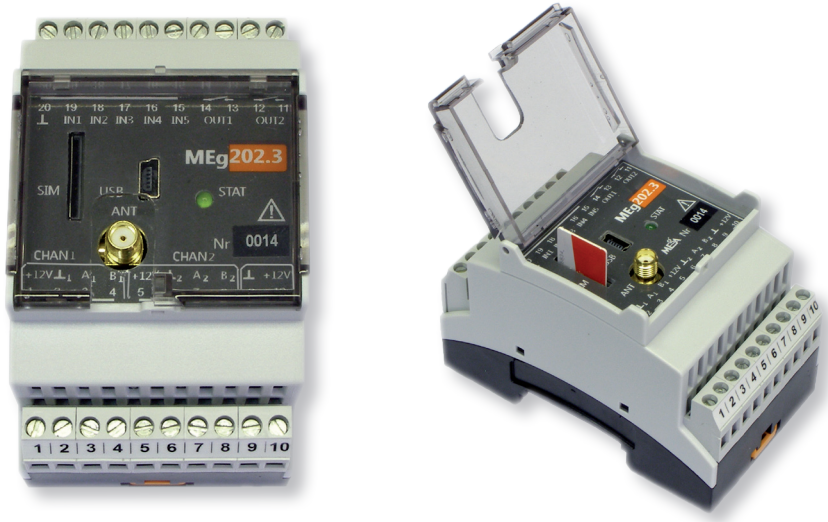
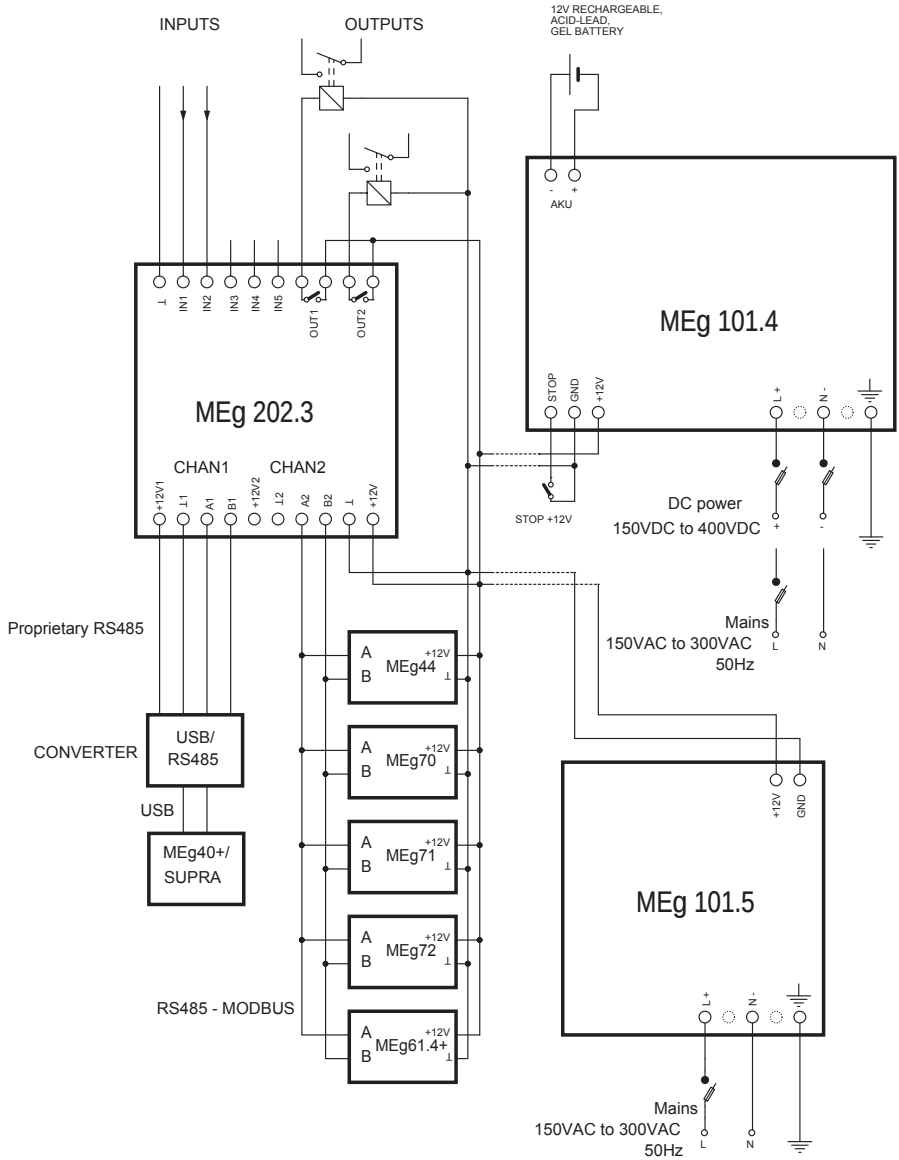


Fig. 3: Example of MEg202.3 communication unit wiring



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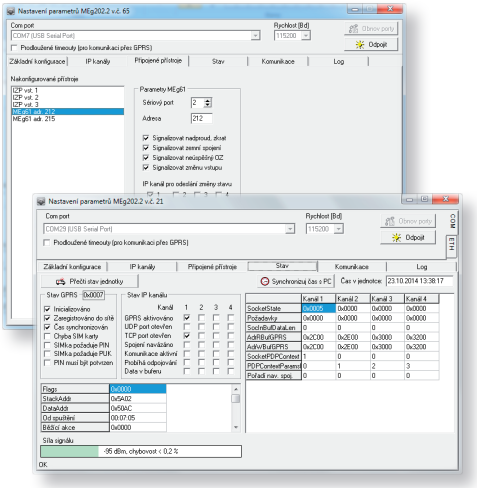

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