

Communication interface converter M-Bus to RS485

RS485toMBus-5M



Instructions manual

Version: 2021/1.0-EN

Communication converters of the M-Port line



RS485toMBus-5 communication converter

RS485toMBus-5 is a communication converter intended for connection of devices with the M-Bus industrial bus to control or computer systems for metering data collection using the RS485 communication interface. The converter transfers the signals between these two interfaces without any modifications to the content of the M-Bus messages.

The M-Bus port can accommodate one to five M-Bus slave devices. The interface reaches above standard durability class of overvoltage protection and is immune against failures on the M-Bus line.

The converter provides a comfortably wide range of DC power voltages to accommodate various simple applications. The power port also has a strong protection against overvoltage.

Operation states of the converter are indicated by four LEDs, this makes for an easy readout of the current state of the converter or possible causes of a failure. The LEDs indicate the state of the power supply, M-Bus communication and fail states of the M-Bus line.

Technical parameters

| RS485 communication interface | |
|--|--|
| Communication signals | A (+ Tx/Rx), B (- Tx/Rx), GND |
| Galvanic separation | 1kV from M-Bus line |
| Protections | overvoltage protection TVS 600W |
| Terminating resistors | A 10kΩ to +5V, B 10kΩ to GND |
| Connector | connector for wires of up to 2.5 mm ² cross-section area |
| M-Bus Master communication interface | |
| Number of connectable devices | 1 to 5 SLAVE devices, idle current max. 7.5mA |
| Baud rate | 300-9600 bps |
| Protections | - overvoltage protection TVS 600W - electronic protection against overloads and short on the line, note: the converter is immune against permanent short on the line |
| Galvanic separation | 1kV from power supply and RS485 |
| Connector | connector for wires of up to 2.5 mm ² cross-section area |
| Power Supply | |
| Recommended range of power supply voltages | |
| DC power supply | 7.5V to 40V |
| AC power supply | 7.5V to 28V |
| Protections | overvoltage protection TVS 1500W |
| Power consumption | 0.25W to 1.1W. Depends on M-Bus line load and communication. Max. consumption during M-Bus line short 1.5W. |
| Connector | connector for wires of up to 2.5 mm ² cross-section area |
| Temperature | |
| Operating range | -20°C to 70°C |
| Mechanical construction | |
| Mechanical design | plastic box |
| Mounting | 35mm DIN rail (EN 50022 top hat rail) |
| Dimensions: height x width x length | 56.5 x 17.5 x 97.5mm |
| Protection classification | IP20 |
| Weight | 52g |

Layout of connectors and status LEDs

Connectors

- **M-Bus**
Connector for connecting the M-Bus line with M-Bus slave devices.
- **Power**
Connector for connecting the power supply.
- **RS485**
Connector for connecting the RS485 line.

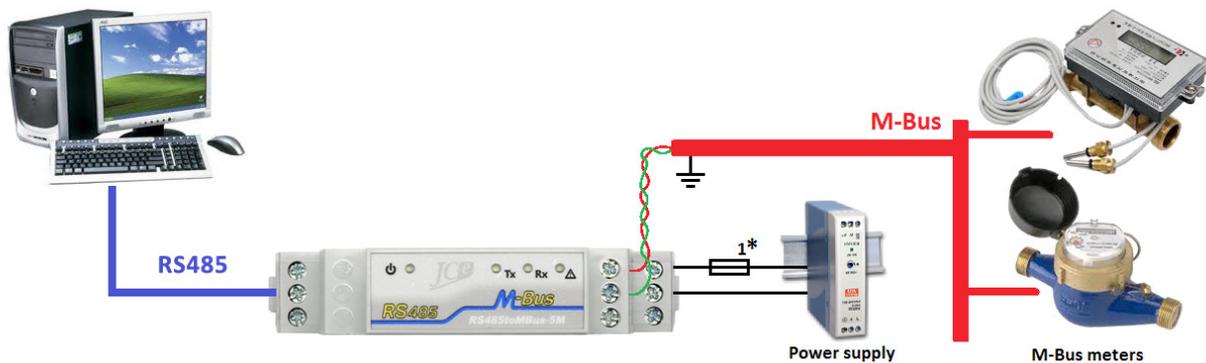


Status LEDs

- Tx** **Transmit** – The status LED is colored green and signifies data transmission on the M-Bus line.
- Rx** **Receive** – The status LED is colored yellow and signifies data transmission on the M-Bus line. In case of exceeding the maximum number of devices connected to the M-Bus line the status LED will flash alternately with the *Overload* LED.
- ⚠** **Overload/Short** – The status LED is colored red and indicates faulty state of the M-Bus line. Due to protection of the converter the data transmission and reception is stopped in this state.
 - **M-Bus line is overloaded**
If there are more than 5 M-Bus SLAVE devices connected to the M-Bus line the *Overload/Short* LED indicator will start to flash. If there is a greater overload, more than 7 M-Bus SLAVE devices are connected, the *Receive* and the *Overload/Short* status LEDs flash alternately.
 - **There is a short on the M-Bus line**
If there is a short circuit between the M-Bus wires, the load on the line is less than 500Ω, or there is a larger number of M-Bus SLAVE devices connected to the line the converter will interpret this as a short on the line. The red *Overload/Short* LED will be turned on permanently.

Note: The default communication mode will be restored immediately after fixing the malfunction.
- ⏻** **Power** – The status LED is colored green and is turned on if a suitable power supply voltage is connected.

Typical application



Typical wiring of the converter with M-Bus devices, power supply and a RS485 communication line.

- **Power Supply**

The recommended range of power supply voltages is 7.5V to 40V DC and 7.5V to 28V AC. The connection of the power supply uses terminals labeled POWER. Maximum power consumption is 1.1W (1.5W in case of a short on the M-Bus line) and depends on the M-Bus line load and power supply.

*Note 1** The use of external fusing is recommended in case of additional power source protection and for example to limit the short circuit current during overvoltage, ...

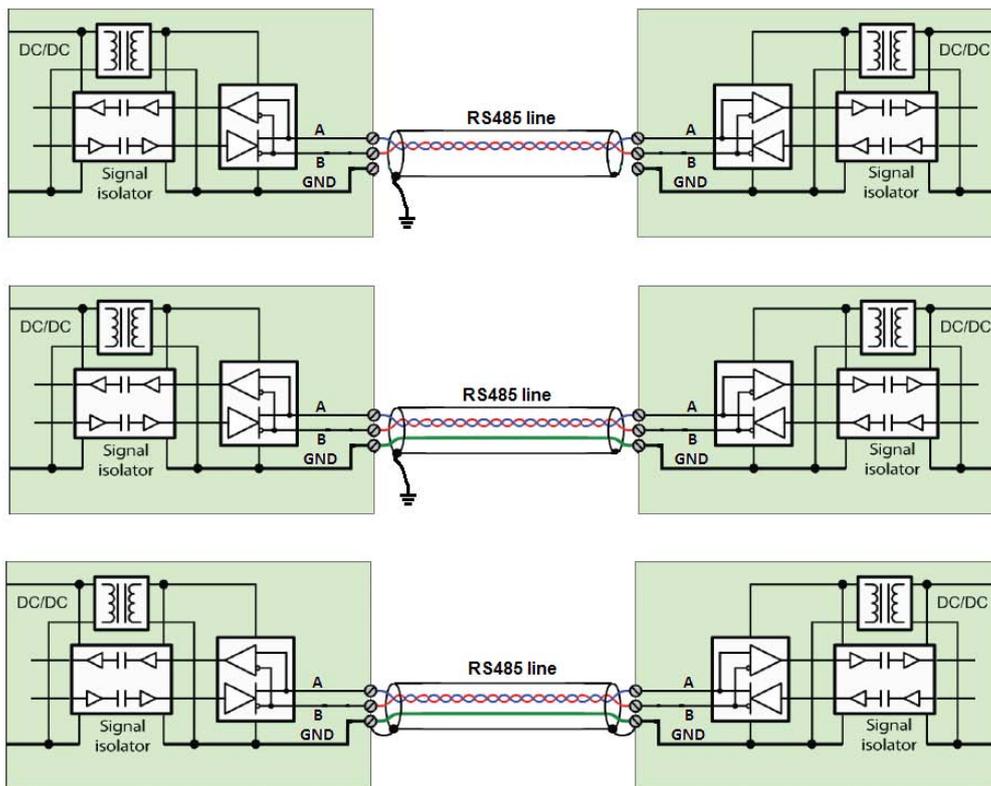
- **RS485 line**

The connection of the RS485 line uses a connector labeled RS-485. The RS485 port has galvanic separation from the M-Bus line. Supported communication speeds are 300 to 9600bps. Switching between transmission and reception is automatic based on reception of messages on the M-Bus line.

The RS485 interface uses data wires labeled as A and B. Signal A is sometimes referred to as +Tx/Rx and signal B as -Tx/Rx. In idle state there is a small voltage close to 5V present between the A and B terminals or a small voltage of 0.2V if the line has a terminating resistor connected to it. The terminal A is slightly positive.

The interface of the converter contains two 10kΩ terminating resistors on the A and B terminals. These resistors are connected to the power supply and define the idle state on the RS485 line with a small pre-voltage.

It is recommended to use a shielded twisted pair cable in the construction of the communication line. In case of connecting the GND signals it is recommended to use an additional internal wire of the shielded cable. The shielding of the cable should be grounded preferably at the entry point of the switchgear cabinet especially with long or outdoor lines. If the line is short and within one room or within a switch gear cabinet it is possible to connect one end of the cable shielding to the GND pin. The other end of the shielding should remain open. These are generic guidelines and their suitability as well as the use of additional overvoltage protections needs to be considered according to the given application.



Recommended ways of connecting the converter to the RS485 line.

• M-Bus line

The interface is of M-Bus Master type and allows for connection of up to five M-Bus SLAVE devices. The maximum idle current on the line is 7.5mA. The interface is protected against overvoltage, overload and short circuit on the line. It is recommended to use a shielded twisted pair cable in the construction of the communication line. The shielding of the cable should be grounded preferably at the entry point of the switchgear cabinet. The M-Bus port is rated at a high level of protection according to the EN 61000-4-5 standard measured also on an unshielded cable. The use of a shielded cable further increases the level of protection. The use of additional rough overvoltage protection is recommended only on the LPZ0A-LPZ1 interface on a building entry point of the M-Bus line.

The communication speed ranges from 300bps to 9600bps. Even parity with one stop bit and 8 bit data word is used as standard.

The connection of the M-Bus line uses a connector labeled M-Bus. The connector allows a connection of wires with up to 2.5 mm² cross-section area. It is recommended to use a shielded twisted pair cable for example J-YStY for the connection of the meters.

Suitable types of cables for connecting the M-Bus devices.

- Indoor environments - LiYCY 2x0.14mm² up to a distance of 100m, LiYCY 2x0.25mm² up to 200m.
- Outdoor/indoor environments - J-YStY 1*2*0.6mm up to 200m, J-YStY 1*2*0.8mm up to 400m.

The distances can be longer for a smaller amount of SLAVE devices but the capacitance of the M-Bus line must be below 80nF for maximum communication speed.

A voltmeter and an amp meter is sufficient for a basic electrical check of the M-Bus line.

The table contains a summary of verification voltages and currents which can be measured during a check.

| M-Bus line | SLAVE device | RS485toM-Bus-5M converter |
|--------------------------|--------------|---------------------------|
| Idle voltage U_{M-Bus} | min. 21V | 29V to 30V |
| Idle current I_{M-Bus} | max. 1.5mA | max. 7.5mA |

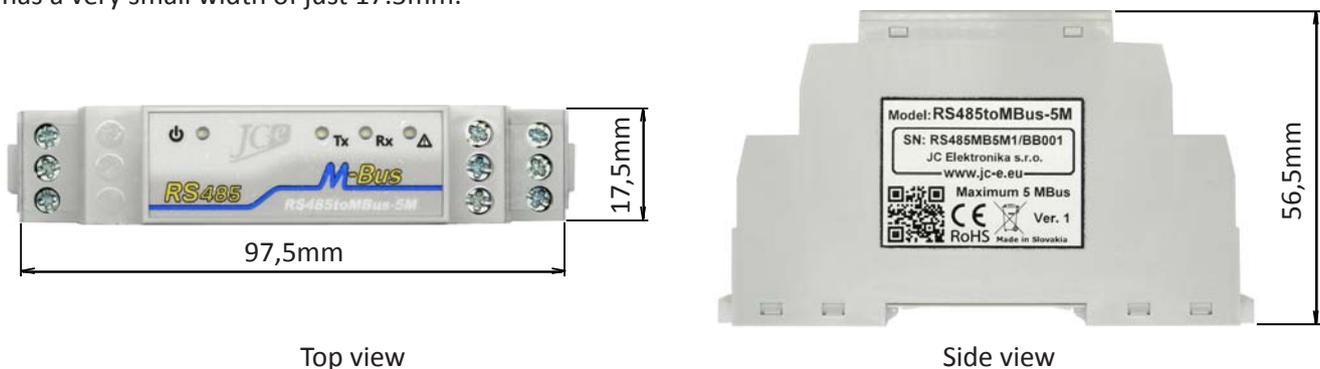
The measurements should be taken in an idle state without ongoing communication and in a state when the converter does not indicate an error on the M-Bus line. The idle voltage on the M-Bus line should be in the 29 to 30V range. The Slave pins of the connected device should have a voltage over 21V which represents the minimal value for a standard M-Bus Slave device (IO-TSS721A). This difference in voltage can be caused by voltage drops on the communication protections and communication line. Using the recommended M-Bus protections and type of wiring guarantees the fulfillment of the minimum voltage requirements.

Maximum current on the line from the converter should be 7.5mA. Its measured value should roughly correspond to the amount of M-Bus Slave devices times 1.5mA.

The idle current of the Slave device must be measured on the wires which lead directly to the meter and do not continue any further. Current through these wires should be smaller or at the very most equal to 1.5mA.

Mechanical parameters of the converter

The converter is built in a standard plastic box designed for mounting on a 35 mm DIN rail. The converter has a very small width of just 17.5mm.



Top view

Side view

EMC compatibility

EMC compatibility of the M-Bus converter has been tested according to the following industrial environment standards in an accredited laboratory.

| EMC emission tests | | |
|--------------------|---|---------|
| Standard | Test | Level |
| EN 55022 | Power line - CONDUCTED EMISSIONS 10/150 kHz - 30 MHz | Class B |
| EN 55022 | RADIATED EMISSIONS (Electric Field) 30 MHz - 1000 MHz | Class B |

| EMC immunity tests | | |
|--------------------|--|-----------------|
| Standard | Test | Level |
| EN 61000-4-2 | ELECTROSTATIC DISCHARGE (ESD) - Contact discharge | ± 4kV |
| EN 61000-4-2 | ELECTROSTATIC DISCHARGE (ESD) - Air discharge | ± 8kV |
| EN 61000-4-4 | ELECTRICAL FAST TRANSIENT/BURST - Power line | ± 4 kV |
| EN 61000-4-4 | ELECTRICAL FAST TRANSIENT/BURST - M-Bus line | ± 4 kV |
| EN 61000-4-5 | SURGE IMMUNITY - Power line. Common/differential mode. | ± 1kV / ± 0,5kV |
| EN 61000-4-5 | SURGE IMMUNITY - M-Bus line. Cable shielding. | ± 4 kV |
| EN 61000-4-5 | SURGE IMMUNITY - M-Bus line. Common/differential mode.* | ± 2kV / ± 1kV |
| EN 61000-4-6 | CONDUCTED DISTURBANCES, INDUCED BY RADIO-FREQUENCY FIELDS 0,15MHz - 80 MHz. Power line and M-Bus line. | 3 V |

* test carried out at the request of the manufacturer. The M-Bus port has an increased durability against over voltage. Carrying out this type of test is not required with the use of shield cable. Reaching a high level of protection on the M-Bus port also guarantees a very high reliability of the converter. The M-Bus interface often poses the greatest risk of over voltage and the ensuing destruction of the converter.

Handling of electronic waste

- A non-functional, discarded electronic device must be handed to a proper collection authority.
- The electronic device must be separated from unsorted communal waste.
- Failure to handle the scrapped electronic device according the mentioned guidelines may cause negative impact on the environment and human health.
- Handing the old device to a proper collection authority will warrant the recovery of useful materials with which you contribute to their repeated use after recycling.
- All information in this paragraph is represented by the following symbol present on every electronic device.
- The purpose of this symbol is to guarantee the retrieval and separate collection of e-waste. These types of devices cannot be disposed into unsorted communal waste.



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