

Communication interface converter M-Bus to RS485 - RS485toMBus-5



Instructions manual

Version: 2014/1.7-EN

Communication converters of the X-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 attains the highest durability class of overvoltage protection and is immune against failures on the M-Bus line.

The converter has a wide range of operating DC and AC voltages with a resettable current fuse.

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 power supply, >1kV from M-Bus
Protections	overvoltage protection TVS 600W
Terminating resistors	A 1k Ω to +5V, B 1k Ω to GND, between A and B 120 Ω - JUMPER
Connector	plug-in 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 1500W - 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, >1kV from RS485
Connector	plug-in connector for wires of up to 2.5 mm ² cross-section area
Power Supply	
Recommended range of power supply voltages	
DC power supply	9V to 34V
AC power supply	8V to 24V
Protections	overvoltage protection TVS 1500W overcurrent protection with a 0.3A resettable PTC fuse
Power consumption	0.4W to 1.1W depends on M-Bus line load and power supply.
Connector	plug-in connector for wires of up to 2.5 mm ² cross-section area
Temperature	
Operating range	-40°C to 70°C
Mechanical construction	
Mechanical design	aluminium box
Mounting	35mm DIN rail (EN 50022 top hat rail)
Dimensions: height x width x length	33 x 57 x 87mm – note: length with connectors 106mm
Protection classification	IP20
Weight	125g

Layout of connectors and status LEDs



Connectors

- **M-Bus** – Plug-in connector for connecting the M-Bus line with M-Bus slave devices.
- **Power** – Plug-in connector for connecting the power supply. *Note:* the polarity doesn't matter.
- **RS485** – Plug-in connector for connecting the RS232 line.
- **JUMPER** – A connector for insertion of a JUMPER which will connect an internal 120Ω termination resistor between the A and B signals on the RS485 line.

Status LEDs

- **Transmit** – The status LED is colored green and signifies data transmission on the M-Bus line.
- **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 DC power supply voltage is 9V to 34V. For AC power the recommended range is 8V to 24V. The connection of the power supply voltage uses a plug-in connector labeled POWER. Maximum power consumption is 1.1W and depends on the load on the M-Bus line.

The converter has its own resettable PTC fuse with a trip current of cca. 0.3A at 20°C.

The PTC fuse represents a basic overcurrent protection of the converter and the power supply.

*Note 1** One of the power wires should be grounded - connected with the PE (Protective Earth) wire. Otherwise the converter will not comply with the EN 55011 EMC standard. Note: this depends on the used power supply and connection of further devices to the same power supply.

*Note 2** The use of external current protection is advised for further protection of the power supply. For example in case a lower trip current than that of the built-in PTC fuse is desired, limiting the short circuit current during overvoltage, etc.

• RS485 line

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

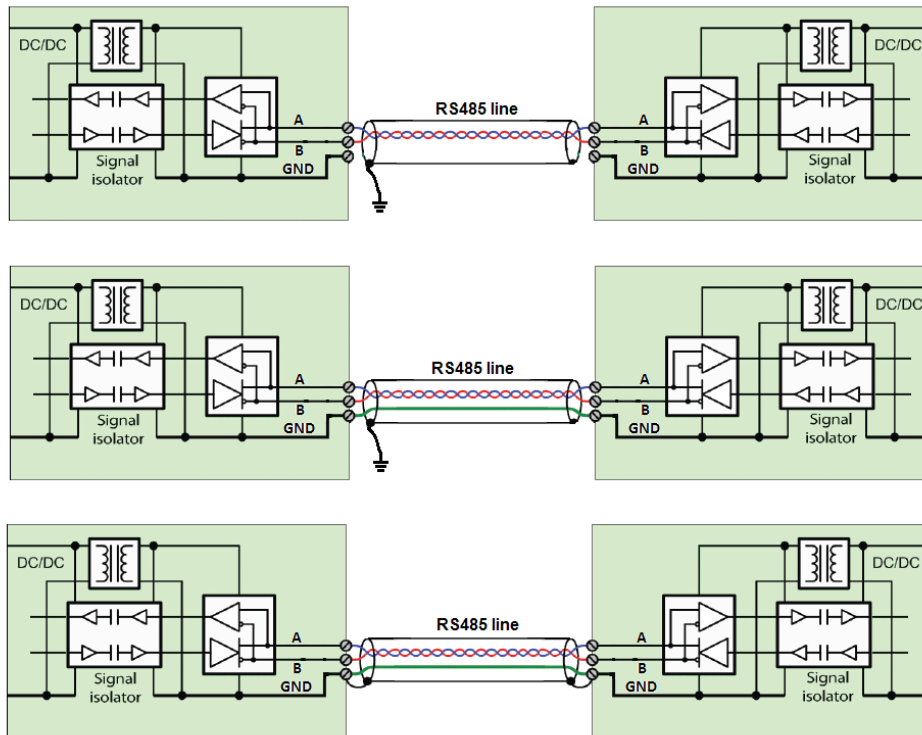
The RS485 interface uses data wires labeled as A and B. Signal A is sometimes referred to as +Tx/Rx and signal B as -Tx/Rx. There is a small voltage about 0.3V between the A and B pins in idle state. The A pin should be slightly positive.

The interface of the converter contains a terminating resistor between the A and B pins and two more resistors of 1kΩ value. These resistors are connected to the power supply voltage and define the idle state on the RS485 line with a small pre-voltage. The 120Ω terminating resistor is configurable. It should be connected at the end of communication line. Its connection is realized by a JUMPER.

The GND pin is the ground of the RS485 line and the internal TVS protections connect to it. It is not necessary to connect the GND signal. But in order to improve the interference resistance of the line in case of electrical potential variation between two RS485 devices, it is recommended to connect their GND pins.

It is recommended to use a shielded twisted pair cable in the construction of the communication line. In case of connection of the GND signals it is recommended to use an additional internal wire of the cable. The shielding of the cable should be grounded preferably at the entry point of the switchgear cabinet especially by long or outdoor lines. If the line is short and within one room or within a switchgear 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 the highest level of protection - Class 5 in the EN 61000-4-5 standard measured 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 plug-in 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 150nF.

A voltmeter and an amp meter is sufficient for a basic electrical check of the M-Bus line. The measurements should be taken in an idle state without an 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.

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.

Mechanical parameters of the converter

The converter is made from a robust aluminium box which ensures excellent mechanical durability, enhanced interference resistance and improved heat dissipation from the converter to the environment. The converter is designed to be mounted on a 35 mm DIN rail (EN 50022 top hat rail).



Top view



Side view with DIN rail attached

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 55011	Power line - CONDUCTED EMISSIONS 10/150 kHz - 30 MHz	Class A
EN 55011	RADIATED EMISSIONS (Electric Field) 30 MHz - 1000 MHz	Class A

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 61000-4-3	RADIATED RADIO-FREQUENCY ELECTROMAG. FIELD 80MHz - 1GHz	10 V/m
EN 61000-4-3	RADIATED RADIO-FREQUENCY ELECTROMAG. FIELD 1,4GHz - 2GHz	10 V/m
EN 61000-4-3	RADIATED RADIO-FREQUENCY ELECTROMAG. FIELD 2GHz - 2,7GHz	3 V/m
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 / ± 1kV
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.*	± 4kV / ± 2kV
EN 61000-4-6	CONDUCTED DISTURBANCES, INDUCED BY RADIO-FREQUENCY FIELDS 0,15MHz - 80 MHz. Power line and M-Bus line.	10 V

* test carried out at the request of the manufacturer. The M-Bus port of the converter achieves the highest level of overvoltage protection according to the EN 61000-4-5 standard. Carrying out this type of test is not required with the use of shield cable. Reaching the highest level of protection on the M-Bus port also guarantees the highest achievable reliability of the converter. The M-Bus interface often poses the greatest risk of overvoltage 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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