Communication interface converter M-Bus to RS232 - RS232toMBus-5

Instructions manual

Version: 2016/1.8-EN

Communication converters of the X-Port line

RS232toMBus-5 communication converter

RS232toMBus-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 common RS232 interface. The converter works as a transparent gateway and the transfer of the M-Bus messages is without modifications to their content or transfer rate.

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 overvoltage protection and 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

RS232 communication interface	
Communication signals	RxD, TxD, GND
Protections	protection against ±15kV ESD, filters
Connector	plug-in connector for wires of up to 2.5 mm² cross-section area
Galvanic separation	1kV from power supply, >1kV from M-Bus
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 - overload and short circuit electronic protection on the line, note: the converter is immune against permanent short on the line
Galvanic separation	1kV from power supply, >1kV from RS232
Connector	plug-in connector for wires of up to 2.5 mm² 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 mm² 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.
- **RS232** – Plug-in connector for connecting the RS232 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 may 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* status LED will start to flash. If there is a greater overload on the line, more than 7 M-Bus SLAVE devices are connected, the *Receive* and *Overload/Short* status LEDs will 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 greater number of M-Bus slave devices connected to the M-Bus line, the converter will interpret such a state as a short circuit on the line. The red *Overload/Short* 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 RS232 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.

- **RS232 line**

    The RS232 interface uses a three wire connection of the TxD, RxD and GND signals. TxD is an output. Data is transmitted through it and it must be connected to RxD signal of the receiving device / PC. RxD is an input and data is received with it from the PC. The RxD signal must be connected to the TxD signal of the transmitting device / PC. The GND signals must be connected directly between both devices.
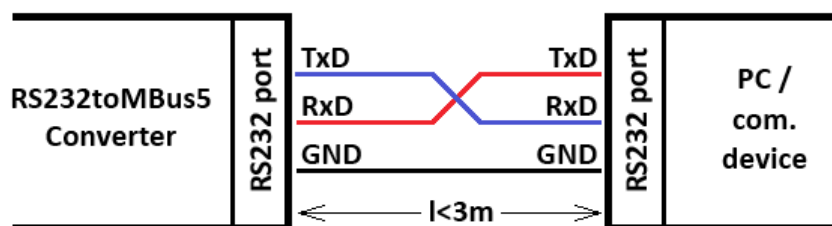
RS232 port connection between the converter and PC.

It is recommended to use a shielded cable for the device connection, for example LiYCY 3x0.14mm².

    When connecting the RS232 line a simple verification is possible using a volt meter. A voltage can be measured between the GND and TxD or RxD signals. The voltage of the TxD signal is in -5V to -12V range depending on the device. TxD signal of the converter is approx. -10V at idle. Voltage on the RxD signal is zero. A negative voltage must appear on both RxD and TxD pins of the converter in a correct connection.

    Note: Signal pinouts on a D-SUB 9 pin connector: 2 – RxD, 3 – TxD, 5 – GND.
    Signal pinouts on a D-SUB 25 pin connector: 3 – RxD, 2 – TxD, 7 – GND.

Note: The RS232 interface is not suited for environments where an overvoltage can carry over to the communication line. It is not equipped with overvoltage protection and its use in industrial environments is only recommended for shorter distances (l < 3m) or in spaces for IT equipment complying to EN55024.

- **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 mm^2 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 2x0.14mm^2 up to a distance of 100m, LiYCY 2x0.25mm^2 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 table contains a summary of verification voltages and currents which can be measured during a check.

M-Bus line	SLAVE device	RS232toMBus-5 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 com. 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 thorough these wires should be smaller or at the very most equal to 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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