

M-Bus interface repeater

RepeaterMBusXL



Instructions manual

Version: 2023/1.2-EN

Communication converters of the XL line



RepeaterMBusXL - M-Bus repeater

The M-Bus repeater is used to extend an M-Bus communication line over the standard distance (suitable for cca. over 1km) or galvanic separation of individual M-Bus line sections.

The repeater splits the M-Bus line into two galvanically separated M-Bus lines and enables message transfer between these two lines without message content changes.

Depending on model the M-Bus master port has a connection capacity for 45, 80, 120 or 190 M-Bus slave devices. The interface has the highest rating of surge protection and is resilient to failures on the M-Bus line.

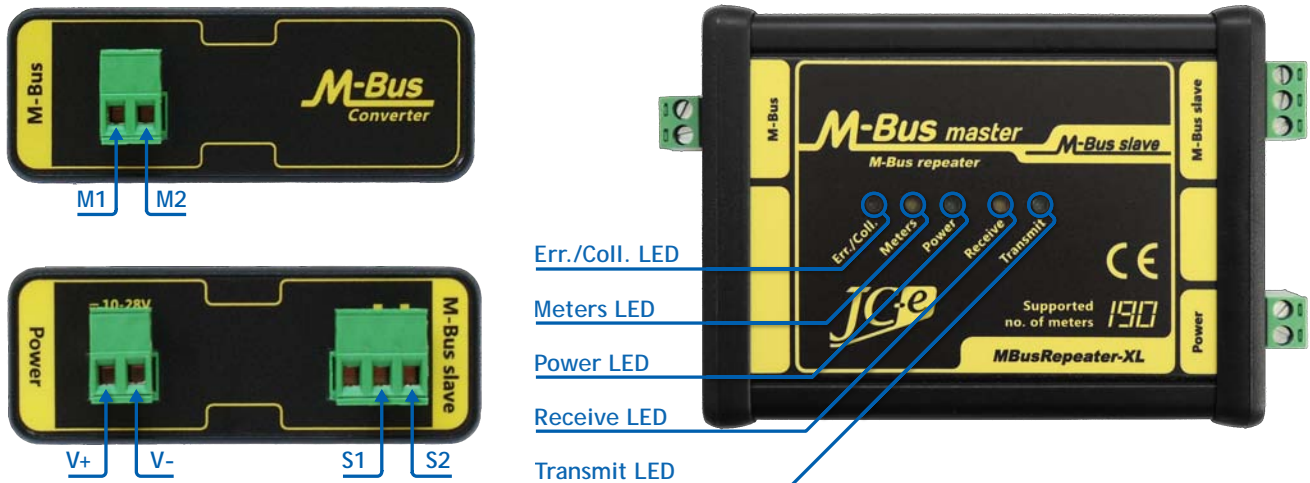
The states of M-Bus master line and the repeater are evaluated and monitored by a processor. Error states are indicated by status LEDs which simplify identification of the repeater's current state and possible causes of a malfunction. The LEDs indicate functionality of the repeater, power source state, M-Bus line loading and possible error states on the line.

The repeater works at a standard level of DC voltages with polarity reversal protection.

Technical parameters

M-Bus slave communication interface	
Power consumption	RxD, TxD, GND
Protections	overvoltage protection TVS 600W
Galvanic separation	>1kV from power supply, 1kV from the M-Bus master line
Connector	plug-in connector for wires of up to 2.5 mm ² cross-section area
M-Bus master communication interface	
Number of attachable devices	four versions: 1 to 45, 80, 120, 190 M-Bus slave devices
Baud rate	300 - 9600 bps
Protection	- overvoltage protection TVS 1500W - electronic protection against overloads, short circuit and external voltage on the line. Time of recovery to normal operation within 1 second. Converter can withstand sustained short circuit on the communication line
Galvanic separation	1kV from power supply, 1kV from the M-Bus slave line
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	12V to 30V. Model XL190 20V to 30V.
Maximum limits of supply voltage - permanent operation at these voltages is not recommended	
Minimum DC voltage	11V - min. voltage required for repeater operation
Maximum DC voltage	31V - at higher the overvoltage protection starts to activate
Protection	overvoltage protection TVS 1500W
Power consumption	0.85W to 15W depends on repeater model and number of M-Bus devices
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	DIN rail 35 mm (EN 50022 top hat rail)
Dimensions: H x W x L	37 x 81.5 x 107 mm without connectors, 37 x 81.5 x 125 mm with connectors
Protection classification	IP40
Weight	220g (XL45, XL80) 240g (XL120, XL190)

Layout of connectors and status LEDs



Connectors

- **M-Bus master** – Plug-in connector for connecting the M-Bus line with M-Bus slave devices.
M1, M2 Connector for connecting the repeated M-Bus line.
- **Power** – Plug-in connector for connecting the DC power supply.
V+ positive pole, **V-** negative pole.
- **M-Bus slave** – Plug-in connector for connecting the primary M-Bus line.
S1, S2 Connector for connecting the primary M-Bus line.

Status LEDs

i Operational states indication

LED	State
Power LED turned on	Repeater and power supply is alright.
Transmit LED flashing	Data is transmitted to the M-Bus line.
Receive LED flashing	Data is received from the M-Bus line.
Meters LED turned on	Load on M-Bus line. Meters are connected to the line.
Meters LED turned off	Disconnected M-Bus line. No meters are connected to the line.
Meters LED fast flashing	Max. amount of meters on M-Bus line reached (2 meters tolerance).

! Malfunction states indication

LED	State
Power LED flashing	Internal repeater error.
Power LED flashing + turned on Err./Coll. LED	External voltage on M-Bus line or Internal repeater error.
Err./Coll. LED flashing or turned on	Repeater overload - too many meters, short on the M-Bus line or capacitive overload on M-Bus line (C of line >5 μ F). When turning on the power - capacitive overload on M-Bus line (C of line >1 μ F). Increased capacitance may be caused by meters during power up. Capacitance can afterwards fall below 1 μ F.
Err./Coll. LED turned on for a short while	During data reception - flashing Receive LED . Communication collision. Simultaneous reply from multiple meters. During data transmission - flashing Transmit LED . An error occurs during transmission (incorrect voltages on the M-Bus line). Internal repeater error or capacitive overload on M-Bus line.

Typical application



Typical wiring of the repeater with M-Bus devices, power supply and connection to the repeated line.

Usage

The main use case for the M-Bus repeater is in extending the maximum length of an M-Bus line. The maximum length of the line is limited mainly by wire resistance and capacity of the line, by number of devices (communication or surge protections etc.) and number of connected M-Bus meters. The chosen communication speed has also an influence on the maximum usable length of the M-Bus line. It is preferable to use the lowest communication speed to obtain the maximum possible line length.

In cases when it is not possible to achieve an error free communication on the required line length at the required communication speed on all meters, it is recommended to split the line into two or more sections using a repeater. The M-Bus repeater will ensure restoration and amplification of the M-Bus signal. The shorter, separated lines will make it possible to achieve an error free communication.

Connecting an M-Bus repeater with a galvanic line separation will increase the durability of the whole line with increased protection against interference and overvoltage. Additionally an easier and better protection against such effects can be made on the shorter lines.

The separated M-Bus lines will not carry over malfunction states such as shorts on the line or overloads. If an M-Bus star network topology is created using the repeaters it will have an increased level of protection against malfunctions and lowered loss of data during malfunctions. The malfunction will affect only part of the network and so will not hinder communication with all meters.

Power Supply

The recommended range of DC power supply voltage is 12V to 30V. The connection of the power supply voltage uses a plug-in connector labeled POWER. Maximum power consumption is 15W and depends on the load on the M-Bus line and repeater model.

*Note 1** The use of external current protection is advised for additional protection of the power supply and to limit the short circuit current during overvoltage.

M-Bus slave port

The interface is of M-Bus slave type and the load is equivalent to two slave devices. The polarity of the M-Bus line connection does not matter.

The data received on the M-Bus slave port is directly transferred to the M-Bus master port and vice versa. The M-Bus ports are galvanically separated.

The connection of the M-Bus line uses a plug-in connector labeled M-Bus slave. The connector allows a connection of wires with up to 2.5 mm² cross-section area.

A check of correct connection is possible with a voltmeter. In resting condition without any data transfer,

the voltage should be higher than 21V and lower than 43V. The current flowing through the connector should be in 2.5 to 3mA range.

M-Bus master port

The interface is of M-Bus Master type and depending on repeater model allows for connection of 45, 80, 120 or 190 M-Bus SLAVE devices. The interface is protected against overvoltage, overload, external voltage 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 according to 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 repeater does not change the communication speed and transfers data at the speed at which it is received.

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 1uF.

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 for checkup measurements.

M-Bus line	SLAVE device	Repeater XL 45	XL 80	XL 120	XL 190
Idle voltage U_{M-Bus}	min. 21V	31V to 35V			
Idle current I_{M-Bus}	max. 1.5mA	max. 67.5mA	120mA	180mA	285mA

The measurements should be taken in an idle state without ongoing communication and in a state when the repeater does not indicate an error on the M-Bus line. The idle voltage on the M-Bus line should be in the 31 to 35V 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 repeater should be depending on the model 67.5mA (XL45), 120mA (XL80), 180mA (XL120) or 285mA (XL190). 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

The repeater is made from a robust aluminium box which ensures excellent mechanical durability, enhanced interference resistance and improved heat dissipation from the repeater to the environment. The repeater 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 repeater 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 master, slave line	± 4 kV
EN 61000-4-5	SURGE IMMUNITY - Power line. Common/differential mode.	± 1kV / ± 500 V
EN 61000-4-5	SURGE IMMUNITY - M-Bus master, slave 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. M-Bus line.	10 V

* test carried out at the request of the manufacturer. The M-Bus port of the repeater 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 repeater. The M-Bus interface often poses the greatest risk of overvoltage and the ensuing destruction of the repeater.

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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