

# Communication interface converter USB to M-Bus – USBtoMBus-XL

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## Instructions manual

Version: 2023/1.3-EN

**Communication converters of the XL line**



## USBtoMBus-XL communication converter

RUSBtoMBus-XL communication converters are durable converters of the M-Bus industrial communication bus to the common USB computer interface. The converters enable easy connection of M-Bus devices to control or computer systems using the USB interface for the purpose of data collection and processing.

The converter creates a virtual serial port after it has been connected to a PC. The communication parameters of this port can be configured in its driver settings or directly in the program that will use this port.

Depending on model the M-Bus 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.

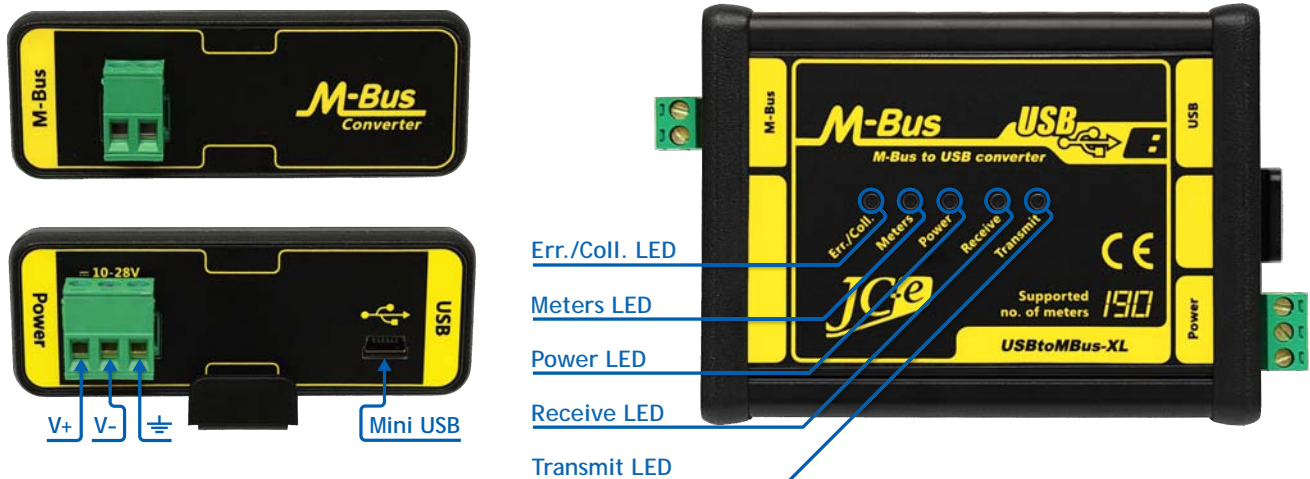
The states of the M-Bus line and the converter are evaluated and monitored by a microprocessor. Error states are indicated by status LEDs which simplify identification of the converter's current state and possible causes of a malfunction. The LEDs also indicate functionality of the converter, power source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

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

## Technical parameters

RS232 communication interface	
Communication signals	RxD, TxD, GND
Protections	protection against $\pm 15\text{kV}$ ESD, filters
Galvanic separation	$>1\text{kV}$ from power supply, $1\text{kV}$ from M-Bus line
Connector	plug-in connector for wires of up to $2.5\text{ mm}^2$ 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	<ul style="list-style-type: none"> <li>- overvoltage protection TVS 1500W</li> <li>- electronic protection against overloads, short circuit and external voltage on the line. Time of recovery to normal operation within 1 second.</li> </ul> Converter can withstand sustained short circuit on the communication line.
Galvanic separation	$1\text{kV}$ from power supply, $1\text{kV}$ from RS232
Connector	plug-in connector for wires of up to $2.5\text{ mm}^2$ 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 converter 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 converter model and number of M-Bus devices
Connector	plug-in connector for wires of up to $2.5\text{ mm}^2$ cross-section area
Temperature	
Operating range	$-40^{\circ}\text{C}$ to $70^{\circ}\text{C}$
Mechanical construction	
Mechanical design	aluminium box
Mounting	DIN rail 35 mm (EN 50022 top hat rail)
Dimensions: H x W x L	38 x 81.5 x 107 mm without connectors, 38 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** – Plug-in connector for connecting the M-Bus line with M-Bus slave devices.
- **Power** – Plug-in connector for connecting the DC power supply.  
V+ positive pole, V- negative pole,  $\perp$  earth ground.
- **USB** – Mini USB connector for PC connection.

### Status LEDs

#### Operational states indication

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

#### Malfunction states indication

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

## Typical application



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

### 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 converter 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.

### USB interface

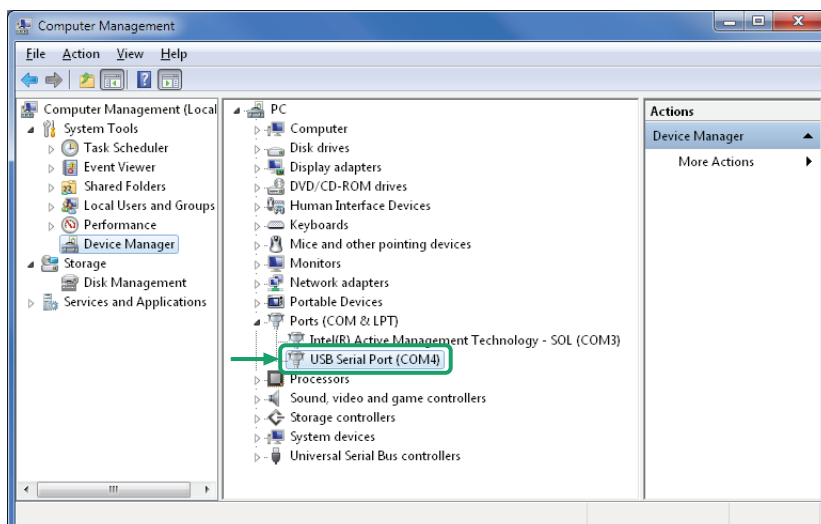
The converter creates a virtual serial port after it has been connected to a PC. The communication parameters of this port can be configured in its driver settings or directly in the program that will use this port.

On Windows 7 systems and newer, the driver for the USB virtual serial port is installed automatically immediately after the converter has been connected to the computer. The drivers for other operating systems and older versions of Windows are available at this address: <http://www.ftdichip.com/Drivers/VCP.htm>

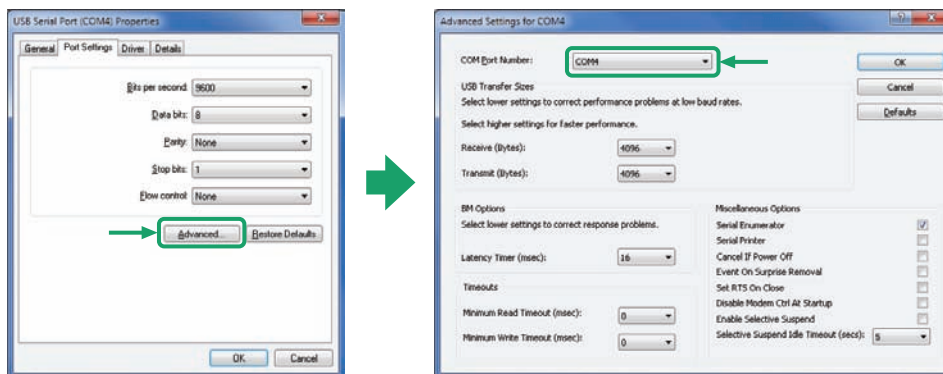
The COM port number depends on the system and it is possible to change it.

Steps to change the COM port number in the Windows operating systems:

1. Click on the *Start* button in the taskbar.
2. Right click on *My Computer*.
3. Choose *Manage* in the context menu.
4. In the *Computer Management* window, click on *Device Manager* in the left panel.
5. In the right panel open the *Ports (COM & LPT)* item.
6. Double click on the *USB Serial Port (COMx)* device - Port number depends on system.



7. On the *Port Settings* tab, press the *Advanced* button.
8. In the *Advanced Settings* window chose the *COM Port Number*.



9. Press the *OK* button for the advanced settings and the *OK* button for the port settings.

The change will occur immediately without the need to restart the computer and the Device manager should show the COM port with the new number.

Other communication parameters of the port in Windows can be changed in the same way as mentioned in the above steps or they can be configured directly in the program that will use the given COM port.

## M-Bus line

The interface is of M-Bus Master type and depending on converter 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 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<sup>2</sup> 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<sup>2</sup> up to a distance of 100m, LiYCY 2x0.25mm<sup>2</sup> 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	Converter 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 converter 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 converter 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 thorough these wires should be smaller or at the very most equal to 1.5mA.

## Mechanical parameters

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 / ± 500 V
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. 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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