Inline Terminal
ILT MBUS
IB IL MBUS-PAC

Device Description

This manual is intended to provide support for installation and usage of the device. The information is believed to be accurate and reliable. However, SysMik GmbH Dresden assumes no responsibility for possible mistakes and deviations in the technical specifications. SysMik GmbH Dresden reserves the right to make modifications in the interest of technical progress to improve our modules and software or to correct mistakes.

We are grateful to you for criticism and suggestions. Further information (device description, available software) can be found on our homepage www.sysmik.de. Please ask for latest information.

SysMik disclaims all warranties in case of improper use or disassembly and software modifications not described in this document or when using improper or faulty tools. Commissioning and operation of the device by qualified personnel only. All applicable regulations have to be observed.

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Content

1 Overview

This terminal is designed for use within an Inline station. It is used to communicate with M-Bus counters according to EN 13757.

Features

- supports up to 30 M-Bus devices
- selectable baud rate
- diagnostic and status indicators

Note: This data sheet is only valid in association with the manual „sysMik User's Guide Inline“ (see [1]).

2 Ordering information

Device	Description	Part number
ILT MBUS	M-Bus terminal	1225-100481-03-3
IB IL MBUS-PAC		2701927

Table 2.1: Ordering information

3 Local status and diagnostic indicators

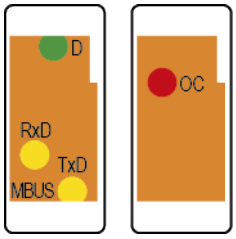


Fig. 3.1: Local status and diagnostic indicators

Indicator	Color	Description
D	green	diagnostics (bus communication and logic voltage)
RxD	yellow	terminal receives data from M-Bus
TxD	yellow	terminal transmits data to M-Bus
OC	red	over current situation on M-Bus (i.e. too many devices or short circuit)

Table 3.1: Local status and diagnostic indicators

4 Wiring

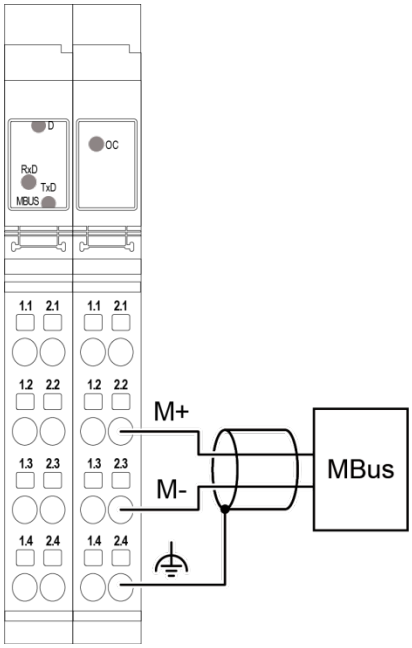


Fig. 4.1: Connecting an M-Bus device

Terminal point	Signal	Assignment
Connector 1		
1.4 / 2.4	FE	shield connection / functional earth
Connector 2		
1.2 / 2.2	M+	M-Bus (positive)
1.3 / 2.3	M-	M-Bus (negative)
1.4 / 2.4	FE	shield connection / functional earth
Terminal points not defined in this table must not be used!		

Table 4.1: Terminal point assignment

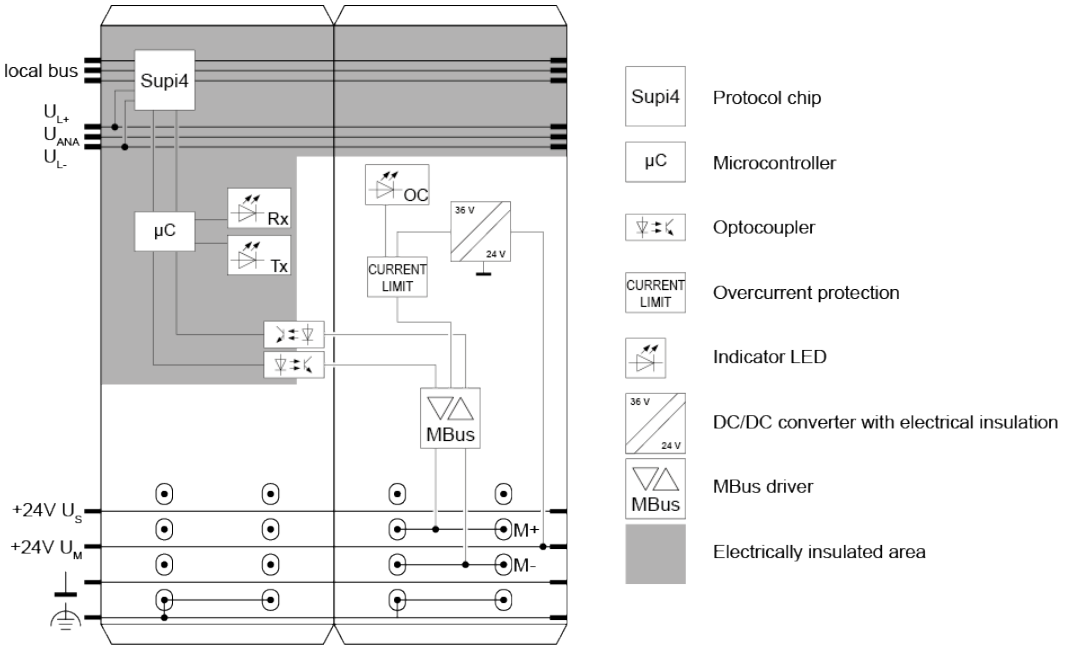


Fig. 4.2: Functional overview

The bus connection of M-Bus devices is polarity independent. Any topology except ring topology can be used. No specific bus cable is required. Commonly used are shielded telephone type cables (typically 4* 0.8 mm, like J-Y(St)Y 2 x 2 x 0.8mm) or, for larger distances, standard mains type (1.5 mm^2).

Note: The shield should only be connected at the M-Bus terminal, not at the M-Bus devices.

4.1 Bus cable length

The maximum length of the M-Bus cable is limited mainly by cable capacity and cable resistance.

4.1.1 Cable capacity

Cable capacity is the reason for low-pass behaviour of the cable and leads to distortion of the bus signals. The effective total capacity comprises all connected bus cables. Lower baud rates allow for longer cables. The number of loads is usually negligible (input capacity ≤ 0.5 nF per device). The above mentioned telephone cable J-Y(St)Y 2 x 2 x 0.8mm has typically a capacity of 100 nF per kilometer.

Baud rate	max. total cable length at 150 nF/km
300 Bd	10 km
2400 Bd	4 km
9600 Bd	1 km

Table 4.1.1.1: Max. total cable length depending on baud rate (typical values)

4.1.2 Cable resistance

Cable resistance R causes a voltage drop U_R along the cable. For proper signal transmission, the voltage drop must not exceed a certain value. The actual load (number and location of devices) defines the maximum cable resistance, and thus the maximum cable length.

Less loads and a larger cable cross section allow for longer cables.

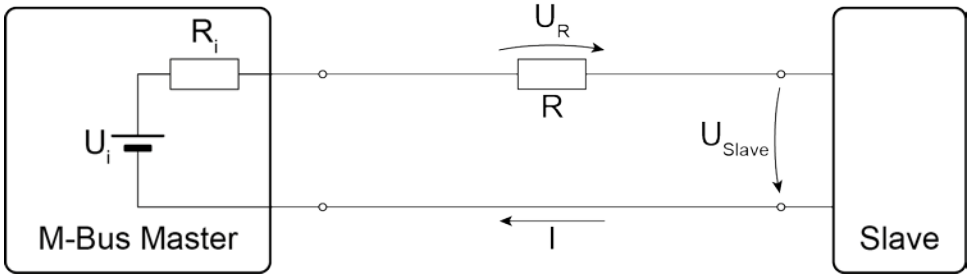


Fig. 4.1.2.1: Simplified schematic

Depending on the number of loads **n**, one of two criterions is decisive for calculating the max. cable length:

a) **n ≥ 12**: Master is sending (state: space)
Requirement: $U_{Slave} \geq 12$ V
With U_{i_space} of typ. 24.2 V, the maximum allowable voltage drop is 12.2 V, of which a part is already caused by R_i (typ. 57 Ω).

$$R_{max} = \frac{12{,}2\ \text{V}}{n \times 1{,}5\ \text{mA}} - 57\ \Omega$$

b) **n < 12**: Slave is answering
Requirement: $U_{Slave} \geq 12$ V
With U_{i_mark} of typ. 37.2 V, the maximum allowable voltage drop is 25.2 V, of which a part is again caused by Ri. But the current is higher than in the previous case a), because the answering device forces a transmitting current of 20 mA (instead of 1.5 mA).

$$R_{max} = \frac{25{,}2\ \text{V}}{(n-1) \times 1{,}5\ \text{mA} + 20\ \text{mA}} - 57\ \Omega$$

Depending on the cable type, R_{max} defines the max. allowed cable length. Keep in mind, that R_{max} is spread over two wires: one toward the device and one back. Usually, this is already taken care of by the cable manufacturer by providing data for the so called loop resistance. The loop resistance of the above mentioned telephone cable with 0.8 mm diameter is about 75 Ω per kilometer.

On the other hand, the calculations above are worst-case scenarios: all loads are connected at the far end of the bus cable. This is in reality rarely the case. If we consider instead an equal distribution of the devices along the bus cable, the cable length could almost be doubled in case of 30 devices (for less devices this multiplier

becomes smaller!). When necessary, own calculations have to be done that take the actual conditions of the planned network into consideration.

The following diagram shows the maximum cable resistance depending on the number of loads (worst-case).

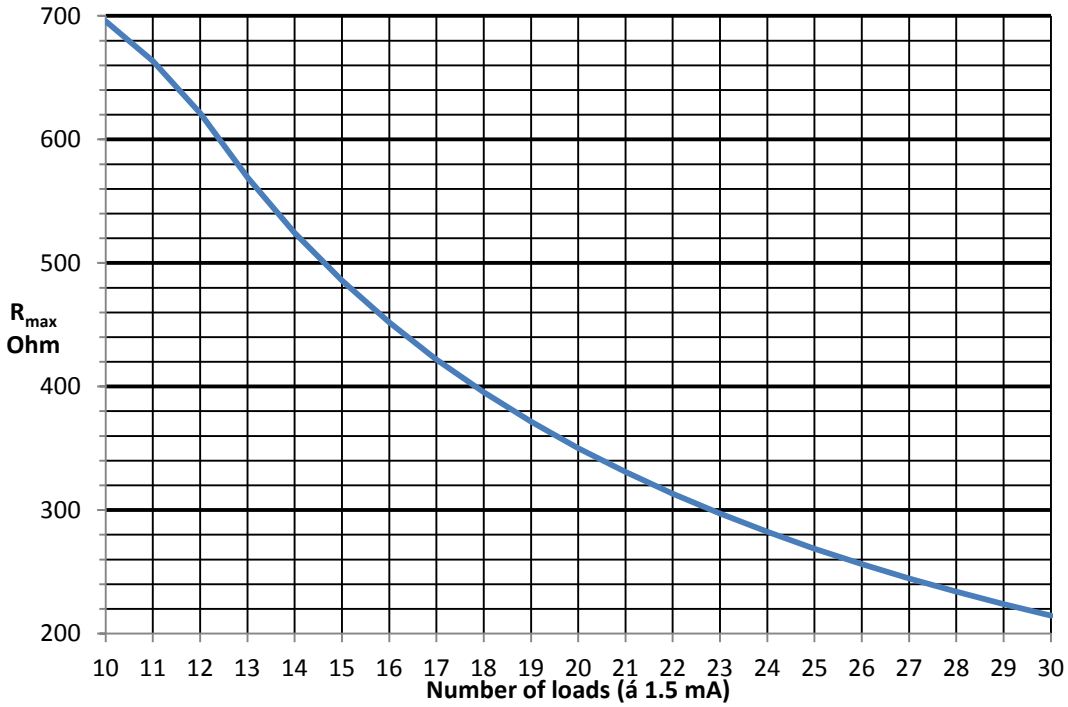
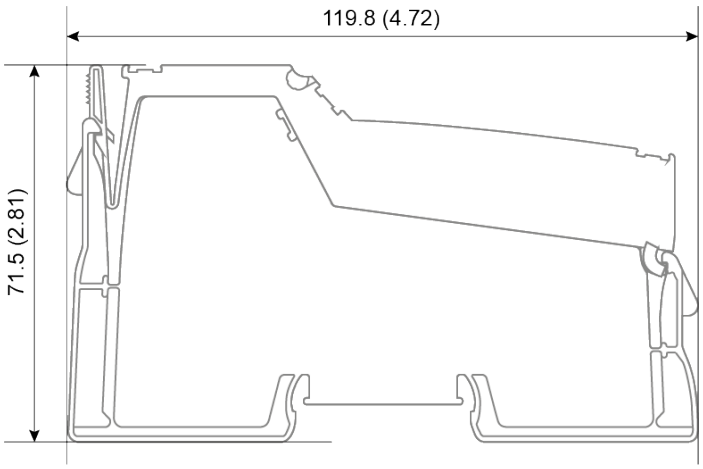


Fig. 4.1.2.2: Max. cable resistance depending on the number of loads

5 Technical data

Dimensions	
 Dimensions in mm (inch)	
Width	24.4 mm / 0.96 inch
Height	119.8 mm / 4.72 inch
Depth	71.5 mm / 2.81 inch

General data		
Color		green
Weight		125 g
Mounting type		DIN rail
Ambient temperature	operation	-25 °C to 55 °C (-13 °F to +131 °F)
	storage/transport	-25 °C to 85 °C (-13 °F to +185 °F)
Permissible humidity		10 % to 95 % (DIN EN 61131-2)
Air pressure		70 kPa to 106 kPa (up to 3000 m / 9843 ft. above sea level)
Degree of protection		IP20
Protection class		III, IEC 61140, EN 61140, VDE 0140-1

Connection data	
Name	Inline connectors
Connection method	spring-cage connection
Conductor cross section solid / stranded	0.08 mm² to 1.5 mm²
Conductor cross section [AWG]	28 to 16

Interface M-Bus	
Connection method	spring-cage connection
Transmission physics	copper
Number of M-Bus unit loads (1.5 mA each)	max. 30
Over current protection M-Bus $I_{M\text{-}Bus}$	> 65 mA
Baud rate, max.	19200 Bd
Bus voltage idle state V_i	typ. 37.2 V
Internal resistance R_i	typ. 57 Ω

Protection of M-Bus interface	
Protection from transients	yes
Overvoltage protection	+/- 60 V permanently
Type of protection	transzorb diode / PTC

Power consumption		
Main circuit supply U_M		24 V DC (via voltage jumper)
I/O voltage range		19.2 V DC to 30 V DC (including all tolerances, including ripple)
Current consumption from U_M,.	typ	26 mA + (n x 3 mA) n = number of unit loads; n = 1..30 example with ten unit loads: 26 mA + (10 x 3 mA) = 56 mA
	max.	160 mA
Communications power U_L		7.5 V (via voltage jumper)
Current consumption from U_L,.	typ.	65 mA
	max.	90 mA
Power dissipation		max. 1.6 W

Electrical isolation / isolation of the voltage areas	
M-Bus / 7.5-V supply (bus logic)	500 V AC, 50 Hz, 1 min
M-Bus / 24-V supply U_M	500 V AC, 50 Hz, 1 min
M-Bus / functional earth ground	500 V AC, 50 Hz, 1 min
7,5-V supply (bus logic) / functional earth ground	500 V AC, 50 Hz, 1 min
24-V supply U_M / functional earth ground	500 V AC, 50 Hz, 1 min
⚠ Electrical isolation of the logic level from the M-Bus interface is ensured by the DC/DC converter.	

Error messages to the higher level control or computer system
Peripheral error in case of U_M supply failure.

Table 5.1: Technical data

6 Literature

[1] SysMik User's Guide Inline

[2] www.sysmik.de