

EQUOBOX LC1

M-BUS ADAPTER/REPEATER

User Guide

Rev 3.3

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1. M-BUS OVERVIEW

1.1 DESCRIPTION of the M-Bus System

The M-Bus (Meter Bus) system is a communication protocol compliant with the EN13757-2 standard. The M-Bus System provides the following advantages:

- High level of data transmission security
- Low wiring costs
- Long distances without requiring repeaters
- Large number of central units
- Detection of both battery-powered and mains-powered devices
- Automatic device recognition
- Vast array of systems and components available
- Different types of bus topology: linear, star, and tree

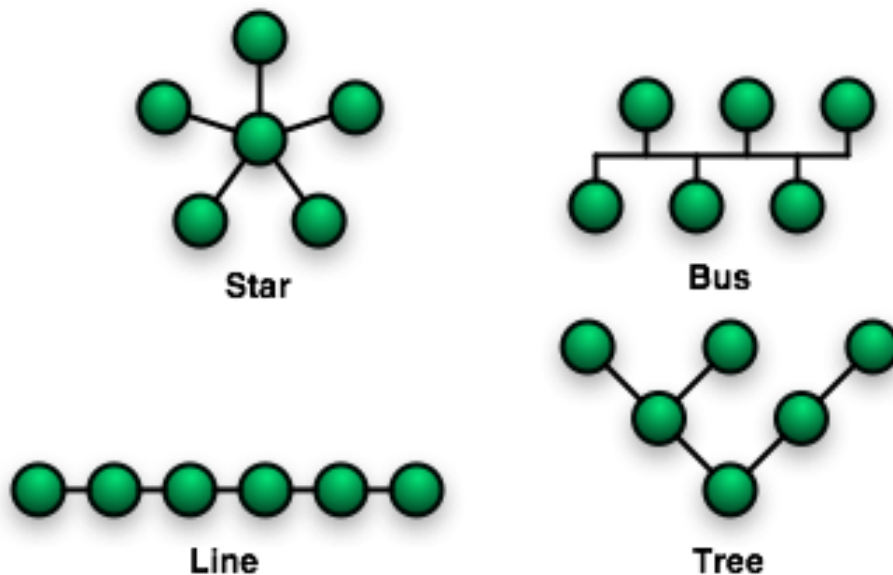


Figure 1 - Bus topologies

1.2 Addressing

The M-bus uses two types of addressing mode to detect the devices

- Primary addressing: up to 250 primary addresses can be allocated within an M-bus system. The primary address is normally allocated while setting up the central units.
- Secondary address: the secondary address consists of 8 bytes and allows the allocation of any number. By default, the secondary address of the devices is the same as the manufacturer serial number. This type of allocation prevents bus conflicts.

1.3 Sizing the M-Bus System

Cable type

- Telephone cable shielded 0.5mm² (4 x 0.8mm)
- NYM cable (1.5mm²)
- Cable maximum capacitive load: 152 nF/km

If you are using a cable of 0.6mm section halve the maximum length and the number of slaves

Follow the instructions provided in the table to size the M-Bus system

Type of plant	Maximum distance	Overall cable length	Cross-section mm ²	Number of devices (slaves)	Max. transmission rate
Small residential buildings	350 m	1000 m	0.8 mm	250	9600 Baud
Large residential buildings	350 m	4000 m	0.8 mm	250	2400 Baud
				64	9600 Baud
Small complex	1000 m	4000 m	0.8 mm	64	2400 Baud
Large complex	3000 m	5000 m	1.5 mm ²	64	2400 Baud
Medium neighbourhood	5000 m	7000 m	1.5 mm ²	16	300 Baud
Point-to-point connection	10000 m	10000 m	1.5 mm ²	1	300 Baud

BUS signal specifications

M-Bus system	u.m.	Condition	Minimum	Typical	Maximum	Measurement unit
Number of devices per segment	n	SIN.EQLC1	0		60	
Transmission rate	T	$C_{segment} \leq 382nF$	300	2400	9600 Baud	Bd
Bus voltage	U	IM=0...400mA	12		42	V
Bus Voltage (Master)	U _M	IM=0...400mA	24	40	42	V
Bus Voltage (slave)	U _{S,R}	$I_S \leq 1.5mA$	±21		±42	V
Bus current	I _{M,V}	SIN.EQLC1	0		90	mA
DC Bus current	I _{M,K}	SIN.EQLC1	130	500	160	mA
Current (slave)	I _{S,R}	US=21...42V	0.75	1.2	1.2	mA
Transmitted current (slave)	I _{S,S}	US=21...42B	11		20	mA

2. SIN.EQLC1 INSTALLATION

2.1 *SIN.EQLC1 Description*

SIN.EQLC1 is a unit that reads M-Bus devices in compliance with the EN 13757-2 standard.

You can connect up to 60 M-Bus devices to each SIN.EQLC1 unit.

The SIN.EQLC1 unit can be used in three different ways:

- Master Mode connected to SIN.EQRTU1
- Master Mode connected to the PC using the EQUOBOX TOOLKIT software (SIN.EQSW1)
- Slave/Repeater Mode, inserted into an already existing M-Bus network in order to expand it or repeat the signal



2.2 SIN.EQLC1 Appearance

SIN.EQLC1 looks like a device for mounting on DIN rail, below connectors / leds are listed:

	A	POWER SUPPLY CONNECTOR (9) – negative pin (-) power supply (24Vac/dc) (8) – positive pin (+) power supply (24Vac/dc)
	B	M-BUS Master CONNECTOR (6) – Pin 1 for connection M-Bus meters (Master mode) (7) – Pin 2 for connection M-Bus meters (Master mode)
	C	M-Bus Slave CONNECTOR (1) – Pin 1 for M-Bus net to extend (Repeater mode) (2) – Pin 2 for M-Bus net to extend (Repeater mode)
	D	CONNECTOR FOR DATALOGGER CONNECTION (3) – Pin A for data logger connection (SIN.EQRTU1) (4) – Pin B for data logger connection (SIN.EQRTU1) (5) – Pin C for data logger connection (SIN.EQRTU1)
	E	CONNECTOR FOR PC CONNECTION MINI-USB-B
	F	LEDs STATUS Ref. Chap 2.6

Figure 2 – Features and connectors Level Converter (SIN.EQLC1)

2.3 Technical characteristics

ELECTRICAL CHARACTERISTICS

Rated Voltage	24Vdc +/- 10% (Rev. HW 1.0 or if not specified) 24Vdc +/- 10%, 24Vac (min 20Vac, max 40Vac) for HW 2.0 versions
Installation category	Class III
Rated Voltage	3W + (0.07W * number of M-Bus slaves)
Maximum consumption	12W

MECHANICAL CHARACTERISTICS

Operating temperature range	From -10°C to +55°C
Storage temperature range	From -25°C to +65°C
Dimensions	90x71x62 mm (HxLxD) – DIN
Installation type	35mm DIN bar (EN60715)
Protection rating	IP20 (EN60529)
Connections	M-Bus Slave: to connect as a repeater / extender M-Bus Master: for the connection to the M-Bus meters Mini-USB Type B: for connection to the software EQUOBOX TOOLKIT (SIN.EQSW1)

M-BUS SECTION

Reference standard	EN13757-2 (Physical Layer)
Baud rate	Min. 300bps – Max. 9600bps
M-Bus-RS232 isolation	1KV AC
M-Bus-USB isolation	1KV AC
Max. number of M-Bus devices	60
Max. number of Repeaters	Unlimited in stand-alone mode for reading current data via USB N°4 as level converter/repeater EQUOBOX RTU M-Bus
Transmission speed	Minimum: 300bps Typical: 2400bps Maximum: 9600bps
Bus voltage	Min. 12V Max. 42V
Short circuit protection	Yes

2.4 Topology and connection to M-Bus network

The M-Bus technology allows good freedom of choice on the network topology, it is possible to connect the devices present in the system according to a star, linear, tree topology as seen in 4 and 5, instead of the ring topology (Fig. 6) is not allowed, it is also not necessary to observe any polarity of the bus, simplifying de facto, the installation.

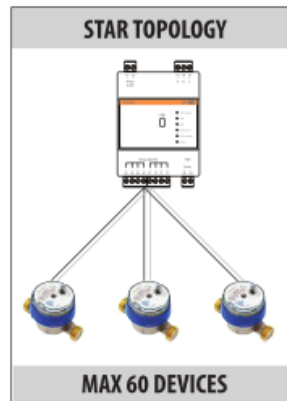


Figure 3 – Start Topology

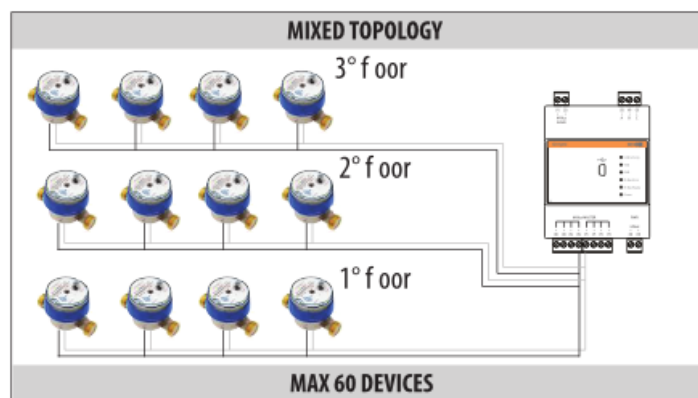


Figure 4 – Mixed Topology

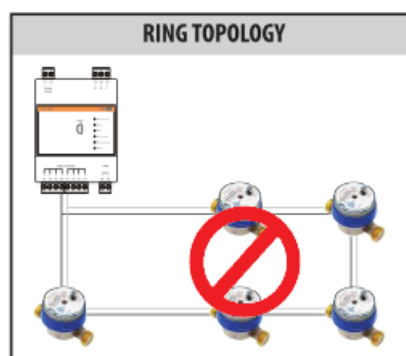


Figure 5 – Loop topology NOT ALLOWED

2.5 SIN.EQLC1 mode of operation

SIN.EQLC1 can be used as an M-Bus communication interface for SIN.EQRTU1 data logger or a PC with a software EQUOBOX ToolKit (SIN.EQSW1) or as a repeater/extender of an M-Bus network. The table below shows the connection diagrams for the different modes of operation.

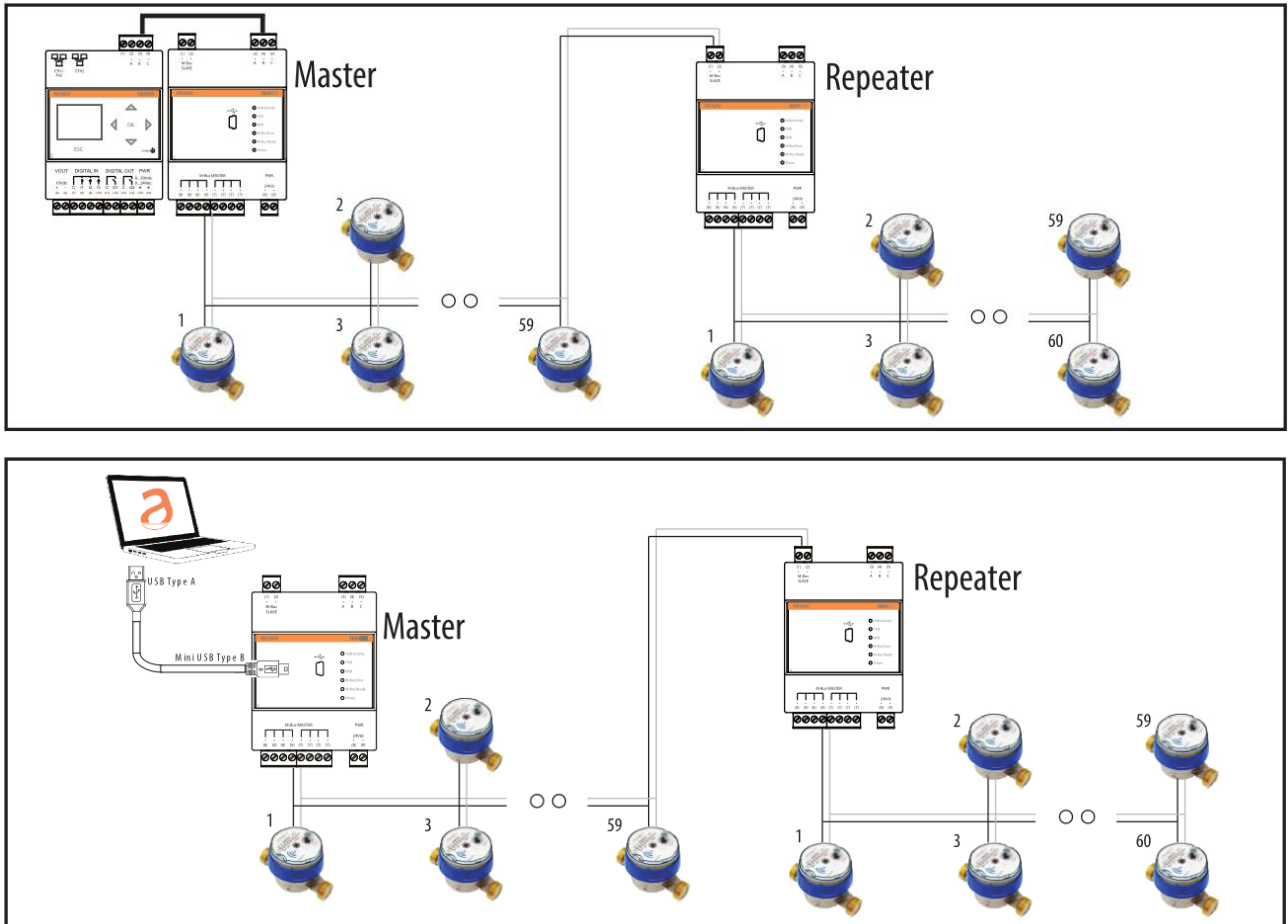


Figure 6 – Allowed connection

2.6 LEDs status

On SIN.EQLC1 device are present n ° 6 LED that indicate the operating status as shown in the figure:

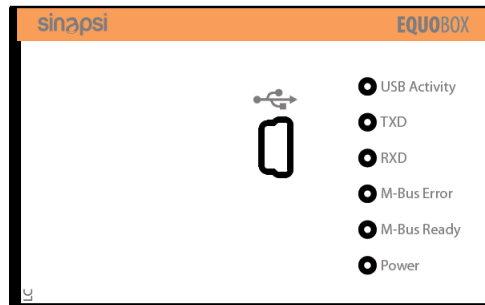


Figure 7 - Status indicators

- USB Activity:
 - 2 blinks → the device is ready to be connected to the PC by means of the mini USB-B cable
 - 5 blinks → PC successfully connected and device correctly recognised by the PC
- TXD: Indicates the status of the data transmission to the M-Bus network connected to terminals (6) and (7)
 - ON → data transmission in progress
 - OFF → no data transmission in progress
- RXD: Indicates the status of the data received by the M-Bus network connected to terminals (6) and (7)
 - ON → data reception in progress
 - OFF → no data reception in progress
- M-Bus error: Indicates whether the BUS current is correct or not
 - ON → BUS overload error (possible short circuit on the M-Bus or excessive number of connected devices)
 - OFF → no errors detected
- M-Bus ready: Indicates that the BUS voltage is correct and that there are no anomalies.
 - ON → The BUS is polarised with enough voltage to allow for proper operation
 - OFF → the BUS voltage is not sufficient to allow for proper operation
- Power: green. Indicates whether the device is powered on
 - ON → The device is powered on correctly
 - OFF → The device is not powered on correctly

2.7 Device power supply

The sizing of the power supply should be done considering that the MBUS devices may draw up to 20mA during communication and that in the process of plant commissioning may verify address conflict, this means that at a SIN.EQLC1 request can respond more slave devices simultaneously, and then, at that moment, the absorbed current by each slave is added. SIN.EQLC1 limits to 300mA the maximum current on the MBUS line. We therefore recommend a 24Vdc power supply (for HW 2.0 versions 24Vac/dc) with minimum power of 12W and a tolerance of voltage value as specified in Chap 2.3.

2.8 Firmware update

Through the EQUOBOX ToolKit software (SIN.EQSW1), it is possible to check the version of firmware in SIN.EQLC1 and if it is necessary to update it. Refer to the SIN.EQSW1 user guide for details.