Surge protection for the M-bus

The function of an M-bus (meter bus) is to transfer meter readings of consumption meters. Data can be centrally read off from all devices connected to an M-bus system, either directly on site or via data transfer in an external control room. This increases e.g. the living quality of tenants and allows to check the energy consumption of an entire building at any time.
The M-bus system is used for consumption cost billing and remote monitoring of

- Community and district heating systems as well as
- Multi-family houses

Centralised and distributed systems can be used to read off data from consumption meters.
If the consumption meters are located in close proximity to the system panel, a simple and cost-effective centralised system architecture is preferred. In this case, every single consumption meter is wired to the system panel in a radial configuration. If a distributed system is used, the data of the consumption meters installed on site are collected in sub-stations and are centrally transmitted to the system panel via the bus line.
As shown in **Figure 9.12.1**, a central master (in the simplest case a PC with a downstream level converter) communicates with the bus devices via a bus line. The installation can be subdivided into M-bus segments using M-bus repeaters. Up to max. 250 slaves such as heat meters, water meters, electricity meters, gas meters, sensors and actuators of any type can be connected per segment. More and more manufacturers integrate the electric M-bus interface including the protocol level in their consumption meters.
The M-bus is a two-wire bus system which is supplied by the bus master. All other bus devices of the M-bus must not be connected to earth during operation. The maximum bus voltage is 42 V.
Lines as well as the connected M-bus devices and protective circuits stress the M-bus segment due to their resistances and

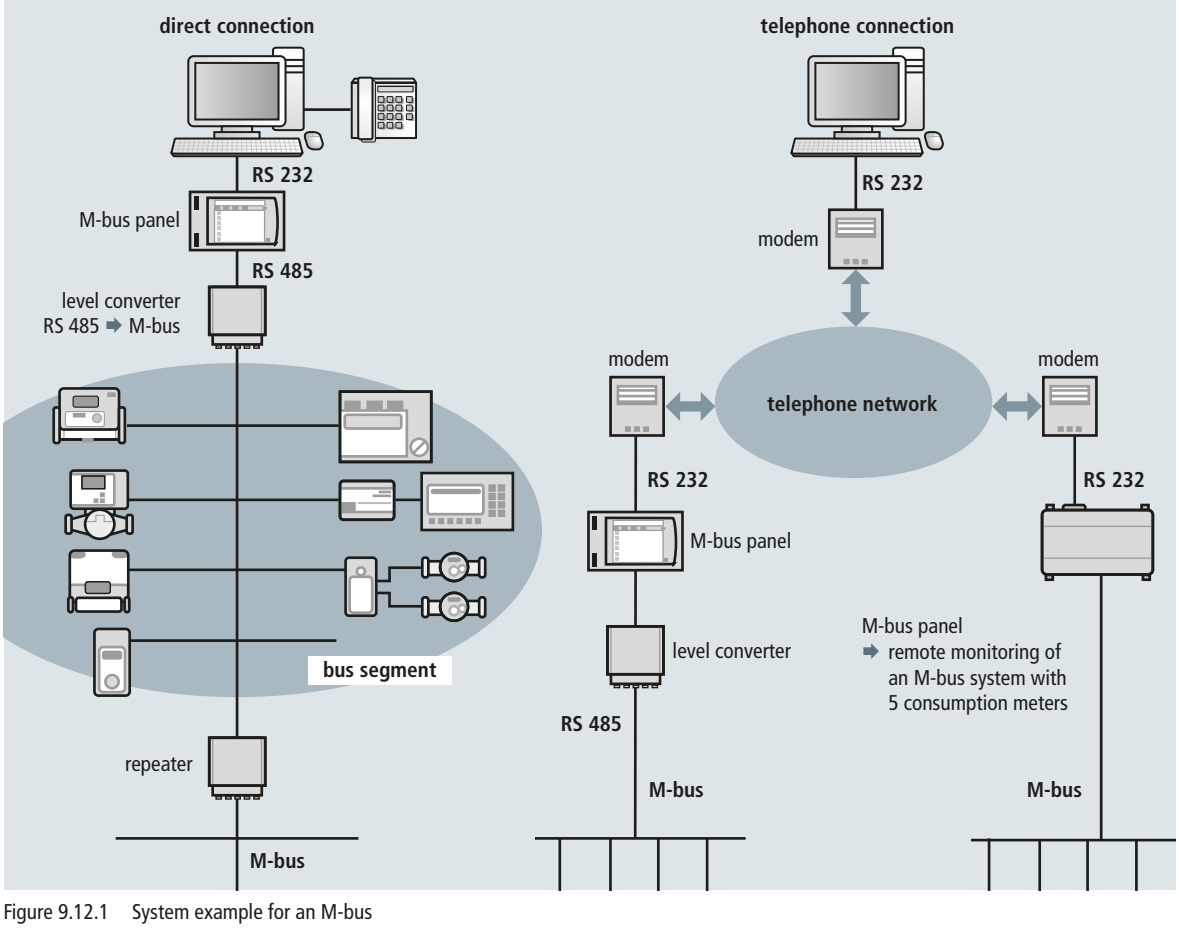


Figure 9.12.1 System example for an M-bus

Line J-Y (ST) Y...x 0.8	Number of bus devices	Current per bus device	Max. voltage drop
0.8 km	60	e.g. 1.5 mA	5.4 V

Table 9.12.1 Maximum voltage drop on the bus line

Baud rate	Max. bus capacitance at a baud rate of 9600	Total capacitance of the bus devices + line
9600	100 nF	60 meters + 0.8 km J-Y (ST) Y ... · 0.8 60 · 1 nF + 0.8 km · 50 nF/km

Table 9.12.2 Maximum baud rate depending on the bus devices (in this case meters) and the line capacitance

Surge protective device		Part No.	Capacitance: core / core	Series impedance per core
BLITZDUCTOR XT	BXT ML2 BD S 48	920 245	0.7 nF	1.0 Ω
BLITZDUCTOR XT	BXT ML2 BE S 24	920 224	0.5 nF	1.8 Ω
BLITZDUCTOR XT	BXT ML2 BE S 5	920 220	2.7 nF	1.0 Ω
DEHNconnect	DCO SD2 MD 48	917 942	0.6 nF	1.8 Ω
DEHNconnect	DCO SD2 ME 24	917 921	0.5 nF	1.8 Ω
DEHNconnect	DCO SD2 E 12	917 987	1.2 nF	–

Table 9.12.3 Capacitances and series impedances of surge protective devices

capacitances and have an impact on the length of the bus line / baud rate.
An M-bus panel has an M-bus standby current of e.g. 375 mA (250 standard loads of 1.5 mA each) which supplies different M-bus devices with different standard loads (e.g. three standard loads are equivalent to 4.5 mA). The cross-section of the copper lines and the sum of the voltage drops in the partial sections up to the relevant bus device define the maximum length of the bus line (**Table 9.12.1**).

Another aspect is the dependence of the maximum transmitted baud rate on the total capacitance in the bus segment. This is shown based on the example of an M-bus panel with a capacitance of 100 nF at a baud rate of 9600:

- Type of line J-Y (ST) Y… x 0.8
- About 75 Ω/km, about 50 nF/km for M-bus devices, e.g. meters, about 1 nF, about 1.5 mA (**Table 9.12.2**).

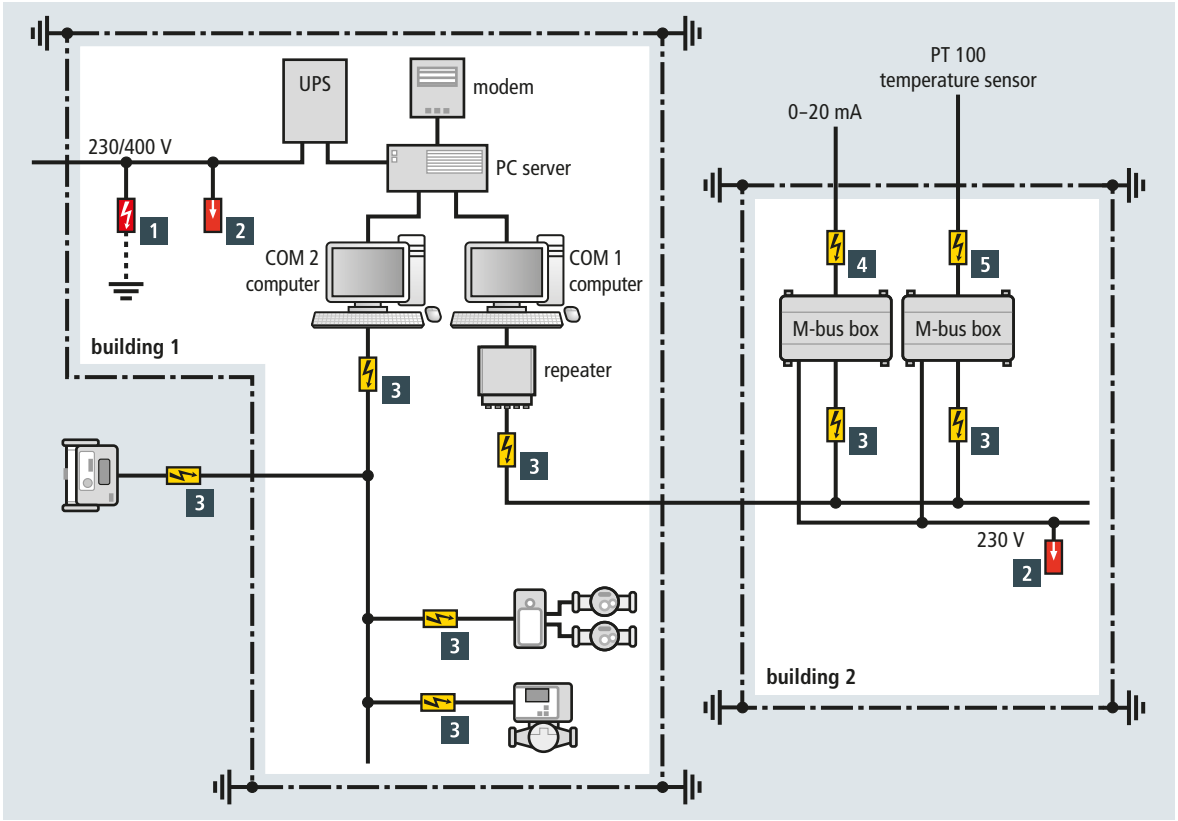
If surge protective devices are used, their series resistances and core / core capacitances must be observed (**Table 9.12.3**).

Building with external lightning protection system

If a building is fitted with an external lightning protection system, lightning equipotential bonding is required.
All cores of power supply and information technology cables and lines entering or leaving the building are connected to the lightning equipotential bonding system via lightning current arresters. **Figure 9.12.2** shows an example of how to protect an interconnected M-bus system from lightning currents and surges.

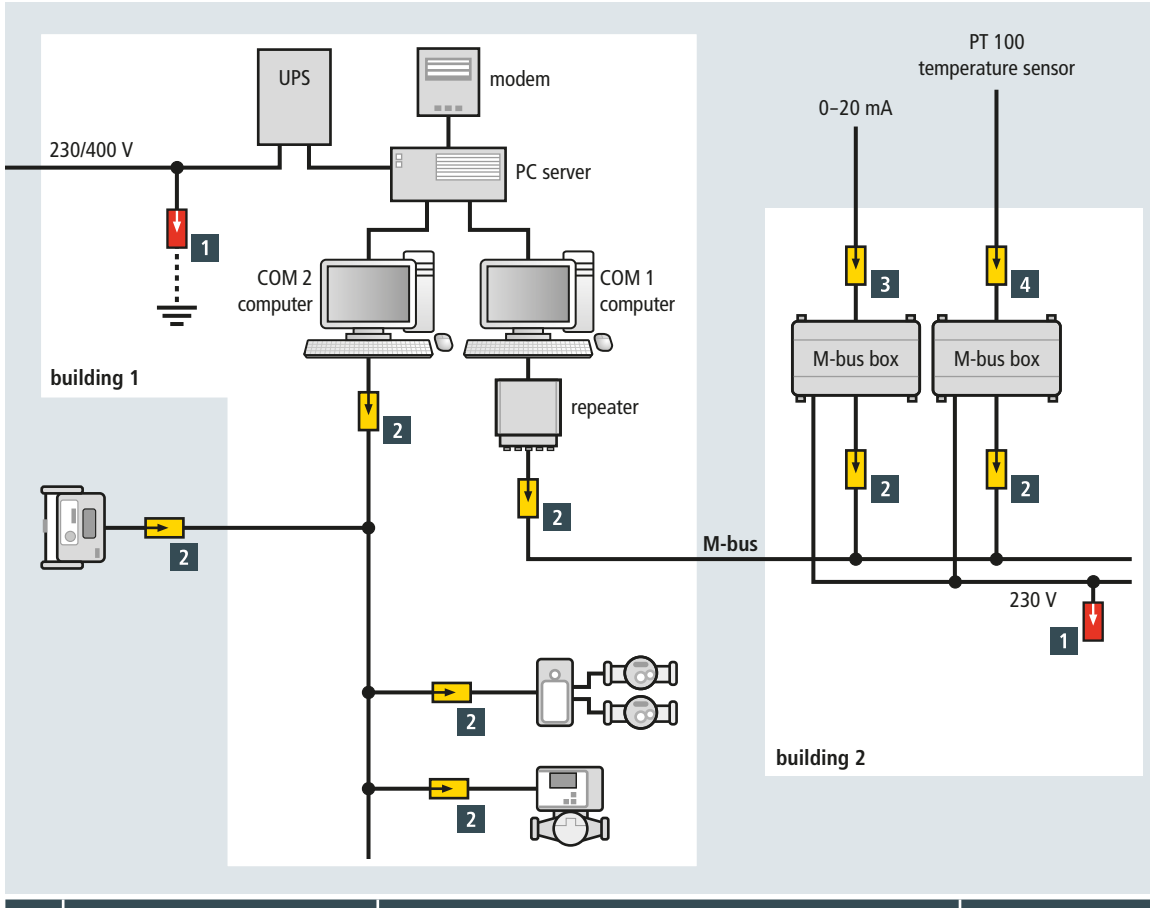
Building without external lightning protection system

If no external lightning protection system is installed, surge protective devices protect the electrical installations and systems. **Figure 9.12.3** shows an example of how to protect an interconnected M-bus system from surges.



No.	Protection for…	Surge protective device	Part No.
Selection of combined arresters according to the system configuration (in the main distribution board next to the entrance point into the building)			
1	Three-phase TN-C system Three-phase TN-S system Three-phase TT system	DEHNventil DV M TNC 255 DEHNventil DV M TNS 255 DEHNventil DV M TT 255	951 300 951 400 951 310
Surge protective devices for the voltage supply			
2	Three-phase TN-S system Three-phase TT system Alternating current TN system Alternating current TT system	DEHNguard DG M TNS 275 DEHNguard DG M TT 275 DEHNguard DG M TN 275 DEHNguard DG M TT 2P 275	952 400 952 310 952 200 952 110
Surge protective devices for signal interfaces			
3	M-bus	BLITZDUCTOR XT BXT ML2 BD S 48 + BXT BAS base part	920 245 + 920 300
4	0–20 mA	BLITZDUCTOR XT BXT ML2 BE S 24 + BXT BAS base part	920 224 + 920 300
5	PT 100 temperature sensor	BLITZDUCTOR XT BXT ML2 BE S 5 + BXT BAS base part	920 220 + 920 300

Figure 9.12.2 Protection concept for an M-bus system in buildings with external lightning protection system



No.	Protection for…	Surge protective device	Part No.
Surge protective devices for the voltage supply			
1	Three-phase TN-S system	DEHNguard DG M TNS 275	952 400
	Three-phase TT system	DEHNguard DG M TT 275	952 310
	Alternating current TN system	DEHNguard DG M TN 275	952 200
	Alternating current TT system	DEHNguard DG M TT 2P 275	952 110
Surge protective devices for signal interfaces			
2	M-bus	DEHNconnect DCO SD2 MD 48	917 942
3	0–20 mA	DEHNconnect DCO SD2 ME 24	917 921
4	PT 100 temperature sensor	DEHNconnect DCO SD2 E 12	917 987

Figure 9.12.3 Protection concept for an M-bus system in buildings without external lightning protection system