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Comprehensive flat metering system

FLAT

Technical description

ISO 9001 **PN-N-18001** **ISO 14001**

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APATOR S.A. offers a comprehensive metering system under the name “FLAT”, which permits the operator to read all the data collected by meters used to track the consumption of media supplied to end-users. This system is based on the M-BUS network, and includes the following elements:

1. A network node (the number of nodes depends on the M-BUS converter used, typically up to 160 nodes):
   - A heat meter, type ELF, LQM-III, LEC-5, equipped with an M-Bus interface, 4 pulse inputs, connected to:
     - water meters with pulse outputs
     - electricity meters with a pulse output
     - gas meters with a pulse output
   - A KW-1 water meter hub with the M-Bus interface and 16 pulse inputs connected to:
     - water meters with pulse outputs
2. A network hub:
   - An M-BUS/RS232 converter with:
     - Automated Meter Reading (AMR) socket
     - Online Automated Meter Reading (OAMR) socket – optional
   - Master Data Stations (MDS) and M-Bus/RS232 converters with AMR sockets – optional

3. A reading subsystem (selected from among the available options):
   - wired, via a PC with the FLAT application, connected by wire to the network hub (via the AMR socket, permanently or only for the time of reading)
   - remote, via a PC with the FLAT application, connected to the Internet (network hub connected to the Internet via the OAMR socket)

4. Auxiliary components:
   - Surge arrester
   - Distribution and mounting boxes

1. M-BUS NETWORK

The M-BUS network is a local network which enables the integration of measuring instruments. Its nodes are connected by a two-wire trunk cable. Its interfaces are supplied from the main line. Each component has a unique network number, which is set during the installation process. The reading of data from the network is possible at a designated location, via the hub device.

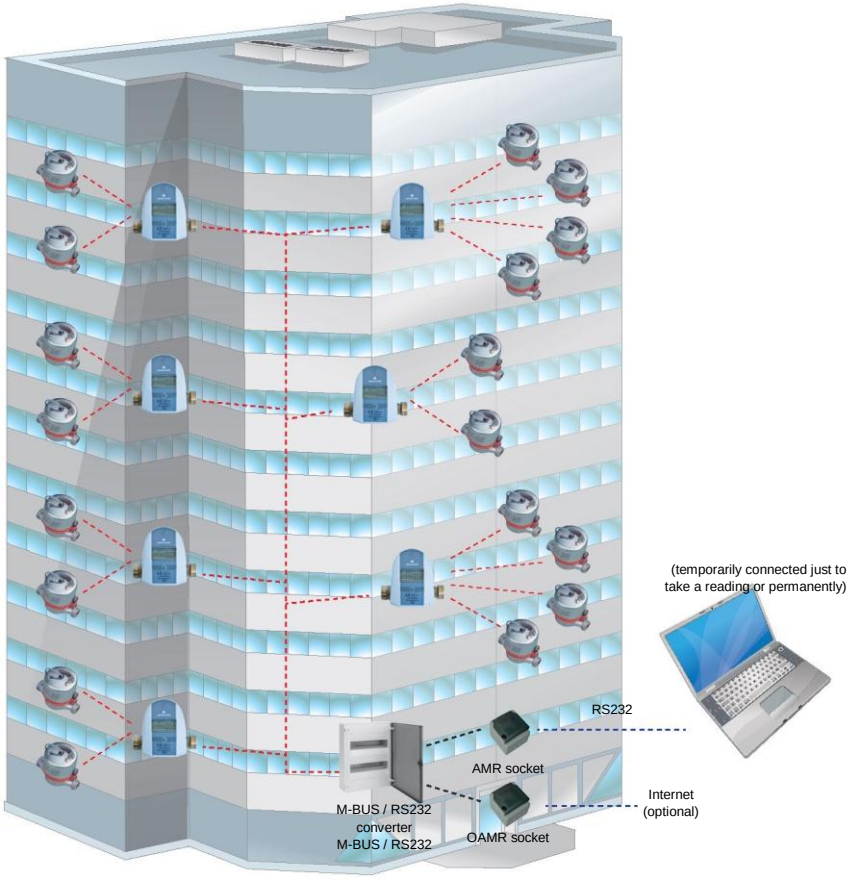

Fig. 1. FLAT metering system – pictorial view

2. INSTALLATION GUIDELINES

2.1. Network topology

a) network node

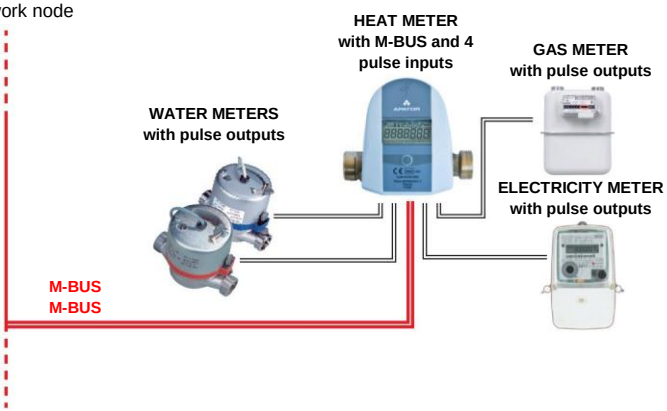

Fig. 2. Sample M-Bus network node

b) network topology using one or several divisions

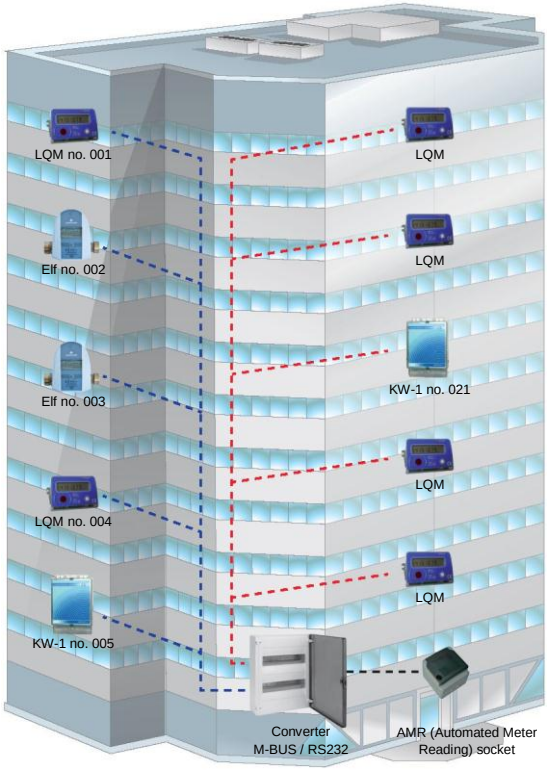

Fig. 3. Sample network with several divisions

c) “tree” network topology

It is also possible to use a tree structure. The tree topology, provided that the wiring is installed carefully, does not deteriorate the transmission quality; however, it does mean increasing the documentation accuracy due to the fact that connections in this topology are less clear in relation to the M-BUS.

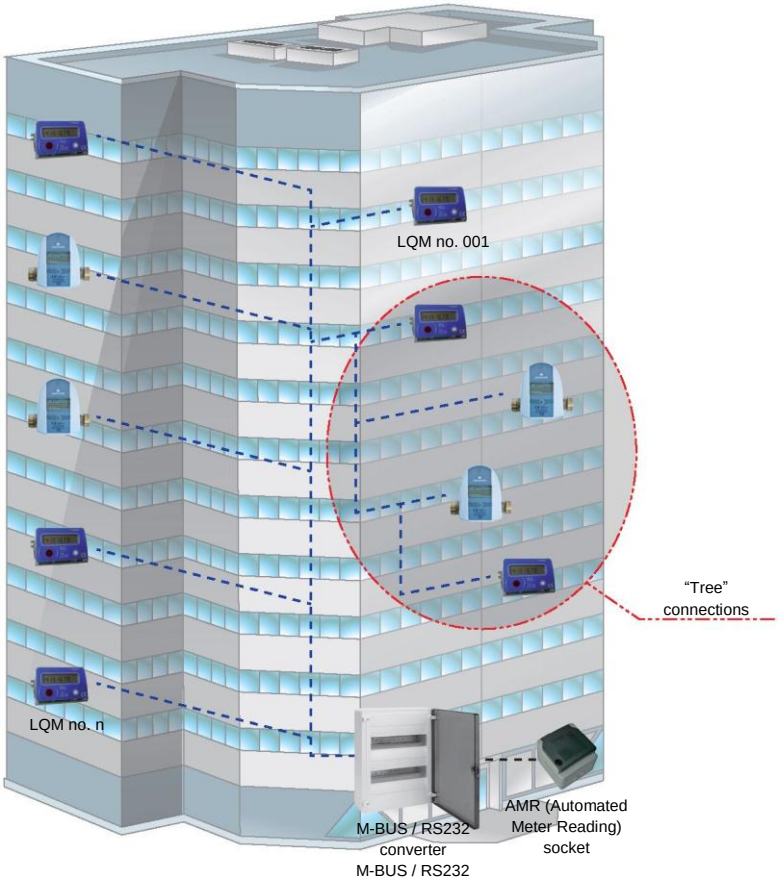

Fig. 4. Tree topology

d) incorrect network topology

Avoid using a loop on the trunk cable, which can happen when two neighbouring divisions are accidentally connected at both ends, for example.

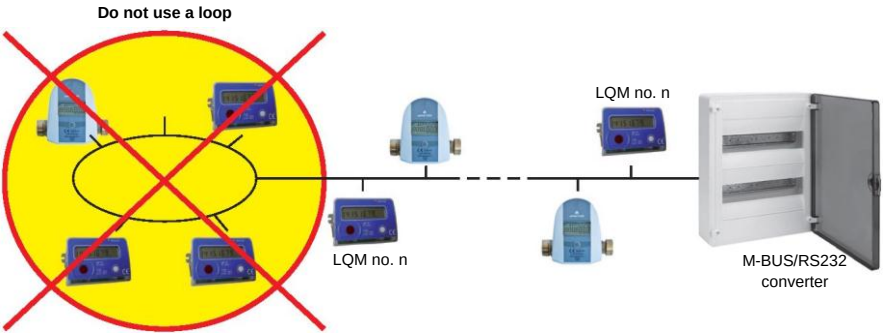

Fig. 5. Incorrect topology

e) extensive M-Bus network

A Master Data Station (MDS) can be used for reading many devices in one location (more than can be connected to an M-Bus/RS232 converter), which can also be connected with a greater number of M-Bus/RS2332 converters. In this network configuration, the reading in any one location can only be performed over a wired computer connection to the terminal AMR socket. Online reading requires the use of one OAMR socket for each M-Bus/RS232 converter. It cannot be used as a terminal converter in a network with MDS stations.

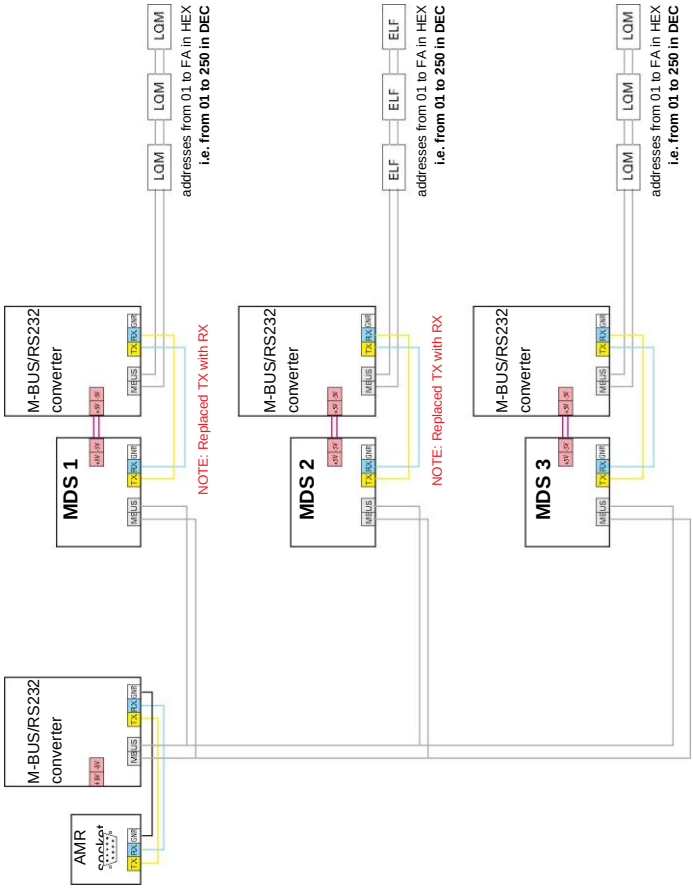

Fig. 6. Connection diagram of a reading network with an MDS

2.2. Network installation

2.2.1. Trunk cable

The following types of cables are recommended:

- I-Y(St)Y: 2x2x0.8
- YCYM: 2x2x0.8

These cables have two pairs each. Use a single pair to connect to an M-BUS network. The additional pair serves as a spare and may, for example, be used for building automation, auxiliary 24 V voltage distribution, etc.

It should be noted that you may use any twisted cable with a pair or two as a trunk cable. The final selection of the cable type may vary from designer to designer.

2.2.2. Trunk cable connection

The network designer should determine the method for branching the trunk cable. The best solution is to use special M-BUS distribution boxes. Depending on the specific conditions, use one junction for several heat meters or use a “distribution box – meter” type configuration. The branching of the trunk cable can be made directly on the terminal strip of the M-BUS interface.

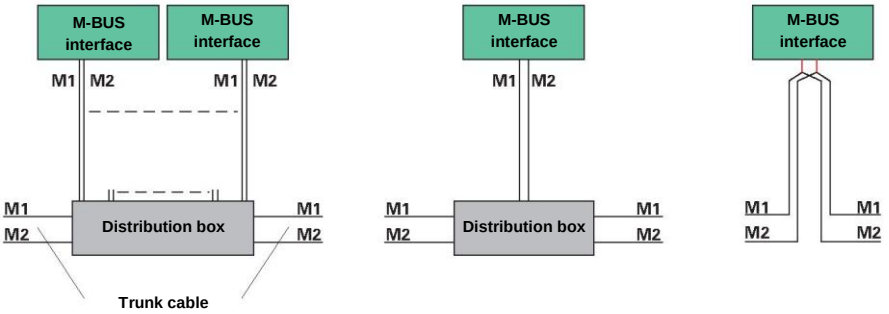

Fig. 7. Trunk cable branching methods

2.3. Lightning protection

The M-BUS network design should take the lightning (surge) protection system into account. Components used to protect the devices connected within a network must form part of the lightning protection system of the entire building. Appropriate regulations can be found in the Building Code.

Any voltage strikes interfering with the M-BUS installation are eliminated by the surge arrester.

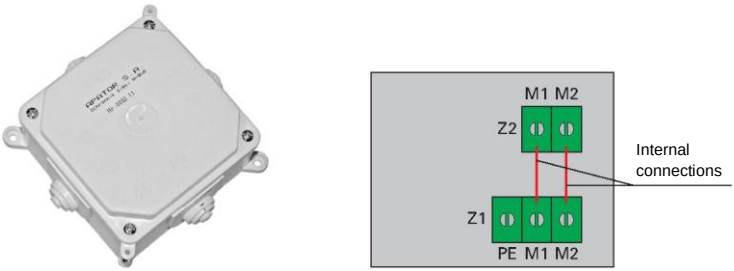

Fig. 8. Terminals of the M-BUS surge arrester

The arrester is equipped with two terminal strips: Z1 and Z2. The terminals marked M1 and M2 are intended for connecting to the trunk cable. Connect the earth bar to terminal PE. The application of two terminal strips facilitates the installation of the arrester in the cabling system and enables the arrester's use as a distribution box. An important stage in designing the installation is the selection of the mounting locations for surge arresters. Bear in mind that the M-Bus/RS232 converter is equipped with surge protection systems because, as a rule, arresters should be mounted at the extreme terminations of trunk cables.

The proper design of lightning protection systems is especially important when the trunk cable is laid outside the building, e.g. in order to add neighbouring buildings to the network. In this case, install surge arresters in the direct vicinity of the trunk cable outlet from the building.

3. Network node

A heat meter equipped with an M-Bus communication module or a KW-1 water meter hub (with the M-Bus interface built in) can serve as an M-Bus network node.
The proper configuration of the network node involves:

- Connecting the trunk cable
- Setting the transmission speed at 2,400 bit/s
- Setting a unique network number within the range 01H – FA (hexadecimal)

The process for setting the transmission speed and network number is described in the instruction manual delivered together with the heat meter and the description of the FLAT application. Bear in mind that network numbers are displayed on the meter screen in the hexadecimal format. Accidental setting of two or more identical network numbers will cause the exclusion of selected meters from the network. It is important that the designer develops clear documentation for the network numbers assigned to respective locations. This considerably shortens the installation start-up duration.

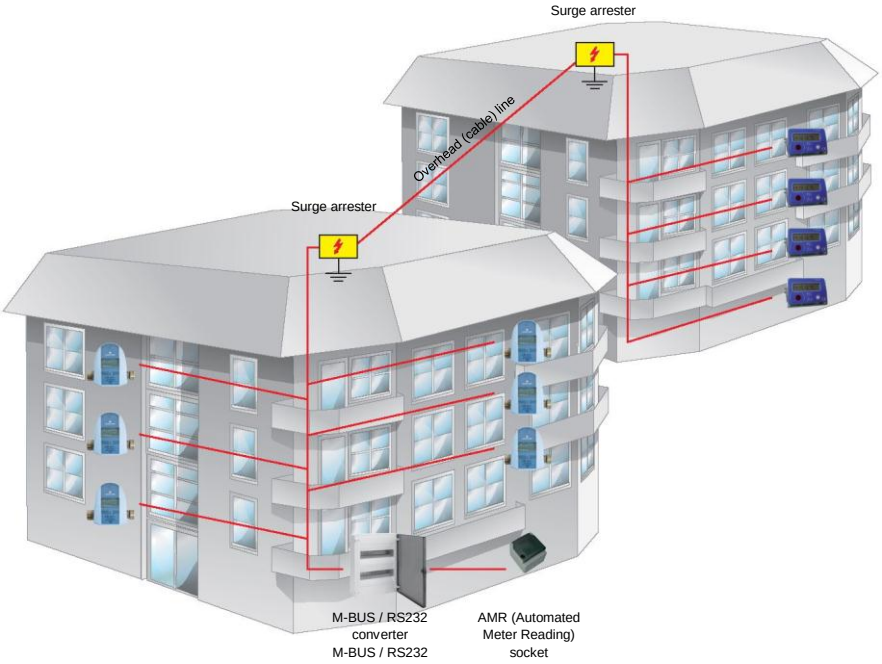

Fig. 9. Surge protection for several buildings

4. Computer connection

The M-Bus/RS232 converter communicates with the reading computer over an asynchronous RS-232C standard serial connection. The reading computer should be equipped with one free RS232C connector of the CANNON DB9 type (9 pin). The data reading procedure takes place after connecting the automated meter reading socket to the RS-232C connector on the computer by a cable.

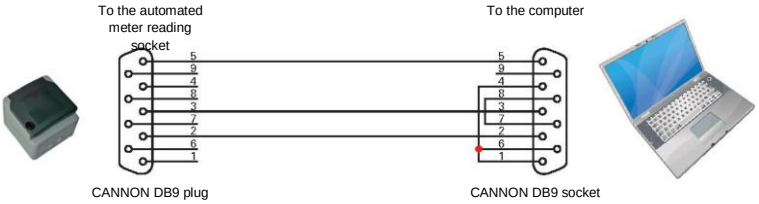

Fig. 10. Schematic diagram of the cable referred to as the “automated meter reading socket – reading computer” (RS-232C cables)

The total length of the LSD connection to the automated meter reading socket and RS-232C cable should not exceed 10 m. This length may be shortened in case of a high level of external interruptions, e.g. working electric motors, refrigeration equipment, etc.

The AMR socket is also fitted with a USB port. This can be used as the computer connection if the computer has no RS232C port.

The connection between the M-Bus/RS232 converter and the computer can also be established via the Internet (Ethernet). Use the OAMR socket for this purpose.

To read the data of all devices in the M-Bus network with a PC, use the FLAT application, whose description can be found in a separate instruction manual.
Network readings may be carried out by connecting a computer (laptop) with the FLAT application to an AMR socket to make a “walk-by” reading, or by the computers permanently connected to the converter located in the administration rooms, or from some other location with access to the Internet.

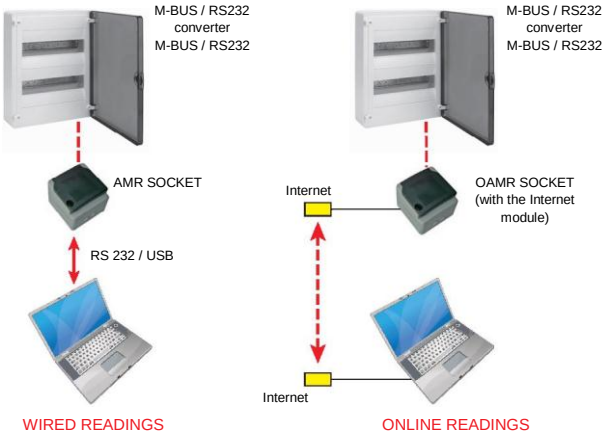

Fig. 11. Methods of connecting a computer intended for reading with the FLAT application

The total permissible length of the LSD connection to the automated meter reading socket and RS-232C cable should not exceed 10 m. This length may be shortened in case of a high level of external interruptions, e.g. working electric motors, refrigeration equipment, etc.

The AMR socket is also fitted with a USB port. This can be used to connect a computer that has no RS232C port.

The connection between the M-Bus/RS232 converter and the computer can also be established via the Internet (Ethernet). Use the OAMR socket for this purpose. The OAMR socket connection to the Internet requires a fixed IP number to be assigned to the socket.

To read the data of all devices in the M-Bus network on a PC, use the FLAT application, whose description can be found in a separate instruction manual.
Network readings may be carried out by connecting a computer (laptop) with the FLAT application to an AMR socket in order to make a “walk-by” reading, or by using computers permanently connected to the converter located in administration rooms, or from some other place with access to the Internet.

AMR socket

OAMR connector

Fig. 12. View of the connectors in the AMR and OAMR sockets