

# M-Bus Master MultiPort 250L

## Installation and User Guide



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# 1 Introduction

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M-Bus is a bus system, which is specially suited for reading of water, heat, cooling, gas and electricity consumption meters.

An M-Bus system consists of an M-Bus Master and a number of meters with M-Bus interface. A network can include different meter types and brands. The cable type used will typically be twisted pair copper.

The connected meters are read by a reading program which is connected to one of the master's communication ports. The master powers the M-Bus slave modules in the meters. Battery supplied meters thereby achieve a longer battery lifetime.

The maximum size of an M-Bus network using Kamstrup M-Bus Master MultiPort 250L is 250 meters. If a number of masters are configured as repeaters and coupled in cascade and only secondary addressing is used, a total of 1,250 meters can be connected, and the total cable length can be up to approx. 14 km.

If primary addressing is used, up to 250 meters can be connected.

Communication in the M-Bus network is asynchronous serial bit transmission in half duplex, which means that it is only possible to communicate in one direction at a time.

Communication speed can be 300, 2400 or 9600 Baud.

M-Bus is standardized according to EN 13757-2 and EN 13757-3.

## 1.1 Design

M-Bus Master MultiPort 250L is built into a solid cabinet, which complies with protection class IP 67.

The power supply is a switch mode type which enables you to connect the master to a power supply between 100 and 240 Volt. The frequency must be 50-60 Hz.

## 2 Functionality

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Kamstrup M-Bus Master MultiPort 250L is an M-Bus master designed for the connection of up to 250 meters with M-Bus interface. The cable length of a master can be up to 2800 m depending on cable type.

The master supports primary, secondary and enhanced secondary addressing.

All inputs are galvanically separated from the M-Bus network.

MultiPort 250L can be accessed from all available communication ports. The integral port controller prevents collision in case of simultaneous communication through more than one port.

When the port controller detects communication on one port, communication on other ports becomes impossible.

When communication on one port is finished, all ports are open to communication.

The Repeater function makes it possible to extend the size of the M-Bus network both as to number of meters and total cable length. If one master and four repeaters are installed in a network, the total cable length can be extended to approx. 14 km and up to 1250 meters can be connected.



## **2.1 Overview of functions**

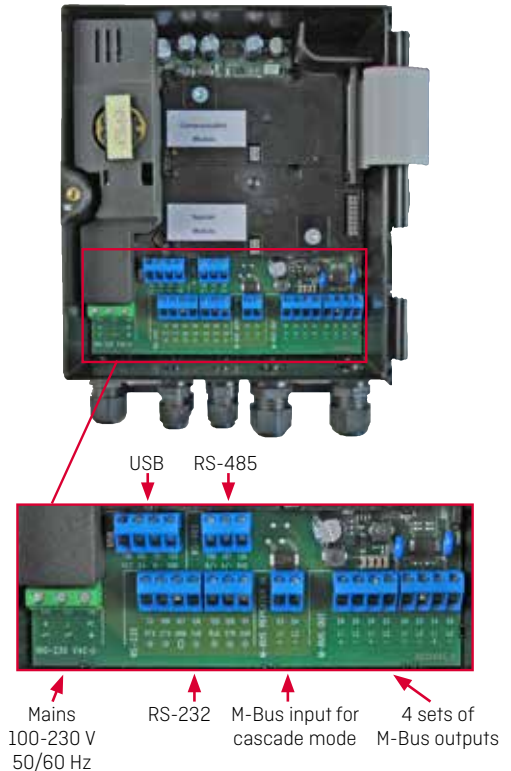
- Usable as transparent master, repeater and level converter
- Supports primary, secondary and enhanced secondary addressing
- Collision detection with break signal
- Up to 250 slaves per master
- Integrated repeater function
- Up to four repeaters in a system = a total of 1250 meters
- Up to 14 km cable length
- 300, 2400, and 9600 baud communication speed
- Byte recovery
- Echo suppression
- Transient protection
- Integrated USB, RS-232 and RS-485 with automatic port controller
- All ports are transparent and galvanically separated from the M-Bus network
- Cable connection via 9 PG cable glands
- Local and remote update of firmware for future functionality
- Up to IP 67 protection class.

### 3 Connections

All connections in MultiPort 250L are screw terminals with max. cable size of 2 mm<sup>2</sup>.

The protection class of M-Bus Master MultiPort 250L can be up to IP 67. IP 67 means full dust protection as well as water tightness for minimum 30 minutes down to 1 metre.

In order to obtain the highest IP protection the cables used must be correctly mounted through the master's unions.



### 3.1 Overview of connections

| Connection number on master | Designation | Colour/connector No. | Description   |
|-----------------------------|-------------|----------------------|---|
| <b>Power supply</b>         |             |                      |   |
| 134                         | N           | Blue                 | Neutral   |
| 135                         | L           | Brown                | Live  |
| 136                         | PE          | Yellow/green         | Protective earth  |
| <b>USB 2.0</b>              |             |                      |   |
| 130                         | VCC         | Red/1                | Max. recommended cable length: 5 m<br>5 V power supply                                    |
| 131                         | D-          | White/2              | Data -  |
| 132                         | D+          | Green/3              | Data +  |
| 133                         | GND         | Black/4              | Ground  |
| <b>RS-232</b>               |             |                      |   |
| 105                         | RxD         | 2                    | Max. recommended cable length: 15 m<br>Received Data                                      |
| 106                         | TxD         | 3                    | Transmitted Data  |
| 107                         | GND         | 5                    | Ground  |
| 108                         | DTR         | 4                    | Data Terminal Ready   |
| 109                         | CTS         | 8                    | Clear To Send   |
| 111                         | DSR         | 6                    | Data Set Ready  |
| 112                         | RTS         | 7                    | Request To Send   |
| <b>RS-485</b>               |             |                      |   |
| 137                         | A/-         |                      | Max. recommended cable length: 1,200 m<br>Transmit/Receive inverted                       |
| 138                         | A+          |                      | Transmit/Receive non-inverted   |
| 139                         | GND         |                      | Ground  |
| <b>M-Bus Repeater Input</b> |             |                      |   |
| 53                          | L1          |                      | Jumper must be set to Repeater<br>M-Bus input to master in repeater mode                  |
| 54                          | L2          |                      | M-Bus input to master in repeater mode  |
| <b>M-Bus Master Output</b>  |             |                      |   |
| 24                          | L1          |                      | 4 sets connection terminals, connection in parallel<br>M-Bus output from master to meters |
| 25                          | L2          |                      | M-Bus output from master to meters  |



### 3.2 Power supply

The power supply of M-Bus Master MultiPort 250L is the switch mode type which requires voltage between 100 V and 240 V. The frequency can be 50 Hz or 60 Hz.

The mains cable is connected to the master through the associated gland. The diameter must be between 4 and 8 mm. The master is supplied without mains cable and we recommend a fixed installation, i.e. without using a mains plug as this would reduce reliability of operation.

### 3.3 USB

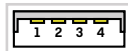
M-Bus Master MultiPort 250L's USB-connection can be used for M-Bus communication on an equal basis with the other serial connections.

The following communication speeds can be used for M-Bus communication:

- 300 Baud 8E1
- 2400 Baud 8E1
- 9600 Baud 8E1

USB version 2.0, which allows up to 5 m cable length, is used. In connection with other USB versions than 2.0 the maximum cable length recommended is 3 m.

The master's integrated port controller makes sure that communication is only possible on one serial port at a time. The master is available with a factory-mounted 145 cm cable fitted with a USB connector type A.



USB connector type A

To be able to communicate with M-Bus Master MultiPort 250L via USB the corresponding USB driver must be installed on the computer used for reading.

The program is available on Kamstrup's home page.

The screenshot shows the Kamstrup website's 'Software downloads' section. The page has a teal header with the Kamstrup logo and navigation links. Below the header is a teal banner with icons for Smart Grid, Water Meters, Thermal Energy Meters, Meter Reading, and Service & Support. A central image shows two people reviewing documents on a solar panel array. Below the image, the 'Software downloads' section is divided into two columns: 'Meter reading programmes' and 'Software for LON'. A red arrow points to the 'M-Bus Master MultiPort 250L' link in the 'Meter reading programmes' column.

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## Software downloads

### Meter reading programmes

- M-Bus Master MultiPort 250L
- Wireless M-Bus, Gsm4g
- Kamstrup LON Smart
- USB tool for assemble water display (documentation)
- SMU250L\* Module Programming

### Software for LON

Retrieve software and documentation for Kamstrup's LON modules.

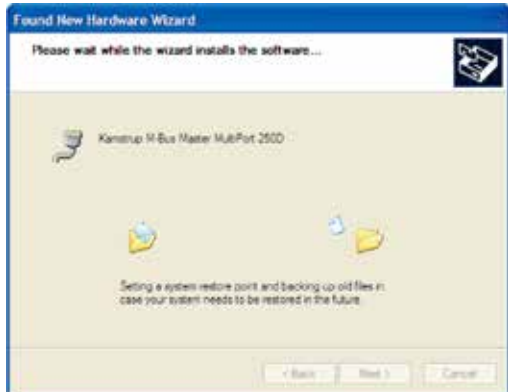
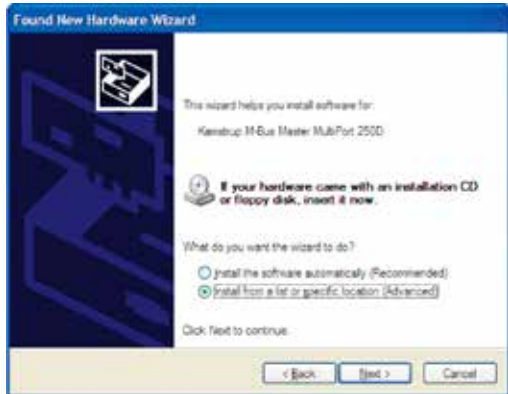
#### Heat, Cooling & Water Meters

- MULTICAL\* 63 & MULTICAL\* 66
- Standard version

When selecting Run, the installation program starts automatically.

When the program is retrieved, it is saved under C:\Kamstrup\M-Bus Master 250L.

Select as shown below in order to install the program.





### 3.4 RS-232

M-Bus Master MultiPort 250L's RS-232-connection can be used for M-Bus communication on an equal basis with the other serial connections.

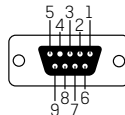
The following communication speeds can be used for M-Bus communication:

- 300 Baud 8E1
- 2400 Baud 8E1
- 9600 Baud 8E1

Maximum recommended cable length is 15 m.

The master's integrated port controller makes sure that communication is only possible on one serial port at a time.

The master is available with a factory-mounted 145 cm RS-232 cable fitted with a DB9F female connector.



RS-232 connector type DB9F

### 3.5 RS-485

M-Bus Master MultiPort 250L's RS-485-connection can be used for M-Bus communication on an equal basis with the other serial connections.

The following communication speeds can be used for M-Bus communication:

- 300 Baud 8E1
- 2400 Baud 8E1
- 9600 Baud 8E1

Maximum recommended cable length is 1,200 m.

The master's integrated port controller makes sure that communication is only possible on one serial port at a time.

### 3.6 M-Bus Output

All meters in an M-Bus network are connected to M-Bus Output terminals 24 and 25. The master includes four sets of connections coupled in parallel.

#### 3.6.1 Current and voltage

|                                   |                 |  |
|-----------------------------------|-----------------|--|
| Bus mark/space                    | 41 V DC/28 V DC |  |
| Detection level, communication    | 7 mA            |  |
| Detection level, collision        | 25 mA           |  |
| Max. normal operating current     | 375 mA          |  |
| Warning level, operating current  | 377 mA          | - Overload LED flashes                   |
| Overload level, operating current | 500 mA          | - Overload LED is constantly illuminated |

### 3.7 M-Bus Repeater Input

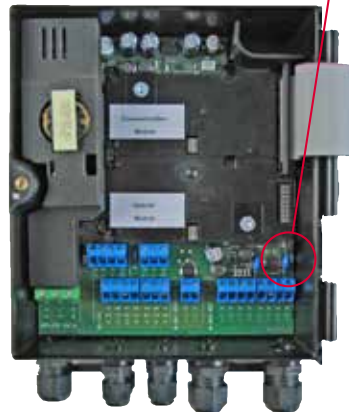
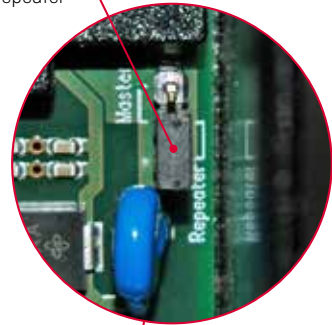
Kamstrup M-Bus Master MultiPort 250L can be used as both master and repeater.

Used as master, up to 250 meters can be connected in an M-Bus system.

The Repeater function makes it possible to extend the size of the M-Bus network both as to number of meters and total cable length. If one master and four repeaters are installed in a network, the total cable length can be extended to approx. 14 km, and up to 1250 meters can be connected.

The master is configured as repeater by placing the jumper on the connector marked Repeater. Using an M-Bus Master MultiPort 250L as a repeater the M-Bus network in front of the repeater is connected to "M-Bus Repeater In" on terminals 53 and 54. The following meters are connected to M-Bus Out on terminals 24 and 25.

Setting as master or repeater



Position of master/repeater jumper.

## 4 Cabling

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Typically unshielded twisted pair cable up to approx. 1.5 mm<sup>2</sup> is used. The cabling topology is typically star or bus or a combination of both. The connection in M-Bus is independent of polarity and no termination resistance at the end of the cabling is needed.

If a cable type with shield is used, it is important that the two M-Bus conductors are not connected to ground or shield. No precise indication as to maximum cable length in an M-Bus network can be given as it depends on various parameters.

The two most important parameters to consider when selecting cable for an M-Bus installation are cable resistance and cable capacity. Generally speaking the resistance limits the number of M-Bus slaves, and the capacity limits the communication speed.

Furthermore, we recommend keeping a certain distance between M-Bus cables and other cables in order to minimize noise from high-power electric machinery.

### 4.1 Special features of M-Bus Master MultiPort 250L

M-Bus Master MultiPort 250L has been designed with the newest cable driver technology, and is, therefore, rather insensitive to the capacity of the M-Bus network.

Thus, designing an M-Bus network to be used together with M-Bus Master MultiPort 250L the limiting factor as to possible cable length will primarily be the cable resistance in the network.

### 4.2 Electrical conditions in an M-Bus network

According to EN 13757-2, the maximum output voltage from an M-Bus Master must not exceed 42 V. The output voltage from M-Bus Master MultiPort 250L is 41 V.

- If the voltage measured over terminals 24-25 is 24 V or more at the most distant meter, there is a high degree of certainty that all meters can be read
- If the voltage is between 20 and 24 V, it will probably be possible to read all meters
- If the voltage is between 18 and 20 V, the meter may be read
- If the voltage is below 18 V it is most likely that the meter cannot be read.

There must be no communication on the M-Bus network when the above measurement is made.

### 4.2.1 M-Bus modules

Each M-Bus module loads the M-Bus network too. According to the standard, an M-Bus module should load the network with 1 unit load (UL) corresponding to 1.5 mA. Some modules, however, load with up to 4 UL.

Capacitively the load of an M-Bus module is 0.5 – 1 nF.

### 4.3 Installation parameters

The following parameters are essential to the possible cable length of an M-Bus network.

#### 4.3.1 Cable

The cable resistance and capacity must be as low as possible. The thicker the cable, the lower the resistance. The thicker the cable, the higher the capacity.

An M-Bus cable must minimum be able to handle 50 V and 500 mA.

| Diameter (mm ø) | Cross section (mm <sup>2</sup> ) | Resistance in Ohm per 1,000 metres | Length in metres per Ohm |
|-----------------|----------------------------------|------------------------------------|--------------------------|
| 0.5             | 0.20                             | 90                                 | 11                       |
| 0.65            | 0.33                             | 53                                 | 19                       |
| 0.8             | 0.50                             | 35                                 | 29                       |
| 1.0             | 0.79                             | 23                                 | 45                       |
| 1.13            | 1.00                             | 18                                 | 57                       |
| 1.26            | 1.25                             | 14                                 | 71                       |
| 1.39            | 1.52                             | 12                                 | 87                       |
| 1.6             | 2.0                              | 8.7                                | 115                      |

Examples of resistance in copper cable.

Please note that the resistance in copper depends on its purity. The purer the copper, the lower its resistance.

| LiYY                    | 2x0.34 mm <sup>2</sup> | 2x0.50 mm <sup>2</sup> | 2x0.75 mm <sup>2</sup> | 2x1.0 mm <sup>2</sup> | 2x1.5 mm <sup>2</sup> |
|-------------------------|------------------------|------------------------|------------------------|-----------------------|-----------------------|
| <b>Current load</b>     | Max. 4.5 A             | Max. 6 A               | Max. 10 A              | Max. 12 A             | Max. 18 A             |
| <b>Cable resistance</b> | 56 Ω/km                | 39 Ω/km                | 26 Ω/km                | 20 Ω/km               | 12 Ω/km               |
| <b>Capacity</b>         | 110 nF/km              | 120 nF/km              | 120 nF/km              | 120 nF/km             | 120 nF/km             |



| J-Y(Sr)YY               | 2x0.60 mm <sup>2</sup> | 2x0.80 mm <sup>2</sup> |  |  |
|-------------------------|------------------------|------------------------|--|--|
| <b>Current load</b>     | -                      | -                      |  |  |
| <b>Cable resistance</b> | 65 Ω/km                | 37 Ω/km                |  |  |
| <b>Capacity</b>         | 120 nF/km              | 100 nF/km              |  |  |

Examples of cable types

In big networks using secondary addressing worst case load must be considered as 250 slaves of 1 UL (Unit Load) each can draw 5.4 A, which thin cables will not be able to withstand.

Please note that resistance can be stated in two different ways in cable specifications; i.e. as cable resistance or as loop resistance.

Loop resistance is the total resistance measured through the two conductors. Cable resistance is the resistance through one conductor. Therefore, loop resistance is always twice the cable resistance.



Measurement of loop resistance.



Measurement of cable resistance.

### 4.3.2 Cable topology

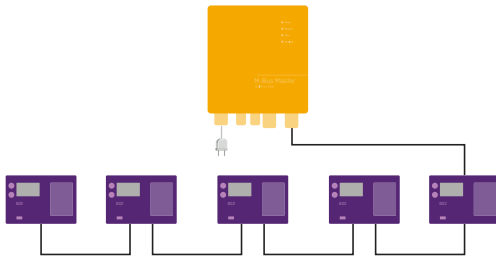
An M-Bus network normally uses bus or star topology, or a combination of both.

The advantage of bus topology is shorter wires. The disadvantage is that a cable interrupt will mean that all the following meters can no longer be read.

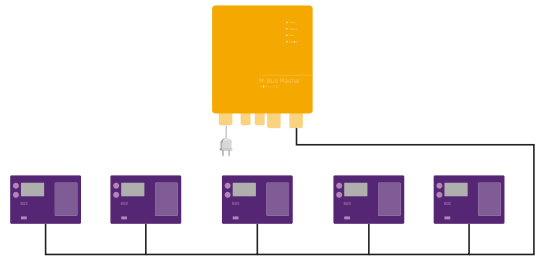
The advantage of star topology is the fact that all the other meters can still be read after a cable interrupt. The disadvantage is a large consumption of cable with a high leading load, which reduces the maximum cable length and makes a reduction of communication speed necessary respectively.

Bus topology offers two solutions, one looping the cable through each meter. This solution presupposes that there is room for two cables and that the connection terminals are prepared for the connection of two sets of cables. All connections are thereby typically made inside the meter.

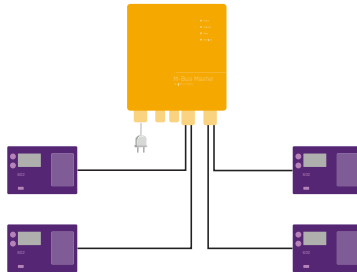
Using bus topology with each individual meter connected to the bus, a number of connections must be established on the bus itself.



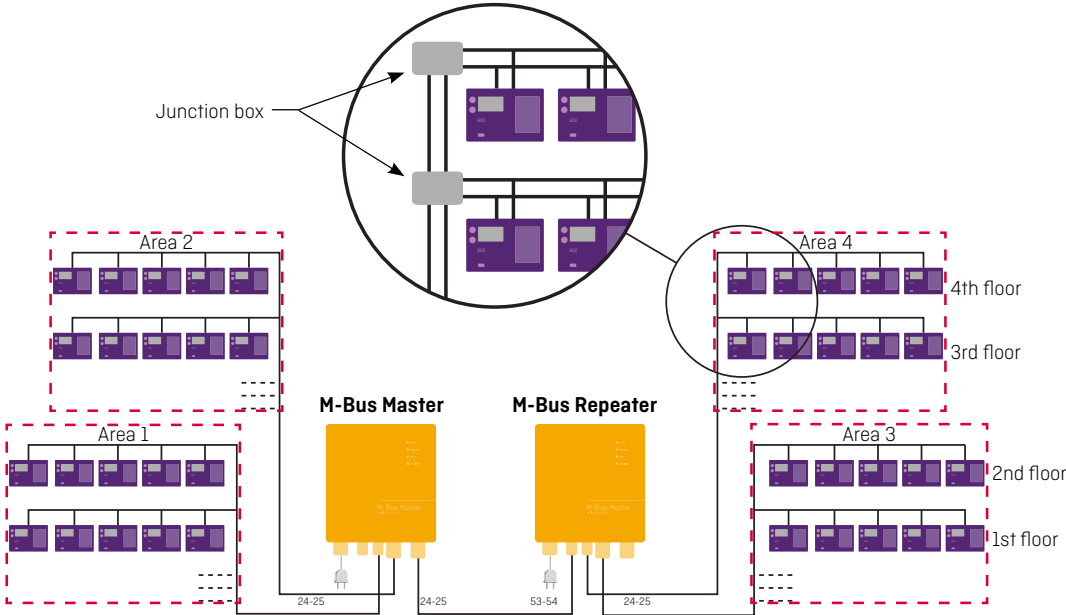
Bus topology with cable looped through meters.



Bus topology with each individual meter connected to the bus.



Star topology connecting each individual meter direct to the M-Bus Master.



Example of the construction of a large M-Bus network.

Dividing the connected meters into several separate cable networks and connecting those individually to the Master will simplify troubleshooting.

### 4.3.3 Examples of network sizes

The below-mentioned tables show examples of possible network sizes with different cable configurations. Each connected repeater increases the possible cable length by the below-mentioned lengths.

#### Cable type 0.34 mm<sup>2</sup> (56 Ohm/110 nF)

| Speed / Number of meters | 10       | 50      | 150   | 250   |
|--------------------------|----------|---------|-------|-------|
| 300 Baud                 | 10,000 m | 2,000 m | 700 m | 400 m |
| 2400 Baud                | 4,000 m  | 2,000 m | 700 m | 400 m |
| 9600 Baud                | 2,000 m  | 2,000 m | 700 m | 400 m |

Possible cable lengths with all meters placed at the end of the cable network.

| Speed / Number of meters | 10       | 50      | 150     | 250   |
|--------------------------|----------|---------|---------|-------|
| 300 Baud                 | 10,000 m | 3,500 m | 1,200 m | 700 m |
| 2400 Baud                | 7,000 m  | 3,500 m | 1,200 m | 700 m |
| 9600 Baud                | 3,500 m  | 3,500 m | 1,200 m | 700 m |

Possible cable lengths with meters evenly distributed in the cable network.

#### Cable type 1.5 mm<sup>2</sup> (12 Ohm/110 nF)

| Speed / Number of meters | 10       | 50      | 150     | 250     |
|--------------------------|----------|---------|---------|---------|
| 300 Baud                 | 10,000 m | 8,000 m | 2,800 m | 1,600 m |
| 2400 Baud                | 10,000 m | 8,000 m | 2,800 m | 1,600 m |
| 9600 Baud                | 3,500 m  | 3,500 m | 2,800 m | 1,600 m |

Possible cable lengths with all meters placed at the end of the cable network.

| Speed / Number of meters | 10       | 50       | 150     | 250     |
|--------------------------|----------|----------|---------|---------|
| 300 Baud                 | 10,000 m | 10,000 m | 4,800 m | 2,800 m |
| 2400 Baud                | 10,000 m | 10,000 m | 4,800 m | 2,800 m |
| 9600 Baud                | 6,500 m  | 6,500 m  | 4,800 m | 2,800 m |

Possible cable lengths with meters evenly distributed in the cable network.

## 5 M-Bus Addressing

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Primary, secondary and enhanced secondary addressing are supported. The master's integrated collision detector enables wild card search for meters in connection with secondary and enhanced secondary addressing. Using wild card search one or several of the digits of the meter's address are replaced by wild cards when searching for meters.

### 5.1 Primary addressing (001-250)

Each meter must have a unique primary address between 001 and 250. If more than one meter have the same address, a collision will occur and the meters cannot be read.

Kamstrup M-Bus modules automatically use the last 2-3 digits of the customer number as their primary address.

### 5.2 Secondary addressing (00000001-99999999)

Secondary addressing uses the last 8 digits of the meter number as M-Bus ID.

Kamstrup MULTICAL® meters use the customer number as their secondary address, which makes it possible to change the secondary address.

### 5.3 Enhanced secondary addressing (00000001-99999999)/(00000001-99999999)

The meter's serial number is used for enhanced secondary addressing. A meter's serial number is unique and cannot be changed after production.

## 6 M-Bus communication

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M-Bus communication is half duplex allowing two-way communication with one M-Bus slave at a time. The master's integrated port controller makes sure that communication is only possible on one serial port at a time.

### 6.1 Communication speed

M-Bus Master MultiPort 250L supports the following communication speeds:

- 300 Baud 8E1
- 2400 Baud 8E1
- 9600 Baud 8E1 (not via GPRS)

### 6.2 Transparent reading

MultiPort 250L is equipped with the following communication possibilities for reading from e.g. remote reading systems, control systems and various controllers with M-Bus interface:

- USB
- RS-232
- RS-485

Communication through the above-mentioned ports is transparent and includes collision detection.

### 6.3 Light Emitting Diodes

The master has four light emitting diodes on its front plate.



#### 6.3.1 Power

Green light emitting diode which is lit when the master is connected to supply power of 100-240 V, 50-60 Hz.

#### 6.3.2 Request

Orange light emitting diode which flashes briefly when a command or a request from the master is transmitted to the M-Bus network.

#### 6.3.3 Data

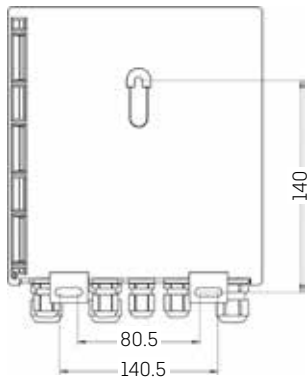
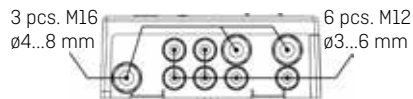
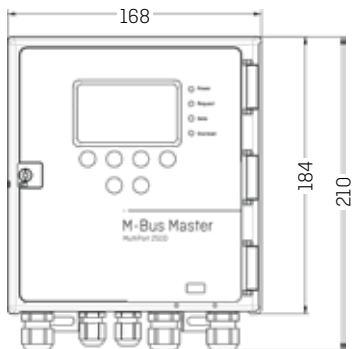
Orange light emitting diode which flashes when an M-Bus slave sends data to the master. The duration depends on the amount of data being sent.

#### 6.3.4 Overload

Red light emitting diode which flashes when the load on the M-Bus network is between 375 and 500 mA. It is permanently lit when the load on the M-Bus network exceeds 500 mA. 375 mA corresponds to 250UL (M-Bus Unit Loads). At 500 mA M-Bus Master MultiPort 250L disconnects due to overload or short circuit condition.

## 7 Dimensioned drawings

All measurements in mm.





## 8 Technical data

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### Electrical (M-Bus)

|                                   |  |
|-----------------------------------|--|
| Number of slaves per master       | 250 at 1 unit load per slave   |
| Total number of slaves            | 1250 at 1 master and 4 repeaters   |
| Cable length per master           | Up to approx. 2800 m, depending on cable type, cable topology and number of connected slaves |
| Total cable length                | Up to approx. 14 km at 1 master and 4 repeaters  |
| Cable thickness                   | Max. 2 mm <sup>2</sup>   |
| Communication ports               | RS-232, RS-485, USB  |
| Communication speeds              | 300/2400/9600 baud   |
| Data frame                        | 1 start bit, 8 data bits, 1 parity bit (even), 1 stop bit                                    |
| Addressing modes, transparent     | Primary/secondary/enhanced secondary   |
| Addressing modes, direct reading  | Primary/secondary  |
| Address range, primary            | 001-250  |
| Address range, secondary          | 00000000-99999999  |
| Address range, enhanced secondary | 00000000-99999999/00000000-99999999  |
| Bus mark/space                    | 41 V DC/28 V DC  |
| Detection level, communication    | 7 mA   |
| Detection level, collision        | 25 mA  |
| Max. normal operating current     | 375 mA   |
| Warning level, operating current  | 377 mA   |
| Overload level                    | 500 mA   |

### Electrical (HTTP)

|                     |  |
|---------------------|--|
| Communication ports | RS-232, RS-485, USB                                |
| Communication speed | 9600/38400 baud.                                   |
| Data frame          | 1 start bit, 8 data bits, 0 parity bit, 1 stop bit |

### **Electrical (in general)**

|                   |                    |
|-------------------|--------------------|
| Power supply      | 100-240 V 50/60 Hz |
| Power consumption | Max. 40 W          |

### **Mechanical**

|                             |   |
|-----------------------------|---|
| Operating temperature range | 0...55 °C, non-condensing, installation indoors |
| Storage temperature range   | 20...+60 °C                                     |
| Protection class            | Up to IP 67, depending on cables                |
| Dimensions                  | 210 x 168 x 64 mm (H x W x D)                   |
| Weight                      | 1 kg  |

### **Approvals and standards**

|           |                        |
|-----------|------------------------|
| Approvals | CE marking             |
| Standards | EN 13757-2, EN 13757-3 |

## **9 Ordering numbers**

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### **Description**

M-Bus Master MultiPort 250L  
RS-232 cable DB 9, 145 cm  
USB cable, 145 cm

### **Ordering No.**

MBM-M200000  
6699-335  
6699-336





