M-Bus

Technical Description

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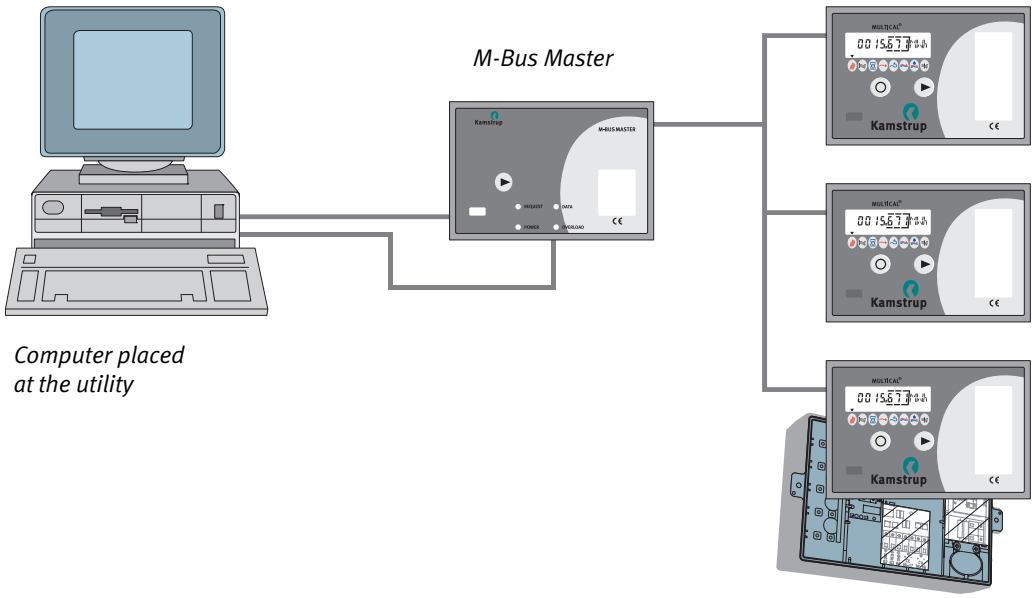
1. Technical description M-Bus

Introduction

This document describes the use of Kamstrup's M-Bus system.

M-Bus is used for electronic reading of district heat meters.

As the data route from meter to accounting program is electronic, the data is secured against errors. It is easy and simple to equip Kamstrup energy meters with an M-Bus Slave, which is inserted at the modular space in the energy meter. It is unnecessary to program the integrating energy meter or the M-Bus Slave as the system is self-configuring.



Computer placed at the utility

Heat meters with M-Bus Slave

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2. M-Bus System

M-Bus system components

The M-Bus system consists of the following elements:

- M-Bus Slave
- M-Bus Master
- M-Bus Cascade module
- M-Bus Modem
- Communication software PcM-Bus
- Communication software PcModem
- Communication software PcLink
- IR head for reading
- Data cabel for reading

The M-Bus Master is built-up as a repeater, which converts signals from e.g. RS232 to M-Bus format (18-30 V/0-20 mA). The M-Bus Master has been constructed to function together with Kamstrup's M-Bus Slaves and Kamstrup's reading software.

The M-Bus Master can supply up to 40 M-Bus Slaves at the power consumption of 1.5 mA

(1 Unit Load) per M-Bus Slave.

One or more M-Bus Cascade modules can be installed, and can comprise up to 250 M-Bus Slaves.

Communication

The communication on the M-Bus consists of vol-tage modulation from M-Bus Master to M-Bus Slave (30 – 18 V) as well as current modulation from M-Bus Slave to M-Bus Master (0 – 20 mA) through an ordinary two-wire cable.

The M-Bus system has been constructed to observe the regulations of the EN 1434-3.

The communication on the M-Bus system is asynchronous serial bit transmission (EN 60870-5-1) in half duplex mode, i.e. the communication consists of 1 start bit, 8 data bits, 1 parity bit (even), 1 stop bit.

The transmission speeds are 300 baud or 2400 baud.

Addresses of M-Bus Slave units

If the M-Bus system is to function with a number of connected M-Bus Slaves, each M-Bus Slave must be given an identification number (address). This is done via MULTICAL®, which contains a unique customer number to the M-Bus Slave. The unique address of the M-Bus Slave is equal to the last 3–8 digits of the customer number, and thereby supports both primary and secondary addressing. The address applies to both types of addressing, and can be re-programmed either by means of the hand-held terminal, MULTITERM, or the verification program of METERTOOL.

Primary addressing

The M-Bus Slave automatically reads the energy meter's costumer number in connection with start or initialisation. The address must lie between 1 and 250.

If the last three digits of the customer number exceed 250 (e.g. 345) the first digit will be ignored and the ID number of the M-Bus Slave will only be determined by the two last digits (e.g. 45).

If 3 systems are available each with 250 M-Bus Slave modules, the number system is build up as follows:

1st. system:
The energy meters are programmed with customer numbers from 1001 to 1250.

2nd. system:
The energy meters are programmed with customer numbers from 2001 to 2250.

3rd. system:
The energy meters are programmed with customer numbers from 3001 to 3250.

Secondary addressing

The M-Bus Slave automatically reads the customer number of the energy meter during start or initialization.

The M-Bus address consists of the last 3 – 8 digits of the customer number, extending the address possibility to 0000 0001 – *9999 9999*.

Note: Kamstrup communication software, PcM-Bus, and Kamstrup M-Bus Master do not support secondary addressing.

The M-Bus module does not support extended secondary address functions, e.g. enhanced secondary addressing, collision detection or wild-card search.

Each M-Bus Slave must have its own addres

The M-Bus Master always sends a message on the bus to a given address, which is encoded in the message (the format). Only the M-Bus Slave in question will reply.

If several M-Bus Slaves have the same address a collision will arise, when the M-Bus Slaves reply to the M-Bus Master.

However, there are two special addresses, which function as follows:

Address 254:
All M-Bus Slaves will answer to this address. The address must solely be used in systems with only one M-Bus Slave connected, e.g. for test.

Address 255:
No M-Bus Slave will answer to this address, but all M-Bus Slaves will receive the message. This message makes it possible e.g. to change the baud rate of a whole system at a time, only by sending a format from the M-Bus Master.

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Operation

It is optional whether the M-Bus Master is to be permanently switched on, or the bus system is to be switched off when not in operation (reading).

The M-Bus system cannot supply the MULTICAL® integrating units. Only the M-Bus Slaves are supplied from the M-Bus Master.

In connection with start-up the M-Bus Master will have an initialization time of approx. 5 sec., and the overload diode will light. After the 5 sec., the diode will switch off and the M-Bus Master is ready.

In case the bus system is turned on constantly, these initialization times will only appear in connection with installation. In addition, the initialization time of M-Bus Slaves is approx. 9 sec., before data can be acquired, and if mounted in MULTICAL® III. However, if the M-Bus Slaves are installed in MULTICAL® the initialization time is approx. 12 sec.

The initiation time for Kamstrup 162/382/351 Combi is typically 7 seconds.

Rarely, a longer initiation time might be necessary – see *Appendix*.

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3. M-Bus Master

Two versions of the M-Bus Master are available. One with a display and one without, however, they function in the same way.

The M-Bus Master is built-up with supply print, connection print and main print.

Furthermore the bracket has room for an extra module – see paragraph 7 and 8.

The main print is placed at the top of the case, and except from transformator, bridge connection and connection terminals everything is mounted on this print.

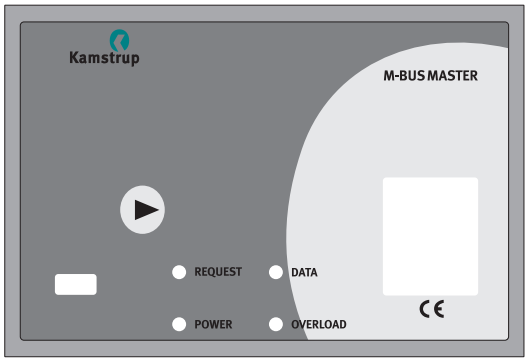
The front plate has four light emitting diodes with the following indications:

Power:
Indicates that the M-Bus Master is supplied with power.

Overload:
Indicates that too much power is drawn from the bus. I.e. either a short-circuit or too many M-Bus Slaves connected to the M-Bus Master.

Request:
Blinks when data are sent from M-Bus Master to M-Bus Slave.

Data:
Blinks when the M-Bus Master receives data from a M-Bus Slave.



M-Bus Master without display

The M-Bus Master is no intelligent unit, but a repeater, which converts a RS232 or an optical format to the M-Bus format.

M-Bus format means:

From M-Bus Master to M-Bus Slave is:

mark » 30 V
space » 18 V

There has to be at least 12 VDC between mark and space.

From M-Bus Slave to M-Bus Master is:

mark = closed current
space = closed current + approx. 17 mA.

The M-Bus Master can send and receive at 300 or 2400 baud both over the optical connection possibility and over the data output in the bracket which can be connected direct to RS232 by means of an adapter cable.

The only difference between the two M-Bus Masters is that M-Bus Master with a display makes it possible to read data from all MULTICAL® heat meters connected, and a computer for reading of data is not necessary.

Following MULTICAL® heat meter data can be read on the display:

1. For all heat meters
   - Info code
   - Energy
   - Volume
   - In A
   - In B
   - Target date
2. For each individual heat meter
   - Target energy
   - Target volume
   - Flow temperature
   - Return temperature
   - Δt, power and flow

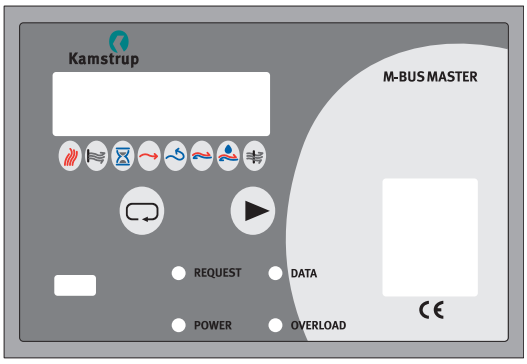
Kamstrup M-Bus Masters can only be used with primary addressing.

For further information – see *the M-Bus Master manual*.

Ordernumbers:

M-Bus Master without display	66-98-11x-xxx
M-Bus Master with display	66-98-A1x-xxx
M-Bus Master manual	5511-185

x = module options (see paragraph 7 and 8)
xxx = Country code – is filled in by Kamstrup A/S.



M-Bus Master with display

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4. M-Bus Slave for MULTICAL®

The M-Bus Slave is a module especially developed for MULTICAL® and is easily installed in the modular space.

The M-Bus Slave is supplied via the M-Bus Master, and there is a galvanic decoupling to MULTICAL®, which cannot be supplied over the M-Bus Master.

The M-Bus Slave is equipped with either two extra in- or outputs, to facilitate remote data acquisition from other meters, e.g. water meter or to read out the energy and volumes pulses from the meter itself.

The M-Bus Slave is an intelligent unit with its own processor and RAM.

The M-Bus Slave automatically collects data from the heat meter every 12 hours. furthermore data is collected during reset/start as well as when data has been sent from M-Bus Slave to M-Bus Master.

Reset is produced by decoupling the supply power to the M-Bus system for a while (at least 1 minute).

The M-Bus Slave can also be initiated from the M-Bus Master by sending the format SND_NKE. Initiation means resetting the internal counters and collecting data from the meter. When the M-Bus Slave collects current data from the meter, communication to the M-Bus network is blocked. This interval is called the initiation time, for MULTICAL® III it is typically 9 seconds, whereas the typical initiation time of a MULTICAL® is 12 seconds.

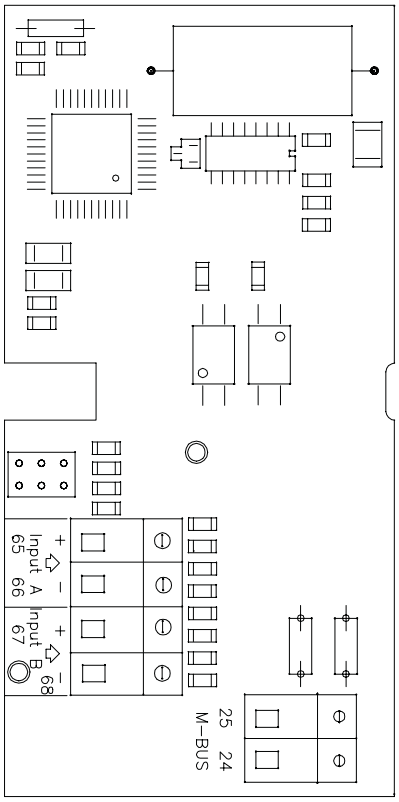
For the creation of M-Bus data packs the M-Bus Slave uses the codings of MULTICAL® (A-B-CCC).

If the coding cannot be found in the M-Bus Slave an error message appears which means that the decimal point will not be correctly placed in the M-Bus data pack.

Each M-Bus Slave has a maximum current consumption of 1 Unit Load (1.5 mA).

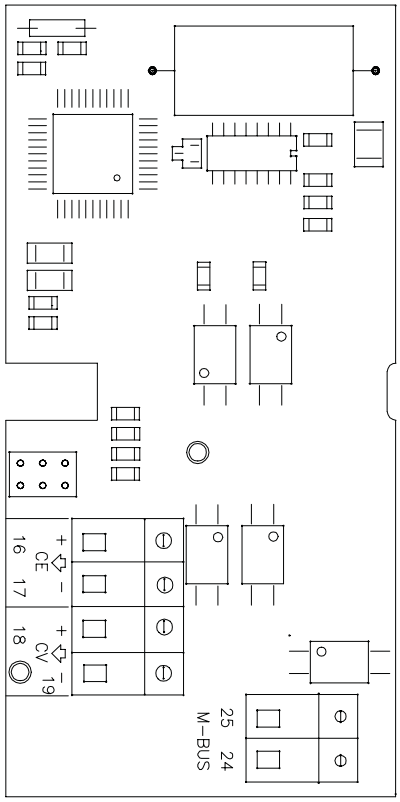
R_{in} = 410 Ω, C_{in} = 0,5 nF.

Pulse inputs



Terminal 24-25 (M-Bus) M-Bus connection
Terminal 65-66 (input A) Pulse input A
Terminal 67-68 (Input B) Pulse input B

Pulse outputs



Terminal 24-25 (M-Bus) M-Bus connection
Terminal 16-17 (CE) Energy pulse
Terminal 67-68 (CV) Volume pulse

Order numbers:

M-Bus Slave for MULTICAL® III/MULTICAL® with pulse inputs	66-04-000-100
M-Bus Slave for MULTICAL® III/MULTICAL® with pulse outputs	66-07-000-100
M-Bus Slave for MULTICAL® with pulse inputs	66-08-000-100
M-Bus Slave for MULTICAL® with pulse outputs	66-09-000-100

There is a difference between the M-Bus Slaves for MULTICAL® III and MULTICAL®.
MULTICAL® transmits a larger amount of data. Please refer to *paragraph 10: Data acquisition of M-Bus*.

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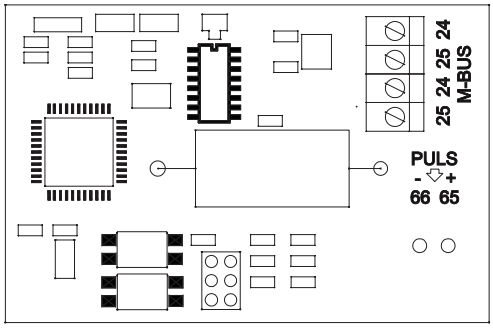
5. M-Bus Slave for MULTICAL® Compact/MULTICAL® 401



M-Bus for MULTICAL® Compact/MULTICAL® 401

Terminal 24-25	*(M-Bus)*	*Connections*
Terminal 65-66	*(Pulse)*	*Not in use*

The M-Bus Slave is a module especially developed for MULTICAL® Compact/MULTICAL® 401, and is easily installed in the module area.

The M-Bus Slave is an intelligent unit with a processor and RAM of its own.

The M-Bus Slave for MULTICAL® Compact/ MULTICAL® 401 is identical with the one for MULTICAL® III, except from the physical dimensions.

There are two versions of the M-Bus module:
– without pulse inputs
– with pulse inputs

Both modules can be used in MULTICAL® Compact as well as MULTICAL® 401, however, the pulse inputs can only be used together with MULTICAL® 401.

Each M-Bus Slave has a max. power consumption of 1 Unit Load (1.5 mA)

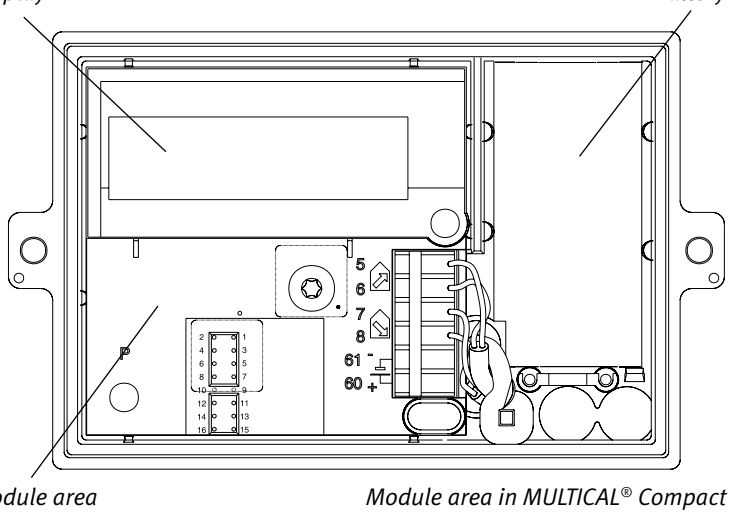
R_{in} = 410 Ω, C_{in} = 0,5 nF.

Data is automatically read every 12 hour, furthermore data is collected during reset/start as well as when data has been sent from M-Bus Slave to M-Bus Master. Reset is produced by decoupling the supply power to the M-Bus system for a while (at least 1 minute).

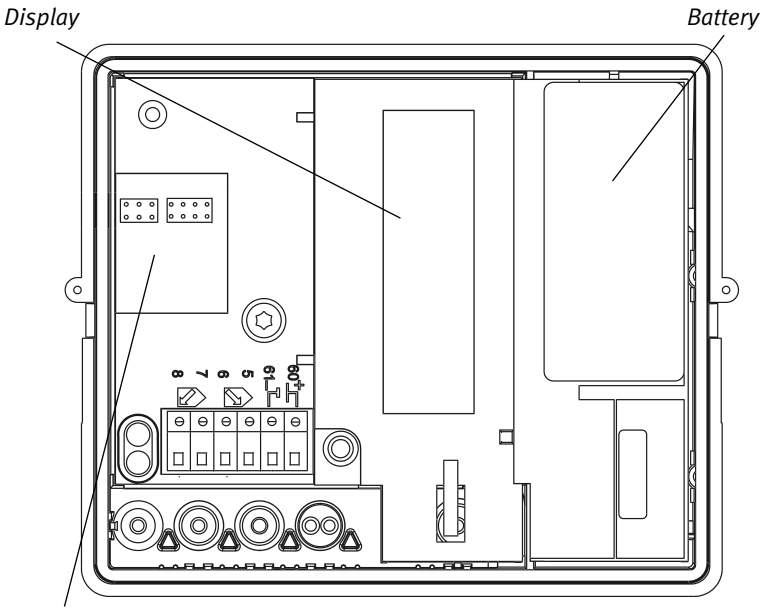
The M-Bus Slave can also be initiated from the M-Bus Master by sending the format SND_NKE. Initiation means resetting the internal counters and collecting data from the meter.

When the M-Bus Slave collects current data from the meter, communication to the M-Bus network is blocked. This interval is called the initiation time, for MULTICAL® Compact/MULTICAL® 401 it is typically 9 seconds.

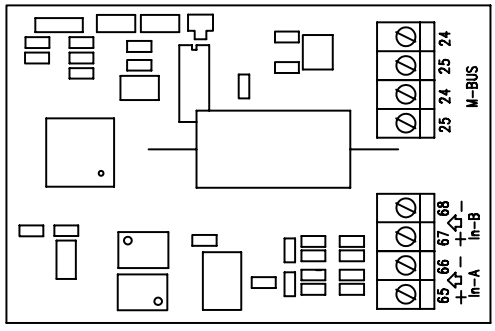
See *Appendix* for further information.



Module area in MULTICAL® Compact



Module area in MULTICAL® 401



M-Bus, pulse inputs for MULTICAL® Compact/MULTICAL® 401

Order numbers:

M-Bus Slave for MULTICAL® Compact/MULTICAL® 401	66-0S-000-100
M-Bus Slave for MULTICAL® Compact/MULTICAL® 401 with pulse inputs	66-0S-000-200

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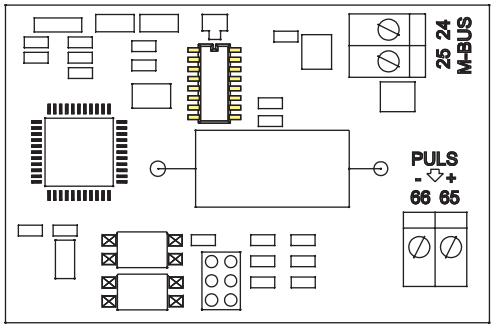
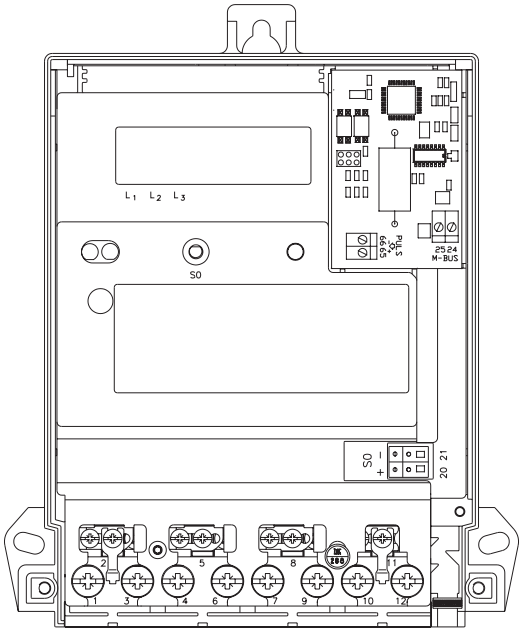
6. M-Bus Slave for Kamstrup 162/382/351 Combi



Terminal 24-25 (M-Bus) Connections
Terminal 65-66 (Pulse) Pulse input



M-Bus Slave mounted in an electricity meter

The M-Bus Slave is especially developed for Kamstrup 162/382/351 Combi, and is easily installed in the modular space of the electricity meter.

The M-Bus Slave for electricity meters is equipped with a pulse input.

The physical dimensions are identical with those of the M-Bus Slave for MULTICAL® Compact, however, it cannot be used for a MULTICAL® Compact.

The M-Bus Slave is an intelligent unit with a processor and RAM of its own, and it automatically finds out in which meter type it is placed.

Data is automatically read every hour, furthermore data is collected during reset/start as well as when data has been sent from M-Bus Slave to M-Bus Master. Reset is produced by decoupling the supply power to the M-Bus system for a while (at least 1 minute).

The M-Bus Slave can also be initiated from the M-Bus Master by sending the format SND_NKE. Initiation means resetting the internal counters and collecting data from the meter.

When the M-Bus Slave collects current data from the meter, communication to the M-Bus network is blocked. This interval is called the initiation time, and is for Kamstrup 162/382/351 COMbi typical 7 seconds.

See *Appendix* for further information.

The power consumption of each M-Bus Slave is 1 Unit Load (1.5 mA).

R_{in} = 410 Ω, C_{in} = 0,5 nF.

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Order numbers:

M-Bus Slave for Kamstrup 162/382/351 Combi	6850-005

7. M-Bus Cascade module

The M-Bus Cascade module can be used to increase the number of M-Bus Slaves in an M-Bus network from 40 to max. 250 M-Bus Slaves (primarily addressing). Furthermore, the cable length can be multiplied by six by using six M-Bus Cascade modules mounted in M-Bus Master units.

The M-Bus Cascade module is mounted in an M-Bus Master and needs neither set-up nor address.

The function of the M-Bus Cascade module is to repeat communication to and from the M-Bus Master.

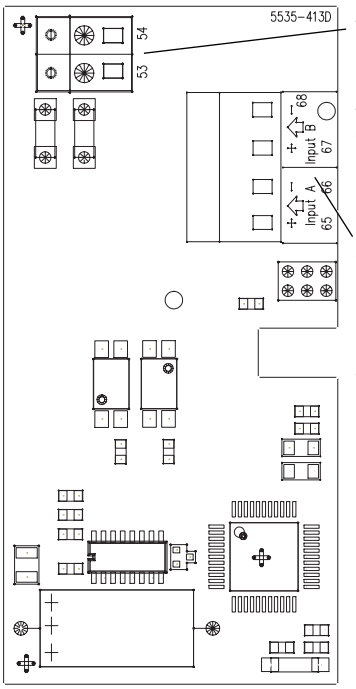
A new M-Bus Master with M-Bus Cascade module is to be connected to an already existing network parallel to one of the connected MULTICAL® energy meters with M-Bus Slave. From the new M-Bus Master a new network with 38 energy meters and 1 M-Bus Cascade module or 40 M-Bus Slaves can be established.

It is possible to connect up to 6 M-Bus Masters and thereby increase the number of energy meters in the network to a total of 250 meters (primarily addressing).

Each M-Bus Cascade module has a power consumption of 2 Unit Loads (3 mA).

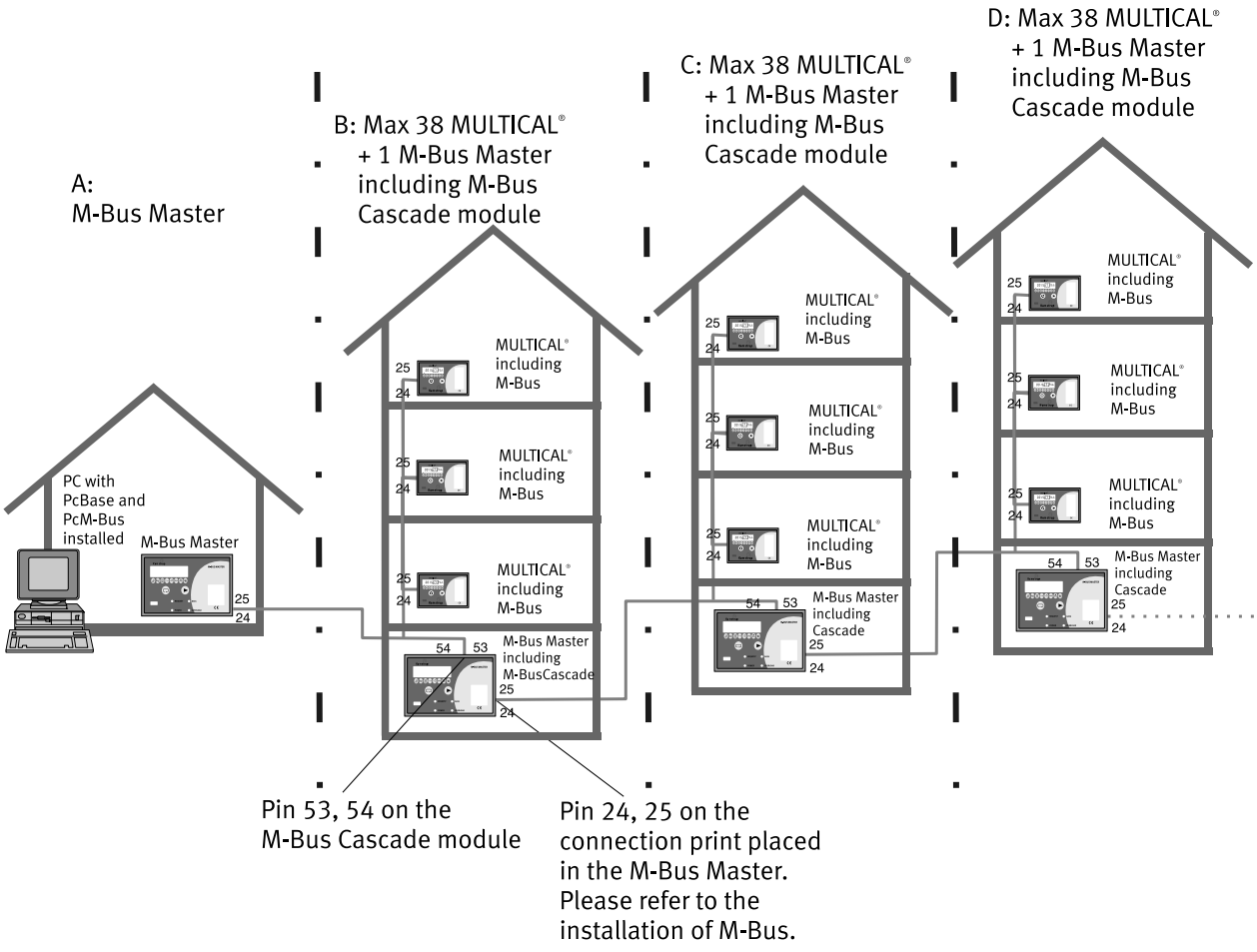
R_{in} = 410 Ω, C_{in} = 0,5 nF.

Extra cable length per unit:
Max. 1.800 m to the most remote M-Bus Slave/0.8 mm².



M-Bus interface (53, 54) To this the M-Bus Slaves are connected.

Input A (65, 66), Input B (67, 68). – Are not in use.



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The number of M-Bus Slave modules/cable length as a function of the number of M-Bus Cascade units in a Kamstrup M-Bus system.

M-Bus Master	Cascade unit = 1 Cascade module + 1 M-Bus Master	Total numbers of M-Bus Slaves	Total cabel lenght 0,5/0,8 mm²
1	0	40	1000/1800 m
	1	38 + 40 = 78	2000/3600 m
	2	38 + 38 + 40 = 116	3000/5400 m
	3	38 + 38 + 38 + 40 = 154	4000/7200 m
	4	38 + 38 + 38 + 38 + 40 = 192	5000/9000 m
	5	38 + 38 + 38 + 38 + 38 + 40 = 230	6000/10800 m
	6	38 + 38 + 38 + 38 + 38 + 38 + 22 = 250	7000/12600 m

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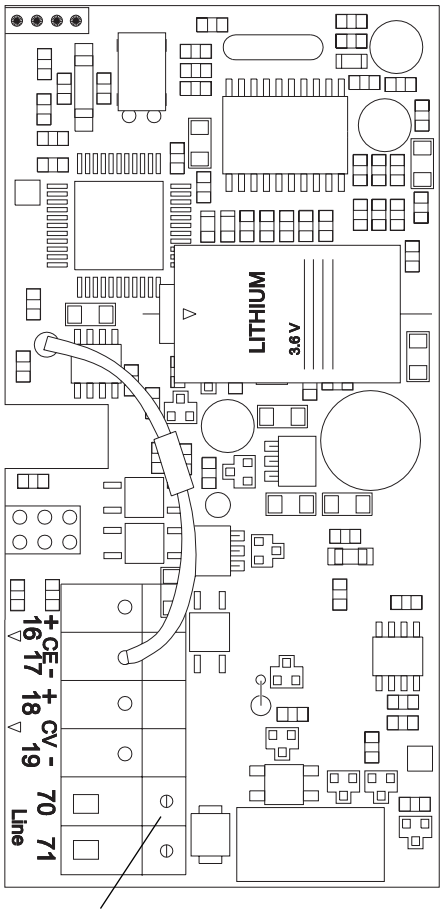
Order numbers:

M-Bus Cascade module 66-98-001-100
1 = module number

8. M-Bus Modem

An M-Bus system of up to 40 meters can be read via the M-Bus Modem.

The M-Bus Modem can be mounted in both M-Bus Master without a display and M-Bus Master with a display.



The line voltage is measured here.

Test

1. When the modem has been installed, the line voltage must be measured on clamps 70 and 71. It must be min. 24 VDC.
2. Remount the top of the M-Bus Master.
3. Make a forced call.

M-Bus Master without a display

Keep pressing the key for min. 10 seconds. The modem module calls the utility at the entered number.

M-Bus Master with display

Keep pressing both keys for min. 10 seconds, until a "Call" appears in the display. The modem module calls the utility at the entered number.

The M-Bus Modem is read via the communication software PcModem, but uses the same database as PcM-Bus.

When the call has been made, we recommend you to call the utility to ensure that the call has been registered by the system software.

Two telephone numbers are entered into the M-Bus Modem:

- Telephone number 1: The data number for remote reading.
- Telephone number 2: An alternative data number for remote reading.

Each number can contain 24 digits.

The M-Bus Modem can be programmed to make calls directly and not via a PABX switchboard according to the *"0 - Pause - dialling tone"* method.

For further information please refer to:

- The M-Bus Master manual
- The M-Bus Modem installation guide
- The PcModem manual

Order numbers:

M-Bus Modem module	66-98-002-319 2 = module number

9. Installation of M-Bus

An M-Bus system is mounted with bus topology, which means that all M-Bus Slaves are coupled to the M-Bus system in parallel. You start from the M-Bus Master, into the first M-Bus Slave, from the first M-Bus Slave and on to the next one etc.

The M-Bus Master has two sets of parallel terminals, which makes it possible to divide the M-Bus in two halves in order to facilitate later error detection.

The M-Bus terminals have the numbers 24 and 25.

The M-Bus is independent of polarity i.e. it is at no consequence how the M-Bus wires are connected to terminals 24 or 25.

A M-Bus Slave is mounted in MULTICAL® by inserting the M-Bus Slave at the module place and mounting the M-Bus cables. Before the identification number can be entered in the M-Bus Slave, the M-Bus Slave must be either reset or initiated.

We recommend that the whole M-Bus system is switched off when mounting new M-Bus Slaves. When all M-Bus Slaves have been connected, the M-Bus system is started (the current to the M-Bus Master is switched on). This start will reset all M-Bus Slaves.

M-Bus Slaves can also be mounted without the M-Bus system being switched off. This means that SND_NKE must be sent to address 255 when all M-Bus Slaves have been mounted in order to initiate them. Failing to do so, the connected M-Bus Slaves will not collect their ID-numbers, so that the M-Bus Master can contact them, until 12 hours later.

Cable length

The cable length depends on the cable resistance and capacity. The cable resistance depends on the cable type and above all the cross section.

General demands:

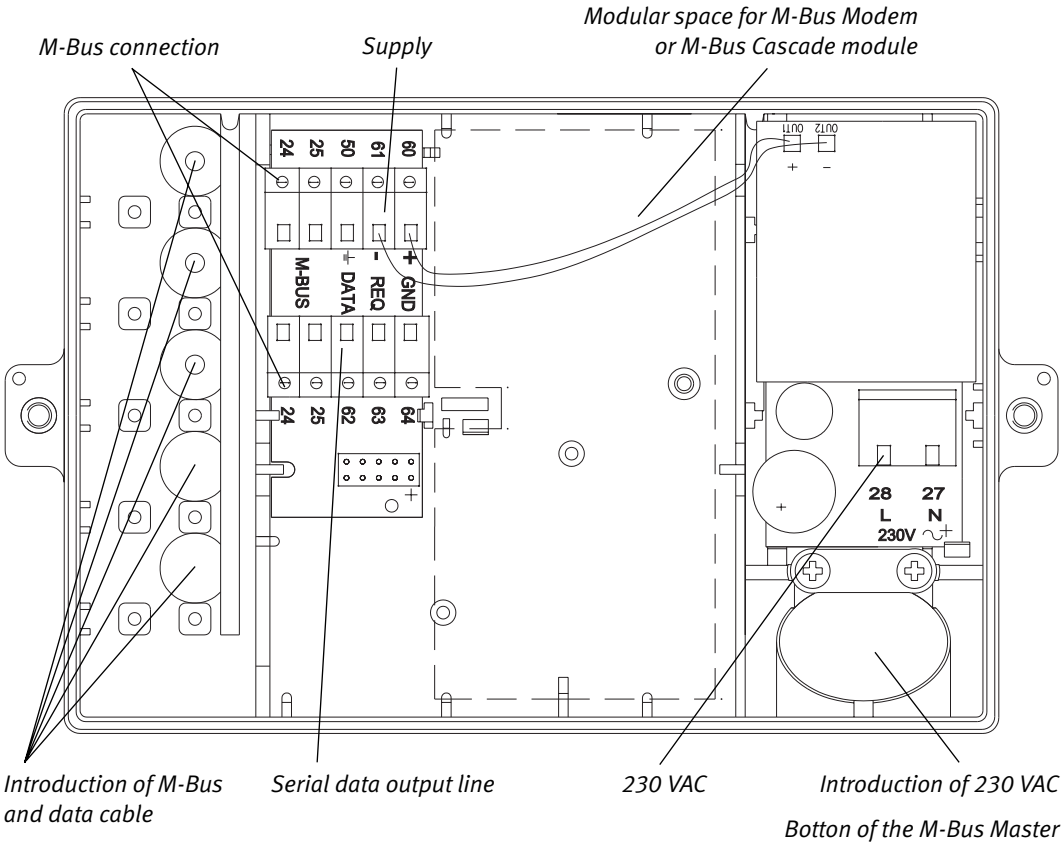
The resistance R must be less than 29 Ω/km.

The capacity C must be less than 180 nF/km.

If e.g. a cable of 2 x 0.8 mm^2 is used, in practice approx 1.800 m cable is used in total in the M-Bus system based on 40 M-Bus Slaves.

In addition – see *tabel on page 11*

Mounting



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230 VAC is connected on terminals 27 and 28.

Power supply is connected on terminals 60 (+) and 61 (-).

M-Bus is connected on terminals 24 and 25, independent on polarity.

Serial data output:

- terminal 62 = DATA: Brown
- terminal 63 = REQUEST: White
- terminal 64 = GND: Green

For correct communication between M-Bus Master and PC, IR head type 66-99-102 or data cable type 66-99-106 from Kamstrup must be used.

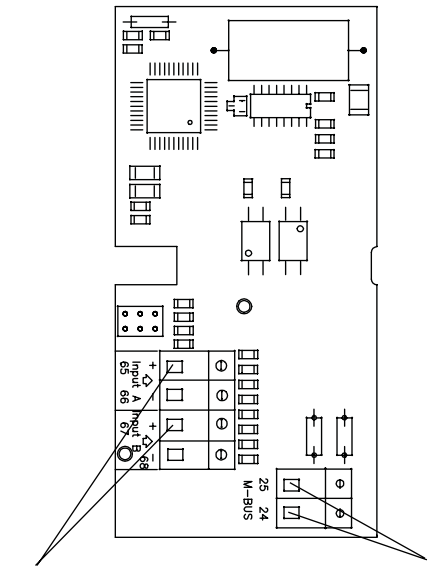
The M-Bus Slave is connected to M-Bus on terminals 24 and 25. It is possible to loop the terminals.

After mounting we recommend to check the voltage on terminals 60 and 61, it should be between 36 and 62 VDC. Then mount the M-Bus Master top part, the light emitting diode designated POWER should be constantly lighted and OVERLOAD will be lighted for approx. 5 sec.

Now the M-Bus power can be checked on terminals 24 and 25. It is not possible, however, to do this in the bracket itself, cables on which to measure must be mounted and drawn through the bracket.

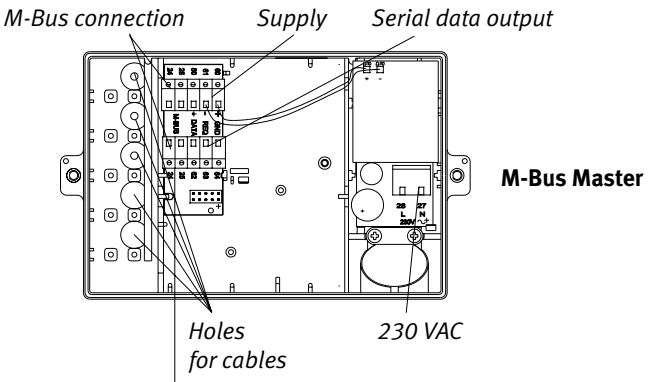
The control can possibly be made on a M-Bus Slave in a MULTICAL®. The power must be between 30 and 36 VDC, if communication is made on the M-Bus.

When the M-Bus Master reads a M-Bus Slave, REQUEST will be lighted briefly and the light emitting diode DATA will be lighted short-term when the M-Bus Slave answers.



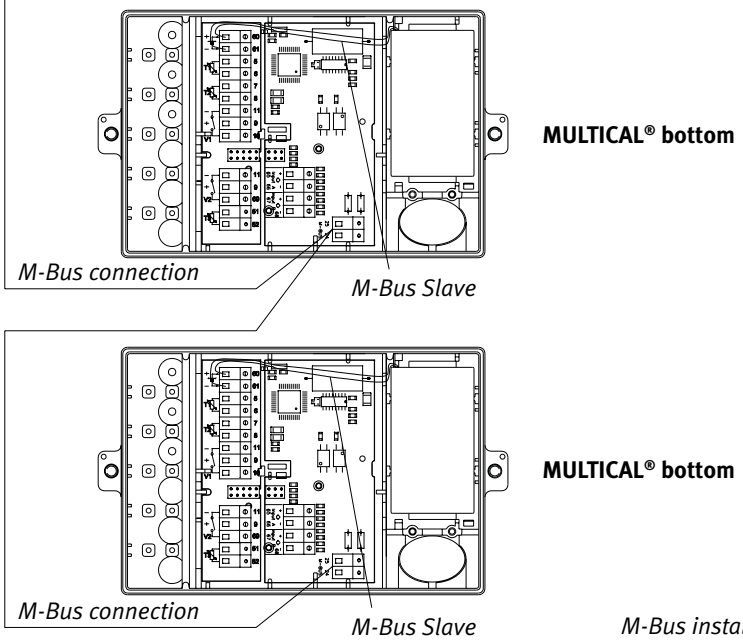
Extra pulse inputs *M-Bus connection*

M-Bus Slave for MULTICAL® III/MULTICAL®



M-Bus cable 2-wire

E.g.: 2 x 0.8 mm²
Max. 1800 m
Max. 40 M-Bus Slave modules.



M-Bus installation

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10. Data reading of M-Bus

A Kamstrup M-Bus system is read by means of a PcM-Bus reading programme installed on a PC.

Data is read via the M-Bus Master through the IR-head, or via a data cable mounted in the bottom of the M-Bus Master.

Data reading of heat meters

Following data message can be read:

66-04-000-100 pulse inputs MULTICAL® III/CDE
66-07-000-100 pulse outputs MULTICAL® III/CDE
66-0S-000-100 MULTICAL® Compact/401:
66-0S-000-200 pulse inputs MULTICAL® Compact/401:

- Customer ID No., TA2, TL2, TA3, TL3, InA, InB, Prog No., Config. No., Date, Energy, Volume, Hour counter, $t_{forward}$, t_{return}, Δt, Power, Flow, Peak power or peak flow, Info Code, Target date, Energy*, Volume*.

NB.: M-Bus Slave modules for MULTICAL® III can be used in MULTICAL® but in such cases it will only tranfer above data telegram. InA and InB are not used in 66-07-000-100 or in 66-0S-000-100.

Following data message can be read:

6608-000-100 pulse inputs MULTICAL®,
66-09-000-100 pulse outputs MULTICAL®:

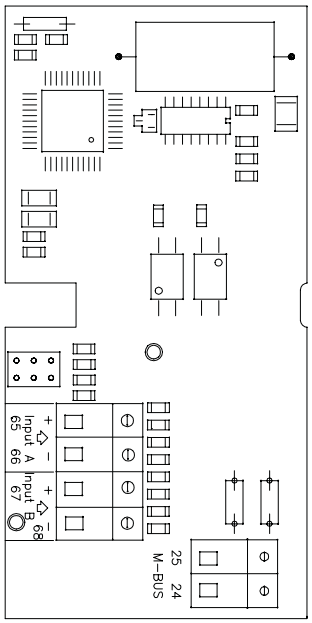
- Customer ID No., TA2, TL2, TA3, TL3, InA, InB, Prog. No., Config. No., Date, Energy, Volume, Hour counter, $t_{forward}$, t_{return}, Δt, Power, Flow, Peak power or peak flow, Info Code, $m^3 \times t_{forward}$, $m^3 \times t_{return}$, Cooling energy, Yearly peak power, Target date, Energy*, Volume*.

NB.: Can only be used in MULTICAL®.
InA and InB are not used in 66-09-000-100.

* Target date data

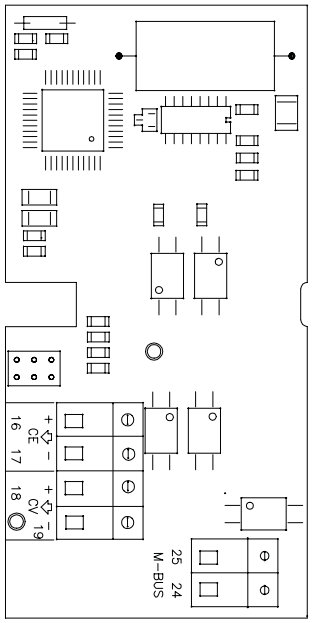
M-Bus Slave for MULTICAL® III/MULTICAL®

Pulse inputs
66-04-000-100
66-08-000-100



Terminal 24-25	*(M-Bus)*	*M-Bus connection*
Terminal 65-66	*(Input A)*	*Pulse input A*
Terminal 67-68	*(Input B)*	*Pulse input B*

Pulse outputs
66-07-000-100
66-09-000-100



Terminal 24-25	*(M-Bus)*	*M-Bus connection*
Terminal 16-17	*(CE)*	*Energy pulse*
Terminal 18-19	*(CV)*	*Volume pulse*

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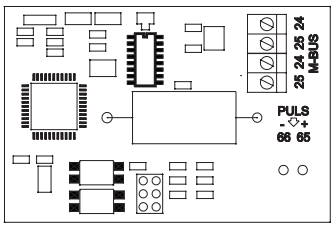
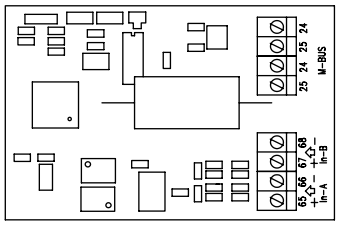
M-Bus Slave for MULTICAL® Compact/MULTICAL® 401

Without pulse inputs



With pulse inputs



Terminal 24-25	*(M-Bus)*	*M-Bus connection*	
Terminal 65-66	*(In A)*	*Pulse input A*	*Not in use for MULTICAL® Compact*
Terminal 67–68	*(In B)*	*Pulse input B*	*Not in use for MULTICAL® Compact*

Data reading of Kamstrup 162/382/351 Combi

Following data telegram can be read:

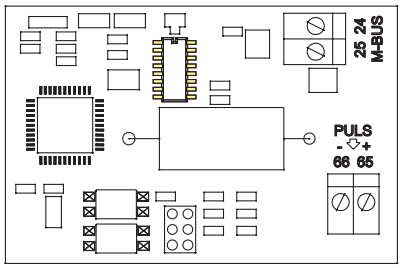
162/282/382:

- Energy, Power, Operating hours, Counter value, Peak power, Customer number, Pulse input, Spec. data, Info Code.

351 Combi:

- Customer number, Operating hours, True energy, Power, Peak power, Pulse input, Spec. data, Info Code.

M-Bus Slave for Kamstrup 162/382/351 Combi

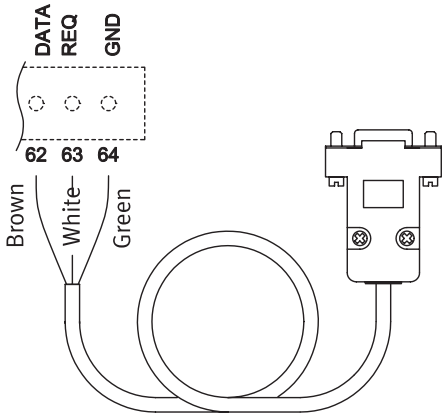


Terminal 24-25	*(M-Bus)*	*M-Bus connection*
Terminal 65-66	*(Pulse)*	*Pulse input*

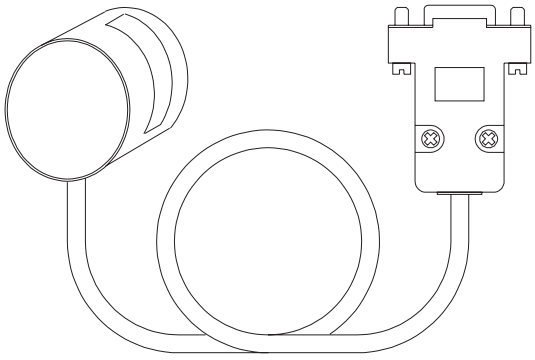
See the *PcM-Bus manual* for further information.

Reading equipment

Data cable for reading



IR head for reading



Data cable or IR head must be used for correct transmission of meter data between M-Bus Master and PC.

Order numbers:

M-Bus Software PcM-Bus	S75-30-007
PcM-Bus manual	5511-722
IR head for reading	66-99-102
Cable for reading	66-99-106

11. Protocol

Commands

The M-Bus concept includes the possibility of various commands from M-Bus Master to M-Bus Slave and from M-Bus Slave to M-Bus Master. For the Kamstrup M-Bus system certain commands which are relevant for the communication with a district heat meter have been chosen.

M-Bus Master to M-Bus Slave:

REQ_UD2 Collects data from the M-Bus Slave

SND_NKE Initiates the M-Bus Slave

SND_UD1 Send data to M-Bus Slave, e.g. new baudrate

M-Bus Slave to M-Bus Master:

RSP_UD1 Sends data to M-Bus Master

CON_ACK Acknowledgement of the receipt of data from the M-Bus Master

The individual commands in detail

The *Appendix* describes all command formats.

M-Bus Master to M-Bus Slave

REQ_UD2: Collect data from M-Bus Slave

STARTCHARACTER	10H
C-FIELD	5BH
A-FIELD	XXH
CHECKSUM	XXH
STOPCHARACTER	16H

Startcharacter: 10H = short format
C-field: 5BH/7BH = REQ_UD2
A-field: Address of M-Bus Slave modules
Checksum: Sum of A and C field, the two least significant Hex digits
Stopcharacter: Always 16H

SND_NKE: Initiate M-Bus Slave.

STARTCHARACTER	10H
C-FIELD	40H
A-FIELD	XXH
CHECKSUM	XXH
STOPCHARACTER	16H

Startcharacter: 10H = short format
C-field: 40H = SND_NKE
A-field: Address of M-Bus Slave modules
Checksum: Sum of A and C field, the two least significant Hex digits
Stopcharacter: Always 16H

SND_UD1: Data to M-Bus Slave (e.g. new baudrate).

STARTCHARACTER	68H
L-FIELD	03H
L-FIELD	03H
STARTCHARACTER	68H
C-FIELD	53H
A-FIELD	XXH
CI-FIELD	XXH
CHECKSUM	XXH
STOPCHARACTER	16H

Startcharacter: 68H = long format
L-field: Desribes the lenght of long format
Startcharacter: 68H = long format
C-field: 53H = SND_UD1
A-field: Address of M-Bus Slave modules
CI-field: Data field, B8H = 300 baud, BBH = 2400 baud
Checksum: Sum of A, C and CI field, the two least significant Hex digits
Stopcharacter: Always 16H

CON_ACK: Data format from M-Bus. Master received and accepted.

SINGLECHARACTER	E5H

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M-Bus Slave to M-Bus Master

RSP_UD1: Data from heat meter to M-Bus Master.

STARTCHARACTER	68H	Startcharacter: 68H = long format
L-FIELD	82 or 92H	L-field: Describes the lenght of long format
L-FIELD	82 or 92H	
STARTCHARACTER	68H	Startcharacter: 68H = long format
C-FIELD	08H	C-field: 08H = RSP_UD1
A-FIELD	XXH	A-field: Address of M-Bus Slave module
CI-FIELD	XXH	CI-field: Data field, answer in variable structure
DATA HEAD		Checksum: Sum from C-field to last data record, the two least significant Hex digits
RECORD ENERGY		
RECORD WATER		
RECORD		

DATA HEAD

ID - No ID - No ID - No ID - No	TYPE A TYPE A TYPE A TYPE A	ID-no, type A Indicates the 8 least significant digits of the MULTICAL® number, is not used by Kamstrup.
MANUFAC. MANUFAC.	00101101 00101100	MANUFAC: M-Bus coded manufacturer code for “KAM”.
GEN. METER	XXH	Gen. meter: Generation of the heat meter.
MEDIA HEAT	04H eller 0CH	Media (heat): Code for district heat meter. 04H for returnn flow meter and 0CH for flow meter.
ACCESS	XXH	Access: Counts 1 every time data is sent to the M-Bus Master.
STATUS	00H	Status: Is set by the M-Bus Slave, must be 00H for correct data – should be checked. See also *page 26*.
SIGNATURE SIGNATURE	00H 00H	Signature: Not used by Kamstrup.

RSP_UD1: Data to the M-Bus Master from Kamstrup 162/382/351 Combi.

STARTCHARACTER	68H	Startcharacter:	68H = long format
L-FIELD	46H	L-field:	Describes the lenght of long format
L-FIELD	46H		
STARTCHARACTER	68H	Startcharacter:	68H = long format
C-FIELD	08H	C-field:	Code for RSP_UD1
A-FIELD	XXH	A-field:	Address of M-Bus Slave module
CI-FIELD	XXH	CI-field:	Data field, answer in variable structure

Data head

ID - No ID - No ID - No ID - No	63 BDC 21 BDC 67 BDC 31 BDC	ID-no, type A As e.g.: costumer no. 31672163	
MANUFAC. MANUFAC.	2DH 2CH	Manufac:	M-Bus coded manufacturer code for “KAM”.
GEN. METER	XXH	Gen. meter:	Generation of electricity meter
MEDIA ELEC.	02H	Media (el.):	Code for electricity
ACCESS	XXH	Access:	Counts 1 every time data is sent to the M-Bus Master.
STATUS	00H	Status:	Is set by M-Bus Slave. 00H for correct data. See also *page 26*.
SIGNATURE SIGNATURE	00H 00H	Signature:	Not used by Kamstrup.

Communication process

Initialization of M-Bus network

M-Bus Master		M-Bus Slave
1. SND_NKE (255), 300 baud or 2400 baud.	→	All M-Bus Slaves collect new data. No acknowledgement is sent.
2. SND_UD1 (255) 300 baud CI = BBH (change to 2400 baud).	→	The M-Bus Slave changes to 2400 baud. No acknowledgement is sent.
3. REQ_UD2 (adr) 2400 baud.	→	Relevant M-Bus Slave answers with data. Enters new data.
4. M-Bus Master (software) stores no data.	←	RSP_UD1 2400 baud. The M-Bus Slave answers with data.

5. The next M-Bus Slave receives a requestes until all M-Bus Slaves have answered

Reading of data, can be up to 12 hours old:
The M-Bus network is supposed to have been initiated.

M-Bus Master		M-Bus Slave
1. SND_UD1 (255) 300 baud CI = BBH (change to 2400 baud)	→	The M-Bus Slave changes to 2400 baud. No acknowledgement is sent.
2. REQ_UD2 (adr) 2400 baud.	→	Request sendes til M-Bus Slave module.
3. M-Bus Master (software) stores no data.	←	RSP_UD1 2400 baud. The M-Bus Slave answers with data.

4. The next M-Bus Slave receives a requestes until all M-Bus Slaves have answered

Reading of fresh data through e.g. data logging

M-Bus Master		M-Bus Slave
1. SND_NKE (255), 300 baud or 2400 baud.	→	All M-Bus Slave collect new data. No acknowledgement is sent. Data ready in MULTICAL® III typically after 9 sec. MULTICAL® typically after 12 sec. In Kamstrup 162/382/351 Combi data is ready typically after 7 sec.
2. SND_UD1 (255) 300 baud CI = BBH (change to 2400 baud).	→	M-Bus Slave changes to 2400 baud. No acknowledgement is sent.
3. REQ_UD2 (adr) 2400 baud.	→	Relevant M-Bus Slave answers with data. Enters new data.
4. The next M-Bus Slave receives a request until all slaves have answered.	←	RSP_UD1 2400 baud. The M-Bus Slave answers with data.

M-Bus Slave and foreign M-Bus masters

When using foreign masters and/or foreign software, the same commands are to be used. The M-Bus Slave only supports the above-mentioned commands.

Is the command SND_NKE (address) used, the M-Bus Slave will answer CON_ACK.

Is the command SND_UD1 (address) used, the M-Bus Slave also answers CON_ACK.

Kamstrup software always uses the address 255, which does not require an acknowledgement from the M-Bus Slave.

The data telegram is in M-Bus format until the "END" character 0FH, see *Appendix*.

The data which follows is in Kamstrup format, which can not be decoded by foreign software/ M-Bus Masters.

The M-Bus Slave will identify itself by the manufacturer code "KAM".

Appendix

1. REQ_UD2 (adr.) → RSP_UD1
   In order to collect heat meter data from a M-Bus Slave REQ_UD1 must be sent from the M-Bus Master. The M-Bus Slave checks the message, and if it is o.k., the M-Bus Slave answers RSP_UD1 – heat meter data packed according to the CEN standard. The collected data will always be at least 12 hours old. When RSP_UD1 has been sent from the M-Bus Slave, new data will be collected from the heat meter. I.e. you can acquire completely fresh data by sending REQ_UD1 twice to the same M-Bus Slave.
   As data acquisition from MULTICAL® III or MULTICAL® means that the bus communication is blocked, an interval of min. 9 sec. between two REQ_UD1 to the same M-Bus Slave is required. MULTICAL® requires an interval of 12 sec. However, at rare intervals bus communication may be blocked for up to 25–30 sec. while measurings of energy, power, flow, temperature etc. are being made.

   The initiation time of the electricity meter is typically 7 sec., but at rare intervals the communication may be blocked for up to 20 sec.

2. SND_NKE (adr.) → CON_ACK
   The M-Bus Master is initiated by means of SND_NKE, and the M-Bus Slave acknowledges receipt of the message by means of CON_ACK.

3. SND_UD1 (adr.) → CON_ACK
   The M-Bus Master wants to change the baud rate of the M-Bus Slave. SND_ UD1 is sent, and the M-Bus Slave accepts with CON_ACK. It should be mentioned that the baud rate cannot be changed until CON_ACK has been transmitted.

   In Rev. C1 and onwards for type 66-04-00-100 this feature is unnecessary, as the M-Bus Slave is furnished with a built-in auto detect of the baud rate, however, nevertheless it is implemented in the M-Bus Slave. The feature is not necessary for 66-07-000-100, 66-08-000-100, 66-09-000-100, 66-0S-000-100 and 66-0S-000-200, but is nevertheless implemented.

RSP_UD1 MULTICAL® III/MULTICAL® Compact/MULTICAL® 401

STARTCHARACTER		68H
L-FIELD		82H
L-FIELD		82H
STARTCHARACTER		68H
C-FIELD		08H
A-FIELD		XXH
CI-FIELD		XXH
DATA HEAD		→
RECORD ENERGY		
RECORD WATER		
RECORD HOUR COUNTER		
RECORD FORWARD TEMPERATURE		
RECORD RETURNN TEMPERATURE		
RECORD F-R TEMPERATURE		
RECORD POWER		
RECORD FLOW		
RECORD READ ENERGY		
RECORD READ WATER		
RECORD READ DATE		
END	OFH	
COSTUMER NO.	10^1	10^0
COSTUMER NO.	10^3	10^2
COSTUMER NO.	10^5	10^4
COSTUMER NO.	10^7	10^6
COSTUMER NO.	10^9	10^8
COSTUMER NO.	10^{11}	10^{10}
PEAK POWER	10^1	10^0
PEAK POWER	10^3	10^2
PEAK POWER	10^5	10^4
PEAK POWER	10^7	10^6
INFO	10^1	10^0
INFO	10^3	10^2
INFO	10^5	10^4
INFO	10^7	10^6
TAR2	10^1	10^0
TAR2	10^3	10^2
TAR2	10^5	10^4
TAR2	10^7	10^6
TL2	10^1	10^0
TL2	10^3	10^2
TL2	10^5	10^4
TL2	10^7	10^6
TAR3	10^1	10^0
TAR3	10^3	10^2
TAR3	10^5	10^4
TAR3	10^7	10^6

Data head →

ID - No.	TYPE A
ID - No.	TYPE A
ID - No.	TYPE A
ID - No.	TYPE A
MANUFAC	00101101
MANUFAC	00101100
GEN. METER	XXH
MEDIA (HEAT)	XXH
ACCESS	XXH
STATUS	00H
SIGNATURE	00H
SIGNATURE	00H

Data record

DIF		DATA
VIF		VALUE
10^1	10^0	BCD
10^3	10^2	BCD
10^5	10^4	BCD
10^7	10^6	BCD
DIF		DATA
VIF		VALUE
TYPE G		
TYPE G		

TL3	10^1	10^0
TL3	10^3	10^2
TL3	10^5	10^4
TL3	10^7	10^6
In A*	10^1	10^0
In A*	10^3	10^2
In A*	10^5	10^4
In A*	10^7	10^6
In B*	10^1	10^0
In B*	10^3	10^2
In B*	10^5	10^4
In B*	10^7	10^6
PROGRAM NO.	10^1	10^0
PROGRAM NO.	10^3	10^2
PROGRAM NO.	10^5	10^4
PROGRAM NO.	10^7	10^6
CONFIGURATION	10^1	10^0
CONFIGURATION	10^3	10^2
CONFIGURATION	10^5	10^4
CONFIGURATION	10^7	10^6
DATE	10^1	10^0
DATE	10^3	10^2
DATE	10^5	10^4
DATE	10^7	10^6
CHECKSUM		
STOPCHARACTER	16H	

***** *InA and InB are not used in MULTICAL® Compact. A "dummy string" is transmitted including the "0" digit.*

RSP_UD1 MULTICAL®

STARTCHARACTER	68H
L-FIELD	92H
L-FIELD	92H
STARTCHARACTER	68H
C-FIELD	08H
A-FIELD	XXH
CI-FIELD	XXH
DATA HEAD	→
RECORD ENERGY	
RECORD WATER	
RECORD HOUR COUNTER	
RECORD FORWARD TEMPERATURE	
RECORD ReturnN TEMPERATURE	
RECORD F-R TEMPERATURE	
RECORD POWER	
RECORD FLOW	
RECORD READ ENERGY	
RECORD READ WATER	
RECORD READ DATE	

DATA HEAD →

ID - NO. (e.g.)	06BCD
ID - NO.	21BCD
ID - NO.	67BCD
ID - NO.	31BCD
MANUFAC.	2DH
MANUFAC.	2CH
GEN. METER	01H
MEDIA (HEAT)	XXH
ACCESS	XXH
STATUS	XXH
SIGNATURE	00H
SIGNATURE	00H

Data record

DIF		DATA
VIF		VALUE
10^1	10^0	BCD
10^3	10^2	BCD
10^5	10^4	BCD
10^7	10^6	BCD
DIF		DATA
VIF		VALUE
TYPE G		
TYPE G		

END	OFH	
COSTUMER NO.	10^1	10^0
COSTUMER NO.	10^3	10^2
COSTUMER NO.	10^5	10^4
COSTUMER NO.	10^7	10^6
COSTUMER NO.	10^9	10^8
COSTUMER NO.	10^{11}	10^{10}
PEAK POWER	10^1	10^0
PEAK POWER	10^3	10^2
PEAK POWER	10^5	10^4
PEAK POWER	10^7	10^6
INFO	10^1	10^0
INFO	10^3	10^2
INFO	10^5	10^4
INFO	10^7	10^6
TAR2	10^1	10^0
TAR2	10^3	10^2
TAR2	10^5	10^4
TAR2	10^7	10^6
TL2	10^1	10^0
TL2	10^3	10^2
TL2	10^5	10^4
TL2	10^7	10^6
TAR3	10^1	10^0
TAR3	10^3	10^2
TAR3	10^5	10^4
TAR3	10^7	10^6
TL3	10^1	10^0
TL3	10^3	10^2
TL3	10^5	10^4
TL3	10^7	10^6
In A	10^1	10^0
In A	10^3	10^2
In A	10^5	10^4
In A	10^7	10^6
In B	10^1	10^0
In B	10^3	10^2
In B	10^5	10^4

In B	10^7	10^6
PROGRAM NO.	10^1	10^0
PROGRAM NO.	10^3	10^2
PROGRAM NO.	10^5	10^4
PROGRAM NO.	10^7	10^6
CONFIGURATION	10^1	10^0
CONFIGURATION	10^3	10^2
CONFIGURATION	10^5	10^4
CONFIGURATION	10^7	10^6
DATE	10^1	10^0
DATE	10^3	10^2
DATE	10^5	10^4
DATE	10^7	10^6
m x $T_{forward}$	10^1	10^0
m^3 x $T_{forward}$	10^3	10^2
m^3 x $T_{forward}$	10^5	10^4
m^3 x $T_{forward}$	10^7	10^6
m^3 x T_{return}	10^1	10^0
m^3 x T_{return}	10^3	10^2
m^3 x T_{return}	10^5	10^4
m^3 x T_{return}	10^7	10^6
COOLING ENERGY	10^1	10^0
COOLING ENERGY	10^3	10^2
COOLING ENERGY	10^5	10^4
COOLING ENERGY	10^7	10^6
YEARS PEAK POWER	10^1	10^0
YEARS PEAK POWER	10^3	10^2
YEARS PEAK POWER	10^4	10^4
YEARS PEAK POWER	10^7	10^6
CHECKSUM		
STOPCHARACTER	16H	

RSP_UD1 Kamstrup 162/382/351 Combi

STARTCHARACTER		68H
L-FIELD		46H
L-FIELD		46H
STARTCHARACTER		68H
C-FIELD		08H
A-FIELD		XXH
CI-FIELD		XXH
DATA HEAD		→
RECORD ENERGY*		
RECORD HOUR COUNTER		
RECORD POWER		
RECORD PEAK POWER		
RECORD TARIF 1		
RECORD TARIF 2		
END	OFH	
TRIP COUNTER VALUE	10^1	10^0
TRIP COUNTER VALUE	10^3	10^2
TRIP COUNTER VALUE	10^5	10^4
TRIP COUNTER VALUE	10^7	10^6
PULSE IN	10^1	10^0
PULSE IN	10^3	10^2
PULSE IN	10^5	10^4
PULSE IN	10^7	10^6
SPEC. DATA	10^1	10^0
SPEC. DATA	10^3	10^2
SPEC. DATA	10^5	10^4
SPEC. DATA	10^7	10^6
INFO	10^1	10^0
INFO	10^3	10^2
INFO	10^5	10^4
INFO	10^7	10^6
CHECKSUM		
STOPCHARACTER	16H	

DATA HEAD →

ID - NO.	XXBCD
ID - NO.	XXBCD
ID - NO.	XXBCD
ID - NO.	XXBCD
MANUFAC.	2DH
MANUFAC.	2CH
GEN. METER	00H
MEDIA (EL.)	02H
ACCESS	00H
STATUS	00H
SIGNATURE	00H
SIGNATURE	00H

Data record

DIF		DATA
VIF		VALUE
10^1	10^0	32 bit integer
10^3	10^2	32 bit integer
10^5	10^4	32 bit integer
10^7	10^6	32 bit integer

** Kamstrup 351 Combi: Reel energy*

VIF: Value Information Field MULTICAL®

HEX	CODING	THEME	UNIT	SIZE	FACTOR
0F	00001111	Energy	GJ	J x 10^7	1000/100/10/1
0E	00001110	Energy	GJ	J x 10^6	1
05	00000101	Energy	kWh	Wh x 10^2	1
06	00000110	Energy	kWh	Wh x 10^3	1
07	00000111	Energy	MWh	Wh x 10^4	100/10/1
17	00010111	Volume	m^3 x 10	m^3 x 10	1
16	00010110	Water	m^3	m^3 x 10^0	1
15	00010101	Water	m^3 x 10^{-1}	m^3 x 10^{-1}	1
14	00010100	Water	m^3 x 10^{-2}	m^3 x 10^{-2}	1
13	00010101	Volume	m^3 x 10^{-3}	m^3 x 10^{-3}	1
22	00100010	Hour counter	Hours	Hours	1
3E	00111110	Flow	m^3/h	m^3/h x 10^0	1
3D	00111101	Flow	m^3/h x 10^{-1}	m^3/h x 10^{-1}	1
3C	00111100	Flow	m^3/h x 10^{-2}	m^3/h x 10^{-2}	1
3B	00111011	Flow	l/h	m^3/h x 10^{-3}	1
59	01011001	Temp. forward	C°	C° x 10^{-2}	1
5D	01011101	Temp. return	C°	C° x 10^{-2}	1
61	01100001	Δt	K	K x 10^{-2}	1
2D	00101101	Power	kW x 10^{-1}	W x 10^2	1
2E	00101110	Power	MW x 10^{-3}	W x 10^3	1
2F	00101111	Power	MW x 10^{-2}	W x 10^4	1/10
6C	01101100	Date	G-type	Date	1

CODING: Coding of the VIF of the data pack

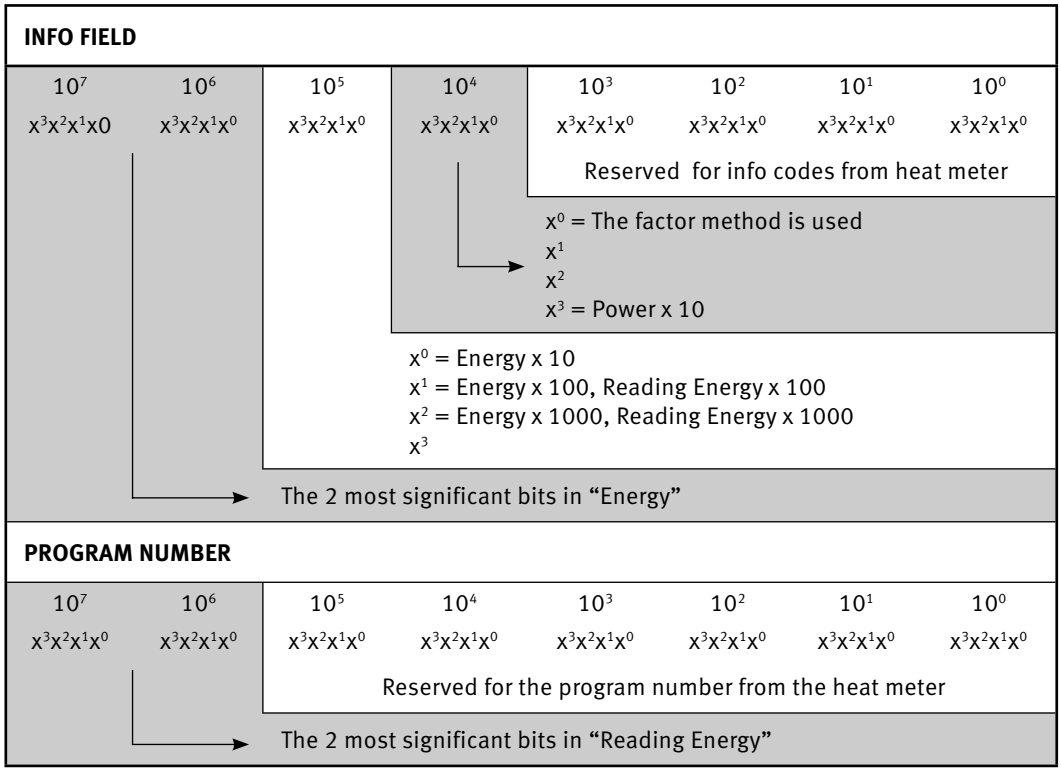
THEME: Subject of record

UNIT: Wanted unit

SIZE: Unit entered in the VIF

FACTOR: The factor, by which the values of the software are multiplied, in order to comply with the units required – *see next page.*

If multiplied with 10, 100 or 1000 the info field and the prog_NO. field change.



DIF: Data Value Field

EMNE	VÆRDI	HEX	BESKRIVELSE
DATE_AFL	01000010	42H	16 Integer, Historic Value, Type G
Energy_AFL	01001100	4CH	8 Digit BCD, Historic Value, Type A
Water_AFL	01001100	4CH	8 Digit BCD, Historic Value, Type A
RESTEN	00001100	0CH	8 Digit BCD, Current Value, Type A

DATA HEAD

DATA	VÆRDI	TYPE	BESKRIVELSE
ID-NO.	XXH	A	Customer number x 10^1/customer number x 10^0
ID-NO.	XXH	A	Customer number x 10^3/customer number x 10^2
ID.NO.	XXH	A	Customer number x 10^5/customer number x 10^4
ID.NO.	XXH	A	Customer number x 10^7/customer number x 10^6
MANUFAC.	00101101	C	[ascii “K” – 64] x 32 x 32 + 1 [ascii “A” – 64] x 32+
MANUFAC.	00101100	C	[ascii “M” – 64] ISO 60870 Standard
GEN. METER	00H	C	Heat meter generation
MEDIA (HEAT)	04H* el. 0CH**	D	Code for heat
ACCESS	XXH	C	Counts 1 after each data transfer to the M-Bus Master
STATUS	XXH***	D	Error code – see below
SIGNATURE	00H	C	Not in use
SIGNATURE	00H	C	Not in use

* 04H is used when data is acquired from a return meter

** 0CH is used when data is acquired from a flow meter

*** Error code: 80H → Error during the last collection of heat meter data, data incorrect or too old.

40H → Error in prog_No., e.g. number unknown. I.e. data not correctly encoded.

The error code should be checked when data is received – only apply to “old” M-Bus Slaves.

Heat meter M-Bus Slaves supplied after 15 April 2003 automatically check the STATUS field, and do not send data on the M-Bus if the field is different from “0”.

The M-Bus Slave makes up to three attempts, at intervals of 5 seconds, to collect correct data from the meter. If the STATUS field remains different from “0”, automatic data update, or the next user effected reading will be awaited.

Physical properties

- Bus independent of polarity
- Dynamic impedance = 35 Ω
- Galvanical isolation from data wires to earth
- Short-circuit proof
- Symmetric around earth
- Transmission speed 300 or 2400 baud
- Maximum resistance in cable = 29 Ω/180 nF per pair
- Connection of 230 VAC (M-Bus Master)
- Current consumption: 10 mA + 1.5 mA per M-Bus Slave.