kamstrup

Technical Description

Wired M-Bus

Water Meters
flowIQ® 2101/3100

M-Bus

Contents

1 Introduction

This technical description describes the wired M-Bus interface of water meters flowIQ® 2101 and flowIQ® 3100.
For further technical information about these water meters, please refer to their respective Technical Description.

1.1 M-Bus

M-Bus is a bus system especially suited for communication with consumption meters. The system consists of an M-Bus Master and one or more meters with M-Bus interface.
M-Bus is standardized in the European standard EN 13757, as well as in the OMS TR02.

1.2 M-Bus communication

Communication on the M-Bus is an asynchronous serial bit transmission in half duplex mode, which means that it is possible only to transmit one way at a time on the M-Bus.

The framing of the communication is 1 start bit, 8 data bits, 1 parity bit (even) and 1 stop bit.

The M-Bus is communicating via voltage modulation from the M-Bus Master to the M-Bus water meter and current modulation from the M-Bus water meter to the M-Bus Master. Communication media is via an ordinary two-wire cable. A twisted pair, non-shielded cable is recommended.

2 M-Bus water meter flowIQ® 2101/3100

The M-Bus water meter supports primary, secondary and enhanced secondary addressing as well as 300, 2400 and 9600 baud communication speed.

The M-Bus water meter flowIQ® 2101/3100 are designed with manufacturer specified VIF extensions, so called VIFE codes.

These VIFE codes are formatting the data, whereby decoding of the content is much easier, as when using manufacturer specified data.

The connection of the M-Bus water meter and the M-Bus network is realized with a fixed two wire cable.

2.1 Physical properties

The M-Bus interface is integrated in the flowIQ® 2101/3100.

The bus is polarity independent.

The M-Bus water meter have a max power consumption of 1 unit load (1.5 mA) drawn from the M-Bus Master.

Rin: 440 Ohm

Cin: 0.5nF

Bus current and voltages according to EN 13757-2.

3 Design

The M-Bus water meters fulfil the requirements in the M-Bus standard EN 13757:2013 as well as the OMS TR02:2015 and can be used in a wide variety of applications using M-Bus protocol.

3.1 Applications

The M-Bus water meters are designed with focus on high flexibility to fulfill a wide pallet of existing and future applications.

3.1.1 Analysis

The flowIQ® 2101/3100 support high quantities of data and all relevant data for analysis can be read out. This is valid for both actual meter data as well as for target data.

3.1.2 Billing

All relevant data for billing purposes can be read out from the flowIQ® 2101/3100.

3.1.3 Emulation

The wired M-Bus datagram in flowIQ® 2101/3100 is fixed and cannot be altered

3.1.4 Controlling and regulating

The water meter can deliver online data in intervals down to 15 seconds (however at reduced battery lifetime) for controlling and regulating purposes with a high communication speed.

4 Installation

As M-Bus is polarity independent there is no + and ÷ to care about.

Configuring the primary address can be done with METERTOOL HCW using an optical readout head or via the M-Bus network. It is recommended that the entire M-Bus system is not powered up during installation of new M-Bus water meters.

5 Data communication

5.1 Bus communication

The M-Bus water meter design is based on the newest technology, offering high-speed communication as well as very frequent reading interval.

The transmission speed is automatically detected by the M-Bus water meter. When the M-Bus water meter receives a message from the M-Bus Master on a certain speed, it will reply with the same speed.

The M-Bus water meters flowIQ® 2101/3100 supports 300, 2400 and 9600 baud communication speed.

5.2 Communication interval

In order to maintain the full 16 years battery lifetime of the water meter, the read out interval shall be longer than 1 minute. Since the most frequent integration interval in the flowIQ® 2101/3100 is 32 seconds, a more frequent reading is not recommended. A more frequent reading interval than 32 seconds will provide redundant information.

5.3 Addressing forms

To make the M-Bus system operate with more M-Bus water meters connected, it is necessary to distinguish between the individual M-Bus water meter. This is done by means of following M-Bus ID numbers in each M-Bus meter:

- Primary address: 001...250, and the special addresses 0, 253, 254 and 255
- M-Bus ID number: 8 digits 00000000… 99999999
- Manufacturer ID: Always 2D2Ch for 'KAM' for Kamstrup M-Bus water meter
- Version ID flowIQ® 2101 1Fh
- Version ID flowIQ® 3100 1Dh
- Device type ID: 06h = Volume warm, 16h = Volume cold
- Fabrication number: Serial number, 8 digits 0000000… 99999999

When the M-Bus Master sends a message on the M-Bus, some or all of the above ID numbers on the M-Bus water meters are encoded in the message. Thus, only the M-Bus water meter with the addressed ID numbers will reply.

Manufacturer ID, Version ID and Fabrication number are permanently encoded into the M-Bus water meter and cannot be changed.

5.3.1 Primary addressing

A valid primary M-Bus address has a value between 000 and 250.

The primary M-Bus address is either configured specific in the flowIQ® 2101/3100 or the last digits of the meter number are used.

As factory default, the primary address in flowIQ® 2101/3100 equals to the last 3 digits of the meter number. If the last 3 digits are larger than 250 (e.g. 345) the first digit is ignored and the M-Bus water meter address is only determined by the last 2 digits (e.g. 45).

During the ordering process specific primary addresses can be specified.

Changing the primary address can be performed in following ways:

- Programming with METERTOOL HCW, via Optical Readout Head
- Remotely, via M-Bus master

In connection with primary addressing of the M-Bus, two or more M-Bus water meters on the same M-Bus system cannot have the same primary address. However, in connection with secondary addressing or enhanced secondary addressing it is possible to distinguish M-Bus water meters with the same primary address on the same M-Bus.

Standard address range for an M-Bus water meter is 001... 250.

In addition to this, there are 4 special addresses that work as follows:

Adr. 000: Ordinary primary address reserved for non-configured M-Bus water meter.

Adr. 253: Used for secondary addressing.
Only M-Bus water meters selected by (enhanced) secondary addressing will reply.

Adr. 254: All M-Bus meters will reply to this address. The address can only be used in systems where only 1 M-Bus water meter is connected.

Adr. 255: No M-Bus meter will reply to this address, but all will receive the message. This address makes it possible e.g. to change the baud rate, on an entire system at the same time, by sending only one telegram.

5.3.2 Secondary addressing

A valid secondary M-Bus address has a value between 00000000 and 99999999 and is in the flowIQ® 2101/3100 identical to the unique serial number.

In connection with secondary addressing, the M-Bus water meters are selected via the primary address 253 with its 8 byte long complete M-Bus ID consisting of:

- M-Bus ID number. Default from Kamstrup: The last 8 digits in the meter number / customer number (4 bytes)
- Manufacturer ID = ASCII characters 'KAM' for Kamstrup encoded to the value 2D2Ch (2 bytes)
- Version/generation ID number for MULTICAL® 21 = 34h (1 byte)
- Device type ID (1 byte)

These 8 bytes make up the secondary address of the M-Bus water meter. It is possible to replace the individual bytes with wildcard characters. See chapter 5.3.4 for further information.

Selection of M-Bus water meter via secondary address
(and deselecting other M-Bus water meter):

Start character	68h	
L-field	0Bh	
L-field	0Bh	
Start character	68h	
C-field	53h or 73h	
A-field	FDh	
CI-field	52h	
ID No. LSB	37 or FF BCD	E.g. M-Bus ID number = 4118737
ID No.	87 or FF BCD	
ID No.	11 or FF BCD	
ID No. MSB	04 or FF BCD	
Man. ID LSB	2Dh or FFh	KAM encoded to 2D2Ch
Man. ID MSB	2Ch or FFh	
Version ID flowIQ 2101	1Dh	
Version ID flowIQ 2101	1Fh	
Device ID	04h, 07h, 0Ah, 0Bh, 0Ch, or 0Dh (see also ID numbers) or FFh	
Checksum	Xxh	
Stop character	16h	

As long as the M-Bus water meter is selected, it will reply to primary address 253, which is dedicated to secondary addressing. The M-Bus water meter is deselected either by

- sending a new selection via primary address 253 with a secondary address – different from the one of the M-Bus water meter (by means of which another M-Bus meter may be selected, if necessary)
  or
- sending normalization (SND_NKE) to primary address 253.

5.3.3 Enhanced secondary addressing

A valid secondary M-Bus address has a value between (M-Bus ID No. 00000000-99999999) / (M-Bus fabrication No. 00000000-99999999) and is, in the flowIQ® 2101/3100, identical to the unique serial number.

The M-Bus water meter secondary address can therefore be extended in order to comprise the 8 digit BCD 'fabrication number' (4 bytes) – identical with the serial number of the meter. This number is unique for each flowIQ® 2101/3100 and cannot be changed after the meter has been produced.

In connection with enhanced secondary addressing, the M-Bus water meter is selected by adding 'fabrication number' as an ordinary data record with DIF = 0Ch (for 4 bytes, 8 digit BCD) and VIF = 78h (for fabrication number) in the selection telegram after the secondary address.

When a M-Bus water meter is selected via enhanced secondary address, it will reply to primary address 253, as it is with the ordinary secondary addressing. The M-Bus water meter is deselected either by

- sending a new selection via primary address 253 with an enhanced or ordinary secondary address – different from the one from the M-Bus water meter (by means of which another M-Bus meter may be selected, if necessary)
  or
- sending a normalization (SND_NKE) to primary address 253.

Selection of M-Bus water meter via enhanced secondary address (and deselecting other M-Bus water meter):

Start character	68h	
L-field	11h	
L-field	11h	
Start character	68h	
C-field	53h or 73h	
A-field	FDh	
CI-field	52h	
ID No. LSB	37 or FF BCD	E.g. M-Bus ID number = 4118737
ID No.	87 or FF BCD	
ID No.	11 or FF BCD	
ID No. MSB	04 or FF BCD	
Man. ID LSB	2Dh or FFh	KAM encoded to 2D2Ch
Man. ID MSB	2Ch or FFh	
Version ID flowIQ2101	1Fh	
Version ID flowIQ 3100	1Dh	
Device ID	16 (cold water), 06 (warm water)	
Record	0Ch DIF:	4 bytes, 8 digit BCD
Fabrication. no.	78h VIF:	Fabrication no. (serial no.), e.g.: 2500176
Fabr. no. LSB	76 or FF BCD	
Fabr. no.	01 or FF BCD	
Fabr. no.	50 or FF BCD	
Fabr. no. MSB	02 or FF BCD	
Checksum	Xxh	
Stop character	16h	

5.3.4 Wildcard search with break detection

The M-Bus water meter supports wild card search for an easy search for connected meters. Some or all digits of the meters secondary and/or enhanced secondary addresses can be replaced with wild cards when searching for meters in an M-Bus network. The integrated break detection functionality eases the meter search on the M-Bus network.

The M-Bus water meter will not compare the wildcard characters with the equivalent digits in "its own" secondary and enhanced secondary address, and the M-Bus water meter will be selected if the other characters match.

The 8 digits in the M-Bus ID number and the 8 digits in the 'fabrication number' (= serial number) can each be replaced by the wildcard character Fh.

The binary values 'Manufacturer ID' (2 bytes), 'Version / generation ID' (1 byte), and 'Device type ID' (1 byte) in the secondary address may be replaced by the wildcard byte value FFh.

The values for DIF = 0Ch (for 4 bytes, 8 digit BCD) and VIF = 78h (for fabrication number) in connection with enhanced secondary addressing cannot be replaced by wildcard values.

By means of wildcard characters (BCD Fh) and values (binary FFh), an M-Bus Master can, relatively quickly, search the M-Bus for connected M-Bus water meters, without knowing the M-Bus water meters primary, secondary or enhanced secondary addresses in advance.

5.4 M-Bus formats

The M-Bus protocol comprises following telegram / message format types:

Single character
Ack. = E5h

Short frame
Start = 10h
C-Field
A-Field
Checksum
Stop = 16h

Control frame
Start = 68h
L-Field = 3
L-Field = 3
Start = 68h
C-Field
A-Field
CI-Field
Checksum
Stop = 16h

Long frame
Start = 68h
L-Field = N + 3
L-Field = N + 3
Start = 68h
C-Field
A-Field
CI-Field
Userdata
(N = 0..252 bytes)
Checksum
Stop = 16h

The meaning of the C-Field

C-FIELD:	40h	SND_NKE		
	08h	RSP_UD		
	0Bh	RSP_SKE		
	49h	REQ_SKE		
	53h	SND_UD (FCB=0)	73h	SND_UD (FCB =1)
	5Ah	REQ_UD1 (FCB=0)	7Ah	REQ_UD1 (FCB =1)
	5Bh	REQ_UD2 (FCB=0)	7Bh	REQ_UD2 (FCB =1)
	43h	SND_UD2		

Note: *In the default application the FCB bit is not used and the M-Bus water meter accepts both FCB = 0 and FCB = 1.*

The meaning of the A-Field

A-FIELD:	xxh	The primary address of the M-Bus water meter.
	FDh	(253) The primary address of the M-Bus water meter in connection with secondary addressing. However, in connection with RSP¬_UD the M-Bus water meter still replies with its own primary address.
	FEh	(254) Address to which all M-Bus water meters will reply. By using this address only one M-Bus water meter can be connected. The M-Bus water meter still replies with its own primary address.
		(255) Joint address where all M-Bus water meters can receive data from the M-Bus Master, but replies are not returned.

The meaning of the CI-Field

CI-FIELD:	50h	Application select/reset. Select is used for logger reading applications. A reset will select the default application.
	51h	Normal transmission of SND_UD, data send (M-Bus Master to M-Bus water meter).
	52h	Opening for secondary addressing (selection of M-Bus water meter) is required.
	72h	Respond in variable structure.
	B8h	Baud rate shift to 300 baud.
	BBh	Baud rate shift to 2400 baud.
	BDh	Baud rate shift to 9600 baud.
	BEh	Baud rate shift to 19200 baud.
	72h	Long 12 bytes APL header in RSP_UD response from device
	7Ah	Short 4 bytes APL header in RSP_UD response from device
	78h	No APL header in RSP_UD response from device
	A0h	Kamstrup specific from master to slave
	A1h	Kamstrup specific from slave to master

Note: As the flowIQ® 2101/3100 M-Bus water meters supports auto baud rate detection, it is not necessary to instruct them with a specific baud rate.

5.5 M-Bus master to M-Bus water meter

Communication on the M-Bus is initiated by the M-Bus Master. After this the addressed M-Bus water meter replies. Basically, there are 2 different communication sequences (from M-Bus Master to M-Bus water meter):

SEND -> CONFIRM
REQUEST -> RESPONSE

When using 'SEND -> CONFIRM' the M-Bus Master sends a command or data to the M-Bus water meter, that replies with an acknowledgement (ACK). The acknowledgement (ACK) just means that the M-Bus water meter has received the telegram successfully, but it has not necessarily accepted the contents.

When using 'REQUEST -> RESPONSE' the M-Bus Master sends a request to the M-Bus water meter, which in return replies with a datagram according to the request.

The M-Bus water meter only supports 'Mode 1' data format where all multi-byte data values to and from the M-Bus water meter are transmitted with Least Significant Byte (LSB) first.

In the default application the FCB / FCV bit in the C-field is not used and the M-Bus water meter accepts both FCB = 0 and FCB = 1.

The M-Bus water meter does not use DFC (Data Flow Control) / ACD (Access Demand) bits, which means that both bits will always have the value 0 in the C-Field from the M-Bus water meter.

The following describes the individual M-Bus telegrams, from M-Bus Master to M-Bus water meter and from M-Bus water meter to M-Bus Master, that are supported.

REQ_UD1:	Short frame. Request for time-critical data alarm.	
	Start character	10h
	C-field	5Ah or 7A
	A-field	xxh or FDh
	Checksum	Xxh
	Stop character	16h

REQ_UD2:	Short frame. Request for data from the M-Bus interface.	
	Start character	10h
	C-field	5Bh or 7B
	A-field	xxh or FDh
	Checksum	xxh
	Stop character	16h

REQ_SKE:	Short frame. Status request.	
	Start character	10h
	C-field	49h
	A-field	xxh or FDh
	Checksum	xxh
	Stop character	16h

SND_NKE:	Short frame. Normalizes the M-Bus water meter.	
	Start character	10h
	C-field	40h
	A-field	xxh or FDh
	Checksum	xxh
	Stop character	16h

SND_UD:	Long frame, Data to the M-Bus water meter.		
	Start character	68h	
	L-field	xxh	length field = number of data bytes N + 3
	L-field	xxh	length field repeated
	Start character	68h	
	C-field	53h	(FCB=0) or 73h (FCB=1) = SND_UD
	A-field	xxh or FDh	
	CI-field	xxh	51h = data send, 52h = secondary address selection
	Data byte 1	xx	
	:	:	
	:	:	
	Data byte 1	xx	
	Checksum	xxh	
	Stop character	16h	

5.6 M-Bus slave to M-Bus master

RSP_UD: Long frame.
Data to M-Bus Master. See telegram later.

RSP_SKE: Short frame.
Data to M-Bus Master. See telegram later.

ACK: Single control character.
Data format from M-Bus Master received successfully.

Description of the codes of the individual formats can be viewed later in this document.

Communication takes place in following sequences:

5.6.1 REQ_UD2 -> RSP_UD

To collect meter data, from the M-Bus water meter, an REQ_UD2 is transmitted from the M-Bus Master.
The M-Bus water meter checks the message, and if it is correct, the M-Bus water meter returns with an RSP_UD, which is meter data packed according to the M-Bus format for RSP_UD.

An example of a RSP_UD datagram can be viewed later in the manual.

5.6.2 REQ_UD1 -> ACK

REQ_UD1 from the M-Bus Master is a request for time-critical (alarm) data from the M-Bus water meter.
The flowIQ® 2101/3100 M-Bus water meter does not support time-critical data (alarm protocol), but it replies with an ACK (link layer receipt) when receiving REQ_UD1, which means that the M-Bus water meter does not have any time-critical (alarm) data to transmit.

In this way, the M-Bus water meter will function in M-Bus systems with other M-Bus interface supporting time-critical data (alarm protocol).

5.6.3 REQ_SKE -> RSP_SKE

REQ_SKE from the M-Bus Master is a request for communication status and for information on whether the M-Bus water meter has any time-critical (alarm) data to send. When receiving an REQ_SKE the M-Bus water meter replies with an RSP_SKE, but as the M-Bus water meter does not support time-critical data (alarm protocol), and cannot have overflow in its input buffer, the status bits ACD (Access Demand) and DFC (Data Flow Control) will always be = 0 in the M-Bus water meter reply, which means that the M-Bus water meter does not have any time-critical (alarm) data to send and has no buffer overflow.

Therefore, the M-Bus water meter will function in M-Bus systems with other M-Bus interface supporting time-critical data (alarm protocol) and using communication status bit.

SND_NKE -> ACK

The M-Bus Master normalizes the M-Bus water meter with an SND_NKE and the M-Bus water meter acknowledges successful receipt of the message by means of an ACK. An SND_NKE to primary address 253 will deselect the M-Bus water meter, if it was selected by means of secondary or enhanced secondary addressing.

SND_UD -> ACK

The M-Bus Master wishes to send data to the M-Bus water meter, or to select/deselect the M-Bus water meter via secondary or enhanced secondary addressing. The M-Bus water meter acknowledges successful receipt of the SND_UD telegram by means of an ACK. The acknowledgement (ACK) just means that the M-Bus water meter has received the telegram successfully in the Data Link Layer and is as such no guarantee that the M-Bus water meter has accepted the contents of the Application Layer.

Therefore, when receiving an SND_UD command with a new baud rate, the M-Bus water meter will acknowledge receipt by means of an ACK, even though it ignores the contents, as the M-Bus water meter automatically detects the baud rate on receipt.

5.7 Information codes

flowIQ® 2101/3100 indicates in the display, and in the wired M-Bus datagram, if a special state in the meter, called info codes, are present:

DRY: Meaning that the meter is not water filled, in this case nothing is measured.

REVERSE: Meaning that the water is flowing in the wrong direction in the meter.

LEAK: Meaning that the water has been running for more than 24 hours.

BURST: Meaning that the water flow is constantly high for more than 30 minutes.

TAMPER: Meaning that the meter has been disassembled in an attempt of fraud.

The info code will disappear from the display and from the wired M-Bus datagram, when the condition that initiated it disappears. Info codes initiate the Temporary error (bit 4) in the status field.

5.7.1 Status field

flowIQ® 2101/3100 info codes are mapped to the error bit 'Temporary error' (bit 4) when any info code is active. Further, the 'Power Low' (bit 2) in the status field is set, when battery power is low.

The 'Status field' in the M-Bus data header can have one of the following values, or the sum of more values:

Status field value	Description
00h	No info code
04h	Power Low on battery
10h	Temporary Error
14h	Power Low and Temporary Error

5.7.2 Temporary error

Temporary Error (Bit 4) is set when one of the info codes is active in flowIQ® 2101/3100.

5.8 Datagram

The datagram in flowIQ® 2101/3100 M-Bus water meter has a fixed data content.

Previously, Kamstrup has placed a number of special registers like configuration values in the manufacturer specified part of the telegram. This has required quite extensive knowledge of the meter in order to decode and format these data correct.

In order to be able to decode special data registers in an easier way, Kamstrup has taken the approach to define a number of manufacturer VIF extensions – so called VIFE. The outcome is that most reading systems can show the special registers in clear reading.

Below an example showing manufacturer specified data vs. Manufacturer specified VIFE:

Manufacturer specified data																
Special	10	00	00	00	5B	C9	A5	02	48	EE	00	00	E0	B2	03	00
0001x	66	19	6D	00	00	00	00	00	C1	00	01	07	08	70	01	06
0002x	00	00	00	00	00											

Manufacturer specified VIFE			
INT8	1234565000344	Inst	Manufacturer specific ->0F
INT4	34000	Inst	Manufacturer specific ->11
INT4	13301000	Inst	Manufacturer specific ->12
INT2	6145	Inst	Manufacturer specific ->1A

The datagram is fixed and cannot be changed. The datagram from flowIQ® 3100 large meter versions differs slightly from the one in flowIQ® 2101, because these large meters do not measure the water temperature.

flowIQ® 2101 and flowIQ® 3100 1.6 and 2.5 and 4.0 m^3/h			
M-Bus data header	**Actual data**	**Monthly data**	**Meter data**
M-Bus ID Manufacturer ID Version ID Device type Access counter Status (set if any info codes is active) Configuration (not used)	Water meter reading (volume) Volume reverse Hour counter Actual flow Actual water temperature Actual ambient temperature Min Flow Day[1)] Max Flow Day[1)] Min water temp Day[1)] Avg. water temp Day[1)] Min ambient temp Day[1)] Max ambient temp Day[1)] Avg. ambient temp Day[1)] Date/Time	Monthly target meter reading Min Flow 1 Month Max Flow 1 Month Min water temp Month Avg. water temp Month Min Ambient temp Month Max Ambient temp Month Avg. Ambient temp Month Target date	Information codes Config number Meter Type (main / sub type) Meter SW Revision
flowIQ® 3100 Q3 = 6.3 m^3/h and higher.			
M-Bus data header	**Actual data**	**Monthly data**	**Meter data**
M-Bus ID Manufacturer ID Version ID Device type Access counter Status (info codes) Configuration (not used)	Water meter reading (volume) Volume reverse Hour counter Actual flow Actual ambient temperature Min Flow Day[1)] Max Flow Day[1)] Min ambient temp Day[1)] Max ambient temp Day[1)] Avg. ambient temp Day[1)] Date/Time	Monthly target meter reading Min Flow 1 Month Max Flow 1 Month Min Ambient temp Month Max Ambient temp Month Avg. Ambient temp Month Target date	Info Config number Meter Type (main / sub type) Meter SW Revision

[1)] *The daily flow and temperatures are the actual daily minimum, average or maximum values logged from midnight until the present reading time.*

6 Reading loggers from flowIQ® 2101/3100 wired M-Bus

The loggers in the flowIQ® 2101/3100 can only be read with an optical reading head, the optical eye in the meter and the program LogView.

7 Configuration of meter via the M-Bus network

Following parameters can be sent to the M-Bus water meter, in order to change the configuration of the flowIQ® 2101/3100:

- Primary M-Bus address
- Date and time

Selection of the M-Bus water meter via secondary address or enhanced secondary address, and application select/reset is obtained via SND_UD telegram from the M-Bus Master to the M-Bus water meter. Selection of device for secondary addressing is made by CI-field = 52h, and application select/reset by CI-field = 50h.

The M-Bus water meter will also reply with an acknowledgement (ACK) when receiving a set of baud rate telegrams (CI-field = B8h... BFh), but will ignore the contents, as the M-Bus interface is furnished with automatic baud rate detection.

The individual datagram for writing data in the M-Bus water meter are shown subsequently.

7.1 Setting Primary M-Bus address

A dedicated register in the flowIQ® 2101/3100 is used for storing the primary address. This register may be overwritten with a new M-Bus primary address using the datagram format below.

Start character	68h	
L-field	06h	
L-field	06h	
Start character	68h	
C-field	53h	(FCB=0) or 73h (FCB=1)
A-field	xxh or FDh	
CI-field	51h	
Record	01h	DIF: 1 byte, binary
Address	7Ah	VIF: Address
Primary add.	xxh	XX = 01h... FAh. For primary address = 1... 250
Checksum	xxh	
Stop character	16h	

Note: *During the ordering process the primary address for each meter can be specified. Normally it is the last 2-3 digits of the customer number.*

7.2 Setting Date and time

To synchronize the time in the meter towards a main application real time clock, the time and date may be sent to the flowIQ® 2101/3100 using the datagram format below.

To avoid disturbing the internal loggers, setting the time must be done in due time before or after an hour shift. Typically the date/time is set once each 24 hour.

Start character	68h	
L-field	09h	
L-field	09h	
Start character	68h	
C-field	53h	(FCB=0) or 73h (FCB=1)
A-field	xxh or FDh	
CI-field	51h	
Record	04h	DIF: 4 bytes, compound data type F
Date and time	6Dh	VIF: Date and time, e.g. 02-09-04 13:10 standard time, valid
Date, time LSB	0Ah	IV, 0, MI5, MI4, MI3, MI2, MI1, MI0
Date, time	2Dh	SU, HY1, HY0, H4, H3, H2, H1, H0
Date, time	82h	Y2, Y1, Y0, D4, D3, D2, D1, D0
Date, time MSB	09h	Y6, Y5, Y4, Y3, M3, M2, M1, M0
Checksum	Xxh	
Stop character	16h	

As flowIQ® 2101/3100 uses two digits to indicate year (00... 99), the flowIQ® 2101/3100 M-Bus always sends information concerning year as 2000... 2099 (bit HY1:HY0 always = 01 in 'Date and time record', VIF = 6Dh and DIF = 04h, compound data type F).

Note: See EN13757-3 Annex A 'Coding of data records' for details on how to decode the Date/Time data type.

7.3 Application select/reset

In connection with application reset the flowIQ® 2101/3100 M-Bus water meter returns an 'ACK'. Nothing further happens and nothing is reset.

8 Protocol

When using M-Bus Masters and/or reading software of another manufacturer, the same commands must be used. The flowIQ® 2101/3100 M-Bus water meter only support commands stated in this description.

The datagram is fixed.

8.1 RSP_UD data flowIQ® 2101/3100 data using Kamstrup specified VIFE

Complete description of reply with examples of readings from the M-Bus water meter (RSP_UD) on request from M-Bus Master (REQ_UD2):

DIF = Data Information Field, DIFE = DIF Extension
VIF = Value Information Field, VIFE = VIF Extension

RSP_UD: Standard profile monthly target data, shown for a Version ID for flowIQ® 2101/3100 water meter.

flowIQ® 2101/flowIQ® 3100:			
Byte	**Field**	**Value**	**Description**
1	Start character	68h	
2	L-field	8Ah	Length 138 bytes
3	L-field	8Ah	Length 138 bytes
4	Start character	68h	
5	C-field	08h	Code for RSP_UD
6	A-field	65h	Primary address (eg. 101)
7	CI-field	72h	
8	ID Number	78 BCD	E.g.: ID = 12345678
9		56 BCD	
10		34 BCD	
11		12 BCD	
12	Man. ID	2Dh	Manufacturer ID for Kamstrup A/S (KAM)
13		2Ch	
14	Version ID	1Fh	Version ID for flowIQ2101 (or 1Dh for flowIQ3100)
15	Device ID	16h	E.g.: 16h = Cold Water
16	Access Number	xxh	Increments after each RSP_UD.
17	Status Field	00h	Error message. 00 = no error.
18	Config	00h	Not used
19		00h	
20	DIF	04h	4 bytes binary
21	VIF	13h	Volume in m^3 with 3 decimals
22	Volume	72h	69.490 m^3
23		0Fh	
24		01h	
25		00h	
26	DIF	04h	4 bytes binary
27	VIF	93h	Reverse volume in m^3 with 3 decimals
28		3Ch	
29	Volume Reverse	13h	0.019 m^3
30		00h	
31		00h	

flowIQ® 2101/flowIQ® 3100:			
Byte	**Field**	**Value**	**Description**
32		00h	
33	DIF	04h	4 bytes binary
34	VIF	22h	Duration of meter power on in hours
35	Hour Counter	30h	304 hours
36		01h	
37		00h	
38		00h	
39	DIF	02h	2 bytes binary
40	VIF	3Bh	Flow in l/h
41	Flow	05h	5 l/h
42		00h	
43	DIF	01h	1 byte binary
44	VIF	5Bh	Media temperature in °C
45	T_{media}	08h	8 °C
46	DIF	01h	1 byte binary
47	VIF	67h	Ambient temperature in °C
48	$T_{ambient}$	25h	37 °C
49	DIF	22h	2 byte binary, minimum value
50	VIF	3Bh	Flow in l/h
51	Min Flow	05h	5 l/h
52		00h	
53	DIF	12h	2 byte binary, maximum value
54	VIF	3Bh	Flow in l/h
55	Max Flow	2Ah	298 l/h
56		01h	
57	DIF	21h	1 byte binary, minimum value
58	VIF	5Bh	Media temperature in °C
59	Min T_{media}	05h	5 °C
60	DIF	01h	1 byte binary
61	VIF	DBh	Kamstrup specific vif: average media temperature
62		FFh	
63		0Fh	
64	Avg T_{media}	07h	7 °C
65	DIF	21h	1 byte binary, minimum value
66	VIF	67h	Ambient temperature in °C
67	Min $T_{ambient}$	0Eh	14 °C
68	DIF	11h	1 byte binary, maximum value
69	VIF	67h	Ambient temperature in °C
70	Max $T_{ambient}$	28h	40 °C
71	DIF	01h	1 byte binary
72	VIF	E7h	Kamstrup specific average ambient temperature
73		FFh	
74		0Fh	
75	Avg $T_{ambient}$	1Ah	26 °C
76	DIF	04h	4 byte binary
77	VIF	6Dh	Type F (Compound CP32)
78	Date/Time	02h	E.g. CP32: 23173782h = 2017-03-23 23:02
79		37h	
80		37h	
81		23h	
82	DIF	44h	4 byte binary, monthly value
83	VIF	13h	Volume in m^3 with 3 decimals
84	V1 Target	A0h	66.976 m^3

flowIQ® 2101/flowIQ® 3100:			
Byte	**Field**	**Value**	**Description**
85		05h	
86		01h	
87		00h	
88	DIF	62h	2 byte binary, monthly minimum value
89	VIF	3Bh	Flow in l/h
90	Min Flow Month	02h	2 l/h
91		00h	
92	DIF	52h	2 byte binary, monthly maximum value
93	VIF	3Bh	Flow in l/h
94	Max Flow Month	D4h	468 l/h
95		01h	
96	DIF	61h	1 byte binary, monthly minimum value
97	VIF	5Bh	Media temperature in °C
98	Min T_{media} Month	04h	4 °C
99	DIF	41h	1 byte binary, monthly value
100	VIF	DBh	Kamstrup specific vif: media ambient temperature
101		FFh	
102		0Fh	
103	Avg T_{media} Month	09h	9 °C
104	DIF	61h	1 byte binary, monthly minimum value
105	VIF	67h	Ambient temperature in °C
106	Min $T_{ambient}$ Month	10h	16 °C
107	DIF	51h	1 byte binary, monthly maximum value
108	VIF	67h	Ambient temperature in °C
109	Max $T_{ambient}$ Month	24h	36 °C
110	DIF	41h	1 byte binary, monthly value
111	VIF	E7h	Kamstrup specific vif: average ambient temperature
112		FFh	
113		0Fh	
114	Avg $T_{ambient}$ Month	18h	24 °C
115	DIF	42h	2 byte binary, monthly value
116	VIF	6Ch	Type G (Compound CP16)
117	Target Date	21h	CP16: 2321h = 2017-03-01
118		23h	
119	DIF	02h	2 byte binary
120	VIF	FFh	Kamstrup specific vif: info code
121		20h	
122	Info	00h	00 = no info codes
123		00h	
124	DIF	06h	6 byte binary
125	VIF	FFh	Kamstrup specific vif: Config number
126		11h	
127	Config Number	DDh	Config no: 175462DEDDh = 0100200013533
128		DEh	
129		62h	
130		54h	
131		17h	
132		00h	
133	DIF	02h	2 byte binary
134	VIF	FFh	Kamstrup specific vif: Meter type
135		1Ah	
136	Meter Type	01h	Meter Type: flowIQ2101 Cold Water
137		22h	

flowIQ® 2101/flowIQ® 3100:			
Byte	**Field**	**Value**	**Description**
138	DIF	02h	2 byte binary
139	VIF	FDh	Kamstrup specific vif: Software revision
140		0Eh	
141	SW Revision	01h	Software revision: D1
142		04h	
143	Checksum	xxh	
144	Stop Character	16h	

flowIQ® 3100:			
Byte	**Field**	**Value**	**Description**
1	Start character	68h	
2	L-field	77h	Length 119 bytes
3	L-field	77h	Length 119 bytes
4	Start character	68h	
5	C-field	08h	Code for RSP_UD
6	A-field	65h	Primary address (e.g. 101)
7	CI-field	72h	
8	ID Number	78 BCD	E.g.: ID = 12345678
9		56 BCD	
10		34 BCD	
11		12 BCD	
12	Man. ID	2Dh	Manufacturer ID for Kamstrup A/S (KAM)
13		2Ch	
14	Version ID	1Dh	Version ID for flowIQ3100
15	Device ID	16h	E.g.: 16h = Cold Water
16	Access Number	xxh	Increments after each RSP_UD.
17	Status Field	00h	Error message. 00 = no error.
18	Config	00h	Not used
19		00h	
20	DIF	04h	4 bytes binary
21	VIF	13h	Volume in m^3 with 3 decimals
22	Volume	72h	69.490 m^3
23		0Fh	
24		01h	
25		00h	
26	DIF	04h	4 bytes binary
27	VIF	93h	Reverse volume in m^3 with 3 decimals
28		3Ch	
29	Volume Reverse	13h	0.019 m^3
30		00h	
31		00h	
32		00h	
33	DIF	04h	4 bytes binary
34	VIF	22h	Duration of meter power on in hours
35	Hour Counter	30h	304 hours
36		01h	
37		00h	
38		00h	
39	DIF	02h	2 bytes binary
40	VIF	3Bh	Flow in l/h
41	Flow	05h	5 l/h
42		00h	

flowIQ® 3100:			
Byte	**Field**	**Value**	**Description**
43	DIF	01h	1 byte binary
44	VIF	67h	Ambient temperature in °C
45	$T_{ambient}$	25h	37 °C
46	DIF	22h	2 byte binary, minimum value
47	VIF	3Bh	Flow in l/h
48	Min Flow	03h	3 l/h
49		00h	
50	DIF	12h	2 byte binary, maximum value
51	VIF	3Bh	Flow in l/h
52	Max Flow	73h	371 l/h
53		01h	
54	DIF	21h	1 byte binary, minimum value
55	VIF	67h	Ambient temperature in °C
56	Min $T_{ambient}$	0Eh	14 °C
57	DIF	11h	1 byte binary, maximum value
58	VIF	67h	Ambient temperature in °C
59	Max $T_{ambient}$	28h	40 °C
60	DIF	01h	1 byte binary
61	VIF	E7h	Kamstrup specific average ambient temperature
62		FFh	
63		0Fh	
64	Avg $T_{ambient}$	1Ah	26 °C
65	DIF	04h	4 byte binary
66	VIF	6Dh	Type F (Compound CP32)
67	Date/Time	02h	E.g. CP32: 23173782h = 2017-03-23 23:02
68		37h	
69		37h	
70		23h	
71	DIF	44h	4 byte binary, monthly value
72	VIF	13h	Volume in m^3 with 3 decimals
73	V1 Target	A0h	66.976 m^3
74		05h	
75		01h	
76		00h	
77	DIF	62h	2 byte binary, monthly minimum value
78	VIF	3Bh	Flow in l/h
79	Min Flow Month	03h	3 l/h
80		00h	
81	DIF	52h	2 byte binary, monthly maximum value
82	VIF	3Bh	Flow in l/h
83	Max Flow Month	A9h	425 l/h
84		01h	
85	DIF	61h	1 byte binary, monthly minimum value
86	VIF	67h	Ambient temperature in °C
87	Min $T_{ambient}$ Month	10h	16 °C
88	DIF	51h	1 byte binary, monthly maximum value
89	VIF	67h	Ambient temperature in °C
90	Max $T_{ambient}$ Month	24h	36 °C
91	DIF	41h	1 byte binary, monthly value
92	VIF	E7h	Kamstrup specific vif: average ambient temperature
93		FFh	
94		0Fh	
95	Avg $T_{ambient}$ Month	18h	24 °C

flowIQ® 3100:			
Byte	Field	Value	Description
96	DIF	42h	2 byte binary, monthly value
97	VIF	6Ch	Type G (Compound CP16)
98	Target Date	21h	CP16: 2321h = 2017-03-01
99		23h	
100	DIF	02h	2 byte binary
101	VIF	FFh	Kamstrup specific vif: info code
102		20h	
103	Info	00h	00 = no info codes
104		00h	
105	DIF	06h	6 byte binary
106	VIF	FFh	Kamstrup specific vif: Config number
107		11h	
108	Config Number	DDh	Config no: 175462DEDDh = 0100200013533
109		DEh	
110		62h	
111		54h	
112		17h	
113		00h	
114	DIF	02h	2 byte binary
115	VIF	FFh	Kamstrup specific vif: Meter type
116		1Ah	
117	Meter Type	03h	Meter Type: flowIQ3100 Cold Water
118		22h	
119	DIF	02h	2 byte binary
120	VIF	FDh	Kamstrup specific vif: Software revision
121		0Eh	
122	SW Revision	01h	Software revision: D1
123		04h	
124	Checksum	xxh	
125	Stop Character	16h	

Note: *A target value may read as zero, until passing the set target date.*

8.2 RSP_SKE response from flowIQ® 2101/3100

Reply from the M-Bus water meter (RSP_SKE) on request for communication status from M-Bus Master (REQ_SKE):

RSP_SKE:			
	Start	10h	
	C-field	0B h	Code for RSP_SKE (ACD bit and DFC bit is always = 0)
	A-field	6A h	Slave address (e.g. address = 106)
	Checksum	xx h	
	Stop	16 h	

The ACD (Access Demand) and DFC (Data Flow Control) status bits (bit 5 and bit 4 respectively) in the C-field will always be = 0 in the reply, which means that the M-Bus water meter does not have any time-critical (alarm) data to send and has no buffer overflow, as the M-Bus water meter does not support time-critical data (alarm protocol). But the (empty) RSP_SKE reply to REQ_SKE request ensures, that the M-Bus water meter will function in M-Bus systems with other M-Bus interfaces, supporting time-critical data (alarm protocol) and using communication status bit.

8.3 Data header in RSP_UD

Data	Value	Type	Description
ID-NO	Xxh	A	M-Bus ID number ∗ 10^1 / M-Bus ID number ∗ 10^0
ID-NO	Xxh	A	M-Bus ID number ∗ 10^3 / M-Bus ID number ∗ 10^2
ID-NO	Xxh	A	M-Bus ID number ∗ 10^5 / M-Bus ID number ∗ 10^4
ID-NO	Xxh	A	M-Bus ID number ∗ 10^7 / M-Bus ID number ∗ 10^6
MANUFACTURER	00101101	C	Manufacturer Id 2D [ascii 'K' - 64]∗32∗32+[ascii 'A' – 64]∗32+
MANUFACTURER	00101100	C	Manufacturer Id 2C [ascii 'M' - 64] ISO 60870 standard
VERSION ID	1Fh 1Dh	C	M-Bus version ID for flowIQ2101 M-Bus version ID for flowIQ3100
DEVICE TYPE ID	Xxh	C	06h = Volume warm 16h = Volume cold
ACCESS NO	Xxh	C	Counts 1 up for each data transmission to M-Bus Master
STATUS	Xxh	C	00h = No Info code 04h = Power Low on battery 10h = Temporary error 14h = Power Low and Temporary error at the same time
ENCRYPTION CONFIGURATION	00h	C	Encryption not used in Wired M-Bus
ENCRYPTION CONFIGURATION	00h	C	Encryption not used in Wired M-Bus

8.4 DIF (Data Information Field)

The DIF codes holds additional information regarding the formatting of the data-value in the records, whether data is binary, real or BCD.

Some examples of DIF codes are listed in the table below.

Subject	Value	Hex	Description
PRIMARY ADDRESS	00000001	01h	8 bit binary, Current Value, Type C
INFO CODE	00000010	02h	16 bit binary, Current Value, Type B
METER TYPE	00000010	02h	16 bit binary, Current Value, Type B
SOFTWARE REVISION	00000010	02h	16 bit binary, Current Value, Type B
VOLUME (Meter reading and reverse)	00000100	04h	32 bit binary, Current Value, Type B
TEMPERATURES Actual	00000001	01h	8 bit binary, Current Value, Type B
TEMPERATURES minimum daily	00100001	21h	8 bit binary, Minimum Value, Type B
TEMPERATURES average daily	00000001	01h	8 bit binary, Current Value, Type B
TEMPERATURES maximum daily	00010001	11h	8 bit binary, Maximum Value, Type B
TEMPERATURES minimum monthly	01100001	61h	8 bit binary, Minimum Monthly Value, Type B
TEMPERATURES average monthly	01000001	41h	8 bit binary, Current Monthly Value, Type B
TEMPERATURES maximum monthly	01010001	51h	8 bit binary, Maximum Monthly Value, Type B
TARGET DATE	01000010	42h	16 bit binary, Compound Data, Type G
FLOW actual	00000010	02h	16 bit binary, Current Value, Type B
FLOW minimum daily	00100010	22h	16 bit binary, Minimum Value, Type B
FLOW maximum daily	00010010	12h	16 bit binary, Maximum Value, Type B
FLOW maximum monthly	01010010	52h	16 bit binary, Maximum Monthly Value, Type B
FLOW minimum monthly	01100010	62h	16 bit binary, Minimum Monthly Value, Type B
HOUR COUNTER	00000100	04h	32 bit binary, Current Value, Type B
DATE AND TIME	00000100	04h	32 bit binary, Compound Data, Type F
TARGET DATE	01000010	42h	16 bit Integer, Historical Value, Type G
TARGET VOLUME	01001100	44h	32 bit binary, Historical Value, Type B
OTHERS	00000100	04h	32 bit binary, Current Value, Type B

Note: *See EN13757-3 Annex A 'Coding of data records' for details on how to decode data types.*

8.5 Primary VIF (Value Information Field)

The VIF codes contain both unit and scaling factor for the record value. The VIF codes for volume and flow will, as far as possible, reflect the display reading in the water meter as regards unit, decimal point and number of decimals.
Thus, the VIF codes for these data values will vary depending on the configuration of the flowIQ® 2101/3100.

The relevant VIF codes are listed in the table below.

VIF (HEX)	Coding (binary)	Subject	Unit	Size
13h	00010011	Meter reading	m^3*10^{-3}	m^3*10^{-3}
14h	00010100	Meter reading	m^3*10^{-2}	m^3*10^{-2}
15h	00010101	Meter reading	m^3*10^{-1}	m^3*10^{-1}
16h	00010110	Meter reading	m^3	m^3*10^{0}
93h	10010011	Volume Reverse	m^3*10^{-3}	m^3*10^{-3}
94h	10010100	Volume Reverse	m^3*10^{-2}	m^3*10^{-2}
95h	10010101	Volume Reverse	m^3*10^{-1}	m^3*10^{-1}
96h	10010110	Volume Reverse	m^3	m^3*10^{0}
22h	00100010	Hour counter	Hours	Hours
3Bh	00111011	Flow	l/h	$m^3/h*10^{-3}$
5Bh	01011011	Water temperature	°C	°C
67h	01100111	Ambient temperature	°C	°C
3Bh	00111011	Min. flow since midnight	l/h	$m^3/h*10^{-3}$
3Bh	00111011	Max. flow since midnight	l/h	$m^3/h*10^{-3}$
5Bh	01011011	Minimum water temperature since midnight	°C	°C
DBh	11011011	Average water temperature since midnight	°C	°C
67h	01100111	Minimum ambient temperature since midnight	°C	°C
67h	01100111	Maximum ambient temperature since midnight	°C	°C
E7h	11100111	Average ambient temperature since midnight	°C	°C
6Dh	01101101	Date and time	F-Type	Date and time
13h	00010011	Meter reading the first day of actual month	m^3*10^{-3}	m^3*10^{-3}
14h	00010100	Meter reading the first day of actual month	m^3*10^{-2}	m^3*10^{-2}
15h	00010101	Meter reading the first day of actual month	m^3*10^{-1}	m^3*10^{-1}
16h	00010110	Meter reading the first day of actual month	m^3	m^3*10^{0}
3Bh	00111011	Min. flow last month	l/h	$m^3/h*10^{-3}$
3Bh	00111011	Max. flow last month	l/h	$m^3/h*10^{-3}$
5Bh	01011011	Minimum water temperature last month	°C	°C
DBh	11011011	Average water temperature last month	°C	°C
67h	01100111	Minimum ambient temperature last month	°C	°C

67h	01100111	Maximum ambient temperature last month	°C	°C
E7h	11100111	Average ambient temperature last month	°C	°C
6Ch	01101100	Target date	CP-16	Date
FFh	11111111	Info code register		
FFh	11111111	Configuration number		
FFh	11111111	Meter main and sub -type		
FDh	11111101	Software revision		
78h	01111000	Serial number	A-Type	Serial no.
79h	01111001	ID no.	A-Type	Meter no.
7Ah	01111010	Primary address	C-Type	Primary address

Note: *See EN13757-3 table 26 for a complete list of primary VIF's and for the compound CP-16 format.*

CODING: VIF-field coding in the data package
SUBJECT: Subject in the record
UNIT: Unit required
SIZE: Unit programmed in VIF

The M-Bus water meter uses information from the meter to place units, decimal points and number of decimals on the values in the M-Bus telegram, ensuring that they correspond to the values read on the meter display, as far as it is supported in the M-Bus protocol.

8.6 Special purpose VIF

Special purpose VIF codes used.

VIF (hex)	Coding	Description	Purpose
FDh	11111011	Second Extension of VIF codes	True VIF in first VIFE using Table 11 (EN13757-3)
FFh	11111111	Manufacturer specific extension	VIFE's and data following are manufacturer specific

Note: *See EN13757-3 table 27 for a complete list of special purpose VIF's*

8.7 Main VIFE-code extension

If primary VIF is 0FDh, a VIFE will follow. The following VIFE codes are used.

VIF (hex)	Coding	Description	Usage
0Eh	00001110	Metrology firmware version	Legal meter software revision
17h	00010111	Error flags (binary)	Meter Error (info) code (see section 5.7.2)

Note: *See En13757-3 table 28, for a complete list of VIFE codes.*

--- End of document ---