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T230 heat meter or cold meter

Topic: Interface description M-Bus

Document number:	**TKB3462_en**
Version:	**1.0**
Date:	**2011-02-09**
Status:	**First edition**

History

Author	Reason for change/Scope of change	Version	Date	Release date
Reißner	First edition in English	1.0	2011-02-09	2011-02-09

Contents

0 Amendments

Date	Place	Description	by

1 Overview

This document describes the function of the T230 meter interface in the next or higher firmware versions to:

7.07.

1.1 Documents used

1.2 Abbreviations and definitions

Abbreviation	Explanation
A-field	**A**ddress field (primary M-bus address)
BCD	binary coded decimal
C-field	**C**ontrol field
CI-field	**C**ontrol /nformation field
CS	**C**heck**s**um = sum of all user octets Modulo 256
DIF	**D**ata **I**nformation **F**ield
DIFE	**D**ata **I**nformation **F**ield **E**xtension
FCB	**F**rame **C**ount **B**it (IEC 870-5-2)
LSB	least significant byte
MSS	M-bus interface (M-Bus- Schnittstelle)
Nb+	Normal operating mode (Normalbetrieb) with calibration seal
Nb-	Normal operating mode (Normalbetrieb) without calibration seal
OSS	Optical interface (optische Schnittstelle)
Rolling frame	A sequence of telegram frames logically belonging together
SND_UD	**SeND U**ser **D**ata
VIF	**V**alue **I**nformation **F**ield
VIFE	**V**alue **I**nformation **F**ield **E**xtension
VM	Previous month (Vormonat)
VJ	Previous year (Vorjahr)

1.3 Communication protocols used

The meter supports M-bus protocols according to EN 13575-2 and EN 13575-3 via the optical and M-bus interfaces. Various modifications apply to the optical interface (check the relevant sections for information).

2 Operating modes of the T230 meter

The meter has different operating modes.
The M-Bus-Interface is accessible only in normal operating mode (with an switout calibration seal).

The "Get meter state" telegram is structured in the form of SND_UD according to section 7.1 and the "0Fh" command. Since this command is universally the same for all operating modes, it is not explicitly mentioned in the table of manufacturer-specific commands (Section 7.4).
The general form of a status request is, for example:

68h L L 68h 53h/73h A 51h 0Fh 0Fh CS 16h

For example, if the FCB is reset, the command for the address A = 254 (FEh) is:

68h 05h 05h 68h 73h FEh 51h 0Fh 0Fh E0h 16h

Generally, the meter's response to the status request comes in the form of a frame with variable length and without header (CI = 78), see section 7.3:

68h L L 68h 08h A 78h 0Fh "status response" CS 16h

The content of "status response" depends on the meter's operating mode and is defined in the following text.

Take the following as a specific example:

- Primary address A = ...0Bh;
- Operating mode = ...Nb- ;
- Version of the firmware not subject to calibration = 7.07
- Version of the firmware subject to calibration = 7.07
- Hardware = ...flash version

The "status response" for this example is: Nb-7.077.07F

68h 13h 13h 68h 08h 0Bh 78h 0Fh 4Eh 62h 2Dh 37h 2Eh 30h 37h 37h 2Eh 30h 37h 46h 55h 16h

The operating modes are defined as follows:

Normal operating mode with calibration seal (Nb+): Status response = Nb+x.xxy.yyz
The meter measures flow rate and temperature within the normal time period. Data traffic is limited to the functions which do not influence meter readings or the measuring function of the meter.

Normal operating mode without calibration seal (No-): Status response = Nb-x.xxy.yyz
The meter measures flow rate and temperature within the normal time period. However, all functions are allowed, including parameterization and starting calibration mode.

3 M-bus interface

3.1 Definition of M-bus interface

Transmission type:	Bit-serial asynchronous (start/stop) transmission in accordance with ISO 1177, half-duplex
Transmission rate:	300 or 2,400 baud, according to baud rate of request (The meter supports the automatic detection of baud rate)
Protocol	in accordance with EN-13757-2 and EN-13757-3

3.2 Baud rates

The meter supports 300 and 2,400 baud rates via M-bus. The meter has an auto baud detection for the above baud rates.

4 Data traffic

4.1 Data traffic in normal operation mode

Only telegrams that do not affect measuring can be used in normal operation mode.

4.1.1 Normal operation mode with calibration seal (Nb+)

The following operations can be used when the calibration seal is activated:

- Status request
- Requesting E²PROM info
- Reading out of RAM/EEPROM data
- Requesting data telegram
- Resetting maxima
- Setting primary address of M-bus
- Setting secondary address of M-bus(property number)
- Setting system time/system date
- Setting “set day”

4.2 Supported standard command telegrams

4.2.1 SND_NKE (normalization)

The meter resets the FCB (see below) and replies with an acknowledge (E5h). In addition, the command to the primary address 253 determines a potential secondary selection of the device.

4.2.2 REQ_UD2 (Read-out request)

The meter issues a data telegram (long frame, CI-field 72h) via the M-bus. The data included in this telegram depends on the operating mode of the meter and how it is parameterized (e.g. via SND_UD commands).

4.2.3 REQ_UD1 (Readout request for time-critical data / alarm data).

The meter always replies with an acknowledge (E5h). Further alarm data is not scheduled.

4.2.4 REQ_SKE (Alarm status request)

The meter replies to this telegram with C-field 0Bh (no alarm, ready to receive).

4.2.5 SND_UD (Send user data).

Send data, parameters and instructions to the meter.
The meter always replies to a SND_UD telegram in the right syntax, either with a SND_UD telegram or with an acknowledge (E5h), even if it was unable to execute or decode the received command.

The following CI-fields (control information field) are supported by T230:

CI = 50h: **Application Reset:** The meter M-bus interface is reset
The sub-codes supported by the application reset are summarized in **Table 2**.

CI = 51h: **Data Send:** The meter decodes the command contained in the telegram body and converts it depending on the meter's operating mode. If several commands are to be transmitted to the meter, they can be linked together ("chained"). Consequently, a shortening of the parameterization time is possible.
A list of the supported commands can be found in **Table 1**.

CI = 52h: **Secondary selection:** using the special primary address FDh (253) in the network layer of the OSI layer model (management layer), the meter can be selected secondarily via its secondary address consisting of property number, manufacturer identification, version and device type. The enhanced secondary selection, which additionally uses the serial number, is also supported.
The use of wildcards (nibble-wise with device and serial number, otherwise byte-wise) is possible.

4.2.5.1 Supported commands with: Data Send (CI = 51h)

The following commands are identified after a CI-field 51h:

Code	Effect
01h 7Ah xxh	Setting the primary address.
0Ch 79h xxh xxh xxh xxh	Setting the secondary address (property number).
04h EDh 00h xxh xxh xxh xxh	Setting date and time (encoded in accordance with data type F (EN-13757-3 Annex A).
04h 6Dh xxh xxh xxh xxh	
0F+ Code (parameter)	Parameterization commands for T230 see section 7.1 and section 7.4

Table 1: Supported commands for CI = 51h

5 Structure of the data telegrams

5.1 Number of M-bus data telegrams (rolling frame)

The meter outputs a large amount of data, not all of which fit into an M-bus frame. For this reason, a number of logically sequenced telegram frames have been defined. With each M-bus data request (e.g. REQ_UD2) the next sequenced telegram frame is output. If the telegram frame that was last output was the final one of the sequence and another data request is issued, the first telegram frame of the sequence will be output again. This is why this function is called a rolling frame. An internal frame counter determines which telegram frame will be output on the next data request.

In normal operating mode there are 5 telegram frames defined in which the frame 4 (previous months) consists of 24 sub frames (one for each previous month.

5.1.1.1 Supported sub-codes with application reset (CI = 50h)

The application reset without sub-code deactivates the rolling frame function; at every REQ_UD the first telegram frame is issued for the respective operating state.

The application reset with sub-code "00h" activates the rolling frame function; at the next REQ_UD the first telegram frame is issued for the respective operating state.

The application reset with sub-codes ≥ "01h" is for controlling the next telegram frame to be issued with rolling frames (see also sect. 5.1). If previously inactive, the rolling frame function is also activated by this application reset.

The following sub-codes with application reset (CI-field 50h) are recognized by the meter:

Sub-code	Effect	effective in operating state
--	Rolling frames are deactivated: The first telegram frame for the respective operating state is issued on REQ_UD: Nb **à** Frame counter = 01h Eb and Pb **à** Frame counter = 06h	Nb Pb Eb
00h	Rolling frames are activated: The first telegram frame for the respective operating state is issued on REQ_UD: Nb **à** Frame counter = 01h Eb and Pb **à** Frame counter = 06h	Nb Pb Eb
01h	The frame counter is set to 01h (current & previous year)	Nb
02h	The frame counter is set to 02h (errors & energy quantity previous month)	Nb

Sub-code	Effect	effective in operating state
03h	The frame counter is set to 03h (energy quantity for previous 24 months)	Nb
31h	The frame counter is set to 04h 01h (first previous month)	Nb
32h	The frame counter is set to 04h 02h (second previous month)	Nb
33h	The frame counter is set to 04h 03h (third previous month)	Nb
...	...	Nb
3Fh	The frame counter is set to 04h 0Fh (15. previous month)	Nb
30h 01h	The frame counter is set to 04h 10h (16. previous month)	Nb
31h 01h	The frame counter is set to 04h 11h (17. previous month)	Nb
32h 01h	The frame counter is set to 04h 12h (18. previous month)	Nb
33h 01h	The frame counter is set to 04h 13h (19. previous month)	Nb
34h 01h	The frame counter is set to 04h 14h (20. previous month)	Nb
35h 01h	The frame counter is set to 04h 15h (21. previous month)	Nb
36h 01h	The frame counter is set to 04h 16h (22. previous month)	Nb
37h 01h	The frame counter is set to 04h 17h (23. previous month)	Nb
38h 01h	The frame counter is set to 04h 18h (24. previous month)	Nb
05h	The frame counter is set to 05h (manufacturer-specific device parameters)	Nb
06h	The frame counter is set to 06 (values for calibration and test operations)	Eb + Pb
07h	The frame counter is set to 07h (manufacturer-specific device parameters for calibration and test operations)	Eb + Pb
08h	The frame counter is set to 08h (compressed values and manufacturer-specific device parameters for calibration and test operations)	Eb + Pb

Table 2: Sub-codes for application reset

Note: The CI-field with 50h is followed by a 1 byte sub-code in compliance with the standard.
In order to initiate the frame counter of the 16th previous month to the 24th. previous month with an application reset 2 bytes were defined as sub-code here.

Using command number 12 (M-bus rolling frame) from sect. 7.4, specific frames can also be preselected for viewing in compliance with the standard.

5.1.2 Deactivating the rolling frame function (default setting)

You can switch off the rolling frame function by performing an application reset with CI = 50h (see section 4.2.5) without sub-code (see **Table 2**). In this functional state, an REQ_UD2 data request triggers only the first frame of normal operation mode.

Default state: Once the meter is connected to the power again and on delivery, the rolling frame function is deactivated. So even M-bus masters which do not support the consecutive frame system can read out the most important billing data of the meter via M-bus and optical interface.

5.1.3 Activating the rolling frame function

You can activate the rolling frame function by performing an application reset with CI = 50h (see section 4.2.5) with sub-code 00h (see **Table 2**).

In normal operation mode the frame counter is set to 01h. Each further data request REQ_UD2 triggers the next of all 28 telegram frames in a sequence.

5.1.4 Output of single telegram frames from the rolling frame

5.1.4.1 Reaction of the M-bus interface

The internal frame counter can be set to the desired telegram frame by performing an application reset with CI = 50h and sub-codes ≥ 01h (see **Table 2**).
The next data request (REQ_UD2) will trigger the output of the selected frame. Afterwards, the internal frame counter will incremented or, if it is at its highest, go back to the first frame of the relevant operating state (frame counter = 01h).
You can also use the manufacturer-specific command with the command number 12 (M-bus. rolling frame) from section 7.5 to define the frame to be output on the next data request (REQ-UD2). Every further data request (REQ_UD2) will trigger the frame that follows in the logical sequence.

5.2 FCB (Frame Count Bit) and Access Counter (read-out counter)

5.2.1 General function

The function of the FCB is defined in IEC 780-5-2 section 4.3.2.1: If the master has understood the slave's response, it will change value of the FCB (0 becomes 1 or 1 becomes 0, also referred to as toggling) for the next read-out request (REQ_UD2).
IEC 780-5-2 section 5.1.2 defines the C-field and the location of the FCB (Frame Count Bit) in the C-field. The FCB is the Bit with the value 2^5.
This is why the C-field for the read-out request REQ_UD2 has the value 5Bh or 7Bh.
The T230 supports the FCB only for the read-out request REQ_UD2.

The access counter has a width of 1 byte and can have a value of between 0 and 255 (00h..FFh). Instead of 256 it restarts at 0.
The access counter is part of a 12-byte header in the telegram frame with the CI-field = 72h. It increases with every telegram frame transfer. You can therefore monitor whether all sent telegram frames have been received.

5.2.2 Implementation in the T230

Interface / Function	Optical interface		M-bus interface	
	primary addressing	secondary addressing	primary addressing	secondary addressing
Addressing	not evaluated		evaluated	evaluated
FCB	not implemented		FCB disconnected from secondary address	FCB disconnected from primary address
Access counter	shared for optical interface		shared for M-bus interface	
Rolling frame function (or compatibility mode)	Configuration independent of M-bus interface		Configuration independent of optical interface	

5.3 M-bus data telegrams during normal operation

The data information fields (DIF or DIFE) also contain the tariff of a record output onto the M-bus. The meaning of the tariff number is not defined in the standards.

The following applies for T230:

- Tariff 1 corresponds to a maximum value
- Tariff 5 corresponds to tariff register 5 (energy quantity in the case of wrong installation)

The meaning of the storage numbers in the data information fields (DIF or DIFE) is not defined in the standards.

The following applies for T230:

- Storage number 1 corresponds to the previous year's value
  Storage number >=2 corresponds to the previous month's value (storage number – 1) e.g.
  storage number 2 is the value of the 1st previous month,
  storage number 3 is the value of the 2nd previous month ….
  storage number 25 is the value of the 24th previous month
- storage number 510 indicates the yearly set day
- storage number 511 indicates the monthly set day

The meaning of identifiers "unit" in the extension data information fields (DIFEs) is not defined in the standards.

The following applies for T230:

- Unit 2 identifies values that are assigned to mid-month values.

5.3.1 Telegram frame 1 :

This frame contains current billing values and the previous year's values.

Telegram bytes	**Telegram frame** 1 **Explanation**
68h L L 68h	Frame of fixed length, L = length
08h A 72h	Variable structure, LSB first, A = M-bus address (1 byte)
78h 56h 34h 12h	Secondary address = property number, e.g. 12345678
A7h 32h	Manufacturer identification, e.g. for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)
07h	Version 07
04h	Derive type e.g. 04: heat in return
Z	Z = access counter (1 byte)
S	S = Status (1 byte) Bit 0..4: acc. to EN 13575-3 Bit 5..7: not used ('0')
00h 00h	Signature
09h	DIF: 2-digit BCD, no DIFE, current value

Telegram bytes	**Telegram frame** 1 **Explanation**
74h	VIF: actuality duration (measurement interval for flow rate) in seconds
08h	8 seconds
09h	DIF: 2-digit BCD, no DIFE, current value
70h	VIF: averaging duration (measurement interval for flow rate * 2) in seconds
16h	16 seconds
0Ch	DIF: 8-digit BCD, no DIFE, current value
06h/0Eh	VIF: Energy quantity (kWh / MJ)
78h 56h 34h 12h	12345678
0Ch	DIF: 8-digit BCD, no DIFE, current value
14h	VIF: Volume (m^3*1/100)
78h 56h 34h 12h	123,465.78 m^3
0Bh	DIF: 6-digit BCD, no DIFE, current value
2Dh	VIF: Heat power (kW/10)
56h 34h 12h	12345.6 kW
0Bh	DIF: 6-digit BCD, no DIFE, current value
3Bh	VIF: Flow rate (l/h)
56h 34h 12h	123.456 m^3/h
0Bh	DIF: 6-digit BCD, no DIFE, current value
5Ah	VIF: Flow temperature (°C/10)
56h 04h 00h/F0h	00045.6 °C / -0045.6 °C
0Bh	DIF: 6-digit BCD, no DIFE, current value
5Eh	VIF: Return temperature (°C/10)
56h 04h 00h/F0h	00045.6 °C / -0045.6 °C
0Bh	DIF: 6-digit BCD, no DIFE, current value
62h	VIF: Temperature difference (°C/10)
56h 04h 00h/F0h	00045.6 °C / -0045.6 °C
0Ch	DIF: 8-digit BCD, no DIFE, current value
78h	VIF: Serial No.
78h 56h 34h 12h	12345678
89h	DIF: 2-digit BCD, DIFE follows, current value
10h	DIFE: Tariff = 1 (Maxima)
71h/72h	VIF: Averaging duration in minutes/hours
07h/60h/24h	7(.5)/60 minutes/24 hours
3Ch	DIF: 8-digit BCD, no DIFE, value during error
22h/23h	VIF: ON time (hours/days) = missing time in hours/days
78h 56h 34h 12h	12345678 h/d
0Ch	DIF: 8-digit BCD, no DIFE, current value
22h/23h	VIF: ON time (hours/days) = operating hours/days
78h 56h 34h 12h	12345678 h/d
0Ch	DIF: 8-digit BCD, no DIFE, current value
26h/27h	VIF: Flow time (hours/days)
78h 56h 34h 12h	12345678 h/d
8Ch	DIF: 8-digit BCD, DIFE follows, current value
90h	DIFE: DIFE follows, Tariff = 5
10h	DIFE: Tariff = 5, i.e. tariff register 5 (energy quantity in the case of

Telegram bytes	Telegram frame 1 Explanation
	wrong installation)
06h/0Eh	VIF: Energy quantity (kWh / MJ)
78h 56h 34h 12h	12345678
9Bh	DIF: 6-digit BCD, DIFE follows, maximum
10h	DIFE: Tariff = 1
2Dh	VIF: Heat power (kW/10)
56h 34h 12h	12345.6 kW
9Bh	DIF: 6-digit BCD, DIFE follows, maximum
10h	DIFE: Tariff = 1
3Bh	VIF: Flow rate (l/h)
56h 34h 12h	123.456 m^3/h
9Bh	DIF: 6-digit BCD, DIFE follows, maximum
10h	DIFE: Tariff = 1
5Ah	VIF: Flow temperature (°C/10)
56h 34h 02h/F2h	2345.6 °C / -2345.6 °C
9Bh	DIF: 6-digit BCD, DIFE follows, maximum
10h	DIFE: Tariff = 1
5Eh	VIF: Return temperature (°C/10)
56h 34h 02h/F2h	2345.6 °C / -2345.6 °C
94h	DIF: 32-bit integer, DIFE follows, maximum
10h	DIFE: Tariff = 1
ADh	VIF: Heat power (kW/10), VIFE follows
6Fh	VIFE: Time = Timestamp for max. power, data type F
78h 56h 34h 12h	12345678
94h	DIF: 32-bit integer, DIFE follows, maximum
10h	DIFE: Tariff = 1
BBh	VIF: Flow rate (l/h), VIFE follows
6Fh	VIFE: Time = Timestamp for max. flow rate, data type F
78h 56h 34h 12h	12345678
94h	DIF: 32-bit integer, DIFE follows, maximum
10h	DIFE: Tariff = 1
DAh	VIF: Flow temperature (°C), VIFE follows
6Fh	VIFE: Time = Timestamp for max. flow temperature, data type F
78h 56h 34h 12h	12345678
94h	DIF: 32-bit integer, DIFE follows, maximum
10h	DIFE: Tariff = 1
DEh	VIF: Return temperature (°C), VIFE follows
6Fh	VIFE: Time = Timestamp for max. return temperature, data type F
78h 56h 34h 12h	12345678
4Ch	DIF: 8-digit BCD, no DIFE, storage number 1 = previous year's value
06h/0Eh	VIF: Energy quantity (kWh / MJ)
78h 56h 34h 12h	12345678
4Ch	DIF: 8-digit BCD, no DIFE, storage number 1 = previous year's value
14h	VIF: Volume (m^3*1/100)
78h 56h 34h 12h	123456.78 m^3
7Ch	DIF: 8-digit BCD, no DIFE, value during error, storage number 1 =

Telegram bytes	**Telegram frame** 1 **Explanation**
	previous year's value
22h/23h	VIF: ON time (hours/days) = missing time in hours/days
78h 56h 34h 12h	12345678 h/d
4Ch	DIF: 8-digit BCD, no DIFE, current value, storage number 1 = previous year's value
26h/27h	VIF: Flow time (hours/days)
78h 56h 34h 12h	12345678 h/d
CCh	DIF: 8-digit BCD, DIFE follows, current value, storage number 1 = previous year's value
90h	DIFE: DIFE follows; Tariff = 5
10h	DIFE: Tariff = 5, i.e. tariff register 5 (energy quantity in the case of wrong installation)
06h/0Eh	VIF: Energy quantity (kWh / MJ)
78h 56h 34h 12h	12345678
DBh	DIF: 6-digit BCD, DIFE follows, maximum, storage number 1 = previous year's value
10h	DIFE: Tariff = 1
2Dh	VIF: Heat power (kW/10)
56h 34h 12h	12345.6 kW
DBh	DIF: 6-digit BCD, DIFE follows, maximum, storage number 1 = previous year's value
10h	DIFE: Tariff = 1
3Bh	VIF: Flow rate (l/h)
56h 34h 12h	123.456 m^3/h
DBh	DIF: 6-digit BCD, DIFE follows, maximum, storage number 1 = previous year's value
10h	DIFE: Tariff = 1
5Ah	VIF: Flow temperature (°C/10)
56h 34h 02h/F2h	2345.6 °C / -2345.6 °C
DBh	DIF: 6-digit BCD, DIFE follows, maximum, storage number 1 = previous year's value
10h	DIFE: Tariff = 1
5Eh	VIF: Return temperature (°C/10)
56h 34h 02h/F2h	2345.6 °C / -2345.6 °C
84h 8Fh 0Fh	DIF: 32-bit integer, storage number 510 = set day value
6Dh	VIF: Time = set day; data type F
35h 17h E1h F1h	Set day e.g. 1 Jan (year 127 = annually) at 23.59
04h	DIF: 32-bit integer, no DIFE
6Dh	VIF: Time = time + date, data type F (time at the device)
78h 56h 34h 12h	12345678
0Fh/ 1Fh	DIF: manufacturer-spec. data, no consecutive frame/ further frame follows (if rolling frame is activated or if data is read-out via the optical interface)
00h 07h	Firmware version: e.g. 07.00
00h	Reserved
20h	Extension byte with additional information (see section 5.4)

Telegram bytes	**Telegram frame** 1 **Explanation**
01h	Frame counter
CS	CS = checksum (1 byte)
16h	Stop character

5.3.2 Telegram frame 2 :

This frame contains further previous year's values and times, e.g. set days and error timestamps (2nd consecutive frame in normal operation read-out).

Telegram bytes	**Telegram frame** 2 **Explanation**
68h L L 68h	Frame of fixed length, L = length
08h A 72h	variable structure, LSB first, A = M-bus address (1 byte)
78h 56h 34h 12h	Secondary address = property number, e.g. 12345678
A7h 32h	Manufacturer identification, e.g. for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)
07h	Version 07
04h	Device type e.g. 04: heat in return
Z	Z = access counter (1 byte)
S	S = Status (1 byte) Bit 0..4: acc. to EN 13575-3 Bit 5..7: not used ('0')
00h 00h	Signature
D4h	DIF: 32-digit integer, DIFE follows, maximum, storage number 1 = previous year's value
10h	DIFE: Tariff = 1
ADh	VIF: Heat power (kW/10), VIFE follows
6Fh	VIFE: Time = Timestamp for max. power, data type F
78h 56h 34h 12h	12345678
D4h	DIF: 32-bit integer, DIFE follows, maximum Storage number 1 = previous year's value
10h	DIFE: Tariff = 1
BBh	VIF: Flow rate (l/h), VIFE follows
6Fh	VIFE: Time = Timestamp for max. flow rate, data type F
78h 56h 34h 12h	12345678
D4h	DIF: 32-digit integer, DIFE follows, maximum, storage number 1 = previous year's value
10h	DIFE: Tariff = 1
DAh	VIF: Flow temperature (°C), VIFE follows
6Fh	VIFE: Time = Timestamp for max. flow temperature, data type F
78h 56h 34h 12h	12345678
D4h	DIF: 32-digit integer, DIFE follows, maximum, storage number 1 = previous year's value
10h	DIFE: Tariff = 1
DEh	VIF: Return temperature (°C), VIFE follows
6Fh	VIFE: Time = Timestamp for max. return temperature, data type F
78h 56h 34h 12h	12345678
44h	DIF: 32-bit integer, storage number 1 = previous year's value
6Dh	VIF: Time = storage time; data type F
78h 56h 34h 12h	12345678
C4h	DIF: 32-bit integer, DIFE follows
8Fh	DIFE: DIFE follows

Telegram bytes	**Telegram frame** 2 **Explanation**
0Fh	DIFE: Storage number 511
6Dh	VIF: Time = monthly set day; data type F
00h 00h E1h FFh	Set day e.g. 1. of each month at 00:00 (month 15 = every month; year 127 = every year)
C4h	DIF: 32-bit integer, DIFE follows
8Fh	DIFE: DIFE follows
4Fh	DIFE: Unit 2; storage number 511
6Dh	VIF: Time = set day for mid-month value; data type F
00h 00h EFh FFh	Set day e.g. 15th of every month at 0:00 clock (month 15 = every month; year 127 = every year)
34h	DIF: 32-bit integer, no DIFE, error value
6Dh	VIF: Time = date of prewarning against pollution, data type F
78h 56h 34h 12h	12345678
34h	DIF: 32-bit integer, value during error
FCh	VIF: VIFE follows, plain text VIF; text is in the following string (length in 1st data byte)
6Eh	VIFE: Time (date/time) of the last occurrence = time stamp for negative temperature difference error, data type F
02h 54h 46h	length = 2 characters, ACSII code for "FT"
78h 56h 34h 12h	12345678
34h	DIF: 32-bit integer, value during error
FCh	VIF: VIFE follows, plain text VIF; text is in the following string (length in 1st data byte)
6Eh	VIFE: Time (date/time) of the last occurrence = time stamp for sensor error, data type F
02h 53h 46h	length = 2 characters, ACSII code for "FS"
78h 56h 34h 12h	12345678
34h	DIF: 32-bit integer, value during error
FCh	VIF: VIFE follows, plain text VIF; text is in the following string (length in 1st data byte)
6Eh	VIFE: Time (date/time) of the last occurrence = electronic error, data type F
02h 45h 46h	length = 2 characters, ACSII code for "FE"
78h 56h 34h 12h	12345678
34h	DIF: 32-bit integer, value during error
FCh	VIF: VIFE follows, plain text VIF; text is in the following string (length in 1st data byte)
6Eh	VIFE: Time (date/time) of the last occurrence = time stamp for flworate error, data type F
03h 31h 46h 46h	length = 3 characters, ACSII code for "FFI"
78h 56h 34h 12h	12345678
34h	DIF: 32-bit integer, value during error
FCh	VIF: VIFE follows, plain text VIF; text is in the following string (length in 1st data byte)
6Eh	VIFE: Time (date/time) of the last occurrence = time stamp for wrong flow direction error, data type F
03h 32h 46h 46h	length = 3 characters, ACSII code for "FF2"

Telegram bytes	Telegram frame 2 Explanation
78h 56h 34h 12h	12345678
0Fh/ 1Fh	DIF: manufacturer-spec. data, no consecutive frame/ further frame follows (if rolling frame ist activated or if data is read-out via the optical interface)
00h 07h	Firmware version: e.g. 07.00
00h	Reserved
20h	Extension byte with additional information (see section 5.4)
02h	Frame counter
CS	CS = checksum (1 byte)
16h	Stop character

5.3.3 Telegram frame 3 :

This frame contains all 24 previous month's values of the energy quantity (3rd consecutive frame in normal operation read-out).

Telegram bytes	Telegram frame 3 Explanation
68h L L 68h	Frame of fixed length, L = length
08h A 72h	Variable structure, LSB first, A = M-bus address (1 byte)
78h 56h 34h 12h	Secondary address = property number, e.g. 12345678
A7h 32h	Manufacturer identification, e.g. for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)
07h	Version 07
04h	Device type e.g. 04: heat in return
Z	Z = access counter (1 byte)
S	S = Status (1 byte) Bit 0..4: acc. to EN 13575-3 Bit 5..7: not used ('0')
00h 00h	Signature
8Ch/CCh	DIF: 8-digit BCD, DIFE follows, (8Ch for even / CCh for odd storage no.)
0zh	DIFE: Storage number for n^{th} previous month (n = 1 to 24 and z = (n+1)/2); range for z =1 to Ch
06h/0Eh	VIF: Energy quantity (kWh / MJ)
78h 56h 34h 12h	12345678
0Fh/ 1Fh	DIF: manufacturer-spec. data, no consecutive frame/ further frame follows (if rolling frame is activated or if data is read-out via the optical interface)
00h 07h	Firmware version: e.g. 07.00
00h	Reserved
20h	Extension byte with additional information (see section 5.4)
03h	Frame counter
CS	CS = checksum (1 byte)

Telegram bytes	**Telegram frame** 3 **Explanation**
16h	Stop character

5.3.4 Telegram frame 4 :

This framework is issued once for each previous month. This frame contains all values of the nth previous month (in this case n = 1; storage no. = 2)
(4th consecutive frame in normal operation read-out).

Telegram bytes	Telegram frame 4 Explanation
68h L L 68h	Frame of fixed length, L = length
08h A 72h	Variable structure, LSB first, A = M-bus address (1 byte)
78h 56h 34h 12h	Secondary address = property number, e.g. 12345678
A7h 32h	Manufacturer identification e.g. for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)
07h	Version 07
04h	Device type e.g. 04: heat in return
Z	Z = access counter (1 byte)
S	S = Status (1 byte) Bit 0..4: acc. to EN 13575-3 Bit 5..7: not used ('0')
00h 00h	Signature
8Ch	DIF: 8-digit BCD, DIFE follows
01h	DIFE: Storage number 2 = 1st previous month
06h/0Eh	VIF: Energy quantity (kWh / MJ)
78h 56h 34h 12h	12345678 (energy quantity 1st previous month)
8Ch	DIF: 8-digit BCD, DIFE follows
01h	DIFE: Storage number 2 = 1st previous month
14h	VIF: Volume (m^3*1/100)
78h 56h 34h 12h	123456.78 m^3 (Volume 1st previous month)
BCh	DIF: 8-digit BCD, DIFE follows, value during error
01h	DIFE: Storage number 2 = 1st previous month
22h/23h	VIF: On time (hours/days) = missing time in hours/days
78h 56h 34h 12h	12345678 h/d (missing time 1st previous month)
8Ch	DIF: 8-digit BCD, DIFE follows
01h	DIFE: Storage number 2 = 1st previous month
26h/27h	VIF: Flow time (hours/days)
78h 56h 34h 12h	12345678 h/d (flow time 1st previous month)
8Ch	DIF: 8-digit BCD, DIFE follows, current value
91h	DIFE: Tariff = 5, DIFE follows, storage number 2 = 1st previous month
10h	DIFE: Tariff = 5, i.e. tariff register 5 (energy quantity in the case of wrong installation)
06h/0Eh	VIF: Energy quantity (kWh / MJ)
78h 56h 34h 12h	12345678 (energy quantity in the case of wrong installation 1st previous month)
9Bh	DIF: 6-digit BCD, DIFE follows, maximum
11h	DIFE: Tariff = 1, storage no. 2 = 1st previous month
2Dh	VIF: Heat power (kW/10)
56h 34h 12h	12345.6 kW (max. heat power 1st previous month)

Telegram bytes	**Telegram frame** 4 **Explanation**
9Bh	DIF: 6-digit BCD, DIFE follows, maximum
11h	DIFE: Tariff = 1, storage no. 2 = 1st previous month
3Bh	VIF: Flow rate (l/h)
56h 34h 12h	123.456 m^3/h (max. flow rate 1st previous month)
9Bh	DIF: 6-digit BCD, DIFE follows, maximum
11h	DIFE: Tariff = 1, storage no. 2 = 1st previous month
5Ah	VIF: Flow temperature (°C/10)
56h 34h 02h/F2h	2345.6 °C / -2345.6 °C (max. flow temperature 1st previous month)
9Bh	DIF: 6-digit BCD, DIFE follows, maximum
11h	DIFE: Tariff = 1, storage no. 2 = 1st previous month
5Eh	VIF: Return temperature (°C/10)
56h 34h 02h/F2h	2345.6 °C / -2345.6 °C (max. return temperature 1st previous month)
94h	DIF: 32-bit integer, DIFE follows, maximum
11h	DIFE: Tariff = 1, storage no. 2 = 1st previous month
ADh	VIF: Heat power (kW/10), VIFE follows
6Fh	VIFE: Time = Timestamp for max.heat power, data type F
78h 56h 34h 12h	12345678 (timestamp for max. heat power 1st previous month)
94h	DIF: 32-bit integer, DIFE follows, maximum
11h	DIFE: Tariff = 1, storage no. 2 = 1st previous month
BBh	VIF: Flow rate (l/h), VIFE follows
6Fh	VIFE: Time = Timestamp for max. flow rate, data type F
78h 56h 34h 12h	12345678 (timestamp for max. flow rate 1st previous month)
94h	DIF: 32-bit integer, DIFE follows, maximum
11h	DIFE: Tariff = 1, storage no. 2 = 1st previous month
DAh	VIF: Flow temperature (°C), VIFE follows
6Fh	VIFE: Time = Timestamp for max. flow temperature, data type F
78h 56h 34h 12h	12345678 (timestamp for max. flow temperature 1st previous month)
94h	DIF: 32-bit integer, DIFE follows, maximum
11h	DIFE: Tariff = 1, storage no. 2 = 1st previous month
DEh	VIF: Return temperature (°C), VIFE follows
6Fh	VIFE: Time = Timestamp for max. return temperature, data type F
78h 56h 34h 12h	12345678 (timestamp for max. return temperature 1st previous month)
84h	DIF: 32-bit integer, DIFE follows
01h	DIFE: Storage number 2 = 1st previous month
6Dh	VIF: Time = storage time; data type F
78h 56h 34h 12h	12345678
8Ch	DIF: 8-digit BCD, DIFE follows
81h	DIFE: Storage number 2 = 1st previous month
40h	DIFE: Unit 2 = mid-month value
06h/0Eh	VIF: Energy quantity (kWh / MJ)
78h 56h 34h 12h	12345678 (energy quantity 1st previous month)
8Ch	DIF: 8-digit BCD, DIFE follows
81h	DIFE: Storage number 2 = 1st previous month
40h	DIFE: Unit 2 = mid-month value
14h	VIF: Volume (m^3*1/100)
78h 56h 34h 12h	123456.78 m^3 (Volume 1st previous month)

Telegram bytes	Telegram frame 4 Explanation
8Ch	DIF: 8-digit BCD, DIFE follows, current value
91h	DIFE: Tariff = 5, DIFE follows, storage number 2 = 1st previous month
50h	DIFE: Tariff = 5, i.e. tariff register 5 (energy quantity in the case of wrong installation; Unit 2 = mid-month value)
06h/0Eh	VIF: Energy quantity (kWh / MJ)
78h 56h 34h 12h	12345678 (energy quantity in the case of wrong installation 1st previous month)
84h	DIF: 32-bit integer, DIFE follows
81h	DIFE: Storage number 2 = 1st previous month
40h	DIFE: Unit 2 = mid-month value
6Dh	VIF: Time = storage time; data type F
78h 56h 34h 12h	12345678
0Fh/ 1Fh	DIF: manufacturer-spec. data, no consecutive frame/ further frame follows (if rolling frame is activated or if data is read-out via the optical interface)
00h 07h	Firmware version: e.g. 07.00
00h	Reserved
20h	Extension byte with additional information (see section 5.4)
04h	Frame counter
CS	CS = checksum (1 byte)
16h	Stop character

5.3.5 Telegram frame 5 :

This frame contains manufacturer-specific values (5th consecutive frame in normal operation read-out)

Telegram bytes	Telegram frame 5 Explanation
68h L L 68h	Frame of fixed length, L = length
08h A 72h	Variable structure, LSB first, A = M-bus address (1 byte)
78h 56h 34h 12h	Secondary address = property number, e.g. 12345678
A7h 32h	Manufacturer identification, e.g. for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)
07h	Version 07
04h	Device type e.g. 04: heat in return
Z	Z = access counter (1 byte)
S	S = Status (1 byte) Bit 0..4: acc. to EN 13575-3 Bit 5..7: not used ('0')
00h 00h	Signature
0Fh	DIF: manufacturer-specific date, no consecutive frame
VO VR KT	Parameter temperature measurement in hex format (6 bytes) VO(4)/VR(4)/KT(4)
FFh	Separator

Telegram bytes	**Telegram frame** 5 **Explanation**
CRC	CRC actual value (2 bytes) in hex format
FFh	Separator
12h	Nominal measuring value (1 byte) 0A: 0.6 m^3/h; 01: 1.5 m^3/h; 01: 2.5 m^3/h
FFh	Separator
Adj	Adjustment values(16 bytes) A0(4)/A1(4)/A2(4)/A3(4)/A4(4)/A5(4)/A6(4)/ A8(4) All values in complements of two (see Appendix A)
FFh	Separator
Fine adj.	Flow rate fine adjustment (24 bytes) A(4)/B(4)/C(4)/D(4)/E(4)/F(4)/G(4)/H(4)/I(4)/K(4)/L(4)/M(4)
FFh	Separator
ABCDEF	Extension (3 bytes) Bit A.3: 0 = Installation in return / 1 = Installation in flow Bit A.1: Negative flow rate (F1-Neg) Bit A.0: Negative temperature difference (Diff-Neg) Bit B.3: Wrong installation of volume measurement unit Bit B.2: Wrong installation of sensor Bit B.1: F4 prewarning Bit B.0: F0 prewarning Bit D.1: Error internal communication (F9) Bit D.0: 8-hours-error (F8) Bit E.3: Error in EEPROM (F7) Bit E.2: Short-circuit in return temperature sensor (F6) Bit E.1: Short-circuit in flow temperature sensor (F5) Bit E.0: Battery exhausted (F4) Bit F.3: Temperature electronics defective (F3) Bit F.2: Interruption in return temperature sensor (F2) Bit F.1: Interruption in flow temperature sensor (F1) Bit F.0: Flow rate error (F0)
FFh	Separator

Telegram bytes	**Telegram frame** 5 **Explanation**
MSP2	Parameter for flow rate measuring tube 2 (18 bytes) V1(1)/V1Adj(1) / V2(2)/V2Adj(2) / DAC_U(2) / DAC_O(2) / DAC_M(2) / AF(2) / B+C+H +I (4) / Reset counter(4) / Warm start counter(2) / F7-prewarning counter(4) / F7_prewarning identification (2) / F0_U(2) / F0_O(2) / LZ_Komp(2) F7_prewarning identification: Bit 7: both non EP parameters are incorrect (incorrect checksum) Bit 6: both non EP parameters could not be written without error Bit 5: CS error during read non EP circular buffer Bit 4: CS error during read lifetime maxima Bit 3: CS error during read previous year's values Bit 2: CS error during read previous month's values Bit 1: CS error during read BUGFIX Bit 0: corrected error from EP-EEPROM area Nibble B is HN from "EP_Merker3" Nibble C is LN from "EP_Merker12" Nibble H is HN from "EP_Merker6" Nibble I is LN from "EP_Merker6"
FFh	Separator
MSP1	Parameter for flow rate measuring tube 1 (30 bytes) Quality factor(4) / Threshold V(8) / Threshold R(8) / DAC_V(2) / DAC_R(2) / SLZ(8) / WZ(2) /nLZM(2) /n0LZM(1)/SI(1)/EFE(2)/MS(1)/FT(1)/EF0(2) / KC(4) / KRZK(4) / EP_KQ(4) / ERR(4). ERR, Bit 15-0: EP_EVAL_ACTIVE, EP_RQ_RESET, EP_RQ_F_EEP, EP_RQ_F_CRC, EP_F_EEP-Early w, F_List, EP_F_CRC, EP_F_EEP, F0, F0-Latch, ULatch, F3, F4, F8, F9, fast motion
FFh	Separator
VT	Prescaler (12 bytes) nUS(2)/PhiV(4)/PhiW(2)/W0(4) nUS = Number of US measurements (in BCD format); PhiV, PhiW, W0 = Prescaler (in hex two's complement) Numbers in parentheses are byte
FFh	Separator
VTF	Prescaler energy quantity in the case of wrong installation (4 bytes) W0F(4) = Prescaler (in hex two's complement) Numbers in parentheses are byte
FFh	Separator
Sim	Simulation (7 byte) Tr(4)/Tv(4)/Q(6) Simulation parameters for return temperature, flow temperature and flow rate
FFh	Separator
Config	Device configuration (6 bytes) i(1)/g(1)/n(1)/t(1)/S(1) /R(1)/Q(2)/T(2)/A(2)

Telegram bytes	**Telegram frame** 5 **Explanation**

	i = 0: no additional interface
	i = 1 to i = 3: reserved
	i = 4: Radio interface version 1
	i = 5 to i = 7: reserved
	I = 8: M-bus interface
	i = 9 to i = F: reserved
	
	g.0: 0=Error as basic display;
	1=Energy quantity or similar as basic display
	g.1: 0=Unit kWh or MJ;
	1=Unit MWh or GJ (only in LC display)
	g.2: 0=Standard error display;
	1=delayed error display
	g.3: 0=Pb lock inactive;
	1= Pb lock activated
	
	n = 1: Decimal place static;
	
	t.0: 0= Control button released;
	1= Control button locked
	t.1: 0=Commissioning lock inactive;
	1=IB lock active
	t.2: 0=Loop lock inactive;
	1=Loop lock active
	
	S.0: 0=Without calibration seal;
	1=With calibration seal
	S.1: 0= TR real;
	1= TR simulated
	S.2: 0= Temperatures real;
	1= Temperatures simulated
	S.3: 0= Flow rate real;
	1= Flow rate simulated
	
	R.0: 0= Rolling frame M-bus interface deactivated;
	1= Rolling frame M-bus interface activated
	R0.1: 0= Rolling frame optical interface deactivated;
	1= Rolling frame optical interface activated
	
	Q = Measurement interval for flow rate
	08h = 2 seconds
	10h = 4 seconds
	20h = 8 seconds
	T = Measurement interval for temperature
	08h = 8 seconds
	1Eh = 30 seconds
	3Ch = 60 seconds
	3Dh = adaptive measurement interval (60s or measurement interval for flow rate)

Telegram bytes	**Telegram frame** 5 **Explanation**
	A = Starting-threshold (output *5% of qi)
FFh	Separator
FW1	Version of firmware part protected with calibration seal (2 byte), e.g. for 7.01: 01h 07h
FFh	Separator
FW2	Version of firmware part not protected with calibration seal (2 byte), e.g. for 7.12: 12h 07h
FFh	Separator
00h 07h	Firmware version: e.g. 07.00
00h	Reserved
20h	Extension byte with additional information (see section 5.4)
05h	Frame counter
CS	CS = checksum (1 byte)
16h	Stop character

5.4 Extension byte with additional information

All frames in Nb and Eb/Pb have a part with manufacturer-specific data before the checksum (CS). This part is separated from the records by the DIF "0Fh" ("1Fh", if consecutive frames follow).

A part of the manufacturer-specific data is the "Extension byte with additional information". The meaning of the single bits is as follows:

Extension byte.7 and Extension byte.6	= 01 **à** Nb
Extension byte.5	Calibration seal (not) set
Extension byte.4	Installation in flow/return
Extension byte.3	reserved
Extension byte.2	Meter is secondary selected (via MSS)
Extension byte.1	Rolling frame OSS activated/deactivated
Extension byte.0	Rolling frame MSS activated/deactivated

5.5 Value output

The following values are issued via the existing interfaces or LC display:

Explanation	Output via...		
	...Opto	...MBus	...LCD
Energy quantity Nb	yes	yes	yes
Energy quantity Nb in the case of wrong installation	yes	yes	yes
Volume Nb	yes	yes	yes
Customer ID	yes	yes	yes
Power Nb	yes	yes	yes
Flow rate Nb	yes	yes	yes
flow temperature Nb	yes	yes	yes
return temperature Nb	yes	yes	yes
Temperature difference Nb	yes	yes	yes
Volume Nb previous year)	yes	yes	yes
Energy quantity Nb previous year	yes	yes	yes
Energy quantity Nb in the case of wrong installation previous year	yes	yes	yes
Error massage	recoded	recoded	yes
Device number	yes	yes	yes
Averaging duration	yes	yes	yes
max. power Nb	yes	yes	yes
Time stamp for max. power	yes	yes	yes
max. flowrate Nb	yes	yes	yes
Time stamp for max. Flow rate	yes	yes	yes
max. temperatures Nb	yes	yes	yes
Time stamp for max. flow temperature	yes	yes	yes
Time stamp for max. return temperature	yes	yes	yes
Operating time	yes	yes	yes
Missing time	yes	yes	yes
Installation site	yes	yes	-----
M-bus address	yes	yes	yes
Extension	yes	yes	-----
missing time previous year	yes	yes	yes
Annual set day	yes	yes	yes
max. power Nb previous year	yes	yes	yes
Time stamp for max. power previous year	yes	yes	yes
max. flow rate Nb previous year	yes	yes	yes
Time stamp for max. flow rate previous year	yes	yes	yes
max. temperatures Nb previous	yes	yes	yes

Explanation	**Output via...**		
	...Opto	**...MBus**	**...LCD**
year			
Time stamp for max. flow temperature previous year	yes	yes	yes
Time stamp for max. return temperature previous year	yes	yes	yes
Time stamp for storage time previous year	yes	yes	yes
max. power Nb previous months	yes	yes	yes
Time stamp for max. power previous months	yes	yes	yes
max. flow rate Nb previous months	yes	yes	yes
Time stamp for max. flow rate previous months	yes	yes	yes
Max. temperatures Nb previous months	yes	yes	yes
Time stamp for max. flow temperature previous months	yes	yes	yes
Time stamp for max. return temperature previous months	yes	yes	yes
Time stamp for storage time previous months	yes	yes	yes
Missing time previous months	yes	yes	yes
Energy quantity Nb previous months	yes	yes	yes
Energy quantity Nb in the case of wrong installation Previous months	yes	yes	yes
Volume Nb previous months	yes	yes	yes
Time stamp for F0 prewarning	yes	yes	yes
Monthly set day	yes	yes	yes
Mid-month set day	yes	yes	yes
Energy quantity Nb at mid-month set day	yes	yes	yes
Volume Nb for mid-month set day	yes	yes	yes
Energy quantity wrong installation Nb for mid-month set day	yes	yes	yes
Storage time of values for mid-month set day	yes	yes	yes
System date and time	yes	yes	yes
Nominal measuring value	yes	yes	-----
Adjustment values	yes	yes	-----
Device configuration	yes	yes	partly
Simulation	yes	yes	partly
Prescaler Nb	yes	yes	-----
Prescaler Nb energy quantity in the case of wrong installation	yes	yes	-----
Parameter for measuring tube 1	yes	yes	-----

Explanation	Output via...		
	...Opto	...MBus	...LCD
Parameter for measuring tube 2	yes	yes	-----
Parameter for temperature measuring	yes	yes	-----
CRC (actual) for EP code area	yes	yes	yes
Flow rate time meter	yes	yes	yes
Flow rate time meter previous year	yes	yes	yes
Flow rate time meter previous months	yes	yes	yes
Time stamp for wrong flow direction error	yes	yes	yes
Time stamp for negative temperature difference	yes	yes	yes
Time stamp for sensor error	yes	yes	yes
Time stamp for electronic error	yes	yes	yes
Time stamp for flow rate error	yes	yes	yes
Flow rate fine adjustment	yes	yes	-----
Energy quantity Pb	yes	-----	Pb-W
Volume Pb	yes	-----	Pb-V
Flow rate Pb	yes	-----	Pb-Q
Return temperature Pb	yes	-----	Pb-TR
Temperature difference Pb	yes	-----	Pb-T
Prescaler Eb, Pb	yes	-----	-----
Address Break register	yes	-----	-----

Table 3: Assignment of values to the output interfaces

Note: Values to be output via radio interface in future will be fixed in a forthcoming project (e.g. radio interface for T230).

6 Supported commands

6.1 “M-bus standard commands“

Request master															**Response slave**
		C	A	CS		Comment									
Initialization (SND_NKE)	**10h**	**40h**	**A**	**CS**	**16h**	FCB will be reset at master and slave									**E5h**
Date request (REQ_UD2)	**10h**	**5Bh/7Bh**	**A**	**CS**	**16h**	Data telegrams according to section "Description of data telegrams"									**see comment**
Deselection for secondary addressing	**10h**	**40h**	**FDh**	**CS**	**16h**	or selection of another secondary address									**E5h**
		C	A	CS		Comment									
Status request (REQ_SKE)	**10h**	**49h**	**A**	**CS**	**16h**	Response **RSP_SKE** is in the form "**10h 0Bh A CS 16h**"									**RSP_SKE**
		C	A	CS		Comment									
Alarm protocol (REQ_UD1)	**10h**	**5Ah/7Ah**	**A**	**CS**	**16h**	The alarm protocol is not supported by the communication interface									**E5h**
		L	L		C	A	CI	extended secondary address					CS		
Selection with secondary address	**68h**	**0Bh**	**0Bh**	**68h**	**53h/73h**	**FDh**	**52h**	**SAddr0-3**	**Man**	**Version**	**Device type**		**CS**	**16h**	**E5h**
Enhanced selection	**68h**	**11h**	**11h**	**68h**	**53h/73h**	**FDh**	**52h**	**SAddr1-4**	**Man**	**Version**	**Device type**	**0Ch**	**78h**	**Fab0-3**	**CS**	**16h**	**E5h**
	Wildcards (F) are possible! Secondary address (e.g: 01234567 --> SAddr0 = 67h, SAddr1 = 45h, SAddr2= 23h, SAddr3 = 01h) Manufacturer ID (Man = A7h 32h) ; Version (e.g. 04h); Device type (e.g. 04h --> heat, installation in return) Device number (e.g: 87654321 --> Fab0 = 21h, Fab1 = 43h, Fab2= 54h, Fab3 = 87h)														

Table 4: List of M-bus standard commands (to be continued)

Request master														**Response slave**
		L	L		C	A	CI	DIF	VIF	Data	CS			
Setting the primary address	**68h**	**06h**	**06h**	**68h**	**53h/73h**	**A**	**51h**	**01h**	**7Ah**	**Prim. Addr.**	**CS**	**16h**		**E5h**
	Deliverey state of the meters: primary address 0													
Setting the secondary address	**68h**	**09h**	**09h**	**68h**	**53h/73h**	**A**	**51h**	**0Ch**	**79h**	**Sec. Addr.**	**CS**	**16h**		**E5h**
	Delivery state of the meters: Secondary address = property number													
		L	L		C	A	CI	DIF	VIF	VIFE	Data	CS		
Setting date and time	**68h**	**0Ah**	**0Ah**	**68h**	**53h/73h**	**A**	**51h**	**04h**	**EDh**	**00h**	**Date/Time**	**CS**	**16h**	**E5h**
(obsolete, due to compatibility)	Date and time acc. to data type F (4 Bytes) from DIN EN 13575-3 Annex A													
		L	L		C	A	CI	DIF	VIF	Data	CS			
Setting date and time	**68h**	**09h**	**09h**	**68h**	**53h/73h**	**A**	**51h**	**04h**	**6Dh**	**Date/Time**	**CS**	**16h**		**E5h**
(current Syntax)	Date and time acc. to data type F (4 Bytes) from DIN EN 13575-3 Annex A													
		L	L		C	A	CI	Sub-code	CS		Content of the data telegram			
Resetting M-bus device = Application Reset	**68h**	**03h**	**03h**	**68h**	**53h/73h**	**A**	**50h**		**CS**	**16h**	Effect on data telegram see Table 2			**E5h**
Application reset with 1-byte sub-code	**68h**	**04h**	**04h**	**68h**	**53h/73h**	**A**	**50h**	**xxh**	**CS**	**16h**	Effect on data telegram see Table 2			**E5h**
Application reset with 2-byte sub-code	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**50h**	**xxh yyh**	**CS**	**16h**	Effect on data telegram Table 2			**E5h**
	For meaning and value of the sub-code bytes see Table 2													

Table 5: List of M-bus standard commands (continued)

7 Manufacturer-specific commands

7.1 Response of commands

If the so-called M-bus standard commands (see section 6.1) have a correct syntax, they are answered by the reaction indicated in the "Response slave" column (E5h, data frame or RSP_SKE).

Each valid command telegram with manufacturer-specific command according to section 7.4 is acknowledged by the meter with an SND_UD frame containing a response code or by the output of the requested data.
In the case of a chain of commands, one response is assigned to each command within the response frame.
Faulty or invalid telegrams with correct syntax are also replayed by a response code. The response code can also be an indication of incorrect command processing. The response codes are described in **Table 6**.

Response code (hexadecimal)	Explanation
00	Command was executed
01	Syntax error
02	Telegram not defined
0F	invalid in Nb/Qb

Table 6: Meaning of the response codes

7.2 Syntax of manufacturer-specific commands

The commands are transferred to the meter by means of an SND-UD structure (send user data from master to slave = meter).
The first DIF in the structure is a “0Fh“, i.e. the following data in the command is manufacturer-specific.

To save time, a chain of several commands (up to a max. telegram length of 256 byte) can be created. Each command is separated from the previous one by an additional "0Fh" byte. If certain commands are to be processed in a special way, this is mentioned in the "Restrictions" column of the command table in section 7.5.

Request master												**Response slave**
		L	L		C	A	CI	DIF	Data	CS		
send user data SND_UD	**68h**	**L**	**L**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**see "New Tg code" and "Parameter" columns of command table in section 7.5, possibly several in a chain**	**CS**	**16h**	RSP_UD frame (see section 7.3) with the data elements (see "Tg response" column of command table in section 7.5): “Acknowledgement“ (see Table 6) or. “Data“ (see “Explanation“ column in section 7.5)

7.3 Syntax of response to manufacturer-specific command

The meter responds to a syntactically correct command either with the acknowledge **“E5h”** or an RSP_UD frame (**Re**ac**SP**ond **_U**ser **D**ata).

The CI-field = 78h indicates that the response telegram does not have a header.

Response slave											
		L	L		C	A	CI	DIF	Data	CS	
respond user data (RSP_UD)	**68h**	**L**	**L**	**68h**	**08h**	**A**	**78h**	**0Fh**	**see the "Tg response" column and, if necessary, the "Explanation" column of the command table in section 7.5**	**CS**	**16h**

7.4 Assignment of the "New Tg codes" to the operating states

Some commands are only allowed in certain meter operating states. (E. g. Adjustment values must not be changeable in normal operation mode).
This is controlled for the relevant meter by the operating state-based assigning of the most significant nibble in "New Tg code":

Operating state	MSN (Most Significant Nibble) in "New Tg code“
Nb-	4
Nb	5
Nb	6
Nb	7

Table 7: Assignment of the "New Tg codes" in section 7.5 to the operating states

7.5 Table of manufacturer-specific commands

Note: The values displayed in the columns "Nes Tg code" and "Parameter" are hex digits within the data part of the SND_UD frame.

Command number	Function	Level	New Tg code	Parameter	Tg response	Explanation	Restrictions
1	EEPROM info	Nb	56 20		Data or error response code	Data = (aaaabbbbeeeeffffnnxx): aa aa, bb bb - Start and end address of the Q area ee ee, ff ff - Start and end address of the device properties nn nn - The meter’s internal month index xx - Type of EEPROM used	Chain: only as last element
2	read EEPROM	Nb	56 10	aa aa an nn	Data or error response code	aaaaa =initial address (max. 1FFFFh) nnn = number of bytes for read-out -1 (24 bit, hexadecimal) Scope of validity: 001h..FFFh accordingly 2 .. 4096 byte. At the OSS, data may be output in a number of consecutive telegrams. At the MSS nnn is automatically shortened for the data to fit into one telegram (max. 228 bytes) Data in hex format.	Chain: only as last element
3	Setting property number	Nb	5E	kk kk kk kk	Response code	8-digit, BCD. (at the same time secondary M-bus address) (no more than 15 changes per day possible)	none
4	Set primary M-bus address	Nb	5A 00	pp	Response code	Sets the primary M-bus address. The property number is the secondary address. (no more than 31 changes per day possible); pp in hex	none

Command number	Function	Level	New Tg code	Parameter	Tg response	Explanation	Restrictions
5	Set monthly set day	Nb	5F 00	tt	Response code	On the monthly set day, the values are stored into the previous month's archive. tt = day; e.g.: 27 = 1Bh => ”5F 00 1B”h Note: The archiving time for monthly and annual set days can be set to 24.00 (end of the day) or to 00.00 (beginning of the day) in Eb by using the commands "22 60" or "22 70" respectively.	none
6	Read RAM	Nb	56 00	0x xx yy	Data or error response code	xxx = initial address; yy = number of bytes; (2-246 bytes) RAM usage depends on version.	Chain: only as last element
7	Status request	all	0F		Data or error response code	Data is: s = "Nb+" or "Nb-" or "Pb+" or "Eb-" or "Qb-" (3 bytes) FW = version no. of firmware not subject to calibration, e.g.: 7.07 (4 bytes) FWEP = version no. of firmware subject to calibration, e.g.: 7.07 (4 bytes) TYP = type of the installed micro controller (F = flash, M = mask) (1 byte)	Chain: only as last element
8	Set annual set day	Nb	59	tt mm	Response code	On the set day volume, energy quantity, missing time , power maximum and flowrate maximum are stored into the previous year's archive. tt = day; mm = month, e.g.: 31.10 = 1Fh 0Ah => "59 1F 0A" Note: The archiving time for monthly and annual set days can be set to 24.00 (end of the day) or to 00.00 (beginning of the day) in Eb by using the commands "22 60" or "22 70" respectively.	none
9	Set system date	Nb	58	tt mm jj	Response code	tt = day; mm = month; jj = year-1900, e.g.: 28.10.2006 = 1Ch 0Ah 6Ah => "58 1C 0A 6A"h Only years between 2000 and 2099 are allowed!	none
10	Set system time	Nb	57	hh mm ss	Response code	hh = hour; mm = minute; ss = second e.g.: 15:10:25 = 0Fh 0Ah 19h=> "57 0F 0A 19"h	none
11	Control CRC (for EP code area)	Nb	56 30		ssssnnnn or error response code	ssss = reference value CRC check number nnnn = actual value CRC check number Values in hexadecimal.	Chain: only as last element
12	M-Bus, rolling frame	Nb	63 50	rr vv	Response code	Rolling frame setting for M-bus rr: FFh **à** rolling frame deactivated ('compatibility mode') 00h **à** rolling frame activated (frame counter = 01h) 01h..05h **à** frames 01 to 05 (Nb frames) vv: 01h..18h previous month to be output (only evaluated if rr = 04h), otherwise required as dummy	none

Command number	Function	Level	New Tg code	Parameter	Tg response	Explanation	Restrictions
13	Activate and deactivate output of mid-month values	Nb+Eb +Pb	70 00	nn	Response code	nn = 01h **à** output of mid-month values in frames 2 and 4 activated nn = 00h **à** output of mid-month values in frames 2 and 4 deactivated Note: At midnight the function is disabled automatically	none
14	Enter set day for mid-month values	Nb+Eb +Pb	70 10	nn	Response code	nn = mid-month set day in hex (allowed range 01h ..1Fh) parameter nn = 00h blocks the record on mid-month values Note: The archiving time for monthly and annual set days can be set to 24.00 (end of the day) or to 00.00 (beginning of the day) in Eb by using the commands "22 60" or "22 70" respectively.	none

Notes: