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M-Bus Module Generation 4

Topic: Interface Description

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History

Author	Reason for change/scope of change	Version	Date	Release date
Reißner	First edition in English	1,1	2008-10-06	2008-10-06

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0 Overview of revisions

Date	location	description	by
11. Sep. 2008	Appendix D	Decoding of error flags (binary) (device type specific)	Reißner

1 Introduction

1.1 Reason for document

Description of the M-bus module of the L+G M-bus generation 4

(valid as from M-bus firmware version: 4.01

can be used as from meter firmware: 5.15

The M-bus modules of M-bus generation 2 have the following firmware versions:

FW 2.01,
FW 2.02,
FW 2.03,
FW 2.04,
FW 2.06,
FW 2.61.

The M-bus modules of M-bus generation 4 have the following firmware versions:

FW 4.01.

1.2 Documents used

1.3 Abbreviations and definitions

Abbreviation	Explanation
G4	4th M-bus generation
G2	2nd M-bus generation
MI module	M-bus module with pulse inputs
VM	Previous month
VJ	Previous year
DIF	**D**ata **I**nformation **F**ield
DIFE	**D**ata **I**nformation **F**ield **E**xtension
VIF	**V**alue **I**nformation **F**ield
VIFE	**V**alue **I**nformation **F**ield **E**xtension
ASB	Output control byte
TelBitCode	128-bit long binary number that can be used to select values for M-bus output permanently in the meter

2 Overview

2.1 Versions

The modules are available as pure M-bus modules (called “M-bus module” in this document) and as M-bus modules with two integrated pulse inputs (called “MI modules” in this document).

This document only applies to the M-bus interface. This is the same for all variants of the module.

2.2 Characteristics

- **Hardware and software per DIN EN 1434-3, EN 13757-2, and EN 13757-3**
- **Transmission rates 300 / 1200 / 2400 / 4800 / 9600 baud (switchable via M-bus)**
- **Automatic baudrate detection (switchable, in the case of power-on active)**
- **Update timebase** in fast read-out mode every 4 seconds
  Adaptive update timebase in normal read-out mode:
  During operation of the meter with a power supply unit every 10 seconds
  During battery operation of the meter
  or on reserve power of the meter’s power supply unit every 15 minutes

2.3 Operation in G2 compatibility mode:

In this case, the M-bus output is controlled in such a way that there is no difference from the previous modules of generation 2 during normal mode (except for the firmware identification in the manufacturer-specific part) and in fast read-out mode in value output onto the M-bus:

Transmission of all data relevant for billing in normal mode:

Ownership number, device number, heat quantity, volume, flowrate, power, flow temperature, return temperature, temperature difference, previous year's values, maxima, operating time, missing days, measuring period, errors, set day, installation location, system time, values for the last previous month

Other features

- Data telegrams configurable to individual requirements
- Support for addressing using secondary address
- Mode for quick read-out with reduced data telegram content
- Application reset
- Enhanced selection
- Collision detection
- M-bus primary address can be set

- M-bus secondary address can be set (only possible in module slot 1)
- Date and the time can be set
- Tariff clock switching times can be set
- Direct tariff control with M-bus command

2.4 Display in modern mode (G4-compatible).

- Flow and return temperatures with one decimal place
- Negative values are represented in the customer-specific part of the status byte and in addition to the coding in the form per EN 13757-3 Annex B2 (“F” on the MSD).
  Example: The BCD-value „F00123“ ist to be interpreted as „-00123“
- Volumes are output in the tariff registers, if the meter has stored volumes there.

2.5 New functions of generation 4

- Values can be temporarily selected for output from a list (see clause 5.1.1: Value pool) with selection DIFs and VIFs that are not part of the standard output.
- It is possible to configure an individual form of M-bus output from a list of 63 possible values (see clause 5.1.1: Value pool) permanently using TelBitCodes (parameterizable on the meter).
- Adaptive update timebase in normal mode
  (15 minutes / 10 seconds depending on the power supply of the meter)
- Read-out of all previous month’s values
  (in groups for each previous month)
- Read-out of the logbook info telegram
  (providing info on the structure of the logbook data for read-out, followed by interpretation)
- Read-out of the data logger info telegrams
  (providing info on the structure of the data logger archives for read-out followed by interpretation)
- Read-out of EEPROM data
  (with this command, the raw data for the logbook and data logger can be read out of the UH50 step by step)

3 Hardware Connection

- The module complies with the standards EN 1434-3, EN 13757-2 and EN 13757-3
- The MI module can only be plugged into the module slot 1; the M-bus module can be plugged into both module slots (1 and 2).
- The meter automatically detects which module has been plugged in and displays this on the LCD (after call-up using the loop and advance button).
- The bus lines are brought into the housing of the meter through a sleeve and connected at the M-bus terminals of the module. The connections are not polarized. If there is a cable shield, it is clamped under the appropriate clip in the terminal compartment. The cable shield must not be electrically connected to the meter.
- On the MI-module, the pulse inputs are connected to the corresponding terminals as required. If the pulse generator is an electronic component (e.g. open collector), it is important to pay attention to the polarity of the connecting cables. Connection according to meter instruction manual.

4 Configuration of the M-Bus modules

4.1 Standard modes:

The parameters for the M-bus functionality of the modules are stored in the EEPROM of the meter and can be modified using the operating software PappaWin and in some cases using M-bus commands.

When the M-bus voltage is applied, these parameters are loaded into the module from the meter where they control the M-bus mode and the type of data output.

4.1.1 Mode

1. Normal read-out with a frame of variable length with up to 255 bytes
2. Fast read-out with a frame of variable length with up to 8 data values

4.1.2 Type of data output

1. G2-compatibility mode

   outputs the data in the same way as the old M-bus modules of generation 2 if the TelBitCodes are set appropriately in the meter (factory setting)
2. Extended G4 mode with output according to EN 13757-3 (modern output)
   a. Flow and return temperatures with one decimal place.
   b. Negative values are represented in the customer-specific part of the status byte and in addition to the coding in the form per EN 13757-3 Annex B2 (“F” on the MSD) .
   Example: The BCD-value „F00123“ ist to be interpreted as „-00123“
   c. Yearly set day with date and time.
   d. Volumes are output in the tariff registers, if the meter has stored volumes there.

4.1.3 Output with fixed-length frame

For reasons of compatibility, the M-bus module supports output in a fixed-length frame according to EN 1434-3:1997. Unlike the modules of the 2nd generation, this type of output is no longer set using jumpers but using the operating software PappaWin on the meter or with the M-bus command “Set read-out control byte” and stored in the EEPROM of the meter.

4.2 Special functions in modern mode (G4)

The M-bus module G4 features not only the standard modes stated above but also further special functions. If the module is switched into one of these special functions, this switchover will not be stored permanently in the EEPROM of the meter but remains in the volatile RAM of the M-bus module. The special function in each case is terminated by:

- Switching the M-bus voltage on and off.
- The command “Reset mode” (application reset).
- With the command “Reset to normal or fast read-out mode” (Table 1.3) to the standard mode that was active before the special function.
- Call-up of another special function.
- Switchover of the output control byte (value output G2 or G4-compatible or fixed-length frame)
- Setting or resetting the user lock.
- Changing the primary or secondary address (the secondary address not on module interface 2)

4.2.1 Output of the previous month’s values

With the command “Load previous month’s data into module” (Table 1.3), the module is switched to the previous month’s read-out mode with a volatile setting. At the same time, the data belonging to the previous month of call-up variables “Mon”" (Mon = 1 to Mon = 60) are loaded from the meter into the module.

With the command “data request” (REQ_UD2), the data of the previous month’s block are output onto the M-bus as a variable-length frame.

For read-out of a further previous month’s block, the command “load previous month’s data into module” with the corresponding call-up variables “Mon” followed by “Data request” must be sent to the module.

The previous month’s read-out mode is terminated by one of the events described in section 4.2.

4.2.2 Reading out the logbook and data logger

The information of the logbook and data logger are stored in a space-saving format in the EEPROM of the meter.

4.2.2.1 Reading out info telegrams for the logbook and data logger

With the command “Load info telegrams into module” (Table 1.3), information on the structure of the logbook and data logger data and their storage location in the EEPROM are transferred from the meter to the module.

The “Log” byte in the command decides which info telegram is to be loaded:

- Log = 00 **à** Info telegram for the logbook
- Log = 01 **à** Info telegram for the data logger hourly archive
- Log = 02 **à** Info telegram for the data logger daily archive
- Log = 03 **à** Info telegram for the data logger monthly archive
- Log = 04 **à** Info telegram for the data logger yearly archive

With the command “data request”, the data of the info telegram are output onto the M-bus as a variable-length frame.

An appropriately programmed master can interpret these info telegrams and read out the data with the M-bus module step by step as an agent with the command “Load EEPROM data into module“ and create the logbook or result list of the data logger from these.

The info telegram mode is terminated by one of the events described in section 4.2.

4.2.2.2 Reading out the EEPROM

With the command „Load EEPROM data into module”, it is possible to transfer into the M-bus module a number of EEPROM bytes stated in the command starting from an EEPROM address in the command but no more than 228 bytes (because of the structure of the variable-length frame). If more than 228 bytes are requested in the command, the M-bus module shortens the output to 228 bytes.

With the command “data request”, the data read out of the EEPROM are output onto the M-bus as a variable-length frame.

The EEPROM read-out mode is terminated by one of the events described in section 4.2.

5 Software Protocol

A complete, detailed description of the M-bus protocol is provided by the standards EN 1434-3, EN 13757-2, and EN 13757-3.

This section is therefore intended to be a specific supplement dealing with telegram support and data telegram structure.

In data telegrams with a variable structure, the length of the data telegrams and the sequence of the data blocks within the telegram are no warranted qualities.

For more detailed information about the above functions, see “The M-Bus: A Documentation”. This document can be obtained from the M-bus user group (Internet: http://www.m-bus.com)

In addition to DIN EN 1434-3, the module also performs the following functions:

- Secondary addressing
- Collision detection
- M-bus primary address can be set
- M-bus secondary address can be set (not in module slot 2)
- Date and the time can be set

- Automatic baudrate detection (can be deactivated)
- Enhanced selection
- Tariff switchover
- Mode selectable
  (normal mode or fast read-out mode)
- User lock (can be set and reset)
- Type of display selectable
  (compatible with generation 2, compatible with generation 4, fixed-length frame)
- Reading out previous month's value groups
- Reading out logbook info telegram
- Reading out data logger info telegrams
- Reading out EEPROM raw data for evaluation of the logbook and data logger
- M-bus addresses and parameters changed via the optical interface of the meter are also transferred to the module when the M-bus voltage is connected, as soon as the meter has been switched back to normal mode (Nb).

5.1 Supported command telegrams

The supported telegrams are summarized in tables 1.1 to 1.4. Commands newly introduced for the M-bus module G4 are designated “yes” in column “New in G4”. In column “Lockable”, “yes” is stated if execution of this command can be blocked by setting the user lock.

After commands that change the operating parameters stored in the meter (primary or secondary address, normal and fast read-out, set or cancel user lock, set read-out byte, set tariffs, set date and time), internal communication is established with the meter. Only when the changed data are read back from the meter into the module can the M-bus module be read out again. A waiting time of approx. 2 seconds must be allowed for this.

Request master													**Response slave**	**new in G4**	**lockable**
		C	A	CS		Comment									
Initialization (SND_NKE)	**10h**	**40h**	**A**	**CS**	**16h**								**E5h**		
Data 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**	The response **RSP_SKE** has the form "**10h 0Bh A CS 16h**"							**RSP_SKE**	yes	
		L	L		C	A	CI	CS		Comment					
Switch over to 300 baud	**68h**	**03h**	**03h**	**68h**	**53h/73h**	**A**	**B8h**	**CS**	**16h**	After power-on auto. baudrate detection			**E5h**		
Switch over to 1200 baud	**68h**	**03h**	**03h**	**68h**	**53h/73h**	**A**	**BAh**	**CS**	**16h**	After power-on auto. baudrate detection			**E5h**		
Switch over to 2400 baud	**68h**	**03h**	**03h**	**68h**	**53h/73h**	**A**	**BBh**	**CS**	**16h**	After power-on auto. baudrate detection			**E5h**		
Switch over to 4800 baud	**68h**	**03h**	**03h**	**68h**	**53h/73h**	**A**	**BCh**	**CS**	**16h**	After power-on auto. baudrate detection			**E5h**		
Switch over to 9600 baud	**68h**	**03h**	**03h**	**68h**	**53h/73h**	**A**	**BDh**	**CS**	**16h**	After power-on auto. baudrate detection			**E5h**	yes	
		L	L		C	A	CI			CS		Comment			
Switch over to fast read-out mode	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**A1h**	**CS**	**16h**		**E5h**		yes
Switch over to normal operating mode	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**A0h**	**CS**	**16h**		**E5h**		yes
Set the user lock	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**A2h**	**CS**	**16h**		**E5h**		
Reset the user lock	**68h**	**L**	**L**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**Key**	**CS**	**16h**	L<=32	**E5h**		
	The key for resetting the user lock can be obtained from the manufacturer.														
		L	L		C	A	CI			CS		Comment			
Automatic baudrate detection active	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**A4h**	**CS**	**16h**	After power-on automatically active	**E5h**		
Automatic baudrate detection off	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**A5h**	**CS**	**16h**		**E5h**		

Table 1.1 List of the commands supported by the M-bus module of the 4th generation

Request master																		Response slave	new in G4	lockable
		L	L		C	A	CI			CS										
Switchover to tariff 1	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**B1h**	**CS**	**16h**							**E5h**		
Switchover to tariff 2	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**B2h**	**CS**	**16h**							**E5h**		
Switchover to tariff 3	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**B3h**	**CS**	**16h**							**E5h**		
Tariff acquitision switched off	**68h**	**06h**	**06h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**B0h**	**CS**	**16h**							**E5h**		
		C	A	CS		Comment														
Alarm protocol	**10h**	**5Ah/7Ah**	**A**	**CS**	**16h**	The alarm protocol is not supported by the module												**E5h**		
		L	L		C	A	CI	Extended secondary address									CS			
Selection of the secondary address	**68h**	**0Bh**	**0Bh**	**68h**	**53h/73h**	**FDh**	**52h**	**SAddr0-3**	**Man**	**Gen**	**Med**						**CS**	**16h**	**E5h**		
Enhanced selection	**68h**	**11h**	**11h**	**68h**	**53h/73h**	**FDh**	**52h**	**SAddr1-4**	**Man**	**Gen**	**Med**	**0Ch**	**78h**	**Fab0-3**			**CS**	**16h**	**E5h**		
	Wildcards (F) are possible! Secondary address (e.g: 01234567 --> SAddr0 = 67h, SAddr1 = 45h, SAddr2= 23h, SAdr3 = 01h) Manufacturer ID (Man = A7h 32h) ; Generation (Gen = 04h); Medium (e.g. Med = 04h --> heat, installation in return) Devive number (e.g: 87654321 --> Fab0 = 21h, Fab1 = 43h, Fab2= 54h, Fab3 = 87h)																			
		L	L		C	A	CI	DIF	VIF	Data	CS									
Set the primary address	**68h**	**06h**	**06h**	**68h**	**53h/73h**	**A**	**51h**	**01h**	**7Ah**	**Prim. Addr.**	**CS**	**16h**						**E5h**		yes
	As-delivered state of the heat meter : Primary address 0																			
Set the secondary address	**68h**	**09h**	**09h**	**68h**	**53h/73h**	**A**	**51h**	**0Ch**	**79h**	**Sec. Addr.**	**CS**	**16h**						**E5h**		yes
(only on module slot 1)	As-delivered state of the heat meter : Secondary address = device number																			
		L	L		C	A	CI	DIF	VIF	VIFE	Data	CS								
Set date and time	**68h**	**0Ah**	**0Ah**	**68h**	**53h/73h**	**A**	**51h**	**04h**	**EDh**	**00h**	**Date/Time**	**CS**	**16h**					**E5h**		yes
	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									
Set date and time	**68h**	**09h**	**09h**	**68h**	**53h/73h**	**A**	**51h**	**04h**	**6Dh**	**Date/Time**	**CS**	**16h**						**E5h**		yes
	Date and time acc. to data type F (4 Bytes) from DIN EN 13575-3 Annex A																			
Tariff acquisition		L	L		C	A	CI	DIF	DIFE1	DIFE2	VIF	VIFE	Data	CS						
Set the switchover times	**68h**	**L**	**L**	**68h**	**53h/73h**	**A**	**51h**	**04h/84h**	**Tariff**		**FDh**	**30h**	**Date/Time**	**...**						
							...	**44h/C4h**	**Tariff**		**FDh**	**30h**	**Date/Time**	**CS**	**16h**			**E5h**		
	Tariff: Tariff acquisition switched off (no ID number), tariff 1 (20h), tariff 2 (30h) or tariff 3 (80h 10h) Date and time acc. to data type F (4 bytes) from DIN EN13757-3 (Annex A). The date is ignored.																			
		L	L		C	A	CI		CS		Content of the data telegram									
Reset mode (Appl. Reset)	**68h**	**03h**	**03h**	**68h**	**53h/73h**	**A**	**50h**		**CS**	**16h**	Response telegram in normal operating mode							**E5h**		yes
Normal operating mode (Appl. Reset)	**68h**	**04h**	**04h**	**68h**	**53h/73h**	**A**	**50h**	**00h**	**CS**	**16h**	Response telegram in normal operating mode							**E5h**		yes
Fast read-out mode (Appl. Reset)	**68h**	**04h**	**04h**	**68h**	**53h/73h**	**A**	**50h**	**51h**	**CS**	**16h**	Response telegram in fast read-out mode							**E5h**		yes

Table 1.2 List of the commands supported by the M-bus module of the 4th generation

These commands are used to call up the new modes in the M-bus modules of the 4th generation:

Request master																Response slave	new in G4	lockable
		L	L		C	A	CI				CS							
Load previous month's data into module (previous month read-out mode)	**68**	**06h**	**06h**	**68**	**53h/73h**	**A**	**51h**	**0Fh**	**A8h**	**Mon**	**CS**	**16h**				**E5h**	yes	yes
	Mon = requested previous month's value --> 01h = 1st prev. month … 3Ch = 60th prev. month																	
	The data requested with the command above are output onto the M-bus with the command RQ_UD2																	
		L	L		C	A	CI				CS							
Load info telegrams into module (info telegram read-out mode)	**68**	**06h**	**06h**	**68**	**53h/73h**	**A**	**51h**	**0Fh**	**AAh**	**Log**	**CS**	**16h**				**E5h**	yes	yes
	Log = 00h --> Info telegram for logbook is loaded into the module Log = 01h --> Info telegram for data logger hourly archive is loaded into the module Log = 02h --> Info telegram for data logger daily archive is loaded into the module Log = 03h --> Info telegram for data logger monthly archive is loaded into the module Log = 04h --> Info telegram for data logger yearly archive is loaded into the module																	
	The data requested with the command above are output onto the M-bus with the command RQ_UD2																	
		L	L		C	A	CI							CS				
Load EEPROM data into module (EEPROM read-out mode)	**68**	**09h**	**09h**	**68**	**53h/73h**	**A**	**51h**	**0Fh**	**A9h**	**Blk0**	**Blk1**	**Blk2**	**Blk3**	**CS**	**16h**	**E5h**	yes	yes
	Blk0..Blk3 = Address in the EEPROM and number of bytes to be read out - 1 (aaaaannn) e.g. 01234h for the EEPROM address 01234; 0E3h for 228 bytes to be read out: Blk0 = 01; Blk1 = 23; Blk2 = 40; Blk3 = E3																	
	The data requested with the command above are output onto the M-bus with the command RQ_UD2																	
		L	L		C	A	CI			CS								
Switch back to normal and fast read-out mode	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**0Fh**	**AFh**	**CS**	**16h**					**E5h**	yes	yes
	The module falls back into the mode in which it was before switchover to one of the above modes																	
		L	L		C	A	CI						CS					
Set read-out control byte (type of data output)	**68**	**08h**	**08h**	**68**	**53h/73h**	**A**	**51h**	**01h**	**FDh**	**8Bh**	**00h**	**ASB**	**CS**	**16h**		**E5h**	yes	
	ASB = 00h --> Modern data output G4-compatible ASB = 01h --> Downward compatible data output G2-compatible ASB = 02h --> Data output in a fixed-length frame (EN 1434-3: 1997)																	

Table 1.3 List of the commands additionally supported by the M-bus module of the 4th generation

Using the following commands of Table 1.4, value output onto the M-bus interface can be controlled.

The response telegram generated with these commands is kept in the volatile RAM of the module. Selection is reset for the following events.

- Switching the M-bus voltage on and off.
- The command “Reset mode" (application reset).
- Switching back from the new modes according to Table 1.3 into normal and fast read-out mode.
- Switchover from normal to fast read-out mode and vice versa.
- Switchover of the output control byte (value output G2 or G4-compatible or fixed-length frame)
- Setting or resetting the user lock.

Note: A permanent change of the value output onto the M-bus interface in normal and/or fast read-out mode is possible using the PappaWin operating software by customer-specific parameterization of the TelBitCode in the meter.

Request master															**Response slave**	**new in G4**	**lockable**
Output value selection via Appl. Reset		L	L		C	A	CI		CS		Content of the selected data telegram						
Consumption values (Appl. Reset)	**68h**	**04h**	**04h**	**68h**	**53h/73h**	**A**	**50h**	**10h**	**CS**	**16h**	W, V				**E5h**		yes
Billing values (Appl. Reset)	**68h**	**04h**	**04h**	**68h**	**53h/73h**	**A**	**50h**	**20h**	**CS**	**16h**	W, V, W VJ, V VJ, BT, FT, tariff register, tariff register prev. Year				**E5h**		yes
Extended billing values (Appl. Reset)	**68h**	**04h**	**04h**	**68h**	**53h/73h**	**A**	**50h**	**30h**	**CS**	**16h**	W, V, W VJ, V VJ, Pmax, Pmax VJ, Q, BT, FT				**E5h**		yes
Instantaneous values (Appl. Reset)	**68h**	**04h**	**04h**	**68h**	**53h/73h**	**A**	**50h**	**50h**	**CS**	**16h**	W, V, P, Q, Tv, Tr				**E5h**		yes
Start-up values (Appl. Reset)	**68h**	**04h**	**04h**	**68h**	**53h/73h**	**A**	**50h**	**80h**	**CS**	**16h**	Serial number, set day				**E5h**		yes
All or nothing		L	L		C	A	CI				CS						
All values (dep. on mode)	**68h**	**04h**	**04h**	**68h**	**53h/73h**	**A**	**51h**	**7Fh**			**CS**	**16h**			**E5h**		
All values (dep. on mode)	**68h**	**06h**	**06h**	**68h**	**53h/73h**	**A**	**51h**	**C8h**	**3Fh**	**7Eh**	**CS**	**16h**			**E5h**		
No values	**68h**	**06h**	**06h**	**68h**	**53h/73h**	**A**	**51h**	**7Fh**	**FEh**	**0Dh**	**CS**	**16h**			**E5h**		
Special values (e.g. heat quantity):		L	L		C	A	CI	ID			CS						
Heat quantity	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**08h**	**05h**		**CS**	**16h**	W, tariff register		**E5h**		
Heat quantity previous year	**68h**	**05h**	**05h**	**68h**	**53h/73h**	**A**	**51h**	**48h**	**05h**		**CS**	**16h**	W VJ, tariff register VJ		**E5h**		
General:		L	L		C	A	CI				CS		Comment				
Selected data	**68h**	**L**	**L**	**68h**	**53h/73h**	**A**	**51h**	**Selection ID(s)**			**CS**	**16h**	The following condition applies: L<=249		**E5h**		
	See section value pool, table 2.1 to table 2.6, column "Selection ID DIFs and VIFs"																

Abbreviations in column "Content of the selected data telegram":

W = Heat quantity
V = Volume
Pmax = Maximum power
Q = Flowrate
BT = Operating time (days or hours)
FT = Missing time (days or hours)
Tv = Flow temperature
Tr = Return temperature

Table 1.4 List of the commands supported by the M-bus module of the 4th generation

5.1.1 Value pool

With the M-bus modules of generation 4, it is possible to use the “selected data” command (Table 1.4) to select not only a subset of the data available in the normal and fast read-out but all values are available from the value pool (Table 2.1 to Table 2.7) for selection for the output onto the M-bus interface. If multiple lines are listed for one value in the column “Selection ID of DIFs + VIFs,” it is sufficient to state any of these lines in the command. The sequence of the output values cannot be influenced.
In normal read-out mode, the number of values selected in this way is limited by the limitation of the length of the M-bus response telegram for value output to 228 bytes net. If the telegram resulting from a selection becomes too long, the M-bus module G4 suppresses all value combinations (consisting of DIFs, VIFs and data) that exceed the maximum length during value output.
In fast read-out mode, the maximum number of value combinations (consisting of DIFs, VIFs and data) that can be output is limited to eight. If more than eight value combinations are selected with the “selected data” command, the module will only output eight value groups. During fast read-out no pre-stored values (previous month’s values and previous year’s values) can be output.

Reference number	Value pool	Source or ID number in the optional telegram	Value type	Selection ID DIFs + VIFs	TelBitCode	new in G4
127	locked for system	--	--	--	0000 0000 0000 0000 0000 0000 0000 0000	
126	locked for system	--	--	--	0000 0000 0000 0000 0000 0000 0000 0000	
125	locked for system	--	--	--	0000 0000 0000 0000 0000 0000 0000 0000	
124	Update time	Dynamic M-bus parameter	Instantaneous value	08h 74h	1000 0000 0000 0000 0000 0000 0000 0000	
123	Averaging time	Dynamic M-bus parameter	Instantaneous value	08h 70h	0800 0000 0000 0000 0000 0000 0000 0000	
122	Quantity of heat	6.8	Instantaneous value	08h 06h 08h 07h 08h 0Eh 08h 0Fh	0400 0000 0000 0000 0000 0000 0000 0000	
121	Volume	6.26	Instantaneous value	08h 14h 08h 15h	0200 0000 0000 0000 0000 0000 0000 0000	
120	Heat power	6.4	Instantaneous value	08h 2Dh	0100 0000 0000 0000 0000 0000 0000 0000	
119	Flowrate	6.27	Instantaneous value	08h 3Bh	0080 0000 0000 0000 0000 0000 0000 0000	
118	Flow temperature	6.29	Instantaneous value	08h 5Ah	0040 0000 0000 0000 0000 0000 0000 0000	
117	Return temperature	6.28	Instantaneous value	08h 5Eh	0020 0000 0000 0000 0000 0000 0000 0000	

Table 2.1 Value pool of the values that can be output by the M-bus module of the 4th generation onto the M-bus

Reference number	Value pool	Source or ID number in the optional telegram	Value type	Selection ID DIFs + VIFs	TelBitCode	new in G4
116	Temperature difference	6.30	Instantaneous value	08h 62h	0010 0000 0000 0000 0000 0000 0000 0000	
115	Volume / previous year	6.26*01	Instantaneous value	48h 14h 48h 15h	0008 0000 0000 0000 0000 0000 0000 0000	
114	Heat quanity / previous year	6.8*01	Instantaneous value	48h 06h 48h 07h 48h 0Eh 48h 0Fh	0004 0000 0000 0000 0000 0000 0000 0000	
113	Serial number	9.20	Instantaneous value	08h 78h	0002 0000 0000 0000 0000 0000 0000 0000	
112	Measurement period for maxima	6.35	Instantaneous value	88h 10h 71h 88h 10h 72h	0001 0000 0000 0000 0000 0000 0000 0000	
111	Heat power maximum	6.6	Maximum value	98h 10h 2Dh	0000 8000 0000 0000 0000 0000 0000 0000	
110	Heat power maximum / previous year	6.6*01	Maximum value	D8h 10h 2Dh	0000 4000 0000 0000 0000 0000 0000 0000	
109	Timestamp heat power maximum / previous year	9.36.1*01	Maximum value	D8h 10h ADh 6Fh	0000 2000 0000 0000 0000 0000 0000 0000	X
108	Flowrate maximum	6.33	Maximum value	98h 10h 3Bh	0000 1000 0000 0000 0000 0000 0000 0000	
107	Flow temperature maximum	9.4	Maximum value	98h 10h 5Ah	0000 0800 0000 0000 0000 0000 0000 0000	
106	Return temperature maximum	9.4	Maximum value	98h 10h 5Eh	0000 0400 0000 0000 0000 0000 0000 0000	
105	Operating time	6.31	Instantaneous value	08h 22h 08h 23h	0000 0200 0000 0000 0000 0000 0000 0000	
104	Error time	6.32	Value during error state	38h 22h 38h 23h	0000 0100 0000 0000 0000 0000 0000 0000	
103	Error time / previous year	6.32*01	Value during error state	78h 22h 78h 23h	0000 0080 0000 0000 0000 0000 0000 0000	
102	Yearly set day (without time) (G2-compatible --> type G)	6.36	Instantaneous value	48h 6Ch	0000 0040 0000 0000 0000 0000 0000 0000	
101	Monthly set day (23:59 instead of 24:00)	6.36*02	Instantaneous value	C8h 8Fh 0Fh 6Dh	0000 0020 0000 0000 0000 0000 0000 0000	X

Table 2.2 Value pool of the values that can be output by the M-bus module of the 4th generation onto the M-bus

Reference number	Value pool	Source or ID number in the optional telegram	Value type	Selection ID DIFs + VIFs	TelBitCode	new in G4
100	Tariff register 1	6.8.1 / .2 / .3	Instantaneous value	88h 20h 06h 88h 20h 07h 88h 20h 0Eh 88h 20h 0Fh 88h 20h 14h 88h 20h 15h	0000 0010 0000 0000 0000 0000 0000 0000	
99	Tariff register 2	6.8.4	Instantaneous value	88h 30h 06h 88h 30h 07h 88h 30h 0Eh 88h 30h 0Fh 88h 30h 14h 88h 30h 15h	0000 0008 0000 0000 0000 0000 0000 0000	
98	Tariff register 3	6.8.5	Instantaneous value	88h 80h 10h 06h 88h 80h 10h 07h 88h 80h 10h 0Eh 88h 80h 10h 0Fh 88h 80h 10h 14h 88h 80h 10h 15h	0000 0004 0000 0000 0000 0000 0000 0000	
97	Tariff register 1 / previous year	6.8.1*01 / .2 /.3	Instantaneous value	C8h 20h 06h C8h 20h 07h C8h 20h 0Eh C8h 20h 0Fh C8h 20h 14h C8h 20h 15h	0000 0002 0000 0000 0000 0000 0000 0000	
96	Tariff register 2 / previous year	6.8.4*01	Instantaneous value	C8h 30h 06h C8h 30h 07h C8h 30h 0Eh C8h 30h 0Fh C8h 30h 14h C8h 30h 15h	0000 0001 0000 0000 0000 0000 0000 0000	

Table 2.3 Value pool of the values that can be output by the M-bus module of the 4th generation onto the M-bus

Reference number	Value pool	Source or ID number in the optional telegram	Value type	Selection ID DIFs + VIFs	TelBitCode	new in G4
95	Tariff register 3 / previous year	6.8.5*01	Instantaneous value	C8h 80h 10h 06h C8h 80h 10h 07h C8h 80h 10h 0Eh C8h 80h 10h 0Fh C8h 80h 10h 14h C8h 80h 10h 15h	0000 0000 8000 0000 0000 0000 0000 0000	
94	Flow temperature / 1st previous month	9.4*02	Maximum value	98h 11h 5Ah	0000 0000 4000 0000 0000 0000 0000 0000	
93	Timestamp flow temperature / 1st previous month	9.36.3*02	Maximum value	98h 11h DAh 6Fh	0000 0000 2000 0000 0000 0000 0000 0000	X
92	Return temperature / 1st previous month	9.4*02	Maximum value	98h 11h 5Eh	0000 0000 1000 0000 0000 0000 0000 0000	
91	Timestamp return temperature / 1st previous month	9.36.4*02	Maximum value	98h 11h DEh 6Fh	0000 0000 0800 0000 0000 0000 0000 0000	X
90	Flowrate / 1st previous month	6.33*02	Maximum value	98h 11h 3Bh	0000 0000 0400 0000 0000 0000 0000 0000	
89	Timestamp Flowrate / 1st previous month	9.36.2*02	Maximum value	98h 11h BBh 6Fh	0000 0000 0200 0000 0000 0000 0000 0000	X
88	Heat power / 1st previous month	6.6.*02	Maximum value	98h 11h 2Dh	0000 0000 0100 0000 0000 0000 0000 0000	
87	Timestamp Leistung / 1st previous month	9.36.1*02	Maximum value	98h 11h ADh 6Fh	0000 0000 0080 0000 0000 0000 0000 0000	X
86	Error days / 1st previous month	6.32*02	Value during error state	B8h 01h 22h B8h 01h 23h	0000 0000 0040 0000 0000 0000 0000 0000	
85	Heat quantity / 1st previous month	6.8*02	Instantaneous value	88h 01h 06h 88h 01h 07h 88h 01h 0Eh 88h 01h 0Fh	0000 0000 0020 0000 0000 0000 0000 0000	
84	Tariff register 1 / 1st previous month	6.8.1*02 / .2 /.3	Instantaneous value	88h 21h 06h 88h 21h 07h 88h 21h 0Eh 88h 21h 0Fh 88h 21h 14h 88h 21h 15h	0000 0000 0010 0000 0000 0000 0000 0000	
83	Tariff register 2 / 1st previous month	6.8.4*02	Instantaneous value	88h 31h 06h 88h 31h 07h 88h 31h 0Eh 88h 31h 0Fh 88h 31h 14h 88h 31h 15h	0000 0000 0008 0000 0000 0000 0000 0000	

Table 2.4 Value pool of the values that can be output by the M-bus module of the 4th generation onto the M-bus

Reference number	Value pool	Source or ID number in the optional telegram	Value type	Selection ID DIFs + VIFs	TelBitCode	new in G4
82	Tariff register 3 / 1st previous month	6.8.5*02	Instantaneous value	88h 81h 10h 06h 88h 81h 10h 07h 88h 81h 10h 0Eh 88h 81h 10h 0Fh 88h 81h 10h 14h 88h 81h 10h 15h	0000 0000 0004 0000 0000 0000 0000 0000	
81	Volume / 1st previous month	6.26*02	Instantaneous value	88h 01h 14h 88h 01h 15h	0000 0000 0002 0000 0000 0000 0000 0000	
80	Date and time	9.36	Instantaneous value	08h 6Dh	0000 0000 0001 0000 0000 0000 0000 0000	
79	Flowrate time meter	9.31	Instantaneous value	08h 26h 08h 27h	0000 0000 0000 8000 0000 0000 0000 0000	X
78	Flowrate time meter / previous year	9.31*01	Instantaneous value	48h 26h 48h 27h	0000 0000 0000 4000 0000 0000 0000 0000	X
77	Flowrate time meter / 1st previous month	9.31*02	Instantaneous value	88h 01h 26h 88h 01h 27h	0000 0000 0000 2000 0000 0000 0000 0000	X
76	Device number pulse input 1	9.0.1	Instantaneous value	88h 40h 78h	0000 0000 0000 1000 0000 0000 0000 0000	X
75	Medium for pulse input 1	9.5*04	Instantaneous value	88h 40h FDh 09h	0000 0000 0000 0800 0000 0000 0000 0000	X
74	Meter reading pulse input 1	8.26.1	Instantaneous value	88h 40h 15h 88h 40h 16h	0000 0000 0000 0400 0000 0000 0000 0000	X
73	Meter reading pulse input 1 / previous year	8.26.1*01	Instantaneous value	C8h 40h 15h C8h 40h 16h	0000 0000 0000 0200 0000 0000 0000 0000	X
72	Meter reading pulse input 1 / 1st previous month	8.26.1*02	Instantaneous value	88h 41h 15h 88h 41h 16h	0000 0000 0000 0100 0000 0000 0000 0000	X
71	Device number pulse input 2	9.0.2	Instantaneous value	88h 80h 40h 78h	0000 0000 0000 0080 0000 0000 0000 0000	X
70	Medium for pulse input 2	9.5*04	Instantaneous value	88h 80h 40h FDh 09h	0000 0000 0000 0040 0000 0000 0000 0000	X
69	Meter reading pulse input 2	8.26.2	Instantaneous value	88h 80h 40h 15h 88h 80h 40h 16h	0000 0000 0000 0020 0000 0000 0000 0000	X

Table 2.5 Value pool of the values that can be output by the M-bus module of the 4th generation onto the M-bus

Reference number	Value pool	Source or ID number in the optional telegram	Value type	Selection ID DIFs + VIFs	TelBitCode	new in G4
68	Meter reading pulse input 2 / previous year	8.26.2*01	Instantaneous value	C8h 80h 40h 15h C8h 80h 40h 16h	0000 0000 0000 0010 0000 0000 0000 0000	X
67	Meter reading pulse input 2 / 1st previous month	8.26.2*02	Instantaneous value	88h 81h 40h 15h 88h 81h 40h 16h	0000 0000 0000 0008 0000 0000 0000 0000	X
66	Error flags heat meter (device-specific)	Dynamic M-bus parameter	Instantaneous value	08h FDh 17h	0000 0000 0000 0004 0000 0000 0000 0000	X
65	Read-out meter UH50	9.68	Instantaneous value	08h FDh 08h	0000 0000 0000 0002 0000 0000 0000 0000	X
64	Storage date 1st prev. month	9.36.6*02	Instantaneous value	88h 01h 6Dh	0000 0000 0000 0001 0000 0000 0000 0000	X
63	Maximum temperature difference / 1st prev. month	9.40*02	Maximum value	98h 11h 62h	0000 0000 0000 0000 8000 0000 0000 0000	X
62	Timestamp maximum temperature difference / 1st prev. month	9.36.70*02	Maximum value	98h 11h E2h 6Fh	0000 0000 0000 0000 4000 0000 0000 0000	X
61	Yearly set day (23:59 instead of 24:00) (G4-compatible: Type F)	6.36	Instantaneous value	48h 6Dh	0000 0000 0000 0000 2000 0000 0000 0000	X
60	Spare	--	--	--	0000 0000 0000 0000 0000 0000 0000 0000	
59	Spare	--	--	--	0000 0000 0000 0000 0000 0000 0000 0000	
58	Spare	--	--	--	0000 0000 0000 0000 0000 0000 0000 0000	
:	:	:	:	:	:	
:	:	:	:	:	:	
1	Spare	--	--	--	0000 0000 0000 0000 0000 0000 0000 0000	
0	Spare	--	--	--	0000 0000 0000 0000 0000 0000 0000 0000	

Table 2.6 Value pool of the values that can be output by the M-bus module of the 4th generation onto the M-bus

In the table below, entire value groups can be called up with a selection ID (with DIFs and VIFs) for the sake of simplicity.

Line	Value pool	Selection ID DIFs + VIFs	TelBitCode	new in G4
1	All update times	C8 3F 74	1000 0000 0000 0000 0000 0000 0000 0000	
2	All averaging times	C8 3F 70	0800 0000 0000 0000 0000 0000 0000 0000	
3	All heat quanitites	C8 3F 06 C8 3F 07 C8 3F 0E C8 3F 0F	0404 001F 803C 0000 0000 0000 0000 0000	
4	All volumes	C8 3F 14 C8 3F 15	0208 0000 0002 0000 0000 0000 0000 0000	
5	All heat powers	C8 3F 2D	0100 E000 0180 0000 0000 0000 0000 0000	
6	All flowrates	C8 3F 3B	0080 0000 0600 0000 0000 0000 0000 0000	
7	All flow temperatures	C8 3F 5B	0040 0800 6000 0000 0000 0000 0000 0000	
8	All return temperatures	C8 3F 5F	0020 0400 1800 0000 0000 0000 0000 0000	
9	All temperature differences	C8 3F 62	0010 0000 0000 0000 0000 0000 0000 0000	
10	All serial numbers	C8 3F 78	0002 0000 0000 0000 0000 0000 0000 0000	
11	All operating times	C8 3F 22 C8 3F 23	0000 0200 0000 E000 0000 0000 0000 0000	
12	All time stamps	C8 3F 6C	0000 2000 2A80 0000 4000 0000 0000 0000	
13	All pulse input values pulse input 1	C8 7F 15 C8 7F 16	0000 0000 0000 1F00 0000 0000 0000 0000	X
14	All pulse input values pulse input 2	C8 BF 40 15 C8 BF 40 16	0000 0000 0000 00F8 0000 0000 0000 0000	X

Table 2.7 Value pool of the values that can be output by the M-bus module of the 4th generation onto the M-bus

5.2 Description of the data telegrams

5.2.1 Assignment of tariff numbers, storage numbers and units

Among other things, the data information fields (DIF or DIFE) contain the encrypted tariff of a value output onto the M-bus. The assignment of the tariff number to tariffs is not defined as mandatory in the standards.

For the M-bus modules of Landis+Gyr, the following applies:

- Tariff 1 corresponds to a maximum value
- Tariff 2 corresponds to tariff register 1
- Tariff 3 corresponds to tariff register 2
- Tariff 4 corresponds to tariff register 3

The storage numbers in the data information fields (DIF or DIFE) are not defined as mandatory in the standards either.

For the M-bus modules of Landis+Gyr, the following applies:

- 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 ….

The unit numbers in the extension data information fields (DIFE) have the following assignment in the M-bus modules of generation 4:

- Data of unit 0 are assigned to the meter
- Data of unit 1 are assigned to pulse input 1
- Data of unit 2 are assigned to pulse input 2

5.2.2 Identification of the M-bus function in the data telegram

In all read-out modes except for fast read-out mode with G2-compatible data output and in the fixed-length frame, the M-bus module provides in the manufacturer-specific part of the response telegram an information byte in whose low nibble the current read-out mode, and in whose high nibble the output control byte is coded:

	Read-out mode output type	Value of the information byte	Can be identified by
Read-out mode	Normal read-out mode	x0	Fourth byte in the manufacturer-specific data record
	Fast read-out mode	x1	Fourth byte in the manufacturer-specific data record (modern output) or not transferred (compatible output) but there it is the only response telegram with CI=0x72 and without a manufacturer-specific data record
	Previous month's read-out mode	x8	Fourth byte in the manufacturer-specific data record
	EEPROM read-out mode	x9	Last byte in the manufacturer-specific data record
	Info telegram read-out mode	xA	Last byte in the manufacturer-specific data record
Output control byte	G4-compatible output	0y	
	G2-compatible output	1y	
	Fixed-length frame	(2y)	Not transferred in normal and fast read-out mode, but there it is the only response telegram with CI=0x73

Table 5 Assignment of information byte to read-out mode and output type

5.2.3 G2-compatibility mode

An M-bus module of generation 4 can be used in the same way as an M-bus module of the previous generation 2.

5.2.4 Complete data telegram in normal read-out mode

The telegram described below is just an example. The sequence and type of values output on the M-Bus is not a warranted feature.

Table 6: Data telegram in normal read-out mode

Telegram bytes	Explanation	DIN EN 62056-21
68h L L 68h	Frame of fixed length, L = length	
08h	Response with data	
A	A = M-bus address (1 byte)	9.6
72h	LSB first, header of 12 bytes length	
78h 56h 34h 12h	Secondary address = ownership number, e.g. 12345678	9.21
A7h 32h	Manufacturer identification for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)	
04h	M-bus module generation 4	
04h	Medium: Heat	
Z	Z = Acces No.(1 byte)	
S	S = Status (1 byte) Bit 0..4: acc. to EN 13575-3 telegram bytes Bit 5: 1 = negative heat power Bit 6: 1 = negative flowrate Bit 7: 1 = negative temperature difference	(F)
00h 00h	Signature	
09h	DIF: 2-digit BCD, no DIFE, instantaneous value	
74h	VIF: updating time in seconds	
04h	4 seconds	
09h	DIF: 2-digit BCD, no DIFE, instantaneous value	
70h	VIF: Averaging time in seconds	
08h	8 seconds	
0Ch	DIF: 8-digit BCD, no DIFE, instantaneous value	6.8
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
0Ch	DIF: 8-digit BCD, no DIFE, instantaneous value	6.26
14h/15h	VIF: Volume (m^3*1/100, m^3*1/10)	
78h 56h 34h 12h	123456.78 m^3	
0Bh	DIF: 6-digit BCD, no DIFE, instantaneous value	6.4
2Dh/2Eh	VIF: Heat power (kW/10, kW)	
56h 34h 12h	12345.6 kW	
0Bh	DIF: 6-digit BCD, no DIFE, instantaneous value	6.27
3Bh	VIF: Flowrate (l/h)	
56h 34h 12h	123.456 m^3/h	
0Ah	DIF: 4-digit BCD, no DIFE, instantaneous value	6.29
5Bh	VIF: Flow temperature (°C)	
23h 01h	123 °C	
0Ah	DIF: 4-digit BCD, no DIFE, instantaneous value	6.28
5Fh	VIF: Return temperature (°C)	
23h 01h	123 °C	
0Ah	DIF: 4-digit BCD, no DIFE, instantaneous value	6.30
62h	VIF: Temperature difference (°C/10)	
34h 12h	123.4 °C	

Telegram bytes	Table 6: Data telegram in normal read-out mode Explanation	DIN EN 62056-21
4Ch	DIF: 8-digit BCD, no DIFE, storage number 1 = previous year's value	6.26*01
14h/15h	VIF: Volume (m^3*1/100, m^3*1/10)	
78h 56h 34h 12h	123456.78 m^3	
4Ch	DIF: 8-digit BCD, no DIFE, storage number 1 = previous year's value	6.8*01
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
0Ch	DIF: 8-digit BCD, no DIFE, instantaneous value	9.20
78h	VIF: Serial No.	
78h 56h 34h 12h	12345678	
89h	DIF: 2-digit BCD, DIFE follows, instantaneous value	6.35
10h	DIFE: Tariff = 1	
71h/72h	VIF: Averaging time in minutes/hours	
07h/15h/30h/60h/ 03h/06h/12h/24h	7(.5)/15/30/60 minutes/3/6/12/24 hours	
9Bh	DIF: 6-digit BCD, DIFE follows, maximum	6.6
10h	DIFE: Tariff = 1	
2Dh/2Eh	VIF: Heat power (kW/10, kW)	
56h 34h 12h	12345.6 kW	
DBh	DIF: 6-digit BCD, DIFE follows, maximum, storage number 1 = previous year's value	6.6*01
10h	DIFE: Tariff = 1	
2Dh/2Eh	VIF: Heat power (kW/10, kW)	
56h 34h 12h	12345.6 kW	
9Bh	DIF: 6-digit BCD, DIFE follows, maximum	6.33
10h	DIFE: Tariff = 1	
3Bh	VIF: Flowrate (l/h)	
56h 34h 12h	123.456 m^3/h	
9Ah	DIF: 4-digit BCD, DIFE follows, maximum	9.4
10h	DIFE: Tariff = 1	
5Bh	VIF: Flow temperature (°C)	
23h 01h	123 °C	
9Ah	DIF: 4-digit BCD, DIFE follows, maximum	9.4
10h	DIFE: Tariff = 1	
5Fh	VIF: Return temperature (°C)	
23h 01h	123 °C	
0Ch	DIF: 8-digit BCD, no DIFE, instantaneous value	6.31
22h/23h	VIF: ON time (hours/days) = operating hours/days	
78h 56h 34h 12h	12345678 days	
3Ch	DIF: 8-digit BCD, no DIFE, value during error	6.32
22h/23h	VIF: ON time (hours/days) = missing hours/days	
78h 56h 34h 12h	12345678 days	
7Ch	DIF: 8-digit BCD, no DIFE, value during error, storage number 1 = previous year's value	6.32*01
22h/23h	VIF: ON time (hours/days) = missing hours/days	
78h 56h 34h 12h	12345678 days	
42h	DIF: 16-bit integer, DIFE follows, Storage number 1 = previous year's value	6.36
6Ch	VIF: Time = set day; data type G	

Telegram bytes	Table 6: Data telegram in normal read-out mode Explanation	DIN EN 62056-21
01h 01h	Set day 01.01.; year of the set day is always 0 because not available in the meter	
8Ch	DIF: 8-digit BCD, DIFE follows, instantaneous value	6.8.1/ 6.8.2/ 6.8.3
20h	DIFE: Tariff = 2; i.e. tariff register 1	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
8Ch	DIF: 8-digit BCD, DIFE follows, instantaneous value	6.8.4
30h	DIFE: Tariff = 3; i.e. tariff register 2	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
8Ch	DIF: 8-digit BCD, DIFE follows, instantaneous value	6.8.5
80h	DIFE: DIFE follows	
10h	DIFE: Tariff = 4; i.e. tariff register 3	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
CCh	DIF: 8-digit BCD, DIFE follows, instantaneous value, storage number 1 = previous year's value	6.8.1*01/ 6.8.2*01/ 6.8.3*01
20h	DIFE: Tariff = 2; i.e. tariff register 1	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
CCh	DIF: 8-digit BCD, DIFE follows, instantaneous value, storage number 1 = previous year's value	6.8.4*01
30h	DIFE: Tariff = 3; i.e. tariff register 2	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
CCh	DIF: 8-digit BCD, DIFE follows, instantaneous value, storage number 1 = previous year's value	6.8.5*01
80h	DIFE: DIFE follows	
10h	DIFE: Tariff = 4; i.e. tariff register 3	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
9Ah	DIF: 4-digit BCD, DIFE follows, maximum	9.4*02
11h	DIFE: Tariff = 1, memory no. 2 = 1st previous month's value	
5Bh	VIF: Flow temperature (°C)	
23h 01h	123 °C	
9Ah	DIF: 4-digit BCD, DIFE follows, maximum	9.4*02
11h	DIFE: Tariff = 1, memory no. 2 = 1st previous month's value	
5Fh	VIF: Return temperature (°C)	
23h 01h	123 °C	
9Bh	DIF: 6-digit BCD, DIFE follows, maximum	6.33*02
11h	DIFE: Tariff = 1, memory no. 2 = 1st previous month's value	
3Bh	VIF: Flowrate (l/h)	
56h 34h 12h	123,456 m3/h	
9Bh	DIF: 6-digit BCD, DIFE follows, maximum	6.6*02
11h	DIFE: Tariff = 1, memory no. 2 = 1st previous month's value	
2Dh/2Eh	VIF: Heat power (kW/10, kW)	
56h 34h 12h	12345.6 kW	
BCh	DIF: 8-digit BCD, DIFE follows, value during error	6.32*02

Telegram bytes	Table 6: Data telegram in normal read-out mode Explanation	DIN EN 62056-21
01h	DIFE: Storage number 2 = 1st previous month's value	
22h/23h	VIF: ON time (hours/days) = missing hours/days	
78h 56h 34h 12h	12345678 days	
8Ch	DIF: 8-digit BCD, DIFE follows	6.8*02
01h	DIFE: Storage number 2 = 1st previous month's value	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
8Ch	DIF: 8-digit BCD, DIFE follows, instantaneous value	6.8.1*02/ 6.8.2*02/ 6.8.3*02
21h	DIFE: Tariff = 2; i.e. tariff register 1 Storage number 2 = 1st previous month's value	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
8Ch	DIF: 8-digit BCD, DIFE follows, instantaneous value	6.8.4*02
31h	DIFE: Tariff = 3; i.e. tariff register 2 Storage number 2 = 1st previous month's value	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
8Ch	DIF: 8-digit BCD, DIFE follows, instantaneous value	6.8.5*02
81h	DIFE: DIFE follows, memory no. 2 = 1st prev. month's value	
10h	DIFE: Tariff = 4; i.e. tariff register 3	
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
8Ch	DIF: 8-digit BCD, DIFE follows	6.26*02
01h	DIFE: Storage number 2 = 1st previous month's value	
14h/15h	VIF: Volume (m^3*1/100, m^3*1/10)	
78h 56h 34h 12h	123456.78 m^3	
04h	DIF: 32-bit integer, no DIFE, instantaneous value	9.36
6Dh	VIF: Time; data type F	
00h 0Bh CCh 19h	Date and time of meter	
0Fh	DIF: Manufacturer-specific data	9.7
01h 04h	Firmware version 04.01	
00h	Reserved	
10h	Information byte: G2-compatible output, normal mode see Table 5 Assignment of information byte to read-out mode and output type	
20h	Extension byte D0 with additional information D0.0 = 1 **à** F0 prewarning D0.5 = 1 **à** Automatic baudrate detection D0.6 = 1 **à** User lock set D0.7 = 0 **à** Installation in return / D0.7: = 1 **à** Installation in flow	
CS	CS = checksum (1 byte)	
16h	Stop character	

Table 6 Output of the values for G2-compatible output in normal mode

5.2.5 Complete data telegram in fast read-out mode

The telegram described below is just an example. The sequence and type of values output on the M-Bus is not a warranted feature.

Telegram bytes	Table 7: Data telegram in fast read-out mode Explanation	DIN EN 62056-21
68h L L 68h	Header of the long frame, L = length data	
08h	Response with data	
A	A = M-bus address (1 byte)	9.6
72h	LSB first, header of 12 bytes length	
78h 56h 34h 12h	Secondary address = ownership number, e.g. 12345678	9.21
A7h 32h	Manufacturer identification for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)	
04h	M-bus module generation 4	
04h	Medium: Heat	
Z	Z = Acces No.(1 byte)	
S	S = Status (1 byte) Bit 0..4: acc. to EN 13575-3 telegram bytes Bit 5: 1 = negative heat power Bit 6: 1 = negative flowrate Bit 7: 1 = negative temperature difference	(F)
00h 00h	Signature	
09h	DIF: 2-digit BCD, no DIFE, instantaneous value	
74h	VIF: updating time in seconds	
04h	4 seconds	
09h	DIF: 2-digit BCD, no DIFE, instantaneous value	
70h	VIF: Averaging time in seconds	
04h	4 seconds	
0Ch	DIF: 8-digit BCD, no DIFE, instantaneous value	6.8
06h/07h/0Eh/0Fh	VIF: Heat quantity (kWh, MWh/100, MJ, GJ/100)	
78h 56h 34h 12h	12345678 kWh/MJ	
0Ch	DIF: 8-digit BCD, no DIFE, instantaneous value	6.26
14h/15h	VIF: Volume (m^3*1/100, m^3*1/10)	
78h 56h 34h 12h	123456.78 m^3	
0Bh	DIF: 6-digit BCD, no DIFE, instantaneous value	6.4
2Dh/2Eh	VIF: Heat power (kW/10, kW)	
56h 34h 12h	12345.6 kW	
0Bh	DIF: 6-digit BCD, no DIFE, instantaneous value	6.27
3Bh	VIF: Flowrate (l/h)	
56h 34h 12h	123.456 m^3/h	
0Ah	DIF: 4-digit BCD, no DIFE, instantaneous value	6.29
5Bh	VIF: Flow temperature (°C)	
23h 01h	123 °C	
0Ah	DIF: 4-digit BCD, no DIFE, instantaneous value	6.28
5Fh	VIF: Return temperature (°C)	
23h 01h	123 °C	
CS	CS = checksum (1 byte)	
16h	Stop character	

Table 7 Output of the values for G2-compatible output in fast read-out mode

Special aspect: In the case of G2-compatible output, the manufacturer-specific part of the data output is suppressed; in G4-compatible output it is transmitted:

Telegram bytes	Table 8: Data telegram in fast read-out mode, G4 compatible Explanation	DIN EN 62056-21
68h L L 68h	Header of the long frame, L = length data	
08h	Response with data	
A	A = M-bus address (1 byte)	9.6
72h	LSB first, header of 12 bytes length	
78h 56h 34h 12h	Secondary address = ownership number, e.g. 12345678	9.21
A7h 32h	Manufacturer identification for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)	
04h	M-bus module generation 4	
04h	Medium: Heat	
Z	Z = Acces No.(1 byte)	
S	S = Status (1 byte) Bit 0..4: acc. to EN 13757-3 telegram bytes Bit 5: 1 = negative heat power Bit 6: 1 = negative flowrate Bit 7: 1 = negative temperature difference	(F)
00h 00h	Signature	
0Ah	DIF: 4-digit BCD, no DIFE, instantaneous value	6.28
5Eh	VIF: Return temperature (°C) with 1 decimal place	
30h 12h	123.0 °C	
0Fh	DIF: Manufacturer-specific data	9.7
01h 04h	Firmware version 04.01	
00h	Reserved	
01h	Information byte: G4-compatible output, fast read-out mode see Table 5 Assignment of information byte to read-out mode and output type	
20h	Extension byte D0 with additional information D0.0 = 1 **à** F0 prewarning D0.5 = 1 **à** Automatic baudrate detection D0.6 = 1 **à** User lock set D0.7 = 0 **à** Installation in return / D0.7: = 1 **à** Installation in flow	
CS	CS = checksum (1 byte)	
16h	Stop character	

Table 8 Output of the values for G4-compatible output in fast read-out mode

5.2.6 Data telegram in previous month's read-out mode

With the command

"68h 06h 06h 68 53h/73h A 51h 0Fh A8h Mon CS 16h"

the M-bus module is switched over to the previous month's read-out mode.
At the same time, the module fetches the data with the variable "Mon" of the previous month's group from the meter.
With the read command REQ_UD2, the data of the previous month's group are output onto the M-bus.

The length of the fixed-length frame is different depending on the previous month that is read out:

- From the 1st to the 30th previous month, one DIF and one DIFE are enough to represent storage number 2 to storage number 31 (see Table 9).
- Above the 31st previous month, one DIF and two DIFEs are required to represent storage number 32 to storage number 61 (see 2nd example in Table 10).

Telegram bytes	Table 9: Data telegram in previous month's read-out mode **Explanation**	**DIN EN 62056-21**
68h A0h A0h 68h	Header of the long frame, L = length data	
08h	Response with data	
2Dh	A = M-bus address (1 byte), e.g. 45	9.6
72h	LSB first, header of 12 bytes length	
11h 22h 33h 45h	Secondary address = ownership number, e.g. 45332211	9.21
A7h 32h	Manufacturer identification for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)	
04h	M-bus module generation 4	
04h	Medium: Heat	
02h	Acces No.(1 byte), e.g.: 2	
00h	Status (1 byte) Bit 0..4: acc. to EN 13575-3 telegram bytes Bit 5: 1 = negative heat power Bit 6: 1 = negative flowrate Bit 7: 1 = negative temperature difference	(F)
00h 00h	Signature	
9Ah 11h	DIF+DIFE: 4-digit BCD, maximum, tariff 1, storage number 2	
5Ah	VIF: Flow temperature in °C with 1 decimal place	
70h 09h	097.0 °C **à** Maximum flow temperature, 1st previous month	9.4*02
94h 11h	DIF+DIFE: 32-bit integer, maximum, tariff 1, storage number 2	
DAh	VIF, VIFE follows: Flow temperature in °C, 1 decimal place	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
00h 00h 01h 1Bh	01.11. 2008 00:00 **à** Timestamp of max. flow temperature 1st previous month	9.36.3*02
9Ah 11h	DIF+DIFE: 4-digit BCD, maximum, tariff 1, storage number 2	
5Eh	VIF: Return temperature in °C with 1 decimal place	
60h 03h	036.0 °C **à** Maximum return temperature, 1st previous month	9.4*02
94h 11h	DIF+DIFE: 32-bit integer, maximum, tariff 1, storage number 2	
DEh	VIF, VIFE follows: Return temperature in °C, 1 decimal place	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
2Dh 0Dh 04h 1Bh	04.11. 2008 13:45 **à** Timestamp of max. return temperature 1st previous month	9.36.4*02

Telegram bytes	Table 9: Data telegram in previous month's read-out mode Explanation	DIN EN 62056-21
9Bh 11h	DIF+DIFE: 6-digit BCD, maximum, tariff 1, storage number 2	
3Bh	VIF: Volumetric flow in m^3/h with 3 decimal places	
48h 00h 00h	000.048 m^3/h **à** Maximum flowrate, 1st previous month	6.33*02
94h 11h	DIF+DIFE: 32-bit integer, maximum, tariff 1, storage number 2	
BBh	VIF, VIFE follows: Volumetric flow in m^3/h with 3 decimal places	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
0Fh 02h 07h 1Bh	07.11. 2008 02:15 o'clock **à** Timestamp max. flowrate, 1st previous month	9.36.2*02
9Bh 11h	DIF+DIFE: 6-digit BCD, maximum, tariff 1, storage number 2	
2Dh	VIF: Heat power in W x factor 100	
37h 00h 00h	000037 * 100 W **à** 3.7 kW maximum head power, 1st previous month	6.6.*02
94h 11h	DIF+DIFE: 32-bit integer, maximum, tariff 1, storage number 2	
ADh	VIF, VIFE follows: Heat power in W * factor 100	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
1Eh 07h 03h 1Bh	03.11. 2008 07:30 o'clock **à** Timestamp max. heat power, 1st previous month	9.36.1*02
BCh 01h	DIF+DIFE: 8-digit BCD, error value, storage number 2	
23h	VIF: Time in days	
87h 65h 43h 21h	21436587 Tage **à** Missing time, 1st previous month	6.32*02
8Ch 01h	DIF+DIFE: 8-digit BCD, instantaneous value, storage number 2	
06h	VIF: Heat quantity in kWh	
78h 56h 34h 12h	12345678 kWh **à** Heat quantity, 1st previous month	6.8*02
8Ch 21h	DIF+DIFE: 8-digit BCD, instantaneous value, tariff 2, storage number 2	
06h	VIF: Heat quantity in kWh	
78h 00h 00h 00h	00000078 kWh **à** Heat quantity, tariff register 1, 1st previous month	6.8.1*02 / 6.8.2*02 / 6.8.3*02
8Ch 31h	DIF+DIFE: 8-digit BCD, instantaneous value, tariff 3, storage number 2	
00h 78h 00h 00h	00007800 kWh **à** Heat quantity, tariff register 2, 1st previous month	6.8.4*02
8Ch 81h 10h	DIF+DIFE+DIFE: 8-digit BCD, instantaneous value, tariff 4, storage number 2	
06h	VIF: Heat quantity in kWh	
12h 00h 00h 00h	00000012 kWh **à** Quantity of heat, tariff register 3, 1st previous month	6.8.5*02
8Ch 01h	DIF+DIFE: 8-digit BCD, instantaneous value, storage number 2	
14h	VIF: Volume in with 2 decimal places	
17h 47h 02h 00h	000247.71 m^3 **à** Volume, 1st previous month	6.26*02
8Ch 01h	DIF+DIFE: 8-digit BCD, instantaneous value, storage number 2	
27h	VIF: Flowrate time in days	
21h 43h 65h 87h	87654321 days **à** Flowrate time, 1st previous month	9.31*02
8Ch 41h	DIF+DIFE: 8-digit BCD, instantaneous value, unit 1, storage number 2	
16h	VIF: Volume in m^3	
01h 02h 03h 04h	04030201 m^3 **à** Volume pulse input 1, 1st previous month	8.26.1*02
8Ch 81h 40h	DIF+DIFE+DIFE: 8-digit BCD, instantaneous value, unit 2, storage number 2	
16h	VIF: Volume in m^3	

Telegram bytes	Table 9: Data telegram in previous month's read-out mode Explanation	DIN EN 62056-21
02h 03h 04h 05h	05040302 m^3 **à** Volume pulse input 2, 1st previous month	8.26.2*02
84h 01h	DIF+DIFE: 32-bit integer, instantaneous value, storage number 2	
6Dh	VIF: Point in time Time/date type F per EN 13757-3 Annex A	
00h 00h 01h 1Ch	01.12. 2008 00:00 o'clock **à** Time of previous month's storage, 1st previous month	9.36.6*02
9Ah 11h	DIF+DIFE: 4-digit BCD, maximum, tariff 1, storage number 2	
62h	VIF: Temperature difference in °C with 1 decimal place	
10h 06h	061.0 °C **à** Maximum temperature difference, 1st previous month	9.40*02
9Ah 11h	DIF+DIFE: 32-bit integer, maximum, tariff 1, storage number 2	
E2h	VIF, VIFE follows: Temperature difference in °C with 1 decimal place	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
0Fh 05h 13h 1Bh	19.11. 2008 05:15 o'clock timestamp maximum temperature difference, 1st previous month	9.36.7*02
0Fh	DIF: Start of the manufacturer-specific data	
01h 04h	Firmware version 04.01	
00h	Reserved	
08h	Information byte: G4-compatible output, previous month's read-out mode see Table 5 Assignment of information byte to read-out mode and output type	
A0h	Extension byte D0 with additional information D0.0 = 1 **à** F0 prewarning D0.5 = 1 **à** Automatic baudrate detection D0.6 = 1 **à** User lock set D0.7 = 0 **à** Installation in return / D0.7: = 1 **à** Installation in flow	
CS	CS = checksum (1 byte)	
16h	Stop character	

Table 9 Output of the 1st previous month for G4-compatible output

The data fields in the previous month's memory are filled with "empty values" by default (e.g. 00h 00h 00h 00h). If a previous month's group for which no values have yet been stored in the meter is read out, these empty values are output.
In interpreting the timestamp of type F acc. to EN 13757-3 Annex A, the following must be considered:
A day with the value 0 means: This point in time is repeated daily. But if all four bytes of the timestamp read out have the value "00h," it is an "empty value."

Telegram bytes	Table 10: Data telegram for e.g.: 40th previous month's block Explanation	DIN EN 62056-21
68h B2h B2h 68h	Header of the long frame, L = length data	
08h	Response with data	
2Dh	A = M-bus address (1 byte), e.g. 45	9.6
72h	LSB first, header of 12 bytes length	
11h 22h 33h 45h	Secondary address = ownership number, e.g. 45332211	9.21
A7h 32h	Manufacturer identification for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)	
04h	M-bus module generation 4	
04h	Medium: Heat	
02h	Acces No.(1 byte), e.g.: 2	

Telegram bytes	Table 10: Data telegram for e.g.: 40th previous month's block Explanation	DIN EN 62056-21
00h	Status (1 byte) Bit 0..4: acc. to EN 13575-3 telegram bytes Bit 5: 1 = negative heat power Bit 6: 1 = negative flowrate Bit 7: 1 = negative temperature difference	(F)
00h 00h	Signature	
DAh 94h 01h	DIF+2DIFE: 4-digit BCD, maximum, tariff 1, storage number 41	
5Ah	VIF: Flow temperature in °C with 1 decimal place	
00h 00h	000.0 °C **à** Maximum flow temperature, 40th previous month	9.4*02
D4h 94h 01h	DIF+2DIFE: 32-bit integer, maximum, tariff 1, storage number 41	
DAh	VIF, VIFE follows: Flow temperature in °C, 1 decimal place	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
00h 00h 00h 00h	Empty value **à** Timestamp max. flow temperature, 40th previous month	9.36.3*41
DAh 94h 01h	DIF+2DIFE: 4-digit BCD, maximum, tariff 1, storage number 41	
5Eh	VIF: Return temperature in °C with 1 decimal place	
00h 00h	000.0 °C **à** Maximum return temperature, 40th previous month	9.4*41
DAh 94h 01h	DIF+2DIFE: 4-digit BCD, maximum, tariff 1, storage number 41	
DEh	VIF, VIFE follows: Return temperature in °C, 1 decimal place	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
00h 00h 00h 00h	Empty value **à** Timestamp max. return temperature, 40th previous month	9.36.4*41
DBh 94h 01h	DIF+2DIFE: 6-digit BCD, maximum, tariff 1, storage number 41	
3Bh	VIF: Volumetric flow in m^3/h with 3 decimal places	
00h 00h 00h	000.000 m^3/h **à** Maximum flowrate, 40th previous month	6.33*41
DBh 94h 01h	DIF+2DIFE: 6-digit BCD, maximum, tariff 1, storage number 41	
BBh	VIF, VIFE follows: Volumetric flow in m^3/h with 3 decimal places	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
00h 00h 00h 00h	Empty value **à** Timestamp max. flowrate , 40th previous month	9.36.2*41
DBh 94h 01h	DIF+2DIFE: 6-digit BCD, maximum, tariff 1, storage number 41	
2Dh	VIF: Heat power in W x factor 100	
00h 00h 00h	000000 * 100 W **à** 0 kW maximum heat power, 40th previous month	6.6.*41
D4h 94h 01h	DIF+2DIFE: 32-bit integer, maximum, tariff 1, storage number 41	
ADh	VIF, VIFE follows: Heat power in W * factor 100	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
00h 00h 00h 00h	Empty value **à** Timestamp max. heat power, 40th previous month	9.36.1*41
FCh 84h 01h	DIF+2DIFE: 8-digit BCD, error value, storage number 41	
23h	VIF: Time in days	
00h 00h 00h 00h	00000000 days **à** Missing time, 40th previous month	6.32*41
CCh 84 01h	DIF+2DIFE: 8-digit BCD, instantaneous value, storage number 41	
06h	VIF: Heat quantity in kWh	
00h 00h 00h 00h	00000000 kWh **à** Quantity of heat, 40th previous month	6.8*41
CCh A4h 01h	DIF+2DIFE: 8-digit BCD, instantaneous value, tariff 2, storage number 41	
06h	VIF: Heat quantity in kWh	
00h 00h 00h 00h	00000000 kWh **à** Quantity of heat, tariff register 1, 40th previous month	6.8.1*41 / 6.8.2*41 / 6.8.3*41
CCh B4 01h	DIF+2DIFE: 8-digit BCD, instantaneous value, tariff 3, storage number 41	

Telegram bytes	Table 10: Data telegram for e.g.: 40th previous month's block Explanation	DIN EN 62056-21
00h 00h 00h 00h	00000000 kWh **à** Quantity of heat, tariff register 2, 40th previous month	6.8.4*41
CCh 84h 11h	DIF+2DIFE: 8-digit BCD, instantaneous value, tariff 4, storage number 41	
06h	VIF: Heat quantity in kWh	
00h 00h 00h 00h	00000000 kWh **à** Quantity of heat, tariff register 3, 40th previous month	6.8.5*41
CCh 84h 01h	DIF+2DIFE: 8-digit BCD, instantaneous value, storage number 41	
14h	VIF: Volume in with 2 decimal places	
00h 00h 00h 00h	000000,00 m^3 **à** Volume, 40th previous month	6.26*41
CCh 84h 01h	DIF+2DIFE: 8-digit BCD, instantaneous value, storage number 41	
27h	VIF: Flowrate time in days	
00h 00h 00h 00h	00000000 days **à** Flowrate time, 40th previous month	9.31*41
CCh C4h 01h	DIF+DIFE: 8-digit BCD, instantaneous value, unit 1, storage number 41	
16h	VIF: Volume in m^3	
00h 00h 00h 00h	00000000 m^3 **à** Volume pulse input 1, 40th previous month	8.26.1*41
8Ch 81h 40h	DIF+2DIFE: 8-digit BCD, instantaneous value, unit 2, storage number 41	
16h	VIF: Volume in m^3	
00h 00h 00h 00h	00000000 m^3 **à** Volume pulse input 2, 40th previous month	8.26.2*41
C4h 84h 01h	DIF+2DIFE: 32-bit integer, instantaneous value, storage number 41	
6Dh	VIF: Point in time Time/date type F per EN 13757-3 Annex A	
00h 00h 00h 00h	Empty value **à** Point in time of previous month's storage 40th previous month	9.36.6*41
DAh 94h 01h	DIF+2DIFE: 4-digit BCD, maximum, tariff 1, storage number 41	
62h	VIF: Temperature difference in °C with 1 decimal place	
00h 00h	000.0 °C **à** Maximum temperature difference, 40th previous month	9.40*41
D4h 94h 01h	DIF+2DIFE: 32-bit integer, maximum, tariff 1, storage number 41	
E2h	VIF, VIFE follows: Temperature difference in °C with 1 decimal place	
6Fh	VIFE: Time/date type F per EN 13757-3 Annex A	
00h 00h 00h 00h	Empty value **à** Timestamp max. temperature difference, 40th previous month	9.36.7*41
0Fh	DIF: Start of the manufacturer-specific data	
01h 04h	Firmware version 04.01	
00h	Reserved	
08h	Information byte: G4-compatible output, normal mode see Table 5 Assignment of information byte to read-out mode and output type	
20h	Extension byte D0 with additional information D0.0 = 1 **à** F0 prewarning D0.5 = 1 **à** automatic baudrate detection D0.6 = 1 **à** User lock set D0.7 = 0 **à** Installation in return / D0.7: = 1 **à** Installation in flow	
CS	CS = checksum (1 byte)	
16h	Stop character	

Table 10 Output of the 40th previous month for G4-compatible output;
(in this example, nothing has yet been stored in the meter for the 40th previous month)

5.2.7 Data telegram in info telegram mode logbook

With the command

“68 06h 06h 68 53h/73h A 51h 0Fh AAh Log CS 16h”
with 00h for the variable “Log”

the M-bus module is switched over into the telegram mode for the logbook.
At the same time, the module fetches the data for the info telegram of the logbook from the meter.
With the read command REQ_UD2, the data of the info telegram for the logbook are output onto the M-bus.

How this M-bus output is to be interpreted is shown below.

Telegram bytes	Table 11: Info telegram logbook **Explanation**	**DIN EN 62056-21**
68h Lh Lh 68h	Header of the long frame, L = length data (e.g. 53h)	
08h	Response with data	
2Dh	A = M-bus address (1 byte), e.g. 45	9.6
72h	LSB first, header of 12 bytes length	
11h 22h 33h 44h	Secondary address = ownership number, e.g. 44332211	9.21
A7h 32h	Manufacturer identification for LUG ID = (ASCII(‘L’)-64)*32*32+(ASCII(‘U’)-64)*32+(ASCII(‘G’)-64)	
04h	M-bus module generation 4	
04h	Medium: Heat	
03h	Acces No.(1 byte), e.g.: 3	
00h	Status (1 byte) Bit 0..4: acc. to EN 13575-3 telegram bytes Bit 5: 1 = negative heat power Bit 6: 1 = negative flowrate Bit 7: 1 = negative temperature difference	(F)
00h 00h	Signature	
0Fh	DIF: Start of the manufacturer-specific data	
00h	Info byte about membership of info telegram (variable “Log”), e.g. 00h **à** Logbook	
30h 30h 3Ch 39h 30h 26h 30h 30h 3Ch 3Dh 3Fh 26h 30h 30h 3Ch 36h 30h 26h 30h 30h 3Ch 38h 37h 26h 30h 30h 38h 30h 30h 26h 30h 30h 38h 38h 34h 26h 30h 30h 38h 39h 30h 26h 30h 30h 3Bh 32h 3Fh 26h 30h 30h 3Bh 33h 30h 26h 30h 30h 3Bh 3Fh 37h 26h 30h 31h 26h 32h 30h	Block of data for the info telegram Length of the data block = length L(from line 1) – 12h bytes In this example: Length of the data block = 53h -12h Bytes = 41h bytes	

Telegram bytes	Table 11: Info telegram logbook Explanation	DIN EN 62056-21
0Ah	Information byte: G4-compatible output, info telegram mode see Table 5 Assignment of information byte to read-out mode and output type	
CS	CS = checksum (1 byte)	
16h	Stop character	

Table 11 Output of the info telegram for the logbook

Decoded, the block of data for the info telegram from the example looks like this:

Addr.:45 Nr.:44332211 Manuf.: LUG Gen.:4 Med.: Heat (installation in flow) Cnt.:3 Stat.:0
Info telelegram logbook:
00C90&00CDF&00C60&00C87&00800&00884&00890&00B2F&00B30&00BF7&01&20

The conversion from the received data block to plain-text output is described in Appendix B.

5.2.8 Data telegram in info telegram mode data logger

With the command

“68 06h 06h 68 53h/73h A 51h 0Fh AAh Log CS 16h”

For the data logger hourly archive, the variable “Log” has the value 01h.
For the data logger daily archive, the variable “Log” has the value 02h.
For the data logger monthly archive, the variable “Log” has the value 03h.
For the data logger yearly archive, the variable “Log” has the value 04h.

the M-bus module is switched over to the telegram mode for the data logger.
At the same time, the module fetches the data for the info telegram of the logbook from the meter.
With the read command REQ_UD2, the data of the info telegram for the logbook are output onto the M-bus.

How this M-bus output is to be interpreted is shown below.

Telegram bytes	Table 12: Info telegram data logger, e.g.: Hourly archive Exlanation	DIN EN 62056-21
68h Lh Lh 68h	Header of the long frame, L = length data (e.g. 50h)	
08h	Response with data	
2Dh	A = M-bus address (1 byte), e.g. 45	9.6
72h	LSB first, header of 12 bytes length	
11h 22h 33h 44h	Secondary address = ownership number, e.g. 44332211	9.21
A7h 32h	Manufacturer identification for LUG ID = (ASCII(‘L’)-64)*32*32+(ASCII(‘U’)-64)*32+(ASCII(‘G’)-64)	
04h	M-bus module generation 4	
04h	Medium: Heat	
03h	Acces No.(1 byte), e.g.: 3	
00h	Status (1 byte) Bit 0..4: acc. to EN 13575-3 telegram bytes Bit 5: 1 = negative heat power Bit 6: 1 = negative flowrate Bit 7: 1 = negative temperature difference	(F)

Telegram bytes	Table 12: Info telegram data logger, e.g.: Hourly archive Exlanation	DIN EN 62056-21
00h 00h	Signature	
0Fh	DIF: Start of the manufacturer-specific data	
01h	Info byte about membership of the info telegram (variable “Log”), i.e. 01h **à** Hourly archive data logger	
0Fh 01h 30h 35h 3Ah 33h 38h 26h 30h 3Fh 3Eh 3Bh 3Fh 26h 30h 30h 30h 30h 26h 30h 33h 31h 34h 26h 30h 31h 30h 35h 30h 3Bh 30h 3Ch 30h 3Eh 30h 3Fh 30h 39h 30h 3Ah 26h 30h 38h 26h 30h 33h 26h 30h 3Ch 26h 30h 30h 26h 30h 26h 30h 26h 30h 26h 30h 26h 30h 26h 30h	Block of data for the info telegram Length of the data block = length L (from line 1) – 12h bytes In this example: Length of the data block = 50h -12h Bytes = 3Eh bytes	
0Ah	Information byte: G4-compatible output, info telegram mode see Table 5 Assignment of information byte to read-out mode and output type	
CS	CS = checksum (1 byte)	
16h	Stop character	

Table 12 Output of the info telegram for the hourly archive of the data logger

Decoded, the block of data for the info telegram from the example looks like this:

Addr.:45 Nr.:44332211 Manuf.: LUG Gen.:4 Med.: Heat (installation in flow) Cnt.:3 Stat.:0
Info telelegram data logger hourly archive:
05A38&0FEBF&0000&0314&01050B0C0E0F090A&08&03&0C&00&0&0&0&0&0&0

The conversion from the received data block to plain-text output is described in Appendix C.

5.2.9 Data telegram in EEPROM read-out mode

With the command

“68 09h 09h 68 53h/73h A 51h 0Fh A9h Blk0 Blk1 Blk2 Blk3 CS 16h”

The variables Blk0, Blk1, Blk2, and Blk3 contain 5 characters for the initial address from which read-out from the EEPROM is to be performed and 3 characters for the number of bytes to be transmitted -1 byte in hexadecimal form “aaaaannn”.

Example: Read-out in the EEPROM is to be performed from address “1BCDEh” “228 bytes”. The address is already in hex format. From the number of the 228 bytes, one byte must be subtracted **à** 227 bytes; converted to hex format this is “3Eh”. The address parameter aaaa is “1BCDE,” the number parameter nnn is “0E3”. This means that Blk0 “1Bh,” Blk1 is “CDh” Blk2 is “E0h” and Blk3 is “3Eh”.

With the example command "68h 09h 09h 68 53h 2Dh 51h 0Fh A9h 1Bh CDh E0h 3Eh CS 16h," the module is switched over to EEPROM read-out mode.
At the same time, the module fetches the desired EEPROM data from the meter.
With the read command REQ_UD2, the EEPROM data are output onto the M-bus.

How this M-bus output is to be interpreted is shown below.

Telegram bytes	Table 13**:** Data telegram EEPROM read-out **Explanation**	**DIN EN 62056-21**
68h Lh Lh 68h	Header of the long frame, L = length data (e.g. 54h)	
08h	Response with data	
2Dh	A = M-bus address (1 byte), e.g. 45	9.6
72h	LSB first, header of 12 bytes length	
11h 22h 33h 44h	Secondary address = ownership number, e.g. 44332211	9.21
A7h 32h	Manufacturer identification for LUG ID = (ASCII('L')-64)*32*32+(ASCII('U')-64)*32+(ASCII('G')-64)	
04h	M-bus module generation 4	
04h	Medium: Heat	
05h	Acces No.(1 byte), e.g.: 3	
00h	Status (1 byte) Bit 0..4: acc. to EN 13575-3 telegram bytes Bit 5: 1 = negative heat power Bit 6: 1 = negative flowrate Bit 7: 1 = negative temperature difference	(F)
00h 00h	Signature	
0Fh	DIF: Start of the manufacturer-specific data	
Bh CDh E0h 3Eh	Info bytes via call parameter aaaaannn (Blk0 to Blk3)	
01h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 01h FFh 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 01h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 01h FFh 00h 00h 00h 00h 00h	Block of EEPROM data Length of the data block = length L(from line 1) – 15h bytes In this example: Length of the data block = 54h -15h Bytes = 3Fh bytes	
09h	Information byte: G4-compatible output, EEPROM read-out mode see Table 5 Assignment of information byte to read-out mode and output type	
CS	CS = checksum (1 byte)	
16h	Stop character	

Table 13 Output of the info telegram for the hourly archive of the data logger

Decoded, the block of data for the info telegram from the example looks like this:

Addr.:45 Nr.:44332211 Manuf.: LUG Gen.:4 Med.: Heat (installation in flow) Cnt.:3 Stat.:0
EEPROM data 03Eh + 1 bytes from address 1BCDEh
01h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 01h FFh 00h 00h 00h
00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 01h 00h 00h 00h 00h
00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 01h FFh 00h 00h 00h 00h 00h

The EEPROM data are transmitted in packed format to save battery capacity and time so that the bytes displayed in the “Block of EEPROM data” belong directly to the queried EEPROM data.

Notes:

1. The EEPROM uses “wrap around,” for read-out, which means:
   if the highest EEPROM address was reached and further data are read out in the same command during read-out, the read-out is continued with the EEPROM address “00000”.
2. The M-bus module can transmit up to 228 bytes of EEPROM data in one variable-length frame for reasons of syntax.
   If more data are requested in the read-out command, the module truncates the number of read-out data to 228 bytes.

5.2.10 RSP_SKE

The status request REQ_SKE is not supported by M-bus modules of generation 4.
To meet formal requirements, the M-bus module of generation 4 responds to a status request REQ_SKE with the response RSP_SKE as a short frame with the C-field = 0B:

10h 0Bh A CS 16h.

Appendix A
Explanation of pseudohex

The hex numbers in the value range 0h to 9h are represented as ASCII values in the normal way with 30h to 39h.

The hex numbers in the value range Ah to Fh are represented as ASCII values in the normal way with 4Ah to 5Ah. To simplify data transmission of the meter, we transmit these characters in pseudo-hex code: 3Ah to 3Fh (that corresponds to the following ASCII characters. “A” **à** “:”; “B” **à** “;”; “C” **à** “<”, “D” **à** “=”; “E” **à** “>”; and “F” **à** “?”).

Hex characters	**0..9**	**A**	**B**	**C**	**D**	**E**	**F**
Pseudo hex characters	**0..9**	**:**	**;**	**<**	**=**	**>**	**?**

Appendix B
Decoding of the info telegram for the logbook

The data block is decoded in the following steps:

The undecoded block is:
30h 30h 3Ch 39h 30h 26h 30h 30h 3Ch 3Dh 3Fh 26h 30h 30h 3Ch 36h 30h 26h 30h 30h 3Ch 38h 37h 26h 30h 30h 38h 30h 30h 26h 30h 30h 38h 38h 34h 26h 30h 30h 38h 39h 30h 26h 30h 30h 3Bh 32h 3Fh 26h 30h 30h 3Bh 33h 30h 26h 30h 30h 3Bh 3Fh 37h 26h 30h 31h 26h 32h 30h

First, all separators (&= ASCII characters 26h) are decoded:
30h 30h 3Ch 39h 30h **&** 30h 30h 3Ch 3Dh 3Fh **&** 30h 30h 3Ch 36h 30h **&** 30h 30h 3Ch 38h 37h **&** 30h 30h 38h 30h 30h **&** 30h 30h 38h 38h 34h **&** 30h 30h 38h 39h 30h **&** 30h 30h 3Bh 32h 3Fh **&** 30h 30h 3Bh 33h 30h **&** 30h 30h 3Bh 3Fh 37h **&** 30h 31h **&** 32h 30h

The characters between the separators (“&”) are now hex numbers coded in pseudo hex code (see Appendix A).

Hex numbers represented as digits:
0h 0h Ch 9h 0h **&** 0h 0h Ch Dh Fh **&** 0h 0h Ch 6h 0h **&** 0h 0h Ch 8h 7h **&** 0h 0h 8h 0h 0h **&** 0h 0h 8h 8h 4h **&** 0h 0h 8h 9h 0h **&** 0h 0h Bh 2h Fh **&** 0h 0h Bh 3h 0h **&** 0h 0h Bh Fh 7h **&** 0h 1h **&** 2h 0h

The result in plain text is:
00C90&00CDF&00C60&00C87&00800&00884&00890&00B2F&00B30&00BF7&01&20

Structure of the logbook info string:

Data =
(aaaaa&bbbbb&eeeee&fffff&ggggg&hhhhh&iiiii&kkkkk&lllll&mmmmm&nn&xx)
, with:

aaaaa, bbbbb	- Start and end address of the Q area
eeeee, fffff	- Start and end address of the device properties (MLFB)
ggggg, hhhhh	- Start and end address of the logbook previous month’s area
iiiii, kkkkk	- Start and end address of the logbook shift register
lllll, mmmmm	- Start and end address of the logbook circulating buffer
nn	- The meter’s internal month index
xx	- Type of EEPROM used

For the pure logbook info, the data from ggggg to nn are important.
From this data, a suitably programmed M-bus master can read out the EEPROM data from the meter using the EEPROM read-out command (see Section 5.2.9) and decode the logbook of the meter from this.

Appendix C

Decoding the info telegram for a data logger archive

The data block is decoded in the following steps:

The undecoded block is:
30h 35h 3Ah 33h 38h 26h 30h 3Fh 3Eh 3Bh 3Fh 26h 30h 30h 30h 30h 26h 30h 33h 31h 34h 26h 30h 31h 30h 35h 30h 3Bh 30h 3Ch 30h 3Eh 30h 3Fh 30h 39h 30h 3Ah 26h 30h 38h 26h 30h 33h 26h 30h 3Ch 26h 30h 30h 26h 30h 26h 30h 26h 30h 26h 30h 26h 30h 26h 30h

First, all separators (&= ASCII characters 26h) are decoded:
30h 35h 3Ah 33h 38h **&** 30h 3Fh 3Eh 3Bh 3Fh **&** 30h 30h 30h 30h **&** 30h 33h 31h 34h **&** 30h 31h 30h 35h 30h 3Bh 30h 3Ch 30h 3Eh 30h 3Fh 30h 39h 30h 3Ah **&** 30h 38h **&** 30h 33h **&** 30h 3Ch **&** 30h 30h **&** 30h **&** 30h **&** 30h **&** 30h **&** 30h **&** 30h

The characters between the separators (“&”) are now hex numbers coded in pseudo hex code (see Appendix A).

Hex numbers represented as digits:
0h 5h Ah 3h 8h **&** 0h Fh Eh Bh Fh **&** 0h 0h 0h 0h **&** 0h 3h 1h 4h **&** 0h 1h 0h 5h 0h Bh 0h Ch 0h Eh 0h Fh 0h 9h 0h Ah **&** 0h 8h **&** 0h 3h **&** 0h Ch **&** 0h 0h **&** 0h **&** 0h **&** 0h **&** 0h **&** 0h **&** 0h

The result in plain text is:
05A38&0FEBF&0000&0314&01050B0C0E0F090A&08&03&0C&00&0&0&0&0&0&0

Structure of the data logger info string:

Data =
SSSSS&XXXXX&ssss&xxxx&aabbccdeeffgghh&mm&nn&MS&TT&k&j&z&x&y&t;
with:

SSSSS = EEPROM start address for the archive;
XXXXX = EEPROM end address for the archive;
ssss = Start pointer in the queried archive;
xxxx = Pointer to current entry in the queried archive;
aa = Data source for channel 1;
bb = Data source for channel 2;
…
hh = Data source for channel 8;
mm = Data logger width (number of channels);
nn = Averaging time in the yearly archive
MS = volume measuring unit;
TT = Tariff type;
k = Flag EP_Kilo;
j = Flag EP_Joule;
z = Flag EP_BZeitStd;
x = Decimal place pulse input 1;
y = Decimal place pulse input 2;
t = Flag TF_VolReg;

From this data, a suitably programmed M-bus master can read out the EEPROM data from the meter using the EEPROM read-out command (see Section 5.2.9) and decode the data logger archive of the meter from this.

Appendix D

Decoding of error flags (binary) (device type specific)

With the selection DIF 08h and the VIF FDh 17h the manufacturer specific error flags of the UH50 can be selected.
Mit der Auswahl-DIF 08h und den VIFs FDh 17h können die herstellerspezifischen Fehlerflags des UH50 angewählt werden.

With the service software PappaWin the manufacturer specific error flags can be permanently configured to be part of the Mbus frame (TelBitCodes
„0000 0000 0000 0004 0000 0000 0000 0000“ (Reference number 66 ,Table 2,6).

Telegram bytes	Table 14: Decoding of error flags (binary) (device type specific) Explanation	DIN EN 62056-21
68h L L 68h	Header of the long frame, L = length data	
08h	Response with data	
A	A = M-bus address (1 byte)	9.6
72h	LSB first, header of 12 bytes length	
A7h 32h	Manufacturer identification for LUG ID = (ASCII(‘L’)-64)*32*32+(ASCII(‘U’)-64)*32+(ASCII(‘G’)-64)	
04h	M-bus module generation 4	
04h	Medium: Heat	
Z	Z = Acces No.(1 byte)	
S	S = Status (1 byte) Bit 0..4: acc. to EN 13757-3 telegram bytes Bit 5: 1 = negative heat power Bit 6: 1 = negative flowrate Bit 7: 1 = negative temperature difference	(F)
00h 00h	Signature	
02h	DIF: 16-bit integer, no DIFE, instantaneous value	
FDh 17h	VIF+ VIFE: Error flags (binary) (Device type specific)	
00h 07h	00h 07h (msb - 0000 0000 0000 0111 - lsb) i.e.: F0, F1, F2, exactly allocation of the 16 bits see Table 15	
0Fh	DIF: Manufacturer-specific data	9.7
01h 04h	Firmware version 04.01	
00h	Reserved	
01h	Information byte: G4-compatible output, fast read-out mode see Table 5 Assignment of information byte to read-out mode and output type	
21h	Extension byte D0 with additional information D0.0 = 1 **à** F0 prewarning D0.5 = 1 **à** Automatic baudrate detection D0.6 = 1 **à** User lock set D0.7 = 0 **à** Installation in return / D0.7: = 1 **à** Installation in flow	
CS	CS = checksum (1 byte)	
16h	Stop character	

Table 14 Example for output of device type specific error flags (binary)

Bit-No.	Identifier	Explanation
0	F0	Error during flow metering (e.g. Air in measuring pipe)
1	F1	Interruption of flow temperature sensor
2	F2	Interruption of return temperature sensor
3	F3	Electronic for temperature evaluation defective
4	F4[1]	Battery empty[1]
5	F5	Short-circuit flow temperature sensor
6	F6	Short-circuit return temperature sensor
7	F7	Fault in the internal memory (CRC)
8	F8	Error F1, F2, F5 or F6 pending for longer than 8h.
9	F9	Error in the electronics
10	F0V	Prewarning for soiling of the measurement tube
11	F7V [2]	Correctable error in the internal memory EEPROM[2]
12	-	Always 0
13	-	Always 0
14	-	Always 0
15	-	Always 0

Table 15 Mapping of device type specific error flags (binary)

[1] The UH50 with firmware 5.15 doubles the error bit F5 at the place of the F4. From UH50 > FW 5.15 the error is corrected.

[2] The UH50 with firmware 5.15 the bit for F7V is allways 1. From UH50 > FW 5.15 the error is corrected.