

ENERGY-INT 6

Communication description

Software Version 01



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1 Introduction

The M-Bus (Meter Bus) is a new European standard for remote reading of meters. It can be used for all types of consumption meters and for various sensors and actuators.

This document does not deal with the M-Bus protocol in detail. Further information about this can be found on the Internet at www.m-bus.com.

The RS-232 communication module is a serial interface for communication with external devices, e.g. a PC.

2 Communication interfaces

SHARKY-HEAT is equipped with three communication interfaces:

- Optical ZVEI: In the ZVEI interface, a light pulse or a missing light pulse corresponds to each bit.
- M-BUS: M-Bus communication is over a two-wire line. This interface is an open-collector output, not a floating contact.
- RS-232: The module board contains a 3-pole terminal strip with terminals marked DAT, REQ and GND (ground). This connection can be used in conjunction with the HYD cable adapter for PC communication.

2.1 Communication priorities

Mutual influence between interfaces:

| Interface | Priority |
|--------------|----------|
| Optical ZVEI | 1 |
| M-Bus | 2 |

| Interface | Priority |
|--------------|----------|
| Optical ZVEI | 1 |
| RS-232 | 2 |

The M-Bus and RS-232 interfaces can no longer be used during optical communication. Any communication in progress over the ZVEI interface is re-routed to the M-Bus when the M-Bus is detected.

2.2 Telegram formats

Communication complies with:

- IEC 870-5-1 Telecontrol equipment and systems; Transmission protocols; Section One - Transmission frame formats.

2.3 UART

Baud rates

- M-Bus: 300 and 2400 bauds (300 bauds: transmission in Interrupt Mode), no automatic baud rate switching
- RS-232: 300 and 2400 bauds
- ZVEI optical: 2400 bauds

Parity detection

to IEC 870-5-1; 8 data bits; parity even; 1 stop bit (8E1)

2.4 Protocol layer

1. IEC 870-5-1 corresponding to EN 1434-3
2. Data output (RSP_UD)
 - a) Variable protocol
 - b) Least Significant Byte first (Mode 1) for multi-byte variables
 - c) All response telegrams also available for C1 errors

2.5 Connection set-up for optical ZVEI

To activate the optical ZVEI interface, a '0' - '1' bit pattern must be sent continuously at 2400 bauds for 2.2 s (= 480 bytes + \$55 + 8 data bits + no parity + 1 stop bit). The actual communication can be started after a pause of 11 to 330 bit times (2400 bauds).

2.6 Connection set-up for M-Bus/RS-232

After connection to the M-Bus/RS-232, the MSP430 interface module needs max. 590 ms before it is ready for reliable communication. => A wait time of 590 ms must be observed between connection of the M-Bus/RS-232 and the start of communication.

2.7 Addressing

The meter can be addressed using two addressing variants: with a logic address (primary address) or by using a filter via its ex works identification (secondary address).

2.7.1 Selection (secondary address)

Request telegram: 68 0B 0B 68 53 FD 52 NN NN NN NN HH HH ID MM CS 16
 Response: E5 (only if filter matches)

Structure of filter:

| | | |
|--------------------------|------------------------|-----------------|
| 4-byte BCD | NN (serial number) | \$F digit joker |
| 2-byte HST | HH (manufacturer code) | \$FF byte joker |
| 1-byte ID (Sharky: \$28) | ID (ident. code) | \$FF joker |
| 1-byte SMED | MM (medium code) | \$FF joker |

After selection, the meter behaves as if it also had the primary address \$FD and can therefore be operated via the primary address \$FD (response always with own primary address).

2.7.2 Deselection

Request telegram: 10 40 FD CS 16
 Response: E5

To reliably end communication with the selected meter, the meter must be deselected. The primary address \$FD then becomes free again and can be used for communication with another meter.

3 Reading the meter:

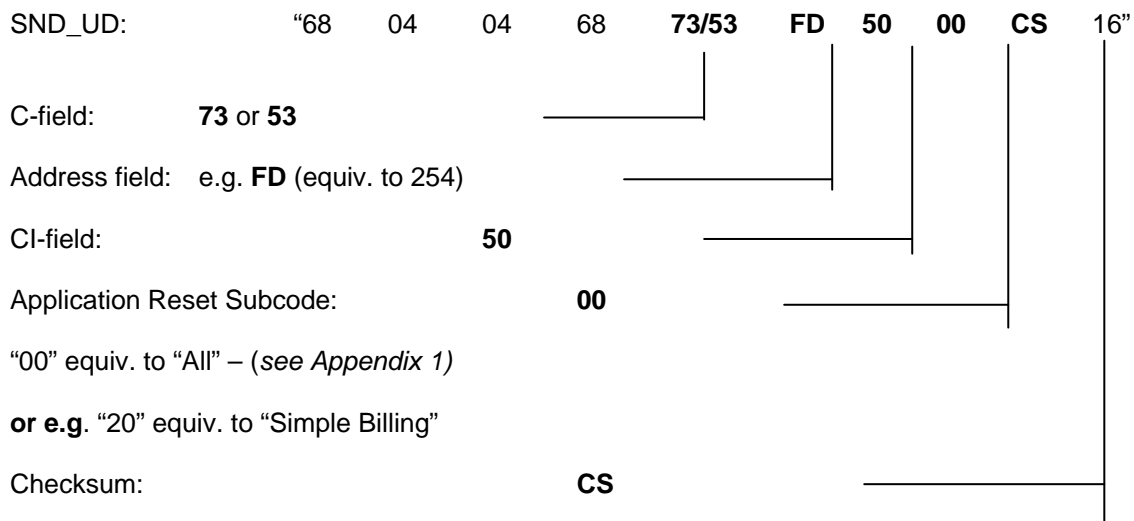
Procedure:

1. Define response – “Define response values”
2. Request response
3. Interpretation of data

3.1 Standard data reading (Application Reset 0)

Meter reading always uses a long frame with the following structure:

To make sure the standard value “0” (All) is obtained, an Application Reset should be carried out with subcode “0”:



3.2 Request response

The following command must be sent to obtain a response from the meter:

| Request telegram: | | Response |
|-------------------|----------------|----------|
| REQ_UD2 | 10 7B AA CS 16 | RSP_UD |

3.3 Interpretation of data

The data received basically corresponds to the protocol structure of EN1434-3. The unit definitions are contained in Appendix 2.

4 Customer telegram

Registers can be read or programmed direct in the meter using subtables.

The HYDRO-SET program from HYDROMETER can be used to set the customer telegram. This program can be downloaded at:

<http://www.hydrometer.com/systeme/download.html>

5 Parametrization of meter

The meter is equipped with a number of registers that can be set without breaking the calibration seal.

5.1 Structure of instruction set

| Byte | Meaning | Description/content/value |
|------------------|----------------------------|---------------------------|
| | Header Long Frame (HLF) | |
| HLF 1 | 1st start character | \$68 |
| HLF 2 | Long field | 3 + x |
| HLF 3 | Long field | 3 + x |
| HLF 4 | 2nd start character | \$68 |
| HLF 5 | C-field | \$53 SND_UD |
| HLF 6 | A-field | (Bus) address of meter |
| HLF 7 | CI-field | \$51 data send mode 1 |
| | Variable Data Blocks (VDB) | |
| VDB 1.. VDB x | | |
| | End of Long Frame (ALF) | |
| ALF 1 | Checksum | |
| ALF 2 | Stop character | \$16 |

5.2 Date and time

The date and time can be changed with the following telegram:

Send:

\$68 \$09 \$09 \$68 \$53 \$ FE \$51 **\$04 \$6D [Date Time (4-Byte Mbus Type F)]** Check \$16

Example: (15.05.2006):

\$68 \$09 \$09 \$68 \$53 \$FE \$51 \$04 \$6D \$0F \$0A \$CF \$05 \$00 \$16

Read: \$E5

5.3 New primary address

If VBD1 = \$01 and VDB2 = \$7A, VDB3 is used as new primary address.

Send: \$68 \$06 \$06 \$68 \$53 \$FE \$51 **\$01 \$7A [Address]** Check \$16

Example (address 5):

 \$68 \$06 \$06 \$68 \$53 \$FE \$51 **\$01 \$7A \$05** \$22 \$16

Read: \$E5

Special cases:

| A-field | Function | Use |
|---------|-------------------------------------|--------------------------|
| \$FD | Characters for secondary addressing | Secondary addressing |
| \$FE | Broadcast (to all) with response | Only one meter connected |
| \$FF | Broadcast (to all) without response | System-wide control |

5.4 Serial number / customer number

The new meter number NNUM can be defined with the following telegram:
4-byte BCD

Send: \$68 \$09 \$09 \$68 \$53 \$FE \$51 **\$0C \$79 NNUM** Check \$16

Example (SN 12345678):

 \$68 \$09 \$09 \$68 \$53 \$FE \$51 **\$0C \$79 \$78 \$56 \$34 \$12** \$3B \$16

Read: \$E5

Note: The NNUM is part of the secondary address.

5.5 New reading date 1

If VBD1 = \$44, VDB2 = \$ED and VDB3 = \$7E, VDB4 and VDB5 are used as new next reading date (data type F).

Send: \$68 \$10 \$10 \$68 \$53 \$FE \$51 **[DATE]** Check \$16

Example (01.05.2006) :

\$68 \$10 \$10 \$68 \$53 \$FE \$51 **\$42 \$EC \$7E \$C1 \$05** \$17 \$16

Read: \$E5

5.6 New reading date 2

If VBD1 = \$84, VDB2 = \$ED and VDB3 = \$7E, VDB4 and VDB5 are used as new next reading date (data type F).

Send: \$68 \$10 \$10 \$68 \$53 \$FE \$51 **[DATE]** Check \$16

Example (31.12.2006) :

\$68 \$11 \$11 \$68 \$53 \$FE \$51 **\$82 \$01 \$EC \$7E \$DF \$0C** \$7D \$16

Read: \$E5

5.7 Pulse input counter 1

If IMPIN1PL = 0, IMPCNT1 can be changed. This programming facility can be disabled by HYD!
4-byte BCD

Send: \$68 \$0B \$0B \$68 \$53 \$FE \$51 **\$8C \$40 \$FD \$3A** IMPCNT1 Check \$16

Example (55667788):

\$68 \$0B \$0B \$68 \$53 \$FE \$51 **\$8C \$40 \$FD \$3A \$88 \$77 \$66 \$55** \$5F \$16

Read: \$E5

5.8 Pulse input counter 2

If IMPIN2PL = 0, IMPCNT2 can be changed. This programming facility can be disabled by HYD!

4-byte BCD

Send: \$68 \$0B \$0B \$68 \$53 \$FE \$51 **\$8C \$80 \$40 \$FD \$3A IMPCNT1** Check \$16

Example (66554433):

 \$68 \$0B \$0B \$68 \$53 \$FE \$51 **\$8C \$80 \$40 \$FD 3A \$33 \$44 \$55 \$66** \$57 \$16

Read: \$E5

5.9 Clearing operating hours

If NCLROTC = 0, ONTIME can be cleared in the field by communication.

3-byte BCD

Send: \$68 \$08 \$08 \$68 \$53 \$FE \$51 **\$0B \$26 XX XX XX** Check \$16

Example (clearing):

 \$68 \$08 \$08 \$68 \$53 \$FE \$51 **\$0B \$26 \$00 \$00 \$00** \$D3 \$16

Read: E5

5.10 Clearing error day counter

If NCLREDC = 0, ERRDAY can be cleared in the field by communication.

1-byte BCD

Send: \$68 \$06 \$06 \$68 \$53 \$FE \$51 **\$39 \$27 XX** Check \$16

Example (clearing):

 \$68 \$06 \$06 \$68 \$53 \$FE \$51 **\$39 \$27 \$00** \$02 \$16

Read: E5

5.11 Monthly values (last month)

The monthly memory with a capacity of 24 months is located in the EEPROM at address 0x2300 to 0x28FF, with 64 bytes per month.

| Address | Month |
|---------|------------------------|
| 0x2300 | January of even year |
| 0x2340 | February of even year |
| 0x2380 | March of even year |
| 0x23C0 | April of even year |
| 0x2400 | May of even year |
| 0x2440 | June of even year |
| 0x2480 | July of even year |
| 0x24C0 | August of even year |
| 0x2500 | September of even year |
| 0x2540 | October of even year |
| 0x2580 | November of even year |
| 0x25C0 | December of even year |
| 0x2600 | January of odd year |
| 0x2640 | February of odd year |
| 0x2680 | March of odd year |
| 0x26C0 | April of odd year |
| 0x2700 | May of odd year |
| 0x2740 | June of odd year |
| 0x2780 | July of odd year |
| 0x27C0 | August of odd year |
| 0x2800 | September of odd year |
| 0x2840 | October of odd year |
| 0x2880 | November of odd year |
| 0x28C0 | December of odd year |

Each entry has the following structure:

| Value | Size | Type | Address |
|--------------------------------------|---------|--------------|---------|
| • Date | 2 bytes | M-Bus type G | 0 |
| • Energy 1/10 display value | 4 bytes | BCD | 2 |
| • Tariff energy 1 1/10 display value | 4 bytes | BCD | 6 |
| • Tariff energy 2 1/10 display value | 4 bytes | BCD | 10 |
| • Tariff definition 1 | 2 bytes | HY spec. | 14 |
| • Tariff definition 2 | 2 bytes | HY spec. | 16 |
| • Volume 1/10 display value | 4 bytes | BCD | 18 |
| • Error day counter | 1 byte | BCD | 22 |
| • Maximum monthly flow rate | 3 bytes | BCD | 23 |
| • Maximum monthly power | 4 bytes | BCD | 27 |
| • Day of maximum monthly flow rate | 1 byte | hex | 28 |
| • Day of maximum monthly power | 1 byte | hex | 29 |
| • Pulse counter 1 | 4 bytes | BCD | 30 |
| • Pulse counter 2 | 4 bytes | BCD | 34 |
| • IMPIN1DEF | 1 byte | HY spec. | 35 |
| • IMPIN2DEF | 1 byte | HY spec. | 36 |
| • ONTIME | 3 bytes | BCD | 39 |

5.11.1 Reading

Write read pointer to address

AppResSubCode 0xC0

Collect data (read pointer is always incremented by data block size)

- Check address, as possibly wrong if communication error
- Interpret response

5.11.2 Deletion

Deletion is not possible in the field, so do not write.

5.12 Deleting error log

The event memory with a capacity of 31 entries is located in the EEPROM at address 0x2284 to 0x22FF, with 4 bytes per entry. The administration data is located at address 0x2280.

| Address | Value | Type |
|---------|------------------|-----------------|
| 0x2280 | Save next index | hex mask = 0x7C |
| 0x2282 | Delete last date | M-Bus type G |
| 0x2284 | Index 0 | |
| 0x2288 | Index 1 | |
| | | |
| 0x22FC | Index 30 | |

Each entry has the following structure:

Byte 1

Event byte

| Mask | Source |
|------|-------------------------------|
| 0x01 | RAM checksum error |
| 0x02 | Back-up power supply |
| 0x04 | Temperature measurement error |
| 0x10 | Change of PLEV |
| 0xE0 | Program start counter |

Byte 2 and 3:

Date of saving (M-Bus data type G)

Byte 4 :

| Bit | Source |
|------|-------------|
| 0x1F | Hour |
| 0x20 | Leak at In1 |
| 0x40 | Leak at In2 |
| 0x80 | Data change |

5.12.1 Reading

Write read pointer to address

AppResSubCode 0xC0

Collect data

- Check address, as possibly wrong if communication error
- Interpret response

5.12.2 Set read pointer

Send:

\$68 \$0D \$0D \$68 \$53 \$FE \$51 \$2F \$0F \$00 \$01 \$6E \$03 \$03 AdrLo AdrHi \$80Check \$16

Example (0x2300):

\$68 \$0D \$0D \$68 \$53 \$FE \$51 \$2F \$0F \$00 \$01 \$6E \$03 \$03 \$00 \$23 \$80 Check \$16

Read: \$E5

6 Appendix 1

Application Reset Subcode:

| Application Reset Subcode | Telegram data |
|---------------------------|---|
| 0 "All" | Current energy Current tariff energy 1 Current tariff energy 2 Current volume Current power CURRENT FLOW RATE Current forward temperature T_H Current return temperature T_C Current temperature difference Current operating hours Current date and time Reading date 1 (memory number = 1) <ul style="list-style-type: none"> • Energy • Volume • Tariff energy 1 • Tariff energy 2 • Date • Next reading date 1 Reading date 2 (memory number = 2) <ul style="list-style-type: none"> • Energy • Volume • Tariff energy 1 • Tariff energy 2 • Date • Next reading date 2 Pulse IN register <ul style="list-style-type: none"> • Current pulse input counter 1 • Current pulse input counter 2 |

| | |
|---------------------------------|--|
| <p>1 "User data"</p> | <p>Current energy Current tariff energy 1 Current tariff energy 2 Current volume Current power Current flow rate Current forward temperature T_H Current return temperature T_C Current temperature difference Current operating hours Current date and time Reading date 1 (memory number = 1) <ul style="list-style-type: none"> • Energy • Volume • Tariff energy 1 • Tariff energy 2 • Date • Next reading date 1 Reading date 2 (memory number = 2) <ul style="list-style-type: none"> • Energy • Volume • Tariff energy 1 • Tariff energy 2 • Date • Next reading date 2 Reading date 1 last year (memory number = 3) <ul style="list-style-type: none"> • Energy • Volume • Tariff energy 1 • Tariff energy 2 • Date Reading date 2 last year (memory number = 4) <ul style="list-style-type: none"> • Energy • Volume • Tariff energy 1 • Tariff energy 2 • Date </p> |
| <p>2 "Simple billing"</p> | <p>As 1</p> |
| <p>3 "Enhanced billing"</p> | <p>Current energy Current volume Current flow rate Current forward temperature T_H Current return temperature T_C Current tariff energy 1 Current error day counter Current pulse input counter 1 Current pulse input counter 2 Tariff limit 2 reached</p> |

| | |
|--|---|
| <p>4 "Multi-tariff billing"</p> | <p>Current energy Current volume Current tariff energy 1 Current tariff energy 2 Current pulse input counter 1 Current operating hours Error day counter Current flow rate Current power Current forward temperature T_H Current return temperature T_C Date of last monthly memory Energy of last monthly memory Volume of last monthly memory Pulse counter 1 of last monthly memory Tariff energy 1 of last monthly memory Operating hours of last monthly memory Error day counter of last monthly memory</p> |
| <p>5 "Instantaneous values"</p> | <p>Current energy Current tariff energy 1 Current tariff energy 2 Current volume Current power Current flow rate Current forward temperature T_H Current return temperature T_C Current operating hours Current error day counter</p> |
| <p>6 "Load management values for management"</p> | <p>Proprietary data number: 4 -> \$0F \$04 SWVER READPTR READLEN Bytes</p> <ul style="list-style-type: none"> • Application reset subcode = 0x60 makes READPTR = 0x2900 and READLEN = maximum possible length • READPTR is automatically incremented by READLEN for every REQ_UD2 |
| <p>7 "Reserved"</p> | <p>As 1</p> |
| <p>8 "Installation and startup"</p> | <p>Current date and time (\$04 \$6D DTFZEIT) Next reading date 1 Next reading date 2</p> |
| <p>11 "Manufacturing"</p> | <p>Proprietary data number: 4 -> \$0F \$04 SWVER READPTR READLEN Bytes</p> <ul style="list-style-type: none"> • Application reset subcode = 0xB0 makes READPTR = 0x200 and READLEN = maximum possible length • READPTR is automatically incremented by READLEN for every REQ_UD2 |
| <p>12 "Development"</p> | <p>As 11 without Init READPTR and READLEN</p> |
| <p>13 "Selftest"</p> | <p>Current energy Current date and time</p> |
| <p>14 "Reserved"</p> | <p>As 0</p> |
| <p>15 "Reserved"</p> | <p>RAMTEL</p> |

7 Appendix 2

M-Bus units:

| | DIV | VIF | Unit |
|--------------------------------|-----------|-----------------|--------------------------|
| Current energy | 0x0C | 0x05 | 0.1 kWh |
| | 0x0C | 0x06 | 1 kWh |
| | 0x0C | 0x07 | 10 kWh |
| | 0x0C | 0x86 0x75 | 1 kWh * 10 ⁻¹ |
| | 0x0C | 0x FB 0x81 0x72 | 1 MWh * 10 ⁻⁴ |
| | 0x0C | 0x FB 0x81 0x73 | 1 MWh * 10 ⁻³ |
| | 0x0C | 0x FB 0x81 0x74 | 1 MWh * 10 ⁻² |
| | 0x0C | 0x0F | 10 MJ |
| | 0x0C | 0x0E | 1 MJ |
| | 0x0C | 0x0D | 0.1 MJ |
| | 0x0C | 0x84 0x3D | 10 kBtu |
| | 0x0C | 0x83 0x3D | 1 kBtu |
| | 0x0C | 0x82 0x3D | 0.1 kBtu |
| | 0x0C | 0xFB 0x0E | 10 Mcal |
| | 0x0C | 0xFB 0x0D | 1 Mcal |
| | 0x0C | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Current volume | 0x0C | 0x12 | 0.1 l |
| | 0x0C | 0x13 | 1 l |
| | 0x0C | 0x14 | 10 l |
| | | | |
| Current flow rate | 0x0B | 0x3A | 0.1 l/h |
| | 0x0B | 0x3B | 1 l/h |
| | 0x0B | 0x3C | 10 l/h |
| | | | |
| Current power | 0x0C | 0x2A | 0.1 W |
| | 0x0C | 0x2B | 1 W |
| | 0x0C | 0x2C | 10 W |
| | | | |
| Current time | 0x04 | 0x6D | Type F |
| | | | |
| Current forward temperature | 0x0A | 0x5A | 0.1 °C |
| | | | |
| Current return temperature | 0x0A | 0x5E | 0.1 °C |
| | | | |
| Current temperature difference | 0x0A | 0x62 | 0.1 °C |
| | | | |
| Current tariff energy 1 | 0x8C 0x10 | 0x05 | 0.1 kWh |
| | 0x8C 0x10 | 0x06 | 1 kWh |
| | 0x8C 0x10 | 0x07 | 10 kWh |
| | 0x8C 0x10 | 0x0F | 10 MJ |
| | 0x8C 0x10 | 0x0E | 1 MJ |
| | 0x8C 0x10 | 0x0D | 0.1 MJ |
| | 0x8C 0x10 | 0x84 0x3D | 10 kBtu |

| | | | |
|--------------------------------|-----------|-----------|----------|
| | 0x8C 0x10 | 0x83 0x3D | 1 kBtu |
| | 0x8C 0x10 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x10 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x10 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x10 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Current tariff energy 2 | 0x8C 0x20 | 0x05 | 0.1 kWh |
| | 0x8C 0x20 | 0x06 | 1 kWh |
| | 0x8C 0x20 | 0x07 | 10 kWh |
| | 0x8C 0x20 | 0x0F | 10 MJ |
| | 0x8C 0x20 | 0x0E | 1 MJ |
| | 0x8C 0x20 | 0x0D | 0.1 MJ |
| | 0x8C 0x20 | 0x84 0x3D | 10 kBtu |
| | 0x8C 0x20 | 0x83 0x3D | 1 kBtu |
| | 0x8C 0x20 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x20 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x20 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x20 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Current operating hours | 0x0B | 0x26 | h |
| | | | |
| Reading date 1 energy | 0x4C | 0x05 | 0.1 kWh |
| | 0x4C | 0x06 | 1 kWh |
| | 0x4C | 0x07 | 10 kWh |
| | 0x4C | 0x0F | 10 MJ |
| | 0x4C | 0x0E | 1 MJ |
| | 0x4C | 0x0D | 0.1 MJ |
| | 0x4C | 0x84 0x3D | 10 kBtu |
| | 0x4C | 0x83 0x3D | 1 kBtu |
| | 0x4C | 0x82 0x3D | 0.1 kBtu |
| | 0x4C | 0xFB 0x0E | 10 Mcal |
| | 0x4C | 0xFB 0x0D | 1 Mcal |
| | 0x4C | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 1 volume | 0x4C | 0x12 | 0.1 l |
| | 0x4C | 0x13 | 1 l |
| | 0x4C | 0x14 | 10 l |
| | | | |
| Reading date 1 tariff energy 1 | 0xCC 0x10 | 0x05 | 0.1 kWh |
| | 0xCC 0x10 | 0x06 | 1 kWh |
| | 0xCC 0x10 | 0x07 | 10 kWh |
| | 0xCC 0x10 | 0x0F | 10 MJ |
| | 0xCC 0x10 | 0x0E | 1 MJ |
| | 0xCC 0x10 | 0x0D | 0.1 MJ |
| | 0xCC 0x10 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x10 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x10 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x10 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x10 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x10 | 0xFB 0x0C | 0.1 Mcal |
| | | | |

| | | | |
|---|-----------|-----------|----------|
| Reading date 1 tariff energy 2 | 0xCC 0x20 | 0x05 | 0.1 kWh |
| | 0xCC 0x20 | 0x06 | 1 kWh |
| | 0xCC 0x20 | 0x07 | 10 kWh |
| | 0xCC 0x20 | 0x0F | 10 MJ |
| | 0xCC 0x20 | 0x0E | 1 MJ |
| | 0xCC 0x20 | 0x0D | 0.1 MJ |
| | 0xCC 0x20 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x20 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x20 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x20 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x20 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x20 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 1 time | 0x42 | 0x6c | Type G |
| | | | |
| Next reading date 1 | 0x42 | 0xEC 0x7E | Type G |
| | | | |
| Reading date 1 last year energy | 0xCC 0x01 | 0x05 | 0.1 kWh |
| | 0xCC 0x01 | 0x06 | 1 kWh |
| | 0xCC 0x01 | 0x07 | 10 kWh |
| | 0xCC 0x01 | 0x0F | 10 MJ |
| | 0xCC 0x01 | 0x0E | 1 MJ |
| | 0xCC 0x01 | 0x0D | 0.1 MJ |
| | 0xCC 0x01 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x01 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x01 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x01 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x01 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x01 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 1 last year volume | 0xCC 0x01 | 0x12 | 0.1 l |
| | 0xCC 0x01 | 0x13 | 1 l |
| | 0xCC 0x01 | 0x14 | 10 l |
| | | | |
| Reading date 1 last year tariff energy 1 | 0xCC 0x11 | 0x05 | 0.1 kWh |
| | 0xCC 0x11 | 0x06 | 1 kWh |
| | 0xCC 0x11 | 0x07 | 10 kWh |
| | 0xCC 0x11 | 0x0F | 10 MJ |
| | 0xCC 0x11 | 0x0E | 1 MJ |
| | 0xCC 0x11 | 0x0D | 0.1 MJ |
| | 0xCC 0x11 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x11 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x11 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x11 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x11 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x11 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 1 last year tariff energy 2 | 0xCC 0x21 | 0x05 | 0.1 kWh |

| | | | |
|--------------------------------|-----------|-----------|----------|
| | 0xCC 0x21 | 0x06 | 1 kWh |
| | 0xCC 0x21 | 0x07 | 10 kWh |
| | 0xCC 0x21 | 0x0F | 10 MJ |
| | 0xCC 0x21 | 0x0E | 1 MJ |
| | 0xCC 0x21 | 0x0D | 0.1MJ |
| | 0xCC 0x21 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x21 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x21 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x21 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x21 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x21 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 1 last year time | 0xC2 0x01 | 0x6c | Type G |
| | | | |
| Reading date 2 energy | 0x8C 0x01 | 0x05 | 0.1 kWh |
| | 0x8C 0x01 | 0x06 | 1 kWh |
| | 0x8C 0x01 | 0x07 | 10 kWh |
| | 0x8C 0x01 | 0x0F | 10 MJ |
| | 0x8C 0x01 | 0x0E | 1 MJ |
| | 0x8C 0x01 | 0x0D | 0.1MJ |
| | 0x8C 0x01 | 0x84 0x3D | 10 kBtu |
| | 0x8C 0x01 | 0x83 0x3D | 1 kBtu |
| | 0x8C 0x01 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x01 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x01 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x01 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 2 volume | 0x8C 0x01 | 0x12 | 0.1 l |
| | 0x8C 0x01 | 0x13 | 1 l |
| | 0x8C 0x01 | 0x14 | 10 l |
| | | | |
| Reading date 2 tariff energy 1 | 0x8C 0x11 | 0x05 | 0.1 kWh |
| | 0x8C 0x11 | 0x06 | 1 kWh |
| | 0x8C 0x11 | 0x07 | 10 kWh |
| | 0x8C 0x11 | 0x0F | 10 MJ |
| | 0x8C 0x11 | 0x0E | 1 MJ |
| | 0x8C 0x11 | 0x0D | 0.1 MJ |
| | 0x8C 0x11 | 0x84 0x3D | 10 kBtu |
| | 0x8C 0x11 | 0x83 0x3D | 1 kBtu |
| | 0x8C 0x11 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x11 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x11 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x11 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 2 tariff energy 2 | 0x8C 0x21 | 0x05 | 0.1 kWh |
| | 0x8C 0x21 | 0x06 | 1 kWh |
| | 0x8C 0x21 | 0x07 | 10 kWh |
| | 0x8C 0x21 | 0x0F | 10 MJ |
| | 0x8C 0x21 | 0x0E | 1 MJ |
| | 0x8C 0x21 | 0x0D | 0.1 MJ |

| | | | |
|--|-----------|-----------|----------|
| | 0x8C 0x21 | 0x84 0x3D | 10 kBtu |
| | 0x8C 0x21 | 0x83 0x3D | 1 kBtu |
| | 0x8C 0x21 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x21 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x21 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x21 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 2 time | 0x82 0x01 | 0x6C | Type G |
| | | | |
| Next reading date 2 | 0x82 0x01 | 0xEC 0x7E | Type G |
| | | | |
| Reading date 2 last year energy | 0x8C 0x02 | 0x05 | 0.1 kWh |
| | 0x8C 0x02 | 0x06 | 1 kWh |
| | 0x8C 0x02 | 0x07 | 10 kWh |
| | 0x8C 0x02 | 0x0F | 10 MJ |
| | 0x8C 0x02 | 0x0E | 1 MJ |
| | 0x8C 0x02 | 0x0D | 0.1 MJ |
| | 0x8C 0x02 | 0x84 0x3D | 10 kBtu |
| | 0x8C 0x02 | 0x83 0x3D | 1 kBtu |
| | 0x8C 0x02 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x02 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x02 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x02 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 2 last year volume | 0x8C 0x02 | 0x12 | 0.1 l |
| | 0x8C 0x02 | 0x13 | 1 l |
| | 0x8C 0x02 | 0x14 | 10 l |
| | | | |
| Reading date 2 last year tariff energy 1 | 0x8C 0x12 | 0x05 | 0.1 kWh |
| | 0x8C 0x12 | 0x06 | 1 kWh |
| | 0x8C 0x12 | 0x07 | 10 kWh |
| | 0x8C 0x12 | 0x0F | 10 MJ |
| | 0x8C 0x12 | 0x0E | 1 MJ |
| | 0x8C 0x12 | 0x0D | 0.1 MJ |
| | 0x8C 0x12 | 0x84 0x3D | 10 kBtu |
| | 0x8C 0x12 | 0x83 0x3D | 1 kBtu |
| | 0x8C 0x12 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x12 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x12 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x12 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 2 last year tariff energy 2 | 0x8C 0x22 | 0x05 | 0.1 kWh |
| | 0x8C 0x22 | 0x06 | 1 kWh |
| | 0x8C 0x22 | 0x07 | 10 kWh |
| | 0x8C 0x22 | 0x0F | 10 MJ |
| | 0x8C 0x22 | 0x0E | 1 MJ |
| | 0x8C 0x22 | 0x0D | 0.1 MJ |
| | 0x8C 0x22 | 0x84 0x3D | 10 kBtu |
| | 0x8C 0x22 | 0x83 0x3D | 1 kBtu |

| | | | |
|-------------------------------|-------------------|-----------|----------|
| | 0x8C 0x22 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x22 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x22 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x22 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Reading date 2 last year time | 0x82 0x02 | 0x6c | Type G |
| | | | |
| Error day counter | 0x09 | 0xA7 0x18 | Days |
| | | | |
| Pulse input 1 | 0x8C 0x40 | 0x05 | 0.1 kWh |
| | 0x8C 0x40 | 0x06 | 1 kWh |
| | 0x8C 0x40 | 0x07 | 10 kWh |
| | 0x8C 0x40 | 0x0F | 10 MJ |
| | 0x8C 0x40 | 0x0E | 1 MJ |
| | 0x8C 0x40 | 0x0D | 0.1 MJ |
| | 0x8C 0x40 | 0x84 0x3D | 10 kBtu |
| | 0x8C 0x40 | 0x83 0x3D | 1 kBtu |
| | 0x8C 0x40 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x40 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x40 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x40 | 0xFB 0x0C | 0.1 Mcal |
| | 0x8C 0x40 | 0x12 | 0.1 l |
| | 0x8C 0x40 | 0x13 | 1 l |
| | 0x8C 0x40 | 0x14 | 10 l |
| | 0x8C 0x40 | 0x15 | 100 l |
| | 0x8C 0x40 | 0xFD 0x3A | No unit |
| | | | |
| Pulse input 2 | 0x8C 0x80 0x40 | 0x05 | 0.1 kWh |
| | 0x8C 0x80 0x40 | 0x06 | 1 kWh |
| | 0x8C 0x80 0x40 | 0x07 | 10 kWh |
| | 0x8C 0x80 0x40 | 0x0F | 10 MJ |
| | 0x8C 0x80 0x40 | 0x0E | 1 MJ |
| | 0x8C 0x80 0x40 | 0x0D | 0.1 MJ |
| | 0x8C 0x80 0x40 | 0x84 0x3D | 10 kBtu |
| | 0x8C 0x80 0x40 | 0x83 0x3D | 1 kBtu |
| | 0x8C 0x80 0x40 | 0x82 0x3D | 0.1 kBtu |
| | 0x8C 0x80 0x40 | 0xFB 0x0E | 10 Mcal |
| | 0x8C 0x80 0x40 | 0xFB 0x0D | 1 Mcal |
| | 0x8C 0x80 0x40 | 0xFB 0x0C | 0.1 Mcal |
| | 0x8C 0x80 0x40 | 0x12 | 0.1 l |

| | | | |
|---------------------------------------|-------------------|-----------|-------------|
| | 0x8C 0x80 0x40 | 0x13 | 1 l |
| | 0x8C 0x80 0x40 | 0x14 | 10 l |
| | 0x8C 0x80 0x40 | 0x15 | 100 l |
| | 0x8C 0x80 0x40 | 0xFD 0x3A | No unit |
| | | | |
| Current tariff def. 1 | 0x82 0x10 | 0x7F | Proprietary |
| | | | |
| Current tariff def. 2 | 0x82 0x20 | 0x7F | Proprietary |
| | | | |
| Latest monthly memory date | 0xC2 0x02 | 0x6C | Type G |
| | | | |
| Latest monthly memory | | | |
| Latest monthly memory energy | 0xCC 0x02 | 0x05 | 0.1 kWh |
| | 0xCC 0x02 | 0x06 | 1 kWh |
| | 0xCC 0x02 | 0x07 | 10 kWh |
| | 0xCC 0x02 | 0x0F | 10 MJ |
| | 0xCC 0x02 | 0x0E | 1 MJ |
| | 0xCC 0x02 | 0x0D | 0.1 MJ |
| | 0xCC 0x02 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x02 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x02 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x02 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x02 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x02 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| | | | |
| Latest monthly memory volume | 0xCC 0x02 | 0x12 | 0.1 l |
| | 0xCC 0x02 | 0x13 | 1 l |
| | 0xCC 0x02 | 0x14 | 10 l |
| | | | |
| Latest monthly memory tariff energy 1 | 0xCC 0x12 | 0x05 | 0.1 kWh |
| | 0xCC 0x12 | 0x06 | 1 kWh |
| | 0xCC 0x12 | 0x07 | 10 kWh |
| | 0xCC 0x12 | 0x0F | 10 MJ |
| | 0xCC 0x12 | 0x0E | 1 MJ |
| | 0xCC 0x12 | 0x0D | 0.1 MJ |
| | 0xCC 0x12 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x12 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x12 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x12 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x12 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x12 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| | | | |
| Latest monthly memory tariff energy 2 | 0xCC 0x22 | 0x05 | 0.1 kWh |
| | 0xCC 0x22 | 0x06 | 1 kWh |

| | | | |
|---|----------------|-----------|-------------|
| | 0xCC 0x22 | 0x07 | 10 kWh |
| | 0xCC 0x22 | 0x0F | 10 MJ |
| | 0xCC 0x22 | 0x0E | 1 MJ |
| | 0xCC 0x22 | 0x0D | 0.1 MJ |
| | 0xCC 0x22 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x22 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x22 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x22 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x22 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x22 | 0xFB 0x0C | 0.1 Mcal |
| | | | |
| Latest monthly memory max. flow rate | 0xDB 0x02 | 0x3A | 0.1 l/h |
| | 0xDB 0x02 | 0x3B | 1 l/h |
| | 0xDB 0x02 | 0x3C | 10 l/h |
| | | | |
| Latest monthly memory max. power | 0xDC 0x02 | 0x2A | 0.1 W |
| | 0xDC 0x02 | 0x2B | 1 W |
| | 0xDC 0x02 | 0x2C | 10 W |
| | | | |
| Latest monthly memory tariff def. 1 | 0xC2 0x12 | 0x7F | Proprietary |
| | | | |
| Latest monthly memory tariff def. 2 | 0xC2 0x22 | 0x7F | Proprietary |
| | | | |
| Latest monthly memory error day counter | 0xC9 0x02 | 0xA7 0x18 | Days |
| | | | |
| Latest monthly memory pulse input 1 | 0xCC 0x42 | 0x05 | 0.1 kWh |
| | 0xCC 0x42 | 0x06 | 1 kWh |
| | 0xCC 0x42 | 0x07 | 10 kWh |
| | 0xCC 0x42 | 0x0F | 10 MJ |
| | 0xCC 0x42 | 0x0E | 1 MJ |
| | 0xCC 0x42 | 0x0D | 0.1 MJ |
| | 0xCC 0x42 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x42 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x42 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x42 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x42 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x42 | 0xFB 0x0C | 0.1 Mcal |
| | 0xCC 0x42 | 0x12 | 0.1 l |
| | 0xCC 0x42 | 0x13 | 1 l |
| | 0xCC 0x42 | 0x14 | 10 l |
| | 0xCC 0x42 | 0x15 | 100 l |
| | 0xCC 0x42 | 0xFD 0x3A | No unit |
| | | | |
| Latest monthly memory pulse input 2 | 0x8C 0x80 0x40 | 0x05 | 0.1 kWh |
| | 0xCC 0x82 0x40 | 0x06 | 1 kWh |
| | 0xCC 0x82 | 0x07 | 10 kWh |

| | | | |
|--|-------------------|-----------|---------------------------|
| | 0x40 | | |
| | 0xCC 0x82 0x40 | 0x0F | 10 MJ |
| | 0xCC 0x82 0x40 | 0x0E | 1 MJ |
| | 0xCC 0x82 0x40 | 0x0D | 0.1 MJ |
| | 0xCC 0x82 0x40 | 0x84 0x3D | 10 kBtu |
| | 0xCC 0x82 0x40 | 0x83 0x3D | 1 kBtu |
| | 0xCC 0x82 0x40 | 0x82 0x3D | 0.1 kBtu |
| | 0xCC 0x82 0x40 | 0xFB 0x0E | 10 Mcal |
| | 0xCC 0x82 0x40 | 0xFB 0x0D | 1 Mcal |
| | 0xCC 0x82 0x40 | 0xFB 0x0C | 0.1 Mcal |
| | 0xCC 0x82 0x40 | 0x12 | 0.1 l |
| | 0xCC 0x82 0x40 | 0x13 | 1 l |
| | 0xCC 0x82 0x40 | 0x14 | 10 l |
| | 0xCC 0x82 0x40 | 0x15 | 100 l |
| | 0xCC 0x82 0x40 | 0xFD 0x3A | No unit |
| | | | |
| Latest monthly memory operating hours | 0xCB 0x02 | 0x26 | h |
| | | | |
| Current tariff enable 1 | 0x81 0x10 | 0xFD 0x1A | Digital output |
| | | | |
| Current tariff enable 2 | 0x81 0x20 | 0xFD 0x1A | Digital output |
| | | | |
| Error status | 0x02 | 0xFD 0x17 | ZVERRBI; Leakage error |
| | | | |
| Leakage flow rate | 0x0B | 0xBA 0x69 | 0.1 l/h |
| | 0x0B | 0xBB 0x69 | 1 l/h |
| | 0x0B | 0xBC 0x69 | 10 l/h |