

B21

User Manual



B21

User Manual

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Chapter 1: Product Overview

Overview

This chapter describes the parts of the meter and the different meter types.

In this chapter

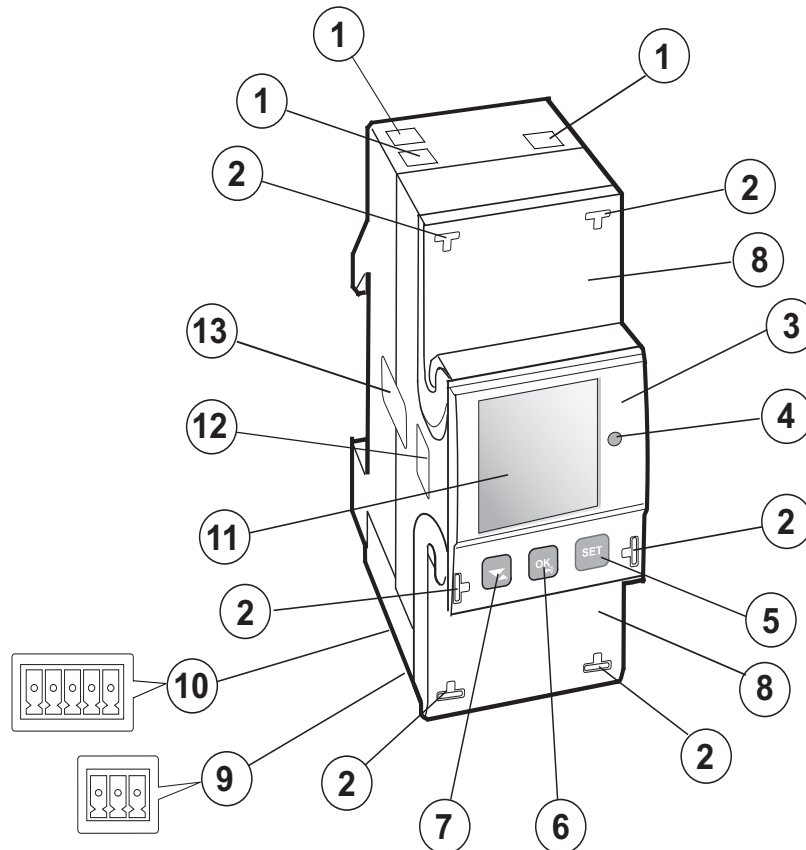
The following topics are covered in this chapter:

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| 1.2 Meter Types | 12 |

1.1 Meter Parts

Illustration

The parts of the meter are shown in the illustration below:



Parts description

The following table describes the parts of the meter:



| Item | Description | Comments |
|------|----------------|--|
| 1 | Terminal block | Terminals for all voltages and currents. |
| 2 | Sealing points | Seal thread is used to seal the cover. |
| 3 | Product data | Contains data about the meter type. |
| 4 | LED | Flashes in proportion to the energy measured. |
| 5 | Set button | Enter configuration mode. |
| 6 | OK/Exit button | Press to perform an action or to select a menu. Press and hold to exit to the previous menu or to toggle between default and main menu. |
| 7 | Down/Up button | Toggle down/up. (toggle right/left in the main menu.) |

| Item | Description | Comments |
|------|---------------------------------------|---|
| 8 | Sealable terminal cover | Protective cover with printed wiring diagram on the inside. |
| 9 | Terminal for communication connection | |
| 10 | Terminal for input/output connection | |
| 11 | Display | LCD for meter reading |
| 12 | Optical communication interface | For IR communication. |
| 13 | Sealing label | On both sides of the meter. |

1.2 Meter Types

Main groups

The B21 is a direct connected Electricity Meter for currents $\leq 65\text{A}$.

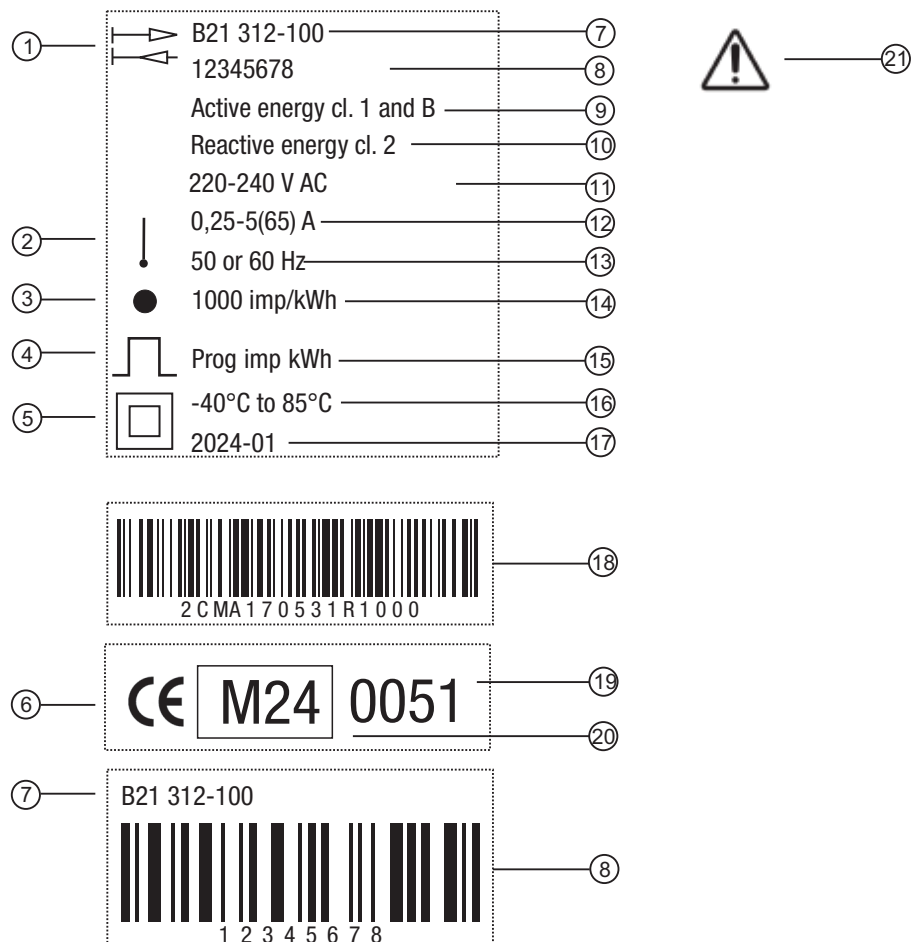
Subgroups

The main meter group is further divided into subgroups depending on the functionality of the meter:

| Subgroup | Functionality |
|----------|---|
| Silver | Class 0,5 S or Class 1, Tariffs, Fixed I/O, Resettable registers, Import/export of energy, Active energy, Reactive energy, Pulse output/alarm |
| Bronze | Import/export of energy, Active energy, Reactive energy, Class 1, Pulse output/alarm |
| Steel | Active energy import, Class 1, Pulse output/alarm |

Product label

The meter type information that is reflected on the labels on the meter is shown in the example picture below:



Product label information

The information on the product label is explained in the table below:

| Item | Description |
|------|---|
| 1 | Import/export of energy |
| 2 | 1-element metering |
| 3 | LED |
| 4 | Pulse output |
| 5 | Protection class II |
| 6 | Declaration of product safety |
| 7 | Type designation |
| 8 | Serial number |
| 9 | Accuracy active energy |
| 10 | Accuracy reactive energy |
| 11 | Voltage |
| 12 | Current |
| 13 | Frequency |
| 14 | LED pulse frequency |
| 15 | Pulse frequency |
| 16 | Temperature range |
| 17 | Date of manufacture (year and week) |
| 18 | ABB ID |
| 19 | Notified body |
| 20 | MID and year of verification |
| 21 | Caution, refer to accompanying document |

Chapter 2: Installation

Overview This chapter describes how to mount the B21 meters and how to connect them to an electricity network. The chapter also contains information about how to perform a basic configuration of the meter.

Information about how to connect I/O and communication options is also included in this chapter.

In this chapter The following topics are covered in this chapter:

| | | |
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| 2.1 | Mounting the Meter | 15 |
| 2.2 | Environmental Considerations | 17 |
| 2.3 | Installing the Meter | 18 |
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2.1 Mounting the Meter

General

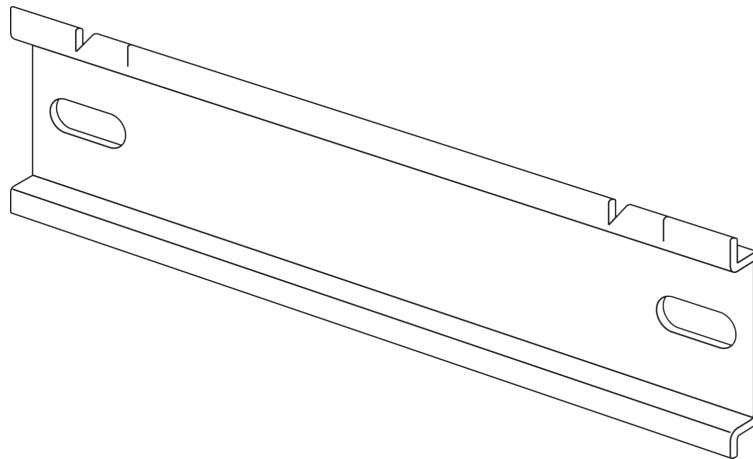
This section describes different ways to mount the B21 meters. For some methods of mounting additional accessories are needed. For further information about accessories, refer to the Main Catalog (2CMC480001C0201).

DIN-rail mounted

The B21 meters are intended to be mounted on a DIN-rail (DIN 50022). If this method of mounting is used no extra accessories are needed and the meter is fastened by snapping the DIN-rail lock onto the rail.

DIN-rail

The following picture shows a DIN-rail.



Wall mounted

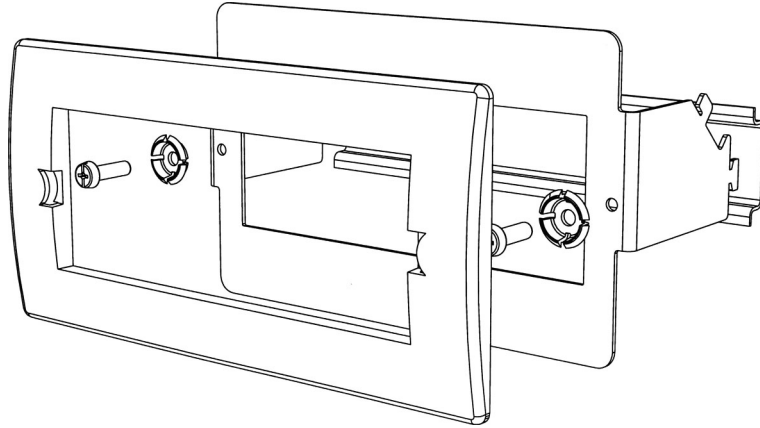
The recommended way to mount the meter on a wall is to mount a separate DIN-rail on the wall and then mount the meter on the rail.

Flush mounted

To flush-mount the meter a flush-mount kit should be used.

Flush-mount kit

The following picture shows a flush-mount kit.



2.2 Environmental Considerations

Ingress protection

To comply with the protection requirements the product must be mounted in protection class IP 51 enclosures, or better, according to IEC 60259.

Mechanical environment

In accordance with the Measuring Directive (2014/32/UE), the product complies with M1, which means that it can be operated in "...locations with vibration and shocks of low significance, e.g. for instruments fastened to light supporting structures subject to negligible vibrations and shocks transmitted from local blasting or pile-driving activities, slamming doors, etc."

Electromagnetic environment

In accordance with the Measuring Directive (2014/32/UE), the product complies with E2, which means that it can be operated "...in locations with electromagnetic disturbances corresponding to those likely to be found in other industrial buildings."

Climatic environment

In order to work properly the product should not be operated outside the specified temperature range of -40°C to +70°C.

In order to work properly the product should not be exposed to humidity exceeding the specified 75% yearly average, 95% on 30 days/year.

2.3 Installing the Meter



Warning – Electrical equipment should only be installed, accessed, serviced and maintained by qualified electrical personnel.

Working with high voltage is potentially lethal. Persons subjected to high voltage may suffer cardiac arrest, burn injuries, or other severe injuries. To avoid such injuries, make sure to disconnect the power supply before you start the installation.



Warning – For safety reasons it is recommended that the equipment is installed in a way that makes it impossible to reach or touch the terminal blocks by accident.

The best way to make a safe installation is to install the unit in an enclosure. Further, access to the equipment should be limited through use of lock and key, controlled by qualified electrical personnel.



Warning – The meters must always be protected by fuses on the incoming side.

In order to allow for maintenance of transformer rated meters, it is recommended that there should be a short circuiting device installed near the meter.

Installation requirements

Meters with wireless communication should not be installed closer than 20 cm from people.

Install the meter

Follow the steps in the table below to install and verify the installation of the meter:

| Step | Action |
|--------------------------------|---|
| 1 | Switch off the main power. |
| 2 | Place the meter on the Din rail and make sure it snaps onto it. |
| 3 | Strip the cable insulation to the length that is indicated on the meter. |
| 4 | Connect the cables according to the wiring diagram that is printed on the meter and tighten the screws. See <i>Technical Data</i> for recommended values. |
| 5 | Install the circuit protection. See <i>table 2:1</i> below for the correct fuse. |
| 6 | If inputs/outputs are used, connect the cables according to the wiring diagram that is printed on the meter and tighten the screws. Then connect to an external power supply. See <i>Technical Data</i> for recommended values. |
| 7 | If communication is used, connect the cables according to the wiring diagram that is printed on the meter and tighten the screws. See <i>Technical Data</i> for recommended values. |
| Verify the installation | |
| 8 | Check that the meter is connected to the specified voltage and that voltage phase connections and the neutral (if used) are connected to the correct terminals. |
| 9 | Switch on the power. If a warning symbol is displayed, refer to the error codes in <i>Troubleshooting</i> . |

| Step | Action |
|------|--|
| 10 | Under the menu item “Instantaneous Values” on the meter, check that the voltages, currents, power and power factors are reasonable and that the power direction is what to be expected (the total power should be positive for a load that consumes energy). When doing the check the meter should be connected to the intended load, preferably a load with a current above zero on all phases to make the check as complete as possible. |

Circuit protection Use the information in this table to select the correct fuse for the circuit protection.

Table: 2:1

| Meter type | Max circuit protection |
|------------------|---|
| Direct connected | 65 A MCB, C characteristic or 65A fuse type gL-gG |

2.3.1 Configuring the meter

Default settings For information about how to change the default settings of the meter, refer to the chapter called *Meter Settings*.

Default settings The following table lists the default settings of the meter that normally need to be changed. Check the settings of the meter to see if they need to be reconfigured.

| Parameter | Direct connected meters |
|-----------------|-------------------------|
| Pulse frequency | 10 imp/kWh |
| Pulse length | 100 ms |

2.4 Wiring Diagrams

General

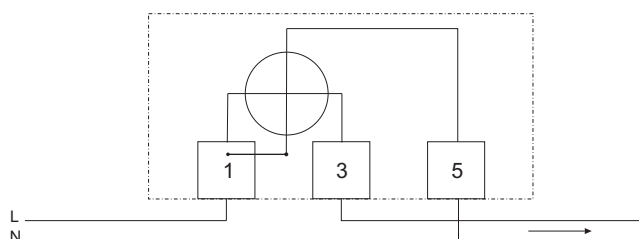


This section describes how to connect the meter to an electricity network. The terminal numbers in the wiring diagrams listed below correspond to the marking on the terminal block of the meter.

2.4.1 Direct connected meters

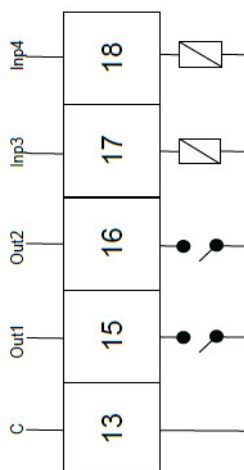
2-wire connection

The following diagram shows a 2-wire connection of a direct connected 1-phase meter:

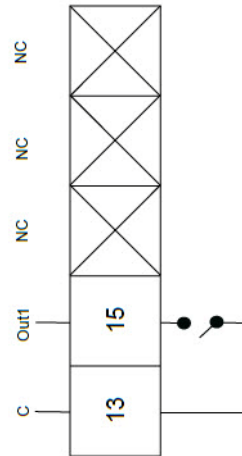


2.4.2 Inputs/outputs

2 outputs, 2 inputs

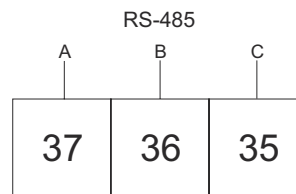


1 output

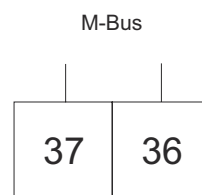


2.4.3 Communication

RS 485



M-Bus




Chapter 3: User Interface

| | |
|----------|--|
| Overview | This chapter describes the different display views and the menu structure. |
|----------|--|

| | |
|-------------------|---|
| In this chapter | The following topics are covered in this chapter: |
| 3.1 Display | 23 |

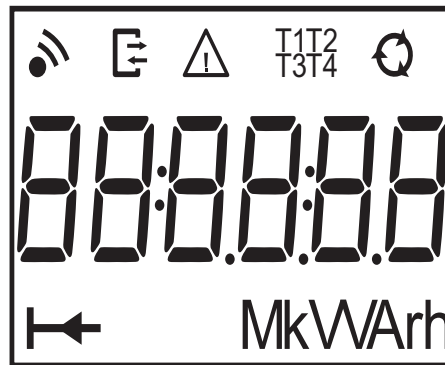
3.1 Display

General

The display contains two main views, the Default menu and the Main menu. Use the Exit button  to toggle between the views. In both views a number status icons are displayed in the upper part of the display. These icons are explained in *table 3:1* below. In the same manner the bottom part of the display has an explanatory text to describe what is shown or highlighted at the moment.

Default menu

The following image shows an example of the layout of the Default menu:



Energy values

The following table explains the content of the 20 available pages in the Default menu:



| Page | Unit | Text on display | Explaining text |
|------|-------|--|--|
| 1/20 | kWh | ACT.NRG.IMP.TOT arrow right | Measures the total imported active energy. |
| 2/20 | kWh | ACT.NRG.EXP.TOT arrow left | Measures the total exported active energy. |
| 3/20 | kvarh | REACT.NRG.IMP.TOT arrow right | Measures the total imported reactive energy. |
| 4/20 | kvarh | REACT.NRG.EXP.TOT arrow left | Measures the total exported reactive energy. |
| 5/20 | kWh | ACT.NRG.IMP.TAR1 T1 blinks, arrow right | Measures the imported active energy for tariff 1 |
| 6/20 | kWh | ACT.NRG.IMP.TAR2 T2 blinks, arrow right | Measures the imported active energy for tariff 2 |
| 7/20 | kWh | ACT.NRG.IMP.TAR3 T3 blinks, arrow right | Measures the imported active energy for tariff 3 |





| Page | Unit | Text on display | Explaining text |
|-------|-------|--|--|
| 8/20 | kWh | ACT.NRG.IMP.TAR4 T4 blinks, arrow right | Measures the im-ported active energy for tariff 4 |
| 9/20 | kWh | ACT.NRG.EXP.TAR1 T1 blinks, arrow left | Measures the ex-ported active energy for tariff 1 |
| 10/20 | kWh | ACT.NRG.EXP.TAR2 T2 blinks, arrow left | Measures the ex-ported active energy for tariff 2 |
| 11/20 | kWh | ACT.NRG.EXP.TAR3 T3 blinks, arrow left | Measures the ex-ported active energy for tariff 3 |
| 12/20 | kWh | ACT.NRG.EXP.TAR4 T4 blinks, arrow left | Measures the ex-ported active energy for tariff 4 |
| 13/20 | kvarh | REACT.NRG.IMP.TAR1 T1 blinks, arrow right | Measures the im-ported reactive en-ergy for tariff 1 |
| 14/20 | kvarh | REACT.NRG.IMP.TAR2 T2 blinks, arrow right | Measures the im-ported reactive en-ergy for tariff 2 |
| 15/20 | kvarh | REACT.NRG.IMP.TAR3 T3 blinks, arrow right | Measures the im-ported reactive en-ergy for tariff 3 |
| 16/20 | kvarh | REACT.NRG.IMP.TAR4 T4 blinks, arrow right | Measures the im-ported reactive en-ergy for tariff 4 |
| 17/20 | kvarh | REACT.NRG.EXP.TAR1 T1 blinks, arrow left | Measures the ex-ported reactive en-ergy for tariff 1 |
| 18/20 | kvarh | REACT.NRG.EXP.TAR2 T2 blinks, arrow left | Measures the ex-ported reactive en-ergy for tariff 2 |
| 19/20 | kvarh | REACT.NRG.EXP.TAR3 T3 blinks, arrow left | Measures the ex-ported reactive en-ergy for tariff 3 |
| 20/20 | kvarh | REACT.NRG.EXP.TAR4 T4 blinks, arrow left | Measures the ex-ported reactive en-ergy for tariff 4 |

Status Icons

The status icons that can be seen on the display are explained in the following table.

Table: 3:1

| Icon | Indication |
|---|---|
|  | Wireless communication. |
|  | Communication is in progress. The meter is either sending or receiving information. |

| Icon | Indication |
|---|---|
|  | Metering in progress. Clockwise rotation indicates import. Counter clockwise rotation indicates export. |
| T1 T2 T3 T4 | Active tariff. |
|    | Error, warning, note |

Main menu

Main menu text

Depending on the meter type all or a subset of the following text strings may be available in the display:

| Text | Explanation |
|--------|-------------------------|
| rE9 | Energy registers |
| I nSt | Instantaneous values |
| I _0 | I/O |
| StAtUS | Status |
| SEt | Settings |
| ESc | Escape to previous menu |

Main menu structure

The following table describes the main menu structure and its content:

| rE9 | I nSt | I _0 | StAtUS | SEt |
|-----------------------------|---------------------|-------|-----------------|-----------------|
| Active Energy Import | Active Power | I/O 1 | System Log | |
| Active Energy Export | Reactive Power | I/O 2 | Event Log | |
| Active Energy Net | Apparent Power | I/O 3 | Net Quality Log | |
| Reactive Energy Import | Phase Voltage | I/O 4 | System Status | Pulse Output |
| Reactive Energy Export | Main Voltage | | Audit Log | I/O |
| Reactive Energy Net | Current | | Settings Log | Alarm |
| Apparent Energy Import | Frequency | | About | |
| Apparent Energy Export | Power Factor | | | RS 485 |
| Apparent Energy Net | Phase Angle Power | | | IR Side |
| Active Energy Import Tariff | Phase Angle Voltage | | | Wireless |
| Active Energy Export Tariff | Phase Angle Current | | | Upgrade Consent |

| <i>rE9</i> | <i>I n5t</i> | <i>I _0</i> | <i>5tAtU5</i> | <i>5Et</i> |
|---|------------------|-------------|---------------|----------------------|
| Reactive Energy Import Tariff | Current Quadrant | | | Pulse LED |
| Reactive Energy Export Tariff | | | | Tariff |
| Resettable Reactive Energy Export Total | | | | Resettable registers |

Chapter 4: Meter Settings

Overview This chapter gives an overview of the meter settings and configuration options.

In this chapter The following topics are covered in this chapter:

- 4.1 Settings and Configurations 29
 - 4.1.1 Setting Pulse Output 29
 - 4.1.2 Setting I/O 30
 - 4.1.3 Setting Alarm 30
 - 4.1.4 Setting M-Bus 32
 - 4.1.5 Setting RS-485 32
 - 4.1.6 Setting IR Side 33
 - 4.1.7 Setting Upgrade Consent 35
 - 4.1.8 Setting Pulse LED 35
 - 4.1.9 Setting Tariff 35
 - 4.1.10Resetting Resettable Registers 35





4.1 Settings and Configurations

Configurable functions

Depending on the meter type, all or a subset of the following functions can be configured:




- Pulse output (Pul.Out.) on display
- I/O
- Alarm
- M-Bus
- RS-485
- IR Side
- Wireless (W-less on display)
- Upgrade Consent (Upgr.Cons) on display
- Pulse LED (Puls.LED) on display
- Tariff
- Resettable registers (Rst.Rg on display)

Setting a value

When setting a value, the  button is pressed and held to activate the set-option. The  button is used to change the options that can be set, such as on or off. The  button is used to toggle between digits. The option/digit that is active for setting is blinking, and stops blink when the option is selected by pressing the  button.

4.1.1 Setting Pulse Output

To set the pulse output, perform the following steps:

1. Select *SEt* in the main menu, press .
2. Select “Pulse out” (*PUL SE* on the display), press .
3. Select one of the pulse outputs, press .


The display will show *QUAnt*.


4. Press  to set the energy type for the selected pulse output.



The display will show what type of energy is measured on the selected pulse output. Depending on meter type, the available choices are:

| Display text | Energy type | Unit |
|-----------------|--------------------------|-------|
| <i>ActE I H</i> | Active energy imported | kWh |
| <i>ActE EH</i> | Active energy exported | kWh |
| <i>rEA I H</i> | Reactive energy imported | kvarh |
| <i>rEA EH</i> | Reactive energy exported | kvarh |
| <i>InActE</i> | Inactive | - |

Use S to set the energy type. Press and hold F to step back.

5. Press  once and F to get to the next menu (*FrEQ*). The display will show the frequency. The interval that can be set is 1-999999 imp/kWh or 1-

999999 imp/MWh. The frequency is set one digit at the time. The digit active for setting is blinking. Use  to decrease/increase the digit. To change digit, press F. Press and hold F to step back.

6. Press  once and F to get to the next menu (L E n g l h). The display will show the pulse length in milliseconds. The interval for the pulse length is from 10 to 990 ms. The pulse is set in the same way as the frequency. Press and hold F to step back.
7. Press  once and F to get to the next menu (O U T P U T). The display will show the setting for the selected pulse output. Depending on the meter type, the available choices are:

| 4 static I/Os | 1 static I/O |
|---------------|--------------|
| Off | Off |
| Out 1 | Out 1 |
| Out 2 | - |

Make the output setting. Press and hold F twice to step back to the pulse selection menu.







Note – The option is set to “no output” when pressing the  button.

8. The first pulse output is now fully configured.

4.1.2 Setting I/O

To set the I/O, perform the following steps:

1. Select S E t in the main menu, press .
2. Select I _ O, press .
3. The display will now show I _ I _ O. To change I/O, use . To set an I/O, press the  button. Different choices can be made for the I/O:
 - Alarm out (A L A R T)
 - Communication out (C O M M)
 - Pulse out (P U L S E)
 - Tariff out (T A R I F F)
 - Always on (O N)
 - Always off (O F F)

4.1.3 Setting Alarm

To set the alarm, perform the following steps:



1. Select S E t in the main menu, press .
2. Select A L, press .
3. The display will show what quantity will be measured (Q U A N T). Depending on the meter type, different quantities are available. See *table 4:1* and

table 4:2 for available quantities and interval/units for the different quantities. Set the desired quantity.








4. Press  once to get to the next menu. The display will show what level the alarm will trigger on (ON LEVEL). Set the alarm level.
5. Press  once to get to the next menu. The display will show the time that the measured value has to be higher than the limit set in the previous step in order for the alarm to trigger (ON DEL). Set the time limit.
6. Press  once to get to the next menu. The display will show what level the alarm will cease on (OFF LEVEL). Set the alarm level.
7. Press  once to get to the next menu. The display will show the time that the measured value has to be lower than the limit set in the previous step in order for the alarm to cease (OFF DEL). Set the time limit.
8. Press  once to get to the next menu. The display will show if the alarm will be logged or not (LOG). The available values are “on” and “off”. Set logging to on or off.
9. Press  once to get to the next menu. The display will show what output the alarm is set on (or if no output is set; OUTPUT). The available choices are dependent on meter type, see table 4:2.
10. The first alarm is now fully configured. If your meter supports multiple alarms, then use  to set the remaining alarms the same way as the first alarm was configured.

Table: 4:1








| 1-phase meter | Interval/Unit |
|----------------------|-----------------|
| Inactive | - |
| Current | 0.01-99.99 A/kA |
| Voltage | 0.1-999.9 V/kV |
| Active power total | 0-9999 W/kW/MW |
| Reactive power total | 0-9999 W/kW/MW |
| Apparent power total | 0-9999 W/kW/MW |
| Power factor total | 0.000-0.999 |

Table: 4:2

| 4 static I/Os | 1 static I/O |
|---------------|--------------|
| No output | No output |
| Out 1 | Out 1 |
| Out 2 | |








4.1.4 Setting M-Bus

To set the wired M-Bus interface, perform the following steps:

1. Select **SEt** in the main menu, press .
2. Select **M-BUS**, press .
3. Press  once to get to the next menu (**baUD**). The display will show the baudrate. See *Table 4:3* for baudrate options. Set baudrate.
4. Press  once to get to the next menu (**AddrE5**). The display will show the address. See *Table 4:3* for address range. Set address.
5. Press  once to get to the next menu (**AccE55**). The display will show the access level. See *Table 4:3* for options. Set the access level.
6. Press  once to get to the next menu (**Send 5E**). The display will show the Send status info. See *Table 4:3* for options. Set the send info status.
7. Press  once to get to the next menu (**PASSWd**). The display will show if the password is to be reset. See *Table 4:3* for options. Set the option.

4.1.5 Setting RS-485
















The RS-485 uses the EQ bus and the Modbus protocol to communicate. To set the RS-485 communication depending on protocol, perform the following steps:

| Step | EQ bus | Modbus |
|------|---|--|
| 1 | Select SEt in the main menu, press  . | Select SEt in the main menu, press  . |
| 2 | Select RS-485 , press  . | Select RS-485 , press  . |
| 3 | Select Protoc , press  to see the selected protocol. | Select Protoc , press  to see the selected protocol. Press and hold F to step back to the previous menu. |
| 4 | If required, then use S and F to set the protocol to EQ bus (EQbus). The display will go back to the default menu. Go to SEt >> RS-485 . If not required, then press and hold F to step back to the previous menu. | If required, then use S and F to set the protocol to Modbus (Modbus). The display will go back to the default menu. Go to SEt >> RS-485 . If not required, then press and hold F to step back to the previous menu. |
| 5 | Press  once to get to the next menu. The display will show the baudrate (baUD). See <i>Table 4:3</i> for baudrate options. Set baudrate. | Press G once to get to the next menu. The display will show the baudrate (baUD). See <i>Table 4:3</i> for baudrate options. Set baudrate. |
| 6 | Press G once to get to the next menu. The display will show the address (AddrE5). See <i>Table 4:3</i> for address range. Set address. | Press G once to get to the next menu. The display will show the address (AddrE5). See <i>Table 4:3</i> for address range. Set address. |
| 7 | Press G once to get to the next menu. The display will show the Oct. TO (OctE5). See <i>Table 4:3</i> for options. Set Oct. TO. | Press G once to get to the next menu. The display will show the Parity (PARity). See <i>Table 4:3</i> for options. Set Parity. |


| Step | EQ bus | Modbus |
|------|--|--------|
| 8 | Press G once to get to the next menu. The display will show the Inac. TO (Inac. TO). See <i>Table 4:3</i> for options. Set Inac. TO. | |
| 9 | Press G once to get to the next menu. The display will show if the password is to be reset (PASS'd). See <i>Table 4:3</i> for options. Set the option. | |

4.1.6 Setting IR Side

The IR Side uses the M-Bus and the EQ busⁱ protocol to communicate. To set the IR Side communication depending on protocol, perform the following steps:

| Step | M-Bus | EQ bus |
|------|---|---|
| 1 | Select <i>SEt</i> in the main menu, press  . | Select <i>SEt</i> in the main menu, press  . |
| 2 | Select <i>OPt</i> , press  . Select <i>Protoc</i> , press  . | Select <i>OPt</i> , press  . Select <i>Protoc</i> , press  . |
| 3 | If required, then press  and set the protocol to M-Bus (<i>mbUS</i>). The display will go back to the default menu. Go to <i>SEt >> OPt</i> . If not required, then press and hold F to step back to the previous menu. | If required, then press  and set the protocol to EQ bus (<i>eqbus</i>). The display will go back to the default menu. Go to <i>SEt >> OPt</i> . If not required, then press and hold F to step back to the previous menu. |
| 4 | Press  once to get to the next menu (<i>bAud</i>). The display will show the baudrate. See <i>Table 4:3</i> for baudrate options. Set baudrate. | Press G once to get to the next menu (<i>bAud</i>). The display will show the baudrate. See <i>Table 4:3</i> for baudrate options. Set baudrate. |
| 5 | Press G once to get to the next menu (<i>AddrE5</i>). The display will show the address. See <i>Table 4:3</i> for address range. Set address. | Press  once to get to the next menu (<i>AddrE5</i>). The display will show the address. See <i>Table 4:3</i> for address range. Set address. |
| 6 | Press  once to get to the next menu (<i>AccESS</i>). The display will show the access level. See <i>Table 4:3</i> for options. Set the access level. | Press G once to get to the next menu (<i>Oct. TO</i>). The display will show the Oct. TO. See <i>Table 4:3</i> for options. Set Oct. TO. |
| 7 | Press  once to get to the next menu (<i>Send St</i>). The display will show the Send status info. See <i>Table 4:3</i> for options. Set the send info status. | Press  once to get to the next menu (<i>Inac. TO</i>). The display will show the Inac. TO. See <i>Table 4:3</i> for options. Set Inac. TO. |
| | Press  once to get to the next menu (<i>PASS'd</i>). The display will show if the password is to be reset. See <i>Table 4:3</i> for options. Set the option. | Press  once to get to the next menu (<i>PASS'd</i>). The display will show password reset option. Set if the password shall be reset or not. |

- i. EQ bus is a communication protocol designed for internal communication with ABB meters. The protocol is based on the following IEC standards; 62056-42, 62056-46, 62056-53, 62056-61, 62056-62.

| Step | M-Bus | EQ bus |
|------|---|--------|
| | Press  once to get to the next menu (<i>UPgrAd</i>). The display will show the upgrade mode. See <i>Table 4:3</i> for options. Set the upgrade mode. | |

Protocol details

The following table shows the intervals and options for the different protocols:




Table: 4:3

| Protocol | Access level | Upgrade mode | Send Status Info | Reset password | Parity | Baudrate | Address | Inter octet timeout (ms) | Inactivity timeout (ms) |
|------------------------------------|------------------------|--------------------|----------------------------|----------------|-----------------|---|----------|--------------------------|-------------------------|
| EQ bus (when used through RS-485) | - | - | - | Yes, No | - | 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 125000, 230400, 250000, 460800 | 16-16381 | 20-6000 | 0-2000 |
| Modbus (when used through RS-485) | - | - | - | - | None, Odd, Even | 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 | 1-247 | - | - |
| M-Bus (when used through IR-Side) | Open, Password, Closed | Active, Not Active | Always, Never, When not OK | Yes, No | - | 2400, 4800, 9600, 19200, 38400 | 1-250 | - | - |
| EQ bus (when used through IR-Side) | - | - | - | Yes, No | - | 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 125000, 230400 | | | |

4.1.7 Setting Upgrade Consent




Upgrade Consent can be set to *Allowed* or *Not Allowed*. Setting it to *Allowed* means you agree to updates of the meter. Setting it to *Not Allowed* means no upgrades will take place.

To set Upgrade Consent, perform the following steps:

1. Select **SEt** in the main menu, press .
2. Select “Upgrade Consent” (**UPGr** on the display), press .
3. Press  to set Upgrade Consent.








4.1.8 Setting Pulse LED

To set pulse LED, perform the following steps:

1. Select **SEt** in the main menu, press .
2. Select “Pulse LED” (**PU LED** on the display), press .
3. Press  to set the type of energy that the LED shall indicate on.



4.1.9 Setting Tariff

The tariff source can be set to input, or communication. To set the tariffs, perform the following steps:

| Step | Input | Communication |
|------|--|---|
| 1 | Select SEt in the main menu, press  . | Select SEt in the main menu, press  . |
| 2 | Select ERR iFF , press  . | Select ERR iFF , press  . |
| 3 | Press  and select Input (i nPUt). | Press  and select Comm (Comm). |
| 4 | Use  to toggle to the first configuration. Four configurations are available. Set the tariff that shall be active for each configuration. | The tariff source is now set for communication. |
| 5 | - | - |

4.1.10 Resetting Resettable Registers

To reset registers, perform the following steps:

1. Select **SEt** in the main menu, press .
2. Select “Resettable registers” (**r5t r9** on the display), press .
3. The display will show the different registers to reset. Depending on the meter type, the available choices are:

| Register | On the display |
|--------------------------------|--------------------|
| Active Energy Imported Total | $A_{ct} I \bar{I}$ |
| Active Energy Exported Total | $A_{ct} EH$ |
| Reactive Energy Imported Total | $rER I \bar{I}$ |
| Reactive Energy Exported Total | $rER EH$ |
| Reset all | A_{LL} |

4. Toggle through the pages and reset the desired registers.

Chapter 5: Technical Description

Overview This chapter contains technical descriptions of the meter functions. Depending of the meter type, the meter may contain all or a subset of the functions described in this chapter.

In this chapter The following topics are covered in this chapter:

- 5.1 Energy Values 39
- 5.2 Instrumentation 40
- 5.3 Alarm 41
- 5.4 Inputs and Outputs 42
 - 5.4.1 Tariff Inputs 42
 - 5.4.2 Pulse Outputs 43
- 5.5 Logs 45
 - 5.5.1 System Log 45
 - 5.5.2 Event Log 46
 - 5.5.3 Net Quality Log 46
 - 5.5.4 Audit Log 46
 - 5.5.5 Settings Log 47
 - 5.5.6 Event codes 47

5.1 Energy Values

General

The energy values are stored in energy registers. The different energy registers can be divided into:

- Registers containing active, reactive or apparent energy
- Resettable registers

The energy values can be read via communication or directly in the display with the help of the buttons.

Primary value

In transformer connected meters with external current transformers, and sometimes also external voltage transformers, the register value is multiplied by the total transformer ratio before it is presented on the display or sent out via communication. This value is called primary value.

Presentation of register values

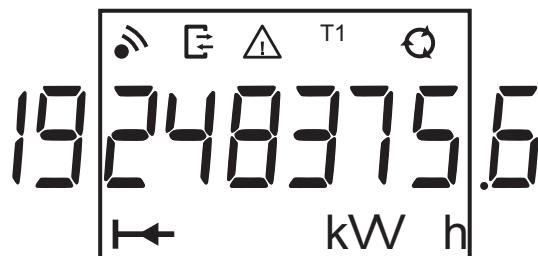
In direct connected meters the energy is usually displayed with a fixed unit and number of decimals (normally kWh, with no decimals).

In transformer connected meters where primary values are displayed, the energy values can be rather big when the total transformer ratio is big. Normally the meter automatically adapts the unit and number of decimals displayed to the value.

In case the energy is displayed with fixed units and number of decimals the energy will "roll over" to zeros when the energy is incremented if all nines are displayed. The meter can however contain more digits internally, which can be read out via communication if the meter is equipped with a communication interface. See the example below where the value 248375 is displayed, while the internal register contains 19248375.6.

Image

The following picture shows a display with fixed unit and numbers of decimals:



5.2 Instrumentation

Instrumentation functions

The following table shows the complete instrumentation functions of the B21 meters. Depending on the meter type all or a subset of the following functions are available.

| Instrumentation | B21 |
|---------------------|-----|
| Active power | X |
| Reactive power | X |
| Apparent power | X |
| Voltage | X |
| Current | X |
| Frequency | X |
| Power factor | X |
| Phase angle power | X |
| Phase angle voltage | X |
| Phase angle current | X |
| Current quadrant | X |
| THD | X |

Accuracy

All instrumentation data accuracy is defined within the voltage range 20 % of the stated nominal voltage and within the current range 5 % of the base current to the maximum current.

The accuracy of all instrumentation data except the voltage and current phase-angles is the same as the stated energy metering accuracy. The accuracy for the voltage and current phase-angles is 2 degrees.

5.3 Alarm

General

The purpose of the alarm function is to enable monitoring of quantities in the meter. Monitoring can be set to high or low level detection. High level detection gives an alarm when the level of a quantity goes above the set level. Low level detection gives an alarm when the value goes below the set level.

It is possible to configure 25 alarms. Configuration can be done via communication or with the buttons directly on the meter.

Quantities

Depending on the meter type all or a subset of the following quantities can be monitored:

| | |
|--------------|----------------|
| Voltage | Reactive power |
| Current | Apparent power |
| Active power | Power factor |

Functional description

When the value of the monitored quantity passes the activation level, and remains there for a period of time equal or longer than the specified time delay, the alarm is activated. In the same way, the alarm is deactivated when the value passes the deactivation level and remains there for a time equal or longer than the specified time delay.

If the activation level is higher than the deactivation level, the alarm is activated when the value of the monitored quantity is higher than the activation level.

If the activation level is lower than the deactivation level, the alarm is activated when the value of the monitored quantity is lower than the activation level.

5.4 Inputs and Outputs

General

Inputs/outputs are built with optocouplers and are galvanically isolated from other meter electronics. They are polarity independent and handle both DC and AC voltage.

An input that is not connected equals having its voltage off.

The equivalent circuitry of the outputs is an ideal relay in series with a resistor.

Functionality of inputs

The inputs count pulses, register activity and current status and the data can be read directly on the meter display or via communication

Register activity can be reset via communication or via the buttons directly on the meter.

Functionality of outputs

The outputs can be controlled by communication or alarm.

5.4.1 Tariff Inputs

Tariff control

On meters with tariff functionality, the tariffs are controlled either via communication, the internal clock or by 1 or 2 tariff inputs.

Tariff control via inputs is done by applying a proper combination of “voltage” or “no voltage” to the input(s). Each combination of “voltage”/“no voltage” will result in that the meter will register the energy in a particular tariff register.

In combined meters with both active and reactive metering, both quantities are controlled by the same inputs and the active tariff for active and reactive energy will always be the same.

Indication of active tariff

The active tariff is displayed on the LCD by the text "Tx" in the status field, where x is the tariff number. The active tariff can also be read via communication.

Input coding, meters with 4 tariffs

The coding of the inputs is binary. The following table describes the default coding.

| Input 4 | Input 3 | Tariff |
|---------|---------|--------|
| OFF | OFF | = T1 |
| OFF | ON | = T2 |
| ON | OFF | = T3 |
| ON | ON | = T4 |

Input coding, meters with 2 tariffs

The coding of the inputs is binary. The following table describes the default coding.

| Input 3 | Tariff |
|---------|--------|
| OFF | = T1 |
| ON | = T2 |

5.4.2 Pulse Outputs

About pulse outputs

Meters equipped with pulse outputs may have up to 4 outputs.

On the pulse outputs the meter sends out a specified number of pulses (pulse frequency) per kilowatt hour (kilovar for reactive pulse outputs).

For direct connected meters no external transformers are used and the amount of pulses sent out are in proportion to the energy flowed through the meter.

5.4.2.1 Pulse Frequency and Pulse length

General

Pulse frequency and pulse length can be set via the buttons on the meter or via communication. If the meter have more than 1 pulse output, all outputs will have the same pulse frequency and pulse length.

Pulse frequency

The pulse frequency is configurable and can be set to a value between 1-9999 impulses. The value must be an integer. The unit is selectable and may be set to imp/kWh, imp/Wh or imp/MWh.

Pulse length

The pulse length can be set to a value between 10-990 ms.

Deciding pulse frequency/length

If the power is too high for a certain pulse length and pulse frequency, there is a risk that the pulses may go into one another. If this happens the meter will emit a new pulse (relay closed) before the previous one has terminated (relay open) and the pulse will be missed. In worst case the relay may be closed at all times.

To avoid this problem a calculation should be made to work out the maximum pulse frequency allowed at a particular site based upon an estimated maximum power and the meter's pulse output data.

Formula

The formula to use for this calculation is:

$$\text{Max pulse frequency} = 1000 * 3600 / U / I / (P_{\text{pause}} + P_{\text{length}})$$

where U and I is the estimated maximum element voltage (in volts) and current (in amperes). Plength and Ppause are the pulse length and the required pulse pause (in seconds). A reasonable minimum pulse length and pulse pause is 30 ms which conforms to the S0 and IEC standard.



Note – U and I have to be the primary values in a transformer connected meter if the CT and VT for the external transformers are programmed into the meter.

Example 1

In a direct connected 1-element meter with estimated maximum voltage and current of 250 V and 65 A and pulse length 100 ms and required pulse pause 30 ms, the maximum allowed pulse frequency will be:

$$1000 * 3600 / 250 / 65 / (0.030 + 0.100) = 1704 \text{ impulses / kWh (kvarh)}$$

5.5 Logs

General

The meter contains a total of five different logs:

- System Log
- Event Log
- Net Quality Log
- Audit log
- Settings Log

Log events can be read via communication or directly in the display of the meter.

A maximum of 500 log events can be stored in the System Log, the Event Log and the Net Quality Log. When the maximum number of events for a log is reached, the oldest events will be overwritten.

A maximum of 40 log events can be stored in the Audit Log. When the maximum number of events for this log is reached, no more events can be stored. A new firmware upgrade attempt will be unsuccessful because no more log events can be stored.

A maximum of 80 log events can be stored in the Settings Log. When the maximum number of events for this log is reached, no more events can be stored. A new setting for either CT/VT or number of elements will not be accepted because no more log events can be stored.

It is possible to delete all entries in the System Log, The Event Log and the Net Quality Log via communication.

5.5.1 System Log

This log stores events that relate to errors in the meter.

Contents

The following information is stored in an event:

- Date and time
- Event Code
- Duration

The following events are stored in this log:

- Program CRC Error - Error when checking firmware consistency.
 - Persistent Storage Error - Data stored in long-term memory is corrupt.
 - RTC Circuit Error - Error when trying to read date and time from real-time clock.
-

5.5.2 Event Log

This log stores events that relate to alarms and configuration warnings.

Contents

The following information is stored in an event:

- Date and Time
- Event Code
- Duration

The following events are stored in this log:

- Date Not Set Warning - Date has not been configured for RTC.
 - Time Not Set Warning - Time has not been configured for RTC.
 - Negative Power Element 1 Warning - Element 1 measures negative power.
 - Negative Total Power Warning - Total power is measured as negative.
 - Alarm Current
 - Alarm Active Power
 - Alarm Reactive Power
 - Alarm Apparent power
 - Alarm Power Factor
-

5.5.3 Net Quality Log

This log stores alarms and information that relates to net quality.

Contents

The following events are stored in this log

- Voltage Missing Warning - Voltage is missing
 - Frequency Warning - Net frequency is not stable
 - Alarm Voltage
-

5.5.4 Audit Log

The Audit Log stores an event after an attempt has been made to upgrade the firmware.

Firmware upgrade on the meter can only be performed by the administrator-user via the EQ Bus protocol. Any firmware upgrade attempt stored in the audit log has been initiated by the administrator-user.

Contents

The following information is stored in an event:

- Date and Time
- Firmware version
- Active Energy import

- Active Energy import Tariff 1
 - Active Energy import Tariff 2
 - Active Energy import Tariff 3
 - Active Energy import Tariff 4
 - Active Energy Export
 - Firmware Upgrade status
-

5.5.5 Settings Log

This log stores an event when the transformer ratio is reconfigured.

Contents

The following information is stored in an event:

- Date and Time
 - Firmware version
 - Active Energy import
 - Active Energy import Tariff 1
 - Active Energy import Tariff 2
 - Active Energy import Tariff 3
 - Active Energy import Tariff 4
 - Active Energy Export
 - Elements
-

5.5.6 Event codes

Description

The following table describes the event codes that may occur in the System log, the Event log and the Net quality log:

| Event code | Event |
|------------|------------------------------|
| 41 | Program CRC error |
| 42 | Persistent storage error |
| 53 | RTC circuit error |
| 1000 | Voltage Missing Warning |
| 1007 | Negative Total Power Warning |
| 1008 | Frequency Warning |
| 2013 | Alarm 1 active |
| 2014 | Alarm 2 active |
| 2015 | Alarm 3 active |
| 2016 | Alarm 4 active |
| 2017 | Alarm 5 active |
| 2018 | Alarm 6 active |

| Event code | Event |
|------------|-----------------|
| 2019 | Alarm 7 active |
| 2020 | Alarm 8 active |
| 2021 | Alarm 9 active |
| 2022 | Alarm 10 active |
| 2023 | Alarm 11 active |
| 2024 | Alarm 12 active |
| 2025 | Alarm 13 active |
| 2026 | Alarm 14 active |
| 2027 | Alarm 15 active |
| 2028 | Alarm 16 active |
| 2029 | Alarm 17 active |
| 2030 | Alarm 18 active |
| 2031 | Alarm 19 active |
| 2032 | Alarm 20 active |
| 2033 | Alarm 21 active |
| 2034 | Alarm 22 active |
| 2035 | Alarm 23 active |
| 2036 | Alarm 24 active |
| 2037 | Alarm 25 active |

Chapter 6: Technical data

| | |
|----------|--|
| Overview | This chapter contains technical data and product drawings. |
|----------|--|

| | |
|-----------------|---|
| In this chapter | The following topics are covered in this chapter: |
| | 6.1 Technical Specifications 50 |
| | 6.2 Physical dimensions 52 |

6.1 Technical Specifications

Specifications for B21 direct connected meter

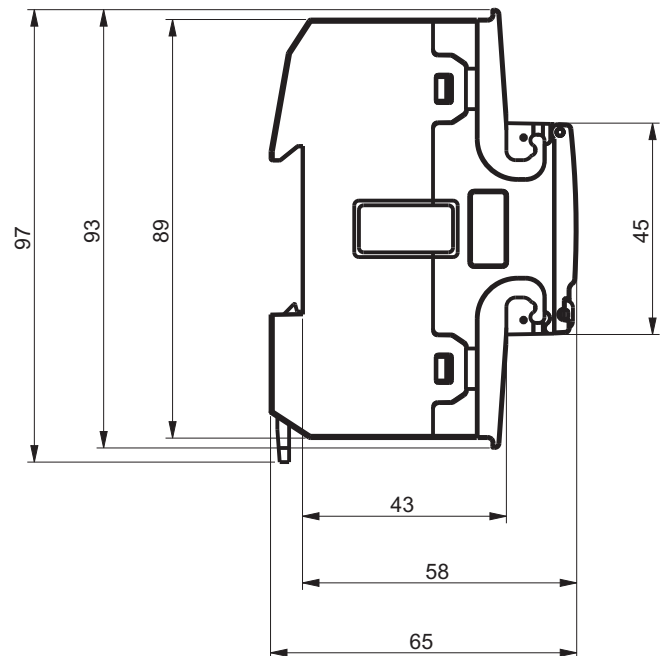
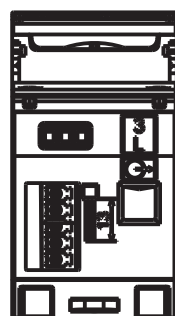
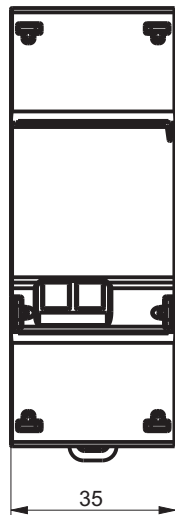
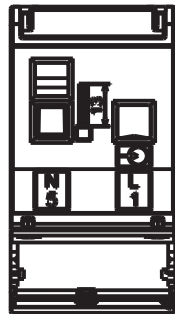
| | |
|------------------------------------|--|
| Voltage/current inputs | |
| Nominal voltage | 230 VAC |
| Voltage range | 220–240 VAC (-20% – +15%) |
| Power dissipation voltage circuits | 0.9 VA (0.4 W) total |
| Power dissipation current circuits | 0.014 VA (0.014 W) at 230 VAC and I_b |
| Base current I_b | 5 A |
| Reference current I_{ref} | 5 A |
| Transitional current I_{tr} | 0.5 A |
| Maximum current I_{max} | 65 A |
| Minimum current I_{min} | 0.25 A |
| Starting current I_{st} | < 20 mA |
| Terminal wire area | 1–25 mm ² |
| Recommended tightening torque | 3 Nm |
| General data | |
| Frequency | 50 or 60 Hz ± 5% |
| Accuracy Class | B (Cl. 1) and Reactive Cl. 2 |
| Active energy | 1% |
| Display of energy | 6-digit LCD |
| Mechanical | |
| Material | Polycarbonate in transparent front glass. Glass reinforced polycarbonate in bottom case and upper case. Polycarbonate in terminal cover. |
| Weight | |
| Environmental | |
| Operating temperature | -40°C to +70°C |
| Storage temperature | -40°C to +85°C |
| Humidity | 75% yearly average, 95% on 30 days/year. |
| Resistance to fire and heat | Terminal 960°C, cover 650°C (IEC 60695-2-1) |
| Resistance to water and dust | IP 20 on terminal block without protective enclosure and IP 51 in protective enclosure, according to IEC 60529. |
| Mechanical environment | Class M1 in accordance with the Measuring Instrument Directive (MID), (2014/32/UE). |
| Electromagnetic environment | Class E2 in accordance with the Measuring Instrument Directive (MID), (2014/32/UE). |
| Outputs | |
| Current | 2–100 mA |
| Voltage | 24 VAC–240 VAC, 24 VDC–240 VDC. For meters with only 1 output, 5–40VDC. |
| Pulse output frequency | Prog. 1–9999 imp/MWh, 1–9999 imp/kWh, 1–9999 imp/Wh |

| | |
|--|---|
| Pulse length | 10–990 ms |
| Terminal wire area | 0.5–1 mm ² |
| Recommended tightening torque | 0.25 Nm |
| Inputs | |
| Voltage | 0–240 V AC/DC |
| OFF | 0–12 V AC/DC |
| ON | 57–240 V AC/24–240 V DC |
| Min. pulse length | 30 ms |
| terminal wire area | 0.5–1 mm ² |
| Recommended tightening torque | 0.25 Nm |
| Communication | |
| Terminal wire area | 0.5–1 mm ² |
| Recommended tightening torque | 0.25 Nm |
| M-Bus | EN 13757-2, EN 13757-3 |
| Modbus | Modbus Application Protocol Specification V1, 1b |
| EQ bus | 62056-42, 62056-46, 62056-53, 62056-61, 62056-62 |
| Pulse indicator(LED) | |
| Pulse frequency | 1000 imp/kWh |
| Pulse length | 40 ms |
| EMC compatibility | |
| Impulse voltage test | 6 kV 1.2/50µs (IEC 60060-1) |
| Surge voltage test | 4 kV 1.2/50µs (IEC 61000-4-5) |
| Fast transient burst test | 4 kV (IEC 61000-4-4) |
| Immunity to electromagnetic HF-fields | 80 MHz–2 GHz at 10 V/m (IEC61000-4-3) |
| Immunity to conducted disturbance | 150kHz–80MHz (IEC 61000-4-6) |
| Immunity to electromagnetic disturbances | 2–150 kHz for kWh-meters |
| Radio frequency emission | EN 55022, class B (CISPR22) |
| Electrostatic discharge | 15 kV (IEC 61000-4-2) |
| Standards | IEC 62052-11, IEC 62053-21 class 1 & 2, IEC 62053-23 class 2, IEC 62054-21, GB/T 17215.211-2006, GBT 17215.321-2008 class 1 & 2, GB 4208-2008, EN 50470-1, EN 50470-3 category B. |

6.2 Physical dimensions

B21

The following drawing shows the physical dimensions of the B21 meters.



Chapter 7: Measurement Methods

| | |
|----------|---|
| Overview | This chapter contains information about measurement theory and the most commonly used measurement methods. The information can be used to better understand the meter behavior and/or to pick the correct measurement method. |
|----------|---|

| | |
|-----------------|---|
| In this chapter | The following topics are covered in this chapter: |
| | 7.1 Measuring Energy 54 |
| | 7.1.1 Single Phase, 1-Element Metering 56 |

7.1 Measuring Energy

Active energy

It is easy to understand the need for a utility to measure active energy, since the information is necessary to bill the customer correctly. Usually the more energy the customer consumes the higher the accuracy of the meter needs to be. Normally 4 accuracy classes are used: 2%- (small consumers, e.g. households), 1%-, 0.5%- and 0.2%-meters with defined power levels for each class.

Also from a customer point of view it is easy to understand the need to measure the active energy as it can give him information about where and when energy is consumed. This information can then be used to take measures to decrease the consumption.

In many cases it is desired to simplify the measurement. In such cases simplified methods can be used of which the most common are described in this chapter. These methods most often require a balanced load, which means that the impedance is the same in all phases giving the same current amplitude and power factor in all phases.

Reactive energy

Sometimes there is also a need to measure the reactive energy. Consumer equipment often introduces a phase shift between current and voltage due to the fact that the load has a more or less reactive component, e.g. motors that have an inductive component, etc. A reactive load will increase the current which means that the power source generator and the size of the power lines have to increase which in turn means higher cost for the utility. A higher current also means that the line losses increase.

Because of that, the maximum permissible phase shift is sometimes governed in the terms of the contract that the consumer have with the power supplier. If the consumer exceeds a specified maximum reactive load, he will be liable for an extra charge. This type of contract will require a utility meter that measures reactive energy and/or power.

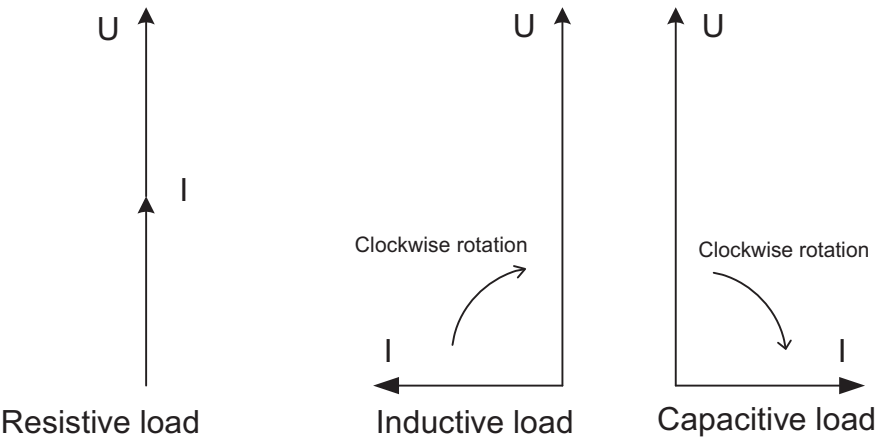
Also, from the customer's point of view, it may be of some interest to measure reactive energy/power since it gives knowledge about the nature of the load. That is, how big the different loads are and how they vary over time. This knowledge can be used in the planning how to decrease the reactive power/energy to decrease the electricity bill.

Resistive, inductive and capacitive loads

Resistive loads don't give rise to any phase shifts. Inductive loads have phase shift in one direction with the current lagging the voltage, while capacitive loads produces a phase shift in the opposite direction with the current leading the voltage. As a result, inductive and capacitive loads can be used to compensate each other

Illustration

The following illustration shows a vector diagram for resistive, inductive and capacitive loads:

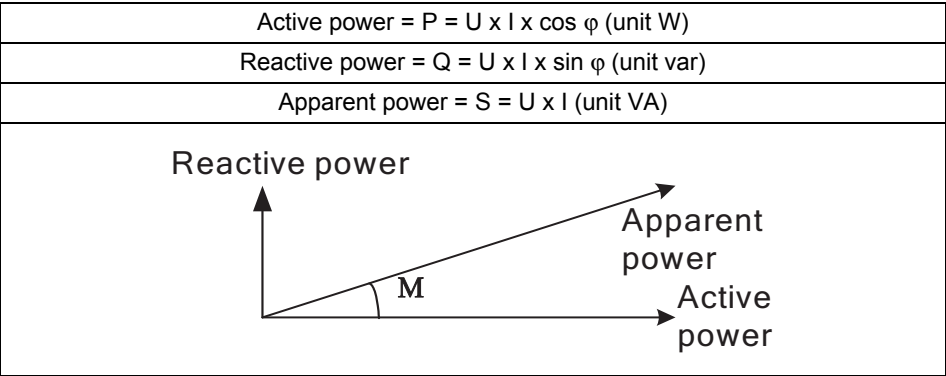


Phase displacement

A load that consumes both reactive and active energy can be divided into active and reactive components. The angle between the apparent power ($U \times I$) vector and the active power component is described as phase displacement angle or power factor angle, often referred to as ϕ . $\cos \phi$ is referred to as the power factor.

Illustration

The following illustration shows a vector diagram for a load with an active and a reactive component:

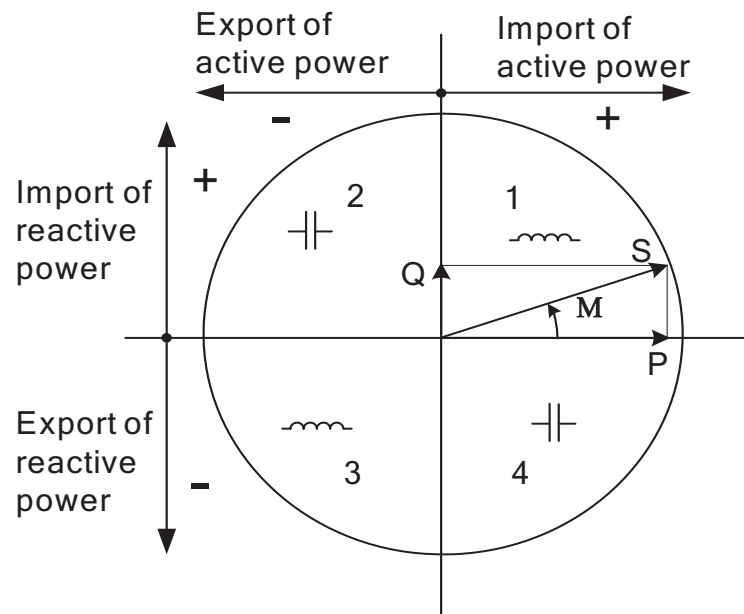


The 4 power quadrants

The type of load can be represented geometrically by four quadrants. In the first quadrant the load is inductive and active and energy is imported (energy is delivered from the utility to the customer). In the second quadrant the load is capacitive and active energy is exported and reactive energy is imported. In the third quadrant the load is inductive and active and reactive energy is exported. In the last quadrant the load is capacitive and active energy is imported and reactive energy exported.

Illustration

The following illustration shows the loads



7.1.1 Single Phase, 1-Element Metering

1- element metering in a 2-wire system

In a 2-wire installation a single phase meter is used. Normally the 2 wires are a phase voltage and the neutral.

The active energy consumed by the load is the product of momentary voltage and current integrated over the desired measuring time period.

Calculating active power

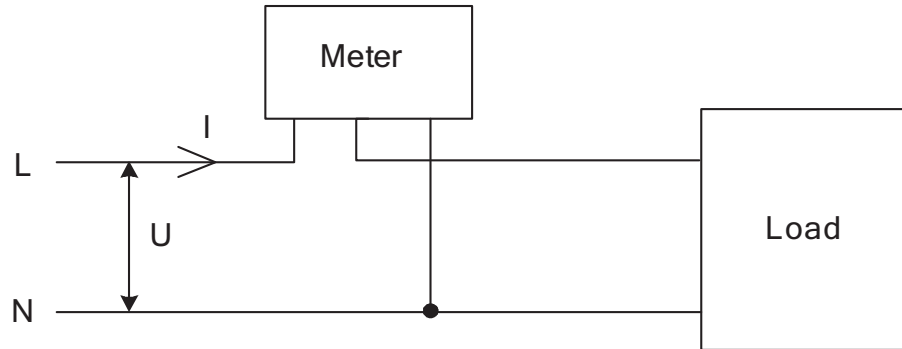
In the case where no harmonics is present and the rms value of the voltage and current is constant, the active power can be expressed as:

$$P = U_{\text{rms}} * I_{\text{rms}} * \cos \varphi$$

where φ is the phase angle between the voltage and the current.

Illustration

The following illustration shows a direct connected single phase meter measuring the active energy (E) consumed by a load.

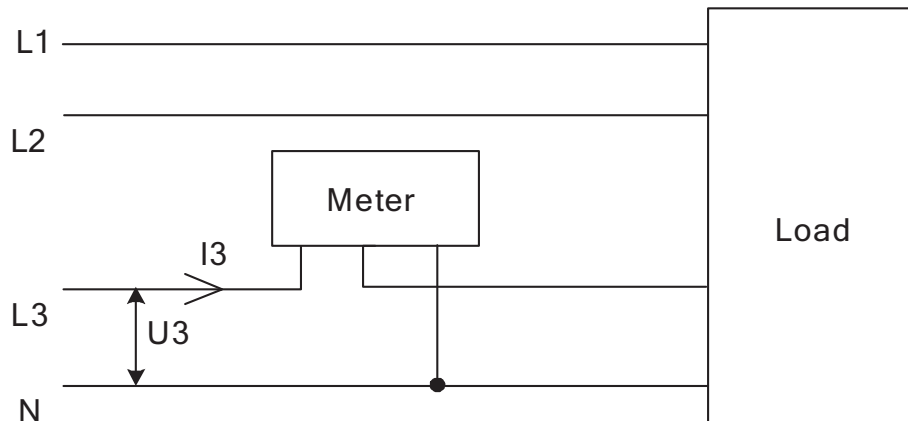


1-element metering in a 4-wire system

In 4-wire system the single element metering method only gives correct results in a balanced system (same voltage, current and power factor in all phases). This method should not be used for accurate measurement, but can be used when high accuracy is not needed.

Illustration

The following illustration shows single phase metering in a 3-phase system.



Chapter 8: Service & Maintenance

Overview

This chapter contains information about service and maintenance of the product.

In this chapter

The following topics are covered in this chapter:

8.1 Service and Maintenance 59

8.1 Service and Maintenance

| | |
|----------------|--|
| Service | This product contains no parts that can be repaired or exchanged. A broken meter must be replaced. |
|----------------|--|

| | |
|-----------------|---|
| Cleaning | If the meter needs to be cleaned, use a lightly moistened cloth with a mild detergent to wipe it. |
|-----------------|---|



Caution – Be careful that no liquid gets into the meter since it can ruin the equipment.

Chapter 9: Communication with Modbus

Overview

This chapter describes the mapping from meter data to Modbus and how to read and write to registers.

In this chapter

The following topics are covered in this chapter:

| | |
|---|----|
| 9.1 About the Modbus Protocol | 61 |
| 9.1.1 Function Code 3 (Read holding registers) | 61 |
| 9.1.2 Function Code 16 (Write multiple registers) | 63 |
| 9.1.3 Function Code 6 (Write single register) | 64 |
| 9.2 Reading and Writing to Registers | 66 |
| 9.3 Mapping Tables | 67 |
| 9.4 Configuration | 76 |
| 9.4.1 Alarms | 76 |
| 9.4.2 Inputs and outputs | 77 |
| 9.4.3 Tariffs | 79 |

9.1 About the Modbus Protocol

General

Modbus is a master-slave communication protocol that can support up to 247 slaves organized as a multidrop bus. The communication is half duplex. Services on Modbus are specified by function codes.

The function codes are used to read or write 16 bit registers. All metering data, such as active energy, voltage or firmware version, is represented by one or more such registers. For further information about the relation between register number and metering data, refer to “Mapping Tables” on page - 70.

The Modbus protocol is specified in its entirety in Modbus Application Protocol Specification V1.1b. The document is available at <http://www.modbus.org>

Supported function codes

The following function codes are supported:

- Function code 3 (Read holding registers)
 - Function code 6 (Write single register)
 - Function code 16 (Write multiple registers)
-

Modbus request frame

A Modbus request frame generally has the following structure:

| | | | |
|---------------|---------------|------|-------------|
| Slave Address | Function Code | Data | Error Check |
|---------------|---------------|------|-------------|

| | |
|---------------|--|
| Slave address | Modbus slave address, 1 byte. |
| Function code | Decides the service to be performed. |
| Data | Dependent on the function code. The length varies. |
| Error check | CRC, 2 bytes |

Message types

The network messages can be query-response or broadcast type. The query-response command sends a query from the master to an individual slave and is generally followed by a response.

The broadcast command sends a message to all slaves and is never followed by a response. Broadcast is supported by function code 6 and 16.

9.1.1 Function Code 3 (Read holding registers)

General

Function code 3 is used to read measurement values or other information from the electricity meter. It is possible to read up to 125 consecutive registers at a time. This means that multiple values can be read in one request.

Request frame

A request frame has the following structure:

| Slave Address | Function Code | Address | No. of Registers | Error Check |
|---------------|---------------|---------|------------------|-------------|
|---------------|---------------|---------|------------------|-------------|

Example of a request

The following is an example of a request. (read total energy import, etc...)

| | |
|------------------------------|------|
| Slave address | 0x01 |
| Function code | 0x03 |
| Start address, high byte | 0x50 |
| Start address, low byte | 0x00 |
| No. of registers, high byte | 0x00 |
| No. of registers, low byte | 0x18 |
| Error check (CRC), high byte | 0x54 |
| Error check (CRC), low byte | 0xC0 |

Response frame

A response frame has the following structure:

| Slave Address | Function Code | Byte Count | Register Values | Error Check |
|---------------|---------------|------------|-----------------|-------------|
|---------------|---------------|------------|-----------------|-------------|

Example of a response

The following is an example of a response:

| | |
|-------------------------------------|------|
| Slave address | 0x01 |
| Function code | 0x03 |
| Byte count | 0x30 |
| Value of register 0x5000, high byte | 0x00 |
| Value of register 0x5000, low byte | 0x15 |
| ... | |
| Value of register 0x5017, high byte | 0xFF |
| Value of register 0x5017, low byte | 0xFF |
| Error check (CRC), high byte | 0XX |
| Error check (CRC), low byte | 0XX |

In this example, the slave with the Modbus address 1 responds to a read request. The number of data bytes is 0x30. The first register (0x5000) has the value 0x0015 and the last (0x5017) has the value 0xFFFF

9.1.2 Function Code 16 (Write multiple registers)

General

Function code 16 is used to modify settings in the meter, such as date/time, to control output and to reset values, such as power fail counter. It is possible to write up to 123 consecutive registers in a single request. This means that several settings can be modified and/or several reset operations can be performed in a single request.

Request frame

A request frame has the following structure:

| Slave Address | Function Code | Start Address | No. of Registers | Byte Count | Register Values | Error Check |
|---------------|---------------|---------------|------------------|------------|-----------------|-------------|
|---------------|---------------|---------------|------------------|------------|-----------------|-------------|

Example of a request

The following is an example of a request (set Date/Time to November 11, 2010, 12:13:14):

| | |
|-------------------------------------|------|
| Slave address | 0x01 |
| Function code | 0x10 |
| Start address, high byte | 0x8A |
| Start address, low byte | 0x00 |
| No. of registers, high byte | 0x00 |
| No. of registers, low byte | 0x03 |
| Byte count | 0x06 |
| Value of register 0x8A00, high byte | 0x0A |
| Value of register 0x8A00, low byte | 0x0B |
| Value of register 0x8A01, high byte | 0x0B |
| Value of register 0x8A01, low byte | 0x0C |
| Value of register 0x8A02, high byte | 0x0D |
| Value of register 0x8A02, low byte | 0x0E |
| Error check (CRC), high byte | 0x8C |
| Error check (CRC), low byte | 0x82 |

In this example the master sends a write request to the slave that has the Modbus address 1. The first register to write is 0x8A00 and the number of registers to write is 0x03. This means that the registers 0x8A00 to 0x8A02 are written. Register 0x8A00 is set to the value 0x0A0B, and so on.

Response frame

A response frame has the following structure:

| Slave Address | Function Code | Start Address | No. of Registers | Error Check |
|---------------|---------------|---------------|------------------|-------------|
|---------------|---------------|---------------|------------------|-------------|

Example of a response

The following is an example of a response:

| | |
|------------------------------|------|
| Slave address | 0x01 |
| Function code | 0x10 |
| Register address, high byte | 0x8A |
| Register address, low byte | 0x00 |
| No. of registers, high byte | 0x00 |
| No. of registers, low byte | 0x03 |
| Error check (CRC), high byte | 0xAA |
| Error check (CRC), low byte | 0x10 |

In the example above the slave with the Modbus address 1 responds to a write request. The first register is 0x8A00 and 0x03 registers have been successfully written to.

9.1.3 Function Code 6 (Write single register)

General

Function code 6 can be used as an alternative to function code 16 if there is only one register to be written. It can, for example be used to reset the power fail counter.

Request frame

A request frame has the following structure:

| Slave Address | Function Code | Register Address | Register Value | Error Check |
|---------------|---------------|------------------|----------------|-------------|
|---------------|---------------|------------------|----------------|-------------|

Example of a request

The following is an example of a request (reset power fail counter):

| | |
|-----------------------------|------|
| Slave address | 0x01 |
| Function code | 0x06 |
| Register address, high byte | 0x8F |
| Register address, low byte | 0x00 |
| No. of registers, high byte | 0x00 |
| No. of registers, low byte | 0x01 |

| | |
|------------------------------|------|
| Error check (CRC), high byte | 0x62 |
| Error check (CRC), low byte | 0xDE |

Response frame Using function code 6, the response frame is an echo of the request frame.

9.1.3.1 Exception Responses

General If an error should occur while processing a request, then the meter gives an exception response that contains an exception code.

Exception frame An exception frame has the following structure:


| | | | |
|---------------|---------------|----------------|-------------|
| Slave Address | Function Code | Exception Code | Error Check |
|---------------|---------------|----------------|-------------|

In the exception response the function code is set to the function code of the request plus 0x80.

Exception codes The exception codes that are used are listed in the following table:

| Exception code | Exception | Definition |
|----------------|----------------------|--|
| 01 | Illegal function | A function code that is not supported has been used. |
| 02 | Illegal data address | The requested register is outside the allowed range. |
| 03 | Illegal data value | The structure of a received message is incorrect. |
| 04 | Slave device failure | Processing the request fail due to an internal error in the meter. |

9.2 Reading and Writing to Registers

| | |
|------------------------------|---|
| Readable registers | <p>The readable range in the modbus mapping are registers 1000-8EFF (hexadecimal). Reading any registers within this range will result in a normal Modbus response. It is possible to read any number of registers between 1 and 125, i.e., it is not necessary to read all registers of a quantity listed on one line in the mapping tables. Any attempt to read outside this range will result in an illegal data address exception (Modbus exception code 2).</p> |
| Multi-register values | <p>For quantities that are represented as more than 1 register, the most significant byte is found in the high byte of the first (lowest) register. The least significant byte is found in the low byte of the last (highest) register.</p> |
| Unused registers | <p>Unused registers within the mapping range, for example missing quantities in the connected meter, will result in a normal Modbus response but the value of the register will be set to “invalid”.</p> <p>For quantities with data type “unsigned”, the value will be FFFF in all registers. For quantities with data type “signed”, the value is the highest value possible to express. That means that a quantity that is represented by only one register will have the value 7FFF. A quantity that is represented by 2 registers will have the value 7FFFFFFF, and so on.</p> |
| Writing to registers | <p>Writing to registers is only permitted to the registers listed as writable in the mapping tables. Attempting to write to a register that is listed as writable but that is not supported by the meter will not result in an error indication.</p> |
| | <p> Note – It is not possible to modify parts of a setting, e.g. to set only the year and month of the Date/time setting.</p> |
| Confirm set values | <p>After you set a value in the meter, it is recommended that you read the value to confirm the result, since it is not possible to confirm if a write was successful from the Modbus response.</p> |

9.3 Mapping Tables

Introduction

The purpose of this section is to explain the relation between register number and metering data.

Contents of the mapping tables

The following table explains the content of the mapping tables:

| | |
|-----------------|--|
| Quantity | Name of the meter quantity or other information available in the meter. |
| Details | Refinement of the Quantity column. |
| Start Reg (Hex) | Hexadecimal number for the first (lowest) Modbus Register for this quantity. * |
| Size | Number of Modbus registers for the meter Quantity. A Modbus Register is 16 bits long. |
| Res. | Resolution of the value for this Quantity (if applicable). |
| Unit | Unit for the Quantity (if applicable). |
| Data type | Data type for this Quantity, i.e. how the value in the Modbus registers should be interpreted. |

*It is expressed exactly as it is sent on the bus. That is, it should not be subtracted by 40 000 or decremented by 1, as is common for Modbus products.

Total energy accumulators

All registers in the following table are read only:

| Quantity | Details | Start reg (Hex) | Size | Res. | Unit | Data type |
|------------------------|---------|-----------------|------|-------|----------|-----------|
| Active import | kWh | 5000 | 4 | 0,01 | kWh | Unsigned |
| Active export | kWh | 5004 | 4 | 0,01 | kWh | Unsigned |
| Active net | kWh | 5008 | 4 | 0,01 | kWh | Signed |
| Reactive import | kvarh | 500C | 4 | 0,01 | kvarh | Unsigned |
| Reactive export | kvarh | 5010 | 4 | 0,01 | kvarh | Unsigned |
| Reactive net | kvarh | 5014 | 4 | 0,01 | kvarh | Signed |
| Apparent import | kVAh | 5018 | 4 | 0,01 | kVAh | Unsigned |
| Apparent export | kVAh | 501C | 4 | 0,01 | kVAh | Unsigned |
| Apparent net | kVAh | 5020 | 4 | 0,01 | kVAh | Signed |
| Active import CO2 | kVAh | 5024 | 4 | 0,001 | kg | Unsigned |
| Active import Currency | kVAh | 5034 | 4 | 0,001 | currency | Unsigned |

Energy accumulators divided into tariffs

All registers in the following table are read only:

| Quantity | Details | Start reg (Hex) | Size | Res. | Unit | Data type |
|-----------------|----------|-----------------|------|------|-------|-----------|
| Active import | Tariff 1 | 5170 | 4 | 0,01 | kWh | Unsigned |
| Active import | Tariff 2 | 5174 | 4 | 0,01 | kWh | Unsigned |
| Active import | Tariff 3 | 5178 | 4 | 0,01 | kWh | Unsigned |
| Active import | Tariff 4 | 517C | 4 | 0,01 | kWh | Unsigned |
| Active export | Tariff 1 | 5190 | 4 | 0,01 | kWh | Unsigned |
| Active export | Tariff 2 | 5194 | 4 | 0,01 | kWh | Unsigned |
| Active export | Tariff 3 | 5198 | 4 | 0,01 | kWh | Unsigned |
| Active export | Tariff 4 | 519C | 4 | 0,01 | kWh | Unsigned |
| Reactive import | Tariff 1 | 51B0 | 4 | 0,01 | kvarh | Unsigned |
| Reactive import | Tariff 2 | 51B4 | 4 | 0,01 | kvarh | Unsigned |
| Reactive import | Tariff 3 | 51B8 | 4 | 0,01 | kvarh | Unsigned |
| Reactive import | Tariff 4 | 51BC | 4 | 0,01 | kvarh | Unsigned |
| Reactive export | Tariff 1 | 51D0 | 4 | 0,01 | kvarh | Unsigned |
| Reactive export | Tariff 2 | 51D4 | 4 | 0,01 | kvarh | Unsigned |
| Reactive export | Tariff 3 | 51D8 | 4 | 0,01 | kvarh | Unsigned |
| Reactive export | Tariff 4 | 51DC | 4 | 0,01 | kvarh | Unsigned |

Energy accumulators per phase

All registers in the following table are read only:

| Quantity | Details | Start reg (Hex) | Size | Res. | Unit | Data type |
|---------------|---------|-----------------|------|------|------|-----------|
| Active import | L1 | 5460 | 4 | 0,01 | kWh | Unsigned |
| Active import | L2 | 5464 | 4 | 0,01 | kWh | Unsigned |
| Active import | L3 | 5468 | 4 | 0,01 | kWh | Unsigned |
| Active export | L1 | 546C | 4 | 0,01 | kWh | Unsigned |
| Active export | L2 | 5470 | 4 | 0,01 | kWh | Unsigned |
| Active export | L3 | 5474 | 4 | 0,01 | kWh | Unsigned |
| Active net | L1 | 5478 | 4 | 0,01 | kWh | Signed |
| Active net | L2 | 547C | 4 | 0,01 | kWh | Signed |
| Active net | L3 | 5480 | 4 | 0,01 | kWh | Signed |

| Quantity | Details | Start reg (Hex) | Size | Res. | Unit | Data type |
|-----------------|---------|-----------------|------|------|-------|-----------|
| Reactive import | L1 | 5484 | 4 | 0,01 | kvarh | Unsigned |
| Reactive import | L2 | 5488 | 4 | 0,01 | kvarh | Unsigned |
| Reactive import | L3 | 548C | 4 | 0,01 | kvarh | Unsigned |
| Reactive export | L1 | 5490 | 4 | 0,01 | kvarh | Unsigned |
| Reactive export | L2 | 5494 | 4 | 0,01 | kvarh | Unsigned |
| Reactive export | L3 | 5498 | 4 | 0,01 | kvarh | Unsigned |
| Reactive net | L1 | 549C | 4 | 0,01 | kvarh | Signed |
| Reactive net | L2 | 54A0 | 4 | 0,01 | kvarh | Signed |
| Reactive net | L3 | 54A4 | 4 | 0,01 | kvarh | Signed |
| Apparent import | L1 | 54A8 | 4 | 0,01 | kVAh | Unsigned |
| Apparent import | L2 | 54AC | 4 | 0,01 | kVAh | Unsigned |
| Apparent import | L3 | 54B0 | 4 | 0,01 | kVAh | Unsigned |
| Apparent export | L1 | 54B4 | 4 | 0,01 | kVAh | Unsigned |
| Apparent export | L2 | 54B8 | 4 | 0,01 | kVAh | Unsigned |
| Apparent export | L3 | 54BC | 4 | 0,01 | kVAh | Unsigned |
| Apparent net | L1 | 54C0 | 4 | 0,01 | kVAh | Signed |
| Apparent net | L2 | 54C4 | 4 | 0,01 | kVAh | Signed |
| Apparent net | L3 | 54C8 | 4 | 0,01 | kVAh | Signed |

Resettable energy accumulators

All registers in the following table are read only:

| Quantity | Start reg (Hex) | Size | Res. | Unit | Data type |
|----------------------------|-----------------|------|------|------|-----------|
| Resettable active import | 552C | 4 | 0,01 | kWh | Unsigned |
| Resettable active export | 5530 | 4 | 0,01 | kWh | Unsigned |
| Resettable reactive import | 5534 | 4 | 0,01 | kWh | Unsigned |
| Resettable reactive export | 5538 | 4 | 0,01 | kWh | Unsigned |

Instantaneous values

All registers in the following table are read only:

| Quantity | Details | Start reg (Hex) | Size | Res. | Unit | Value range | Data type |
|---------------------|---------|-----------------|------|-------|------|---------------|-----------|
| Voltage | L1-N | 5B00 | 2 | 0,1 | V | | Unsigned |
| Voltage | L2-N | 5B02 | 2 | 0,1 | V | | Unsigned |
| Voltage | L3-N | 5B04 | 2 | 0,1 | V | | Unsigned |
| Voltage | L1-L2 | 5B06 | 2 | 0,1 | V | | Unsigned |
| Voltage | L3-L2 | 5B08 | 2 | 0,1 | V | | Unsigned |
| Voltage | L1-L3 | 5B0A | 2 | 0,1 | V | | Unsigned |
| Current | L1 | 5B0C | 2 | 0,01 | A | | Unsigned |
| Current | L2 | 5B0E | 2 | 0,01 | A | | Unsigned |
| Current | L3 | 5B10 | 2 | 0,01 | A | | Unsigned |
| Current | N | 5B12 | 2 | 0,01 | A | | Unsigned |
| Active power | Total | 5B14 | 2 | 0,01 | W | | Signed |
| Active power | L1 | 5B16 | 2 | 0,01 | W | | Signed |
| Active power | L2 | 5B18 | 2 | 0,01 | W | | Signed |
| Active power | L3 | 5B1A | 2 | 0,01 | W | | Signed |
| Reactive power | Total | 5B1C | 2 | 0,01 | var | | Signed |
| Reactive power | L1 | 5B1E | 2 | 0,01 | var | | Signed |
| Reactive power | L2 | 5B20 | 2 | 0,01 | var | | Signed |
| Reactive power | L3 | 5B22 | 2 | 0,01 | var | | Signed |
| Apparent power | Total | 5B24 | 2 | 0,01 | VA | | Signed |
| Apparent power | L1 | 5B26 | 2 | 0,01 | VA | | Signed |
| Apparent power | L2 | 5B28 | 2 | 0,01 | VA | | Signed |
| Apparent power | L3 | 5B2A | 2 | 0,01 | VA | | Signed |
| Frequency | | 5B2C | 1 | 0,01 | Hz | | Unsigned |
| Phase angle power | Total | 5B2D | 1 | 0,1 | ° | -180°-+180° | Signed |
| Phase angle power | L1 | 5B2E | 1 | 0,1 | ° | -180°-+180° | Signed |
| Phase angle power | L2 | 5B2F | 1 | 0,1 | ° | -180°-+180° | Signed |
| Phase angle power | L3 | 5B30 | 1 | 0,1 | ° | -180°-+180° | Signed |
| Phase angle voltage | L1 | 5B31 | 1 | 0,1 | ° | -180°-+180° | Signed |
| Phase angle voltage | L2 | 5B32 | 1 | 0,1 | ° | -180°-+180° | Signed |
| Phase angle voltage | L3 | 5B33 | 1 | 0,1 | ° | -180°-+180° | Signed |
| Phase angle current | L1 | 5B37 | 1 | 0,1 | ° | -180°-+180° | Signed |
| Phase angle current | L2 | 5B38 | 1 | 0,1 | ° | -180°-+180° | Signed |
| Phase angle current | L3 | 5B39 | 1 | 0,1 | ° | -180°-+180° | Signed |
| Power factor | Total | 5B3A | 1 | 0,001 | - | -1,000-+1,000 | Signed |
| Power factor | L1 | 5B3B | 1 | 0,001 | - | -1,000-+1,000 | Signed |
| Power factor | L2 | 5B3C | 1 | 0,001 | - | -1,000-+1,000 | Signed |

| Quantity | Details | Start reg (Hex) | Size | Res. | Unit | Value range | Data type |
|------------------|---------|-----------------|------|-------|------|---------------|-----------|
| Power factor | L3 | 5B3D | 1 | 0,001 | - | -1,000-+1,000 | Signed |
| Current quadrant | Total | 5B3E | 1 | | - | 1-4 | Unsigned |
| Current quadrant | L1 | 5B3F | 1 | | - | 1-4 | Unsigned |
| Current quadrant | L2 | 5B40 | 1 | | - | 1-4 | Unsigned |
| Current quadrant | L3 | 5B41 | 1 | | - | 1-4 | Unsigned |



Note – Powers are sent out as 32 bit signed integers, expressed in W (or var/VA) with 2 decimals. This means that the maximum power possible to express is approximately ± 21 MW. If the power is higher than that, then the user is advised to read power from the DMTME mapping instead, where the scaling is in W without decimals.

Outputs

The following table contains both writable and read only registers:

| Quantity | Details | Start Reg (Hex) | Size | Possible values | Data type | Read/ Write |
|----------|---------|-----------------|------|-----------------|-----------|-------------|
| Output 1 | | 6300 | 1 | ON=1, OFF=0 | Unsigned | R/W |
| Output 2 | | 6301 | 1 | ON=1, OFF=0 | Unsigned | R/W |

Production data and identification

All registers in the following table are read only:

| Quantity | Start Reg (Hex) | Size | Data type |
|------------------------|-----------------|------|--|
| Serial number | 8900 | 2 | Unsigned |
| Meter firmware version | 8908 | 8 | ASCII string (up to 16 characters) |
| Modbus mapping version | 8910 | 1 | 2 bytes |
| Type designation | 8960 | 6 | ASCII string (12 characters, including null termination) |

Meter firmware version is expressed as a string of 3 digits separated by periods, e.g. 1.0.0. Unused bytes at the end are set to binary 0.

In the **Modbus mapping version** register the high byte corresponds to the Major version (1-255), and the low byte corresponds to the Minor version (0-255).

Miscellaneous

In the following table Date/time and current tariff are writable. All other registers are read only:

| Quantity | Start Reg (Hex) | Description | Size | Data type | Read/Write |
|----------------|-----------------|---|------|-----------|------------|
| Date/time | 8A00 | Byte 0: year* Byte 1: month Byte 2: day Byte 3: hour Byte 4: minute Byte 5: second | 3 | Date/Time | R/W |
| Day of week | 8A03 | Weekdays (1-7, Mo=1) | 1 | Unsigned | R |
| DST active | 8A04 | 1=DST active 0=DST inactive | 1 | Unsigned | R |
| Day type | 8A05 | Value 0-3 correspond to day type 1-4 | 1 | Unsigned | R |
| Season | 8A06 | Value 0-3 correspond to season 1-4 | 1 | Unsigned | R |
| Current tariff | 8A07 | Tariff 1-4 | 1 | Unsigned | R/W |

| Quantity | Start Reg (Hex) | Description | Size | Data type | Read/Write |
|--|-----------------|--|------|-----------|------------|
| Power fail counter | 8A2F | | 1 | Unsigned | R |
| Power outage time | 8A39 | Byte 0-2: days* Byte 3: hours Byte 4: minutes Byte 5: seconds | 3 | Date/Time | R |
| Reset counter for active energy import | 8A48 | | 4 | Unsigned | R |
| Reset counter for active energy export | 8A4C | | 4 | Unsigned | R |
| Reset counter for reactive energy import | 8A50 | | 4 | Unsigned | R |
| Reset counter for reactive energy export | 8A54 | | 4 | Unsigned | R |

* Byte 0 is the highest byte of the lowest register

The **Reset counter** registers show the number of times the resettable energy accumulators have been reset.

Settings

All registers in the following table have read and write access:

| Quantity | Start Reg (hex) | Size | Res. | Unit | Data type |
|---|-----------------|------|-------|--------------|-----------|
| Current transformer ratio numerator | 8C04 | 2 | | - | Unsigned |
| Voltage transformer ratio numerator | 8C06 | 2 | | - | Unsigned |
| Current transformer ratio denominator | 8C08 | 2 | | - | Unsigned |
| Voltage transformer ratio denominator | 8C0A | 2 | | - | Unsigned |
| CO2 conversion factor | 8CE0 | 2 | 0.001 | kg/kWh | Unsigned |
| Currency conversion factor | 8CE2 | 2 | 0.01 | Currency/kWh | Unsigned |
| LED source (0 = active energy, 1 = reactive energy) | 8CE4 | 1 | | - | Unsigned |
| Number of elements (values 1-3) | 8CE5 | 1 | | - | Unsigned |

Operations

All registers in the following table are write only:

| Quantity | Details | Start Reg (hex) | Size | Action | Data type |
|---|---------|-----------------|------|--------------------------------------|-----------|
| Reset power fail counter | | 8F00 | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset power outage time | | 8F05 | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset input counter | Input 1 | 8F0B | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset input counter | Input 2 | 8F0C | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset input counter | Input 3 | 8F0D | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset input counter | Input 4 | 8F0E | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset stored state | input 1 | 8F13 | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset stored state | Input 2 | 8F14 | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset stored state | input 3 | 8F15 | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset stored state | Input 4 | 8F16 | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset resettable active energy import | | 8F1B | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset resettable active energy export | | 8F1C | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset resettable reactive energy import | | 8F1D | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset resettable reactive energy export | | 8F1E | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset Previous values | | 8F1F | 1 | Write the value 1 to perform a reset | Unsigned |
| Reset Demand | | 8F20 | 1 | Write the value 1 to perform a reset | Unsigned |

DMTME multimeters

Parts of the Modbus mapping is compatible with the ABB DMTME multimeters. All registers in the following table are read only:

| Quantity | Start Reg (Hex) | Size | Unit | Data type |
|------------------------------|-----------------|------|----------|-----------|
| Phase Voltage L1-N | 1002 | 2 | Volt | Unsigned |
| Phase Voltage L2-N | 1004 | 2 | Volt | Unsigned |
| Phase Voltage L3-N | 1006 | 2 | Volt | Unsigned |
| Line Voltage L1-L2 | 1008 | 2 | Volt | Unsigned |
| Line Voltage L2-L3 | 100A | 2 | Volt | Unsigned |
| Line Voltage L1-L3 | 100C | 2 | Volt | Unsigned |
| Line Current L1 | 1010 | 2 | mA | Unsigned |
| Line Current L2 | 1012 | 2 | mA | Unsigned |
| Line Current L3 | 1014 | 2 | mA | Unsigned |
| 3-Phase Sys. Power Factor | 1016 | 2 | *1000 | Signed |
| Power Factor L1 | 1018 | 2 | *1000 | Signed |
| Power Factor L2 | 101A | 2 | *1000 | Signed |
| power Factor L3 | 101C | 2 | *1000 | Signed |
| 3-Phase Sys. Apparent Power | 1026 | 2 | VA | Unsigned |
| Apparent Power L1 | 1028 | 2 | VA | Unsigned |
| Apparent Power L2 | 102A | 2 | VA | Unsigned |
| Apparent Power L3 | 102C | 2 | VA | Unsigned |
| 3-Phase Sys. Active Power | 102E | 2 | Watt | Unsigned |
| Active Power L1 | 1030 | 2 | Watt | Unsigned |
| Active Power L2 | 1032 | 2 | Watt | Unsigned |
| Active Power L3 | 1034 | 2 | Watt | Unsigned |
| 3-Phase Reactive power | 1036 | 2 | VAr | Unsigned |
| Reactive Power L1 | 1038 | 2 | VAr | Unsigned |
| Reactive power L2 | 103A | 2 | VAr | Unsigned |
| Reactive Power L3 | 103C | 2 | VAr | Unsigned |
| 3-Phase Sys. Active energy | 103E | 2 | Wh*100 | Unsigned |
| 3-Phase Sys. Reactive energy | 1040 | 2 | VArh*100 | Unsigned |
| Frequency | 1046 | 2 | mHz | Unsigned |
| Current transformer ratio | 11A0 | 2 | 1-999999 | Unsigned |
| Voltage transformer ratio | 11A2 | 2 | 1-9999 | Unsigned |

9.4 Configuration

Introduction

This section describes how to configure the following functions:

- Alarms
 - Tariffs
-

9.4.1 Alarms

General

Alarm configuration defines the set of quantities to monitor. It also defines the threshold values, delays and actions to perform for each alarm. Each alarm is configured individually.

Alarm configuration registers

The following table describes the group of registers for configuring the alarm parameters:

| Function | Start Reg (Hex) | Size | Description | Read/write |
|--------------|-----------------|------|--|------------|
| Alarm number | 8C60 | 1 | The number (identifier) for the alarm to configure | R/W |
| Quantity | 8C61 | 3 | The quantity to monitor | R/W |
| Thresholds | 8C64 | 8 | ON and OFF thresholds to used to decide when the alarm is active | R/W |
| Delays | 8C6C | 4 | ON and OFF delays, defining the time that the measured value must be above/below the configured thresholds before the alarm triggers | R/W |
| Actions | 8C70 | 2 | Actions to perform when alarm is triggered | R/W |

Thresholds registers

The Thresholds registers are used to read and write the ON and OFF threshold values for an alarm. The scaling is the same as where the quantity appears in the normal mapping tables. The first (lowest) 4 registers are the ON threshold and the last 4 registers are the OFF threshold. Data type is signed 64 bit integer.

Delays registers

The Delays registers are used to read or write the ON and OFF delays for an alarm. The delay is expressed in milliseconds. The first (lowest) 2 registers are the ON delay and the last 2 registers are the OFF delay. Data type is unsigned 32 bit integer.

Write alarm configuration

Follow the steps in the table below to configure the parameters for monitoring the value of a number of quantities in the meter:

| Step | Action |
|------|--|
| 1 | Write the number of the alarm to configure to the Alarm number register. This is a value between 1 and 25. |
| 2 | Write the OBIS code for the quantity to monitor to the Quantity registers. |
| 3 | Write the ON and OFF thresholds to the Thresholds registers. |
| 4 | Write the ON and OFF delays to the Delays registers. |
| 5 | Write the actions to perform to perform to the Action registers. |
| 6 | Repeat step 1 to 4 for all alarms that shall be used. |

Read alarm configuration

Follow the steps in the table below to read the current configuration of monitoring parameters for alarms.

| Step | Action |
|------|---|
| 1 | Write the number of the alarm to read configuration for to the Alarm number register. This is a value between 1 and 25. |
| 2 | Read the Quantity registers to get the quantity monitored in the selected alarm. |
| 3 | Read the Thresholds registers to get the ON and OFF thresholds. |
| 4 | Read the Delays registers to get the ON and OFF delays. |
| 5 | Read the Action registers to get the actions performed when an alarm is triggered. |
| 6 | Repeat step 1 to 4 for all alarms. |

9.4.2 Inputs and outputs

General

Inputs and outputs configuration defines the function for each physical I/O port. It also defines the parameters for the logical pulse outputs.

I/O values

The following table lists the possible values for I/O port function:

| Value | Function |
|-------|----------------------|
| 0 | Input |
| 1 | Communication output |
| 2 | Alarm output |
| 3 | Pulse output |
| 4 | Tariff output |
| 5 | Output always ON |
| 6 | Output always OFF |

Pulse output configuration registers

The following table describes the group of registers for configuring the pulse outputs:

| Function | Start Reg (Hex) | Size | Description | Read/write |
|---------------------------------|-----------------|------|--|------------|
| Pulse output instance | 8C10 | 1 | The instance number of the pulse output | R/W |
| Port number | 8C11 | 1 | The physical I/O port on which the pulses are sent out | R/W |
| Pulse frequency active energy | 8C15 | 2 | The pulse frequency, measured in pulses/kWh with 3 decimals. This is relevant only if Energy quantity is set to active energy. | R/W |
| Pulse frequency reactive energy | 8C17 | 2 | The pulse frequency, measured in pulses/kvarh with 3 decimals. This is relevant only if Energy quantity is set to reactive energy. | R/W |
| Pulse length | 8C19 | 2 | The duration of a pulse, measured in milliseconds | R/W |
| Turn off pulse output | 8C1B | 1 | Write the value 1 to this register to turn off the selected pulse output instance | R/W |

Write pulse output configuration

Follow the steps in the table below to configure the pulse outputs:

| Step | Action |
|------|--|
| 1 | Select the pulse output instance to configure by writing a number to the Pulse output instance register. Allowed values are 1-4. |
| 2 | Write to the Port number register to decide to which physical port the pulses are sent out for the selected pulse output. Allowed values are 0-4, where 0 means No Output. |
| 3 | Write the OBIS code of the quantity that shall be used for the selected pulse output to the Energy quantity registers. Possible OBIS codes are listed above. |
| 4 | Write the desired pulse frequency to the Pulse frequency active or reactive energy registers, depending on the selected energy type. |
| 5 | Write the desired pulse length to the Pulse length registers. |
| 6 | Repeat steps 1 to 5 for all pulse outputs. |

Turn off a pulse output

Follow the steps in the table below to turn off a pulse output instance:

| Step | Action |
|------|--|
| 1 | Select the pulse output instance to configure by writing a number to the Pulse output instance register. Allowed values are 1-4. |
| 2 | Write the value 1 to the Turn off pulse output register. |

Read pulse output configuration

Follow the steps in the table below to read the current pulse output configuration:

| Step | Action |
|------|---|
| 1 | Select the pulse output instance to read configuration for by writing a number to the Pulse output instance register. Allowed values are 1-4. |
| 2 | Read the Port number register to get the I/O port number used by the selected pulse output instance. |
| 3 | Read the Energy quantity registers to get the OBIS code of the quantity used for the selected pulse output instance. |
| 4 | Read the Pulse frequency active or reactive energy registers, depending on the selected energy type, to get the pulse frequency used by the selected pulse output instance. |
| 5 | Read the Pulse length registers to get the pulse length used by the selected pulse output instance. |
| 6 | Repeat steps 1 to 5 for all pulse outputs. |

9.4.3 Tariffs

General

Tariff configuration defines the currently used tariff source, i.e. communication or inputs. It also defines the settings that are specific for each of these sources.

Mapping table

The following table shows an overview of the mapping table:

| Quantity | Details | Start Reg (Hex) | Size |
|----------|---------------------|-----------------|------|
| Tariffs | Tariff source | 8C90 | 1 |
| Tariffs | Input configuration | 8C91 | 1 |

Tariff source register

The Tariff source register is used to read or write the source used for controlling the tariffs. Possible values are listed in the table below:

| Value | Description |
|-------|---------------|
| 1 | Communication |
| 2 | Inputs |

Input configuration register

The Input configuration register is used for reading and writing tariff input configuration. It decides how many tariffs are used, and which tariff is activated for every combination of values on the inputs. The following table describes the contents of the Input configuration register:

| Byte | Bits | Description | Possible values |
|---------------|-------------|--|-------------------------|
| 0 (high byte) | Entire byte | The number of tariffs to use | 1-4 |
| 1 (low byte) | 0-1* | Tariff to activate when both inputs are OFF | 0-3 (0 = tariff 1, etc) |
| | 2-3* | Tariff to activate when input 3 is ON and input 4 is OFF | 0-3 |
| | 4-5* | Tariff to activate when input 3 is OFF and input 4 is ON | 0-3 |
| | 6-7* | Tariff to activate when both inputs are ON | 0-3 |

* Bit 0 is the least significant bit.

Chapter 10:Communication with M-Bus

| | |
|-----------------|---|
| Overview | This chapter describes how to read meter data and to send commands to the meter over M-Bus. |
|-----------------|---|

| | |
|------------------------|---|
| In this chapter | The following topics are covered in this chapter: |
| | 10.1 Protocol Description 103 |
| | 10.2 Standard Readout of Meter Data 119 |
| | 10.3 Special Readout of Meter Data 151 |
| | 10.4 Sending Data to the Meter 168 |

10.1 Protocol Description

General

The communication protocol described in this chapter meets the requirements of EN 13757-2 and EN 13757-3.

The communication can be divided in two parts. One part is reading data from the meter and the other part is sending data to it.

The data readout procedure starts when the master sends a REQ_UD2 telegram to the meter. The meter responds with a RSP_UD telegram. A typical readout is a multi-telegram readout.

Some data in the meter can only be read by first sending a SND_UD followed by REQ_UD2. This is true for load profiles, demand and log files.

Using SND_UD telegrams data can be sent to the meter.

Communication objects

The following quantities can be read by sending a REQ_UD2 to the meter

| Register | Communication objects |
|----------------------------------|--|
| Active import energy, total | Total cumulative active imported energy |
| Active import energy, tariff 1 | Cumulative active imported energy tariff 1 |
| Active import energy, tariff 2 | Cumulative active imported energy tariff 2 |
| Active import energy, tariff 3 | Cumulative active imported energy tariff 3 |
| Active import energy, tariff 4 | Cumulative active imported energy tariff 4 |
| Reactive import energy, total | Total cumulative reactive imported energy |
| Reactive import energy, tariff 1 | Cumulative reactive imported energy tariff 1 |
| Reactive import energy, tariff 2 | Cumulative reactive imported energy tariff 2 |
| Reactive import energy, tariff 3 | Cumulative reactive imported energy tariff 3 |
| Reactive import energy, tariff 4 | Cumulative reactive imported energy tariff 4 |
| Active export energy, total | Total cumulative active exported energy |
| Active export energy, tariff 1 | Cumulative active exported energy tariff 1 |
| Active export energy, tariff 2 | Cumulative active exported energy tariff 2 |
| Active export energy, tariff 3 | Cumulative active exported energy tariff 3 |
| Active export energy, tariff 4 | Cumulative active exported energy tariff 4 |
| Reactive export energy, total | Total cumulative reactive exported energy |
| Reactive export energy, tariff 1 | Cumulative reactive exported energy tariff 1 |
| Reactive export energy, tariff 2 | Cumulative reactive exported energy tariff 2 |
| Reactive export energy, tariff 3 | Cumulative reactive exported energy tariff 3 |
| Reactive export energy, tariff 4 | Cumulative reactive exported energy tariff 4 |
| Outputs | Read and set status of outputs |
| Inputs, current state | Read current state of inputs |
| Inputs, stored state | Read and reset stored state of inputs |
| Inputs, counter | Read and clear input pulse counters |
| Current N | |
| Voltage, L1-N | Instantaneous voltage between L1 and neutral |

| Register | Communication objects |
|-----------------------------------|--|
| Active Power, Total | Instantaneous total active power |
| Active energy net Tot. | |
| Active energy net L1 | |
| Power factor tot. | |
| Power factor L1 | |
| Active energy currency conversion | |
| Reactive Power, Total | Instantaneous total reactive power |
| Reactive Power, L1 | Instantaneous reactive power in L1 |
| Reactive energy net Tot. | |
| Reactive energy net L1 | |
| Apparent Power, Total | Instantaneous total apparent power |
| Apparent Power, L1 | Instantaneous apparent power in L1 |
| Voltage phase angle, L1 | Instantaneous voltage phase angle for L1 (L1 voltage is reference) |
| Current phase angle, L1 | Instantaneous current phase angle for L1 (L1 voltage is reference) |
| Phase angle power, Total | Instantaneous phase angle for total power |
| Phase angle power L1 | Instantaneous phase angle power for L1 |
| Installation check | Read result of and clear installation check |
| Current quadrant, Total | Quadrant in which the meter is measuring |
| Current quadrant, L1 | Quadrant in which the meter is measuring, L1 |
| Power fail counter | Read and reset power fail counter |
| Total power outage time | Read and reset total power outage time |
| Current tariff | Read and set current tariff |
| Manufacturer | Manufacturer information |
| FW-version | Firmware version |
| Frequency | |
| Warning flags | Read warning flags |
| Info flags | Read info flags |
| Alarm flags | Read alarm flags |
| Error flags | Read error flags |
| Date and time | Read and set date and time |
| Event log | Read event log data |
| System log | Read system log data |
| Audit log | Read audit log data |
| Net quality log | Read net quality log data |
| Apparent import energy, total | Total cumulative apparent imported energy |
| Apparent export energy, total | Total cumulative apparent exported energy |
| Active import energy, L1 | Cumulative active imported energy in the L1 phase |
| Active export energy, L1 | Cumulative active exported energy in the L1 phase |
| Reactive import energy, L1 | Cumulative reactive imported energy in the L1 phase |

| Register | Communication objects |
|------------------------------------|---|
| Reactive export energy, L1 | Cumulative reactive exported energy in the L1 phase |
| Apparent import energy, L1 | Cumulative apparent imported energy in the L1 phase |
| Apparent export energy, L1 | Cumulative apparent exported energy in the L1 phase |
| Resettable active energy imp. Tot. | |
| Resettable active energy exp. Tot. | |

Read/write commands

The following tasks are possible to perform with SND_UD telegrams:

| Command |
|---|
| Set tariff |
| Set primary address |
| Change baudrate |
| Reset power fail counter |
| Reset power outage time |
| Set CT Ratio numerator |
| Set CT Ratio denominator |
| Set VT Ratio numerator |
| Set VT Ratio denominator |
| Select Status information |
| Reset stored state input |
| Reset input counters |
| Set output |
| Set date time |
| Set date |
| Send Password |
| Freeze Max demand |
| Set communication access level |
| Read Request Load profile |
| Read request previous values |
| Read request demand (maximum and minimum |
| Read request Log (System, Event, quality, audit and Transformer Logs) |
| Read/Write Alarm settings |
| Read/Write Tariff settings |

10.1.1 Telegram Format

General

M-Bus uses 3 different telegram formats. The formats are identified by the start character.

| Single Character | Short Frame | Long Frame |
|------------------|-------------|-------------------------|
| E5H | Start (10h) | Start (68h) |
| | C-Field | L-Field |
| | A-Field | L-Field |
| | Check Sum | Start (68h) |
| | Stop (16h) | C-Field |
| | | A-Field |
| | | CI-Field |
| | | User Data (0-252 Bytes) |
| | | Check Sum |
| | | Stop (16h) |

The **Single Character** format consists of a single character and is used to acknowledge received telegrams.

The **Short Frame** format is identified by its start character (10h) and consists of five characters. Besides the C- and A-fields it includes the check sum and the stop character 16h.

The **Long Frame** format is identified by its start character (68h) and consists of a variable number of characters. After the start character the L-field is transmitted twice, then the start character once again followed by the C-, A- and CI-fields. The user data (0 - 252 bytes) is transmitted after the CI-field followed by the check sum and the stop character (16h).

10.1.1.1 Field description

General

All fields in the telegram have a length of 1byte (8 bits).

The L-Field

The L-Field (length field) gives the size of the user data (in bytes) plus 3 (for the C-, A- and CI-Fields). It is transmitted twice in the telegrams using the long frame format.

The C-Field

The C-Field (control field) contains information about the direction of the data flow and error handling. Besides labeling the functions and the actions caused by

them, the control field specifies the direction of data flow and is responsible for various parts of the communication to and from the meter.

The following table shows the coding of the C-Field:

| Bit No. | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------------|---|-----|-----|-----|----|----|----|----|
| To meter | 0 | PRM | FCB | FCV | F3 | F2 | F1 | F0 |
| From meter | 0 | PRM | 0 | 0 | F3 | F2 | F1 | F0 |

The primary message bit (**PRM**) is used to specify the direction of the data flow. It is set to 1 when a telegram is sent from a master to the meter and to 0 in the other direction.

The frame count bit valid (**FCV**) is set to 1 by the master to indicate that the frame count bit (**FCB**) is used. When the FCV is set to 0, the meter ignores the FCB.

The FCB is used to indicate successful transmission procedures. A master shall toggle the bit after a successful reception of a reply from the meter. If the expected reply is missing, or the reception of it is faulty, the master resends the same telegram with the same FCB. The meter answers, to a REQ_UD2-request with toggled FCB and a set FCV, with a RSP_UD containing the next telegram of a multi-telegram answer. If the FCB is not toggled it will repeat the last telegram. The actual values will be updated in a repeated telegram.

On receipt of a SND_NKE the meter clears the FCB. The meter uses the same FCB for primary addressing, secondary addressing and point-to-point communication.

The bits 0 to 3 (F0, F1, F2 and F3) of the control field are the function code of the message. The following table shows the function codes:

| Comand | C-Field (binary) | C-Field (hex) | Telegram | Description |
|---------|------------------|---------------|-------------|---|
| SND_NKE | 0100 0000 | 40 | Short frame | Initialization of meter |
| SND_UD | 01F1 0011 | 53/73 | Long frame | Send user data to meter |
| REQ_UD2 | 01F1 1011 | 5b | Short frame | Request for class 2 data |
| RSP_UD | 0000 1000 | 08 | Long frame | Data transfer form meter to master after request. |

A-Field

The A-Field (address field) is used to address the recipient in the calling direction, and to identify the sender of information in the receiving direction. The size of this field is one byte, and can therefore take values from 0 to 255.

The following table shows the allocation of addresses:

| Address | Description |
|---------|-----------------|
| 0 | Factory default |

| Address | Description |
|---------|---|
| 1-250 | Can be given to meters as individual primary addresses, either via the bus (secondary addressing) or via the buttons directly on the meter. |
| 251-252 | Reserved for future use. |
| 253 | Used by the secondary addressing procedure (FDh). |
| 254 | Used for point-to-point communication (FEh). The meter replies with its primary address. |
| 255 | Used for broadcast transmissions to all meters (FFh). None of the meters replies to a broadcast message. |

CI-Field

The CI-field (control information) codes the type and sequence of application data to be transmitted in the frame. Bit two (counting begins with bit 0, value 4), called M-bit or Mode bit, in the CI-field gives information about the used byte sequence in multi-byte data structures. For communication with the meter, the Mode bit shall not be set (Mode 1) meaning the least significant byte of a multi-byte record is transmitted first.

The following table shows the codes to be used by the master:

| CI_Field codes | Application |
|----------------|-----------------------|
| 51h | Data send |
| 52h | Selection of slaves |
| B8h | Set baudrate to 300 |
| B9h | Set baudrate to 600 |
| Bah | Set baudrate to 1200 |
| BBh | Set baudrate to 2400 |
| BCh | Set baudrate to 4800 |
| BDh | Set baudrate to 9600 |
| BEh | Set baudrate to 19200 |
| BFh | Set baudrate to 38400 |

The meter uses code 72 in the CI-Field to respond to requests for user data.

User data

The User Data contains the data to be sent to the recipient.

The following table shows the structure of the data sent from the meter to the master:

| Fixed data header | Data records | MDH |
|-------------------|--------------------------|--------|
| 12 bytes | Variable number of bytes | 1 byte |

The following table shows the structure of the data sent from the master to the meter:

| |
|--------------------------|
| Data records |
| Variable number of bytes |

Fixed data header

The following table shows the structure of the fixed data header:

| ID No. | Manufacturer | Version | Medium | Access No. | Status | Signature |
|---------|--------------|---------|--------|------------|--------|-----------|
| 4 bytes | 2 bytes | 1 byte | 1 byte | 1 byte | 1 byte | 2 byte |

The following list explains the content of the fixed data header:

- **Identification No.** is the 8-digit serial number of the meter (BCD coded).
- **Manufacturer** is set to 0442h meaning ABB
- **Version** specifies the version of the protocol implementation. The meters currently use the protocol version equal to 0x20.
- **Medium** byte is set to 02h to indicate electricity.
- **Access number** is a counter that counts successful accesses.
- **Status byte** is used to indicate the meter status.

| Bit | Meaning |
|-----|--------------------|
| 0 | Meter busy |
| 1 | Internal error |
| 2 | Power low |
| 3 | Permanent error |
| 4 | Temporary error |
| 5 | Installation error |
| 6 | Not used |
| 7 | Not used |

- **Signature** is set to 00 00h

Data records

The data, together with information regarding coding, length and the type of data is transmitted in data records. The maximum total length of the data records is 240 bytes.

The following table shows the structure of the data record (transmitted left to right):

| Data Record Header | | | | Data |
|------------------------------|------------|-------------------------------|------------|-----------|
| Data Information Block (DIB) | | Value Information Block (VIB) | | |
| DIF | DIFE | VIF | VIFE | |
| 1 byte | 0-10 bytes | 1 byte | 0-10 bytes | 0-n bytes |

Each Data record consists of a data record header (DRH) and the actual data. The DRH in turn consists of the data information block (DIB) to describe the length, type and coding of the data, and the value information block (VIB) to give the value of the unit and the multiplier.

Data information block (DIB)

The DIB contains at least one byte (Data Information Field, DIF), and is in some cases expanded with, a maximum of 10, DIFE's (Data Information Field Extension).

The following table shows the structure of the Data Information Field (DIF):

| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---------------|---------------------------------|----------------|-------|------------|-------|-------|-------|
| Extension bit | LSB ¹ of storage No. | Function Field | | Data Field | | | |

1. Least significant bit.

The following list explains the content of the DIF:

- The **Extension Bit** is set when the next byte is a DIFE.
- The **LSB of storage No.** is normally set to 0 to indicate actual value. (1=stored value).
- The **Function Field** is set to 00 for instantaneous values, 01 for maximum values and 10 for minimum values.
- The **Data Field** shows the format of the data. The following table shows the coding of the data field:

| Code | Meaning | Length |
|------|----------------|--------|
| 0000 | No Data | 0 |
| 0001 | 8 Bit Integer | 1 |
| 0010 | 16 Bit Integer | 2 |
| 0100 | 32 Bit Integer | 4 |
| 0111 | 64 Bit Integer | 8 |
| 1010 | 4 digit BCD | 2 |
| 1111 | 6 digit BCD | 3 |
| 1100 | 8 digit BCD | 4 |

| Code | Meaning | Length |
|------|-------------------------|----------|
| 1101 | Variable Length (ASCII) | Variable |
| 1110 | 12 digit BCD | 6 |

The following table shows the structure of the Data Information Field Extension (DIFE)

| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---------------|-------|--------|-------|-------------|-------|-------|-------|
| Extension bit | Unit | Tariff | | Storage No. | | | |

The following list explains the content of the DIFE:

- **Unit** is used for power and energy values show the type of power/energy. It is also used to define the number of inputs/outputs and to specify sign of offset when accessing event log data.
- **Tariff** is used for energy values to give tariff information.
- **Storage number** is set to 0 in values read to indicate momentary values. Storage number bigger than 0 is used to indicate previously stored values, i.e, values stored at a specific point of time in the past.

Value Information block (VIB)

VIB follows a DIF or DIFE without extension bit. It contains one value information field (VIF) and is in some cases expanded with up to 10 value information field extensions (VIFE).

The following table shows the structure of the value information field (VIF):

| Bit 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------------|-------------------|---|---|---|---|---|---|
| Extension Bit | Value Information | | | | | | |

Value information contains information about the value (unit, status, etc.) The extension bit is set when the next byte is a VIFE.

If VIF or VIFE = FFh the next VIFE is manufacturer specific. The manufacturer specific VIFE has the same construction as a VIF. If the extension bit of the manufacturer specific VIFE is set, and the VIFE is less than 1111 1000, the next byte is a standard VIFE, otherwise it is the first data byte. If the extension bit of the manufacturer specific VIFE is set and the VIFE is bigger than or equal to 1111 1000, the next byte is an extension of manufacturer specific VIFE's.

Data

The Data follows a VIF or a VIFE without the extension bit set.

Manufacturer data header (MDH)

The manufacturer data header (MDH) is either made up by the character 1Fh that indicates that more data will follow in the next telegram, or by 0Fh indicating the last telegram.

Check sum

The Check Sum is used to recognize transmission and synchronization faults. It is calculated from the arithmetical sum, of the bytes from the control field to the last user data, without taking carry digits into account .

10.1.2 Value Information Field codes

10.1.2.1 Standard VIF codes

| VIF-code | Description | Range coding | Range |
|-----------|------------------------|---|---|
| E000 0nnn | Energy | $10^{(nnn-3)}$ Wh | 0.001Wh to 10000Wh |
| E010 1nnn | Power | $10^{(nnn-3)}$ W | 0.001W to 10000W |
| E010 00nn | Duration | nn = 00 seconds nn = 01 minutes nn = 10 hours nn = 11 days | |
| E110 110n | Time point | n = 0: date n = 1: time & date | Data type G Data type F or 6 byte BCD coding |
| E111 1000 | Fabrication No. | | 00000000 to 99999999 |
| E111 1010 | Bus address | | 0-250 |
| 1111 1011 | Extension of VIF-codes | | Not used by the meter |
| 1111 1101 | Extension of VIF-codes | | True VIF is given in the first VIFE and is coded using Table FD |
| 1111 1111 | Manufacturer specific | | Next VIFE is manufacturer specific |

10.1.2.2 Standard codes for VIFE used with extension indicator FDh

If the VIF contains the extension indicator FDh the true VIF is contained in the first VIFE.

| VIFE-code | Description |
|-----------|---|
| E000 1010 | Manufacturer |
| E000 1100 | Version |
| E000 1110 | Firmware Version |
| E001 1010 | Digital Output (binary) |
| E001 1011 | Digital Input (binary) |
| E001 1100 | baudrate |
| E010 01nn | Interval length, 00: seconds, 01: minutes), 10: hours, 11: days |

| VIFE-code | Description |
|-----------|-----------------------|
| E100 nnnn | $10^{(nnnn-9)}$ Volts |
| E101 nnnn | $10^{(nnnn-12)}$ A |
| E110 0001 | Cumulating counter |
| E001 0110 | Password |

10.1.2.3 Standard codes for VIFE

The following values for VIFE's are defined for an enhancement of VIF's other than FDh and FBh:

| VIFE-code | Description |
|-----------|---|
| E010 0111 | Per measurement (interval) ^{1 2} |
| E011 1001 | Start date(/time) of |
| E110 1f1b | Date (/time) of, b = 0: end of, b = 1: begin of, f is not used in meters, always 0 ^{1 2} |
| 1111 1111 | Next VIFE is manufacturer specific |

1. Date (/time) of “or duration of” relates to the information which the whole data record contains.
2. The information about usage of data type F (date and time) or data type G (date) can be derived from the data field (0010b: type G/0100: type F).

10.1.2.4 First manufacturer specific VIFE-codes

| VIFE-code | Description |
|-----------|---|
| E000 0000 | Total |
| E000 0001 | L1 |
| E000 0100 | N |
| E001 0000 | Pulse frequency |
| E001 0011 | Tariff |
| E001 0100 | Installation check |
| E001 0101 | Status of values |
| E001 0111 | Current quadrant |
| E001 1000 | Power fail counter |
| E010 0000 | Current Transformer ratio numerator (CT ratio) |
| E010 0001 | Voltage Transformer ratio numerator (VT ratio) |
| E010 0010 | Current Transformer ratio denominator (CT ratio) |
| E010 0011 | Voltage Transformer ratio denominator (VT ratio) |
| E010 0101 | Currency conversion factor (curr * 10 ⁻³ /kWh) |

| VIFE-code | Description |
|-----------|---|
| E010 0110 | Error flags |
| E010 0111 | Warning flags |
| E010 1000 | Information flags |
| E010 1001 | Alarm flags |
| E100 0nnn | Phase angle voltage (degrees *10 ⁽ⁿⁿⁿ⁻³⁾) |
| E100 1nnn | Phase angle current (degrees *10 ⁽ⁿⁿⁿ⁻³⁾) |
| E101 0nnn | Phase angle power (degrees *10 ⁽ⁿⁿⁿ⁻³⁾) |
| E101 1nnn | Frequency (Hz *10 ⁽ⁿⁿⁿ⁻³⁾) |
| E110 0nnn | Power factor (*10 ⁽ⁿⁿⁿ⁻³⁾) |
| E110 1010 | Change communication write access level |
| E110 1100 | Power outage time |
| E110 1111 | Event type |
| E111 0000 | Measurement period |
| E111 0001 | Reset counter for energy |
| E111 0010 | Resettable register |
| E111 0110 | Sequence number (audit log) |
| E111 1000 | Extension of manufacturer specific VIFE's, next VIFE(s) used for numbering |
| E111 1001 | Extension of manufacturer specific VIFE's, next VIFE(s) specifies actual meaning |
| E111 1110 | Extension of manufacturer specific VIFE's, next VIFE(s) used for manufacturer specific record errors/status |

10.1.2.5 VIFE-Codes for reports of record errors (meter to master)

| VIFE-code | Type of record error | Error group |
|-----------|-------------------------------------|-------------|
| E000 0000 | None | |
| E001 0101 | No data available (undefined value) | |
| E001 1000 | Data error | Data errors |

10.1.2.6 VIFE-Codes for object actions (master to meter)

| VIFE-code | Action | Description |
|-----------|-------------|-------------------------------|
| E000 0111 | Clear | Set data to zero |
| E000 1011 | Freeze data | Freeze data to storage number |

10.1.2.7 2:nd manufacturer specific VIFE followed after VIFE 1111 1000 (F8 hex):

| VIFE-code | Description |
|-----------|----------------------------|
| Ennn nnnn | Used for numbering (0-127) |

10.1.2.8 2:nd manufacturer specific VIFE followed after VIFE 1111 1001 (F9 hex):

| VIFE-code | Description |
|-----------|---|
| E000 0001 | DST, day of week, day type, season |
| E000 0100 | Quantity specification of load profile |
| E000 0110 | Quantity specification of event log |
| E000 0110 | Tariff source |
| E001 0000 | Readout request of active imported energy load profile in format energy register values at end of intervals |
| E001 0001 | Readout request of active imported energy load profile in format energy consumption per interval |
| E001 0010 | Readout request of reactive imported energy load profile in format energy register values at end of intervals |
| E001 0011 | Readout request of reactive imported energy load profile in format energy consumption per interval |
| E001 0100 | Readout request of input 1 counter load profile in format counter register values at end of intervals |
| E001 0101 | Readout request of input 1 counter load profile in format number of counts per interval |
| E001 0110 | Readout request of input 2 counter load profile in format counter register values at end of intervals |
| E001 0111 | Readout request of input 2 counter load profile in format number of counts per interval |
| E001 1001 | Readout request of previous values |
| E001 1010 | Readout request of event log |
| E001 1100 | Readout request of active exported energy load profile in format energy register values at end of intervals |
| E001 1101 | Readout request of active exported energy load profile in format energy consumption per interval |
| E001 1110 | Readout request of reactive exported energy load profile in format energy register values at end of intervals |
| E001 1111 | Readout request of reactive exported energy load profile in format energy consumption per interval |
| E010 0000 | Readout request of apparent imported energy load profile in format energy register values at end of intervals |

| VIFE-code | Description |
|-----------|---|
| E010 0001 | Readout request of apparent imported energy load profile in format energy consumption per interval |
| E010 0010 | Readout request of apparent exported energy load profile in format energy register values at end of intervals |
| E010 0011 | Readout request of apparent exported energy load profile in format energy consumption per interval |
| E010 0100 | Readout request of input 3 counter load profile in format counter register values at end of intervals |
| E010 0101 | Readout request of input 3 counter load profile in format number of counts per interval |
| E010 0110 | Readout request of input 4 counter load profile in format counter register values at end of intervals |
| E010 0111 | Readout request of input 4 counter load profile in format number of counts per interval |
| E010 1000 | Readout request of current load profile |
| E010 1001 | Readout request of voltage load profile |
| E010 1010 | Readout request of THD voltage load profile |
| E010 1011 | Readout request of THD current load profile |
| E010 1100 | Readout request of power factor load profile |
| E010 1110 | System log |
| E010 1111 | Audit log |
| E011 0000 | Net quality log |
| E011 0010 | Event log |
| E011 0011 | Event type system log |
| E011 0100 | Event type audit log |
| E011 0101 | Event type net quality log |
| E011 0111 | Event type event log |
| E011 1nnn | Energy in currency (currency * 10 ⁿⁿⁿ⁻³) |

10.1.2.9 2:nd manufacturer specific VIFE followed after VIFE 1111 1110 (FE hex):

| VIFE-code | Description |
|-----------|---|
| E000 opsl | Data status for load profile, o = overflow, p = power outage during interval, s = short interval, l = long interval |

10.1.3 Communication process

General

The Data Link Layer uses two kinds of transmission services:

| | |
|-----------------|---------|
| Send/Confirm | SND/CON |
| Request/Respond | REQ/RSP |

When the meter has received a correct telegram it waits between 35 and 80 ms before it responds. A telegram is considered as correct if it passes the following tests:

- Start /Parity /Stop bits per character
- Start /Check Sum /Stop characters per telegram format
- In case of a long frame, the number of additional characters received match the L-field (= L Field + 6).
- If the received data is reasonable

The time between a response from the meter and a new message from the master must be at least 20 ms.

Send/confirm procedure

SND_NKE is used to initiate communication with the meter. When the meter has received an NKE followed by a REQ_UD2 (see description below), the 1st telegram from the meter is sent out.

If the meter was selected for secondary addressing it will be deselected. The value of the FCB is cleared in the meter, i.e., the meter expects that the first telegram from a master with FCV=1 contains an FCB=1.

The meter can either confirm a correct reception with the single character acknowledge E5h), or it can omit confirmation because it did not receive the telegram correctly.

SND_UD is used to send data to the meter. The meter either confirms reception of a correct message or it omits confirmation because it did not receive the telegram correctly.

Request/respond procedure

REQ_UD2 is used by the master to request data from the meter. **RSP_UD** is used by the meter to transfer data to the master. The meter indicates to the master that more data will follow in the next telegram by sending 1Fh as the last user data.

If the meter does not respond to the REQ_UD2, it's an indication that the message was not received correctly or that the address does not match.

10.1.3.1 Selection and secondary addressing

General

It is possible to communicate with the meter using secondary addressing. The secondary addressing takes place with the help of a selection:

| | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----------|--------------------------|------------------------------|-------------|----|-----|
| 68h | 0Bh | 0Bh | 68h | 53h | FDh | 52h | ID 1-4 | Manu- facturer 1-2 | Gener- ation ¹ | Me- dium | CS | 16h |
|-----|-----|-----|-----|-----|-----|-----|-----------|--------------------------|------------------------------|-------------|----|-----|

1. Generation means the same thing as version.

The master sends a SND_UD with the control information 52h to the address 253 (FDh) and fills the specific meter secondary address fields (identification number, manufacturer, version and medium) with the values of the meter that is to be addressed. The address (FDh) and the control information (52h) is the indication for the meter to compare the following secondary address with its own, and to change into the selected state should it match. In this case the meter answers the selection with an acknowledgement (E5h), otherwise it does not reply. Selected state means that the meter can be addressed with the bus address 253 (FDh).

Wild cards

During selection individual positions of the secondary addresses can be occupied by wildcards. Such a wildcard means that this position will not be taken into account during selection. In the identification number each individual digit can be wild-carded by a wildcard nibble Fh while the fields for manufacturer, version and medium can be wild-carded by a wildcard byte FFh. The meter will remain selected until it receives a selection command with non-matching secondary addresses, a selection command with CI=56h, or a SND_NKE to address 253.

10.2 Standard Readout of Meter Data

General

This section describes the readout of the default telegrams containing energy and instrumentation values etc. The data readout procedure starts when the master sends a REQ_UD2 telegram to the meter. The meter responds with a RSP_UD telegram. A typical readout is a multi-telegram readout. The last DIF in the user data part of the telegram is 1F to indicate that there is more data in the next telegram, or 0F if there are no more telegrams.

For EQ meters there are up to 7 default telegrams to read. In meters with internal clock more telegrams may follow, containing previous values data. The most recent values are sent out first having storage number 1, then the second most recently stored values with storage number 2 and so on until all stored previous values have been read. If no previous values exist in a meter with internal clock a telegram is sent out where all data is marked with status byte for "No data available".

It is also possible to read previous values starting from a specific date and backwards in time by sending a special read request.



Note – Note: Normally the meter is configured to send out power values as 32 bit integers, expressed in W (or var/VA) with 2 decimals. This means that the maximum power possible to express is approximately ± 21 MW

Below following sections is an example of a readout of the 7 default telegrams and 2 previous values telegrams, containing the most recent snapshot of previous values. Note that these are examples only, data types and scaling of the quantities can differ between meters, as well as the allocation of quantities to different telegrams.

10.2.1 Example of the 1st telegram (all values are hexadecimal)

| Byte No. | Size | Value | Description |
|----------|------|---------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | FA | L-field, calculated from C field to last user data |
| 3 | 1 | FA | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 08 | C-field, RSP_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 72 | CI-field, variable data respond, LSB first |
| 8-11 | 4 | xxxxxxx | Identification Number, 8 BCD digits |
| 12-13 | 2 | 4204 | Manufacturer: ABB |
| 14 | 1 | 02 | Version |
| 15 | 1 | 02 | Medium, 02 = Electricity |
| 16 | 1 | xx | Number of accesses |
| 17 | 1 | xx | Status |
| 18-19 | 2 | 0000 | Signature (0000 = no encryption) |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 20 | 1 | 0E | DIF size, 12 digit BCD |
| 21 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 22 | 1 | xx | VIFE status |
| 23-28 | 6 | xxxxxxxxxxx | Active imported energy, Total |
| 29 | 1 | 8E | DIF size, 12 digit BCD |
| 30 | 1 | 10 | DIFE, tariff 1 |
| 31 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 32 | 1 | xx | VIFE status |
| 33-38 | 6 | xxxxxxxxxxx | Active imported energy, Tariff 1 |
| 39 | 1 | 8E | DIF size, 12 digit BCD |
| 40 | 1 | 20 | DIFE, tariff 2 |
| 41 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 42 | 1 | xx | VIFE status |
| 43-48 | 6 | xxxxxxxxxxx | Active imported energy, Tariff 2 |
| 49 | 1 | 8E | DIF size, 12 digit BCD |
| 50 | 1 | 30 | DIFE, tariff 3 |
| 51 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 52 | 1 | xx | VIFE status |
| 53-58 | 6 | xxxxxxxxxxx | Active imported energy, Tariff 3 |
| 59 | 1 | 8E | DIF size, 12 digit BCD |
| 60 | 1 | 80 | DIFE, |
| 61 | 1 | 10 | DIFE, tariff 4 |
| 62 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 63 | 1 | xx | VIFE status |
| 64-69 | 6 | xxxxxxxxxxx | Active imported energy, Tariff 4 |
| 70 | 1 | 8E | DIF size, 12 digit BCD |
| 71 | 1 | 40 | DIFE, unit 1 |
| 72 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 73 | 1 | xx | VIFE status |
| 74-79 | 6 | xxxxxxxxxxx | Active exported energy, Total |
| 80 | 1 | 8E | DIF size, 12 digit BCD |
| 81 | 1 | 50 | DIFE, tariff 1, unit 1 |
| 82 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 83 | 1 | xx | VIFE status |
| 84-89 | 6 | xxxxxxxxxxx | Active exported energy, Tariff 1 |
| 90 | 1 | 8E | DIF size, 12 digit BCD |
| 91 | 1 | 60 | DIFE, tariff 2, unit 1 |
| 92 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 93 | 1 | xx | VIFE status |
| 94-99 | 6 | xxxxxxxxxxx | Active exported energy, Tariff 2 |
| 100 | 1 | 8E | DIF size, 12 digit BCD |

| Byte No. | Size | Value | Description |
|----------|------|------------------|---|
| 101 | 1 | 70 | DIFE, tariff 3, unit 1 |
| 102 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 103 | 1 | xx | VIFE status |
| 104-109 | 6 | xxxxxxxxxxx | Active exported energy, Tariff 3 |
| 110 | 1 | 8E | DIF size, 12 digit BCD |
| 111 | 1 | C0 | DIFE, unit 1 |
| 112 | 1 | 10 | DIFE, tariff 4 |
| 113 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 114 | 1 | xx | VIFE status |
| 115-120 | 6 | xxxxxxxxxxx | Active exported energy, Tariff 4 |
| 121 | 1 | 01 | DIF size, 8 bit integer |
| 122 | 1 | FF | VIF next byte is manufacturer specific |
| 123 | 1 | 93 | VIFE current tariff |
| 124 | 1 | xx | VIFE status |
| 125 | 1 | xx | Current tariff |
| 126 | 1 | 04 | DIF size, 32 bit integer |
| 127 | 1 | FF | VIF next byte is manufacturer specific |
| 128 | 1 | A0 | VIFE CT ratio numerator |
| 129 | 1 | xx | VIFE status |
| 130-133 | 4 | xxxxxxx | Current transformer ratio numerator |
| 134 | 1 | 04 | DIF size, 32 bit integer |
| 135 | 1 | FF | VIF next byte is manufacturer specific |
| 136 | 1 | A1 | VIFE VT ratio numerator |
| 137 | 1 | xx | VIFE status |
| 138-141 | 4 | xxxxxxx | Voltage transformer ratio numerator |
| 142 | 1 | 04 | DIF size, 32 bit integer |
| 143 | 1 | FF | VIF next byte is manufacturer specific |
| 144 | 1 | A2 | VIFE CT ratio denominator |
| 145 | 1 | xx | VIFE status |
| 146-149 | 4 | xxxxxxx | Current transformer ratio denominator |
| 150 | 1 | 04 | DIF size, 32 bit integer |
| 151 | 1 | FF | VIF next byte is manufacturer specific |
| 152 | 1 | A3 | VIFE VT ratio denominator |
| 153 | 1 | xx | VIFE status |
| 154-157 | 4 | xxxxxxx | Voltage transformer ratio denominator |
| 158 | 1 | 07 | DIF size, 64 bit integer |
| 159 | 1 | FF | VIF next byte is manufacturer specific |
| 160 | 1 | A6 | VIFE error flags (binary) |
| 161 | 1 | xx | VIFE status |
| 162-169 | 8 | xxxxxxxxxxxxxxxx | 64 Error flags |
| 170 | 1 | 07 | DIF size, 64 bit integer |

| Byte No. | Size | Value | Description |
|----------|------|----------------------------|--|
| 171 | 1 | FF | VIF next byte is manufacturer specific |
| 172 | 1 | A7 | VIFE warning flags (binary) |
| 173 | 1 | xx | VIFE status |
| 174-181 | 8 | xxxxxxxxxxxxxxxx | 64 Warning flags |
| 182 | 1 | 07 | DIF size, 64 bit integer |
| 183 | 1 | FF | VIF next byte is manufacturer specific |
| 184 | 1 | A8 | VIFE information flags (binary) |
| 185 | 1 | xx | VIFE status |
| 186-193 | 8 | xxxxxxxxxxxxxxxx | 64 Information flags |
| 194 | 1 | 07 | DIF size, 64 bit integer |
| 195 | 1 | FF | VIF next byte is manufacturer specific |
| 196 | 1 | A9 | VIFE alarm flags (binary) |
| 197 | 1 | xx | VIFE status |
| 198-205 | 8 | xxxxxxxxxxxxxxxx | 64 Alarm flags |
| 206 | 1 | 0E | DIF size, 12 digit BCD |
| 207 | 1 | ED | VIF time/date |
| 208 | 1 | xx | VIFE status |
| 209-214 | 6 | xxxxxxxxxx | Time and date (sec,min,hour,day,month,year) |
| 215 | 1 | 01 | DIF size, 8 bit integer |
| 216 | 1 | FF | VIF next byte is manufacturer specific |
| 217 | 1 | F9 | VIF extension of manufacturer specific VIFE's, next VIFE specifies actual meaning |
| 218 | 1 | 81 | VIFE DST, day of week, day type, season |
| 219 | 1 | xx | VIFE status |
| 220 | 1 | xx | DST data in bit 0: 1:DST active, 0:DST inactive Day of week data in bit 1-3: 001-111; Monday-Sunday Type of day data in bit 4-5: 00-11; Type of day 1-4 Season data in bit 6-7: 00-11; Season 1-4 |
| 221 | 1 | 0D | DIF size, variable length, ASCII coding |
| 222 | 1 | FD | VIF extension of VIF-codes |
| 223 | 1 | 8E | VIFE Firmware |
| 224 | 1 | xx | VIFE status |
| 225 | 1 | 0C* | Byte specifying length, *see note below |
| 226-237 | 12* | xxxxxxxxxxxxxxxx xxxxxx | Firmware version (ASCII coded, LSB byte first), *see note below |
| 238 | 1 | 0D | DIF size, variable length, ASCII coding |
| 239 | 1 | FF | VIF next byte is manufacturer specific |
| 240 | 1 | AA | VIFE Type designation |
| 241 | 1 | xx | VIFE status |
| 242 | 1 | 0B | Byte specifying length |
| 243-253 | 11 | xxxxxxxxxxxxxxxx xxxxx | Type designation (ASCII coded, LSB byte first), for example: A44 552-100 |
| 254 | 1 | 1F | DIF, more records will follow in next telegram |

| Byte No. | Size | Value | Description |
|----------|------|-------|---|
| 255 | 1 | xx | CS checksum, calculated from C field to last data |
| 256 | 1 | 16 | Stop character |

10.2.2 Example of 2nd telegram (all values are hexadecimal)

| Byte No. | Size | Value | Description |
|----------|------|---------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | FC | L-field, calculated from C field to last user data |
| 3 | 1 | FC | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 08 | C-field, RSP_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 72 | CI-field, variable data respond, LSB first |
| 8-11 | 4 | xxxxxxx | Identification Number, 8 BCD digits |
| 12-13 | 2 | 4204 | Manufacturer: ABB |
| 14 | 1 | 02 | Version |
| 15 | 1 | 02 | Medium, 02 = Electricity |
| 16 | 1 | xx | Number of accesses |
| 17 | 1 | xx | Status |
| 18-19 | 2 | 0000 | Signature (0000 = no encryption) |
| 20 | 1 | 04 | DIF size, 32 bit integer |
| 21 | 1 | FF | VIF next byte is manufacturer specific |
| 22 | 1 | 98 | VIFE Power fail counter |
| 23 | 1 | xx | VIFE status |
| 24-27 | 4 | xxxxxxx | Power fail counter |
| 28 | 1 | 04 | DIF size, 32 bit integer |
| 29 | 1 | A9 | VIF for units W with resolution 0,01W |
| 30 | 1 | xx | VIFE status |
| 31-34 | 4 | xxxxxxx | Active power, Total |
| 35 | 1 | 04 | DIF size, 32 bit integer |
| 36 | 1 | A9 | VIF for units W with resolution 0,01W |
| 37 | 1 | FF | VIFE next byte is manufacturer specific |
| 38 | 1 | 81 | VIFE L1 |
| 39 | 1 | xx | VIFE status |
| 40-43 | 4 | xxxxxxx | Active power, L1 |
| 44 | 1 | 04 | DIF size, 32 bit integer |
| 45 | 1 | A9 | VIF for units W with resolution 0,01W |
| 46 | 1 | FF | VIFE next byte is manufacturer specific |
| 47 | 1 | 82 | VIFE L2 |
| 48 | 1 | xx | VIFE status |
| 49-52 | 4 | xxxxxxx | Active power, L2 |
| 53 | 1 | 04 | DIF size, 32 bit integer |

| Byte No. | Size | Value | Description |
|----------|------|---------|---|
| 54 | 1 | A9 | VIF for units W with resolution 0,01W |
| 55 | 1 | FF | VIFE next byte is manufacturer specific |
| 56 | 1 | 83 | VIFE L3 |
| 57 | 1 | xx | VIFE status |
| 58-61 | 4 | xxxxxxx | Active power, L3 |
| 62 | 1 | 84 | DIF size, 32 bit integer |
| 63 | 1 | 80 | DIFE (Unit = 0) |
| 64 | 1 | 40 | DIFE (Unit = 1, => xx10 (2)) |
| 65 | 1 | A9 | VIF for units var with resolution 0,01var |
| 66 | 1 | xx | VIFE status |
| 67-70 | 4 | xxxxxxx | Reactive power, Total |
| 71 | 1 | 84 | DIF size, 32 bit integer |
| 72 | 1 | 80 | DIFE (Unit = 0) |
| 73 | 1 | 40 | DIFE (Unit = 1, => xx10 (2)) |
| 74 | 1 | A9 | VIF for units var with resolution 0,01var |
| 75 | 1 | FF | VIFE next byte is manufacturer specific |
| 76 | 1 | 81 | VIFE L1 |
| 77 | 1 | xx | VIFE status |
| 78-81 | 4 | xxxxxxx | Reactive power, L1 |
| 82 | 1 | 84 | DIF size, 32 bit integer |
| 83 | 1 | 80 | DIFE (Unit = 0) |
| 84 | 1 | 40 | DIFE (Unit = 1, => xx10 (2)) |
| 85 | 1 | A9 | VIF for units var with resolution 0,01var |
| 86 | 1 | FF | VIFE next byte is manufacturer specific |
| 87 | 1 | 82 | VIFE L2 |
| 88 | 1 | xx | VIFE status |
| 89-92 | 4 | xxxxxxx | Reactive power, L2 |
| 93 | 1 | 84 | DIF size, 32 bit integer |
| 94 | 1 | 80 | DIFE (Unit = 0) |
| 95 | 1 | 40 | DIFE (Unit = 1, => xx10 (2)) |
| 96 | 1 | A9 | VIF for units var with resolution 0,01var |
| 97 | 1 | FF | VIFE next byte is manufacturer specific |
| 98 | 1 | 83 | VIFE L3 |
| 99 | 1 | xx | VIFE status |
| 100-103 | 4 | xxxxxxx | Reactive power, L3 |
| 104 | 1 | 84 | DIF size, 32 bit integer |
| 105 | 1 | 80 | DIFE (Unit = 0) |
| 106 | 1 | 80 | DIFE (Unit = 0) |
| 107 | 1 | 40 | DIFE (Unit = 1, => x100 (4)) |
| 108 | 1 | A9 | VIF for units VA with resolution 0,01VA |
| 109 | 1 | xx | VIFE status |

| Byte No. | Size | Value | Description |
|----------|------|---------|---|
| 110-113 | 4 | xxxxxxx | Apparent power, Total |
| 114 | 1 | 84 | DIF size, 32 bit integer |
| 115 | 1 | 80 | DIFE (Unit = 0) |
| 116 | 1 | 80 | DIFE (Unit = 0) |
| 117 | 1 | 40 | DIFE (Unit = 1, => x100 (4)) |
| 118 | 1 | A9 | VIF for units VA with resolution 0,01VA |
| 119 | 1 | FF | VIFE next byte is manufacturer specific |
| 120 | 1 | 81 | VIFE L1 |
| 121 | 1 | xx | VIFE status |
| 122-125 | 4 | xxxxxxx | Apparent power, L1 |
| 126 | 1 | 84 | DIF size, 32 bit integer |
| 127 | 1 | 80 | DIFE (Unit = 0) |
| 128 | 1 | 80 | DIFE (Unit = 0) |
| 129 | 1 | 40 | DIFE (Unit = 1, => x100 (4)) |
| 130 | 1 | A9 | VIF for units VA with resolution 0,01VA |
| 131 | 1 | FF | VIFE next byte is manufacturer specific |
| 132 | 1 | 82 | VIFE L2 |
| 133 | 1 | xx | VIFE status |
| 134-137 | 4 | xxxxxxx | Apparent power, L2 |
| 138 | 1 | 84 | DIF size, 32 bit integer |
| 139 | 1 | 80 | DIFE (Unit = 0) |
| 140 | 1 | 80 | DIFE (Unit = 0) |
| 141 | 1 | 40 | DIFE (Unit = 1, => x100 (4)) |
| 142 | 1 | A9 | VIF for units VA with resolution 0,01VA |
| 143 | 1 | FF | VIFE next byte is manufacturer specific |
| 144 | 1 | 83 | VIFE L3 |
| 145 | 1 | xx | VIFE status |
| 146-149 | 4 | xxxxxxx | Apparent power, L3 |
| 150 | 1 | 04 | DIF size, 32 bit integer |
| 151 | 1 | FD | VIF extension of VIF-codes |
| 152 | 1 | C8 | VIFE for units V with resolution 0,1V |
| 153 | 1 | FF | VIFE next byte is manufacturer specific |
| 154 | 1 | 81 | VIFE L1 |
| 155 | 1 | xx | VIFE status |
| 156-159 | 4 | xxxxxxx | Voltage L1 - N |
| 160 | 1 | 04 | DIF size, 32 bit integer |
| 161 | 1 | FD | VIF extension of VIF-codes |
| 162 | 1 | C8 | VIFE for units V with resolution 0,1V |
| 163 | 1 | FF | VIFE next byte is manufacturer specific |
| 164 | 1 | 82 | VIFE L2 |
| 165 | 1 | xx | VIFE status |

| Byte No. | Size | Value | Description |
|----------|------|---------|---|
| 166-169 | 4 | xxxxxxx | Voltage L2 - N |
| 170 | 1 | 04 | DIF size, 32 bit integer |
| 171 | 1 | FD | VIF extension of VIF-codes |
| 172 | 1 | C8 | VIFE for units V with resolution 0,1V |
| 173 | 1 | FF | VIFE next byte is manufacturer specific |
| 174 | 1 | 83 | VIFE L3 |
| 175 | 1 | xx | VIFE status |
| 176-179 | 4 | xxxxxxx | Voltage L3 - N |
| 180 | 1 | 04 | DIF size, 32 bit integer |
| 181 | 1 | FD | VIF extension of VIF-codes |
| 182 | 1 | C8 | VIFE for units V with resolution 0,1V |
| 183 | 1 | FF | VIFE next byte is manufacturer specific |
| 184 | 1 | 85 | VIFE L1 - L2 |
| 185 | 1 | xx | VIFE status |
| 186-189 | 4 | xxxxxxx | Voltage L1 - L2 |
| 190 | 1 | 04 | DIF size, 32 bit integer |
| 191 | 1 | FD | VIF extension of VIF-codes |
| 192 | 1 | C8 | VIFE for units V with resolution 0,1V |
| 193 | 1 | FF | VIFE next byte is manufacturer specific |
| 194 | 1 | 86 | VIFE L2 - L3 |
| 195 | 1 | xx | VIFE status |
| 196-199 | 4 | xxxxxxx | Voltage L3 - L2 |
| 200 | 1 | 04 | DIF size, 32 bit integer |
| 201 | 1 | FD | VIF extension of VIF-codes |
| 202 | 1 | C8 | VIFE for units V with resolution 0,1V |
| 203 | 1 | FF | VIFE next byte is manufacturer specific |
| 204 | 1 | 87 | VIFE L1 - L3 |
| 205 | 1 | xx | VIFE status |
| 206-209 | 4 | xxxxxxx | Voltage L1 - L3 |
| 210 | 1 | 04 | DIF size, 32 bit integer |
| 211 | 1 | FD | VIF extension of VIF-codes |
| 212 | 1 | DA | VIFE for units A with resolution 0,01A |
| 213 | 1 | FF | VIFE next byte is manufacturer specific |
| 214 | 1 | 81 | VIFE L1 |
| 215 | 1 | xx | VIFE status |
| 216-219 | 4 | xxxxxxx | Current L1 |
| 220 | 1 | 04 | DIF size, 32 bit integer |
| 221 | 1 | FD | VIF extension of VIF-codes |
| 222 | 1 | DA | VIFE for units A with resolution 0,01A |
| 223 | 1 | FF | VIFE next byte is manufacturer specific |
| 224 | 1 | 82 | VIFE L2 |

| Byte No. | Size | Value | Description |
|----------|------|---------|---|
| 225 | 1 | xx | VIFE status |
| 226-229 | 4 | xxxxxxx | Current L2 |
| 230 | 1 | 04 | DIF size, 32 bit integer |
| 231 | 1 | FD | VIF extension of VIF-codes |
| 232 | 1 | DA | VIFE for units A with resolution 0,01A |
| 233 | 1 | FF | VIFE next byte is manufacturer specific |
| 234 | 1 | 83 | VIFE L3 |
| 235 | 1 | xx | VIFE status |
| 236-239 | 4 | xxxxxxx | Current L3 |
| 240 | 1 | 04 | DIF size, 32 bit integer |
| 241 | 1 | FD | VIF extension of VIF-codes |
| 242 | 1 | DA | VIFE for units A with resolution 0,01A |
| 243 | 1 | FF | VIFE next byte is manufacturer specific |
| 244 | 1 | 84 | VIFE N |
| 245 | 1 | xx | VIFE status |
| 246-249 | 4 | xxxxxxx | Current N |
| 250 | 1 | 0A | DIF size, 4 digit BCD |
| 251 | 1 | FF | VIF next byte is manufacturer specific |
| 252 | 1 | E9 | VIFE Frequency with resolution 0.01Hz |
| 253 | 1 | xx | VIFE status |
| 254-255 | 2 | xxxx | Frequency |
| 256 | 1 | 1F | DIF more records will follow in next telegram |
| 257 | 1 | xx | CS checksum, calculated from C field to last data |
| 258 | 1 | 16 | Stop character |

10.2.3 Example of 3rd telegram (all values are hexadecimal)

| Byte No. | Size | Value | Description |
|----------|------|---------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | F4 | L-field, calculated from C field to last user data |
| 3 | 1 | F4 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 08 | C-field, RSP_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 72 | CI-field, variable data respond, LSB first |
| 8-11 | 4 | xxxxxxx | Identification Number, 8 BCD digits |
| 12-13 | 2 | 4204 | Manufacturer: ABB |
| 14 | 1 | 02 | Version |
| 15 | 1 | 02 | Medium, 02 = Electricity |
| 16 | 1 | xx | Number of accesses |
| 17 | 1 | xx | Status |
| 18-19 | 2 | 0000 | Signature (0000 = no encryption) |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 20 | 1 | 0E | DIF size, 12 digit BCD |
| 21 | 1 | FF | VIF next byte is manufacturer specific |
| 22 | 1 | EC | VIFE Power outage time |
| 23 | 1 | xx | VIFE status |
| 24-29 | 6 | xxxxxxxxxxx | Power outage time (sec, min, hour, days, LSB first) |
| 30 | 1 | 02 | DIF size, 16 bit integer |
| 31 | 1 | FF | VIF next byte is manufacturer specific |
| 32 | 1 | E0 | VIFE power factor with resolution 0,001 |
| 33 | 1 | xx | VIFE status |
| 34-35 | 2 | xxxx | Power factor, Total |
| 36 | 1 | 02 | DIF size, 16 bit integer |
| 37 | 1 | FF | VIF next byte is manufacturer specific |
| 38 | 1 | E0 | VIFE power factor with resolution 0,001 |
| 39 | 1 | FF | VIFE next byte is manufacturer specific |
| 40 | 1 | 81 | VIFE L1 |
| 41 | 1 | xx | VIFE status |
| 42-43 | 2 | xxxx | Power factor, L1 |
| 44 | 1 | 02 | DIF size, 16 bit integer |
| 45 | 1 | FF | VIF next byte is manufacturer specific |
| 46 | 1 | E0 | VIFE power factor with resolution 0,001 |
| 47 | 1 | FF | VIFE next byte is manufacturer specific |
| 48 | 1 | 82 | VIFE L2 |
| 49 | 1 | xx | VIFE status |
| 50-51 | 2 | xxxx | Power factor, L2 |
| 52 | 1 | 02 | DIF size, 16 bit integer |
| 53 | 1 | FF | VIF next byte is manufacturer specific |
| 54 | 1 | E0 | VIFE power factor with resolution 0,001 |
| 55 | 1 | FF | VIFE next byte is manufacturer specific |
| 56 | 1 | 83 | VIFE L3 |
| 57 | 1 | xx | VIFE status |
| 58-59 | 2 | xxxx | Power factor, L3 |
| 60 | 1 | 02 | DIF size, 16 bit integer |
| 61 | 1 | FF | VIF next byte is manufacturer specific |
| 62 | 1 | D2 | VIFE phase angle power with resolution 0.1 |
| 63 | 1 | xx | VIFE status |
| 64-65 | 2 | xxxx | Phase angle power, Total |
| 66 | 1 | 02 | DIF size, 16 bit integer |
| 67 | 1 | FF | VIF next byte is manufacturer specific |
| 68 | 1 | D2 | VIFE phase angle power with resolution 0.1 |
| 69 | 1 | FF | VIFE next byte is manufacturer specific |
| 70 | 1 | 81 | VIFE L1 |

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 71 | 1 | xx | VIFE status |
| 72-73 | 2 | xxxx | Phase angle power, L1 |
| 74 | 1 | 02 | DIF size, 16 bit integer |
| 75 | 1 | FF | VIF next byte is manufacturer specific |
| 76 | 1 | D2 | VIFE phase angle power with resolution 0.1 |
| 77 | 1 | FF | VIFE next byte is manufacturer specific |
| 78 | 1 | 82 | VIFE L2 |
| 79 | 1 | xx | VIFE status |
| 80-81 | 2 | xxxx | Phase angle power, L2 |
| 82 | 1 | 02 | DIF size, 16 bit integer |
| 83 | 1 | FF | VIF next byte is manufacturer specific |
| 84 | 1 | D2 | VIFE phase angle power with resolution 0.1 |
| 85 | 1 | FF | VIFE next byte is manufacturer specific |
| 86 | 1 | 83 | VIFE L3 |
| 87 | 1 | xx | VIFE status |
| 88-89 | 2 | xxxx | Phase angle power, L3 |
| 90 | 1 | 02 | DIF size, 16 bit integer |
| 91 | 1 | FF | VIF next byte is manufacturer specific |
| 92 | 1 | C2 | VIFE phase angle voltage with resolution 0.1 |
| 93 | 1 | FF | VIFE next byte is manufacturer specific |
| 94 | 1 | 81 | VIFE L1 |
| 95 | 1 | xx | VIFE status |
| 96-97 | 2 | xxxx | Phase angle voltage, L1 |
| 98 | 1 | 02 | DIF size, 16 bit integer |
| 99 | 1 | FF | VIF next byte is manufacturer specific |
| 100 | 1 | C2 | VIFE phase angle voltage with resolution 0.1 |
| 101 | 1 | FF | VIFE next byte is manufacturer specific |
| 102 | 1 | 82 | VIFE L2 |
| 103 | 1 | xx | VIFE status |
| 104-105 | 2 | xxxx | Phase angle voltage, L2 |
| 106 | 1 | 02 | DIF size, 16 bit integer |
| 107 | 1 | FF | VIF next byte is manufacturer specific |
| 108 | 1 | C2 | VIFE phase angle voltage with resolution 0.1 |
| 109 | 1 | FF | VIFE next byte is manufacturer specific |
| 110 | 1 | 83 | VIFE L3 |
| 111 | 1 | xx | VIFE status |
| 112-113 | 2 | xxxx | Phase angle voltage, L3 |
| 114 | 1 | 02 | DIF size, 16 bit integer |
| 115 | 1 | FF | VIF next byte is manufacturer specific |
| 116 | 1 | CA | VIFE phase angle current with resolution 0.1 |
| 117 | 1 | FA | VIFE next byte is manufacturer specific |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 118 | 1 | 81 | VIFE L1 |
| 119 | 1 | xx | VIFE status |
| 120-121 | 2 | xxxx | Phase angle current, L1 |
| 122 | 1 | 02 | DIF size, 16 bit integer |
| 123 | 1 | FF | VIF next byte is manufacturer specific |
| 124 | 1 | CA | VIFE phase angle current with resolution 0.1 |
| 125 | 1 | FF | VIFE next byte is manufacturer specific |
| 126 | 1 | 82 | VIFE L2 |
| 127 | 1 | xx | VIFE status |
| 128-129 | 2 | xxxx | Phase angle current, L2 |
| 130 | 1 | 02 | DIF size, 16 bit integer |
| 131 | 1 | FF | VIF next byte is manufacturer specific |
| 132 | 1 | CA | VIFE phase angle current with resolution 0.1 |
| 133 | 1 | FF | VIFE next byte is manufacturer specific |
| 134 | 1 | 83 | VIFE L3 |
| 135 | 1 | xx | VIFE status |
| 136-137 | 2 | xxxx | Phase angle current, L3 |
| 138 | 1 | 8E | DIF size, 12 digit BCD |
| 139 | 1 | 80 | DIFE, |
| 140 | 1 | 40 | DIFE, unit 2 |
| 141 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 142 | 1 | xx | VIFE status |
| 143-148 | 6 | xxxxxxxxxxx | Reactive imported energy, Total |
| 149 | 1 | 8E | DIF size, 12 digit BCD |
| 150 | 1 | 90 | DIFE, tariff 1 |
| 151 | 1 | 40 | DIFE, unit 2 |
| 152 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 153 | 1 | xx | VIFE status |
| 154-159 | 6 | xxxxxxxxxxx | Reactive imported energy, Tariff 1 |
| 160 | 1 | 8E | DIF size, 12 digit BCD |
| 161 | 1 | A0 | DIFE, tariff 2 |
| 162 | 1 | 40 | DIFE, unit 2 |
| 163 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 164 | 1 | xx | VIFE status |
| 165-170 | 6 | xxxxxxxxxxx | Reactive imported energy, Tariff 2 |
| 171 | 1 | 8E | DIF size, 12 digit BCD |
| 172 | 1 | B0 | DIFE, tariff 3 |
| 173 | 1 | 40 | DIFE, unit 2 |
| 174 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 175 | 1 | xx | VIFE status |
| 176-181 | 6 | xxxxxxxxxxx | Reactive imported energy, Tariff 3 |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 182 | 1 | 8E | DIF size, 12 digit BCD |
| 183 | 1 | 80 | DIFE, |
| 184 | 1 | 50 | DIFE, tariff 4, unit 2 |
| 185 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 186 | 1 | xx | VIFE status |
| 187-192 | 6 | xxxxxxxxxxx | Reactive imported energy, Tariff 4 |
| 193 | 1 | 8E | DIF size, 12 digit BCD |
| 194 | 1 | C0 | DIFE, unit bit 0 |
| 195 | 1 | 40 | DIFE, unit bit 1, unit bit0-1-> unit 3 |
| 196 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 197 | 1 | xx | VIFE status |
| 198-203 | 6 | xxxxxxxxxxx | Reactive exported energy, Total |
| 204 | 1 | 8E | DIF size, 12 digit BCD |
| 205 | 1 | D0 | DIFE, tariff 1, unit bit 0 |
| 206 | 1 | 40 | DIFE, unit bit 1, unit bit 0-1-> unit 3 |
| 207 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 208 | 1 | xx | VIFE status |
| 209-214 | 6 | xxxxxxxxxxx | Reactive exported energy, Tariff 1 |
| 215 | 1 | 8E | DIF size, 12 digit BCD |
| 216 | 1 | E0 | DIFE, tariff 2, unit bit 0 |
| 217 | 1 | 40 | DIFE, unit bit 1, unit bit 0-1-> unit 3 |
| 218 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 219 | 1 | xx | VIFE status |
| 220-225 | 6 | xxxxxxxxxxx | Reactive exported energy, Tariff 2 |
| 226 | 1 | 8E | DIF size, 12 digit BCD |
| 227 | 1 | F0 | DIFE, tariff 3, unit bit 0 |
| 228 | 1 | 40 | DIFE, unit bit 1, unit bit 0-1-> unit 3 |
| 229 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 230 | 1 | xx | VIFE status |
| 231-236 | 6 | xxxxxxxxxxx | Reactive exported energy, Tariff 3 |
| 237 | 1 | 8E | DIF size, 12 digit BCD |
| 238 | 1 | C0 | DIFE, unit bit 0 |
| 239 | 1 | 50 | DIFE, tariff 4, unit bit 1, unit bit 0-1-> unit 3 |
| 240 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 241 | 1 | xx | VIFE status |
| 242-247 | 6 | xxxxxxxxxxx | Reactive exported energy, Tariff 4 |
| 248 | 1 | 1F | DIF, more records will follow in next telegram |
| 249 | 1 | xx | CS checksum, calculated from C field to last data |
| 250 | 1 | 16 | Stop character |

10.2.4 Example of the 4th telegram (all values are hexadecimal)

| Byte No. | Size | Value | Description |
|----------|------|---------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | AE | L-field, calculated from C field to last user data |
| 3 | 1 | AE | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 08 | C-field, RSP_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 72 | CI-field, variable data respond, LSB first |
| 8-11 | 4 | xxxxxxx | Identification Number, 8 BCD digits |
| 12-13 | 2 | 4204 | Manufacturer: ABB |
| 14 | 1 | 02 | Version |
| 15 | 1 | 02 | Medium, 02 = Electricity |
| 16 | 1 | xx | Number of accesses |
| 17 | 1 | xx | Status |
| 18-19 | 2 | 0000 | Signature (0000 = no encryption) |
| 20 | 1 | 01 | DIF size, 8 bit integer |
| 21 | 1 | FF | VIF next byte is manufacturer specific |
| 22 | 1 | 97 | VIFE current quadrant |
| 23 | 1 | xx | VIFE status |
| 24 | 1 | xx | Current quadrant, total |
| 25 | 1 | 01 | DIF size, 8 bit integer |
| 26 | 1 | FF | VIF next byte is manufacturer specific |
| 27 | 1 | 97 | VIFE current quadrant |
| 28 | 1 | FF | VIF next byte is manufacturer specific |
| 29 | 1 | 81 | VIFE L1 |
| 30 | 1 | xx | VIFE status |
| 31 | 1 | xx | Current quadrant, L1 |
| 32 | 1 | 01 | DIF size, 8 bit integer |
| 33 | 1 | FF | VIF next byte is manufacturer specific |
| 34 | 1 | 97 | VIFE current quadrant |
| 35 | 1 | FF | VIF next byte is manufacturer specific |
| 36 | 1 | 82 | VIFE L2 |
| 37 | 1 | xx | VIFE status |
| 38 | 1 | xx | Current quadrant, L2 |
| 39 | 1 | 01 | DIF size, 8 bit integer |
| 40 | 1 | FF | VIF next byte is manufacturer specific |
| 41 | 1 | 97 | VIFE current quadrant |
| 42 | 1 | FF | VIF next byte is manufacturer specific |
| 43 | 1 | 83 | VIFE L3 |
| 44 | 1 | xx | VIFE status |
| 45 | 1 | xx | Current quadrant, L3 |

| Byte No. | Size | Value | Description |
|----------|------|-------|----------------------------|
| 46 | 1 | 81 | DIF size, 8 bit integer |
| 47 | 1 | 40 | DIFE (Unit = 1) |
| 48 | 1 | FD | VIF extension of VIF-codes |
| 49 | 1 | 9A | VIFE digital output |
| 50 | 1 | xx | VIFE status |
| 51 | 1 | xx | Output 1, current state |
| 52 | 1 | 81 | DIF size, 8 bit integer |
| 53 | 1 | 80 | DIFE, |
| 54 | 1 | 40 | DIFE (Unit = 2) |
| 55 | 1 | FD | VIF extension of VIF-codes |
| 56 | 1 | 9A | VIFE digital output |
| 57 | 1 | xx | VIFE status |
| 58 | 1 | xx | Output 2, current state |
| 59 | 1 | 81 | DIF size, 8 bit integer |
| 60 | 1 | C0 | DIFE (Unit = 1) |
| 61 | 1 | 40 | DIFE (Unit = 2) |
| 62 | 1 | FD | VIF extension of VIF-codes |
| 63 | 1 | 9A | VIFE digital output |
| 64 | 1 | xx | VIFE status |
| 65 | 1 | xx | Output 3, current state |
| 66 | 1 | 81 | DIF size, 8 bit integer |
| 67 | 1 | 80 | DIFE, |
| 68 | 1 | 80 | DIFE, |
| 69 | 1 | 40 | DIFE (Unit = 4) |
| 70 | 1 | FD | VIF extension of VIF-codes |
| 71 | 1 | 9A | VIFE digital output |
| 72 | 1 | xx | VIFE status |
| 73 | 1 | xx | Output 4, current state |
| 74 | 1 | 81 | DIF size, 8 bit integer |
| 75 | 1 | 40 | DIFE (Unit = 1) |
| 76 | 1 | FD | VIF extension of VIF-codes |
| 77 | 1 | 9B | VIFE digital input |
| 78 | 1 | xx | VIFE status |
| 79 | 1 | xx | Input 1 current state |
| 80 | 1 | 81 | DIF size, 8 bit integer |
| 81 | 1 | 80 | DIFE, |
| 82 | 1 | 40 | DIFE (Unit = 2) |
| 83 | 1 | FD | VIF extension of VIF-codes |
| 84 | 1 | 9B | VIFE digital input |
| 85 | 1 | xx | VIFE status |
| 86 | 1 | xx | Input 2 current state |

| Byte No. | Size | Value | Description |
|----------|------|-------|---|
| 87 | 1 | 81 | DIF size, 8 bit integer |
| 88 | 1 | C0 | DIFE (Unit = 1) |
| 89 | 1 | 40 | DIFE (Unit = 2) |
| 90 | 1 | FD | VIF extension of VIF-codes |
| 91 | 1 | 9B | VIFE digital input |
| 92 | 1 | xx | VIFE status |
| 93 | 1 | xx | Input 3 current state |
| 94 | 1 | 81 | DIF size, 8 bit integer |
| 95 | 1 | 80 | DIFE, |
| 96 | 1 | 80 | DIFE, |
| 97 | 1 | 40 | DIFE (Unit = 4) |
| 98 | 1 | FD | VIF extension of VIF-codes |
| 99 | 1 | 9B | VIFE digital input |
| 100 | 1 | xx | VIFE status |
| 101 | 1 | xx | Input 4 current state |
| 102 | 1 | C1 | DIF size, 8 bit integer, storage number 1 |
| 103 | 1 | 40 | DIFE (Unit = 1) |
| 104 | 1 | FD | VIF extension of VIF-codes |
| 105 | 1 | 9B | VIFE digital input |
| 106 | 1 | xx | VIFE status |
| 107 | 1 | xx | Input 1, stored state (1 if current state has been 1) |
| 108 | 1 | C1 | DIF size, 8 bit integer, storage number 1 |
| 109 | 1 | 80 | DIFE, |
| 110 | 1 | 40 | DIFE (Unit = 2) |
| 111 | 1 | FD | VIF extension of VIF-codes |
| 112 | 1 | 9B | VIFE digital input |
| 113 | 1 | xx | VIFE status |
| 114 | 1 | xx | Input 2, stored state (1 if current state has been 1) |
| 115 | 1 | C1 | DIF size, 8 bit integer, storage number 1 |
| 116 | 1 | C0 | DIFE (Unit = 1) |
| 117 | 1 | 40 | DIFE (Unit = 2) |
| 118 | 1 | FD | VIF extension of VIF-codes |
| 119 | 1 | 9B | VIFE digital input |
| 120 | 1 | xx | VIFE status |
| 121 | 1 | xx | Input 3, stored state (1 if current state has been 1) |
| 122 | 1 | C1 | DIF size, 8 bit integer, storage number 1 |
| 123 | 1 | 80 | DIFE, |
| 124 | 1 | 80 | DIFE, |
| 125 | 1 | 40 | DIFE (Unit = 4) |
| 126 | 1 | FD | VIF extension of VIF-codes |
| 127 | 1 | 9B | VIFE digital input |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 128 | 1 | xx | VIFE status |
| 129 | 1 | xx | Input 4, stored state (1 if current state has been 1) |
| 130 | 1 | 8E | DIF size, 12 digit BCD |
| 131 | 1 | 40 | DIFE (Unit = 1) |
| 132 | 1 | FD | VIF extension of VIF-codes |
| 133 | 1 | E1 | VIFE cumulating counter |
| 134 | 1 | xx | VIFE status |
| 135-140 | 6 | xxxxxxxxxxx | Counter 1 (input 1) |
| 141 | 1 | 8E | DIF size, 12 digit BCD |
| 142 | 1 | 80 | DIFE, |
| 143 | 1 | 40 | DIFE (Unit = 2) |
| 144 | 1 | FD | VIF extension of VIF-codes |
| 145 | 1 | E1 | VIFE cumulating counter |
| 146 | 1 | xx | VIFE status |
| 147-152 | 6 | xxxxxxxxxxx | Counter 2 (input 2) |
| 153 | 1 | 8E | DIF size, 12 digit BCD |
| 154 | 1 | C0 | DIFE (Unit = 1) |
| 155 | 1 | 40 | DIFE (Unit = 2) |
| 156 | 1 | FD | VIF extension of VIF-codes |
| 157 | 1 | E1 | VIFE cumulating counter |
| 158 | 1 | xx | VIFE status |
| 159-164 | 6 | xxxxxxxxxxx | Counter 3 (input 3) |
| 165 | 1 | 8E | DIF size, 12 digit BCD |
| 166 | 1 | 80 | DIFE, |
| 167 | 1 | 80 | DIFE, |
| 168 | 1 | 40 | DIFE (Unit = 4) |
| 169 | 1 | FD | VIF extension of VIF-codes |
| 170 | 1 | E1 | VIFE cumulating counter |
| 171 | 1 | xx | VIFE status |
| 172-177 | 6 | xxxxxxxxxxx | Counter 4 (input 4) |
| 178 | 1 | 1F | DIF, more records will follow in next telegram |
| 179 | 1 | xx | CS checksum, calculated from C field to last data |
| 180 | 1 | 16 | Stop character |

10.2.5 Example of the 5th telegram (all values are hexadecimal)

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | A4 | L-field, calculated from C field to last user data |
| 3 | 1 | A4 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 08 | C-field, RSP_UD |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 72 | CI-field, variable data respond, LSB first |
| 8-11 | 4 | xxxxxxx | Identification Number, 8 BCD digits |
| 12-13 | 2 | 4204 | Manufacturer: ABB |
| 14 | 1 | 02 | Version |
| 15 | 1 | 02 | Medium, 02 = Electricity |
| 16 | 1 | xx | Number of accesses |
| 17 | 1 | xx | Status |
| 18-19 | 2 | 0000 | Signature (0000 = no encryption) |
| 20 | 1 | 0E | DIF size, 12 digit BCD |
| 21 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 22 | 1 | FF | VIFE next byte is manufacturer specific |
| 23 | 1 | F2 | VIFE resettable energy |
| 24 | 1 | xx | VIFE status |
| 25-30 | 6 | xxxxxxxxxxx | Resettable active imported energy, Total |
| 31 | 1 | 8E | DIF size, 12 digit BCD |
| 32 | 1 | 40 | DIFE (Unit = 1) |
| 33 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 34 | 1 | FF | VIFE next byte is manufacturer specific |
| 35 | 1 | F2 | VIFE resettable energy |
| 36 | 1 | xx | VIFE status |
| 37-42 | 6 | xxxxxxxxxxx | Resettable active exported energy, Total |
| 43 | 1 | 8E | DIF size, 12 digit BCD |
| 44 | 1 | 80 | DIFE |
| 45 | 1 | 40 | DIFE (Unit = 2) |
| 46 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 47 | 1 | FF | VIFE next byte is manufacturer specific |
| 48 | 1 | F2 | VIFE resettable energy |
| 49 | 1 | xx | VIFE status |
| 50-55 | 6 | xxxxxxxxxxx | Resettable reactive imported energy, Total |
| 56 | 1 | 8E | DIF size, 12 digit BCD |
| 57 | 1 | C0 | DIFE (Unit = 1) |
| 58 | 1 | 40 | DIFE (Unit = 2) |
| 59 | 1 | 84 | VIF for units kvar with resolution 0,01kvarh |
| 60 | 1 | FF | VIFE next byte is manufacturer specific |
| 61 | 1 | F2 | VIFE resettable energy |
| 62 | 1 | xx | VIFE status |
| 63-68 | 6 | xxxxxxxxxxx | Resettable reactive exported energy, Total |
| 69 | 1 | 04 | DIF size, 32 bit integer |
| 70 | 1 | FF | VIFE next byte is manufacturer specific |
| 71 | 1 | F1 | VIFE reset counter |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 72 | 1 | xx | VIFE status |
| 73-76 | 4 | xxxxxxx | Reset counter for active imported energy, Total |
| 77 | 1 | 84 | DIF size, 32 bit integer |
| 78 | 1 | 40 | DIFE (Unit = 1) |
| 79 | 1 | FF | VIFE next byte is manufacturer specific |
| 80 | 1 | F1 | VIFE reset counter |
| 81 | 1 | xx | VIFE status |
| 82-85 | 4 | xxxxxxx | Reset counter for active exported energy, Total |
| 86 | 1 | 84 | DIF size, 32 bit integer |
| 87 | 1 | 80 | DIFE |
| 88 | 1 | 40 | DIFE (Unit = 2) |
| 89 | 1 | FF | VIFE next byte is manufacturer specific |
| 90 | 1 | F1 | VIFE reset counter |
| 91 | 1 | xx | VIFE status |
| 92-95 | 4 | xxxxxxx | Reset counter for reactive imported energy, Total |
| 96 | 1 | 84 | DIF size, 32 bit integer |
| 97 | 1 | C0 | DIFE (Unit = 1) |
| 98 | 1 | 40 | DIFE (Unit = 2) |
| 99 | 1 | FF | VIFE next byte is manufacturer specific |
| 100 | 1 | F1 | VIFE reset counter |
| 101 | 1 | xx | VIFE status |
| 102-105 | 4 | xxxxxxx | Reset counter for reactive exported energy, Total |
| 106 | 1 | 0E | DIF size, 12 digit BCD |
| 107 | 1 | FF | VIFE next byte is manufacturer specific |
| 108 | 1 | F9 | VIF extension of manufacturer specific VIFE's |
| 109 | 1 | C4 | Energy in CO2 with resolution 0,001 kg |
| 110 | 1 | xx | VIFE status |
| 111-116 | 6 | xxxxxxxxxxx | CO2 for active imported energy, Total |
| 117 | 1 | 0E | DIF size, 12 digit BCD |
| 118 | 1 | FF | VIFE next byte is manufacturer specific |
| 119 | 1 | F9 | VIF extension of manufacturer specific VIFE's |
| 120 | 1 | C9 | Energy in Currency with resolution 0,01 currency |
| 121 | 1 | xx | VIFE status |
| 122-127 | 6 | xxxxxxxxxxx | Currency for active imported energy, Total |
| 128 | 1 | 04 | DIF size, 32 bit integer |
| 129 | 1 | FF | VIFE next byte is manufacturer specific |
| 130 | 1 | A4 | CO2 conversion factor in g/kWh |
| 131 | 1 | xx | VIFE status |
| 132-133 | 4 | xxxxxxx | CO2 conversion factor for active energy |
| 134 | 1 | 04 | DIF size, 32 bit integer |
| 135 | 1 | FF | VIFE next byte is manufacturer specific |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 136 | 1 | A5 | Currency conversion factor in 0,001 currency/kWh |
| 137 | 1 | xx | VIFE status |
| 138-143 | 4 | xxxxxxx | Currency conversion factor for active energy |
| 144 | 1 | 8E | DIF size, 12 digit BCD |
| 145 | 1 | 80 | DIFE |
| 146 | 1 | 80 | DIFE |
| 147 | 1 | 40 | DIFE, Unit 4 |
| 148 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 149 | 1 | xx | VIFE status |
| 150-155 | 6 | xxxxxxxxxxx | Apparent imported energy, Total |
| 156 | 1 | 8E | DIF size, 12 digit BCD |
| 157 | 1 | C0 | DIFE, Unit bit 0 |
| 158 | 1 | 80 | DIFE, Unit bit 1 |
| 159 | 1 | 40 | DIFE, Unit bit 2, Unit bit 0-2 -> Unit 5 |
| 160 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 161 | 1 | xx | VIFE status |
| 162-167 | 6 | xxxxxxxxxxx | Apparent exported energy, Total |
| 168 | 1 | 1F | DIF, more records will follow in next telegram |
| 169 | 1 | xx | CS checksum, calculated from C field to last data |
| 170 | 1 | 16 | Stop character |

10.2.6 Example of the 6th telegram (all values are hexadecimal)

| Byte No. | Size | Value | Description |
|----------|------|---------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | F7 | L-field, calculated from C field to last user data |
| 3 | 1 | F7 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 08 | C-field, RSP_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 72 | CI-field, variable data respond, LSB first |
| 8-11 | 4 | xxxxxxx | Identification Number, 8 BCD digits |
| 12-13 | 2 | 4204 | Manufacturer: ABB |
| 14 | 1 | 02 | Version |
| 15 | 1 | 02 | Medium, 02 = Electricity |
| 16 | 1 | xx | Number of accesses |
| 17 | 1 | xx | Status |
| 18-19 | 2 | 0000 | Signature (0000 = no encryption) |
| 20 | 1 | 0E | DIF size, 12 digit BCD |
| 21 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 22 | 1 | FF | VIFE next byte is manufacturer specific |
| 23 | 1 | 81 | VIFE L1 |

| Byte No. | Size | Value | Description |
|----------|------|-------------|--|
| 24 | 1 | xx | VIFE status |
| 25-30 | 6 | xxxxxxxxxxx | Active imported energy, L1 |
| 31 | 1 | 0E | DIF size, 12 digit BCD |
| 32 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 33 | 1 | FF | VIFE next byte is manufacturer specific |
| 34 | 1 | 82 | VIFE L2 |
| 35 | 1 | xx | VIFE status |
| 36-41 | 6 | xxxxxxxxxxx | Active imported energy, L2 |
| 42 | 1 | 0E | DIF size, 12 digit BCD |
| 43 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 44 | 1 | FF | VIFE next byte is manufacturer specific |
| 45 | 1 | 83 | VIFE L3 |
| 46 | 1 | xx | VIFE status |
| 47-52 | 6 | xxxxxxxxxxx | Active imported energy, L3 |
| 53 | 1 | 8E | DIF size, 12 digit BCD |
| 54 | 1 | 80 | DIFE |
| 55 | 1 | 40 | DIFE, Unit 2 |
| 56 | 1 | 84 | VIF for units kvarh with resolution 0,01 kvarh |
| 57 | 1 | FF | VIFE next byte is manufacturer specific |
| 58 | 1 | 81 | VIFE L1 |
| 59 | 1 | xx | VIFE status |
| 60-65 | 6 | xxxxxxxxxxx | Reactive imported energy, L1 |
| 66 | 1 | 8E | DIF size, 12 digit BCD |
| 67 | 1 | 80 | DIFE |
| 68 | 1 | 40 | DIFE, Unit 2 |
| 69 | 1 | 84 | VIF for units kvarh with resolution 0,01 kvarh |
| 70 | 1 | FF | VIFE next byte is manufacturer specific |
| 71 | 1 | 82 | VIFE L2 |
| 72 | 1 | xx | VIFE status |
| 73-78 | 6 | xxxxxxxxxxx | Reactive imported energy, L2 |
| 79 | 1 | 8E | DIF size, 12 digit BCD |
| 80 | 1 | 80 | DIFE |
| 81 | 1 | 40 | DIFE, Unit 2 |
| 82 | 1 | 84 | VIF for units kvarh with resolution 0,01 kvarh |
| 83 | 1 | FF | VIFE next byte is manufacturer specific |
| 84 | 1 | 83 | VIFE L3 |
| 85 | 1 | xx | VIFE status |
| 86-91 | 6 | xxxxxxxxxxx | Reactive imported energy, L3 |
| 92 | 1 | 8E | DIF size, 12 digit BCD |
| 93 | 1 | 80 | DIFE |
| 94 | 1 | 80 | DIFE |

| Byte No. | Size | Value | Description |
|----------|------|-------------|--|
| 95 | 1 | 40 | DIFE, Unit 4 |
| 96 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 97 | 1 | FF | VIFE next byte is manufacturer specific |
| 98 | 1 | 81 | VIFE L1 |
| 99 | 1 | xx | VIFE status |
| 100-105 | 6 | xxxxxxxxxxx | Apparent imported energy, L1 |
| 106 | 1 | 8E | DIF size, 12 digit BCD |
| 107 | 1 | 80 | DIFE |
| 108 | 1 | 80 | DIFE |
| 109 | 1 | 40 | DIFE, Unit 4 |
| 110 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 111 | 1 | FF | VIFE next byte is manufacturer specific |
| 112 | 1 | 82 | VIFE L2 |
| 113 | 1 | xx | VIFE status |
| 114-119 | 6 | xxxxxxxxxxx | Apparent imported energy, L2 |
| 120 | 1 | 8E | DIF size, 12 digit BCD |
| 121 | 1 | 80 | DIFE |
| 122 | 1 | 80 | DIFE |
| 123 | 1 | 40 | DIFE, Unit 4 |
| 124 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 125 | 1 | FF | VIFE next byte is manufacturer specific |
| 126 | 1 | 83 | VIFE L3 |
| 127 | 1 | xx | VIFE status |
| 128-133 | 6 | xxxxxxxxxxx | Apparent imported energy, L3 |
| 134 | 1 | 8E | DIF size, 12 digit BCD |
| 135 | 1 | 40 | DIFE, Unit 1 |
| 136 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 137 | 1 | FF | VIFE next byte is manufacturer specific |
| 138 | 1 | 81 | VIFE L1 |
| 139 | 1 | xx | VIFE status |
| 140-145 | 6 | xxxxxxxxxxx | Active exported energy, L1 |
| 146 | 1 | 8E | DIF size, 12 digit BCD |
| 147 | 1 | 40 | DIFE, Unit 1 |
| 148 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 149 | 1 | FF | VIFE next byte is manufacturer specific |
| 150 | 1 | 82 | VIFE L2 |
| 151 | 1 | xx | VIFE status |
| 152-157 | 6 | xxxxxxxxxxx | Active exported energy, L2 |
| 158 | 1 | 8E | DIF size, 12 digit BCD |
| 159 | 1 | 40 | DIFE, Unit 1 |
| 160 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |

| Byte No. | Size | Value | Description |
|----------|------|-------------|--|
| 161 | 1 | FF | VIFE next byte is manufacturer specific |
| 162 | 1 | 83 | VIFE L3 |
| 163 | 1 | xx | VIFE status |
| 164-169 | 6 | xxxxxxxxxxx | Active exported energy, L3 |
| 170 | 1 | 8E | DIF size, 12 digit BCD |
| 171 | 1 | C0 | DIFE, Unit bit 0 |
| 172 | 1 | 40 | DIFE, Unit bit 1, unit bit0-1-> unit 3 |
| 173 | 1 | 84 | VIF for units kvarh with resolution 0,01 kvarh |
| 174 | 1 | FF | VIFE next byte is manufacturer specific |
| 175 | 1 | 81 | VIFE L1 |
| 176 | 1 | xx | VIFE status |
| 177-182 | 6 | xxxxxxxxxxx | Reactive exported energy, L1 |
| 183 | 1 | 8E | DIF size, 12 digit BCD |
| 184 | 1 | C0 | DIFE, Unit bit 0 |
| 185 | 1 | 40 | DIFE, Unit bit 1, unit bit0-1-> unit 3 |
| 186 | 1 | 84 | VIF for units kvarh with resolution 0,01 kvarh |
| 187 | 1 | FF | VIFE next byte is manufacturer specific |
| 188 | 1 | 82 | VIFE L2 |
| 189 | 1 | xx | VIFE status |
| 190-195 | 6 | xxxxxxxxxxx | Reactive exported energy, L2 |
| 196 | 1 | 8E | DIF size, 12 digit BCD |
| 197 | 1 | C0 | DIFE, Unit bit 0 |
| 198 | 1 | 40 | DIFE, Unit bit 1, unit bit0-1-> unit 3 |
| 199 | 1 | 84 | VIF for units kvarh with resolution 0,01 kvarh |
| 200 | 1 | FF | VIFE next byte is manufacturer specific |
| 201 | 1 | 83 | VIFE L3 |
| 202 | 1 | xx | VIFE status |
| 203-208 | 6 | xxxxxxxxxxx | Reactive exported energy, L3 |
| 209 | 1 | 8E | DIF size, 12 digit BCD |
| 210 | 1 | C0 | DIFE, Unit bit 0 |
| 211 | 1 | 80 | DIFE, Unit bit 1 |
| 212 | 1 | 40 | DIFE, Unit bit 2, unit bit0-2-> unit 5 |
| 213 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 214 | 1 | FF | VIFE next byte is manufacturer specific |
| 215 | 1 | 81 | VIFE L1 |
| 216 | 1 | xx | VIFE status |
| 217-222 | 6 | xxxxxxxxxxx | Apparent exported energy, L1 |
| 223 | 1 | 8E | DIF size, 12 digit BCD |
| 224 | 1 | C0 | DIFE, Unit bit 0 |
| 225 | 1 | 80 | DIFE, Unit bit 1 |
| 226 | 1 | 40 | DIFE, Unit bit 2, unit bit0-2-> unit 5 |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 227 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 228 | 1 | FF | VIFE next byte is manufacturer specific |
| 229 | 1 | 82 | VIFE L2 |
| 230 | 1 | xx | VIFE status |
| 231-236 | 6 | xxxxxxxxxxx | Apparent exported energy, L2 |
| 237 | 1 | 8E | DIF size, 12 digit BCD |
| 238 | 1 | C0 | DIFE, Unit bit 0 |
| 239 | 1 | 80 | DIFE, Unit bit 1 |
| 240 | 1 | 40 | DIFE, Unit bit 2, unit bit0-2-> unit 5 |
| 241 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 242 | 1 | FF | VIFE next byte is manufacturer specific |
| 243 | 1 | 83 | VIFE L3 |
| 244 | 1 | xx | VIFE status |
| 245-250 | 6 | xxxxxxxxxxx | Apparent exported energy, L3 |
| 251 | 1 | 1F | DIF, more records will follow in next telegram |
| 252 | 1 | xx | CS checksum, calculated from C field to last data |
| 253 | 1 | 16 | Stop character |

10.2.7 Example of the 7th telegram (all values are hexadecimal)

| Byte No. | Size | Value | Description |
|----------|------|-------------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | B6 | L-field, calculated from C field to last user data |
| 3 | 1 | B6 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 08 | C-field, RSP_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 72 | CI-field, variable data respond, LSB first |
| 8-11 | 4 | xxxxxxx | Identification Number, 8 BCD digits |
| 12-13 | 2 | 4204 | Manufacturer: ABB |
| 14 | 1 | 02 | Version |
| 15 | 1 | 02 | Medium, 02 = Electricity |
| 16 | 1 | xx | Number of accesses |
| 17 | 1 | xx | Status |
| 18-19 | 2 | 0000 | Signature (0000 = no encryption) |
| 20 | 1 | 8E | DIF size, 12 digit BCD |
| 21 | 1 | 80 | DIFE |
| 22 | 1 | C0 | DIFE, Unit 2 |
| 23 | 1 | 40 | DIFE, Unit 4 |
| 24 | 1 | 84 | VIF for unit kWh with resolution 0,01kWh |
| 25 | 1 | xx | VIFE status |
| 26-31 | 6 | xxxxxxxxxxx | Active net energy, Total |

| Byte No. | Size | Value | Description |
|----------|------|-------------|--|
| 32 | 1 | 8E | DIF size, 12 digit BCD |
| 33 | 1 | 80 | DIFE |
| 34 | 1 | C0 | DIFE, Unit 2 |
| 35 | 1 | 40 | DIFE, Unit 4 |
| 36 | 1 | 84 | VIF for unit kWh with resolution 0,01kWh |
| 37 | 1 | FF | VIFE next byte is manufacturer specific |
| 38 | 1 | 81 | VIFE L1 |
| 39 | 1 | xx | VIFE status |
| 40-45 | 6 | xxxxxxxxxxx | Active net energy, L1 |
| 46 | 1 | 8E | DIF size, 12 digit BCD |
| 47 | 1 | 80 | DIFE |
| 48 | 1 | C0 | DIFE, Unit 2 |
| 49 | 1 | 40 | DIFE, Unit 4 |
| 50 | 1 | 84 | VIF for unit kWh with resolution 0,01kWh |
| 51 | 1 | FF | VIFE next byte is manufacturer specific |
| 52 | 1 | 82 | VIFE L2 |
| 53 | 1 | xx | VIFE status |
| 54-59 | 6 | xxxxxxxxxxx | Active net energy, L2 |
| 60 | 1 | 8E | DIF size, 12 digit BCD |
| 61 | 1 | 80 | DIFE |
| 62 | 1 | C0 | DIFE, Unit 2 |
| 63 | 1 | 40 | DIFE, Unit 4 |
| 64 | 1 | 84 | VIF for unit kWh with resolution 0,01kWh |
| 65 | 1 | FF | VIFE next byte is manufacturer specific |
| 66 | 1 | 83 | VIFE L3 |
| 67 | 1 | xx | VIFE status |
| 68-73 | 6 | xxxxxxxxxxx | Active net energy, L3 |
| 74 | 1 | 8E | DIF size, 12 digit BCD |
| 75 | 1 | C0 | DIFE, Unit 1 |
| 76 | 1 | C0 | DIFE, Unit 2 |
| 77 | 1 | 40 | DIFE, Unit 4 |
| 78 | 1 | 84 | VIF for unit kvarh with resolution 0,01kvarh |
| 79 | 1 | xx | VIFE status |
| 80-85 | 6 | xxxxxxxxxxx | Reactive net energy, Total |
| 86 | 1 | 8E | DIF size, 12 digit BCD |
| 87 | 1 | C0 | DIFE, Unit 1 |
| 88 | 1 | C0 | DIFE, Unit 2 |
| 89 | 1 | 40 | DIFE, Unit 4 |
| 90 | 1 | 84 | VIF for unit kvarh with resolution 0,01kvarh |
| 91 | 1 | FF | VIFE next byte is manufacturer specific |
| 92 | 1 | 81 | VIFE L1 |

| Byte No. | Size | Value | Description |
|----------|------|-------------|--|
| 93 | 1 | xx | VIFE status |
| 94-99 | 6 | xxxxxxxxxxx | Reactive net energy, L1 |
| 100 | 1 | 8E | DIF size, 12 digit BCD |
| 101 | 1 | C0 | DIFE, Unit 1 |
| 102 | 1 | C0 | DIFE, Unit 2 |
| 103 | 1 | 40 | DIFE, Unit 4 |
| 104 | 1 | 84 | VIF for unit kvarh with resolution 0,01kvarh |
| 105 | 1 | FF | VIFE next byte is manufacturer specific |
| 106 | 1 | 82 | VIFE L2 |
| 107 | 1 | xx | VIFE status |
| 108-113 | 6 | xxxxxxxxxxx | Reactive net energy, L2 |
| 114 | 1 | 8E | DIF size, 12 digit BCD |
| 115 | 1 | C0 | DIFE, Unit 1 |
| 116 | 1 | C0 | DIFE, Unit 2 |
| 117 | 1 | 40 | DIFE, Unit 4 |
| 118 | 1 | 84 | VIF for unit kvarh with resolution 0,01kvarh |
| 119 | 1 | FF | VIFE next byte is manufacturer specific |
| 120 | 1 | 83 | VIFE L3 |
| 121 | 1 | xx | VIFE status |
| 122-127 | 6 | xxxxxxxxxxx | Reactive net energy, L3 |
| 128 | 1 | 8E | DIF size, 12 digit BCD |
| 129 | 1 | 80 | DIFE |
| 130 | 1 | 80 | DIFE |
| 131 | 1 | 80 | DIFE |
| 132 | 1 | 40 | DIFE, Unit 8 |
| 133 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 134 | 1 | xx | VIFE status |
| 135-140 | 6 | xxxxxxxxxxx | Apparent net energy, Total |
| 141 | 1 | 8E | DIF size, 12 digit BCD |
| 142 | 1 | 80 | DIFE |
| 143 | 1 | 80 | DIFE |
| 144 | 1 | 80 | DIFE |
| 145 | 1 | 40 | DIFE, Unit 8 |
| 146 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 147 | 1 | FF | VIFE next byte is manufacturer specific |
| 148 | 1 | 81 | VIFE L1 |
| 149 | 1 | xx | VIFE status |
| 150-155 | 6 | xxxxxxxxxxx | Apparent net energy, L1 |
| 156 | 1 | 8E | DIF size, 12 digit BCD |
| 157 | 1 | 80 | DIFE |
| 158 | 1 | 80 | DIFE |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 159 | 1 | 80 | DIFE |
| 160 | 1 | 40 | DIFE, Unit 8 |
| 161 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 162 | 1 | FF | VIFE next byte is manufacturer specific |
| 163 | 1 | 82 | VIFE L2 |
| 164 | 1 | xx | VIFE status |
| 165-170 | 6 | xxxxxxxxxxx | Apparent net energy, L2 |
| 171 | 1 | 8E | DIF size, 12 digit BCD |
| 172 | 1 | 80 | DIFE |
| 173 | 1 | 80 | DIFE |
| 174 | 1 | 80 | DIFE |
| 175 | 1 | 40 | DIFE, Unit 8 |
| 176 | 1 | 84 | VIF for unit kVAh with resolution 0,01kVAh |
| 177 | 1 | FF | VIFE next byte is manufacturer specific |
| 178 | 1 | 83 | VIFE L3 |
| 179 | 1 | xx | VIFE status |
| 180-185 | 6 | xxxxxxxxxxx | Apparent net energy, L3 |
| 186 | 1 | 1F | DIF, more records will follow in next telegram |
| 187 | 1 | xx | CS checksum, calculated from C field to last data |
| 188 | 1 | 16 | Stop character |

10.2.8 Example of the 8th telegram (all values are hexadecimal)

This example telegram contains the most recent snapshot of previous values.

| Byte No. | Size | Value | Description |
|----------|------|---------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | DE | L-field, calculated from C field to last user data |
| 3 | 1 | DE | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 08 | C-field, RSP_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 72 | CI-field, variable data respond, LSB first |
| 8-11 | 4 | xxxxxxx | Identification Number, 8 BCD digits |
| 12-13 | 2 | 4204 | Manufacturer: ABB |
| 14 | 1 | 02 | Version |
| 15 | 1 | 02 | Medium, 02 = Electricity |
| 16 | 1 | xx | Number of accesses |
| 17 | 1 | xx | Status |
| 18-19 | 2 | 0000 | Signature (0000 = no encryption) |
| 20 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 21 | 1 | 00 | DIFE, storage number bit 1-4 |
| 22 | 1 | ED | VIF for time/date point |

| Byte No. | Size | Value | Description |
|----------|------|--------------|---|
| 23 | 1 | E8 | VIFE indicating end of period |
| 24 | 1 | xx | VIFE status |
| 25-30 | 6 | xxxxxxxxxxxx | Time and date (sec,min,hour,day,month,year) |
| 31 | 1 | 4E | DIF size, 12 digit BCD, storage number bit 0 |
| 32 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 33 | 1 | xx | VIFE status |
| 34-39 | 6 | xxxxxxxxxxxx | Active imported energy, Total |
| 40 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 41 | 1 | 40 | DIFE, Unit 1 |
| 42 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 43 | 1 | xx | VIFE status |
| 44-49 | 6 | xxxxxxxxxxxx | Active exported energy, Total |
| 50 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 51 | 1 | 80 | DIFE, |
| 52 | 1 | 40 | DIFE, unit 2 |
| 53 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 54 | 1 | xx | VIFE status |
| 55-60 | 6 | xxxxxxxxxxxx | Reactive imported energy, Total |
| 61 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 62 | 1 | C0 | DIFE, unit 1 |
| 63 | 1 | 40 | DIFE, unit 2 |
| 64 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 65 | 1 | xx | VIFE status |
| 66-71 | 6 | xxxxxxxxxxxx | Reactive exported energy, Total |
| 72 | 1 | 4E | DIF size, 12 digit BCD, storage number bit 0 |
| 73 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 74 | 1 | FF | VIFE next byte is manufacturer specific |
| 75 | 1 | 81 | VIFE L1 |
| 76 | 1 | xx | VIFE status |
| 77-82 | 6 | xxxxxxxxxxxx | Active imported energy, L1 |
| 83 | 1 | 4E | DIF size, 12 digit BCD, storage number bit 0 |
| 84 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 85 | 1 | FF | VIFE next byte is manufacturer specific |
| 86 | 1 | 82 | VIFE L2 |
| 87 | 1 | xx | VIFE status |
| 88-93 | 6 | xxxxxxxxxxxx | Active imported energy, L2 |
| 94 | 1 | 4E | DIF size, 12 digit BCD, storage number bit 0 |
| 95 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 96 | 1 | FF | VIFE next byte is manufacturer specific |
| 97 | 1 | 83 | VIFE L3 |
| 98 | 1 | xx | VIFE status |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 99-104 | 6 | xxxxxxxxxxx | Active imported energy, L3 |
| 105 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 106 | 1 | 40 | DIFE, Unit 1 |
| 107 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 108 | 1 | FF | VIFE next byte is manufacturer specific |
| 109 | 1 | 81 | VIFE L1 |
| 110 | 1 | xx | VIFE status |
| 111-116 | 6 | xxxxxxxxxxx | Active exported energy, L1 |
| 117 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 118 | 1 | 40 | DIFE, Unit 1 |
| 119 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 120 | 1 | FF | VIFE next byte is manufacturer specific |
| 121 | 1 | 82 | VIFE L2 |
| 122 | 1 | xx | VIFE status |
| 123-128 | 6 | xxxxxxxxxxx | Active exported energy, L2 |
| 129 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 130 | 1 | 40 | DIFE, Unit 1 |
| 131 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 132 | 1 | FF | VIFE next byte is manufacturer specific |
| 133 | 1 | 83 | VIFE L3 |
| 134 | 1 | xx | VIFE status |
| 135-140 | 6 | xxxxxxxxxxx | Active exported energy, L3 |
| 141 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 142 | 1 | 10 | DIFE, tariff 1, storage number bit 1-4 |
| 143 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 144 | 1 | xx | VIFE status |
| 145-150 | 6 | xxxxxxxxxxx | Active imported energy, tariff 1 |
| 151 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 152 | 1 | 20 | DIFE, tariff 2, storage number bit 1-4 |
| 153 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 154 | 1 | xx | VIFE status |
| 155-160 | 6 | xxxxxxxxxxx | Active imported energy, tariff 2 |
| 161 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 162 | 1 | 30 | DIFE, tariff 3, storage number bit 1-4 |
| 163 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |
| 164 | 1 | xx | VIFE status |
| 165-170 | 6 | xxxxxxxxxxx | Active imported energy, tariff 3 |
| 171 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 172 | 1 | 80 | DIFE, tariff bits 0-1, storage number bit 1-4 |
| 173 | 1 | 10 | DIFE, tariff bits 2-3, tariff 4 |
| 174 | 1 | 84 | VIF for units kWh with resolution 0,01kWh |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 175 | 1 | xx | VIFE status |
| 176-181 | 6 | xxxxxxxxxxx | Active imported energy, tariff 4 |
| 182 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 183 | 1 | 90 | DIFE, tariff 1, storage number bit 1-4, unit bit 0 |
| 184 | 1 | 40 | DIFE, unit bit 1 |
| 185 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 186 | 1 | xx | VIFE status |
| 187-192 | 6 | xxxxxxxxxxx | Reactive imported energy, tariff 1 |
| 193 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 194 | 1 | A0 | DIFE, tariff 2, storage number bit 1-4, unit bit 0 |
| 195 | 1 | 40 | DIFE, unit bit 1 |
| 196 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 197 | 1 | xx | VIFE status |
| 198-203 | 6 | xxxxxxxxxxx | Reactive imported energy, tariff 2 |
| 204 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 205 | 1 | B0 | DIFE, tariff 3, storage number bit 1-4, unit bit 0 |
| 206 | 1 | 40 | DIFE, unit bit 1 |
| 207 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 208 | 1 | xx | VIFE status |
| 209-214 | 6 | xxxxxxxxxxx | Reactive imported energy, tariff 3 |
| 215 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 216 | 1 | 80 | DIFE, tariff bits 0-1, storage number bit 1-4, unit bit 0 |
| 217 | 1 | 50 | DIFE, tariff 4, unit bit 1 |
| 218 | 1 | 84 | VIF for units kvarh with resolution 0,01kvarh |
| 219 | 1 | xx | VIFE status |
| 220-225 | 6 | xxxxxxxxxxx | Reactive imported energy, tariff 4 |
| 226 | 1 | 1F | DIF, more records will follow in next telegram |
| 227 | 1 | xx | CS checksum, calculated from C field to last data |
| 228 | 1 | 16 | Stop character |

10.2.9 Example of the 9th telegram (all values are hexadecimal)

This example telegram contains the most recent snapshot of previous values, continued from telegram 8. Second most recent snapshot would be sent out in 10th and 11th telegram, and so on.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 4B | L-field, calculated from C field to last user data |
| 3 | 1 | 4B | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 08 | C-field, RSP_UD |
| 6 | 1 | xx | A-field, address |

| Byte No. | Size | Value | Description |
|----------|------|-------------|--|
| 7 | 1 | 72 | CI-field, variable data respond, LSB first |
| 8-11 | 4 | xxxxxxx | Identification Number, 8 BCD digits |
| 12-13 | 2 | 4204 | Manufacturer: ABB |
| 14 | 1 | 02 | Version |
| 15 | 1 | 02 | Medium, 02 = Electricity |
| 16 | 1 | xx | Number of accesses |
| 17 | 1 | xx | Status |
| 18-19 | 2 | 0000 | Signature (0000 = no encryption) |
| 20 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 21 | 1 | 00 | DIFE, storage number bit 1-4 |
| 22 | 1 | ED | VIF for time/date point |
| 23 | 1 | E8 | VIFE indicating end of period |
| 24 | 1 | xx | VIFE status |
| 25-30 | 6 | xxxxxxxxxxx | Time and date (sec,min,hour,day,month,year) |
| 31 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 32 | 1 | 40 | DIFE, storage number bit 1-4, unit bit 0 |
| 33 | 1 | FD | VIF FD -> next VIFE specifies type of value |
| 34 | 1 | 61 | Cumulation counter |
| 35 | 1 | xx | VIFE status |
| 36-41 | 6 | xxxxxxxxxxx | Number of pulses registered on input 1 |
| 42 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 43 | 1 | 80 | DIFE, storage number bit 1-4, unit bit 0 |
| 44 | 1 | 40 | DIFE, unit bit 1 |
| 45 | 1 | FD | VIF FD -> next VIFE specifies type of value |
| 46 | 1 | 61 | Cumulation counter |
| 47 | 1 | xx | VIFE status |
| 48-53 | 6 | xxxxxxxxxxx | Number of pulses registered on input 2 |
| 54 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 55 | 1 | C0 | DIFE, storage number bit 1-4, unit bit 0 |
| 56 | 1 | 40 | DIFE, unit bit 1 |
| 57 | 1 | FD | VIF FD -> next VIFE specifies type of value |
| 58 | 1 | 61 | Cumulation counter |
| 59 | 1 | xx | VIFE status |
| 60-65 | 6 | xxxxxxxxxxx | Number of pulses registered on input 3 |
| 66 | 1 | CE | DIF size, 12 digit BCD, storage number bit 0 |
| 67 | 1 | 80 | DIFE, storage number bit 1-4, unit bit 0 |
| 68 | 1 | 80 | DIFE, unit bit 1 |
| 69 | 1 | 40 | DIFE, unit bit 2 |
| 70 | 1 | FD | VIF FD -> next VIFE specifies type of value |
| 71 | 1 | 61 | Cumulation counter |
| 72 | 1 | xx | VIFE status |

| Byte No. | Size | Value | Description |
|----------|------|-------------|---|
| 73-78 | 6 | xxxxxxxxxxx | Number of pulses registered on input 4 |
| 79 | 1 | 0F | DIF indicating that this is the last telegram |
| 80 | 1 | xx | CS checksum, calculated from C field to last data |
| 81 | 1 | 16 | Stop character |

10.3 Special Readout of Meter Data

Introduction

Some data in the meter can only be read by first sending a SND_UD followed by a REQ_UD2.



Note – An NKE should always be sent before sending any of the commands described below. If the meter is in the middle of another special data readout process it will not respond correctly to the command.

After reading the first telegram, it is possible to continue reading by sending repeated REQ_UD2 commands

If the data item that has been read is normal and without any specific status associated with it, no status-VIFE or 0 will be sent out. If the status is “data error” or “no data available”, the standard M-Bus status coding will be sent out (18 hex or 15 hex).

Readable data

The data that can be read in this way is:

- Load profile
- Previous values
- Logs

Date, date/time format

In some cases data specifying date or date/time is contained in the read request command.

The format for date used in the commands is M-Bus data type G:

| | |
|--|-------------------|
| Day in bits 0-4 | Valid values 1-31 |
| Months in bits 8-11 | Valid values 1-12 |
| Year in bits 5-7 and 12-15 (bits 5-7 are the LSB bits) | Valid values 1-99 |

The format for date/time is 6 bytes BCD or M-Bus data type F. M-Bus data type F consists of

| | |
|---|-------------------|
| Minutes in bits 0-5 | Valid values 0-59 |
| Hours in bits 8-12 | Valid values 0-23 |
| Day in bits 16-20 | Valid values 1-31 |
| Months in bits 24-27 | Valid values 1-12 |
| Year in bits 21-23 and 28-31 (MSB bits) | Valid values 0-99 |

If a date or date/time is specified in the command, the meter sends out data for that period. If no data is stored in the meter for the specified period, the meter will send out data from the nearest date backward in time. Therefore it is recommended that the system should check the date sent in the telegram to verify that it is the requested date. If no data is stored in the meter for the specified date, or for

any date backward in time, all data in the telegram will have the status byte marked as “no data available” (15 hex).

10.3.1 Readout of Load Profile Data

Read request for a specified date

A read request for a specified date is performed by sending the following SND_UD to the meter followed by a REQ_UD2 (all values are hexadecimal).

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0A | L-field, calculated from C field to last user data |
| 3 | 1 | 0A | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 02 | DIF size, 2 byte integer |
| 9 | 1 | EC | VIF time point, date, M-Bus data type G |
| 10 | 1 | FF | VIF next byte is manufacturer specific |
| 11 | 1 | F9 | VIF extension of manufacturer specific VIFE's, next VIFE specifies actual meaning. |
| 12 | 1 | xx | VIFE specifies data requested: 10: Active import energy register values at end of interval 11: Active import energy consumption per interval 12: Reactive import energy register values at end of interval 13: Reactive import energy consumption per interval 14: Input 1 register values at end of interval 15: Input 1 number of counts per interval 16: Input 2 register values at end of interval 17: Input 2 number of counts per interval 1C: Active export energy register values at end of interval 1D: Active export energy consumption per interval 1E: Reactive export energy register values at end of interval 1F: Reactive export energy consumption per interval 20: Apparent import energy register values at end of interval 21: Apparent import energy consumption per interval 22: Apparent export energy register values at end of interval 23: Apparent export energy consumption per interval 24: Input 3 register values at end of interval 25: Input 3 number of counts per interval 26: Input 4 register values at end of interval 27: Input 4 number of counts per interval 28: Current average values per interval 29: Voltage average values per interval 2A: THD voltage average values per interval 2B: THD current average values per interval 2C: Power factor average values per interval |
| 13-14 | 2 | xxxx | Date (M-Bus data type G, LSB byte sent first) |

| Byte No. | Size | Value | Description |
|----------|------|-------|---|
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |

Read request for a specified date and time

A read request for a specified time is performed by sending the following SND_UD to the meter followed by a REQ_UD2 (all values are hexadecimal).

| Byte No. | Size | Value | Description |
|----------|------|------------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0E | L-field, calculated from C field to last user data |
| 3 | 1 | 0E | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 0E | DIF size, 12 digit BCD data |
| 9 | 1 | ED | VIF time point, date, M-Bus data type G |
| 10 | 1 | FF | VIF next byte is manufacturer specific |
| 11 | 1 | F9 | VIF extension of manufacturer specific VIFE's, next VIFE specifies actual meaning. |
| 12 | 1 | xx | VIFE specifies data requested: 10: Active import energy register values at end of interval 11: Active import energy consumption per interval 12: Reactive import energy register values at end of interval 13: Reactive import energy consumption per interval 14: Input 1 register values at end of interval 15: Input 1 number of counts per interval 16: Input 2 register values at end of interval 17: Input 2 number of counts per interval 1C: Active export energy register values at end of interval 1D: Active export energy consumption per interval 1E: Reactive export energy register values at end of interval 1F: Reactive export energy consumption per interval 20: Apparent import energy register values at end of interval 21: Apparent import energy consumption per interval 22: Apparent export energy register values at end of interval 23: Apparent export energy consumption per interval 24: Input 3 register values at end of interval 25: Input 3 number of counts per interval 26: Input 4 register values at end of interval 27: Input 4 number of counts per interval 28: Current average values per interval 29: Voltage average values per interval 2A: THD voltage average values per interval 2B: THD current average values per interval 2C: Power factor average values per interval |
| 13-18 | 6 | xxxxxxxxxx | Time/date (sec:min:hour / day-month-year) |
| 19 | 1 | xx | CS checksum, calculated from C field to last data |

| Byte No. | Size | Value | Description |
|----------|------|-------|----------------|
| 20 | 1 | 16 | Stop character |

Read request for load profile, quantities with phase no. specified

A read request for a load profile, quantities with phase no. specified is performed by sending the following SND_UD to the meter followed by a REQ_UD2 (all values are hexadecimal).

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 10 | L-field, calculated from C field to last user data |
| 3 | 1 | 10 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 0E | DIF size, 12 digit BCD data |
| 9 | 1 | ED | VIF time point, date and time |
| 10 | 1 | FF | VIF next byte is manufacturer specific |
| 11 | 1 | F9 | VIF extension of manufacturer specific VIFE's, next VIFE specifies actual meaning. |
| 12 | 1 | xx | VIFE specifies data requested: 10: Active import energy register values at end of interval 11: Active import energy consumption per interval 12: Reactive import energy register values at end of interval 13: Reactive import energy consumption per interval 14: Input 1 register values at end of interval 15: Input 1 number of counts per interval 16: Input 2 register values at end of interval 17: Input 2 number of counts per interval 1C: Active export energy register values at end of interval 1D: Active export energy consumption per interval 1E: Reactive export energy register values at end of interval 1F: Reactive export energy consumption per interval 20: Apparent import energy register values at end of interval 21: Apparent import energy consumption per interval 22: Apparent export energy register values at end of interval 23: Apparent export energy consumption per interval 24: Input 3 register values at end of interval 25: Input 3 number of counts per interval 26: Input 4 register values at end of interval 27: Input 4 number of counts per interval 28: Current average values per interval 29: Voltage average values per interval 2A: THD voltage average values per interval 2B: THD current average values per interval 2C: Power factor average values per interval |
| 13 | 1 | FF | Next byte is manufacturer specific |

| Byte No. | Size | Value | Description |
|----------|------|-------------|--|
| 14 | 1 | xx | Entity corresponding to phase nos. L1,L2,L3,L1-L2,L2-L3,L1-L3, N |
| 15-20 | 6 | xxxxxxxxxxx | Time/date (sec:min:hour / day-month-year) |
| 21 | 1 | xx | CS checksum, calculated from C field to last data |
| 22 | 1 | 16 | Stop character |

Read request for load profile with channel no. specified as input

A read request for a load profile with channel no. specified as input is performed by sending the following SND_UD to the meter followed by a REQ_UD2 (all values are hexadecimal).

| Byte No. | Size | Value | Description |
|----------|------|-------------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 11 | L-field, calculated from C field to last user data |
| 3 | 1 | 11 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 0E | DIF size, 12 digit BCD data |
| 9 | 1 | ED | VIF time point, date and time |
| 10 | 1 | FF | VIF next byte is manufacturer specific |
| 11 | 1 | F9 | VIF extension of manufacturer specific VIFE's, next VIFE specifies actual meaning. |
| 12 | 1 | B8 | Read load profile data based upon the channel no. specified. Register value will be read |
| 13 | 1 | FF | Next byte is manufacturer specific |
| 14 | 1 | F8 | Next byte is manufacturer specific, used for numbering |
| 15 | 1 | xx | Specifies channel no. where channel nos=>0...7 |
| 16-21 | 6 | xxxxxxxxxxx | Time/date (sec:min:hour / day-month-year) |
| 22 | 1 | xx | CS checksum, calculated from C field to last data |
| 23 | 1 | 16 | Stop character |

Comments

The data is sent out with 12 load profile values in each telegram. This means that 2 telegrams must be read for 1 day of load profile values when the interval length

is 60 minutes. If the interval length is 30 minutes 4 telegrams must be read and if the interval length is 15 minutes 8 telegrams must be read.

Beside the interval data the date/time information for the day record and the interval length is sent out.

Reading load profile energy values can be done either as register values, or as consumption per interval values. This is controlled by the VIFE used in the read-out request.

When the load profile data is read out as consumption per interval the register value at the start of the 1:st interval is also sent out. The date/time information is sent out in format M-Bus data type F.

When the load profile data is read out as consumption per interval the date/time information specifies the start of the 1:st interval and the date/time-stamp for the register value in the frame sent out. When the load profile data is read out as register values the date/time information specifies the end of the 1:st interval the frame sent out.

The register values have same data and value information bytes (DIF, DIFE's, VIF, VIFE's) as the momentary register values, but with storage number 1 to indicate that it is stored historical data.

If the load profile search type is set to raw format, it is only possible to read register values or average values, i.e., not consumption values per interval. In this case the values stored in the meter are sent out in the order they were stored, starting with the most recent. This means that there may exist duplicate time-stamps as well as jumps in time in any direction.

Status information

The manufacturer specific coding of the status information is used to indicate the following:

- Date/time was changed during the interval
- Data overflow in interval
- Intervals are too long or too short
- Power outage occurred during the interval

If one or several of these status events occur during an interval, the extra VIFE's FF FE 0x are sent out, where x is a bit 4-0 and have the following meaning if set:

| | |
|-------|---|
| Bit 4 | Date/time was changed during the interval |
| Bit 3 | Data overflow in interval |
| Bit 2 | Power outage occurred during interval |
| Bit 1 | Short interval |
| Bit 0 | Long interval |

10.3.1.1 Examples of Readouts of Load Profile Data

Introduction

In the following are a number of practical examples of load profile readouts. All data is hexadecimal and comments are preceded by a semicolon.

Readout of day 1 of active energy load profile register values

Reading active energy import total

10 40 fe 3e 16

Reading acknowledge

e5

Sending Direct access with Date command

68 0a 0a 68 73 fe 51 02 ec ff f9 10 69 11 32 16; Readout load profile with date specified, Date 09-01-2011 (9th January 2011)

Reading acknowledge

e5

Sending Request User Data 2:

10 7b fe 79 16

Data block 1:

68 89 89 68 08 00 72

00 00 00 00 42 04 10 02 18 2a 00 00 ;Header Information

44 ed eb 00 24 00 69 11; Date and time at the end of the interval (09-01-2011), 9th-January-2011.

01 fd a5 00 01 ;Interval length = 1 minute

4e 84 15 00 00 00 00 00 00 ;Total active import energy, value 15 hex indicating data not available

4e 84 15 00 00 00 00 00 00

4e 84 15 00 00 00 00 00 00

4e 84 15 00 00 00 00 00 00

4e 84 15 00 00 00 00 00 00

4e 84 15 00 00 00 00 00 00

4e 84 15 00 00 00 00 00 00

4e 84 15 00 00 00 00 00 00

4e 84 15 00 00 00 00 00 00

4e 84 00 39 58 17 00 00 00 ;Total Active import energy 1758.39 kwh

4e 84 00 39 58 17 00 00 00 ;Total Active Import Energy 1758,39 kwh

4e 84 00 39 58 17 00 00 00 ;Total Active Import Energy 1758.39 kwh

1f 1e 16

Sending Request User Data 2

10 5b fe 59 16

Data block 2:

68 80 80 68 08 00 72 00 00 00 00 42 04 10 02 19

2a 00 00

44 ed eb 00 30 00 69 11 Date and Time MBus data type F format 9th January 2011

01 fd a5 00 01 ;Interval length 1 minute.

4e 84 00 39 58 17 00 00 00 ;Total Active Import Energy 1739.58 kwh

4e 84 00 39 58 17 00 00 00 ;Total Active Import Energy 1739.58 kwh

4e 84 00 39 58 17 00 00 00 ;Total Active Import Energy 1739.58 kwh

4e 84 00 39 58 17 00 00 00

4e 84 00 39 58 17 00 00 00

4e 84 00 39 58 17 00 00 00

4e 84 00 39 58 17 00 00 00

4e 84 00 39 58 17 00 00 00

4e 84 15 00 00 00 00 00 00

4e 84 15 00 00 00 00 00 00

4e 84 15 00 00 00 00 00 00

1f 23 16

1f at the end of the 2nd telegram indicates there are more frames to follow.

10.3.2 Readout of Previous Values

Read request

A read request is performed by sending the following SND_UD to the meter (all values are hexadecimal) followed by a REQ_UD2

| Byte No. | Size | Value | Description |
|----------|------|-------|---|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0A | L-field, calculated from C field to last user data |
| 3 | 1 | 0A | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 02 | DIF size, 2 byte integer |
| 9 | 1 | EC | VIF time point, date, M-Bus data type G |
| 10 | 1 | FF | VIF next byte is manufacturer specific |
| 11 | 1 | F9 | VIF extension of manufacturer specific VIFEs, next VIFE specifies actual meaning. |

| Byte No. | Size | Value | Description |
|----------|------|-------|---|
| 12 | 1 | 19 | VIFE specifies Previous values |
| 13-14 | 2 | xxxx | Date (M-Bus data type G, LSB byte sent first) |
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |

Comments

Previous values data for all channels that is stored at the end of a period is sent out in one or more telegrams depending on the number of channels that are used. The most recent values are sent out first having storage number 1, then the second most recently stored values with storage number 2 and so on until all stored previous values have been read. Beside the previous register values a date/time stamp for the end of the period is sent out in the telegram. The date/time information is sent out in format 6 byte BCD in order second, minute, hour, day, month and year.



Note – Previous values are also sent out in a normal readout sequence. This sequence takes it start after the default telegrams that contain current values of energy registers, instrumentation values, etc...

10.3.2.1 Examples of Readouts of Previous Values

Readout of previous values data

Sending initialize command

10 40 fe 3e 16

Reading acknowledge

e5

Sending Direct access with Date command

68 0a 0a 68 73 fe 51 02 ec ff f9 19 68 11 3a 16 ; Date 8th January, year 11

Reading acknowledge

e5

Sending Request User Data 2:

10 7b fe 79 16

Meter sends out data telegram:

Data block 1:

68 e3 e3 68 08 00 72 00 00 00 00 42 04 10 02 01 2a 00 00; Data header

ce 00 ed eb 00 00 00 00 08 01 11; Date/Time stamp for previous values, here 08-01-11 / 00:00:00 (day-month-year / sec:min:hour)

ce 00 84 00 39 58 17 00 00 00; Daily value for total import active energy, here 1758.39 kwh

ce 40 84 00 35 18 27 01 00 00; Daily value for total export active energy, here 12718.35 kwh

ce 80 40 84 00 23 75 02 00 00 00; Daily value for total import reactive energy, here 275.23 kvarh

ce c0 40 84 00 35 02 00 00 00 00; Daily value for total export reactive energy, here 2.35 kvarh

ce 00 84 ff 81 00 27 83 75 07 00 00; Daily value for active energy import L1, here 77583.27 kwh

ce 00 84 ff 82 00 23 75 02 00 00 00; Daily value for active energy import L2, here 275.23 kwh

ce 00 84 ff 83 00 35 02 00 00 00 00; Daily value for active energy import L3, here 2.35 kwh

ce 40 84 ff 81 00 39 58 17 00 00 00; Daily value for active energy export L1, here 1758.39 kwh

ce 40 84 ff 82 00 35 18 27 01 00 00; Daily value for active energy export L2, here 12718.35 kwh

ce 40 84 ff 83 00 27 83 75 07 00 00; Daily value for active energy export L3, here

77583.27 kwh

ce 10 84 00 00 00 00 00 00 00; Daily value for tariff 1 active energy, here 0.0 kwh

ce 20 84 00 00 00 00 00 00 00; Daily value for tariff 2 active energy, here 0.0 kwh

ce b0 00 84 00 00 00 00 00 00 00; Daily value for tariff 3 active energy, here 0.0 kwh

ce 80 10 84 00 00 00 00 00 00 00; Daily value for tariff 4 active energy, here 0.0 kwh

ce 90 40 84 00 00 00 00 00 00 00; Daily value for tariff 1 reactive energy, here 0.0 kvarh

ce a0 40 84 00 00 00 00 00 00 00; Daily value for tariff 2 reactive energy, here 0.0 kvarh

ce b0 40 84 00 00 00 00 00 00 00; Daily value for tariff 3 reactive energy, here 0.0 kvarh

ce 80 50 84 00 00 00 00 00 00 00; Daily value for tariff 4 reactive energy, here 0.0 kvarh

1f; Dif 1F-> more daily values exist

6e 16; Checksum and stop byte

Sending Request User Data 2:

10 5b fe 59 16

Data block 2:

68 4b 4b 68 08 00 72 00 00 00 00 42 04 10 02 02 2a 00 00; Data header

ce 00 ed eb 00 00 00 00 08 01 11; Date/Time stamp for previous values, here 08-01-11 / 00:00:00 (day-month-year / sec:min:hour)

ce 40 fd e1 00 00 00 00 00 00 00; Daily value for input 1 counter, here 0 pulses

ce 80 40 fd e1 00 00 00 00 00 00 00; Daily value for input 1 counter, here 0 pulses

ce c0 40 fd e1 00 00 00 00 00 00 00; Daily value for input 1 counter, here 0 pulses

ce 80 80 40 fd e1 00 00 00 00 00 00 00; Daily value for input 1 counter, here 0 pulses

0f; Dif 0F-> no more daily values exist

cd 16 ; Checksum and stop byte

Readout of previous values data

System sends read request command for previous values with date 1:st of July 06:

68 0A 0A 68 73 FE 51 02 EC FF F9 19 C1 07 89 16

Meter sends out acknowledge:

E5

System sends out request UD2:

10 7B FE 79 16

Meter sends out data telegram:

68 9C 9C 68 08 00 72 44 47 24 00 42 04 02 02 09 00 00 00 ;Data header

The date/time stamp and the monthly values have storage number 1, that is, it is the 1:st (most recent in time) set of monthly values

CE 00 ED 6B 00 00 00 01 07 06 ;Date/time stamp for previous values, here 01-07-06 / 00:00:00 (day-month-year / sec:min:hour)

CE 00 04 35 08 00 00 00 00 ;Monthly value for total active energy, 8.35 kWh

CE 10 04 62 02 00 00 00 00 ;Monthly value for tariff 1 active energy, 2.62 kWh

CE 20 04 27 02 00 00 00 00 ;Monthly value for tariff 2 active energy, 2.27 kWh

CE 30 04 79 00 00 00 00 00 ;Monthly value for tariff 3 active energy, 0.79 kWh

CE 80 10 04 65 02 00 00 00 ;Monthly value for tariff 4 active energy, 2.65 kWh

CE 80 40 04 04 02 00 00 00 ;Monthly value for total reactive energy, 2.04 kvarh

CE 90 40 04 64 00 00 00 00 ;Monthly value for tariff 1 reactive energy, 0.64 kWh

CE B0 40 04 19 00 00 00 00 ;Monthly value for tariff 3 reactive energy, 0.19 kWh

CE 80 50 04 65 00 00 00 00 ;Monthly value for tariff 4 reactive energy, 0.65 kWh

CE 40 FD 61 00 00 00 00 00 ;Monthly value for input 1 counter, 0 pulses

CE 80 40 FD 61 00 00 00 00 00 ;Monthly value for input 2 counter, 0 pulses

1F ;Dif 1F -> more monthly values exist

00 00 00 00 00 00 00 00 ;Pad bytes

62 16 ;Checksum and stop byte

System sends out request UD2:

10 5B FE 59 16

Meter sends out data telegram:

```

68 9C 9C 68 08 00 72 44 47 24 00 42 04 02 02 0A 00 00 00
8E 01 ED 6B 00 00 00 01 06 06 ;Date/time stamp for previous values, 01-06-
06 / 00:00:00 (day-month-year / sec:min:hour)

8E 01 04 17 05 00 00 00 00 8E 11 04 55 01 00 00 00 00 8E 21 04 27
02 00 00 00 00 8E 31 04 31 00 00 00 00 00 8E 81 10 04 04 01 00 00
00 00 8E 81 40 04 26 01 00 00 00 00 8E 91 40 04 38 00 00 00 00 00
8E A1 40 04 55 00 00 00 00 8E B1 40 04 07 00 00 00 00 00 8E 81
50 04 25 00 00 00 00 00 8E 41 FD 61 00 00 00 00 00 00 8E 81 40 FD
61 00 00 00 00 00 00 0F 00 00 00 00 00 00 00 00 00 00 00 00 E9 16

```

10.3.3 Readout of Event Log Data

Read request

Each one of the existing logs can be read by sending the following SND_UD to the meter followed by a REQ_UD2 (all values are hexadecimal).

| Byte No. | Size | Value | Description |
|----------|------|------------|---|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 12 | L-field, calculated from C field to last user data |
| 3 | 1 | 12 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 8E or EC | DIF size, 6 byte BCD, storage number bit 0 is 0 or 1 |
| 9 | 1 | 8x or Cx | DIFE storage number bits 1-4, unit bit 6 is 0 or 1 |
| 10 | 1 | 8x | DIFE storage number bits 5-8 |
| 11 | 1 | 8x | DIFE storage number bits 9-12 |
| 12 | 1 | 0x | DIFE storage number bits 13-16 |
| 13 | 2 | ED | VIF time/date |
| 14 | 1 | FF | VIF next byte is manufacturer specific |
| 15 | 1 | F9 | VIF extension of manufacturer specific VIFE's, next VIFE specifies actual meaning. |
| 16 | 1 | 1A | VIFE Specification for different Logs: System Log = 0x2e Audit Log = 0x2f Net Quality Log = 0x30 Event Log = 0x32 |
| 17-22 | 6 | xxxxxxxxxx | Time/date (sec:min:hour / day-month-year) |
| 23 | 1 | xx | CS checksum, calculated from C field to last data |
| 24 | 1 | 16 | Stop character |

Event Offset

The meter supports offset values 0 and -1 for reading the System, Event, Audit, Net Quality logs. If the offset mentioned is 0 then meter will read the log in the

forward direction. If the offset value mentioned is -1 then it will read the data in the backward direction from the given date.

Data

The data will be sent out with 5 events in each telegram. If less than 5 events is stored in the meter for the specified date/time and offset all data in the telegram after the last stored event will have status byte marked as "no data available" (15 hex).

The data sent out for each event is:

- Event type (1 byte binary coded).
 - Date/time stamp for start of the event (6 byte bcd in order sec:min:hour/day:month:year)
 - Duration of the event (in seconds)
-

10.3.3.1 Example of readout of log data

Readout of Net Quality Log with date and time specified as input

Send Nke.

10 40 fe 3e 16

Meter Responds with E5

E5

Read request net quality log with Offset -1.

68 12 12 68 73 fe 51 ce c0 80 80 00 ed ff f9 30 01 02 03 22 12 11 b0 16;Read net quality log with offset value -1. Date and Time specified as input, 22-12-2011 01:02:03

Meter Responds with E5.

E5.

Send Req UD2.

10 7B FE 79 16.

Meter responds with long frame data for net quality Log:

68 88 88 68 08 00 72 00 00 00 00 42 04 20 02 16 2a 00 00 ; Header Information

02 ff f9 b5 00 e1 07;Event Type net quality Log

0e ed b9 00 21 47 23 06 01 10 ;Date and Time 10.01.06 23:47:21

04 a0 00 dd 03 00 00 ;Duration

02 ff f9 b5 00 de 07 ;Event Type net quality Log

0e ed b9 00 21 47 23 06 01 10 ;Date and Time 10.02.06 23:47:21

04 a0 00 dd 03 00 00 ;Duration

02 ff f9 b5 00 f0 03 ;Event Type net quality Log

0e ed b9 00 11 47 23 06 01 10 ;Date and time 10.02.06 23:47:11

04 a0 00 e7 03 00 00 ;Duration

02 ff f9 b5 00 e8 03

0e ed b9 00 11 47 23 06 01 10

04 a0 00 e7 03 00 00

02 ff f9 b5 00 e2 07

0e ed b9 00 11 47 23 06 01 10

04 a0 e7 03 00 00

1f 70 16;1F indicates there are more frames to follow.

Readout of 4 telegrams of event log data with offset -1

System sends event log read request command (date/time 14/3-06 09:51:40), offset -1

68 12 12 68 73 FE 51 CE C0 80 80 00 ED FF F9 1A 40 51 09 14 03 06 06 16

Meter sends out acknowledge:

E5

System sends out request UD2:

10 7B FE 79 16

Meter sends out data telegram:

68 7E 7E 68 08 00 72 42 10 00 00 42 04 02 02 05 00 00 00 ;Data header

01 FF 6F 01 ;Total power outage

0E ED 39 24 19 09 14 03 06 ;Time/date 39:24:09 / 14-03-06 (sec:min:hour / day-month-year)

04 20 FE 00 00 00 ;Duration 254 seconds

01 FF 6F 01 ;Total power outage

0E ED 39 12 45 15 13 03 06 ;Time/date 12:45:15 / 13-03-06 (sec:min:hour / day-month-year)

04 20 5B 00 00 00 ; Duration 91 seconds

01 FF 6F 0F ;Abnormal negative power

0E ED 39 28 44 15 13 03 06 04 20 23 00 00 00

01 FF 6F 01 ;Total power outage

0E ED 39 44 38 15 13 03 06 04 20 52 01 00 00

01 FF 6F 0D ;Undervoltage on phase 3, level 2

0E ED 39 36 25 15 13 03 06 04 20 3E 00 00 00

1F ;Dif 1F -> More events exist

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ;Pad bytes

0A 16 ;Checksum and stopbyte

10.4 Sending Data to the Meter

General

This section describes the telegrams that can be sent to an EQ meter. Some of the telegrams contain data, others do not. Data sent in the telegram is sometimes stored in the meter, sometimes used by the meter to perform a certain action. Telegrams that contains no data usually initiates a certain action in the meter.

Write access level protection

Some of the commands can be protected by a password. There are 3 different levels of write access level protection:

- Open
- Open by password
- Closed

The write access level can be set either via the buttons directly on the meter or via communication using the *set write access level* command.

If the access level is set to *Open*, the meter will always accept the command as long as the the meter is properly addressed and the syntax and checksum are correct.

If the access level is set to *Open by password* the specific command sent to the meter must be preceded by a *send password* command in order for the meter to accept the command.

If the access level is set to *Closed* the meter will not accept any command, but will just return an acknowledge character (E5 hex). To change this access level protection, the access level has to be set to *Open* via the buttons directly on the meter.



Note – Commands that are not affected by the write access level protection only require a correct message with correct address, syntax and checksum to be accepted.

10.4.1 Set tariff

For meters with tariff control the active tariff is set by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 07 | L-field, calculated from C field to last user data |
| 3 | 1 | 07 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 01 | DIF size, 8 bit integer |

| Byte No. | Size | Value | Description |
|----------|------|-------|---|
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | 13 | VIFE tariff |
| 11 | 1 | xx | New tariff |
| 12 | 1 | xx | CS checksum, calculated from C field to last data |
| 13 | 1 | 16 | Stop character |

10.4.2 Set primary address

The primary address is set by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 06 | L-field, calculated from C field to last user data |
| 3 | 1 | 06 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 01 | DIF size, 8 bit integer |
| 9 | 1 | 7A | VIFE Bus Address |
| 10 | 1 | xx | New primary address |
| 11 | 1 | xx | CS checksum, calculated from C field to last data |
| 12 | 1 | 16 | Stop character |

10.4.3 Change baudrate

The baudrate of the electrical M-Bus interface is set by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 03 | L-field, calculated from C field to last user data |
| 3 | 1 | 03 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | Bx | CI-field, New baudrate (where x=>8..F) |
| 8 | 1 | xx | CS checksum, calculated from C field to last data |
| 9 | 1 | 16 | Stop character |

10.4.4 Reset power fail counter

The power fail counter is reset to 0 by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 07 | L-field, calculated from C field to last user data |
| 3 | 1 | 07 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 00 | DIF size, no data |
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | 98 | VIFE no. of power fails |
| 11 | 1 | 07 | VIFE clear |
| 12 | 1 | xx | CS checksum, calculated from C field to last data |
| 13 | 1 | 16 | Stop character |

10.4.5 Set Current transformer (CT) ratio - numerator

The current transformer ratio (CT) numerator is set by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|---------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0a | L-field, calculated from C field to last user data |
| 3 | 1 | 0a | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 04 | DIF size, 32 bit integer |
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | 20 | VIFE CT ratio numerator |
| 11-14 | 4 | xxxxxxx | New CT ratio numerator |
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |

10.4.6 Set current transformer (CT) ratio - denominator

The current transformer ratio (CT) denominator is set by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|----------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0a | L-field, calculated from C field to last user data |
| 3 | 1 | 0a | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 04 | DIF size, 32 bit integer |
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | 22 | VIFE CT ratio denominator |
| 11-14 | 4 | xxxxxxxx | New CT ratio denominator |
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |

10.4.7 Select status information

To change the way the status information is sent out the following command is sent (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 07 | L-field, calculated from C field to last user data |
| 3 | 1 | 07 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 01 | DIF size, 8 bit integer |
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | 15 | VIFE status of values (status byte on the values) |
| 11 | 1 | xx | 0=never, 1=status if not OK=always |
| 12 | 1 | xx | CS checksum, calculated from C field to last data |
| 13 | 1 | 16 | Stop character |

10.4.8 Reset of stored state for input 1

Reset of stored state for input 1 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 08 | L-field, calculated from C field to last user data |
| 3 | 1 | 08 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | C0 | DIF size, no data, storage number 1 |
| 9 | 1 | 40 | DIFE unit=1 |
| 10 | 1 | FD | VIF extension of VIF codes |
| 11 | 1 | 9B | VIFE digital input |
| 12 | 1 | 07 | VIFE clear |
| 13 | 1 | xx | CS checksum, calculated from C field to last data |
| 14 | 1 | 16 | Stop character |

10.4.9 Reset of stored state for input 2

Reset of stored state for input 2 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 09 | L-field, calculated from C field to last user data |
| 3 | 1 | 09 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | C0 | DIF size, no data, storage number 1 |
| 9 | 1 | 80 | DIFE unit=0 |
| 10 | 1 | 40 | DIFE unit=2 |
| 11 | 1 | FD | VIF extension of VIF codes |
| 12 | 1 | 9B | VIFE digital input |
| 13 | 1 | 07 | VIFE clear |
| 14 | 1 | xx | CS checksum, calculated from C field to last data |
| 15 | 1 | 16 | Stop character |

10.4.10 Reset of stored state for input 3

Reset of stored state for input 3 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 09 | L-field, calculated from C field to last user data |
| 3 | 1 | 09 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | C0 | DIF size, no data, storage number 1 |
| 9 | 1 | C0 | DIFE unit=1 |
| 10 | 1 | 40 | DIFE unit=2 |
| 11 | 1 | FD | VIF extension of VIF codes |
| 12 | 1 | 9B | VIFE digital input |
| 13 | 1 | 07 | VIFE clear |
| 14 | 1 | xx | CS checksum, calculated from C field to last data |
| 15 | 1 | 16 | Stop character |

10.4.11 Reset of stored state for input 4

Reset of stored state for input 4 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0A | L-field, calculated from C field to last user data |
| 3 | 1 | 0A | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | C0 | DIF size, no data, storage number 1 |
| 9 | 1 | 80 | DIFE unit=0 |
| 10 | 1 | 80 | DIFE unit=0 |
| 11 | 1 | 40 | DIFE unit=4 |
| 12 | 1 | FD | VIF extension of VIF codes |
| 13 | 1 | 9B | VIFE digital input |
| 14 | 1 | 07 | VIFE clear |
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |

10.4.12 Reset of input counter 1

Reset of input counter 1 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 08 | L-field, calculated from C field to last user data |
| 3 | 1 | 08 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | C0 | DIF size, no data |
| 9 | 1 | 40 | DIFE unit=1 |
| 10 | 1 | FD | VIF extension of VIF codes |
| 11 | 1 | 9B | VIFE cumulating counters |
| 12 | 1 | 07 | VIFE clear |
| 13 | 1 | xx | CS checksum, calculated from C field to last data |
| 14 | 1 | 16 | Stop character |

10.4.13 Reset of input counter 2

Reset of input counter 2 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 09 | L-field, calculated from C field to last user data |
| 3 | 1 | 09 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 80 | DIF size, no data |
| 9 | 1 | 80 | DIFE unit=0 |
| 10 | 1 | 40 | DIFE unit=2 |
| 11 | 1 | FD | VIF extension of VIF codes |
| 12 | 1 | E1 | VIFE cumulating counters |
| 13 | 1 | 07 | VIFE clear |
| 14 | 1 | xx | CS checksum, calculated from C field to last data |
| 15 | 1 | 16 | Stop character |

10.4.14 Reset of input counter 3

Reset of input counter 3 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 09 | L-field, calculated from C field to last user data |
| 3 | 1 | 09 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 80 | DIF size, no data |
| 9 | 1 | C0 | DIFE unit=1 |
| 10 | 1 | 40 | DIFE unit=2 |
| 11 | 1 | FD | VIF extension of VIF codes |
| 12 | 1 | E1 | VIFE cumulating counters |
| 13 | 1 | 07 | VIFE clear |
| 14 | 1 | xx | CS checksum, calculated from C field to last data |
| 15 | 1 | 16 | Stop character |

10.4.15 Reset of input counter 4

Reset of input counter 4 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0A | L-field, calculated from C field to last user data |
| 3 | 1 | 0A | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 80 | DIF size, no data |
| 9 | 1 | 80 | DIFE unit=0 |
| 10 | 1 | 80 | DIFE unit=0 |
| 11 | 1 | 40 | DIFE unit=4 |
| 12 | 1 | FD | VIF extension of VIF codes |
| 13 | 1 | E1 | VIFE cumulating counters |
| 14 | 1 | 07 | VIFE clear |
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |

10.4.16 Set output 1

Setting the state of output 1 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 08 | L-field, calculated from C field to last user data |
| 3 | 1 | 08 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 81 | DIF size, 8 bit integer |
| 9 | 1 | 40 | DIFE unit=1 |
| 10 | 1 | FD | VIF extension of VIF codes |
| 11 | 1 | 1A | VIFE digital output |
| 12 | 1 | xx | output 1, new state |
| 13 | 1 | xx | CS checksum, calculated from C field to last data |
| 14 | 1 | 16 | Stop character |

10.4.17 Set output 2

Setting the state of output 2 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 09 | L-field, calculated from C field to last user data |
| 3 | 1 | 09 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 81 | DIF size, 8 bit integer |
| 9 | 1 | 80 | DIFE unit=0 |
| 10 | 1 | 40 | DIFE unit=2 |
| 11 | 1 | FD | VIF extension of VIF codes |
| 12 | 1 | 1A | VIFE digital output |
| 13 | 1 | xx | output 2, new state |
| 14 | 1 | xx | CS checksum, calculated from C field to last data |
| 15 | 1 | 16 | Stop character |

10.4.18 Set output 3

Setting the state of output 3 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 09 | L-field, calculated from C field to last user data |
| 3 | 1 | 09 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 81 | DIF size, 8 bit integer |
| 9 | 1 | C0 | DIFE unit=1 |
| 10 | 1 | 40 | DIFE unit=2 |
| 11 | 1 | FD | VIF extension of VIF codes |
| 12 | 1 | 1A | VIFE digital output |
| 13 | 1 | xx | output 3, new state |
| 14 | 1 | xx | CS checksum, calculated from C field to last data |
| 15 | 1 | 16 | Stop character |

10.4.19 Set output 4

Setting the state of output 4 is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0A | L-field, calculated from C field to last user data |
| 3 | 1 | 0A | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 81 | DIF size, 8 bit integer |
| 9 | 1 | 80 | DIFE unit=0 |
| 10 | 1 | 80 | DIFE unit=0 |
| 11 | 1 | 40 | DIFE unit=4 |
| 12 | 1 | FD | VIF extension of VIF codes |
| 13 | 1 | 1A | VIFE digital output |
| 14 | 1 | xx | output 4, new state |
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |

10.4.20 Reset power outage time

Reset of power outage time is performed by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 07 | L-field, calculated from C field to last user data |
| 3 | 1 | 07 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 00 | DIF size, no data |
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | EC | VIFE power outage time |
| 11 | 1 | 07 | VIFE clear |
| 12 | 1 | xx | CS checksum, calculated from C field to last data |
| 13 | 1 | 16 | Stop character |

10.4.21 Send password

Password is sent with the following command (all values are hexadecimal).

| Byte No. | Size | Value | Description |
|----------|------|------------------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0E | L-field, calculated from C field to last user data |
| 3 | 1 | 0E | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | Xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 07 | DIF size, 8 byte integer |
| 9 | 1 | FD | VIF extension of VIF codes |
| 10 | 1 | 16 | VIFE password |
| 11-18 | 8 | xxxxxxxxxxxxxxxx | Password |
| 19 | 1 | xx | CS checksum, calculated from C field to last data |
| 20 | 1 | 16 | Stop character |

10.4.22 Set password

Password is set by sending the following command (all values are hexadecimal).



Note – If the meter is password protected the old password must be sent before a new can be set.

| Byte No. | Size | Value | Description |
|----------|------|----------------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0F | L-field, calculated from C field to last user data |
| 3 | 1 | 0F | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 07 | DIF size, 8 byte integer |
| 9 | 1 | FD | VIF extension of VIF codes |
| 10 | 1 | 96 | VIFE password |
| 11 | 1 | 00 | VIFE write (replace) |
| 12-19 | 8 | xxxxxxxxxxxxxx | Password |
| 20 | 1 | xx | CS checksum, calculated from C field to last data |
| 21 | 1 | 16 | Stop character |

10.4.23 Set date and time

Date and time is set by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.



Note – Before sending the command an NKE should be sent. If the meter is in the middle of a special data readout process it will not respond to the set date and time command.

| Byte No. | Size | Value | Description |
|----------|------|------------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0B | L-field, calculated from C field to last user data |
| 3 | 1 | 0B | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 0E | DIF size, 12 digit BCD |
| 9 | 1 | 6D | VIF time/date |
| 10-15 | 6 | xxxxxxxxxx | Time and date (sec, min, hour, day, month, year) |
| 16 | 1 | xx | CS checksum, calculated from C field to last data |
| 17 | 1 | 16 | Stop character |

It is also possible to set date/time using the M-Bus data type F;

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 09 | L-field, calculated from C field to last user data |
| 3 | 1 | 09 | L-field, repeated |

| Byte No. | Size | Value | Description |
|----------|------|---------|---|
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 04 | DIF size, 32 bit integer |
| 9 | 1 | 6D | VIF time/date |
| 10-13 | 1 | xxxxxxx | Time and date. Min, hour, day, month, year coded according to M-Bus data type F: <ul style="list-style-type: none"> • Minutes in bits 0-5. Valid values 0-59 • Hours in bits 8-12. Valid values 0-23 • Day in bits 16-20. Valid values 1-31 • Month in bits 24-27. Valid values 1-12 • Year in bits 21-23 and 28-31 (MSB bits). Valid values 0-99. All other bits are unused |
| 14 | 1 | xx | CS checksum, calculated from C field to last data |
| 15 | 1 | 16 | Stop character |

10.4.24 Set date

The date is set by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 07 | L-field, calculated from C field to last user data |
| 3 | 1 | 07 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 02 | DIF size, 16 bit integer |
| 9 | 1 | 6C | VIF date |
| 10-11 | 1 | xxxx | Date (day, month, year coded according to M-Bus data type G) |
| 12 | 1 | xx | CS checksum, calculated from C field to last data |
| 13 | 1 | 16 | Stop character |

10.4.25 Reset demand, previous values, load profile and logs

All data for demand, previous values, load profile and logs is cleared by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 08 | L-field, calculated from C field to last user data |

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 3 | 1 | 08 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 00 | DIF size, no data |
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | F9 | VIF extension of manufacturer specific VIFE's, next VIFE specifies actual meaning |
| 11 | 1 | xx | VIFE specifies data to be cleared: <ul style="list-style-type: none"> • 82: Demand • 83: Previous values • 84: Load profile • 85: Event log • AE: System log • B0: Net quality log |
| 12 | 1 | 07 | VIFE clear |
| 13 | 1 | xx | CS checksum, calculated from C field to last data |
| 14 | 1 | 16 | Stop character |

10.4.26 Reset resettable active energy import

Reset of resettable active energy import is performed by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 08 | L-field, calculated from C field to last user data |
| 3 | 1 | 08 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 00 | DIF size, no data |
| 9 | 1 | 84 | VIFE specifying energy |
| 10 | 1 | FF | VIFE next byte is manufacturer specific |
| 11 | 1 | F2 | Resettable registers |
| 12 | 1 | 07 | VIFE clear |
| 13 | 1 | xx | CS checksum, calculated from C field to last data |
| 14 | 1 | 16 | Stop character |

10.4.27 Reset resettable active energy export

Reset of resettable active energy export is performed by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 09 | L-field, calculated from C field to last user data |
| 3 | 1 | 09 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 80 | DIF size, no data |
| 9 | 1 | 40 | DIFE, unit=1 |
| 10 | 1 | 84 | VIFE specifying energy |
| 11 | 1 | FF | VIFE next byte is manufacturer specific |
| 12 | 1 | F2 | Resettable registers |
| 13 | 1 | 07 | VIFE clear |
| 14 | 1 | xx | CS checksum, calculated from C field to last data |
| 15 | 1 | 16 | Stop character |

10.4.28 Reset resettable reactive energy import

Reset of resettable active energy export is performed by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 08 | L-field, calculated from C field to last user data |
| 3 | 1 | 08 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 80 | DIF size, no data |
| 9 | 1 | 80 | DIFE, unit=0 |
| 10 | 1 | 40 | DIFE unit=2 |
| 11 | 1 | 84 | VIFE specifying energy |
| 12 | 1 | FF | VIFE next byte is manufacturer specific |
| 13 | 1 | F2 | Resettable registers |
| 14 | 1 | 07 | VIFE clear |
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |

10.4.29 Reset resettable reactive energy export

Reset of resettable active energy export is performed by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0A | L-field, calculated from C field to last user data |
| 3 | 1 | 0A | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 80 | DIF size, no data |
| 9 | 1 | C0 | DIFE, unit=1 |
| 10 | 1 | 40 | DIFE unit=3 |
| 11 | 1 | 84 | VIFE specifying energy |
| 12 | 1 | FF | VIFE next byte is manufacturer specific |
| 13 | 1 | F2 | Resettable registers |
| 14 | 1 | 07 | VIFE clear |
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |

10.4.30 Set write access level

The write access level is set by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|---|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 07 | L-field, calculated from C field to last user data |
| 3 | 1 | 07 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 01 | DIF size, 8 bit integer |
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | 6A | VIFE write control |
| 11 | 1 | xx | Write control (1: Closed, 2: Open by password, 3: Open) |
| 12 | 1 | xx | CS checksum, calculated from C field to last data |
| 13 | 1 | 16 | Stop character |

10.4.31 Set tariff source

Tariffs can be controlled by inputs, communication or internal clock.

The tariff source is set by sending the following command (all values are hexadecimal). The command is affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|-------|---|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 08 | L-field, calculated from C field to last user data |
| 3 | 1 | 08 | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 01 | DIF size, 8 bit integer |
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | F9 | VIF extension of manufacturer specific VIFE's, next VIFE specifies actual meaning |
| 11 | 1 | 06 | VIFE tariff source |
| 12 | 1 | xx | Tariff source (0: Internal clock, 1: Communication command, 2: Inputs) |
| 13 | 1 | xx | CS checksum, calculated from C field to last data |
| 14 | | 16 | Stop character |

10.4.32 Set currency conversion factor

The currency conversion factor is set by sending the following command (all values are hexadecimal). The command is not affected by the write protection level set.

| Byte No. | Size | Value | Description |
|----------|------|---------|--|
| 1 | 1 | 68 | Start character |
| 2 | 1 | 0A | L-field, calculated from C field to last user data |
| 3 | 1 | 0A | L-field, repeated |
| 4 | 1 | 68 | Start character |
| 5 | 1 | 53/73 | C-field, SND_UD |
| 6 | 1 | xx | A-field, address |
| 7 | 1 | 51 | CI-field, data send, LSB first |
| 8 | 1 | 04 | DIF size, 32 bit integer |
| 9 | 1 | FF | VIF next byte is manufacturer specific |
| 10 | 1 | 25 | VIFE currency conversion factor |
| 11-14 | 4 | xxxxxxx | Currency conversion factor in currency/kWh with 3 decimals |
| 15 | 1 | xx | CS checksum, calculated from C field to last data |
| 16 | 1 | 16 | Stop character |