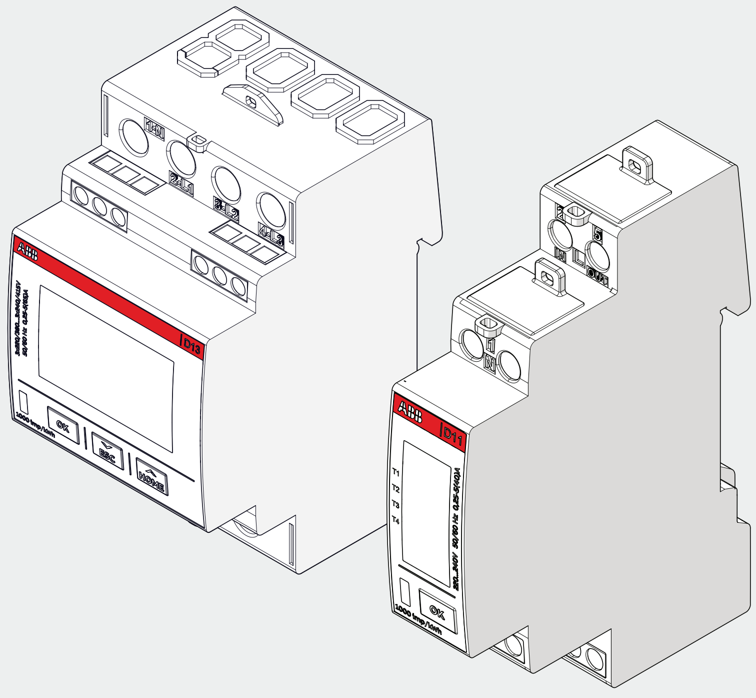
Energy Meter

D11 15 - D13 15

Communication manual



D11 15 - D13 15 Communication manual 9AKK108468A8827 Rev A

Table of Contents

1.Communication with Modbus

This chapter describes the mapping from meter data to Modbus and how to read and write to registers. The chapter contains information for all functionality and data for the complete A series family. For single phase meters some data does not exist, for example data for phase 2 and 3.

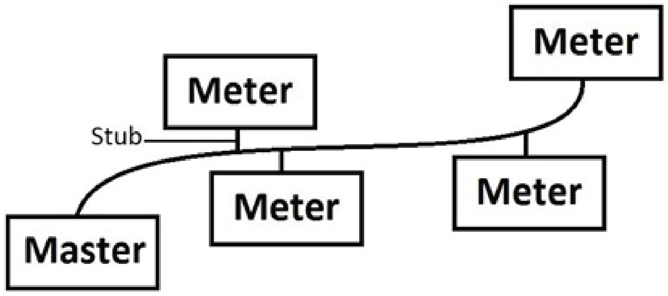
1.1.Bus Description

Modbus communication in the D13-15 meters is done on a 3-wire (A, B and Common) polarity dependent bus according to the RS-485 standard. Maximum number of meters connected to one physical bus is 247 (which is the same as the individual device address range in Modbus).

Topology

The RS-485 bus uses line topology, see figure below. Stubs at the meter connections are allowed but should be kept as short as possible and no longer than 1 m.

Bus termination in both ends of the line should be used. The resistors should have the same values as the characteristic impedance of the cable which normally is 120 ohm.



Line Topology

Cable

Cable used is non shielded or shielded twisted pair cable with wire area of 0.35...1.5 mm². If shielded cable is used the shield should be connected to ground in one end. Maximum length of the bus is 700 m.

1.2.Modbus Protocol

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 - 103.

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

Modbus request frame	
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.

1.3.Function Code 3 (Read holding registers)

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 structure

Slave address	Function code	Address	No. of registers	Error check

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

Request frame	
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 structure

Slave address	Function code	Byte count	Registers values	Error check

The following is an example of a response:

Response frame	
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	0xXX
Error check (CRC), low byte	0xXX

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.

1.4.Function Code 16 (Write multiple registers)

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 structure

Slave address	Function code	Start address	No. of registers	Byte count	Registers values	Error check

The following is an example of a request (setup Alarm action):

Request frame	
Slave address	0x01
Function code	0x10
Start address, high byte	0x8C
Start address, low byte	0x69
No. of registers, high byte	0x00
No. of registers, low byte	0x02
Byte count	0x04
Value of register 0x8C69, high byte	0x00
Value of register 0x8C69, low byte	0x03
Value of register 0x8C69, high byte	0x00
Value of register 0x8C69, low byte	0x02
Error check (CRC), high byte	0x7A
Error check (CRC), low byte	0xEA

In this example the master sends a write request to the slave that has the Modbus address 1. The first register to write is 0x8C69 and the number of registers to write is 0x02. This means that the registers 0x8C69 to 0x8C67 are written. Register 0x8C69 is set to the value 0x0003, and so on.

Response frame structure

Slave address	Function code	Start address	No. of registers	Error check

The following is an example of a response:

Response frame	
Slave address	0x01
Function code	0x10
Register address, high byte	0x8C
Register address, low byte	0x69
No. of registers, high byte	0x00
No. of registers, low byte	0x02
Error check (CRC), high byte	0xBB
Error check (CRC), low byte	0x44

In the example above the slave with the Modbus address 1 responds to a write request. The first register is 0x8C69 and 0x02 registers have been successfully written to.

1.5.Function Code 6 (Write single register)

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 structure

Slave address	Function code	Register address	Register value	Error check

The following is an example of a request (setup function of port 2 always off):

Request frame	
Slave address	0x01
Function code	0x06
Register address, high byte	0x8C
Register address, low byte	0x18
Value of register 0x8C18, high byte	0x00
Value of register 0x8C18, low byte	0x01
Error check (CRC), high byte	0xA2
Error check (CRC), low byte	0x9C

Response frame structure

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

1.6.Exception Responses

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

Exception frame structure

Slave address	Function code	Exception	Error check

Exception frame
Slave address
Function code
Exception
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:

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

1.7.Reading and Writing to Registers

Readable registers

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).

Multi-register values

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.

Unused registers

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”.

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.

Writing to registers

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.

It is not possible to modify parts of a setting, e.g. to set only the year and month of the Date/time setting.

Confirm set values

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.

1.8.Mapping Tables

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

Contents 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	kvah	5018	4	0,01	kvah	Signed
Active import CO2		5024	4	0,001	kg	Unsigned
Active import Currency		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
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	L1	54A8	4	0,01	kVAh	Unsigned
Apparent	L2	54AC	4	0,01	kVAh	Unsigned
Apparent	L3	54B0	4	0,01	kVAh	Unsigned

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
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
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

Inputs and 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
Input 1	Current state	6308	1	ON=1, OFF=0	Unsigned	R
Input 1	Counter	6318	4		Unsigned	R

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)
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).

Settings

All registers in the following table have read and write access except number of elements which is read only:

Quantity	Start Reg (Hex)	Size	Res.	Unit	Data type
CO2 conversion factor	8CE0	2	0.001	kg/kWh	Unsigned
Currency conversion factor	8CE2	2	0.01	Currency/ kWh	Unsigned
LED type	8CE4	1		-	Unsigned
LED type: (OFF = 0, ACTIVE ENERGY IMPORT-EXPORT = 6, REACTIVE ENERGY IMPORT-EXPORT = 7, APPARENT ENERGY = 5)					
Wire type	8CE5	1		-	Unsigned
Wire type: (WIRE_3P4W3C = 1, WIRE_3P3W3C = 2, WIRE_2P3W2C = 4, WIRE_1P2W1C = 5)					

Operations

All registers in the following table are write only:

Quantity	Details	Start Reg (Hex)	Size	Action	Data type
Reset input counter	Input 1	8F0B	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 System log		8F31	1	Write the value 1 to	Unsigned
Reset Event log		8F32	1	Write the value 1 to	Unsigned

1.9.Event logs

Mapping table

The following table shows an overview of the mapping table:

Log type	Details	Start Reg (Hex)	Size
Erros	Header	6500	16
Erros	Data block	6510	105
Alarms	Header	65B0	16
Alarms	Data block	65C0	105
Warnings	Header	6710	16
Warnings	Data block	6720	105

Header and data block

There is one pair of header and data block for each log type, located in the registers listed in the mapping table above. In the tables showing the structure of the header and data block below the register numbers are valid for the System log. However the headers and data blocks for all log types share the same structure, so the tables are applicable for all log types if the register numbers are exchanged to correct values.

Structure of the header

The following table describes the header:

Function	Start Reg (Hex)	Size	Description	Read/Write
Get next block	6500	1	Write value 1 to this register to load the next block of log entries	R/W
Entry number	6501	1	Write to this register to choose an entry number to start reading from	R/W
Direction	6507	1	Write to this register to choose the direction of reading	R/W

Data block

The data block contains the log entries, consisting of timestamp, event counter, event category, event id and duration. There is space for up to 15 log entries in the data block.

The log is read by repeatedly loading new values into the data block in backward or forward direction in time.

The event appearing in the first position in the data block has the entry number indicated by Entry number register. In case of backwards reading the events in the other positions follow in ascending entry number order, i.e. going towards older events. In case of forward reading the events in the other positions follow in descending entry number order, i.e. going towards more recent events.

Structure of the data block

The following table describes the structure of the data block:

Entry position	Contents	Start Reg (Hex)	Size	Description
1	Timestamp	6510	3	Date and time when the event occured (Date/Time format). D13 doesn't have RTC then in this register will be filled with 0xFF
1	Category	6513	1	The category of this log entry (exception, warning, error or information)
1	Event id	6514	1	The id for this log entry, identifying what has happened
1	Duration	6515	2	The duration of this event measured in seconds
...				
...				
15	Timestamp	6572	3	Date and time when the event occur ed (Date/Time format). D13 doesn't have RTC then in this register will be filled with 0xFF
15	Category	6575	1	The category of this log entry (exception, warning, error or information)
15	Event id	6576	1	The id for this log entry, identifying what has happened
15	Duration	6577	2	The duration of this event measured in seconds

Category

Possible values for the category register are shown in the table below:

Category	Description
2	Error
4	Warning
8	Alarm

Event id

Contains a code related to the triggered alarm number or to the error or warning see the table below:

Errors	**Number**
ERROR_AUDIT_LOG	40
ERROR_PROGRAM_CRC	41
ERROR_PERSISTENT_STORAGE	42
ERROR_RAM_CRC	43
ERROR_FW_UP_INV_IMAGE	44
ERROR_FW_UP_MAX_COUNT	45
ERROR_FW_UP	46
ERROR_FW_UP_MAX_INV_IMG_COUNT	47
ERROR_ABB_SPECIFIC_STR_6	48
ERROR_ABB_SPECIFIC_STR_7	49
ERROR_ABB_SPECIFIC_STR_8	50
ERROR_ACREF	51
ERROR_MAINBOARDTEMP_SENSOR	52
ERROR_RTC_CIRCUIT	53

Warnings	**Number**
WARNING_U1_LOW	1000
WARNING_U2_LOW	1001
WARNING_U3_LOW	1002
WARNING_MID_NOT_LOCKED	1003
WARNING_NEG_POW_ELEMENT_1	1004
WARNING_NEG_POW_ELEMENT_2	1005
WARNING_NEG_POW_ELEMENT_3	1006
WARNING_NEG_TOT_POW	1007
WARNING_FREQUENCY	1008
WARNING_NOT_USED2	1009
WARNING_DATE_NOT_SET	1010
WARNING_TIME_NOT_SET	1011
WARNING_U2_CONNECT	1012
WARNING_U3_CONNECT	1013
WARNING_I1_MISSING	1014
WARNING_I2_MISSING	1015
WARNING_I3_MISSING	1016
WARNING_I2_CONNECT	1017
WARNING_I3_CONNECT	1018
WARNING_PHASE1_CONNECTED_TO_NEUTRA	1021
WARNING_PHASE2_CONNECTED_TO_NEUTRA	1022
WARNING_PHASE3_CONNECTED_TO_NEUTRA	1023
WARNING_PULSES_MERGED_1	1024
WARNING_PULSES_MERGED_2	1025
WARNING_POWERFAIL	1030

Alarms	**Number**
ALARM_1_ACTIVE	2013
ALARM_2_ACTIVE	2014
ALARM_3_ACTIVE	2015
ALARM_4_ACTIVE	2016
ALARM_5_ACTIVE	2017
ALARM_6_ACTIVE	2018
ALARM_7_ACTIVE	2019
ALARM_8_ACTIVE	2020
ALARM_9_ACTIVE	2021
ALARM_10_ACTIVE	2022
ALARM_11_ACTIVE	2023
ALARM_12_ACTIVE	2024
ALARM_13_ACTIVE	2025
ALARM_14_ACTIVE	2026
ALARM_15_ACTIVE	2027
ALARM_16_ACTIVE	2028
ALARM_17_ACTIVE	2029
ALARM_18_ACTIVE	2030
ALARM_19_ACTIVE	2031
ALARM_20_ACTIVE	2032
ALARM_21_ACTIVE	2033
ALARM_22_ACTIVE	2034
ALARM_23_ACTIVE	2035
ALARM_24_ACTIVE	2036
ALARM_25_ACTIVE	2037
ALARM_COMP1_ACTIVE	2038
ALARM_COMP2_ACTIVE	2039
ALARM_COMP3_ACTIVE	2040
ALARM_COMP4_ACTIVE	2041
ALARM_COMP5_ACTIVE	2042
ALARM_COMP6_ACTIVE	2043

Reading Event logs

Readout of logs is controlled by the Entry number register.

After writing to the Entry number register, the log entries are available in the registers of the data block. To get the next set of entries the Get next entry register is used.

- **Read the 15 most recent logs**

Follow the steps in the table below to read the 15 most recent log entries:

Step	Action
1	Write the value 1 to the entry number register
2	Read the data block

- **Read the entire history**

Follow the steps in the table below to read the entire history of logs, backwards in time:

Step	Action
1	Write the value 0 to the Entry number register to make sure the reading starts from the most recent entry
2	Write the value 1 to the Get next entry register
3	Read the data block. First time this step is performed the logs in the data block are the most recent up to the 15th most recent. Second time this step is performed the logs in the data block are the 16th to the 30th
4	Repeat steps 2 and 3 until there are no more entries stored. When all entries have been read, all registers in the data block are set to 0xFFFF

The entry number register is reset to 0 after a restart.

Audit logs

Readout of audit logs is controlled by the Entry number register. After writing to the Entry number register, the log entries are available in the registers of the data block. To get the next set of entries the Get next entry register is used.

- **Mapping table**

Follow the steps in the table below to read the most recent audit log entries:

Function	Details	Start Register	Size
Audit Log	Header	6660	7
Audit Log	Data Block	6670	68

- **Header for Audit log**

The following table describes Audit Log header registers:

Log type	Details	Start Reg (Hex)	Size	Description
Audit log	Get next	6660	1	Write value 1 to this register to load the next block of log entries
Audit log	Entry number	6661	1	Write to this register to choose an entry number to start reading from
Audit log	Direction	6667	1	Write to this register to choose the direction of reading
Audit log	Data Block	6670	51	Read the data block

- **Table of the contend of the data block**

Item	Function	Start Reg (Hex)	Size	Read/Write
1	Entry nr	6670	2	R
2	Upgrade counter	6672	1	R
3	FW version major	6673	1	R
4	FW version minor	6674	1	R
5	FW version patch	6675	1	R
6	Wires	6676	1	R
7	TRAFO_V_Prim	6677	2	R
8	TRAFO_V_Sec	6679	2	R
9	TRAFO_I_Prim	667B	2	R
10	TRAFO_I_Sec	667D	2	R
11	ACTIVE_ENERGY_IMPORT_TOTAL	667F	4	R
12	ACTIVE_ENERGY_IMPORT_L1	6683	4	R
13	ACTIVE_ENERGY_IMPORT_L2	6687	4	R
14	ACTIVE_ENERGY_IMPORT_L3	668B	4	R
15	ACTIVE_ENERGY_IMPORT_TAR1	668F	4	R
16	ACTIVE_ENERGY_IMPORT_TAR2	6693	4	R
17	ACTIVE_ENERGY_IMPORT_TAR3	6697	4	R
18	ACTIVE_ENERGY_IMPORT_TAR4	669B	4	R
19	ACTIVE_ENERGY_EXPORT_TOT	669F	4	R

- **Read the entire history**

Follow the steps in the table below to read the entire history of audit logs, backwards in time:

Step	Action
1	Write the value 0 to the Entry number register to make sure the reading starts from the most recent entry
2	Write the value 1 to the Get next entry register
3	Write the value 1 to the Direction register
4	Read the data block. First time this step is performed the logs in the data block are the most recent. Second time this step is performed the logs in the data block is the 2nd
5	Repeat steps 2 and 4 until there are no more entries stored. When all entries have been read, all registers in the data block are set to 0xFFFF

The entry number register is reset to 0 after a restart.

1.10.Configuration

This section describes how to configure the following functions:

- Alarms
- I/O
- Tariffs

Alarms

Alarm configuration defines the set of quantities to monitor. It is 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	Data type	Read/Write
Alarm number	8C60	1	The number (identifier) for the alarm to configure	R/W
Parameter	8C61	1	The parameter to monitor	R/W
Threshold	8C64	4	Thresholds used to decide when the alarm is active	R/W
Hysteresis	8C68	1	Hysteresis to be applied to the turn off threshold	R/W
Delay	8C69	1	Delay, defining the time that the measured value must be above/below the configured thresholds before the alarm triggers	R/W
Type	8C6B	1	The type of alarm: cross up or down 0 – alarm disable 1 – alarm cross up 2 – alarm cross down	R/W
Action	8C6C	2	Actions to perform when alarm is triggered	R/W

Instance should be selected before reading the configuration datablock.
The meter will update the link of the slot according with the last entrance.

Register	Bit number	Description	Possible values
0x8C69	0 (least significant bit)	Write entry to log	1 = use this action 0 = don’t use
	1	Set output	1 = use this action 0 = don’t use
	2	Bit not used	
0x8C6A	(Entire register)	Number of the output to turn on. Ignored if Set output bit above is set to 0	

• **Alarm number**

The number (identifier) for the alarm to configure.

• **Parameter**

The following table lists the Parameter Number for the Parameter monitored by alarm that can be monitored by an alarm:

Parameter monitored	Parameter Number	Alarm threshold range	Resolution
Voltage L1	1	0-999000	0.1
Voltage L2	2	0-999000	0.1
Voltage L3	3	0-999000	0.1
Voltage L1-L2	4	0-999000	0.1
Voltage L2-L3	5	0-999000	0.1
Voltage L1-L3	6	0-999000	0.1
Current L1	7	0-999000	0.01
Current L2	8	0-999000	0.01
Current L3	9	0-999000	0.01
Current N	10	0-999000	0.01
Active power total	11	0-999000	0.001
Active power L1	12	0-999000	0.001
Active power L2	13	0-999000	0.001
Active power L3	14	0-999000	0.001
Reactive power total	15	0-999000	0.001
Reactive power L1	16	0-999000	0.001
Reactive power L2	17	0-999000	0.001
Reactive power L3	18	0-999000	0.001
Apparent power total	19	0-999000	0.001
Apparent power L1	20	0-999000	0.001
Apparent power L2	21	0-999000	0.001
Apparent power L3	22	0-999000	0.001
Power factor total	23	0-0.99	0.001
Power factor L1	24	0-0.99	0.001
Power factor L2	25	0-0.99	0.001
Power factor L3	26	0-0.99	0.001
Frequency	27	0-999000	0.01

• **Thresholds**

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

• **Hysteresis**

Hysteresis to be applied to the turn off threshold.

• **Delay**

Delay, defining the time that the measured value must be above/below the configured thresholds before the alarm triggers.

• **Type**

The type of alarm: cross up or down:

- 0 – alarm disable
- 1 – alarm cross up
- 2 – alarm cross down

• **Action**

Actions to perform when alarm is triggered.

- **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 Parameter Number for the parameter to monitor to the Parameter ity registers
3	Write the thresholds to the Thresholds registers
4	Write the hysteresis to the Hysteresis registers
5	Write the delays to the Delays registers
6	Write the type of alarm to the Type registers
7	Write the actions to perform to perform to the Action registers
8	Repeat steps 1 to 7 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 Parameter registers to get the parameter monitored in the chosen alarm
3	Read the Thresholds registers to get the threshold to set the alarm to ON
4	Read the Hysteresis register to get the hysteresis to set the alarm to OFF
5	Read the Delays registers to get the delay time to turn ON and OFF the alarm
6	Read the Type register to get the alarm type: disable, cross up or cross down
7	Read the Action registers to get the actions performed when an alarm is triggered
8	Repeat steps 1 to 7 for all alarms

1.11.Inputs and outputs

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

Mapping table

The following table shows an overview of the mapping table:

Quantity	Details	Start Reg (Hex)	Size
Inputs and outputs	I/O port configuration	8C0C	4
Inputs and outputs	Pulse output configuration	8C10	6

I/O port configuration registers

The following table describes the group of registers for read the configuration of physical I/O ports:

Register	Start Reg (Hex)	Size	Description	Read/Write
I/O port 1	8C0C	1	Function of first I/O port	R
I/O port 2	8C0D	1	Function of second I/O port	R

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

Value	Function	Observation
0	Disabled	
1	Pulse input	
2	Alarm	The I/O will be defined during alarm setting
4	Tariff	
5	Pulse	The I/O will be defined during pulse setting
6	Always on	
7	Always off	
8	Communication	

Pulse input, Always on, Always off and Communication configuration registers

The following table describes the group of registers for read and write the configuration of physical I/O ports:

Function	Start Reg (Hex)	Size	Description	Read/Write
Pulse input	0x8C16	1	The physical I/O port. Table Bitwise physical port	R / W
Always on	0x8C17	1	The physical I/O port. Table Bitwise physical port	R / W
Always off	0x8C18	1	The physical I/O port. Table Bitwise physical port	R / W
Communication	0x8C19	1	The physical I/O port. Table Bitwise physical port	R / W

- **Table Bitwiser**

The following table describe the bit that need to be set according to the I/O port.

Register Nr	Bit Nr	Description	Definition
0x8C16 0x8C17 0x8C18 0x8C19	0	The physical I/O port 1	1 = link to the port 0 = not linked
	1	The physical I/O port 2	1 = link to the port. 0 = not linked
	2	The physical I/O port 3	1 = link to the port 0 = not linked
	3	The physical I/O port 4	1 = link to the port 0 = not linked
	4 - 7	Not used	0

Pulse output configuration registers

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

Function	Start Reg (Hex)	Size	Definition	Description	Read/Write
Digital output	8C10	1	Digital output	The physical I/O port on which the pulses are sent out	R/W
Setting pulse output (size 5 register)	8C11	1	Type of Energy	Quantity according Table 1	R/W
		2	Set the frequency	The pulse frequency measured in pulses/MWh or Mvarh	
		2	Pulse length	The duration of a pulse measured in milliseconds	

1. To configure the physical I/O port with pulse output, it must send all registers in the same frame.
2. To read the configuration of the physical I/O port first must write the slot number in the register 0x8C10 then read the other register. If the physical I/O port functionality is not pulse output, all the register will return 0xFF.

Type of Energy

Quantity	Code
Inactive pulse output	0
Active energy import total	1
Active energy export total	2
Reactive energy import total	3
Reactive energy export total	4
Apparent energy import export	5
Active energy import export	6
Reactive energy import export	7

Write pulse output configuration

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

Step	Action
1	Choose the physical I/O port on which the pulses are sent out output instance register. Allowed values are 2
2	Write the deseired type of Energy, the frequency and pulse length. It must send all the registers in the frame

Read pulse output configuration

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

Step	Action
1	Choose 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 chosen pulse output instance
3	Read the Energy quantity registers to get the OBIS code of the quantity used for the chosen pulse output instance
4	Read the Pulse frequency active or reactive energy registers, depending on the chosen energy type, to get the pulse frequency used by the chosen pulse output instance
5	Read the Pulse length registers to get the pulse length used by the chosen pulse output instance
6	Repeat steps 1 to 5 for all pulse outputs

1.12.Tariffs

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

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
0	Inputs
1	Communication

Tariff selection

The Tariff selection is used to select which tariff to accumulate on.

Quantity	Details	Start Reg (Hex)	Size
Tariffs	Active tariff	8A07	1

4 communication source 4 tariff can be selected (T1,T2,T3,T4) while for Input source only T1 and T2 can be set:

Value	Description
1	T1
2	T2
3	T3
4	T4

1.13.Communication examples

This section contains a number of Modbus communication examples with commented byte data sent and received. Regarding Modbus addresses, data resolution, size, unit and type see section 9.4 Mapping Tables.

Reading energy values

Below is a readout example of energy register values with commented byte data sent and received in hexadecimal format. The readout is divided into four readings. The first three because the registers are located at different address areas and the last readings because the area exceeds the maximum number of Modbus addresses that can be read out (125) with the read holding register command (03).

Sending Read Request			
05 03 50 00 00 24 55 55	;05=Modbus address, 03=Read holding register, 50 00=Address 5000hex, 00 24hex=36 Modbus words=72 bytes		
Reading answer			
05 03 48	;05=Modbus address,	03=read holding register,	48hex=72 bytes
00 00 00 00 00 0D 12 90	;Total active import energy,	00000000000D1290hex	→ 8567.20 kWh
00 00 00 00 00 03 12 09	;Total active export energy,	0000000000031209hex	→ 2012.25 kWh
00 00 00 00 00 0A 00 86	;Total active net energy,	00000000000A0086hex	→ 6554.94 kWh
00 00 00 00 00 04 17 05	;Total reactive import energy,	0000000000041705hex	→ 2680.37 kvarh
00 00 00 00 00 01 2B 18	;Total reactive export energy,	000000000012B18hex	→ 765.68 kvarh
00 00 00 00 00 02 EB ED	;Total reactive net energy,	000000000002EBEDhex	→ 1914.69 kvarh
00 00 00 00 00 0E A7 FE	;Total apparent energy	00000000000EA7FEhex	→ 9605.10 kVAh
2F 9F			

Sending Read Request			
05 03 51 70 00 30 55 7D	;05=Modbus address, 03=Read holding register, 51 70=Address 5170hex, 00 30hex=48 Modbus words=96 bytes		
Reading answer			
05 03 60	;05=Modbus address	03=read holding register,	60hex=96 bytes
00 00 00 00 00 04 5F 06	;Tariff 1 active import energy,	0000000000045F06hex	→ 2864.70 kWh
00 00 00 00 00 00 D3 EA	;Tariff 2 active import energy,	000000000000D3EAhex	→ 542.50 kWh
00 00 00 00 00 07 0B 20	;Tariff 3 active import energy,	0000000000070B20hex	→ 4616.00 kWh
00 00 00 00 00 00 D4 80	;Tariff 4 active import energy,	000000000000D480hex	→ 544.00 kWh
FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	;FF FF FF FF means no data available at these addresses		
00 00 00 00 00 00 10 D1	;Tariff 1 active export energy,	00000000000010D1hex	→ 43.05 kWh
00 00 00 00 00 01 AD F6	;Tariff 2 active export energy,	000000000001ADF6hex	→ 1100.70 kWh
00 00 00 00 00 00 F1 FE	;Tariff 3 active export energy,	000000000000F1FEhex	→ 619.50 kWh
00 00 00 00 00 00 61 44	;Tariff 4 active export energy,	0000000000006144hex	→ 249.00 kWh
E5 C5			

Sending Read Request			
05 03 51 B0 00 30 55 41 7D	;05=Modbus address, 03=Read holding register, 51 B0=Address 51B0hex, 00 30hex=48 Modbus words=96 bytes		
Reading answer			
05 03 60	;05=Modbus address,	03=read holding register,	60hex=96 bytes
00 00 00 00 00 00 33 53	;Tariff 1 reactive import energy,	0000000000003353hex	→ 131.39 kvarh
00 00 00 00 00 00 BD 71	;Tariff 2 reactive import energy,	000000000000BD71hex	→ 484.97 kvarh
00 00 00 00 00 02 76 14	;Tariff 3 reactive import energy,	0000000000027614hex	→ 1613.00 kvarh
00 00 00 00 00 00 B0 2C	;Tariff 4 reactive import energy	000000000000B02Chex	→ 451.00 kvarh
FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	;FF FF FF FF means no data available at these addresses		
00 00 00 00 00 00 A4 54	;Tariff 1 reactive export energy,	000000000000 A454hex	→ 420.68 kvarh
00 00 00 00 00 00 1C 20	;Tariff 2 reactive export energy,	0000000000001C20hex	→ 72.00 kvarh
00 00 00 00 00 00 28 0A	;Tariff 3 reactive export energy,	000000000000280Ahex	→ 102.50 kvarh
00 00 00 00 00 00 42 9A	;Tariff 4 reactive export energy,	000000000000429Ahex	→ 170.50 kvarh
E8 41			

Sending Read Request			
05 03 54 60 00 3C 54 71 7D	;05=Modbus address, 03=Read holding register, 54 60=Address 5460hex, 00 3Chex=60 Modbus words=120 bytes		
Reading answer			
05 03 78	;05=Modbus address,	03=read holding register,	78hex=120 bytes
00 00 00 00 00 03 12 92	;L1 active import energy,	0000000000031292hex	→ 2013.62 kWh
00 00 00 00 00 04 98 E1	;L2 active import energy,	00000000000498E1hex	→ 3012.81 kWh
00 00 00 00 00 05 66 55	;L3 active import energy,	0000000000056655hex	→ 3538.77 kWh
00 00 00 00 00 00 92 3A	;L1 active export energy,	000000000000923Ahex	→ 374.34 kWh
00 00 00 00 00 01 1C 9B	;L2 active export energy,	0000000000011C9Bhex	→ 728.59 kWh
00 00 00 00 00 01 63 33	;L3 active export energy,	0000000000016333hex	→ 909.31 kWh
00 00 00 00 00 02 80 58	;L1 active net energy,	0000000000028058hex	→ 1639.28 kWh
00 00 00 00 00 03 7C 45	;L2 active net energy,	0000000000037C45hex	→ 2284.21 kWh
00 00 00 00 00 04 03 21	;L3 active net energy,	0000000000040321hex	→ 2629.45 kWh
00 00 00 00 00 00 6B 11	;L1 reactive import energy,	0000000000006B11hex	→ 274.09 kvarh
00 00 00 00 00 00 69 DC	;L2 reactive import energy,	00000000000069DChex	→ 271.00 kvarh
00 00 00 00 00 04 67 4E	;L3 reactive import energy,	000000000004674Ehex	→ 2885.90 kvarh
00 00 00 00 00 00 62 E5	;L1 reactive export energy,	00000000000062E5hex	→ 253.17 kvarh
00 00 00 00 00 01 88 A1	;L2 reactive export energy,	00000000000188A1hex	→ 1005.13 kvarh
00 00 00 00 00 00 64 FA	;L3 reactive export energy,	00000000000064FAhex	→ 258.50 kvarh
21 B0			

Sending Read Request			
05 03 54 9C 00 30 94 44	;05=Modbus address, 03=Read holding register, 54 9C=Address 5460hex, 00 3Chex=60 Modbus words=120 bytes		
Reading answer			
05 03 60	;05=Modbus address,	03=read holding register,	60hex=96bytes
00 00 00 00 00 00 08 2B	;L1 reactive net energy,	000000000000082Bhex	→ 20.91 kvarh
FF FF FF FF FF FE E1 3C	;L2 reactive net energy,	FFFFFFFFFFFEE13Chex	→ -734.12 kvarh
00 00 00 00 00 04 02 54	;L3 reactive net energy,	0000000000040254hex	→ 2627.40 kvarh
00 00 00 00 00 03 70 F5	;L1 apparent import energy,	00000000000370F5hex	→ 2255.25 kVAh
00 00 00 00 00 05 1D BD	;L2 apparent import energy,	0000000000051DBDhex	→ 3352.93 kVAh
00 00 00 00 00 06 C7 B5	;L3 apparent import energy,	000000000006C7B5hex	→ 4443.41 kVAh
00 00 00 00 00 00 E3 AC	;L1 apparent export energy,	000000000000E3AChex	→ 582.84 kVAh
00 00 00 00 00 01 88 1F	;L2 apparent export energy,	000000000001881Fhex	→ 1003.83 kVAh
00 00 00 00 00 02 1E F8	;L3 apparent export energy	0000000000021EF8hex	→ 1390.00 kVAh
00 00 00 00 00 02 8D 49	;L1 apparent net energy,	0000000000028D49hex	→ 1672.41 kVAh
00 00 00 00 00 03 95 9E	L2 apparent net energy,	000000000003959Ehex	→ 2349.10 kVAh
00 00 00 00 00 04 A8 BD	;L3 apparent net energy,	000000000004A8BDhex	→ 3053.41 kVAh
96 D2			

Below is a readout example of the total active imported energy with comments of byte data sent and received.

Sending Read Request				
05 03 50 00 00 04 54 8D	;05=Modbus address, 03=Read holding register, 50 00=Address 5000hex, 00 04=4 Modbus words=8 bytes			
Reading answer				
05 03 08	;05=Modbus address,	03=read holding register,	5B 00=address 5B00hex	84hex=132 bytes
00 00 00 00 00 0D 12 F5	;Total active imported energy=00000000000D12F5hex= =856821dec			→ 8568.21kWh
DD C3				

Reading Instrumentation values

Below is a readout example of all instrumentation values with comments of byte data sent and received.

Sending Read Request			
05 03 5B 00 00 42 D7 5B	;05=Modbus address, 03=Read holding register, 5B 00=Address 5B00hex, 00 42=42hex Modbus words=66dec=132 bytes		
Reading answer			
05 03 84	;05=Modbus address,	03=read holding register,	84hex=132 bytes
00 00 09 05	;L1-N voltage=00000905hex=2309dec		→ 230.9 V
00 00 09 17	;L2-N voltage=00000917hex=2327dec		→ 232.7 V
00 00 09 26	;L3-N voltage=00000926hex=2342dec		→ 234.2 V
00 00 0F AC	;L1-L2 voltage=00000FAChex=4012dec		→ 401.2 V
00 00 0F CA	;L3-L2 voltage=00000FAChex=4042dec		→ 404.2 V
00 00 0F C0	;L1-L3 voltage=00000FAChex=4032dec		→ 403.2 V
00 00 00 65	;L1 current=00000065hex=101dec		→ 1.01 A
00 00 00 C9	;L2 current=000000C9hex=201dec		→ 2.01 A
00 00 01 2E	;L3 current=0000012Ehex=302dec		→ 3.02 A
00 00 00 86	;Neutral current=00000086hex=134dec		→ 1.34 A
00 01 E8 E4	;Active total power=0001E8E4hex=125156		→ 1251.56 W
00 00 5A E2	;L1 active power=00005AE2hex=23266		→ 232.66 W
00 00 B0 97	;L2 active power=0000B097hex=45207		→ 452.07 W
00 00 DD 6B	;L3 active power=0000DD6Bhex=56683		→ 566.83 W
00 00 75 41	;Reactive total power=00007541hex=30017		→ 300.17 var
00 00 00 1C	;L1 reactive power=0000001Chex=23266		→ 0.28 var
FF FF D0 4A	;L2 reactive power=FFFFD04Ahex=-12214		→ -122.14 var
00 00 A4 DB	;L3 reactive power=0000A4DBhex= 42203		→ 422.03 var
00 02 25 C3	;Apparent total power=000225C3hex=140739		→ 1407.39 VA
00 00 5A E2	;L1 apparent power=00005AE2hex=23266		→ 232.66 VA
00 00 B6 DF	;L2 apparent power=0000B6DFhex=46815		→ 468.15 VA
00 01 14 02	;L3 apparent power=00011402=70658		→ 706.58 VA
13 83	;Frequency=1383=4995		→ 49.95 Hz
00 87	;Total power phase angle=0087=135		→ 13.5 degrees
00 00	;L1 power phase angle=0000=0		→ 0 degrees
FF 6A	;L2 power phase angle=FF6A=-150		→ -15.0 degrees
01 6F	;L3 power phase angle=016F=367		→ 36.7 degrees
00 00	;U1 phase angle=0000=0		→ 0 degrees
04 AF	;U2 phase angle=04AF=1199		→ 119.9 degrees
FB 4E	;U3 phase angle=FB4E=-1202		→-120.2 degrees
FF FF FF FF FF FF	;FF FF FF…… means no data available at these addresses		
FF F3	;I1 phase angle=FFF3=-13		→-1.3 degrees
04 09	;I2 phase angle=0409=1033		→ 103.3 degrees
FC AE	;I3 phase angle=FCAE=--850		→-85.0 degrees
03 CC	;Total power factor=03CC=972		→ 0.972
03 E8	;L1 power factor=03E8=1000		→ 1.000
03 C6	;L2 power factor=03C6=966		→ 0.966
03 22	;L3 power factor=0322=802		→ 0.802
00 01	;Total active quadrant=0001=1		→ 1
00 01	;L1 active quadrant=0001=1		→ 1
00 04	;L2 active quadrant=0004=4		→ 1
00 01	;L3 active quadrant=0001=1		→ 1
D7 5E	;Checksum		

Below is a readout example of the U1 voltage with comments of byte data sent and received.

Sending Read Request	
05 03 5B 00 00 02 D6 AB	;05=Modbus address, 03=Read holding register, 5B 00=Address 5B00hex, 00 02=2 Modbus words=4 bytes
Reading answer	
05 03 04	;05=Modbus address, 03=read holding register, 04hex=4 bytes
00 00 09 05	;L1-N voltage=00000905hex=2309 → 230.9V
79 A0	;Checksum

Writing parameters

Below is example to configure the physical I/O port with pulse output.

Write 2 at register 0x8C10	
01 10 8C 10	;01=Modbus address, 10=Write multiple registers, 8C 10=Address 8C10hex
00 01	;00 02=2 Modbus words
02	;04=4 bytes
00 02	;00 00 01 F4=000001F4hex=500dec
68 C9	;Checksum
Reading answer	
01 10 8C 10	;01=Modbus address, 10=Write multiple registers, 8C 10=Address 8C10hex
00 01	;00 01=1 Modbus words
2A 9C	;Checksum

Setting the type of energy, frequency of the pulse and the pulse length. Write in the 5 registers together start at 0x8C11	
01 10 8C 11	;01=Modbus address, 10=Write multiple registers, 8A 00=Address 8A00hex
00 05	;00 05=5 Modbus words
0A	;0A=10 bytes
00 02	;00 02 hex = Type of Energy is Active energy export total
00 00 00 64	;Set the frequency of the pulse 00 00 00 00 64 = 100 Hertz
F5 FC	;Checksum
Reading answer	
01 10 8C 11	;01=Modbus address, 10=Write multiple registers, 8C 11=Address 8C11hex
00 01	;00 05=5 Modbus words
7A 9F	;Checksum

2.Communication with M-Bus

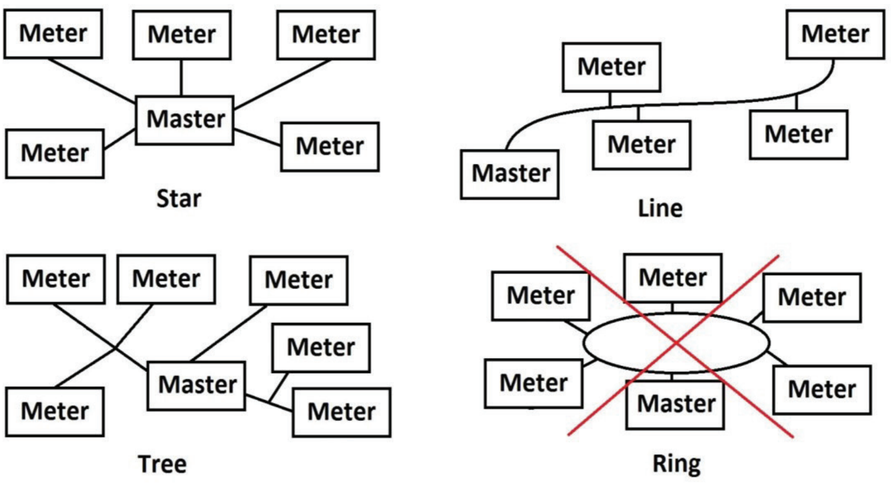
This chapter describes how to read meter data and to send commands to the meter over M-Bus. The chapter contains information for all functionality and data for the complete D1x-15 series family. For single phase meters some data does not exist, for example data for phase 2 and 3.

2.1.Bus Description

M-bus is a 2-wire polarity independent bus, optimized for master-slave communication with gas, water, heat and electricity meters. Number of meters on one physically connected bus is 1-250. A bus can be extended by using a repeater.

Topology

M-bus topology is flexible and star, line, tree topology or a mix of these can be used, see figure below. Ring topology can not be used. Bus termination is not required.



Cable

It is recommended to use non shielded twisted pair cable with wire area of 0.8 mm², for example two-wire standard telephone cable JYStY N*2*0.8 mm². If shielded cable is used the shield must not be connected to any of the two bus wires. Maximum total length of the bus is 1000 m. Maximum length between a slave and a repeater is 350 m.

2.2.M-Bus Protocol

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, log files and normally for har-monics.

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 D11-D13 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

Register	Communication objects
Inputs, counter	Read and clear input pulse counter 1 and 2
Current N	Instantaneous current in the neutral wire
Current, L1	Instantaneous current in the L1 phase
Current, L2	Instantaneous current in the L2 phase
Current, L3	Instantaneous current in the L3 phase
Voltage, L1-N	Instantaneous voltage between L1 and neutral
Voltage, L2-N	Instantaneous voltage between L2 and neutral
Voltage, L3-N	Instantaneous voltage between L3 and neutral
Voltage, L1-L2	Instantaneous voltage between L1 and L2
Voltage, L2-L3	Instantaneous voltage between L2 and L3
Voltage, L1-L3	Instantaneous voltage between L1 and L3
Active Power, Total	Instantaneous total active power
Active Power, L1	Instantaneous active power in L1
Active Power, L2	Instantaneous active power in L2
Active Power, L3	Instantaneous active power in L3
Active energy net Total	Total cumulative active net energy
Active energy net L1	Cumulative active net energy in L1
Active energy net L2	Cumulative active net energy in L2
Active energy net L3	Cumulative active net energy in L3
Power factor tot.	Instantaneous total power factor
Power factor L1	Instantaneous power factor in L1
Power factor L2	Instantaneous power factor in L2
Power factor L3	Instantaneous power factor in L3
Active energy currency conversion factor	Price in currency per kWh
Active import energy, total in Currency	Total cumulative active imported energy expressed in currency
Active energy CO2 conversion factor	CO2 emission in kg per kWh
Active import energy, total in CO2	Total cumulative active imported energy expressed in CO2
Reactive Power, Total	Instantaneous total reactive power
Reactive Power, L1	Instantaneous reactive power in L1
Reactive Power, L2	Instantaneous reactive power in L2
Reactive Power, L3	Instantaneous reactive power in L3
Reactive energy net Tot.	Total cumulative reactive net energy
Reactive energy net L1	Cumulative reactive net energy in L1
Reactive energy net L2	Cumulative reactive net energy in L2
Reactive energy net L3	Cumulative reactive net energy in L3
Apparent Power, Total	Instantaneous total apparent power
Apparent Power, L1	Instantaneous apparent power in L1
Apparent Power, L2	Instantaneous apparent power in L2
Apparent Power, L3	Instantaneous apparent power in L3
Apparent energy Tot.	Total cumulative apparent energy
Apparent energy L1	Cumulative apparent energy in L1
Apparent energy L2	Cumulative apparent energy in L2
Apparent energy L3	Cumulative apparent energy in L3
Wiring settings	1 : 3P4W 2: 3P3W 4: 2P3W 5: 1P2W
Current quadrant, Total	Quadrant in which the meter is measuring
Current quadrant, L1	Quadrant in which the meter is measuring, L1
Current quadrant, L2	Quadrant in which the meter is measuring, L2
Current quadrant, L3	Quadrant in which the meter is measuring, L3
Current tariff	Read and set current tariff
FW-version	Firmware version
Frequency	Instantaneous mains frequency
Warning logs	Read warning logs data

Read/write commands

The following tasks are possible to perform with SND_UD telegrams:

Command
Set tariff
Set primary address
Change baud rate
Reset input counters
Set output
Send Password
Set communication access level
Read request Log (Error, Alarm, Warning)
Set pwd
Reset Res.Reg Active Import
Reset Res.Reg Active Export
Reset Res.Reg Reactive Import
Reset Res.Reg Reactive Export
Set tariff Source
Set CO2 Conv. Factor
Set CUR Conv. Factor

Telegram Format

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 ac-knowledge 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).

• **Field description**

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

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.

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 tele-gram with the same FCB. The meter answers, to a REQ_UD2-request with tog-gled 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 from 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
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 baud rate to 300
B9h	Set baud rate to 600
Bah	Set baud rate to 1200
BBh	Set baud rate to 2400
BCh	Set baud rate to 4800
BDh	Set baud rate to 9600

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 4204h 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	LSB1 of storage No.	Function Field		Data Field			

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
1011	6 digit BCD	3
1100	8 digit BCD	4
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 informatiuon field (VIF):

Bit No.	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 man-ufacturer 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.

NOTE: the last VIFE indicates the availability of measurement (00: Available, 15: Not available)

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.

Value Information Field codes

- **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

• 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	Baud rate
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

• 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).

• First manufacturer specific VIFE-codes

VIFE-code	Description
E000 0000	Total
E000 0001	L1
E000 0010	L2
E000 0011	L3
E000 0100	N
E000 0101	L1-L2
E000 0110	L3-L2
E000 0111	L1-L3
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

VIFE-code	Description
E010 0000	Current Transformer (CT) ratio primary current
E010 0001	Voltage Transformer (VT) ratio primary voltage
E010 0010	Current Transformer (CT) ratio secondary current
E010 0011	Voltage Transformer (VT) ratio secondary voltage
E010 0100	CO2 conversion factor (kg * 10^{-3} /kWh)
E010 0101	Currency conversion factor (curr * 10^{-3} /kWh)
E010 0110	Error flags
E010 0111	Warning flags
E010 1000	Information flags
E010 1001	Alarm flags
E010 1010	Type designation (e.g. A43 552-100)
E010 1011	Sub interval
E010 1101	Number of elements
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 1101	Current harmonics
E110 1110	Voltage harmonics
E110 1111	Event type
E111 0000	Measurement period
E111 0001	Reset counter for energy
E111 0010	Resettable register
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

- **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

- **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

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

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

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

VIFE-code	Description
E000 0010	Quantity specification of maximum demand
E000 0011	Quantity specification of previous values
E000 0100	Quantity specification of load profile
E000 0110	Tariff source
E000 1010	DST, day of week, day type, season
E000 1011	Telegram set
E001 0000	Readout request of active imported energy load profile in format energy register values at end of intervals
E001 0010	Readout request of reactive imported energy load profile in format energy register values at end of intervals
E001 0100	Readout request of input 1 counter load profile in format counter register values at end of intervals
E001 0110	Readout request of input 2 counter load profile in format counter register values at end of intervals
E001 1000	Readout request of maximum demand
E001 1001	Readout request of previous values
E001 1011	Readout request of current harmonics
E001 1100	Readout request of active exported energy load profile in format energy register values at end of intervals

VIFE-code	Description
E001 1110	Readout request of reactive exported energy load profile in format energy register values at end of intervals
E010 0000	Readout request of apparent imported energy load profile in format energy register values at end of intervals
E010 0010	Readout request of apparent exported energy load profile in format energy register values at end of intervals
E010 0100	Readout request of input 3 counter load profile in format counter register values at end of intervals
E010 0110	Readout request of input 4 counter load profile in format counter register values at end of intervals
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 1101	Readout request of voltage harmonics
E010 1110	System log
E011 0000	Net quality log
E011 0010	Event log
E011 0011	Event type system log
E011 0101	Event type net quality log
E011 0111	Event type event log
E011 1000	Readout request of load profile based on channel number
E100 0nnn	Energy in CO2 (kg $*10^{nnn-7}$)
E100 1nnn	Energy in currency (currency $* 10^{nnn-3}$)
E101 snnn	Level nnn (binary coding), s=1 for sliding, 0 for non-sliding

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

VIFE-code	Description
E00t opsl	Data status for load profile, t=time change, o = overflow, p = power outage during interval, s = short interval, l = long interval

Communication process

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 tele-gram from the meter is sent out.

If the meter was selected for secondary addressing it will de 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 ac-knowledge E5h), or it can omit confirmation because it did not receive the tele-gram 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 tele-gram 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.

• Selection and secondary addressing

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-factu-rer 1-2	Gene-ration[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 ad-dresses, a selection command with CI=56h, or a SND_NKE to address 253.

2.3.Standard Readout of Meter Data

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.

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.

Example of the 1st D11-D13 telegram (all values are hexadecimal)

Byte No.	Size	Value	Description
1	1	68	Start character
2	1	76	L-field, calculated from C field to last user data
3	1	76	L-field, repeated
4	1	68	Start character
5	1	08	C-filed, RSP_UD
6	1	xx	A-field, address
7	1	72	CI_filed, variable data respond, LSB first
8	4	xxxxxxxx	Identification Number, 8 BCD digits
12	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	2	0000	Signature (0000 = no encryption)
20	1	0E	DIF size 12 digit BCD
21	1	84	VIF for units kWh with reoslution 0,01 kWh
22	1	xx	VIFE status
23	6	xxxxxxxxxxxx	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 0,01 kWh
32	1	xx	VIFE status
33	6	xxxxxxxxxxxx	Active imported energy, tariff 1
39	1	8E	DIF size 12 digit BCD
40	1	20	DIFE tariff 2
41	2	84	VIF for units kWh with resolution 0,01 kWh
43	1	xx	VIFE status
44	6	xxxxxxxxxxxx	Active imported energy tariff 2
50	1	8E	DIF size 12 digit BCD
51	1	30	DIFE tariff 3
52	1	84	VIF for units kWh with resoluino 0,01 kWh
53	1	xx	VIFE status

Byte No.	Size	Value	Description
54	6	xxxxxxxxxxxx	Active imported energy tariff 3
60	1	8E	DIF size 12 BCD
61	1	80	DIFE
62	1	10	DIFE tariff 4
63	1	84	VIF for units kWh with resoltution 0,01 kWh
64	1	xx	VIFE status
65	6	xxxxxxxxxxxx	Active imported energy tariff 4
71	1	8E	DIF size 12 digit BCD
72	1	40	DIFE unit 1
73	1	84	VIF for units kWh with resolution 0,01 kWh
74	1	xx	VIFE status
75	6	xxxxxxxxxxxx	Active exported energy total
81	1	8E	DIF size 12 digit BCD
82	1	50	DIFE tariff 1 unit 1
83	1	84	VIF for units kWh resolution 0,01 kWh
84	1	xx	VIFE status
85	6	xxxxxxxxxxxx	Active exported energy tariff 1
91	1	8E	DIF size 12 digit BCD
92	1	60	DIFE tariff 2 unit 1
93	1	84	VIF for units kWh with resolution 0,01 kWh
94	1	xx	VIFE status
95	6	xxxxxxxxxxxx	Active exported energy Tariff 2
101	1	8E	DIF size 12 digit BCD
102	1	70	DIFE tariff 3 unit 1
103	1	84	VIF for units kWh with resolution 0,01 kWh
104	1	xx	VIFE status
105	6	xxxxxxxxxxxx	Active exported energy tariff 3
111	1	8E	DIF size 12 digit BCD
112	1	C0	DIFE unit 1
113	1	10	DIFE tariff 4
114	1	84	VIF for unit kWh with resolution 0,01 kWh
115	1	xx	VIFE status
116	6	xxxxxxxxxxxx	Active exported energy tariff 4
122	1	01	DIF size 8 bit integer
123	1	FF	VIF next byte is manufacturer specific
124	1	93	VIFE current tariff
125	1	xx	VIFE status
126	1	xx	Current tariff
127	1	04	DIF size 32 bit integer
128	1	FF	VIF next byte is mnaufacturer specifi c
129	1	A0	VIFE CT ratio primary current
130	1	xx	VIFE status
131	4	xxxxxxxx	Current transformer ratio primary current
135	1	04	DIF size 32 bit integer
136	1	FF	VIF next byte is manufacturer specific
137	1	A1	VIFE VT ratio primary voltage
138	1	xx	VIFE status
139	4	xxxxxxxx	Voltage transformer ratio primary voltage
143	1	04	DIF size 32 bit integer
144	1	FF	VIF next byte is manufacturer specific
145	1	A2	VIFE CT ratio secondary current
146	1	xx	VIFE status
147	4	xxxxxxxx	Current transformer ratio secondary current
151	1	04	DIF size 32 bit integer
152	1	FF	VIF next byte is manufacturer specific

Byte No.	Size	Value	Description
153	1	A3	VIFE VT ratio secondary voltage
154	1	xx	VIFE status
155	4	xxxxxxxx	Voltage transformer ratio secondary voltage
159	1	07	DIF size, 64 bit integer
160	1	FF	VIF next byte is manufacturer specific
161	1	A6	VIFE error flags (binary)
162	1	xx	VIFE status
163	8	xxxxxxxxxxxxxxxx	64 Error flags
171	1	07	DIF size 64 bit integer
172	1	FF	VIF next byte is manufacturer specific
173	1	A7	VIFE warning flags(binary)
174	1	xx	VIFE status
175	8	xxxxxxxxxxxxxxxx	64 Warning flags
183	1	07	DIF size 64 bit integer
184	1	FF	VIF next byte is manufacturer specific
185	1	A8	VIFE information flags (binary)
186	1	xx	VIFE status
187	8	xxxxxxxxxxxxxxxx	64 information flags
195	1	07	DIF size 64 bit integer
196	1	FF	VIF next byte is mnanufacturer specific
197	1	A9	VIFE alarma flags (binary)
198	1	xx	VIFE status
199	8	xxxxxxxxxxxxxxxx	64 Alarm flags
207	1	FD	VIF extension of VIF codes
208	1	8E	VIFE firmware
209	1	xx	VIFE status
210	1	0C	byte specifying length of following ASCII string, see below
211	12	xxxxxxxxxxxxxxxxxxxxxxxx	Firmware version (ASCII coded, LSB byte first), containing of a character followed by three or four numbers (0-255) separated by periods. Length can be 6-16 bytes
223	1	0D	DIF size variable length ASCII coding
224	1	FF	VIF next byte is manufacturer specific
225	1	AA	VIFE type designation
226	1	xx	VIFE status
227	1	0B	Byte specifying length
228	12	xxxxxxxxxxxxxxxxxxxxxx	Type designator (ASCII coded, LSB first)
240	1	1F	DIF more records will follow in next telegrams
241	1	xx	CS checksum calculated from C field to last data
242	1	16	Stop character

Example of 2nd D13 telegram (all values are hexadecimal)

Byte No.	Size	Value	Description
1	1	68	Start character
2	1	B1	L-field, calculated from C field to last user data
3	1	B1	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	4	xxxxxxxx	Identification Number, 8 BCD digits
12	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	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	4	xxxxxxxx	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	4	xxxxxxxx	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	4	xxxxxxxx	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	4	xxxxxxxx	Active power, L2
53	1	04	DIF size, 32 bit integer
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	4	xxxxxxxx	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	4	xxxxxxxx	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

Byte No.	Size	Value	Description
77	1	xx	VIFE status
78	4	xxxxxxxx	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	4	xxxxxxxx	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	4	xxxxxxxx	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
110	4	xxxxxxxx	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	4	xxxxxxxx	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	4	xxxxxxxx	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	4	xxxxxxxx	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

Byte No.	Size	Value	Description
153	1	FF	VIFE next byte is manufacturer specific
154	1	81	VIFE L1
155	1	xx	VIFE status
156	4	xxxxxxxx	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
166	4	xxxxxxxx	Voltage L2 - N
170	1	4	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	4	xxxxxxxx	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	4	xxxxxxxx	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	4	xxxxxxxx	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	4	xxxxxxxx	Voltage L1 - L3
210	1	04	DIF size, 32 bit integer
211	1	FD	VIF extension of VIF-codes
212	1	D9	VIFE for units A with resolution 0,001A
213	1	FF	VIFE next byte is manufacturer specific
214	1	81	VIFE L1
215	1	xx	VIFE status
216	4	xxxxxxxx	Current L1
220	1	04	DIF size, 32 bit integer
221	1	FD	VIF extension of VIF-codes
222	1	D9	VIFE for units A with resolution 0,001A
223	1	FF	VIFE next byte is manufacturer specific
224	1	82	VIFE L2
225	1	xx	VIFE status
226	4	xxxxxxxx	Current L2
230	1	04	DIF size, 32 bit integer
231	1	FD	VIF extension of VIF-codes

Byte No.	Size	Value	Description
232	1	D9	VIFE for units A with resolution 0,001A
233	1	FF	VIFE next byte is manufacturer specific
234	1	83	VIFE L3
235	1	xx	VIFE status
236	4	xxxxxxxx	Current L3
240	1	04	DIF size, 32 bit integer
241	1	FD	VIF extension of VIF-codes
242	1	D9	VIFE for units A with resolution 0,001A
243	1	FF	VIFE next byte is manufacturer specific
244	1	84	VIFE N
245	1	xx	VIFE status
246	4	xxxxxxxx	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	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

Example of 3rd D13 telegram (all values are hexadecimal)

Byte No.	Size	Value	Description
1	1	68	Start character
2	1	87	L-field, calculated from C field to last user data
3	1	87	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	4	xxxxxxxx	Identification Number, 8 BCD digits
12	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	2	0000	Signature (0000 = no encryption)
20	1	02	DIF size, 16 bit integer
21	1	FF	VIF next byte is manufacturer specific
22	1	E0	VIFE power factor with resolution 0,001
23	1	xx	VIFE status
24	2	xxxx	Power factor, Total
26	1	02	DIF size, 16 bit integer
27	1	FF	VIF next byte is manufacturer specific
28	1	E0	VIFE power factor with resolution 0,001
29	1	FF	VIFE next byte is manufacturer specific
30	1	81	VIFE L1
31	1	xx	VIFE status
32	2	xxxx	Power factor, L1
34	1	2	DIF size, 16 bit integer
35	1	FF	VIF next byte is manufacturer specific
36	1	E0	VIFE power factor with resolution 0,001
37	1	FF	VIFE next byte is manufacturer specific
38	1	82	VIFE L2
39	1	xx	VIFE status
40	2	xxxx	Power factor, L2
42	1	2	DIF size, 16 bit integer
43	1	FF	VIF next byte is manufacturer specific
44	1	E0	VIFE power factor with resolution 0,001
45	1	FF	VIFE next byte is manufacturer specific
46	1	83	VIFE L3
47	1	xx	VIFE status
48	2	xxxx	Power factor, L3
50	1	2	DIF size, 16 bit integer
51	1	FF	VIF next byte is manufacturer specific
52	1	D2	VIFE phase angle power with resolution 0.1
53	1	xx	VIFE status
54	2	xxxx	Phase angle power, Total
56	1	02	DIF size, 16 bit integer
57	1	FF	VIF next byte is manufacturer specific
58	1	8E	DIF size, 12 digit BCD
59	1	80	DIFE,
60	1	40	DIFE, unit 2
61	1	84	VIF for units kvarh with resolution 0,01kvarh
62	1	xx	VIFE status
63	6	xxxxxxxxxxxx	Reactive imported energy, Total

Byte No.	Size	Value	Description
69	1	8E	DIF size, 12 digit BCD
70	1	90	DIFE, tariff 1
71	1	40	DIFE, unit 2
72	1	84	VIF for units kvarh with resolution 0,01kvarh
73	1	xx	VIFE status
74	6	xxxxxxxxxxxx	Reactive imported energy, Tariff 1
80	1	8E	DIF size, 12 digit BCD
81	1	A0	DIFE, tariff 2
82	1	40	DIFE, unit 2
83	1	84	VIF for units kvarh with resolution 0,01kvarh
84	1	xx	VIFE status
85	6	xxxxxxxxxxxx	Reactive imported energy, Tariff 2
91	1	8E	DIF size, 12 digit BCD
92	1	B0	DIFE, tariff 3
93	1	40	DIFE, unit 2
94	1	84	VIF for units kvarh with resolution 0,01kvarh
95	1	xx	VIFE status
96	6	xxxxxxxxxxxx	Reactive imported energy, Tariff 3
102	1	8E	DIF size, 12 digit BCD
103	1	80	DIFE,
104	1	50	DIFE, tariff 4, unit 2
105	1	84	VIF for units kvarh with resolution 0,01kvarh
106	1	xx	VIFE status
107	6	xxxxxxxxxxxx	Reactive imported energy, Tariff 4
113	1	8E	DIF size, 12 digit BCD
114	1	C0	DIFE, unit bit 0
115	1	40	DIFE, unit bit 1, unit bit0-1-> unit 3
116	1	84	VIF for units kvarh with resolution 0,01kvarh
117	1	xx	VIFE status
118	6	xxxxxxxxxxxx	Reactive exported energy, Total
124	1	8E	DIF size, 12 digit BCD
125	1	D0	DIFE, tariff 1, unit bit 0
126	1	40	DIFE, unit bit 1, unit bit 0-1-> unit 3
127	1	84	VIF for units kvarh with resolution 0,01kvarh
128	1	xx	VIFE status
129	6	xxxxxxxxxxxx	Reactive exported energy, Tariff 1
135	1	8E	DIF size, 12 digit BCD
136	1	E0	DIFE, tariff 2, unit bit 0
137	1	40	DIFE, unit bit 1, unit bit 0-1-> unit 3
138	1	84	VIF for units kvarh with resolution 0,01kvarh
139	1	xx	VIFE status
140	6	xxxxxxxxxxxx	Reactive exported energy, Tariff 2
146	1	8E	DIF size, 12 digit BCD
147	1	F0	DIFE, tariff 3, unit bit 0
148	1	40	DIFE, unit bit 1, unit bit 0-1-> unit 3
149	1	84	VIF for units kvarh with resolution 0,01kvarh
150	1	xx	VIFE status
151	6	xxxxxxxxxxxx	Reactive exported energy, Tariff 3
157	1	8E	DIF size, 12 digit BCD
158	1	C0	DIFE, unit bit 0
159	1	50	DIFE, tariff 4, unit bit 1, unit bit 0-1-> unit 3
160	1	84	VIF for units kvarh with resolution 0,01kvarh
161	1	xx	VIFE status
162	6	xxxxxxxxxxxx	Reactive exported energy, Tariff 4
168	1	01	DIF size, 8 bit integer

Byte No.	Size	Value	Description
169	1	FF	VIF next byte is manufacturer specific
170	1	AD	VIFE number of elements
171	1	xx	VIFE status
172	1	xx	Wiring setting
173	1	01	DIF size, 8 bit integer
174	1	FF	VIF next byte is manufacturer specific
175	1	97	VIFE current quadrant
176	1	xx	VIFE status
177	1	xx	Current quadrant, total
178	1	01	DIF size, 8 bit integer
179	1	FF	VIF next byte is manufacturer specific
180	1	97	VIFE current quadrant
181	1	FF	VIF next byte is manufacturer specific
182	1	81	VIFE L1
183	1	xx	VIFE status
184	1	xx	Current quadrant, L1
185	1	01	DIF size, 8 bit integer
186	1	FF	VIF next byte is manufacturer specific
187	1	97	VIFE current quadrant
188	1	FF	VIF next byte is manufacturer specific
189	1	82	VIFE L2
190	1	xx	VIFE status
191	1	xx	Current quadrant, L2
192	1	01	DIF size, 8 bit integer
193	1	FF	VIF next byte is manufacturer specific
194	1	97	VIFE current quadrant
195	1	FF	VIF next byte is manufacturer specific
196	1	83	VIFE L3
197	1	xx	VIFE status
198	1	xx	Current quadrant, L3
199	1	1F	DIF, more records will follow in next telegram
200	1	xx	CS checksum, calculated from C field to last data
201	1	16	Stop character

Example of the 4th D13 telegram (all values are hexadecimal)

Byte No.	Size	Value	Description
1	1	68	Start character
2	1	BF	L-field, calculated from C field to last user data
3	1	BF	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	4	xxxxxxxx	Identification Number, 8 BCD digits
9	2	4204	Manufacturer: ABB
10	1	02	Version
12	1	02	Medium, 02 = Electricity
13	1	xx	Number of accesses
14	1	xx	Status
15	2	0000	Signature (0000 = no encryption)
16	1	81	DIF size, 8 bit integer
17	1	40	DIFE (Unit = 1)
18	1	FD	VIF extension of VIF-codes
19	1	9A	VIFE digital output
20	1	xx	VIFE status
21	1	xx	Output 1, current state
22	1	81	DIF size, 8 bit integer
23	1	80	DIFE,
24	1	40	DIFE (Unit = 2)
25	1	FD	VIF extension of VIF-codes
36	1	9A	VIFE digital output
37	1	xx	VIFE status
38	1	xx	Output 2, current state

Byte No.	Size	Value	Description
29	1	81	DIF size, 8 bit integer
30	1	C0	DIFE (Unit = 1)
31	1	40	DIFE (Unit = 2)
32	1	FD	VIF extension of VIF-codes
33	1	9B	VIFE digital input
34	1	xx	VIFE status
35	1	xx	Input 1 current state
36	1	81	DIF size, 8 bit integer
37	1	80	DIFE,
38	1	80	DIFE,
39	1	40	DIFE (Unit = 4)
40	1	FD	VIF extension of VIF-codes
41	1	9B	VIFE digital input
42	1	xx	VIFE status
42	1	xx	Input 2 current state
44	1	C1	DIF size, 8 bit integer, storage number 1
45	1	C0	DIFE (Unit = 1)
46	1	40	DIFE (Unit = 2)
47	1	FD	VIF extension of VIF-codes
48	1	9B	VIFE digital input
49	1	xx	VIFE status
50	1	xx	Input 3, stored state (1 if current state has been 1)
51	1	C1	DIF size, 8 bit integer, storage number 1
52	1	80	DIFE,
53	1	80	DIFE,
54	1	40	DIFE (Unit = 4)
55	1	FD	VIF extension of VIF-codes
56	1	9B	VIFE digital input
57	1	xx	VIFE status
58	1	xx	Input 4, stored state (1 if current state has been 1)
59	1	8E	DIF size, 12 digit BCD
60	1	C0	DIFE (Unit = 1)
61	1	40	DIFE (Unit = 2)
62	1	FD	VIF extension of VIF-codes
63	1	E1	VIFE cumulating counter
64	1	xx	VIFE status
65	6	xxxxxxxxxxxx	Counter 1 (input 1)
66	1	8E	DIF size, 12 digit BCD
67	1	80	DIFE,
68	1	80	DIFE,

Byte No.	Size	Value	Description
69	1	40	DIFE (Unit = 4)
70	1	FD	VIF extension of VIF-codes
71	1	E1	VIFE cumulating counter
72	1	xx	VIFE status
73	6	xxxxxxxxxxxx	Counter 2 (input 2)
74	1	0E	DIF size, 12 digit BCD
75	1	84	VIF for units kWh with resolution 0,01kWh
76	1	FF	VIFE next byte is manufacturer specific
77	1	F2	VIFE resettable energy
78	1	xx	VIFE status
79	6	xxxxxxxxxxxx	Resettable active imported energy, Total
80	1	8E	DIF size, 12 digit BCD
81	1	40	DIFE (Unit = 1)
82	1	84	VIF for units kWh with resolution 0,01kWh
83	1	FF	VIFE next byte is manufacturer specific
84	1	F2	VIFE resettable energy
85	1	xx	VIFE status
86	6	xxxxxxxxxxxx	Resettable active exported energy, Total
87	1	8E	DIF size, 12 digit BCD
88	1	80	DIFE
89	1	40	DIFE (Unit = 2)
90	1	84	VIF for units kvarh with resolution 0,01kvarh
91	1	FF	VIFE next byte is manufacturer specific
92	1	F2	VIFE resettable energy
93	1	xx	VIFE status
94	6	xxxxxxxxxxxx	Resettable reactive imported energy, Total
95	1	8E	DIF size, 12 digit BCD
96	1	C0	DIFE (Unit = 1)
97	1	40	DIFE (Unit = 2)
98	1	84	VIF for units kvar with resolution 0,01kvarh
99	1	FF	VIFE next byte is manufacturer specific
100	1	1F	DIF, more records will follow in next telegram
101	1	F2	VIFE resettable energy
102	1	xx	VIFE status
103	6	xxxxxxxxxxxx	Resettable reactive exported energy, Total
104	1	04	DIF size, 32 bit integer
105	1	FF	VIFE next byte is manufacturer specific
106	1	F1	VIFE reset counter
107	1	xx	VIFE status
108	4	xxxxxxxx	Reset counter for active imported energy, Total
109	1	84	DIF size, 32 bit integer
110	1	40	DIFE (Unit = 1)
111	1	FF	VIFE next byte is manufacturer specific
112	1	F1	VIFE reset counter
113	1	xx	VIFE status
114	4	xxxxxxxx	Reset counter for active exported energy, Total
115	1	84	DIF size, 32 bit integer
116	1	80	DIFE
117	1	40	DIFE (Unit = 2)
118	1	FF	VIFE next byte is manufacturer specific
119	1	F1	VIFE reset counter
120	1	xx	VIFE status
121	4	xxxxxxxx	Reset counter reactive imported energy, Total
122	1	84	DIF size, 32 bit integer
123	1	C0	DIFE (Unit = 1)

Byte No.	Size	Value	Description
124	1	40	DIFE (Unit = 2)
125	1	FF	VIFE next byte is manufacturer specific
126	1	F1	VIFE reset counter
127	1	xx	VIFE status
128	4	xxxxxxxx	Reset counter reactive exported energy, Total
129	1	0E	DIF size, 12 digit BCD
130	1	FF	VIFE next byte is manufacturer specific
131	1	F9	VIF extension of manufacturer specific VIFE's
132	1	C4	Energy in CO2 with resolution 0,001 kg
133	1	xx	VIFE status
134	6	xxxxxxxxxxxx	CO2 for active imported energy, Total
135	1	0E	DIF size, 12 digit BCD
136	1	FF	VIFE next byte is manufacturer specific
137	1	F9	VIF extension of manufacturer specific VIFE's
138	1	C9	Energy in Currency with resolution 0,01 currency
138	1	xx	VIFE status
140	6	xxxxxxxxxxxx	Currency for active imported energy, Total
141	1	04	DIF size, 32 digits integer
142	1	FF	VIFE next byte is manufacturer specific
143	1	24	VIF for CO2 conversion factor Kg/kWh
144	1	xx	VIFE status
145	4	xxxxxxxx	CO2 conversion factor Kg/kWh
146	1	04	DIF size, 32 digits integer
147	1	FF	VIFE next byte is manufacturer specific
148	1	24	VIF for CUR conversion factor CUR/kWh
149	1	xx	VIFE status
150	4	xxxxxxxx	CUR conversion factor Kg/kWh
151	1	84	DIF size 32 bit integer
152	1	80	DIFE (unit = 0)
153	1	80	DIFE (unit = 0)
154	1	40	DIFE (unit = 1, => x100 (4))
155	1	A9	VIF for units VA with resolution 0,01 VA
156	1	xx	VIFE status
157	6	xxxxxxxxxxxx	Import apparent energy, Total
158	1	84	DIF size 32 bit integer
159	1	C0	DIFE (unit = 0)
160	1	80	DIFE (unit = 0)
161	1	40	DIFE (unit = 1, => x100 (4))
162	1	A9	VIF for units VA with resolution 0,01 VA
163	1	xx	VIFE status
164	6	xxxxxxxxxxxx	export apparent energy, Total
165	1	1F	DIF, more records will follow in next telegram
166	1	xx	CS checksum, calculated from C field to last data
167	1	16	Stop character

Example of the 5th D13 telegram (all values are hexadecimal)

Byte No.	Size	Value	Description
1	1	68	Start character
2	1	93	L-field, calculated from C field to last user data
3	1	93	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	4	xxxxxxxx	Identification Number, 8 BCD digits
12	2	4204	Manufacturer: ABB
14	1	02	Version
15	1	01	Medium, 02 = Electricity
16	1	xx	Number of accesses
17	1	xx	Status
18	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
24	1	xx	VIFE status
25	6	xxxxxxxxxxxx	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	6	xxxxxxxxxxxx	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	6	xxxxxxxxxxxx	Active imported energy, L3
53	1	8E	DIF size, 12 digit BCD
54	1	40	DIFE, Unit 1
55	1	84	VIF for units kWh with resolution 0,01kWh
56	1	FF	VIFE next byte is manufacturer specific
57	1	81	VIFE L1
58	1	xx	VIFE status
59	6	xxxxxxxxxxxx	Active exported energy, L1
65	1	8E	DIF size, 12 digit BCD
66	1	40	DIFE, Unit 1
67	1	84	VIF for units kWh with resolution 0,01kWh
68	1	FF	VIFE next byte is manufacturer specific
69	1	82	VIFE L2
70	1	xx	VIFE status
71	6	xxxxxxxxxxxx	Active exported energy, L2
77	1	8E	DIF size, 12 digit BCD
78	1	40	DIFE, Unit 1
79	1	84	VIF for units kWh with resolution 0,01kWh
80	1	FF	VIFE next byte is manufacturer specific
81	1	83	VIFE L3
82	1	xx	VIFE status
83	6	xxxxxxxxxxxx	Active exported energy, L3

Byte No.	Size	Value	Description
89	1	8E	DIF size, 12 digit BCD
90	1	80	DIFE
91	1	40	DIFE, Unit 2
92	1	84	VIF for units kvarh with resolution 0,01 kvarh
93	1	FF	VIFE next byte is manufacturer specific
94	1	81	VIFE L1
95	1	xx	VIFE status
96	6	xxxxxxxxxxxx	Reactive imported energy, L1
102	1	8E	DIF size, 12 digit BCD
103	1	80	DIFE
104	1	40	DIFE, Unit 2
105	1	84	VIF for units kvarh with resolution 0,01 kvarh
106	1	FF	VIFE next byte is manufacturer specific
107	1	82	VIFE L2
108	1	xx	VIFE status
109	6	xxxxxxxxxxxx	Reactive imported energy, L2
115	1	8E	DIF size, 12 digit BCD
116	1	80	DIFE
117	1	40	DIFE, Unit 2
118	1	84	VIF for units kvarh with resolution 0,01 kvarh
119	1	FF	VIFE next byte is manufacturer specific
120	1	83	VIFE L3
121	1	xx	VIFE status
122	6	xxxxxxxxxxxx	Reactive imported energy, L3
128	1	8E	DIF size, 12 digit BCD
129	1	C0	DIFE, Unit bit 0
130	1	40	DIFE, Unit bit 1, unit bit0-1-> unit 3
131	1	84	VIF for units kvarh with resolution 0,01 kvarh
132	1	FF	VIFE next byte is manufacturer specific
133	1	81	VIFE L1
134	1	xx	VIFE status
135	6	xxxxxxxxxxxx	Reactive exported energy, L1
141	1	8E	DIF size, 12 digit BCD
142	1	C0	DIFE, Unit bit 0
143	1	40	DIFE, Unit bit 1, unit bit0-1-> unit 3
144	1	84	VIF for units kvarh with resolution 0,01 kvarh
145	1	FF	VIFE next byte is manufacturer specific
146	1	82	VIFE L2
147	1	xx	VIFE status
148	6	xxxxxxxxxxxx	Reactive exported energy, L2
154	1	8E	DIF size, 12 digit BCD
155	1	C0	DIFE, Unit bit 0
156	1	40	DIFE, Unit bit 1, unit bit0-1-> unit 3
157	1	84	VIF for units kvarh with resolution 0,01 kvarh
158	1	FF	VIFE next byte is manufacturer specific
159	1	83	VIFE L3
160	1	xx	VIFE status
161	6	xxxxxxxxxxxx	Reactive exported energy, L3
167	1	8E	DIF size, 12 digit BCD
168	1	80	DIFE
169	1	80	DIFE
170	1	40	DIFE, Unit 4
171	1	84	VIF for unit kVAh with resolution 0,01kVAh
172	1	FF	VIFE next byte is manufacturer specific
173	1	81	VIFE L1

Byte No.	Size	Value	Description
174	1	xx	VIFE status
175	6	xxxxxxxxxxxx	Apparent imported energy, L1
181	1	8E	DIF size, 12 digit BCD
182	1	80	DIFE
183	1	80	DIFE
184	1	40	DIFE, Unit 4
185	1	84	VIF for unit kVAh with resolution 0,01kVAh
186	1	FF	VIFE next byte is manufacturer specific
187	1	82	VIFE L2
188	1	xx	VIFE status
189	6	xxxxxxxxxxxx	Apparent imported energy, L2
195	1	8E	DIF size, 12 digit BCD
196	1	80	DIFE
197	1	80	DIFE
198	1	40	DIFE, Unit 4
199	1	84	VIF for unit kVAh with resolution 0,01kVAh
200	1	FF	VIFE next byte is manufacturer specific
201	1	83	VIFE L3
202	1	xx	VIFE status
203	6	xxxxxxxxxxxx	Apparent imported 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	6	xxxxxxxxxxxx	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
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	6	xxxxxxxxxxxx	Apparent exported energy, L2
223	1	8E	DIF size, 12 digit BCD
237	1	C0	DIFE, Unit bit 0
225	1	80	DIFE, Unit bit 1
238	1	40	DIFE, Unit bit 2, unit bit0-2-> unit 5
227	1	84	VIF for unit kVAh with resolution 0,01kVAh
239	1	FF	VIFE next byte is manufacturer specific
229	1	82	VIFE L3
240	1	xx	VIFE status
231	6	xxxxxxxxxxxx	Apparent exported energy, L3
241	1	1F	DIF, more records will follow in next telegram
242	1	xx	CS checksum
243	1	16	Stop character

Example of the 6th D13 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	8	C-field, RSP_UD
6	1	xx	A-field, address
7	1	72	CI-field, variable data respond, LSB first
8	4	xxxxxxxx	Identification Number, 8 BCD digits
12	2	4204	Manufacturer: ABB
14	1	2	Version
15	1	2	Medium, 02 = Electricity
16	1	xx	Number of accesses
17	1	xx	Status
18	2	0	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	6	xxxxxxxxxxxx	Active net energy, Total
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	6	xxxxxxxxxxxx	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	6	xxxxxxxxxxxx	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	6	xxxxxxxxxxxx	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

Byte No.	Size	Value	Description
79	1	xx	VIFE status
80	6	xxxxxxxxxxxx	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
93	1	xx	VIFE status
94	6	xxxxxxxxxxxx	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	6	xxxxxxxxxxxx	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	6	xxxxxxxxxxxx	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	6	xxxxxxxxxxxx	Apparent 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	6	xxxxxxxxxxxx	Apparent energy, L1
156	1	8E	DIF size, 12 digit BCD
157	1	80	DIFE
158	1	80	DIFE
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

Byte No.	Size	Value	Description
164	1	xx	VIFE status
165	6	xxxxxxxxxxxx	Apparent 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	6	xxxxxxxxxxxx	Apparent energy, L3
186	1	0F	DIF, no more records will follow in next telegram
187	1	xx	CS checksum, calculated from C field to last data
188	1	16	Stop character

2.4.Special Readout of Meter Data

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

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 re-peated REQ_UD2 commands

If the data item that has been read is normal and without any specific status asso-ciated 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:

- Logs

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	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	8x or Cx	DIF size, 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	1	FF	VIF next byte is manufacturer specific
14	1	F9	VIF extension of manufacturer specific VIFE's, next VIFE specifies actual meaning.
15	1	xx	VIFE Specification for different Logs: Error Log = 0x2e Alarm Log = 0x30 Warning Log = 0x32
16	1	xx	CS checksum, calculated from C field to last data
17	1	16	Stop character

Event Offset

The meter supports offset values 0 and -1 for reading the System, Event, 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)
- Duration of the event (in seconds)

• **Example of readout of log data**

Readout of Warning Logs

Send Nke.

10 40 fe 3e 16

Meter Responds with E5

Read request warning logs with Offset -1 (reading from most recent log data).

68 08 08 68 73 FE 51 C0 40 FF F9 30 3D 16

Meter Responds with E5.

Send Req UD2.

10 7B FE 79 16.

Reading telegram 1
68 8D 8D 68 08 00 72 00 00 00 80 42 04 23 02 A2 00 00 00 02 FF F9 B7 80 00 E7 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 E6 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 E5 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 E4 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 DE 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 1F 3C 16

Sending Request User Data 2
10 5B FE 59 16

Reading telegram 2
68 8D 8D 68 08 00 72 00 00 00 80 42 04 23 02 A3 00 00 00 02 FF F9 B7 80 00 E3 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 E2 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 E1 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 E0 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 DD 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 1F 2C 16

Sending Request User Data 2
10 7B FE 79 16

Reading telegram 3
68 8D 8D 68 08 00 72 00 00 00 80 42 04 23 02 A4 00 00 00 02 FF F9 B7 80 00 DF 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 DE 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 DD 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 15 00 00 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 15 00 00 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 0F 70 16

How to read a telegram (Telegram 1):
68 8D 8D 68 08 00 72 00 00 00 80 42 04 23 02 A2 00 00 00 02 FF F9 B7 80 00 E7 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 E6 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 E5 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 E4 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 02 FF F9 B7 80 00 DE 07 0E ED B9 15 00 00 00 00 00 00 04 A0 15 00 00 00 00 1F 3C 16

Log
02: DIB - 2 Bytes integer
FF F9 B7 80 00 : VIB for alarm log
E7 07: Data value = Event ID 2023 (Alarm 11 active)
Date and Time
0E: BCD6 bytes
ED B9: VIB for date and time
15: Vife status (data is not available on D11 and D13)
00 00 00 00 00 00: Data value
Duration
04: DIB 4 bytes integer
A0: VIB for duration
15: VIFE status (data is not available on D11 and D13)
00 00 00 00: Data value

2.5.Sending Data to the Meter

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 pro-tection, the access level has to be set to Open via the buttons directly on the meter.

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.

Set tariff

For meters with tariff control the active tariff is set by sending the following com-mand (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	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

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

Change baud rate

The baud rate 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.

After the baud rate has been changed a command must be sent to the meter (any command, for example NKE or REQ_UD2) that is received correctly by the me-ter before a certain time out time (normally 30 seconds) for the meter to keep the new baud rate. Otherwise the meter falls back to use the baud rate that was used before the baud rate change. This functionality is used to prevent changing to a baud rate that doesn't work for some reason.

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 baud rate (where x=>8..F)
8	1	xx	CS checksum, calculated from C field to last data
9	1	16	Stop character

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 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	C0	DIFE unit = 1
10	1	40	DIFE unit = 1
11	1	FD	VIF extension of VIF Codes
12	1	E1	VIFE Cumulating Counters
13	1	07	VIFE Clear
14	1	xx	CS checksum
15	1	16	Stop Character

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

Send access Mbus 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

Set access Mbus password

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

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	xxxxxxxxxxxxxxxx	Password
20	1	xx	CS checksum, calculated from C field to last data
21	1	16	Stop character

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

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

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

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

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

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 hexa-decimal). 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 (1: Communication command, 2: Inputs)
13	1	xx	CS checksum, calculated from C field to last data
14		16	Stop character

Set CO2 conversion factor

The co2 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	24	VIFE CO2 conversion factor in g/kWh
11-14	4	xxxxxxxx	CO2 conversion factor
15	1	xx	CS checksum, calculated from C field to last data
16	1	16	Stop character

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	xxxxxxxx	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

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