

PIPERSBERG

M-Bus Telegram Format and Description



 octave

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1. M-Bus Module system Telegram Data Sets

Data set	Register Name	Type	Bit	Value
1	Error Flags	Bitwise Int16	- 0 1 2 3 4 5 6 7 8 9 10	0x0000 - OK 0x0001 - Leakage 0x0002 - Pipe Burst 0x0004 - Reverse Flow 0x0008 - Dry 0x0010 - Critical Configuration 0x0020 - Measurement Fail 0x0040 - Tamper 0x0080 - Battery 0x0100 - Units Change 0x0200 - Watch Dog 0x0400 - Service Required
2	AMR Serial Number (special supplier information)	16 values of Int 8 array	[MSB] [LSB] [0][1][2]...[15]	
3	Time point	Int8		Module Date and Time dd/mm/yy hh:mm:ss
4	Volume accumulation positive value	double		Forward volume. Contain volume resolution and measurement units.
5	Volume accumulation negative value	double		Reverse volume. Contain volume resolution and measurement units.
6	Volume flow	float		Current flow. Contain flow resolution and measurement units.
7	Flow temperature	float		Current temperature in °C all time.
8	Net Signed Volume	double		Net signed volume. Contain volume resolution and measurement units.
9	Net Unsigned Volume	double		Net unsigned volume. Contain volume resolution and measurement units.

2. M-Bus Module system parameters units

Name	Value type
Serial communication Baud Rate	300, 2400 (default), 9600.
Serial communication Parity Configuration	0 – Even 1 – Odd 2 – None (default)
Flow Units	0 – Cubic Meters/Hour (default) 1 – US Gallons/Minute
Flow Resolution	[0] = 0.001x , [1] = 0.01x, [2] = 0.1x, [3] = 1x (default), [4] = 10x, [5] = 100x, [6] = 1000x [7] = 10000x For example: if index= 3 -> Flow resolution = 1
Volume Units	0 – Cubic Meters (default) 1 – Cubic Feet 4 – US Gallons
Volume Resolution	[0] = 0.001x , [1] = 0.01x, [2] = 0.1x, [3] = 1x (default), [4] = 10x, [5] = 100x, [6] = 1000x [7] = 10000x For example: if index= 3-> Volume resolution = 1

3. Octave Mbus module settings

The screenshot displays the Octave User Interface (Version: 4.0003 b57) with the 'Alarms' tab selected. The interface includes a top status bar with meter and software information, a central settings panel, and a bottom status bar.

Meter Information:
Meter Type: 2" ISO
Meter ID: 8ARD0100002058
HW ID: 0602180789
Calib. Date: 160418

Software Information:
Version: 4.01.39
ASIC Version: 20.16384.1
Checksum: 0x74780BF7
Comp. Date: Jan 3 2017

Alarms Settings:
Type: Mbus
Mode: Mbus
Slave Address: 1 [1 - 250] Baud Rate: 2400
Mode: Polling Polling Period (min): 6
AMR Serial Number: 8ARD0100002058
Units: Flow Rate: m³ / h - Volume: m³
Flow Resolution: 1 Volume Resolution: 1

Alarms List:
 Low Battery Measurement Fail
 Leakage Flow Rate Alarm
 Reverse Flow Tamper Detection
 Pipe Burst
 Dry Pipe

Buttons: Disconnect, Read Device Values, Tool Box, Settings, Logs, Apply

Status Bar: CONNECTION Error Report

4. Octave Simulator settings

The screenshot shows the 'Flow Simulation' dialog box with the following settings:

Flow Simulation: OFF

Flow (m³ / h): 26.500

Positive Volume (m³): 1534.000

Negative Volume (m³): 0.000

5. Mbus Master read result

M-Bus Sheet V2.0 demo version

Location	Addr.	ID	Baud	Man	Version	Medium	Data sets
	1	00000000	2400	ARD	12	Water	1,2,3,4,5,6,7,8,9,10

Slaves: 1 COM-port: COM4
 Search baud rate(s): 2400
 GSM-modem (8N1)
 SND_NKE Search_addr.
 Multi Tel. Search id
 App. Res. Read M-Bus
 Time interval [s]: 10 Poll M-Bus
 Status: idle Log M-Bus Modem
 Write log to file IDS+ MDK

Print slavelist Save slavelist Load slavelist Delete doubles CSV separator

Addr.	ID-no.	Man	No.	Value	Unit	Description	Type	Module	St.-No.
1	00000000	ARD	1	\$0000		error flags	error	0	0
1	00000000	ARD	2	A300820160925		special supplier information	instant.	0	0
1	00000000	ARD	3	30.08.16 09:31:12 Win V		time point	instant.	0	0
1	00000000	ARD	4	123456247.1	m ³	volume accumulation positiv	instant.	0	0
1	00000000	ARD	5	123456789.4	m ³	volume accumulation negativ	instant.	0	0
1	00000000	ARD	6	0.36	m ³ /h	volume flow	instant.	0	0
1	00000000	ARD	7	0.000	°C	flow temperature	instant.	0	0

Print data Save data Load data Clear data Import Register Zoom data

```
68 6C 6C 68 08 01 72 00 00 00 00 44 06 0C 07 01 00 00 00 32 FD 17 00 00 00 FD 67 10 00 00 00 35 32
39 30 36 31 30 32 38 30 30 33 41 06 6D 0C 1F 09 1E 28 00 07 96 BB 75 A7 ED 95 49 00 00 00 00 07 96
BC 75 D6 02 96 49 00 00 00 04 3C 24 00 00 00 05 58 00 00 00 07 96 90 75 D1 EA FF FF FF FF FF FF
FF 07 96 90 75 D1 B4 9A 38 00 00 00 00 00 16
```

Clear log Exit

M-Bus Sheet V2.0 demo version

Location	Addr.	ID	Baud	Man	Version	Medium	Data sets
	1	00000000	2400	ARD	12	Water	1,2,3,4,5,6,7,8,9,10

Slaves: 1 COM-port: COM4
 Search baud rate(s): 2400
 GSM-modem (8N1)
 SND_NKE Search_addr.
 Multi Tel. Search id
 App. Res. Read M-Bus
 Time interval [s]: 10 Poll M-Bus
 Status: idle Log M-Bus Modem
 Write log to file IDS+ MDK

Print slavelist Save slavelist Load slavelist Delete doubles CSV separator

Addr.	ID-no.	Man	No.	Value	Unit	Description	Type	Module	St.-No.
1	00000000	ARD	4	123456247.1	m ³	volume accumulation positiv	instant.	0	0
1	00000000	ARD	5	123456789.4	m ³	volume accumulation negativ	instant.	0	0
1	00000000	ARD	6	0.36	m ³ /h	volume flow	instant.	0	0
1	00000000	ARD	7	0.000	°C	flow temperature	instant.	0	0
1	00000000	ARD	8	-542.3	m ³	volume	instant.	0	0
1	00000000	ARD	9	99999457.7	m ³	volume	instant.	0	0
1	00000000	ARD	10	\$00		M-Bus state			

Print data Save data Load data Clear data Import Register Zoom data

```
68 6C 6C 68 08 01 72 00 00 00 00 44 06 0C 07 01 00 00 00 32 FD 17 00 00 00 FD 67 10 00 00 00 35 32
39 30 36 31 30 32 38 30 30 33 41 06 6D 0C 1F 09 1E 28 00 07 96 BB 75 A7 ED 95 49 00 00 00 00 07 96
BC 75 D6 02 96 49 00 00 00 04 3C 24 00 00 00 05 58 00 00 00 07 96 90 75 D1 EA FF FF FF FF FF FF
FF 07 96 90 75 D1 B4 9A 38 00 00 00 00 00 16
```

Clear log Exit

6. Telegram detailed description

6.1 Slave (Octave) to Master response

68 6C 6C 68 08 01 72 00 00 00 00 44 06 0C 07 01 00 00 00 32 FD 17 00 00 0D FD 67 10 00 00 00
 35 32 39 30 36 31 30 32 38 30 30 33 41 06 6D 0C 1F 09 1E 28 00 07 96 BB 75 A7 ED 95 49 00 00
 00 00 07 96 BC 75 D6 02 96 49 00 00 00 00 04 3C 24 00 00 00 05 5B 00 00 00 00 07 96 75 D1 EA
 FF FF FF FF FF FF 07 96 75 D1 B4 9A 3B 00 00 00 00 09 16

6.2 Long Frame Fields

6.2.1 Start character, Length field

68 – Start

6C – L Field

6C – L Field

68 – Start

6.2.2 Control Field, Functional Field

08 – C Field. Long Frame. Data Transfer from Slave **MBDOC48X** (Table 1)

Name	C Field Binary	C Field Hex.	Telegram	Description
SND_NKE	0100 0000	40	Short Frame	Initialization of Slave
SND_UD	01F1 0011	53/73	Long/Control Frame	Send User Data to Slave
REQ_UD2	01F1 1011	5B/7B	Short Frame	Request for Class 2 Data
REQ_UD1	01F1 1010	5A/7A	Short Frame	Request for Class1 Data (see 8.1: Alarm Protocol)
RSP_UD	00AD 1000	08/18/28/38	Long/Control Frame	Data Transfer from Slave to Master after Request

Table 1 Control Codes of the M-Bus Protocol (F : FCB-Bit, A : ACD-Bit, D : DFC-Bit)

6.2.3 Primary Address

01 – A Field. Slave Address

6.2.4 Control Information Field (CI)

72 – CI Filed. Variable Data Response **MBDOC48X** (Table 4)

CI M=0	CI M=1	Application	Defined in
70h		report of general application errors	Usergroup March '94
71h		report of alarm status	Usergroup March '94
72h	76h	variable data respond	EN1434-3
73h	77h	fixed data respond	EN1434-3

Table 4 CI-Field codes used by the slave

6.2.5 Secondary Address

00 00 00 00 – ID 8 BCD numbers (Example 78 56 34 12 -> ID=12345678)

6.2.6 Manufacturer ID

44 06 – Manufacturer ID. ARD. Formula:

The field **manufacturer** is coded unsigned binary with 2 bytes. This manufacturer ID is calculated from the ASCII code of EN 61107 manufacturer ID (three uppercase letters) with the following formula:

$$\begin{aligned}
 \text{IEC 870 Man. ID} &= [\text{ASCII}(1\text{st letter}) - 64] \cdot 32 \cdot 32 \\
 &+ [\text{ASCII}(2\text{nd letter}) - 64] \cdot 32 \\
 &+ [\text{ASCII}(3\text{rd letter}) - 64]
 \end{aligned}$$

6.2.7 Octave Mbus module SW version

0C – Module SW Version (12)

6.2.8 Measured Medium

07 – Water

8.4.1 Measured Medium Variable Structure

Medium	Code bin. Bit 7 .. 0	Code hex.
Other	0000 0000	00
Oil	0000 0001	01
Electricity	0000 0010	02
Gas	0000 0011	03
Heat (Volume measured at return temperature: outlet)	0000 0100	04
Steam	0000 0101	05
Hot Water	0000 0110	06
Water	0000 0111	07
Heat Cost Allocator.	0000 1000	08

6.2.9 Transmission Counter

01 – Transmission Counter. History 6 transmissions

6.2.10 Mbus State

00 – Errors State of meter

6.2.11 Signature (Not in use)

00 00 – Signature 1 and 2 (not in use)

6.2.12 Error Flags

32 FD 17 00 00 – Error Flags

0x32 – DIF. 0x32=00110010

0 – Extension bit. No DIF byte following. Next byte is VIF

0 – Storage number. Not in use

11 – Function field

Code	Description	Code	Description
00b	Instantaneous value	01b	Maximum value
10b	Minimum value	11b	Value during error state

0010 – Data Field

Length in Bit	Code	Meaning	Code	Meaning
0	0000	No data	1000	Selection for Readout
8	0001	8 Bit Integer	1001	2 digit BCD
16	0010	16 Bit Integer	1010	4 digit BCD
24	0011	24 Bit Integer	1011	6 digit BCD
32	0100	32 Bit Integer	1100	8 digit BCD
32 / N	0101	32 Bit Real	1101	variable length
48	0110	48 Bit Integer	1110	12 digit BCD
64	0111	64 Bit Integer	1111	Special Functions

Table 5 Coding of the data field

0xFD – VIF. In case of VIF = FDh and VIF = FBh the true VIF is given by the next byte and the coding is taken from the table for secondary VIF (8.4.4 Extension of primary VIF-Codes)

0x17 – Primary VIFE. 0x17=00010111

0 – Extension bit (E) = 0: no VIF byte following, next byte is value:

0010111 – Error flags (binary). See 8.4.4 Extension of primary VIF-Codes

a) Codes used with extension indicator SFD

Coding	Description	Group
E000 00nn	Credit of 10 ⁿⁿ⁻³ of the nominal local legal currency units	Currency Units
E000 01nn	Debit of 10 ⁿⁿ⁻³ of the nominal local legal currency units	
E000 1000	Access Number (transmission count)	Enhanced Identification
E000 1001	Medium (as in fixed header)	
E000 1010	Manufacturer (as in fixed header)	
E000 1011	Parameter set identification	
E000 1100	Model / Version	
E000 1101	Hardware version #	
E000 1110	Firmware version #	
E000 1111	Software version #	
E001 0000	Customer location	Implementation of all TC294 WG1 requirements (improved selection ..)
E001 0001	Customer	
E001 0010	Access Code User	
E001 0011	Access Code Operator	
E001 0100	Access Code System Operator	
E001 0101	Access Code Developer	
E001 0110	Password	
E001 0111	Error flags (binary)	
E001 1000	Error mask	
E001 1001	Reserved	

0x0000 – Value Field

Bit	Value
-	0x0000 - OK
0	0x0001 - Leakage
1	0x0002 - Pipe Burst
2	0x0004 - Reverse Flow
3	0x0008 - Dry
4	0x0010 - Critical Configuration
5	0x0020 - Measurement Fail
6	0x0040 - Tamper
7	0x0080 - Battery
8	0x0100 - Units Change
9	0x0200 - Watch Dog
10	0x0400 - Service Required

6.2.13 Special Supplier Information (AMR Serial Number)

0D FD 67 10 00 00 00 35 32 39 30 36 31 30 32 38 30 33 41 – Special Supplier Information (AMR SN)

0x0D – DIF. 0x0D = **00001101**

0 – Extension bit. No DIF byte following. Next byte is VIF

0 – Storage number. Not in use

00 – Function field

Code	Description	Code	Description
00b	Instantaneous value	01b	Maximum value
10b	Minimum value	11b	Value during error state

1101 – Data Field

Length in Bit	Code	Meaning	Code	Meaning
0	0000	No data	1000	Selection for Readout
8	0001	8 Bit Integer	1001	2 digit BCD
16	0010	16 Bit Integer	1010	4 digit BCD
24	0011	24 Bit Integer	1011	6 digit BCD
32	0100	32 Bit Integer	1100	8 digit BCD
32 / N	0101	32 Bit Real	1101	variable length
48	0110	48 Bit Integer	1110	12 digit BCD
64	0111	64 Bit Integer	1111	Special Functions

Table 5 Coding of the data field

0xFD – VIF. In case of VIF = FDh and VIF = FBh the true VIF is given by the next byte and the coding is taken from the table for secondary VIF (chapter 8.4.4)

0x67 – Primary VIFE. (chapter 8.4.4) 0x67=01100111

0 – Extension bit (E) = 0: no VIF byte following, next byte is value:

1100111 – Special supplier information. See chapter 8.4.4

Coding	Description	Group
E110 0000	Reset counter	
E110 0001	Cumulation counter	
E110 0010	Control signal	
E110 0011	Day of week	
E110 0100	Week number	
E110 0101	Time point of day change	
E110 0110	State of parameter activation	
E110 0111	Special supplier information	
E110 10pp	Duration since last cumulation [hour(s)..years(s)] ●	

0x10 – 1e+0

00 00 00 35 32 39 30 36 31 30 32 38 30 30 33 41 – A300820160925

6.2.14 Time Stamp

06 6D 0B 35 14 9D 91 00 – Time stamp

0x06 – DIF. 0x06 = 00000110

0 – Extension bit. No DIF byte following. Next byte is VIF

0 – Storage number. Not in use

00 – Function field

Code	Description	Code	Description
00b	Instantaneous value	01b	Maximum value
10b	Minimum value	11b	Value during error state

0110 – Data Field

Length in Bit	Code	Meaning	Code	Meaning
0	0000	No data	1000	Selection for Readout
8	0001	8 Bit Integer	1001	2 digit BCD
16	0010	16 Bit Integer	1010	4 digit BCD
24	0011	24 Bit Integer	1011	6 digit BCD
32	0100	32 Bit Integer	1100	8 digit BCD
32 / N	0101	32 Bit Real	1101	variable length
48	0110	48 Bit Integer	1110	12 digit BCD
64	0111	64 Bit Integer	1111	Special Functions

Table 5 Coding of the data field

0x6D – VIF. 0x6D = 01101101. **Primary VIF: E000 0000b .. E111 1011b** The unit and multiplier is taken from the table for primary VIF (chapter 8.4.3). Time point E110 110n. In our case n=1: time & date

8.4.3 Codes for Value Information Field (VIF)

The first block of the table contains integral values, the second typically averaged values, the third typically instantaneous values and the fourth block contains parameters (E: extension bit).

Coding	Description	Range Coding	Range
E000 0nnn	Energy	10 ⁽ⁿⁿⁿ⁻³⁾ Wh	0.001Wh to 10000Wh
E000 1nnn	Energy	10 ⁽ⁿⁿⁿ⁾ J	0.001kJ to 10000kJ
E001 0nnn	Volume	10 ⁽ⁿⁿⁿ⁻⁶⁾ m ³	0.001l to 10000l
E001 1nnn	Mass	10 ⁽ⁿⁿⁿ⁻³⁾ kg	0.001kg to 10000kg
E010 00nn	On Time	nn = 00 seconds nn = 01 minutes nn = 10 hours nn = 11 days	
E010 01nn	Operating Time	coded like OnTime	
E010 1nnn	Power	10 ⁽ⁿⁿⁿ⁻³⁾ W	0.001W to 10000W
E011 0nnn	Power	10 ⁽ⁿⁿⁿ⁾ J/h	0.001kJ/h to 10000kJ/h
E011 1nnn	Volume Flow	10 ⁽ⁿⁿⁿ⁻⁶⁾ m ³ /h	0.001l/h to 10000l/h
E100 0nnn	Volume Flow ext.	10 ⁽ⁿⁿⁿ⁻⁷⁾ m ³ /min	0.0001l/min to 1000l/min
E100 1nnn	Volume Flow ext.	10 ⁽ⁿⁿⁿ⁻⁹⁾ m ³ /s	0.001ml/s to 10000ml/s
E101 0nnn	Mass flow	10 ⁽ⁿⁿⁿ⁻³⁾ kg/h	0.001kg/h to 10000kg/h
E101 10nn	Flow Temperature	10 ⁽ⁿⁿ⁻³⁾ °C	0.001°C to 1°C
E101 11nn	Return Temperature	10 ⁽ⁿⁿ⁻³⁾ °C	0.001°C to 1°C
E110 00nn	Temperature Difference	10 ⁽ⁿⁿ⁻³⁾ K	1mK to 1000mK
E110 01nn	External Temperature	10 ⁽ⁿⁿ⁻³⁾ °C	0.001°C to 1°C
E110 10nn	Pressure	10 ⁽ⁿⁿ⁻³⁾ bar	1mbar to 1000mbar
E110 110n	Time Point	n = 0 date n = 1 time & date	data type G data type F
E110 1110	Units for H.C.A.		dimensionless
E110 1111	Reserved		
E111 00nn	Averaging Duration	coded like OnTime	

0C 1F 09 1E 28 00 – In M-Bus package transferred Date and Time in Epoch format (in seconds). Epoch date is 1970. Years - year since Epoch, i.e 2016-1970 = 36

Converts MM/DD/YY HH:MM:SS to actual seconds since epoch. Epoch year is assumed at Jan 1, 00:00:01am.

<http://www.epochconverter.com/>

6.2.15 Volume Forward (Positive contribution)

07 96 BB 75 A7 ED 95 49 00 00 00 00 – Forward Volume

0x07 – DIF. 0x07 = 00000111

0 – Extension bit. No DIF byte following. Next byte is VIF

0 – Storage number. Not in use

00 – Function field

Code	Description	Code	Description
00b	Instantaneous value	01b	Maximum value
10b	Minimum value	11b	Value during error state

0111 – Data Field

Length in Bit	Code	Meaning	Code	Meaning
0	0000	No data	1000	Selection for Readout
8	0001	8 Bit Integer	1001	2 digit BCD
16	0010	16 Bit Integer	1010	4 digit BCD
24	0011	24 Bit Integer	1011	6 digit BCD
32	0100	32 Bit Integer	1100	8 digit BCD
32 / N	0101	32 Bit Real	1101	variable length
48	0110	48 Bit Integer	1110	12 digit BCD
64	0111	64 Bit Integer	1111	Special Functions

Table 5 Coding of the data field

0x96 – VIF. 0x96 = 10010110. **Primary VIF: E000 0000b .. E111 1011b** The unit and multiplier is taken from the table for primary VIF (chapter 8.4.3). Volume $E0010nnn 10^{(nnn-6)}m^3$. In our case $10^{(110-6)}=10^{(6-6)}=1m^3$.

8.4.3 Codes for Value Information Field (VIF)

The first block of the table contains integral values, the second typically averaged values, the third typically instantaneous values and the fourth block contains parameters (E: extension bit).

Coding	Description	Range Coding	Range
E000 0nnn	Energy	$10^{(nnn-3)}$ Wh	0.001Wh to 10000Wh
E000 1nnn	Energy	$10^{(nnn)}$ J	0.001kJ to 10000kJ
E001 0nnn	Volume	$10^{(nnn+6)}$ m ³	0.001l to 10000l
E001 1nnn	Mass	$10^{(nnn-3)}$ kg	0.001kg to 10000kg
		nn = 00 seconds	

0xBB – VIFE. Chapter 8.4.5 VIFE. 10111011 – Accumulation only if positive contributions.

1 - Next byte is VIFE

8.4.5 Codes for Value Information Field Extension (VIFE)

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

VIFE-Code	Description
E00x xxxx	Reserved for object actions (master to slave): see table on page 75 or for error codes (slave to master): see table on page 74
E010 0000	per second
E010 0001	per minute
E010 0010	per hour
E010 0011	per day
E010 0100	per week
E010 0101	per month
E010 0110	per year
E010 0111	per revolution / measurement
E010 100p	increment per input pulse on input channel #p
E010 101p	increment per output pulse on output channel #p
E010 1100	per liter
E010 1101	per m ³
E010 1110	per kg
E010 1111	per K (Kelvin)
E011 0000	per kWh
E011 0001	per GJ
E011 0010	per kW
E011 0011	per (K*l) (Kelvin*liter)
E011 0100	per V (Volt)
E011 0101	per A (Ampere)
E011 0110	multiplied by sek
E011 0111	multiplied by sek / V
E011 1000	multiplied by sek / A
E011 1001	start date(/time) of ① ②
E011 1010	VIF contains uncorrected unit instead of corrected unit
E011 1011	Accumulation only if positive contributions
E011 1100	Accumulation of abs value only if negative contributions
E011 1101 to E011 1111	Reserved

0x75 – VIFE. Chapter 8.4.5 01110nnn – multiplicative correction factor 10^{nnn-6} . $10^{101-6} = 10^{5-6} = 10^{-1}$. 0 – next byte is data

VIFE-Code	Description
E100 u000	u=1: upper, u=0: lower limit value
E100 u001	# of exceeds of lower u=0) / upper (U=1) limit
E100 uf1b	Date (/time) of: b=0: begin, b=1: end of, f=0: first, f=1: last, ① u=0: lower, u=1: upper limit exceed
E101 ufnn	Duration of limit exceed (u,f: as above, nn=duration)
E110 0fnn	Duration of ① (f: as above, nn=duration)
E110 1x0x	Reserved
E110 1f1b	Date (/time) of ① ② (f,b: as above)
E111 0nnn	Multiplicative correction factor: 10^{nnn-6}
E111 10nn	Additive correction constant: 10^{nn-3} * unit of VIF (offset)
E111 1100	Reserved
E111 1101	Multiplicative correction factor: 10^3
E111 1110	future value
E111 1111	next VIFE's and data of this block are manufacturer specific

A7 ED 95 49 00 00 00 00 – Data in hex 4995EDA7=1234562471

6.2.16 Volume Reverse (Negative Contribution)

07 96 BC 75 D6 02 96 49 00 00 00 00 – Reverse Volume

0x07 – DIF. 0x07 = 00000111

0 – Extension bit. No DIF byte following. Next byte is VIF

0 – Storage number. Not in use

00 – Function field

Code	Description	Code	Description
00b	Instantaneous value	01b	Maximum value
10b	Minimum value	11b	Value during error state

0111 – Data Field

Length in Bit	Code	Meaning	Code	Meaning
0	0000	No data	1000	Selection for Readout
8	0001	8 Bit Integer	1001	2 digit BCD
16	0010	16 Bit Integer	1010	4 digit BCD
24	0011	24 Bit Integer	1011	6 digit BCD
32	0100	32 Bit Integer	1100	8 digit BCD
32 / N	0101	32 Bit Real	1101	variable length
48	0110	48 Bit Integer	1110	12 digit BCD
64	0111	64 Bit Integer	1111	Special Functions

0x96 – VIF. 0x96 = 10010110. **Primary VIF: E000 0000b .. E111 1011b** The unit and multiplier is taken from the table for primary VIF (chapter 8.4.3). Volume E0010nnn $10^{(nnn-6)}m^3$. In our case $10^{(110-6)}=10^{(6-6)}=1m^3$.

8.4.3 Codes for Value Information Field (VIF)

The first block of the table contains integral values, the second typically averaged values, the third typically instantaneous values and the fourth block contains parameters (E: extension bit).

Coding	Description	Range Coding	Range
E000 0nnn	Energy	$10^{(nnn-3)}$ Wh	0.001Wh to 10000Wh
E000 1nnn	Energy	$10^{(nnn)}$ J	0.001kJ to 10000kJ
E001 0nnn	Volume	$10^{(nnn-6)}$ m ³	0.001l to 10000l
E001 1nnn	Mass	$10^{(nnn-3)}$ kg	0.001kg to 10000kg

nn = 00 seconds
-- = 00 seconds

0xBC – VIFE. Chapter 8.4.5 VIFE. 10111100 – Accumulation only if negative contributions. 1 - Next byte is VIFE

8.4.5 Codes for Value Information Field Extension (VIFE)

The following values for VIFE's are defined for an enhancement of VIF's other than \$FD and \$FB:

VIFE-Code	Description
E00x xxxx	Reserved for object actions (master to slave); see table on page 75 or for error codes (slave to master); see table on page 74
E010 0000	per second
E010 0001	per minute
E010 0010	per hour
E010 0011	per day
E010 0100	per week
E010 0101	per month
E010 0110	per year
E010 0111	per revolution / measurement
E010 100p	increment per input pulse on input channel #p
E010 101p	increment per output pulse on output channel #p
E010 1100	per liter
E010 1101	per m ³
E010 1110	per kg
E010 1111	per K (Kelvin)
E011 0000	per kWh
E011 0001	per GJ
E011 0010	per kW
E011 0011	per (K*l) (Kelvin*liter)
E011 0100	per V (Volt)
E011 0101	per A (Ampere)
E011 0110	multiplied by sek
E011 0111	multiplied by sek / V
E011 1000	multiplied by sek / A
E011 1001	start date(/time) of 0 0
E011 1010	VIF contains uncorrected unit instead of corrected unit
E011 1011	Accumulation only if positive contributions
E011 1100	Accumulation of abs value only if negative contributions
E011 1101 to E011 1111	Reserved

0x75 – VIFE. Chapter 8.4.5 **01110nnn** – multiplicative correction factor $10^{nn-6} \cdot 10^{101-6} = 10^{5-6} = 10^{-1}$. **0** – next byte is data

VIFE-Code	Description
E100 u000	u=1: upper, u=0: lower limit value
E100 u001	# of exceeds of lower u=0) / upper (U=1) limit
E100 ufb	Date (/time) of: b=0: begin, b=1: end of, f=0: first, f=1: last, u=0: lower, u=1: upper limit exceed
E101 ufan	Duration of limit exceed (u,f: as above, nn=duration)
E110 ofan	Duration of (f: as above, nn=duration)
E110 lx0x	Reserved
E110 lfb	Date (/time) of (f,b: as above)
E111 0nnn	Multiplicative correction factor: 10^{nnn-6}
E111 10nn	Additive correction constant: 10^{nn-3} * unit of VIF (offset)
E111 1100	Reserved
E111 1101	Multiplicative correction factor: 10^3
E111 1110	future value
E111 1111	next VIFE's and data of this block are manufacturer specific

D6 02 96 49 00 00 00 00 – Data in hex 499602D6 = 1234567894

6.2.17 Volume Flow (Flow Rate)

04 3C 24 00 00 00 – Flow rate (volume flow)

0x04 – DIF. 0x04 = 00000100

0 – Extension bit. No DIF byte following. Next byte is VIF

0 – Storage number. Not in use

00 – Function field

Code	Description	Code	Description
00b	Instantaneous value	01b	Maximum value
10b	Minimum value	11b	Value during error state

0100 – Data Field

Length in Bit	Code	Meaning	Code	Meaning
0	0000	No data	1000	Selection for Readout
8	0001	8 Bit Integer	1001	2 digit BCD
16	0010	16 Bit Integer	1010	4 digit BCD
24	0011	24 Bit Integer	1011	6 digit BCD
32	0100	32 Bit Integer	1100	8 digit BCD
32 / N	0101	32 Bit Real	1101	variable length
48	0110	48 Bit Integer	1110	12 digit BCD
64	0111	64 Bit Integer	1111	Special Functions

0x3C – VIF. 0x3C = 00111100. **Primary VIF: E000 0000b .. E111 1011b** The unit and multiplier is taken from the table for primary VIF (chapter 8.4.3). Volume Flow E0111nnn $10^{(nnn-6)}m^3/h$. In our case $10^{(100-6)}=10^{(4-6)}=0.01m^3/h$. 0 – next byte is data

8.4.3 Codes for Value Information Field (VIF)

The first block of the table contains integral values, the second typically averaged values, the third typically instantaneous values and the fourth block contains parameters (E: extension bit).

Coding	Description	Range Coding	Range
E000 0nnn	Energy	10 ⁽ⁿⁿⁿ⁻³⁾ Wh	0.001Wh to 10000Wh
E000 1nnn	Energy	10 ⁽ⁿⁿⁿ⁾ J	0.001kJ to 10000kJ
E001 0nnn	Volume	10 ⁽ⁿⁿⁿ⁻⁶⁾ m ³	0.001l to 10000l
E001 1nnn	Mass	10 ⁽ⁿⁿⁿ⁻³⁾ kg	0.001kg to 10000kg
E010 00nn	On Time	nn = 00 seconds nn = 01 minutes nn = 10 hours nn = 11 days	
E010 01nn	Operating Time	coded like OnTime	
E010 1nnn	Power	10 ⁽ⁿⁿⁿ⁻³⁾ W	0.001W to 10000W
E011 0nnn	Power	10 ⁽ⁿⁿⁿ⁾ J/h	0.001kJ/h to 10000kJ/h
E011 1nnn	Volume Flow	10 ⁽ⁿⁿⁿ⁻⁶⁾ m ³ /h	0.001l/h to 10000l/h

24 00 00 00 – Data in hex 24 = 36

6.2.18 Temperature

05 5B 00 00 00 00 – Temperature

0x05 – DIF. 0x05 = 00000101

0 – Extension bit. No DIF byte following. Next byte is VIF

0 – Storage number. Not in use

00 – Function field

Code	Description	Code	Description
00b	Instantaneous value	01b	Maximum value
10b	Minimum value	11b	Value during error state

0101 – Data Field

Length in Bit	Code	Meaning	Code	Meaning
0	0000	No data	1000	Selection for Readout
8	0001	8 Bit Integer	1001	2 digit BCD
16	0010	16 Bit Integer	1010	4 digit BCD
24	0011	24 Bit Integer	1011	6 digit BCD
32	0100	32 Bit Integer	1100	8 digit BCD
32 / N	0101	32 Bit Real	1101	variable length
48	0110	48 Bit Integer	1110	12 digit BCD
64	0111	64 Bit Integer	1111	Special Functions

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0x5B – VIF. 0x5B = **01011011**. **Primary VIF: E000 0000b .. E111 1011b** The unit and multiplier is taken from the table for primary VIF (chapter 8.4.3). Flow Temperature E10110nn $10^{(nn-3)} \text{ } ^\circ\text{C}$. In our case $10^{(11-3)}=10^{(3-3)}= 1^\circ\text{C}$. **0** – next byte is data

8.4.3 Codes for Value Information Field (VIF)

The first block of the table contains integral values, the second typically averaged values, the third typically instantaneous values and the fourth block contains parameters (E: extension bit).

Coding	Description	Range Coding	Range
E000 0nnn	Energy	$10^{(nnn-3)}$ Wh	0.001Wh to 10000Wh
E000 1nnn	Energy	$10^{(nnn)}$ J	0.001kJ to 10000kJ
E001 0nnn	Volume	$10^{(nnn-6)}$ m ³	0.001l to 10000l
E001 1nnn	Mass	$10^{(nnn-3)}$ kg	0.001kg to 10000kg
E010 00nn	On Time	nn = 00 seconds nn = 01 minutes nn = 10 hours nn = 11 days	
E010 01nn	Operating Time	coded like OnTime	
E010 1nnn	Power	$10^{(nnn-3)}$ W	0.001W to 10000W
E011 0nnn	Power	$10^{(nnn)}$ J/h	0.001kJ/h to 10000kJ/h
E011 1nnn	Volume Flow	$10^{(nnn-6)}$ m ³ /h	0.001l/h to 10000l/h
E100 0nnn	Volume Flow ext.	$10^{(nnn-7)}$ m ³ /min	0.0001l/min to 1000l/min
E100 1nnn	Volume Flow ext.	$10^{(nnn-9)}$ m ³ /s	0.001ml/s to 10000ml/s
E101 0nnn	Mass flow	$10^{(nnn-3)}$ kg/h	0.001kg/h to 10000kg/h
E101 10nn	Flow Temperature	$10^{(nn-3)}$ °C	0.001°C to 1°C

00 00 00 00 – Data

6.2.19 Volume (Net Signed)

07 96 75 D1 EA FF FF FF FF FF FF – Net signed volume

0x07 – DIF. 0x07 = **00000111**

0 – Extension bit. No DIF byte following. Next byte is VIF

0 – Storage number. Not in use

00 – Function field

Code	Description	Code	Description
00b	Instantaneous value	01b	Maximum value
10b	Minimum value	11b	Value during error state

0111 – Data Field

Length in Bit	Code	Meaning	Code	Meaning
0	0000	No data	1000	Selection for Readout
8	0001	8 Bit Integer	1001	2 digit BCD
16	0010	16 Bit Integer	1010	4 digit BCD
24	0011	24 Bit Integer	1011	6 digit BCD
32	0100	32 Bit Integer	1100	8 digit BCD
32 / N	0101	32 Bit Real	1101	variable length
48	0110	48 Bit Integer	1110	12 digit BCD
64	0111	64 Bit Integer	1111	Special Functions

0x96 – VIF. $0x96 = 10010110$. **Primary VIF: E000 0000b .. E111 1011b** The unit and multiplier is taken from the table for primary VIF (chapter 8.4.3). Volume $E0010nnn 10^{(nnn-6)}m^3$. In our case $10^{(110-6)}=10^{(6-6)}=1m^3$.

8.4.3 Codes for Value Information Field (VIF)

The first block of the table contains integral values, the second typically averaged values, the third typically instantaneous values and the fourth block contains parameters (E: extension bit).

Coding	Description	Range Coding	Range
E000 0nnn	Energy	$10^{(nnn-3)}$ Wh	0.001Wh to 10000Wh
E000 1nnn	Energy	$10^{(nnn)}$ J	0.001kJ to 10000kJ
E001 0nnn	Volume	$10^{(nnn-6)}$ m ³	0.001l to 10000l
E001 1nnn	Mass	$10^{(nnn-3)}$ kg	0.001kg to 10000kg

nn = 00 seconds

0x75 – VIFE. Chapter 8.4.5 **01110nnn** – multiplicative correction factor $10^{nnn-6} \cdot 10^{101-6}=10^{5-6}=10^{-1}$. **0** – next byte is data

VIFE-Code	Description
E100 u000	u=1: upper, u=0: lower limit value
E100 u001	# of exceeds of lower u=0 / upper (U=1) limit
E100 uf1b	Date (/time) of: b=0: begin, b=1: end of, f=0: first, f=1: last, u=0: lower, u=1: upper limit exceed
E101 unfn	Duration of limit exceed (u,f: as above, nn=duration)
E110 0fnn	Duration of (f: as above, nn=duration)
E110 1x0x	Reserved
E110 1f1b	Date (/time) of (f,b: as above)
E111 0nnn	Multiplicative correction factor: 10^{nnn-6}
E111 10nn	Additive correction constant: $10^{nn-3} \cdot$ unit of VIF (offset)
E111 1100	Reserved
E111 1101	Multiplicative correction factor: 10^3
E111 1110	future value
E111 1111	next VIFE's and data of this block are manufacturer specific

D1 EA FF FF FF FF FF FF – Data in hex FFFFFFFFEEAD1 = -5423

6.2.20 Volume (Net Unsigned)

07 96 75 D1 B4 9A 3B 00 00 00 00 – Net unsigned volume

0x07 – DIF. 0x07 = 00000111

0 – Extension bit. No DIF byte following. Next byte is VIF

0 – Storage number. Not in use

00 – Function field

Code	Description	Code	Description
00b	Instantaneous value	01b	Maximum value
10b	Minimum value	11b	Value during error state

0111 – Data Field

Length in Bit	Code	Meaning	Code	Meaning
0	0000	No data	1000	Selection for Readout
8	0001	8 Bit Integer	1001	2 digit BCD
16	0010	16 Bit Integer	1010	4 digit BCD
24	0011	24 Bit Integer	1011	6 digit BCD
32	0100	32 Bit Integer	1100	8 digit BCD
32 / N	0101	32 Bit Real	1101	variable length
48	0110	48 Bit Integer	1110	12 digit BCD
64	0111	64 Bit Integer	1111	Special Functions

0x96 – VIF. 0x96 = 10010110. **Primary VIF: E000 0000b .. E111 1011b** The unit and multiplier is taken from the table for primary VIF (chapter 8.4.3). Volume E0010nnn $10^{(nnn-6)}m^3$. In our case $10^{(110-6)}=10^{(6-6)}=1m^3$.

8.4.3 Codes for Value Information Field (VIF)

The first block of the table contains integral values, the second typically averaged values, the third typically instantaneous values and the fourth block contains parameters (E: extension bit).

Coding	Description	Range Coding	Range
E000 0nnn	Energy	$10^{(nnn-3)}$ Wh	0.001Wh to 10000Wh
E000 1nnn	Energy	$10^{(nnn)}$ J	0.001kJ to 10000kJ
E001 0nnn	Volume	$10^{(nnn-6)}$ m ³	0.0011 to 100001
E001 1nnn	Mass	$10^{(nnn-3)}$ kg nn = 00 seconds	0.001kg to 10000kg

0x75 – VIFE. Chapter 8.4.5 01110nnn – multiplicative correction factor 10^{nnn-6} . $10^{101-6}=10^{5-6}=10^{-1}$. 0 – next byte is data

VIFE-Code	Description
E100 u000	u=1: upper, u=0: lower limit value
E100 u001	# of exceeds of lower u=0) / upper (U=1) limit
E100 uf1b	Date (/time) of: b=0: begin, b=1: end of, f=0: first, f=1: last, ⓪ u=0: lower, u=1: upper limit exceed
E101 ufnn	Duration of limit exceed (u,f: as above, nn=duration)
E110 0fnn	Duration of ⓪ (f: as above, nn=duration)
E110 1x0x	Reserved
E110 1f1b	Date (/time) of ⓪ ⓪ (f,b: as above)
E111 0nnn	Multiplicative correction factor: 10^{nn-6}
E111 10nn	Additive correction constant: 10^{nn-3} • unit of VIF (offset)
E111 1100	Reserved
E111 1101	Multiplicative correction factor: 10^3
E111 1110	future value
E111 1111	next VIFE's and data of this block are manufacturer specific

D1 B4 9A 3B 00 00 00 00 – Data in hex 3B9AB4D1 = 999994577

7. Write Commands

7.1 Application reset

\$68\$03\$03\$68\$73\$FE\$50\$C1\$16 (E5)

7.2 Set primary address

- Address 2

\$68\$06\$06\$68\$73\$FE\$51\$01\$7A\$02\$3F\$16

Set address 2 without changing anything else

- Address 5

\$68\$06\$06\$68\$53\$FE\$51\$01\$7A\$05\$42\$16

Set address 5 without changing anything else

7.3 Data request

- **SND_NKE**

\$10\$40\$01\$41\$16

01 – Slave address

- **Request all data**

\$68\$05\$05\$68\$53\$01\$51\$7F\$7E\$A2\$16

53 – C-field. Send User Data to Slave (chapter 5.3 Table 1)

Name	C Field Binary	C Field Hex.	Telegram	Description
SND_NKE	0100 0000	40	Short Frame	Initialization of Slave
SND_UD	01F1 0011	53/73	Long/Control Frame	Send User Data to Slave
REQ_UD2	01F1 1011	5B/7B	Short Frame	Request for Class 2 Data
REQ_UD1	01F1 1010	5A/7A	Short Frame	Request for Class1 Data (see 8.1: Alarm Protocol)
RSP_UD	00AD 1000	08/18/28/38	Long/Control Frame	Data Transfer from Slave to Master after Request

01 – Slave Address

51 – CI field. Mode 1 (chapter 6.1 Table 2)

Mode 1	Mode 2	Application	Definition in
51h	55h	data send	EN1434-3
52h	56h	selection of slaves	Usergroup July '93

7F\$7E - Global readout request: The DIF-Code \$7F is defined as "selection of all data for readout request", i.e. all storage numbers, units, tariffs and functions. If this DIF is the last byte of user data or the VIF=\$7E follows, then all data is requested. So the selection of all data of one slave can be done with a SND_UD and the character \$7F as the user data. If there follows a DIF unequal to \$7E, then all subfields of this VIF are selected for readout (chapter 6.4.3)

- **REQ_UD2 Read data sets (send after one of the next commands)**

\$10\$5B\$01\$5C\$16

7.4 Specified Data Request

- **SND_NKE**

\$10\$40\$01\$41\$16

01 – Slave address

- **Request selection with specified data field (13 - Volume, 5A – Flow temperature). See 8.4.3 VIF**

\$68\$07\$07\$68\$53\$01\$51\$08\$13\$08\$5A\$22\$16

08 – C field (chapter 5.3 Table 1)

Name	C Field Binary	C Field Hex.	Telegram	Description
SND_NKE	0100 0000	40	Short Frame	Initialization of Slave
SND_UD	01F1 0011	53/73	Long/Control Frame	Send User Data to Slave
REQ_UD2	01F1 1011	5B/7B	Short Frame	Request for Class 2 Data
REQ_UD1	01F1 1010	5A/7A	Short Frame	Request for Class1 Data (see 8.1: Alarm Protocol)
RSP_UD	00AD 1000	08/18/28/38	Long/Control Frame	Data Transfer from Slave to Master after Request

13 and **5A** – VIF (Value Information Field, Chapter 8.4.3)

Coding	Description	Range Coding	Range
E000 0nnn	Energy	10 (nnn-3) Wh	0.001Wh to 10000Wh
E000 1nnn	Energy	10 (nnn) J	0.001kJ to 10000kJ
E001 0nnn	Volume	10 (nnn-6) m ³	0.001l to 10000l
E101 10nn	Flow Temperature	10 (nn-3) °C	0.001°C to 1°C

Or

- **Request selection with specified data field (13 - Volume, 5A – Flow temperature, 6D – Time Stamp). See 8.4.3 VIF**

\$68\$09\$09\$68\$53\$01\$51\$08\$13\$08\$5A\$08\$6D\$97\$16

E110 110n	Time Point	n = 0 date n = 1 time & date	data type G data type F
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1. Set date time

\$68\$09\$09\$68\$53\$01\$51\$04\$6D\$23\$3D\$0F\$05\$8A\$16

Example: Set date time: 2017.03.29 15:05

\$23\$3D\$0F\$05 = 0010 0011 0011 1101 0000 1111 0000 0101

Bit	7	6	5	4	3	2	1	0		
	0	0	1	0	0	0	1	1	Year, Month, Day	
Bit	15	14	13	12	11	10	9	8		
	0	0	1	1	1	1	0	1		
Bit	23	22	21	20	19	18	17	16	Hour	<0 to 23>
	0	0	0	0	1	1	1	1		
Bit	31	30	29	28	27	26	25	24	Minutes	<0 to 59>
	0	0	0	0	0	1	0	1		

Year: [(7 to 4)>>1 | (15 to 13)>>5] <0 to 99>

Year = 0010 0011 0011 1101 => 00010001 = 00010001 => 17

Month: [3 to 0] <1 to 12>

Month = 0011 = 3

Day [12 to 8] <1 to 31>

Day = 1 1101 = 29

Hour = 0000 1111 = 15

Minutes = 0000 0101 = 05

2. Search Address

2.1 Search Address 1

\$10\$7B\$01\$7C\$16

2.2 Search address 2

\$10\$7B\$02\$7D\$16

3. Search ID

\$10\$40\$FF\$3F\$16

\$68\$0B\$0B\$68\$73\$FD\$52\$FF\$FF\$FF\$0F\$FF\$FF\$FF\$FF\$CA\$16 **0FFFFFFF**

\$68\$0B\$0B\$68\$73\$FD\$52\$FF\$FF\$FF\$1F\$FF\$FF\$FF\$FF\$DA\$16 **1FFFFFFF**

\$10\$7B\$FD\$78\$16