HYDROMETER

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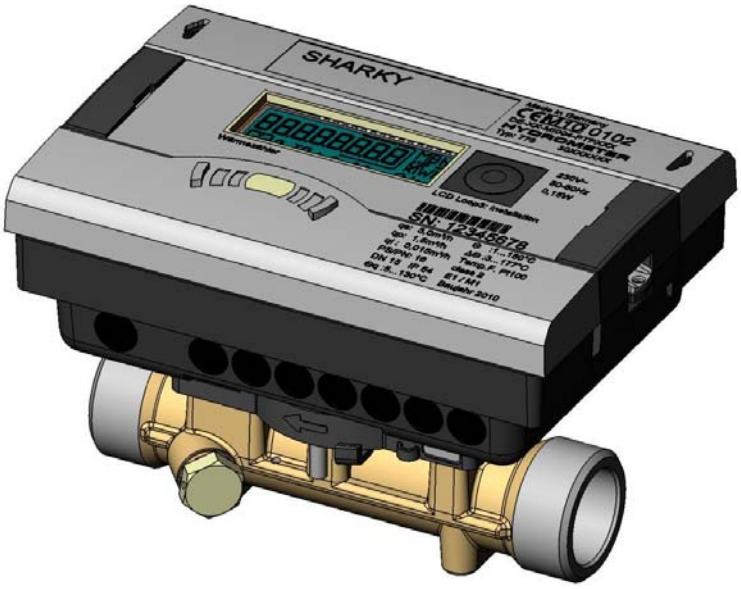
SHARKY 775

Communication description



MBus ID = 0x2F

V1.4 changes reserved

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DIEHL Metering

Contents

1 Introduction

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

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

The RS-485 and RS-232 communication module is a serial interface for communication with external devices, e.g. a PC.

2 Communication interfaces

SHARKY 775 is equipped with five communication interfaces:

- Optical ZVEI.
- M-BUS: M-Bus communication is over a two-wire line.
- Integrated radio with 868MHz or 434MHz.
- RS-2485: The module board contains a 4-pole terminal strip with terminals marked D+, D-, Vcc and GND (ground). This module needs an external supply voltage of 12Vdc ±5V at <5W.
- RS-232: The module board contains a 3-pole terminal strip with terminals marked DAT, REQ and GND (ground). This connection can be used in conjunction with the HYD cable adapter for PC communication.

2.1 Communication priorities

Mutual influence between interfaces:

Interface	Priority
optical ZVEI	1
modules	2

Port 2 is no longer being usable if integrated radio is active.

2.2 Telegram formats

Communication complies with:

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

2.3 UART

Baud rates

- M-Bus: 300 and 2400 baud, 8E1
  automatic baud rate detection and switching
- RS-485: 300 and 2400 baud, 8E1
- RS-232: 300 and 2400 baud, 8E1
- ZVEI optical: 2400 baud, 8E1

2.4 Protocol layer

1. EN 13757-3
2. Data output
   a) Variable protocol
   b) “Least Significant Byte first” (Mode 1) for multi-byte variables
   c) All response telegrams also available for C-1 error

2.5 Connection set-up for optical ZVEI

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

2.6 Addressing

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

2.6.1 Selection (secondary address)

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

Structure of filter:

4-byte BCD	NN (serial number)	$F digit joker
2-byte HST	HH (manufacturer code)	$FF byte joker
1-byte ID (SHARKY 775: $2F)	ID (identification code)	$FF joker
1-byte SMED	MM (medium code)	$FF joker

After selection, the meter can be operated via the primary address $FD (response always with own primary address).

2.6.2 Deselection

Request telegram:	10 40 FD CS 16
Response:	E5 (If the meter is selected before, otherwise no response)

To reliably end communication with the selected meter, the meter must be deselected. So the primary address $FD is free again and can be used for communication with other meters. The deselection can be performed with a specifically wrong filter.

3 Reading the meter:

Procedure:

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

3.1 Standard data reading (Application Reset 0)

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

To make sure the standard value “00” (All) is obtained, an Application Reset should be carried out with sub-code “00”:

SND_UD: “68 04 04 68 **73/53** **FD** **50** **00** **CS** 16”

C-field: **73** or **53**

Address field: e.g. **FD** (equiv. to 253)

CI-field: **50**

Application Reset Sub-code: **00**

“00” equiv. to “All” – (*see Appendix 1)*

or e.g. “20” equiv. to “Simple Billing”

Checksum: **CS**

3.2 Request response

The following command must be sent to obtain a response from the meter SHARKY 775:

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

3.3 Interpretation of data

The data received basically corresponds to the protocol structure of EN13757-3.
e.g.: containing the definition of units

3.3.1 Mbus Status Byte

Bit	*description*	*usage*
0	reserved	-
1	any application error	-
2	power low	E - 8 E - 9
3	permanent error	C - 1, E - 4
4	temporary error	E - 1, E - 3, E - 6, E - 7, leak error
5	manufacturer specific	*1)
6	manufacturer specific	*1)
7	manufacturer specific	*1)

*1)

error	**C - 1**	**E - 8**	**E - 4**	**E - 1**	**E - 7**	**E - 9**	**E - 3**	**E - 6**	**Leak error**	**E - 5**
Mbus status Byte	0x08	0x04	0x28	0x50	0x70	0x84	0xB0	0xD0	0xF0	0x10
priority	high									low

4 Customer telegram

Registers at each port can be read or programmed direct in the meter.

The IZAR@SET program from HYDROMETER can be used to set the customer telegram.
This program can be downloaded at:
http://www.hydrometer.de (download area)

5 Default telegram

From manufacture side the following telegrams are standard (if no special telegram content is agreed):

Port1 *	**Port2**
current energy	current energy
current tariff register 1 energy	current volume
current tariff register 2 energy	current flow rate
current volume	current power
current power	current forward temperature
current flow rate	current return temperature
current forward temperature	current tariff register 1 energy
current return temperature	current error hours
current difference temperature	current pulse input counter 1
current operating days	current pulse input counter 2
current time	
accounting date 1 - energy	
accounting date 1 - volume	
accounting date 1 - tariff 1	
accounting date 1 - tariff 2	
accounting date 1 - date	

* *Application Reset Subcode 0x30*

Information:
If the user telegram is empty, the meter sends instead of an empty protocol the Application Reset Subcode 0x30 – protocol.
This is identical to the standard protocol Port 2. (Port 2 is fix predefined with Application Reset Subcode 0x30)

6 Meter Parameterisation

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

6.1 Structure of instruction set

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

6.2 Date and time

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

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

Example: 03/22/2011 08:30

$68 $09 $09 $68 $53 $FE $51 **$04 $6D $1E $08 $76 $13** $00 $16

answer: $E5

6.3 New primary address

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

Example (address 5):

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

answer: $E5

6.4 Serial number / customer number

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

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

Example (SN 12345678):

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

answer: $E5

Note: The NNUM is part of the secondary address.

6.5 New reading date 1

Programming a new future reading date 1 (data type G).

Send: $68 $08 $08 $68 $73 $FE $51 **$42 $EC $7E [Set Accounting Date1] Check** $16

Example: 06/01/2012

$68 $08 $08 $68 $73 $FE $51 **$42 $EC $7E $81 $16** $04 $16

answer: $E5

6.6 New reading date 2

Programming a new future reading date 2 (data type G).

Send: $68 $09 $09 $68 $73 $FE $51 **$C2 $01 $EC $7E [Set Accounting Date2] Check** $16

Example: 12/31/2012

$68 $09 $09 $68 $73 $FE $51 **$C2 $01 $EC $7E $9F $1C** $AA $16

answer: $E5

6.7 Pulse input counter 1

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

Send: $68 $0B $0B $68 $73 $FE $51 **$8C $40 $FD $3A [Set IMPCNT1]** Check $16

Example (55667788):

$68 $0B $0B $68 $73 $FE $51 **$8C $40 $FD $3A $88 $77 $66 $55** $7F $16

answer: $E5

6.8 Pulse input counter 2

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

4-byte BCD

Send: $68 $0C $0C $68 $53 $FE $51 **$8C $80 $40 $FD $3A [Set IMPCNT2]** Check $16

Example (66554433):

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

answer: $E5

6.9 Clearing operating days

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

Send: $68 $07 $07 $68 $53 $FE $51 **$0A $27 [clear operation days]** Check $16

Example (clearing):

$68 $07 $07 $68 $53 $FE $51 **$0A $27 $00 $00** $D3 $16

answer: E5

6.10 Clearing error hour counter

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

Send: $68 $08 $08 $68 $73 $FE $51 **$0A $A6 $18 [clear error hours]** Check $16

Example (clearing):

$68 $08 $08 $68 $73 $FE $51 **$0A $AC $18 $00 $00** $90 $16

answer: E5

6.11 Send application reset subcode (App.Rst.)

(see also the appendix)

Send: $68 $04 $04 $68 $53 $FE $50 **[App.Rst.]** Check $16

Example (App.Rst. C0): $68 $04 $04 $68 $53 $FE $50 **$C0** $61 $16

answer: $E5

6.12 Periodical Log

The periodical log, which has got a size of 24 data blocks, is located in the EEPROM at address 0x1880 up to 0x28FF with 64 byte ($40) per data block. The addresses of the data blocks per storage are located at 0x1880, 0x18C0, 0x1900, 0x1940, 0x1980, ….. 0x1E00, 0x1E40.
A description how to read the meter, see 6.14. 12 readings are necessary to get the whole periodical log. With each reading you get 2 data blocks.

Each entry has the following structure:

Value	Size	Type	Address
• Date and time stamp	2 Byte	MBus type G	0
• Energy resolution as LCD	4 Byte	BCD	2
• Tariff register 1 as LCD	4 Byte	BCD	6
• Tariff register 2 as LCD	4 Byte	BCD	10
• Volume resolution as LCD	4 Byte	BCD	14
• Pulse input counter 1	4 Byte	BCD	18
• Pulse input counter 2	4 Byte	BCD	22
• Tariff definition 1	2 Byte	HY spec.	26
• Tariff definition 2	2 Byte	HY spec.	28
• Definition pulse input counter 1	1 Byte	HY spec.	30
• Definition pulse input counter 2	1 Byte	HY spec.	31
• Error hour counter	2 Byte	BCD	32
• Maximum flow rate	3 Byte	BCD	34
• Time maximum flow rate	2 Byte	MBus type F (Lbyte)	37
• Date maximum flow rate	2 Byte	MBus type G	39
• Maximum power	4 Byte	BCD	41
• Time maximum power	2 Byte	MBus type F (Lbyte)	45
• Date maximum power	2 Byte	MBus type G	47
• ONTIME (operating days)	2 Byte	BCD	49
• Maximum/ average forward temperature	2 Byte	HEX (0.1°C res)	51
• Time maximum forward temperature	2 Byte	MBus type F (Lbyte)	53
• Date maximum forward temperature	2 Byte	MBus type G	55
• Maximum/ average return temperature	2 Byte	HEX (0.1°C res)	57
• Time maximum return temperature	2 Byte	MBus type F (Lbyte)	60
• Date maximum return temperature	2 Byte	MBus type G	62

6.12.1 Reading

As described in 6.14

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

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

6.12.2 Deletion

Deletion is not possible in the field and therefore not described here.

6.13 Deleting error log

The event memory with a capacity of 127 entries is located in the EEPROM at address 0x1680 to 0x1880, with 4 bytes per entry. The administration data is located at address 0x00.

address:	EEPROM
communication address:	0x1680
EEPROM address:	0x280
length:	0x200

example:

address	value	type
0x1680	ondex content next storrage	hex mask = 0x7C
0x1682	date last delete	MBus type G
0x1684	index content “0”	
0x1688	index content “1”	
….	….	
0x1880	index content “127”	

every entry is structured as follows:

1. byte	2. byte	3. byte with event	4. byte mit source
date MBus Typ G		0x01 C-1 checksum error 0x02 E-8 mains supply lack backup 0x04 E-1 error temperature- measuring 0x20 leakage error at input 1 0x40 leakage error at input 2 0x80 protection seal	0x1F hour 0x20 low bit SFCNT 0x40 reset ONTIME or ERRHOUR

A description how to read the meter, see 6.14. 4 readings are necessary to get the whole error log.

6.14 Data memory read

Define answer:

- Send App.Res.SubCode 0xC0
- Set read pointer

Due to the size of the specific memory must be read several times if necessary.

6.14.1 Set read pointer (Insert address)

send: $68 $09 $09 $68 $53 $FE $51 **$03 $FD $1F [AdrLo AdrHi] $80** [Check] $16

Example memory error (0x1680; length $80):

$68 $09 $09 $68 $53 $FE $51 **$03 $FD $1F $80 $16 $80** $F7 $16

answer: $E5

6.14.2 Reading (REQ_UD2) – 128 Byte

send: $10 $7B $FE $79 $16

answer: [defined telegram] – may be interpreted in accordance with appendix.

7 Appendix 1

Application Reset Subcode:

Application Reset-Subcode	Telegram data
0x00 „All“	current energy current tariff register 1 current tariff register v2 current volume current power current flow rate current forward temperature current return temperature current difference temperature current operating days current date and time Accounting date1 (storage number = 1) • energy • volume • tariff register1 • tariff register2 • date • date next accounting date1 Accounting date2 (storage number = 3) • energy • volume • tariff register1 • tariff register2 • date • date next accounting date2 Pulse in- Register • current pulse input counter 1 • current pulse input counter 2

0x10 „User data“	current energy current tariff register 1 current tariff register 2 current volume current power current flow rate current forward temperature current return temperature current difference temperature current operating days current date and time Accounting date1 (storage number = 1) • energy • volume • tariff register 1 • tariff register 2 • date • date next accounting date1 Accounting date2 (storage number = 3) • energy • volume • tariff register 1 • tariff register 2 • date • date next accounting date2 Accounting date1 previous year (storage number = 2) • energy • volume • tariff register 1 • tariff register 2 • date Accounting date2 previous year (storage number = 4) • energy • volume • tariff register 1 • tariff register 2 • date
0x20 „Simple billing“	like 1 or current date and time current energy current tariff register 1 Accounting date1 (storage number = 1) • energy • tariff register 1 • date • date next accounting date1 current volume current forward temperature current return temperature current flow rate current power GLYKOLTEXT PULSTEXT TENR HistoryLog2 data

0x30 „Enhanced billing“	current energy current volume current flow rate current forward temperature current return temperature current tariff register 1 current error hours Pulse in- Register at mounted pulse input module • current pulse input counter 1 • current pulse input counter 2 tariff enable 2
0x40 „Multi tariff billing“	current energy current volume current tariff register 1 current tariff register 2 current pulse input counter 1 at mounted pulse input module current operating days current error hours current flow rate current power current forward temperature current return temperature Periodical Log 0 last values (storage number = 5) • date • energy • volume • pulse input counter 1 • tariff register 1 • operating days • error hours
0x50 „Instant values“	current energy current tariff register 1 current tariff register 2 current volume current power current flow rate current forward temperature current return temperature current operating days current error hours
0x60 „Load Management values for management“	manufacturer specific data number 4 • 0x0F 0x04 • SWVER READPTR *data (number = READLEN)* • READPTR is incremented by every readout by READLEN
0x70 „Reserved“	like 1
0x80 „Installation and startup“	current date and time date next accounting date1 date next accounting date2 software version
0xB0 „Manufacturing“	manufacturer specific data number 4 • 0x0F 0x04 • SWVER READPTR *data (number = READLEN)* • READPTR is incremented by every readout by READLEN
0xC0 „Development“	like 0xB0 without init READPTR and READLEN

0xD0 „Selftest“	current energy current date and time
0xE0 „Reserved“	like 0
0xF0 „Reserved“	Adjustable telegram

8 Appendix 2

8.1 MBus Units

All transmitted values are coded according to EN 13757-3.

8.2 Coding of units

Value type	Display unit at field mode	VIF
energy	0.001 kWh	0x03
	0.01 kWh	0x04
	0.1 kWh	0x05
	1 kWh	0x06
	0.001 MWh	0x06
	0.01 MWh	0x07
	0.1 MWh	0xFB 0x00
	1 MWh	0xFB 0x01
	0.001 GJ	0x0E
	0.01 GJ	0x0F
	0.1 GJ	0xFB 0x08
	1 GJ	0xFB 0x09
	0.001 Gcal	0xFB 0x0D
	0.01 Gcal	0xFB 0x0E
	0.1 Gcal	0xFB 0x0F
	1 Gcal	0xFB 0x8F 0x77
	0.001 MBtu	0x83 0x3D
	0.01 MBtu	0x84 0x3D
	0.1 MBtu	0x85 0x3D
	1 MBtu	0x86 0x3D
volume	0.001 m³	0x13
	0.01 m³	0x14
	0.1 m³	0x15
	1 m³	0x16
	0.001 gal	0x90 0x3D
	0.01 gal	0x91 0x3D
	0.1 gal	0x92 0x3D
	1 gal	0x93 0x3D
	10 gal	0x94 0x3D
	100 gal	0x95 0x3D
flow rate	0.001 m³/h	0x3B
	0.01 m³/h	0x3C
	0.1 m³/h	0x3D
	1 m³/h	0x3E
	0.001 gpm	0xC1 0x3D
	0.01 gpm	0xC2 0x3D
	0.1 gpm	0xC3 0x3D

	1 gpm	0xC4 0x3D
power	0.001 kW	0x2B
	0.01 kW	0x2C
	0.1 kW	0x2D
	1 kW	0x2E
	0.001 MBtu/h	0x83 0xA2 0x3D
	0.01 MBtu/h	0x84 0xA2 0x3D
	0.1 MBtu/h	0x85 0xA2 0x3D
	1 MBtu/h	0x86 0xA2 0x3D
forward temperature	0.1 °C	0x5A
	0.1 °F	0xDA 0x3D
return temperature	0.1 °C	0x5E
	0.1 °F	0xDE 0x3D
difference temperature	0.1 °C	0x62
	0.1 °F	0x62 0x3D
without unit		0xFD 0x 3A
time	1h	0xFD 0x32

8.3 Hex error code meanings

Ah – Eh

Such a code in any digit position signals a general error of the complete data field. The display at the meter is “ERR”.

8.4 Coding of current value

	DIV					VIF
Value	Device Subunit	Tariff	Storage-number	Function field	Data field	
current energy	-	0	0	0	0x0C	energy
current volume	-	0	0	0	0x0C	volume
current tariff counter 1	-	1	0	0	0x0C	energy volume time
current tariff counter 2	-	2	0	0	0x0C	energy volume time
current tariff counter 3	-	3	0	0	0x0C	energy volume time
current tariff counter 4	-	4	0	0	0x0C	energy volume time
current flow rate	-	0	0	0 3	0x0B	flow rate
current power	-	0	0	0 3	0x0C	power
current forward temperature	-	0	0	0 3	0x0A	forward temperature

current return temperature	-	0	0	0 3	0x0A	return temperature
current difference temperature	-	0	0	0 3	0x0A	difference temperature
current time	-	0	0	0	0x04	0x6D
current operating days	-	0	0	0	0x0A	0x27
current error hours	-	0	0	0	0x0A	0xA6 0x18
current pulse input counter 1	1	0	0	0	0x0C	volume energy without unit
current pulse input counter 2	2	0	0	0	0x0C	volume energy without unit
current tariff 1 definition	-	1	0	0	0x02	0x7F
current tariff 2 Definition	-	2	0	0	0x02	0x7F
current tariff 3 Definition	-	3	0	0	0x02	0x7F
current tariff 4 Definition	-	4	0	0	0x02	0x7F
current tariff 1 gate output (enable)	-	1	0	0	0x01	0xFD 0x1A
current tariff 2 gate output (enable)	-	2	0	0	0x01	0xFD 0x1A
current tariff 3 gate output (enable)	-	3	0	0	0x01	0xFD 0x1A
current tariff 4 gate output (enable)	-	4	0	0	0x01	0xFD 0x1A
current error status	-	0	0	0	0x02	0xFD 0x17
current leak flow rate 0.001 m³/h	-	0	0	0	0x0B	0xBB 0x69
current leak flow rate 0.01 m³/h	-	0	0	0	0x0B	0xBC 0x69
current leak flow rate 0.1 m³/h	-	0	0	0	0x0B	0xBD 0x69
current leak flow rate 1 m³/h	-	0	0	0	0x0B	0xBE 0x69
battery change date	-	0	0	0 3	0x02	0xFD 0x70
identification number HY (WNUM)	-	0	0	0	0x0C	0x78
next due date 1	-	0	1	0	0x02	0xEC 7E
next due date 2	-	0	2	0	0x02	0xEC 7E

8.5 Coding of stored values

Stored values are coded like current values with a different storage number.

Type	Storage number	Available values
accounting date 1	1	date energy volume tariff counter 1 tariff counter 2 tariff 1 definition tariff 2 definition pulse input counter 1 pulse input counter 2
previous accounting date 1	2	date energy volume tariff counter 1 tariff counter 2 tariff 1 definition tariff 2 definition pulse input counter 1 pulse input counter 2
accounting date 2	3	date energy volume tariff counter 1 tariff counter 2 tariff 1 definition tariff 2 definition pulse input counter 1 pulse input counter 2
previous accounting date 2	4	date energy volume tariff counter 1 tariff counter 2 tariff 1 definition tariff 2 definition pulse input counter 1 pulse input counter 2
periodical log 0	5(newest)..28	date energy volume tariff counter 1 tariff counter 2 tariff 1 definition tariff 2 definition pulse input counter 1 pulse input counter 2 max flow rate max power error hour counter operating days average return temperature average forward temperature

Coding of storage date:

- data field = 0x02
- VIF = 0x6C