

HYDRUS 2.0

Communication over interfaces



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1 Introduction

The M-Bus (Meter Bus) is an 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.

2 Communication interfaces

HYDRUS is equipped with an M-Bus communication interface:

- M-Bus communication is over a two-wire line.

2.1 Telegram formats

Communication complies with:

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

2.2 UART

Baud rates

- M-Bus: 300 and 2400 bauds (300 bauds: transmission in Interrupt Mode)

Parity detection

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

2.3 Protocol layer

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

2.4 Connection set-up for M-Bus

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

2.5 Addressing

The meter can be addressed using two addressing variants: with a logic address (primary address) or by using a secondary address.

2.5.1 Selection (secondary address)

Request telegram: 68 0B 0B 68 53 FD 52 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 (HYDRUS: \$24)	ID (ident. code)	\$FF joker
1-byte SMED	MM (medium code)	\$FF joker

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

3 Reading the meter:

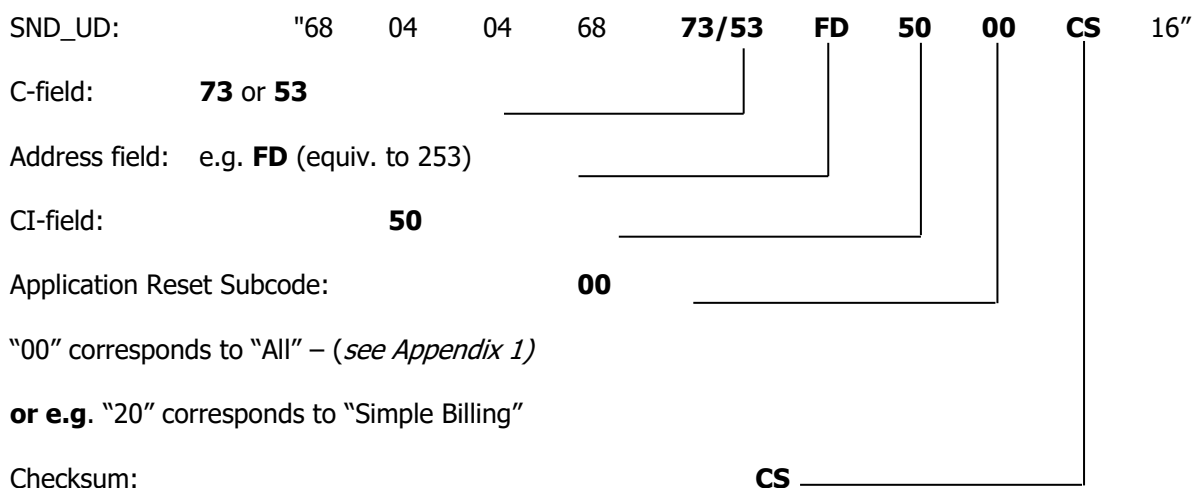
Procedure:

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

3.1 Standard data reading (Application Reset 0)

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

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



3.2 Request response

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

Request telegram		Response
REQ_UD2	10 7B <i>FD*</i> CS 16	RSP_UD

*FD**: Address

3.3 Interpretation of data

The data received basically corresponds to the protocol structure of EN1375-3.
The units are defined in *Appendix 2*.

4 Customer telegram

Registers can be read or programmed direct in the meter using subtables.
The customer telegram can be used for M-Bus, Open Metering Radio or Real Data Radio.

The IZAR@MOBILE 2 program from Diehl Metering can be used to set the customer telegram.
This program can be downloaded at:

www.diehl.com/metering

5 Parametrization of meter

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

5.1 Structure of command set

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

5.2 New primary address

The new M-Bus address AI can be defined with the following telegram:

Send:

68 06 06 68 53 Adr 51 01 7A AI Check 16

Read:

E5

Special cases:

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

5.3 Serial number / customer number

The new meter number can be defined with the following telegram:

Send:

68 09 09 68 53 Adr 51 0C 79 NUM Check 16

Read:

E5

Note: The NUM is part of the secondary address.

6 Appendix 1 Telegram data for Real Data Radio, Open Metering Radio and M-Bus Communication

Application Reset Subcode:

Application Reset Subcode	Telegram data
0 (0x00) "Standard answer"	Current total volume Current forward volume Current return volume Current flow rate Current medium temperature Current ambient temperature Error flags Current date and time Date of due date 1 Total volume of due date 1 Date of due date 2 Total volume of due date 2
1 (0x10) "Fixed network frame"	Configurable
2 (0x20) "Mobile frame"	Configurable

3 (0x30) "Enhanced billing"	Current total volume Current forward volume Current return volume Error flags Date of due date 1 Total volume of due date 1 Date of previous due date 1 Total volume of previous due date 1 Date of due date 2 Total volume of due date 2 Date of previous due date 2 Total volume of previous due date 2
4 (0x40) "Multi tariff billing"	As 3
5 (0x50) "Instantaneous values"	Current total volume Current forward volume Current return volume Current flow rate Current medium temperature Error flags Current operating hours Current error hours
6 (0x60) "History log entry 1"	Current application select Logging period Log Entry 1: Date and time Log Entry 1: Total volume Log Entry 1: Forward volume Log Entry 1: Return volume Log Entry 1: Error flags Log Entry 1: Minimum flow rate Log Entry 1: Maximum flow rate Log Entry 1: Error hours Log Entry 1: Medium temperature Log Entry 1: Ambient temperature 0x1F
6 (0x61) "History log entry 2"	Current application select Log Entry 2: Date and time Log Entry 2: Total volume Log Entry 2: Forward volume Log Entry 2: Return volume Log Entry 2: Error flags Log Entry 2: Minimum flow rate Log Entry 2: Maximum flow rate Log Entry 2: Error hours Log Entry 2: Medium temperature Log Entry 2: Ambient temperature 0x1F

6 (0x62) "History log entry 3"	Current application select Log Entry 3: Date and time Log Entry 3: Total volume Log Entry 3: Forward volume Log Entry 3: Return volume Log Entry 3: Error flags Log Entry 3: Minimum flow rate Log Entry 3: Maximum flow rate Log Entry 3: Error hours Log Entry 3: Medium temperature Log Entry 3: Ambient temperature
7 (0x70) "Static frame"	Configurable
8 (0x80) "Setup answer"	Other FW-Version FabricationNumber Metrological FW version Current date and time Ownership number
9 (0x90) "Testing"	Unused
10 (0xA0) "Calibration"	Unused
11 (0xB0) "Command reply"	Response of last executed command
12 (0xC0) "Development"	Unused
13 (0xD0) "Manufacturing Identification"	Production id version Production id Production number Customer serial number Material number Material number index FW version Device services
14 (0xE0) "Installation frame"	Configurable
15 (0xF0) "User defined answer"	Configurable

Registers can be read or programmed direct in the meter using subtables (Appendix 1).
The IZAR@MOBILE 2 program from Diehl Metering can be used to set some of the tables.
This program can be downloaded at:

www.diehl.com/metering

Please note the following:

When sending an empty Application Reset, the HYDRUS 2 behaves as follows:

Current Application Reset Subcode is automatically changed to Application Reset Subcode 0 (0x00).

7 Appendix 2 M-Bus units		
Value	DIB	VIB

Total volume m ³ ,0	0x0C	0x16
Total volume m ³ ,1	0x0C	0x15
Total volume m ³ ,2	0x0C	0x14
Total volume m ³ ,3	0x0C	0x13
Total volume ft ³ ,0	0x0C	0xFB 0xA1 0x77
Total volume ft ³ ,1	0x0C	0xFB 0xA1 0x76
Total volume ft ³ ,2	0x0C	0xFB 0xA1 0x75
Total volume ft ³ ,3	0x0C	0xFB 0xA1 0x74
Total volume gal,0	0x0C	0x93 0x3D
Total volume gal,1	0x0C	0x92 0x3D
Total volume gal,2	0x0C	0x91 0x3D
Total volume gal,3	0x0C	0x90 0x3D
Total volume igal,0	0x0C	0xFC 0x76 0x04 0x6C 0x61 0x67 0x69
Total volume igal,1	0x0C	0xFC 0x75 0x04 0x6C 0x61 0x67 0x69
Total volume igal,2	0x0C	0xFC 0x74 0x04 0x6C 0x61 0x67 0x69
Total volume igal,3	0x0C	0xFC 0x73 0x04 0x6C 0x61 0x67 0x69
Return volume m ³ ,0	0x0C	0x96 0x3C
Return volume m ³ ,1	0x0C	0x95 0x3C
Return volume m ³ ,2	0x0C	0x94 0x3C
Return volume m ³ ,3	0x0C	0x93 0x3C
Return volume ft ³ ,0	0x0C	0xFB 0xA1 0xF7 0x3C
Return volume ft ³ ,1	0x0C	0xFB 0xA1 0xF6 0x3C
Return volume ft ³ ,2	0x0C	0xFB 0xA1 0xF5 0x3C
Return volume ft ³ ,3	0x0C	0xFB 0xA1 0xF4 0x3C
Return volume gal,0	0x0C	0x93 0xBD 0x3C
Return volume gal,1	0x0C	0x92 0xBD 0x3C
Return volume gal,2	0x0C	0x91 0xBD 0x3C
Return volume gal,3	0x0C	0x90 0xBD 0x3C
Return volume igal,0	0x0C	0xFC 0xF6 0x3C 0x04 0x6C 0x61 0x67 0x69
Return volume igal,1	0x0C	0xFC 0xF5 0x3C 0x04 0x6C 0x61 0x67 0x69
Return volume igal,2	0x0C	0xFC 0xF4 0x3C 0x04 0x6C 0x61 0x67 0x69
Return volume igal,3	0x0C	0xFC 0xF3 0x3C 0x04 0x6C 0x61 0x67 0x69
Forward volume m ³ ,0	0x0C	0x96 0x3B
Forward volume m ³ ,1	0x0C	0x95 0x3B
Forward volume m ³ ,2	0x0C	0x94 0x3B
Forward volume m ³ ,3	0x0C	0x93 0x3B
Forward volume ft ³ ,0	0x0C	0xFB 0xA1 0xF7 0x3B
Forward volume ft ³ ,1	0x0C	0xFB 0xA1 0xF6 0x3B
Forward volume ft ³ ,2	0x0C	0xFB 0xA1 0xF5 0x3B
Forward volume ft ³ ,3	0x0C	0xFB 0xA1 0xF4 0x3B
Forward volume gal,0	0x0C	0x93 0xBD 0x3B
Forward volume gal,1	0x0C	0x92 0xBD 0x3B
Forward volume gal,2	0x0C	0x91 0xBD 0x3B
Forward volume gal,3	0x0C	0x90 0xBD 0x3B
Forward volume igal,0	0x0C	0xFC 0xF6 0x3B 0x04 0x6C 0x61 0x67 0x69
Forward volume igal,1	0x0C	0xFC 0xF5 0x3B 0x04 0x6C 0x61 0x67 0x69
Forward volume igal,2	0x0C	0xFC 0xF4 0x3B 0x04 0x6C 0x61 0x67 0x69
Forward volume igal,3	0x0C	0xFC 0xF3 0x3B 0x04 0x6C 0x61 0x67 0x69
Flow rate m ³ /s,2	0x0B	0x4F
Flow rate m ³ /s,3	0x0B	0x4E
Flow rate m ³ /min,0	0x0B	0x47

Flow rate m ³ /min,1	0x0B	0x46
Flow rate m ³ /min,2	0x0B	0x45
Flow rate m ³ /min,3	0x0B	0x44
Flow rate m ³ /h,0	0x0B	0x3E
Flow rate m ³ /h,1	0x0B	0x3D
Flow rate m ³ /h,2	0x0B	0x3C
Flow rate m ³ /h,3	0x0B	0x3B
Flow rate gal/s,0	0x0B	0x93 0xBD 0xA0 0x76
Flow rate gal/s,1	0x0B	0x93 0xBD 0xA0 0x75
Flow rate gal/s,2	0x0B	0x93 0xBD 0xA0 0x74
Flow rate gal/s,3	0x0B	0x93 0xBD 0xA0 0x73
Flow rate gal/min,0	0x0B	0x93 0xBD 0xA1 0x76
Flow rate gal/min,1	0x0B	0x93 0xBD 0xA1 0x75
Flow rate gal/min,2	0x0B	0x93 0xBD 0xA1 0x74
Flow rate gal/min,3	0x0B	0x93 0xBD 0xA1 0x73
Flow rate gal/h,0	0x0B	0x93 0xBD 0xA2 0x76
Flow rate gal/h,1	0x0B	0x93 0xBD 0xA2 0x75
Flow rate gal/h,2	0x0B	0x93 0xBD 0xA2 0x74
Flow rate gal/h,3	0x0B	0x93 0xBD 0xA2 0x73
Flow rate ical/s,0	0x0B	0xFC 0xA0 0x76 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/s,1	0x0B	0xFC 0xA0 0x75 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/s,2	0x0B	0xFC 0xA0 0x74 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/s,3	0x0B	0xFC 0xA0 0x73 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/min,0	0x0B	0xFC 0xA1 0x76 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/min,1	0x0B	0xFC 0xA1 0x75 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/min,2	0x0B	0xFC 0xA1 0x74 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/min,3	0x0B	0xFC 0xA1 0x73 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/h,0	0x0B	0xFC 0xA2 0x76 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/h,1	0x0B	0xFC 0xA2 0x75 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/h,2	0x0B	0xFC 0xA2 0x74 0x04 0x6C 0x61 0x67 0x69
Flow rate ical/h,3	0x0B	0xFC 0xA2 0x73 0x04 0x6C 0x61 0x67 0x69
Flow rate ft ³ /s,0	0x0B	0xFB, 0xA1, 0xA0, 0x77
Flow rate ft ³ /s,1	0x0B	0xFB, 0xA1, 0xA0, 0x76
Flow rate ft ³ /s,2	0x0B	0xFB, 0xA1, 0xA0, 0x75
Flow rate ft ³ /s,3	0x0B	0xFB, 0xA1, 0xA0, 0x74
Flow rate ft ³ /min,0	0x0B	0xFB, 0xA1, 0xA1, 0x77
Flow rate ft ³ /min,1	0x0B	0xFB, 0xA1, 0xA1, 0x76
Flow rate ft ³ /min,2	0x0B	0xFB, 0xA1, 0xA1, 0x75
Flow rate ft ³ /min,3	0x0B	0xFB, 0xA1, 0xA1, 0x74
Flow rate ft ³ /h,0	0x0B	0xFB, 0xA1, 0xA2, 0x77
Flow rate ft ³ /h,1	0x0B	0xFB, 0xA1, 0xA2, 0x76
Flow rate ft ³ /h,2	0x0B	0xFB, 0xA1, 0xA2, 0x75
Flow rate ft ³ /h,3	0x0B	0xFB, 0xA1, 0xA2, 0x74
Date time	0x04	0x6D
Operating hours	0x0B	0x26
Medium temperature 0,1 °C	0x0A	0x5A
Medium temperature 0,1 °F	0x0A	0xDA 0x3D
Ambient temperature 0,1 °C	0x0A	0x66
Ambient temperature 0,1 °F	0x0A	0xE6 0x3D
Error flags	0x04	0xFD 0x17
Other-FW-Version	0x03	0xFD 0x0F

Metrological FW-Version	0x03	0xFD 0x0E
Remaining battery life	0x02	0xFD 0x74
Battery renewal date	0x02	0xFD 0x70
Due date 1 total volume	0x4C	depends on unit (see total volume)
Due date 1 return volume	0x4C	depends on unit (see return volume)
Due date 1 forward volume	0x4C	depends on unit (see forward volume)
Due date 1 reading date	0x42	0x6C
Due date 1 next reading date	0x42	0xEC 0x7E
Due date 1 second to last total volume	0x8C 0x01	depends on unit (see total volume)
Due date 1 second to last return volume	0x8C 0x01	depends on unit (see return volume)
Due date 1 second to last forward volume	0x8C 0x01	depends on unit (see forward volume)
Due date 1 second to last reading date	0x82 0x01	0x6C
Due date 1 third to last total volume	0xCC 0x01	depends on unit (see total volume)
Due date 1 third to last return volume	0xCC 0x01	depends on unit (see return volume)
Due date 1 third to last forward volume	0xCC 0x01	depends on unit (see forward volume)
Due date 1 third to last reading date	0xC2 0x01	0x6C
Due date 2 total volume	0x8C 0x02	depends on unit (see total volume)
Due date 2 return volume	0x8C 0x02	depends on unit (see return volume)
Due date 2 forward volume	0x8C 0x02	depends on unit (see forward volume)
Due date 2 reading date	0x82 0x02	0x6C
Due date 2 next reading date	0x82 0x02	0xEC 0x7E
Due date 2 second to last total volume	0xCC 0x02	depends on unit (see total volume)
Due date 2 second to last return volume	0xCC 0x02	depends on unit (see return volume)
Due date 2 second to last forward volume	0xCC 0x02	depends on unit (see forward volume)
Due date 2 second to last reading date	0xC2 0x02	0x6C
Due date 2 third to last total volume	0x8C 0x03	depends on unit (see total volume)
Due date 2 third to last return volume	0x8C 0x03	depends on unit (see return volume)
Due date 2 third to last forward volume	0x8C 0x03	depends on unit (see forward volume)
Due date 2 third to last reading date	0x82 0x03	0x6C
Log entry 1 total volume	0x8C 0x04	depends on unit (see total volume)
Log entry 1 return volume	0x8C 0x04	depends on unit (see return volume)

Log entry 1 forward volume	0x8C 0x04	depends on unit (see forward volume)
Log entry 1 minimum flow rate	0xAB 0x04	depends on unit (see flow rate)
Log entry 1 maximum flow rate	0x9B 0x04	depends on unit (see flow rate)
Log entry 1 current flow rate	0x8B 0x04	depends on unit (see flow rate)
Log entry 1 operating hour	0x8B 0x04	0x26
Log entry 1 current medium temperature	0x8A 0x04	depends on unit (see medium temperature)
Log entry 1 Current ambient temperature	0x8A 0x04	depends on unit (see ambient temperature)
Log entry 1 Current Error flags	0x84 0x04	0xFD 0x17
Log entry 1 Error hours counter	0x8A 0x04	0xA6 0x18
Log entry 1 date	0x84 0x04	0x6D
Log entry 2 total volume	0xCC 0x04	depends on unit (see total volume)
Log entry 2 return volume	0xCC 0x04	depends on unit (see return volume)
Log entry 2 forward volume	0xCC 0x04	depends on unit (see forward volume)
Log entry 2 minimum flow rate	0xEB 0x04	depends on unit (see flow rate)
Log entry 2 maximum flow rate	0xDB 0x04	depends on unit (see flow rate)
Log entry 2 current flow rate	0xCB 0x04	depends on unit (see flow rate)
Log entry 2 operating hour	0xCB 0x04	0x26
Log entry 2 current medium temperature	0xCA 0x04	depends on unit (see medium temperature)
Log entry 2 Current ambient temperature	0xCA 0x04	depends on unit (see ambient temperature)
Log entry 2 Current Error flags	0xC4 0x04	0xFD 0x17
Log entry 2 error hours counter	0xCA 0x04	0xA6 0x18
Log entry 2 date	0xC4 0x04	0x6D
Log entry 3 total volume	0x8C 0x05	depends on unit (see total volume)
Log entry 3 return volume	0x8C 0x05	depends on unit (see return volume)
Log entry 3	0x8C 0x05	depends on unit (see forward volume)

forward volume		
Log entry 3 minimum flow rate	0xAB 0x05	depends on unit (see flow rate)
Log entry 3 maximum flow rate	0x9B 0x05	depends on unit (see flow rate)
Log entry 3 current flow rate	0x8B 0x05	depends on unit (see flow rate)
Log entry 3 operating hour	0x8B 0x05	0x26
Log entry 3 current medium temperature	0x8A 0x05	depends on unit (see medium temperature)
Log entry 3 Current ambient temperature	0x8A 0x05	depends on unit (see ambient temperature)
Log entry 3 Current Error flags	0x84 0x05	0xFD 0x17
Log entry 3 error hours counter	0x8A 0x05	0xA6 0x18
Log entry 3 date	0x84 0x05	0x6D
Error hours counter	0x0A	0xA6 0x18
Ownership BCD number	0x0C	0xFD 0x11
Ownership number ASCII	0x0D	0xFD 0x11
Fabrication number	0x07	0x78
Production number	0x0C	0x78
Logging period	0x81 0x04	In Hours: 0xFD 0x26 In Days: 0xFD 0x27 In Months: 0xFD 0x28
Selected application block	0x01	0xFD 0xFD 0x00

8 Description of LC display

Operation:

Meter information can be called up on the LCD. The display information is arranged in a number of display loops. These display loops contain the display windows, which are provided by automatically changing displays (shown as display window in one line).

The display window can be changed by pressing the button. Each press of the button changes to the next display window.

To save the battery, the meter switches to sleep mode (display off) if the button is not pressed for approx. 4 minutes; it can be woken up by pressing the button.

After awakening, the display shows first a screen check (i.e. all symbols in the display are briefly switched on and off) and then the total volume. This remains for at least 10 seconds on the display (also when the optical button is pressed). Afterwards the display loop can be switched with the help of the optical button.

The meter is factory pre-configured with one of the following loops:

Minimum loop
Display test
Total volume
Battery lifetime
Firmware version / Checksum

Medium loop
Display test
Total volume
Battery lifetime
Firmware version / Checksum
Current flow
Errors / Alarms

Maximum loop
Display test
Total volume
Battery lifetime
Firmware version / Checksum
Current flow
Errors / Alarms
High resolution total volume
Due date / Due date volume
Reverse volume

In the following, you can see the comprehensive factory settings for the loops

- Display test (88)
- Current total volume (01)
- Battery lifetime (02)
- Software version alternating with the checked sum of the software (03)
- Current flow rate (m³/h) (04)
- Error messages (05)
- Total volume high resolution (07)
- Total volume of the due date function alternating with the modification of the due date (08)
- Current reverse volume (09)