



**Badger Meter Europa GmbH**

# **ModMAG<sup>®</sup> M1000**

## **M-Bus interface**



# **USER MANUAL**

July 2016

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## 1. Basic safety recommendation

Please see “Basic safety recommendations” in installation and operation manual ModMAG® M1000.

## 2. Introduction

The ModMAG® M1000 M-Bus interface is providing a EN13757 compatible M-Bus interface to the Badger ModMAG® M1000 flow meter with the following features:

- M-Bus primary and secondary address selection
- The primary address is saved in a non-volatile memory
- 300, 2400 and 9600 baud communication speed
- Automatic baud rate detection
- Standard M-Bus serial communication parameters: 8 data bits, 1 parity even bit 1 stop bit.
- Five different M-Bus response telegrams with different meter values (according to EN13757-3, chapter 4.22, table 2):
  - All
  - Instantaneous values
  - Testing
  - Calibration
  - Manufacturing
- M-Bus wrapper command for ModBus® communication

## 3. Meter settings

If the M-Bus interface is used, please activate it in the meter. The interface can be configured for M-Bus in the programm menu **Main menu/Communication/Interface**. The primary address can also be entered under **Main menu/Communication/M-Bus/Address** (factory setting on 0 [zero]).

Main Menu > Communications > Interface > M-Bus

```
Main Menu
Communications ▶
```

```
Communications
Interface
M-Bus
```

Main Menu > Communications > M-Bus > (Primary) Address > 0

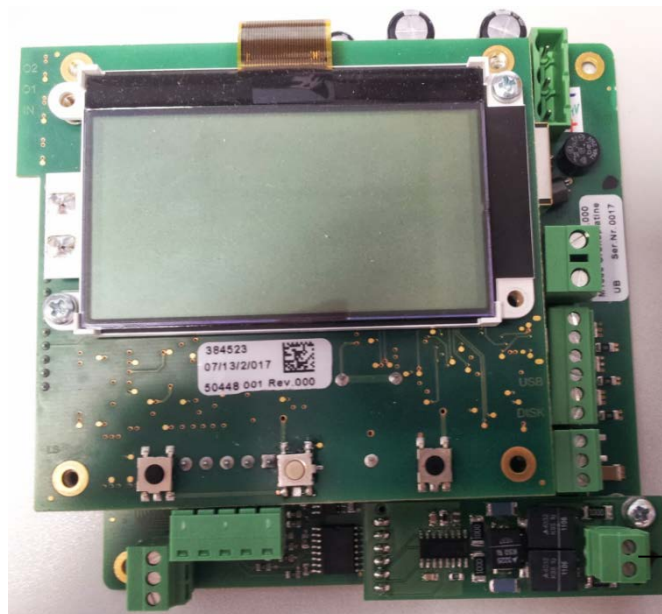
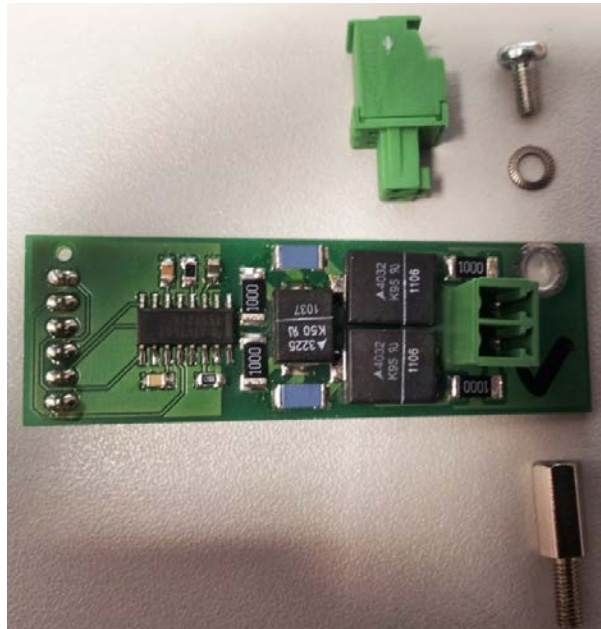
```
Communications
M-Bus ▶
```

```
M-Bus
Address
0
```



#### 4. Hardware

The additional M-Bus interface board is plugged in the communication socket (right lower corner) of the ModMAG<sup>®</sup> M1000 main board. The interface board should be properly fastened to main board.



#### 5. Electrical connection

Use shielded cable

Terminal	Description
X602/1	M-Bus
X602/2	M-Bus



## 6. M-Bus addressing

### 6.1. Primary address

The module may be addressed using its primary address (range: 0...250). The default (factory setting) primary address of the module is 0 (zero). The primary address can be reconfigured using the appropriate M-Bus command (see below).

### 6.2. Secondary address

The module may be addressed using the secondary address selection scheme of M-Bus. The secondary address consists of:

- PCB serial number (8 digits BCD)
- Manufacturer code (BMI, 0x09A9)
- Generation (0x01)
- Measured medium (0x07, cold water)

e.g.: 19100995,09A9,01,07

Any wildcard selection using the joker character ('F') is also possible:

19100995,FFFF,FF,FF

1910FFFF,FFFF,FF,FF

19100995,FFFF,FF,07

etc.

### 6.3. M-Bus commands

Since the device has got only two SND\_UD commands, it is not possible to send multiple commands within one M-Bus telegram.

### 6.4. Setting primary address

The default (factory setting) primary address of the module is 0 (zero). You may program any other primary address in the range of 1 to 249 by using the standard M-Bus SND\_UD command for primary address setting:

Request (values in hex):

68 06 06 68 73/53 PAddr 51 01 7A NewAddr ChkS 16

Answer (values in hex):

E5

PAddr: Current primary address of the device

NewAddr: New primary address to program

Please note that the primary address is immediately written in the non-volatile flash memory of the module. The number of write cycles of the flash memory is limited.



### 6.5. Slave Select

This command selects slave and can be used for testing communication

Slave Select Request

```
68 0B 0B 68 53 FD 52 FF FF FF FF FF FF FF FF 9A 16
```

Where:

68	Start of Long Frame
0B 0B	L Field
68	Start
53	C Field        SND_UD
FD	A Field
52	CI Field - selection of slaves
FF FF FF FF	S/N - no filter
FF FF	Manufacturer - no filter
FF	Generation - no filter
FF	Medium - no filter
9A	Check Sum
16	Stop

Slave Select Answer

```
E5
```

### 6.6. Changing M-Bus response telegram

The module may answer a M-Bus REQ\_UD2 (request user data 2) telegram with one of five different M-Bus RSP\_UD (respond user data) telegrams, (according to EN13757-3 chapter 4.22 table 2):

- All
- Instantaneous values
- Testing
- Calibration
- Manufacturing

The telegram is selected by sending the appropriate M-Bus application reset telegram.



Request (values in hex):

```
68 03 03 68 73/53 PAddr 50 ChkS 16 set "All" telegram
68 04 04 68 73/53 PAddr 50 00 ChkS 16 set "All" telegram
68 04 04 68 73/53 PAddr 50 50 ChkS 16 set "Instantaneous" telegram
68 04 04 68 73/53 PAddr 50 90 ChkS 16 set "Testing" telegram
68 04 04 68 73/53 PAddr 50 A0 ChkS 16 set "Calibration" telegram
68 04 04 68 73/53 PAddr 50 B0 ChkS 16 set "Manufacturing" telegram
```

Answer to all of the above requests (values in hex):

E5

The next (and all the following) REQ\_UD2 requests are then answered with the selected telegram.

Please note that the RSP\_UD telegram setting is not written immediately in the non-volatile flash memory of the module but only:

- On the cyclic 24 hours reset
- Or if a set primary address command has been received and executed
- Or if the command to write the configuration area to flash has been received and executed.

#### 6.7. Write configuration area to flash

The module has got a configuration area which holds settings for e.g. the primary address, the selected answer telegram etc. These settings are kept in volatile RAM memory unless they are written in the non-volatile flash memory. If the user wants to save the configuration in the non-volatile memory, he may execute the command below:

Request (values in hex):

```
68 06 06 68 73/53 PAddr 51 00 FE 00 ChkS 16
```

save configuration to flash

Answer (values in hex):

E5



### 6.8. Send ModBus® commands

Since not all of the ModBus® registers of the ModMAG® M1000 are retrievable using "native" M-Bus commands, it is also possible to encapsulate "native" ModBus® commands within a M-Bus command. It is then possible to use all the ModBus® commands understood by the ModMAG® M1000 (0x03, 0x04, 0x06 and 0x10, register reading and writing) with a M-Bus interface too.

Request (values in hex):

```
68 LL LL 68 73/53 PAddr 51 0F [ModBus] ChkS 16
send ModBus® command
```

LL: Length byte of M-Bus telegram

[ModBus]: ModBus® command without CRC

e.g.:

```
68 0A 0A 68 73/53 PAddr 51 0F 01 03 00 43 00 05 ChkS 16
```

The underlined part is the ModBus® command for reading the address 0x0043 (5 registers) of the ModMAG® M1000.

Answer (values in hex):

```
68 LL LL 68 08 PAddr 72 SecAddr AccessCtr Status Signature
0F [ModBus] ChkS 16
```

e.g.:

```
68 1D 1D 68 08 00 72 95 09 10
19 A9 09 01 07 08 01 00 00 Header for M-Bus RSP_UD
0F Flag: manufacturer specific
01 03 0A 31 39 31 30 30 39 39 35 00 00 ModBus® answer
ChkS 16
```

Please note also that these commands are compatible with M-Bus physical and link layers, but not completely compatible with the application layer. Therefore, all standard M-Bus communication lines will transmit the command, however, the software on the application side must be able to understand and interpret the command.





### 6.9. M-Bus REQ\_UD2 answers

As mentioned before, the module may answer a REQ\_UD2 data request by five different RSP\_UD answers according to its configuration:

All: Contains the volumes, flow rate, flow speed, flow direction, etc.

Instantaneous: Contains a short form of "All" with only the volumes, flow rate and flow direction (smaller telegram = faster reading)

Testing: Contains the meter diagnostic counters of the ModMAG® M1000

Calibration: Contains the meter calibration registers of the ModMAG® M1000

Manufacturing: Contains the product identification registers of the ModMAG® M1000

Request (values in hex):

```
10 7B/5B PAddr ChkS 16 REQ_UD2
```

Answer (values in hex):

```
68 04 04 68 08 PAddr 70 08 ChkS 16
```

CI = 0x70: Report of application errors

0x08: Application too busy for handling readout requests (see also, EN13757-3, chapter 8.3)

#### 6.9.1. M-Bus REQ\_UD2 answer „All“

N°	Unit	Tariff	Storage	Data	Value	Funct.	VIB
0	0	0	0	REAL4	1.854350e-003	Inst.	Volume [m <sup>3</sup> ]
1	1	0	0	REAL4	0.000000e+000	Inst.	Volume [m <sup>3</sup> ]
2	2	0	0	REAL4	1.854350e-003	Inst.	Volume [m <sup>3</sup> ]
3	3	0	0	REAL4	1.854350e-003	Inst.	Volume [m <sup>3</sup> ]
4	4	0	0	REAL4	0.000000e+000	Inst.	Volume [m <sup>3</sup> ]
5	5	0	0	REAL4	1.854350e-003	Inst.	Volume [m <sup>3</sup> ]
6	0	0	0	REAL4	0.000000e+000	Inst.	m/s
7	0	0	0	REAL4	0.000000e+000	Inst.	Volume Flow [l/sec] ->*10E3



N°	ModBus® register	Description
0	0x0207	TOTALIZER_T1PLUS in m <sup>3</sup>
1	0x0209	TOTALIZER_T1MINUS in m <sup>3</sup>
2	0x020B	TOTALIZER_T1BIDIR in m <sup>3</sup>
3	0x020F	TOTALIZER_T2PLUS in m <sup>3</sup>
4	0x0211	TOTALIZER_T2MINUS in m <sup>3</sup>
5	0x0213	TOTALIZER_T2BIDIR in m <sup>3</sup>
6	0x00E9	Flow velocity in m/s
7	0x00ED	Flow rate in m <sup>3</sup> /s

### 6.9.2. M-Bus REQ\_UD2 answer „Instantaneous“

N°	Unit	Tariff	Storage	Data	Value	Funct.	VIB
0	0	0	0	REAL4	1.854350e-003	Inst.	Volume [m <sup>3</sup> ]
1	1	0	0	REAL4	0.000000e+000	Inst.	Volume [m <sup>3</sup> ]
2	2	0	0	REAL4	1.854350e-003	Inst.	Volume [m <sup>3</sup> ]
3	3	0	0	REAL4	1.854350e-003	Inst.	Volume [m <sup>3</sup> ]
4	4	0	0	REAL4	0.000000e+000	Inst.	Volume [m <sup>3</sup> ]
5	5	0	0	REAL4	1.854350e-003	Inst.	Volume [m <sup>3</sup> ]
6	0	0	0	REAL4	0.000000e+000	Inst.	Volume Flow [l/sec] ->*10E3

N°	ModBus® register	Description
0	0x0207	TOTALIZER_T1PLUS in m <sup>3</sup>
1	0x0209	TOTALIZER_T1MINUS in m <sup>3</sup>
2	0x020B	TOTALIZER_T1BIDIR in m <sup>3</sup>
3	0x020F	TOTALIZER_T2PLUS in m <sup>3</sup>
4	0x0211	TOTALIZER_T2MINUS in m <sup>3</sup>
5	0x0213	TOTALIZER_T2BIDIR in m <sup>3</sup>
6	0x00ED	Flow rate in m <sup>3</sup> /s

### 6.9.3. M-Bus REQ\_UD2 answers “Testing”

N°	Unit	Tariff	Storage	Data	Value	Funct.	VIB
0	0	0	14	INT2	2163	Inst.	Commulation counter
1	0	0	2	INT2	2163	Inst.	Commulation counter
2	0	0	0	INT2	0	Inst.	Error Flags (binary)



N°	ModBus® register	Description
0	0x0119	Measure counter
1	0x0201	Empty pipe counter
2	0x0232	Fault (bit field 16bit)

#### 6.9.4. M-Bus REQ\_UD2 answer "Calibration"

N°	Unit	Tariff	Storage	Data	Value	Funct.	VIB
0	0	0	0	INT2	50	Inst.	mm
1	0	0	2	REAL4	0.000000e+000	Inst.	No VIF
2	0	0	2	REAL4	0.000000e+000	Inst.	m/s
3	0	0	4	REAL4	7.692835e+008	Inst.	No VIF
4	0	0	0	REAL4	2.003202e-001	Inst.	Current [mA]
5	0	0	0	INT2	0	Inst.	Hz
6	0	0	1	INT2	2	Inst.	Hz
7	0	0	6	REAL4	0.000000e+000	Inst.	No VIF

N°	ModBus® register	Description
0	0x006F	Detector diameter in mm
1	0x0071	Detector factor
2	0x0075	Detector offset in m/s
3	0x0079	Amplifier factor
4	0x007D	Detector current in mA
5	0x0081	Power line frequency in Hz
6	0x0082	Excitation frequency in Hz
7	0x010B	Scale factor in %



## 6.9.5. M-Bus REQ\_UD2 answer "Manufacturing"

N°	Unit	Tariff	Storage	Data	Value	Funct.	VIB
0	0	0	0	INT2	4	Inst.	Model / Version
1	0	0	0	Var.	M1000	Inst.	Model / Version
2	0	0	1	Var.	M1000R_E_STM32F107RC	Inst.	Model / Version
3	0	0	0	Var.	v1.0.4	Inst.	Software version #
4	0	0	0	Var.	May 15 2013	Inst.	No VIF
5	0	0	1	Var.	10:21:36	Inst.	No VIF
6	0	0	2	Var.	6B47	Inst.	No VIF
7	0	0	3	Var.	29EE	Inst.	No VIF

N°	ModBus® register	Description
0	0x0000	Product code
1	0x0001	Product name
2	0x0009	Firmware name
3	0x0019	Application version
4	0x0023	Compile date [MMM:DD:YYYY]
5	0x0033	Compile time [HH:MM:SS]
6	0x0048	OTP boot checksum
7	0x004B	Flash OS checksum

## 7. Technical data

The ModMAG® M-Bus interface is providing an EN13757 compatible M-Bus interface to the ModMAG® M1000 flow meter.

M-Bus interface	2 wire EN13757 compatible M-Bus interface 300, 2400, 9600 baud auto-baud detection 8 data bits 1 stop bit 1 even parity bit 1 M-Bus unit load (1.5 mA) 15 mA active M-Bus current M-Bus input with reversible mains protection 2 pin clamp
Isolation	1500 V <sub>RMS</sub> isolation between M-Bus interface and ModMAG® M1000



## **8. Return of goods for repair / Harmlessness declaration**

Please refer to our claims return form/harmlessness declaration under [www.badgermeter.de/service/return\\_of\\_goods](http://www.badgermeter.de/service/return_of_goods).



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