ModMAG®
M-Series® | Electromagnetic Flow Meters

ModMAG® M1000

M-Bus interface

Badger Meter

MAG-UM-04003-EN-01 (January 2022)

User manual

CONTENT

1. BASIC SAFETY RECOMMENDATION

Please see "Basic safety recommendations" in installation and operation manualModMAG® M1000.

2. INTRODUCTION

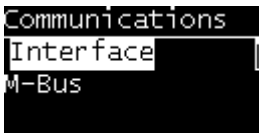
The ModMAG® M1000 M-Bus interface is providing a EN13757 compatible M-Bus inter-face to the Badger ModMAG® M1000 flow meter with the following features:

- 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 bit1 stop bit.
- Five different M-Bus response telegrams with different meter values (according toEN13757-3, chapter 4.22, table 2):
  - All
  - Instantaneous values
  - Testing
    - Calibration
    - Manufacturing
- M-Bus wrapper command for ModBus® communication

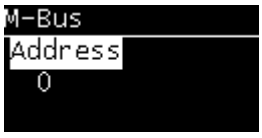
3. METER SETTINGS

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

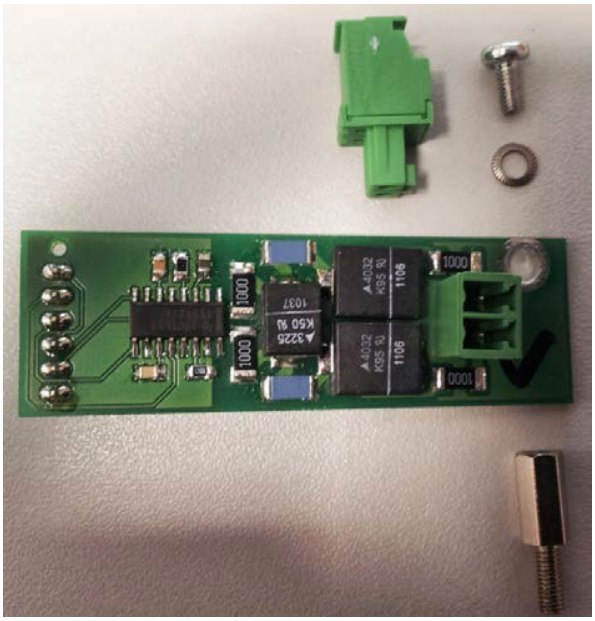


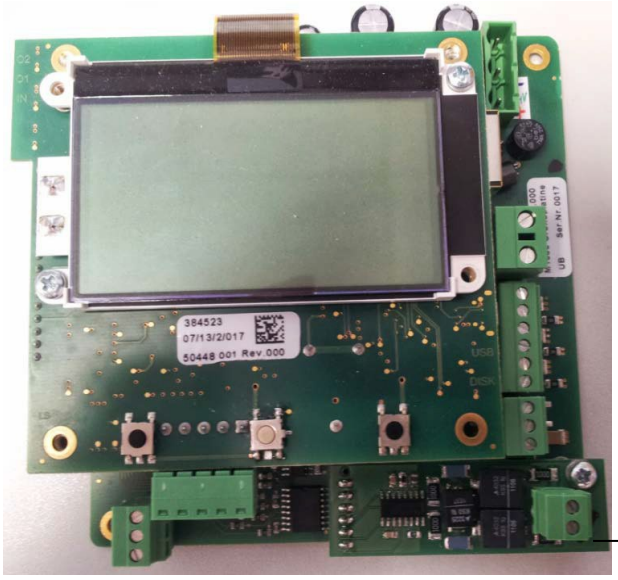
Main Menu > Communications > M-Bus > (Primary) Address > 0



4. HARDWARE

The additional M-Bus interface board is plugged in the communication socket (right lower corner) of the ModMAG® 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 standardM-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 AnswerE5
```

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 theselected telegram.

Please note that the RSP_UD telegram setting is not written immediately in thenon-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 receivedand 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):

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 (5registers) of the ModMAG® M1000.

Answer (values in hex):

`68 LL LL 68 08 PAddr 72 SecAddr AccessCtr Status Signature0F [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^3]
1	1	0	0	REAL4	0.000000e+000	Inst.	Volume [m^3]
2	2	0	0	REAL4	1.854350e-003	Inst.	Volume [m^3]
3	3	0	0	REAL4	1.854350e-003	Inst.	Volume [m^3]
4	4	0	0	REAL4	0.000000e+000	Inst.	Volume [m^3]
5	5	0	0	REAL4	1.854350e-003	Inst.	Volume [m^3]
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^3
1	0x0209	TOTALIZER_T1MINUS in m^3
2	0x020B	TOTALIZER_T1BIDIR in m^3
3	0x020F	TOTALIZER_T2PLUS in m^3
4	0x0211	TOTALIZER_T2MINUS in m^3
5	0x0213	TOTALIZER_T2BIDIR in m^3
6	0x00E9	Flow velocity in m/s
7	0x00ED	Flow rate in m^3/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^3]
1	1	0	0	REAL4	0.000000e+000	Inst.	Volume [m^3]
2	2	0	0	REAL4	1.854350e-003	Inst.	Volume [m^3]
3	3	0	0	REAL4	1.854350e-003	Inst.	Volume [m^3]
4	4	0	0	REAL4	0.000000e+000	Inst.	Volume [m^3]
5	5	0	0	REAL4	1.854350e-003	Inst.	Volume [m^3]
6	0	0	0	REAL4	0.000000e+000	Inst.	Volume Flow [l/sec] ->*10E3

N°	Modbus register	Description
0	0x0207	TOTALIZER_T1PLUS in m^3
1	0x0209	TOTALIZER_T1MINUS in m^3
2	0x020B	TOTALIZER_T1BIDIR in m^3
3	0x020F	TOTALIZER_T2PLUS in m^3
4	0x0211	TOTALIZER_T2MINUS in m^3
5	0x0213	TOTALIZER_T2BIDIR in m^3
6	0x00ED	Flow rate in m^3/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 interface300, 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 RMS isolation between M-Bus interface andModMAG® M1000

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