

PadPuls M1

1-channel M-Bus
pulse converter
for reed signals



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This documentation is valid from M-Bus generation: \$09

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1 Functional description

The PadPuls M1 adapts consumption measuring instruments, such as, electricity, gas or water meters to the M-Bus system. The meters that are to be adapted must have a floating pulse output. The user can configure the PadPuls M1 with the MBCONF program so that the counted impulses are converted to units such as kWh, m³, J and so on. With its user interface the configuration of MBCONF is very easy.

When connected to the M-Bus the PadPuls M1 is powered by the bus. A built-in battery ensures that metering continues even if the M-Bus fails for longer than the normal calibration time of the water meter or heat counter. The battery also ensures that the meter readings and the configuration data is maintained in RAM. Therefore the battery jumper should be plugged in at all times. The jumper serves only to disconnect the battery from the circuitry if the battery needs to be replaced.

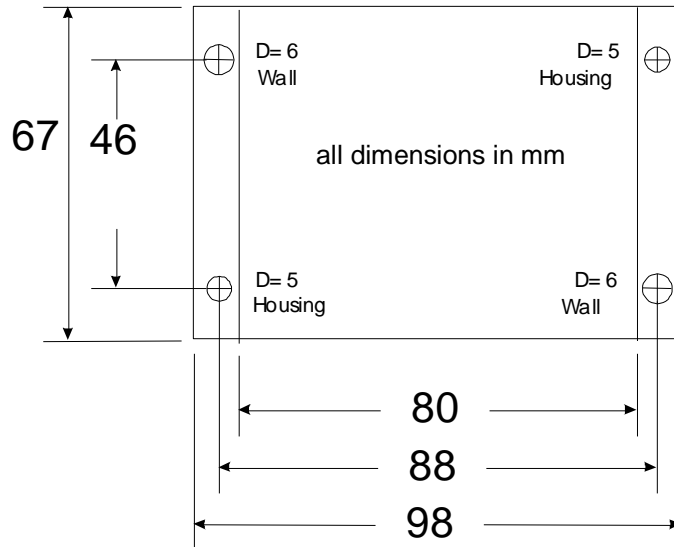
Device data can be protected against unauthorized configuration. The PadPuls M1 can be switched to protection mode with a special M-Bus telegram. In this operating mode, subsequent changes to device parameters cannot be made. The protection mode can then only be disabled by opening the sealable housing and pressing the unprotect pushbutton.



2 Installation and startup

2.1 Mounting the case

The housing is fixed to the wall with two screws, which are screwed diagonally through the holes marked with “wall”. The heads of the screws should be maximum 6 mm in diameter so that the cover is not screwed as well.

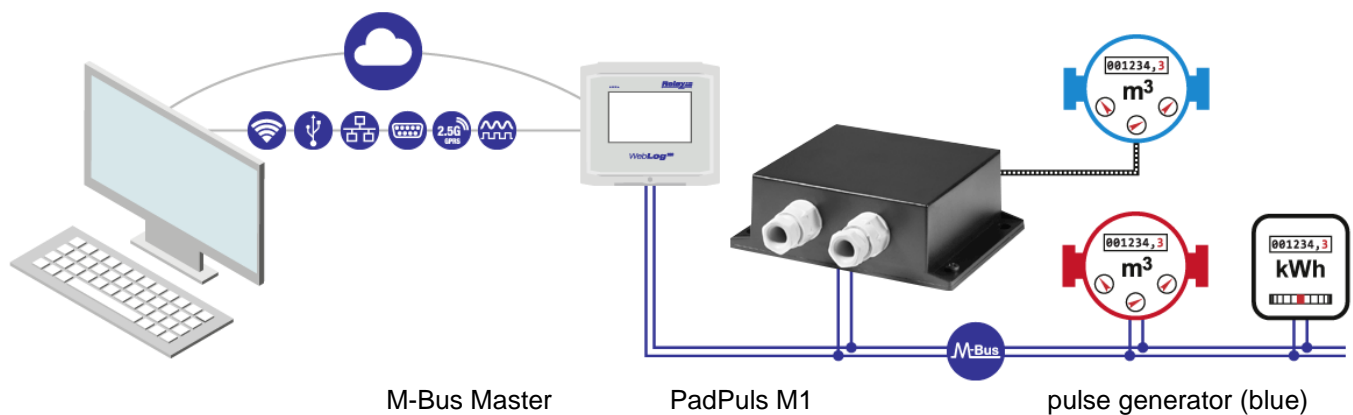


2.2 Opening the case

To deactivate the write protection or connect the cables the housing cover can be opened by removing the metal screws above at the left and below at the right. The unprotect pushbutton is then accessible from outside; the unit is unprotected by pressing this button. Use a suitable adhesive seal to prevent unnoticed opening of the housing.

2.3 Connecting

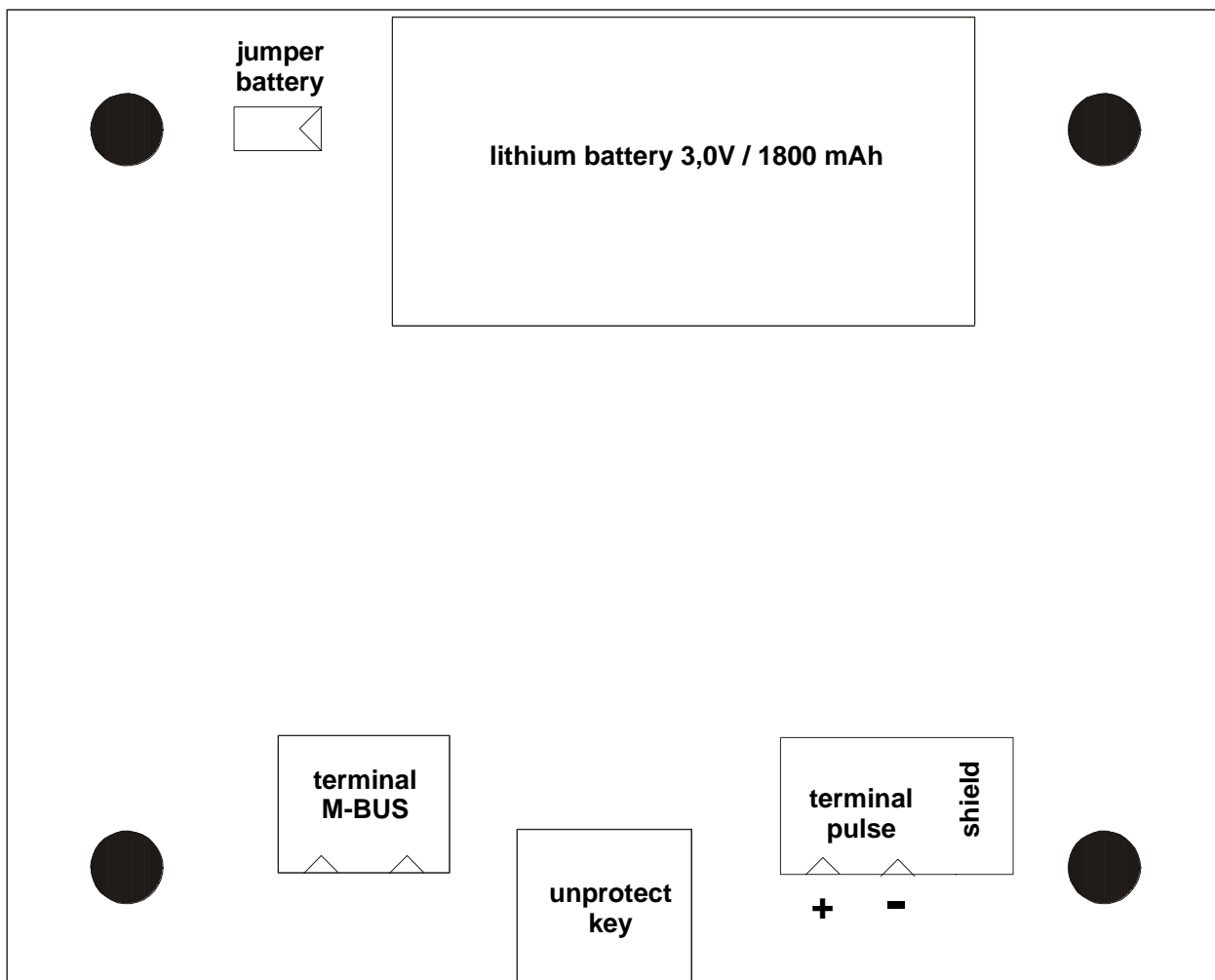
The following drawing shows a typical application of the PadPuls M1:



After opening the housing please lead the M-Bus cable through the left cable gland of the cover and connect the cable to the left terminal. Then do the same with the cable of the pulse generator (right side). Please connect an optional shielding to the terminal labelled with „shield“. Connect the shielding only to the PadPuls.

- Impulse devices with floating contacts (reed contacts) are connected to the terminals marked with “pulse” using any polarity. If cable shielding is available, it can be wired **single-sided** to the terminal marked with “shield”.
- Impulse devices with optocouplers or electrically isolated transistor outputs must be connected to the “pulse” with the correct polarity. The left-hand terminal is the positive connection and the middle terminal the negative connection.

The following graphic shows the position of the terminals and the button:



Attention: The battery jumper is plugged in at the factory and should not be removed as the PadPuls M1 will otherwise lose configuration. In this case, a new configuration including programming of the ID is necessary.

3 Parameterization using MBCONF

The device is supplied with a basic configuration (address 0, unprotected) and must be adapted by the customer to the respective installation. Parameterization requires the MBCONF program. You will find the free software on our CD "Tools & Docs" and for download on our homepage www.relay.de.

3.1 Installation

The software MBCONF for configuration of the pulse adaptor is a 32-bit application, which can be executed on IBM-PC compatible computers under the operating systems Windows 10 / 8.1 / 7 / XP / 2000 / 98 / 95. The desktop PC or laptop must have a free serial RS232C interface to connect the M-Bus level converter. You can alternatively use an USB or Ethernet to M-Bus level converter with a driver for a virtual serial port. We recommend our service tool Micro-Master USB (art.no. MR003USB). The PadPuls M1 to be parameterized must be connected directly (i.e. as only M-Bus device) to the M-Bus output of the level converter.

Please run the file "MBCONF_SETUP.EXE" from Windows Explorer or via "Start – Execute" to install the software. Subsequently you select the language of the installation procedure. The setup software can create a program group and a link on the desktop on demand. You can then execute both versions for German and English language either from start menu or desktop.

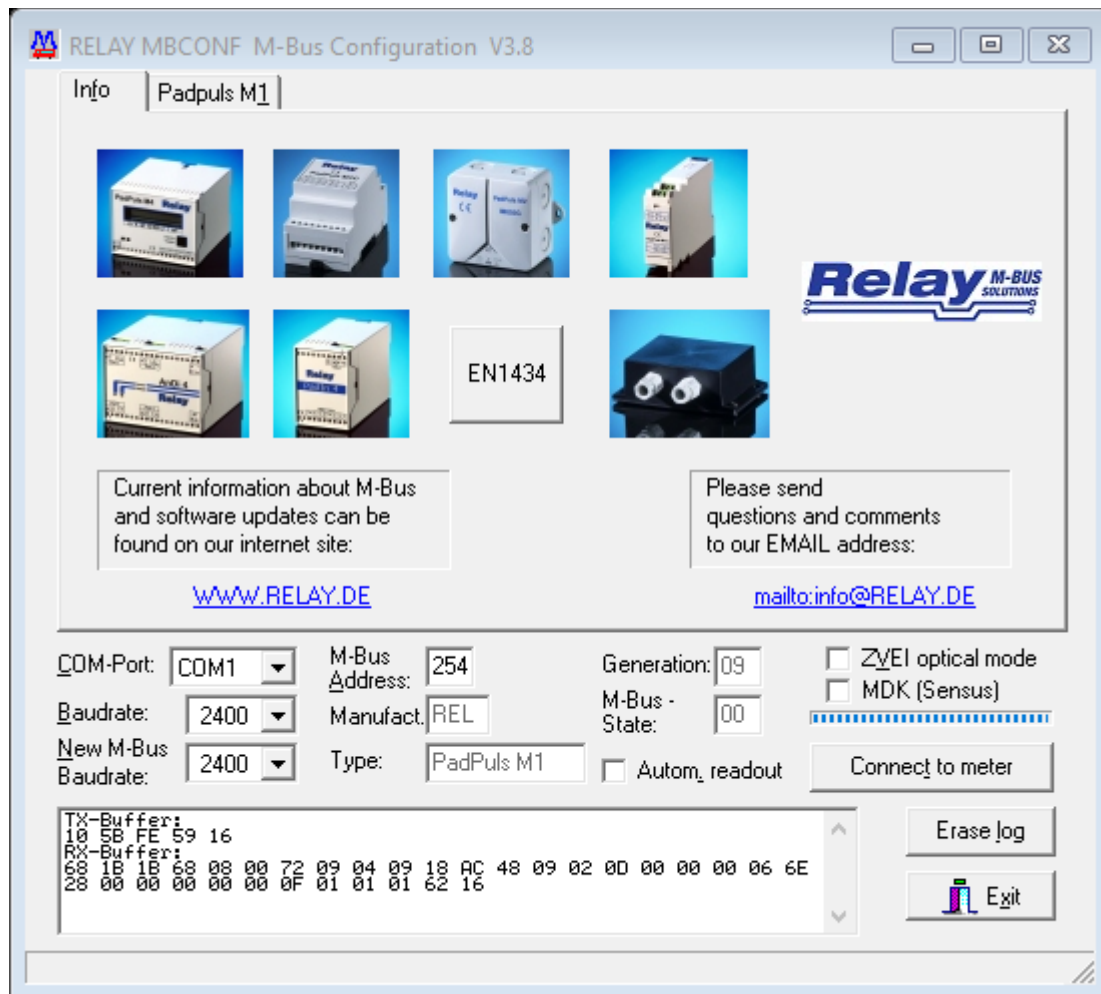
3.2 Operation

After program start the user operates the software according to the Windows conventions with the mouse or the keyboard. If you stay with the mouse on a button or an input field, then a hint to its function appears. Light-grey fields and boxes cannot be edited.

All input fields and buttons have an underlined letter. The function can be activated by simultaneous pressing of the keys [ALT] and the respective letter. Within dialogs the cursor can be moved with the keys [TAB] or [SHIFT] [TAB] forward and backward. [SPACE] activates or deactivates selection boxes. Multiple selection boxes (arrow at the right edge) can be activated with [↓]. The user then selects an entry with [↓] and [↑]. By pressing [RETURN] the selected entry is taken over. With [ESC] the selection box is left without transfer.

The program is arranged as a sheet system. The sheet "Info" contains general options of the communication with the M-Bus device to be configured. In this sheet the user can select the serial port of the PC, the baudrate of the PC, the baudrate of the M-Bus device and the M-Bus primary address which is used for communication. After a successful connection with the M-Bus device, further manufacturer information is shown in the sheet "Info" and additional device-specific sheets are displayed.

3.3 Sheet Info



This sheet shows some photos of supported M-Bus devices from the product range of the Relay GmbH, the PadMess GmbH and further manufacturers. Here are also links to our Internet page, from which the current version of the program can be downloaded, and to the email address for criticism and suggestions to the program.

The lower third of this card is likewise visible in every other card. Here the following input fields and buttons are always attainable:

COM-Port

is the serial port of the PC to which the M-Bus level converter is connected. The selected port will be saved in an INI file and will be restored on startup. Therefore the COM-Port has to be configured only once.

Baudrate

is the transmission speed of the serial port of the PC used for parameterization. Possible selections for this used M-Bus baudrate are 300, 2400 or 9600 baud. Attention: Baudrates of more than 2400 baud are not supported by all M-Bus level converters which are available on the

market! The selected baudrate must be identical to the baudrate of the M-Bus device. (see: “New M-Bus Baudrate”). The PadPuls M1 supports all three baudrates.

| | |
|----------------------------------|---|
| <u>N</u>ew M-Bus Baudrate | allows reprogramming the baudrate of the M-Bus device. The new baudrate is sent to the M-Bus device after a change in the appropriate selection box. If the M-Bus slave accepts this command, it acknowledges the telegram with the single character „\$E5“ (\$ for hexadecimal notation) using the old baudrate. Afterwards the device switches to the new baudrate. This button is not needed for the PadPuls M1, because it automatically detects the baudrate used by the master. |
| M-Bus <u>A</u>ddress | is the primary address of the connected M-Bus slave. In a direct connection with only one slave you can use the broadcast address 254. Using this address every M-Bus device must answer regardless of its own address. |
| <u>C</u>onnect to meter | is used to request data from the slave. The type of device is then automatically recognized. The items “Manufact.”, “Generation”, “Type” and “M-Bus State” will then be refreshed. New sheets are generated depending on manufacturer and type of the M-Bus device. A single sheet appears in case of PadPuls M1. |
| <u>M</u>anufact. | is an item that shows the 3-letter manufacturer code after successful reading (“Connect to meter”). This item is read only. |
| <u>G</u>eneration | shows the revision connected M-Bus device. This item is read only. |
| <u>T</u>ype | shows the type (here: PadPuls M1) of the connected device. This item is read only. |
| <u>M</u>-Bus State | shows the M-Bus state of the connected device. This item is read only. |
| <u>Z</u>VEI optical mode | if this option is activated, devices with an optical interface and M-Bus protocol according to EN 1434-3 can be read and programmed using an optical reading head. |
| <u>M</u>DK (Sensus) | This switch activates the readout with an MDK from Sensus. |
| <u>A</u>utom. readout | if this option is activated, the software always reads the data after writing (useful for checking the correct programming). |

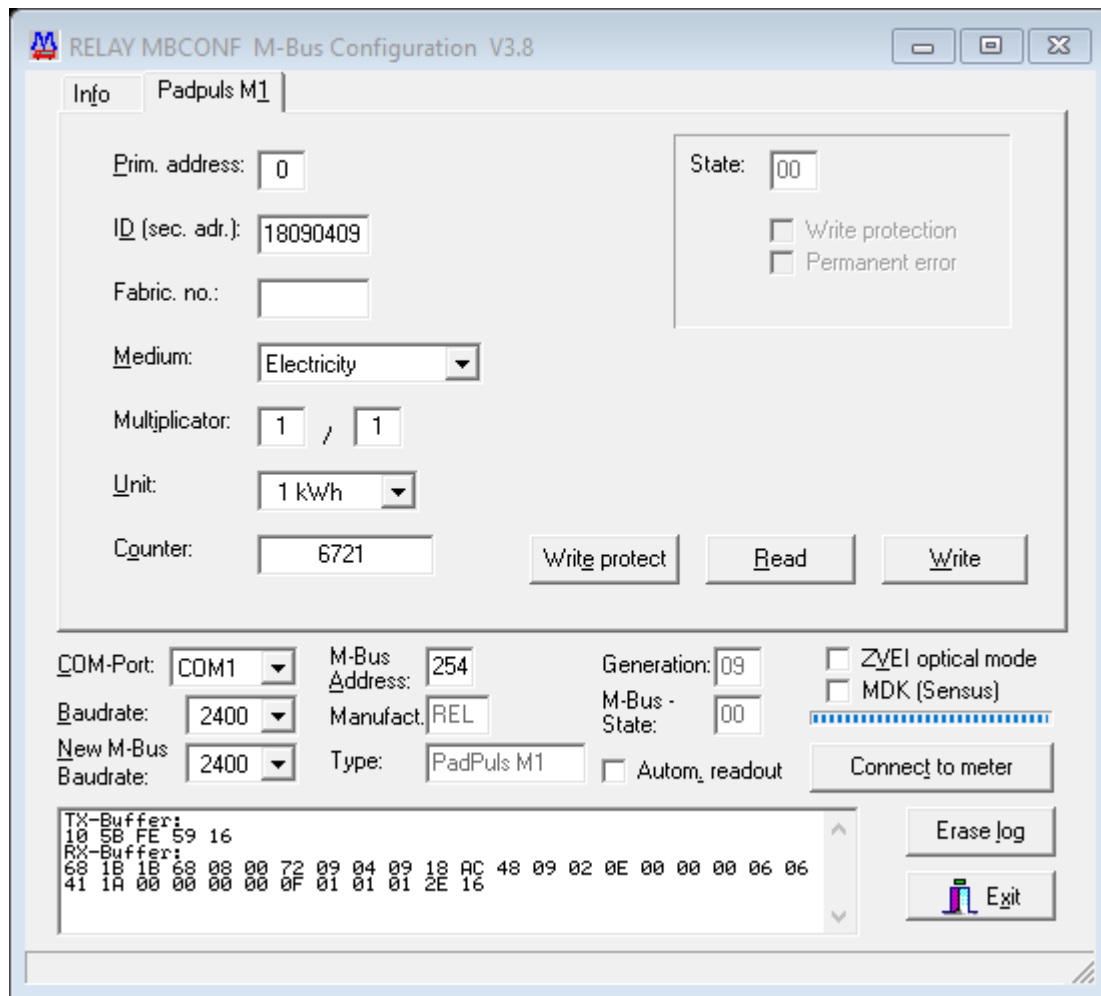
Log-Window

The so-called log window is always visible. All M-Bus communication steps are logged in this window. Data is displayed in hexadecimal notation. It is possible to mark outputs in the log window and copy them with the keys "CTRL-C" to the windows clipboard. The data can then easily be imported to any text editor for documentation. As soon as the maximum storage capacity of the window is achieved, no more data is logged. If you want to keep on logging, you have to delete the logged data.

The following buttons are also always visible:

- | | |
|------------------|---|
| Erase log | clears all outputs inside the log window. |
| Exit | terminates the program and stores the current setting of serial port (port no.) into the INI file |

3.4 Sheet M1



This sheet shows the current settings and values of the PadPuls M1. The following input boxes and buttons are used to change the parameters of the pulse adapter:

Prim. address is the primary M-Bus address of the selected device. Values between 1 and 250 can be entered in this field for new assignment of the address. After pressing the “Write” button the software programs this primary address and further variable settings on this sheet into the M-Bus device.

ID (sec. adr.) is the 8-digit M-Bus ID (identification no.), which is also used for secondary addressing of this port.
Pre-programmed ID = YYMM + last 4 digits of serial no.
e.g. ser.no. = 15005, production date = Nov. 2017 (1711) → ID = 17115005

Fabric no. is not used for the PadPuls M1.

Medium describes the measured medium of the connected meter. Examples: Oil,

| | |
|--------------------------------|---|
| Multiplicator | Water, Heat, Electricity is the pulse increment (multiplicator) of the connected meter. For each registered pulse the device adds “multiplicator” to the counter. The numerator can take values between 0 (no counting) and 255, the denominator between 1 and 255. |
| <u>Unit</u> | is the physical unit of the counter and of the pulse increment. All proper units including variants with power of ten, from the DIN EN 13757-3 are offered in the selection list. Examples: m3, kWh, MJ |
| <u>Counter</u> | is the accumulated counter. It has to be related to the unit mentioned above. The 5 byte binary type counter can be programmed equal to the counter of the connected meter in a range of 0 to 1×10^{12} or in detail 1.099.511.627.775 (= 00 FF FF FF FF FF hex.). |
| <u>State</u> | shows the M-Bus state in hexadecimal notation. |
| <u>Write protection</u> | is marked, if the device is protected against programming. Then you cannot configure the adapter. The protection can be removed after opening the sealable front cover of the housing and pressing the “Unprotect” pushbutton. |
| <u>Permanent Error</u> | is not used for the PadPuls M1. |
| <u>Write protect</u> | transmits a command to the PadPuls M1 to activate write protection. The PadPuls then allows no further configuration. It is protected against unnoticed manipulation. |
| <u>Read</u> | reads the M-Bus device and refreshes the data on the selected sheet. |
| <u>Write</u> | sends the current options to the pulse converter, which stores this data into the battery buffered memory. The PadPuls M1 changes the options only if the write protection is deactivated. It is recommended to read and check the data after writing. |

Notes:

1. Please first press the button „Connect to meter“ after connecting a new M-Bus device. Afterwards all sheets are refreshed.
2. Examples for configuration of pulse increment and unit:
 - Water meter with counter = 45120 l and 1 Pulse = 10 l:
Choice 1: Unit = 10 l, Multiplier = 1 / 1, Counter = 4512 (x 10 l)
Choice 2: Unit = 1 l, Multiplier = 10 / 1, Counter = 45120 (x 1 l)
 - Electricity meter with counter = 78346 kWh and 64 pulses / kWh:
Choice: Unit = 1kWh, Multiplier = 1 / 64, Counter = 78346 (x 1kWh)
 - Electricity meter with counter = 112,345 kWh and 1000 pulses / kWh:
Choice: Unit = 1Wh, Multiplier = 1 / 1, Counter = 1123454 (x 0,001Wh)

4 M-Bus Telegrams

1) General

- Communications according to EN13757-2 and -3
- Transmission rates 300, 2400 and 9600 Bd with auto-baud detect
- Primary and secondary addressing with wild cards
- SND_NKE / E5, SND_UD / E5, REQ_UD2 / RSP_UD is supported

2) Definitions

- All values are specified in hexadecimal
- Empty fields in the “Contents” line are variable
- Index 1 designates the least-significant byte in fields containing several bytes

3) RSP_UD Telegram

| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|--------|-------|--------|--------|-------|----|---|----|-----|-----|-----|-----|------|------|
| Name | Start | Length | Length | Start | C | A | CI | ID1 | ID2 | ID3 | ID4 | MAN1 | MAN2 |
| Inhalt | 68 | 1B | 1B | 68 | 08 | | 72 | | | | | AC | 48 |

| Byte | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|--------|-----|-----|----|---------|------|------|-----|-----|--------|--------|--------|--------|--------|
| Name | GEN | MED | TC | Status | SIG1 | SIG2 | DIF | VIF | Count1 | Count2 | Count3 | Count4 | Count5 |
| Inhalt | | | | 00 / 80 | 00 | 00 | 06 | | | | | | |

| Byte | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
|----------|--------|-------|-------|-----------|-------------|----|------|
| Name | Count6 | Spez. | Index | Numerator | Denominator | CS | Stop |
| Variable | 00 | 0F | 01 | | | | 16 |

Notes:

- Manufacturer MAN = “REL” (48AC)
- Generation GEN (at this time \$09, reserved range from \$01 to \$0F)
- Status bit 7 (MSB):
 - 1 → write protection set
 - 0 → write protection removed
- VIF: Set by the user; VIF = unit with decimal power (MSB not set)
- Count: Meter reading (most-significant byte = Count6 always zero)
- Numerator / Denominator: Impulse value (increment in multiples of the VIF per impulse):

$$1 \text{ Pulse} = \frac{\text{Numerator}}{\text{Denominator}} \cdot \text{VIF}$$

4) Configuration Telegram

| | | | | | | | | | | | | | |
|--------|-------|--------|--------|-------|----|---|----|------|------|------|------|------|-----|
| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Name | Start | Length | Length | Start | C | A | CI | DIF1 | VIF1 | PAdr | DIF2 | VIF2 | ID1 |
| Inhalt | 68 | 1C | 1C | 68 | 53 | | 51 | 01 | 7A | | 07 | 79 | |

| | | | | | | | | | | | | | |
|--------|-----|-----|-----|------|------|-----|-----|------|------|--------|--------|--------|--------|
| Byte | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| Name | ID2 | ID3 | ID4 | MAN1 | MAN2 | GEN | MED | DIF3 | VIF3 | Count1 | Count2 | Count3 | Count4 |
| Inhalt | | | | | | | | 06 | | | | | |

| | | | | | | | | |
|--------|--------|--------|-------|-------|-----------|-------------|----|------|
| Byte | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |
| Name | Count5 | Count6 | Spez. | Index | Numerator | Denominator | CS | Stop |
| Inhalt | | 00 | 0F | 01 | | | | 16 |

Notes:

- Variables to be configured can only be changed when the write protection is not set
- Grey fields can be altered:
 - PAdr = Address (range 0–250)
 - ID = ID number (BCD)
 - MED = Medium
 - VIF3 = Unit and decimal power of the meter reading (MSB = 0)
 - Count = Pulse count (5 bytes binary, Count6 is always 00h)
 - Meter / denominator: impulse value (range 1–255 each)
- Miscellaneous fields (MAN and GEN are ignored)
- ID, MAN, GEN and MED are coded as in the fixed header of the variable data structure from EN13757-3
- The data block “Protect index denominator numerator” is specific to the manufacturer and is optional

4) Telegram to Set the Write Protection

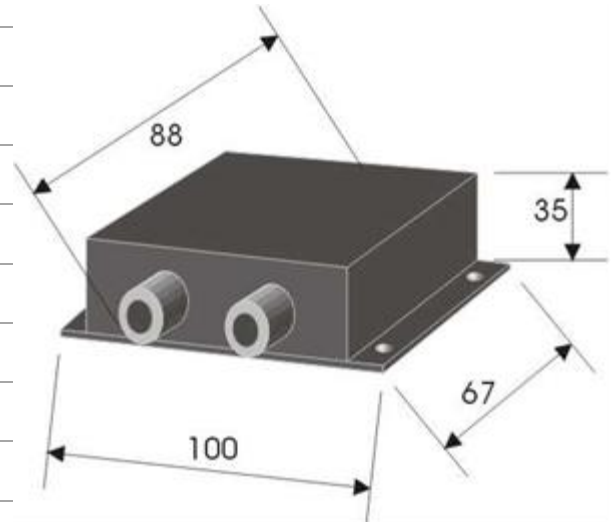
| | | | | | | | | | | | |
|--------|-------|--------|--------|-------|----|---|----|-------|---------|----|------|
| Byte | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Name | Start | Length | Length | Start | C | A | CI | Spez. | Protect | CS | Stop |
| Inhalt | 68 | 05 | 05 | 68 | 53 | | 51 | 0F | 55 | | 16 |

The write protection can only be reset by pressing the pushbutton on the circuit board. See chapter 2.3.

5 Technical Data

5.1 General

| | |
|-----------------------|-----------------------------|
| Mounting | Wall mounting |
| Material | ABS plastic, black |
| W x L x H | (100 x 88 x 35) mm |
| Protective Class | IP50 |
| Operating temperature | 0 to 60 °C |
| Storage temperature | -25 to 60°C |
| Humidity | 10% to 70% (non condensing) |
| Cable glands | 2 x PG7, light-grey |
| Terminals cable-Ø | 0,3 to 2,0 mm ² |



5.2 M-Bus Interface

| | |
|------------------|---|
| Standard | EN13757-2 and EN13757-3 |
| Reading interval | Any frequently, no battery load during communication |
| Baudrates | 300, 2400 and 9600 Baud with automatic detection |
| Addressing | Primary (address programmed to 0 on delivery) Secondary with wildcards, ID programmable |
| | Pre-programmed ID = YYMM + last 4 digits of serial no. e.g. serial no. = 15005 , production date = Nov. 2017 (1711) → ID = 17115005 |

5.3 Power Supply

| | |
|------------------|--|
| Principle | Remote supply by M-Bus with automatic switch to battery on bus fail |
| Current M-Bus | Max. 1,5 mA (1 unit load), no load of the battery |
| Battery type | Lithium 3V, type 2/3AA, capacity 1800 mAh, firmly soldered |
| Battery current | Typical 6µA (contact open), plus 4µA for closed contact |
| Battery lifetime | At 25°C: min. 9 years (contacts open, max. 50 Mio. pulses per year.) At 60°C: min. 7 years (contacts open, max. 50 Mio. pulses per year.) |

5.4 Reed-Input

| | |
|-----------------------|----------------|
| Contact voltage | 2.5V to 3.4V |
| Contact current | 2 to 4 μ A |
| Guaranteed debouncing | 1.0 ms |
| Cable length | maximum 2m |

5.5 Requirements to contacts of pulse generators

| | |
|------------------|--|
| Potential | Floating, Isolation to ground > 1 M Ω |
| Resistance | Contact open > 10 M Ω , contact open < 10k Ω |
| Maximum capacity | Incl. cable: 2nF |
| Contact duration | \geq 5 ms |
| Contact pause | \geq 40 ms |
| Pulsfrequenz | \leq 12,5 Hz at pulse length = pause length (each 40 ms) |

5.6 Ordering information

| Artikelnummer | Beschreibung |
|---------------|---|
| IM001G | PadPuls M1, 1-channel M-Bus pulse converter, wall mounting |
| IM001 | PadPuls M1, 1-channel M-Bus pulse converter, only board without housing |