

# PadPuls M2C IM003GC / IMG003CB

# PadPuls M4C IM002GC

2/4-channel M-Bus pulse converter  
for rail mounting



## Table of content

1	Functional description .....	3
2	Installation and Startup .....	4
2.1	Activation .....	4
2.2	Connecting .....	5
2.2.1	Two / Four Channel Mode .....	5
2.2.2	Tariff Mode .....	6
2.3	Mounting the case .....	7
3	Parameterization using MBCONF .....	8
3.1	Installation .....	8
3.2	Operation .....	8
3.3	Sheet Info .....	9
3.4	Sheets M2 Port1 to Port4 .....	12
4	M-Bus Telegrams .....	16
4.1	RSP_UD in short telegram mode .....	16
4.2	RSP_UD in long telegram mode .....	18
4.3	SND_UD telegrams (Configuration) .....	20
5	Technical Data .....	22
5.1	General .....	22
5.2	M-Bus Interface .....	22
5.3	Power Supply .....	22
5.4	Inputs .....	23
5.5	Requirements to contacts of pulse generators .....	23
5.6	Requirements to tariff signals .....	23
5.7	Ordering Information .....	23

**This documentation is valid from M-Bus generation: \$42 (M2C) u. \$15 (M4C)**

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# 1 Functional description

The PadPuls M2C / M4C adapts consumption measuring instruments, such as, electricity, gas or water meters to the M-Bus system. However, the meters to be adapted must have a floating pulse output. Up to two / four impulse meters can simultaneously be connected to the inputs of these devices. Optionally the user can activate a tariff function, by which energy or volume pulses are accumulated in separate meter readings for primary and secondary tariffs. In this case a floating signal for tariff switch is used at Port 2 and / or port 4. If a voltage signal is available as tariff switch, a special, galvanically isolated input of the PadPuls is used. This enables e.g. the direct use of the main supply voltage (230V or 110V) from a ripple control receiver of the power supplier.

Each port or each tariff of the PadPuls can be read by M-Bus using its own primary and secondary address. The PadPuls M2C / M4C thus acts as two / four stand-alone M-Bus slaves! The user configures the pulse collector with the software MBCONF. The accumulated pulses are converted into kWh, m<sup>3</sup>, J or other physical units. The user interface of MBCONF allows the operator to get an easy access to the configuration.

When connected to the M-Bus the PadPuls is powered by the bus. A built-in battery ensures that metering continues if the M-Bus connection is interrupted. Two battery options are available for PadPuls M2C while the PadPuls M4C is only available with the bigger battery. The version with the higher capacity allows M-Bus independent metering for several years.

Another feature of the PadPuls is the due-date function. Meter data are saved separately at the preset due-date at 00:00 hour (day change to the due-date) by the implemented clock with calendar function. The due-date can be changed without loss of the already stored counters. Additionally the M-Bus Master can initiate an immediate execution of the due-date function by sending of the so-called „Freeze“ command. A „Freeze“ sent to all pulse collectors using the broadcast address 255 is helpful for generating reading profiles of an M-Bus system. Afterwards the master software polls the data of all meters. From the generation \$42 (M2C) and \$15 (M4C) the PadPuls automatically stores the start values of the last 15 months for each channel. These values can be read at any time. The user decides whether the monthly values are included in the M-Bus protocol or not (factory setting).

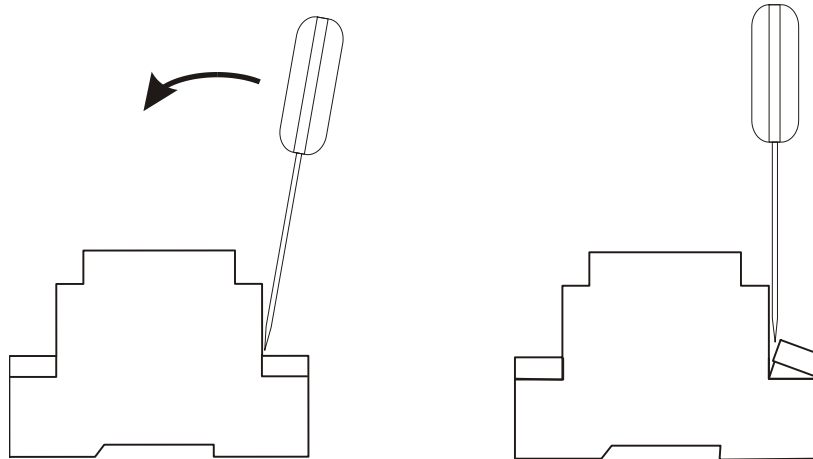
The complete configuration data is saved into a non-volatile memory (EEPROM). Additional security is provided by daily saving of meter readings into this EEPROM. In case of M-Bus fail and empty battery the last saved data is restored on power up.

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

## 2 Installation and Startup

### 2.1 Activation

Coming from factory the PadPuls M2C / M4C first must be activated. The upper terminal cover of the housing must be opened (see drawing) and the jumper has to be placed on both pins. Then battery operation and data saving is activated at M-Bus failure.



After removing the cover you have access to the following control elements:

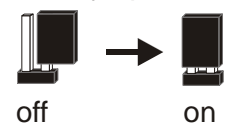
If you have completed all assembly and configuration work, you should protect the device against manipulation with one sticker (seal) on the terminal cover and the case.

The PadPuls is supplied by M-Bus if it is available. In this normal state the internal battery is then not loaded. Only when the M-Bus fails, the battery automatically takes over the supply. There is no loss of data and the counting function is continued. The PadPuls draws approximately 1.5mA current (one unit load) from the M-Bus.

battery jumper      unprotect button



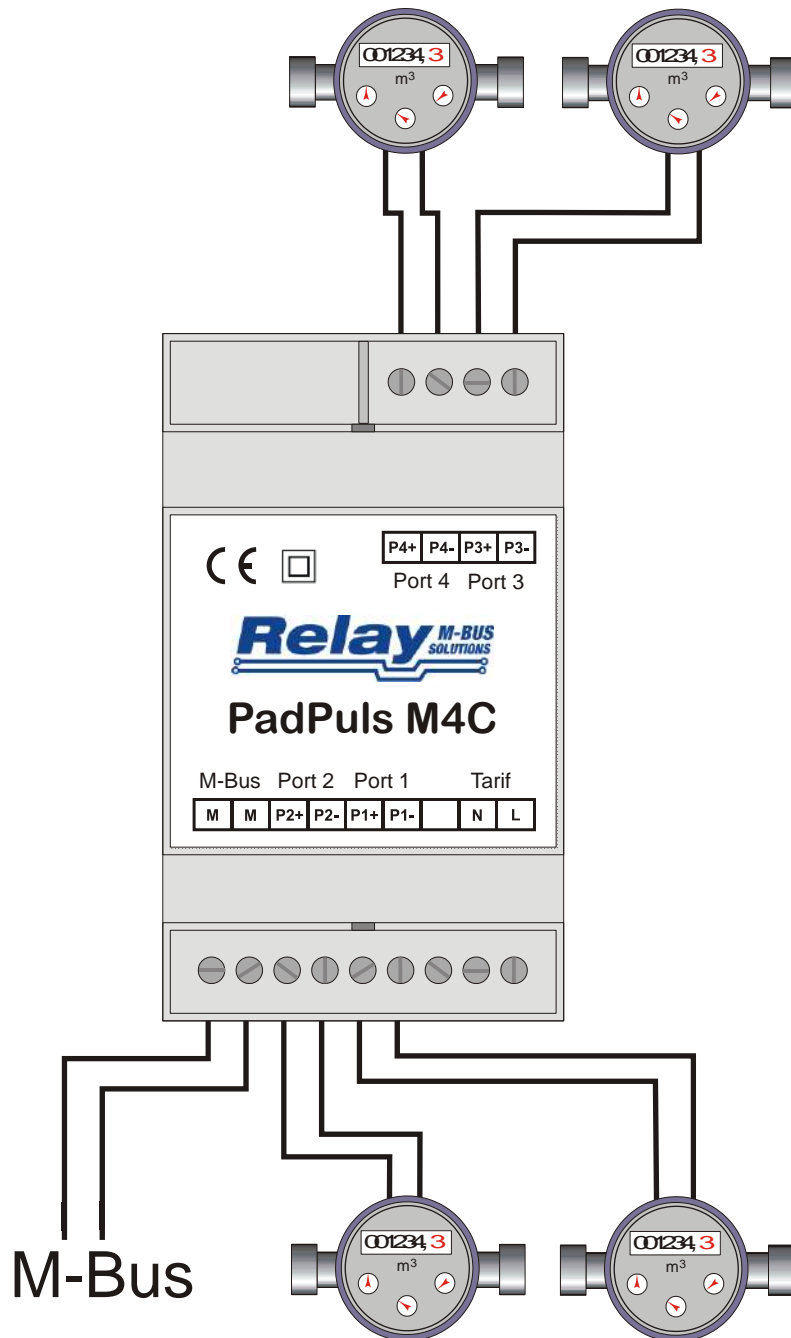
battery operation



## 2.2 Connecting

### 2.2.1 Two / Four Channel Mode

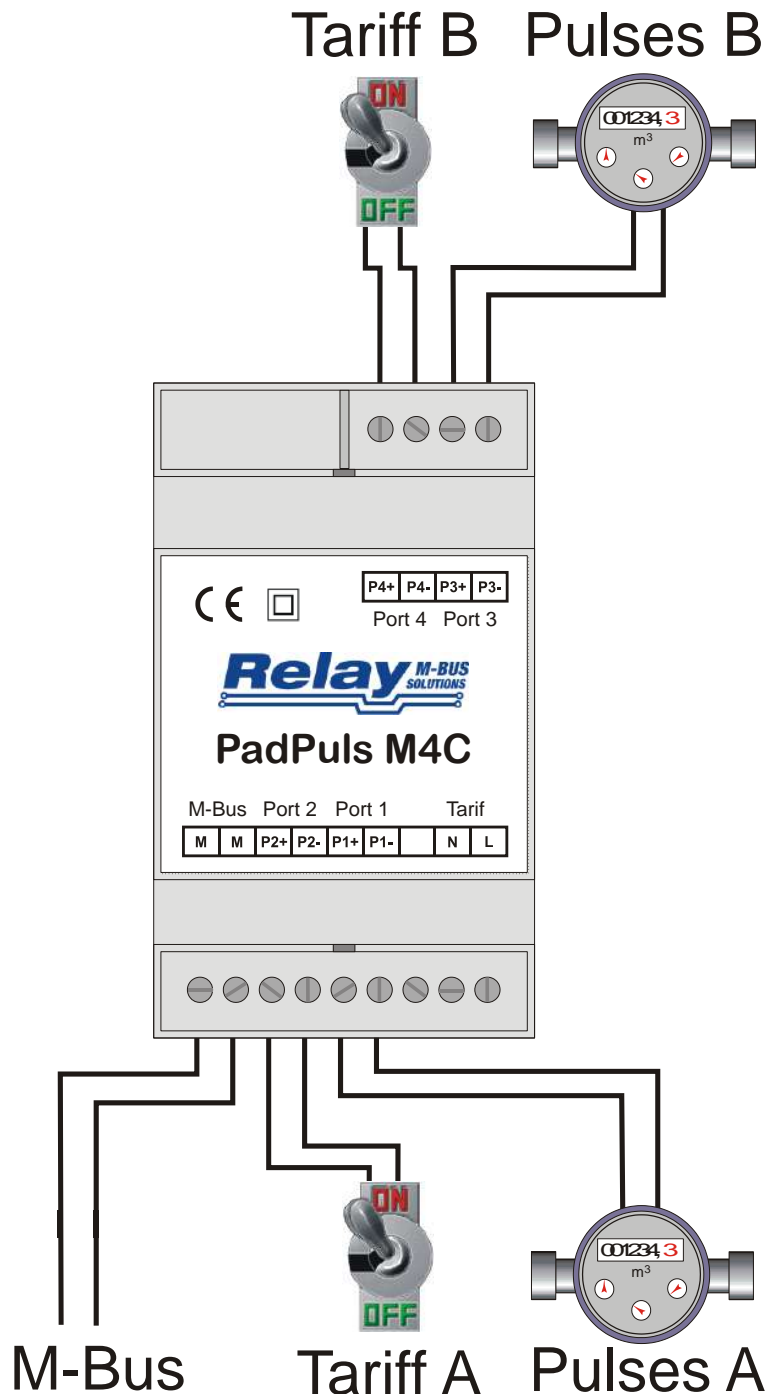
The following figure shows the link of two counters with impulse outputs to the PadPuls M4C. We recommend to use 2-wire cables (twisted pair, NYM or j-Y(St)Y) with a max.length of 10m. In any case it must be noted that the total capacity of the cable plus impulse generator attached at any port may not exceed 2nF (optional 12nF with activated “long pulse sampling”).



- The two ports 3 and 4 are not available at the PadPuls M2C !
- If not all ports of PadPuls are used, you should not attach a cable to the respective unused port. The capacity of an open-circuited cable reduces the lifetime of the battery in stand-alone operation (no M-Bus available).
- If the pulse frequency is over 18 Hz, false countings can occur.

## 2.2.2 Tariff Mode

The following graph represents the diagram of connections in the tariff mode with two counters and a two tariff signal generator:



The tariff mode can be activated with the configuration software MBCONF. You are using this operating mode to adapt a meter with two tariffs supplying just one joint pulse output and a tariff switch signal to the M-Bus. Port1 is the pulse input and Port2 is the tariff switch. The PadPuls counts the incoming pulses to channel 1 while the input at channel 2 is open and to channel 2 while the input at channel 2 is closed. You can alternatively use a voltage signal (230VAC), e.g. a ripple control receiver, as a tariff switch signal at the terminals N (neutral conductor) and L (phase). There is also the option for a second tariff B with Port3 as the pulse input and Port4 as tariff switch signal.

The specifications of the impulse and tariff signal generator can be taken from the technical data. The maximum pulse frequency to be counted is 18Hz.

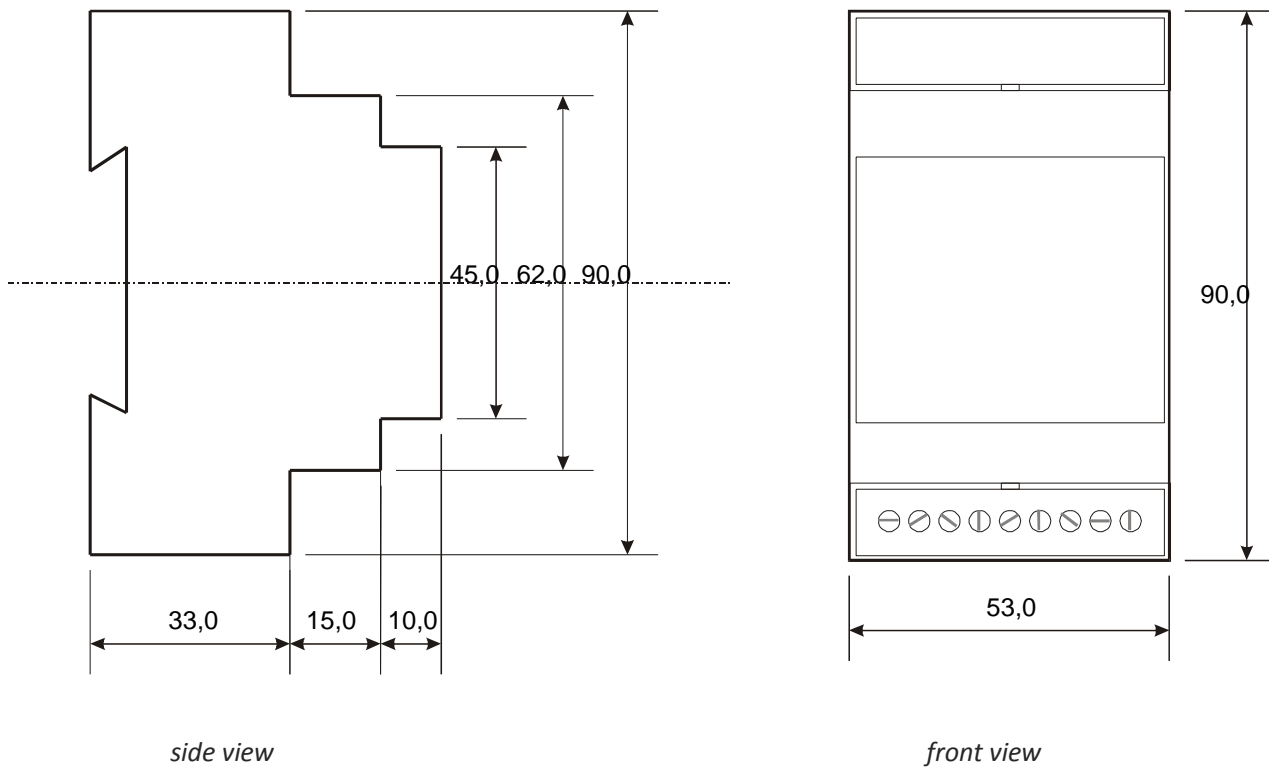
- If the pulse frequency is over 18 Hz, false countings can occur

## 2.3 Mounting the case

The rear side of the housing of the PadPuls M2C / M4C has a special mechanism for mounting on a DIN rail according to DIN EN 50022. Please take care of the following environmental conditions:

- Temperature: 0 to 55°C
- Humidity (not condensing): 10% to 70%
- No large amounts of dust at the installation (protective class IP40)

The following drawings show the mechanical dimensions of the device (all dimensions in mm):



## 3 Parameterization using MBCONF

The configuration of the device must be adapted to the respective installation by the customer. The current version \$42 of PadPuls M2 and version \$15 of the PadPuls M4C requires the use of the program MBCONF from version 3.5 (download at [www.relay.de](http://www.relay.de)). From the above mentioned version, the user can choose between the short telegram (backwards compatible to version \$41 respectively \$14) and the long telegram with additional 15 monthly values, version no., fabrication no. and error flags.

### 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 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

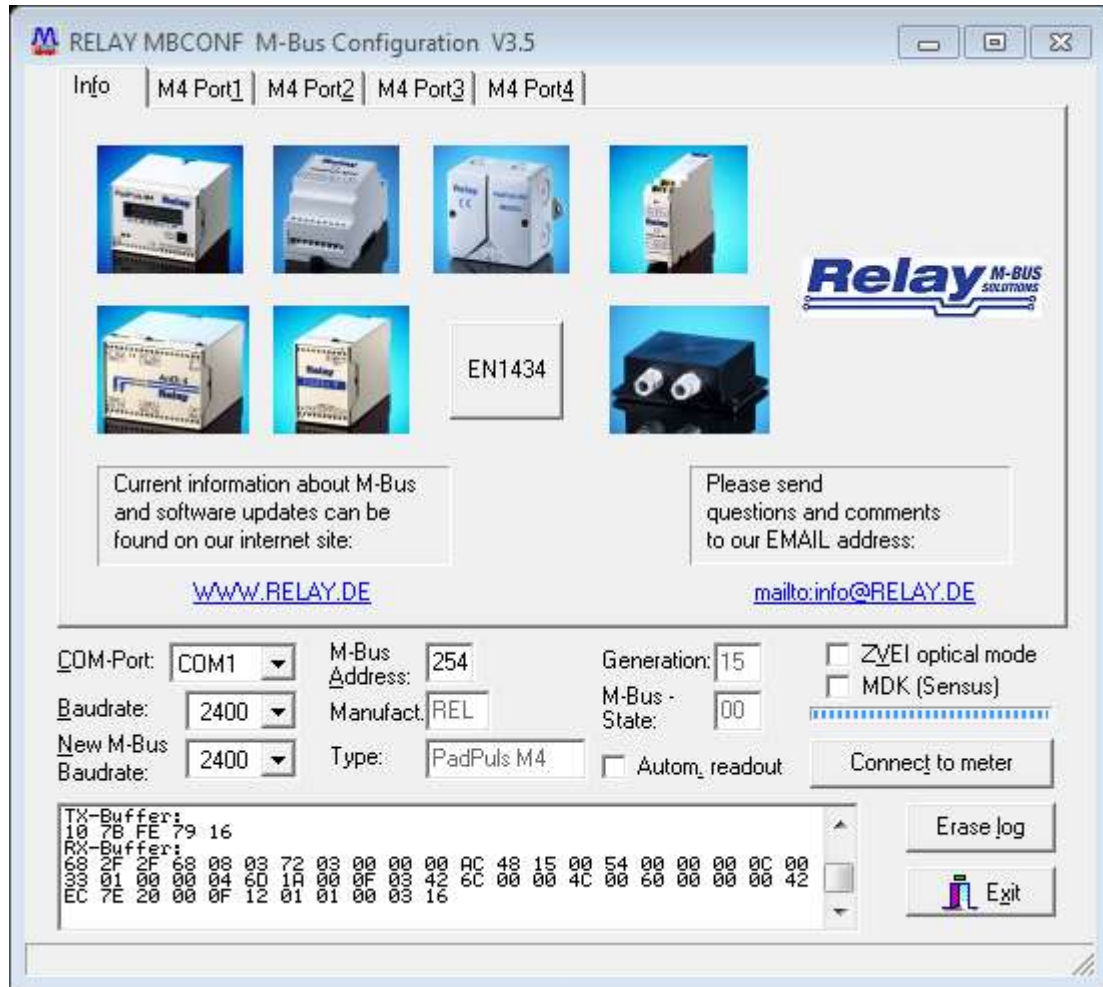
After program start the user operates the software according to the Windows conventions with the mouse or the keyboard. If you stay with the mouse on a button or an input field, then a hint to its function appears. Light-grey fields and boxes cannot be edited.

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 M2C / M4C from version \$42 / \$15 supports the baudrates 300, 2400 and 9600 Bd.

**New 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, because it automatically detects the baudrate used by the master.

**M-Bus Address**

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.

**Connect 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 for each channel appears in case of PadPuls M2C and M4C. The sheets are labelled “M2 Port1” for the first up to “M2 Port4” for the fourth channel.

**Manufact.**

is an item that shows the 3-letter manufacturer code after successful reading (“Connect to meter”). This item is read only.

**Generation**

shows the revision connected M-Bus device. This item is read only.

**Type**

shows the type (here: PadPuls M4) of the connected device. This item is read only.

**M-Bus State**

shows the M-Bus state of the connected device. This item is read only.

**ZVEI 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.

**MDK (Sensus)**

This switch activates the readout with an MDK from Sensus.

**Autom. readout**

if this option is activated, the software always reads the data after writing (useful for checking the correct programming).

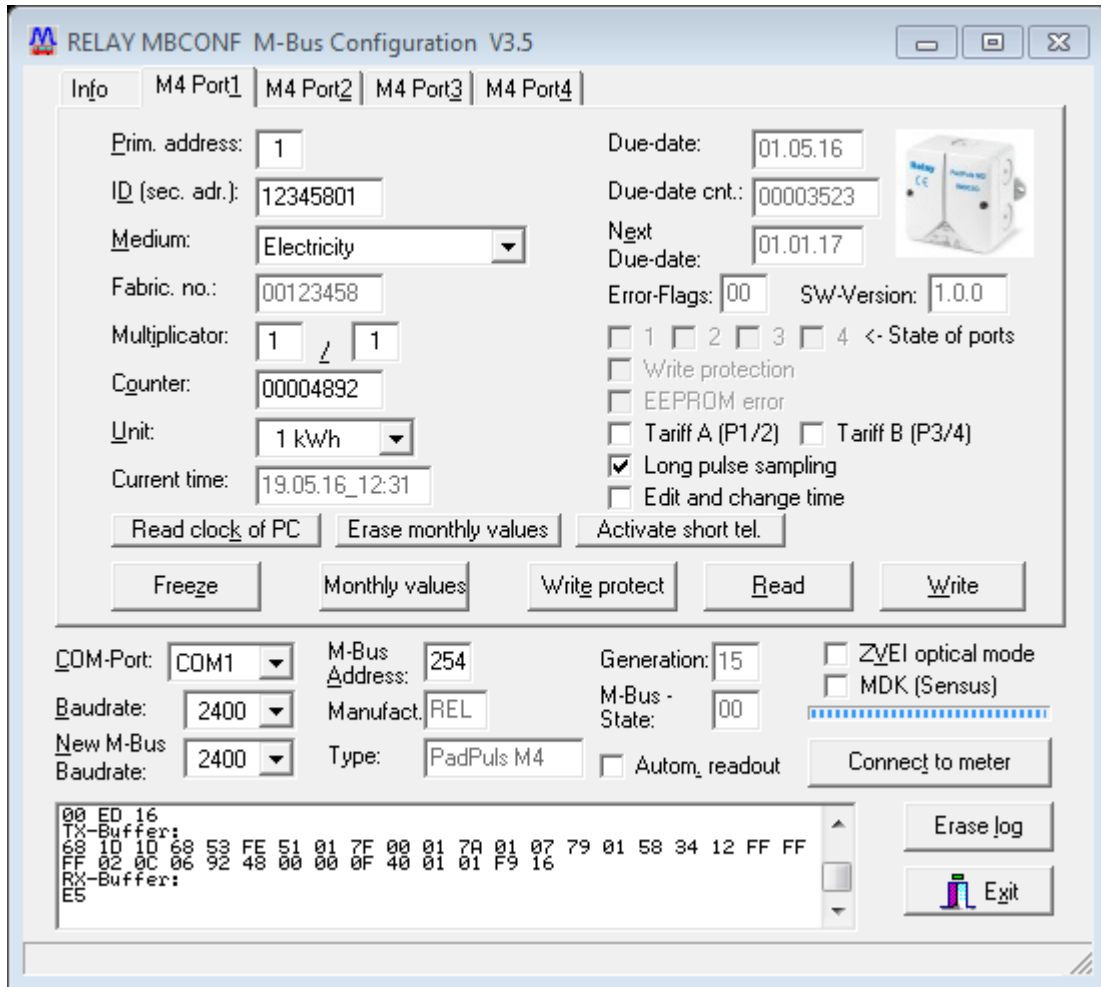
## Log-Window

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:

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

### 3.4 Sheets M2 Port1 to Port4



This sheet shows the current settings and values of the respectively pulse channel (port) of the PadPuls M2C/M4C (in this example: M4C Port 1 in the mode “long telegram”). 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 port. 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. PadPuls actory default: ID = 6 digit fab.no. + channel no (01, 02, 03 or 04).

**Medium** describes the measured medium of the connected meter. Examples: Oil, Water, Heat, Electricity

<b>Fabric-no.</b>	is the fabrication number (serial number) of the device. The preset IDs of all channels of PadPuls are derived from the fab.no.: ID = last 6 digits of the fabric.no. plus 2 digit channel no. This field is read only and only displayed, if the channel is configured to “long telegram” mode.
<b>Multiplicator</b>	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 99, the denominator between 1 and 256.
<b>Unit</b>	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.
<b>Counter</b>	is the accumulated counter. It has to be related to the unit mentioned above. The counter can be programmed equal to the counter of the connected meter in a range of 0 to 99999999.
<b>Current time</b>	is the current date and time-of-day of the internal clock in the format DD.MM.YY_hh.mm. This field can only be edited and modified in the PadPuls, if the switch “Edit and change time” is activated. The button “Read clock of PC” once transfers the current date and time of the PC into this window. The time-of-day and the date always apply to all ports of PadPuls M2. The internal clock does not support daylight saving!
<b>Due-date</b>	is the last due-date (date of the last storage of the due-date counter) in the format DD.MM.YY. This field is read only.
<b>Due-date cnt.</b>	is the counter which was saved at the due-date. This field is read only.
<b>Next Due-date</b>	is the next (future) due-date (date of the next storage of the counter) in the format DD.MM.YY. The counter will be saved at 00:00, e.g. with due-date 01.01 at change from 31 <sup>st</sup> of December 23:59 to 1 <sup>st</sup> of January 00:00. This field can only be edited and programmed, if the switch “Edit and change time” is marked. This field is individual for each channel.
<b>SW-Version</b>	Firmware version, e.g. V1.0.0. This field is read only.
<b>Error-Flags</b>	shows 8 Bits for EEPROM errors in due date and monthly values in hexadecimal format. \$00 = no error. This field is read only.
<b>State of ports</b>	shows the current input state of all ports (a closed contact is marked). This item is read only.

<b>Write protection</b>	is marked, if the device is protected against programming. Then you cannot configure the adapter. The protection can be removed after opening the sealable housing and pressing the “Unprotect” pushbutton.
<b>EEPROM error</b>	is marked, if there was an error while reading the non-volatile memory. In this case you must reconfigure the device.
<b>Tariff A (P1/2)</b>	is used for activation of the tariff mode on port 1 and 2. The tariff mode will be switched on after pressing the “Write” button, if the check box is marked. Port 1 is then used as pulse input and port 2 or the N/L (230VAC) input is used for the tariff switch. With an open tariff switch the pulses are accumulated to the counter for port 1 (main tariff). With a closed tariff contact the pulses increment the counter for port 2 (special tariff).
<b>Tariff B (P3/4)</b>	is used for activation of the tariff mode on port 3 and 4. The tariff mode will be switched on after pressing the “Write” button, if the check box is marked. Port 3 is then used as pulse input and port 4 is used for the tariff switch. With an open tariff switch the pulses are accumulated to the counter for port 3 (main tariff). With a closed tariff contact the pulses increment the counter for port 4 (special tariff).
<b>Long pulse sampling</b>	activates a longer charging of the contacts before sampling the inputs. This allows higher capacitors and / or many pulse generators with S <sub>o</sub> interface (photocoupler with capacitors) to be connected. On delivery the extended pulse sampling is activated. The lifetime of battery is increased for about 10% if this feature is not used.
<b>Edit and change time</b>	activation of this check box allows editing and programming of the “Current time” and “Next due-date”. The checkbox is deactivated automatically after successful configuration with “Write”.
<b>Read clock of PC</b>	once gets the current date and time from the clock of the PC and transfers it into the item “Current time”.
<b>Erase monthly values</b>	erases all existing monthly start values (only in long telegram mode).
<b>Activate long tel.</b>	transmits a command to the PadPuls switch this channel to the long telegram mode (incl. monthly values, fabr.no., version and error flags).
<b>Activate short tel.</b>	transmits a command to the PadPuls to switch this channel to the short telegram mode (excl. monthly values, fabr.no., version and error flags).

<b>Freeze</b>	transmits a command to the PadPuls instructing it to freeze the counters. The PadPuls then copies the current counter to the “due-date counter” and the current date to the (last) “due-date”. The storage is done simultaneously for all ports. This behaviour is similar to the behaviour at due-date. The freeze command can be used with the broadcast address 255 to order all PadPuls devices to save the current counters. Then the M-Bus master has enough time to read all meters and get values of the same time (reading profiles).
<b>Monthly values</b>	shows the 15 monthly start values in ascending order in a window (only in long telegram mode).
<b>Write protect</b>	transmits a command to the PadPuls to activate write protect. The PadPuls M2 then allows no further configuration. It is protected against unnoticed manipulation.
<b>Read</b>	reads the M-Bus device and refreshes the data on the selected sheet.
<b>Write</b>	sends the current options to the pulse converter, which saves this data into the non-volatile memory. The PadPuls changes the options only if the write protection is deactivated. It is recommended to read and check the data after writing.

**Hints:**

1. The variables „Current time“, „Write protection“, „Long pulse sampling “ and the command „Freeze“ always apply to all ports. Therefore you need to edit these items only in one sheet. Attention: From version \$42 (M2C) and \$15 (M\$C) the field „Next due-date“ is individual for each port. The write protection should be activated after successful configuration of all ports.
2. Please first press the button „Connect to meter“ after connecting a new M-Bus device. Afterwards all sheets are refreshed.
3. 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. With activated tariff option the pulses are evaluated with the adjustments of the respective port. Therefore you should take care that both ports have the same pulse increment and unit.



## 4 M-Bus Telegrams

### 4.1 RSP\_UD in short telegram mode

Position	1	2	3	4	5	6	7	8	9	10	11	12
Name:	Start	Length	Length	Start	C	A	Cl	ID <sub>0</sub>	ID <sub>1</sub>	ID <sub>2</sub>	ID <sub>3</sub>	Man <sub>0</sub>
Value (hex):	68	2F	2F	68	08		72					AC

13	14	15	16	17	18	19	20	21	22	23	24	25	26
Man <sub>1</sub>	Gen	Med	TC	Status	Sig <sub>0</sub>	Sig <sub>1</sub>	DIF1	VIF1	Stand <sub>0</sub>	Stand <sub>1</sub>	Stand <sub>2</sub>	Stand <sub>3</sub>	DIF2
48					00	00	0C						04

27	28	29	30	31	32	33	34	35	36	37	38	39	40
VIF2	Date <sub>0</sub>	Date <sub>1</sub>	Date <sub>2</sub>	Date <sub>3</sub>	DIF3	VIF3	LeStD <sub>0</sub>	LeStD <sub>1</sub>	DIF4	VIF4	StStn <sub>0</sub>	StStn <sub>1</sub>	StStn <sub>2</sub>
6D					42	6C			4C				

41	42	43	44	45	46	47	48	49	50	51	52	53
StStn <sub>3</sub>	DIF5	VIF5	VIFE5	StDat <sub>0</sub>	StDat <sub>1</sub>	DIF6	Info	Num.	Deno.	PStat	CS	Stop
	42	EC	7E			0F						16

Byte sequence of the RSP\_UD (short telegram)

- A: primary address
- ID<sub>0-3</sub>: identification no. for secondary addressing
- Man<sub>0-1</sub>: manufacturer code
- Gen: revision of firmware (at this time \$42 for M2C, \$15 for M4C)
- Med: medium
- TC: transmission counter (number of transmitted RSP\_UD)
- State: most significant bit set (bit 7) → write protected  
bit 3 set (permanent error) → error in EEPROM data
- VIF1=VIF4: selected VIF (value information field → physical unit)
- Stand: current counter
- Date: current date (EN13757-3: data type F)
- LeStD: last due-date, date of the due-date counter (EN13757-3: data type G)
- StStn: due-date counter
- StDat: next (future) due-date
- Info: 1 byte with information about tariff and sampling method)
- Num.: numerator of pulse increment(1..99)
- Den.: denominator of pulse increment (1..255, 0 → 256)

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

- PStat: state of inputs (current input state of the ports, bit0 = Port1.. bit 3= Port4)



**Byte 48 (Info)**

Bit	7	6	5	4	3	2	1	0
Value (bin)	x	Sampling	x	Tariff A	0	0	0	Select

Select: number of the port, for which the data is valid

0: Port1, 1: Port2, 2: Port3, 3: Port4

Tariff A: tariff A (Port 1 = count input, Port2 = counter / tariff signal)

0: tariff off (Port2=count input), 1: tariff on (Port2=tariff signal)

Tariff B: tariff B (Port 3 = count input, Port4 = counter / tariff signal)

0: tariff off (Port3=count input), 1: tariff on (Port4=tariff signal)

Sampling: duration of a sampling

0: short (0.5ms), 1: long (1.5ms)

No.	Unit	Tariff	Storage	Data type	Value	Function	Description
1	0	0	0	BCD8	00001678	Inst.	Energy [kWh]
2	0	0	0	INT4	26.04.2016 13:37	Inst.	Actual date and time
3	0	0	1	INT2	01.01.2016	Inst.	Due date
4	0	0	1	BCD8	00001541	Inst.	Energy at due-date [kWh]
5	0	0	1	INT2	01.01.2017	Inst.	Next due-date
6	0	0	0	Special	00 01 01 00	Inst.	Manufacturer specific data

*Sample of a short telegram*

## 4.2 RSP\_UD in long telegram mode

Position	1	2	3	4	5	6	7	8	9	10	11	12
Name:	Start	Length	Length	Start	C	A	CI	ID <sub>0</sub>	ID <sub>1</sub>	ID <sub>2</sub>	ID <sub>3</sub>	Man <sub>0</sub>
Value (hex):	68	BA	BA	68	08		72					AC

13	14	15	16	17	18	19	20	21	22	23	24	25	26
Man <sub>1</sub>	Gen	Med	TC	Status	Sig <sub>0</sub>	Sig <sub>1</sub>	DIF1	VIF1	Stand <sub>0</sub>	Stand <sub>1</sub>	Stand <sub>2</sub>	Stand <sub>3</sub>	DIF2
48					00	00	0C						04

27	28	29	30	31	32	33	34	35	36	37	38	39	40
VIF2	Date <sub>0</sub>	Date <sub>1</sub>	Date <sub>2</sub>	Date <sub>3</sub>	DIF3	VIF3	LeStD <sub>0</sub>	LeStD <sub>1</sub>	DIF4	VIF4	StStn <sub>0</sub>	StStn <sub>1</sub>	StStn <sub>2</sub>
6D					42	6C			4C				

41	42	43	44	45	46	47	48	49	50	51	52	53	54
StStn <sub>3</sub>	DIF5	VIF5	VIFE5	StDat <sub>0</sub>	StDat <sub>1</sub>	DIF6	VIF6	FabN <sub>0</sub>	FabN <sub>1</sub>	FabN <sub>2</sub>	FabN <sub>3</sub>	DIF7	DIFE7
	42	EC	7E			0C	78					89	04

55	56	57	58	59	60	61	62	63	64	65	66	67
VIF7	VIFE7	Size	DIF8	DIFE8	VIF8	VIFE8	Interv	DIF9	DIFE9	VIF	MDat <sub>0</sub>	MDat <sub>1</sub>
FD	22	15	89	04	FD	28	01	82	0B	6C		

68	69	70	71	72	73	74	75	76	77	78	79	80	81
DIF10	DIFE10	VIF1	M <sub>1</sub> ST <sub>0</sub>	M <sub>1</sub> ST <sub>1</sub>	M <sub>1</sub> ST <sub>2</sub>	M <sub>1</sub> ST <sub>3</sub>	DIF11	DIFE11	VIF1	M <sub>2</sub> ST <sub>0</sub>	M <sub>2</sub> ST <sub>1</sub>	M <sub>2</sub> ST <sub>2</sub>	M <sub>2</sub> ST <sub>3</sub>
8C	04						CC	04					

82	83	84	85	86	87	88	89	90	91	92	93	94	95
DIF12	DIFE12	VIF1	M <sub>3</sub> ST <sub>0</sub>	M <sub>3</sub> ST <sub>1</sub>	M <sub>3</sub> ST <sub>2</sub>	M <sub>3</sub> ST <sub>3</sub>	DIF13	DIFE13	VIF1	M <sub>4</sub> ST <sub>0</sub>	M <sub>4</sub> ST <sub>1</sub>	M <sub>4</sub> ST <sub>2</sub>	M <sub>4</sub> ST <sub>3</sub>
8C	05						CC	05					

...

159	160	161	162	163	164	165	166	167	168	169	170	171	172
DIF23	DIFE23	VIF1	M <sub>14</sub> ST <sub>0</sub>	M <sub>14</sub> ST <sub>1</sub>	M <sub>14</sub> ST <sub>2</sub>	M <sub>14</sub> ST <sub>3</sub>	DIF24	DIFE24	VIF1	M <sub>15</sub> ST <sub>0</sub>	M <sub>15</sub> ST <sub>1</sub>	M <sub>15</sub> ST <sub>2</sub>	M <sub>15</sub> ST <sub>3</sub>
CC	0A						8C	0B					

173	174	175	176	177	178	179	180	181	182	183	184	185	186
DIF25	DIFE25	VIF1	SLen	VER <sub>0</sub>	VER <sub>1</sub>	VER <sub>2</sub>	VER <sub>3</sub>	VER <sub>4</sub>	DIF26	VIF26	VIFE26	ErrFlag	DIF6
0D	FD	0F	05		2E		2E		01	FD	17		0F

187	188	189	190	191	192
Info	Num.	Deno.	PStat	CS	Stop
					16

Byte sequence of the RSP\_UD (long telegram)

FabN<sub>0-3</sub>: Fabrication number  
 MDat<sub>0-1</sub>: Date of the monthly value with storage no. = 22 (recently month)  
 MxST<sub>0-3</sub>: Monthly value (start value) no. X (X = 1..15 equals due-date no. 8..22)  
 VER<sub>0-5</sub>: Version of the firmware in the format as string x.y.z (example: 1.0.0)  
 ErrFlag: Error flags, binary

Unit	Tariff	Storage	Data type	Value	Function	Description
0	0	0	BCD8	00688888	Inst.	Volume [l]
0	0	0	INT4	26.04.2016 13:45	Inst.	Actual date and time
0	0	1	INT2	01.01.2016	Inst.	Due date
0	0	1	BCD8	00067890	Inst.	Energy at due-date [kWh]
0	0	1	INT2	01.01.2017	Inst.	Next due-date
0	0	0	BCD8	00776655	Inst.	Fabrication number
0	0	8	BCD2	15	Inst.	Number of storage values
0	0	8	BCD2	01	Inst.	Interval of storage values (months)
0	0	22	INT2	01.04.2016	Inst.	Date of storage value no. 22
0	0	8	BCD8	00000000	Inst.	Volume [l], oldest month
0	0	9	BCD8	00000000	Inst.	Volume [l]
0	0	10	BCD8	00000000	Inst.	Volume [l]
0	0	11	BCD8	00000000	Inst.	Volume [l]
0	0	12	BCD8	00000000	Inst.	Volume [l]
0	0	13	BCD8	00000000	Inst.	Volume [l]
0	0	14	BCD8	00000000	Inst.	Volume [l]
0	0	15	BCD8	00000000	Inst.	Volume [l]
0	0	16	BCD8	00000000	Inst.	Volume [l]
0	0	17	BCD8	00000000	Inst.	Volume [l]
0	0	18	BCD8	00000000	Inst.	Volume [l]
0	0	19	BCD8	00000000	Inst.	Volume [l]
0	0	20	BCD8	00000000	Inst.	Volume [l]
0	0	21	BCD8	00061756	Inst.	Volume [l]
0	0	22	BCD8	00063250	Inst.	Volume [l], recently month
0	0	0	Var.	1.0.0	Inst.	Software version #
0	0	0	INT1	0	Inst.	Error flags (binary)
0	0	0	Special	09 01 01 00	Inst.	Manufacturer specific data

*Example of a long telegram*

### 4.3 SND\_UD telegrams (Configuration)

Position	1	2	3	4	5	6	7	8	9	10	11	12
Name:	Start	Length	Length	Start	C	A	CI	DIF1	VIF1	Anw.	DIF2	VIF2
Value (hex):	68			68	53		51	01	7F		01	7A

13	14	15	16	17	18	19	20	21	22	23	24	25	26
PAdr	DIF3	VIF3	ID <sub>0</sub>	ID <sub>1</sub>	ID <sub>2</sub>	ID <sub>3</sub>	Man <sub>0</sub>	Man <sub>1</sub>	Gen	Med	DIF4	VIF4	Stand <sub>0</sub>
	07	79					AC	48			0C		

27	28	29	30	31	32	33	34	35	36	37	38	39	40
Stand <sub>1</sub>	Stand <sub>2</sub>	Stand <sub>3</sub>	DIF5	VIF5	Date <sub>0</sub>	Date <sub>1</sub>	Date <sub>2</sub>	Date <sub>3</sub>	DIF6	VIF6	StDat <sub>0</sub>	StDat <sub>1</sub>	DIF7
			04	6D					42	6C			0F

41	42	43	44	45
Opt.	Num.	Deno.	CS	Stop
				16

*SND\_UD telegram*

Abbreviations see RSP\_UD.

Port: selected port (used with address 254)  
 0=Port1, 1=Port2, 2=Port3, 3=Port4  
 PAdr: new primary address of the port  
 Num.: Numerator of pulse increment (1..99, BCD format)  
 Deno.: Denominator of pulse increment (1..255, 0 -> 256, binary format)  
 Option: Options (tariff, sampling). Coding like Info (Byte 48 RSP\_UD).

The PadPuls analyzes the individual data records on the basis of the DIF. Therefore the order of the records is allowed to vary. Exception: 0C VIF Stand<sub>0..4</sub> must start at position 24. It is also possible to transmit only parts of the SND\_UD specified above. The manufacturer-specific appendix of the telegram is always first analyzed and must be included therefore in any case. The optional record „DIF1 VIF1 Anw“ selects a port to be addressed with global address 254. This must always be the first record in the telegram.

Position	1	2	3	4	5	6	7	8	9	10	11
Name:	Start	Length	Length	Start	C	A	CI	DIF	Prot.	CS	Stop
Value (hex):	68	05	05	68	53		51	0F	55		16

*Protection telegram*

This telegram activates the write protection (valid for all channels).

Position	1	2	3	4	5		6	7	8	9	10	11	12
Name	Start	Length	Length	Start	C		A	CI	DIF	VIF	Anw.	CS	Stop
Value (hex):	68	06	06	68	53			51	01	7F			16

Select telegram (new method)

Anw. specifies the Port of the PadPuls M2, which answers to a REQ\_UD2 at address 254:  
 Port1: Anw=00 / Port2: Anw=01 / Port3: Anw=10 / Port4: Anw=11

Position	1	2	3	4	5	6	7	8	9
Name:	Start	Length	Length	Start	C	A	CI	CS	Stop
Value (hex):	68	03	03	68	53		54		16

Freeze telegram

On reception of this telegram the pulse adapter saves the current counters of all ports into the due-date counters and the current date into the due-dates.

Position	1	2	3	4	5	6	7	8	9	10
Name:	Start	Length	Length	Start	C	A	CI	Sub	CS	Stop.
Value (hex):	68	04	04	68	53		50	20		16

Telegram for switching to short telegram

On reception of this telegram „application reset“ with subcode \$20 (simple billing) the pulse counter switches the respective channel to the short telegram mode (see chapt. 4.1).

Position	1	2	3	4	5	6	7	8	9	10
Name:	Start	Length	Length	Start	C	A	CI	Sub	CS	Stop.
Value (hex):	68	04	04	68	53		50	30		16

Telegram for switching to long telegram

On reception of this telegram „application reset“ with subcode \$30 (enhanced billing) the pulse counter switches the respective channel to the long telegram mode (see chapt. 4.2).

Position	1	2	3	4	5	6	7	8	9	10
Name	Start	Length	Length	Start	C	A	CI	Sub	CS	Stop.
Value (hex):	68	04	04	68	53		50	80		16

Telegram for erasing the monthly values

This telegram „application reset“ with subcode \$80 (installation and startup) erases the monthly values of the respective channel.

## 5 Technical Data

### 5.1 General

Mounting	Rail mounting according to DIN EN 50022
Material	ABS plastic, light-grey
W x L x H	(53 x 91 x 58) mm
Protective class	IP40
Operating temperature	0 to 55 °C
Storage temperature	-20 to 70°C
Humidity	10% to 70% (not condensing)
Terminal cable Ø	Fixed wire: max. 4,0 mm <sup>2</sup> / Flexible wire: max. 2,5 mm <sup>2</sup>
Accuracy RTC	25 ppm at 25°C

### 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 (all channels are programmed to 0 on delivery)  Secondary with wildcards, 1 prim. and 1 sec. address programmable per channel  Preprogrammed ID = 6 digit fabrication no. + 2 digit channel no., e.g. Fab.-no. = 123456: ID channel 1 = 12345601, ID channel 2 = 12345602 etc.

### 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 types	IM003GC: Lithium 3V, coin type CR2032, capacity 230 mAh, replaceable  IM003GCB / IM003GC: Lithium 3V, type 2/3AA, capacity 1800 mAh, firmly soldered
Battery current	Typical 6µA (contacts not closed)

## 5.4 Inputs

Contact voltage	2.5V to 3.6V (dynamic sampling)
Contact current	30 $\mu$ A
Guaranteed debouncing	5.0 ms
Connection cable	Maximal 10m

## 5.5 Requirements to contacts of pulse generators

Potential	Floating, Isolation to ground > 1 M $\Omega$
Resistance	Contact open > 1 M $\Omega$ , contact open < 2k $\Omega$
Maximum capacity	Incl. cable: 2nF (short pulse sampling), 12nF (long pulse sampling)
Contact duration	$\geq$ 30 ms
Contact pause	$\geq$ 30 ms
Pulse frequency	$\leq$ 18 Hz

## 5.6 Requirements to tariff signals

Potential	Floating, Isolation to ground > 1 M $\Omega$
Resistance	Contact open 1 M $\Omega$ , contact open < 2k $\Omega$
Maximum capacity	Incl. cable: 2nF (short pulse sampling), 12nF (long pulse sampling)
Signal shape	Static signal
Voltage tariff signal N/L	100VAC bis 250VAC
Frequency tariff signal N/L	45Hz bis 65 Hz
Isolation to M-Bus N/L	1,5 kV

## 5.7 Ordering Information

Ordering number	Description
IM003GC	PadPuls M2C, 2 channel M-Bus pulse converter, rail mounting, small battery (230mAh)
IM003GCB	PadPuls M2C, 2 channel M-Bus pulse converter, rail mounting, big battery (1800mAh)
IM002GC	PadPuls M4C, 4 channel M-Bus pulse converter, rail mounting, big battery (1800mAh)
MR003USB	M-Bus Micro-Master USB (mobile service tool for M-Bus meters)