# IZAR PORT® PULSE MINI

## Technical documentation

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**Content**

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# 1 Introduction

This document contains a technical description of the Diehl Metering IZAR PORT PULSE MINI. The IZAR PORT PULSE MINI is an M-Bus device which is able to convert pulse interfaces of resource consumption meters (e.g. electricity, heat, water, and other meter) into the M-Bus protocol. The IZAR PORT PULSE MINI has got two independent pulse inputs. The pulses from the meters are counted up and can be read out using the M-Bus protocol. Additionally, each pulse counter has got an user-definable physical medium and physical unit according to EN1434-4.
The IZAR PORT PULSE MINI is also able to multiply the counted pulses with an integer value and divide the result by an integer. Therefore, even non-integer pulse ratios (e.g. 1.5 pulses / litre) can be displayed correctly. The internal pulse accumulation register is not altered by this operation, therefore, the correct number of pulses is counted always. The multiplier and divisor can be altered without changing the pulse accumulation register.
The HYDRO-PORT software is used for configuration of the IZAR PORT PULSE MINI and runs with Windows® 95 / 98 / ME / NT SP4 / 2000 / XP.
To understand this document you should be familiar with the basic concepts of the M-Bus.
Useful are the documents provided on the official M-Bus homepage (http://www.mbus.com), especially “The M-Bus, A Documentation”.

## 2 Versions and Accessories

| | |
|---|---|
| IZAR PORT PULSE MINI | Pulse to M-Bus converter with 2 pulse inputs. |

| | |
|---|---|
| IZAR CENTER 25 | M-Bus Level Converter for connecting up to 25 M-Bus devices. |
| IZAR CENTER 25 Memory | M-Bus Level Converter / Master with 256 MByte non-volatile memory for connecting up to 25 M-Bus devices. |
| IZAR CENTER 60 | M-Bus Level Converter / Repeater for connecting up to 60 M-Bus devices. |
| IZAR CENTER 60 MEMORY | M-Bus Level Converter / Master with 256 MByte non-volatile memory for connecting up to 60 M-Bus devices. |
| IZAR CENTER 120 | M-Bus Level Converter / Repeater for connecting up to 250 M-Bus devices. |
| IZAR CENTER 120 MEMORY | M-Bus Level Converter / Repeater with 256 MByte non-volatile memory for connecting up to 250 M-Bus devices. |
| IZAR CENTER 250 | M-Bus Level Converter / Repeater for connecting up to 250 M-Bus devices. |
| IZAR CENTER 250 MEMORY | M-Bus Level Converter / Repeater with 256 MByte non-volatile memory for connecting up to 250 M-Bus devices. |

## 3 Descriptions

The following terms and phrases (M-Bus specific and not M-Bus specific) are used throughout this document. The following list gives an overview with explanation.

| | |
|---|---|
| M-Bus Level Converter / Repeater | Device which converts the electrical signals of a RS232 (V.24) PC interface to M-Bus signals. This device is necessary to connect a PC to an M-Bus network. Usually a level converter is a "dumb" device which is not optimising the signal quality and a repeater is more sophisticated device which enhances the signal quality. |
| M-Bus Slave / Device | Devices which are connected to the M-Bus. The M-Bus is a hierarchical bus system which has got exactly one master and several slaves (or devices). The IZAR PORT PULSE MINI is an M-Bus slave (device). |
| RS232 | One of the PC data interfaces. Works with –12 .. –3 V and +3 V.. +12 V voltage levels. The transmission type is bit serial with a user defined number of bits per data word. Usually 8 bits (= 1 byte) are used per data word and additionally 1 start bit and 1 stop bit. There may also be a parity bit, therefore, a data word may contain 10 or 11 bits. The M-Bus is always using 1 start bit, 8 data bits, 1 parity bit (parity even), and 1 stop bit (8E1). 8N1 (= 8 data bits, no parity bit, and 1 stop bit) is also very common. |
| Modem (AT commands) | Modulator / demodulator. A device capable of transmitting digital signals using a standard, analogue phone line, a digital phone line (ISDN), or a wireless phone connection (e.g. GSM network). Most modems understand the so called Hayes AT command set. The PC is using this command set to control a modem. |

# 4 IZAR PORT PULSE MINI

## 4.1 General Features

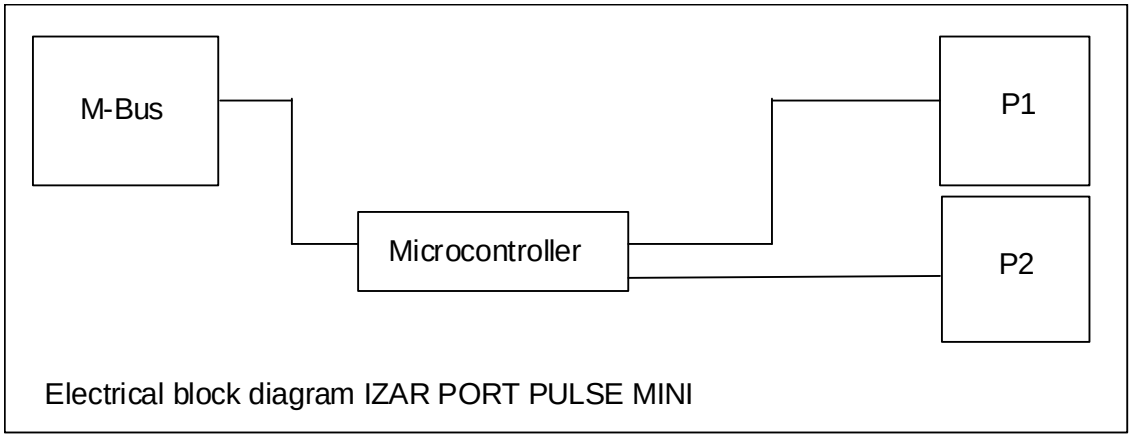
- Two independent, voltage free pulse inputs with relay, Reed Contact or Open Collector Transistor (3,3 V, 10 µA, open resistance > 500 KΩ, closed resistance < 1 KΩ)
- Max. pulse frequency: 50 Hz
- Minimum pulse width: 7,5 ms
- Two internal pulse counters, each one with 48 bit (0 .. 1,4 e14)

- M-Bus output (1 M-Bus "unit load"), one M-Bus address for each input
- M-Bus transmission speed 300 or 2400 baud (automatic detection and switching)
- 8 data bits, 1 stop bit (8E1), 1 parity bit (even)
- Programmable physical unit and medium for each input
- Factor for translating pulses to "real" physical units in each internal pulse counter

- Power supply via M-Bus or backup battery with a lifetime of 5..7 years (automatic detection), unlimited lifetime if M-Bus is always connected, battery used only when m-Bus fails

- Housing - protection class IP 54
- Operating temperature: + 0°C .. + 60 °C
- Storing capability: -20 °C .. + 70 °C
- Relative Humidity: 10 % .. 80 %, not condensing

## 4.2 Simplified Electrical Block Diagram



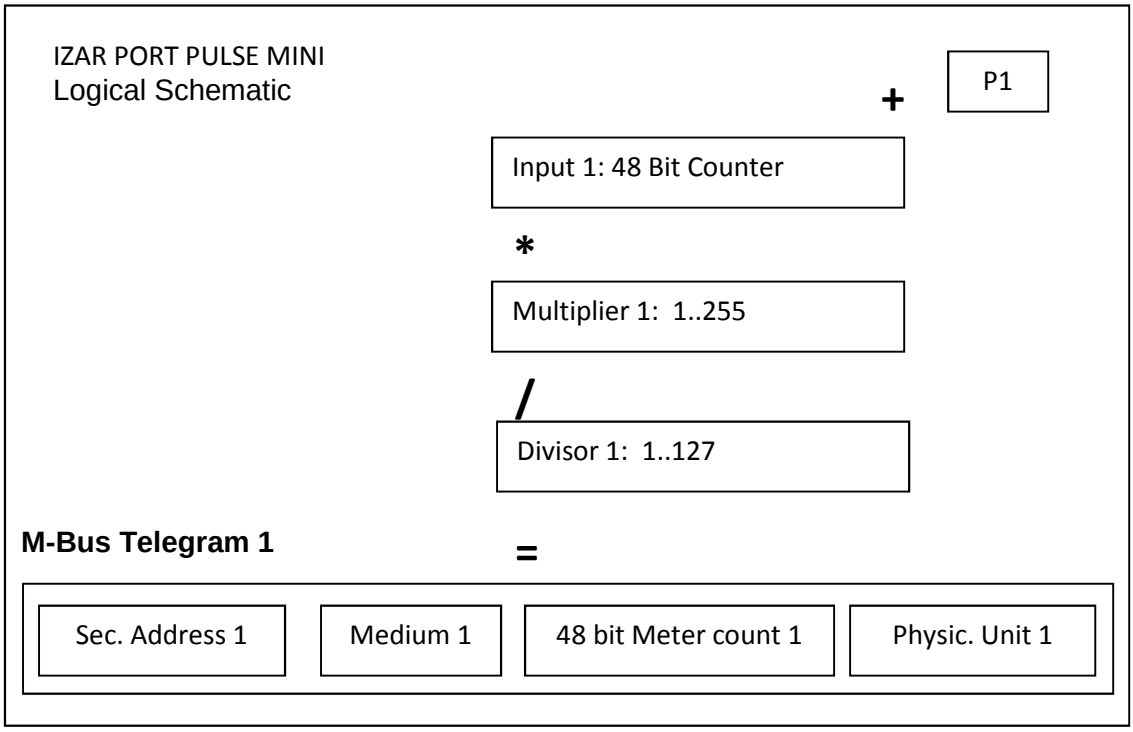

Electrical block diagram IZAR PORT PULSE MINI

The core part of the IZAR PORT PULSE MINI is a Microchip PIC microcontroller with 4 MHz clock speed. The PIC performs the following tasks:

- Counting the pulses on both pulse inputs and storing the results to a 48 bit pulse accumulator register each.
- Controlling the M-Bus communication (300 and 2400 baud auto baud detect). If an M-Bus telegram with the address of the IZAR PORT PULSE MINI is detected the respective answer is generated and sent. The meter counts can be multiplied with an integer value (8 bit, 1..255) and divided by an integer value (7 bit, 1..127).Therefore, even non-integer pulse ratios (e.g. 1.5 litre / pulse) can be displayed with their correct physical unit.

- Controlling the M-Bus voltage. At M-Bus power fail the microcontroller switches to a low-power state in which it is only able to count pulses from the contact pulse inputs. Communication is no longer possible.

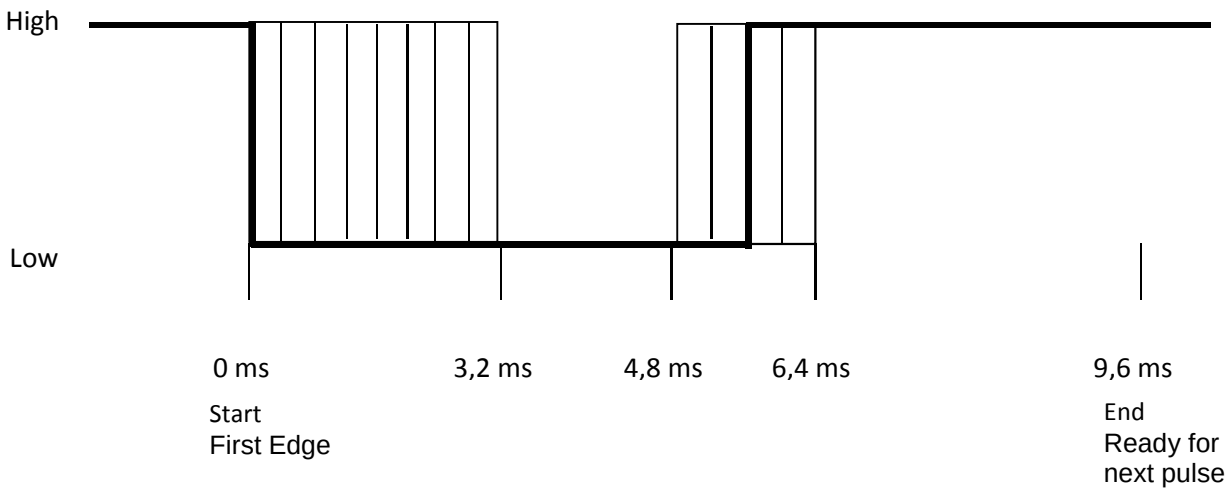
### 4.3 Simplified Logical Schematic




The simplified logical schematic shows one of the two pulse inputs (P1, Z2). Any pulse detected at the input is added to the 48 bit internal pulse accumulation register of input 1. If during an M-Bus communication the meter count is requested the content of the pulse accumulation register is multiplied with Multiplier 1 (range: 1..255) and divided by Divisor 1 (range: 1..127). The result is the 48 bit meter count 1 which is returned in an M-Bus data record with user-definable physical unit and medium. The pulse accumulation register is not altered by the arithmetical operations and, therefore, contains always the correct pulse count regardless of the multiplier or divisor.

### 4.4 Pulse detection

The pulse detection algorithm of the IZAR PORT PULSE MINI is shown in principal beneath. There is no difference between pulse input 1 and 2:




**Start:** Wait for a falling edge at the pulse input

- Detect a falling edge at the pulse input (High -> Low)
- Wait 3.2 ms
- For 1.6 ms check every 256 µs if the pulse input is still Low. If the pulse input is not Low -> go back to **Start**
- Pulse accumulation register = pulse accumulation register + 1.
- Wait until the pulse input is High again.
- If the pulse input is High again check every 3.2 ms if the pulse input is still high. If yes -> go back to **Start**

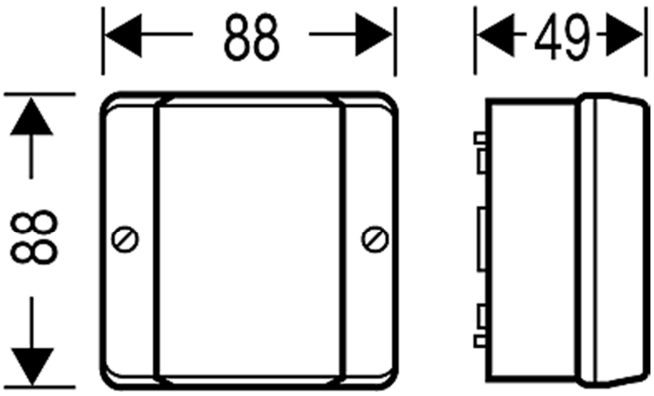
Therefore, the minimum pulse width is 4.8 ms (specified: 7.5 ms) and the maximum frequency is approx. 100 Hz (specified: 50 Hz).

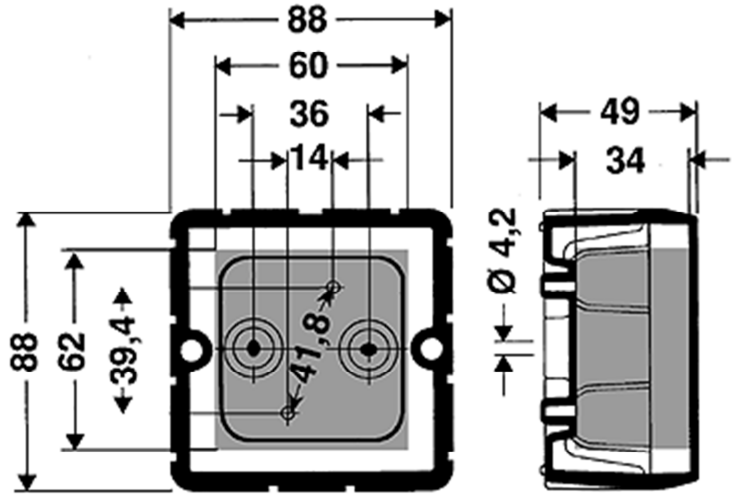
The hatched area in the time diagram above shows where e.g. a contact bounce may appear which is not counted.

### 4.5 Housing

The IZAR PORT PULSE MINI is prepared for wall fixing. Therefore you need two holes in a distance of 36mm. For mounting you have to remove the housing cover.

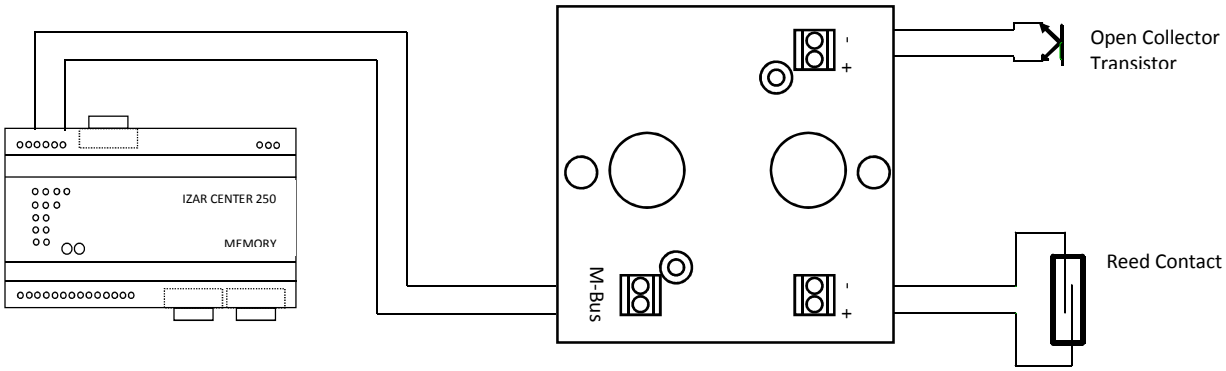
| | |
|---|---|
| Dimensions | 88 x 88 x 49 mm |
| Weight | Approx. 200g (incl. printed board assembly) |
| Material | PS (thermoplastic polystyrene) |
| Housing type | DP 9020 |
| Protection class | IP54 |
| Temperature resistance | -40°C ... +70°C (Housing without printed board) |




Drawings not true to size

## 4.6 Connections




| Connection | Description |
|---|---|
| P1+ | Contact input 1 + |
| P1- | Contact input 1 - |
| P2+ | Contact input 2 + |
| P2- | Contact input 2 - |
| M-Bus | M-Bus input (polarity independent) |
| M-Bus | M-Bus input (polarity independent) |

## 4.7 Application

The IZAR PORT PULSE MINI is used in places where a resource meter with pulse interface has to be connected to an M-Bus network. The contact inputs **P1** und **P2** are used for connecting voltage free pulse contacts (e.g. Reed Contact, Relay Contact, Open Collector Transistor Output).
In the first case the current necessary to recognize a closed pulse contact comes from the M-Bus power supply or the internal backup battery (in case of M-Bus failure). Therefore, no additional power supply is necessary. The contact current is very low (approx. 10 µA) which may cause electromagnetic influence on the counted pulses in areas with high electromagnetic fields. However, using short, shielded cables may overcome this problem. Due to the internal backup battery the IZAR PORT PULSE MINI is continuing the pulse counting even if the M-Bus power supply fails temporarily.

## 5 M-Bus Communication

The IZAR PORT PULSE MINI communicates according to M-Bus protocol EN1434-4.

| | |
|---|---|
| Format: | 8 data bits, 1 stop bit (8E1), 1 parity bit (even) |
| Baud rate: | 300 or 2400 Baud (automatic detection and switching) |
| Data format: | LSB always first |
| Primary address: | Adjustable (default: 01) |
| Secondary address: | Two addresses adjustable (for each input) |
| Manufacturer code: | HYD (2324) |
| Medium: | Adjustable (default: P1: 02, electricity P2: 07, water) |
| Generation: | 95 |

All figures in the next chapters are hexadecimal, "ChS" stands for the checksum of the M-Bus telegram, "PAd" for the primary address, "SAd" for the secondary address, "Med" for the medium.

### 5.1 Primary Addressing

The IZAR PORT PULSE MINI has got one primary address for both pulse inputs. The primary address is user definable via M-Bus command. By default the primary address of the IZAR PORT PULSE MINI is set to 1.
Apart from his primary address the IZAR PORT PULSE MINI answers to M-Bus addresses FE (M-Bus broadcast to all devices with answer from the devices) and FF (M-Bus broadcast to all devices without answer from the devices). On request to M-Bus address FD the IZAR PORT PULSE MINI answers only if it is selected (see 5.2).

**Note:**
For each pulse input the IZAR PORT PULSE MINI has a separate secondary address, but however only one primary address.

### 5.2 Secondary address selection

**Selection:**
68 0B 0B 68 73/53 FD 52 SAd0 SAd1 SAd2 SAd3 24 23 95 Med ChS 16

**Answer:**
E5 or non

**Deselection:**
10 40 FD ChS 16

**Answer:**
E5 or none

SAdX : Secondary address of the IZAR PORT PULSE MINI. Each input has its own secondary address.

| | |
|---|---|
| Input P1 : | The secondary address for pulse input 1 matches with the serial number on the front side of the IZAR PORT PULSE MINI |
| Input P2 : | The secondary address for pulse input 1 matches with the serial number +1 |

Med : Code for Medium (adjustable)

### 5.3 M-Bus Telegrams

#### 5.3.1 Status Request

**Request (REQ-UD2):**
10 7B/5B PAd/FE ChS 16

**Answer 1 (RSP-UD --primary addressing--):**
68 36 36 68 08 PAd 72 SAd0 SAd1 SAd2 SAd3 24 23 95 Med

| | |
|---|---|
| 01 | Number of risings (access number) |
| 00 | 00 = Block contains P1 or (P1 and P2)<br>01 = Block only contains P2 |
| 26 | Internal logic version (2.6) |
| 01 | Regulation value of the internal oscillating circuit |
| 06 06 00 00 00 00 00 00 | 1. Meter count pulse input 1<br>(Example: 0 energy [kWh]) |
| 02 86 28 01 01 | 2. Multiplicator and divisor for P 1 (example: multiplier: 1, divisor: 1) |
| 86 40 16 03 00 00 00 00 00 | 3. Meter count pulse input 2<br>(Example: 3 volume [m3]) |
| 82 40 96 28 01 01 | 4. Multiplier and divisor for P2<br>(Example: Multiplicator: 1, divisor: 1) |
| 87 40 79 00 00 00 18 24 23 95 07 | 5. Secondary address P2<br>(Secondary address: 18000000,<br>Manufacturer code: HYD (2324)<br>Medium: Water (07)<br>Generation: 95) |

ChS 16

**Request (REQ-UD2):**
10 7B/5B FD ChS 16

**Answer 2 (RSP-UD --secondary addressing P1--):**
68 1C 1C 68 08 PAd 72 SAd0 SAd1 SAd2 SAd3 24 23 95 Med 01

| | |
|---|---|
| 01 | Number of risings (access number) |
| 00 | 00 = Block contains P1 or (P1 and P2)<br>01 = Block only contains P2 |

| | |
|---|---|
| 26 | Internal logic version (2.6) |
| 01 | Regulation value of the internal oscillating circuit |
| 06 06 00 00 00 00 00 00 | 1. Meter count pulse input 1 (example: 0 energy [kWh]) |
| 02 86 28 01 01 | 2. Multiplicator and divisor for pulse input 1 (Example: Multiplicator: 1, divisor: 1) |

ChS 16

**Request (REQ-UD2):**
10 7B/5B FD ChS 16

**Answer 2 (RSP-UD --secondary addressing P2--):**
68 1C 1C 68 08 PAd 72 SAd0 SAd1 SAd2 SAd3 24 23 95 Med 01

| | |
|---|---|
| 01 | Number of risings (access number) |
| 01 | 00 = Block contains P1 or (P1 and P2)<br>01 = Block contains only P2 |
| 26 | Internal logic version (2.6) |
| 01 | Regulation value of the internal oscillating circuit |
| 06 06 03 00 00 00 00 00 | 1. Meter count pulse input 2 (Example: 0 energy [kWh]) |
| 02 86 28 01 01 | 2. Multiplicator and divisor for Pulse input 2 (Example: Multiplicator: 1, Divisor: 1) |

ChS 16

### 5.3.2 Programming parameters

**Request (SND-UD, --both inputs simultaneously--):**
68 37 37 68 53/73 Pad/FD/FE 51

| | |
|---|---|
| 01 7A PAd | 1. New primary address |
| 07 79 SAd0 SAd1 SAd2 SAd3 24 23 95 Med1 | 2. New secondary address pulse input 1 |
| 87 40 79 SAd0 SAd1 SAd2 SAd3 24 23 95 Med2 | 3. New secondary address pulse input 2 |
| 02 VIF 28 ML DV | 4. New Multiplicator / divisor pulse input 1 (VIF: Code for physical unit, adjustable) |
| 82 40 VIF 28 ML DV | 5. New Multiplicator / divisor pulse input 2 (VIF: Code for physical unit, adjustable) |
| 06 VIF 00 00 00 00 00 00 | 6. New meter count pulse input 1 (corrected) (VIF: Code for physical unit, adjustable) |
| 86 40 VIF 00 00 00 00 00 00 | 7. New meter count pulse input 2 (corrected) |

(VIF: Code for physical unit, adjustable)

ChS 16

**Answer:**
E5 or none

**Request (SND-UD, --only input P1--):**
68 1D 1D 68 53/73 Pad/FD/FE 51
01 7A PAd 1. New primary address
07 79 SAd0 SAd1 SAd2 SAd3 24 23 95 Med1
2. New secondary address pulse input 1
02 VIF 28 ML DV 3. New Multiplicator / divisor pulse input 1
(VIF: Code for physical unit, adjustable)
06 VIF 00 00 00 00 00 00 4. New meter count pulse input 1 (corrected)
(VIF: Code for physical unit, adjustable)

Chs 16

**Answer:**
E5 or none

**Request (SND-UD, --only input P2--):**
68 20 20 68 53/73 Pad/FD/FE 51
01 7A PAd 1. New primary address
87 40 79 SAd0 SAd1 SAd2 SAd3 24 23 95 Med2
2. New secondary address pulse input 2
82 40 VIF 28 ML DV 3. New Multiplicator / divisor pulse input 2
(VIF: Code for physical unit, adjustable)
86 40 VIF 00 00 00 00 00 00 4. New meter count pulse input 2 (corrected)
(VIF: Code for physical unit, adjustable)

Chs 16

**Answer:**
E5 or none

### 5.3.3 Meter count parameterization

The meter counts of the two pulse inputs have to be set „corrected" in the IZAR PORT PULSE MINI. That means that the raw values (before multiplication and division) of the pulse registers have to be programmed.

Example:

| | |
|---|---|
| Multiplicator: | 3 |
| Divisor: | 2 |
| Meter count: | 123456 (has to be displayed in the RSP_UD telegram) |

The raw value which has to be programmed would be:

Meter count * divisor / multiplicator

-> 123456 * 2 / 3 = 82304

The IZAR PORT PULSE MINI will display the meter count

82304 * 3 / 2 = 123456

## 6 List of all M-Bus commands

| **IZAR PORT PULSE MINI Function Selection-Telegrams** | | | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Telegram Type** | **CI** | **Address** | **Manufact.** | **Gen.** | **Medium** |
| Selection | SND_UD | 52 | Serial N. | 23 24 (HYD) | 96 | 19 |
| | | | | | 97 | 0E |
| | | | | | 95 | Medium |
| Deselection | SND_NKE | 40 | FD (253) | | | |

| **IZAR PORT PULSE MINI Function Status Request** | | | | |
|---|---|---|---|---|
| **Description** | **Telegram Type** | | | |
| Request | REQ_UD2 | | | |

| **IZAR PORT PULSE MINI Function SND_UD Telegrams** | | | | |
|---|---|---|---|---|
| **Description** | **Telegram Type** | **CI** | | |
| Parameterization | SND_UD | 51 | | |
| Programming Meter Counts | SND_UD | 51 | | |

## 7 Technical Data

| **Conformity tests (CE)** | |
|---|---|
| **Emissions** | EN 61000-6-3 : 2007 ( Emission standard for residential, commercial and light-industrial environments ) |
| **EMC** | EN 61000-6-1 : 2007+ A1:2011+AC:2012 ( Immunity for residential, commercial and light-industrial environments ) |
| **Compliance Laboratory** | Bureau Veritas Consumer Product Service / European Compliance Laboratory / Nuremberg / Germany |

| **IZAR PORT PULSE MINI** | |
|---|---|
| **Inputs** | 2 x contact inputs for Reed contacts, relay or Open Collector Transistor alternatively |
| **Contact inputs** | Max. 30 µW (3 V, 10 µA) contact power per input<br>Inactive: contact resistance > 500 K<br>Active: contact resistance < 1 K |
| **Min. Pulse Duration** | > 7,5 ms |
| **Max. Pulse Frequency** | < 50 Hz (per input) |
| **Pulse Accumulation** | 48 Bit signed integer value (per input) |
| **Factor** | User defined 8 Bit multiplier (1..255) and 7 Bit divisor (1..127)<br>Integer multiplication and division performed at each M-Bus request for meter values. Pulse accumulation register is not altered by arithmetic operations. |

| **Communication (M-Bus)** | |
|---|---|
| **Baudrates** | 300 and 2400 Baud, automatic detection and switching |
| **Data word format** | 8 data bits, even parity, 1 stop bit (8E1) |
| **M-Bus load** | 1 standard load |
| **Backup time while M-Bus failure** | > 3 months (pulse frequency 50 Hz)<br>> 5 years (pulse frequency 0 Hz) |