

RAD-DI8-IFS

I/O extension module with 8 digital inputs or 2 pulse inputs

INTERFACE

Data sheet
104837_en_00

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1 Description

The **RAD-DI8-IFS** I/O extension module can be used in conjunction with Radioline wireless modules and other Interface system (IFS) master devices. In a station structure, you can connect up to 32 I/O extension modules to a wireless module via the DIN rail connector.

The **RAD-DI8-IFS** digital I/O extension module is used for processing eight digital input signals 0 ... 30.5 V DC or two pulse signals 0 ... 100 Hz.

Features

- Easy and tool-free I/O mapping via thumb wheel on the front
- Modular design via TBUS DIN rail connector (hot-swap capable)
- 8 digital inputs (0 ... 30.5 V DC)
- 2 pulse inputs (0 ... 100 Hz)
- International approvals
- Installation in Ex zone 2

**WARNING: Explosion hazard when used in potentially explosive areas**

The module is a category 3 item of electrical equipment. Follow the instructions provided here during installation and observe the safety instructions.



Make sure you always use the latest documentation.
It can be downloaded from the product at phoenixcontact.net/products.



Use the I/O extension module in connection with the RAD-2400-IFS wireless module, firmware version 1.40 or higher.

This data sheet is valid for all products listed on the following page:

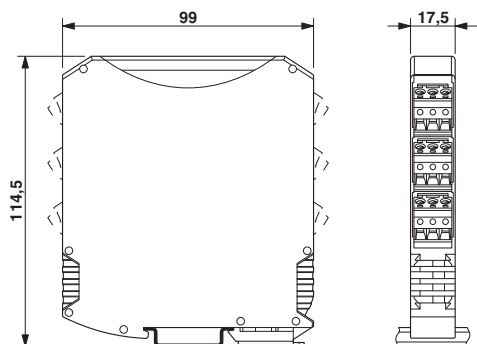
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3 Ordering data

Description	Type	Order No.	Pcs. / Pkt.
Digital I/O extension module with 8 digital inputs (0 ... 30.5 V DC) or 2 pulse inputs (0 ... 100 Hz), with screw connection, including DIN rail connector	RAD-DI8-IFS	2901539	1
Accessories	Type	Order No.	Pcs. / Pkt.
2400 MHz wireless transceiver with RS-232, RS-485 2-wire interface, expandable with I/O extension modules, with screw connection, antenna connection: RSMA (female), including DIN rail connector	RAD-2400-IFS	2901541	1
Bidirectional, Radioline 900 MHz transceiver for wireless transmission of serial and I/O data	RAD-900-IFS	2901540	1
DIN rail connector for DIN rail power supply unit, gold-plated contacts, for DIN rail mounting, 5-pos.	ME 17,5 TBUS 1,5/ 5-ST-3,81 GN	2709561	10
Digital I/O extension module with 8 digital transistor outputs (30.5 V DC/200 mA), with screw connection, including DIN rail connector	RAD-DO8-IFS	2902811	1

4 Technical data

Dimensions (nominal sizes in mm)



Dimensions W / H / D	17.5 mm / 99 mm / 114.5 mm
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General data

Surge voltage category	II
Mounting position	Any , on standard DIN rail NS 35 in accordance with EN 60715
Degree of protection	IP20
Pollution degree	2
Type of housing	PA 6.6-FR , green

Supply

Supply voltage range	19.2 V DC ... 30.5 V DC (T-connector)
Max. current consumption	max. 18 mA (At 24 V DC, at 25°C)
Transient surge protection	Yes

Digital input

Number of inputs	8
Input signal Voltage	0 V DC ... 30.5 V DC
Switching level "1" signal	10 V DC ... 30.5 V DC
Switching level "0" signal	0 V DC ... 4 V DC
Input frequency	≤ 10 Hz (Static mode)
Max. current consumption	< 1 mA

Pulse input

Number of channels	2
Voltage input signal	0 V DC ... 30.5 V DC
Switching level "1" signal	10 V DC ... 30.5 V DC
Switching level "0" signal	0 V DC ... 4 V DC
Input frequency	< 100 Hz (Pulse counter mode)
Pulse length	min. 5 ms (Pulse/pause ratio 1:1)
Process data channel	32 Bit (per channel)

Electrical isolation

Digital I/O	50 V (Rated insulation voltage (between the channel groups 1...4 and 5...8/TBUS supply, reinforced insulation according to EN 61010, EN 50178))
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Test voltage

Digital I/O	1.5 kV AC (50 Hz, 1 min.)
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Connection data

Connection method	Screw connection
Conductor cross section, solid	0.2 mm ² ... 2.5 mm ²
Conductor cross section, stranded	0.2 mm ² ... 2.5 mm ²
Conductor cross section AWG/kcmil	24 ... 14
Stripping length	7 mm
Tightening torque	0.6 Nm

Status indication

Status display	Green LED (supply voltage, PWR) Green LED (bus communication, DAT) Red LED (periphery error, ERR) Yellow LED (counter mode, CNT) Yellow LED (digital input, DI1) Yellow LED (digital input, DI2) Yellow LED (digital input, DI3) Yellow LED (digital input, DI4) Yellow LED (digital input, DI5) Yellow LED (digital input, DI6) Yellow LED (digital input, DI7) Yellow LED (digital input, DI8)
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Ambient conditions


Ambient temperature (operation)	-40 °C ... 70 °C -40 °F ... 158 °F
Ambient temperature (storage/transport)	-40 °C ... 85 °C -40 °F ... 185 °F
Permissible humidity (operation)	20 % ... 85 %
Permissible humidity (storage/transport)	20 % ... 85 %
Altitude	2000 m
Vibration (operation)	In accordance with IEC 60068-2-6: 5 g, 10 Hz - 150 Hz
Shock	16 g, 11 ms

Certification

Conformance

CE-compliant

ATEX

 II 3 G Ex nA IIC T4 Gc X

IECEX

Applied for

UL, USA / Canada

UL applied for

Conformance

EMC directive 2004/108/EC

EN 61000-6-2; EN 61000-6-4

Ex directive (ATEX)

EN 60079-0; EN 60079-15

5 Safety regulations and installation notes

5.1 Installation and operation

Follow the installation instructions.



NOTE: Installation, operation, and maintenance may only be carried out by qualified specialist personnel.

Error-free operation of this device can only be ensured if transport, storage, and assembly are carried out correctly and operation and maintenance are carried out with care.

When installing and operating the device, the applicable safety directives (including national safety directives), accident prevention regulations, as well as general technical regulations, must be observed.



NOTE: Access to circuits within the device is not permitted.

Do not repair the device yourself but replace it with an equivalent device.

Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from a failure to comply.



NOTE: The IP20 degree of protection (IEC 60529/EN 60529) of the device is intended for a clean and dry environment. Do not subject the device to mechanical and/or thermal loads that exceed the specified limits.

For the safety data, please refer to the operating instructions and certificates (EC-type examination certificate, other approvals, if necessary).

5.2 Safety regulations for installation in potentially explosive areas

Installation in zone 2



WARNING: Explosion hazard

The device is designed for installation in zone 2 potentially explosive areas according to directive 94/9/EC. Observe the specified conditions for use in potentially explosive areas.



WARNING: Explosion hazard

Install the device into a housing (control or distributor box) that meets the requirements of EN 60079-0 and EN 60079-15 and has at least IP54 protection (EN 60529).



WARNING: Explosion hazard

When installing and connecting the supply and signal circuits observe the requirements of EN 60079-14. Only devices suitable for operation in Ex zone 2 and the conditions at the application site may be connected to the circuits in zone 2.



WARNING: Explosion hazard

In potentially explosive areas, only connect and disconnect cables when the power is disconnected.

Installation/removal of the devices on/from the TBUS DIN rail connector may only be performed when no voltage is applied.



WARNING: Explosion hazard

Only use category 3G devices (ATEX 94/9/EC).



WARNING: Explosion hazard

The device must be stopped and immediately removed from the Ex area if it is damaged or was subject to an impermissible load or stored incorrectly or if it malfunctions.

Installation in areas with a danger of dust explosions



WARNING: Explosion hazard

The device has not been designed for use in potentially dust-explosive atmospheres.

6 Installation



NOTE: electrostatic discharge!
 The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and EN 61340-5-1.

6.1 Structure

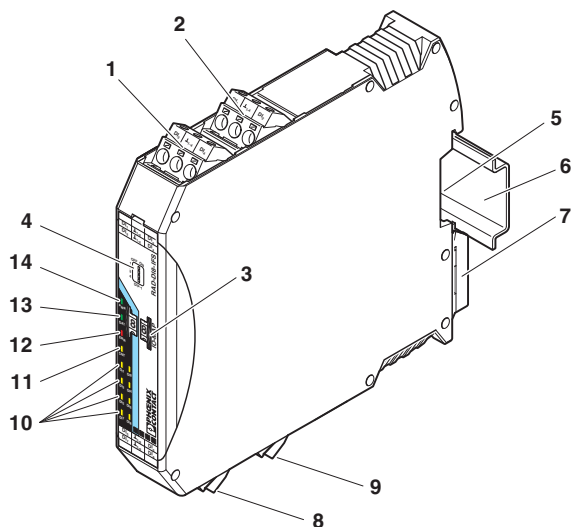


Figure 1 RAD-DI8-IFS

Pos.	Designation
1	Digital inputs 3 + 4
2	Digital inputs 1 + 2, DI1: Pulse input 1
3	I/O MAP address setting via thumb wheel
4	DIP switch for switching between static mode and pulse counter mode for digital inputs
5	Connection option for TBUS DIN rail connector
6	DIN rail
7	Metal foot catch for DIN rail fixing
8	Digital inputs 5 + 6
9	Digital inputs 7 + 8, DI7: Pulse input 2
10	Status LEDs for digital inputs DI1 ... DI8
11	CNT status LED, green (pulse counter mode)
12	ERR status LED, red (communication error)
13	DAT status LED, green (BUS communication)
14	PWR status LED, green (supply voltage)

6.2 Basic circuit diagram

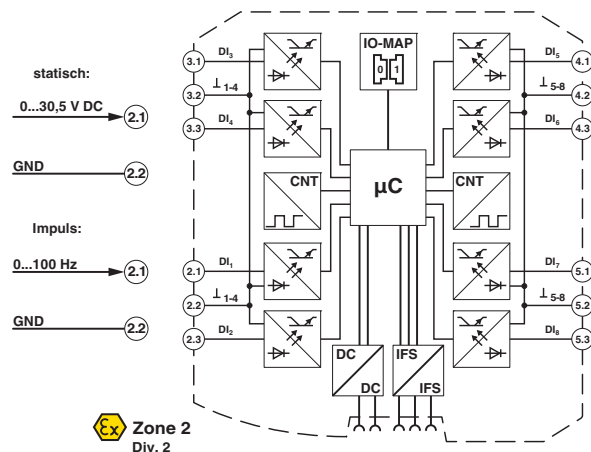


Figure 2 RAD-DI8-IFS basic circuit diagram

6.3 Setting the DIP switches

Static mode or pulse counter mode can be selected using the DIP switch.

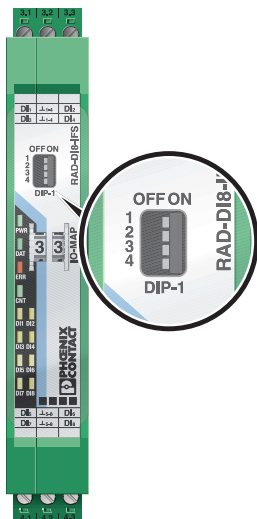


Figure 3 DIP switches

Input	Configuration	DIP switch			
		1	2	3	4
Digital IN					
DI1 ... DI8	Static mode	OFF	n. c.	n. c.	n. c.
Counter IN					
DI1+DI7	Pulse counter mode	ON	n. c.	n. c.	n. c.

n. c. = not connected, DIP switches 2 ... 4 have no function

- After setting the DIP switch: Switch the device to disconnected and then apply the current again (power-up).

6.4 Network applications (operating mode)

You can set the network application of the wireless module with the PSI-CONF software. All RAD-2400-IFS Radioline wireless modules are set to I/O data mode (wire in/wire out) by default.

Wireless module in I/O data mode (wire in/wire out)

In an I/O-to-I/O network, only the I/O signals of the connected analog and digital I/O extension modules are transmitted. Assign the inputs and outputs of the extension modules quickly using the white thumbwheel.

In this mode, the serial RS-232 and RS-485 interfaces on the wireless module are deactivated.

Wireless module in PLC/Modbus RTU mode

In PLC/Modbus RTU mode, the wireless master operates as a Modbus slave. The master PLC controls all commands and initiates all data requests.

Input and output data is stored in a Modbus Memory Map in the master wireless module.

In this mode, you can access process and diagnostic data for the individual network devices via a Modbus controller.

6.5 Functions in pulse counter mode

Max. counter state: 4.294.967.295

Overflow: When the maximum counter state is reached, the counter state is automatically set to 0.

You can manually reset the counter state in various ways.

Reset counter state via power up

- Disconnect the device power supply and then reconnect the voltage (power up).

Reset counter state via Modbus RTU

- Reset the counter states via Modbus RTU as follows:
DI1: bit 0 = 1 (register 40xx1)
DI7: bit 1 = 1 (register 40xx1)

Reset counter state by setting the inputs

- DI1: set input DI3 for 0.5 seconds.
DI7: set input DI5 for 0.5 seconds.

6.6 I/O MAP address in the Radioline wireless system

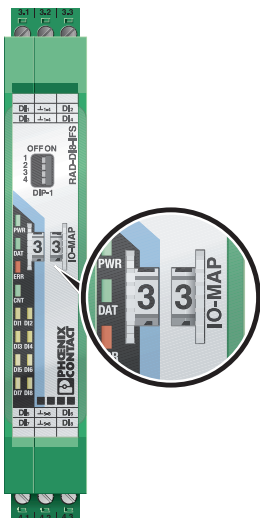


Figure 4 Thumb wheel

Use the thumb wheel to set the I/O MAP address. The address is used to address the I/O module for use in the Radioline wireless system.

The following conditions must be met:

The I/O MAP address of an input module may only appear once in the network.

Thumb wheel settings	Description
01 - 99	I/O MAP address
00	Delivery state
** , 1* - 9*	Setting not permitted
*1 - *9	Interface System slave address, for use with other Interface System (IFS) master devices

Wireless module in I/O data mode (wire in/wire out)

The input device must be provided with the same I/O MAP address as the assigned output device at the other wireless station (I/O mapping).

Example:	I/O MAP address
RAD-DI8-IFS	02
RAD-DO8-IFS	02

Only the RAD-DO8-IFS module can be assigned to the RAD-DI8-IFS module.

Static mode	The digital inputs DI1 ... DI8 can be mapped to the digital outputs DO1 ... DO8 of the RAD-DO8-IFS extension module.
Pulse counter mode	No function in the I/O data mode

Wireless module in PLC/Modbus RTU mode

Static mode	The I/O data of the eight digital inputs (DI1 ... DI8) is stored in an internal Modbus memory map in the master wireless module. Access to process and diagnostic data via the Modbus RTU controller
Pulse counter mode	Access to 32-bit process data from the pulse inputs DI1 + DI7 via the Modbus RTU controller

You can read or write the process data via the serial interface of the RAD-2400-IFS master wireless module (RAD-ID = 01) using the Modbus RTU command (see Section 7).

6.7 Display and diagnostic elements

The RAD-DI8-IFS I/O extension module uses a total of 12 LEDs to indicate the operating states.

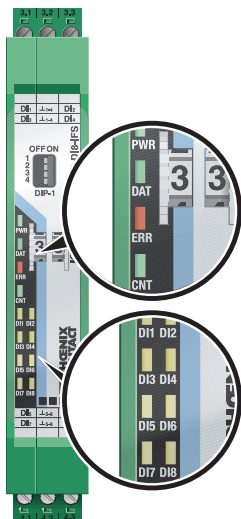


Figure 5 Display and diagnostic elements

PWR LED

The green PWR LED indicates the supply voltage status.

- Off: No supply voltage
- On: Supply voltage OK

DAT LED

The green DAT LED indicates the bus communication status.

- Off: No communication
- Flashing: Configuration/addressing mode
- On: Cyclic data communication

ERR LED

The red ERR LED indicates the error status, e.g., no corresponding output module found (e.g., incorrect addressing).

- Off: No error
- Flashing: **Slow (1.4 HZ):** I/O-MAP address changed, mode switched using DIP switch 1, but not yet read via wireless module.
Fast (2.8 Hz): no bus communication
- On: Critical internal error

CNT LED

The green CNT LED indicates that pulse counter mode is activated.

- Off: Static mode of digital inputs DI1 ... DI8
- Flashing: Mode switched using DIP switch 1, but not yet read via wireless module.
- On: Pulse counter mode of digital inputs DI1 + DI7

DI1 ... DI8

The yellow DI1 ... DI8 LEDs indicate the state of the digital inputs. In pulse counter mode: the DI1 + DI7 LEDs flash in time with the recorded pulses. The DI3 and DI5 LEDs light up when the counter state is reset.

- DI3 On (0.5 s): Counter state DI1 reset to 0
- DI5 On (0.5 s): Counter state DI7 reset to 0

6.8 Digital inputs

The eight inputs are arranged in two groups of four inputs each with a common ground (GND).

The two DC groups are electrically isolated from one another, from the supply voltage (via bus foot), and from other electronic components.

Static mode	DIP1=OFF - STATIC	Static digital inputs DI1 ... DI8 activated, 0 ... 30.5 V DC
Pulse counter mode	DIP1=ON - IMPULSE	Pulse inputs DI1 + DI7 activated, pulse 0 ... 100 Hz

6.9 Assembly/removal

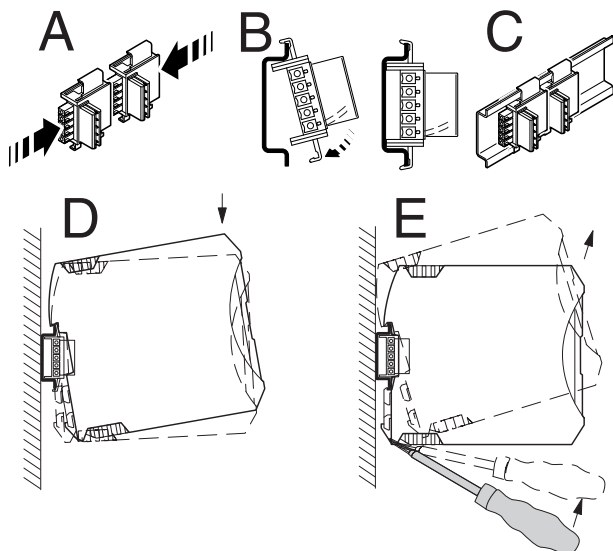


Figure 6 Mounting and removing



NOTE: The use of the TBUS DIN rail connector for the supply of modules is only possible with 24 V DC devices.

- When using the DIN rail connector, first insert it in the 35 mm DIN rail according to EN 60715 (see Figure 6, A - C).
The DIN rail connector is used to bridge the power supply and communication.



In this case, it is vital to observe the mounting direction of the module and DIN connector: snap-on foot at the bottom and connector on the left.

- Install the module in a suitable housing to meet the requirements for the protection class.
- Before startup, check that the RAD-DI8-IFS is operating, wired, and marked correctly.
- You can establish a connection between two DIN rail connectors using MINI COMBICON plug-in connectors: MC 1,5/5-ST-3,81 (female, 1803604); IMC 1,5/5-ST-3,81 (male, 1857919).



The maximum cable length is 10 m. Use shielded cables.

6.10 Connecting the cables

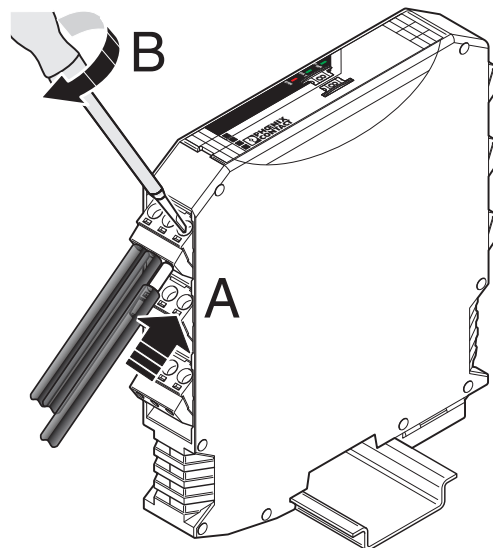


Figure 7 Connection of the cables

- Crimp ferrules to the wires.
Permissible cable cross section: 0.2...2.5 mm².
- Insert the wire with ferrule into the corresponding connection terminal block.
- Use a screwdriver to tighten the screw in the opening above the connection terminal block.
Tightening torque: 0.6 Nm

7 Process data

You can read the process data via the serial interface of the RAD-2400-IFS master wireless module (RAD-ID = 01) using the Modbus RTU command.

With the PSI-CONF software, you can set the wireless module's network application to "PLC/Modbus RTU mode".

The process image of the I/O modules consists of ten data words of which eight are being used.

I/O module	RAD-DI8-IFS	RAD-DI8-IFS	RAD-DI8-IFS
Module type	02 _{hex}	40 _{hex}	40 _{hex}
	Static mode	Pulse counter mode	Pulse counter mode
Number of registers	02 _{hex}	06 _{hex}	02 _{hex}
	Static inputs	Pulse inputs	Reset counter states
Address space	30xx0 ... 30xx1	30xx0 ... 30xx5	40xx0 ... 40xx1
Modbus function code	fc04	fc04	fc 03, 16

xx = I/O-MAP address set using the thumbwheel

30xx0	Module type and currentness of data															
Currentness of data (high byte)	Module type (low byte)															
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Reserved									X	X	X	X	X	X	X	X

Register values:

Module type	If the module type in the register is invalid or unavailable, then the register value is 0
Currentness of data	If the data in the register is not up-to-date, then the register value is 1. This is the case, for example, if the wireless connection or communication with an input module fails. In this case, the IN process data is retained in the Modbus table, but is no longer updated.

The read I/O data is only valid and current if a valid module type value is returned by the slave and the "Currentness of data" register value equals 0.

30xx1	Digital inputs DI1 ... DI8 (static mode)																
Static channel (high byte)								Static channel (low byte)									
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
Reserved								DI	DI	DI	DI	DI	DI	DI	DI		
									8	7	6	5	4	3	2	1	
Terminal point																	
										5.x	5.x	4.x	4.x	3.x	3.x	2.x	2.x

30xx2	DI1: 32-bit pulse input, pulse counter mode																
Counter state DI1 (high byte)								Counter state DI1 (low byte)									
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Terminal point																	
																	2.x

30xx3	DI1: 32-bit pulse input, pulse counter mode																
Counter state DI1 (high byte)								Counter state DI1 (low byte)									
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Terminal point																	
																	2.x

30xx4	DI7: 32-bit pulse input, pulse counter mode																
Counter state DI7 (high byte)								Counter state DI7 (low byte)									
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
Terminal point																	
																	5.x

30xx5	DI7: 32-bit pulse input, pulse counter mode																
Counter state DI7 (high byte)								Counter state DI7 (low byte)									
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
Terminal point																	
																	5.x

30xx6 ... 30xx9	Reserved
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40xx1		Reset of counter states DI1/DI7													
High byte								Counter state DI1/DI7 (low byte)							
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Reserved														X	X

Bit 0 = 1: counter state DI1 reset to 0

Bit 1 = 1: counter state DI7 reset to 0

40xx2 ... 40xx9	Reserved
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7.1 Functions in pulse counter mode

Max. counter state: 4.294.967.295

Reset counter state via Modbus RTU

- Reset the counter states via Modbus RTU as follows:
DI1: bit 0 = 1 (register 40xx1)
DI7: bit 1 = 1 (register 40xx1)

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