

RAD-IN/OUT-2D-CNT

Extension modules for the bidirectional wireless transmission system

INTERFACE

Data sheet
102982_en_02

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1 Description

The RAD-ISM-...-SET-BD-BUS-ANT bidirectional wireless system comprises two transceiver modules. The transceivers can transmit and receive wireless signals. The transmit/receive function is managed automatically.

Extension modules can be connected to this system to adapt the number of signals to be transmitted (digital or analog) to the requirements. The bus foot connector is used to supply the extension modules and establish communication via an internal data bus.

The **RAD-IN-2D-CNT** extension module can be used to read in voltage pulses of 0.1 V AC/DC ... 30 V AC/DC, which are mapped via the corresponding **RAD-OUT-2D-CNT** output module.



Make sure you always use the latest documentation.
It can be downloaded at www.phoenixcontact.net/catalog.



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

2 Ordering data

Description	Type	Order No.	Pcs./Pkt.
Digital extension module with two digital inputs for measuring pulses and frequencies	RAD-IN-2D-CNT	2885223	1
Digital extension module with two digital outputs for outputting pulses and frequencies	RAD-OUT-2D-CNT	2885236	1

3 Technical data

Power supply	RAD-IN-2D-CNT	RAD-OUT-2D-CNT
Supply voltage U_B (via bus foot)	24 V DC	
Backup power	12 V DC ... 30 V DC; 45 mA, maximum	–
Tolerance	-50%/+25%	
Protection against polarity reversal	Yes	
Current consumption (at U_B)		
Maximum	45 mA	115 mA
Typical	35 mA	90 mA

Pulse/frequency input (RAD-IN-2D-CNT)	
Channels	2
Input signals	0.1 V AC/DC ... 30 V AC/DC
Input impedance	
LOW	1 k Ω
HIGH	90 k Ω
Input frequency	0.1 Hz ... 10 kHz (with 50% duty cycle)
Minimum pulse length	
High time	50 μ s
Low time	50 μ s
Minimum HIGH signal	
Single ended	3.6 V DC
Differential mode	100 mV _{PP}

Pulse/frequency output (RAD-OUT-2D-CNT)	
Channels	2
Version	Transistor output
Switching voltage	U_B (30 V DC, maximum)
Output current (at maximum switching voltage)	
Terminal block 4/13	Limited to 0.75 W at 23°C
Terminal block 3/14	27 mA, maximum
Output of counter pulses	
Clock frequency	
High speed	10 kHz (with 50% duty cycle)
Low speed	10 Hz (with 50% duty cycle)
Frequency output	0.1 Hz ... 10 kHz (with 50% duty cycle)

Climatic data	
Ambient temperature	
Operation (IEC 60068-1/UL 508)	-20°C ... +65°C
Storage	-40°C ... +85°C
Relative humidity	20% to 85% (no condensation)

Indicators

LED: Status	ON/OFF/flashing
LED: Pulse IN/OUT 1 + 2	ON/OFF

General data

Housing material
Degree of protection
Mounting
Mounting position
Dimensions (W x H x D)
Weight
Conductor cross-section

RAD-IN-2D-CNT

RAD-OUT-2D-CNT

Polyamide PA, non-reinforced	
IP20	
On TS35 DIN rail according to EN 60715	
Any	
22.5 mm x 99 mm x 114.5 mm	
120 g, approximately	110 g, approximately
0.2 mm ² ... 2.5 mm ²	

Approvals

CE

CE

UL



TELEMETERING EQUIPMENT FOR HAZARDOUS LOCATIONS

LISTED 9EXO

Class I Div 2 Groups A, B, C, D T5

These devices must be wired in accordance with Class I, Division 2 wiring methods as described in the National Electrical Code, Article 501-4(b) or the authority having jurisdiction. Transmitter unit is to be used with a purely resistive antenna when installed in Class I, Division 2 areas.

Conformance with EMC Directive 2004/108/EC

Noise immunity	According to EN 61000-6-2
Noise emission	According to EN 61000-6-4

Conformance with ATEX Directive 94/9/EC

ATEX	II 3 G EEx nL IIC T5
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4 Block diagram

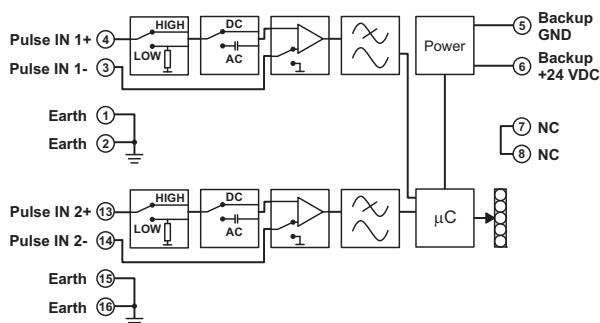


Figure 1 Block diagram for the RAD-IN-2D-CNT

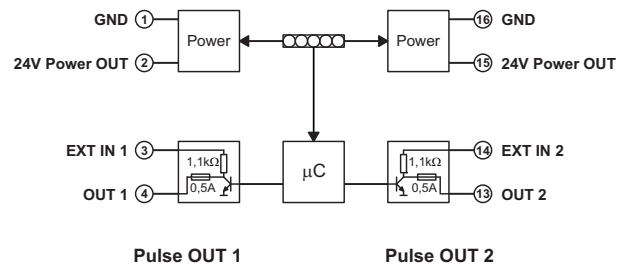


Figure 2 Block diagram for the RAD-OUT-2D-CNT

5 Safety regulations

5.1 Installation notes

**WARNING: Correct usage**

- Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions described. When installing and operating the device, the applicable regulations and safety directives (including national safety directives), as well as general technical regulations, must be observed. Observe the technical data in this data sheet and subsequent documentation (www.phoenixcontact.com).
- In order to protect the modules against electrostatic discharge when working on control cabinets, the operating personnel must remove electrostatic discharge before opening control boxes or control cabinets and before touching the modules.
- The modules are snapped onto a DIN rail within a control cabinet or control box. The control cabinet/box must meet the requirements of EN 60950-1:2001 in terms of fire protection shielding.
- The device must not be modified. Do not repair the device yourself, replace it with an equivalent device. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from violation.
- The IP20 degree of protection (EN 60529) of the device is intended for use in a clean and dry environment. The device must not be subject to any strain or load, which exceeds the limits described.
- In the electrical system of the building, a 2-pos. disconnecting device must be provided to isolate the equipment from the supply circuit.

5.2 Installation in the Ex area (zone 2)



The device is designed for installation in zone 2 potentially explosive areas according to Directive 94/9/EC.

**WARNING: Correct usage in potentially explosive areas**

- The device is not designed for use in atmospheres with a danger of dust explosions.
- Observe the specified conditions for use in potentially explosive areas.
- Install the device in housing (control or distributor box) that meets the requirements of EN 60079-15 and has at least IP54 protection (EN 60529).
- When installing and connecting the supply and signal circuits, observe the requirements of EN 60079-14. Only devices which are designed for operation in Ex zone 2 and are suitable for the conditions at the installation location may be connected to the circuits in zone 2.
- In potentially explosive areas, snap the device on or off the bus foot and connect or disconnect the cables only when the power is disconnected.
- 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.

6 Structure

6.1 RAD-IN-2D-CNT

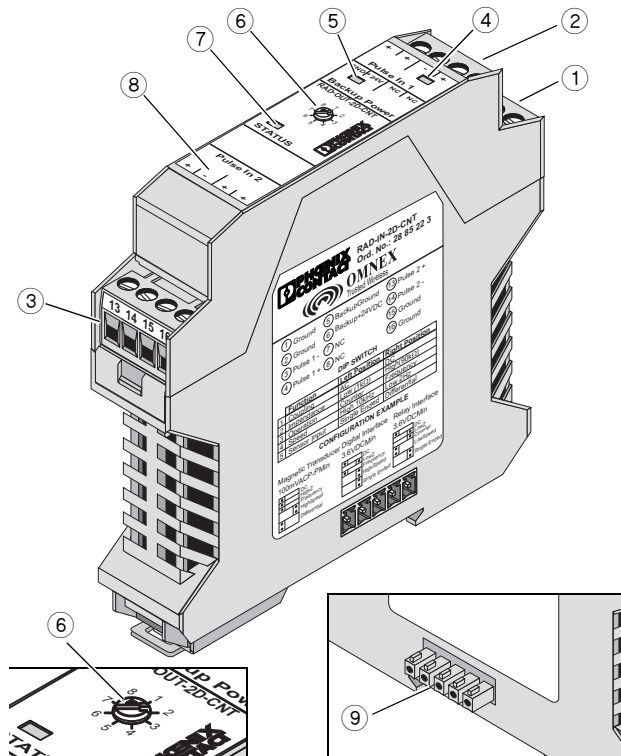


Figure 3 Structure of the RAD-IN-2D-CNT

- 1 Connector: Pulse IN 1
- 2 Connector: Backup power
- 3 Connector: Pulse IN 2
- 4 LED: Pulse IN 1
- 5 LED: Backup power
- 6 Rotary switch with pos. 1 to 8
- 7 LED: Status
- 8 LED: Pulse IN 2
- 9 Bus foot connector

6.2 RAD-OUT-2D-CNT

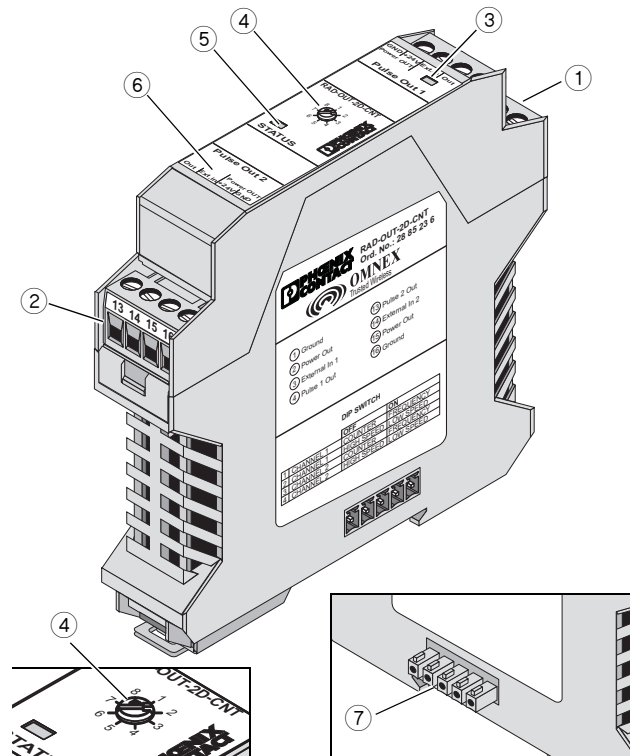


Figure 4 Structure of the RAD-OUT-2D-CNT

- 1 Connector: Pulse OUT 1
- 2 Connector: Pulse OUT 2
- 3 LED: Pulse OUT 1
- 4 Rotary switch with pos. 1 to 8
- 5 LED: Status
- 6 LED: Pulse OUT 2
- 7 Bus foot connector

6.3 Assignment of input and output modules

In order to enable the transmission of signals, it is necessary to provide and assign the input module with a corresponding output module. This is done via the rotary switch (6 in Figure 3 and 4 in Figure 4) with the corresponding coding of 1 to 8.

The input module must have the same coding as the assigned output module at the other end of the transmission system.



The number of extension modules is limited to eight extensions per system.

6.4 Display and diagnostic elements

Status LED

As soon as the wireless connection has been established between the transceiver modules and it is possible to transfer signals between the input module and the corresponding output module, this is indicated via the status LED (LED ON, 7 in Figure 3 and 5 in Figure 4).

The RAD-IN-2D-CNT input module and the RAD-OUT-2D-CNT output module must be configured with the same function (frequency or counter).

If no corresponding output module is found (e.g., incorrect addressing) or the input and output modules have been assigned different functions, the status LED flashes.

Pulse IN LEDs (RAD-IN-2D-CNT)

The "Pulse IN 1" (4 in Figure 3) and "Pulse IN 2" (8 in Figure 3) LEDs light up when a pulse is present at the input.

Pulse OUT LEDs (RAD-OUT-2D-CNT)

The "Pulse OUT 1" (3 in Figure 4) and "Pulse OUT 2" (6 in Figure 4) LEDs light up when a pulse is output at the output.



A power up is required following any change to the coding in order for the configuration to be applied.

6.5 Pulse inputs (RAD-IN-2D-CNT)

Both pulse inputs of the RAD-IN-2D-CNT input module can process voltage pulses of 0.1 V AC/DC to 30 V AC/DC. Depending on the configuration of the DIP switches, various operating modes are supported.

6.6 Pulse outputs (RAD-OUT-2D-CNT)

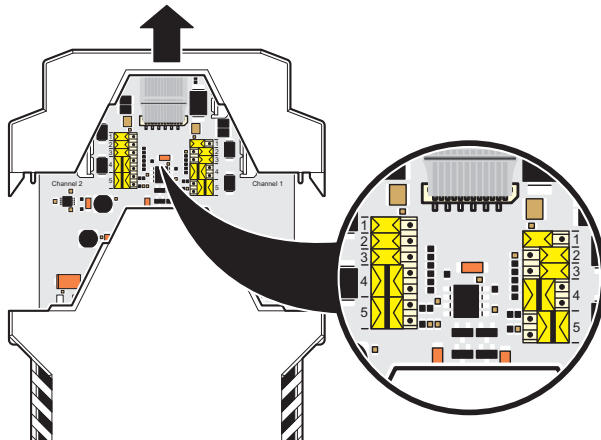
Both pulse outputs of the RAD-OUT-2D-CNT output module are designed as transistor outputs (see Figure 2). Depending on the application, the transistor can function either as a switch or as a voltage pulse output (see "Connection examples" on page 12).

In counter mode, the number of pulses counted is output either with 10 kHz (high speed) or 10 Hz (low speed) and 50% duty cycle.

In frequency mode, the measured input frequency is output with a fixed 50% duty cycle.

7 DIP switches

7.1 RAD-IN-2D-CNT



A power up is required following any change to the coding in order for the configuration to be applied.

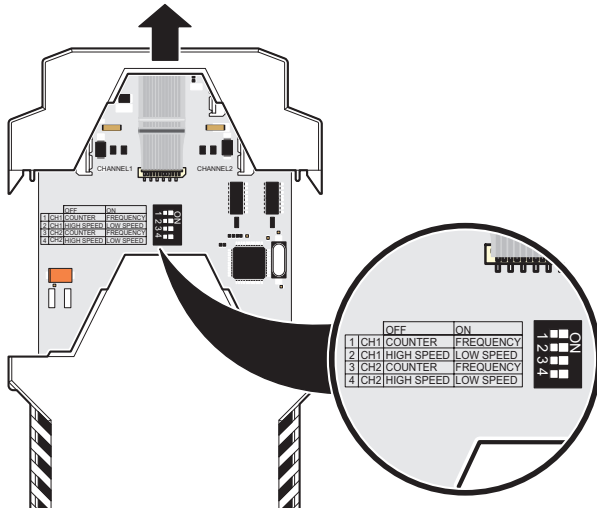
Figure 5 DIP switches on the RAD-IN-2D-CNT

Each channel is configured with 5 DIP switches:

DIP switch	Designation	Function
DIP 1	Coupling	<p>AC or DC coupling</p> <p>DC: Direct coupling of a voltage AC: Coupling via a filter</p> <p>Filters the AC component, which has been modulated to a DC voltage, so that only this is used as the pulse input. If the DC voltage component is greater than 1.5 V DC, set the switch to AC (see also DIP 5 "Sensor Input").</p>
DIP 2	Impedance	<p>Input impedance</p> <p>Low: 1 kΩ input resistance (recommended switch position). Here interference is suppressed with low power. High: 90 kΩ input resistance (alternative switch position). For use when connecting sensors, which can only operate a low current.</p>
DIP 3	Operation Mode	<p>Operating mode</p> <p>Frequency: Frequency measurement Counter: Pulse counting</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Ensure the setting is the same on the RAD-OUT-2D-CNT output module.</p> </div>
DIP 4	Speed	<p>Low pass filter</p> <p>Low: Filter ON – up to 10 Hz This setting depends on the voltage (minimum of 5 Hz at 3.6 V, maximum of 10 Hz at 24 V). It is recommended in the event of slow input signals (< 2 Hz) to increase resistance to interference. High: Filter OFF – up to 10 kHz For the transmission of frequencies up to 10 kHz or for counting fast pulses up to 50 s.</p>

DIP switch	Designation	Function
DIP 5	Sensor Input	Input circuit Common mode: For single-ended signals (fixed switching threshold at 3.6 V DC, typical). Differential mode: For differential (not single-ended) signals, e.g., inductive encoders (minimum amplitude of 100 mV _{PP}).

7.2 RAD-OUT-2D-CNT




A power up is required following any change to the coding in order for the configuration to be applied.

Figure 6 DIP switches on the RAD-OUT-2D-CNT

Each channel is configured with two DIP switches:

DIP switch	Channel	Function
DIP 1	Operation Mode CH 1	Operating mode channel 1 OFF: Counter mode Output of the number of transmitted pulses with a fixed frequency of 10 Hz or 10 kHz (selection via DIP 2) as a square-wave voltage with 50% duty cycle. ON: Frequency mode Mapping of the transmitted frequency as a square-wave voltage with 50% duty cycle.
DIP 2	Speed CH 1	Only for "counter mode" (DIP 1 = OFF): Selection of the clock frequency for pulse output High speed (OFF): Output of pulses with a clock frequency of 10 kHz Low speed (ON): Output of pulses with a clock frequency of 10 Hz <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> The pulses are mapped with 50% duty cycle. </div>
DIP 3	Operation Mode CH 2	Operating mode channel 2 OFF: Counter mode Output of the number of transmitted pulses with a fixed frequency of 10 Hz or 10 kHz (selection via DIP 2) as a square-wave voltage with 50% duty cycle. ON: Frequency mode Mapping of the transmitted frequency as a square-wave voltage with 50% duty cycle.

DIP switch	Channel	Function
DIP 4	Speed CH 2	<p>Only for "counter mode" (DIP 3 = OFF): Selection of the clock frequency for pulse output</p> <p>High speed (OFF): Output of pulses with a clock frequency of 10 kHz</p> <p>Low speed (ON): Output of pulses with a clock frequency of 10 Hz</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">  The pulses are mapped with 50% duty cycle. </div>

8 Functions

Both pulse inputs of the RAD-IN-2D-CNT input module can process voltage pulses of 0.1 V AC/DC to 30 V AC/DC. They are mapped again via the RAD-OUT-2D-CNT output module as a square-wave voltage with 50% duty cycle. Depending on the configuration of the DIP switches, various operating modes are supported.

8.1 Counter mode

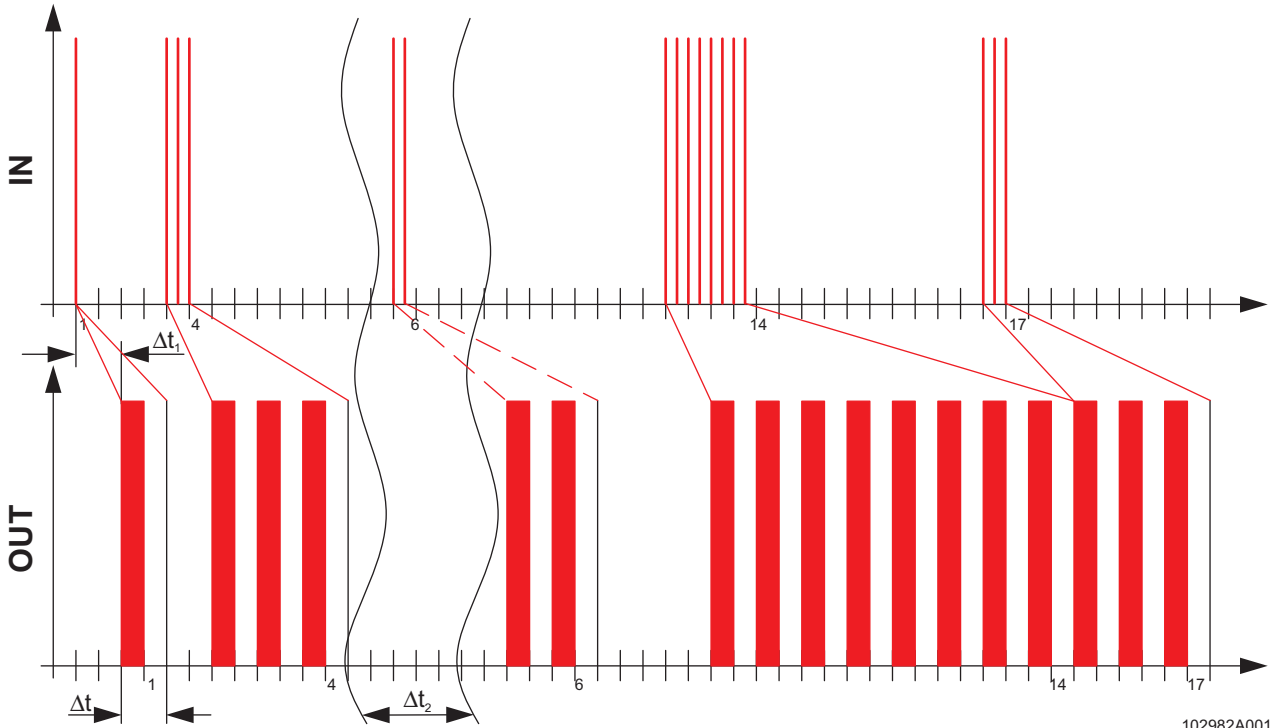
The incoming pulses are continuously recorded by an internal counter at the input module and transmitted as accumulated values to the output module. Here, the difference from the last transmitted value is calculated and output as a pulse with 50% duty cycle. The RAD-IN-2D-CNT input module has a 30-bit memory that continues to record the pulses in the event that the wireless connection is interrupted. As soon as the wireless connection is restored, the pulses measured during this period are transmitted as the current counter status and output on the RAD-OUT-2D-CNT (see Figure 7).

In addition, the RAD-IN-2D-CNT can be supplied with an additional voltage source of 12 V DC to 30 V DC (backup power, see 2 in Figure 3). It is thus possible to count and save incoming pulses even if the primary power supply is interrupted. The incoming pulses during downtime are transmitted as the current counter status and output on the RAD-OUT-2D-CNT as soon as the primary power supply and the wireless connection are restored.

Example (see Figure 7 on page 10):

RAD-IN-2D-CNT		→	RAD-OUT-2D-CNT		
Recorded pulses (accumulated value)	Transmitted counter status	→	Incoming pulse value	Last value	Output
0	0	→	0	0	0
1	1	→	1	0	1
4	4	→	4	1	3
6	6	→	6	4	2
14	14	→	14	6	8
17	17	→	17	14	3

DIP switches 2 and 4 on the output module can be used to select an output signal of 10 Hz or 10 kHz (see "DIP switches" on page 7). This enables pulse stretching, i.e., fast or brief incoming pulses are mapped as slow pulses with 10 Hz.



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Figure 7 Pulse stretching (diagram)

Δt = Fixed time interval (100 ms = 10 Hz)

Δt_1 = Time offset due to wireless transmission

Δt_2 = Interruption of wireless connection or primary voltage on the input module

8.2 Frequency mode

The incoming frequency is measured on the RAD-IN-2D-CNT input module and transmitted to the RAD-OUT-2D-CNT output module as a value. Here, a frequency is generated from the received value as a square-wave voltage with 50% duty cycle.

The measuring cycle period is 1.5 seconds. If the input frequency changes within this update time, a combined frequency is output from the previous value and the current value. Therefore, in the worst-case scenario it can take a maximum of 3 seconds before the correct value is set on the output module.

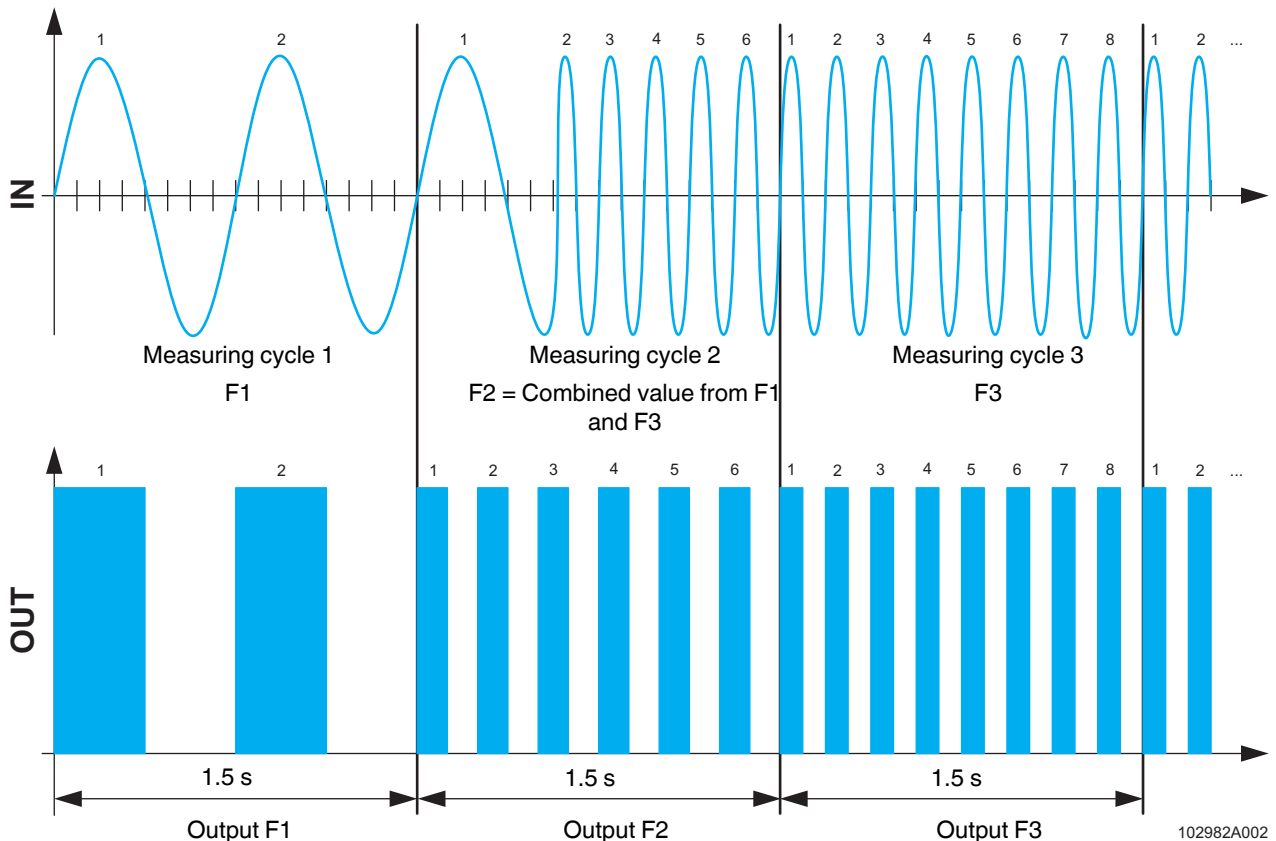


Figure 8 Combined frequency (diagram)

9 Behavior in the event of interrupted wireless connection

The wireless connection can be monitored using the RF link relay on the RAD-ISM-2400-BD-BUS (Order No. 2867746). For additional diagnostic options on the RAD-ISM-2400-BD-BUS, please refer to the module-specific data sheet at www.phoenixcontact.net/catalog.

The RAD-IN-2D-CNT input module has a 30-bit memory that continues to record the pulses in the event that the wireless connection is interrupted. As soon as the wireless connection is restored, the pulses measured during this period are transmitted as the current counter status and output on the RAD-OUT-2D-CNT.

In addition, the RAD-IN-2D-CNT can be supplied with an additional voltage source of 12 V DC to 30 V DC (backup power, see 2 in Figure 3). It is thus possible to count and save incoming pulses even if the primary power supply is interrupted. The incoming pulses during downtime are transmitted as the current counter status and output on the RAD-OUT-2D-CNT as soon as the primary power supply and the wireless connection are restored.

10 Connection examples

10.1 RAD-IN-2D-CNT

Open collector

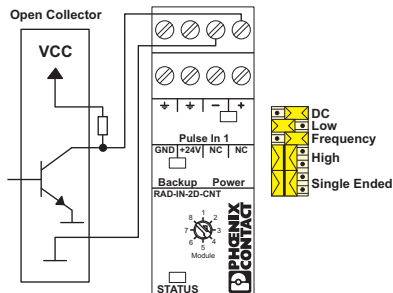


Figure 9 Open collector

Recommended DIP switch settings:

- DIP 1 "Coupling": DC
- DIP 2 "Impedance": LOW
- DIP 3 "Operation Mode": Depending on the application: either in counter or in frequency mode
- DIP 4 "Speed": Depending on the application: if the pulse length of the pulses to be measured is at least 100 ms or greater, the low pass filter can be activated (DIP to low) to suppress interference. If you are measuring shorter signal lengths, set the DIP switch to high.
- DIP 5 "Sensor Input": Single ended

Optocoupler or relay

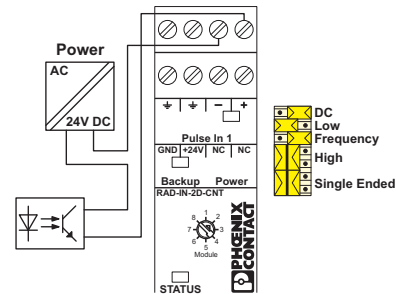


Figure 10 Optocoupler or relay

Recommended DIP switch settings:

- As for the "Open collector" example

For relay applications:

- Set DIP 4 "Speed" to "low" to compensate for contact chatter.

Magnetic measuring transducer

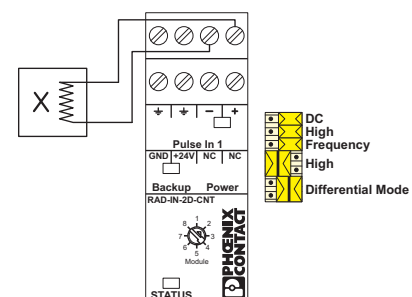


Figure 11 Magnetic measuring transducer

Recommended DIP switch settings:

- DIP 1 "Coupling": DC
- DIP 2 "Impedance": HIGH
- DIP 3 "Operation Mode": Depending on the application: either in counter or in frequency mode
- DIP 4 "Speed": HIGH
- DIP 5 "Sensor Input": Differential mode

10.2 RAD-OUT-2D-CNT

Switched load

The integrated transistor in the module output can switch loads (such as relays or optocouplers). A self-resetting fuse protects the transistor against damage due to short circuit. The switch position of the DIP switches should be selected according to the application as described in "DIP switches" on page 7.

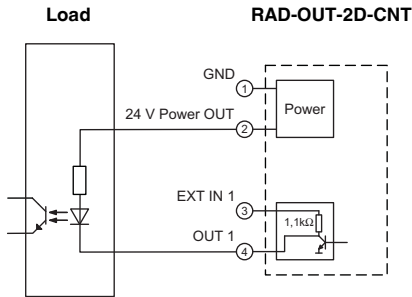


Figure 12 Passive load: Optocoupler

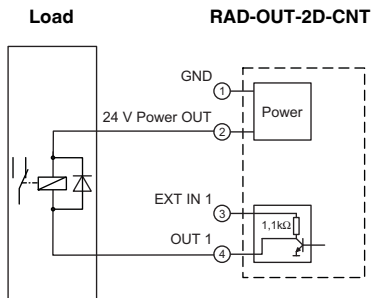


Figure 13 Passive load: Relay

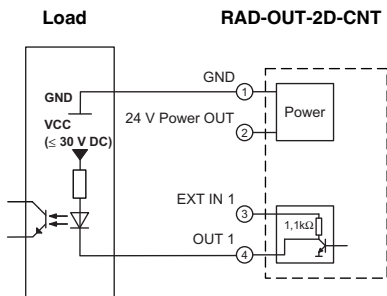


Figure 14 Load with external power supply: Optocoupler

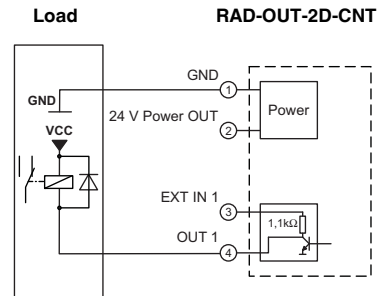


Figure 15 Load with external power supply: Relay

Voltage output for subsequent control systems

If the downstream electronics requires a HIGH/LOW voltage level, the required communications power can be connected to the EXT terminal block. The logic ground must also be connected to the module ground (OUT GND terminal block). The HIGH/LOW signal can then be picked up at the OUT terminal block.

The switch position of the DIP switches should be selected according to the application as described in "DIP switches" on page 7.

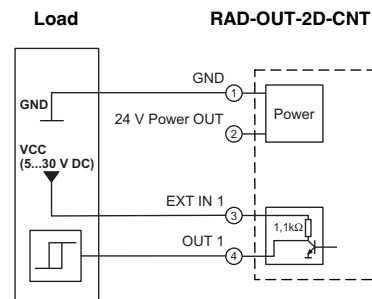


Figure 16 Voltage output for subsequent control systems

11 Troubleshooting

Error description	Error cause	Remedy
Status LED flashing	No wireless connection	Check wireless connection at head station
	Address coding of input and output modules does not match	Select same coding on input and output module via the address encoding switch
	Input and output module are assigned different operating modes	Set same operating mode (frequency or counter) on the input and output module via DIP 3/DIP 1
No output signal at terminal block 4/13	Output not supplied with voltage	Supply voltage to output (terminal block 3/14), externally or install bridge (2 to 3 or 14 to 15)
Pulse IN LED not flashing	Input signal not detected; sensor cannot operate current	Set input impedance at DIP 2 on the input module to the "High" position
	In common mode: DC offset (> 1.5 V): DC component of the signal voltage > 1.5 V; switching threshold exceeded	Set DIP 1 on the input module to the "AC" position (AC coupling)
	In common mode: Signal voltage < 3.6 V: switching threshold not reached	Set DIP 5 on the input module to the "differential" position
	In differential mode: Signal amplitude too low (< 100 mV _{PP})	Amplify signal Select different sensor
Pulse output does not end, even though an input pulse is no longer present	Clock frequency on the output module is too low or input clock frequency is considerably greater than output clock frequency	Change output clock frequency (DIP 2/ DIP 4) on the output module to 10 kHz