- 2-channel
- Inputs EEx ia IIC
- Device installation in Zone 1, Zone 2, or Zone 22
- Module can be exchanged under voltage in Zone 1 (hot swap)
- Frequency measurement, pulse-rate measurement, flow-rate measurement
- Rotational speed monitoring
- Standstill monitoring
- Rotation direction detection, flow direction detection
- Frequency measuring range up to 32 kHz
- Lead breakage (LB) monitoring for each field circuit
- EMC acc. to NAMUR NE 21

Function

The RSD-FI-Ex2 transfers frequencies of digital input signals from the hazardous area via the fieldbus into the safe area.

Signallers may be 2 VORTEX signallers, 2 magnetic sensors or 2 proximity sensors based on DIN EN 60947-5-6 (NAMUR) or correspondingly wired mechanical contacts.

Signal processing takes place in the RSD-FI-Ex2. Depending on the configuration, the device acts as a frequency meter, a pulse rate meter, a flow meter, rotation direction monitor, flow direction monitor, speed monitor or acceleration meter.

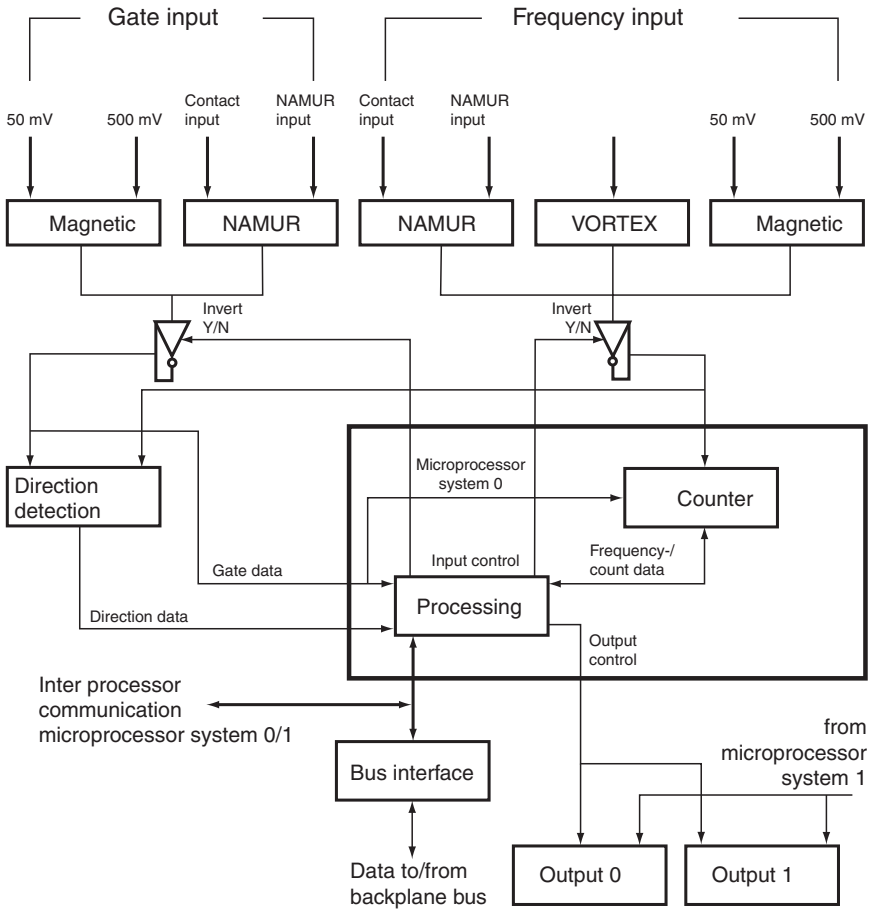
Messages concerning lead breakage of field circuits are transferred via the bus.

The inputs are galvanically isolated from the bus and the power supply.

Application

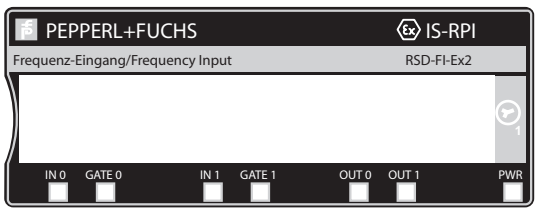
- Frequency measurement
- Signal rate measurement
- Flow control monitoring
- Flow direction monitoring
- Rotation direction monitoring
- Rotation speed monitoring
- Acceleration measurement

Connection



Composition

Front View



LED PWR	green: Power-ON module is operating
LED IN 0, IN 1	frequency input channel 0/1 yellow: signal present flashing red: lead breakage
LED GATE 0, GATE 1	gate input channel 0/1 yellow: signal present flashing red: lead breakage
LED OUT 0, OUT 1	output channel 0/1 yellow: output active
LED 0	red: internal fault (module) or Power-ON test

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Supply	
Connection	terminals 34, 50 V+; 35, 51 V-
Rated voltage	8.88 ... 9.5 V
Power loss	4.25 W
Power consumption	4.25 W
Interface	
Interface type	manufacturer specific bus
Cycle time	1.2 ms
Input	
Frequency input	
Number of channels	2
Connection	**NAMUR:** terminals: ch 0: 6-, 7+; ch 1: 8+, 9- **magnetic sensor 50 mV:** terminals: ch 0: 4+, 6-; ch 1: 11+, 9- **magnetic sensor 500 mV:** terminals: ch 0: 5+, 3-; ch 1: 10+, 12- **VORTEX 3 V:** terminals: ch 0: 0sig, 2+, 3-; ch 1: 15sig, 13+,12- **VORTEX 6 V:** terminals: ch 0: 1sig, 2+, 3-; ch 1: 14sig, 13+,12-
Preparation time	≤ 4 ms
Input frequency	1 ... 32000 Hz , sine 1 ... 20000 Hz , rectangular
Input pulse length	≥ 20 µs
Gate entrance	
Number of channels	2
Connection	**NAMUR:** terminals: ch 0: 23-, 24+; ch 1: 25+, 26- **magnetic sensor 50 mV:** terminals: ch 0: 21+, 23-; ch 1: 28+, 26- **magnetic sensor 500 mV:** terminals: ch 0: 22+, 20-; ch 1: 27+, 29-
Inputs NAMUR	
Rated values	acc. to EN 60947-5-6 (NAMUR)
Switching point/switching hysteresis	1.2 ... 2.1 mA , approx. 0.2 mA
Pulse/Pause ratio	≥ 25 µs / ≥ 25 µs
Line monitoring	breakage I ≤ 0.35 mA , short-circuit I ≥ 6 mA
Inputs magnetic sensor	
Input signal	magnetic sensor 50 mV: 50 mV , 28 V AC_{pp} magnetic sensor 500 mV: 500 mV , 28 V AC_{pp}
Inputs VORTEX	
Transmitter supply voltage	**VORTEX 3 V:** 15 V at20 mA **VORTEX 6 V**: 15 V at 20 mA
Response threshold	**VORTEX 3 V:** 3 V **VORTEX 6 V:** 6 V
Output	
Number/Type	1 potential free relay contact
Connection	terminals ch 0: 17 NO, 18 NC, 37 COM; ch 1: 31 NO, 32 NC, 46 COM backplane bus
Contact loading	24 V / 93 mA
Energized/De-energized delay	10 ms / 5 ms
Mechanical life	1 x 10^5 vat max. contact loading
Directive conformity	
Electromagnetic compatibility	
Directive 2004/108/EC	EN 61326-1:2006
Explosion protection	
Directive 94/9/EC	EN 60079-0: 2006, EN 60079-11: 2007, EN 60079-26: 2007, EN 61241-0: 2006, EN 61241-11: 2006
Standard conformity	
Insulation coordination	EN 50178:1997
Electrical isolation	EN 60079-11:2007
Electromagnetic compatibility	NE 21:2006
Protection degree	IEC 60529
Climatic conditions	IEC 60721
Ambient conditions	
Classification	3K3
Ambient temperature	-20 ... 70 °C (253 ... 343 K)
Storage temperature	-20 ... 100 °C (253 ... 373 K)
Relative humidity	95 % non-condensing
Shock resistance	15 g peak, 11 ms period
Vibration resistance	2 g , 10 ... 500 Hz according to IEC 60068-2-6
Damaging gas	acc. to ISA-S71.04-1985, severity level G3
Mechanical specifications	
Connection type	terminals

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Core cross-section		≤ 2.5 mm^2
Protection degree		IP20, for in-situ installation a separate housing is required with a minimum of IP54
Mass		approx. 200 g
Mounting		DIN rail mounting
Data for application in connection with Ex-areas		
EC-Type Examination Certificate		DMT 98 ATEX E 014 X , for additional certificates see www.pepperl-fuchs.com
Group, category, type of protection		⟨Ex⟩ II (1)2G EEx ia/ib IIB/IIC II (1D)(2D)
Temperature class		T4
Supply		only in connection with the power units RSD2-PSD2-Ex4.34, RSA6-PSD-Ex4.34
NAMUR		
Voltage	U_o	14.7 V DC
Current	I_o	15 mA
Power	P_o	30 mW
External capacitance	C_o	620 nF
External inductance	L_o	80 mH
L/R-ratio		0.65 mH/Ω
Magnetic sensor		
Voltage	U_o	14.7 V DC
Current	I_o	10 mA
Power	P_o	18 mW
External capacitance	C_o	620 nF
External inductance	L_o	150 mH
L/R-ratio		1.03 mH/Ω
VORTEX		
Voltage	U_o	26.5 V DC
Current	I_o	82 mA
Power	P_o	520 mW
External capacitance	C_o	95 nF
External inductance	L_o	2 mH
L/R-ratio		0.06 mH/Ω
Output		
Voltage	U_i	28 V DC
Current	I_i	93 mA
Power	P_i	651 mW
Internal capacitance	C_i	negligible
Internal inductance	L_i	negligible
Internal bus		customer specific
Statement of conformity		
Group, category, type of protection, temperature classification		⟨Ex⟩ II 3D IP54 T 90°C
Electrical isolation		
Input/input		no electrical isolation
Input/Output		safe electrical isolation acc. to EN 60079-11: 2007, voltage peak value 60 V
Input/power supply		safe electrical isolation acc. to EN 60079-11: 2007, voltage peak value 60 V
Input/Internal Bus		safe electrical isolation acc. to EN 60079-11: 2007, voltage peak value 60 V
Internal bus/power supply		safe electrical isolation acc. to EN 60079-11: 2007, voltage peak value 60 V
Output/power supply		safe electrical isolation acc. to EN 60079-11: 2007, voltage peak value 60 V
Output/Internal Bus		safe electrical isolation acc. to EN 60079-11: 2007, voltage peak value 60 V
Output/Output		safe electrical isolation acc. to EN 60079-11: 2007, voltage peak value 60 V

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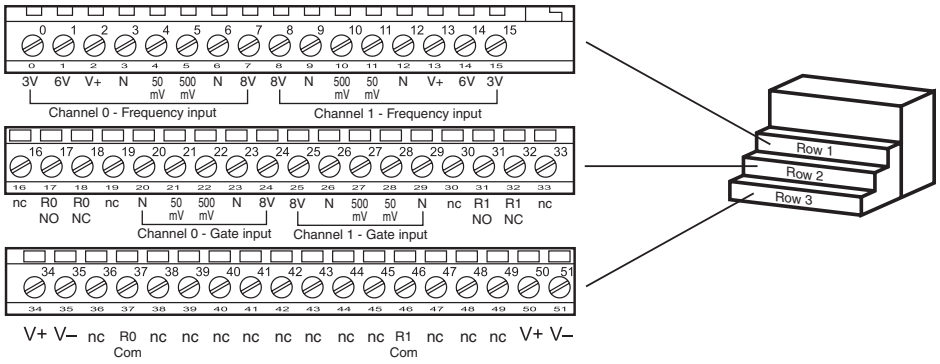
Electrical connection

Terminal base assignment



Supplementary information

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see www.pepperl-fuchs.com.

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Additional information

- 2 frequency inputs, 2 gate inputs and 2 outputs
- Signalling of NAMUR lead break display for all conductors via the internal bus to the control system and red flashing fault LEDs for each channel
- Deactivation of lead break monitoring via the bus, channel by channel
- Alarm when a maximum frequency or acceleration is exceeded
- Frequency mode of operation with independent settings for each frequency input; can be configured by software
- A selection of 4 measurement ranges is available: 50 mV, 500 mV (magnetic sensor), VORTEX and NAMUR
- Frequency range up to 32 kHz
- Frequency calculation for a time period or a counter state
- Programmable measurement value scaling
- Calculation of the acceleration value
- 1 power supply channel for 2 modules
- The module has to be powered via the intrinsically safe power supplies RSD2-PSD2-Ex4.34 or RSA6-PSD-Ex4.34

In order to achieve the EMC protection class, screened power lines and screens for the individual channels must be used. The electric strength of the wire insulation must be ≥ 500 V.

Please note!

Applies to VORTEX signals and magnetic sensors:
For operation with magnetic sensors and VORTEX signals (not for NAMUR signals) at frequencies over 1 kHz, the channel ground must be connected with the housing ground. In this case, the intrinsically safe circuits are connected with the housing ground. Note in this connection the requirements of your country for setting up the system.

Resolution and accuracy

$$\text{Resolution [\%]} = \frac{100}{\text{Freq. counter x Min. freq. sampl. time}}$$

Temperature sensor

µC cycle = 20 MHz, counter frequency = 5 MHz						
Minimum frequency sampling time in ms	**Accuracy**					**Resolution**
	Sampling accuracy in %	Accuracy of time base in %	Total accuracy in the most unfavourable case in %	Deviation due to of total accuracy		
				Frequency range 1.0 ... 3276.7 in Hz	Frequency range 1 ... 32767 in Hz	
2	-0.02	-0.0225	-0.0425	-0.1 ... 1.4	-1 ... 14	0.01
4	-0.01	-0.0225	-0.0325	-0.1 ... 1.1	-1 ... 11	0.005
5	-0.008	-0.0225	-0.0305	-0.1 ... 1.0	-1 ... 10	0.004
10	-0.004	-0.0225	-0.0265	-0.1 ... 0.9	-1 ... 9	0.002
20	-0.002	-0.0225	-0.0245	-0.1 ... 0.8	-1 ... 8	0.001
50	-0.0008	-0.0225	0.0233	-0.1 ... 0.8	-1 ... 8	0.0004
100	-0.0004	-0.0225	0.0229	-0.1 ... 0.8	-1 ... 8	0.0002
200	-0.0002	-0.0225	0.0227	-0.1 ... 0.7	-1 ... 7	0.0001
500	-0.00008	-0.0225	0.02258	-0.1 ... 0.7	-1 ... 7	0.00004
1000	-0.00004	-0.0225	-0.02254	-0.1 ... 0.7	-1 ... 7	0.00002

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Input parameter

Frequency

Calculated frequency value. The exact frequency is generated down to 1 or 1.0 Hz (depending on the frequency range). Values under those given above are generated as 0 or 0.0.

Range: 0.0 ... 3,276.7

or 0 ... 32,767, depending on the status of the frequency range bit

Percentage of the measurement range or acceleration value

Value of the frequency calculation, scaled at the maximum frequency value.

Range: 0.0 ... 100.0

or, depending on the acceleration measurement range bit, "Acceleration or percentage of the measurement range", the calculated acceleration value in Hz/s.

Range: -32,768 ... +32,767

Direction

Display of the current direction of rotation of the encoder.

Range: 0 = standstill
1 = clockwise
2 = anti-clockwise
3 = no direction of rotation detected

Status parameter

Alarm when the maximum frequency or maximum acceleration is exceeded

Changes the status from 0 to 1 when the maximum frequency or maximum acceleration programmed by the user is exceeded.

This alarm activates the corresponding output channel.

Output 1 responds to alarm channel 1; output 0 responds to alarm channel 0.

Range: 0 = ≤ maximum frequency
1 = > maximum frequency

or

Range: 0 = ≤ maximum acceleration
1 = > maximum acceleration

Alarm for missing pulse

This alarm is generated if no frequency input pulse has been recorded. The "Missing pulse multiplier" is the primary determiner if this bit is set. If the "Missing pulse multiplier" is set to 0, the bandwidth restriction determines when this alarm bit will be set.

Range: 0 = normal
1 = no pulse

NAMUR lead break alarm

Set if NAMUR lead break monitoring has detected an interruption on one of the frequency or gate inputs of a channel.

Range: 0 = normal
1 = lead break

Status of outputs

The status of the outputs is generated. A channel output is activated when the frequency/acceleration alarm is triggered.

Range: 0 = output OFF
1 = output ON

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Output parameters

The following parameters are used to control the module behaviour in normal operation. They can be programmed by the user. The majority of these parameters are used to reset and manipulate signals.

Initialise start process

Prevents the alarm for missing pulse from being triggered during the start-up phase of a process for an amount of time specified by the "Missing pulse multiplier".

Range: 0 = normal operation
1 = start process - prevents the alarm for missing pulse from being triggered.

Default: 0

Configuration parameters

Minimum frequency sampling time or time base

Specifies the minimum time in ms during which pulses will be counted by the module for calculating the frequency. If no pulse is recorded within this time, the sampling time is automatically extended by the amount of time defined by the "Missing pulse multiplier" or the bandwidth limit.

Range:	0 = 2 ms	4 = 10 ms	8 = 200 ms
	1 = 2 ms	5 = 20 ms	9 = 500 ms
	2 = 4 ms	6 = 50 ms	10 = 1000 ms
	3 = 5 ms	7 = 100 ms	
Default:	0		

The number of pulses required to terminate a sampling process

The frequency calculation is started when the specified number of input pulses have been recorded or the minimum sampling time has elapsed, whichever comes first.

Range: 0 ... 63 (0 = the frequency is calculated only based on the minimum sampling time)

Frequency range

Specifies the frequency range of the frequency input. The exact frequency is generated down to 1 or 1.0 Hz (depending on the frequency range). Values under those given above are generated as 0 or 0.0.

Range: 0 = 1 ... 32,767, 0 is generated under 1 Hz
1 = 1.0 ... 3,276.7, 0.0 is generated under 1.0 Hz

Default: 0

Selection Frequency alarm value or acceleration alarm value

Determines whether the value in question in the word for maximum frequency/maximum acceleration is an acceleration or a frequency alarm value. If frequency value is selected, acceleration will not be calculated.

Range: 0 = frequency alarm value
1 = acceleration alarm value

Default: 0

Maximum frequency or maximum acceleration

Defines the maximum permissible frequency or acceleration value on the input. If this value is exceeded by a channel, the alarm for max. frequency or acceleration will be triggered. This value is also used in calculating the measurement value as a percentage of the measurement range when the frequency alarm is activated.

Range: 1 ... 32,767
1.0 ... 3,276.7

or -32,768 ... +32,767, depending on the settings for the frequency range and frequency/acceleration alarm. If the bit = 0, no acceleration calculation will be performed in acceleration mode.

Default: 0. Depending on the other settings, this means either 32,767 or 3,276.7 or no acceleration calculation.

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Bandwidth limit

Defines the input frequency range of the frequency module. This parameter has a secondary control function for the alarm when the pulse is missing.

Range: 0 = 1 ... 32,767 Hz
1 = 1 ÷ minimum frequency sampling time

Default: 0

If = 0:

The frequency sampling time is extended to 2 s as long as no pulse has been recorded on the frequency input during the minimum frequency sampling time. The minimum frequency is 1 Hz. The alarm for a missing pulse is triggered after 2 s.

See Alarm for missing pulse.

If = 1:

Limits the frequency sampling time to twice the minimum frequency sampling time and the smallest frequency to be calculated to 1 ÷ minimum frequency sampling time. The alarm for missing pulse is triggered after twice the minimum frequency sampling time. See Alarm for missing pulse.

Missing pulse multiplier

Specifies the number of minimum frequency sampling times after which an alarm for missing pulse will be generated during normal operation. This parameter has a primary control function for triggering the alarm for missing pulse.

It also has a primary influence on the bandwidth of the channel.

See Alarm for missing pulse.

Range: 0 (no multiplier), 1, 2, 8, 32

Default: 0 (no multiplier)

Missing pulse delay multiplier

Specifies the number of minimum frequency sampling times in the start-up phase during which the alarm for missing pulse is suppressed. This can be used to prevent an alarm from being triggered during the start process. This parameter takes preference over an alarm for missing pulse.

Range: 0 (no delay)
1 (2 sampling times + 2-second delay)
2 (8 sampling times+ 2-second delay)
3 (32 sampling times + 2-second delay)

Default: 0 (no delay)

Frequency of scaling multiplier

Defines a multiplier for scaling the frequency measurement value.

Range: 1 ... 256
Default: 0 (multiplier = 1, no scaling)

Frequency of scaling divisor

Defines a divisor for scaling the frequency measurement value. The combination of the frequency scaling multiplier and divisor, the maximum frequency and the frequency range should be checked in the configuration software on the user side to ensure that no invalid combination has been configured.

If the combination of the frequency scaling multiplier and divisor and the current frequency exceeds the frequency range of the module during operation, the frequency/acceleration alarm will be triggered.

The scaled frequency value can not be used to trigger the outputs (an output is always triggered with the current frequency value).

Range: 1 ... 256

Default: 0 (multiplier = 1, no scaling)

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Acceleration calculation time

Specifies the number of frequency sampling cycles that will be used to calculate the acceleration value.

Range:
0 = 8
1 = 16
2 = 32
3 = 64

Default: 0 (the sliding mean is calculated from the last 8 sampling times).

Example:

If 8 is the set value, the result of the first frequency calculation will be saved. Then this value will be subtracted from the 9th calculation, the result will be divided by the time between the sampling cycles and stored as the acceleration value. The result of the 9th frequency calculation is saved and is subtracted from the 17th calculation, etc.

Error handling for NAMUR lead break monitoring and alarm for missing pulse

Defines error handling for all inputs when a NAMUR lead break alarm or an alarm for missing pulse is generated.

Range:
0 = no alarm
1 = alarm only
2 = maximum frequency value in the input data word
3 = minimum frequency value in the input data word

Default: 0

NAMUR lead break monitoring, frequency inputs

Activates/deactivates NAMUR lead break monitoring for the frequency inputs.

Range:
0 = lead break monitoring deactivated
1 = lead break monitoring activated

Default: 0

NAMUR lead break monitoring, gate inputs

Activates/deactivates NAMUR lead break monitoring for the gate inputs.

Range:
0 = lead break monitoring deactivated
1 = lead break monitoring activated

Default: 0

Inversion of the frequency input

The input signal will be inverted if a mechanical contact is connected to the NAMUR frequency input instead of a NAMUR sensor.

Range:
0 = normal NAMUR
1 = inversion of the input

Default: 0

Inversion of gate input

The gate signal will be inverted if a mechanical contact is connected to the NAMUR gate instead of a NAMUR sensor.

Range:
0 = normal NAMUR
1 = inversion of the input

Default: 0

Acceleration or percentage of the measurement range

This bit defines whether the acceleration value or the percentage of the measurement range will be generated in the input data word.

Range:
0 = percentage of the measurement range (no calculation of acceleration, alarm deactivated)
1 = acceleration value (percent of the measurement range is not calculated).

Default: 0

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