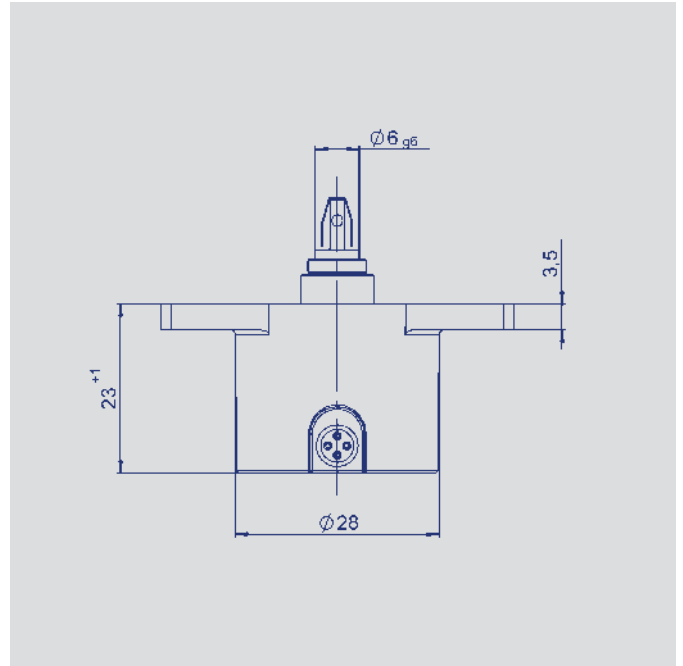


**NOVOHALL
Rotary Sensor
non-contacting**

Series RSC-2800



Special features

- Non-contacting, magnetic technology
- Measuring range up to 360°
- Available with push-on coupling or marked shaft
- Simple mounting
- Protection class IP54, IP65, IP67
- Long life
- Very small hysteresis
- Resolution up to 14 bit
- Linearity $\leq \pm 0.5\%$
- Single output and redundant versions
- European E1 approved

Applications

- Mechanical engineering
 - Textile machines
 - Packaging machines
 - Sheet metal and wire processing machines
- Automation technology
- Medical appliances
- Mobile machinery
 - Industrial trucks
 - Construction machines
 - Agricultural and forestry machines

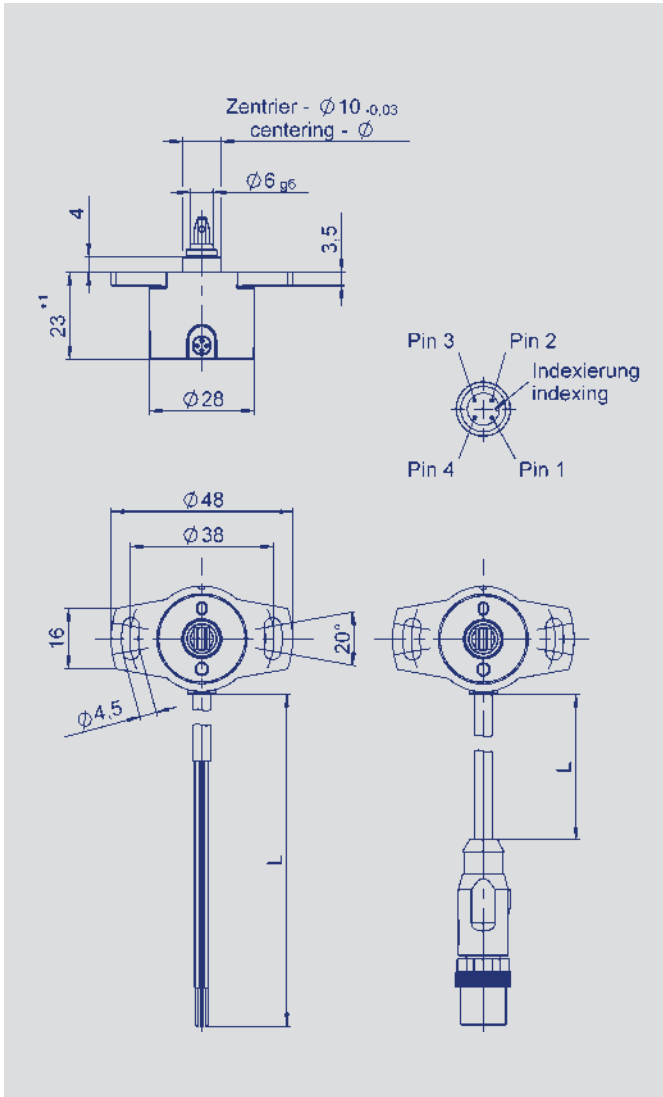
The **RSC-2800 sensor** utilizes a contactless magnetic measurement technology to determine the measured angle. Unlike conventional Hall sensors, the orientation of the magnetic field is measured. The position information corresponding to the angular position is transmitted via a variety of analog and digital interfaces.

The housing is made of a special high grade temperature-resistant plastic material. Elongated slots allow simplicity in mounting together with ease of mechanical adjustment. Three shaft options are available, including a push-on coupling option that ensures fast and simple installation.

Contents

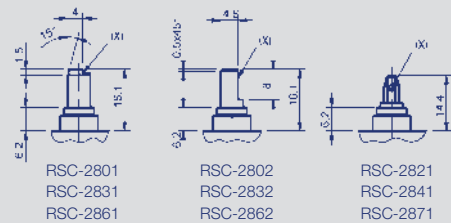
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Mechanical Data



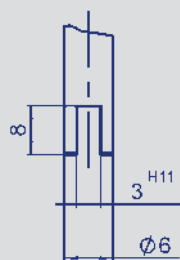
Description		
Housing	High grade, temperature-resistant plastic, PPS-GF40	
Shaft	Stainless steel, X8CrNiS18-9 1.4305	
Bearing	Sintered bronze bushing	
Electrical connections	Cable 4 x 0.5 mm ² , AWG 20, TPE insulated, shielded (voltage / current) Cable 4 x 2 x 0.25 mm ² , AWG 24, TPE insulated, shielded (SSI / Incremental) Cable 5 x 0.14 mm ² , AWG 26, PUR insulated, shielded (SPI) Connector M12x1, 4-pin / 8-pin on cable L = 0,15 m	
Mechanical Data		
Dimensions	see dimension drawing	
Mounting	2 screws M4 and washers	
Starting torque of mounting screws with washer at housing flange	180	Ncm
Mechanical travel	360 continuous	°
Permitted shaft load (axial / radial) static or dynamic	20	N
Torque	0.15 (IP54), 0.5 (IP65); 1.0 (IP67)	Ncm
Maximum operational speed	800	min ⁻¹
Weight	ca. 50	g
Vibration (IEC 68000-2-6)	5 ... 2000 Amax = 0.75 amax = 20	Hz mm g
Shock (IEC 68000-2-27)	50 (6 ms)	g
Protection class (DIN EN 60529)	IP54 / IP65 / IP67	
Operating Temperature	-40 ... +85 (-25 ... +85 with M12 connector)	
Life	> 50 x 10 ⁶ (mechanically)	movem.

Shaft designs

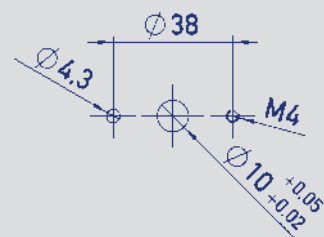


ixi -Wellenmarkierung / shaft marking

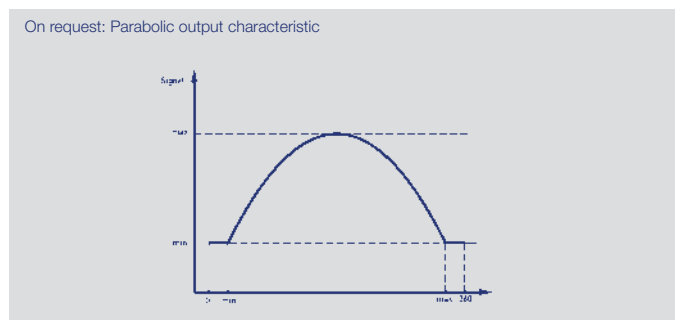
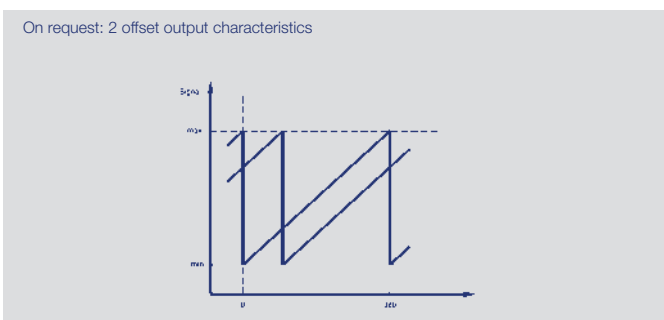
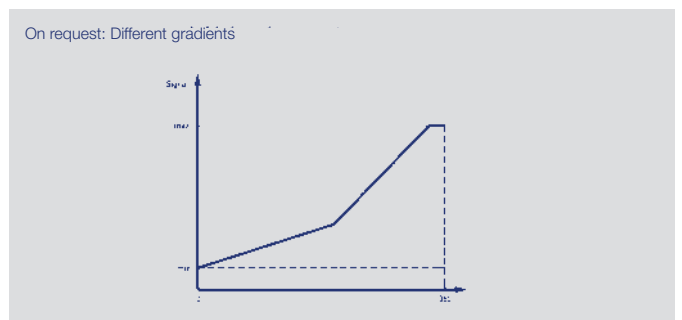
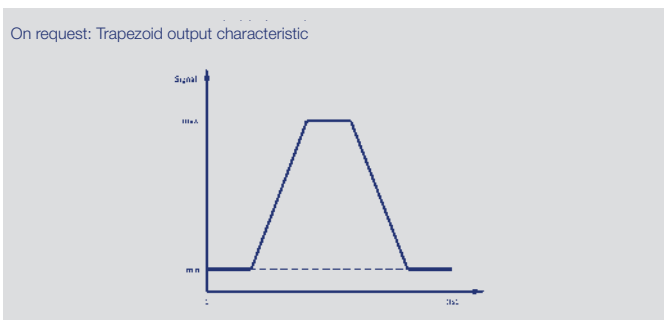
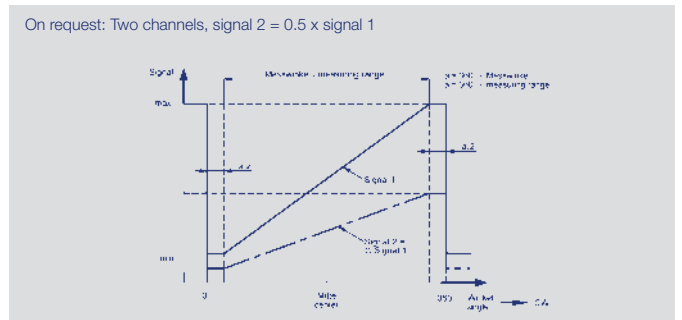
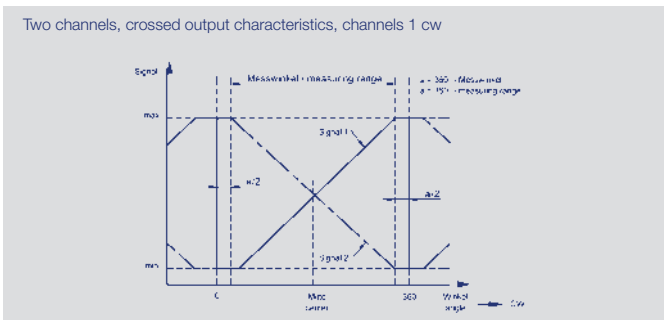
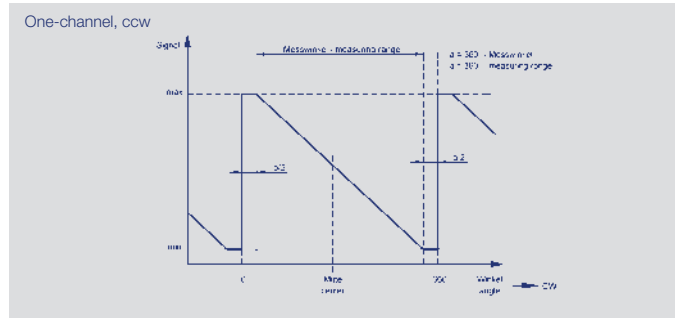
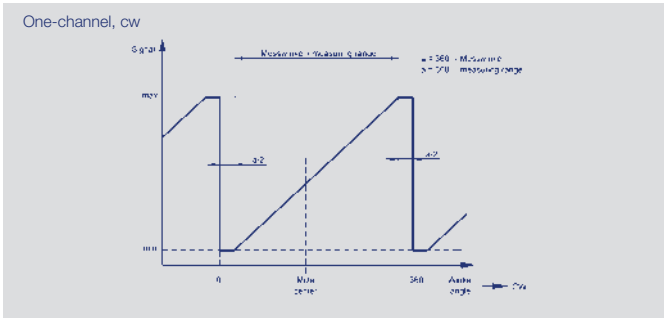
Recommended dimensions of driving shaft
for RSC-2821 / RSC-2841 / RSC-2871
Parallel offset < 0.05 mm.



Recommended hole pattern
2 x $\varnothing 4,3$ or 2 x M4



Output Characteristics



Technical Data
Analog Versions
- Voltage
- Current
for Industrial Applications

Technical Data - Versions for Industrial Applications

Design optimized for use in machine and plant applications. High reliability. Simple interface to PLC. Many options.

Type Designations	RSC - 28 _ _ _ _ - 2 _ _ _ _ ratiometric	RSC - 28 _ _ _ _ - 1 1 _ _ _ _ analog voltage	RSC - 28 _ _ _ _ - 1 2 _ _ _ _ analog current	
Electrical Data				
Output signal	ratiometric to supply voltage 0.25...4.75 VDC 0.5...4.5 VDC (load ≥ 1 k Ω)	0.1 ... 10 VDC (load ≥ 10 k Ω)	4 ... 20 mA (burden ≤ 500 Ω)	
Number of channels	1 or 2	1	1	
Update rate	typ. 5			kHz
Resolution	12			bit
Measuring range	0 to 30° up to 0 to 360, in 10° steps			°
Independent linearity	≤ 0.5			\pm % FS
Repeatability	≤ 0.1			°
Hysteresis	< 0.1			°
Temperature error at measuring range 30 up to 170°	≤ 0.625	≤ 0.94	≤ 0.94	\pm % FS
Temperature error at measuring range 180 up to 360°	≤ 0.31	≤ 0.5	≤ 0.5	\pm % FS
Supply voltage U_b	5 (4.5 ... 5.5)	24 (18 ... 30)	24 (18 ... 30)	VDC
Current consumption (w/o load)	typical 15 (typ. 8 on request) per channel			mA
Reverse voltage	yes, supply lines			
Short circuit protection	yes (vs. GND and supply voltage)			
Insulation resistance (500 VDC)	≥ 10			M Ω
Cross-section cable	AWG 26, 0.14 (AWG 20, 0.5)*			mm ²
Environmental Data				
MTTF (DIN EN ISO 13849-1 parts count method, w/o load)	356 (single) 210 (per channel) partly redundant	107	105	years years
Functional safety	If you need assistance in using our products in safety-related systems, please contact us			
EMC compatibility	EN 61000-4-2 electrostatic discharges (ESD) 4 kV, 8 kV EN 61000-4-3 electromagnetic fields 10 V/m EN 61000-4-4 electrical fast transients (burst) 1 kV EN 61000-4-6 conducted disturbances, induced by RF fields 10 V eff. EN 61000-4-8 power frequency magnetic fields 3 A/m EN 55011/EN 55022/A1 radiated disturbances class B			



*) The cross-sections of the lead wires will be increased to 0.5 mm².
The changeover is carried out depending on model type and starts from Q1-2016.
For questions, please call your local distributor or our hotline on +49 711 4489 250.

Connection assignment

Signal	Cable code 2 _ _	Connector M12 code 501
GND	BN	pin 3
Supply voltage U_b	GN	pin 1
Output 1	WH	pin 2
Not assigned / output 2	YE	pin 4

Cable shielding connect to GND.



When the shaft marking points towards the cable outlet, the sensor is located near the electrical center position.

Ordering code
Analog Versions
- Voltage
- Current
for Industrial Applications

Ordering specifications

Preferred types printed in bold:

- Delivery time up to 25 pcs. within 10 working days EXW
- best low-volume pricing

Supply voltage Ub

- 1: 24 V (18 ... 30 V)
2: 5 V (4.5 ... 5.5 V)

Output signal - supply voltage = 24 V

- 1: 0.1 ... 10 V
2: 4 ... 20 mA

Output signal - supply voltage = 5 V

- 1: 0.25 ... 4.75 V ratiometric to supply voltage (5 ... 95 %)
2: 0.5 ... 4.5 V ratiometric to supply voltage (10 ... 90 %)

Output characteristics

- 1: rising cw
2: rising ccw
3: **crossed output characteristics, channel 1 rising / channel 2 falling cw**
Other output characteristics on request

Electrical connection

- 201: Cable 4-pole, L = 0.5 m shielded
202: **Cable 4-pole, L = 1 m shielded**
206: **Cable 4-pole, L = 3 m shielded**
210: Cable 4-pole, L = 5 m shielded
220: Cable 4-pole, L = 10 m shielded
501: **Connector M12, 4-pin, with cable, L = 0.15 m, shielded**
Cable versions and assembled connectors on request

R S C - 2 8 3 2 - 6 3 6 - 2 1 1 - 2 0 2

Series

Mechanical version

- 2801: 6 mm shaft with marking, IP54*
2831: 6 mm,shaft with marking, IP65*
2861: 6 mm shaft with marking, IP67*
2802: 6 mm shaft with flattening, IP54
2832: 6 mm shaft with flattening, IP65
2862: 6 mm shaft with flattening, IP67
2821: push-on coupling, IP54
2841: push-on coupling, IP65
2871: push-on coupling, IP67
Other shaft designs on request

Measuring range

- 03: measuring range 0° ... 30° min.
...
06, 12, 18, 24, 36
...
36: measuring range 0° ... 360° max.
Other angles on request

Numbers of channels

- 6: single output 1 x supply voltage / 1 x output
7: partly redundant 1 x supply voltage / 2 x output (only at supply voltage = 5 V)

*) Not recommended for new designs

Technical Data
Analog Versions
- Voltage
for mobile Applications

Technical Data - Versions for Mobile Applications		
These versions are optimized for the high requirements in mobile applications. Tested to the highest requirements as ISO-pulse and high interferences to ECE-R10 (E1)		
Type Designations	RSC - 28 _ _ - _ _ _ - 2 _ _ - _ _ _ ratiometric	
Electrical Data		
Output Signal	ratiometric to supply voltage 0.25 ... 4.75 VDC 0.5 ... 4.5 VDC (load \geq 1 k Ω)	
Number of channels	1	
Update rate	typ. 5	kHz
Resolution	12	bit
Measuring range	0 to 30° up to 0 to 360, in 10° steps	°
Independent linearity	\leq 0.5	\pm % FS
Repeatability	\leq 0.1	°
Hysteresis	\leq 0.1	°
Temperature error at measuring range 30 up to 170°	\leq 0.625	\pm % FS
Temperature error at measuring range 180 up to 360°	\leq 0.31	\pm % FS
Supply voltage U _b	5 (4.5 ... 5.5)	VDC
Current consumption (w/o load)	typical 15 (typ. 8 on request) per channel	mA
Reverse voltage	yes, supply lines	
Short circuit protection	yes (vs. GND and supply)	
Insulation resistance (500 VDC)	\geq 10	M Ω
Cross-section cable	AWG 20, 0.5	mm ²
Environmental Data		
MTTF (DIN EN ISO 13849-1 parts count method, w/o load)	356	years
Functional Safety	If you need assistance in using our products in safety-related systems, please contact us	
EMC compatibility	Interference emission and immunity to ECE-R10 (E1) (ISO 11452-2, ISO 11452-5, CISPR 25, ISO 7637-2)	

Connection assignment	
Signal	Cable code 25 _
GND	BN
Supply voltage U _b	GN
Output 1	WH
Not assigned	YE



When the shaft marking points towards the cable outlet, the sensor is located near the electrical center position.

Ordering Code
Analog Versions
- Voltage
for mobile Applications

Ordering specifications

Preferred types printed in bold:

- Delivery time up to 25 pcs. within 10 working days EXW
- best low-volume pricing

Supply voltage U_b

2: Supply voltage = 5 V (4.5 ... 5.5 V)

Output signal

1: 0.25 ... 4.75 V ratiometric to supply voltage (5 ... 95 %)
2: 0.5 ... 4.5 V ratiometric to supply voltage (10 ... 90 %)

Output characteristics

1: rising cw
2: rising ccw
Other output characteristics on request

Electrical connection

252: Cable 4-pole, L = 1 m unshielded
256: Cable 4-pole, L = 3 m unshielded
Cable versions and assembled connectors on request

R S C - 2 8 3 2 - 6 3 6 - 2 1 1 - 2 5 2

Series

Mechanical version

2801: 6 mm shaft with marking, IP54*
2831: 6 mm, shaft with marking, IP65*
2861: 6 mm shaft with marking, IP67*
2802: 6 mm shaft with flattening, IP54
2832: 6 mm shaft with flattening, IP65
2862: 6 mm shaft with flattening, IP67
2821: push-on coupling, IP54
2841: push-on coupling, IP65
2871: push-on coupling, IP67
Other shaft designs on request

Measuring range

03: measuring range 0° ... 30° min.
...
06, 12, 18, 24, 36
...
36: measuring range 0° ... 360° max.
Other angles on request

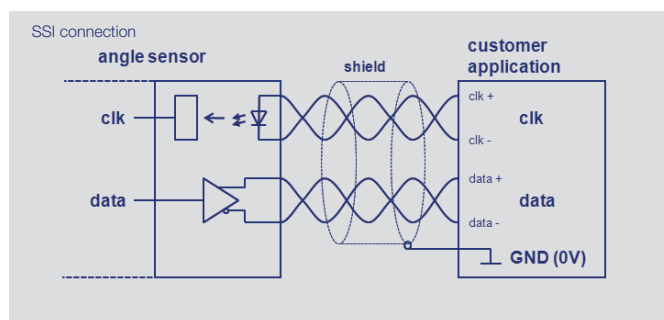
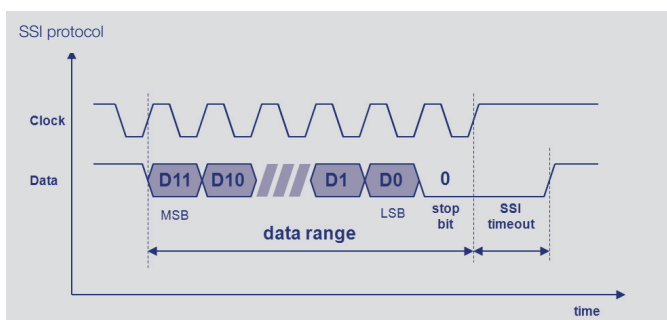
Numbers of channels

6: single output

*) Not recommended for new designs

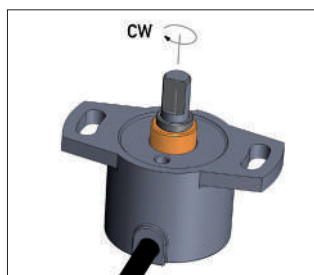
Technical Data SSI interface

Type Designations	RSC - 28 _ _ - 212 - 41 _ - _ _ _ supply voltage 5 VDC	RSC - 28 _ _ - 212 - 44 _ - _ _ _ supply voltage 24 VDC	
Electrical Data			
Protocol	SSI 13 bit (12 bit data + 1 stop bit)		
Inputs	RS422-compatible, CLK lines electrically isolated via optocouplers		
Monoflop time (tm)	16		µs
Coding	Gray code		
Update rate (internal)	2 000		kHz
Resolution across 360°	12		bit
Measuring range	360		°
Independent linearity	typ. 0.5		±% FS
Repeatability	≤ 0,2		°
Hysteresis	0.7 (lower hysteresis on request)		°
Temperature error	0.375		±% FS
Supply voltage Ub	5 (4.5 ... 5.5)	24 (18 ... 30)	VDC
Current consumption (w/o load)	typ. 27	typ. 10	mA
Reverse voltage	yes, supply lines		
Short circuit protection	yes (output vs. GND and supply voltage)	yes (output vs. GND)	
Ohmic load at outputs	≥ 120		Ω
Max. clock rate	1		MHz
Insulation resistance (500 VDC)	≥ 10		MΩ
Cross-section cable	AWG 24, 0,25		
Environmental Data			
MTTF (DIN EN ISO 13849-1 parts count method, w/o load, wc)	148	104	years
Functional safety	If you need assistance in using our products in safety-related systems, please contact us		
EMC compatibility	EN 61000-4-2 electrostatic discharges (ESD) 4 kV, 8 kV EN 61000-4-3 electromagnetic fields 10 V/m EN 61000-4-4 electrical fast transients (Burst) 1 kV EN 61000-4-6 conducted disturbances, induced by RF fields 10 V eff. EN 55016-2-3 radiated disturbances class B		



Connection assignment

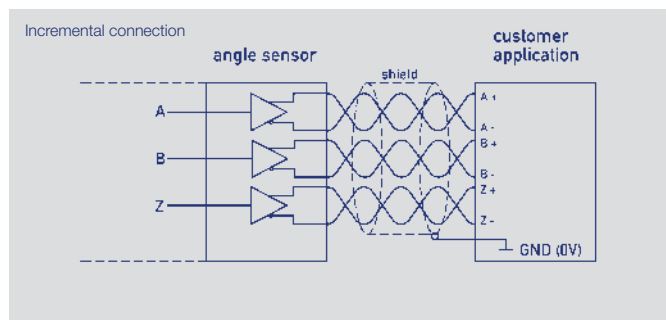
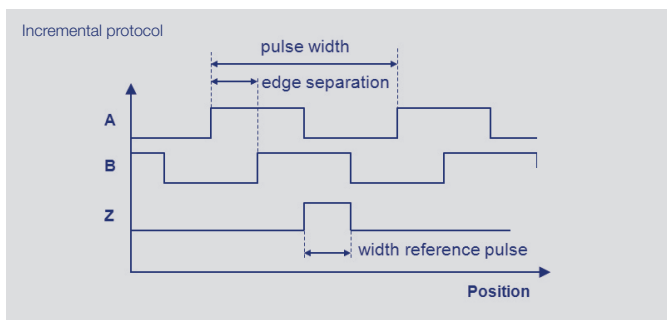
Signal	Cable code 4 _ _	Connector M12 code 531
Supply voltage Ub	WH	pin 1
GND	BN	pin 2
Signal output SSI Data+	PK	pin 6
Signal output SSI Data-	GY	pin 5
Clock input SSI Clk+	YE	pin 4
Clock input SSI Clk-	GN	pin 3
Not assigned	BU	pin 7
Not assigned	RD	pin 8



When the shaft marking points towards the cable outlet, the sensor is located near the electrical center position.

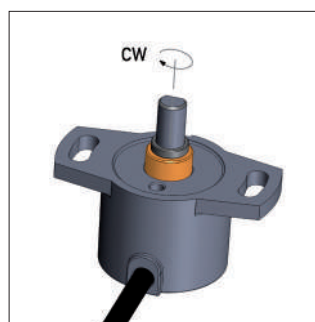
Technical Data Incremental interface

Type Designations	RSC - 28 ___ - 2 ___ - 515 - ___ supply voltage 5 VDC	RSC - 28 ___ - 2 ___ - 535 - ___ supply voltage 24 VDC, TTL	RSC - 28 ___ - 2 ___ - 539 - ___ supply voltage 24 VDC, HTL	
Electrical Data				
Outputs	A+ / A- B+ / B- Z+ / Z-			
Level	RS-422, TTL-compatible	RS-422, TTL-compatible	HTL-compatible, push-pull	
Length Z-pulse	distance between 2 edges A / B			
Pulses per revolution	1024	512	256	128
Counts per revolution (after quadrature)	4096	2048	1024	512
Minimum edge separation	8			
Ohmic load at outputs	≥ 120 per channel A / B / Z			
Minimum input frequency of counter input	min. 32			
Measuring range	360			
Independent linearity	typ. 0.5			
Repeatability	≤ 0.2			
Hysteresis	≤ 0.7 (lower hysteresis on request)			
Temperature error	≤ 0.375			
Supply voltage Ub	5 (4.5 ... 5.5)	24 (18 ... 30)	24 (18 ... 30)	
Current consumption (w/o load)	typ. 20	typ. 10	typ. 10	
Reverse voltage	yes, supply lines			
Short circuit protection	yes (outputs vs. GND and supply voltage)	yes (outputs vs. GND)	yes (outputs vs. GND and supply voltage)	
Insulation resistance (500 VDC)	≥ 10			
Cross-section cable	AWG 24, 0.25			
Environmental Data				
MTTF (DIN EN ISO 13849-1 parts count method, w/o load)	246	126	126	
Functional safety	If you need assistance in using our products in safety-related systems, please contact us			
EMC compatibility	EN 61000-4-2 electrostatic discharges (ESD) 4 kV, 8 kV EN 61000-4-3 electromagnetic fields 10 V/m EN 61000-4-4 electrical fast transients (Burst) 1 kV EN 61000-4-6 conducted disturbances, induced by RF fields 10 V eff. EN 55016-2-3 radiated disturbances class B			



Connection assignment

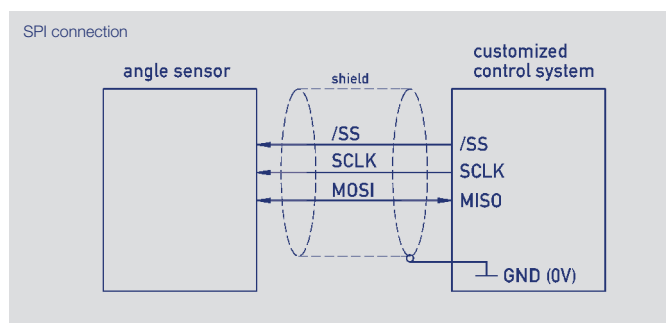
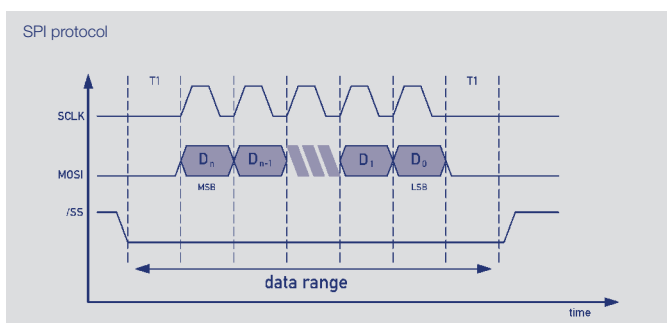
Signal	Cable code 4 __	Connector M12 code 531
Supply voltage Ub	WH	pin 1
GND	BN	pin 2
A+	YE	pin 4
A-	GN	pin 3
B+	PK	pin 6
B-	GY	pin 5
Z+	BU	pin 7
Z-	RD	pin 8



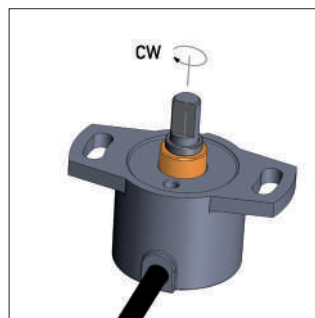
When the shaft marking is pointing away from the cable outlet, the sensor is located at the reference pulse (Z).

Technical Data SPI interface

Type Designations	RSC - 28 __ - 214 - 8__ - ____ supply voltage 5 VDC	
Electrical Data		
Protocol	SPI	
Level SCLK, MOSI / MISO , /SS	TTL level (see application note SPI protocol)	
Update rate (internal)	5	kHz
Resolution across 360°	14	bit
Measuring range	360	°
Independent linearity	≤ 0.5	± % FS
Repeatability	≤ 0.1	°
Hysteresis	≤ 0.1	°
Temperature error	≤ 0.625	± % FS
Supply voltage Ub	5 (4.5 ... 5.5)	VDC
Current consumption (w/o load)	typ. 15	mA
Reverse voltage	yes, supply lines	
Short circuit protection	yes, vs. GND and supply voltage	
Max. clock rate	400	kHz
Insulation resistance (500 VDC)	≥ 10	MΩ
Cross-section cable	AWG 26, 0.14	mm ²
Environmental Data		
MTTF (DIN EN ISO 13849-1 parts count method, w/o load)	316	years
Functional safety	If you need assistance in using our products in safety-related systems, please contact us.	
EMV compatibility	EN 61000-4-2 electrostatic discharges (ESD) 4kV, 8kV EN 61000-4-3 electromagnetic fields: 10V/m EN 61000-4-4 electrical fast transients (Burst) 1kV EN 61000-4-6 conducted disturbances, induced by RF fields 10 V/m eff. EN 61000-4-8 Power frequency magnetic fields 3 A/m EN 55011/EN 55022/a1 Radiated disturbances class B	



Connection assignment	
Signal	Cable code 302
Supply voltage Ub	GN
GND	BN
MOSI / MISO	YE
SCLK	GY
/SS (slave select)	WH



When the shaft marking points towards the cable outlet, the sensor is located near the electrical center position.

**Ordering code
Digital Versions
- SSI
- Incremental
- SPI**

Ordering specifications

Preferred types printed in bold:

- Delivery time up to 25 pcs. within 10 working days EXW
- Best low volume pricing

Interface

- 4: Synchronous-Serial Interface (SSI)**
- 5: Incremental Interface A / B / Z**
- 8: Serial Peripheral Interface (SPI)**

Interface parameters for SSI Interface

- 11: 5 V (4.5...5.5 V) supply voltage, output RS422 comp., Gray code, rising cw**
- 12: 5 V (4.5...5.5 V) supply voltage, output RS422 comp., Gray code, rising ccw
- 41: 24 V (18...30 V) supply voltage, output RS422 comp., Gray code, rising cw**
- 42: 24 V (18...30 V) supply voltage, output RS422 comp., Gray code, rising ccw

Interface parameters for Incremental Interface

- 15: 5 V (4.5...5.5 V) supply voltage, output RS422, TTL-compatible**
 - 35: 24 V (18...30 V) supply voltage, output RS422, TTL-compatible**
 - 39: 24 V (18...30 V) supply voltage, output RS422, HTL-compatible, push-pull**
- On request: high side and low side outputs
UWV signals instead of ABZ signals for motor commutation
Absolute position at Power On (Power on burst)

Interface parameters for SPI Interface

- 31: 5 V (4.5 V...5.5 V) supply, binary code, rising cw**

Electrical connection

SPI:

302: Cable 5-pole, L = 1 m, shielded,

SSI / Incremental:

432: Cable 8-pole, L = 1 m, shielded

436: Cable 8-pole, L = 3 m, shielded

440: Cable 8-pole, L = 5 m, shielded

450: Cable 8-pole, L = 10 m, shielded,

531: Connector M12x1, 8-pin, with cable, L = 0.15 m, shielded

Cable versions and assembled connectors on request.

R S C - 2 8 3 2 - 2 1 2 - 4 1 1 - 4 3 2

Series

Resolution SSI Interface

- 12: 12 bit**
- Other resolutions on request

Resolution Incremental Interface

- 12: 1024 ppr - 4096 counts (after quadrature)**
- 11: 512 ppr - 2048 counts (after quadrature)
- 10: 256 ppr - 1024 counts (after quadrature)
- 09: 128 ppr - 512 counts (after quadrature)
- Other resolutions on request

Resolution SPI Interface

- 14: 14 bit**

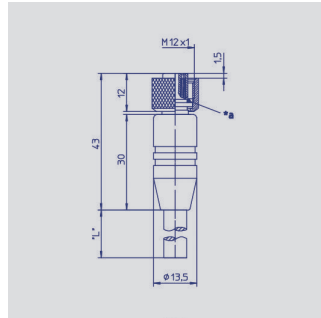
Interface

- 2: Digital Interface**

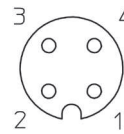
Mechanical version

- 2802: 6 mm-shaft with flattening, IP54
- 2832: 6 mm-shaft with flattening, IP65**
- 2862: 6 mm-shaft with flattening, IP67
- 2821: push-on-coupling, IP54
- 2841: push-on-coupling, IP65**
- 2871: push-on-coupling, IP67
- Other shaft versions on request

Accessories
Connector system M12

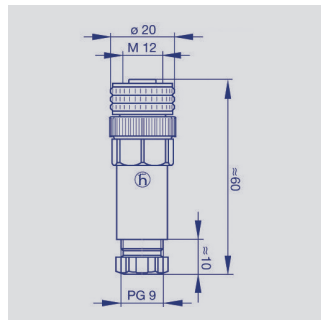


Pin assignment
 1 = brown
 2 = white
 3 = blue
 4 = black

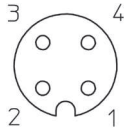


M12x1 Mating female connector, 4-pin, straight, A-coded, with molded cable, shielded, IP67, open ended

Connector housing	Plastic PA	
Cable sheath	PUR; Ø = max. 6 mm, -25 °C...+80 °C (moved) -50 °C...+80 °C (fixed)	
Wires	PP, 0.34 mm ²	
Length	Type	P/N
2 m	EEM 33-32	005600
5 m	EEM 33-62	005609
10 m	EEM 33-97	005650

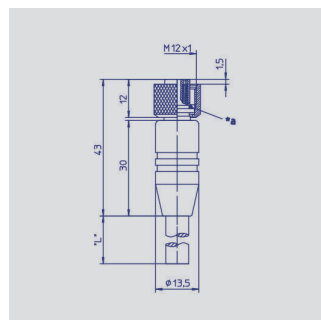
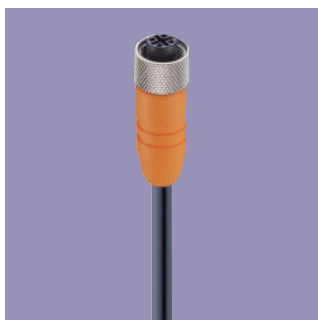


Pin assignment

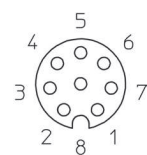


M12x1 Mating female connector, 4-pin, straight, A-coded, with coupling nut, screw termination, IP67, not shielded

Connector housing	Plastic PBT	
housing	-25 °C...+90 °C	
For wire gauge	6...8 mm, max. 0.75 mm ²	
Type	EEM 33-88, P/N 005633	



Pin assignment
 1 = white
 2 = brown
 3 = green
 4 = yellow
 5 = grey
 6 = pink
 7 = blue
 8 = red



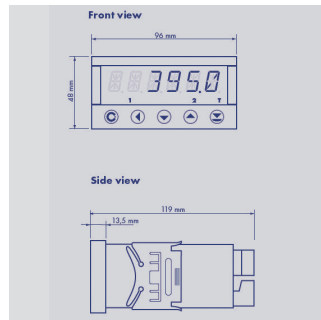
M12x1 Mating female connector, 8-pin, straight, A-coded, with molded cable, shielded, IP67, open ended

Connector housing	Plastic PA	
Cable sheath	PUR; Ø = max. 8 mm, -25 °C...+80 °C (moved) -50 °C...+80 °C (fixed)	
Wires	PP, 0.25 mm ²	
Length	Type	P/N
2 m	EEM 33-86	005629
5 m	EEM 33-90	005635
10 m	EEM 33-92	005637

**Multifunctional
Measuring Device
with Display
Series MAP-4000**

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Special features

- Supply voltage 10 ... 30 VDC, 80 ... 250 V DC or AC
- high accuracy
- direct connection of potentiometric and standardized signals
- adjustable supply voltage for sensors 5 ... 24 V
- Temperature coefficient 100 ppm/K
- optional RS 232, RS 485, analog output, limited switch
- complete data see separate data sheet MAP-4000

Ordering specifications

Number comparator relays

- 0: none
- 2: 2 relays
- 4: 4 relays

Analog output

- 0: no analog output
- 1: analog output present

Interface

- 0: no interface
- 1: RS 232
- 2: RS 485

M A P - 4 0 1 0 - 0 0 0 - 1 0 1

- Display colour**
1: red

Data storage (only with interface)

- 0: not storage
- 1: RTC storage
- 2: FAST storage

Series

Supply voltage U_b
00: 10 ... 30 V AC/DC
10: 80 ... 250 V AC

Adjustable supply voltage (5 ... 24 V / max. 1.2 W)
1: with supply voltage

The specifications contained in our datasheets are intended solely for informational purposes. The documented specification values are based on ideal operational and environmental conditions and can vary significantly depending on the actual customer application. Using our products at or close to one or more of the specified performance ranges can lead to limitations regarding other performance parameters. It is therefore necessary that the end user verifies relevant performance parameters in the intended application. We reserve the right to change product specifications without notice.