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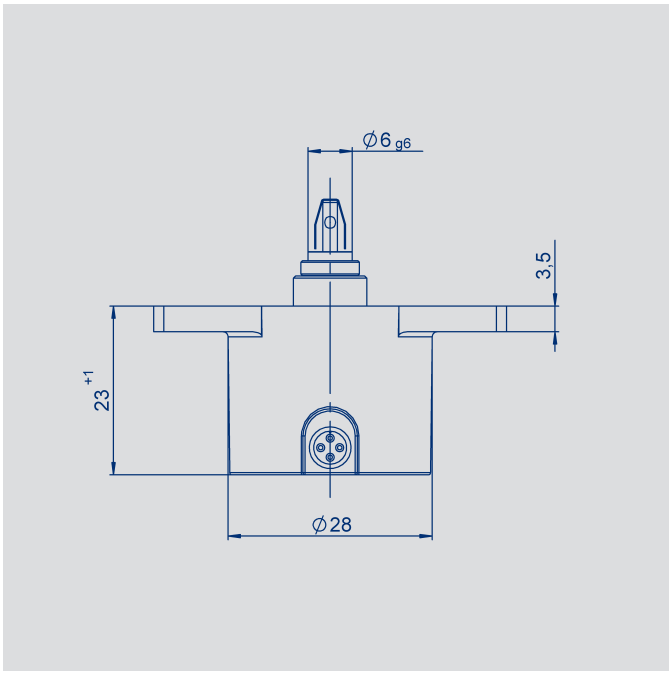
NOVOHALL
Rotary Sensor
non-contacting

Series RSC-2800

E1



VDC mA INC SSI SPI

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 ≤ ±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.

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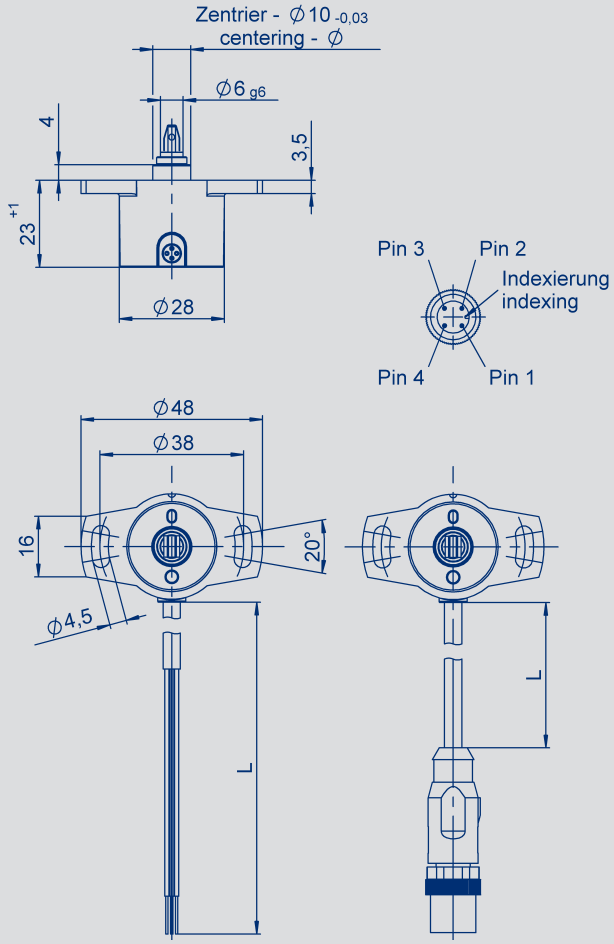
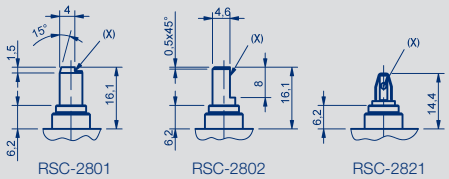
Contents

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 mm², AWG 20, TPE insulated, shielded (voltage / current) Cable 4 x 2 x 0.25 mm², AWG 24, TPE insulated, shielded (SSI / Incremental) Cable 5 x 0.14 mm², 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)	°C
Life	> 50 x 10^6 (mechanically)	movem.

Shaft designs



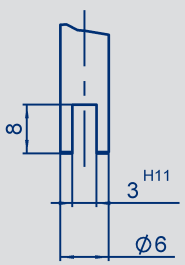
RSC-2801
RSC-2831
RSC-2861

RSC-2802
RSC-2832
RSC-2862

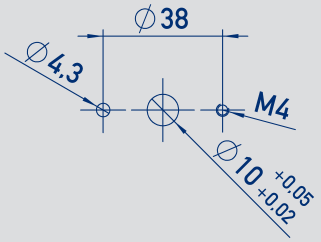
RSC-2821
RSC-2841
RSC-2871

(X) =Wellenmarkierung / shaft marking

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

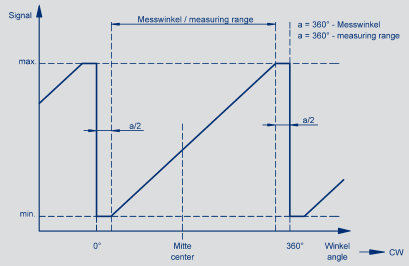


Recommended hole pattern
2 x Ø 4,3 or 2 x M4

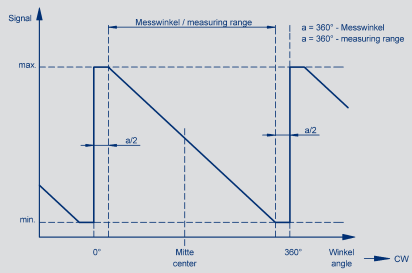


Output Characteristics

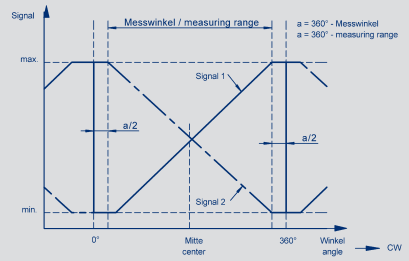
One-channel, cw



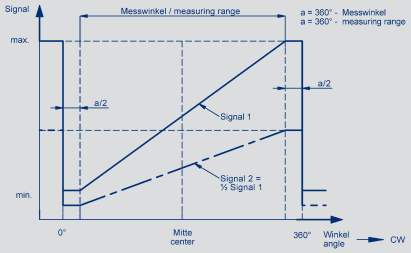
One-channel, ccw



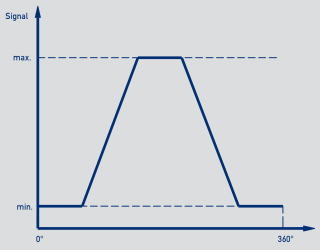
Two channels, crossed output characteristics, channels 1 cw



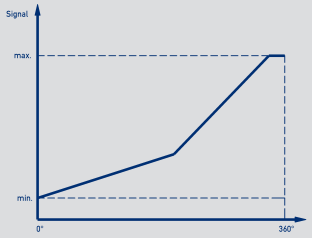
On request: Two channels, signal 2 = 0.5 x signal 1



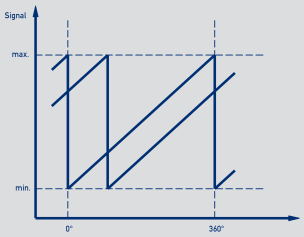
On request: Trapezoid output characteristic



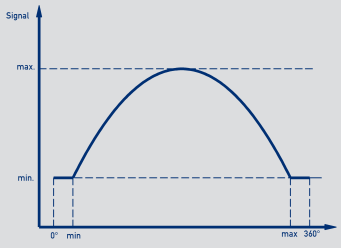
On request: Different gradients



On request: 2 offset output characteristics



On request: Parabolic output characteristic



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.

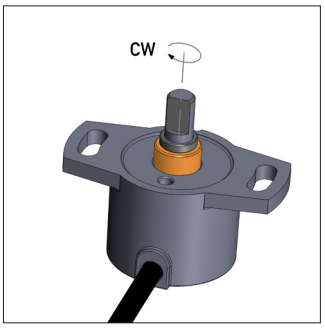
Type Designations	**RSC - 28 _ _ - _ _ _ - 2 _ _ - _ _ _ ratiometric**	**RSC - 28 _ _ - _ _ _ - 1 1 _ - _ _ _ analog voltage**	**RSC - 28 _ _ - _ _ _ - 1 2 _ - _ _ _ analog current**	
Electrical Data				
Output signal	ratiometric to supply voltage 0.25...4.75 VDC 0.5...4.5 VDC (load ≥1 kΩ)	0.1 ... 10 VDC (load ≥10 kΩ)	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			± % FS
Repeatability	≤ 0.1			°
Hysteresis	< 0.1			°
Temperature error at measuring range 30 up to 170° Temperature error at measuring range 180 up to 360°	≤ 0.625 ≤ 0.31	≤ 0.94 ≤ 0.5	≤ 0.94 ≤ 0.5	± % FS ± % FS
Supply voltage Ub	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			MΩ
Cross-section cable	AWG 26, 0.14 (AWG 20, 0.5)*			mm²
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 CE	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 Ub	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

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)

Series

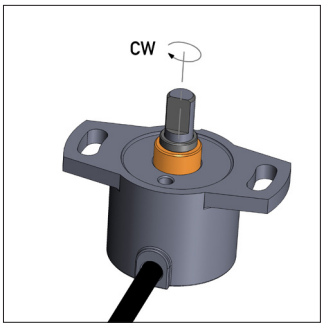
Mechanical version
2801: 6 mm shaft with marking, IP54*
2831: 6 mm,shaft with marking, IP65*
2861: 6 mm shaft with marking, IP67*
2802: 6 mm shaft with flattening, IP54
2832: 6 mm shaft with flattening, IP65
2862: 6 mm shaft with flattening, IP67
2821: push-on coupling, IP54
2841: push-on coupling, IP65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

*) Not recommended for new designs

Technical Data
Analog Versions
- Voltage
for mobile Applications

Technical Data - Versions for Mobile Applications These versions are optimzed 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 ≥ 1 kΩ)	
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	≤ 0.5	± % FS
Repeatability	≤ 0.1	°
Hysteresis	≤ 0.1	°
Temperature error at measuring range 30 up to 170°	≤ 0.625	± % FS
Temperature error at measuring range 180 up to 360°	≤ 0.31	± % FS
Supply voltage Ub	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)	≥ 10	MΩ
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 Ub	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 Ub
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

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

Series

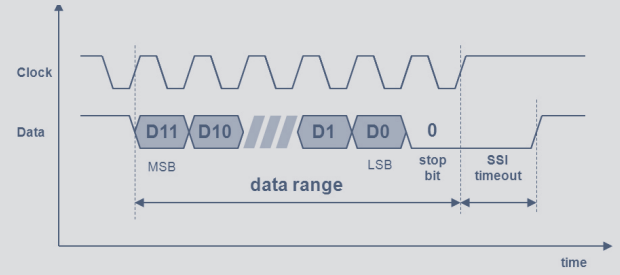
Mechanical version
2801: 6 mm shaft with marking, IP54*
2831: 6 mm,shaft with marking, IP65*
2861: 6 mm shaft with marking, IP67*
2802: 6 mm shaft with flattening, IP54
2832: 6 mm shaft with flattening, IP65
2862: 6 mm shaft with flattening, IP67
2821: push-on coupling, IP54
2841: push-on coupling, IP65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

*) Not recommended for new designs

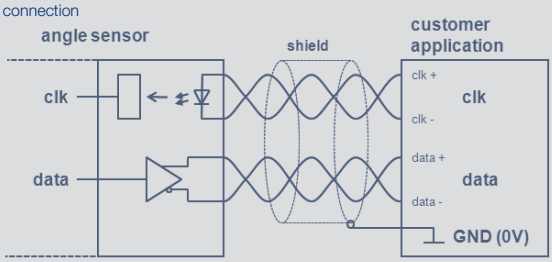
Technical Data
SSI interface

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		mm^2
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 CE	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		

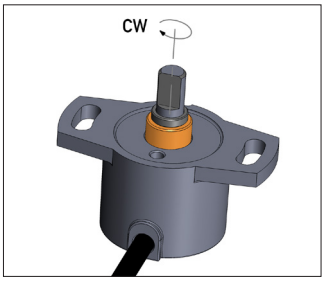
SSI protocol



SSI connection



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

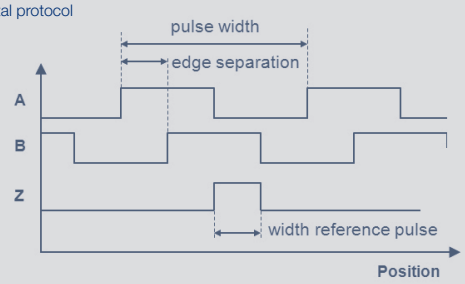


When the shaft marking points towards the cable outlet, the sensor is located near the electrical center position.

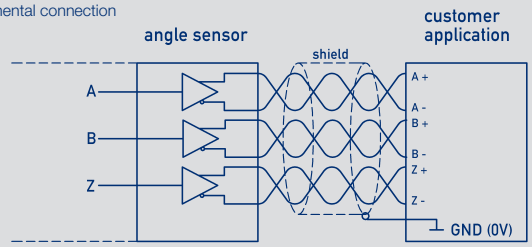
Technical Data
Incremental interface

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			ppr
Counts per revolution (after quadrature)	4096 2048 1024 512			
Minimum edge separation	8			µs
Ohmic load at outputs	≥ 120 per channel A / B / Z			Ω
Minimum input frequency of counter input	min. 32			kHz
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)	24 (18 ...30)	VDC
Current consumption (w/o load)	typ. 20	typ. 10	typ. 10	mA
Reverse voltage	yes, supply lines			
Short circuit protection	yes (ouputs vs. GND and supply voltage)	yes (outputs vs. GND)	yes (outputs vs. GND and supply voltage)	
Insulation resistance (500 VDC)	≥ 10			MΩ
Cross-section cable	AWG 24, 0.25			mm^2
Environmental Data				
MTTF (DIN EN ISO 13849-1 parts count method, w/o load)	246	126	126	years
Functional safety	If you need assistance in using our products in safety-related systems, please contact us			
EMC compatibility CE	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			

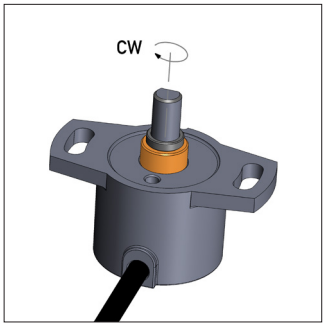
Incremental protocol



Incremental connection



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

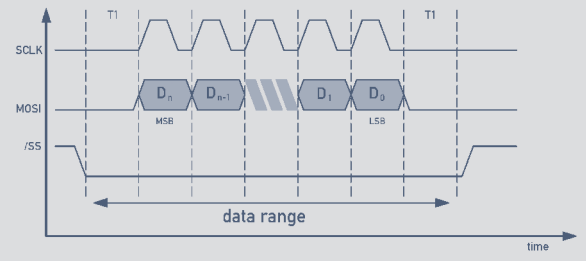


When the shaft marking is pointing away from the cable outlet, the sensor is located at the reference pulse (Z).

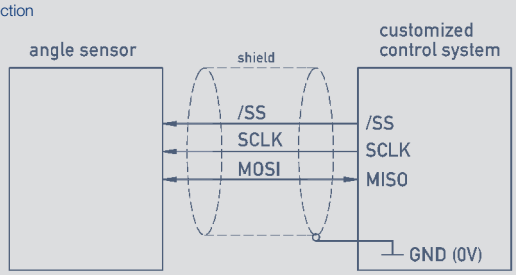
Technical Data
SPI interface

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 CE	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	

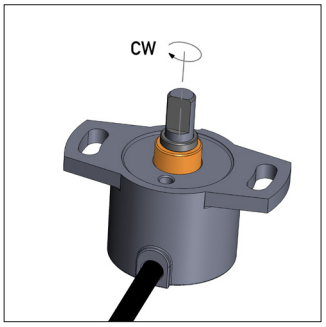
SPI protocol



SPI connection



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
UVW 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

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

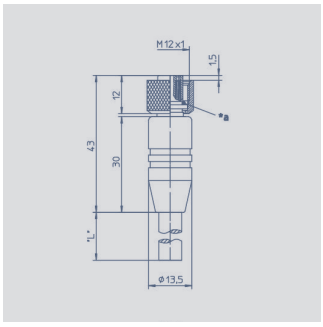
Interface
2: Digital Interface

Resolution SSI Interface
12: 12 bit
Other resolutions on request

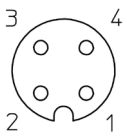
Resolution Incremental Interface
12: 1024 ppr - 4096 counts (after quadrature)
11: 512 ppr - 2048 counts (after quadrature)
10: 256 ppr - 1024 counts (after quadrature)
09: 128 ppr - 512 counts (after quadrature)
Other resolutions on request

Resolution SPI Interface
14: 14 bit

Accessories
Connector system M12



Pin assignment

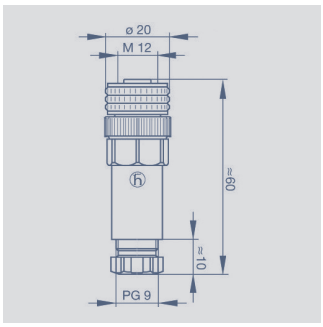


1 = brown
2 = white
3 = blue
4 = black

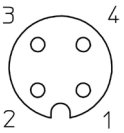
M12x1 Mating female connector, 4-pin, straight, A-coded, with molded cable, shielded, IP67, open ended

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 mm²

Length	Type	P/N
2 m	EEM 33-32	005600
5 m	EEM 33-62	005609
10 m	EEM 33-97	005650



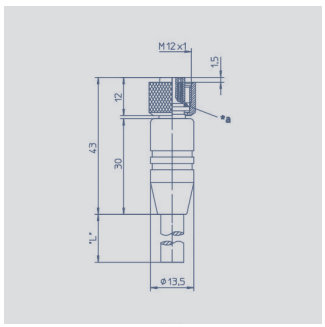
Pin assignment



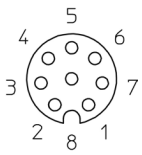
M12x1 Mating female connector, 4-pin, straight, A-coded, with coupling nut, screw termination, IP67, not shielded

Connector housing	Plastic PBT -25 °C...+90 °C
For wire gauge	6...8 mm, max. 0.75 mm²

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 mm²

Length	Type	P/N
2 m	EEM 33-86	005629
5 m	EEM 33-90	005635
10 m	EEM 33-92	005637

novotechnik
Siedle Group

Multifunctional Measuring Device with Display Series MAP-4000

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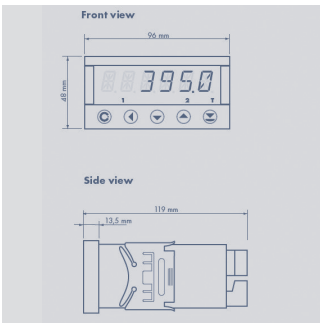

Special features

- Supply voltage 10 ... 30 VDC, 80 ... 250 V DC or AC
- high accuracy
- direct connection of potentiometric and standardized signals
- adjustable supply voltage for sensoren 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 Ub
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