

Section 8: Sensors/Electrical/Technical

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Sensors Index by Product Line

Product Line	Type	Separate Bracket Required	Pages
TaskMaster[®] Cylinders	TaskMaster	No	1.20-1.21
ISO 1552 Series TRB Cylinders	Series ST6	Yes	2.93-2.97
ISO 1552 Series PRA Cylinders	Series ST6	Yes	2.93-2.97
ISO 1552 Series 523 Green Cylinders	Series ST6 & ST8	No	2.93-2.97
Series ICS Stainless Steel Cylinders (D2)	Series ST8	Yes	2.115-2.116
Series ICS Stainless Steel Cylinders (D1)	Series ST8	Yes	2.129-2.130
Series ICL Clean Line Cylinders	Series ST6	Yes	2.140-2.141
Octagon ISO Mini Cylinders	Series ST6 & ST8	Yes	3.64-3.67
Octagon ISO Mini Cylinders (SF1 sensor)	SF1	No	3.34-3.51
Series MM Mini Cylinders	Series MM	Yes	3.114
Series 131 Cylinders (10mm bore only)	Series 131	Yes	3.412, 3.144
RexMover Rodless Cylinders	Series ST8	No	4.48
Easy-2-Combine System:			
GSU Guided Shuttle Units	Series ST4	No	5.6-5.7
MSC Mini Slides	Series ST4	No	5.20-5.21
MSF Mini Slides	Series ST4	No	5.31-5.32
ZSC Mini Slides	Series SH4*	No	5.46
GPC-E Guided Cylinders	Series ST6	No	5.56
GPC-ST Guided Cylinders	Series ST4	No	5.62-5.63
RCM Rotary Modules	Series ST4	No	5.86-5.87
GSP Grippers	Series ST4	No	5.111-5.112
MSN Mini Slides	Series ST4	No	5.156-5.157
RAP Rotary Actuators, Rack-and-Pinion	RAP/RAN	Yes	5.167
RAN Rotary Actuators, Vane Type	RAP/RAN	No	5.184-5.185
RWT Index Tables	Series SH4*	Yes	5.189
GPC and GPC-TL Guided Cylinders	Series ST6	No	5.212
TWC Twin Rod Cylinders	Series SH4*	No	5.231-5.239
CCI Compact Cylinders	Series ST6	No	6.78
Series 2709 Clamping Cylinders	Series ST8	Yes	7.9-7.10

*Series SH4 sensors have specific part numbers for specific actuators - see the actuator pages.

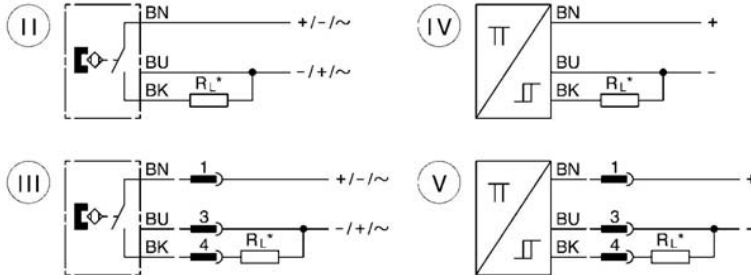
Additional sensor detail information is found in our on-line catalog.

Sensors/Electrical/Technical

Sensor Series ST4



▲ Cylinder switch ST4, electrically (Reed contact) and electronic (contactless PNP)



00118445



BN = brown, BK = black, BU = blue
 * Note on the protective circuit in the case of an inductive load:
 DC voltage = diode or Z diode; AC voltage = resistor and condensator or varistor

Fig.	Contact type	Symbol	Length of cable [m] Material	Connector	Ambient temperature range	Operating voltage	Switching current I max.	Part no.
A	Reed	II (3-wire)	3 PUR	-	-25 °C to +75 °C (-13 °F to +167 °F)	AC/DC 10 ... 30 V	100 mA	0 830 100 640
A	Reed	II (3-wire)	5 PUR	-	-25 °C to +75 °C (-13 °F to +167 °F)	AC/DC 10 ... 30 V	100 mA	0 830 100 641
B	Reed	III (3-wire)	0,3 PUR	M8x1	-25 °C to +75 °C (-13 °F to +167 °F)	AC/DC 10 ... 30 V	100 mA	0 830 100 440
A	contactless	IV (3-wire)	3 PUR	-	-25 °C to +75 °C (-13 °F to +167 °F)	AC/DC 10 ... 30 V	70 mA	0 830 100 642
A	contactless	IV (3-wire)	5 PUR	-	-25 °C to +75 °C (-13 °F to +167 °F)	AC/DC 10 ... 30 V	70 mA	0 830 100 643
B	contactless	V (3-wire)	0,3 PUR	M8x1	-25 °C to +75 °C (-13 °F to +167 °F)	AC/DC 10 ... 30 V	70 mA	0 830 100 441

A = Cable connection; B = Plug-in connection M8x1 with knurled screw.
 Power supply with protective extra-low voltage (PELV/SELV) according to DIN EN 50178, classification VDE 0160.

Part no.	Switching capacity max.	Rs [Ω]	Voltage drop U at I max.	Operational current (without load) not switched	Operational current (without load) switched	Switching frequency max.	Short-circuit protection	Polarity safe
0 830 100 640	3 W / 5 VA	15	I x Rs	-	< 5 mA	0,5 KHz	no	yes
0 830 100 641	3 W / 5 VA	15	I x Rs	-	< 5 mA	0,5 KHz	no	yes
0 830 100 440	3 W / 5 VA	15	I x Rs	-	< 5 mA	0,5 KHz	no	yes
0 830 100 642	3 W / 5 VA	15	< 2,5 V	< 8 mA	< 20 mA	1,0 KHz	yes	yes
0 830 100 643	3 W / 5 VA	15	< 2,5 V	< 8 mA	< 20 mA	1,0 KHz	yes	yes
0 830 100 441	3 W / 5 VA	15	< 2,5 V	< 8 mA	< 20 mA	1,0 KHz	yes	yes

- General characteristics:
- Degree of protection: IP 67 (NEMA 6) - IEC 60529 (DIN VDE 0470)
 - Switching point accuracy (temperature = constant): ±0,1 mm
 - Indicator: LED (yellow = operating status: switched)
 - Materials, body: polyamide

- Reed:
- Rs = protective resistor for reed contact
 - Shock resistance max.: 30 g / 11 msec (contact closes)
 - Vibration resistance: 10–55 Hz, 1 mm
 - Switching response times ON / OFF: ~ 0,5 msec / ~ 0,1 msec

Approximate figures for hysteresis, response travel and overrun speed, see last page of switches.

Sensors/Electrical/Technical

Sensor Series ST4

Rexroth
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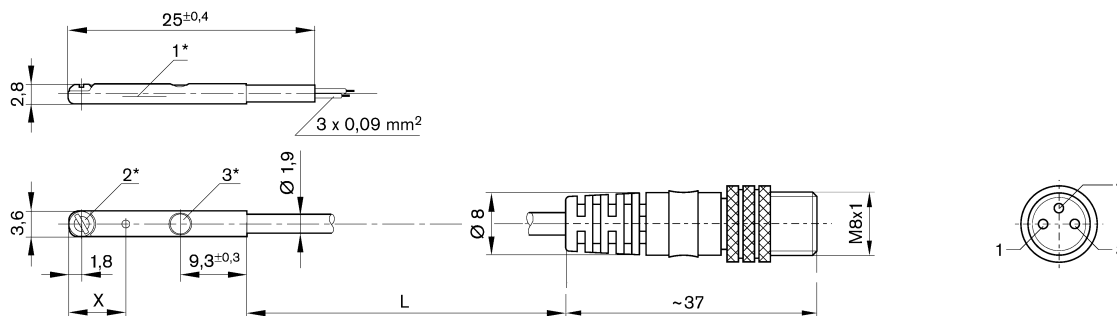


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Ambient temperature min. / max.	-25 °C / +75 °C
Protection class according to DIN EN 60529:2000	IP67
Switching time on	±0,1 0,5 ms
Switching time off	0,1 ms
LED	yellow
Shock resistance	30 g / 11 ms
Vibration resistance	10-55 Hz, 1 mm
materials:	
Sensor	polyamide

	type of contact	Ambient temperature min. / max. [°C]	cable length L [m]	n-Wire	Operational voltage AC [V]	DC operating voltage [V]	DC switching current [A]	Part No.
	Reed	-	0,3 0,5	3	10 - 30	10 - 30	0,1	R412004577 R412004578
	PNP solid-state	-25 / 75	0,3 0,5	3	-	10 - 30	0,1	R412004580 R412004581
Part No.	Switching capacity [VA]	protective resistor [Ω]	Voltage drop [V]	operating current, not switched [mA]	operating current, switched [mA]	Max. switching frequency [kHz]		Short-circuit protected
R412004577 R412004578	3 W / 5 VA	15	< 1,5	-	< 5	0,5	-	+
R412004580 R412004581	3 W / 5 VA	-	< 2,5	< 8	< 20	0,1	+ -	+

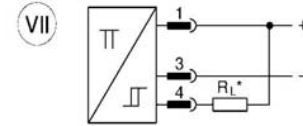
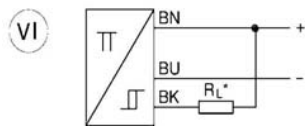
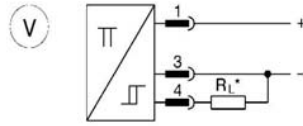
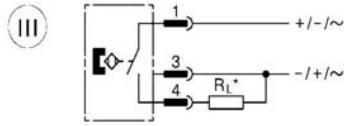
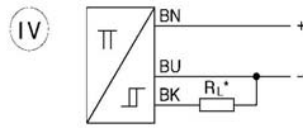
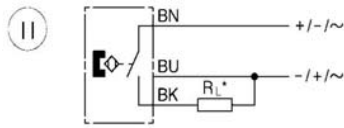
dimensions



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1* = sensor element 2* = clamping screw 3* = LED
X = PNP, 6 mm, Reed, 10 mm
(1) BN=brown (3) BU=blue (4) BK=black

▲ ★ Cylinder switch Series ST6, electrically (Reed contact) and electronic (contactless)



00111961



BN=brown, BK=black, BU=blue

Style	Contact type	Symbol	Cable length(m) Material	Connector	Ambient temperature range	Operating voltage	Switching current max. (A)	Part no.
B	Reed	II (3-wire)	3 PUR	-	-20 to +70 °C (-4 to +158 °F)	10 ... 30VAC/DC	AC/DC 0.13	0830100629
B	Reed	II (3-wire)	5 PUR	-	-20 to +70 °C (-4 to +158 °F)	10 ... 30VAC/DC	AC/DC 0.13	0830100630
B	Reed	II (3-wire)	10 PUR	-	-20 to +70 °C (-4 to +158 °F)	10 ... 30VAC/DC	AC/DC 0.13	R412004575
A	Reed	III (3-wire)	0.3 PUR	M8 X 1	-20 to +70 °C (-4 to +158 °F)	10 ... 30VAC/DC	AC/DC 0.13	0830100488
C	Reed	III (3-wire)	0.3 PUR	M12 X 1	-20 to +70 °C (-4 to +158 °F)	10 ... 30VAC/DC	AC/DC 0.13	0830100432
D	Reed	III (3-wire)	0.3 PUR	M8 X 1	-20 to +70 °C (-4 to +158 °F)	10 ... 30VAC/DC	AC/DC 0.13	0830100434
D	Reed	III (3-wire)	0.5 PUR	M8 X 1	-20 to +70 °C (-4 to +158 °F)	10 ... 30VAC/DC	AC/DC 0.13	0830100436
B	contactless PNP	IV (3-wire)	3 PUR	-	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100631
B	contactless PNP	IV (3-wire)	5 PUR	-	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100632
B	contactless PNP	IV (3-wire)	10 PUR	-	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	R412004576
A	contactless PNP	V (3-wire)	0.3 PUR	M8 X 1	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100489
C	contactless PNP	V (3-wire)	0.3 PUR	M12 X 1	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100433
D	contactless PNP	V (3-wire)	0.3 PUR	M8 X 1	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100435
D	contactless PNP	V (3-wire)	0.3 PVC	M8 X 1	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	R412004762
D	contactless PNP	V (3-wire)	0.5 PUR	M8 X 1	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100437
B	contactless NPN	(3-wire)	3 PUR	-	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100633
B	contactless NPN	(3-wire)	5 PUR	-	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100634
A	contactless NPN	(3-wire)	0.3 PUR	M8 X 1	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100430
C	contactless NPN	(3-wire)	0.3 PUR	M12 X 1	-10 to +70 °C (-14 to +158 °F)	10 ... 30VDC	DC 0.1	0830100431

A = Plug-in connection M8 x 1; B = Cable connection; C = Plug-in connection M12x1; D = Plug-in conn M8 x 1 w/knurled screw

Part no.	Switching capacity max.		Voltage drop U at I _{max} .	Operational curr. (w/o load) not switched	Operational current (w/o load) switched	Switching frequency max.	Short circuit protection	Polarity safe
0830100629	3W / 5VA	15	≤3.6V	-	-	< 300 Hz	no	yes
0830100630	3W / 5VA	15	≤3.6V	-	-	< 300 Hz	no	yes
R412004575	3W / 5VA	15	≤3.6V	-	-	< 300 Hz	no	yes
0830100488	3W / 5VA	15	≤3.6V	-	-	< 300 Hz	no	yes
0830100432	3W / 5VA	15	≤3.6V	-	-	< 300 Hz	no	yes
0830100434	3W / 5VA	15	≤3.6V	-	-	< 300 Hz	no	yes
0830100436	3W / 5VA	15	≤3.6V	-	-	< 300 Hz	no	yes
0830100631	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
0830100632	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
R412004576	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
0830100489	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
0830100433	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
0830100435	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
R412004762	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
0830100437	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
0830100633	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
0830100634	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
0830100430	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes
0830100431	-	-	≤2.5V	<20 mA	<30 mA	< 1 kHz	yes	yes

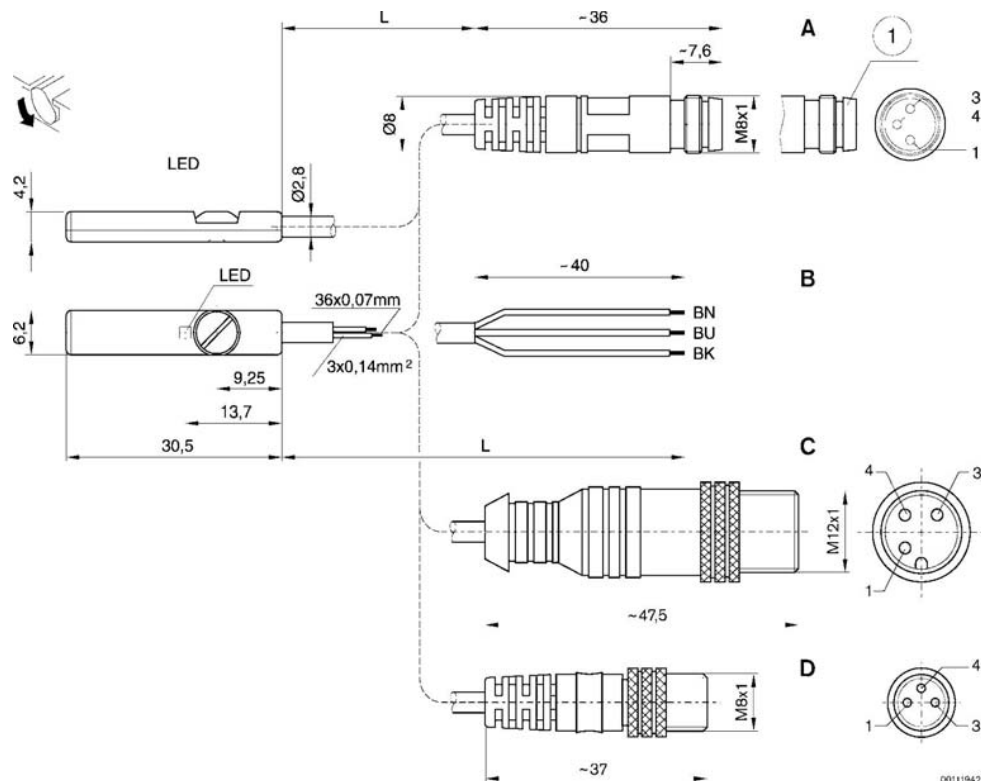
General characteristics:

- Degree of protection: IP 67 - IEC 60529 (DIN VDE 0470) (NEMA 6)
- Switching point accuracy (temperature = constant): ± 0,1 mm
- Indicator: LED (yellow = operating status: switched)
- Materials, body: polyamide

Reed:

- R_s = protective resistor for reed contact
- Shock resistance max.: 30 g / 11 msec (contact closes)
- Vibration resistance: 10–55 Hz, 1 mm
- Switching response times ON / OFF: ~ 0,5 msec / ~ 0,1 msec

Approximate figures for hysteresis, response travel and overrun speed, see last page of switches



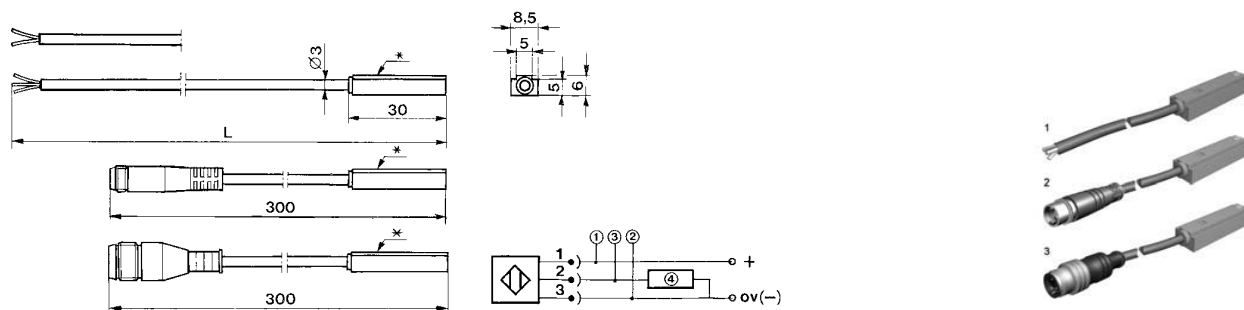
(1) Plug-in connection can be combined with electrical connector 6.5 dia.
 BN=brown, BK=black, BU=blue

Sensors/Electrical/Technical

Sensor Series ST8

Rexroth
Bosch Group

▲ ★ **Sensors, Series ST8**



1) LED 2) switching point
1 = brown 2 = blue 3 = black 4 = load

▲ ★ **Part no.**

Symbol	Fig.	Part no.	Type	Ambient temperature range	Voltage drop	Contact type
	1	275-013-231-0	with 2,5 m cable	-25 °C to +75 °C (-13 °F to +167 °F)	< 3 V	Reed*
	1	275-015-231-0	with 10 m cable	-25 °C to +75 °C (-13 °F to +167 °F)	< 3 V	Reed*
	2	275-011-132-0	0,3 m + M8 connector	-25 °C to +75 °C (-13 °F to +167 °F)	< 3 V	Reed
	1	275-013-111-0	with 2,5 m cable	—	< 2 V	PNP
	1	275-015-111-0	with 10 m cable	—	< 2 V	PNP
	2	275-011-112-0	0,3 m + M8 connector	-25 °C to +75 °C (-13 °F to +167 °F)	< 2 V	PNP
	2	275-012-312-0	0,3 m + M8 connector ¹⁾	—	< 2 V	PNP
	3	275-012-112-0	0,3 m + M12 connector	—	< 2 V	PNP
	2	275-011-122-0	0,3 m + M8 connector	-25 °C to +75 °C (-13 °F to +167 °F)	< 2 V	NPN

- ¹⁾ according EN 50082-2
 - Degree of protection: IP 67 - IEC 529 (NEMA 6)
 - Indication LED
 - De-energization delay: appr. 20 ms
 - Leakage current: 10 µA
 - Internal consumption: 10 mA
 - Operating voltage DC 10–30
 - Max. continuous current < 150 mA
 - Material: polyimide (housing) PVC (cable 3 x 0,14 mm²) PUR (cable 3 x 0,14 mm² with connector)

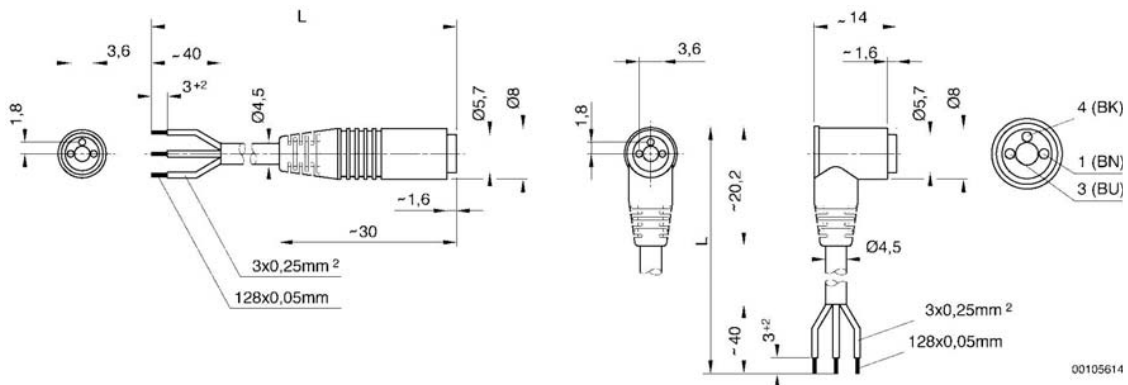
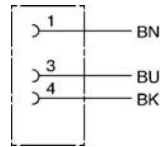
*Also rated for 240 VAC

Sensors/Electrical/Technical

Electrical connectors, snap connection, 6.5 dia.

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▲ ★ Electrical connectors with cable, snap connection, angled and straight, 6.5 dia.



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BN = brown; BU = blue; BK = black

Length of cable L [m] Material	Part no. angled	Part no. straight
3 PUR	1 834 484 084	1 834 484 082
5 PUR	1 834 484 085	1 834 484 083
10 PUR	1 834 484 199	-

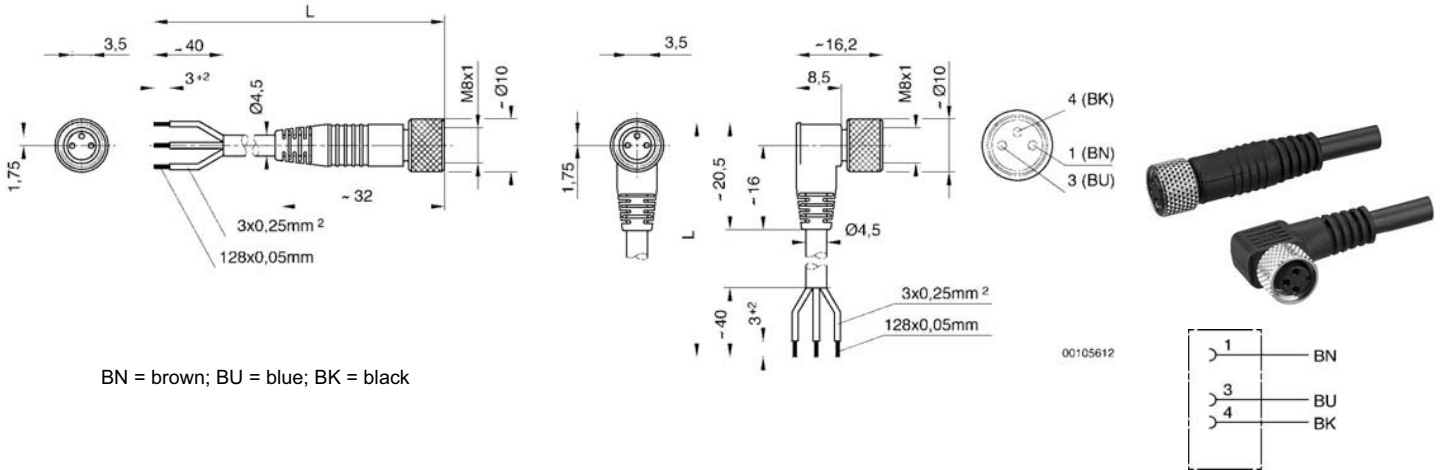
- Operating voltage max.: 30 V AC / 36 V DC
- Degree of protection: IP 65 - IEC 529 (DIN VDE 0470) (NEMA 4).
- Ambient temperature range: -40 °C to +85 °C (-40 °F to +185 °F)
- Piping type: PUR hose (black, extremely flexible).

Sensors/Electrical/Technical

Electrical connectors, 8mm dia. and M8x1 threaded coupling



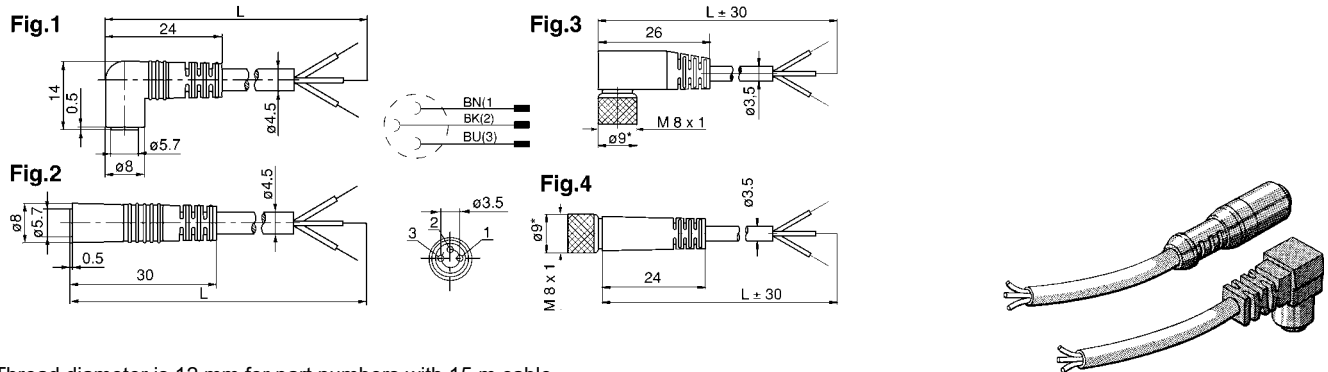
★ **Electrical connectors, M8x1 threaded coupling, angled and straight**



Length of cable [m] Material	Part no. angled	Part no. straight
3 PUR	1 834 484 167	1 834 484 166
5 PUR	1 834 484 169	1 834 484 168
10 PUR	1 834 484 248	1 834 484 247
15 PUR	1 834 484 249	-
-	1 834 484 174	1 834 484 173

- Operating voltage: 60 V AC / 75 V DC
- Degree of protection: IP 67 - IEC 529 (DIN VDE 0470) (NEMA 6).
- Ambient temperature range: -40 °C to +85 °C (-40 °F to +185 °F)
- Piping type: PUR hose (black, extremely flexible).

▲ **Connector with cable, 8 mm dia. and M8**



* Thread diameter is 12 mm for part numbers with 15 m cable.
BK = Black BU = Blue BN = Brown

▶ **Code No.**

Length of cable L [m]	Fig. 1 Part No.	Fig. 2 Part No.	Fig. 3 Part No.	Fig. 4 Part No.
2	894-601-621-2	894-601-611-2	894-620-141-2	894-620-131-2
5	894-601-620-2	894-601-610-2	894-620-140-2	894-620-130-2
10	894-601-622-2	894-601-612-2	894-620-142-2	894-620-132-2
15	894-601-623-2	894-601-613-2	894-620-143-2	894-620-133-2

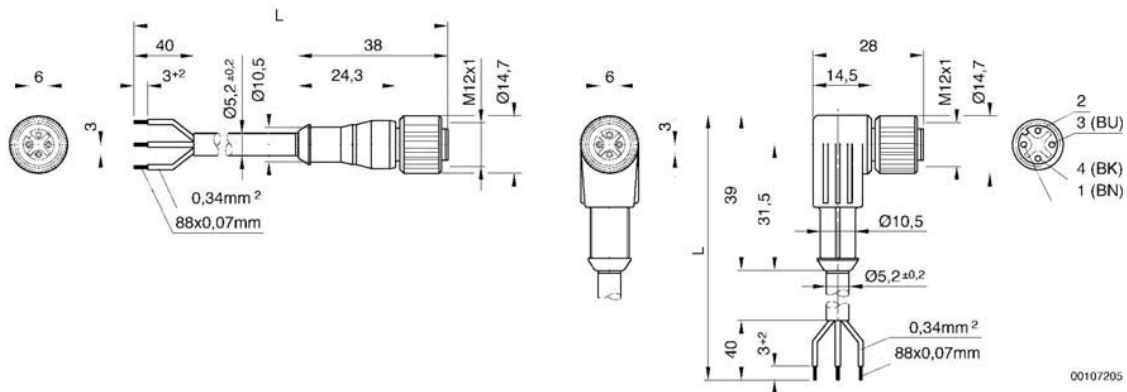
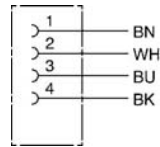
- Operating voltage: AC 60 V / DC 75 V
- Degree of protection: NEMA 4 [IP 65] - IEC 529 (DIN VDE 0470)
- Cross section of cable: 3 x 0,25 mm², 3 x 0,34 mm² by 15 m cable with thread
- Piping type: PVC - hose (black, extremely flexible)
- Insulation class: C to VDE 0110

Sensors/Electrical/Technical

Electrical connectors, M12x1 threaded coupli

Rexroth
Bosch Group

▲ ★ Electrical connectors, M12x1 threaded coupling, angled and straight (4 pins)



BN = brown; BU = blue; BK = black

Length of cable [m] Material	Part no. angled	Part no. straight
3 PUR	1 834 484 259	1 834 484 256
5 PUR	1 834 484 260	1 834 484 257
10 PUR	1 834 484 261	1 834 484 258
-	1 834 484 178	1 834 484 177

- Operating voltage: 250 V AC/ 300 V DC
- Degree of protection: IP 67 - IEC 529 (DIN VDE 0470) (NEMA 6).
- Ambient temperature range: -40 °C to +85 °C (-40 °F to +185 °F)
- Piping type: PUR hose (black, extremely flexible).

Calculation of Torque

$M_t = M_\alpha + M_{TP} + M_E$	M_t Total Torque (Nm)
$M_\alpha = K \cdot J \cdot \frac{\varphi \cdot \pi}{180 \cdot t^2}$	M_α Moment Related to Inertia (Nm) K Coefficient = 2 J Moment of Inertia (kg·m ²) φ Angle of Rotation (degrees) t Rotation Time (s)
$M_{TP} = K \cdot m_{TP} \cdot 9.81 \cdot L_T$ (see fig 1)	M_{tp} Moment from off center load due to gravity (Nm) K Coefficient = 5 L_T Moment Arm Length (m) m_{TP} Mass (kg)
$M_E = \text{actual value}$ (see fig 2)	M_E External Moment (if existing) (Nm)

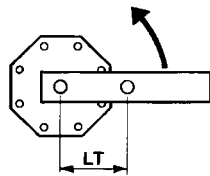


Fig. 1

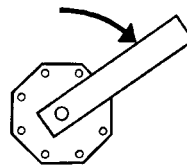


Fig. 2

Calculation of Kinetic Energy

$E = \frac{1}{2} J \cdot \omega_2^2$	E Kinetic Energy (J) J Moment of Inertia (kg·m ²)
$\omega_2 = K \cdot \omega_1$	ω₂ Angular Velocity at Time of Impact (hypothetical) (rad / s) K Coefficient = 1.5
$\omega_1 = \frac{\varphi \cdot \pi}{180 \cdot t}$	ω₁ Average Angular Velocity (rad / s) φ Angle of Rotation (degrees) t Rotation Time (s)

Moment of inertia (J) for different objects

Shape	Sketch	Requirement	Inertia moment J (kg · m ²)	Remarks
Disc		Diameter d (m) Mass m (kg)	$J = \frac{md^2}{8}$	
Stepped disc		Diameter d ₁ (m) d ₂ (m) Mass Portion d ₁ , m ₁ (kg) Portion d ₂ , m ₂ (kg)	$J = \frac{(m_1d_1^2 + m_2d_2^2)}{8}$	When d ₂ is much smaller than d ₁ value of d ₂ is negligible
Shaft, pivoted at one end		Bar length l (m) Mass m (kg)	$J = ml^2/3$	
Shaft centrally pivoted		Bar length l (m) Mass m (kg)	$J = ml^2/12$	
Rectangular block		Side length a (m) b (m) Mass m (kg)	$J = \frac{m(a^2 + b^2)}{12}$	
Shaft with load		Arm length l (m) mass of concentrated load m ₁ (kg) mass of arm m ₂ (kg)	$J = m_1 \cdot l^2 + m_2l^2/3$	When m ₂ is much smaller than m ₁ assume m ₂ to be 0 for calculation

Torque

1	Nm =	8.8507 in.lbs.	1 in.lbs. =	0.1130	Nm
1	Nm =	0.73756 ft.lbs.	1 ft.lbs. =	1.3558	Nm

Force

1	N =	0.22481 lbf	1 lbf =	4.4482	N
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Pressure

1	bar =	14.5038 psi	1 psi =	0.0689	bar
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Energy

1	mJ =	0.00885 in.lbs.	1 in.lbs. =	113.0	mJ
1	J =	8.8507 in.lbs.	1 in.lbs. =	0.1130	J
1	Nm =	8.8507 in.lbs.	1 in.lbs. =	0.1130	Nm

Weight

1	kg =	2.20462 lbs.	1 lbs. =	0.4536	kg
1	kg =	35.2740 oz.	1 oz. =	0.0283	kg

Length

1	mm =	0.03937 in.	1 in. =	25.400	mm
1	m =	39.3701 in.	1 in. =	0.0254	m
1	m =	3.28084 ft.	1 ft. =	0.3048	m

Flow

1	l/min =	0.03531 cfm	1 cfm =	28.3168	l/min
1	l/min =	0.001 Cv	1 Cv =	1000	l/min

Velocity

1	m/s =	39.3701 in/s	1 in/s =	0.0254	m/s
1	m/s =	3.28084 ft/s	1 ft/s =	0.3048	m/s