Rotary Actuators

Series VRS / VRA

Sizes 32, 40, 50, 63, 80, 100 & 125 mm

Rotation 96°, 186° and 366°

PDE2655TCUK

ENGINEERING YOUR SUCCESS.

WARNING

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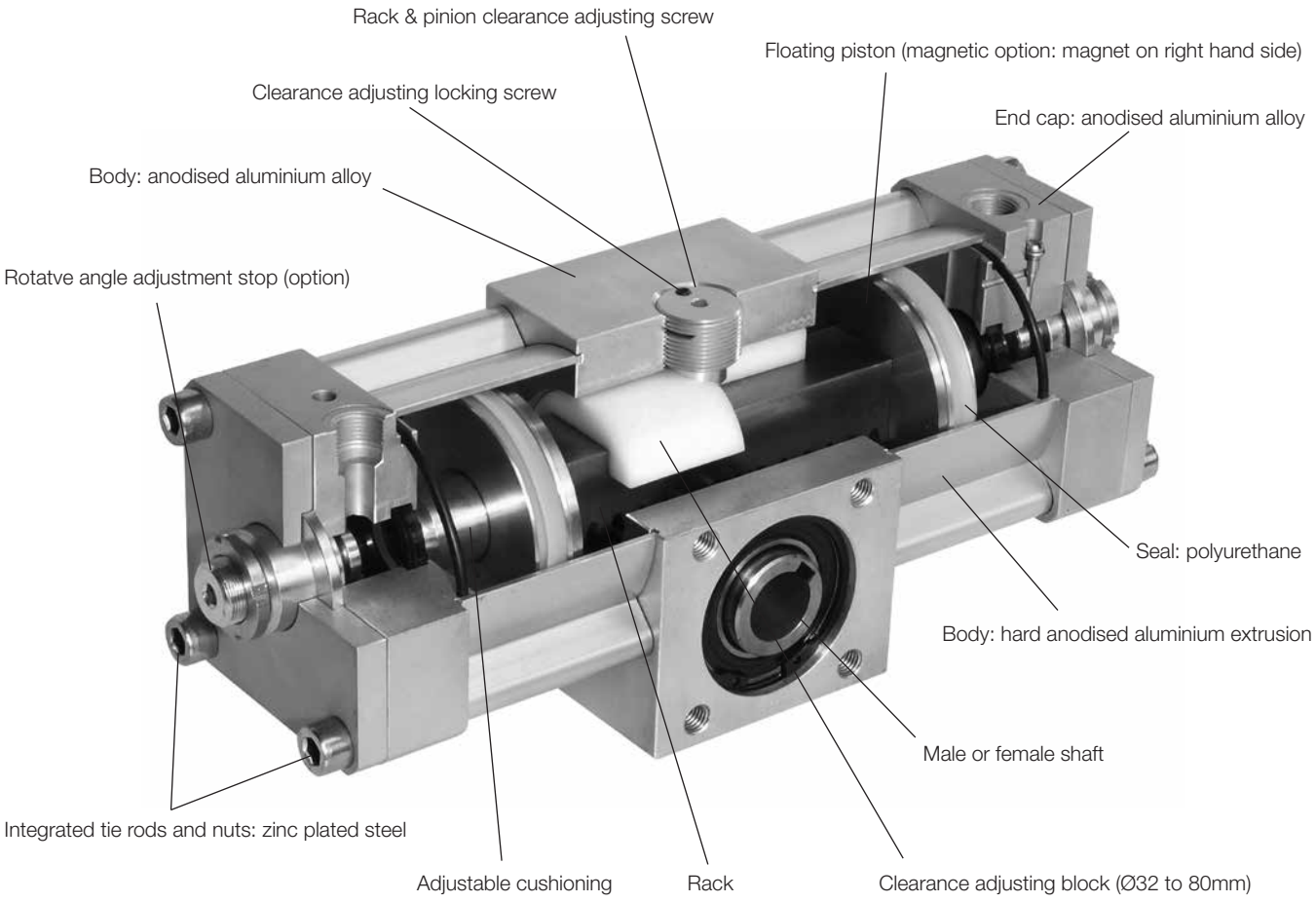
Contents

- Transforms the rectilinear motion of 2 single acting opposite cylinders into rotary motion via a rack and pinion drive contained within the cylinder body.
- Various tasks can be handled by use of a torque cylinder, including gate opening and closing, clamping and agitation of fluids and raw materials.
- Key points of the VRS / VRA cylinder design
  lightweight materials (aluminium alloy)
  accuracy in motion (cushioning, clearance compensation - bores up to 80mm)
  long life (floating piston, nitrile seals, adjustable cushions)
  good resistance to corrosion
  easy cleaning (extruded body)
- Operates with dry, lubricated or non lubricated air
- The range includes bores from Ø32 to 125mm with rotative angles of 96°, 186° and 366°
- Magnetic piston versions can be fitted with P8S sensors and brackets
- Several options are available; rotative angle adjustable stop, male shaft or female shaft (through)

VRS standard version (Ø32 to 125mm)



VRA version (Ø32 to 80mm) for corrosive environment

- Aluminium blanking plate for the clearance adjustment screw
- Rack and pinion gear contained in waterproof enclosure (silicone seal)
- Stainless steel waterproof ball bearings
- Stainless steel pinion
- Stainless steel circlips, internal tie rods and screws
- Optional Magnetic version

Material specification

	VRS	VRA
Rack	XC40 steel	XC40 steel
Floating piston	Aluminium	Aluminium
Magnet (***M version)	Magnetic elastomer	Magnetic elastomer
Piston seals	Polyurethane	Polyurethane
Rack and pinion gear seals		Silicone
Body	Anodised aluminium	Anodised aluminium
Integrated tie rods, nuts, circlips, screws	Zinc plated steel	303 stainless steel
Body	Hard anodised aluminium extrusion	Hard anodised aluminium extrusion
End caps	Anodised aluminium	Anodised aluminium
Male or female transmission shaft	XC40 steel	304 stainless steel (female)
Cushion sleeve	Brass	Brass
Clearance adjusting block (Ø 32 to 80mm)	Acetal	Acetal
Adjusting screw blanking plate		Aluminium + silicone seal

Condition of use

	Ø 32 to 80mm	Ø 100 and 125mm
Temperature range	-10°C to +60°C (14°F to 140°F)	
Pressure range (bar)	0.5 to 10 7 to 145 psi)	0.3 to 10 (4 to 145 psi)
Air condition	Filtered air 40µ, lubricated or non lubricated, dry or non dry	

Theoretical torque

Ø Bore mm	Pinion Module	ØPm	Torque (N.m) 2 bar	4 bar	6 bar	8 bar	10 bar
32	1.5	20	2.4	4.8	7.2	9.6	12
40	2	40	5.0	10.0	15.0	20.0	25
50	2	40	8.0	16.0	24.0	32.0	40
63	3	54	17.0	34.0	51.0	68.0	85
80	3	54	27.0	54.0	81.0	108.0	135
100	5	75	58.0	116.0	174.0	232.0	290
125	5	75	92.0	184.0	276.0	368.0	460

The table above shows the theoretical torque at different pressures. A maximum efficiency of 80% should be assured due to functional losses.

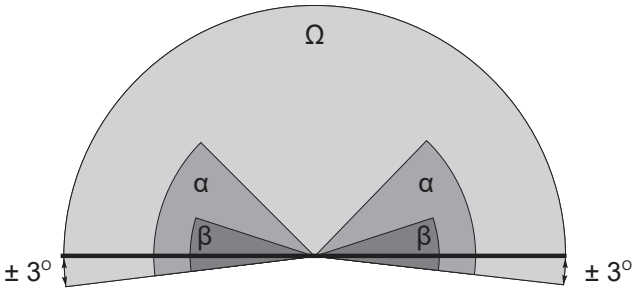
Technical data

Bore (mm)		32	40	50	63	80	100	125
Maximum load (N)	Axial	110	350	350	1050	1050	2500	2500
	Radial	35	220	220	900	900	2000	2000
Cushion angle (°)		50	45	45	32	32	30	30
Nominal moment of inertia (kg.m²)		0.003	0.01	0.02	0.1	0.2	0.3	0.4
Rotative angle (-1°)					96°, 186°, 366°			
Angular tolerance		0°10'	0°10'	0°10'	0°10'	0°10'	1°	1°

Technical data

Rotative angle adjustable stop and cushion angle

Ø Cylinder bore (mm)		32	40	50	63	80	100	125
Rotative angle	Ω	96° 186° 366°	96° 186° 366°	96° 186° 366°	96° 186° 366°	96° 186° 366°	96° 186° 366°	96° 186° 366°
Cushion angle	α	50°	45°	45°	32°	32°	30°	30°
Adjustable angle (R option: Adjustable stop)	β	15°	15°	15°	15°	15°	15°	15°



Maintenance

After 2 million cycles in nominal moment of inertia conditions, the cylinder should be dismantled and seals replaced.
When assembling, grease gear and rack with ESSO GP GREASE or equivalent. Adjust clearance of gear and rack (Ø 32 to 80 cylinder bore) with the screw (1) in order to obtain the following minimum operating pressures (unloaded cylinder), then secure the adjustment with the screw (2).

Backlash adjustment

Ø Bore (mm)	Minimum operating pressure
Ø 32 and 40	0.5 bar (7 psi)
Ø 50 and 63	0.4 bar (6 psi)
Ø 80	0.3 bar (4 psi)

Weight - kg (lbs)

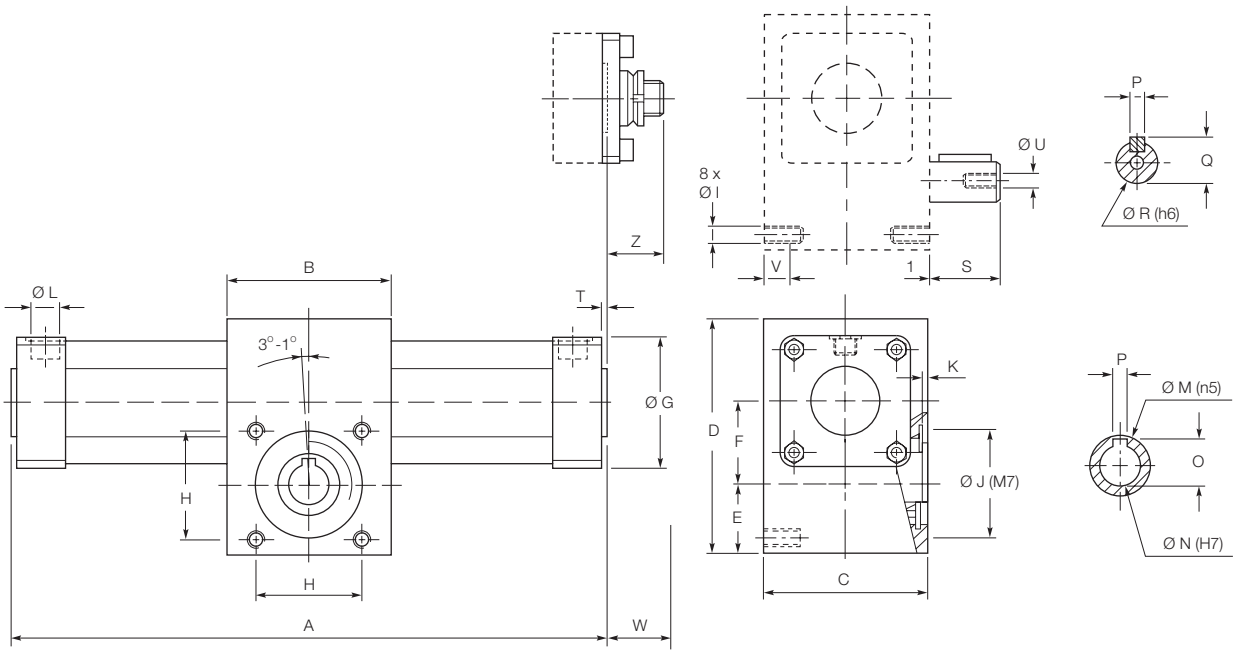
Standard cylinder : Female shaft, 0° rotation, magnetic or non magnetic

Bore (mm)	32	40	50	63	80	100	125
Standard cylinder	1.30 (2.9)	2.20 (4.8)	2.50 (5.5)	5.30 (11.7)	6.20 (13.7)	15.70 (34.6)	17.80 (39.2)
For male shaft	0.10 (0.2)	0.20 (0.4)	0.20 (0.4)	0.45 (1.0)	0.45 (1.0)	1.50 (3.3)	1.50 (3.3
For one adjustable stop	0.15 (0.3)	0.25 (0.5)	0.35 (0.8)	0.35 (0.8)	0.40 (0.9)	1.00 (2.2)	1.00 (2.2)
Per 90° of rotation	0.10 (0.2)	0.30 (0.7)	0.40 (0.9)	0.70 (1.5)	0.80 (1.8)	2.00 (4.4)	2.30 (5.0)

Example : VRM050-186FRN Weight = 2.5 + 0.35 x 1 + 0.40 x 2 = 3.65 kg
(5.5 + 0.77 x 1 + 0.88 x 2 = 8.04 lbs)

Dimensions (mm)

Cylinder bores Ø 32 to 80mm



The location of the shaft key is indicated when the pistons are on the left.
First rotation as indicated (clockwise).

Ω : Rotative angle 96°, 186° or 366°

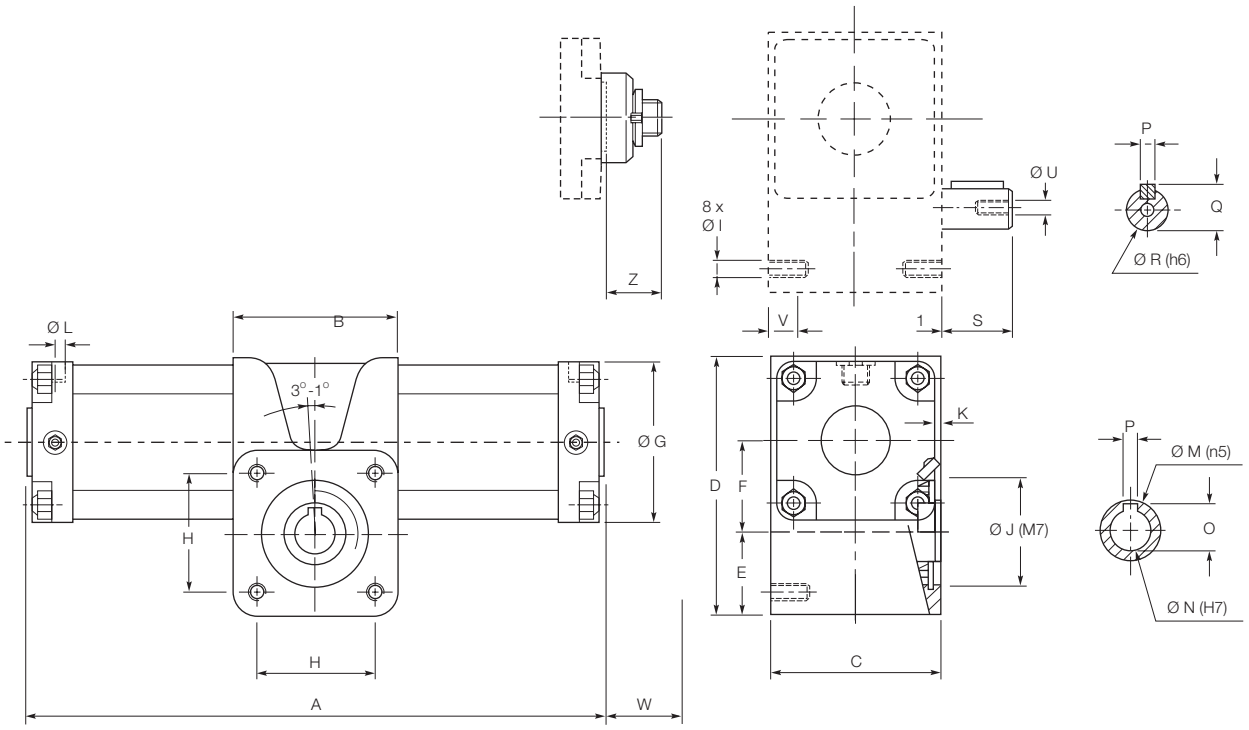
Ø	A*	B	C	D	E	F	G	H	I	J	K	L
32	128 + 0.523 Ω	50	50	72	25.0	24.0	45	35	M6	35	2.0	G1/8"
40	163 + 0.6981 Ω	65	65	95	32.5	29.5	52	47	M8	47	3.0	G1/4"
50	163 + 0.6981 Ω	65	65	95	32.5	29.5	65	47	M8	47	3.0	G1/4"
63	209 + 0.9424 Ω	95	95	126	40.0	38.0	75	62	M10	62	3.5	G3/8"
80	209 + 0.9424 Ω	95	95	126	40.0	38.0	95	62	M10	62	3.5	G3/8"

Ø	M	N	O	P	Q	R	S	T	U	V	W*	Z
32	17	10	11.7	4	13.5	12	20	2	M4 x 10	10	22	31
40	25	15	17.2	5	18.0	16	30	3	M5 x 15	12	24	35
50	25	15	17.2	5	18.0	16	30	3	M5 x 15	12	29	35
63	35	24	27.2	8	27.0	24	40	3	M8 x 20	15	32	32
80	35	24	27.2	8	27.0	24	40	3	M8 x 20	15	32	32

* Add W to A for the magnetic version (magnet on right hand side as standard).

Dimensions (mm)

Cylinder bores Ø 100 to 125mm



The location of the shaft key is indicated when the pistons are on the left.
First rotation as indicated (clockwise).

Ω : Rotative angle 96°, 186° or 366°

Ø	A*	B	C	D	E	F	G	H	I	J	K	L
100	304 + 1.309 Ω	130	142	188	64.0	53.5	115	90	M14	90	4.5	G1/2"
125	304 + 1.309 Ω	130	142	188	64.0	53.5	140	90	M14	90	4.5	G1/2"

Ø	M	N	O	P	Q	R	S	U	V	W*	Z
100	55	35	38.7	10	38.5	35	50	M12 x 20	24	4	38
125	55	35	38.7	10	38.5	35	50	M12 x 20	24	4	38

* Add W to A for the magnetic version (magnet on right hand side as standard).

Ordering references

Standard										Option
V R	S	M	0 5 0	-	1 8 6	F	R	N	1	3

	Version
S	Standard Bores 32 - 125 mm
A	Corrosive Environment Bores 32 - 100 mm

	Series
M	Magnetic

Ø mm
32
40
50
63
80
100
125

Rotation Angle
096 = 96°
186 = 186°
366 = 366°

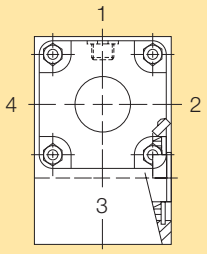
	Shaft
F	Female
M	Male

	Left Endplate
N	Without angle adjustment
R	With angle adjustment

	Right Endplate
N	Without angle adjustment
R	With angle adjustment

	Left Endplate
1	Standard position of port
2, 3, 4	Other positions

	Right Endplate
1	Standard position of port
2, 3, 4	Other positions



Position of port to diagram above. (Position 1 as standard if not specified)

Maintenance - Seal kit

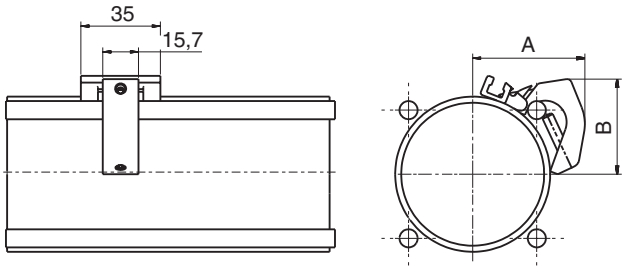
Bore (mm)	32	40	50	63	80	100	125
Actuators VRS/ VRSM Actuators VRA / VRAM	JJVRA032	JJVRA040	JJVRA050	JJVRA063	JJVRA080	JJVR100	JJVR125

Sensors

VRSM and VRAM cylinders can be fitted with sensors.
These sensors use the following mounting bracket.

Ø Bore (mm)	32	40	50	63	80	100	125
Mounting bracket			P8S-TMA0X*				
A	35	39	48	50	58	70	
B	30	35	42	48	56	65	

Note: Mounting brackets and sensors must be ordered seperately
* Please consult Technical Department for 125 mm bore.



Adapter for tie-rod design

Description	Weight [kg]	Order code
Double jointed adapter for bore Ø 32 to 125 mm	0.07	P8S-TMA0X

Electronic sensors

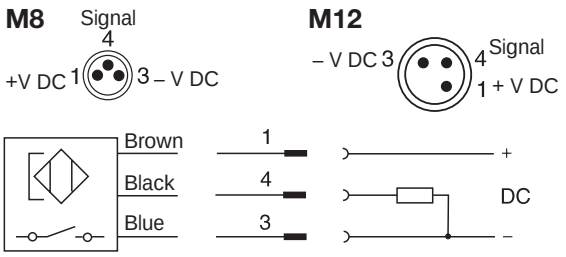
The electronic sensors are "Solid State", i.e. they have no moving parts at all. They are provided with short-circuit protection and transient protection as standard. The built-in electronics make the sensors suitable for applications with high on and off switching frequency, and where very long service life is required.

Reed sensors

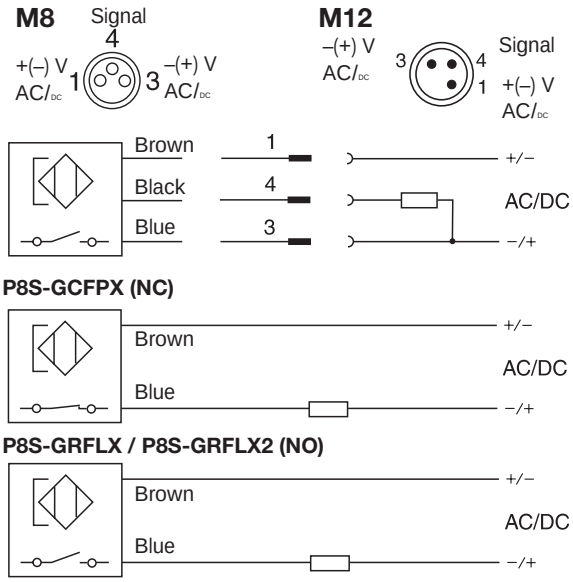
The sensors are based on proven reed switches, which offer reliable function in many applications. Simple installation, a protected position on the cylinder and clear LED indication.

	Electronic	Reed
Cylinder type:	Profile with T-slot	
Cylinder type with adaptor:	Profile with S-slot (dovetail) | Tie rods | Round cylinders	
Installation:	Drop-in. Fixed by 1.5 mm stainless steel allen key or flathead screwdriver.	
Housing length:	34.7 mm | 31.5 mm (ATEX)	
Output Type / Function:	PNP, Normally Open (NO) | NPN, Normally Closed (NC)	Normally Open (NO) | Normally Closed (NC)
Switching (on/off) switching frequency:	≤1000 Hz	± 400 Hz
Degree of Protection (IP):	IP67	
Power consumption:	≤ 10 mA	-
Input Supply Voltage Range:	10 to 30 V DC | 18 to 30 V DC (ATEX)	10 to 30 | 10 to 120 | 10 to 230 V AC/DC (2-wire) | 10 to 30 V AC/DC (3-wire)
Voltage Drop:	≤ 2,2 V	≤ 3,5 V (2-wire NO) | ≤ 0,1 V (3-wire) | ≤ 0,1 V (2-wire NC)
Continuous output current:	≤ 100 mA | ≤ 70 mA (ATEX)	≤ 100 mA (2-wire NO) | ≤ 500 mA (3-wire) | ≤ 500 mA (2-wire NC)
Switching capacity:	-	≤ 10 W
Hazardous area category:	3G / 3D (ATEX)	-
Protection Class:	III	II (2-wire) | III (3-wire)
Response Sensitivity:	2.65.. 2.95 mT	2.1.. 3.4 mT
Overrun Distance:	3 mm	9 mm
Histeresis:	≤ 0.5 mT	≤ 0.2 mT
Repeatability:	≤ 0.1 mT	
Reverse Polarity Protection:	Yes	
Short-circuit Protection:	Yes	-
Power-up Pulse Protection:	Yes	-
Ambiant Operating Temperature Range:	-25 to +75 °C (PUR cable) | -20 to +70°C (PVC cable) | -20 to +45°C (ATEX)	
Shock and Vibration resistance:	30 g 11 ms / 10 … 55 Hz, 1 mm	
EMC:	According to EN 60947-5-2	
Industry Standard:	CE | C UL US | RoHs | Ex	CE | C UL US | RoHs
UL Certification:	On request	
Housing Material:	Plastic polyamid PA12 (ATEX) | PA66	Plastic polyamid PA12 (2-wire 240V) | PA66
Cable Specification:	PUR (Polyurethane) | PVC (Polyvinyl Chloride)	
Conductor Cross-Section:	0.14 mm² (3 wire)	0.14 mm² (3-wire) | 0.12 mm² (2-wire)
Colour of LED:	Yellow	
Connection Style:	M8 snap-in | M8R (knurled nuts) | M12 (knurled nuts) | None (Flying lead)	

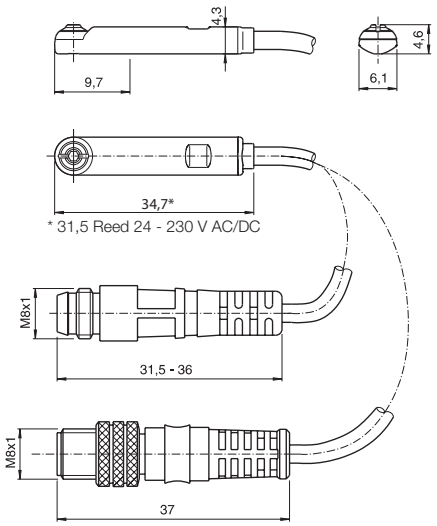
Electronic sensors



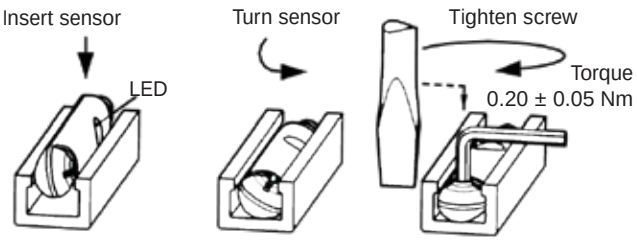
Reed sensors



Dimensions [mm]



Sensor Installation



Sensors

Output/function	Cable/connector	Weight [kg]	Order code
Electronic sensors, 10-30 V DC			
PNP type, normally open	0.27 m PUR cable and 8 mm snap-in male connector	0.007	**P8S-GPSHX**
PNP type, normally open	0.27 m PUR cable and M12 screw male connector	0.015	**P8S-GPMHX**
PNP type, normally open	3 m PVC cable without connector	0.030	**P8S-GPFLX**
PNP type, normally open	10 m PVC cable without connector	0.110	**P8S-GPFTX**
Reed sensors, 10-30 V AC/DC			
Normally open	0.27 m PUR cable and 8 mm snap-in male connector	0.007	**P8S-GSSHX**
Normally open	0.27 m PUR cable and M12 screw male connector	0.015	**P8S-GSMHX**
Normally open	3 m PVC cable without connector	0.030	**P8S-GSFLX**
Normally open	10 m PVC cable without connector	0.110	**P8S-GSFTX**
Normally closed	5 m PVC cable without connector without LED	0.050	**P8S-GCFPX**
Reed sensors, 10-120 V AC/DC			
Normally open	3 m PVC cable without connector	0.030	**P8S-GRFLX**
Reed sensors, 24-230 V AC/DC			
Normally open	3 m PVC cable without connector	0.030	**P8S-GRFLX2**

Male connectors for connecting cables

Cable connectors for producing your own connecting cables. The connectors can be quickly attached to the cable without special tools. Only the outer sheath of the cable is removed. The connectors are available for M8 screw connectors and meet protection class IP 65.

Technical data

Operating voltage:	max. 32V AC/DC
Operating current per contact:	max. 4 A
Connection cross section:	0.25.... 0.5 mm² (conductor diameter min 0.1)
Protection class:	IP65 And IP 67 when plugged and screwed down (EN 60529)
Temperature range:	- 25... +85°C

Connector	Weight [kg]	Order Code
M8 screw connector	0.018	**P8CS0803J**
M12 screw connector	0.022	**P8CS1204J**

Connecting cables

Description	Weight [g]	For Product Series	Order Code
Cable flex PVC 3 meter with 8mm snap-in connector / flying leads	70	P8S Sensors with M8	**9126344341**
Cable flex PVC 10 meter with 8mm snap-in connector / flying leads	210	P8S Sensors with M8	**9126344342**
Cable PUR 3 meter with 8mm snap-in female connector / flying leads	70	P8S Sensors with M8	**9126344345**
Cable flex PUR 10 meter with 8mm snap-in connector / flying leads	210	P8S Sensors with M8	**9126344346**
Cable PVC 2.5 meter with M8 screw connector / flying leads	60	P8S Sensors with knurled M8	**KC3102**
Cable PVC 5 meter with M8 screw female connector / flying leads	120	P8S Sensors with knurled M8	**KC3104**

Specifying air quality (purity) in accordance with ISO8573-1:2010, the international standard for compressed air quality

ISO8573-1 is the primary document used from the ISO8573 series as it is this document which specifies the amount of contamination allowed in each cubic metre of compressed air.

ISO8573-1 lists the main contaminants as Solid Particulate, Water and Oil. The purity levels for each contaminant are shown separately in tabular form, however for ease of use, this document combines all three contaminants into one easy to use table.

ISO8573-1:2010 CLASS	Solid Particulate				Water		Oil
	Maximum number of particles per m^3			Mass Concentration mg/m^3	Vapour Pressure Dewpoint	Liquid g/m^3	Total Oil (aerosol liquid and vapour) mg/m^3
	0,1 - 0,5 micron	0,5 - 1 micron	1 - 5 micron				
0	As specified by the equipment user or supplier and more stringent than Class 1						
1	≤ 20 000	≤ 400	≤ 10	-	≤ -70 °C	-	0,01
2	≤ 400 000	≤ 6 000	≤ 100	-	≤ -40 °C	-	0,1
3	-	≤ 90 000	≤ 1 000	-	≤ -20 °C	-	1
4	-	-	≤ 10 000	-	≤ +3 °C	-	5
5	-	-	≤ 100 000	-	≤ +7 °C	-	-
6	-	-	-	≤ 5	≤ +10 °C	-	-
7	-	-	-	5 - 10	-	≤ 0,5	-
8	-	-	-	-	-	0,5 - 5	-
9	-	-	-	-	-	5 - 10	-
X	-	-	-	> 10	-	> 10	> 10

Specifying air purity in accordance with ISO8573-1:2010
When specifying the purity of air required, the standard must always be referenced, followed by the purity class selected for each contaminant (a different purity class can be selected for each contamination if required).
An example of how to write an air quality specification is shown below:

ISO 8573-1:2010 Class 1.2.1
ISO 8573-1:2010 refers to the standard document and its revision, the three digits refer to the purity classifications selected for solid particulate, water and total oil. Selecting an air purity class of 1.2.1 would specify the following air quality when operating at the standard's reference conditions:

Class 1 - Particulate
In each cubic metre of compressed air, the particulate count should not exceed 20,000 particles in the 0.1 - 0.5 micron size range, 400 particles in the 0.5 - 1 micron size range and 10 particles in the 1 - 5 micron size range.

Class 2 - Water
A pressure dewpoint (PDP) of -40°C or better is required and no liquid water is allowed.

Class 1 - Oil
In each cubic metre of compressed air, not more than 0.01mg of oil is allowed. This is a total level for liquid oil, oil aerosol and oil vapour.

ISO8573-1:2010 Class zero
- **Class 0 does not mean zero contamination.**
- **Class 0 requires the user and the equipment manufacturer to agree contamination levels as part of a written specification.**
- **The agreed contamination levels for a Class 0 specification should be within the measurement capabilities of the test equipment and test methods shown in ISO8573 Pt 2 to Pt 9.**
- **The agreed Class 0 specification must be written on all documentation to be in accordance with the standard.**
- **Stating Class 0 without the agreed specification is meaningless and not in accordance with the standard.**
- **A number of compressor manufacturers claim that the delivered air from their oil-free compressors is in compliance with Class 0.**
- **If the compressor was tested in clean room conditions, the contamination detected at the outlet will be minimal. Should the same compressor now be installed in typical urban environment, the level of contamination will be dependent upon what is drawn into the compressor intake, rendering the Class 0 claim invalid.**
- **A compressor delivering air to Class 0 will still require purification equipment in both the compressor room and at the point of use for the Class 0 purity to be maintained at the application.**
- **Air for critical applications such as breathing, medical, food, etc typically only requires air quality to Class 2.2.1 or Class 2.1.1.**
- **Purification of air to meet a Class 0 specification is only cost effective if carried out at the point of use.**

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