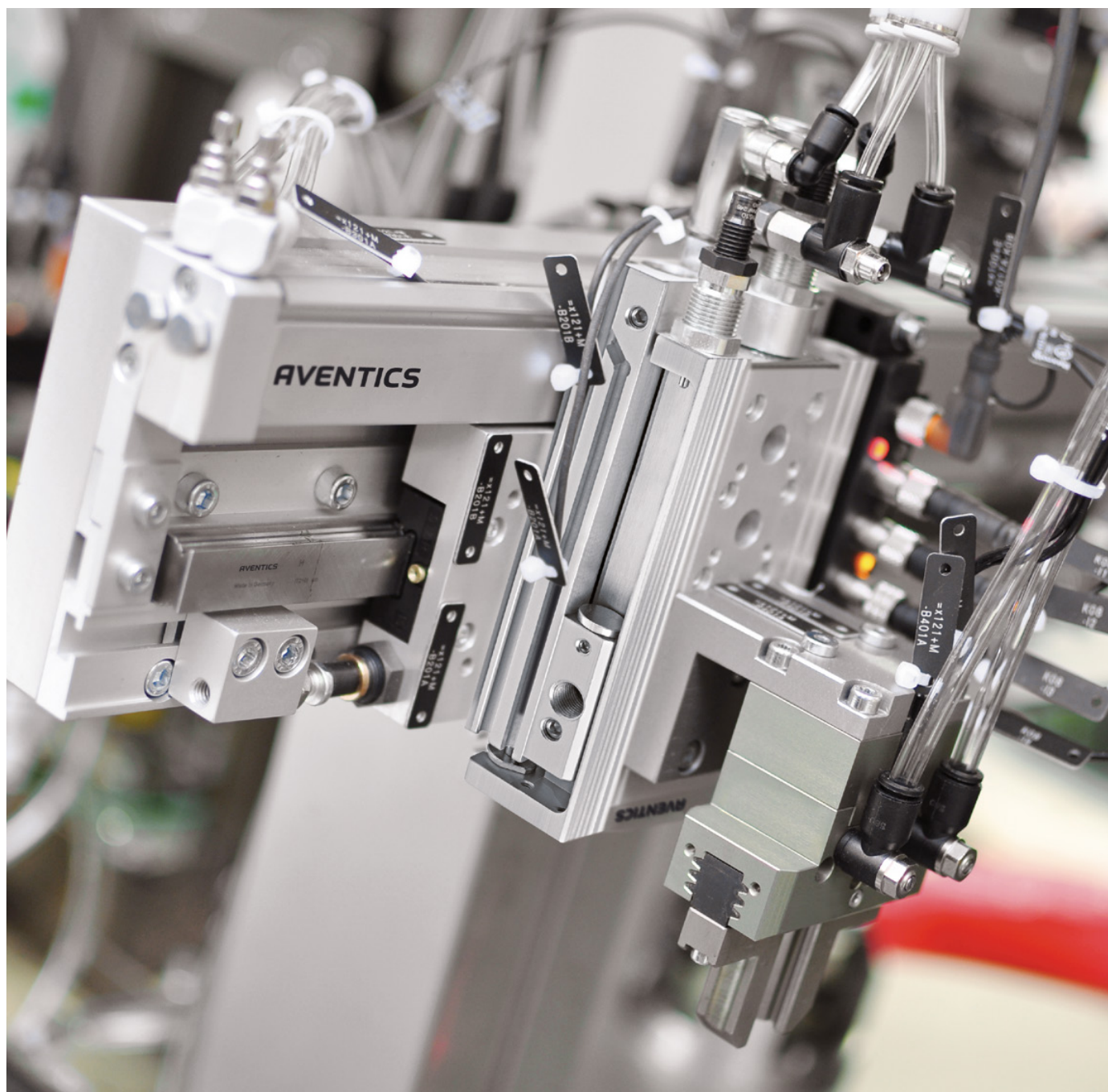




HIGHLY SENSITIVE, SAFE
AND RELIABLE
SENSOR TECHNOLOGY
FOR PNEUMATIC CYLINDERS

Pneumatics
It's that easy





The choice is yours

We offer a wide range of sensors for pneumatic cylinders with complex, highly innovative sensor solutions and unparalleled operating ease of use, as well as many sensors for standard tasks. Always perfectly matched to your application.

Intelligent sensor technology – the foundation for precision and reliability

There is no such thing as semi-precise. In our work, we accept nothing less than absolute precision. Anything else would be a contradiction in terms. In automation technology, tolerance has its limits, which are extremely narrow. Processes demand precision; controls require accurate signals. These tasks are a perfect fit for sensor technology from AVENTICS.

The right sensor solutions for every cylinder application

Automation technology demands excellent functionality and precision, which in turn require solid expertise at all levels. In addition to the quality of an individual sensor solution, with well matched sensors and connections, application-specific integration makes a critical difference in overall quality. Perfectly matched cylinders and sensors guarantee the best results.



- Broad range of first-class components
- Specific application experience and cross-technology expertise in different industries

Together with our customers, we have worked for decades to develop our experience and a product portfolio that is precisely tailored to meet the needs of the respective industry. Take advantage of our experience and talk to our industry experts – available around the world wherever you need them!

04 Fundamentals of sensor technology

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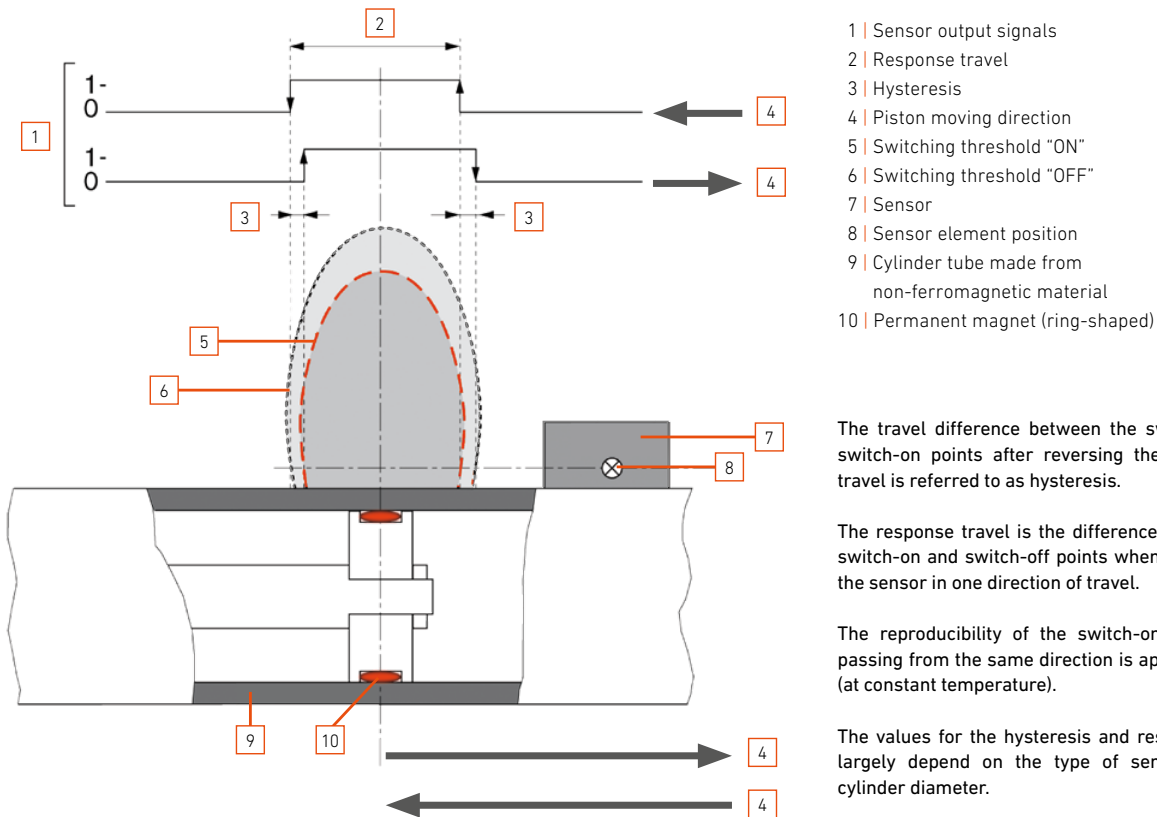
Invisible but detectable: Sensors measure changes in magnetic fields

Magnetic proximity switching in pneumatic drives

Different sensor technologies are used to confirm the piston position of a pneumatic cylinder and to input signals into the control system. Depending on the measurement task and application, simple electric magnetic sensors or complex non-contact electronic sensors may be the right choice. All sensor types use the measurability of changes in magnetic fields as their basic functional principle. On a cylinder with a non-ferromagnetic cylinder tube, a magnetically sensitive

sensor is mounted externally and operated by the magnetic field of a permanent magnet integrated into the cylinder piston. With proximity sensors, piston movement within the sensor range intensifies magnetic induction, and the sensor reacts as soon as a specific threshold is reached. In contrast, distance measuring sensors work according to the Hall effect principle.

Sensor switching characteristics



Sensor technology uses the principle of magnetic proximity switching for non-contact measurements and signals

Various sensor technologies

Various sensor principles are used in automation technology. Depending on the application, you may choose from electrical cylinder sensors based on reed contacts with contact blades or fully electronic, absolutely contact-free sensors with semiconductor elements.

Electric sensors (Reed)

For the electric sensor with Reed contact, two contact studs in a small glass tube are oppositely magnetized by the magnetic field of the piston ring magnet. The Reed contact is closed and can be evaluated by the control.

Electronic sensors (PNP, NPN)

Electronic sensors operate on a completely non-contact basis and consist of a magnetically sensitive semi-conductor sensor element and sensor electronics with a threshold value switch. When a certain magnetic induction value is exceeded, a signal is generated and transmitted to the control via an output stage.

Hall effect sensors

Electrical current flows through a thin semi-conductor wafer. A magnetic field is applied at a right angle to the wafer surface. This causes the charge carrier in the element to be diverted from the current flow direction, which can be measured as Hall voltage at a right angle to the direction of current.

GMR effect sensors

A GMR sensor element consists of two oppositely magnetized conductive layers separated by an insulating layer. If a magnetic field acts on these layers, the magnetic fields align themselves in the same direction. This results in a change in the electric resistance, which can be measured and used as signal information.

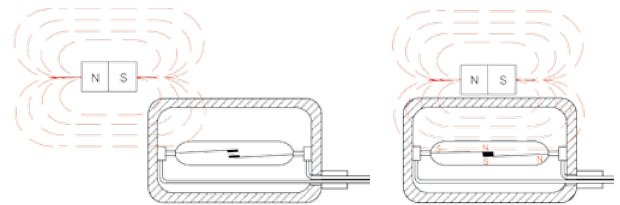
System display of different sensor technologies using the AVENTICS ST6 sensor series as an example

ST6 with Reed

Reed sensor



Reed contact

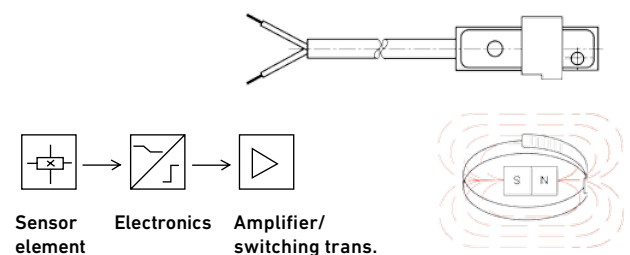


ST6 with GMR

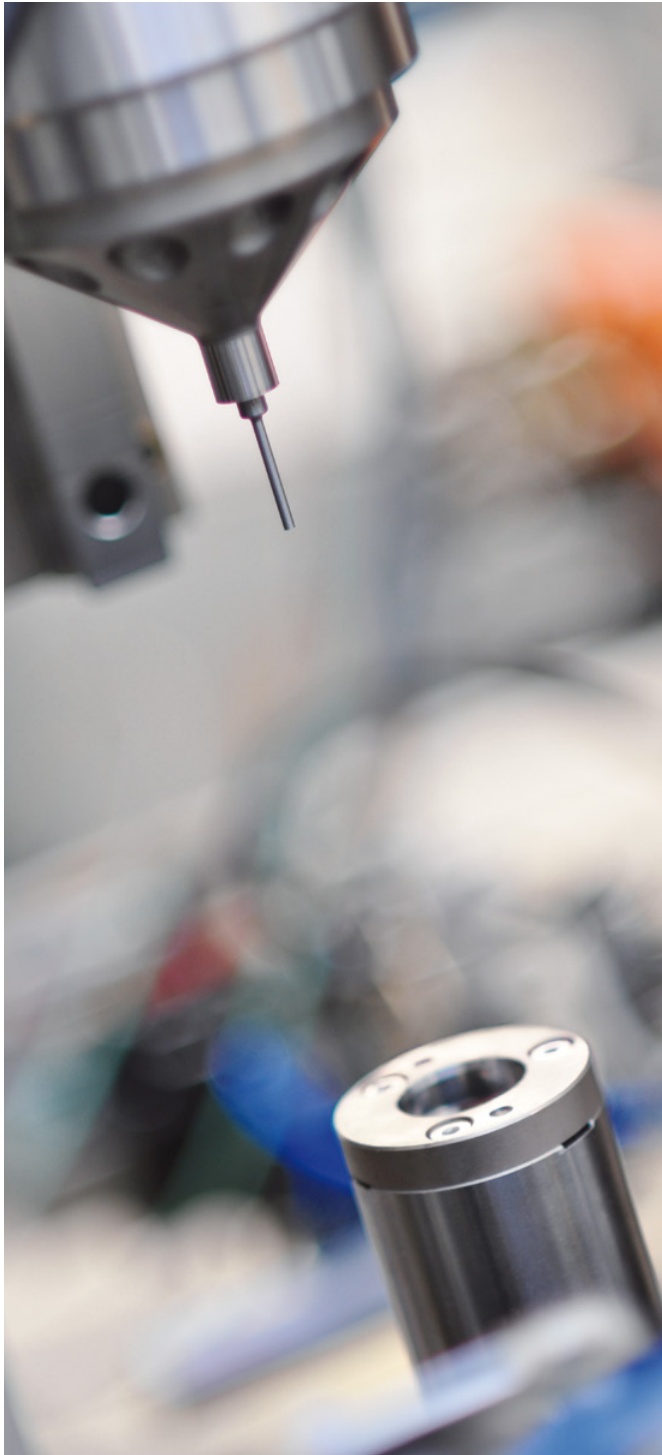
Electronic magnetic field sensor



The electronic magnetic field sensor



High-tech sensors from AVENTICS – providing new impulses in automation technology



Quality and reliability

Nothing gets past AVENTICS high-tech sensor technology. Inquisitive and diligent, honest and confident. Always the right impulses for reliable process control, precisely when you need it: the fundamental prerequisite for reliable quality and process repeatability.

Perfectly matched sensors and cylinders

Perfect harmony for excellent system operation. Well – acquainted products communicate with ease; information never goes missing. The AVENTICS sensor range has it all – practical experience, reliable quality and cutting-edge innovations:



- Distance measuring sensors that not only measure piston positions, but also distances traveled
- Two-point sensors with “eyes” in the front and back of their “heads”

Precision. Down to the last millisecond

Highly sensitive sensor technology is increasingly important in factory automation. Ever faster processes, shorter cycle times and the trend toward greater precision, especially in small handling, require uncompromising accuracy. AVENTICS sensors set standards in this area. Some control technologies are actually not able to process their measurements quickly enough, so the sensors have to be slowed down through artificial signal stretching.

Systematic, user-oriented, proven – the AVENTICS sensor range

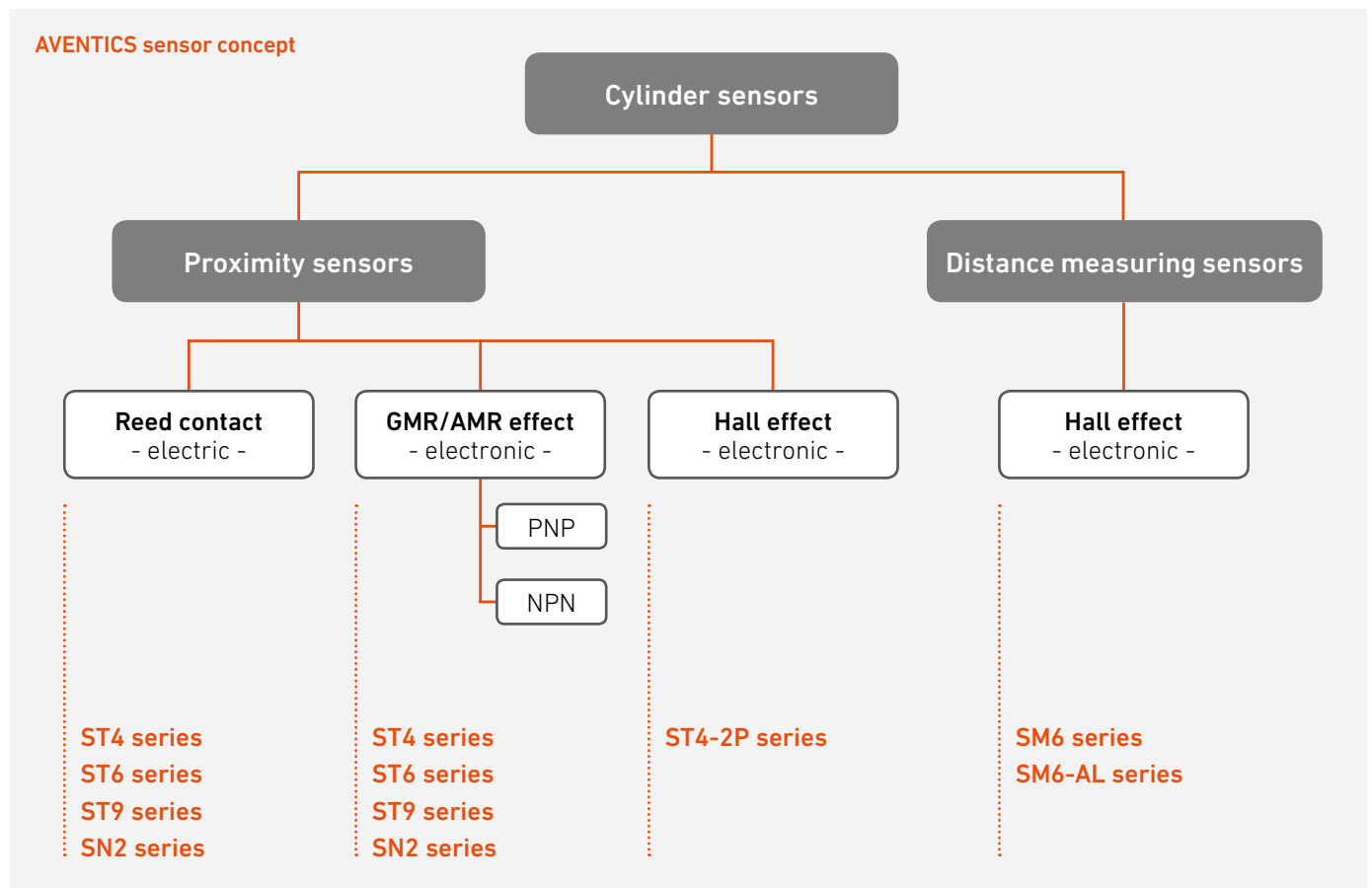
Cylinder sensors with comprehensive technology for targeted use

An extensive range of sensor technologies needs to reflect a multitude of applications, as well as highly individual machine designs, control systems and working environments. AVENTICS product range is well equipped to meet diverse requirements and always has the right solutions at hand. Whether you need distance measuring sensors or proximity sensors, electronic or electric solutions – with an optimum sensor/magnet combination tailored to the AVENTICS cylinder series, reliable functioning is a given.

Comprehensive product range

To account for all possibilities, in addition to sensors from its core series, AVENTICS offers a wide range of additional sensor series and sensors with specific extra features.

- Sensors for all conventional sensor nuts
- Special sensor mountings for all cylinder series for assembly without a slot
- ATEX sensors, welding-proof sensors, sensors with pulse stretching, heat-resistant sensors, sensors with UL approval
- Optional connection types M8, M12, and open cable ends
- Versions with “+” output switching (PNP) or “–” output switching (NPN)

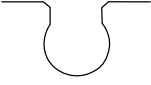
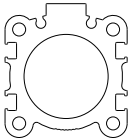
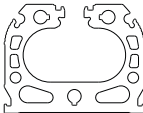
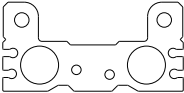
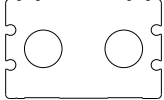
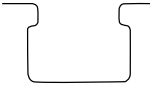
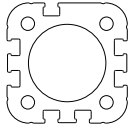
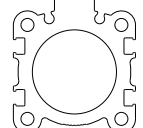
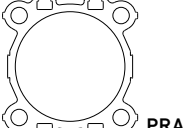
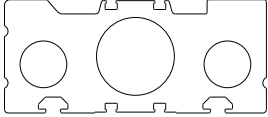
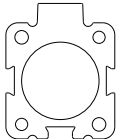


Mountings, nut geometries and compatibility

From the cylinder to the right sensor

From rodless cylinders with large travel distances to the smallest short-stroke cylinders, or from guided slides and pneumatic grippers of a handling system to sturdy ISO standard cylinders – it's good to know that suitable sensors are available for every type of pneumatic actuator. An additional major advantage is being able to rely on sensors from the same product family that can be used in a wide variety of contexts. Just like the sensors offered by AVENTICS.

Examples of AVENTICS nut geometries

Sensor nut	Cylinder series			
 4 mm C-nut	 SSI	 RTC	 MSC	 RCM
 6 mm T-nut	 CCI	 SSI	 PRA	 GPC
 Dovetail nut	 KHZ			

Installation in nuts or with sensor mountings

The most elegant method to position sensors in the cylinder profile is to use the sensor nuts provided for mounting. They require no additional installation space and can be easily positioned and secured with only a single turn. For mounting independent from the nut geometry, specifically developed sensor mountings are available for all sensors, cylinders and application conditions.

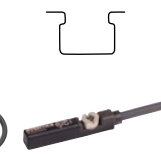
Examples of sensor mountings

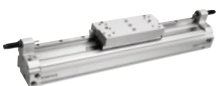
CB1 series								
								
Sensors	ST6, SN1, SN2	ST6, SM6	ST4, ST6	ST6	SN1, SN2	SM6, SM6-AL, ST6, SN2	ST6	SM6-AL
Cylinders	TRB, CVI, 523	MNI, ICM	MNI, ICM, CSL-RD	KHZ	MNI	ITS	ICL	RTC

Overview of the basic compatibility between the sensor series and cylinder series

Recommended sensors
for on-cylinder mounting:

- via the nut: ●
- via sensor mounting: ○

						
SM6 series	SM6-AL series	ST4 series	ST4-2P series	ST6 series	ST9 series	SN2 series
Page 10	Page 11	Page 12	Page 13	Page 14	Page 15	Page 16

MNI  ISO	○		○	○	○		○
ICM  ISO							
CSL 			○	○	○		○
RPC 					○		
CCI/KPZ  ISO	●				●		
SSI 	●		●	●	●		
KHZ 					○	●	
PRA/CVI  ISO	●	○	●	●	●		○
TRB/CVI  ISO	○				○		○
ITS  ISO	○	○			○		○
ICL  ISO					○		
RTC 		○	●		○		
GSU/CKP 			●				
GPC 	●		●	●	●		
MSC 			●	●			
MSN 			●	●			
RCM 			●	●			

SM6 sensor series – analog distance measuring sensors for cylinders with 6 mm T-nut

Excellent sensor technology with

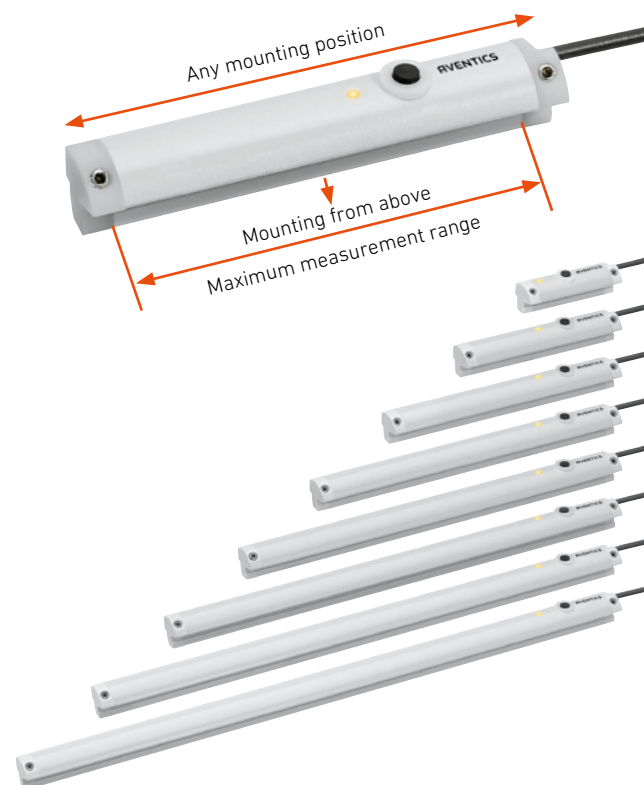
a flexible measurement range. The sensors from the SM6 series allow the piston position on a pneumatic cylinder to be measured with high precision and ease. The SM6 can be used with all standard cylinders – special cylinders are not required. Thanks to simple mounting in the nut from above, flexible settings within the maximum distance measurement range and an extremely high proximity switching rate, the SM6 sensor is ideal for demanding automation solutions.

- Suitable for 6 mm nut
- Zero point and measurement range settings via teach-in button
- Choice of any mounting position and cable exit
- Mounting from above in the nut ("drop-in" mounting)
- High accuracy and linearity
- Excellent repeatability and reliability through proven Hall sensors
- Eight different sizes offered in the series to meet all required distance measurement ranges

Series	SM6
Type of contact	Hall, electronic
Max. distance meas. range	32, 64, 96, 128, 160, 192, 224, 256 mm
Electric version	4-pin
Supply voltage	DC 15 to 30 V DC
Proximity switching interval	1 ms
Typical distance resolution	0.05 mm
Reproducibility	$\leq \pm 0.1$ mm
Linearity deviation	0.3 mm
Analog output, current	4 to 20 mA
Analog output, voltage	0 to 10 V DC
Typical idle current	25 mA
Protection class	IP65, IP67
Ambient temperature	-20 to +70 °C
Connection variants	Free wire ends, M8



SM6 sensor series



Connection variants:



SM6-AL sensor series – perfect distance measurement and high operating comfort

Sensor for continuous recording of piston movements

The analog SM6-AL distance measuring sensor enables high-resolution distance measurement and exact positioning in measurement ranges from 107 to 1,007 millimeters. The distance measuring sensor is thus perfectly suited for the continuous recording of piston movements in pneumatic cylinders and is an ideal solution for cylinders with medium and long strokes. The robust, chemical-resistant aluminum housing, as well as a cable sleeve support, guarantee a long sensor service life and reduce maintenance costs.

- Zero point and measurement range settings via teach-in button
- Choice of any mounting position and cable exit
- High accuracy and linearity
- Excellent repeatability and reliability through proven Hall sensors
- A flexible selection of sizes is offered in the series to meet all required distance measurement ranges
- Convenient communication via IO-Link with teach pad and 4-color LED display

Series	SM6-AL
Type of contact	Hall, electronic
Max. distance meas. range	107 to 1,007 mm
Electric version	4-pin
Supply voltage	DC 15 to 30 V DC
Proximity switching interval	< 1.15 ms
Typical distance resolution	≤ 0.03 % FSR
Reproducibility	≤ 0.06 % FSR
Linearity deviation	0,5 mm
Analog output, current	4 to 20 mA
Analog output, voltage	0 to 10 V DC
Typical idle current	35 mA
Protection class	IP65, IP67
Ambient temperature	-20 to +70 °C
Connection variants	M8

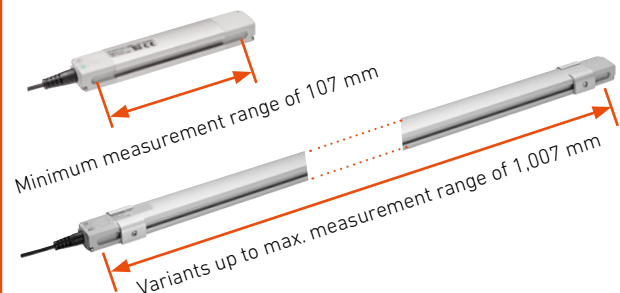
FSR = Full Scale Range, max. measurement range



SM6-AL sensor series



 **IO-Link**



Connection variants:



ST4 sensor series – our smallest sensor for handling technology

Precise, reliable, flexible, and user-friendly

High-tech in the smallest of spaces. Minimum dimensions the sensors in the ST4 series the right choice when every millimeter counts. They can be integrated in all pneumatic actuators and are ideal for small handling. The ST4 can be assembled quickly and easily with just a ¼ turn of the combination screw.

- Suitable for 4 mm C-nut
- Mounting from above in the nut ("drop-in" mounting)
- Robust housing, LED display
- Combined mounting screw with hexagon socket and slotted screw
- Captive screw, fixing via quarter turn



Series	ST4
Type of contact	Reed, electronic PNP, NPN, 3-pin
Dimensions in mm (LxHxW)	Approx. 23,7/26,3 x 4,7 x 2,9
Supply voltage	10-30 V AC/DC
Continuous current	100 mA
Reproducibility	≤ ± 0.1 mm
Protection class	IP65, IP67
Ambient temperature	-40/-30 to +80°C/variant-dependent
Connection variants	Free wire ends, M8, M12



ST4 sensor series



Connection variants:



ST4-2P sensor series – the two-point sensor makes so many things even easier

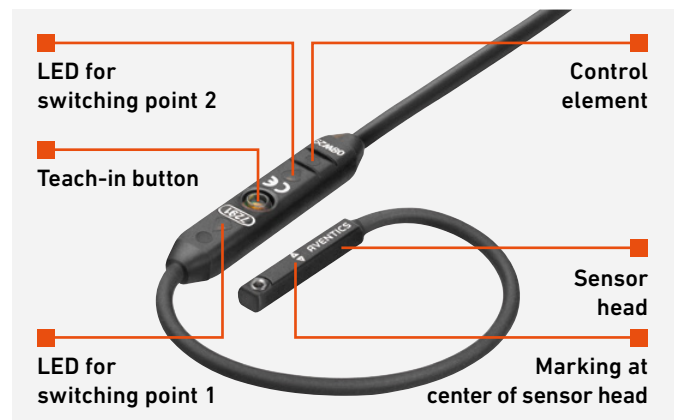
ST4-2P series with two switching points

ST4-2P series sensors make it possible to measure any two switching points in a 50 mm range using just one sensor in a 4 mm C-slot. As a result, there is no need to install a second sensor, making the process easier, faster, and more precise. Assembly and cabling effort is also halved. A serial interface is provided for diagnosis and configuration.

- Suitable for 4 mm C-nut
- Zero point and measurement range settings via teach-in button or IO-Link
- Versions with or without I/O link interface



Series	ST4-2P
Type of contact	Hall, make-contact 2 x PNP, 4-pin
Dimensions in mm (LxHxW)	Approx. 19,5 x 2,9 x 3,8
Supply voltage	12-30 V AC/DC
Continuous current	≤ 100 mA
Reproducibility	≤ ± 0.1 mm at constant T
Protection class	IP65, IP67
Ambient temperature	-25 to +75 °C
Connection variants	Free wire ends, M8, M12



ST4-2P sensor series



 **IO-Link**

Connection variants:



ST6 sensor series – the classic sensor in automation for the 6 mm T-nut

Universal use, flexible integration, and excellent form

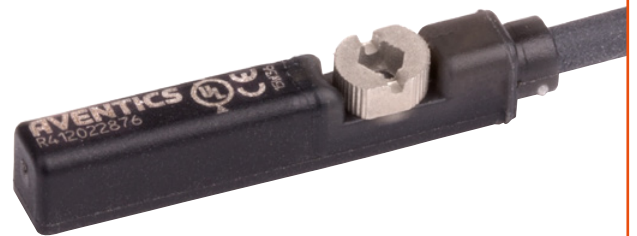
ST6 series sensors are suitable for mounting in the 6 mm T-slot as well as sensor mounting to the cylinder. They are perfectly suited for mounting to all round cylinders, tie rod cylinders, and profile cylinders. With their optimized, compact shape, the sensors can be flush-fit into existing slots and integrated into any machine environment, even with sensor mounting. Retaining ribs on the side of the sensor enable simple mounting, including in hard-to-reach locations or for overhead assembly. The durable mounting screw holds the sensor in the desired position and can withstand shocks or vibrations.

- Universal sensors for the standardized 6 mm nut
- Mounting from above in the nut ("drop-in" mounting)
- Wide range of versions with different line lengths and connections
- Combined mounting screw with hexagon socket and slotted screw
- Captive screw, fixing via ¼ turn
- Reed and electronic PNP or NPN sensor versions
- Versions with ATEX certification or temperature resistance
- Protected against polarity reversal, short-circuit-resistant



Series	ST6
Type of contact	Reed, electronic PNP, NPN
Dimensions in mm (LxHxW)	Approx. 29.5/32.5 x 5.8 x 4.8/5.7
Supply voltage	10-30 V AC/DC, variants up to 230 V AC/DC
Continuous current	100 mA, 130 mA (Reed)
Reproducibility	± 0.1 mm
Switching function	Make contact
Protection class	IP65, IP67, IP68, IP69K
Ambient temperature	-30 to +80 °C, Heat-resistant variants up to 120 °C
Connection variants	Free wire ends, M8, M12
Electronic version	2-wire, 3-wire
Cable material	PUR/PVC/TPI
Certificates	cULus, CE, variant with ATEX 3G/3D

ST6 sensor series



Connection variants:



ST9 sensor series – versatile sensor for cylinders with dovetail nuts

Ideal sensor solution for short-stroke cylinders

The sensors in the ST9 series are specifically developed for short-stroke cylinders and offer a lean design and practical handling. They slide easily into the 9 mm dovetail nut and can be securely fastened with a single screw. Especially with extremely short cylinders, the electrical connection located at the side of the housing enables easy tightening and removal of the lines.

- Suitable for 9 mm dovetail nut
- Wide range of versions with different line lengths and connections
- With M8 plug directly on the sensor housing or free wire ends
- Service-friendly, since the line can be mounted directly on the housing
- Reed and electronic PNP sensor versions

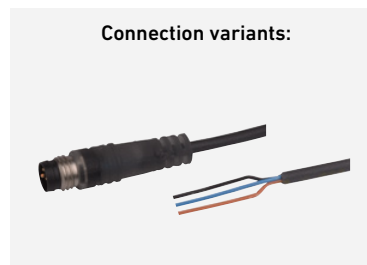


Series	ST9
Type of contact	Reed, electronic PNP
Dimensions in mm (LxHxW)	Approx. 26.6 x 14 x 9.5
Supply voltage	10-30 V AC/DC
Continuous current	130 mA
Reproducibility	≤ ± 0,1 mm
Protection class	IP65, IP67
Ambient temperature	-20 to +80 °C
Connection variants	Free wire ends, M8

ST9 sensor series



Connection variants:



SN2 sensor series – universal sensor, highly compatible with different cylinders

Wide variety of functions, compact design

With their universal functionality and form, the sensors in the SN2 series are at home in nearly every industry and application. They are designed as an especially robust reed sensor for a wide voltage range of up to 240 V AC. With their wide range of mounting options, they can be assembled on almost all cylinder series. Matching sensor mountings are available for all cylinder forms and profiles to guarantee secure mounting.

- Cubic sensor solution for universal applications
- A wide variety of sensor mountings for use with many different cylinders
- With M8 plug (2-, 3-, and 4-pin) directly on the sensor housing or free wire ends
- Service-friendly, since the line can be mounted directly on the housing
- Reed and electronic PNP and NPN sensor versions
- Additional variant with pulse stretching



Series	SN2
Type of contact	Reed, electronic PNP, NPN
Dimensions in mm (LxHxW)	Approx. 22 x 26 x 16
Supply voltage	12-36 V (PNP, NPN), up to 240 V AC (Reed)
Continuous current	130 mA
Reproducibility	$\leq \pm 0.1$ mm
Protection class	IP65, IP67
Ambient temperature	-20 to +80 °C also up to +120 °C
Connection variants	Free wire ends, M8

SN2 sensor series



Connection variants:



Finding the optimum sensors for your application

Not better, not worse, just different. All AVENTICS sensors work reliably and precisely. Which specific sensor is right for your application depends solely on the cylinders used, the machine design, the specific measurement tasks and the desired operating ease of use.

Cylinder and mounting

When selecting the right sensor, the initial criteria are the cylinder and mounting options. For pneumatic drives equipped with sensor nuts, sensors specifically designed for this configuration should always be the first choice. This enables simple, secure and rapid assembly at any time, without additional sensor mountings.

Measurement task, accuracy level and ease of adjustment

A variety of specially designed sensor mountings enables variable use of the sensor series with many different cylinders and profiles from the AVENTICS product range. You are free to choose the sensor you wish, whether you need a special sensor type or highly specific functions. In addition, the differences between electric and electronic sensors, described below, should be taken into account.

Electric sensors (Reed)	Electronic sensors (PNP, NPN)
Not protected against short circuits	Short circuit protected
For AC/DC voltage	For DC voltage only
Wide voltage range (0-240 V AC/DC)	Voltage range generally limited (typically 0-36 V)
Residual ripple not critical	Permissible residual ripple of supply voltage limited
No current consumption in non-switched state	Low current consumption, even in non-switched state
Affected by wear (especially with inductive and capacitive loads)	Wear-free
At high acceleration, false switching possible due to vibration or shocks	Switching function not affected by vibration or shocks
Bounce possible (in μs range)	Bounce free
Potential-free	Not potential-free
Long service life, average of 10 million switching cycles	"Unlimited" service life

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AVENTICS

Rexroth Pneumatics Corporate Website

Engineering Tools for pneumatics | AVENTICS
Product Configurator

Welcome to our Product Configurator

Piston rod cylinders **Rodless cylinders** **Small Handling**

Cylinder-valve units **Valve systems** **Maintenance units**

Use the interactive tools – save time and money

The AVENTICS sensor concept offers a perfectly coordinated system consisting of cylinders, sensors, and other accessories. Our customers are able to configure a complete product (cylinders, sensors, and accessories) at any time according to their individual needs and order it using a single material number. At the same time, all of the required documents are displayed and can be directly taken over in your own construction. You can reach the online configurator tool via the online catalog and the catalog pages for the product in question. Program navigation is intuitive and easy to understand.

Matching sensors are shown after you select your specially configured cylinder. You make a decision and receive one order number for the complete product, including the catalog price, parts list with item drawing, circuit diagram, and dimensioned drawing. 2-D and 3-D CAD data is also included.

Discover exciting videos on sensor fitting

 Proximity sensors ST4/ST6:
www.aventics.com/proximity_sensors

 Distance measuring sensors SM6 und SM6-AL:
www.aventics.com/distance_measuring_sensors

Pneumatic cylinder
SSI-DA-020-0100-4-00-2-000-

Sensor configuration

Without Sensor

With Sensor

Series

☒ ST6

☐ ST4

☐ ST4-2P

☐ SM6

Function

☒ REED

☐ PNP

☐ NPN

☐ Distance measuring

Cable length

☒ 0.3 m + M8x1 with knurled screw

☐ 1 m

☐ 3 m

☐ 5 m

Measurement range

☒ None

Pneumatic cylinder
SSI-DA-020-0100-4-02-3-000-PC3-

Sensor arrangement

☒ Front

☐ Rear

Orientation

☒ 0° / 0° (12h)

Pneumatic cylinder
SSI-DA-020-0100-4-02-3-000-PC3-01

List price: 127.93 EUR

Description	Series SSI	Series SSI
Piston diameter	020	Diameter 20
Stroke	0100	Stroke in mm
Function	4	Double acting with magnet
Piston rod end	02	Internal (female) thread
Piston rod	3	Through rod
Piston rod extension	000	Piston rod extension in mm
Sensor type	PC3	ST4 M8x1 w. knurled screw PNP
Sensor position	01	End position front 12h

Spares parts

Base cylinder SSI-DA-020-0100-4-02-3-000-00-00

Sensor RM12019493 ST4-PN-M8IT-030

2-D and 3-D CAD data is also included.

Take the next step – in person or online

Use our service

We are constantly in direct dialog with our customers and are a competent contact partner for both technical and commercial topics. If you have questions about sensor technology and would like support in creating the ideal configuration for your application, you can draw from the technological and industry expertise of our consultants at any time.

Your homepage for non-stop service

The AVENTICS Internet portal is available round the clock and supports you in all areas of the business process – from configuration through to the delivery. Our range of sophisticated engineering tools, offered to you at absolutely no charge, is unique. With the product configurator, you get results quickly and easily online. The online catalog provides information on all product details and shows which sensors are available in



the different versions and connection types and for which cylinders. The technical information section contains additional important notes on function and specifications.



www.engineering-tools.com



Online catalog

The fastest point of entry is via our online catalog. Here you can start your search directly by entering a part number or keyword.



CAD

Your desired object can be issued here directly as a CAD file in various formats, as a PDF file, or for further configuration in your software.



Configurators

The configurator can be reached by clicking the selected product. After selecting your product, you can begin to adapt it to your own specifications.



Calculation programs

Here you can specify the dimensions or loadbearing capacity of your components with a wide variety of calculation options. We also provide an air consumption calculator as a special feature.



Circuit diagram software

With the D&C Scheme Editor, you can quickly and easily create circuit diagrams that are based on your component layout and linked to your catalog selection.



eShop

The eShop is our online shop that answers your price requests and monitors the whole order process up to delivery.

AVENTICS

www.aventics.com

info@aventics.com

Follow us:



Germany

AVENTICS GmbH
Ulmer Straße 4
30880 Laatzen, Germany
Tel +49 511 2136-522
Fax +49 511 2136-163
www.aventics.de

USA

AVENTICS Corporation
PO Box 13597
1953 Mercer Road (40511)
Lexington, KY 40512
Tel +1 859 254-8031
www.aventics.us

China

AVENTICS Group
2002 Unit, Asdendas Plaza, No 333
Tianyaoqiao Road, Xuhui district
Shanghai, China, 200030
Tel +86 21 2426 9666
www.aventics.cn

Further contacts

www.aventics.com/contact

Your contact:



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