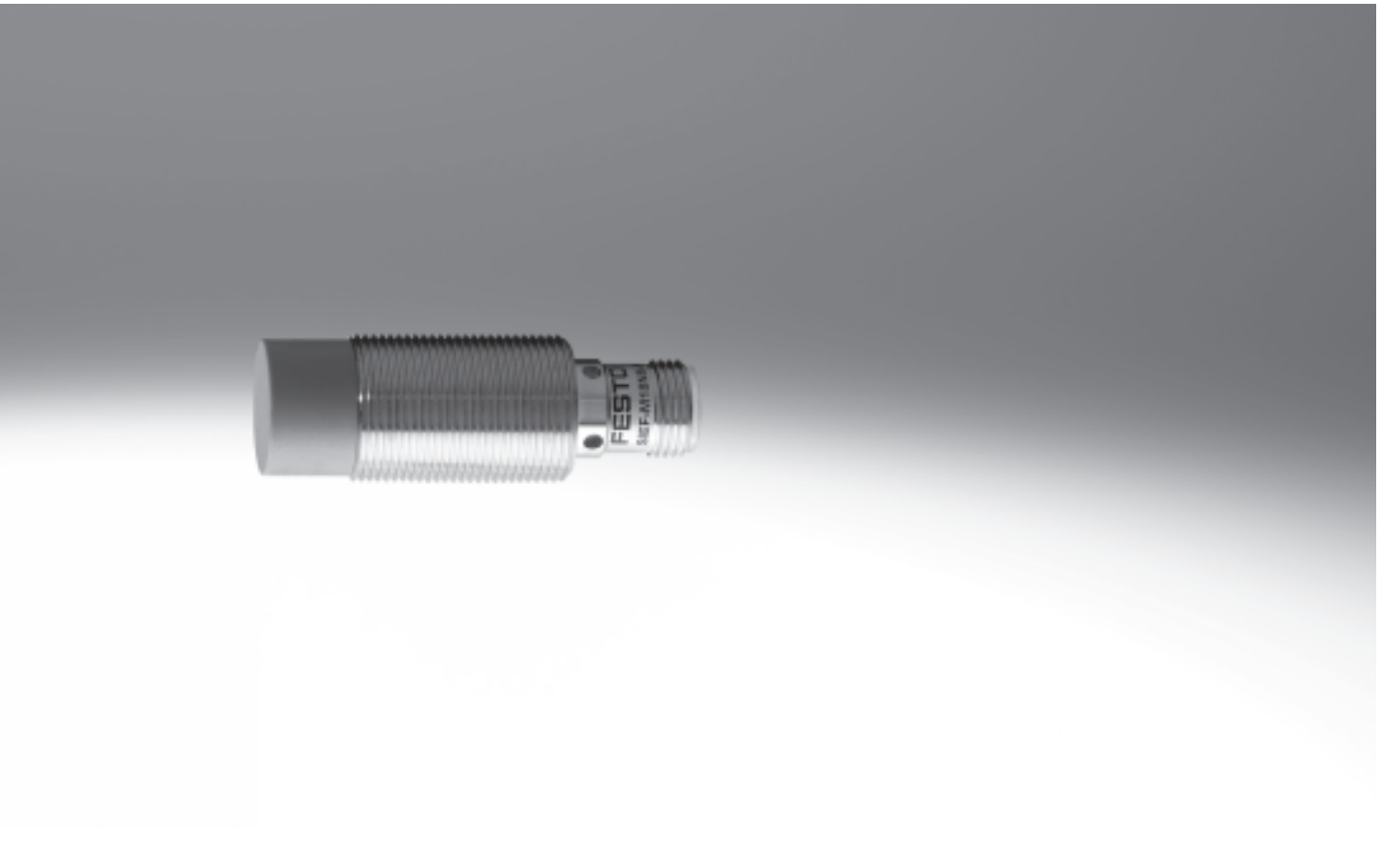
Inductive sensors



Inductive sensors

Key features

General

An inductive proximity sensor is a contactless sensor, i.e. it responds without direct contact to the approach of a metal or galvanic object. Proximity sensors are one of the basic elements of industrial automation technology.
At the heart of this sensor is a coil, carrying an alternating current, which generates an alternating magnetic field. When a metallic object enters this magnetic field, the impedance of the coil and, consequently, the vibration amplitude changes. This change can, when electrically amplified, be used as a variable for the distance between the detected object and the coil.
Due to the hysteresis effect, there is a difference between the measured distance when the object moves towards the proximity sensor and the measured distance when it moves away. This prevents oscillation of the output.
A contactless sensor offers the following advantages:

- No mechanical wear and tear, which in turn means a longer service life
- No downtime due to contaminated or bonded contacts
- No contact bounce and thus no switching errors
- High switching frequencies
- Vibration-resistant
- High degree of protection thanks to a fully encapsulated housing
- Any mounting position

Operating distances

The operating distance is the distance at which an object approaching the active surface of the proximity sensor triggers a change of signal.
The operating distance is measured in accordance with IEC 60947-5-2 (EN 60947-5-2) using a square standard test plate, which moves in the axial direction.
This standard target is made of steel, e.g. type FE 360 to ISO 630, has a smooth surface, a square shape and a thickness of 1 mm. The length of the side of the square corresponds to the diameter of the active surface or to three times the rated operating distance Sn of the proximity sensor, whichever value is the larger.

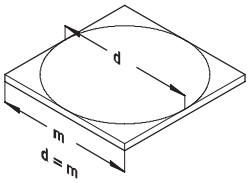
Rated operating distance S_n:
This is the distance for which the proximity sensor is designed. This value does not take deviations due to tolerances, voltage or temperature into account.

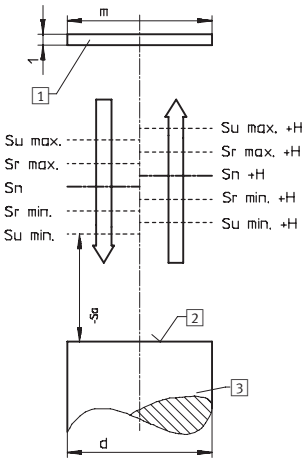
Effective operating distance S_r:
This is the measured operating distance for a specific switch with a nominal voltage and an ambient temperature of 23 ±5 °C.
The following rule applies:
0.9 x Sn < Sr < 1.1 x Sn. This means that the maximum permissible production tolerance is ±10 %.

Usable operating distance S_u:
This distance takes account of the expected additional deviations, which are caused in a specific range by temperature and operating voltage fluctuations.
The following rule applies:
0.9 x Sr < Su < 1.1 x Sr.
The effective operating distance Su may therefore deviate from the real operating distance Sr by a maximum of ±10%.
The temperature and operating voltage ranges can be found in the technical data.

Assured operating distance S_a:
This operating distance is guaranteed by the manufacturer for all specified operating conditions. It provides the basis for a reliable design.
The following rule applies:
0 < Sa < 0.81 x Sn.
The assured operating distance therefore lies between 0 and the lowest value for the effective operating distance.

Note:
Objects that are smaller than the standard target defined above generally lead to shorter operating distances.



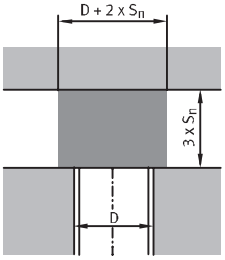


1 Test plate
2 Active surface
3 Sensor
H = Hysteresis

Installation instructions

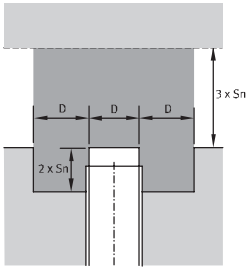
Flush mounting

Proximity sensors for flush mounting can be surrounded by metal up as far as the level of the active surface without their function being impaired.



Non-flush mounting

In the case of proximity sensors for non-flush mounting, a metal-free area is required around the active surface in order to guarantee faultless functioning.



Installation instructions (continued)

Mounting

Sensors without threads should if possible be secured with adhesive. Sensors can be clamped with moderate pressure if the pressure is distributed over as large an area as possible. Concentrated pressure, e.g. as produced by grub screws, can easily cause damage to sensors. Inductive sensors must not be used as mechanical stops.

Distances between sensors

Adjacent sensors must not be allowed to interfere with each other during operation. For this reason, a minimum distance, which depends on the sensor size, must be maintained between the sensors (Table ➔ 111).

Minimum distances between sensors [mm]

Size / design	∅ 6.5 mm	M8x1	M12x1	M18x1	M30x1.5	Q8B	Q40B
SIEN							
Flush mounting	4	3	12	22	30	–	–
Non-flush mounting	–	8	16	32	60	–	–
SIES							
Flush mounting	–	–	–	–	–	3	–
Non-flush mounting	–	–	–	–	–	50	140
SIEF							
Flush mounting	–	–	12	18	30	–	–
Non-flush mounting	–	24	24	36	60	–	–
SIEH-CR							
Flush mounting	–	–	28	34	–	–	–

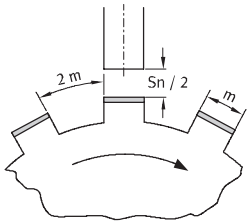
Glossary

Repetition accuracy

Repetition accuracy as defined by IEC 60947-5-2 and EN 60947-5-2 refers to the repetition accuracy of the real operating distance Sr over a period of 8 hours, at an ambient temperature of 23 ± 5 °C and a fixed operating voltage U_B. The specified repetition accuracies refer to this definition. Consecutive measurements generally produce a much better repetition accuracy.

Switching frequency

The maximum switching frequency specifies the highest permissible number of pulses per second for a constant pulse/interval ratio of 1:2 at half of the rated operating distance Sn. Measurement is performed in compliance with IEC/EN 60947-5-2.



Magnetic fields

Inductive sensors SIEF are immune to interference caused by magnetic fields.
The other sensor types are not normally influenced by permanent magnetic fields or low-frequency alternating fields. Nevertheless, strong fields can saturate the ferrite core of these sensors and thus increase the operating distance or even cause the device to switch. No permanent damage is caused, however. High-frequency fields in the order of several kHz (SIEH-...-CR) or several hundred kHz (other series) can severely impair the switching function, as the oscillator frequency of these devices lies within this range. If problems occur with interfering magnetic fields, screening is recommended.

Cable length

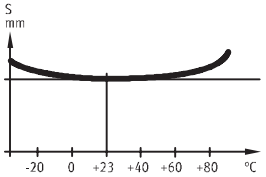
With proximity sensors, long cables result in:

- A capacitive load at the output
- Greater sensitivity to interference

The cable length should therefore be no longer than 300 m given favourable conditions.

Temperature drift of the real operating distance

The specified operating distances refer to a nominal ambient temperature of 23 °C. The operating distance as a function of the ambient temperature corresponds approximately to the curve shown in the diagram on the right. The temperature of the object itself has virtually no effect on the operating distance. Within the permissible temperature range, which generally lies between –25 °C and +70 °C, the operating distance varies by a maximum of ±10% compared with the value at 23 °C.



Inductive sensors

Key features

Reduction factors

The specified operating distances refer to precisely defined measurement conditions (see above). Other materials generally lead to a reduction in the operating distance. The corresponding reduction factors are specified for each individual sensor and for the most commonly used metals.

Typical value ranges:	
Steel (St37 or FE360)	1
Brass	0.35 ... 0.5
Copper	0.25 ... 0.45
Aluminium	0.35 ... 0.50
Stainless steel	0.6 ... 1

For special applications, sensors SIEF with a reduction factor of 1 for all metals are available ex-stock.

SIEF with reduction factor 1 for all metals

Like all inductive proximity sensors, proximity sensors SIEF are able to sense metals without contact and therefore without wear. Thanks to their special structure with a ferrite-free 3-coil system, they have properties that in many applications offer decisive advantages in comparison with conventional inductive sensors:

Reduction factor 1
Proximity sensors SIEF have the same long operating distance for all metals. In installations that frequently sense aluminium or stainless steel, this translates into an additional operating distance of up to 400% with aluminium.

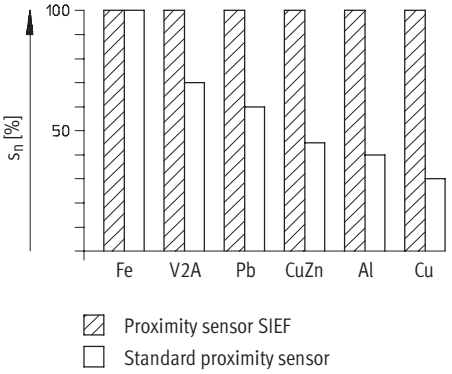
Extremely long operating distance
Proximity sensors SIEF offer a particularly long operating distance, without compromising their ease of installation.

Magnetic field immune
The omission of the ferrite core means that proximity sensors SIEF are immune to interference caused by strong magnetic fields such as those found in electrical welding and many other applications (e.g. lifts, electronic furnaces, etc.).

Wide temperature range
The ambient temperature range of –30 ... +85 °C means that the proximity sensors can be used at extremes of temperature.

High switching frequencies
The fast air-core coils mean that a SIEF is up to 500% faster than a conventional sensor – vital for machines and systems that are becoming increasingly faster.

Excellent EMC resistance
All proximity sensors SIEF exceed the stringent requirements of EN 61 000-6-4.
The proximity sensor SIEF is therefore optimally protected, particularly against conducted interference (e.g. from frequency converters), ensuring that your systems are equipped for the future.



Flush mounting
Flush mounting means that proximity sensors SIEF do not require a metal-free zone around their active surface. Most designs can even be recessed by 1 ... 2 mm to protect against mechanical damage. Unlike partially flush devices, flush proximity sensors SIEF can therefore be installed fully flush.

Non-flush mounting
An integrated pre-attenuation protection system means that non-flush proximity sensors will never be as flexible in terms of installation as flush proximity sensors. The protective effect is produced by means of self-compensation in the innovative multi-coil system.
In practice this means that in contrast to conventional sensors with a ferrite core, the metal-free zones can be significantly smaller. Some designs can even be mounted with metal on three sides. The self-compensator automatically compensates the pre-attenuation. With conventional, non-flush ferrite core sensors, this type of partially flush installation leads to uncontrolled switching. For non-flush proximity sensors SIEF, the integrated self-compensator means maximum operating distance without compromise.

SIEA with analogue output

Devices with an analogue output supply an analogue signal, which is approximately proportional to the object distance. Most models have outputs for both voltage and current.

SIEH-...-CR with stainless steel housing

A new technology for inductive proximity sensors. Unlike conventional technology, with which a high-frequency magnetic field is generated in front of the active surface, in this case the coil is supplied with a current with alternating polarity.
This technology allows:

- Very large operating distances
- Large operating distances even with nonferrous metals such as aluminium, brass, copper, etc.
- Seamless stainless steel housing (active surface encapsulated)

Proximity sensors SIE..., inductive

Product overview

- Designs for DC and AC
- Switch output PNP, NPN or analogue
- ∅ 3 mm ... M30 and special designs
- Corrosion-resistant and welding field immune versions
- Versions with increased switching distance
- Free of copper and PTFE

Detailed product information
➔ www.festo.com/catalogue/sie

Product overview						
Variant	Type	Operating voltage	Switch output / analogue output	Type of mounting	Size	➔ Page
Reduction factor, material-specific						
Standard operating distance	SIEN Basic version	10 ... 30 V DC 15 ... 34 V DC	PNP NPN	Flush fitting Non-flush	∅ 4 mm, M5, ∅ 6.5 mm, M8, M12, M18, M30	115
	SIED Basic version	20 ... 320 V DC 20 ... 265 V AC	2-wire, contactless	Flush fitting Non-flush	M12, M18, M30	118
	SIES Special design	10 ... 30 V DC	PNP NPN	Flush fitting	5x5x25 mm ... 40x40x120 mm	119
	SIEN-...-PA Polyamide housing	10 ... 30 V DC	PNP NPN	Flush fitting Non-flush	M12, M18, M30	120
	SIED-...-PA Polyamide housing	10 ... 300 V DC 20 ... 250 V AC	2-wire, contactless	Flush fitting Non-flush	M12, M18, M30	121
Increased operating distance	SIEH Basic version	10 ... 30 V DC 15 ... 34 V DC	PNP NPN	Flush fitting	∅ 3 mm, M12, M18	124
	SIEH-...-CR Stainless steel housing	10 ... 30 V DC	PNP NPN	Flush fitting	M12, M18	124
Analogue output	SIEA	15 ... 30 V DC	0 ... 10 V and 4 ... 20 mA	Flush fitting	M8, M12, M18, M30	126
Reduction factor 1 for all metals, welding field immune						
Increased operating distance	SIEF Basic version	10 ... 30 V DC	PNP NPN	Non-flush Partially flush	M8, M12, M18, M30	122
	SIEF-...-WA Housing resistant to welding spatter	10 ... 30 V DC	PNP NPN	Flush fitting Partially flush	M12, M18, M30, 40x40 mm	122

Proximity sensors SIE..., inductive

Type codes

SIE	N	–	M	30	NB	–	P	S	–	K	–	L	–	

Type	
SIE	Proximity sensor, inductive

Design	
A	With analogue output
D	For DC and AC
F	With reduction factor 1 for all metals
H	With increased operating distance
N	With standard operating distance
S	Special design

Constructional design	
–	Round
M	Metric parallel thread
Q	Block-shaped
V3	Block-shaped

Size	

Type of mounting	
B	Flush
NB	Non-flush
S	Partially flush

Electrical output	
P	Switch output PNP
N	Switch output NPN
Z	2-wire output
PU	Analogue output 0 ... 10 V
UI	Analogue output 0 ... 10 V and 4 ... 20 mA

Switching element function	
S	Normally open
O	Normally closed
A	Antivalent

Electrical connection	
K	Cable
S	Plug
X	Screw terminals

Indication	
–	Without indication
L	Switching status
2L	Switching status and ready status

Variant	
–	Standard
CR	Stainless steel housing
PA	Polyamide housing
WA	Housing resistant to welding spatter

Proximity sensors SIEN, inductive

Technical data – Standard operating distance, basic version

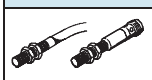
FESTO

General technical data									
Size			∅ 4 mm	M5	∅ 6.5 mm	M8x1	M12x1	M18x1	M30x1.5
Type of mounting			Flush			Flush or non-flush			
Rated operating distance S_n	Flush	[mm]	0.8	0.8	1.5	1.5	2.0	5.0	10.0
	Non-flush	[mm]	–	–	–	2.5	4.0	8.0	15.0
Repetition accuracy	Flush	[mm]	0.04	0.04	0.075	0.075	0.1	0.15	0.3
	Non-flush	[mm]	–	–	–	0.125	0.2	0.2	0.4

Electrical data									
Size			∅ 4 mm	M5	∅ 6.5 mm	M8x1	M12x1	M18x1	M30x1.5
Electrical connection		Cable	3-wire						
		Plug	M8x1, 3-pin				M12x1, 3-pin		
Operating voltage range		[V DC]	10 … 30		15 … 34				
Max. output current as a function of temperature		[mA]	200 at ≤ 70 °C		150 at ≤ 85 °C				
		[mA]			200 at ≤ 50 °C				
Max. switching frequency	Flush	[Hz]	3,000	3,000	1,500	1,500	1,200	800	350
	Non-flush	[Hz]	–	–	–	900	800	300	300
Protection against short circuit			Pulsed						
Protection against polarity reversal			For all electrical connections						
Protection class			IP67						

Materials								
Size	∅ 4 mm	M5	∅ 6.5 mm	M8x1	M12x1	M18x1	M30x1.5
Housing	High-alloy stainless steel				Nickel-plated brass		
Cable sheath	Polyurethane						

Operating and environmental conditions								
Size		∅ 4 mm	M5	∅ 6.5 mm	M8x1	M12x1	M18x1	M30x1.5
Ambient temperature	[°C]	–25 … +70		–25 … +85				
Ambient temperature with flexible cable installation	[°C]	–25 … +70		–25 … +85				
CE mark (see declaration of conformity)		In accordance with EU EMC directive						
Certification		C-Tick						

Ordering data								
Size	S_n [1] [mm]	Type of mounting	Switch output	Switching element function	Electrical connection			
					Cable		Plug	
					Part No.	Type	Part No.	Type
∅ 4 mm								
	0.8	Flush	PNP	Normally open	**150 362**	**SIEN-4B-PS-K-L**	**150 363**	**SIEN-4B-PS-S-L**
				Normally closed	**150 366**	**SIEN-4B-PO-K-L**	**150 367**	**SIEN-4B-PO-S-L**
			NPN	Normally open	**150 360**	**SIEN-4B-NS-K-L**	**150 361**	**SIEN-4B-NS-S-L**
				Normally closed	**150 364**	**SIEN-4B-NO-K-L**	**150 365**	**SIEN-4B-NO-S-L**
M5								
	0.8	Flush	PNP	Normally open	**150 370**	**SIEN-M5B-PS-K-L**	**150 371**	**SIEN-M5B-PS-S-L**
				Normally closed	**150 374**	**SIEN-M5B-PO-K-L**	**150 375**	**SIEN-M5B-PO-S-L**
			NPN	Normally open	**150 368**	**SIEN-M5B-NS-K-L**	**150 369**	**SIEN-M5B-NS-S-L**
				Normally closed	**150 372**	**SIEN-M5B-NO-K-L**	**150 373**	**SIEN-M5B-NO-S-L**

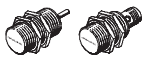
1) Sn Rated operating distance [mm]

Proximity sensors SIEN, inductive

Technical data – Standard operating distance, basic version

FESTO

Ordering data

Size	S_n[1)] [mm]	Type of mounting	Switch output	Switching element function	Electrical connection: Cable Part No.	Cable Type	Plug Part No.	Plug Type
∅ 6.5 mm								
	1.5	Flush	PNP	Normally open	**150 378**	**SIEN-6,5B-PS-K-L**	**150 379**	**SIEN-6,5B-PS-S-L**
				Normally closed	**150 382**	**SIEN-6,5B-PO-K-L**	**150 383**	**SIEN-6,5B-PO-S-L**
			NPN	Normally open	**150 376**	**SIEN-6,5B-NS-K-L**	**150 377**	**SIEN-6,5B-NS-S-L**
				Normally closed	**150 380**	**SIEN-6,5B-NO-K-L**	**150 381**	**SIEN-6,5B-NO-S-L**
M8								
	1.5	Flush	PNP	Normally open	**150 386**	**SIEN-M8B-PS-K-L**	**150 387**	**SIEN-M8B-PS-S-L**
				Normally closed	**150 390**	**SIEN-M8B-PO-K-L**	**150 391**	**SIEN-M8B-PO-S-L**
			NPN	Normally open	**150 384**	**SIEN-M8B-NS-K-L**	**150 385**	**SIEN-M8B-NS-S-L**
				Normally closed	**150 388**	**SIEN-M8B-NO-K-L**	**150 389**	**SIEN-M8B-NO-S-L**
	2.5	Non-flush	PNP	Normally open	**150 394**	**SIEN-M8NB-PS-K-L**	**150 395**	**SIEN-M8NB-PS-S-L**
				Normally closed	**150 398**	**SIEN-M8NB-PO-K-L**	**150 399**	**SIEN-M8NB-PO-S-L**
			NPN	Normally open	**150 392**	**SIEN-M8NB-NS-K-L**	**150 393**	**SIEN-M8NB-NS-S-L**
				Normally closed	**150 396**	**SIEN-M8NB-NO-K-L**	**150 397**	**SIEN-M8NB-NO-S-L**
M12								
	2.0	Flush	PNP	Normally open	**150 402**	**SIEN-M12B-PS-K-L**	**150 403**	**SIEN-M12B-PS-S-L**
				Normally closed	**150 406**	**SIEN-M12B-PO-K-L**	**150 407**	**SIEN-M12B-PO-S-L**
			NPN	Normally open	**150 400**	**SIEN-M12B-NS-K-L**	**150 401**	**SIEN-M12B-NS-S-L**
				Normally closed	**150 404**	**SIEN-M12B-NO-K-L**	**150 405**	**SIEN-M12B-NO-S-L**
	4.0	Non-flush	PNP	Normally open	**150 410**	**SIEN-M12NB-PS-K-L**	**150 411**	**SIEN-M12NB-PS-S-L**
				Normally closed	**150 414**	**SIEN-M12NB-PO-K-L**	**150 415**	**SIEN-M12NB-PO-S-L**
			NPN	Normally open	**150 408**	**SIEN-M12NB-NS-K-L**	**150 409**	**SIEN-M12NB-NS-S-L**
				Normally closed	**150 412**	**SIEN-M12NB-NO-K-L**	**150 413**	**SIEN-M12NB-NO-S-L**
M18								
	5.0	Flush	PNP	Normally open	**150 418**	**SIEN-M18B-PS-K-L**	**150 419**	**SIEN-M18B-PS-S-L**
				Normally closed	**150 422**	**SIEN-M18B-PO-K-L**	**150 423**	**SIEN-M18B-PO-S-L**
			NPN	Normally open	**150 416**	**SIEN-M18B-NS-K-L**	**150 417**	**SIEN-M18B-NS-S-L**
				Normally closed	**150 420**	**SIEN-M18B-NO-K-L**	**150 421**	**SIEN-M18B-NO-S-L**
	8.0	Non-flush	PNP	Normally open	**150 426**	**SIEN-M18NB-PS-K-L**	**150 427**	**SIEN-M18NB-PS-S-L**
				Normally closed	**150 430**	**SIEN-M18NB-PO-K-L**	**150 431**	**SIEN-M18NB-PO-S-L**
			NPN	Normally open	**150 424**	**SIEN-M18NB-NS-K-L**	**150 425**	**SIEN-M18NB-NS-S-L**
				Normally closed	**150 428**	**SIEN-M18NB-NO-K-L**	**150 429**	**SIEN-M18NB-NO-S-L**
M30								
	10.0	Flush	PNP	Normally open	**150 434**	**SIEN-M30B-PS-K-L**	**150 435**	**SIEN-M30B-PS-S-L**
				Normally closed	**150 438**	**SIEN-M30B-PO-K-L**	**150 439**	**SIEN-M30B-PO-S-L**
			NPN	Normally open	**150 432**	**SIEN-M30B-NS-K-L**	**150 433**	**SIEN-M30B-NS-S-L**
				Normally closed	**150 436**	**SIEN-M30B-NO-K-L**	**150 437**	**SIEN-M30B-NO-S-L**
	15.0	Non-flush	PNP	Normally open	**150 442**	**SIEN-M30NB-PS-K-L**	**150 443**	**SIEN-M30NB-PS-S-L**
				Normally closed	**150 446**	**SIEN-M30NB-PO-K-L**	**150 447**	**SIEN-M30NB-PO-S-L**
			NPN	Normally open	**150 440**	**SIEN-M30NB-NS-K-L**	**150 441**	**SIEN-M30NB-NS-S-L**
				Normally closed	**150 444**	**SIEN-M30NB-NO-K-L**	**150 445**	**SIEN-M30NB-NO-S-L**

1) Sn Rated operating distance [mm]

Proximity sensors SIED, inductive

Technical data – Standard operating distance, for DC and AC

FESTO

General technical data					
Size			M12x1	M18x1	M30x1.5
Mounting conditions			Flush or non-flush		
Rated operating distance S_n	Flush	[mm]	2.0	5.0	10.0
	Non-flush	[mm]	4.0	8.0	15.0
Repetition accuracy	Flush	[mm]	±0.1	±0.15	±0.3
	Non-flush	[mm]	±0.2	±0.2	±0.4

Electrical data					
Size			M12x1	M18x1	M30x1.5
Electrical connection			Cable, 3-wire		
			Plug M12x1, 3-pin		
Operating voltage range		[V DC]	20 ... 320		
		[V AC]	20 ... 265		
Max. output current		[mA]	200	300	
Max. switching frequency DC	Flush	[Hz]	1,200	490	220
	Non-flush	[Hz]	900	340	200
Max. switching frequency AC	Flush	[Hz]	25		
	Non-flush	[Hz]	25		
Minimum load current		[mA]	5.0		
Protection against short circuit			No		
Protection against polarity reversal			For all electrical connections		
Protection class			IP67		

Materials	
Housing	Nickel-plated brass; polyamide
Cable sheath	Polyurethane

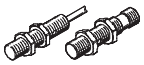
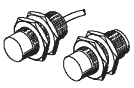
Operating and environmental conditions		
Ambient temperature	[°C]	–25 ... +85
Ambient temperature with flexible cable installation	[°C]	–5 ... +50
CE mark (see declaration of conformity)		In accordance with EU EMC directive In accordance with EU Low Voltage Directive
Certification		C-Tick

Proximity sensors SIED, inductive

Technical data – Standard operating distance, for DC and AC

FESTO

Ordering data

Size	S_n[1)] [mm]	Type of mounting	Switch output	Switching element function	Electrical connection			
					Cable		Plug	
					Part No.	Type	Part No.	Type
M12 – For DC and AC								
	2.0	Flush	2-wire, contactless	Normally open	**538 272**	**SIED-M12B-ZS-K-L**	**538 271**	**SIED-M12B-ZS-S-L**
				Normally closed	**538 274**	**SIED-M12B-ZO-K-L**	**538 273**	**SIED-M12B-ZO-S-L**
	4.0	Non-flush	2-wire, contactless	Normally open	**538 268**	**SIED-M12NB-ZS-K-L**	**538 267**	**SIED-M12NB-ZS-S-L**
				Normally closed	**538 270**	**SIED-M12NB-ZO-K-L**	**538 269**	**SIED-M12NB-ZO-S-L**
M18 – For DC and AC								
	5.0	Flush	2-wire, contactless	Normally open	**538 280**	**SIED-M18B-ZS-K-L**	**538 279**	**SIED-M18B-ZS-S-L**
				Normally closed	**538 282**	**SIED-M18B-ZO-K-L**	**538 281**	**SIED-M18B-ZO-S-L**
	8.0	Non-flush	2-wire, contactless	Normally open	**538 276**	**SIED-M18NB-ZS-K-L**	**538 275**	**SIED-M18NB-ZS-S-L**
				Normally closed	**538 278**	**SIED-M18NB-ZO-K-L**	**538 277**	**SIED-M18NB-ZO-S-L**
M30 – For DC and AC								
	10.0	Flush	2-wire, contactless	Normally open	**538 288**	**SIED-M30B-ZS-K-L**	**538 287**	**SIED-M30B-ZS-S-L**
				Normally closed	**538 290**	**SIED-M30B-ZO-K-L**	**538 289**	**SIED-M30B-ZO-S-L**
	15.0	Non-flush	2-wire, contactless	Normally open	**538 284**	**SIED-M30NB-ZS-K-L**	**538 283**	**SIED-M30NB-ZS-S-L**
				Normally closed	**538 286**	**SIED-M30NB-ZO-K-L**	**538 285**	**SIED-M30NB-ZO-S-L**

1) Sn Rated operating distance [mm]

Proximity sensors SIES, inductive

Technical data – Standard operating distance, special design

FESTO

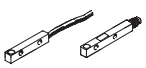
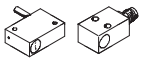
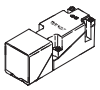
General technical data						
Design		SIES-Q5B-...	SIES-Q8B-...	SIES-V3B-...	SIES-QB-...	SIES-Q40B-...
Type of mounting		Flush				
Rated operating distance S_n	[mm]	0.8	1.5	2.0	2.0	15.0
Repetition accuracy	[mm]	±0.04	±0.075	±0.1	±0.1	±0.75

Electrical data						
Design		SIES-Q5B-...	SIES-Q8B-...	SIES-V3B-...	SIES-QB-...	SIES-Q40B-...
Electrical connection		Cable, 3-wire	Cable, 3-wire Plug, M8x1, 3-pin	Plug, M8x1, 3-pin	Cable, 3-wire	Screw terminals
Operating voltage range	[V DC]	10 ... 30				
Max. output current	[mA]	200		–		
Max. output current as a function of temperature	[mA]	200 at ≤ 70 °C		150 at ≤ 85 °C		
	[mA]			200 at ≤ 50 °C		
Max. switching frequency	[Hz]	3,000	1,500	1,200	1,200	100
Protection against short circuit		Pulsed				
Protection against polarity reversal		For all electrical connections				
Protection class		IP67				IP65

Materials						
Design		SIES-Q5B-...	SIES-Q8B-...	SIES-V3B-...	SIES-QB-...	SIES-Q40B-...
Housing		Nickel-plated brass		Die-cast zinc	Polybutylene terephtalate, reinforced	Polyester
Cable sheath		Polyurethane				–

Operating and environmental conditions						
Design		SIES-Q5B-...	SIES-Q8B-...	SIES-V3B-...	SIES-QB-...	SIES-Q40B-...
Ambient temperature	[°C]	–25 ... +70		–25 ... +85		
CE mark (see declaration of conformity)		In accordance with EU EMC directive				
Certification		C-Tick				

Ordering data

Size	S_n [1] [mm]	Type of mounting	Switch output	Switching element function	Electrical connection: Cable Part No.	Cable Type	Plug Part No.	Plug Type
Special design								
	0.8	Flush	PNP	Normally open	**178 291**	**SIES-Q5B-PS-K-L**	–	
				Normally closed	**174 549**	**SIES-Q5B-PO-K-L**	–	
			NPN	Normally open	**178 290**	**SIES-Q5B-NS-K-L**	–	
				Normally closed	**174 548**	**SIES-Q5B-NO-K-L**	–	
	1.5	Flush	PNP	Normally open	**178 294**	**SIES-Q8B-PS-K-L**	**178 295**	**SIES-Q8B-PS-S-L**
				Normally closed	**174 552**	**SIES-Q8B-PO-K-L**	**174 553**	**SIES-Q8B-PO-S-L**
			NPN	Normally open	**178 292**	**SIES-Q8B-NS-K-L**	**178 293**	**SIES-Q8B-NS-S-L**
				Normally closed	**174 550**	**SIES-Q8B-NO-K-L**	**174 551**	**SIES-Q8B-NO-S-L**
	2.0	Flush	PNP	Normally open	**150 488**	**SIES-QB-PS-K-L**	**150 491**	**SIES-V3B-PS-S-L**
				Normally closed	**150 489**	**SIES-QB-PO-K-L**	–	
			NPN	Normally open	–		**150 490**	**SIES-V3B-NS-S-L**
				Normally closed	–		–	
	15.0	Flush	PNP	Antivalent	–		**150 492**	**SIES-Q40-PA-X-2L** [2]

1) Sn Rated operating distance [mm]
2) Electrical connection with screw terminals

Proximity sensors SIEN-...-PA, inductive

Technical data – Standard operating distance, polyamide housing

FESTO

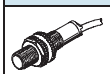
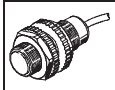
General technical data					
Size			M12x1	M18x1	M30x1.5
Mounting conditions			Flush or non-flush		
Rated operating distance S_n	Flush	[mm]	2.0	5.0	10.0
	Non-flush	[mm]	4.0	8.0	15.0
Repetition accuracy	Flush	[mm]	0.04	0.1	0.2
	Non-flush	[mm]	0.08	0.16	0.3

Electrical data					
Size			M12x1	M18x1	M30x1.5
Electrical connection			Cable, 3-wire		
Operating voltage range		[V DC]	10 ... 30		
Max. output current		[mA]	200		
Max. switching frequency DC	Flush	[Hz]	2,000	1,000	500
	Non-flush	[Hz]	2,000	1,000	500
Protection against short circuit			Pulsed		
Protection against polarity reversal			For all electrical connections		
Protection class			IP65, IP67		

Materials	
Housing	Reinforced polyamide
Cable sheath	Polyvinyl chloride

Operating and environmental conditions		
Ambient temperature	[°C]	–25 ... +70
Ambient temperature with flexible cable installation	[°C]	0 ... 70
CE mark (see declaration of conformity)		In accordance with EU EMC directive
Certification		C-Tick

Ordering data

Size	S_n [1] [mm]	Type of mounting	Switch output	Switching element function	Electrical connection, Cable, Part No.	Type
M12x1						
	2.0	Flush	PNP	Normally open	**538 323**	**SIEN-M12B-PS-K-L-PA**
			NPN		**538 324**	**SIEN-M12B-NS-K-L-PA**
	4.0	Non-flush	PNP	Normally open	**538 329**	**SIEN-M12NB-PS-K-L-PA**
			NPN		**538 330**	**SIEN-M12NB-NS-K-L-PA**
M18x1						
	5.0	Flush	PNP	Normally open	**538 325**	**SIEN-M18B-PS-K-L-PA**
			NPN		**538 326**	**SIEN-M18B-NS-K-L-PA**
	8.0	Non-flush	PNP	Normally open	**538 331**	**SIEN-M18NB-PS-K-L-PA**
			NPN		**538 332**	**SIEN-M18NB-NS-K-L-PA**
M30x1.5						
	10.0	Flush	PNP	Normally open	**538 327**	**SIEN-M30B-PS-K-L-PA**
			NPN		**538 328**	**SIEN-M30B-NS-K-L-PA**
	15.0	Non-flush	PNP	Normally open	**538 333**	**SIEN-M30NB-PS-K-L-PA**
			NPN		**538 334**	**SIEN-M30NB-NS-K-L-PA**

1) Sn Rated operating distance [mm]

Proximity sensors SIED-...-PA, inductive

Technical data – Standard operating distance, polyamide housing, for DC and AC

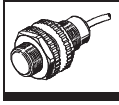
FESTO

General technical data					
Size			M12x1	M18x1	M30x1.5
Mounting conditions			Flush or non-flush		
Rated operating distance S_n	Flush	[mm]	2.0	5.0	10.0
	Non-flush	[mm]	4.0	8.0	15.0
Repetition accuracy	Flush	[mm]	0.04	0.1	0.2
	Non-flush	[mm]	0.08	0.16	0.3

Electrical data					
Size			M12x1	M18x1	M30x1.5
Electrical connection			Cable, 2-wire		
Operating voltage range		[V DC]	10 ... 300		
		[V AC]	20 ... 250		
Max. output current		[mA]	100	300	
Max. switching frequency DC	Flush	[Hz]	60		
	Non-flush	[Hz]	60		
Max. switching frequency AC	Flush	[Hz]	20		
	Non-flush	[Hz]	20		
Minimum load current		[mA]	3.0		
Protection against short circuit			No		
Protection against polarity reversal			For all electrical connections		
Protection class			IP65, IP67		

Materials	
Housing	Reinforced polyamide
Cable sheath	Polyvinyl chloride

Operating and environmental conditions		
Ambient temperature	[°C]	–25 ... +70
Ambient temperature with flexible cable installation	[°C]	0 ... 70
CE mark (see declaration of conformity)		In accordance with EU EMC directive In accordance with EU Low Voltage Directive
Certification		C-Tick

Ordering data						
Size	S_n [1] [mm]	Type of mounting	Switch output	Switching element function	Electrical connection, Cable, Part No.	Type
M12						
	2.0	Flush	2-wire, contactless	Normally open	538 336	SIED-M12B-ZS-K-L-PA
	4.0	Non-flush			538 335	SIED-M12NB-ZS-K-L-PA
M18						
	5.0	Flush	2-wire, contactless	Normally open	538 338	SIED-M18B-ZS-K-L-PA
	8.0	Non-flush			538 337	SIED-M18NB-ZS-K-L-PA
M30						
	10.0	Flush	2-wire, contactless	Normally open	538 340	SIED-M30B-ZS-K-L-PA
	15.0	Non-flush			538 339	SIED-M30NB-ZS-K-L-PA

1) Sn Rated operating distance [mm]

Proximity sensors SIEF, inductive

Technical data – Increased operating distance, reduction factor 1, welding field immune

General technical data							
Size			M8x1	M12x1	M18x1	M30x1.5	40x40 mm
Type of mounting			Non-flush	Flush or partially flush			Partially flush
Rated operating distance S_n	Flush	[mm]	–	3.0	5.0	10.0	–
	Partially flush	[mm]	4.0	8.0	12.0	20.0	35.0
Repetition accuracy	Flush	[mm]	–	0.06	0.1	0.2	–
	Partially flush	[mm]	0.08	0.16	0.24	0.4	0.7

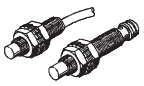
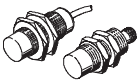
Electrical data							
Size			M8x1	M12x1	M18x1	M30x1.5	40x40 mm
Electrical connection		Cable	3-wire				–
		Plug	M8x1, 3-pin	M12x1, 3-pin, Fixcon			M12x1, 4-pin, Fixcon
Operating voltage range		[V DC]	10 … 30				10 … 65
Max. output current		[mA]	150	200			
Max. switching frequency DC	Flush	[Hz]	–	3,000	2,500	2,000	–
	Partially flush	[Hz]	2,000	2,000	2,000	1,500	250
Protection against short circuit			Pulsed				
Protection against polarity reversal			For all electrical connections				
Protection class			IP67				

Materials						
Size	M8x1	M12x1	M18x1	M30x1.5	40x40 mm
Basic version					
Housing	High-alloy stainless steel; polyamide	Brass, chrome-plated; polybutylene terephtalate			Reinforced polyamide
Cable sheath	Polyurethane				–
Housing resistant to welding spatter					
Housing	–	Brass, PTFE-coated; polybutylene terephtalate			–

Operating and environmental conditions		
Resistance to interference from magnetic fields		Magnetic direct and alternating field
Ambient temperature	[°C]	–30 … +85
CE mark (see declaration of conformity)		In accordance with EU EMC directive
Certification		C-Tick

Proximity sensors SIEF, inductive

Technical data – Increased operating distance, reduction factor 1, welding field immune

Ordering data								
Size	S_n[1)] [mm]	Type of mounting	Switching element function	Electrical connection	Switch output			
					PNP		NPN	
					Part No.	Type	Part No.	Type
Basic version								
M8x1								
	4.0	Partially flush	Normally open	Cable	538 308	SIEF-M8NB-PS-K-L	538 310	SIEF-M8NB-NS-K-L
				Plug	538 307	SIEF-M8NB-PS-S-L	538 309	SIEF-M8NB-NS-S-L
M12x1								
	8.0	Partially flush	Normally open	Cable	538 312	SIEF-M12NB-PS-K-L	538 314	SIEF-M12NB-NS-K-L
				Plug	538 311	SIEF-M12NB-PS-S-L	538 313	SIEF-M12NB-NS-S-L
M18x1								
	12.0	Partially flush	Normally open	Cable	538 316	SIEF-M18NB-PS-K-L	538 318	SIEF-M18NB-NS-K-L
				Plug	538 315	SIEF-M18NB-PS-S-L	538 317	SIEF-M18NB-NS-S-L
M30x1.5								
	10.0	Partially flush	Normally open	Cable	538 320	SIEF-M30NB-PS-K-L	538 322	SIEF-M30NB-NS-K-L
				Plug	538 319	SIEF-M30NB-PS-S-L	538 321	SIEF-M30NB-NS-S-L
40x40 mm								
	35.0	Partially flush	Antivalent	Plug	538 341	SIEF-Q40S-PA-S-2L	538 342	SIEF-Q40S-NA-S-2L
Housing resistant to welding spatter								
M12x1								
	3.0	Flush	Normally open	Plug	538 297	SIEF-M12B-PS-S-L-WA	538 298	SIEF-M12B-NS-S-L-WA
	8.0	Partially flush			538 295	SIEF-M12NB-PS-S-L-WA	538 296	SIEF-M12NB-NS-S-L-WA
M18x1								
	5.0	Flush	Normally open	Plug	538 301	SIEF-M18B-PS-S-L-WA	538 302	SIEF-M18B-NS-S-L-WA
	12.0	Partially flush			538 299	SIEF-M18NB-PS-S-L-WA	538 300	SIEF-M18NB-NS-S-L-WA
M30x1.5								
	10.0	Flush	Normally open	Plug	538 305	SIEF-M30B-PS-S-L-WA	538 306	SIEF-M30B-NS-S-L-WA
	20.0	Partially flush			538 303	SIEF-M30NB-PS-S-L-WA	538 304	SIEF-M30NB-NS-S-L-WA

1) Sn Rated operating distance [mm]

Proximity sensors SIEH, inductive

Technical data – Increased operating distance

FESTO

General technical data						
		Basic version			Stainless steel housing	
Size		∅ 3 mm	M12x1	M18x1	M12x1	M18x1
Type of mounting		Flush				
Rated operating distance S_n	[mm]	1.0	4.0	7.0	6.0	10.0
Repetition accuracy	[mm]	0.02	0.2	0.2	0.3	0.5

Electrical data						
		Basic version			Stainless steel housing	
Size		∅ 3 mm	M12x1	M18x1	M12x1	M18x1
Electrical connection	Cable	3-wire				
	Plug	M8x1, 3-pin	M12x1, 3-pin		M12x1, 3-pin	
Operating voltage range	[V DC]	10 ... 30	15 ... 34		10 ... 30	
Max. output current as a function of temperature	[mA]	100	150 at ≤ 85 °C 200 at ≤ 50 °C		200	
Max. switching frequency	[Hz]	3,000	400	250	600	200
Protection against short circuit		Pulsed				
Protection against polarity reversal		For all electrical connections				
Protection class		IP67				

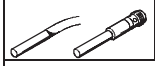
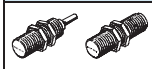
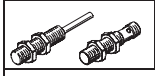
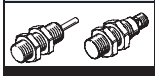
Materials						
		Basic version			Stainless steel housing	
Size		∅ 3 mm	M12x1	M18x1	M12x1	M18x1
Housing		High-alloy stainless steel	Nickel-plated brass		High-alloy steel	
Cable sheath		Polyurethane				

Operating and environmental conditions						
		Basic version			Stainless steel housing	
Size		∅ 3 mm	M12x1	M18x1	M12x1	M18x1
Ambient temperature	[°C]	–25 ... +70	–25 ... +85		–25 ... +70	
Ambient temperature with flexible cable installation	[°C]	–5 ... +70	–5 ... +85		–5 ... +70	
CE mark (see declaration of conformity)		In accordance with EU EMC directive				
Certification		C-Tick				

Proximity sensors SIEH, inductive

Technical data – Increased operating distance

FESTO

Ordering data								
Size	S_n[1)] [mm]	Type of mounting	Switch output	Switching element function	Electrical connection			
					Cable		Plug	
					Part No.	Type	Part No.	Type
∅ 3 mm								
	1.0	Flush	PNP	Normally open	**538 264**	**SIEH-3B-PS-K-L**	**538 263**	**SIEH-3B-PS-S-L**
			NPN	Normally open	**538 266**	**SIEH-3B-NS-K-L**	**538 265**	**SIEH-3B-NS-S-L**
M12x1								
	4.0	Flush	PNP	Normally open	**150 450**	**SIEH-M12B-PS-K-L**	**150 451**	**SIEH-M12B-PS-S-L**
				Normally closed	**150 454**	**SIEH-M12B-PO-K-L**	**150 455**	**SIEH-M12B-PO-S-L**
			NPN	Normally open	**150 448**	**SIEH-M12B-NS-K-L**	**150 449**	**SIEH-M12B-NS-S-L**
				Normally closed	**150 452**	**SIEH-M12B-NO-K-L**	**150 453**	**SIEH-M12B-NO-S-L**
M18x1								
	7.0	Flush	PNP	Normally open	**150 458**	**SIEH-M18B-PS-K-L**	**150 459**	**SIEH-M18B-PS-S-L**
				Normally closed	**150 462**	**SIEH-M18B-PO-K-L**	**150 463**	**SIEH-M18B-PO-S-L**
			NPN	Normally open	**150 456**	**SIEH-M18B-NS-K-L**	**150 457**	**SIEH-M18B-NS-S-L**
				Normally closed	**150 460**	**SIEH-M18B-NO-K-L**	**150 461**	**SIEH-M18B-NO-S-L**
M12x1 – Stainless steel housing								
	6.0	Flush	PNP	Normally open	**538 252**	**SIEH-M12B-PS-K-L-CR**	**538 251**	**SIEH-M12B-PS-S-L-CR**
M18x1 – Stainless steel housing								
	10.0	Flush	PNP	Normally open	**538 256**	**SIEH-M18B-PS-K-L-CR**	**538 255**	**SIEH-M18B-PS-S-L-CR**

1) Sn Rated operating distance [mm]

Proximity sensors SIEA, inductive

Technical data – Analogue output

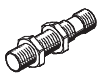
General technical data					
Size		M8x1	M12x1	M18x1	M30x1.5
Type of mounting		Flush			
Distance measuring range	[mm]	0 ... 4	0 ... 6	0 ... 10	0 ... 20
Repetition accuracy	[mm]	0.3	0.3	0.3	0.3
Repetition accuracy under constant conditions	[mm]	±0.01	±0.01	±0.02	±0.05
Displacement resolution	[mm]	0.001	0.001	0.002	0.005

Electrical data					
Size		M8x1	M12x1	M18x1	M30x1.5
Electrical connection	Plug	M8x1, 3-pin	M12x1, 4-pin		
Operating voltage range	[V DC]	15 ... 30			
Max. switching frequency	[Hz]	1,600	1,000	500	200
Protection against short circuit		Pulsed			
Protection against polarity reversal		For operating voltage			
Protection class		IP67			

Materials					
Size		M8x1	M12x1	M18x1	M30x1.5
Housing		Brass, chrome-plated			

Operating and environmental conditions					
Size		M8x1	M12x1	M18x1	M30x1.5
Ambient temperature	[°C]	–25 ... +70			
CE mark (see declaration of conformity)		In accordance with EU EMC directive			
Certification		C-Tick			

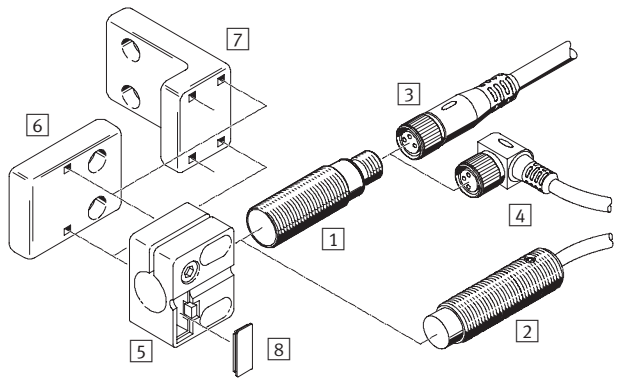
Ordering data

Size	S [1] [mm]	Type of mounting	Analogue output		Electrical connection Plug Part No.	Type
	0 ... 4	Flush	0 ... 10 V	–	**538 291**	**SIEA-M8B-PU-S**
	0 ... 6	Flush	0 ... 10 V	4 ... 20 mA	**538 292**	**SIEA-M12B-UI-S**
	0 ... 10	Flush	0 ... 10 V	4 ... 20 mA	**538 293**	**SIEA-M18B-UI-S**
	0 ... 20	Flush	0 ... 10 V	4 ... 20 mA	**538 294**	**SIEA-M30B-UI-S**

1) S Position measuring range [mm]

Proximity sensors SIE..., inductive

Peripherals overview



Mounting attachments and accessories	
Proximity sensors	
1	SIE...-...-S, with plug
2	SIE...-...-K, with cable
Connecting cables	
3	NEBU-M...G..., SIM-M...-...G
4	NEBU-M...W..., SIM-M...-...W

Mounting attachments and accessories	
Mounting attachments	
5	SIEZ-...B-...
6	SIEZ-UV
7	SIEZ-UH
Inscription label	
8	SIEZ-LB

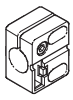
Ordering data – Connecting cables M8x1 Technical data ➔ 169

	Number of wires	Cable length [m]	Part No.	Type
Straight plug socket				
	3	2.5	**541 333**	**NEBU-M8G3-K-2.5-LE3**
		5	**541 334**	**NEBU-M8G3-K-5-LE3**
Angled plug socket				
	3	2.5	**541 338**	**NEBU-M8W3-K-2.5-LE3**
		5	**541 341**	**NEBU-M8W3-K-5-LE3**

Ordering data – Connecting cables M12x1 Technical data ➔ 172

	Number of wires	Cable length [m]	Part No.	Type
Straight plug socket				
	3	2.5	**541 363**	**NEBU-M12G5-K-2.5-LE3**
		5	**541 364**	**NEBU-M12G5-K-5-LE3**
	4	5	**541 328**	**NEBU-M12G5-K-5-LE4**
Angled plug socket				
	3	2.5	**541 367**	**NEBU-M12W5-K-2.5-LE3**
		5	**541 370**	**NEBU-M12W5-K-5-LE3**
	4	5	**541 329**	**NEBU-M12W5-K-5-LE4**

Ordering data – Mounting attachments

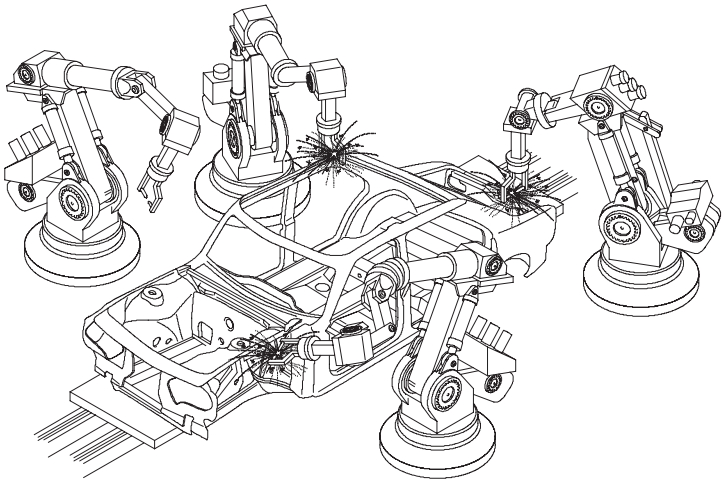
	For design	Part No.	Type
With stop for flush mounting			
	4	**538 343**	**SIEZ-NB-4**
	6.5	**538 344**	**SIEZ-NB-6,5**
	M8	**538 346**	**SIEZ-B-8**
	M12	**538 348**	**SIEZ-B-12**
	M18	**538 350**	**SIEZ-B-18**
	M30	**538 352**	**SIEZ-B-30**
Without stop			
	M8	**538 345**	**SIEZ-NB-8**
	M12	**538 347**	**SIEZ-NB-12**
	M18	**538 349**	**SIEZ-NB-18**
	M30	**538 351**	**SIEZ-NB-30**
	M12, M18	**538 354**	**SIEZ-UH**
		538 355	**SIEZ-UV**
Inscription label			
	M12 ... M30	**538 353**	**SIEZ-LB**

Proximity sensors SIE..., inductive

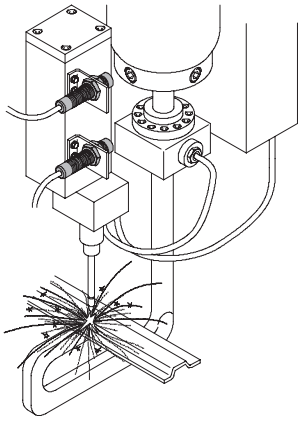
Application examples

FESTO

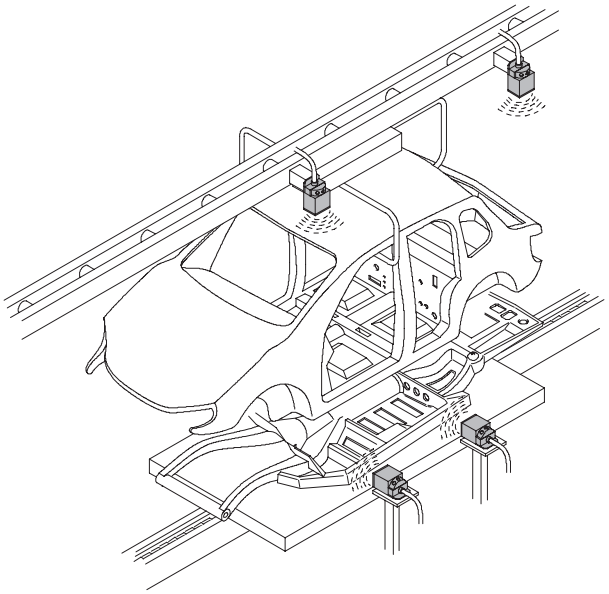
Proximity sensor with switch output



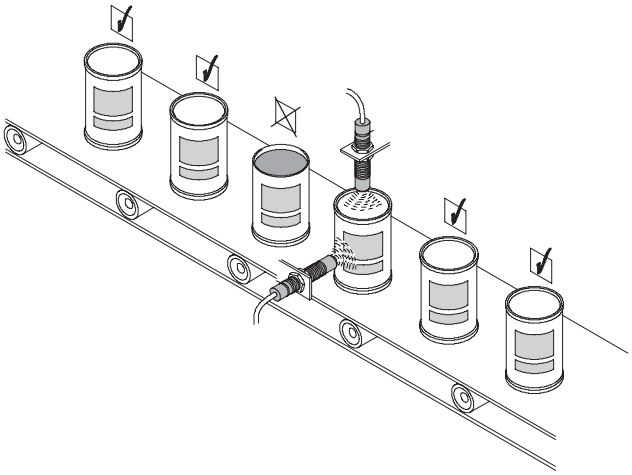
- End-position monitoring in welding robots and automatic welders with magnetic field immune sensors SIEF-WA.



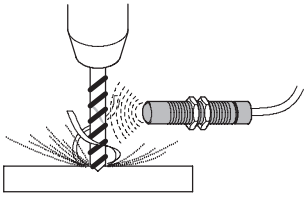
- It can also be used directly next to welding electrodes.



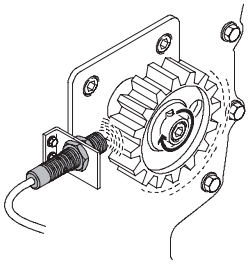
- Thanks to their long operating distance for all metals, block-shaped proximity sensors SIEF-Q40 guarantee reliable operation in transport and conveying systems in the automotive industry.



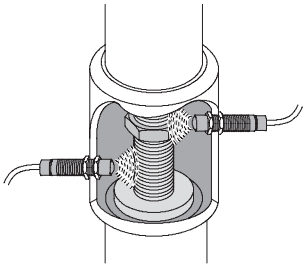
- Detection of cans and checking for the presence of the lid



- Monitoring tools (drill breakage)



- Proximity sensing of the teeth of a gearwheel for monitoring of the machine speed



- Detection of valve positions

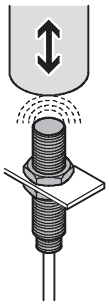
Proximity sensors SIE..., inductive

Application examples

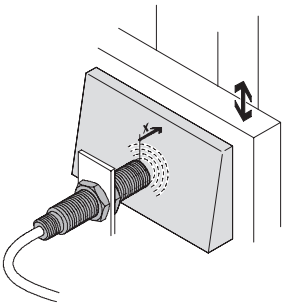
FESTO

Proximity sensors with analogue output

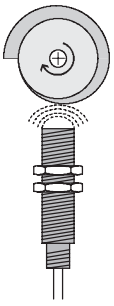
Festo proximity sensors SIEA with analogue output supply an electrical signal, which is proportional to the distance between the active surface of the sensor and the metallic object. This output signal also varies relative to the size of the detected object (if this is smaller than the standard test plate or smaller than the sensor) and its material (different metals require different reduction factors for the nominal operating distance Sn). These effects facilitate a wide range of applications in automation technology.



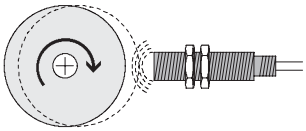
- Direct conversion of linear motion into an electrical signal.



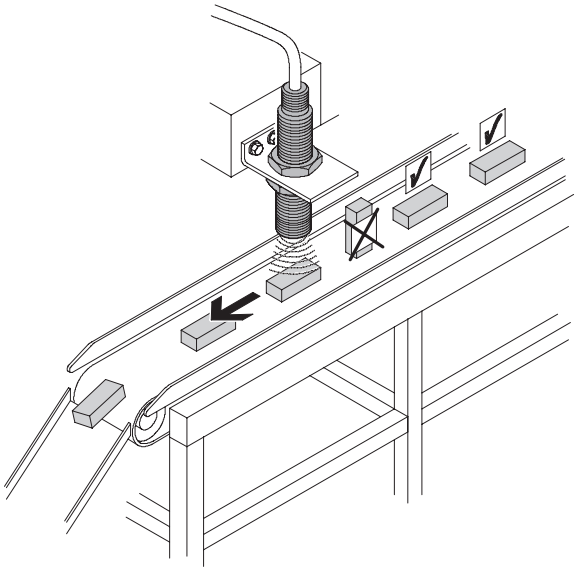
- Conversion of linear motion into an electrical signal using a wedge-shaped conduction component.



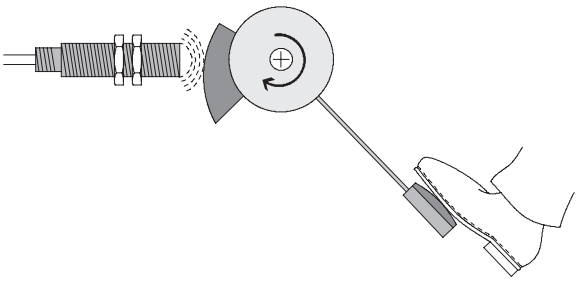
- Conversion of rotation into an electrical signal.



- Checking the smooth running of an axis or shaft.



- Monitoring of metallic workpieces for position, size or material, for example.



- Conversion of a rotation angle or distance into an electrical signal.

Proximity sensors SIE..., inductive