



Special-Sensors for Automation

Inductive Sensors

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Technical alterations are reserved to us without prior announcement. The information provided in this catalogue is for reference only. Product installation information can be found in the instructions supplied with each product.

Inductive Sensors

Application notes

Sensors

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Metal face sensors

The inductive proximity switches series IGV are used in areas with heavy-duty mechanical loads at the sensor's face or where seals between face and housing cannot be used. Chips hitting the front or frequently changing coolants or lubricants do not diminish the function of these proximity switches. The variants with a PTFE coating are particularly well-suited for welding lines and similar environments where sensors are exposed to heavy soiling. Metal face switches are manufactured from stainless steel and are one solid piece. They detect iron and steel through the metal front face.

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POLAR-Switches

The POLAR-switch is ideal for application in cold storage houses and in extreme climate conditions. It is waterproof, safe for cleaning and extremely chemical-resistant. Because of its stainless steel housing, it can withstand vibrations on vehicles. The POLAR-switch is very compact and robust, it can be used from $-60\text{ }^{\circ}\text{C}$ to $+60\text{ }^{\circ}\text{C}$. IGMP 030 S-80 sensors are suitable in cryogenic processes and for medical-technical applications; they can be used for temperatures up to $-80\text{ }^{\circ}\text{C}$.

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TROPICAL-Switches

The TROPICAL switches series IGMF are anticipated for applications in corrosive environment. They are stable particularly at frequent temperature changes and simultaneously high humidity. The permanent work in carwashes is permissible. The high corrosion resisting at simultaneously high mechanical loading capacity is reached through the combination of PTFE and titan stabilized stainless steel. The PTFE-hoods are sealed through fluoroelastomers O-rings surely. The FEP-connecting cable is poured within the housing and freed over a double seal from the housing. Cable lengths up to 100 m are available. The installed LED's are shining through the cable side cap and don't break out the case. IGMW series sensors are suitable for hydro steam environ-

ments with pressures of up to 4 bars. For higher pressures in hydro steam environments, IGFW series sensors made of full stainless steel are recommended.

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120 °C-High temperature switches

The inductive PTFE switches series IGFW and INFW are made entirely of PTFE. The housing cover is securely sealed with a fluoroelastomer O-Ring. These sensors are designed for particularly difficult and aggressive environmental conditions. They can be used in damp and aggressive environments as well as under water (oil). IGMT- and IDT-series proximity switches are designed for use in temperatures up to $120\text{ }^{\circ}\text{C}$.

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160 °C-High temperature switches

Inductive compact devices for ambient temperatures up to $160\text{ }^{\circ}\text{C}$ are available flush and non-flush in the standard designs M12, M18 and M30 with switching distances from 2 mm to 15 mm. The material used is the rugged stainless steel housing combined with high temperature resistant PEEK plastic.

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250 °C-High temperature sensors

The inductive proximity switches series IGH/IDH/IRH are used for ambient temperatures up to $250\text{ }^{\circ}\text{C}$. The units feature optional a plug connection which withstands high temperatures, allowing users to quickly and easily install a replacement sensor head in case of damage without having to replace the sensor cable. The sensors are particularly suited for operation in extreme heat, e. g. in drying ovens or brick kilns. Manufactured from aluminum / stainless steel and PEEK, the robust sensors can be used in rugged industrial environments. Their electronics are housed separately in a plug-gable cable amplifier. The units are connected via a metal armored cable.

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Amplifiers

Switching amplifiers are designed for induction sensors for which it is necessary to separate the sensor coil from the amplifier, e. g. for operating tem-

peratures above $160\text{ }^{\circ}\text{C}$ or for sensor coils which must be exchanged due to frequent damage. The switching amplifiers work statically, that is, if the sensor coil is permanently damped, the switching output also remains activated. Switching interval and hysteresis (IKM 120 GPP, IU 130...) can be set on the amplifier. The sensor cable may have a length of up to 20 m.

Page 3.37 – 3.44

Demanding environment

The "Demanding environment" series is especially designed for harsh environments in which sensors are subjected to high electrical, electromagnetic or mechanical stress. For sensors used in critical applications, EGE has developed special inspection and test methods which place particular emphasis on the disturbances that occur in various production environments. The sensors are designed to be very resistant to the interference spectra produced by, e. g., frequency inverters, wireless communication systems and switching power supplies.

Page 3.51

Surface sensors IFE...

The switches are build as flat sensors. They are used particularly to detect moving sheet metal or steel rods on conveyor belts. The complete sensor is covered, which make the sensor moisture resistant. Reduced overall height affects the operating distance (sn). The IFE switches are self-contained with integral amplifier.

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Dust- and Gas-Ex sensors

Series IGEXa..., IGEX20a... and IGEX22c... are sensors for detecting metals in the Ex area zone 0/20 and zone 2/22 according to ATEX and IECEx. Devices can be delivered in the standard configurations M12, M18 and M30. For extreme environment sensors are available for high and low temperatures (up to $+140\text{ }^{\circ}\text{C}$ and down to $-60\text{ }^{\circ}\text{C}$ respectively), both in IP 68/IP 69.

Inductive Sensors

Technique & Application

Terminology

Operating principal

An inductive proximity switch works with a high frequency oscillating circuit that creates an alternating electro-magnetic field on the active sensor surface by means of a coil. When a metallic object nears this field a damping occurs in the oscillating circuit. If this damping exceeds a threshold value, a switching signal is generated.

Operating distance

The operating distance is the distance between an object and the active sensor surface at which a switching signal is generated. The operating distance depends on the diameter of the coil. Therefore larger sensors are required for longer operating distances. On some of the EGE sensors the operating distance is adjustable.

If a metal object dampens only a part of the alternating field, the operating distance decreases; a larger object increases it. The following approximate values are derived from a standard rectangular measurement plate made of steel ST 37 with an edge length that corresponds to the diameter of the sensor coil or three times the rated operating distance, whichever is greater.

Damping area in %						
150	100	75	50	25	12,5	
Operating distance in %						
110	100	93	86	73	55	

The operating distance is influenced by the material of the object: Constant dimensions for different materials against steel ST 37 yield a changed operating distance.

The following table lists approximate values for the material dependent reduction factors. In practical applications variations could occur due to different alloying, for example.

Material	Operating distance in %
Stell ST37	100
Stainless steel	70
Brass (Br)	50
Copper (Cu)	45
Aluminium (Al)	40

Rated operating distance s_n

The rated operating distance is a device parameter that does not take into account sample variances and external influences such as temperature and supply voltages.

Effective operating distance s_r

The effective operating distance is the operating distance at nominal voltage and a nominal temperature of 23 °C. It is between 90% and 110% of the rated operating distance.

Usable operating distance s_u

The usable operating distance lies in the entire allowable temperature and voltage range between 90% and 110% of the effective operating distance.

Assured operating distance s_a

The assured operating distance takes into account all the external influences and sample variances and lies in the range from 0% to 80% of the usable operating distance. Within this range a guaranteed switching is ensured.

Switch point drift

The operating distances are given for an ambient temperature of 23 °C. In the permissible temperature range the operating distance varies by less than 15% from the value at 23 °C. The temperature of the measured object has no influence on the switch point.

Hysteresis H

The switching hysteresis describes the distance between the turn-on point while approaching an object and the turn-off point during the separation of it from the sensor. The hysteresis brings about a stable switching signal even when there are vibrations, temperature drift, or electrical variations. The hysteresis is defined in EN 60947-5-2 as a maximum 20% from the effective operating distance, and carries a value of typically 10% from the effective operating distance s_r for EGE sensors.

Repeating accuracy R

The repeating accuracy describes the maintenance of the switching point after the repeated approach of an object under specified circumstances. EGE sensors have typical tolerances of less than 3% of the effective operating distance.

Switching frequency

The maximum switching frequency of the sensor is determined at half rated operating distance s_n with standard measurement plates to EN 60947-5-2

Inductive Sensors

Technique & Application

Terminology/Installation and operation

Operating voltage

The operating voltage is the voltage range within EGE sensors function safely. For a constant voltage supply it is important to make sure that the limits are still observed when the residual ripple is included.

Switching current

This current gives the maximum long-term current for the switching output of the sensor at an ambient temperature of 25 °C and ohmic load. At an elevated ambient temperature, the current load capability decreases. For analog outputs, the boundary values given in the appropriate technical data, and particularly the permissible values for resistance loads, must be observed.

Short circuit protection

The short circuit protection ensures the sensor against destruction through a short circuit on the output. After removal of the fault, the output is reactivated. Where a maximum overload current is listed, this should not be exceeded.

Excess-current release

This value indicates the median value of current at which the short circuit protection responds with a tolerance of $\pm 20\%$.

Reverse polarity protection

The reverse polarity protection prevents destruction of the sensor by a reversal of the polarity of the voltage supply.

Voltage drop U_d

The voltage drop arises at the internal resistance of semiconductor elements, which are in the current-path of the output. It is dependent of the load-current and is declared according to EN 60947-5-2 for a mean current of 50 mA.

Residual current I_r

The residual current flows in the load current circuit when the output is blocked. The residual current must be considered when switching sensors in parallel.

Minimum load current I_m

The minimum load current is necessary for flawless operation with two-wire devices.

Current consumption

The current consumption is the maximum value of the no-load current so that the sensor can absorb without a load.

Ambient temperature

The ambient temperature indicates the maximum allowable temperature range for the sensor.

Electromagnetic compatibility EMC

The EMC class is a measure of the noise immunity of the sensor against external electrical and magnetic influences. The information is based on the standard EN 61000-6-2.

Switch-on impulse suppression

EGE sensors have a switch-on suppression that blocks the output during the switch-on phase, when the operational voltage is applied.

Protective system

The protective system indicates the protection of the sensors against penetration of foreign bodies and water to EN 60529.

LED display

EGE sensors with yellow light-emitting diodes indicate the switching status optically.

Housing material

The housing material determines the chemical resistance of the sensor against external influences. For special applications, other housing materials are available.

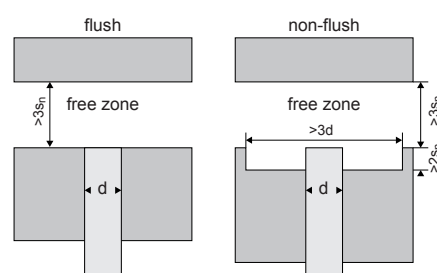
Connection

The connection of the sensors is accomplished through plug-in connections or cables. Different cable types and lengths are available upon request.

Instructions for mounting

Mounting

For flush mounting the sensor can be built into metal up to its active surface without changing its characteristics. For non-flush mounting a metal-free zone around the sensor must be allowed for. A free zone to the material opposite the sensor must be maintained for all sensors.



The indicated free zones are in accordance with the standard EN 60947-5-2.

Fixing nuts are part of delivery for all metal thread sensors.

For mounting clamps see page 3.71.

Inductive Sensors

Technique & Application

Installation and operation

Collocation

When collocating the sensors, a minimum separation must be kept between the devices. When in doubt, a test should be conducted under application conditions. For flush mounting the lateral separation between two sensors must correspond to at least the diameter of the sensor. For non flush mounting, the lateral separation from each other must correspond to at least twice the diameter of the sensor. For oppositely mounted sensors, a minimal separation of six times the rated operating distance should be allowed.

Torques

In order to prevent destruction of the threaded bushing during fitting, the following maximum torques must not be exceeded:

Design	Metal housing	Plastic housing
M5x0.5	3 Nm	–
M8x1	6 Nm	0.25 Nm
M12x1	10 Nm	1 Nm
M18x1	25 Nm	2 Nm
M30x1.5	40 Nm	5 Nm

PTFE sensors may only be tightened by hand.

Instructions for operation

Serial connection

For the serial connection of two wire or three wire sensors the individual voltage drops are added together. Therefore there is a lesser operational voltage at the disposal of the load. The addition of the switch-on delay times should be noted.

Parallel connection

The parallel connection of two wire sensors can only be conditionally recommended since the residual currents are added together and flow through the load. For the parallel connection of three wire sensors, the current consumption of the individual devices is added together. Since this current does not flow through the load, the maximum number of parallel connectable three wire sensors depends only on the power supply.

Approval for safety applications

Sensors for personal security must have a qualification approval according to EN 61508 and must be labeled accordingly. Sensors that are not labeled must not to be used for applications of this kind.



Probes Compact models Amplifiers





POLAR-Series DC | Climativ-proofed –60 °C

Proximity switches

M12 / M18 / M30
Stainless steel sleeve

DC 10...30 V

IP 68 Water-proofed
IP 69 Resistant to
high pressure cleaning



Design	DC PNP • M12x1		DC PNP • M18x1		DC PNP • M30x1.5	
Dimensions						
Installation flush (f) non flush (nf)						
Operating distance sn [mm]	2 f	4 nf	5 f	7 nf	10 f	15 nf
Switching output PNP						
ID-No.	P31145	P31146	P31147	P31148	P31219	P31220
Type	IGMP 02 GSP	IGMP 04 GSP	IGMP 05 GSP	IGMP 08 GSP	IGMP 010 GSP	IGMP 015 GSP
Supply voltage [V]	10...30 DC					
Switching current [mA]	200					
Short circuit proof	•					
Overcurrent release [mA]	230					
Reverse protection	•					
Voltage drop max. [V]	2					
Load current [mA]	–					
Current consumption [mA]	4					
Switching frequency [Hz]	1000					
Ambient temperature [°C]	–55...+60					
Temperature min. [°C]	–60					
Temperature gradient [K/min]	5					
EMC-class	A					
Protection [EN 60529]	IP 68 + IP 69					
LED display	•					
Housing material	PTFE / AISI 316 Ti					
Connection	2 m FEP-cable 3x0.34 mm ²					
Switching current						



POLAR-Series AC | Climativ-proofed –60 °C

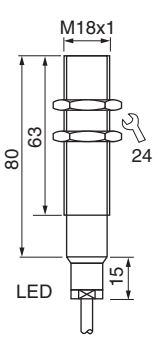
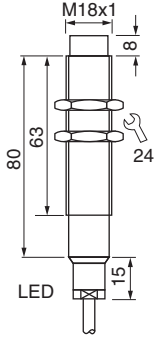




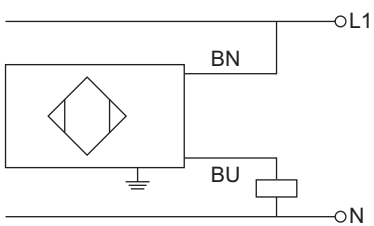
Proximity switches

M18
Stainless steel sleeve

AC 20...250 V

IP 68 Water-proofed
IP 69 Resistant to
high pressure cleaning



Design	AC • M18x1	
Dimensions	 	
Installation flush (f) non flush (nf)	 	
Operating distance sn [mm]	5 f	7 nf
Switching output	 	
ID-No.	P31149	P31150
Type	IGMP 005 WS	IGMP 008 WS
Supply voltage [V]	20...250 AC	
Switching current [mA]	300	
Short circuit proof	-	
Overcurrent release [mA]	-	
Reverse protection	-	
Voltage drop max. [V]	4.5	
Load current [mA]	5	
Current consumption [mA]	2.5	
Switching frequency [Hz]	25	
Ambient temperature [°C]	-55...+60	
Temperature min. [°C]	-60	
Temperature gradient [K/min]	5	
EMC-class	A	
Protection [EN 60529]	IP 68 + IP 69	
LED display	•	
Housing material	PTFE / AISI 316 Ti	
Connection	2 m FEP-cable 3x0.75 mm ²	
		



POLAR-Series | Climativ-proofed –80 °C

Proximity switches

M30

Stainless steel sleeve

IP 68 Water-proofed

–80 °C permanent temperature



Design	M30x1.5
<p><i>Dimensions</i></p> <p>Installation flush (f) non flush (nf)</p>	
Operating distance sn [mm]	3 nf
ID-No.	P31337
Type	IGMP 030 S-80
Supply voltage [V]	–
Switching current [mA]	–
Hysteresis max. [%]	10
Short circuit proof	–
Reverse protection	–
Current consumption [mA]	–
Switching frequency [Hz]	–
Ambient temperature [°C]	–80...+50
EMC-class	A
Protection [EN 60529]	IP 68
LED display	–
Housing material	PTFE / AISI 316 Ti
Connection	2 m FEP-cable 3x0.75 mm², shielded
Sensor for the connection to amplifier IKM 120..., see page 3.35	