SAIET®

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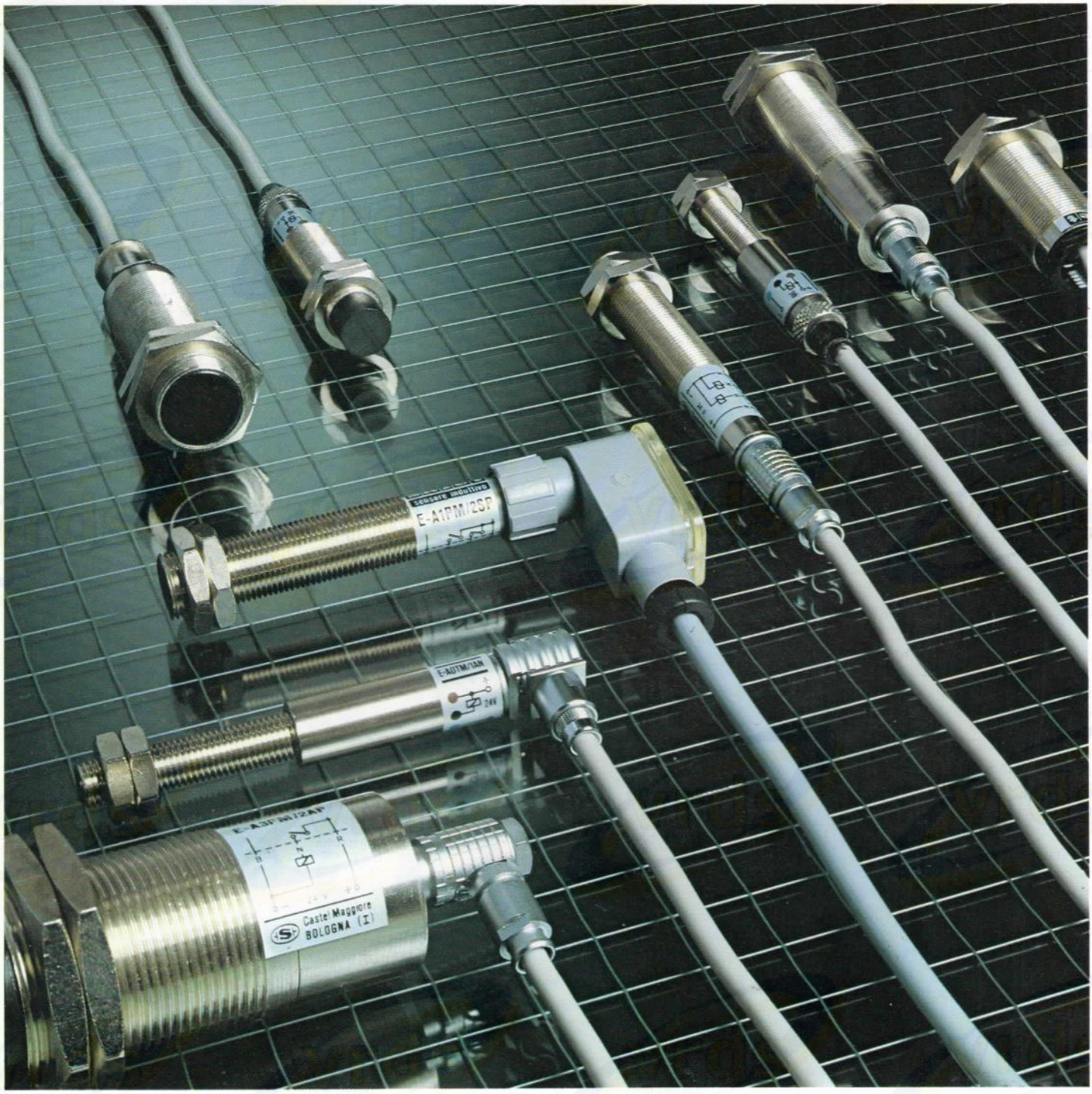
Cylindrical self-amplified inductive proximity sensors

by CENELEC EN 50008 and EN 50036 Standards



Inductive proximity sensors

Operating principle
Inductive proximity sensors take advantage of the phenomenon of the damping of an electro-magnetic field caused by the induced currents (Focault currents) in conducting materials placed in their proximity.
Fig. 1 shows their block diagram. The coil of an oscillator generates an high frequency electro-magnetic field, which induces parasitic currents in close metallic actuators. These currents cause an energy loss in the oscillator, lowering the signal amplitude. This reduction of amplitude is detected by a Schmitt Trigger which guarantees a clean commutation and no bounces and controls a final amplifier to drive an external load. The operating distance depends on the actuating metal, as shown in Fig. 2.

Typical uses
Thanks to the high reliability of the advanced electronic technologies these components are particularly suitable for operation in very difficult working conditions, such as in presence of lubrificants, oils and vibrations, and in installation where the component must be water-tight. Typical appliance fields are machine-tools, plastic and baked clay working machines, packing and automatic wrapping machineries, car industries, etc.
The absence of mechanical contact between actuator and sensors, together with the above facilities, allows practically unlimited life and operations number in comparison with the other types of mechanical switches and avoids also any problem of programmed maintenance.

Self-amplified and non-amplified sensors
Inductive proximity sensors are divided into two categories:
- non-amplified sensors, that are essentially composed of an oscillator and are used to obtain low level signals able to drive a separate amplifier. Their use is particularly required in installations where special safety measures are necessary (buildings with fire or explosions danger). For further details please refer to Saiet catalogue on non-amplified sensors.
- self-amplified sensors (see block diagram in Fig. 1) that are divided into DC and AC sensors.

The whole range of Saiet products complies with the settled international standards (CENELEC) for the standardization of the different types of sensors.

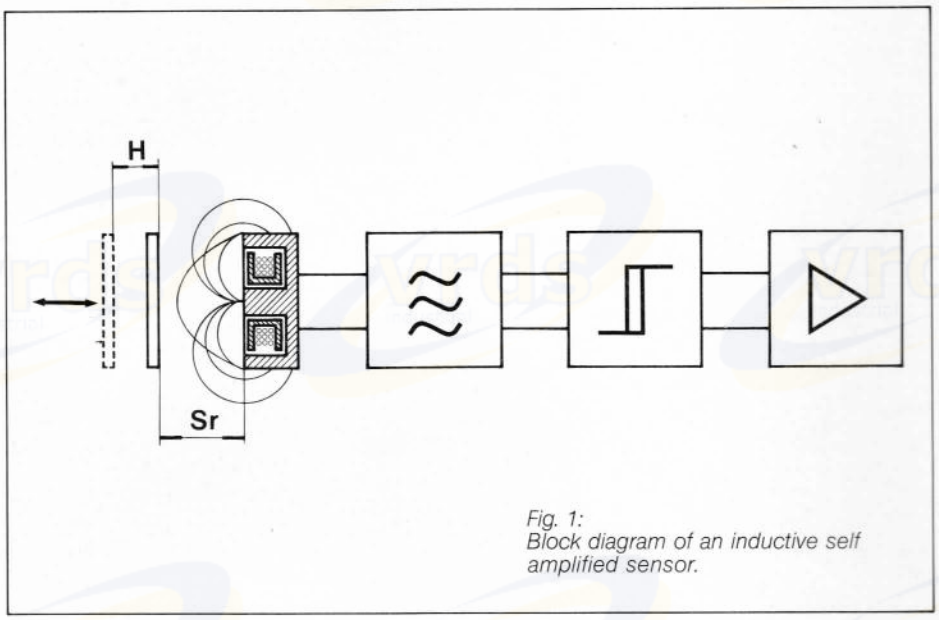


Fig. 1:
Block diagram of an inductive self amplified sensor.

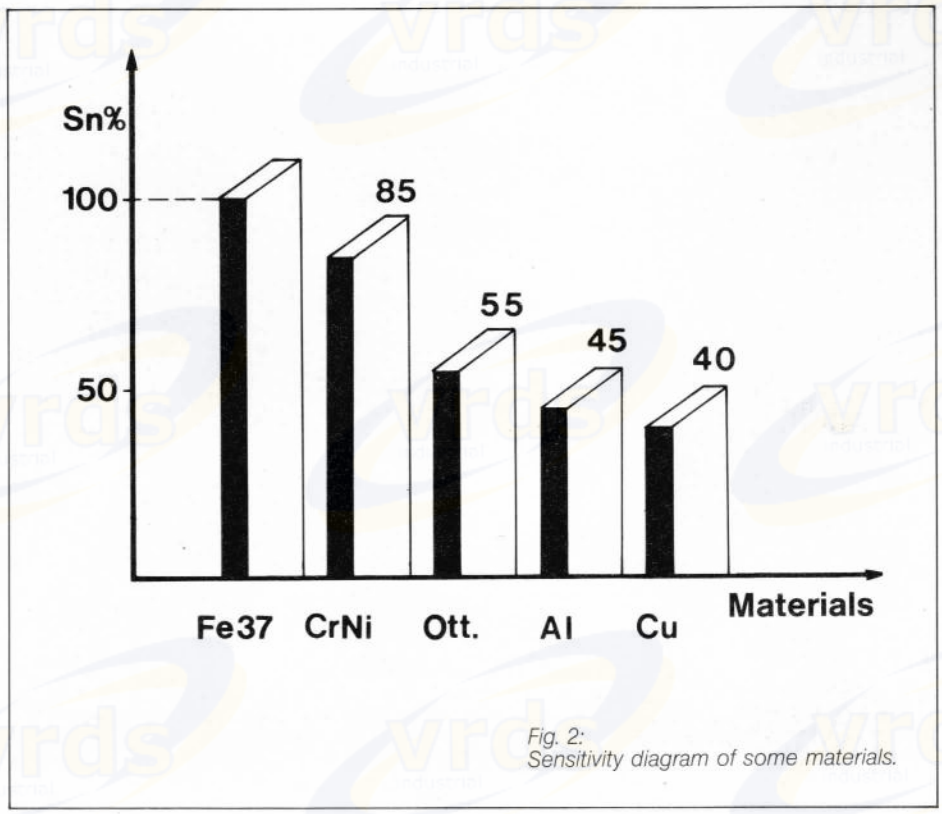


Fig. 2:
Sensitivity diagram of some materials.

Self-amplified inductive sensors

The most important parameters of sensors according to CENELEC Standards now in force follow here below.

Nominal operating distance
It is the geometrical distance between actuator and detector at the steep change of the logical state. The tests are to be done according to CENELEC EN 50010 Standard. The metallic actuators (Fe 37) are square shaped, 1 mm thick; their size is shown in Table I for cylindrical sensors.

Diameter (mm)	Nominal distance Sn (mm)	Fe 37 actuator (mm)
8	1	□ 8x1
8	2	□ 8x1
12	2	□12x1
12	4	□12x1
18	5	□18x1
18	8	□24x1
18	10	□30x1
30	15	□45x1

Table I: Actuator dimensions as function of the diameter and of the operating distance.

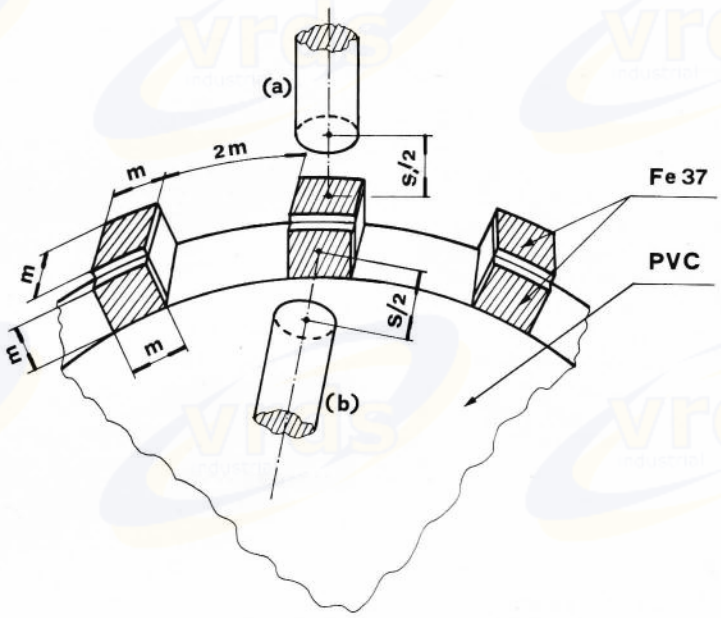


Fig. 3:
method for measuring the operating frequency.

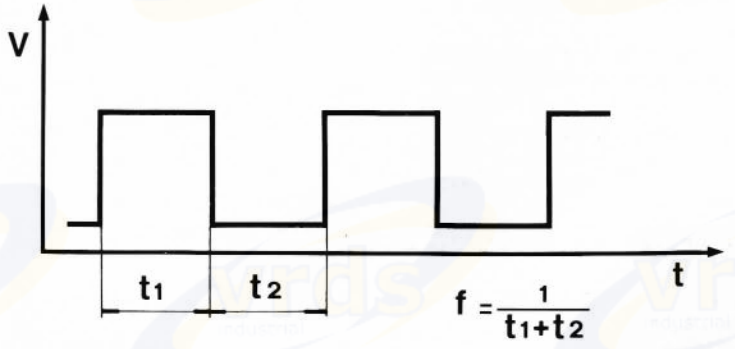


Fig. 4:
graphic of the sensor output signal.

Differential travel
It is the distance between the operating point at the actuator approach and the switching off point at the actuator getting away. Its value is given as percentage of the operating distance.

Repeat accuracy
It is the variation between any value of the operating distance measured in a period 8 hours long at a temperature between 15°C and 30°C and supply voltage within ± 5% of the nominal value.

Operating frequency
According to CENELEC EN 50010 this parameter is measured by means of the dynamic method shown in Fig. 3 with the sensor in positions (a) and (b); S is the nominal operating distance.
The frequency is given by the formula

$$f = \frac{1}{t_1 + t_2}$$ (ref. Fig. 4)

when T_1 or T_2 reach the value 50 µsec.

Ripple
It is given by the ratio in percentage between the residual alternate voltage (ripple) (peak to peak) on the direct supply voltage and the direct supply voltage itself.

Voltage drop
It is the voltage drop measured at activated sensor.

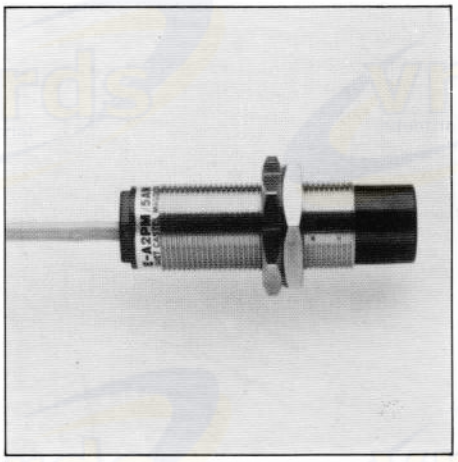
Residual current
It is the load current at quiescent sensor.

Permanent current capacity
It is the maximum current that the sensor can supply in continuos working.

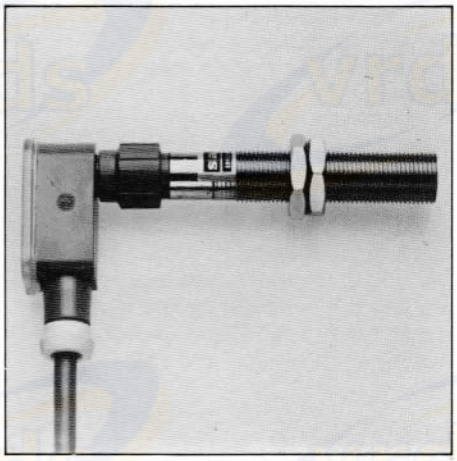
Saiet DC inductive sensors

General features

Being cylindrical shaped (in accordance with CENELEC EN 50008 Standard) and realized according to the most advanced electronic technology, Saiet sensors reach a very high qualitative level of performance and safety. Available in metallic casing and in totally and partially shielded versions (the last one is more sensitive), they are dipped in a poliuretanic resin which makes them dust- and water-proof and shock resistant. All the models can be supplied with connector, with Led indicating the output status and with protection against short-circuit.
Saiet realizes also sensors on specific request of the customers.



Sensor in partially shielded version



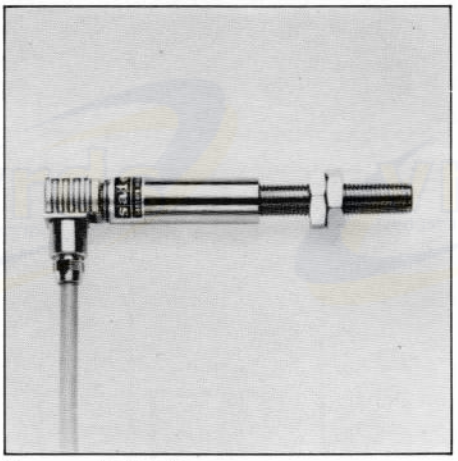
Sensor with HIRSCHMANN connector

General features

- cylindrical threaded shape
- metallic casing
- totally or partially shielded versions
- unlimited number of operations
- shock resistance according to IEC 68.2.27 Standard
- vibration resistance according to IEC 68.2.6 Standard
- protection degree IP 67
- temperature range from − 25°C to + 70°C
- protection against reverse polarity
- protection against inductive electrical noises
- output connecting cable 2 m. long with internal conductors section 0,15 mm²
- conductors colours according to CENELEC standards

Optional features

- three suggested types of connectors (Bendix, Hirschmann, Lemo) or any other on specific request
- Led indicating the output status
- protection against short circuit.

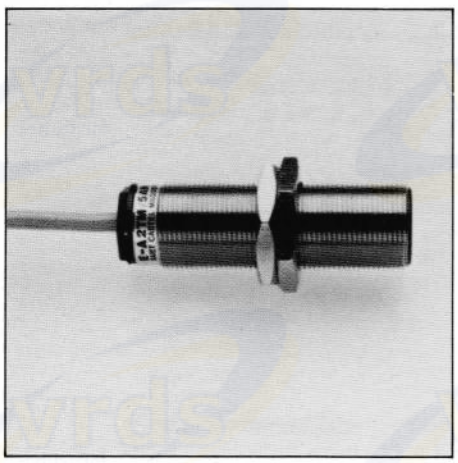


Sensor with LEMO connector

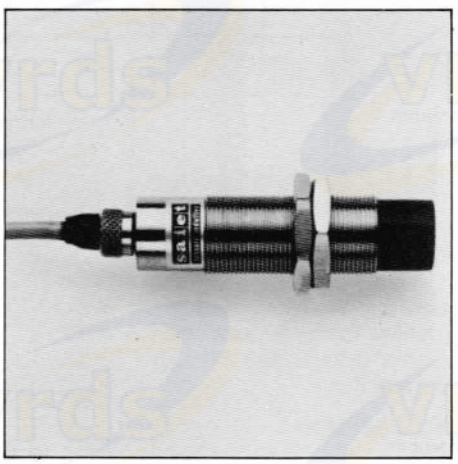
Working features

- tolerance on front operating distance (S) ± 10%(1)
- differential travel as S percentage ≦ 10%
- max output current 250 mA(2)
- repeat accuracy as S function ≦ 0,1 S
- supply voltage from 10 to 30 V
- max ripple 10%(3)
- voltage drop at the max current ≦ 1,5 V
- absorption at quiescent sensor ≦ 5 mA
- operating threshold of short circuit protection (where provided) 150 mA
- operating frequency (dependent on the chosen model) from 150 to 2000 Hz

(1) 15% for diam. 8 mm sensors
(2) 150 mA for diam. 8 mm sensors
(3) 2% for diam. 8 mm sensors



Sensor in totally shielded version

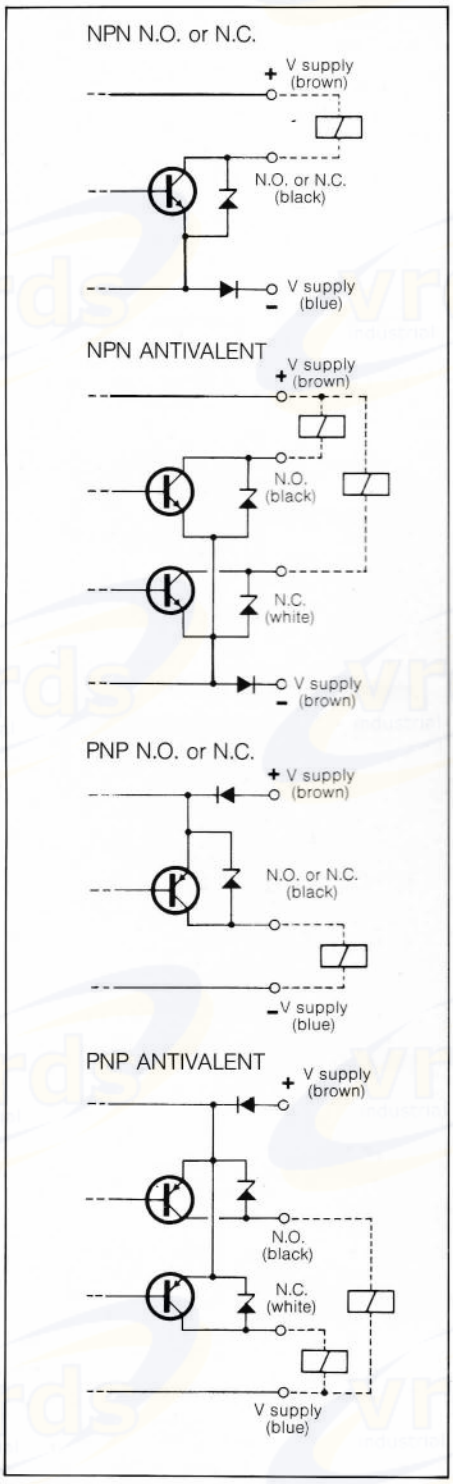


Sensor with BENDIX connector

Appliance features

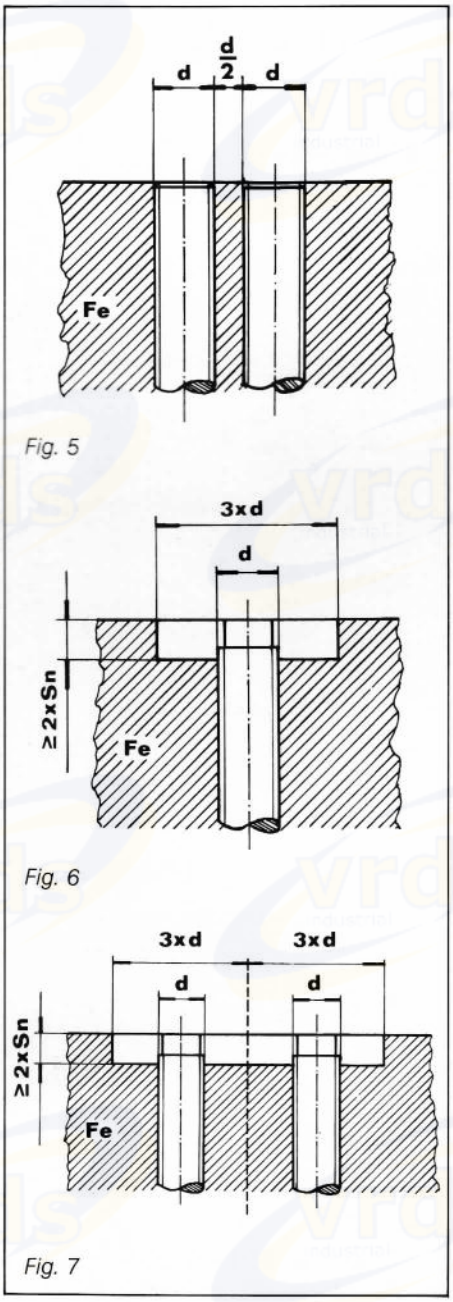
Output types

Two polarities (PNP and NPN) and three functions (normally closed, normally open, antivalent) are available.



Mounting

The totally shielded models can be embedded in metal for flush mounting, respecting, in case of side by side mounting, the distances shown in Fig. 5. The partially shielded types should be mounted respecting the lay-out of Fig. 6. In case appliance requires side by side mounting, follow the instructions of Fig. 7.



Mounting notes

It is a good precaution to provide that cabling is not too long and that it has the minimum possible number of connections to high inductive loads cables (motors, brakes, clutches, self-braking, etc.).
It is better to realize the power supply separately and respecting the required specifications for the ripple. Therefore together with the rectifying bridge it is necessary to provide a capacitor filter that levels the pulsating current (see Fig. 8).

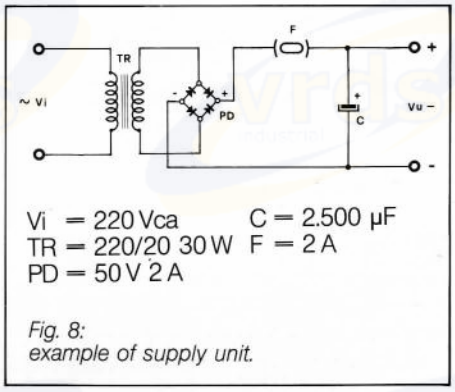


Fig. 8:
example of supply unit.

Functionality test

Test on the sensors must not be effected by means of buzzers or incandescent lamps, but by means of testing devices normally employed in electronics, i.e. oscilloscope and digital multimeters (generally high impedance).

Torque stress for sensor mounting

During the sensor fixing on its support, the torques shown in Tab. I and III (pag. 10 and 11) must not be exceeded while screwing the nuts.

Available Accessories

- Connections for plastic sheath:
  RGK-0 for sensors with code:
  E-A0TM/
  E-A0PM/

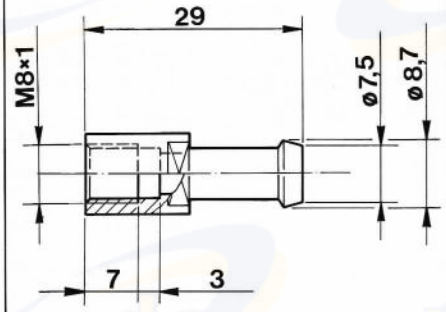
  RGK-1 for sensors with code:
  E-A1TM/
  E-A1PM/

  RGK-2 for sensors with code:
  E-A2TM/
  E-A2PM/
  E-A3TM/
  E-A3PM/

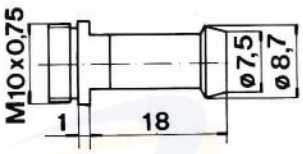
- Connections for metallic sheath:
  RGM-0 for sensors with code:
  E-A0TM/
  E-A0PM/

  RGM-1 for sensors with code:
  E-A1TM/
  E-A1PM/

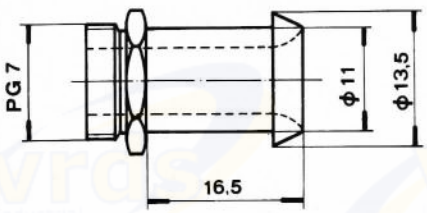
RGK-0



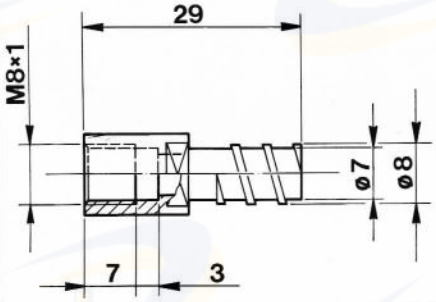
RGK-1



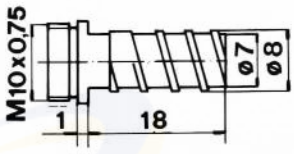
RGK-2



RGM-0



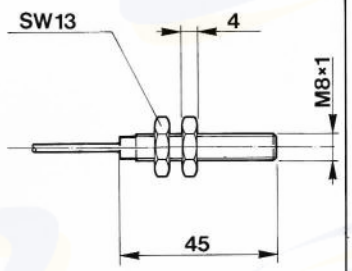
RGM-1



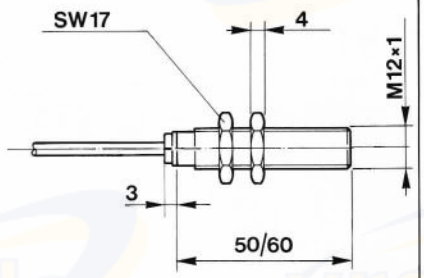
Max dimensions

The measures on the right of the dash refer to the led versions

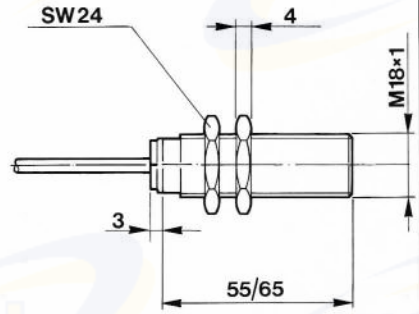
diameter 8 mm :



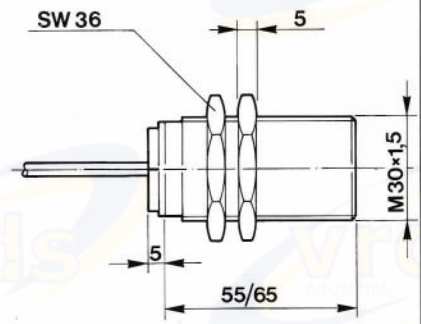
diameter 12 mm :



diameter 18 mm :

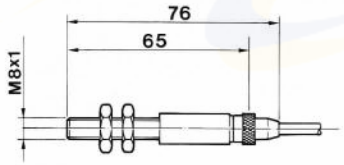


diameter 30 mm :

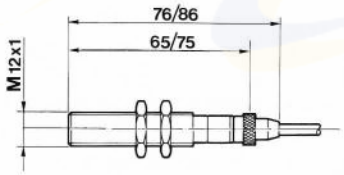


The measures on the right of the dash refer to the led versions

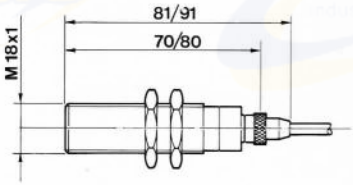
diameter 8 mm :



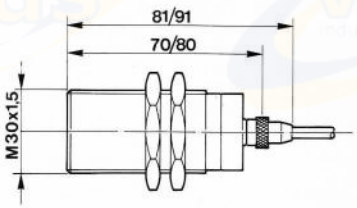
diameter 12 mm :



diameter 18 mm :



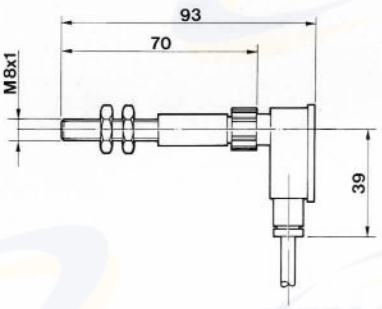
diameter 30 mm :



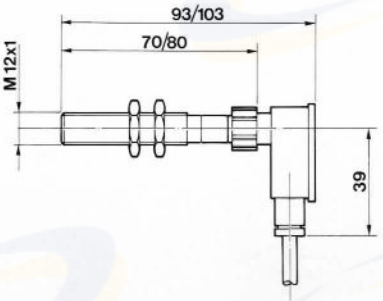
BENDIX connector

The measures on the right of the dash refer to the led versions

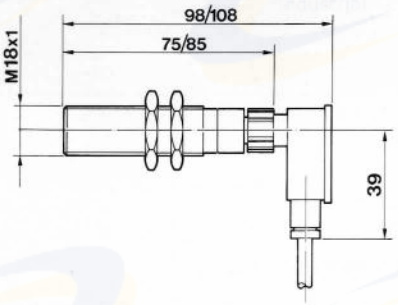
diameter 8 mm :



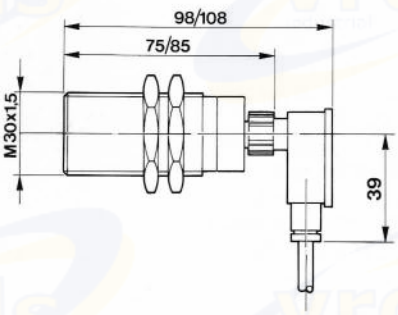
diameter 12 mm :



diameter 18 mm :



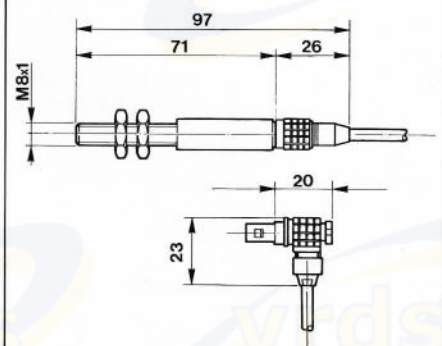
diameter 30 mm :



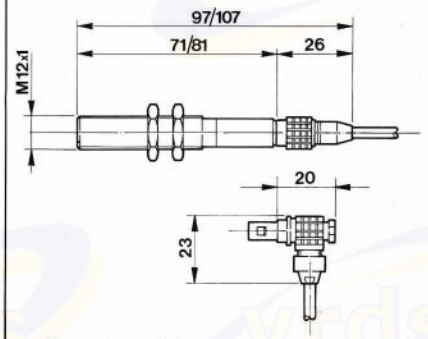
HIRSCHMANN connector

The measures on the right of the dash refer to the led versions

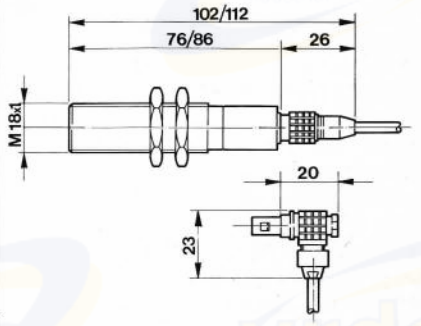
diameter 8 mm :



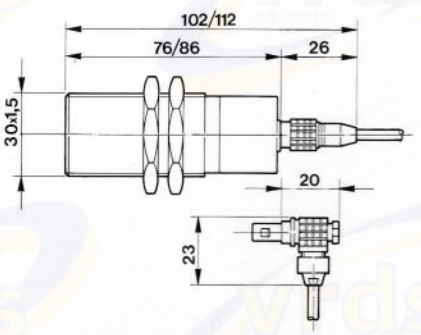
diameter 12 mm :



diameter 18 mm :



diameter 30 mm :

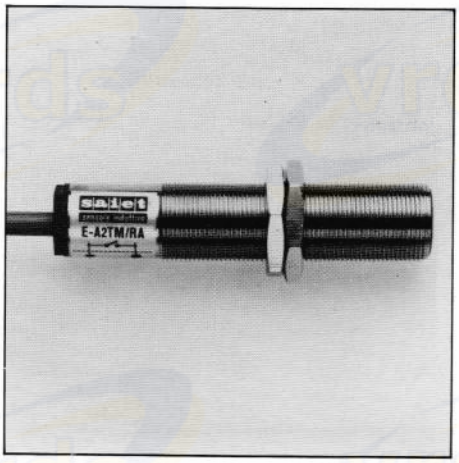


LEMO connector

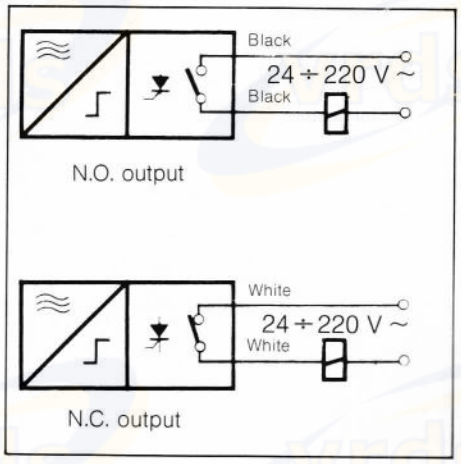
Saiet AC inductive sensors

Working principle

The operating principle is analogous to the DC sensor's one ; therefore the oscillator and the trigger are the same. Since it has to drive an AC load, the output actuator is an SCR with pertinent control circuit.
As the DC types, Saiet AC sensors are threaded and cylindrical shaped and are realized in totally or partially shielded version and in metallic or plastic casing. They comply with CENELEC EN 50036 Standard and some of their features (such as operating voltage range from 24 to 220 V, protections against noises, absence of wrong pulses while turning on) make them extremely versatile in appliance and very reliable in usage.



Sensor in totally shielded version



General features

- sensitive to every metallic material with sensitivity dependent on the actuator metal
- unlimited number of operations
- shock resistance according to IEC 68.2.27 Standard
- vibration resistance according to IEC 68.2.6 Standard
- protection degree IP 67
- temperature range from − 25°C to + 70°C
- absence of wrong pulses while turning on
- protection against electrical interferences of inductive origin
- insulation between case and parts under voltage over 4000 V (the earth conductor, normally supplied with 12 mm diam. sensors, can be supplied on request)
- totally or partially shielded versions
- metallic or plastic casing
- output connecting cable 2 m long with internal conductor section 0,35 mm²

Sensor in partially shielded version

Working features

• tolerance on front operating distance S	± 10%
• max differential travel as S percentage	15%
• repeating accuracy as S function	≦ 0,1 S
• supply voltage range (V_{RMS})	from 21 to 255
• main frequency (Hz)	from 45 to 65
• min inductive load VA	2,5
• max quiescent current (mA)	3
• max operating frequency (Hz)	25
• voltage drop (V_{RMS})	≦ 5

Appliance features

Output types

N.O. and N.C. output are available.

Mounting

Refer to what above described for DC types. In partially shielded plastic models (see Fig. 9) a notch reference on the case indicates the right mounting position on metallic supports.

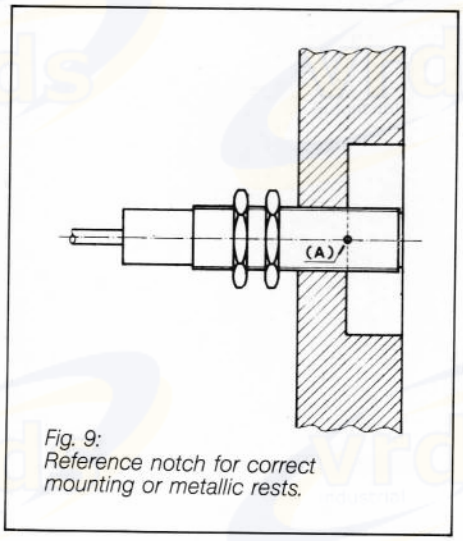


Fig. 9:
Reference notch for correct mounting or metallic rests.

Torque

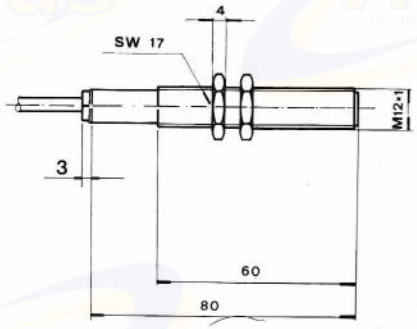
Refer to DC sensors.

Accessories

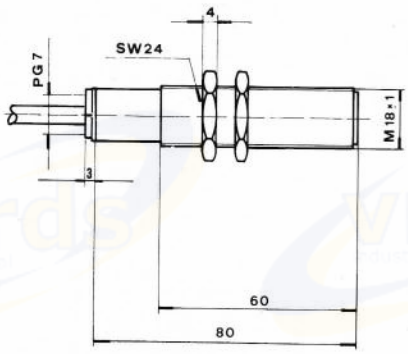
For protecting the output cable we suggest the use of Saiet connection, as described on page 6.

Max dimensions

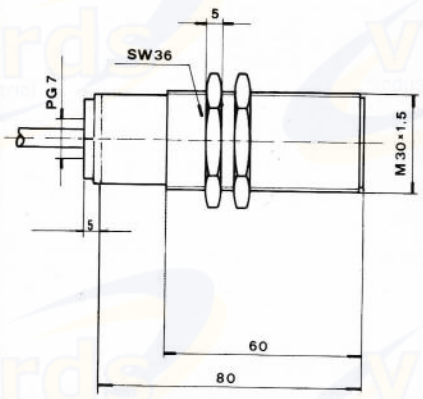
diameter 12 mm.:



diameter 18 mm.:



diameter 30 mm.:



DC sensors

Table I: Standard products

PRODUCTS CODE	DIAMETER AND DIMENSIONS (See Fig. pag. 6-7)				OPERATING DISTANCE							MAX OUTPUT CURRENT		OUTPUT FUNCTION			OUTPUT POLARITY		OPERATING FREQUENCY					SHIELDING		CASING	TORQUE STRESS (Kgm)
	M8x1	M12x1	M18x1	M30x1,5	1 mm	2 mm	4 mm	5 mm	8 mm	10 mm	15 mm	150 mA	250 mA	Open (N.A.)	Closed (N.C.)	Antivalent (S)	NPN	PNP	2000 Hz	1000 Hz	500 Hz	300 Hz	150 Hz	Partial	Total	Metallic	
E-A0TM/3AN	•				•							•		•			•		•							•	0,81
E-A0PM/3AN	•					•						•		•			•		•					•		•	0,81
E-A0TM/3AP	•				•							•		•				•	•						•	•	0,81
E-A0PM/3AP	•					•						•		•				•	•					•		•	0,81
E-A1TM/5AN		•				•							•	•			•		•						•	•	1
E-A1PM/5AN		•					•						•	•			•			•				•		•	1
E-A1TM/5AP		•				•							•	•				•	•						•	•	1
E-A1PM/5AP		•					•						•	•				•		•				•		•	1
E-A1TM/5CN		•				•							•		•		•		•						•	•	1
E-A1PM/5CN		•					•						•		•		•			•				•		•	1
E-A1TM/5CP		•				•							•		•			•	•						•	•	1
E-A1PM/5CP		•					•						•		•			•		•				•		•	1
E-A1TM/5SN		•				•							•			•	•		•						•	•	1
E-A1PM/5SN		•					•						•			•	•			•				•		•	1
E-A1TM/5SP		•				•							•			•		•	•						•	•	1
E-A1PM/5SP		•					•						•			•		•		•				•		•	1
E-A2TM/5AN			•					•					•	•			•			•					•	•	3
E-A2PM/5AN			•						•				•	•			•				•			•		•	3
E-A2TM/5AP			•					•					•	•				•		•					•	•	3
E-A2PM/5AP			•						•				•	•				•			•			•		•	3
E-A2TM/5CN			•					•					•		•		•			•					•	•	3
E-A2PM/5CN			•						•				•		•		•				•			•		•	3
E-A2TM/5CP			•					•					•		•			•		•					•	•	3
E-A2PM/5CP			•						•				•		•			•			•			•		•	3
E-A2TM/5SN			•					•					•			•	•			•					•	•	3
E-A2PM/5SN			•						•				•			•	•				•			•		•	3
E-A2TM/5SP			•					•					•			•		•		•					•	•	3
E-A2PM/5SP			•						•				•			•		•			•			•		•	3
E-A3TM/5AN				•						•			•	•			•					•			•	•	4
E-A3PM/5AN				•							•		•	•			•						•	•		•	4
E-A3TM/5AP				•						•			•	•				•				•			•	•	4
E-A3PM/5AP				•							•		•	•				•					•	•		•	4
E-A3TM/5CN				•						•			•		•		•					•			•	•	4
E-A3PM/5CN				•							•		•		•		•						•	•		•	4
E-A3TM/5CP				•						•			•		•			•				•			•	•	4
E-A3PM/5CP				•							•		•		•			•					•	•		•	4
E-A3TM/5SN				•						•			•			•	•					•			•	•	4
E-A3PM/5SN				•							•		•			•	•						•	•		•	4
E-A3TM/5SP				•						•			•			•		•				•			•	•	4
E-A3PM/5SP				•							•		•			•		•					•	•		•	4

- Order codes
In case optional features are required, look for them in Table II. The code pertinent to the required optional is to be added to the standard product code (as fifth digit just in front of the dash).
Example:
In case the E-A2TM/5AN sensor has to be arranged for LEMO 3 Poles connector, we infer from Tab. II that the required optional code is W3. Therefore the complete code of the sensor will be E-A2TM W3/5AN.

Table II - Optional features

SIMPLE FEATURES	
Description	**Code**
Led indication of output status	L
Protection against short-circuit	C
Output terminal strip	I
Presetting for Hirschmann connector (Type ELST 312)	W1
Presetting for Bendix connector (Type 10-D07-4P)	W2
Presetting for Lemo connector (3 poles type EGJ-OB-303-CNA)	W3
Presetting for Lemo connector (4 poles, type EGJ-OB-304-CNA)	W4

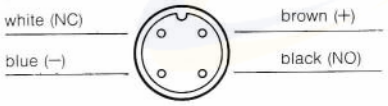
MULTIPLE FEATURES	
Description	**Code**
Led and short circuit protection	U
Led and terminal strip	V
Led and Hirschmann connector	S1
Led and Bendix connector	S2
Led and 3 poles Lemo connector	S3
Led and 4 poles Lemo connector	S4
Short circuit protection and Hirschmann connector	R1
Short circuit protection and Bendix connector	R2
Short circuit protection and 3 poles Lemo connector	R3
Short circuit protection and 4 poles Lemo connector	R4
Led, short circuit protection and Hirschmann connector	Z1
Led, short circuit protection and Bendix connector	Z2
Led, short circuit protection and 3 poles Lemo connector	Z3
Led, short circuit protection and 4 poles Lemo connector	Z4

Connector loose parts

For information some codes of the loose parts (that are to be used in connection to sensors whose fixed parts are shown in Tab. II) follows here below:

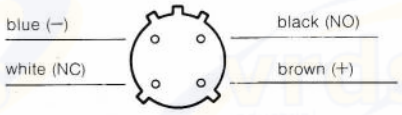
HIRSCHMANN connector:

- ELWIKA 312 A
- ELWIKA 312 S
- ELWIKA 312 PS
- ELWIKA 312 NS



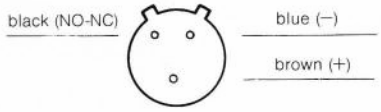
BENDIX connector:

- 10-D06-4S

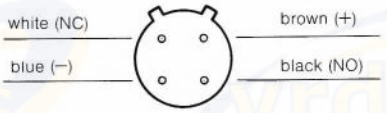


LEMO connector:

- FGJ-OB-303-CNL-D42 } 3 Poles Axial
- FGJ-OB-304-CNL-D42 } 4 Poles



- FHJ-OB-303-CNL-D42 } 3 Poles 90°
- FHJ-OB-304-CNL-D42 } 4 Poles



AC sensors

Table III: Standard products

PRODUCT CODE	DIAMETER AND DIMENSIONS (Figs. 12 A, B, C)			OPERATING DISTANCE						OUTPUT FUNCTION		MAX INDUCTIVE LOAD (VA)						MAX SURGE CURRENT (A) FOR 20 msec		SHIELDING		CASING		TORQUE STRESS (Kgm)
												24V		110V		220V								
	M12x1	M18x1	M30x1,5	2 mm	4 mm	5 mm	8 mm	10 mm	15 mm	Open (NA)	Closed (NC)	8	10	30	45	40	90	2	6	Partial	Total	Metallic	Plastic	
E-A1TM/RA	•			•						•		•		•		•		•			•	•		1
E-A1PM/RA	•				•					•		•		•		•		•		•		•		1
E-A1TM/RC	•			•							•	•		•		•		•			•	•		1
E-A1PM/RC	•				•						•	•		•		•		•		•		•		1
E-A2TM/RA		•				•				•			•		•		•		•		•	•		2,5
E-A2PM/RA		•					•			•			•		•		•		•	•		•		2,5
E-A2TM/RC		•				•					•		•		•		•		•		•	•		2,5
E-A2PM/RC		•					•				•		•		•		•		•	•		•		2,5
E-A2TK/RA		•				•				•			•		•		•		•		•		•	0,5
E-A2PK/RA		•					•			•			•		•		•		•	•			•	0,5
E-A2TK/RC		•				•					•		•		•		•		•		•		•	0,5
E-A2PK/RC		•					•				•		•		•		•		•	•			•	0,5
E-A3TM/RA			•					•		•			•		•		•		•		•	•		4
E-A3PM/RA			•						•	•			•		•		•		•	•		•		4
E-A3TM/RC			•					•			•		•		•		•		•		•	•		4
E-A3PM/RC			•						•		•		•		•		•		•	•		•		4
E-A3TK/RA			•					•		•			•		•		•		•		•		•	1,2
E-A3PK/RA			•						•	•			•		•		•		•	•			•	1,2
E-A3TK/RC			•					•			•		•		•		•		•		•		•	1,2
E-A3PK/RC			•						•		•		•		•		•		•	•			•	1,2

Specifications subject to change without notice.