

Info card

Capacitive sensors



i This info card serves as a supplement to the main position sensors catalogue and to the individual data sheets. For further information and contact addresses please visit www.ifm.com.

Intended use

While in use the products are exposed to influences which may have an effect on function, life, quality and reliability of the product.

It is the customer's responsibility to ensure that the products are suitable for the intended application. This applies in particular to applications in hazardous areas and with adverse environmental influence such as pressure, chemicals, temperature fluctuations, moisture and radiation as well as mechanical stress, especially if the products are not installed properly.

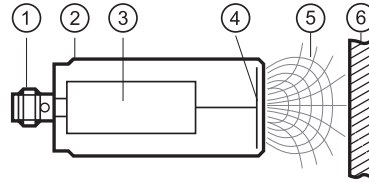
Using the products in applications where the safety of people depends on the function of the product is not permitted. If the instructions are not adhered to, death or severe injury may occur.

Operating principle of a capacitive proximity sensor

The active electrode of the sensor builds up a capacitance in relation to the environment. The capacitance depends on the distance, the size and the material properties (dielectric constant) of the environment.

A change in the external capacitance is evaluated and leads to a switching signal.

The sensor can detect liquid, solid, conductive and non conductive media.

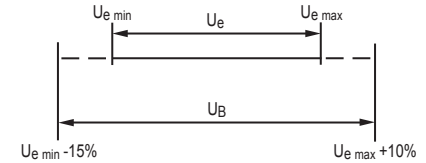


- ① connection
- ② housing
- ③ evaluation electronics
- ④ electrode system
- ⑤ alternating electric field = active zone
- ⑥ target (environment) conductive or non conductive

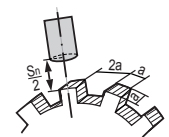
Important terms

| | |
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| Active zone | Area above the active face in which the sensor reacts to a change in the environment or an approaching target. |
| Response time | $< 1/f$ (typical $1/2 f$) unless stated otherwise (f = switching frequency) |
| Type and highest rating of the short-circuit protective devices | Pulsed short circuit protection for short-circuit-proof units. Where relevant, fuse according to data sheet. |
| Output function | <p>Normally open: object within the active zone > output switched.</p> <p>Normally closed: object within the active zone > output blocked.</p> <p>Programmable: choice between normally closed or normally open.</p> <p>Positive switching: positive output signal (to L-).</p> <p>Negative switching: negative output signal (to L+).</p> |

Rated operating voltage U_e



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| Rated insulation voltage | Units with protection class I + II: 250 V AC Units with protection class III: 60 V DC |
| Rated short-circuit current | For short-circuit-proof units: 100 A |
| Rated impulse withstand voltage | Protection class I: 4 kV Protection class II: 6 kV Protection class III: 0.8 kV |
| Power-on delay time | The time the sensor needs to be ready for operation after application of the operating voltage (typically < 300 ms). |
| Operating voltage U_B | Voltage range in which the sensor operates reliably. A stabilised and smoothed direct voltage should be used. |
| EMC | Capacitive sensors meet the requirements of EN 60947-5-2 so that <ul style="list-style-type: none"> • there are no noise levels that affect other equipment in their intended operation. • they are insensitive to electromagnetic interference to be expected during intended operation. |
| Grounding | When capacitive sensors are used, the tanks (also plastic tanks) should be properly grounded. Moreover, an electrical connection of installation chassis to sensor minus may increase operational reliability. |
| Utilisation category | AC units: AC-140 (control of small electromagnetic loads with holding currents < 200 mA) DC units: DC-13 (control of solenoids) |
| Hysteresis | Difference between switch-on and switch-off point. |
| Short-circuit protection | If ifm sensors are protected against excessive current by means of a pulsed short-circuit protection, the inrush current of incandescent lamps, electronic relays or low resistance loads may cause this protection to cut in and turn the sensor off. |
| Minimum load current | Smallest operating current to maintain the conductivity of the switching element. |
| Standard target | A square-shaped grounded metal plate of a thickness of 1 mm with a side length equal to the diameter of the sensing face or $3 \times S_n$, depending on which value is the highest. |
| Product standard | EN 60947-5-2 |
| Residual current | Current flowing in the load circuit with blocked output. Current for the internal supply of 2-wire units. |
| Switch point drift | The shifting of the switch point due to changes in the ambient temperature. |
| Switching frequency f | Damping with standard target at half S_n . The ratio damped to undamped (tooth to gap) = 1 : 2. |
| Protection rating | Describes the protection of electric equipment by means of housings, covers, enclosures and is indicated by the IP code. |
| Voltage drop | Voltage across the output switching element in the conductive state. |



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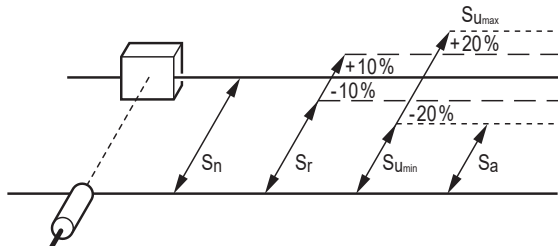
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|----------------------------------|---|
| Current consumption | No-load current for internal supply of 3 or 4-wire DC units. |
| Transport and storage conditions | Unless otherwise indicated in the data sheet, the following applies: Transport and storage temperature: min. = - 40 °C. max. = max. ambient temperature according to the data sheet. The relative air humidity (RH) must not exceed 50 % at +70 °C. At lower temperatures, a higher air humidity is permissible. Shelf life: 5 years Transport and storage height: no restrictions |
| Degree of soiling | Capacitive proximity sensors are designed for degree of soiling 3. |
| Repeatability | Difference between any two Sr measurements. Typically < 10 % of Sr. |

Sensing range (referred to the standard target)

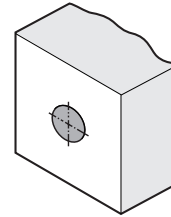


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|---|--|
| Nominal sensing range S_n | = characteristic value of the unit |
| Real sensing range S_r | = individual deviation at room temperature between 90 % and 110 % of S_n |
| Useful sensing range S_u | = switch point drift between 80 % ($S_{u_{min}} = S_a$) and 120 % ($S_{u_{max}}$) of S_r |
| Reliable sensing range = operating distance S_a | = reliably switched between 0 % and 72 % of S_n |
| Safe switch-off distance | = $S_{u_{max}} + \text{hysteresis} = 154 \% \text{ of } S_n$ |

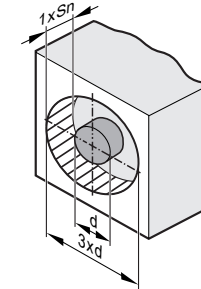
Notes on flush and non-flush installation

Installation instructions cylindrical designs

flush:



non-flush:



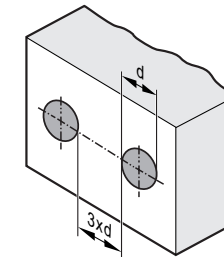
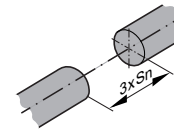
i If the required clear space is not observed for non-flush units, the sensor is predamped. This may lead to permanent switching.

i Quasi-flush sensors may be installed **flush** in non conductive materials and have to be installed **non flush** in conductive materials.

Minimum clearance for installing sensors of the same type

Applies to cylindrical and rectangular sensors.

flush:



non-flush:

