ST series safety sensors with RFID technology
ST series safety sensors with RFID technology

Introduction

In combination with the corresponding safety modules, the sensors of the ST series are suitable for the monitoring of protective devices on machines without inertia and allow the system in which they are used to reach a safety category up to SIL 3 acc. to EN 62061 as well as up to PL e and Category 4 acc. to EN 13849-1.

These sensors use RFID (Radio Frequency Identification) technology and provide high protection against possible manipulation thanks to the uniqueness of the codes transmitted by the actuator. Because they have no mechanical elements, they guarantee a long service life even in applications with frequent operating cycles and under harsh environmental conditions.

Maximum safety with a single device

PL e + SIL 3

The sensors of the ST series are constructed with redundant electronics. As a result, the maximum PL e and SIL 3 safety levels can still be achieved through the use of a single device on a guard. This avoids expensive wiring in the field and allows faster installation. Inside the control cabinet, the two electronic safety outputs must be connected to a safety module with OSSD inputs or to a safety PLC.

Series connection of multiple sensors

PL e + SIL 3

One of the most important features of the ST series from Pizzato Elettrica is the possibility of connecting up to 32 sensors in series, while still maintaining the maximum safety level (PL e) laid down in EN 13849-1.

This connection type is permissible in safety systems which have a safety module at the end of the chain that monitors the outputs of the last ST sensor. The fact that the PL e safety level can be maintained even with 32 sensors connected in series demonstrates the extremely secure structure of each sensor of the ST series.

Series connection with other devices

PL e + SIL 3

The ST series features two safety inputs and two safety outputs, which can be connected in series with other Pizzato Elettrica safety devices. This option allows the creation of safety chains containing various devices. For example, stainless steel safety hinges (HX BEE1 series), transponder sensors (ST series) and door lock sensors (NG or NS series) can be connected in series while still maintaining the maximum PL e and SIL 3 safety levels.

High level coded actuators

The ST series is provided with an electronic system based on RFID technology to detect the actuator. This allows to provide each actuator with different coding and makes it impossible to tamper with a device by using another actuator of the same series. Millions of different coding combinations are possible for the actuators. They are therefore classified as high level coded actuators, according to EN ISO 14119.

Protection degrees IP67 and IP69K

IP69K

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

IP67

Wide actuation range

By utilising the properties of RFID technology, the sensors of the ST series have a wide actuation range, making them very well suited for applications with large tolerances or where mechanical properties change over time.

Actuation from many directions

The sensors of the ST series from Pizzato Elettrica were designed to be activated from various directions, thereby providing the customer with maximum flexibility when positioning the sensors on the guards. Furthermore, the SM D T actuator can be secured in two mutually orthogonal directions.
Programmability

Pizzato Elettrica supplies a programmable version of the ST series sensors. With a simple and brief operation, the sensor can be programmed to recognise the code of a new actuator.

By activating a special input, the sensor is switched to a safe state, during which it waits for a new code to be accepted. As the actuator approaches, the ST sensor performs a number of checks on the code being received, whereby the code must adhere to certain parameters of RFID technology.

If the checks are successful, the sensor uses LEDs to signal the successful completion of the procedure. After programming has been completed, the sensor only recognises the code of the last programmed actuator, thereby preserving the safety level and the reliability of the system in which it is installed.

Laser engraving

All devices are marked using a dedicated indelible laser system. These engravings are therefore suitable for extreme environments too. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Short signal propagation delay

One of the main features of the ST sensors is the short signal propagation time of approx. 7 ms after deactivation of the inputs. This short signal propagation time is particularly advantageous for sensors connected in series.

Stainless steel fixing plates

The stainless-steel fixing plates for the ST sensors not only protect the mounting eyes during installation on surfaces that are not perfectly flat, they also help the sensor better withstand mechanical loads. As a result, the system is safer and more reliable.

Double protection against tampering

Each sensor and actuator of the ST series is supplied with plug-in protection caps to be applied to the holes of the fixing screws, in order to prevent the access. As a result, standard screws can be used instead of tamper-proof screws, and the device is protected from voluntary tampering. Caps also protect the sensor and the actuator from dirt and keep them clean.

Four LEDs for immediate diagnosis

As the LEDs have been designed for quick immediate diagnosis, the status of each input and output is highlighted by one specific LED. By knowing which device is active and which door is open, it is possible to quickly identify an interruption in the safety chain as well as any internal device errors. All of this at a glance, without needing to decode complex flashing sequences.

EDM

On request, the switch can be supplied with EDM function (External Device Monitoring). In this case, the switch itself checks the proper function of the devices connected to the safety outputs. These devices (usually relays or safety contactors) must send a feedback signal to the EDM input, which checks that the received signal is consistent with the state of the safety outputs.

Inverted signalling output

In addition to the standard version, a version with inverted function of signalling output O3 is available to help meet the various needs of the customers.

Insensitivity to dirt

The sensors are completely sealed and retain their safety characteristics even in the presence of dirt or deposits (not ferromagnetic material). This characteristic, combined with the design without recesses, makes them particularly suitable for use in the agricultural and food industries.

Versions with increased actuation distance

In addition to the standard actuation distance of 12 mm, sensors with an actuation distance of 20 mm are also available. The increased actuation distance of the sensors is ideal for installation situations in which it is not possible to ensure that the actuator approaches the sensor in a precise and stable manner.

New compact actuators

Besides standard actuators, the new SM L•T compact actuators are now available. These actuators have a single assembling direction (front), but keep the actuating distance of 12 mm like the actuator SM D•T. Moreover, thanks to the extremely reduced thickness (only 7 mm), they can be installed in small spaces, making RFID technology suitable for small protections.
ST series safety sensors with RFID technology

Selection diagram

**SENSOR**

- **ST DD••N•**
  - PVC cable at the right

- **ST DD••MK**
  - Integrated M12 connector at the right

- **ST DD••M0.1**
  - Cable, length: 0.1 m, with M12 connector at the right

**ACTUATORS**

- **SM L•T**
  - Actuation distance: 12 mm
  - Front fixing

- **SM D•T**
  - Actuation distance: 12 mm
  - Two-sided fastening

- **SM E•T**
  - Actuation distance: 20 mm
  - Front fixing

- **ST DL••N•**
  - PVC cable at the left

- **ST DL••MK**
  - Integrated M12 connector at the left

- **ST DL••M0.1**
  - Cable, length: 0.1 m, with M12 connector at the left

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*product option*

*accessory sold separately*
Code structure for sensor with actuator

**ST DD420N2-D1T**

**Actuator**
- **D0T** low level coded actuator (the sensor recognises any type D0T actuator)
- **D1T** high level coded actuator (the switch recognises one single type D1T actuator)
- **E0T** low level coded actuator (the sensor recognises any type E0T actuator)
- **E1T** high level coded actuator (the switch recognises one single type E1T actuator)
- **L0T** low level coded actuator (the sensor recognises any type L0T actuator)
- **L1T** high level coded actuator (the switch recognises one single type L1T actuator)

**Inputs and outputs**

<table>
<thead>
<tr>
<th>Code</th>
<th>OS safety outputs</th>
<th>O signalling outputs</th>
<th>IS safety inputs</th>
<th>I programming inputs</th>
<th>EDM inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>31</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>42</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>51</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>61</td>
<td>2</td>
<td>1 (inverted)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>71</td>
<td>2</td>
<td>1 (inverted)</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>82</td>
<td>2</td>
<td>1 (inverted)</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: versions 21, 31, 51, 61, 71 are only supplied together with an actuator.

**Supply voltage**
- **0** 24 Vdc
- **1** 12 ... 24 Vdc

**Cable or connector type**
- **N** PVC cable IEC60332-1 (standard)
- **H** PUR cable, halogen free (not available with version ST D•2••••)
- **M** M12 connector

**Code structure for single sensor**

**ST DD420N2**

**Actuator**
- **D0T** low level coded actuator (the sensor recognises any type D0T actuator)
- **D1T** high level coded actuator (the switch recognises one single type D1T actuator)
- **E0T** low level coded actuator (the sensor recognises any type E0T actuator)
- **E1T** high level coded actuator (the switch recognises one single type E1T actuator)
- **L0T** low level coded actuator (the sensor recognises any type L0T actuator)
- **L1T** high level coded actuator (the switch recognises one single type L1T actuator)

**Inputs and outputs**

<table>
<thead>
<tr>
<th>Code</th>
<th>OS safety outputs</th>
<th>O signalling outputs</th>
<th>IS safety inputs</th>
<th>I programming inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>82</td>
<td>2</td>
<td>1 (inverted)</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Supply voltage**
- **0** 24 Vdc
- **1** 12 ... 24 Vdc

**Cable or connector type**
- **N** PVC cable IEC60332-1 (standard)
- **H** PUR cable, halogen free (not available with version ST D•2••••)
- **M** M12 connector

**Code structure for actuator**

**SM D1T**

**Actuator**
- **D0T** low level coded actuator (the sensor recognises any type D0T actuator)
- **D1T** high level coded actuator (the switch recognises one single type D1T actuator)
- **E0T** low level coded actuator (the sensor recognises any type E0T actuator)
- **E1T** high level coded actuator (the switch recognises one single type E1T actuator)
- **L0T** low level coded actuator (the sensor recognises any type L0T actuator)
- **L1T** high level coded actuator (the switch recognises one single type L1T actuator)

**Actuation distance**
- **D** actuation distance 12 mm
- **E** actuation distance 20 mm
- **L** actuation distance 12 mm
**ST series safety sensors with RFID technology**

**Main features**
- Actuation without contact, using RFID technology
- Digitally coded actuator
- Protection degrees IP67 and IP69K
- 4 LEDs for status display of the sensor
- Actuators with various actuation distances

**Quality marks:**
- UL approval: E496318
- EC type examination certificate: MVA 161076157012
- TÜV SÜD approval: Z10 12 11 75157 004
- EAC approval: RU C-IT.AД35.В.00454

**In compliance with standards:**
- Directive 2014/53/EU - RED
- UL 508, CSA 22.2 No.14
- EAC: TÜV SÜD approval: Z10 12 11 75157 004
- EC type examination certificate: M6A 161076157012

**Technical data**

**Housing**
- Housing made of glass fibre reinforced technopolymer, self-extinguishing.
- Versions with integrated cable 6 x 0.5 mm² or 8 x 0.34 mm², length 2 m, other lengths 0.5 m ... 10 m on request
- Versions with M12 stainless steel connector
- Versions with 0.1 m cable length and integrated M12 connector, other lengths 0.1 ... 3 m on request
- Protection degree: IP67 acc. to EN 60529

**General data**
- For safety applications up to: SIL 3 acc. to EN 62061
- Interlock, no contact, coded: PL e acc. to EN ISO 13849-1
- Level of coding acc. to EN ISO 14119:
  - 4 LEDs for status display of the sensor
- Safety parameters:
  - MTTfR: 4077 years
  - PHF: 1.25E-1
  - DC: High
- Service life: 20 years
- Ambient temperature for sensors without cable: -25 °C ... +70°C
- Ambient temperature for sensors with cable: see table page 6
- Storage and transport temperature: -25 °C ... +85°C
- Vibration resistance: 10 g (10 ... 150 Hz) acc. to IEC 60068-2-6
- Shock resistance: 30 gn, 11 ms acc. to EN 60068-2-27
- Pollution degree: 3
- Screw tightening torque: 0.8 ... 2 Nm

**Electrical data of IS1/IS2/EDM inputs**
- Rated operating voltage Ue1: 24 Vdc or 12 ... 24 Vdc
- Rated current consumption Ie1: 5 mA

**Electrical data of OSt1/OS2 safety outputs**
- Rated operating voltage Ue2: 24 Vdc or 12 ... 24 Vdc
- Output type: PNP type OSSD
- Maximum current per output Ie2: 0.25 A
- Minimum current per output Ie2: 0.5 mA
- Thermal current Ith2: 0.25 A
- Utilization category: DC13; Ue2=24 Vdc, Ie2=0.25 A
- Short circuit detection: Yes
- Overcurrent protection: Yes
- Internal self-resettable protection fuse: 0.75 A
- Duration of the deactivation impulses at the safety outputs: < 300 μs
- Maximum permissible capacity between output and output: < 200 nF
- Maximum permitted capacity between output and mass: < 200 nF
- Response time upon deactivation of IS1/IS2 inputs: typically 7 ms, max. 12 ms
- Response time upon actuator removal: typically 80 ms, max. 150 ms

**Electrical data of O3 signalling output**
- Rated operating voltage Ue3: 24 Vdc or 12 ... 24 Vdc
- Output type: PNP
- Maximum current per output Ie3: 0.1 A
- Utilization category: DC12; Ue3=24 Vdc, Ie3=0.1 A
- Short circuit detection: No
- Overcurrent protection: Yes
- Internal self-resettable protection fuse: 0.75 A

**Actuation data**
- Assured operating distance Sao: ≤ minimum: 40 mA
- Assured release distance Snr: ≤ with all outputs at maximum power: 0.7 A
- Rated operating distance Sop: 40 mA
- Rated release distance Snr: ≤ ± 10 %
- Repeated accuracy: ≤ ± 20 %
- Max. switching frequency: 1 Hz
- Distance between two sensors: min. 50 mm

**Power supply electrical data**
- Rated operating voltage Ue SELV:
  - 24 Vdc -15% ... +10% (24 Vdc versions)
  - 12 ... 24 Vdc -30% ... +25% (12 ... 24 Vdc versions)
- Operating current at Ue voltage:
  - minimum: 40 mA
  - with all outputs at maximum power: 0.7 A
- Rated insulation voltage Uis: 32 Vdc
- Rated impulse withstand voltage Uimp: 1.5 kV
- Overvoltage category:
  - US 3: AC 300 V, 50 Hz, 1 s

**Features approved by UL**
- Rating: 24 Vdc, 0.25 A (resistive) Class 2
- Housing features type 1, 4X "indoor use only," 12.
- In compliance with standard: UL 508, CSA 22.2 No.14

**Features approved by TÜV SÜD**
- Supply voltage: 24 Vdc
- Ambient temperature: -25 °C ... +70°C
- Protection degree: IP67
- PL, category: PL e, category 4

In compliance with standards:
- EN 61508-3:2010 (SIL 3), EN 61508-4:2010 (SIL 3)

Please contact our technical department for the list of approved products.

Please contact our technical department for the list of approved products.
Selection table for sensors with high level coded actuators

<table>
<thead>
<tr>
<th>Type</th>
<th>Level of coding acc. to ISO 14119</th>
<th>actuation distance 12 mm</th>
<th>actuation distance 12 mm</th>
<th>actuation distance 20 mm</th>
<th>SM L0T</th>
<th>SM D0T</th>
<th>SM E0T</th>
<th>SM L1T</th>
<th>SM D1T</th>
<th>SM E1T</th>
</tr>
</thead>
<tbody>
<tr>
<td>•OT</td>
<td>low</td>
<td>12 mm</td>
<td>12 mm</td>
<td>20 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>•1T</td>
<td>high</td>
<td>12 mm</td>
<td>12 mm</td>
<td>20 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To order a product with •E-T actuator replace D with E in the codes shown above. Example: ST DD310M0.1-D-T → ST DD310M0.1-E-T

Selection table for sensors

<table>
<thead>
<tr>
<th>OS safety outputs</th>
<th>O signalling outputs</th>
<th>IS safety inputs</th>
<th>I programming inputs</th>
<th>EDM inputs</th>
<th>Programmable</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ST DD310M0.1-D-T</td>
<td>ST DL310M0.1-D-T</td>
<td>ST DD420M0.1-D-T</td>
<td>ST DL420M0.1-D-T</td>
<td>ST DD510M0.1-D-T</td>
<td>ST DL510M0.1-D-T</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Selection table for actuators

The use of RFID technology in ST series sensors makes them suitable for several applications. Pizzato Elettrica offers two different versions of actuators, in order to best suit customers’ specific needs.

Type •OT actuators are all encoded with the same code. This implies that a sensor associated with an actuator type •OT can be activated by other actuators type •OT.

Type •1T actuators are always encoded with different codes. This implies that a sensor associated with an actuator type •1T can be activated only by a specific actuator. Another •1T type actuator will not be recognised by the sensor until a new association procedure is carried out (reprogramming). After reprogramming, the old actuator type •1T will no longer be recognised.

Ambient temperature for sensors with cable

<table>
<thead>
<tr>
<th>Connection type</th>
<th>Output with cable</th>
<th>Output with cable and M12 connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable type</td>
<td>N</td>
<td>H</td>
</tr>
<tr>
<td>Conductors</td>
<td>8x0.34 mm²</td>
<td>8x0.34 mm²</td>
</tr>
<tr>
<td>Application field</td>
<td>General</td>
<td>General, mobile installation</td>
</tr>
<tr>
<td>In compliance with standards</td>
<td>03VV-F</td>
<td>03E70-H</td>
</tr>
<tr>
<td>Sheath</td>
<td>PVC</td>
<td>PUR Halogen Free</td>
</tr>
<tr>
<td>Self-extinguishing</td>
<td>IEC 60332-1-2</td>
<td>IEC 60332-1-2</td>
</tr>
<tr>
<td>Oil resistant</td>
<td>/</td>
<td>UL 758</td>
</tr>
<tr>
<td>Max. speed</td>
<td>/</td>
<td>300 m/min.</td>
</tr>
<tr>
<td>Max. acceleration</td>
<td>/</td>
<td>30 m/s²</td>
</tr>
<tr>
<td>Minimum bending radius</td>
<td>94 mm</td>
<td>70 mm</td>
</tr>
<tr>
<td>Outer diameter</td>
<td>7 mm</td>
<td>7 mm</td>
</tr>
<tr>
<td>End stripped</td>
<td>80 mm</td>
<td>80 mm</td>
</tr>
<tr>
<td>Copper conductors</td>
<td>Class 6 IEC 60228</td>
<td>Class 6 IEC 60228</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-25°C +70°C</td>
<td>-25°C +70°C</td>
</tr>
<tr>
<td>Approvals</td>
<td>CE cULusTUV EAC</td>
<td>CE TUV EAC</td>
</tr>
</tbody>
</table>

The 2D and 3D files are available at www.pizzato.com

Items with code on green background are stock items
Complete safety system
The use of complete and tested solutions guarantees the electrical compatibility between the sensors of the ST series and the safety modules from Pizzato Elettrica, as well as high reliability. The sensors have been tested with the modules listed in the adjacent table.

### Compatible safety modules

<table>
<thead>
<tr>
<th>Sensors</th>
<th>Safety modules</th>
<th>Safety module output contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Instantaneous safety contacts</td>
</tr>
<tr>
<td>CS AR-05*****</td>
<td>3NO</td>
<td>/</td>
</tr>
<tr>
<td>CS AR-06*****</td>
<td>3NO</td>
<td>/</td>
</tr>
<tr>
<td>CS AR-08*****</td>
<td>2NO</td>
<td>/</td>
</tr>
<tr>
<td>CS AT-00*****</td>
<td>3NO 2NO</td>
<td>/</td>
</tr>
<tr>
<td>CS AT-10*****</td>
<td>see page 255</td>
<td>General catalogue safety</td>
</tr>
<tr>
<td>CS MP********</td>
<td>see page 283</td>
<td>General catalogue safety</td>
</tr>
</tbody>
</table>

ST sensors can be used as individual devices provided that the outputs be evaluated by a Pizzato Elettrica safety module (see table for combinable safety modules).

All ST series sensors can be connected, provided that compatibility is checked, to safety modules or safety PLCs with OSSD inputs.

### Possibility of series connection

Possibility of series connection of multiple sensors for simplifying the wiring of the safety system, whereby only the outputs of the last sensor are evaluated by a Pizzato Elettrica safety module of the CS MP series. Both the safety-relevant evaluation and the evaluation of the signalling outputs are performed by the CS MP series.

The adjacent diagram illustrates five logical, linked sub-functions of the sensor.

Function f0 is a basic function and includes the monitoring of the power supply as well as internal, cyclical tests.

Function f1 monitors the status of the inputs, whereas function f2 monitors the position of the actuator in the detection area.

Function f3 is intended to activate or deactivate the safety outputs and check for any faults or short circuits in the outputs.

In the EDM versions, function f4 checks the EDM signal on state changes of the safety outputs.

The safety-related function, which combines the sub-functions mentioned above, only activates the safety outputs if the input signals are correctly applied and the actuator is located within the safe zone.

The status of each sub-function is displayed by corresponding LEDs (PWR, IN, ACT, OUT), thereby providing a quick overview of the operating status of the sensor.

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ST sensors can be used as individual devices provided that compatibility is checked, to safety modules or safety PLCs with OSSD inputs.

### Possibility of series connection

Possibility of series connection of multiple sensors for simplifying the wiring of the safety system, whereby only the outputs of the last sensor are evaluated by a Pizzato Elettrica safety module (see table with compatible safety modules). Each ST sensor is equipped with a signalling output, which – depending on the version – is activated or deactivated when the respective guard is closed. Depending on the specific requirements of the application, this information can be evaluated by a PLC.

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### Internal block diagram (ST D5******)

ST series safety sensors with RFID technology
**Limit activation zone and safe activation zone (ST D•4•••)**

When aligning the sensor with the actuator, the status LEDs use various colours to indicate whether the actuator is in the limit activation zone or in the safe activation zone. The following figures use the ST DD420MK-D1T sensor as an example.

Operating voltage is applied to the sensor, (LED PWR on, green), the inputs are enabled (LED IN on, green), the outputs are deactivated (LED OUT off). The actuator is outside of the actuation zone (LED ACT off).

If the actuator is moved inside the safe activation zone (dark grey area), the ACT LED on the sensor illuminates (green) and it activates the outputs (LED OUT on, green).

When the actuator leaves the safe zone, the sensor keeps the safety outputs enabled. Entry into the limit activation zone (light grey area) is, however, indicated by the ACT LED (orange/green, flashing).

As soon as the actuator exits the limit activation zone, the sensor deactivates the outputs and switches off the OUT and ACT LEDs.

**Operating states (ST D•4•••)**

<table>
<thead>
<tr>
<th>PWR LED</th>
<th>OUT LED</th>
<th>IN LED</th>
<th>ACT LED</th>
<th>Sensor state</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>OFF</td>
<td>Sensor off.</td>
</tr>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>POWER ON</td>
<td>Internal tests upon activation.</td>
</tr>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>RUN</td>
<td>Sensor with inactive inputs.</td>
</tr>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>RUN</td>
<td>Activation of the inputs.</td>
</tr>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>RUN</td>
<td>Input incoherence. Recommended action: check for presence and/or wiring of inputs.</td>
</tr>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>RUN</td>
<td>Actuator in safe area. O3 signalling output active.</td>
</tr>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>RUN</td>
<td>Actuator in limit activation zone, O3 active. Recommended action: bring the sensor back to the safe area.</td>
</tr>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>RUN</td>
<td>Activation of the inputs. Actuator in safe area and safety outputs active.</td>
</tr>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>ERROR</td>
<td>Error on outputs. Recommended action: check for any short circuits between the outputs, outputs and ground or outputs and power supply, then restart the sensor.</td>
</tr>
<tr>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>ERROR</td>
<td>Internal error. Recommended action: restart the sensor. If the failure persists, replace the sensor.</td>
</tr>
</tbody>
</table>

Legend:  = off  = on  = flashing  = alternating colours  = indifferent

**O3 output inverted (ST D•6•••, ST D•7•••, ST D•8•••)**

The version with inverted O3 signalling output allows checking of the actual electrical connection of the sensor by an external PLC. The O3 output will be activated when the actuator is removed and the OS safety outputs are switched off.

**External device monitoring (EDM)**

The ST D•51••• version, in addition to maintaining the operating and safety characteristics of the ST series, allows control of forcibly guided NC contacts of contactors or relays controlled by the safety outputs of the sensor itself. As an alternative to the relays or contactors you can use Pizzato Elettrica expansion modules CS ME-03. See this check is carried out by monitoring the EDM input (External Device Monitoring as defined in EN 61496-1) of the sensor.

This version, with the IS safety inputs, can be used at the end of a series of ST sensors, up to a maximum number of 32 devices, while maintaining the maximum PL e safety level according to EN ISO 13849-1.

For specific applications, this solution allows you to dispense with the safety module connected to the last device in the chain.
### Connection with safety modules

**Connections with CS AR-08•••• safety modules**

- Input configuration with monitored start
- 2 channels / Category 4 / up to SIL 3 / PL e

**Connections with CS AR-05•••• / CS AR-06•••• safety modules**

- Input configuration per manual start (CS AR-05••••) or monitored start (CS AR-06••••)
- 2 channels / Category 4 / up to SIL 3 / PL e

**Connections with CS AT-0•••• safety modules**

- Input configuration with monitored start
- 2 channels / Category 4 / up to SIL 3 / PL e

**Connections with CS MP•••• safety modules**

- The connections vary according to the program of the module
- Category 4 / up to SIL 3 / PL e

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### Internal connections with cable

#### ST D•2••N•
- Brown: A1(+)
- Red/white: OS1
- Blue: A2(-)
- Black/white: OS2
- Black: O3

#### ST D•3••N•
- Brown: A1(+)
- Red: IS1
- Blue: A2(-)
- Black/white: OS1
- Black: O3
- Purple: IS2
- Black/white: O3
- Purple/white: not connected

#### ST D•4••N•
- Brown: A1(+)
- Red: IS1
- Blue: A2(-)
- Red/white: OS1
- Black: O3
- Purple: IS2
- Black/white: O3
- Purple/white: I3

---

### Internal connections with connector

- **Legend**
  - A1-A2: supply
  - IS1-IS2: safety inputs
  - OS1-OS2: safety outputs
  - I3: signalling output
  - EDM: input for monitoring of NC contacts of the contactors

### Series connection

To simplify series connections of the devices, various M12 connectors are available that allow complete wiring. This solution significantly reduces installation times while at the same time maintaining the maximum safety levels PL e and SIL 3.

For further information see general catalogue security 2017-2018.
Operating distances SM D*T/SM L*T actuators

Operating distances SM E*T actuator

Legend:
- Rated operating distance $s_n$ (mm)
- Rated release distance $s_{nr}$ (mm)

Note: The trend of activation areas is indicative, possible application on ferromagnetic surfaces can reduce the activation distances.

Dimensional drawings

All values in the drawings are in mm

ST DD***MK sensor with M12 connector at the right

ST DL***MK sensor with M12 connector at the left

SM D*T actuator

SM E*T actuator

SM L*T actuator

The 2D and 3D files are available at www.pizzato.com