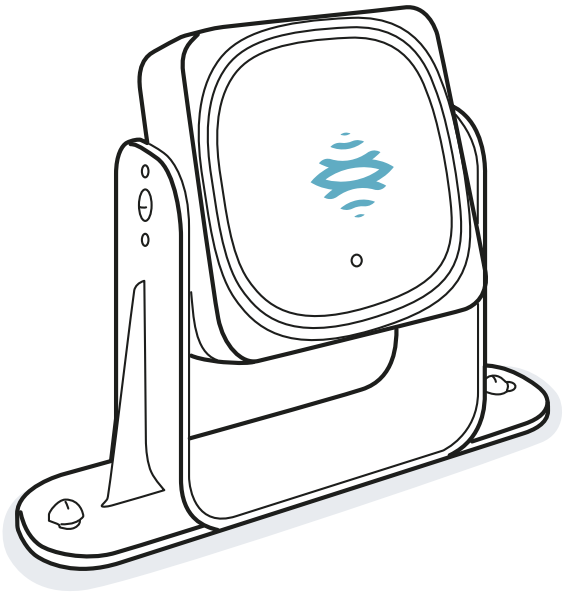
INXPECT

Inxpect Value Line



Instruction manual
v1.1 - EN

Original instructions

WARNING! Anyone who uses this system must read the instruction manual to ensure safety. Read and adhere to the "Safety information" chapter in its entirety before using the system for the first time.

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Contents

Glossary of terms

A

Activated output (ON-state)

Output that switches from OFF to ON-state.

D

Dangerous area

Area to be monitored because it is dangerous for people.

Deactivated output (OFF-state)

Output that switches from ON to OFF-state.

Detection distance 1

Depth of the field of view configured for detection field 1.

Detection distance 2

Depth of the field of view configured for detection field 2.

Detection field 1

Area of the fieldset closer to the sensor. In the absence of detection field 2, it corresponds to the whole fieldset.

Detection field 2

Area of the fieldset that follows detection field 1.

Detection signal 1

Output signal (dual channel) that describes the monitoring status of detection field 1.

Detection signal 2

Output signal (dual channel) that describes the monitoring status of detection field 2.

Detection signal group 1

Output signal (dual channel) that describes the monitoring status of the detection fields belonging to group 1.

Detection signal group 2

Output signal (dual channel) that describes the monitoring status of the detection fields belonging to group 2.

Detection warning 1

Output signal (single channel) that describes the monitoring status of detection field 1.

Detection warning 2

Output signal (single channel) that describes the monitoring status of detection field 2.

Detection warning group 1

Output signal (single channel) that describes the monitoring status of the detection fields belonging to group 1.

Detection warning group 2

Output signal (single channel) that describes the monitoring status of the detection fields belonging to group 2.

F

Field of view

Sensor area of vision characterized by a specific angular coverage.

Fieldset

Structure of the field of view which can be composed of one or two detection fields.

FMCW

Frequency Modulated Continuous Wave

H

Horizontal angular coverage

Property of the field of view that corresponds to the coverage of 110° or 50° on the horizontal plane.

I

Inclination

Sensor rotation around the x-axis. The sensor inclination is the angle between a line perpendicular to the sensor and a line parallel to the ground.

M

Machinery

The system for which the dangerous area is monitored.

Monitored area

Area that is monitored by Inxpect Value Line. It is composed of detection field 1 (e.g. used as alarm area) and detection field 2 (e.g. used as warning area) of all the sensors.

O

OSSD

Output Signal Switching Device

R

RCS

Radar Cross-Section. Measure of how detectable an object is by radar. It depends, among other factors, on the material, dimension and position of the object.

T

Tolerance area

Area of the field of view where detection or not of a moving object/person depends on the characteristics of the same object itself.

V

Vertical angular coverage

Property of the field of view that corresponds to the coverage on the vertical plane.

1. This manual

1.1 Information on this manual

1.1.1 Objectives of this instruction manual

This manual explains how to integrate Inxpect Value Line for safeguarding machinery operators and how to install it, use it and maintain it safely.

The functioning and safety of the machinery to which Inxpect Value Line is connected is out of the scope of this document.

1.1.2 Obligations with regard to this manual

NOTICE: *this manual is an integral part of the product and must be kept for its entire working life.*

It must be consulted for all situations related to the life cycle of the product, from its delivery to decommissioning.

It must be stored so that it is accessible to operators, in a clean location and in good condition.

In the event of manual loss or damage, contact Technical Support (see "Technical Support" on page 108).

Always make the manual available for consultation when the equipment is sold.

1.1.3 Provided documentation

Document	Code	Date	Distribution format
Instruction manual (this manual)	Inxpect VL-IM-7_ 00375_en	MAR 2025	online PDF PDF downloadable from the site https://www.inxpect-tj.com/downloads.html
Installation instructions	Inxpect VL-MI-7_ 00398_multi	FEB 2025	printed PDF downloadable from the site https://www.inxpect-tj.com/downloads.html

1.1.4 Instruction manual updates

Publication date	Code	Hardware version	Firmware version	Updates
MAR 2025	Inxpect VL-IM-7_00375_en_ v1.1	Control unit • C283A: 2.2/2.3 Sensor: • S188A : 1.2	Control unit • C283A: 1.0.0 Sensor: • S188A : 1.0	Added Dynamic configuration management.
FEB 2025	Inxpect VL-IM-7_00375_en_ v1.0	Control unit • C283A: 2.2/2.3 Sensor: • S188A : 1.2	Control unit • C283A: 1.0.0 Sensor: • S188A : 1.0	First publication

1.1.5 Intended users of this instruction manual

The recipients of the instruction manual are:

- the machinery manufacturer onto which the system will be installed
- system installer
- machinery maintenance technician

2. SAFETY

2.1 Safety information

2.1.1 SAFETY MESSAGES

Warnings related to the safety of the user and of the equipment as envisaged in this document are as follows:

WARNING! Indicates a hazardous situation which, if not avoided, may cause death or serious injury.

NOTICE: *indicates obligations that if not observed may cause harm to the equipment.*

2.1.2 SAFETY SYMBOLS ON THE PRODUCT

This symbol marked on the product indicates that the manual must be consulted. In particular, pay attention to the following activities:

- wiring of the connections (see "Terminal blocks and connector pin-outs" on page 86 and "Electrical connections" on page 88)
- cable operating temperature (see "Terminal blocks and connector pin-outs" on page 86)
- control unit cover, which was subjected to a low energy impact test (see "Technical data" on page 84)

2.1.3 PERSONNEL SKILLS

The recipients of this manual and the skills required for each activity presented herein are as follows:

Recipient	Assignments	Skills
Machinery manufacturer	• defines which protective devices should be installed and sets the installation specifications	• knowledge of significant hazards of the machinery that must be reduced • knowledge of the entire machinery safety system and the system on which it is installed
Protection system installer	• installs the system • configures the system • prints configuration reports	• advanced technical knowledge in the electrical and industrial safety fields • knowledge of the dimensions of the dangerous area of the machinery to be monitored • receives instructions from the machinery manufacturer
Machinery maintenance technician	• performs maintenance on the system	• advanced technical knowledge in the electrical and industrial safety fields

2.1.4 INTENDED USE

Inxpect Value Line is a human body detection system.

Depending on its model-type, each sensor performs one of the following protective functions:

- **Access detection function**: access of one or more persons to a hazardous area deactivates the outputs to stop the moving parts of the machinery.
- **Restart prevention function**: prevents unexpected starting or restarting of the machinery. Detection of motion within the dangerous area maintains the outputs deactivated to prevent machinery starting.

It performs the following additional functions:

- **Stop signal**: it forces all the outputs to OFF-state.
- **Restart signal**: it enables the control unit to switch to ON-state the outputs related to all the detection fields with no motion detected. It can be performed:

    - using single channel inputs/OSSDs
    - using dual channel inputs/OSSDs
- **Muting**: it inhibits the detection capability of one or a group of sensors (see "Muting" on page 32).
- **Dynamic configuration switch** (Category 3, according to EN ISO 13849-1): it allows the dynamic switch among previously set configurations (see "System configuration" on page 22).

WARNING! only for Stop signal, Restart signal, Muting and Dynamic configuration switch. Any fault on the sensors or the control unit brings the system to the safe state and makes the additional functions unavailable.

Inxpect Value Line is suitable for protecting the human body in the following scenarios:

- dangerous area protection
- indoor and outdoor applications

2.1.5 IMPROPER USE

The following is deemed improper use in particular:

- any component, technical or electrical modification to the product
- use of the product outside the areas described in this document
- use of the product outside the technical details, see "Technical data" on page 84

2.1.6 EMC-COMPLIANT ELECTRICAL INSTALLATION

NOTICE: *The product is designed for use in an industrial environment. The product may cause interference if installed in other environments. If installed in other environments, measures should be taken to comply with the applicable standards and directives for the respective installation site with regard to interference.*

2.1.7 GENERAL WARNINGS

- Incorrect installation and configuration of the system decreases or inhibits the protective function of the system. Follow the instructions provided in this manual for correct installation, configuration and validation of the system.
- Changes to the system configuration may compromise the protective function of the system. After any changes made to the configuration, validate correct functioning of the system by following the instructions provided in this manual.
- If the system configuration allows access to the dangerous area without detection, implement additional measures (e.g., guards).
- The presence of static objects, in particular metallic objects, within the field of view may limit the efficiency of sensor detection. Keep the sensor field of view unobstructed.
- Check that the temperature of the areas where the system is stored and installed is compatible with the storage and operating temperatures indicated in the technical data of this manual.
- Radiation from this device does not interfere with pacemakers or other medical devices.

2.1.8 WARNINGS FOR THE RESTART PREVENTION FUNCTION

- The restart prevention function is not guaranteed in blind spots. If required, implement adequate additional measures in those areas.
- Machinery restarting must be enabled only in safe conditions. The button for the restart signal, when needed, must be installed:
    - outside of the dangerous area
    - not accessible from the dangerous area
    - in a point where the dangerous area is fully visible

2.1.9 RESPONSIBILITY

The machinery manufacturer and system installer are responsible for the operations listed below:

- Providing adequate integration of the output signals of the system.
- Checking the monitored area of the system and validating it based on the needs of the application.
- Following the instructions provided in this manual.

2.1.10 LIMITS

- The system cannot detect the presence of people who are immobile and not breathing or objects within the dangerous area.
- The system does not offer protection from pieces ejected from the machinery, from radiation, and objects falling from above.
- The machinery command must be electronically controlled.

2.1.11 DISPOSAL

For decommissioning follow the instructions reported in "Disposal" on page 108.

2.2 Conformity

2.2.1 STANDARDS AND DIRECTIVES

Directives	2014/53/EU (RED - Radio equipment)
Standards	ETSI EN 301 489-1 v2.2.3 (only emissions)
	ETSI EN 301 489-3 v2.1.1 (only emissions)
	ETSI EN 300 440 v2.1.1
	IEC/EN 61010-1: 2010
	EN IEC 61000-6-2:2019

2.2.2 CE

The manufacturer, Inxpect SpA, states that Inxpect Value Line complies with the 2014/53/EU directive. The full EU Declaration of Conformity text is available on the company's website: https://www.inxpect-tj.com/downloads.html

3. Get to know Inxpect Value Line

Contents

This section includes the following topics:

Product label description

The following table describes the information contained in the product label:

Part	Description
DC	"yy/ww" : year and week of the product manufacture
Model	Product model (e.g., S188A, C283A)
Type	Product variant, used for commercial purposes only
S/N	Serial number

3.1 Inxpect Value Line

3.1.1 Definition

Inxpect Value Line is an active protection radar system that monitors the dangerous areas of machinery.

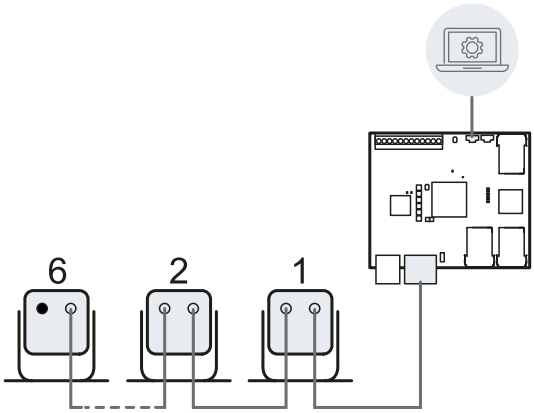
3.1.2 Special features

Some of the special features of this protection system are the following:

- up to two detection fields to signal proximity or prepare the machinery for stopping
- possibility to switch dynamically between max. 8 different preset configurations
- three configurable sensitivity levels
- muting on the entire system or only on some sensors
- immunity to dust and smoke
- reduction of undesired alarms caused by the presence of water or processing waste

3.1.3 Main components

Inxpect Value Line is composed of a control unit and up to six sensors. The system application allows system operation configuration and checks.



3.1.4 Control unit - sensor communication

The sensors communicate with the control unit via CAN bus using diagnostic mechanisms.

For correct functioning, each sensor must be assigned an identification number (Node ID).

Sensors on the same bus must have different Node IDs. By default, the sensor does not have a pre-assigned Node ID.

3.1.5 Control unit - machinery communication

The control unit communicates with the machinery via I/O (see "Control unit inputs" on the next page and "Control unit outputs" on page 16).

3.1.6 Applications

Inxpect Value Line integrates with the machinery control system: when performing protective functions or detecting failures, Inxpect Value Line deactivates the outputs and keeps them deactivated, so the control system can put the area into a safe condition and/or prevent restarting of the machinery.

In the absence of other control systems, Inxpect Value Line can be connected to the devices that control the power supply or machinery start-up.

Inxpect Value Line does not perform normal machinery control functions.

For connection examples, see "Electrical connections" on page 88.

3.2 Control units

3.2.1 Control unit supported

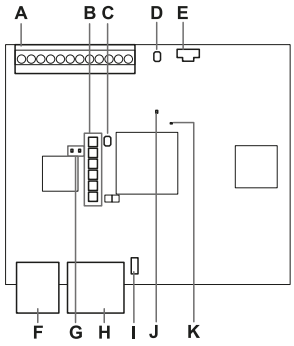
The Inxpect Value Line supports one control unit, called C283A.

3.2.2 Functions

The control unit performs the following functions:

- Collects information from all the sensors via CAN bus.
- Compares the position of detected motion with the set values.
- Deactivates the selected output when at least one sensor detects motion in the detection field.
- Deactivates all the outputs if a failure is detected in one of the sensors or the control unit.
- Manages the inputs and outputs.
- Communicates with the Inxpect Safety application for all configuration and diagnostic functions.
- Allows dynamically switching between different configurations.

3.2.3 Structure



Part	Description
A	I/O terminal block
B	System status LEDs
C	Network parameter reset button / Factory reset button
D	Reserved for internal use. Output reset button
E	Micro-USB port (micro-B type) for connecting the PC and communicating with the Inxpect Safety application
F	Power supply terminal block
G	Power supply LEDs (steady green)
H	CAN bus terminal block for connecting the first sensor
I	DIP switch to turn on/off the bus termination resistance: • On (top position, default) = resistance included • Off (bottom position) = resistance excluded
J	Status LED of hardware functions of the secondary micro-controller: • slow flashing orange: normal behavior • other status: contact Technical Support
K	Status LED of hardware functions of the primary micro-controller: • off: normal behavior • steady red: contact Technical Support

3.2.4 System status LEDs

The LEDs are each dedicated to a sensor, and can display the following statuses:

Status	Meaning
Steady green	Normal sensor function and no motion detected
Orange	Normal sensor function and some motion detected
Flashing red	Sensor in error (see "Sensor LED" on page 69)
Steady red	System error (see "Control unit LED" on page 67)
Flashing green	Sensor in boot status (see "Control unit LED" on page 67)

3.3 Control unit inputs

3.3.1 Introduction

The system has two type 3 dual channel digital inputs (according to IEC/EN 61131-2). Alternatively, the four channels can be used as single channel digital inputs. The ground reference is common for all the inputs (see "Technical references" on page 83).

When using digital inputs, it is mandatory that the additional SNS input "V+ (SNS)" is connected to 24 V DC and that the GND input "V- (SNS)" is connected to the ground to perform the correct input diagnostic.

3.3.2 Input functions

The function of each digital input must be programmed through the Inxpect Safety application. The available functions are the following:

- **Stop signal**: additional function, which manages a specific signal to force all the outputs (detection signals and detection warnings) to OFF-state.
- **Restart signal**: additional function, which manages a specific signal which enables the control unit to switch to ON-state the outputs related to all the detection fields with no motion detected.
- **Muting group 1** or **Muting group 2**: additional function, which manages a specific signal, allowing the control unit to ignore the information from a selected sensor group.
- **Dynamic configuration switch**: additional function, which allows the control unit to select a specific dynamic configuration.
- **System recondition**: configures the system without changing any settings.
- **Restart signal + System recondition**: according to the input signal duration, performs the **Restart signal** function or the **System recondition** function.
- **Acquisition Trigger**: manages a specific signal which allows using Multi-control unit Synchronization (for details, see "Multi-control unit Synchronization (only all S188A-X3 sensors)" on page 35).
  ***Note**: output function available only if all the system sensors are S188A-X3.*

For details about digital input signals, see "Digital input signals" on page 98.

3.3.3 Single or dual channel option

By default, each digital input function needs a signal on both channels to provide redundancy.

The following digital input functions can also be used as a single channel:

- **Restart signal**
- **Muting group “N”**
- **System recondition**
- **Restart signal + System recondition**

In the Inxpect Safety application in **Settings** > **Digital Input-Output**, set the digital input function to **Single channel** and then choose the input function for each channel.

3.3.4 Redundancy mode

Two types of redundancy mode are available for the dual channels input functions:

- **Coherent redundancy**

Input Channel 1	Input Channel 2	Input logic value
0	0	Low
1	1	High
0	1	Error
1	0	Error

- **Inverted redundancy**

Input Channel 1	Input Channel 2	Input logic value
0	1	Low
1	0	High
0	0	Error
1	1	Error

By default, the redundancy mode is coherent. For the following input functions, the inverted redundancy mode can be set to guarantee compatibility with different connected devices:

- **Muting group “N”**
- **Restart signal**
- **Dynamic configuration switch**
- **System recondition**
- **Restart signal + System recondition**

3.3.5 Stop signal debounce filter

The debounce filter allows to filter test pulses in a digital input configured as **Stop signal**. Its enabling is recommended when an ESPE device equipped with OSSD is connected to the digital input.

NOTICE: *debounce filter shall only be enabled with ESPE devices that initiate and internally monitor the OSSD test.*

Per default, the filter is disabled. It can be activated through the Inxpect Safety application (**Settings** > **Advanced** > **Stop signal debounce filter**).

3.3.6 SNS input

The control unit is provided with an **SNS** input (high logic level (1) = 24 V) needed to check the correct functioning of the inputs.

NOTICE: *if at least one input is connected, the SNS input "V+ (SNS)" and the GND input "V- (SNS)" must also be connected.*

3.4 Control unit outputs

3.4.1 Outputs

The system has four digital OSSD short-circuit protected outputs that can be used individually (detection warning) or programmed as dual channel outputs (detection signal).

An output is activated when it switches from OFF to ON-state (from 0 V to 24 V) and deactivated when it switches from ON to OFF-state (from 24 V to 0).

3.4.2 Output functions

The function of each digital output must be programmed through the Inxpect Safety application.

The available functions are the following:

- **Detection signal "N"**: (e.g., alarm signal) switches the selected output to OFF-state when a sensor detects a motion in detection field N*, receives a stop signal from the related input, or when there is a system failure. The selected output remains in OFF-state for at least 100 ms.
  Note*: "N" is the number of the corresponding detection field (e.g.,* ***Detection signal 1*** *for detection field 1,* ***Detection signal 2*** *for detection field 2).*

  Note*: when an OSSD is configured as* ***Detection signal "N"****, a second OSSD is automatically assigned to it.*
- **Detection warning "N"**: switches the selected output to OFF-state when a sensor detects a motion in detection field N*, receives a stop signal from the related input, or when there is a system failure. The selected output remains in OFF-state for at least 100 ms.
  Note*: N is the number of the corresponding detection field (e.g.,* ***Detection warning 1*** *for detection field 1,* ***Detection warning 2*** *for detection field 2).*
- **Detection signal group 1** or **Detection signal group 2**: switches the selected output to OFF-state when at least one sensor detects a motion in a detection field belonging to the group (see "Detection signal/warning group settings" on the next page), receives a stop signal from the related input, or when there is a system failure. The selected output remains in OFF-state for at least 100 ms.
  Note*: when an OSSD is configured as* ***Detection signal group 1*** *or* ***Detection signal group 2****, a second OSSD is automatically assigned to it.*
- **Detection warning group 1** or **Detection warning group 2**: switches the selected output to OFF-state when at least one sensor detects a motion in a detection field belonging to the group (see "Detection signal/warning group settings" on the next page), receives a stop signal from the related input, or when there is a system failure. The selected output remains in OFF-state for at least 100 ms.
- **System diagnostic signal**: switches the selected output to OFF-state when a system fault is detected.
- **Muting enable feedback signal**: switches the selected output to ON-state when a muting signal is received over the configured input and at least one group is in muting.
- **Restart feedback signal**: switches the selected output to ON-state when it is possible to manually restart at least one detection field (Restart signal). It can be set as **Standard** or **Pulsed**.
  - If all the used detection fields are configured as **Automatic** restart (in **Settings** > **Restart function**), the selected output is always in OFF-state;
  - If at least one detection field in use is configured as **Manual** restart (in **Settings** > **Restart function**), the behavior depends on the option selected (see "Restart feedback signal option settings" on the next page.
- **Acquisition Trigger**: manages a specific signal which allows using Multi-control unit Synchronization (for

details, see "Multi-control unit Synchronization (only all S188A-X3 sensors)" on page 35).
***Note**: output function available only if all the system sensors are S188A-X3.*

In the Inxpect Safety application in **Settings** > **Digital Input-Output**, set the digital output function to **Single channel** and then choose the output function for each channel.

3.4.3 Output configurations

The system installer can decide to configure the system as follows:

- two dual channel outputs(e.g., **Detection signal 1** and **Detection signal 2**)
- one dual channel output (e.g., **Detection signal 1**) and two single channel output (e.g., **System diagnostic signal** and **Detection warning 2**)
- each output as a single output (e.g., **Detection warning 2**, **System diagnostic signal**, **Muting enable feedback signal** and **Restart feedback signal**)

***Note**: configuring the system with only one channel output may result in serious injuries in case of an output circuit fault and a failure of the machine to stop.*

3.4.4 Dual channel output configuration

The dual channel output is automatically managed by the Inxpect Safety application and it only matches the single OSSD outputs as follows:

- OSSD 1 with OSSD 2
- OSSD 3 with OSSD 4

3.4.5 Restart feedback signal option settings

If at least one detection field in use is configured as **Manual** restart (in **Settings** > **Restart function**), the behavior of the **Restart feedback signal** depends on the option selected:

Option	Restart feedback signal behavior
Standard	• The selected output is activated (ON-state) if there is no more motion within at least one detection field configured as **Manual** restart. The ON-state lasts as long as there is an absence of motion within one or more detection fields (configured as **Manual** restart) and until the restart signal is activated on the selected input. • The selected output remains in OFF-state if: ◦ none of the detection fields (configured as **Manual** restart) are ready to be restarted, and as long as a motion (or a fault) is detected within at least one detection field (configured as **Manual** restart), or ◦ as long as no motion is detected within any detection fields configured as **Manual** restart, but none can be restarted yet.
Pulsed	• The selected output is activated (ON-state) if there is no more motion within at least one detection field configured as **Manual** restart. The ON-state lasts as long as there is an absence of motion within one or more detection fields (configured as **Manual** restart) and until the restart signal is activated on the selected input. • The selected output switches continuously between ON-state and OFF-state if none of the detection fields (configured as **Manual** restart) are ready to be restarted, and as long as a motion (or a fault) is detected within at least one detection field (configured as **Manual** restart) • The selected output remains in OFF-state as long as no motion is detected within any detection fields configured as **Manual** restart, but none can be restarted yet.

3.4.6 Detection signal/warning group settings

Each detection field of each sensor can be assigned to a group to associate them with the same output.

Through the Inxpect Safety application (in **Settings > Detection field groups**), each detection field of each sensor can be associated with a group or both groups. By default, a detection field does not belong to any group.

WARNING! Consider the detection field dependency choice during the group's configuration. See "Detection fields dependency and detection signal generation" on page 27

Example

It is possible to configure that the following detection fields belong to group 1:

- Detection field 1 of Sensor 1
- Detection field 1 of Sensor 3
- Detection field 2 of Sensor 1

By doing so, a specific output assigned to **Detection signal group 1** or **Detection warning group 1** will switch to the OFF-state when a movement is detected in one of these detection fields.

3.4.7 Output status of detection signal outputs

The output status is the following:

- activated output (24 V DC): idle signal, no motion detected, and normal functioning
- deactivated output (0 V DC): motion detected in the detection field or failure detected in the system

3.4.8 Pulse test for detection signal outputs

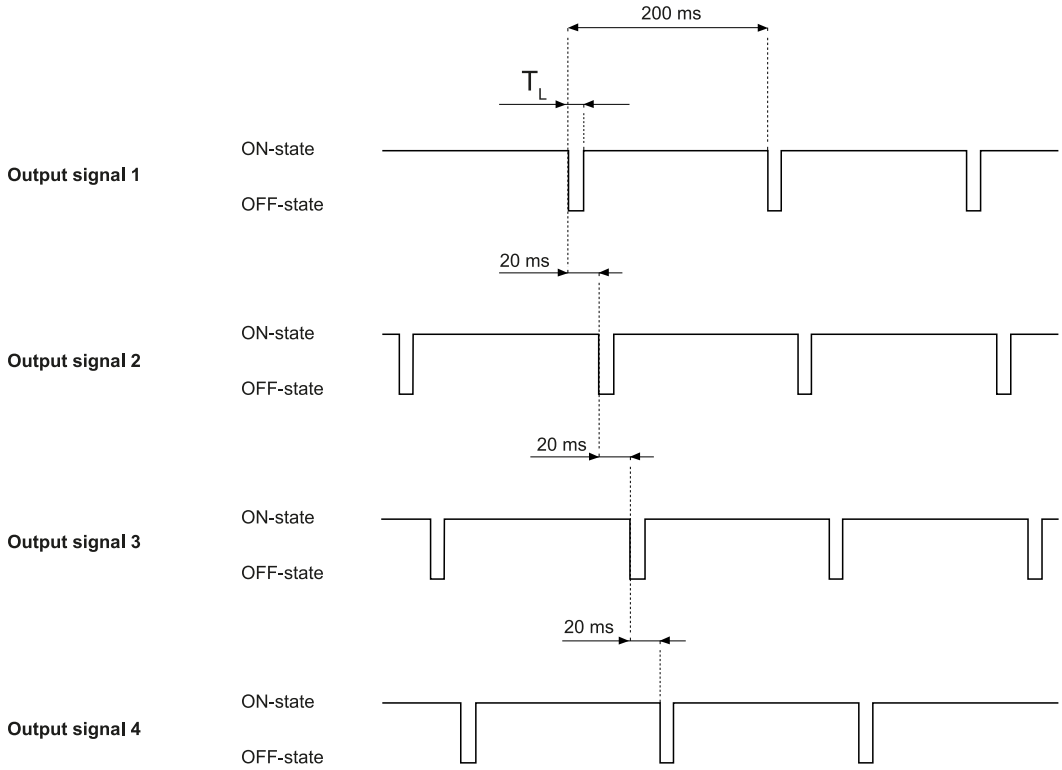
A pulse test is provided for the detection signal output, in particular for the outputs configured as follows:

- **Detection signal "N"**
- **Detection warning "N"**
- **Detection signal group "N"**
- **Detection warning group "N"**

The test is performed with the idle signal periodically pulsed to 0 V to detect short-circuits to either 0 V or 24 V.

The pulse duration at 0 V (T_L) can be set at 300 µs or 2 ms through the Inxpect Safety application (**Settings** > **Digital Input-Output** > **OSSD Pulse width**).

***Note**: the devices connected to the OSSD should not respond to these temporary, self-diagnostic 0 V pulses of the signal.*



For details, see "Technical references" on page 83.

3.4.9 OSSD diagnostic checks

Per default, the OSSD Diagnostic check (e.g., for short-circuits) is deactivated. This check can be activated through the Inxpect Safety application (**Settings** > **Digital Input-Output**).

If activated, the control unit will monitor:

- short-circuit between OSSDs
- 24 V short-circuit
- open circuit (only trips on demand, i.e., when the protective function is activated on the transition from 24 V to GND)

***Note**: the short-circuit to GND (fail-safe fault) is always monitored even if the OSSD diagnostic check is deactivated.*

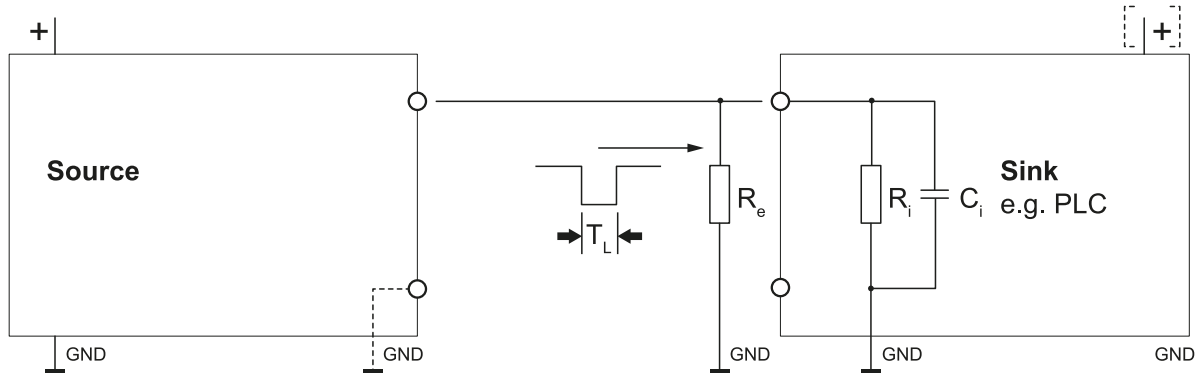
3.4.10 External resistor for OSSD outputs

To guarantee the correct connection between the OSSDs of the control unit and an external device, it may be necessary to add an external resistor.

If the pulse width set (**OSSD Pulse width**) is 300 µs, it is strongly recommended to add an external resistor to guarantee the discharge time of the capacitive load. If it is set at 2 ms, an external resistance must be added if the resistor of the external load is greater than the maximum resistive load allowed (see "Technical data" on page 84).

Below are some standard values for the external resistor:

OSSD Pulse width value	External resistor (R_e)
300 µs	1 kΩ
2 ms	10 kΩ



3.5 Sensors

3.5.1 Sensors supported

Inxpect Value Line supports up to six of the following sensors:

Model	Type	Protective function	Horizontal angular coverage	Vertical angular coverage	Application type
S188A	-X1	Access detection	110°	30°	**Stationary**, **Mobile**
S188A	-X2	Access detection	50°	15°	
S188A	-X3	Restart prevention	110°	30°	**Stationary**

The sensors connected to the control unit can be of different type.

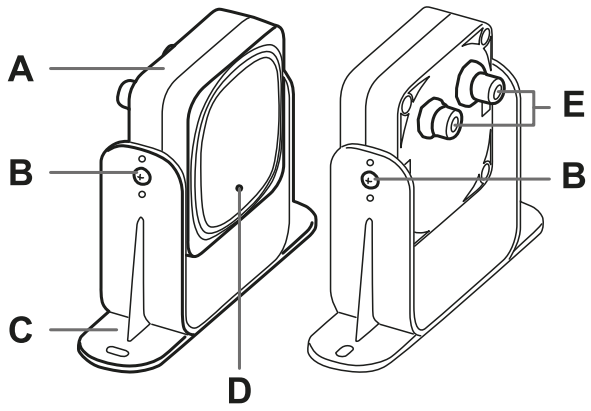
3.5.2 Functions

The sensors perform the following functions:

- Detect motion in their field of view.
- Send the motion detection signal to the control unit through CAN bus.

- Signal to the control unit through CAN bus the failures or faults detected on the sensor during diagnostics.

3.5.3 Structure



Part	Description
A	Sensor
B	Screws for fastening the sensor at a specific inclination
C	Mounting bracket
D	Status LED
E	Connectors for connecting the sensors in a chain and to the control unit

3.5.4 Status LED

Status	Meaning
Steady on	Sensor is working. No motion detected.
Rapid flashing on (100 ms)	Sensor is detecting motion. Not available if the sensor is in muting.
Other conditions	Error (see "Sensor LED" on page 69)

3.6 Inxpect Safety application

3.6.1 Functions

The application permits the following main functions to be performed:

- Configure the system.
- Create the configuration report.
- Check system functioning.
- Download system log.

3.6.2 Inxpect Safety application usage

To use the application, the control unit must be connected to a computer with a data USB cable.

3.6.3 Authentication

The application can be downloaded free of charge at https://www.inxpect-tj.com/downloads.html.

Different user levels are available. The Admin user is in charge of user management. All the passwords can be set through the application and then saved on the control unit.

3.6.4 User levels

These are the functions available for each user level:

	Observer	Expert	Engineer	Admin	Service*
Read system configuration	x	x	x	x	x
Validation	-	x	x	x	x

	Observer	Expert	Engineer	Admin	Service*
Download log files	-	x	x	x	x
Sensor setup (e.g., Node ID) and configuration	-	-	x	x	-
Apply changes	-	-	x	x	-
Digital I/O configuration	-	-	x	x	-
Backup configuration	-	x	x	x	-
Restore configuration	-	-	x	x	-
System labels	-	-	-	x	-
User management	-	-	-	x	-
Technical support and maintenance	-	-	-	-	x
Debug and statistical information	-	-	-	-	x

Note*: Service user can be enabled/disabled by the administrator. Since only Inxpect technicians are allowed to access as Service, the Service user is protected by an activation code.*

3.6.5 Main menu

Page	Function
Dashboard	Display main information on the configured system. ***Note****: the messages show the same information in the log files. For the meanings of the messages, see the chapters on logs in "Troubleshooting" on page 67.*
Configuration	Define the monitored area. Configure the sensors and the detection fields. Define the dynamic configurations. Set the restart timeout.
Settings	Configure the sensor groups. Choose the detection fields dependency. Enable the anti-tampering functions. Synchronize more control units. Configure the inputs and outputs function. Perform the configuration backup and load a configuration. Download the log. Perform the sensor Node ID assignment. Other general functions.
Admin	Configure and manage the users. Perform a factory reset. Set labels for control units and sensors.
Validation	Start the validation procedure. ***Note****: the messages shown in this page are those in the log file. To know the meaning of the messages, see the chapters on logs in "Troubleshooting" on page 67.*
REFRESH CONFIGURATION	Refresh configuration or ignore unsaved changes.
User	Change user profile. Modify account settings.
Control unit	Retrieve control unit information. Close the connection with the control unit and allow it to connect to another control unit.
	Change the language.

3.7 System configuration

3.7.1 System configuration

The control unit parameters have their own default values that can be modified via the Inxpect Safety application (see "Configuration application parameters" on page 96).

When a new configuration is saved, the system generates the configuration report.

***Note**: after a physical change of the system (e.g., new sensor installed), the system configuration must be updated and a new configuration report must be generated, too.*

3.7.2 Dynamic system configuration

Inxpect Value Line allows a real-time adjustment of the most important system parameters, providing the means to switch dynamically among different preset configurations. Via the Inxpect Safety application, once the first system configuration (default configuration) has been set, it is possible to set alternative presets to allow a dynamic real-time reconfiguration of the monitored area. The alternative presets are 7.

3.7.3 Dynamic system configuration parameters

These are the programmable parameters for each sensor:

- detection field (1 or 2)

To know the programmable parameters for each detection field, see "Detection field parameters" on page 27.

All the remaining system parameters cannot be changed dynamically and are considered static.

3.7.4 Dynamic configuration switch

One of the preset configurations can be activated dynamically through the digital inputs (**Dynamic configuration switch**).

To activate one of the preset configurations dynamically, one or both the digital inputs of the control unit can be used. The result is the following:

If...	Then it is possible to switch dynamically between...
only **one** digital input is configured as **Dynamic configuration switch**	**two** preset configurations (see "Case 1" below and "Case 2" on the next page)
both digital inputs are configured as **Dynamic configuration switch** and the encoded channel option is disabled	**four** preset configurations (see "Case 3" on the next page)
both digital inputs are configured as **Dynamic configuration switch** and the encoded channel option is enabled	**eight** preset configurations (see "Case 4" on the next page)

***Note**: the configuration change is safe because two-channel inputs are used.*

***Note**: if the encoded channel option is enabled, any invalid combination that lasts more than 33 ms results in a fault on the inputs that brings the system to a safe state.*

Case 1

The first digital input has been configured as **Dynamic configuration switch**.

Dynamic configuration number	Input 1 (CH1 and CH2)	Input 2
#1	**0**	-
#2	**1**	-

0 = signal deactivated; 1 = signal activated

Case 2

The second digital input has been configured as **Dynamic configuration switch**.

Dynamic configuration number	Input 1	Input 2 (CH1 and CH2)
#1	-	**0**
#2	-	**1**

0 = signal deactivated; 1 = signal activated

Case 3

Both digital inputs have been configured as **Dynamic configuration switch**, and the encoded channel option is disabled.

Dynamic configuration number	Input 1 (CH1 and CH2)	Input 2 (CH1 and CH2)
#1	**0**	**0**
#2	**1**	**0**
#3	**0**	**1**
#4	**1**	**1**

0 = signal deactivated; 1 = signal activated

Case 4

Both digital inputs have been configured as **Dynamic configuration switch**, and the encoded channel option is enabled.

The valid combinations are only those that differ at least by two values, and they are listed below:

Dynamic configuration number	Input 1		Input 2	
	CH1	CH2	CH1	CH2
#1	**1**	**0**	**0**	**0**
#2	**0**	**1**	**0**	**0**
#3	**0**	**0**	**1**	**0**
#4	**0**	**0**	**0**	**1**
#5	**1**	**1**	**1**	**0**
#6	**1**	**1**	**0**	**1**
#7	**1**	**0**	**1**	**1**
#8	**0**	**1**	**1**	**1**

0 = signal deactivated; 1 = signal activated

3.7.5 Consideration on the configuration switch

WARNING! The new dynamic configuration is activated every time the command is received regardless of the system status. Verify that the protection of the area is still guaranteed before switching to another configuration.

The usage of the feature can be split in the following two main categories, resulting in different consequences on the protection of the area.

Sensor mounted on movable machinery

While the machinery with the mounted sensor is moving, in the dynamic switch between different preset configurations the protection is always guaranteed. The sensor itself is moving and any kind of configuration will trip an alarm as soon as a relative movement is detected, even in case of a still person.

When the machinery with the mounted sensor stops, see "Sensor mounted on fixed machinery" on the next page.

Sensor mounted on fixed machinery

If the machinery with the mounted sensor is fixed, the dynamic switch between different preset configurations is secure only if no one is in the monitored area. In fact, for example, if the new configuration has a longer detection field and a person stands still in the new monitored area, it won't be detected until the person moves.

4. Functioning principles

Contents

This section includes the following topics:

4.1 Sensor functioning principles

4.1.1 Introduction

The sensor is an FMCW (Frequency Modulated Continuous Wave) radar device based on a proprietary detection algorithm. It is also a single target sensor that sends pulses and receives information, analyzing the reflection of the nearest moving target that it encounters.

Each sensor has its own fieldset. The fieldset corresponds to the structure of the field of view, which is composed of detection fields (see "Detection fields" on the next page).

4.1.2 Factors that influence the sensor field of view and object detection

WARNING! The presence of conductive material on the sensor could affect its field of view and, thus, object detection. For proper and safe system operation, validate the system under this condition.

4.1.3 Factors that influence the reflected signal

The signal reflected by the object depends on several characteristics of the same object:

- Metallic objects have a very high reflection coefficient, while paper and plastic reflect only a small portion of the signal
- The greater the surface exposed to the radar, the greater the reflected signal
- All other factors being equal, objects positioned directly in front of the radar generate a more significant signal than objects to the side
- Motion speed
- Inclination

All these factors have been analyzed for a human body during the validation of Inxpect Value Line and cannot lead to a dangerous situation. These factors may occasionally influence the behavior of the system causing spurious activation of the protective function.

This behavior can be minimized with an ad hoc installation and a metal protector kit.

4.1.4 Detected and missed objects

The signal analysis algorithm considers only those objects that move within the field of view, ignoring completely static objects.

Furthermore, a *falling objects* algorithm allows ignoring undesired alarms generated by small work waste products that fall in the first part of the sensor's field of view.

4.1.5 Interference with pacemakers or other medical devices

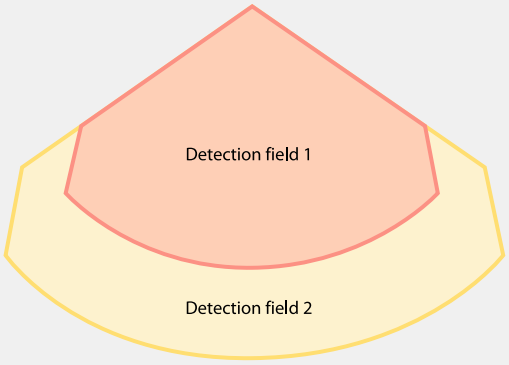
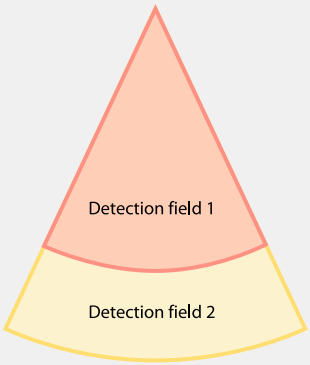
Radiation from Inxpect Value Line does not interfere with pacemakers or other medical devices.

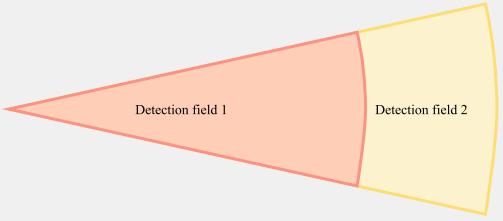
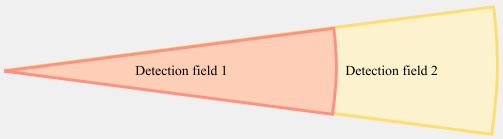
4.2 Detection fields

4.2.1 Introduction

The field of view of each sensor can be composed of up to two detection fields. Each of the two detection fields has a dedicated detection signal.

Detection field examples

Horizontal angular coverage	Detection fields
110° (S188A-X1 and S188A-X3 sensors)	
50° (S188A-X2 sensor)	

Vertical angular coverage	Detection fields
30° (S188A-X1 and S188A-X3 sensors)	
15° (S188A-X2 sensor)	

The detection distance can be programmed for each detection field.

4.2.2 Detection field parameters

These are the programmable parameters for each detection field:

- detection distance
- restart timeout

4.2.3 Detection fields dependency and detection signal generation

If a sensor detects motion within a detection field, its detection signal changes status and, when configured, the related output is deactivated. The behavior of the outputs related to the following detection fields depends on the detection field dependency set:

If...	Then...
the **Dependent mode** is set and thus detection fields are dependent on each other	• if a sensor detects motion within detection field 1, the output related to detection field 2 is also deactivated. Example Detection field configured: 1, 2 Detection field with target detected: 1 Detection field in alarm status: 1, 2 • if a sensor detects motion within detection field 2, only the output related to detection field 2 is deactivated. Example Detection field configured: 1, 2 Detection field with target detected: 2 Detection field in alarm status: 2
the **Independent mode** is set and thus detection fields are independent from each other	• if a sensor detects motion within detection field 1, only the output related to detection field 1 is deactivated. Example Detection field configured: 1, 2 Detection field with target detected: 1 Detection field in alarm status: 1 • if a sensor detects motion within detection field 2, only the output related to detection field 2 is deactivated. Example Detection field configured: 1, 2 Detection field with target detected: 2 Detection field in alarm status: 2

WARNING! If detection fields are independent, an evaluation of the protection of the monitored area must be performed. S188A is a single target sensor. This means that when a target is detected in detection field 1 of a sensor, detection field 2 becomes temporarily blind.

In the **Inxpect Safety** application, click on **Settings** > **Advanced** > Detection field dependency to set the dependency mode of the detection fields.

5. Protective functions

Contents

This section includes the following topics:

5.1 Working modes and protective functions

5.1.1 Introduction

Depending on its model-type, each sensor performs one of the following working modes:

- **Always-on access detection**
- **Always-on restart prevention**

Each working mode is composed of one of the following protective functions:

Function	Description
Access detection	The machinery is reverted into a safe status when one or more persons enter the dangerous area.
Restart prevention	The machinery is prevented from restarting if people are in the dangerous area.

5.1.2 Access detection speed limits

The speed limits of the movements detected by the access detection function (when available) are reported below:

- minimum: 0.1 m/s
- maximum: 1.6 m/s

5.2 Working mode: Always-on access detection

5.2.1 Protective function: access detection

This is the only protective functionavailable for the **Always-on access detection**, that is on S188A-X1 and S188A-X2 sensors.

Access detection allows what follows:

When...	Then...
no motion is detected in the detection field	the outputs remain active
motion is detected in the detection field	• the access detection function remains active • the outputs are deactivated

WARNING! Additional measures must be introduced to ensure the restart prevention function.

5.2.2 T_{OFF} parameter

When the system does not detect motion anymore, the OSSD outputs remain in OFF-state for the time set in the **T_{OFF}** parameter.

The T_{OFF} value can be set from 0.1 s to 60 s.

5.3 Working mode: Always-on restart prevention

5.3.1 Protective function: restart prevention

This is the only protective function available for the **Always-on restart prevention**, that is on S188A-X3 sensor.

The restart prevention allows what follows:

When...	Then...
no motion is detected in the detection field	the outputs remain active
motion is detected in the detection field	• the outputs are deactivated • the restart prevention function remains active

The sensor can detect micro-movements of just a few millimeters, such as breathing movements (with normal breathing or a short apnea) or the movements necessary for a person to remain in balance in an upright or squatting position.

The system sensitivity is higher than the sensitivity that characterizes the access detection function. For this reason, the system reaction to vibrating and moving parts is different.

The sensor guarantees the detection of people moving at any speed from 0 up to 1.6 m/s*, provided that the guidelines described in "Sensor positioning guidelines" below are fulfilled.

Note*: a stationary person still has static residual movements that the radar can detect.*

WARNING! When the restart prevention function is active the monitored area may be affected by the position and inclination of the sensors, as well as by their installation height and angular coverage (see "Sensor position" on page 40).

5.3.2 Restart timeout parameter

When the system does not detect motion anymore, the OSSD outputs remain in OFF-state for the time set in the **Restart timeout** parameter.

The default value is 10 s while the maximum value is 60 s.

5.4 Features of the restart prevention function

5.4.1 Sensor positioning guidelines

The restart prevention function is effective if the sensor can detect a person’s movements or their static residual movements. To detect people who are not standing or squatting, it is important that the sensor can clearly detect the person’s chest.

Particular attention should be paid to the following situations:

- There are objects that limit or prevent the sensor from detecting motion.
- The detection of a lying person is required.
- The sensor does not detect a sufficient portion of the body or does not properly detect the person’s chest.

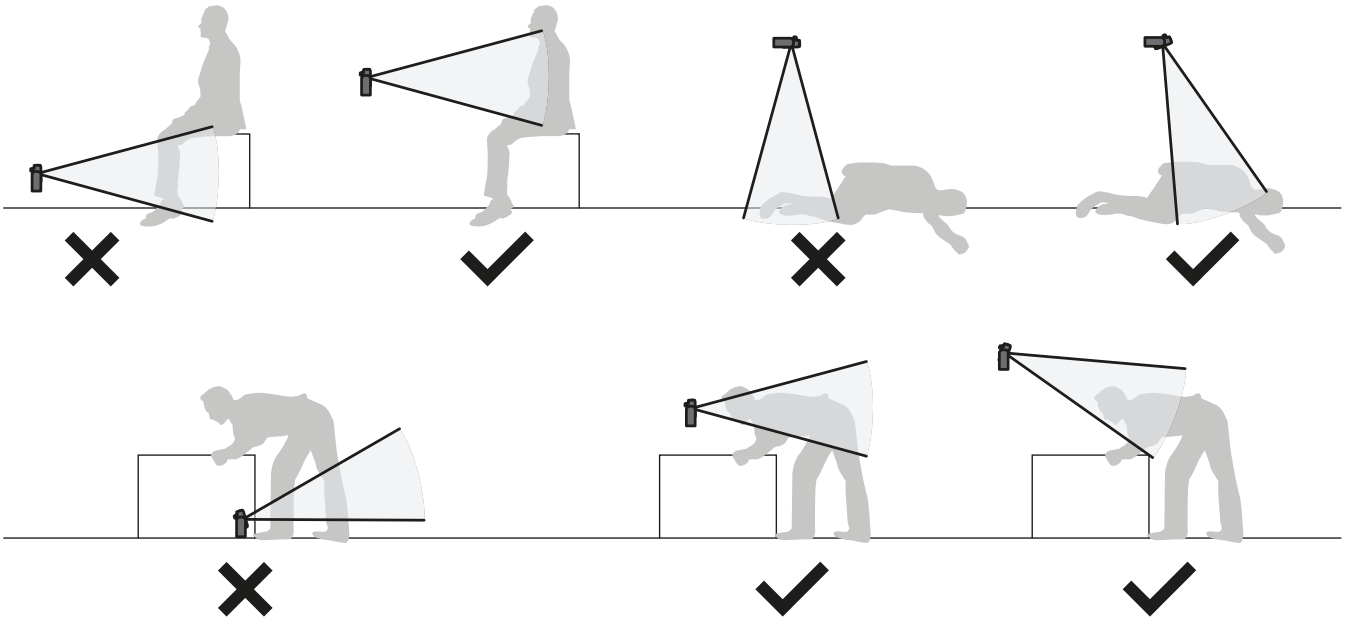
A validation procedure (see "Validate the protective functions" on page 61) must be performed when one or more of the above conditions are met.

If the conditions described above limit the performance of the sensor, take the following steps to reach an appropriate level of performance:

- Increase the **Restart timeout** parameter.
- Change the position of the sensors.
- Add more sensors.

If one or more of the above actions are taken, it is recommended to perform a validation procedure (see "Validate the protective functions" on page 61).

Below are some examples of situations where the above conditions are not met (X) and how to properly position the sensor (✓). These examples are not meant to be exhaustive.



5.4.2 Types of managed restart

NOTICE: *it is the responsibility of the machinery manufacturer to assess if an automatic restart can guarantee the same level of protection as a manual restart.*

For each detection field independently, the system manages the following types of restart:

Type	Conditions for enabling machinery restart
Automatic (default)	The time interval set through the Inxpect Safety application (**Restart timeout**) has passed since the last motion detection*.
Manual	• The time interval set through the Inxpect Safety application (**Restart timeout** for S188A-X3 sensors and $\mathbf{T_{OFF}}$ for S188A-X1 and S188A-X2 sensors) has passed since the last motion detection* and • The **Restart signal** was received correctly** (see "Restart signal + System recondition (dual channel, redundancy mode coherent)" on page 103).

WARNING! For S188A-X1 and S188A-X2 sensors, if the Automatic restart is set, the restart prevention function is not performed, and consequently, the system does not guarantee the detection of a person within the monitored area.

Note*: machinery restart is enabled if no motion is detected up to 30 cm beyond the detection field.*

Note**: (for all types of restart) other dangerous system statuses may prevent the restart of the machinery (e.g., diagnostic fault, sensor masking, etc.)*

5.4.3 Precautions for preventing unexpected restarting

To prevent unexpected restarting the following rules must be followed:

- the set restart timeout must be greater than or equal to 10 s.
- if the sensor is installed at a height of less than 30 cm from the ground, a minimum distance of 30 cm from the sensor must be guaranteed.

5.4.4 Configure the restart function

Type	Procedure
Automatic	1. In the Inxpect Safety application in **Settings** > **Restart function**, select **Automatic**. 2. In the Inxpect Safety application, in **Configuration** for each detection field in use with automatic restart, set the **Restart timeout** parameter (or the $\mathbf{T_{OFF}}$ parameter, if present).
Manual	1. In the Inxpect Safety application in **Settings** > **Restart function**, select **Manual**. 2. If there is a digital input configured as **Restart signal** (**Settings** > **Digital Input-Output**), connect the machinery button for the restart signal as convenient (see "Electrical connections" on page 88). 3. In the Inxpect Safety application, in **Configuration** for each detection field in use with manual restart, set the **Restart timeout** parameter (or the $\mathbf{T_{OFF}}$ parameter, if present).

6. Other functions

Contents

This section includes the following topics:

6.1 Muting

6.1.1 Description

The muting function is an additional function that inhibits the sensing capability of the sensor on which it is activated. It can be activated for a specific sensor or for a group of sensors. This results in keeping the ON-state of the OSSD even when the muted sensors detect motion.

When the muting function is enabled, its effective activation on one or more sensors occurs only as soon as the conditions permit (see "Muting activation conditions" below).

6.1.2 Muting enabling

The muting function can be enabled through digital input (see "Enable muting signal characteristics" below).

WARNING! When the sensor is in muting, no sensor error is available (see"ERROR events (sensor)" on page 77).

The muting function can be enabled for all the sensors simultaneously or only for a group of sensors. Up to two groups can be configured, each associated with a digital input.

Through the Inxpect Safety application, the following must be defined:

- for each input, the group of managed sensors
- for each group, the sensors that belong to it
- for each sensor, whether it belongs to a group or not

***Note**: if the muting function is enabled for one sensor, it is enabled for all the detection fields of the sensor, regardless if the detection fields are dependent or independent and the anti-tampering functions are disabled for that sensor.*

See "Configure the inputs and outputs" on page 60.

6.1.3 Muting activation conditions

The muting function is activated on a specific sensor only in the following conditions:

- All the detection fields involved are motion-free, and the restart timeout has expired for all of them.
- There is no tampering signal or fault signal for that sensor.

When the muting is enabled for a group of sensors, the function is activated as soon as there is no detection in the monitored area of all sensors.

6.1.4 Enable muting signal characteristics

The muting function is enabled only if both logic signals of the dedicated input (or the single logic signal, if it is used as single channel) are at a high logic level (1).

6.1.5 Muting status

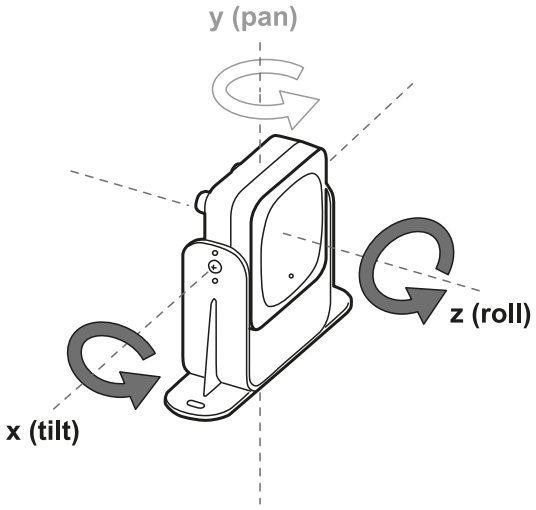
Any output dedicated to the muting status (Muting enable feedback signal) is activated if at least one of the groups of sensors is in muting.

6.2 Anti-tampering functions: anti-rotation around axes

6.2.1 Anti-rotation around axes

The sensor detects rotation around its x-axis and z-axis.

***Note**: the axes are those represented in the figure below, regardless of the installation position of the sensor.*



When the system configuration is saved, the sensor also saves its position. Later, if the sensor detects changes in rotation around these axes, it sends a tamper alert to the control unit. Upon reception of a tampering signal, the control unit deactivates the outputs.

***Note**: when the position is modified with respect to the saved references (i.e., when a sensor is rotated) and the anti-rotation around axes function is enabled, the Inxpect Value Line detects the tampering and sends the message within 5 s.*

6.2.2 Enable the anti-rotation around axes function

The anti-rotation around axes function is disabled by default.

WARNING! If the function is disabled, the system cannot signal a change in the rotation of the sensor around the x-axis and the z-axis and, therefore, cannot signal any changes in the monitored area. See "Checks when the anti-rotation around axes function is disabled" below.

The function can be enabled and configured for each axis of each sensor individually. In the Inxpect Safety application, in **Settings** > **Anti-tampering**, click on the specific option to enable the function for a sensor.

6.2.3 When to enable

Enable the anti-rotation around axes function only if it is necessary to detect a change in the rotation of a sensor around a specific axis.

6.2.4 Checks when the anti-rotation around axes function is disabled

When the anti-rotation around axes function is disabled, perform the following checks.

Protective function	Schedule	Action
Access detection function	Before each machinery restart	Check that the sensor is positioned as defined in the configuration. Check that the monitored area is the same as defined by the configuration. See "Validate the protective functions" on page 61.
Restart prevention function	Each time the outputs are deactivated	

6.3 Anti-tampering functions: anti-masking

6.3.1 Masking signal

The sensor detects the presence of objects that could obstruct the field of view. When the system configuration is saved, the sensor memorizes the surrounding environment. If the sensor subsequently detects variations in the environment that could influence the field of view, it sends a masking signal to the control unit. Upon receiving a masking signal, the control unit deactivates the outputs.

***Note**: the masking signal is not guaranteed in the presence of objects which cause reflection effects that bring their RCS below the minimum detectable threshold.*

***Note**: when the position is modified with respect to the saved references (i.e., when a sensor is masked) and the anti-rotation around axes function is enabled, the Inxpect Value Line detects the tampering and notifies it within 5 s.*

6.3.2 Environment memorization process

The sensor starts the surrounding environment memorization process when the Inxpect Safety application configuration is saved. From that moment, it waits for the system to exit the alarm status and for the scene to be static up to 20 seconds, then scans and memorizes the environment.

***NOTICE:** if the scene is not static during the 20 seconds interval, the system remains in a fault status (SIGNAL ERROR) and the system configuration must be saved again.*

It is recommended to start the memorization process after at least 3 minutes from turning on the system to guarantee that the sensor has reached the operating temperature.

Only at the conclusion of the memorization process it is possible for the sensor to send masking signals.

6.3.3 Causes of masking

Possible causes of masking signals are the following:

- An object that obstructs the field of view of the sensor has been placed in the detection field.
- The environment in the detection field changes significantly, for example, if the sensor is installed on moving parts or if there are moving parts inside of the detection field.
- The configuration was saved with sensors installed in an environment that is different from the working environment.
- There were temperature fluctuations.

6.3.4 Masking signal when the system is turned on

If the system was off for several hours and there were temperature fluctuations, the sensor might send a false masking signal when it is turned on. The outputs activate automatically within 3 minutes when the sensor reaches its working temperature. This does not happen if this temperature is still very far from the reference temperature.

6.3.5 Sensitivity level

The anti-masking function has four levels of sensitivity:

Level	Description	Example application
High	The sensor has the highest sensitivity to changes in the environment. (Suggested level when the field of view is empty up to a meter)	Installations with an empty environment and a height of less than one meter, where objects could occlude the sensor.
Medium	The sensor has low sensitivity to changes in the environment. Occlusion must be evident (deliberate tampering).	Installations with a height of more than one meter, where masking is likely to occur only if voluntary.

Level	Description	Example application
Low	The sensor detects masking only if the sensor occlusion is complete and the objects are highly reflective (e.g., metal, water) near the sensor.	Installations on moving parts, where the environment is changing continuously, but where static objects may be near the sensor (obstacles on the route).
Disabled	The sensor does not detect changes in the environment. ***Note**: it is recommended to enable the function if it is needed to signal the presence of objects that might impede normal detection.*	See "When not enabling the function" below.

The anti-masking function is disabled by default. To enable the function, in the Inxpect Safety application, click **Settings**, then **Anti-tampering** and set the sensitivity level of the function.

6.3.6 Checks when the anti-masking function is disabled

When the anti-masking function is disabled, perform the following checks.

Protective function	Schedule	Action
Access detection function	Before each machinery restart	Remove any objects that obstruct the field of view of the sensor. Reposition the sensor according to the initial installation.
Restart prevention function	Each time the outputs are deactivated	

6.3.7 When not enabling the function

The anti-masking function should not be enabled under the following conditions:

- (For S188A-X3 sensors) The monitored area includes moving parts that stop in different and unpredictable positions.
- The monitored area includes moving parts that vary their position while the sensors are in muting.
- The sensor is positioned on a part that can be moved.
- The presence of static objects is tolerated in the monitored area (e.g., loading/unloading area).

6.4 Multi-control unit Synchronization (only all S188A-X3 sensors)

6.4.1 Introduction

The multi-control unit synchronization function is necessary when multiple Inxpect Value Line are sharing the same area and it allows the interferences between their sensors to be removed using a time synchronization signal.

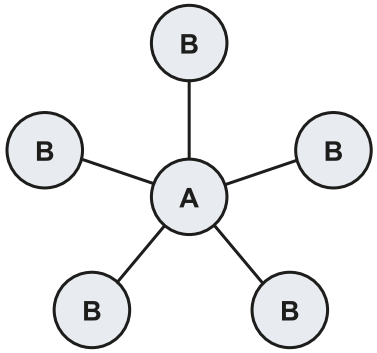
***Note**: the function can be used only if all the sensors are S188A-X3.*

6.4.2 Network topology

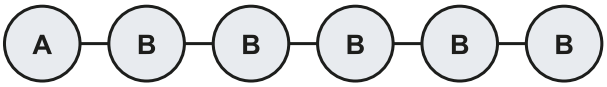
The control units must be connected in a master/slave cabling topology. The following topologies are allowed:

***Note**: the maximum number of slaves that can be connected is 8.*

- Star: every peripheral node (slave **B**, i.e., control unit) is connected to a central node (master **A**, i.e., control unit, PLC, or square wave generator).



- Daisy chain (linear): this is accomplished by connecting each slave **B** (control unit) in series after the master **A** (control unit, PLC, or square wave generator).



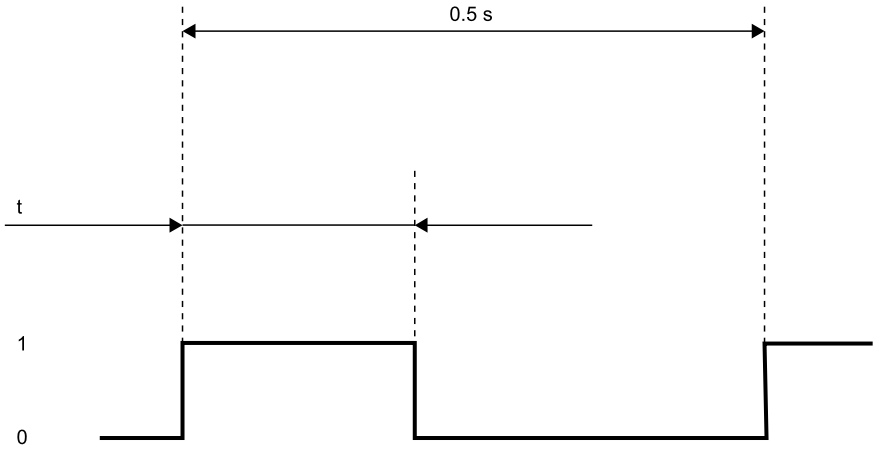
6.4.3 Trigger source

The following synchronization sources are allowed:

- Internal source: the source is the control unit, which acts as the network master.
- External source: the source is a PLC or a square wave generator, which acts as the network master.

6.4.4 Required signal

The control units need a 2 Hz ± 20% synchronization signal frequency. The digital signal required from the trigger (master) to all the control units (slaves) is described in the image below.



With *t* in the range [50 ms, 250 ms].

Synchronization takes place on the rising edge of the signal.

***Note**: if the trigger source is internal, the signal is automatically generated by the control unit (master).*

***Note**: if the topology is daisy chain (linear), the signal is automatically propagated between the slaves without any relevant delay.*

6.4.5 Enable the multi-control unit synchronization function

1. For each control unit, in the Inxpect Safety application click **Settings** > **Multi-control unit synchronization** and assign a different **Control unit channel**.

***Note**: if there are more than four control units, the control units with the same channel must have their monitored areas as far from each other as possible.*

2. Click **Settings** > **Digital Input-Output** and set the digital input-output as follows:

If the network topology is...	And the control unit is...	Then...
star	master*	Configure two of the digital outputs as **Acquisition Trigger**.
	slave	Configure one of the digital inputs as **Acquisition Trigger**.
daisy chain (linear)	master*	Configure two of the digital outputs as **Acquisition Trigger**.
	slave (except the last in the chain)	1. Configure one of the digital inputs as **Acquisition Trigger** 2. Configure two of the digital outputs as **Acquisition Trigger**.
	slave (last of the chain)	Configure one of the digital inputs as **Acquisition Trigger**.

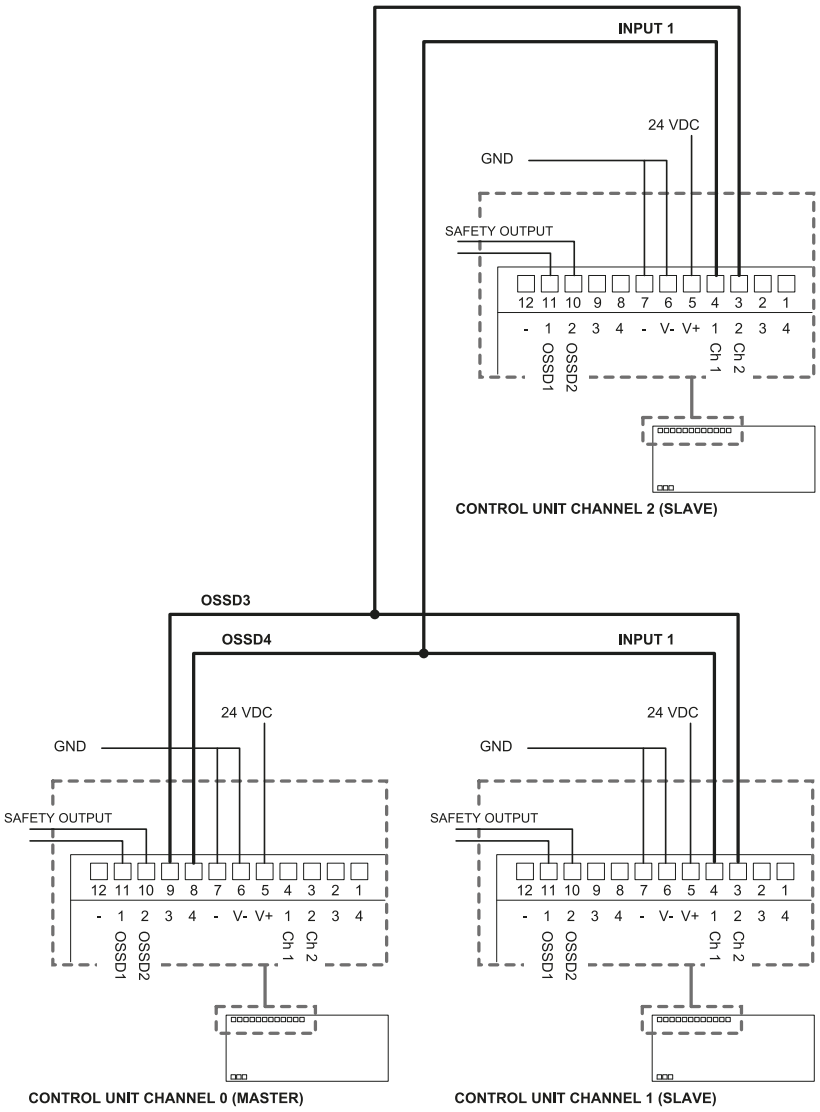
Note*: *present only if the trigger source is internal.*

3. Connect the cables on the I/O terminal blocks of the control unit. See "Electrical connections" on the next page for more details.

6.4.6 Electrical connections

Star example

Internal trigger source (control unit Master) + 2 control units (Slaves)

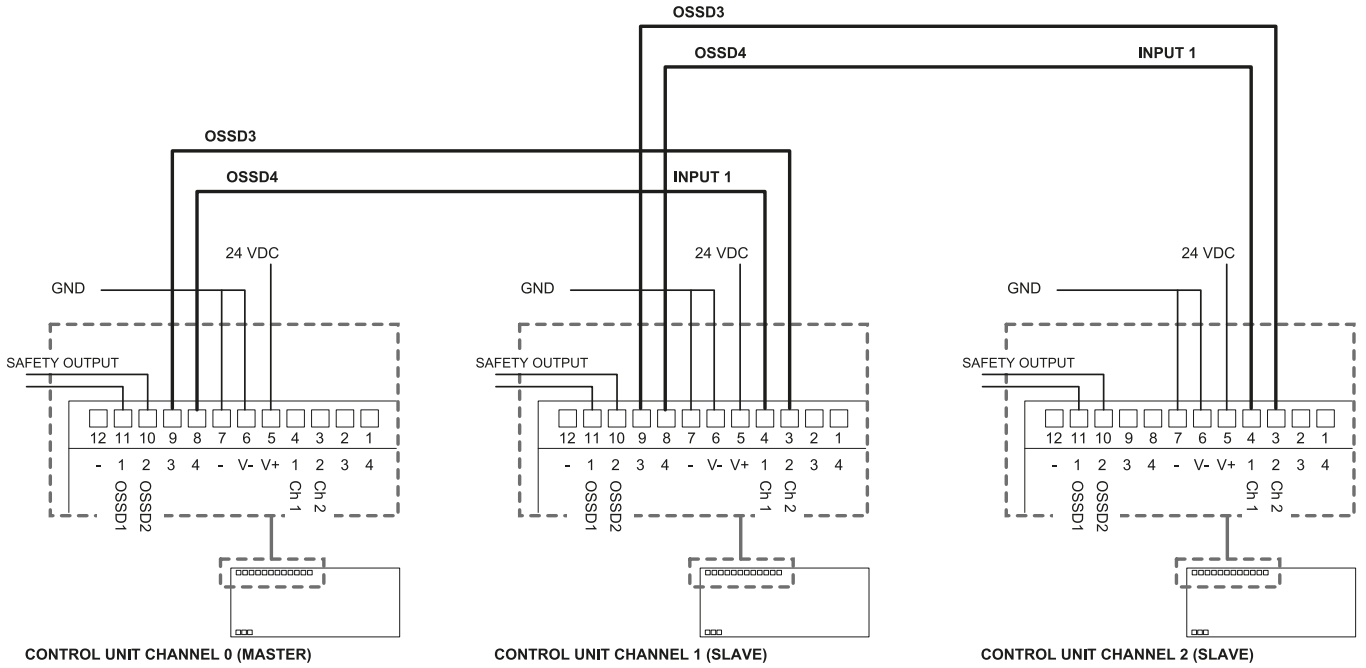


In this example:

- Control unit channel 0 (Master) has OSSD3 and OSSD4 configured as **Acquisition Trigger**.
- Control unit channel 1 (Slave) has Digital Input 1 configured as **Acquisition Trigger**.
- Control unit channel 2 (Slave) has Digital Input 1 configured as **Acquisition Trigger**.

Daisy chain (linear) example

Internal trigger source (control unit Master) + 2 control units (Slaves)



In this example:

- Control unit channel 0 (Master) has OSSD3 and OSSD4 configured as **Acquisition Trigger**.
- Control unit channel 1 (Slave) has OSSD3 and OSSD4 configured as **Acquisition Trigger**, and Digital Input 1 configured as **Acquisition Trigger**.
- Control unit channel 2 (Slave) has Digital Input 1 configured as **Acquisition Trigger**.

6.5 Electromagnetic Robustness

6.5.1 Electromagnetic robustness parameter

With the **Electromagnetic robustness** parameter, it is possible to increase the robustness of the system to electromagnetic interference (e.g., due to sensors of different systems installed too close to each other or problems on the CAN bus).

In the Inxpect Safety application in **Settings** > **Advanced**, the following levels of robustness can be set:

- **Standard** (default)
- **High**
- **Very High**

WARNING! The parameter impacts the system response time for the access detection protective function. According to the chosen level, the maximum guaranteed response time is 100 ms (Standard), 150 ms (High), or 200 ms (Very High).

7. Sensor position

Contents

This section includes the following topics:

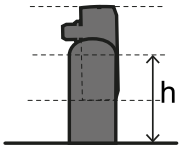
7.1 Basic concepts

7.1.1 Determining factors

The sensor installation height and inclination should be decided together with the detection distances in order to have optimal coverage of the dangerous area.

7.1.2 Sensor installation height

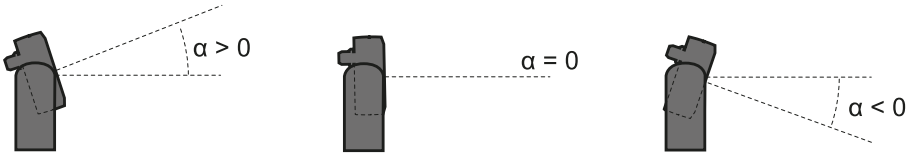
The installation height (h) is the distance between the center of the sensor and the ground or reference plane of the sensor.



7.1.3 Sensor inclination

Sensor inclination is the rotation of the sensor around its x-axis. Inclination is defined as the angle between a line perpendicular to the sensor and a line parallel to the ground. Three examples are presented as follows:

- sensor tilted upwards: α positive
- straight sensor: α = 0
- sensor tilted downwards: α negative



7.2 Sensor field of view

7.2.1 Types of field of view

The field of view of the sensor depends on its model-type:

Model	Type	Protective function	Horizontal angular coverage	Vertical angular coverage
S188A	-X1	Access detection	110°	30°
S188A	-X2	Access detection	50°	15°
S188A	-X3	Restart prevention	110°	30°

7.2.2 Areas and dimensions of the field of view

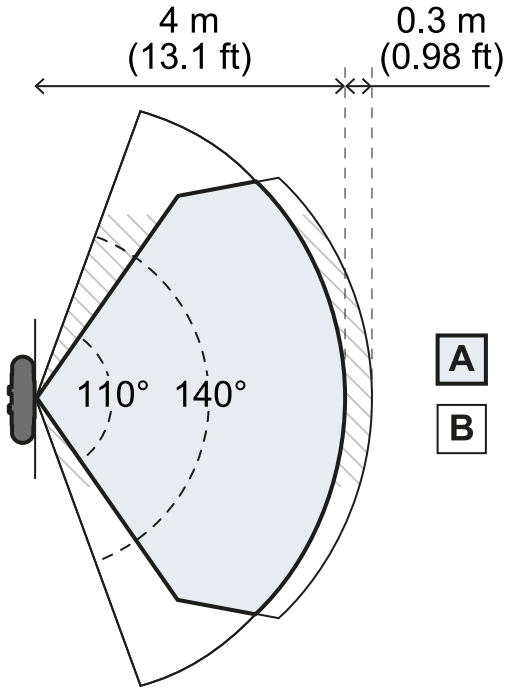
The sensor field of view is composed of two areas:

- detection field: where the detection of objects similar to humans in any position is guaranteed
- tolerance area: where the actual detection of a moving object/person depends on the characteristics of the object itself (see "Factors that influence the reflected signal" on page 25).

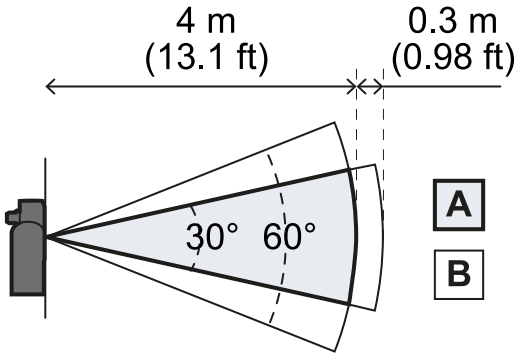
7.2.3 Dimensions for S188A-X1 and S188A-X3

Below are the maximum field of view dimensions **[A]** and the relative tolerance area **[B]**.

The tolerance area dimensions are the same for maximum angular coverage (as described in the figures below) and smaller coverages.



Top view

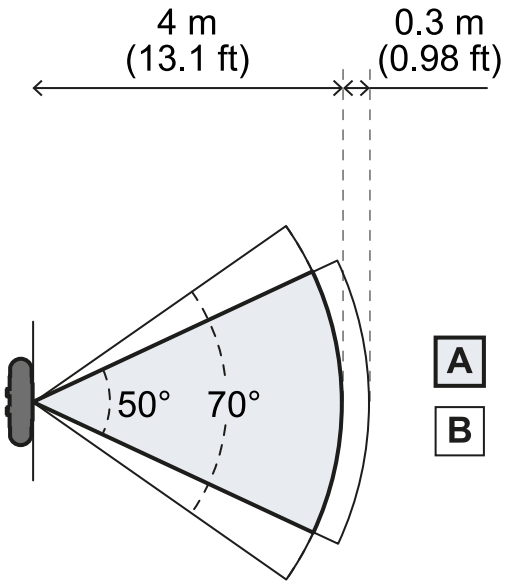


Side view

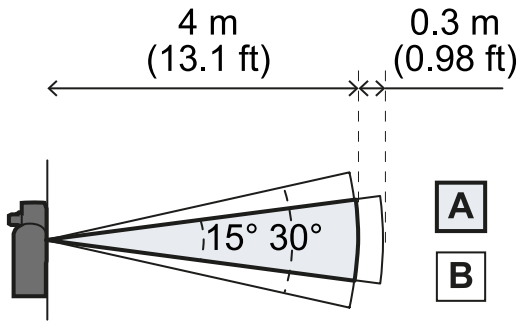
7.2.4 Dimensions for S188A-X2

Below are the maximum field of view dimensions **[A]** and the relative tolerance area **[B]**.

The tolerance area dimensions are the same for maximum angular coverage (as described in the figures below) and smaller coverages.



Top view



Side view

7.2.5 Sensitivity

The system sensitivity level can be defined for the access detection function (for S188A-X1 and S188A-X2 sensors) as well as the restart prevention function (for S188A-X3 sensor). The sensitivity defines the ability of the system to prevent undesired alarms. Only for the access detection function, it also defines the reaction times to motion detection: with high sensitivity the system is more prone to undesired alarms, but detection is faster.

For example, it is recommended to set a lower level of sensitivity for the access detection function if people or objects are in transit at the perimeters of the dangerous area (e.g., forklifts or trucks).

7.3 Separation distance calculation

7.3.1 Introduction

The formula the Inxpect Value Line uses to calculate the separation distance is based on the ISO 13855:2024 standard and is described in the sections below. The standard was used as a guideline to define the separation distance for volumetric devices that can be approached from different directions.

7.3.2 Formula for stationary application

To calculate the separation distance (S) for stationary applications, use the formula below:

$$S = K * T + D_{DS} + Z$$

Where:

Variable	Description	Value	Measurement unit	Notes
K	Maximum approach speed	1600	mm/s	The maximum approach speed is considered to be 1600 mm/s because radar sensors are body protection devices. This is consistent with the definition of approach speed of ISO 13855:2024.
T	Overall system response	See ISO 13855	s	The overall system response time, T, includes portions of time that vary according to machine type, safeguard(s) applied, and elements of the SRP/CS involved in the protective function.

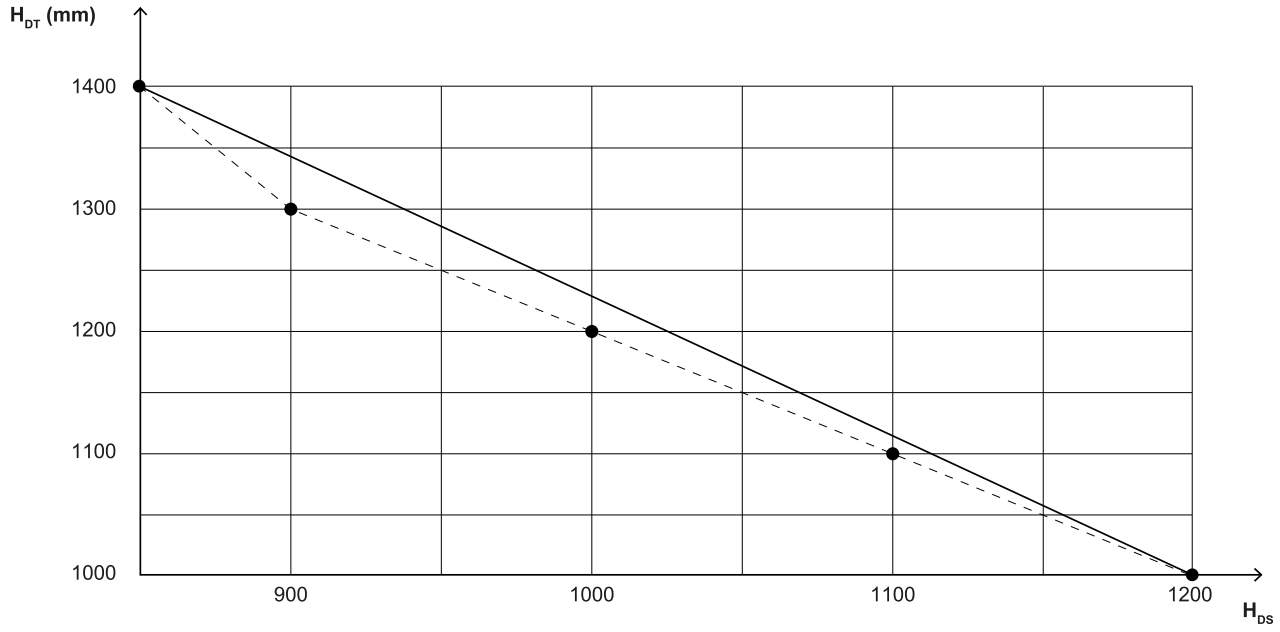
Variable	Description	Value	Measurement unit	Notes
D_{DS}	Reaching distance	• If $H_{DT} \leq 1000$ $D_{DS} = 1200$ • If $1000 < H_{DT} < 1400$, $D_{DS} = 1200 - [(H_{DT} - 1000) * 0.875]$ • If $H_{DT} \geq 1400$, $D_{DS} = 850$	mm	For the definition of H_{DT}, see ISO 13855:2024. For more details about H_{DT}, see "Reaching distance calculation assumptions " below.
Z	Supplemental distance factor	See ISO 13855:2024.	mm	No corrective values for the tolerance zone need to be added to the calculation of the separation distance.

7.3.3 Reaching distance calculation assumptions

The reaching distance, D_{Ds}, can be calculated starting from the height of detection zone H_{DT}, based on the assumptions below:

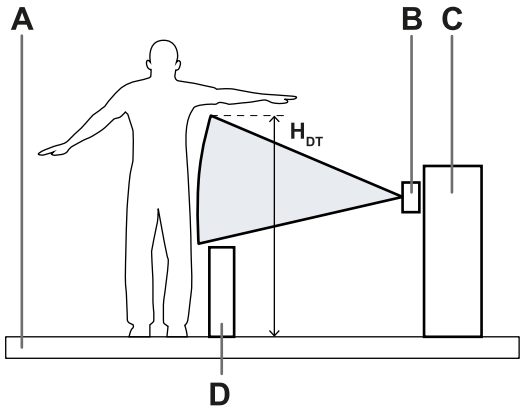
- for H_{DT} higher than 1400 mm, the person could introduce a single arm (see "Example of HDT ≥ 1400 mm (parallel approach)" on the next page).
- for H_{DT} lower than 1000 mm, the person could introduce one arm and part of the upper body (see "Example of HDT ≤ 1000 mm (parallel approach)" on the next page.

The formula for calculating D_{DS} is defined using a conservative approach derived from the values extracted from Table 2 of ISO 13855:2024.



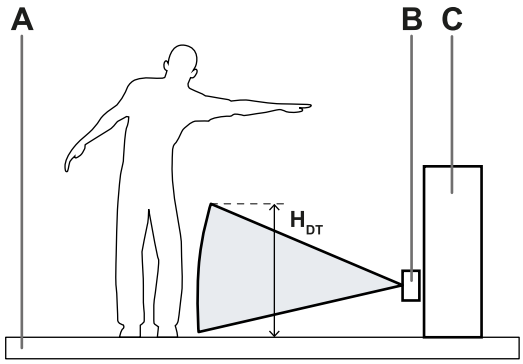
Line	Description
- - - - - - - - - -	Reaching distance over a vertical zone according to Table 2 of ISO 13855
————	Reaching distance according to the formula 1200 - [(H_{DT} - 1000) * 0.875)]

Example of H_{DT} ≥ 1400 mm (parallel approach)



Part	Description
A	Reference plane
B	Radar sensor
C	Hazard zone
D	Obstacle

Example of H_{DT} ≤ 1000 mm (parallel approach)



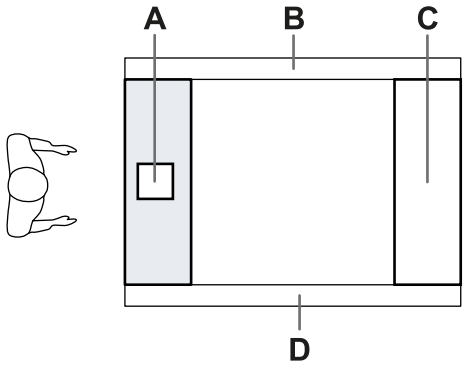
Part	Description
A	Reference plane
B	Radar sensor
C	Hazard zone

7.3.4 Height of detection zone calculation and sensor position

The height of detection zone H_{DT} should be calculated using the guideline of ISO 13855:2024, for both parallel and orthogonal approaches.

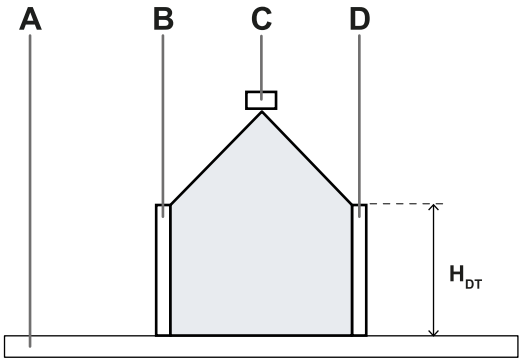
The sensor must be installed to avoid reaching under (see ISO 13855:2024). If the vertical distance of the detection zone from reference plane, H_D, is greater than 200 mm, there is a risk of inadvertent undetected access beneath the detection zone. This must be considered in the risk assessment, and additional protective measures must be applied if necessary.

Example of H_{DT} for the orthogonal approach (top view)



Part	Description
A	Radar sensor
B	Protective structure
C	Hazard zone
D	Protective structure

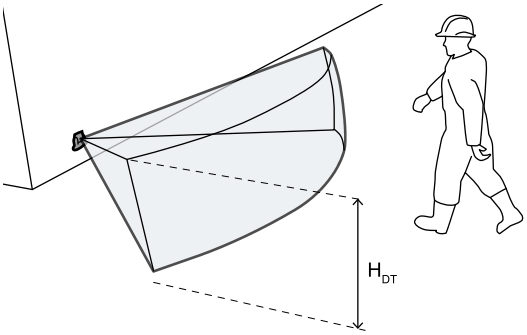
Example of H_{DT} for the orthogonal approach (front view)



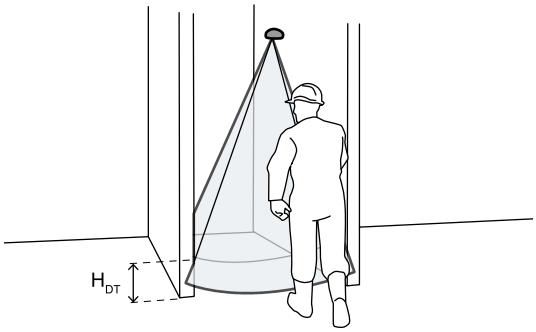
Part	Description
A	Reference plane
B	Protective structure
C	Radar sensor
D	Protective structure

7.3.5 Examples

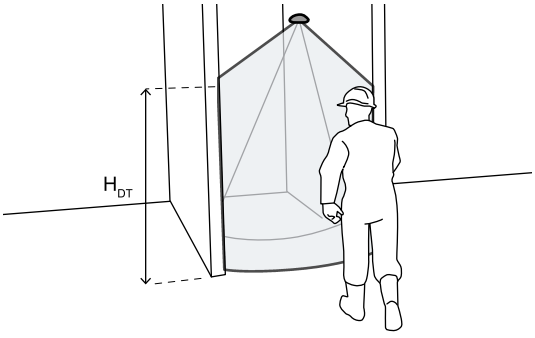
Below is an additional example of identification of H_{DT} for parallel approach **[A]**, and examples of identification of H_{DT} for orthogonal approach **[B]**, **[C]** and **[D]**.



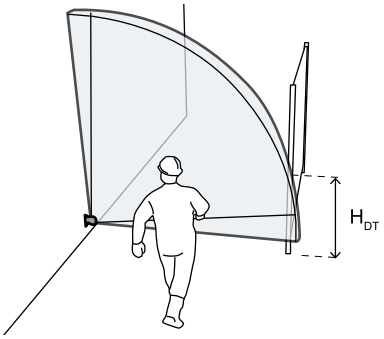
[A]



[B]



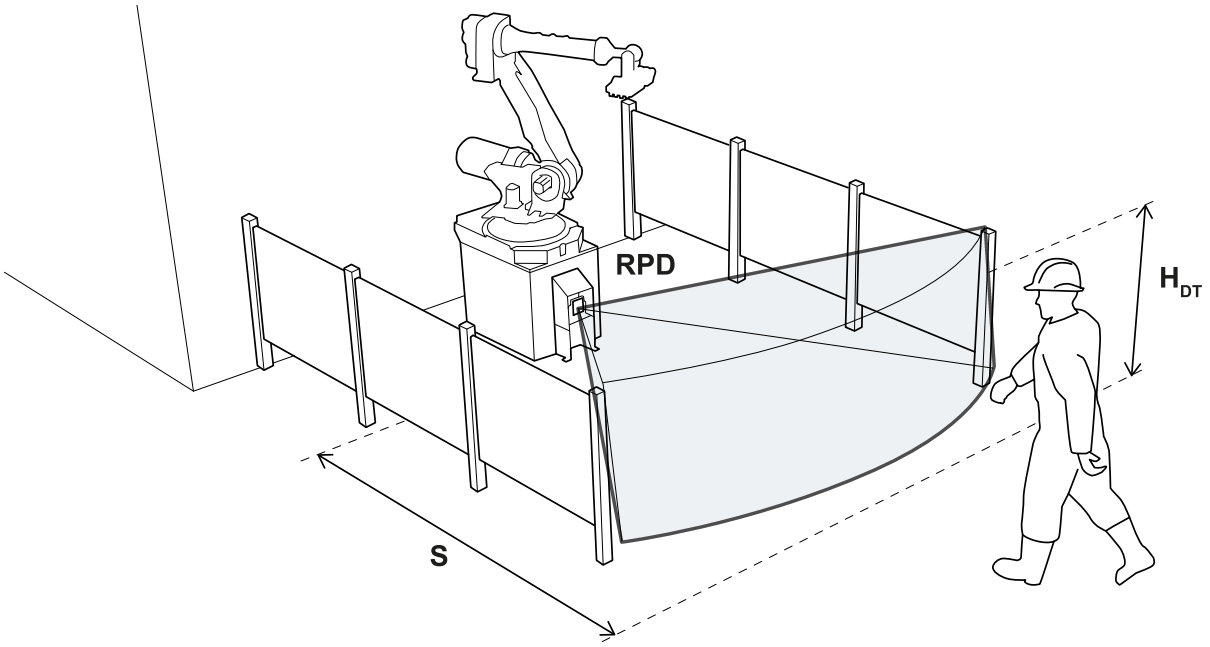
[C]



[D]

7.3.6 Example of calculation of the separation distance - parallel approach

Below is an example of an operator approaching a hazardous area where a radar sensor is used to safeguard the area.



Example

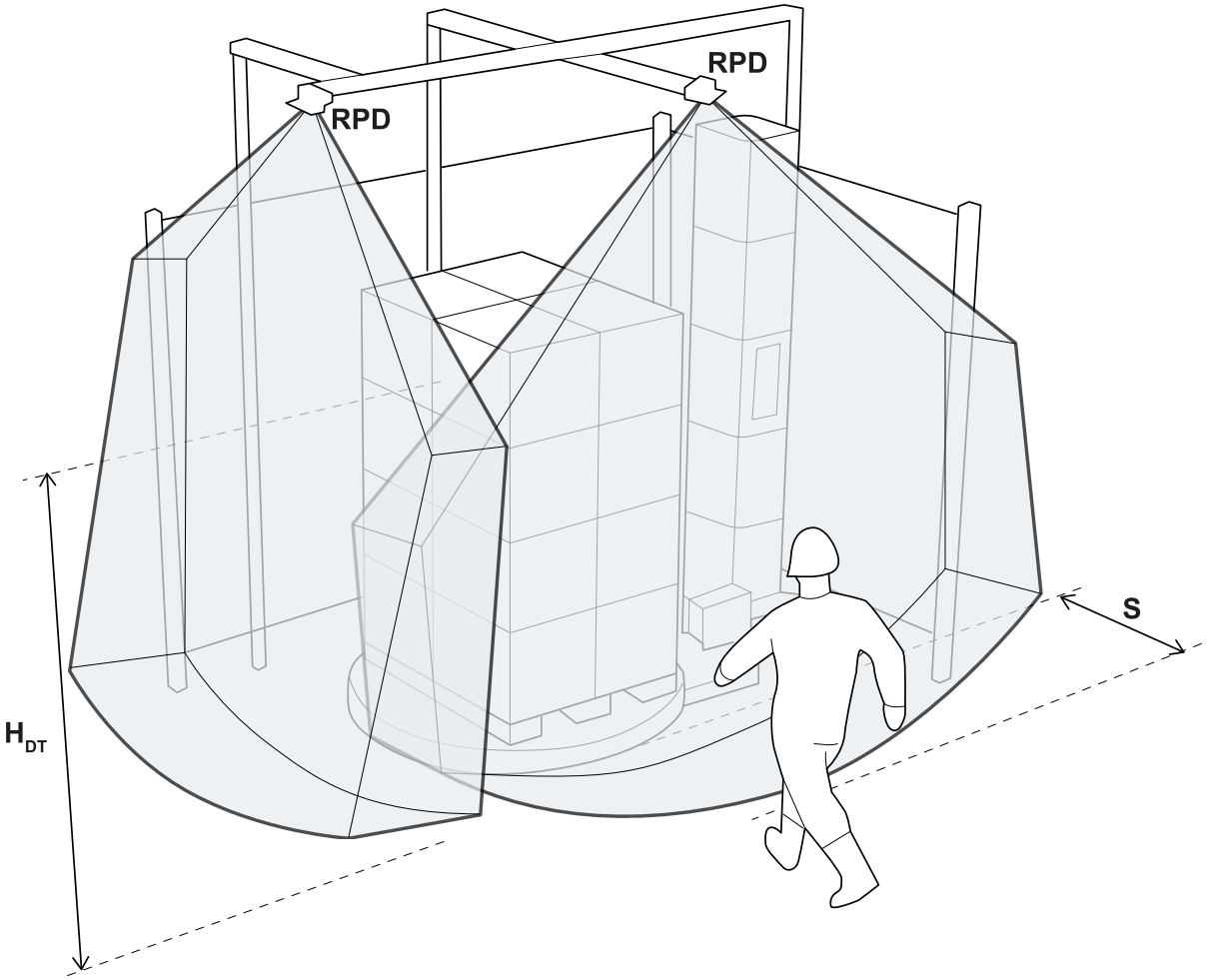
- Overall stopping time T = 0.2 s
- H_{DT} = 1200 mm
- Z_P = 0 mm
- Z_M = 100 mm

According to the formula for the calculation of the reaching distance:
D_{DS} = 1200 - [(H_{DT} - 1000) * 0.875] = 1200 - 175 = 1025 mm

According to these values, the overall separation distance is:
S = 1600 x 0.2 + 1025 + 100 = 1445 mm

7.3.7 Example of calculation of the separation distance - orthogonal approach

Below is an example of an operator approaching a hazardous area where a radar sensor is used to safeguard the area.



Example

- Overall stopping time T = 0.1 s
- H_{DT} = 2200 mm
- Z = 0 mm

According to the formula for the calculation of the reaching distance:
D_{DS} = 850 mm

According to these values, the overall separation distance is:
S = 1600 x 0.1 + 850 + 0 = 1010 mm

7.3.8 Formula for mobile application

To calculate the depth of the separation distance (S) for mobile applications, use the formula below:

$$S = K * T + C$$

Where:

Variable	Description	Value	Measurement unit
K	Maximum vehicle/part of machinery speed *.		mm/s
T	Overall system response time	See ISO 13855**	s
C	Corrective value	200	mm

Note*: only the speed of the vehicle or of the part of machinery is considered. This is based on the assumption that the person recognizes the hazard and stands still.*

Note**: the overall system response time, T, includes portions of time that vary by machine type, the safeguard(s) applied, and the elements of the SRP/CS involved in the protective function.*

Example 1

- maximum vehicle speed = 2000 mm/s
- machinery stopping time = 0.5 s

T = 0.1 s + 0.5 s = 0.6 s

S = 2000 * 0.6 + 200 = 1400 mm

7.4 Calculation of position for sensor height ≤ 1 m

7.4.1 Introduction

The formulas for calculating the optimum position of the sensor for sensors with installation heights less than or equal to 1 m are reported as follows.

7.4.2 Overview of possible installation configurations

The configurations with possible heights (**h**) and inclinations (**α**) are presented as follows:

- **1** = Configuration 1: the field of view of the sensor never intersects the ground
- **2** = Configuration 2: the upper portion of the field of view of the sensor never intersects the ground
- **3** = Configuration 3: the upper portion and the bottom portion of the field of view always intersect the ground
- **X** = Configuration not possible

WARNING! With configurations not listed in these tables or marked with an “x”, protective functions are not guaranteed.

S188A-X1 and S188A-X3 field of view

Installation configuration		α (°)				
		-20	**-10**	**0**	**10**	**20**
h (cm)	0	x	x	x	2	1
	10	x	x	x	2	1
	20	x	x	2	2	1
	30	x	x	2	2	x
	40	x	x	2	2	x
	50	x	2	2	2	x
	60	3	2	2	x	x
	70	3	2	2	x	x
	80	3	2	2	x	x
	90	3	2	2	x	x
	100	3	2	2	x	x

S188A-X2 field of view

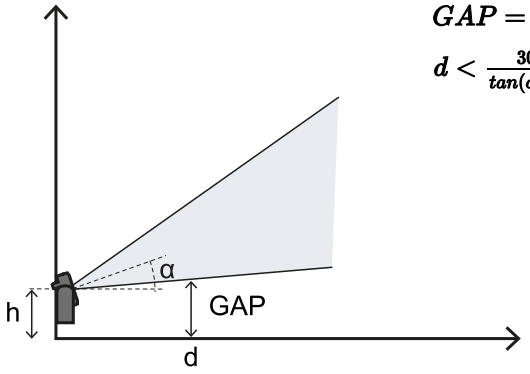
Installation configuration		α (°)				
		-20	-10	0	10	20
h (cm)	0	x	x	x	1	1
	10	x	x	x	1	1
	20	x	x	2	1	x
	30	x	x	2	x	x
	40	x	x	2	x	x
	50	x	3	2	x	x
	60	x	3	2	x	x
	70	x	3	2	x	x
	80	3	3	2	x	x
	90	3	3	2	x	x
	100	3	3	2	x	x

7.4.3 Configuration 1

To guarantee that the sensor also detects access by people crawling, respect the following condition:

$$GAP < 30cm$$

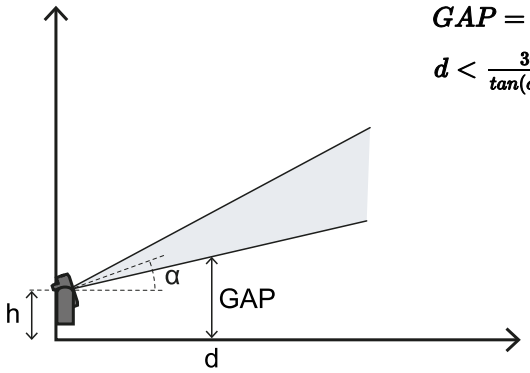
S188A-X1 and S188A-X3 field of view



$$GAP = h + d * tan(\alpha - 15^\circ)$$

$$d < \frac{30-h}{tan(\alpha-15^\circ)}$$

S188A-X2 field of view



$$GAP = h + d * tan(\alpha - 7.5^\circ)$$

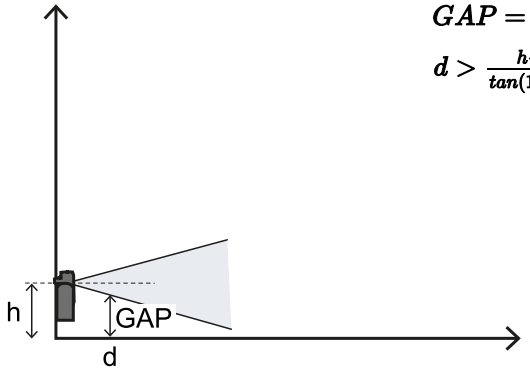
$$d < \frac{30-h}{tan(\alpha-7.5^\circ)}$$

7.4.4 Configuration 2

To guarantee that the sensor also detects the presence of people crawling near the sensor, respect the following condition:

$$GAP < 30cm$$

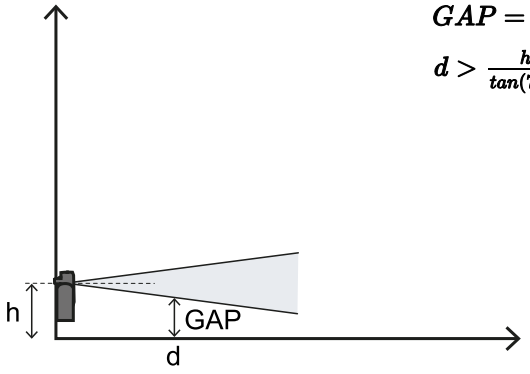
S188A-X1 and S188A-X3 field of view



$$GAP = h - d * tan(15^\circ - \alpha)$$

$$d > \frac{h-30}{tan(15^\circ - \alpha)}$$

S188A-X2 field of view



$$GAP = h - d * tan(7.5^\circ - \alpha)$$

$$d > \frac{h-30}{tan(7.5^\circ - \alpha)}$$

7.4.5 Configuration 3

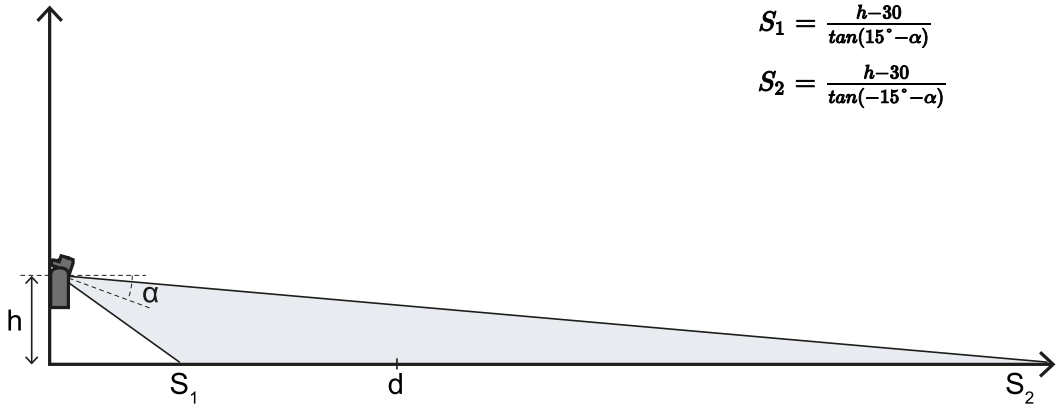
To guarantee optimum performance, respect the following conditions:

$$S_1 < d < S_2$$

S188A-X1 and S188A-X3 field of view

$$S_1 = \frac{h-30}{tan(15^\circ - \alpha)}$$

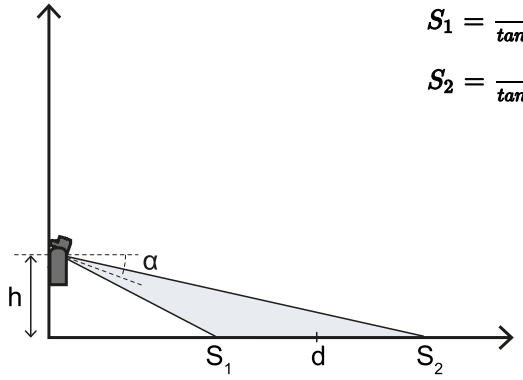
$$S_2 = \frac{h-30}{tan(-15^\circ - \alpha)}$$



S188A-X2 field of view

$$S_1 = \frac{h-30}{tan(7.5^\circ - \alpha)}$$

$$S_2 = \frac{h-30}{tan(-7.5^\circ - \alpha)}$$

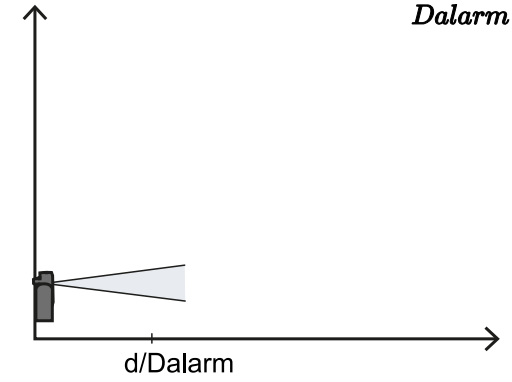


7.4.6 Calculate the real detection distance

The actual detection distance **Dalarm** is the value to be entered on the **Configuration** page of the Inxpect Safety application.

Dalarm indicates the maximum distance between the sensor and the object to be detected.

$$Dalarm = d$$



7.5 Calculation of position for sensor height > 1 m

7.5.1 Introduction

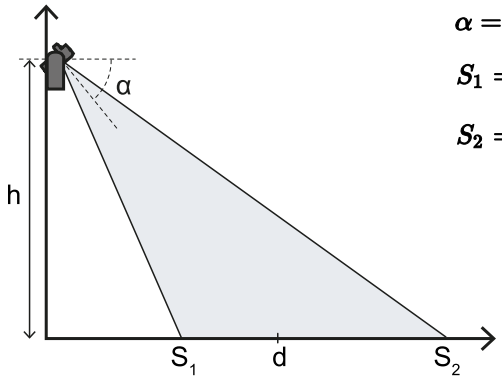
The formulas for calculating the optimum position of the sensor for sensors with installation heights greater than 1 m are reported as follows.

***Note**: the sensor inclination can only be downwards (α negative).*

Element	Description	Measurement unit
α	Sensor inclination	degrees
h	Sensor installation height	cm
d	Detection distance (linear)	cm
Dalarm	Detection distance (real)	cm
S_1	Start detection distance	cm
S_2	End detection distance	cm

7.5.2 S188A-X1 and S188A-X3 field of view

WARNING! It is only possible to check if the other configurations respect the performance levels required by the application through the validation procedure (see "Validate the protective functions" on page 61).



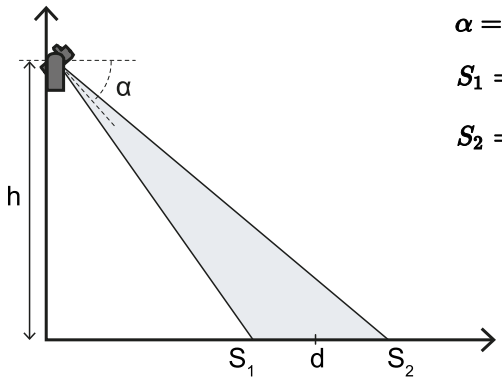
$$\alpha = -(15^\circ + tan^{-1}(\frac{h-60}{d}))$$

$$S_1 = \frac{h}{tan((-\alpha)+15^\circ)}$$

$$S_2 = \frac{h}{tan((-\alpha)-15^\circ)}$$

7.5.3 S188A-X2 field of view

WARNING! It is only possible to check if the other configurations respect the performance levels required by the application through the validation procedure (see "Validate the protective functions" on page 61).



$$\alpha = -(7.5^\circ + tan^{-1}(\frac{h-60}{d}))$$

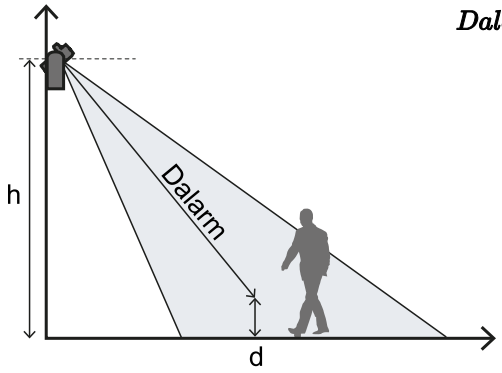
$$S_1 = \frac{h}{tan((-\alpha)+7.5^\circ)}$$

$$S_2 = \frac{h}{tan((-\alpha)-7.5^\circ)}$$

7.5.4 Calculate the real detection distance

The actual detection distance **Dalarm** is the value to be entered on the **Configuration** page of the Inxpect Safety application.

Dalarm indicates the maximum distance between the sensor and the object to be detected.



$$Dalarm = \sqrt{d^2 + (h - 30)^2}$$

7.6 Outdoor installations

7.6.1 Position exposed to precipitation

If the sensor installation position might be exposed to precipitation that can cause undesired alarms, it is recommended to take the following precautions:

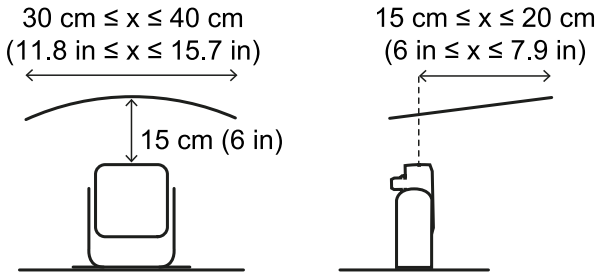
- Make a cover to protect the sensor from rain, hail or snow.
- Position the sensor so that it does not frame the ground where puddles might form.

NOTICE: *Weather conditions outside specifications can prematurely age the device.*

7.6.2 Recommendations for covering the sensor

Below are some recommendations for creating and installing a sensor cover:

- height from sensor: 15 cm
- width: minimum 30 cm, maximum 40 cm
- protrusion from the sensor: minimum 15 cm, maximum 20 cm
- water outflow: at the sides or behind but not in front of the sensor (the cover should be arched and/or tilted backwards)

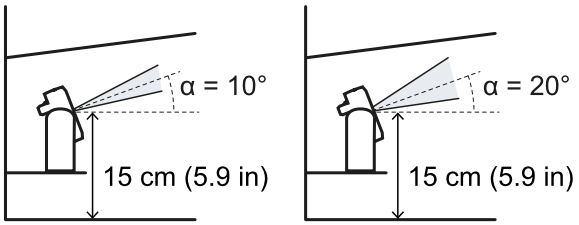


7.6.3 Recommendations for positioning the sensor

Below are some recommendations for defining the sensor position:

- installation height (from the ground to the center of the sensor): minimum 15 cm
- suggested inclination:
  - 10° for S188A-X2
  - 20° for S188A-X1 and S188A-X3

Before installing a sensor facing downwards, make sure there are neither liquids nor radar reflective materials on the floor.



***Note**: for S188A-X1 and S188A-X3 sensors, undesired alarms may occur.*

7.6.4 Position not exposed to precipitation

If the installation position of the sensor is not exposed to precipitation, no special precautions are required.

8. Installation and use procedures

Contents

This section includes the following topics:

8.1 Before installation

8.1.1 Materials required

- Two tamper-proof screws (see "Side screw specifications" on page 85) to mount each sensor.
- Cables to connect the control unit to the first sensor and the sensors to one another (see "CAN bus cables recommended specifications" on page 85).
- A data USB cable with a micro-USB connector (micro-B type).
- A bus terminator (product code: 07000003) with resistance of 120 Ω for the last sensor of the CAN bus.
- A screwdriver for tamper-proof screws (see "Side screw specifications" on page 85) to be used with the Hex pin security bit supplied in the control unit package.
- If necessary, to protect the sensor and to prevent reflections from generating undesired alarms, one Metal protector kit (product code: 90202ZAA) per sensor. See the instructions supplied with the kit for installation instructions.
  ***Note**: the Metal protector kit is particularly recommended if the sensor is installed on parts that are moving, vibrating or that are near vibrating parts.*

8.1.2 Operating system required

- Microsoft Windows 10 or later
- Apple OS X 11.0 or later

8.1.3 Install the Inxpect Safety application

***Note**: if the installation fails, the dependencies needed by the application may be missing. Update your operating system or contact our Technical Support to receive assistance.*

1. Download the application from the https://www.inxpect-tj.com/downloads.html website and install it on the computer.
2. With Microsoft Windows operating system, download and install from the same site also the driver for USB connection.

8.1.4 Initiate Inxpect Value Line

1. Calculate the position of the sensor (see "Sensor position" on page 40) and the depth of the dangerous area (see "Separation distance calculation" on page 42).
2. " Install Inxpect Value Line".
3. "Configure Inxpect Value Line".
4. "Validate the protective functions".

8.2 Install Inxpect Value Line

8.2.1 Install procedure

1. "Install the control unit".
2. "Install sensors on the floor".
3. "Install the sensors on the machinery".

4. "Connect the sensors to the control unit".
   ***Note**: connect the sensors to the control unit off-site if access to the connectors becomes difficult once installed.*

8.2.2 Install the control unit

WARNING! To prevent tampering, make sure the control unit is only accessible to authorized personnel (e.g., key-locked electrical panel)

1. Mount the control unit on the DIN rail.
2. Make electrical connections (see "Terminal blocks and connector pin-outs" on page 86 and "Electrical connections" on page 88).

***NOTICE:** if at least one input is connected, the SNS input "V+ (SNS)" and the GND input "V- (SNS)" must also be connected.*

***NOTICE:** when powered, the system takes about 2 s to start.During that period, the outputs and the diagnostic functions are deactivated, and the green sensor status LEDs of the connected sensors in the control unit flash.*

***NOTICE:** make sure to avoid any EMC interference during the control unit installation.*

***Note**: to correctly connect the digital inputs, see "Voltage and current limits for digital inputs" on page 86.*

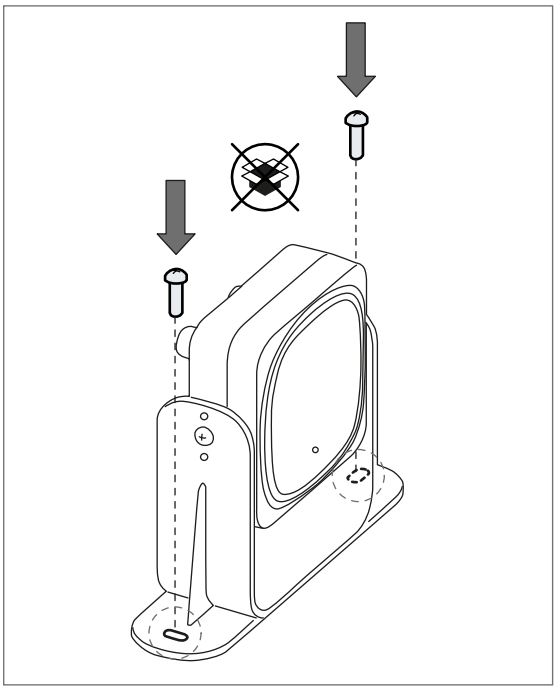
8.2.3 Install sensors on the floor

***Note**: for installation with Metal protector kit (product code 90202ZAA), see the instructions supplied with the kit.*

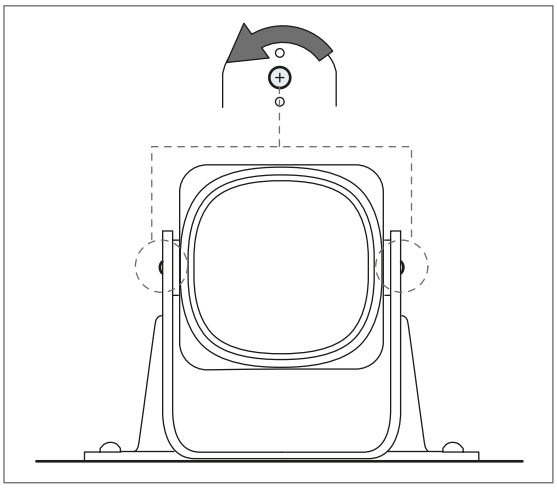
***Note**: the usage of a thread-locking fluid on the threads of fasteners is suggested, especially when the sensor is installed on a moving or vibrating part of the machinery.*

1. Position the sensor as indicated in the configuration report and fasten the bracket with two tamper-proof screws directly onto the floor or another support.

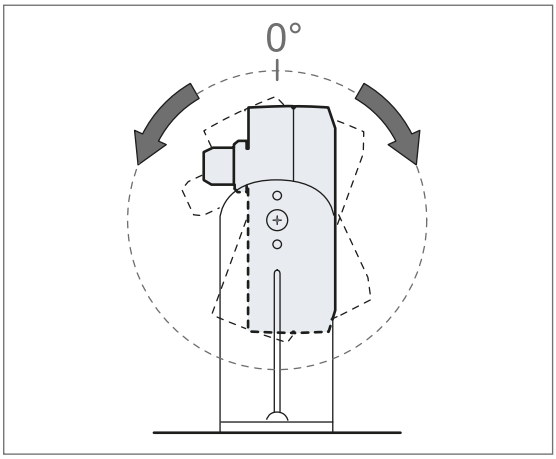
   ***NOTICE:** make sure the support does not inhibit machinery commands.*



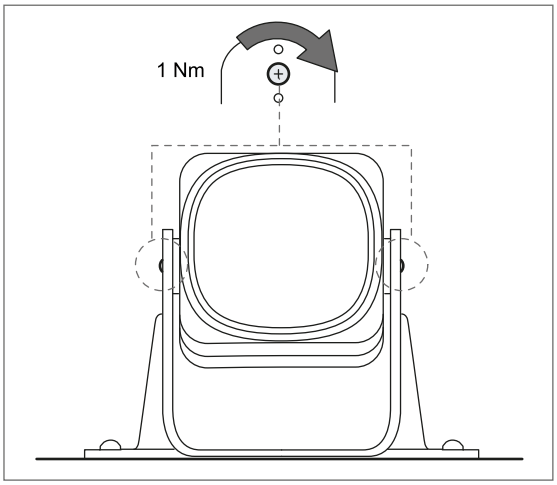
2. Loosen the side screws to tilt the sensor.



3. Tilt the sensor to the desired inclination (see "Sensor position" on page 40).



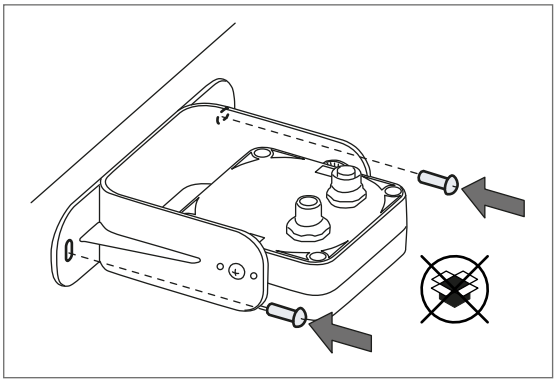
4. Tighten the screws.



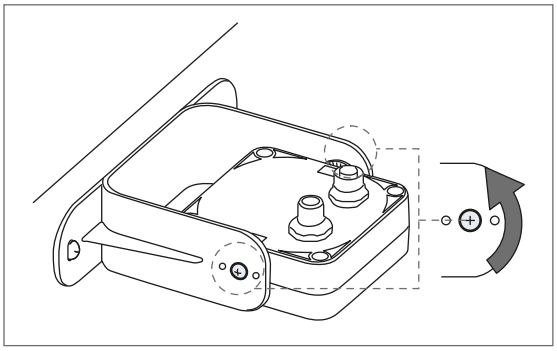
8.2.4 Install the sensors on the machinery

***Note**: if the sensor is installed on parts that vibrate and objects are present in the field of view, the sensor could generate undesired alarms.*

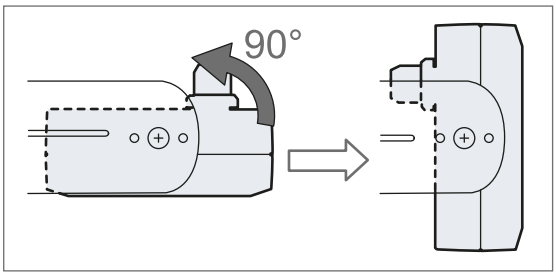
1. Position the sensor as indicated in the configuration report and fasten the bracket with two screws to a machinery support. To select installation height see "Sensor position" on page 40.



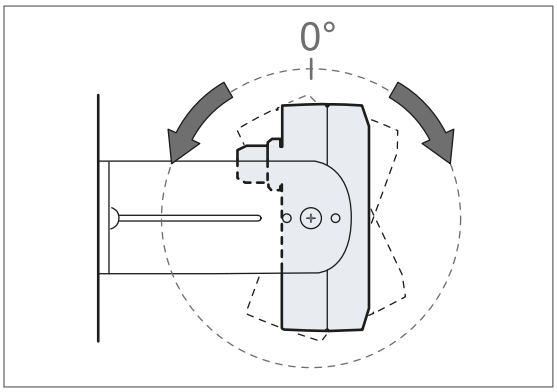
2. Loosen the side screws to tilt the sensor.



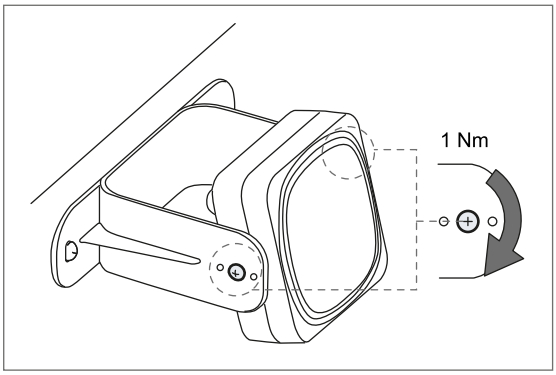
3. Position the sensor parallel to the machinery support.



4. Tilt the sensor up to the desired inclination (see "Sensor position" on page 40).



5. Tighten the screws.



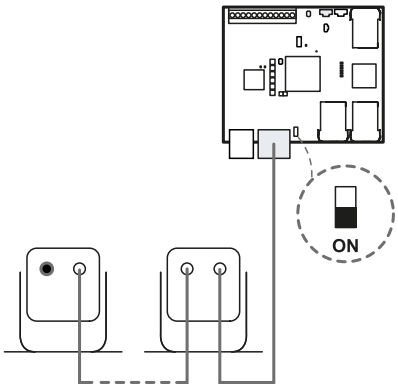
8.2.5 Connect the sensors to the control unit

***Note**: the maximum length of the CAN bus line from the control unit to the last sensor in the chain is 30 m.*

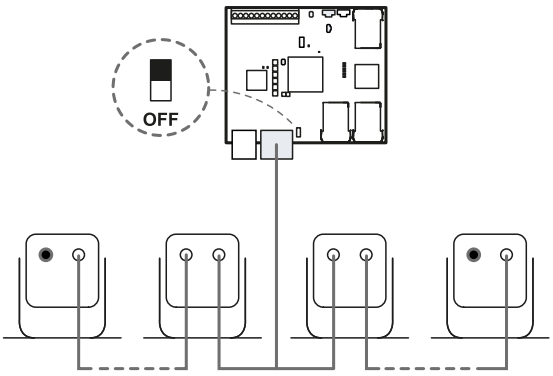
***Note**: when replacing a sensor, in the Inxpect Safety application, click **APPLY CHANGES** to confirm the change.*

1. Decide if the control unit will be positioned at the end of the chain or inside it (see "Chain examples" below).
2. Set the DIP switch of the control unit based on its position in the chain.
3. Connect the desired sensor directly to the control unit.
4. To connect another sensor, connect it to the last sensor in the chain or directly to the control unit to start a second chain.
5. Repeat step 4 for all the sensors to be installed.
6. Insert the bus terminator (product code: 07000003), into the free connector of the last sensor of the chain(s).

8.2.6 Chain examples



Chain with control unit at the end of the chain and a sensor with bus terminator



Chain with control unit inside the chain and two sensors with bus terminator

8.3 Configure Inxpect Value Line

8.3.1 Configure procedure

1. "Start the Inxpect Safety application".
2. "Define the area to be monitored".
3. "Configure the inputs and outputs".
4. "Save and print the configuration".
5. Optional. "Assign the Node IDs".
6. Optional. "Synchronize the control units".

8.3.2 Start the Inxpect Safety application

1. Connect the control unit to the computer using a data USB cable with a micro-USB connector.
2. Supply power to the control unit.

3. Start the Inxpect Safety application.
4. Choose the connection mode (USB).
5. Set a new admin password, memorize it, and provide it only to authorized people.
6. Set the number of sensors.
7. Select the system Inxpect Value Line and the number of sensors.

8.3.3 Define the area to be monitored

WARNING! The system is disabled during configuration. Prepare opportune measures in the dangerous area protected by the system before configuring the system.

1. In the Inxpect Safety application click **Configuration**.
2. Optional. Add the desired number of sensors in the plane.
3. Define the position and inclination of each sensor.
4. Define the detection distance and, only for S188A-X3 sensors, the restart timeout for each detection field of each sensor.

8.3.4 Configure the inputs and outputs

1. In the Inxpect Safety application, click **Settings**.
2. Click **Digital Input-Output** and define the input and output functions.
3. If the muting is managed, click **Settings** > **Muting** and assign the sensors to the groups according to the logic of the digital inputs.
4. If needed, in **Settings** > **Restart function** and choose the type of managed restart.
5. Click **APPLY CHANGES** to save the configuration.

8.3.5 Save and print the configuration

1. In the application, click **APPLY CHANGES**: the sensors will save the inclination set and the surrounding environment. The application will transfer the configuration to the control unit, and once transfer is complete it will generate a configuration report.
2. Click to save and print the report.
   ***Note**: to save the PDF, a printer must be installed on the computer.*
3. Ask the authorized person for a signature.

8.3.6 Assign the Node IDs

Type of assignment

***Note**: if the connected sensors do not already have a Node ID assigned (e.g., at first startup), the system automatically assigns them a Node ID during the installation procedure.*

Three types of assignment are possible:

- Manual: to assign the Node ID to a sensor at a time. Can be performed with all the sensors already connected or after each connection. Useful for adding a sensor or to change Node ID to a sensor.
- Automatic: to assign the Node IDs to all the sensors at once. To be performed when all the sensors are connected.
  ***Note**: the control unit assigns the Node ID in ascending order of sensor ID (SID).*
- Semi-automatic: wizard for connecting the sensors and assign the Node ID one sensor at a time.

Procedure

1. Start the application.
2. Click **Configuration** and verify that the number of sensors in the configuration is the same as those installed.

3. Click **Settings** > **Node ID Assignment**.
4. Proceed according to the type of assignment:

If the assignment is...	Then...
manual	1. Click **DISCOVER CONNECTED SENSORS** to display the connected sensors. 2. To assign a Node ID, click **Assign** for the unassigned Node ID in the **Configured sensors** list. 3. To change a Node ID, click **Change** for the already assigned Node ID in the **Configured sensors** list. 4. Select the SID of the sensor and confirm.
automatic	1. Click **DISCOVER CONNECTED SENSORS** to display the connected sensors. 2. Click **ASSIGN NODE IDS** > **Automatic**: the control unit assigns the Node ID in ascending order of sensor ID (SID).
semi-automatic	Click **ASSIGN NODE IDS** > **Semi-automatic** and follow the instructions displayed.

8.3.7 Synchronize the control units

If there is more than one control unit in the area, see "Enable the multi-control unit synchronization function" on page 36 to configure the system and perform the electrical connections.

8.4 Validate the protective functions

8.4.1 Validation

The validation is addressed to the machinery manufacturer and the system installer.

Once the system has been installed and configured, check that the protective functions are activated/deactivated as expected and that the dangerous area is monitored by the system.

The machinery manufacturer must define all the required tests based on the application conditions.

WARNING! The system response time is not guaranteed during the validation procedure.

WARNING! The Inxpect Safety application facilitates the installation and configuration of the system. Nevertheless, the validation process described below is still required to complete the installation.

8.4.2 Validation procedure for the access detection function (if available)

The sensor must support the access detection function and the following requirements must be fulfilled:

- The target (for stationary applications) or the machinery/vehicle on which the sensor is installed (for mobile applications) must move in compliance with the maximum allowed speed. For details, see "Access detection speed limits" on page 28.
- No objects should completely occlude the target.

Starting conditions

- Machinery switched off (Safe condition)
- Detection signals monitored via digital outputs

Test setup

The following tests aim to validate the sensor’s performance for the access detection protective function.

In stationary applications, all the tests share these parameters:

Target type	Human
Target speed	In the range [0.1, 1.6] m/s, with particular attention to the minimum and the maximum speeds.
Acceptance criteria	The system reaches the safe state when the target accesses the area during the test.

In mobile applications, all the tests share these parameters:

Target type	Human
Machinery/Vehicle speed	In the range [0.1, 1.6] m/s, with particular attention to the minimum and the maximum speeds.
Target movement	Stationary
Acceptance criteria	The system reaches the safe state when, during the movement of the machinery/vehicle, the sensor's field of view reaches the target.

Validation test

The validation procedure of Inxpect Value Line is reported below:

1. Identify the test positions, including those locations where the operator could access during the production cycle:
    a. boundaries of the dangerous area
    b. intermediate points between sensors
    c. positions that are partially hidden by existing or presumed obstacles during the operating cycle
    d. positions indicated by the risk assessor
2. Check that the corresponding detection signal is active or wait for its activation.
3. Perform the test according to the test setup previously defined, moving toward one of the test positions.
4. Check that the test acceptance criteria previously defined are fulfilled. If the test acceptance criteria are not fulfilled, see "Troubleshooting validation" on page 64.
5. Repeat steps 2, 3, and 4 for each test position.

8.4.3 Validation procedure for the restart prevention function (if available)

The sensor must support the restart prevention function and the following requirements must be fulfilled:

- The person must breathe normally.
- No objects should completely occlude the person.

Starting conditions

- Machinery switched off (safe condition)
- Detection signals monitored via digital outputs

Test setup

The following tests aim to validate the performance of the sensor restart prevention protective function.

All the tests share the following parameters:

Configured radar restart timeout	At least 10 s
Target type	Human according to ISO 7250, breathing normally
Target speed	0 m/s
Target pose	Standing or crouching
Test duration	At least 30 s
Acceptance criteria	The detection signal remains deactivated during the test. When the operator leaves the area; the detection signal is activated.

Validation test

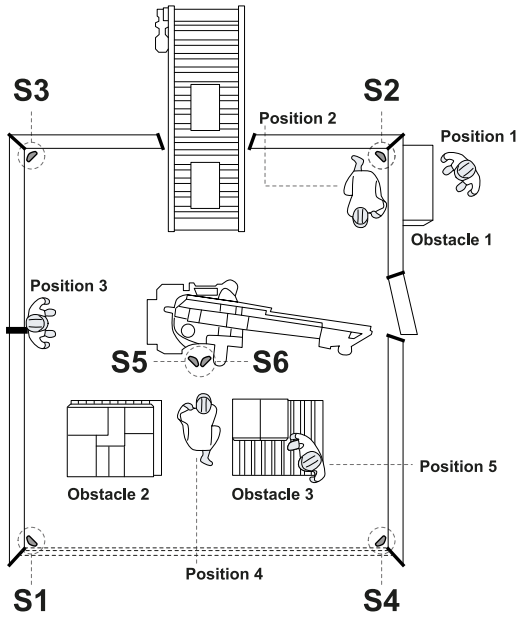
The validation procedure of the Inxpect Value Line system is reported below:

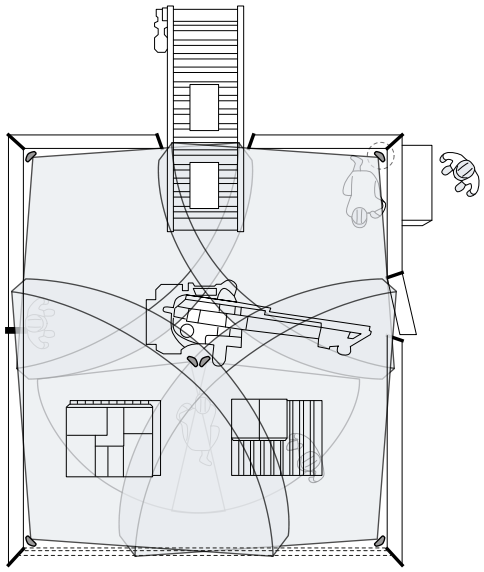
1. Identify the test positions, including those locations where the operator should normally be located during the production cycle:
    - boundaries of the dangerous area
    - intermediate points between sensors
    - positions that are partially hidden by already present or presumed obstacles during the operating cycle
    - positions indicated by the risk assessor
2. Access the dangerous area and go to one of the test positions: the corresponding detection signal should be deactivated.
3. Perform the test according to the test setup previously defined.
4. Check that the test acceptance criteria previously defined are fulfilled.

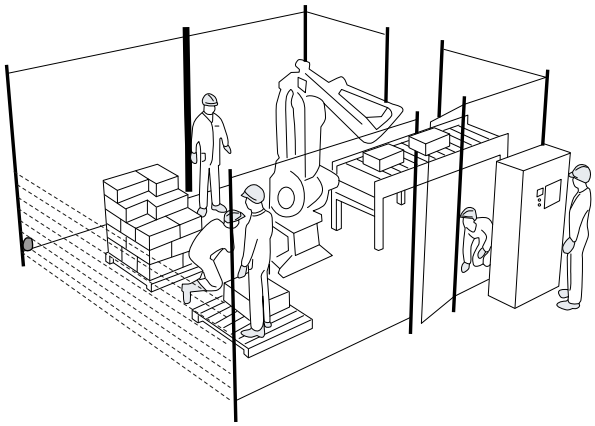
5. If the test acceptance criteria are not fulfilled, see "Validate the system with Inxpect Safety" on the next page.
6. Repeat steps 2, 3, and 4 for each test position.

Example of test positions

The following images show examples of positions to be tested and suggestions about identifying other possible positions of interest.







Position 1: position outside the dangerous area

Position 2: position hidden from the operator’s viewpoint at “Position 1”. Any other similar hidden position should be tested.

Position 3: position at the center distance between two S188A-X3 sensors and/or close to the boundaries of the dangerous area (e.g., along safety fences). This position is suggested to verify that the detection fields of different sensors overlap without leaving uncovered areas. Standing close to the fences also allows for verifying that the sensors are rotated correctly, covering both the right and the left side.

Position 4: possible hidden position by elements in the environment that are present or not present during the validation process. Examples: Obstacle 2 precludes detection by Sensor 1 **(S1)**. Obstacle 3 is partially present during the Validation process but will likely be present during the normal operating cycle and will preclude the detection of Sensor 4 **(S4)**. This position must be covered by additional Sensor 5 **(S5)** and Sensor 6 **(S6)** that should be added within a proper feasibility study.

Position 5: any raised and walkable position required.

Other positions can be indicated by the machine manufacturer.

8.4.4 Validate the system with Inxpect Safety

WARNING! When the validation function is active, the system response time is not guaranteed.

The Inxpect Safety application is helpful during the protective functions validation phase and allows the actual field of view of the sensors to be checked based on their installation position.

1. Click **Validation**: the validation starts automatically.
2. Move in the monitored area as indicated in "Validation test" on page 62 and "Validation procedure for the restart prevention function (if available)" on page 62.
3. Check that the sensor behaves as expected.
4. Check that the distance where the motion is detected is the expected value.

8.4.5 Troubleshooting validation

Problem	Cause	Solution
The detection signal does not remain deactivated during the restart prevention test, or it does not deactivate during the access detection test	Presence of objects obstructing the field of view	If possible, remove the object. Otherwise, implement additional measures in the area where the object is present (e.g., adding new sensors).
	Position of one or more sensors	Position the sensors to ensure that the monitored area is adequate for the dangerous area (see "Sensor position" on page 40).
	Inclination and/or installation height of one or more sensors	1. Change the sensor's inclination and/or installation height to ensure the monitored area is adequate for the dangerous area (see "Sensor position" on page 40). 2. Note or update the inclination and installation height of the sensors in the printed configuration report.
	Inadequate restart timeout	Change the **Restart timeout** parameter through the Inxpect Safety application and verify that it is set to at least 10 seconds for each sensor (**Configuration** > select the affected sensor and detection field)
After that the operator leaves the area, the detection signal does not activate	Presence of moving objects in the sensor's field of view (including vibrations of metal parts where the sensors are installed or vibration of brackets)	Identify the moving objects/brackets and, if possible, tighten all the loose parts
	Reflections of signals	Change the sensor positions or adjust the detection fields reducing the detection distance

8.5 Manage the configuration

8.5.1 Configuration checksums

In the Inxpect Safety application in **Settings** > **Configuration checksums**, it is possible to consult:

- the configuration report hash, a unique alphanumeric code associated with a report. It is computed considering the entire configuration, plus the time of the **APPLY CHANGES** operation, and the name of the computer which did it
- dynamic configuration checksum, associated with a specific dynamic configuration. It considers both common and dynamic parameters

8.5.2 Configuration reports

After changing the configuration, the system generates a configuration report with the following information:

- configuration data
- unique hash
- date and time of configuration change
- name of the computer used for the configuration

The reports are documents that cannot be changed and can only be printed and signed by the machinery safety manager.

***Note**: to save the PDF, a printer must be installed on the computer.*

8.5.3 Change the configuration

WARNING! The system is disabled during configuration. Prepare opportune measures in the dangerous area protected by the system before configuring the system.

1. Start the Inxpect Safety application.
2. Click **User** and enter the admin password.
   ***Note**: after five wrong password entries, application authentication is blocked for one minute.*
3. Depending on what you want to change, follow the instructions below:

To change...	Then...
Monitored area and sensors configuration	Click **Configuration**
System sensitivity	Click **Settings** > **Sensors**
Node ID	Click **Settings** > **Node ID Assignment**
Function of inputs and outputs	Click **Settings** > **Digital Input-Output**
Detection field groups configuration	Click **Settings** > **Detection field groups** and select the group for each detection field of each connected sensor. Then click **Settings** > **Digital Input-Output** and set a digital output as **Detection signal group 1** or **Detection signal group 2** function
Muting	Click **Settings** > **Muting**
Sensor number and positioning	Click **Configuration**

4. Click **APPLY CHANGES**.
5. Upon conclusion of transfer of the configuration to the control unit, click to print the report.
   ***Note**: to save the PDF, a printer must be installed on the computer.*

8.5.4 Display previous configurations

In **Settings**, click **Activity History** and then click **Configuration reports page**: the reports archive opens.

8.6 Other procedures

8.6.1 Change language

1. Click .
2. Select the desired language. The language changes automatically.

8.6.2 Change the admin password

In **Settings** > **Account**, click **CHANGE PASSWORD**.

8.6.3 Restore factory default settings

WARNING! The system is provided without any valid configuration. Therefore the system maintains the safe state at the first start-up until a valid configuration is applied through the Inxpect Safety application by clicking APPLY CHANGES.

WARNING! The procedure resets both the configuration and the password of all the users.

To restore the configuration parameters to the default settings, follow the procedures reported below:

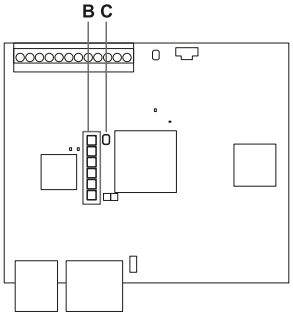
Procedure using the Inxpect Safety application

1. Log in to the Inxpect Safety application as the Admin user.
2. In **Admin** > **FACTORY RESET**.

Procedure using the reset button on the control unit

1. Press and hold the button **[C]** for longer than 10 seconds: all the system status LEDs **[B]** turn on (steady orange), and the system is ready to be reset.
2. Release the button **[C]**: all the system status LEDs **[B]** turn on (flashing green), and the reset procedure starts. The procedure can last up to 30 seconds. Do not switch off the system during the reset.

***Note**: if the button is pressed for longer than 30 seconds, the status of the LEDs switches to red, and the reset is not performed even after the button is released.*



For the default values of the parameters, see "Configuration application parameters" on page 96.

8.6.4 Identify a sensor

In **Settings** > **Node ID Assignment** or **Configuration**, click **Identify by LED** near the desired sensor Node ID: the LED on the sensor flashes for 5 seconds.

8.6.5 Set system labels

In **Admin** > **System labels**, choose the desired labels for the control unit and the sensors.

9. Troubleshooting

Contents

This section includes the following topics:

9.1 Troubleshooting procedures

***Note**: if requested by Technical Support, in **Settings** > **Activity History**, click **Download sensor debug info** to download the files and forward them to Inxpect for debugging.*

9.1.1 Control unit LED

For more details about the LEDs in the control unit, see "Control units" on page 13 and "System status LEDs" on page 14.

LED	Status	Application messages	Problem	Solution
S1*	Steady red	CONTROL UNIT POWER ERROR	At least one voltage value on the control unit is wrong	If at least one digital input is connected, check that the SNS input and the GND input are connected. Check that the input power supply is the specified type (see "General specifications" on page 84).
S2	Steady red	CONTROL UNIT TEMPERATURE ERROR	Control unit temperature value is wrong	Check that the system is operating at the correct operating temperature (see "General specifications" on page 84).
S3	Steady red	OSSD ERROR or INPUT ERROR	At least one input or output is in error	If at least one input is used, check that both the channels are connected and that there is no short-circuit on the outputs. If the problem persists, please contact Technical Support.
S4	Steady red	PERIPHERAL ERROR	At least one of the control unit peripherals is in error	Check the status of the terminal block and connections. If the problem persists, please contact Technical Support.
S5	Steady red	CAN ERROR	Communication error with at least one sensor	Check connections of all sensors in the chain starting from the last sensor in error. Check that all the sensors have an assigned ID (in Inxpect Safety **Settings** > **Node ID Assignment**).

LED	Status	Application messages	Problem	Solution
S6	Steady red	FEE ERROR, FLASH ERROR or RAM ERROR	Configuration saving error, configuration not performed or memory error	Reconfigure or configure the system (see "Manage the configuration" on page 64). If the error persists, please contact Technical Support.
All LEDs from S1 to S5 together	Steady red	DYNAMIC CONFIGURATION ERROR	Error in the selection of the dynamic configuration: invalid ID	Check the preset configurations within the Inxpect Safety application.
All LEDs from S1 to S4 together	Steady red	SENSOR CONFIGURATION ERROR	Error during the configuration of the sensors	Check the sensors connected and try again to perform the configuration of the system via the Inxpect Safety application.
At least one LED	Flashing red	See "Sensor LED" on the next page	Sensor corresponding to the flashing LED in error ** (see"Sensor LED" on the next page)	Check the problem through the LED on the sensor.
At least one LED	Flashing green	See "Sensor LED" on the next page	Sensor corresponding to the flashing LED in error ** (see"Sensor LED" on the next page)	If the issue persists longer than one minute, please contact Technical Support.
All LEDs	Steady orange	-	The system is starting up.	Wait for a few seconds.
All LEDs	Flashing green one after the other in sequence	-	The control unit is in boot state.	Open the latest available version of the Inxpect Safety application, connect to the device and proceed with the automatic recovery procedure. If the issue persists, please contact Technical Support.
All LEDs	Off	In **Dashboard** > **System status** ⚠ icons	Configuration not yet applied to the control unit.	Configure the system.
All LEDs	Off	Progress icon	Configuration transfer to the control unit in progress.	Wait for the transfer to be completed.

***Note**: fault signal on the control unit (steady LED) takes priority over a faulty sensor signal. For the status of the single sensor, check the sensor LED.*

Note: S1 is the first from the top.*

Note*: S1 corresponds to the sensor with ID 1, S2 corresponds to the sensor with ID 2 and so on.*

9.1.2 Sensor LED

Status	Application messages	Problem	Solution
2 flashes *	CAN ERROR	ID not assigned	Assign a Node ID to the sensor (see "Connect the sensors to the control unit" on page 59).
3 flashes *	CAN ERROR	Error in communication with the control unit	Check connections of all sensors in the chain starting from the last sensor in error.

Status	Application messages	Problem	Solution
4 flashes *	SENSOR TEMPERATURE ERROR or SENSOR POWER ERROR	Wrong power supply voltage or temperature value	• Check the sensor connection and that the length of the cables respects maximum limits. • Check that the ambient temperature where the system is functioning complies with the operating temperatures indicated in the technical data in this manual
5 flashes *	MASKING, SIGNAL ERROR	Masking, micro-controller, micro-controller peripherals, radar or radar control in error	Check that the sensor is correctly installed and that the area is free of any objects that obstruct the field of view of the sensors.
	PERIPHERAL ERROR	Error detected by diagnostics relative to the internal micro-controller, its internal peripherals or memories	If the issue persists, please contact Technical Support.
6 flashes *	ACCELEROMETER ERROR	Inclination of the sensor different from the installation inclination	Check if the sensor has been tampered with or if the side screws or fastening screws are loose.

Note *: flashes at 200 ms intervals and then with a 2 s pause.*

9.1.3 Other problems

Problem	Cause	Solution
Undesired detections	Transit of people or objects in close proximity to the detection field	Change the configuration (see "Change the configuration" on page 65).
Machinery in safe status without motion in the detection field	No power supply	Check electrical connection. Contact Technical Support if necessary.
	Failure of the control unit or one or more sensors	Check the status of the LEDs on the control unit (see "Control unit LED" on page 67). Access the Inxpect Safety application. On the **Dashboard** page, mouse-over ⊗ at the control unit or the sensor.
The voltage value detected on the SNS input is zero	The chip that detects inputs is faulty	Contact Technical Support.
The system does not function correctly	Control unit error	Check the status of the LEDs on the control unit (see "Control unit LED" on page 67). Access the Inxpect Safety application. On the **Dashboard** page, mouse-over ⊗ at the control unit or the sensor.
	Sensor error	Check the status of the LEDs on the sensor (see "Sensor LED" above). Access the Inxpect Safety application. On the **Dashboard** page, mouse-over ⊗ at the control unit or the sensor.

9.2 Event log management

9.2.1 Introduction

The event log recorded by the system can be downloaded from the Inxpect Safety application in a PDF file. The system saves up to 4500 events, divided in two sections. In each section the events are displayed from the most

recent to the least recent. Above this limit, the oldest events are overwritten.

9.2.2 Download the system log

WARNING! The system response time is not guaranteed while downloading the log file.

1. Start the Inxpect Safety application.
2. Click **Settings** and then **Activity History**.
3. Click **DOWNLOAD LOG**.
   ***Note**: to save the PDF, a printer must be installed on the computer.*

9.2.3 Log file sections

The first line of the file reports the NID (Network ID) of the device and the date of the download.

The rest of the file log is divided in two sections:

Section	Description	Content	Size	Reset
1	Event log	Information events Error events	3500	At every firmware update or on demand using the Inxpect Safety application
2	Diagnostic event log	Error events	1000	Not possible

9.2.4 Log line structure

Each line in the log file reports the following information, separated by tab character:

- Timestamp (seconds counter from the latest boot)
- Timestamp (absolute/relative value)
- Event type:
  - [ERROR] = diagnostic event
  - [INFO] = information event
- Source
  - CONTROL UNIT = if the event is generated by the control unit
  - SENSOR ID = if the event is generated by a sensor. In this case, the Node ID of the sensor is also provided
- Event description

9.2.5 Timestamp (seconds counter from the latest boot)

An indication of the instant when the event occurred is provided as relative time from the latest boot, in seconds.

Example: 92

Meaning: the event occurred 92 seconds after the latest boot

9.2.6 Timestamp (absolute/relative value)

An indication of the instant when the event occurred is provided.

- After a new system configuration, it is provided as absolute time.

  Format: *YYYY/MM/DD hh:mm:ss*

  Example: 2024/08/08 23:58:00

- After a reboot of the device, it is provided as relative time from the latest boot.

  Format: *Rel. x d hh:mm:ss*

  Example: Rel. 0 d 00:01:32

***Note**: when a new system configuration is performed, even the older timestamps are updated in absolute time format.*

***Note**: during system configuration, the control unit is receiving the local time of the machine where the software is running.*

9.2.7 Event description

A complete description of the event is reported. Whenever possible, depending on the event, additional parameters are reported.

In case of a diagnostic event, an internal error code is also added, useful for the purpose of debug. If the diagnostic event disappears, the label “(Disappearing)” is reported as an additional parameter.

Examples

Detection access (field #3, 1300 mm/40°)

System configuration #15

CAN ERROR (Code: 0x0010) COMMUNICATION LOST

CAN ERROR (Disappearing)

9.2.8 Log file example

Event logs of ISC NID UP304 updated 2020/11/18 16:59:56

[Section 1 - Event logs]

380 2020/11/18 16:53:49 [ERROR] SENSOR#1 CAN ERROR (Disappearing)

375 2020/11/18 16:53:44 [ERROR] SENSOR#1 CAN ERROR (Code: 0x0010) COMMUNICATION LOST

356 2020/11/18 16:53:25 [INFO] CONTROL UNIT System configuration #16

30 2020/11/18 16:53:52 [ERROR] SENSOR#1 ACCELEROMETER ERROR (Disappearing)

27 2020/11/18 16:47:56 [ERROR] SENSOR#1 ACCELEROMETER ERROR (Code: 0x0010) TILT ANGLE ERROR

5 2020/11/18 16:47:30 [ERROR] SENSOR#1 SIGNAL ERROR (Code: 0x0012) MASKING

0 2020/11/18 16:47:25 [INFO] CONTROL UNIT Dynamic configuration #1

0 2020/11/18 16:47:25 [INFO] CONTROL UNIT System Boot #60

92 Rel. 0 d 00:01:32 [INFO] CONTROL UNIT Detection exit (field #2)

90 Rel. 0 d 00:01:30 [INFO] CONTROL UNIT Detection exit (field #1)

70 Rel. 0 d 00:01:10 [INFO] SENSOR#1 Detection access (field #2, 3100 mm/20°)

61 Rel. 0 d 00:01:01 [INFO] SENSOR#1 Detection access (field #1, 1200 mm/30°)

0 Rel. 0 d 00:00:00 [INFO] CONTROL UNIT Dynamic configuration #1

0 0 d 00:00:00 [INFO] CONTROL UNIT System Boot #61

[Section 2 - Diagnostic events log]

380 Rel. 0 d 00:06:20 [ERROR] SENSOR #1 CAN ERROR (Disappearing)

375 Rel. 0 d 00:06:15 [ERROR] SENSOR #1 CAN ERROR (Code: 0x0010) COMMUNICATION LOST

356 Rel. 0 d 00:05:56 [INFO] CONTROL UNIT System configuration #16

30 Rel. 0 d 00:00:30 [ERROR] SENSOR #1 ACCELEROMETER ERROR (Disappearing)

27 Rel. 0 d 00:00:27 [ERROR] SENSOR #1 ACCELEROMETER ERROR (Code: 0x0012) TILT ANGLE ERROR

5 Rel. 0 d 00:00:05 [ERROR] SENSOR #1 SIGNAL ERROR (Code: 0x0014) MASKING

9.2.9 Event list

The event logs are listed below:

Event	Type
Diagnostic errors	ERROR
System Boot	INFO
System configuration	INFO
Factory reset	INFO
Stop signal	INFO
Restart signal	INFO
Detection access	INFO
Detection exit	INFO
Dynamic configuration in use	INFO
Muting status	INFO
Session authentication	INFO
Validation	INFO
Log download	INFO

For further information about the events, see "INFO events" on the next page and " ERROR events (control unit)" on page 76.

9.2.10 Verbosity level

There are six verbosity levels for the log. The verbosity can be set during the configuration of the system via the Inxpect Safety application (**Settings** > **Activity History** > **Log verbosity level**).

Depending on the selected verbosity level, the events are logged in accordance to the following table:

Event	Level 0 (default)	Level 1	Level 2	Level 3	Level 4	Level 5
Diagnostic errors	x	x	x	x	x	x
System Boot	x	x	x	x	x	x
System configuration	x	x	x	x	x	x
Factory reset	x	x	x	x	x	x
Stop signal	x	x	x	x	x	x
Restart signal	x	x	x	x	x	x
Detection access	-	See "Verbosity level for detection access and exit events" below				
Detection exit	-	See "Verbosity level for detection access and exit events" below				
Dynamic configuration in use	-	-	-	-	x	x
Muting status	-	-	-	-	-	x

9.2.11 Verbosity level for detection access and exit events

Depending on the selected verbosity level, the detection access and exit events are logged as follows:

- LEVEL 0: no detection info is logged
- LEVEL 1: the events are logged at the control unit level, and the additional information is the detection distance (in mm) at detection access

  Format:

  CONTROL UNIT Detection access (distance mm)

  CONTROL UNIT Detection exit

- LEVEL 2: the events are logged in a single field at the control unit level, and the additional information is: detection field, detection distance (in mm) at access, and detection field at exit

Format:

CONTROL UNIT Detection access (field #n, distance mm)

CONTROL UNIT Detection exit (field #n)

- LEVEL 3 / LEVEL 4 / LEVEL 5 The events are logged:
  - in a single field at the control unit level, and the additional information is: detection field, detection distance (in mm) at access, and detection field at exit
  - at the sensor level and the additional information read by the sensor is: detection distance (in mm) at access, and detection field at exit

  Format:

  CONTROL UNIT #k Detection access (field #n, distance mm)

  SENSOR #k Detection access (distance mm)

  CONTROL UNIT Detection exit (field #n)

  SENSOR #k Detection exit

9.3 INFO events

9.3.1 System Boot

Every time the system is powered up, the event is logged reporting the incremental count of the boot from the beginning of the life of the device.

Format: *System Boot #n*

Example:

0 2020/11/18 16:47:25 [INFO] CONTROL UNIT SYSTEM BOOT #60

9.3.2 System configuration

Every time the system is configured, the event is logged reporting the incremental count of the configuration from the beginning of the life of the device.

Format: *System configuration #3*

Example:

20 2020/11/18 16:47:25 [INFO] CONTROL UNIT System configuration #3

9.3.3 Factory reset

Every time a factory reset is required, the event is logged.

Format: *Factory reset*

Example:

20 2020/11/18 16:47:25 [INFO] CONTROL UNIT Factory reset

9.3.4 Stop signal

If configured, every change of the Stop Signal is logged as ACTIVATION or DEACTIVATION.

Format: *Stop signal ACTIVATION/DEACTIVATION*

Example:

20 2020/11/18 16:47:25 [INFO] CONTROL UNIT Stop signal ACTIVATION

9.3.5 Restart signal

If configured, every time the system is waiting for the restart signal or the restart signal is received, the event is logged as WAITING or RECEIVED.

Format: *Restart signal WAITING/RECEIVED*

Example:

20 2020/11/18 16:47:25 [INFO] CONTROL UNIT Restart signal RECEIVED

9.3.6 Detection access

Format: *Detection access (field #n, distance mm/azimuth°)*

Example:

20 2020/11/18 16:47:25 [INFO] SENSOR #1 Detection access (field #1, 1200 mm/30°)

9.3.7 Detection exit

After at least one detection access event, a detection exit event related to the same field is logged when the detection signal returns to its default no-motion status.

Depending on the selected verbosity level additional parameters are logged: the detection field number, the sensor which detected the motion.

Format: *Detection exit (field #n)*

Example:

20 2020/11/18 16:47:25 [INFO] CONTROL UNIT Detection exit (field #1)

9.3.8 Dynamic configuration in use

At every change of the dynamic configuration, the new ID of the dynamic configuration selected is logged.

Format: *Dynamic configuration #1*

Example:

20 2020/11/18 16:47:25 [INFO] CONTROL UNIT Dynamic configuration #1

9.3.9 Muting status

Every change of the muting status of each sensor is logged as disabled or enabled.

***Note**: the event indicates a change of the muting status of the system. It does not correspond to the muting request.*

Format: *Muting disabled/enabled*

Example:

20 2020/11/18 16:47:25 [INFO] SENSOR#1 Muting enabled

9.3.10 Session authentication

The status of the session authentication and the interface used (USB) are logged.

Format: *Session OPEN/CLOSE/WRONG PASSWORD/UNSET PASSWORD/TIMEOUT/CHANGE PASSWORD via USB*

Example:

20 2020/11/18 16:47:25 [INFO] CONTROL UNIT Session OPEN via USB

9.3.11 Validation

Every time a validation activity starts or ends on the device, it is logged. The interface used (USB) is logged as well.

Format: *Validation STARTED/ENDED via USB*

Example:

20 2020/11/18 16:47:25 [INFO] CONTROL UNIT Validation STARTED via USB

9.3.12 Log download

Every time a log download is performed on the device, it is logged. The interface used (USB) is logged as well.

Format: *Log download via USB*

Example:

20 2020/11/18 16:47:25 [INFO] CONTROL UNIT Log download via USB

9.4 ERROR events (control unit)

9.4.1 Introduction

A diagnostic error is logged every time the periodic diagnostic functions detect a coming or going fault on the control unit.

9.4.2 Temperature errors (TEMPERATURE ERROR)

Error	Meaning
BOARD TEMPERATURE TOO LOW	Board temperature below minimum
BOARD TEMPERATURE TOO HIGH	Board temperature above maximum

9.4.3 Control unit voltage errors (POWER ERROR)

Error	Meaning
Control unit voltage UNDERVOLTAGE	Undervoltage error for the indicated voltage
Control unit voltage OVERVOLTAGE	Overvoltage error for the indicated voltage
ADC CONVERSION ERROR	ADC conversion error in the micro-controller

The following table describes the control unit voltage:

Screen printing	Description
VIN	Power supply voltage (+24 V DC)
V12	Internal supply voltage
V12 sensors	Sensors power supply voltage
VUSB	USB port voltage
VREF	Inputs reference voltage (**VSNS Error**)
ADC	Analog-digital converter

9.4.4 Peripheral error (PERIPHERAL ERROR)

Error detected by diagnostics relative to the micro-controller, its internal peripherals or memories.

9.4.5 Configuration errors (FEE ERROR)

Indicates that the system must still be configured. This message can appear when the system is first turned on or after reset to default values. It can also represent another error on the FEE (internal memory).

9.4.6 Output errors (OSSD ERROR)

Error	Meaning
OSSD 1 SHORT-CIRCUIT	Short-circuit error on MOS output 1
OSSD 2 SHORT-CIRCUIT	Short-circuit error on MOS output 2
OSSD 3 SHORT-CIRCUIT	Short-circuit error on MOS output 3
OSSD 4 SHORT-CIRCUIT	Short-circuit error on MOS output 4
OSSD 1 NO LOAD	No load on OSSD 1
OSSD 2 NO LOAD	No load on OSSD 2
OSSD 3 NO LOAD	No load on OSSD 3
OSSD 4 NO LOAD	No load on OSSD 4

9.4.7 Flash errors (FLASH ERROR)

A flash error represents an error on the external flash.

9.4.8 Dynamic configuration error (DYNAMIC CONFIGURATION ERROR)

A dynamic configuration error indicates an invalid dynamic configuration ID.

9.4.9 Internal communication error (INTERNAL COMMUNICATION ERROR)

Indicates that there is an internal communication error.

9.4.10 Input error (INPUT ERROR)

Error	Meaning
INPUT 1 REDUNDANCY	Error in the redundancy on Input 1
INPUT 2 REDUNDANCY	Error in the redundancy on Input 2
ENCODING	Invalid encoding when the encoded channel option is enabled
PLAUSIBILITY	0->1->0 transition not compliant with input functionality specification

9.4.11 RAM error (RAM ERROR)

Error	Meaning
INTEGRITY ERROR	Wrong integrity check on the RAM

9.4.12 Sensor configuration errors (SENSOR CONFIGURATION ERROR)

Error occurred on the sensors during the configuration process or at the system power up. At least one of the connected sensors did not get the correct configuration.

As details, the list of sensors not configured is reported.

9.5 ERROR events (sensor)

9.5.1 Introduction

A diagnostic error is logged every time the periodic diagnostic functions detect a coming or going fault on the sensor.

WARNING! No sensor errors are available if the sensor is in muting.

***Note**: if requested by Technical Support, in **Settings** > **Activity History**, click **Download sensor debug info** to download the files and forward them to Inxpect for debugging.*

9.5.2 Radar signal errors (SIGNAL ERROR)

Error	Meaning
HEAD FAULT	Radar not functioning
HEAD POWER OFF	Radar off
MASKING	Presence of object obstructing the field of view of the radar
SIGNAL DYNAMIC	Wrong signal dynamic
SIGNAL MIN	Signal with dynamic below minimum
SIGNAL MIN MAX	Signal with out of range dynamic
SIGNAL MAX	Signal with dynamic over maximum
SIGNAL AVG	Flat signal

9.5.3 Temperature errors (TEMPERATURE ERROR)

Error	Meaning
BOARD TEMPERATURE TOO LOW	Board temperature below minimum
BOARD TEMPERATURE TOO HIGH	Board temperature above maximum

9.5.4 Sensor voltage errors (POWER ERROR)

Error	Meaning
Sensor voltage **UNDERVOLTAGE**	Undervoltage error for the indicated voltage
Sensor voltage **OVERVOLTAGE**	Overvoltage error for the indicated voltage
ADC CONVERSION ERROR	(only for the ADC) ADC conversion error in the micro-controller

The following table describes the sensor voltage:

Screen printing	Description
VIN	Power supply voltage (+12 V DC)
V3.3	Internal chip power supply voltage
V1.2	Micro-controller power supply voltage
V+	Radar reference voltage
VDCDC	Main chip power supply internal voltage
VOPAMP	Operational amplifier voltage
VADC REF	Analog-digital converter (ADC) reference voltage
ADC	Analog-digital converter

9.5.5 Anti-tampering sensor (ACCELEROMETER ERROR)

Error	Meaning
TILT ANGLE ERROR	Sensor inclination around the x-axes
ROLL ANGLE ERROR	Sensor inclination around the z-axes
ACCELEROMETER READ ERROR	Accelerometer reading error

9.5.6 Peripheral error (PERIPHERAL ERROR)

Error detected by diagnostics relative to the micro-controller, its internal peripherals or memories.

9.6 ERROR events (CAN bus)

9.6.1 Introduction

A diagnostic error is logged every time the periodic diagnostic functions detect a coming or going fault on the CAN bus communication.

Depending on the communication bus side, the logged source can be the control unit or a single sensor.

9.6.2 CAN errors (CAN ERROR)

Error	Meaning
TIMEOUT	Timeout on message to sensor/control unit
CROSS CHECK	Two redundant messages do not coincide
SEQUENCE NUMBER	Message with sequence number different from the expected number
CRC CHECK	Packet control code does not match
COMMUNICATION LOST	Impossible to communicate with the sensor
PROTOCOL ERROR	Control unit and sensors have different and incompatible firmware versions
POLLING TIMEOUT	Timeout on data polling

NOTICE: *A shielded cable between the control unit and the first sensor, and between the sensors is strongly recommended. Nevertheless, route the CAN cables separately from high-potential power lines or through an exclusive conduit.*

10. Maintenance

Contents

This section includes the following topics:

10.1 Planned maintenance

Generic maintenance technician

The generic maintenance technician is a person qualified only to perform basic maintenance without the administrator privileges required to modify the configuration of Inxpect Value Line through the application.

10.1.1 Cleaning

Keep the sensor clean and free of any work residues and conductive material to prevent masking and/or poor system operation.

10.2 Extraordinary maintenance

10.2.1 Machinery maintenance technician

The machinery maintenance technician is a qualified person with the administrator privileges required to modify the configuration of Inxpect Value Line through the Inxpect Safety application and perform maintenance and troubleshooting.

10.2.2 Replace a sensor: System recondition function

The system recondition function is useful for replacing an existing sensor without changing current settings. The function can be enabled through digital inputs (**System recondition** or **Restart signal + System recondition**).

***Note**: keep the scene static while running the system recondition function so that the anti-tampering functions can save their references.*

***Note**: while running the system recondition function, the system goes to the safe state, deactivating the OSSDs, until the process is completed.*

1. Configure the digital inputs to perform the system recondition function.
2. Connect a sensor without Node ID in the same position of the CAN bus line as the replaced sensor.
   ***Note**: only one sensor at a time must be connected to complete the procedure correctly.*
3. Activate the function (via digital inputs) and wait for the operation to be performed. See "Control unit LED" on page 67 to know which is the system status.

The following actions are performed:

- The first available Node ID is assigned to the new sensor.
- The previous configuration of the system is applied (**APPLY CHANGES** operation). The operation is saved in the event log as a standard **System configuration** event.
- The event is logged in the reports archive (**Settings** > **Activity History** > **Configuration reports page**) with the “sys-recondition-i” string in the **User, PC** column.

***Note**: for more details, see "Digital input signals" on page 98.*

10.2.3 Back up the configuration to a PC

The current configuration can be backed up, including the input/output settings. The configuration is saved in a .cfg file, which can be used to restore the configuration or to facilitate configuration of several Inxpect Value Line.

1. In **Settings** > **General**, click **BACKUP**.
2. Select the file destination and save.

***Note**: user login credentials are not saved using this backup mode.*

10.2.4 Load a configuration from a PC

1. In **Settings** > **General**, click **RESTORE**.
2. Select the previously saved .cfg file (see "Back up the configuration to a PC" above) and open it.

***Note**: a re-imported configuration requires new downloading onto the control unit and approval according to the safety plan.*

***Note**: this SD Restore function also includes a System recondition operation, see "Replace a sensor: System recondition function" on the previous page.*

11. Technical references

Contents

This section includes the following topics:

11.1 Technical data

11.1.1 General specifications

Detection method	Inxpect motion detection algorithm based on FMCW radar
Frequency	Working band: 24–24.25 GHz Maximum radiated power: 12.6 dBm EIRP (at +25° C) Maximum radiated power: 16.5 dBm EIRP (at -40° C) Modulation: FMCW
Detection interval	From 0 to 4 m
Detectable target RCS	0.17 m²
CRT (Certified Restart Timeout)	10 s
Guaranteed response time	Access detection (if available): < 100 ms * Restart prevention (if available): 10 s **WARNING! During the real-time validation and the download of the log file, the response time is not guaranteed.**
Total consumption	Max. 14 W (control unit and six sensors)
Electrical protections	Polarity inversion Overcurrent through resettable integrated fuse (max. 5 s @ 8 A)
Overvoltage category	II
Altitude	Max. 2000 m ASL
Air humidity	Max. 95%
Noise emission	Negligible**

Note*: *the value depends on the Electromagnetic robustness level set through the Inxpect Safety application, see "Electromagnetic Robustness" on page 39.*

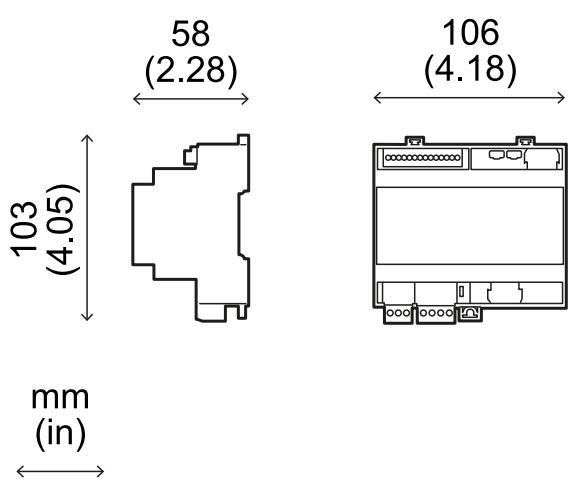
Note**:** *the A-weighted emission sound pressure level does not exceed 70 dB(A).*

11.1.2 Control unit features

Outputs	Configurable as follows: • 4 Output Signal Switching Devices (OSSDs) (used as single channels) • 2 dual channel outputs • 1 dual channel output and 2 Output Signal Switching Devices (OSSDs) High-side outputs (with extended protection function) • Maximum current: 0.4 A • Maximum power: 11.2 W The OSSDs provide what follows: • ON-state: from Uv-1V to Uv (Uv = 24V +/- 4V) • OFF-state: from 0 V to 2.5 V r.m.s.
OSSD characteristic	• Maximum resistive load: 100 KΩ • Minimum resistive load: 70 Ω • Maximum capacitive load: 1000 nF • Minimum capacitive load: 10 nF
Inputs	Configurable as follows: • 4 single channel type 3 digital inputs with common GND • 2 dual channel type 3 digital inputs with common GND • 1 dual channel and 2 single channels type 3 digital inputs with common GND See "Voltage and current limits for digital inputs" on page 86.
Power supply	24 V DC (20–28 V DC) * Maximum current: 1 A
Consumption	Max. 5 W
Assembly	On DIN rail
Weight	With cover: 170 g
Degree of protection	IP20
Terminals	Section: 1 mm² max. Maximum current: 4 A with 1 mm² cables
Impact test	0.5 J, 0.25 kg ball from a 20 cm height
Shock/Bump	In accordance with IEC/EN 61496-1:2013 sec. 5.4.4.2 (IEC 60068-2-27)
Vibration	In accordance with IEC/EN 61496-1:2013 sec. 5.4.4.1 (IEC 60068-2-6)
Pollution degree	2
Outdoor use	No
Operating temperature	From -30 to +60 °C
Storage temperature	From -40 to +80 °C

Note*: it is recommended to supply the control unit by an isolated power source which complies with the standard IEC/EN 60204-1 and fulfils the requirements of:

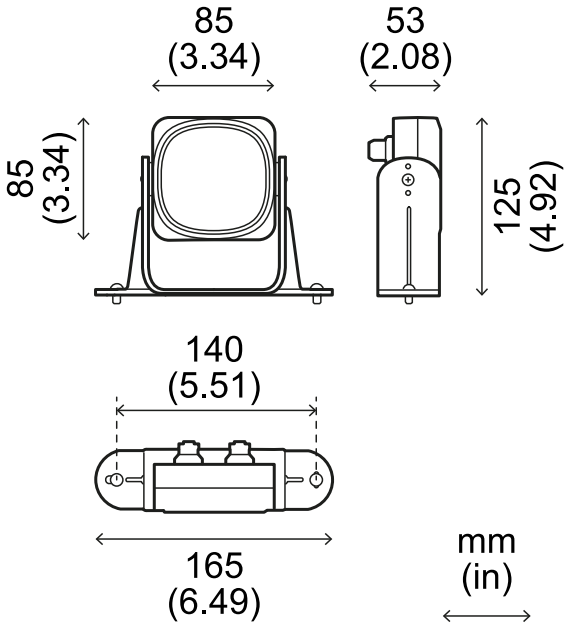
- *Limited-Energy Circuit in accordance with IEC/UL/CSA 61010-1/ IEC/UL/CSA 61010-2-201 or*
- *Limited Power Source (LPS) in accordance with IEC/UL/CSA 60950-1*



11.1.3 Sensor features

Connectors	2 5-pin M12 connectors (1 male and 1 female)
CAN bus termination resistance	120 Ω (not supplied, to be installed with a bus terminator)
Power supply	12 V DC ± 20%, through control unit
Consumption	Max. 1.5 W
Degree of protection	Type 3 enclosure in addition to IP 67 rating
Material	Sensor: PA66 Bracket: PA66 and glass fiber (GF)
Weight	With bracket: 220 g
Impact test	5 J, 0.5 kg ball from a 100 cm height
Shock/Bump	In accordance with IEC/EN 61496-1:2013 sec. 5.4.4.2 (IEC 60068-2-27)
Vibration	In accordance with IEC/EN 61496-1:2013 sec. 5.4.4.1 (IEC 60068-2-6)
Pollution degree	4
Outdoor use	Yes
Operating temperature	From -30 to +60 °C*
Storage temperature	From -40 to +80 °C

Note*: in environmental conditions where the operating temperature can reach values higher than the supported range, install a cover to shield the sensor from sun rays.*

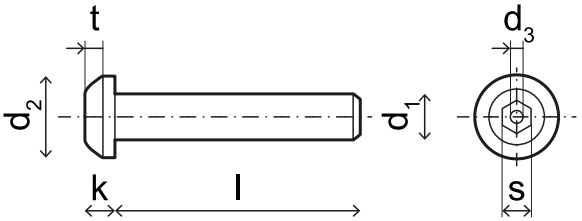


11.1.4 CAN bus cables recommended specifications

Section	2 x 0.34 mm² power supply 2 x 0.22 mm² data line
Type	Two twisted pairs (power supply and data) and one drain wire (or shield)
Connectors	5-pole M12 (see "Connectors M12 CAN bus" on page 87) Connectors shall be type 3 (raintight)
Impedance	120 Ω ±12 Ω (f = 1 MHz)
Shield	Shield with twisted wires in tin-plated copper. To be connected to ground circuit on the power supply terminal block of the control unit.
Standards	Maximum length of each line (from the control unit to the last sensor): 30 m

11.1.5 Side screw specifications

Pin Hex button head security screw



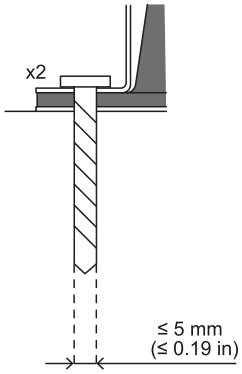
d_1	M4
l	10 mm
d_2	7.6 mm
k	2.2 mm
t	min 1.3 mm
s	2.5 mm
d_3	max. 1.1 mm

11.1.6 Bottom screws specifications

The bottom screws can be:

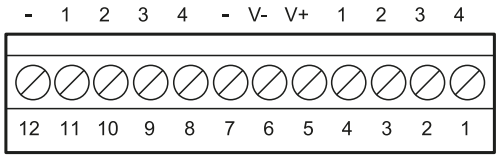
- cheese head
- button head

***Note**: avoid using countersunk head screws.*



11.2 Terminal blocks and connector pin-outs

11.2.1 Digital inputs and outputs terminal block



***Note**: facing the control unit so that the terminal block is on the top left, number 12 is the closest to the control unit corner.*

Terminal block	Symbol	Description	Pin
Digital In	**4**	Input 2, Channel 2, 24 V DC type 3 - INPUT #2-2	1
	3	Input 2, Channel 1, 24 V DC type 3 - INPUT #2-1	2
	2	Input 1, Channel 2, 24 V DC type 3 - INPUT #1-2	3
	1	Input 1, Channel 1, 24 V DC type 3 - INPUT #1-1	4
	V+	V+ (SNS), 24 V DC for diagnostics of the digital inputs (mandatory if at least one input is used)	5
	V-	V- (SNS), common reference for all digital inputs (mandatory if at least one input is used)	6
Digital Out	**-**	GND, common reference for all digital outputs	7
	4	Output 4 (OSSD4)	8
	3	Output 3 (OSSD3)	9
	2	Output 2 (OSSD2)	10
	1	Output 1 (OSSD1)	11
	-	GND, common reference for all digital outputs	12

***Note**: the cables used must have a maximum length of 30 m and the maximum operating temperature must be at least 80 °C.*

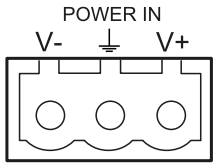
***Note**: use only copper wires with a minimum gauge of 18 AWG and a torque of 0.62 Nm.*

11.2.2 Voltage and current limits for digital inputs

The digital inputs (input voltage 24 V DC) adhere to the following voltage and current limits, in accordance with standard IEC/EN 61131-2:2003.

	Type 3
Voltage limits	
0	from - 3 to 11 V
1	from 11 to 30 V
Current limits	
0	15 mA
1	from 2 to 15 mA

11.2.3 Power supply terminal block



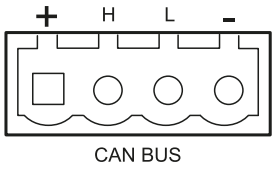
***Note**: connector front view.*

Symbol	Description
V-	GND
⏚	Earth
V+	+ 24 V DC

***Note**: the maximum operating temperature of the cables must be at least 70 °C.*

***Note**: use only copper wires with a minimum gauge of 18 AWG and a torque of 0.62 Nm.*

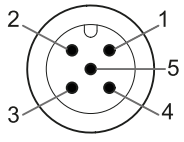
11.2.4 CAN bus terminal block



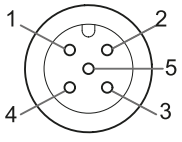
Symbol	Description
+	+ 12 V DC output
H	CAN H
L	CAN L
-	GND

***Note**: the maximum operating temperature of the cables must be at least 70 °C.*

11.2.5 Connectors M12 CAN bus



Male connector

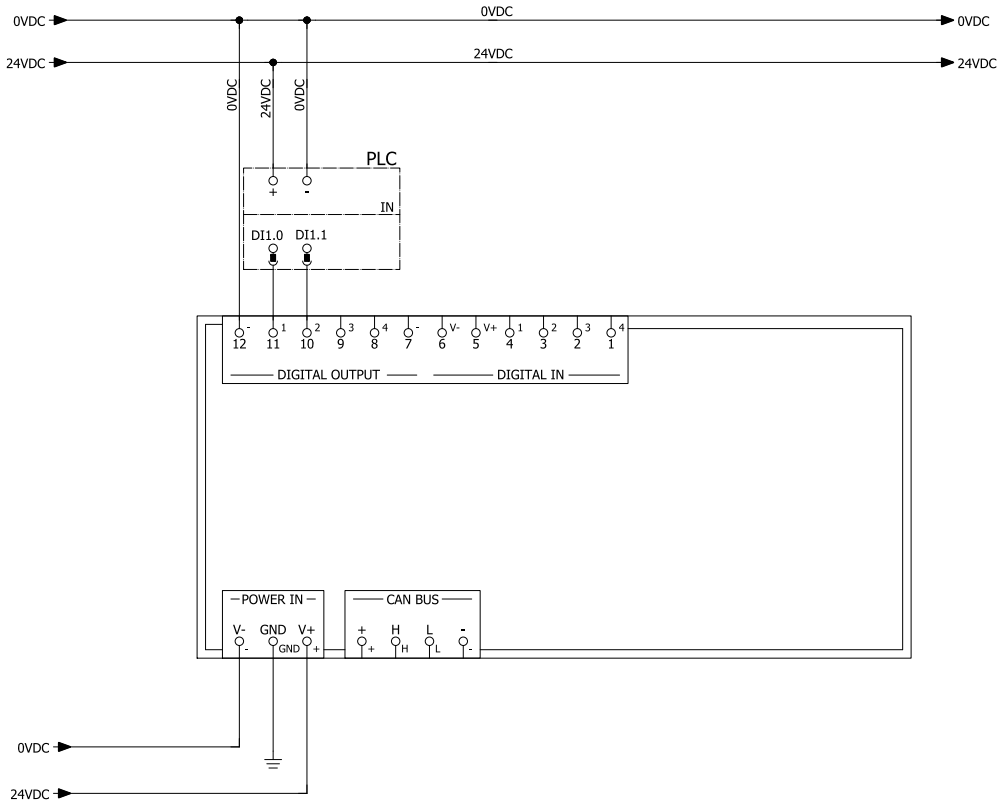


Female connector

Pin	Function
1	Shield to be connected to the functional earth on the power supply terminal block of the control unit.
2	+12 V dc
3	GND
4	CAN H
5	CAN L

11.3 Electrical connections

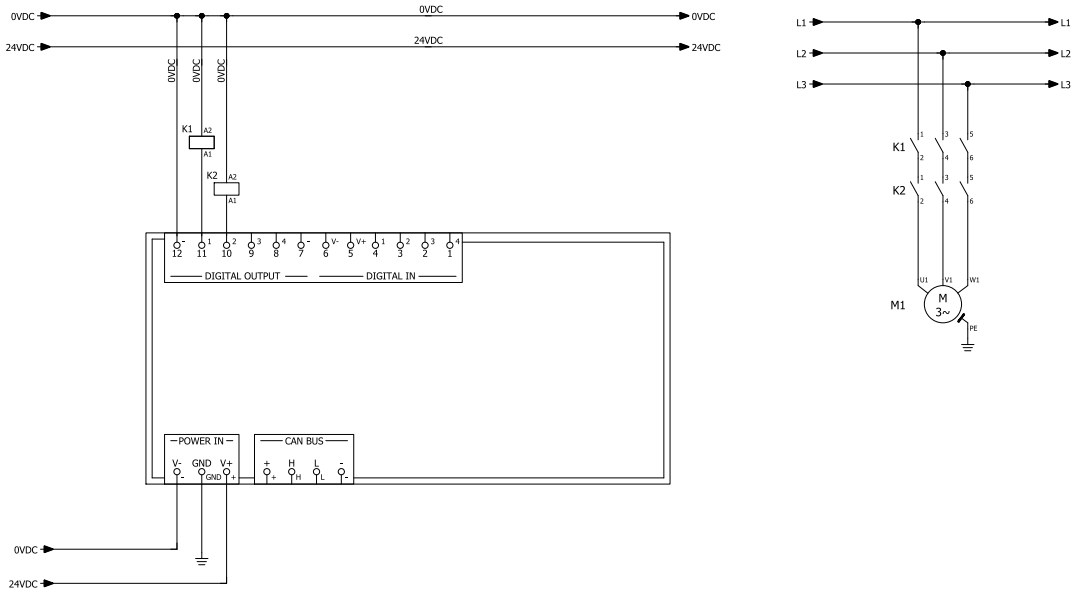
11.3.1 Connection of outputs to the Programmable Logic Controller



Digital I/O settings (through the Inxpect Safety application)

Digital input #1 Not configured
Digital input #2 Not configured
Digital output #1 Detection signal 1
Digital output #2 Detection signal 1
Digital output #3 Not configured
Digital output #4 Not configured

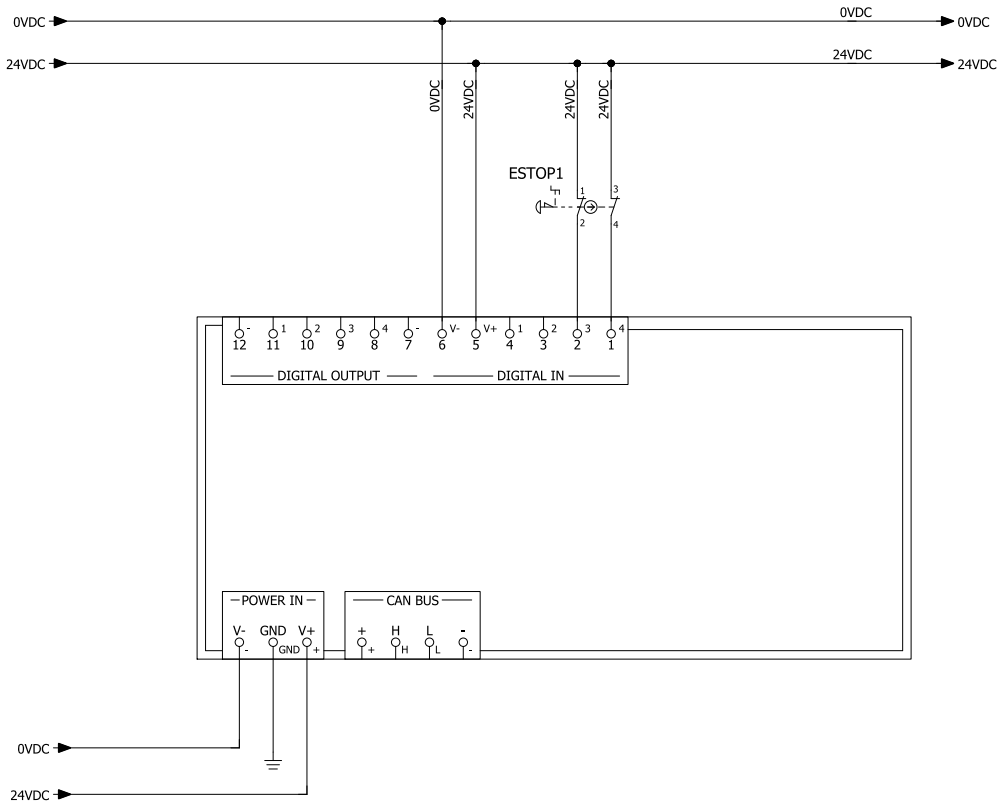
11.3.2 Connection of outputs to an external safety relay



Digital I/O settings (through the Inxpect Safety application)

Digital input #1 Not configured
Digital input #2 Not configured
Digital output #1 Detection signal 1
Digital output #2 Detection signal 1
Digital output #3 Not configured
Digital output #4 Not configured

11.3.3 Connection of stop signal (Emergency button)



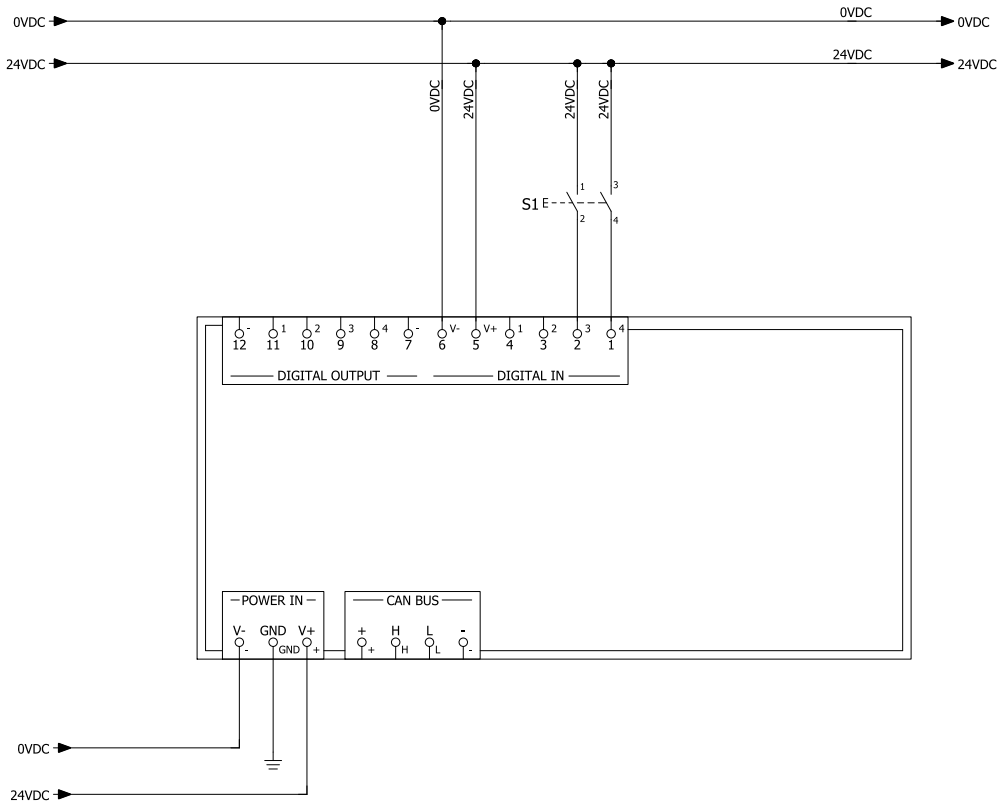
***Note**: the indicated emergency button opens the contact when pressed.*

***Note**: the cables used for wiring the digital inputs must have a maximum length of 30 m.*

Digital I/O settings (through the Inxpect Safety application)

Digital input #1 Not configured
Digital input #2 Stop signal
Digital output #1 Not configured
Digital output #2 Not configured
Digital output #3 Not configured
Digital output #4 Not configured

11.3.4 Connection of restart signal (dual channel)



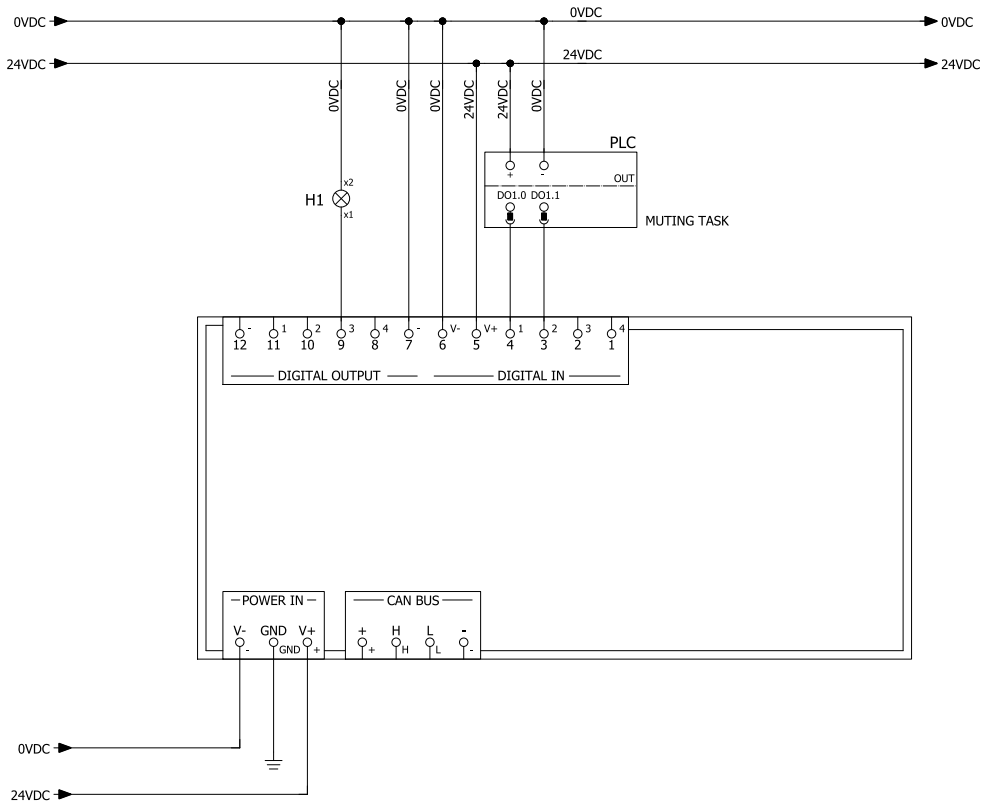
***Note**: the button indicated for the restart signal closes the contact when pressed.*

***Note**: the cables used for wiring the digital inputs must have a maximum length of 30 m.*

Digital I/O settings (through the Inxpect Safety application)

Digital input #1 Not configured
Digital input #2 Restart signal
Digital output #1 Not configured
Digital output #2 Not configured
Digital output #3 Not configured
Digital output #4 Not configured

11.3.5 Connection of the muting input and output (one group of sensors)

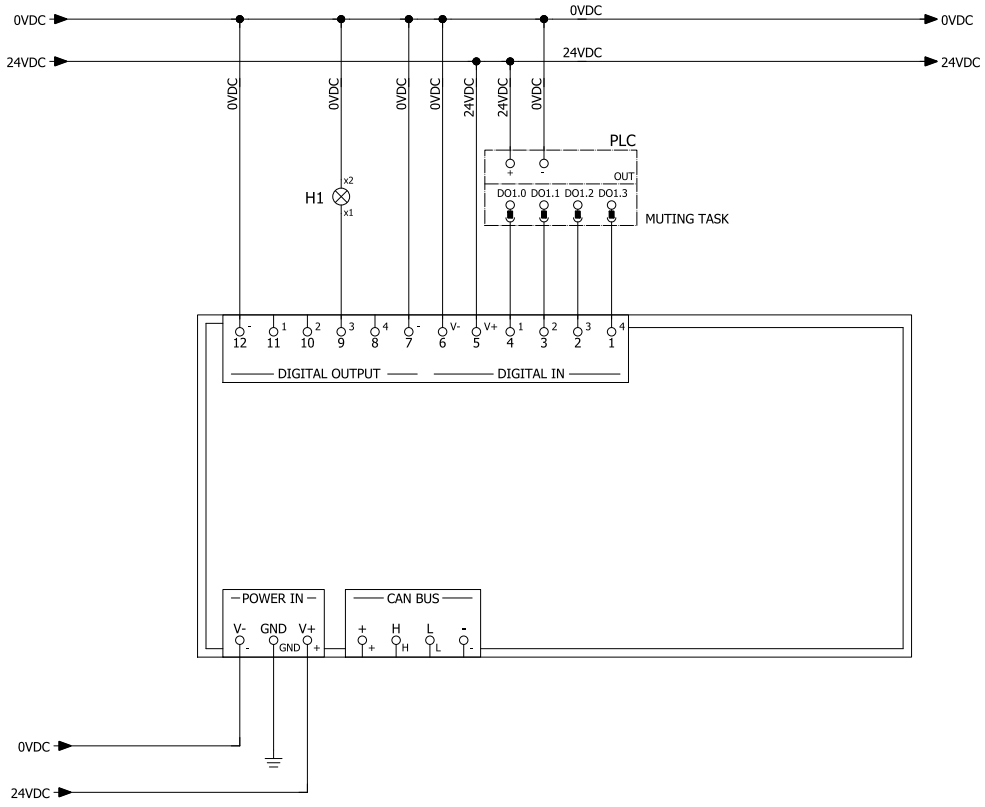


***Note**: the cables used for wiring the digital inputs must have a maximum length of 30 m.*

Digital I/O settings (through the Inxpect Safety application)

Digital input #1 Muting group 1
Digital input #2 Not configured
Digital output #1 Not configured
Digital output #2 Not configured
Digital output #3 Muting enable feedback signal
Digital output #4 Not configured

11.3.6 Connection of the muting input and output (two groups of sensors)

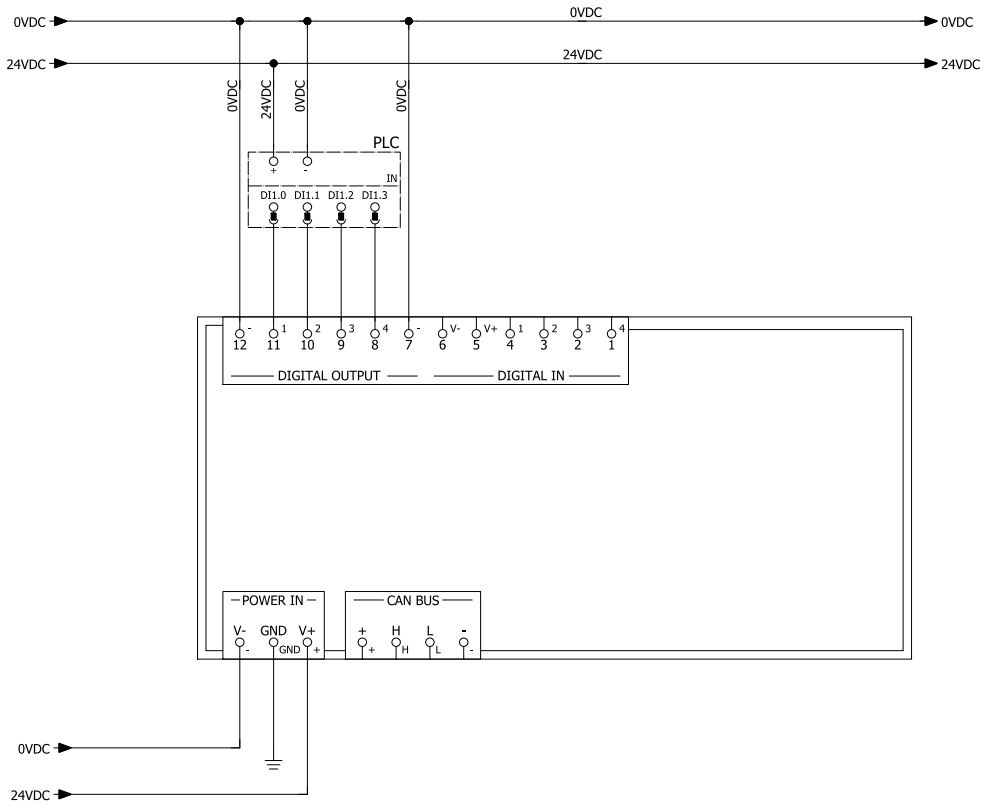


***Note**: the cables used for wiring the digital inputs must have a maximum length of 30 m.*

Digital I/O settings (through the Inxpect Safety application)

Digital input #1 Muting group 1
Digital input #2 Muting group 2
Digital output #1 Not configured
Digital output #2 Not configured
Digital output #3 Muting enable feedback signal
Digital output #4 Not configured

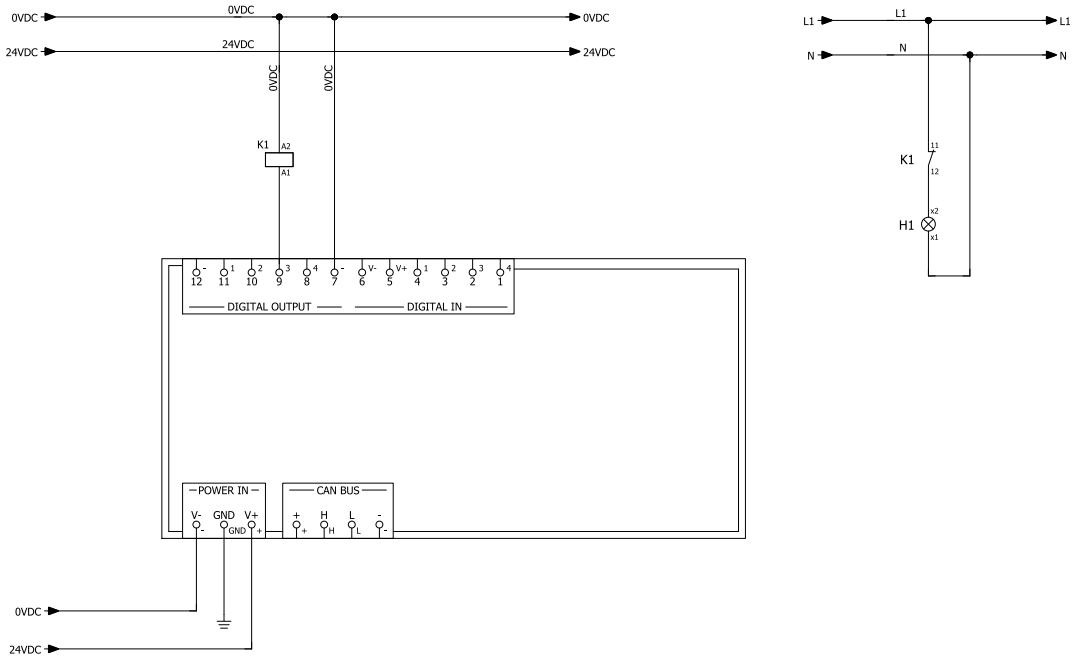
11.3.7 Detection signal 1 and 2 connection



Digital I/O settings (through the Inxpect Safety application)

Digital input #1 Not configured
Digital input #2 Not configured
Digital output #1 Detection signal 1
Digital output #2 Detection signal 1
Digital output #3 Detection signal 2
Digital output #4 Detection signal 2

11.3.8 Diagnostic output connection



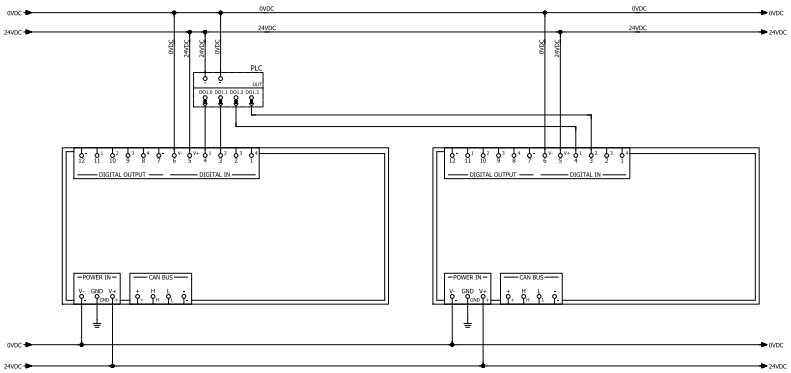
***Note**: the cables used for wiring the digital inputs must have a maximum length of 30 m.*

Digital I/O settings (through the Inxpect Safety application)

Digital input #1 Not configured
Digital input #2 Not configured
Digital output #1 Not configured
Digital output #2 Not configured
Digital output #3 System diagnostic signal
Digital output #4 Not configured

11.3.9 Multi-control unit Synchronization

***Note**: the function can be used only if all the sensors are S188A-X3.*



***Note**: only if the Inxpect Safety application supports the function.*

Digital I/O settings (through the Inxpect Safety application)

Control unit #1

- Control unit channel 0
- Digital input #1 Acquisition Trigger

Control unit #2

- Control unit channel 1
- Digital input #1 Acquisition Trigger

11.4 Configuration application parameters

11.4.1 Parameter list

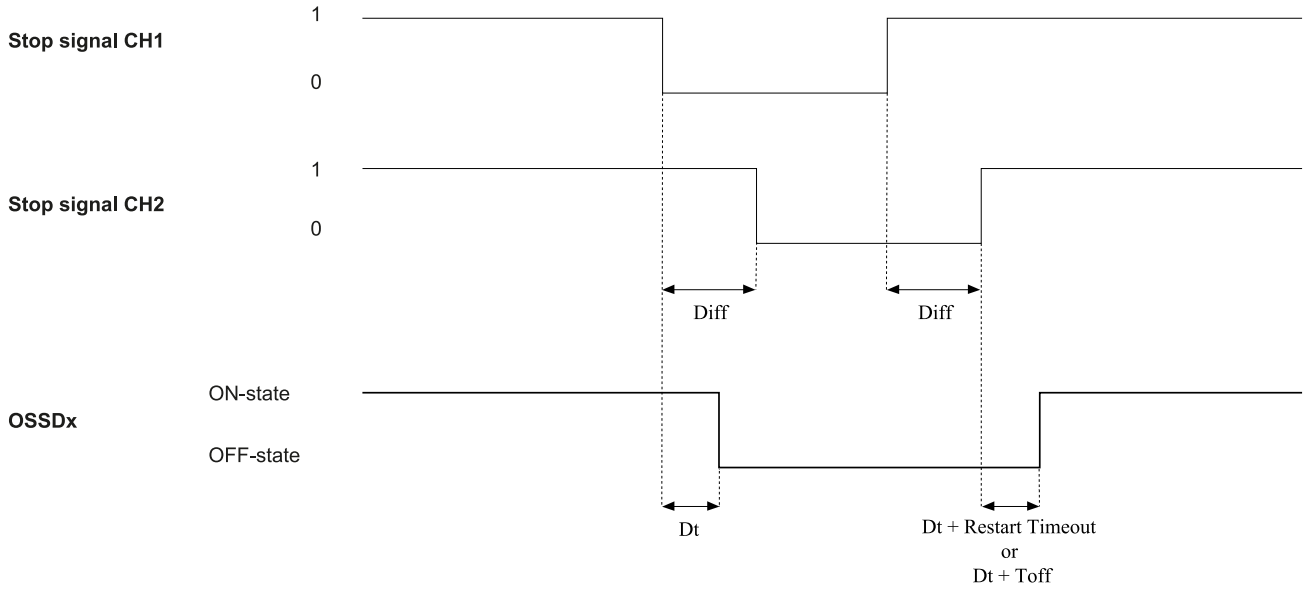
Parameter	Min	Max	Default value
Settings > Account			
Password	-	-	Not available
Configuration			
Number of installed sensors	1	6	1
Plane	Dim. X: 1000 mm Dim. Y: 1000 mm	Dim. X: 20000 mm Dim. Y: 65000 mm	Dim. X: 8000 mm Dim. Y: 4000 mm
Position (for each sensor)	X: 0 mm Y: 0 mm	X: 65000 mm Y: 65000 mm	X: 1000 mm Y: 1000 mm
Rotation 1 (for each sensor)	0°, 90°, 180°, 270°		0°
Rotation 2 (for each sensor)	0°	359°	0°
Rotation 3 (for each sensor)	-90°	90°	0°

Parameter	Min	Max	Default value
Sensor installation height (for each sensor)	0 mm	10000 mm	0 mm
Detection Distance 1 (for each sensor)	0 mm	4000 mm	1000 mm
Detection Distance 2 (for each sensor)	0 mm	3000 mm	0 mm
Restart timeout (for each detection field of each sensor)	0 ms	60000 ms	10000 ms
T_{OFF}	100 ms	60000 ms	100 ms
Settings > Advanced			
Detection field dependency	Enabled, Disabled		Enabled
Electromagnetic robustness	Standard, High, Very High		Standard
Access sensitivity	Normal, High, Very High		Normal
Restart sensitivity	Normal, High, Very High		Normal
Stop signal debounce filter	Enabled, Disabled		Disabled
Settings > Advanced > Multi-control unit synchronization			
Control unit channel	0	3	0
Settings > Anti-tampering			
Anti-masking sensitivity (for each sensor)	Disabled, Low, Medium, High		Disabled
Anti-rotation around axes (for each sensor)	Disabled, Enabled		Disabled
Settings > Digital Input-Output			
Digital input (for each input)	Not configured, Stop signal, Restart signal, Muting group 1, Muting group 2, Dynamic configuration switch, System recondition, Restart signal + System recondition, Single channel, Acquisition Trigger		Not configured
Digital input channel (for each channel of each input)	Not configured, Muting group 1, Muting group 2, Restart signal, System recondition		Not configured
Redundancy mode	Coherent, Inverted		Coherent
Encoded channel	Enabled, Disabled ***Note**: available only when both the digital inputs are configured as Dynamic configuration switch*		Disabled
Digital output (for each output)	Not configured, System diagnostic signal, Muting enable feedback signal, Restart feedback signal, Detection signal 1, Detection signal 2, Detection warning 1, Detection warning 2, Detection signal group 1, Detection signal group 2, Detection warning group 1, Detection warning group 2, Acquisition Trigger		Not configured
OSSD Pulse width	Short (300 µs), Long (2 ms)		Short (300 µs)
Short-circuit/Open circuit diagnostics	Enabled, Disabled	Disabled	Short-circuit/Open circuit diagnostics
Settings > Muting			
Group for muting (for each sensor)	None, Group 1, Group 2, both		Group 1
Settings > Restart function			
Detection field 1, 2	Automatic, Manual		Automatic
Settings > Activity History			
Log verbosity level	0	5	0
Admin > System labels			
Control unit	-		-
Sensor 1	-		-
Sensor 2	-		-

Parameter	Min	Max	Default value
Sensor 3	-		-
Sensor 4	-		-
Sensor 5	-		-
Sensor 6	-		-
Admin > Users management			
User name	-		-
Access level	Admin, Engineer, Expert, Observer, Service		Observer

11.5 Digital input signals

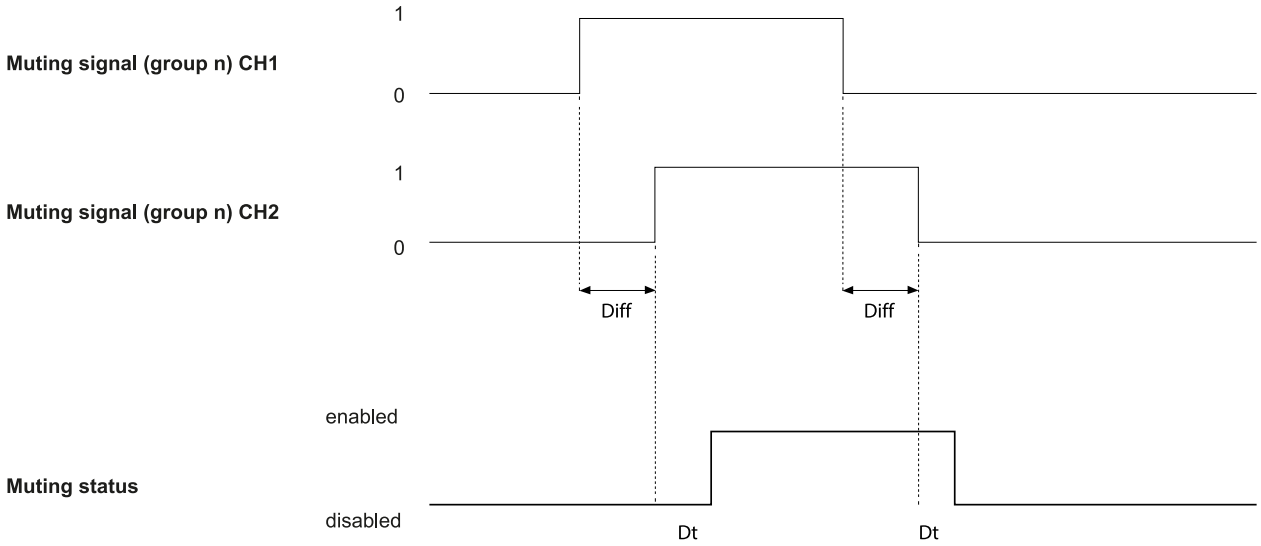
11.5.1 Stop signal



Part	Description
OSSDx: **Detection signal "N"/Detection signal group "N"**	Detection signal outputs deactivate on the falling edge of at least one of the two input channels of the input signal. They remain in OFF-state as long as one of the two input channels remains to the low logic status (0).
Stop signal CH1 **Stop signal CH2**	Interchangeable channel. As soon as one channel goes to the low logic level (0), Detection signal 1 and Detection signal 2 are set to OFF-state.
Diff	Less than 50 ms. If the value is greater than 50 ms, the diagnostic alarm starts and the system deactivates the outputs.
Dt	Activation delay. If the Stop signal debounce filter is disabled, less than 5 ms. If the Stop signal debounce filter is enabled, less than 50 ms.

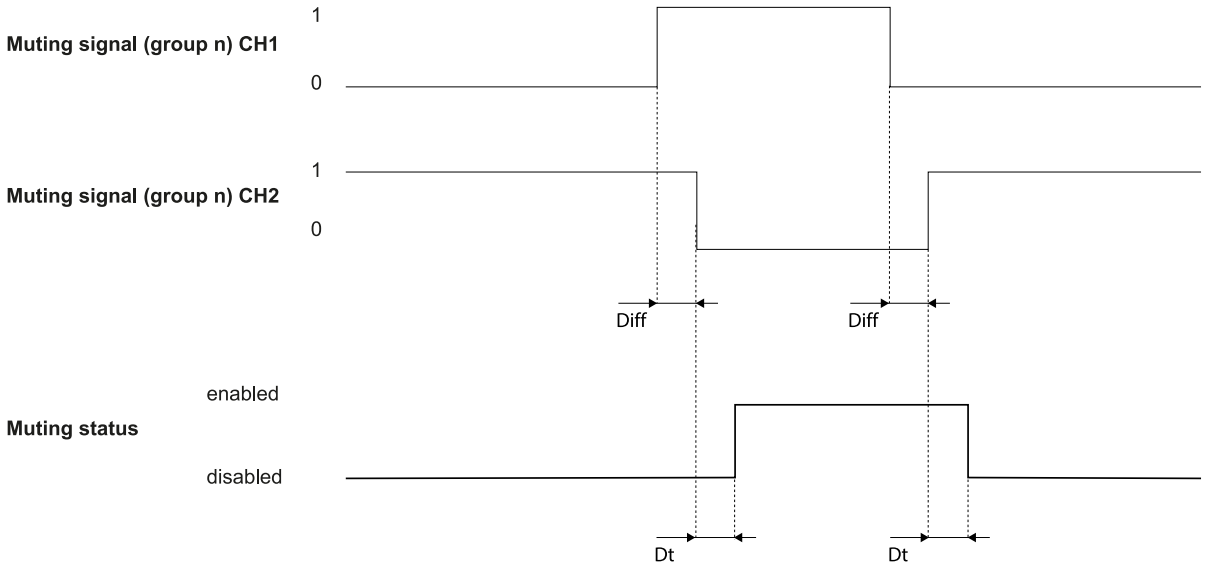
11.5.2 Muting (dual channel)

Redundancy mode coherent



Part	Description
Diff	Less than 100 ms. If the value is greater than 100 ms, the diagnostic alarm starts and the system deactivates the outputs.
Muting signal (group *n*) CH 1 **Muting signal (group *n*) CH 2**	Interchangeable channel.
Muting status	They are enabled as long as both channels are at a high logic level (1) and deactivated when both channels go to a low logic level (0).
Dt	Activation/deactivation delay. Less than 50 ms.

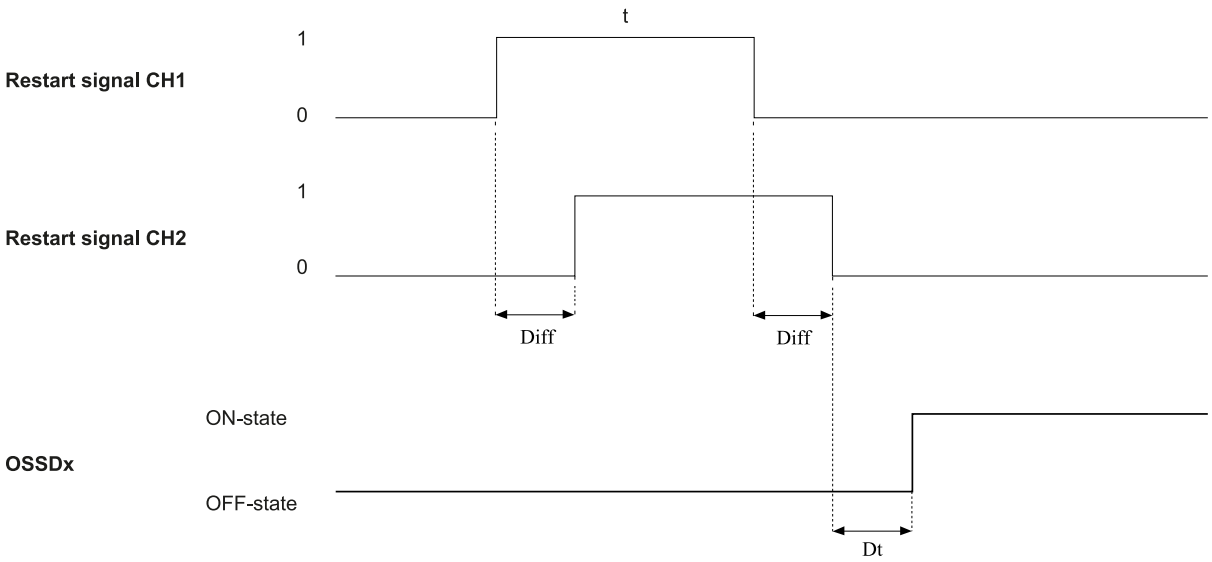
Redundancy mode inverted



Part	Description
Diff	Less than 100 ms. If the value is greater than 100 ms, the diagnostic alarm starts and the system deactivates the outputs.
Muting status	They are enabled as long as channel 1 of the Muting signal is at a high logic level (1) and channel 2 is at a low logic level (0). Disabled as long as channel 1 is at a low logic level (0) and channel 2 is at a high logic level (1).

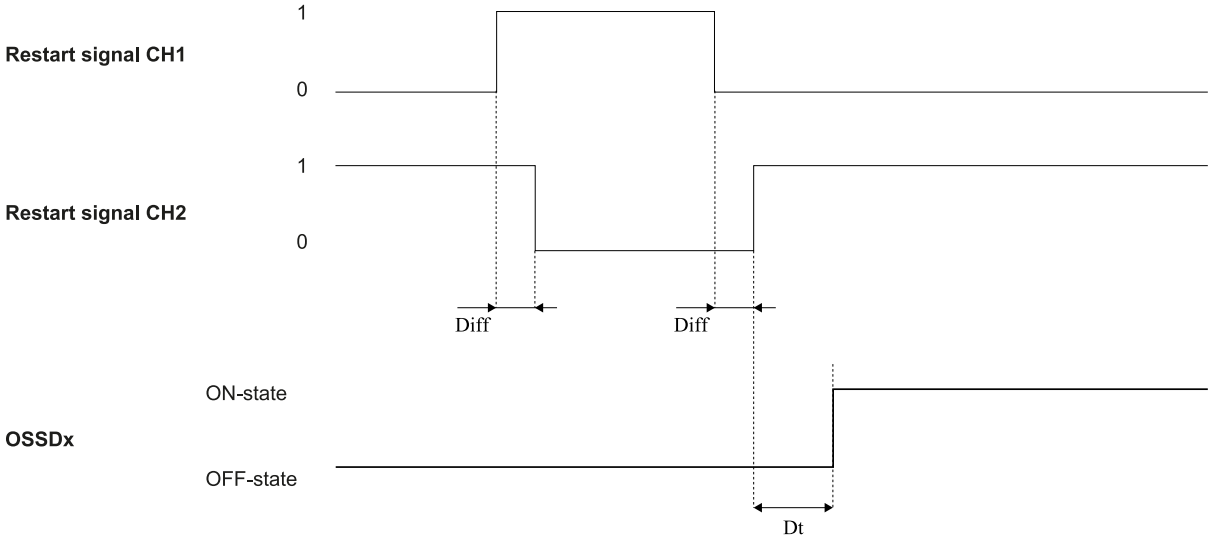
Part	Description
Dt	Activation/deactivation delay. Less than 50 ms.

11.5.3 Restart signal (dual channel, redundancy mode coherent)



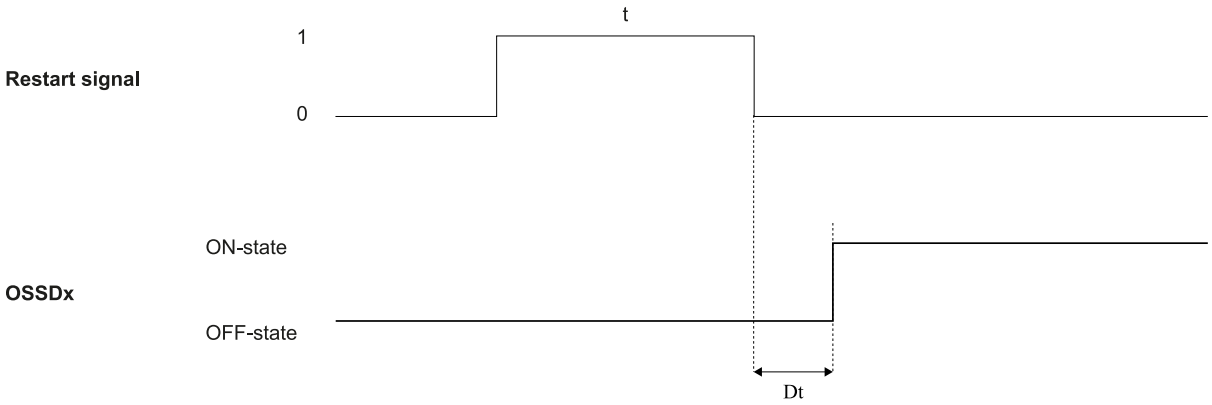
Part	Description
OSSDx: **Detection signal "N"/Detection signal group "N"**	Detection signal outputs go to ON-state as soon as the last channel has correctly completed the transition 0 -> 1 -> 0.
Restart signal CH1 **Restart signal CH2**	Interchangeable channel. Both channels of Restart signal must have a transition of logical level 0 -> 1 ->0. The time they stay at a high logical level (t) must be at least 200 ms and less than 5 s.
Dt	Activation delay. Less than 50 ms.
Diff	Less than 100 ms. If the value is greater than 100 ms, the system maintains the outputs deactivated.

11.5.4 Restart signal (dual channel, redundancy mode inverted)



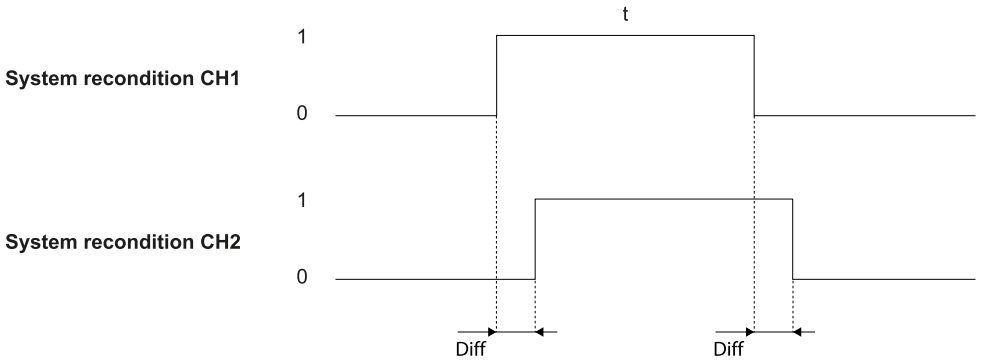
Part	Description
OSSDx: **Detection signal "N"/Detection signal group "N"**	Detection signal outputs go to ON-state as soon as the last channel has correctly completed the transition.
Restart signal CH1 **Restart signal CH2**	Channel 1 of the Restart signal must have a transition of logical level 0 -> 1 -> 0. Channel 2 of Restart signal must have a transition of logical level 1 -> 0 -> 1. The time Channel 1 stays at a high logical level and the time Channel 2 stays at a low logical level (t) must be at least 200 ms and less than 5 s.
Dt	Activation delay. Less than 50 ms.
Diff	Less than 100 ms. If the value is greater than 100 ms, the system maintains the outputs deactivated.

11.5.5 Restart signal (single channel)



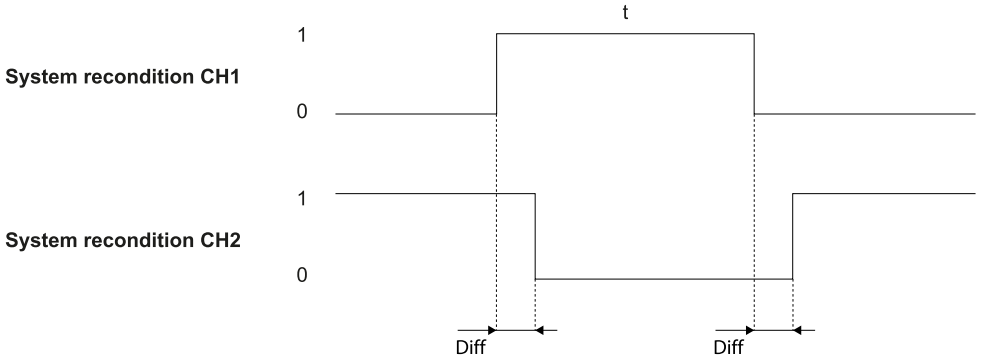
Part	Description
OSSDx: **Detection signal "N"/Detection signal group "N"**	Detection signal outputs go to ON-state as soon as the Restart signal has correctly completed the transition 0 -> 1 -> 0.
Restart signal	The channel must have a transition of logical level 0 -> 1 ->0. The time they stay at a high logical level (t) must be at least 200 ms and less than 5 s.
Dt	Activation delay. Less than 50 ms.

11.5.6 System recondition (dual channel, redundancy mode coherent)



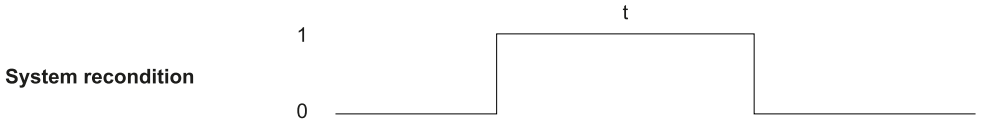
Part	Description
System recondition CH1 **System recondition CH2**	Interchangeable channel. Both channels of System recondition must have a transition of logical level 0 -> 1 ->0. They must stay at a high logical level (t) for at least 10 s and less than 30 s.
Diff	Less than 100 ms. If the value is greater than 100 ms, the system maintains the outputs deactivated.

11.5.7 System recondition (dual channel, redundancy mode inverted)



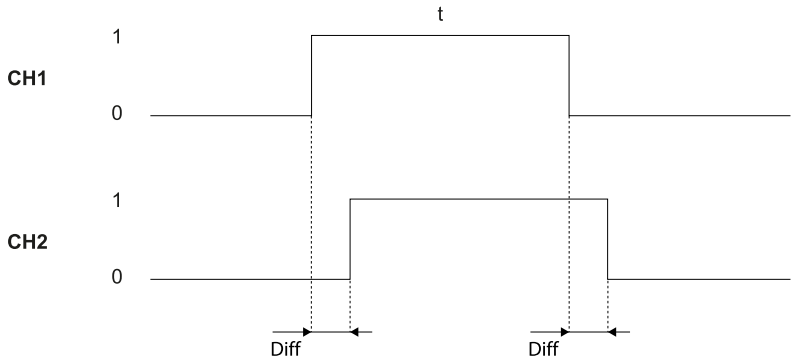
Part	Description
System recondition CH1 **System recondition CH2**	Channel 1 of System recondition must have a transition of logical level 0 -> 1 -> 0. Channel 2 of System recondition must have a transition of logical level 1 -> 0 -> 1. The time Channel 1 stays at a high logical level and the time Channel 2 stays at a low logical level (t) for at least 10 s and less than 30 s.
Diff	Less than 100 ms. If the value is greater than 100 ms, the system maintains the outputs deactivated.

11.5.8 System recondition (single channel)



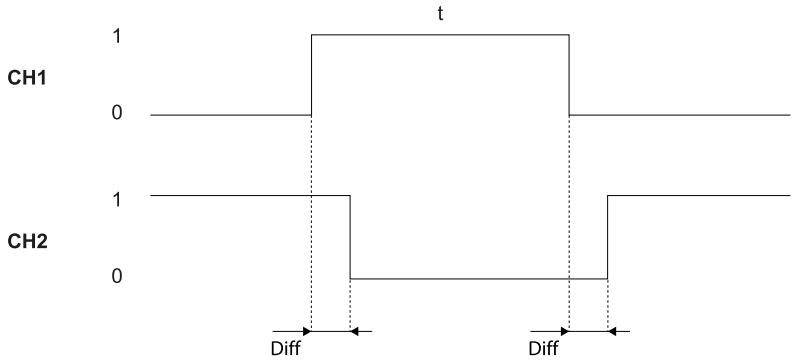
Part	Description
System recondition	The channel must have a transition of logical level 0 -> 1 ->0. The time it stays at a high logical level (t) must be at least 10 s and less than 30 s.

11.5.9 Restart signal + System recondition (dual channel, redundancy mode coherent)



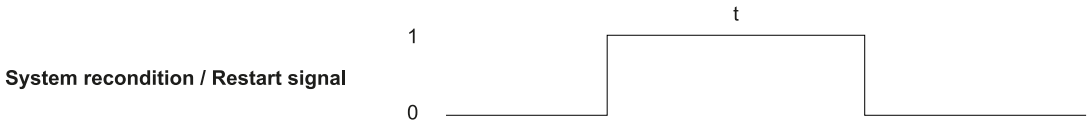
Part	Description
CH1 **CH2** **(Restart signal)**	Interchangeable channel. Both channels must have a transition of logical level 0 -> 1 ->0. The time they stay at a high logical level (t) must be at least 200 ms and less than 5 s. For details about the behavior of Detection signal 1 and 2 outputs and the deactivation delay, see "Restart signal (dual channel, redundancy mode coherent)" on page 100.
CH1 **CH2** **(System recondition)**	Interchangeable channel. Both channels must have a transition of logical level 0 -> 1 ->0. They must stay at a high logical level (t) for at least 10 s and less than 30 s.
Diff	Less than 100 ms. If the value is greater than 100 ms, the system maintains the outputs deactivated.

11.5.10 Restart signal + System recondition (dual channel, redundancy mode inverted)



Part	Description
CH1 **CH2** **(Restart signal)**	Channel 1 of the Restart signal must have a transition of logical level 0 -> 1 -> 0. Channel 2 of Restart signal must have a transition of logical level 1 -> 0 -> 1. The time Channel 1 stays at a high logical level and the time Channel 2 stays at a low logical level (t) must be at least 200 ms and less than 5 s. For details about the behavior of Detection signal 1 and 2 outputs and the deactivation delay, see "Restart signal (dual channel, redundancy mode inverted)" on page 101.
CH1 **CH2** **(System recondition)**	Channel 1 of System recondition must have a transition of logical level 0 -> 1 -> 0. Channel 2 of System recondition must have a transition of logical level 1 -> 0 -> 1. The time Channel 1 stays at a high logical level and the time Channel 2 stays at a low logical level (t) for at least 10 s and less than 30 s.
Diff	Less than 100 ms. If the value is greater than 100 ms, the system maintains the outputs deactivated.

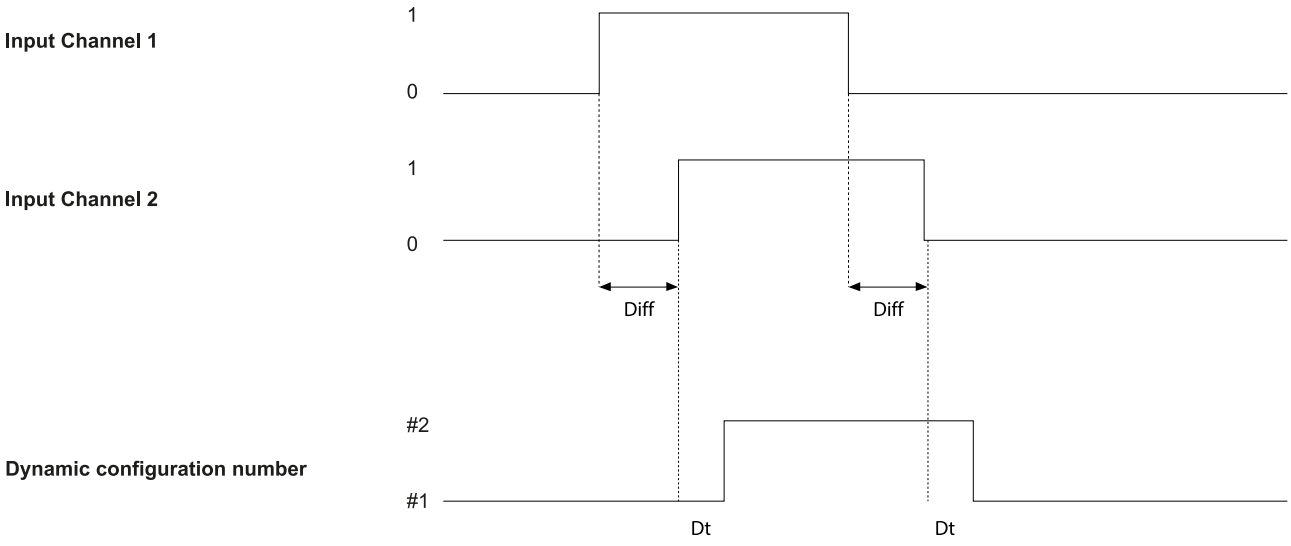
11.5.11 Restart signal + System recondition (single channel)



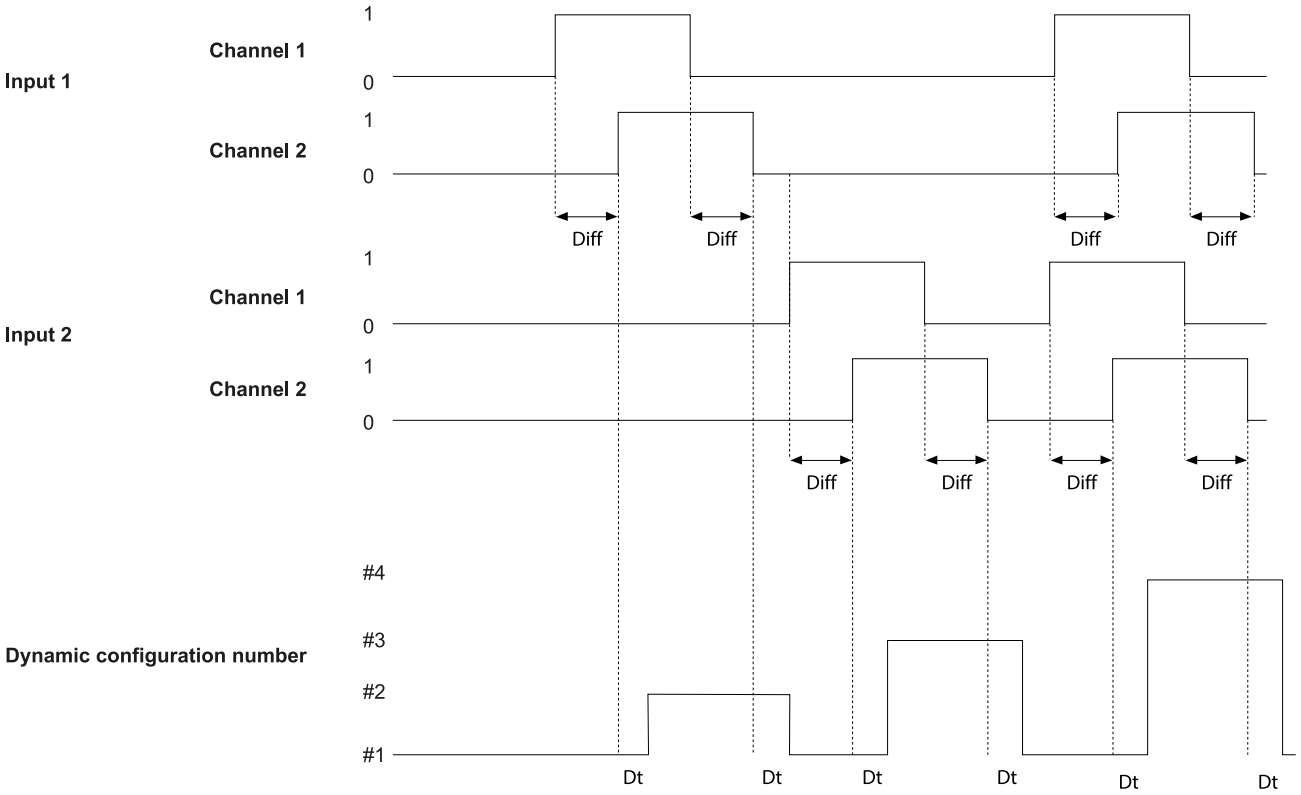
Part	Description
Restart signal	The channel must have a transition of logical level 0 -> 1 ->0. The time it stays at a high logical level (t) must be at least 200 ms and less than 5 s. For details about the behavior of Detection signal 1 and 2 outputs and the deactivation delay, see "Restart signal (single channel)" on page 101.
System recondition	The channel must have a transition of logical level 0 -> 1 ->0. The time it stays at a high logical level (t) must be at least 10 s and less than 30 s.

11.5.12 Dynamic configuration switch (redundancy mode coherent)

With one input



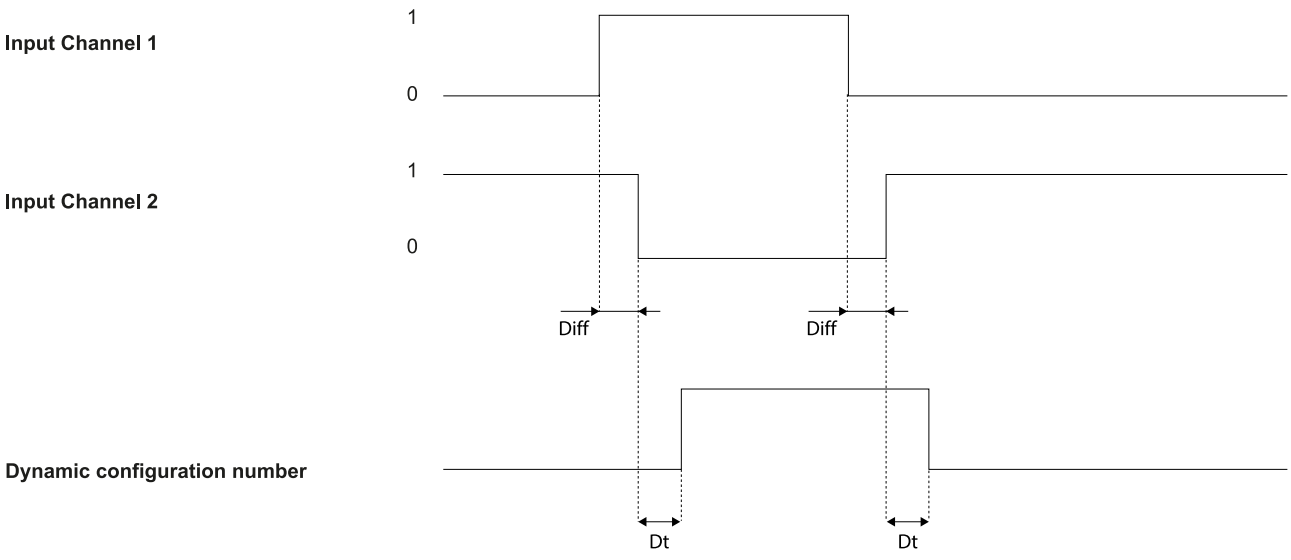
With two inputs (encoded channels disabled)



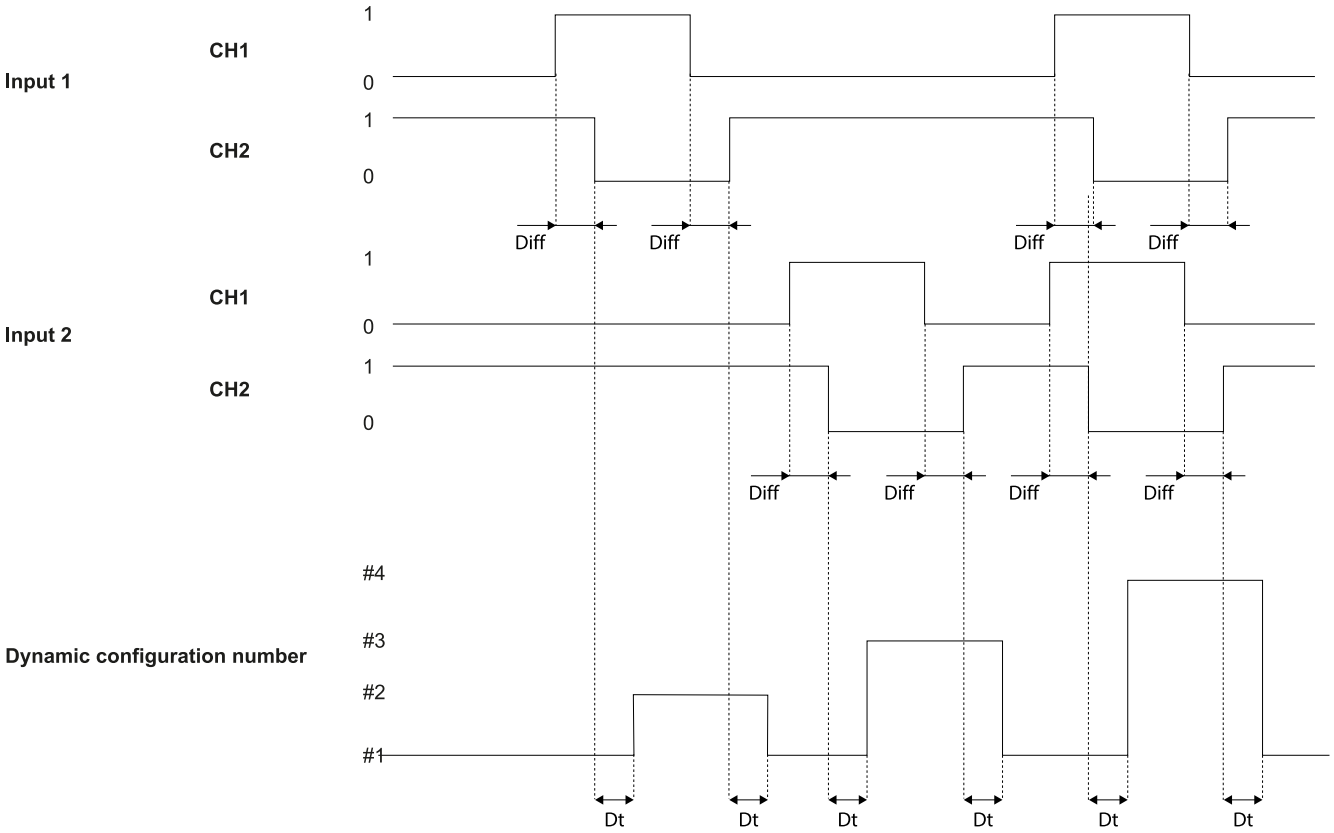
Part	Description
Diff	Less than 100 ms. If the value is greater than 100 ms, the diagnostic alarm starts and the system deactivates the outputs.
Dynamic configuration number	For details about the dynamic configuration number and the encoded channel option, see "System configuration" on page 22.
Dt	Activation/deactivation delay. Less than 50 ms.

11.5.13 Dynamic configuration switch (redundancy mode inverted)

With one input



With two inputs



Part	Description
Diff	Less than 100 ms. If the value is greater than 100 ms, the diagnostic alarm starts and the system deactivates the outputs.
Dynamic configuration number	For details about the dynamic configuration number and the encoded channels option, see "System configuration" on page 22.
Dt	Activation/deactivation delay. Less than 50 ms.

12. Appendix

Contents

This section includes the following topics:

12.1 System software

12.1.1 Introduction

The aim of this appendix is to provide and clarify the information related to the system software. It includes the information necessary for the integrator during the installation and integration.

Considering that Inxpect Value Line is an embedded system provided with a firmware already deployed on board, no software integration is required by the system installer or by the end user.

12.1.2 Configuration

The system configuration can be performed by means of a PC-based configuration tool, called the Inxpect Safety application.

The system configuration is described in "Installation and use procedures" on page 55.

12.1.3 Competence

Although no competence is required for software integration, a skilled person is required for system installation and configuration, as described in "Installation and use procedures" on page 55.

12.1.4 Installation instructions

The firmware is already deployed on the hardware, the PC-based configuration tool includes a self-explanatory setup installer.

12.1.5 Outstanding anomalies

At the moment of the issue of this document, no software/firmware anomalies or bugs are known.

12.1.6 Backward compatibility

Backward compatibility is guaranteed.

12.1.7 Change control

Any change proposal suggested by the integrator or the end user should be forwarded to Inxpect and evaluated by the Product Owner.

12.2 Disposal

Inxpect Value Line contains electrical parts. As set forth in European Directive 2012/19/EU, do not dispose of the product with unsorted urban waste materials.

It is the responsibility of the owner/distributor to dispose of these products, as well as other electrical and electronic equipment, through specific waste collection facilities indicated by the waste disposal services.

Correct disposal and recycling will contribute to the prevention of potentially harmful consequences to the environment and human health.

For more detailed information about disposal, contact the waste disposal services or the representative from whom you purchased the product.

For instructions on how to disassemble the components for proper and sustainable disposal, download the disassembly instructions from the https://www.inxpect-tj.com/downloads.html website.

12.3 Service and warranty

12.3.1 Technical Support

Inxpect SpA
Via Serpente, 91
25131 Brescia (BS) - Italy
Tel: +39 030 5785105
email: safety-support@inxpect.com
website: www.inxpect-tj.com

12.3.2 How to return the product

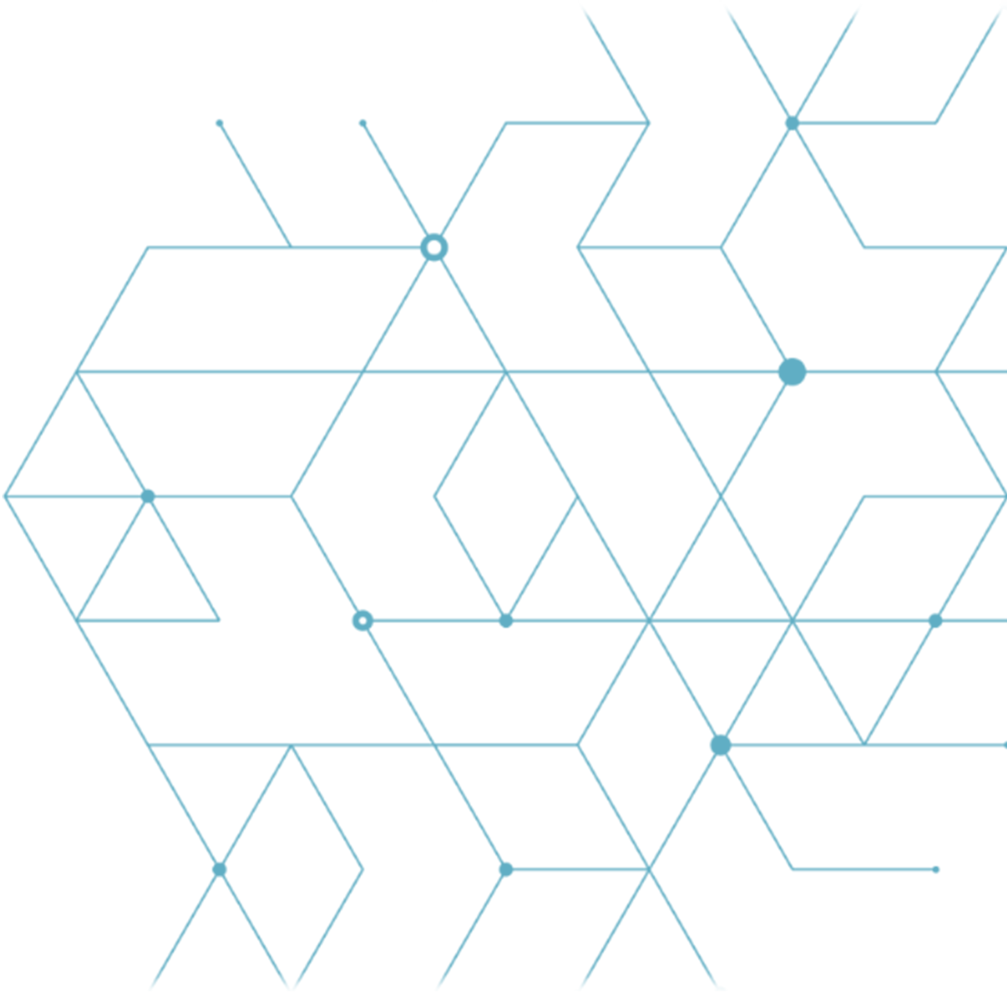
If necessary, complete the request with information about the return on the website www.inxpect.com/industrial/rma. Then, return the product to the local distributor or exclusive distributor. **Use the original packaging. Shipping costs are at the customer's expense**.

Area distributor	Manufacturer
Note distributor information here:	Inxpect SpA Via Serpente, 91 25131 Brescia (BS) Italy www.inxpect.com

12.3.3 Service and warranty

Refer to www.inxpect.com for the following information:

- terms, exclusions and cancellation of the warranty
- general conditions of the Return Merchandise Authorization (RMA)



INXPECT

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