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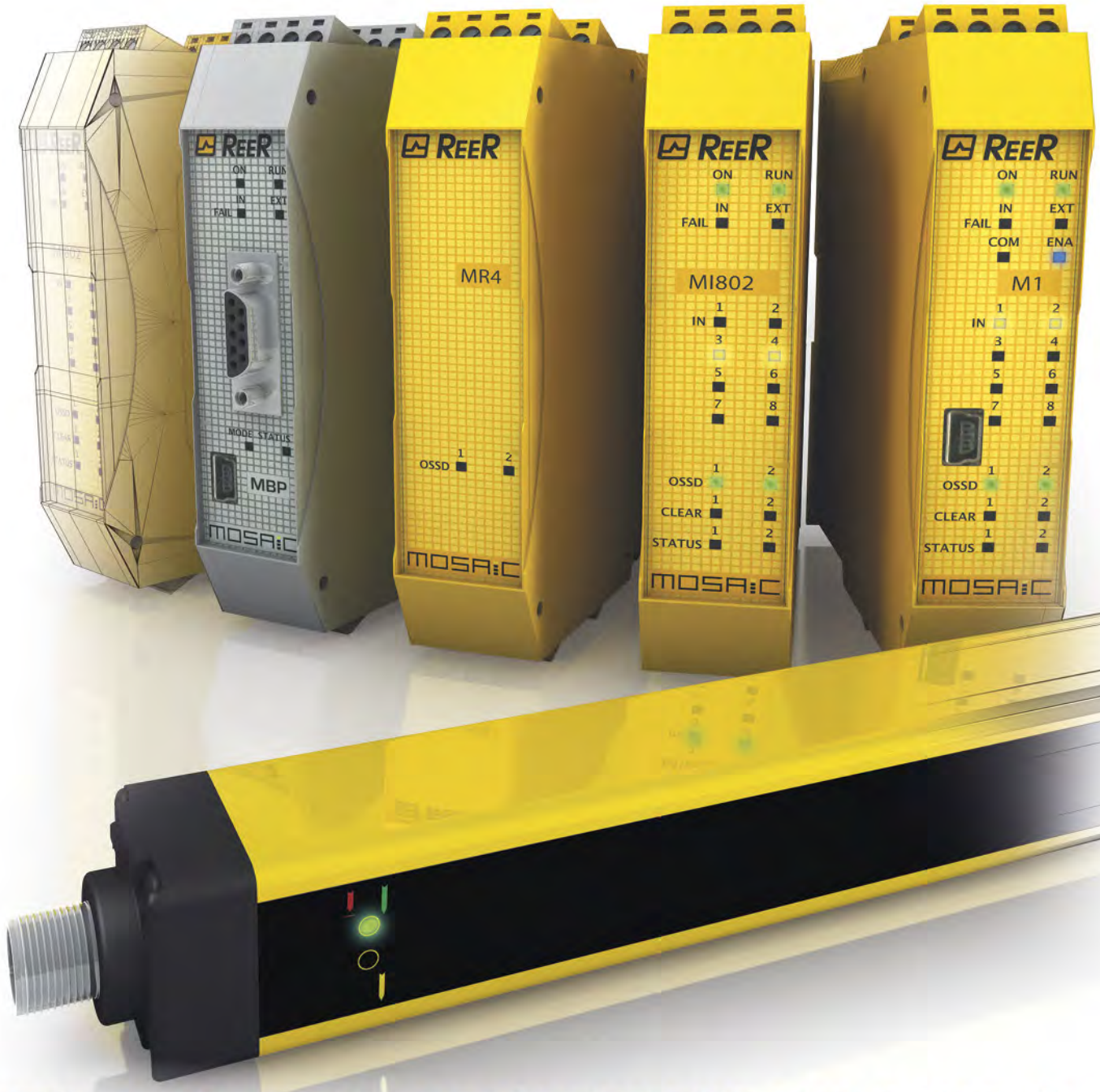

SAFETY AUTOMATION MEASUREMENT AND CONTROL

Catalog n.13

INTRODUCTION TO THIS EDITION

The present edition of the ReeR Safety and Automation Catalog presents at least one novelty of evidently great interest. The new line of configurable safety controllers Mosaic places itself at the state of the art, not only within ReeR's range, but in the whole market of machine safety. By reviewing this catalog you will discover the various features that make Mosaic unique and innovative, from the powerful, versatile and unexpectedly user-friendly graphic configuration software, to the extreme modularity and reduced size of the device.
A revolution in the design of the safety part of potentially every future electrical cabinet.

The already popular EOS line of safety light curtains is enriched by further models, in particular by the IP69K-rated WT series, optimised for applications in the food & beverage industry among the rest.
No problem with extreme temperatures and rugged applications, all coming with a compact mechanical size.

Our offer is further enlarged by the new Magnus line of coded magnetic safety switches, ideal match for Mosaic, and by several integrations and useful range completions.

We do hope that all these news will be a stimulus for you, as well as a valid support in doing your work.

Turin, July 2011

WHAT'S NEW IN THIS VERSION

ADMIRAL LR DB
ADMIRAL LR DB WTH

with Dual-Beam Technology

See page 67

MAGNUS

Safety magnetic switches

See page 159

MOSAIC

Safety configurable controller

See page 165

EOS WTF / WTHF

IP 69K watertight enclosure suitable for Food & Beverage

See page 192

AND MORE...

- **Janus MM TRX** modular system: see page 87
- **SL TRX** and **ST TRX** muting arms for Janus MM TRX series: see page 99
- **Janus ML TRX V** and **Janus MT TRX V** for high-speed conveyors: see page 87
- **Janus J LRH M12** with 80 m operating range, also available with integrated laser pointer: see page 94
- Two-hand control relay **AD SRT**: see page 182
- Emergency stop and safety gate monitoring relays **AD SRE4 - AD SRE4C** and **AD SRE3 - AD SRE3C**: see pages 183 and 184
- **FMC-SB** columns with pre-installed independent adjustable mirrors: see page 206
- **PSE** protective screen for EOS: see page 211
- **SFB 180E** swivel fastening brackets for EOS: see page 212

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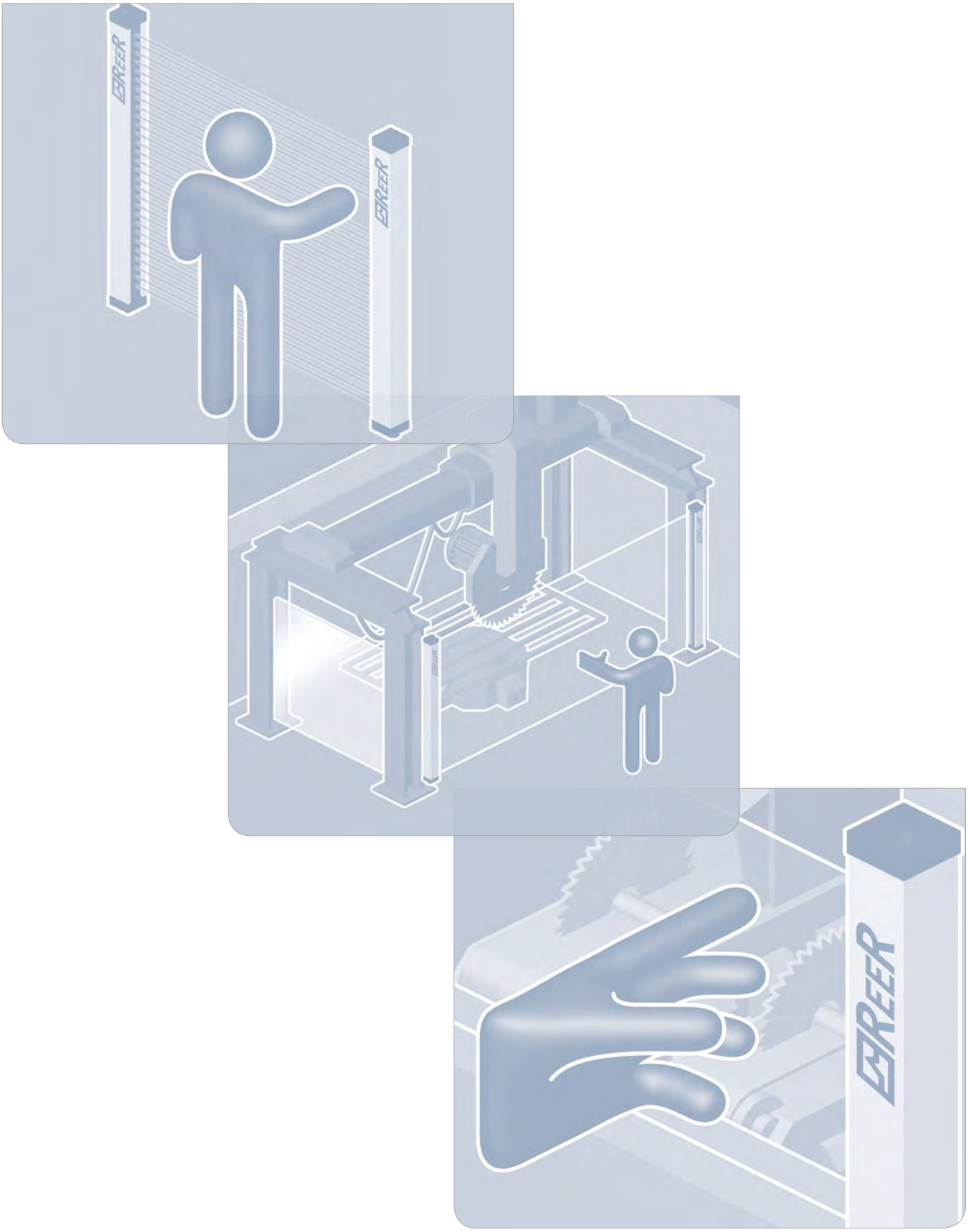


SAFETY IN THE WORKING ENVIRONMENT

INTERNATIONAL STANDARD

Many important changes have been introduced in regulations on safety of machinery, starting from 2010. In practice several of these have already had some impact since 2005 and 2006, when the overlap period began for Standards on safety-related machine control systems.

In particular, this concerns the crucial family of Standards under the umbrella of ISO 13849, and IEC 61508 which impacts safety of machinery especially through IEC 62061. Thus, important statistical concepts derived from process safety and related, in varying degrees, to probability of dangerous failure, are covered by machine safety, resulting in new classifications of safety-related control systems for machinery and protection devices. These include PLs (Performance Levels, for ISO) and SILs (Safety Integrity Levels, for IEC). PL and SIL come next to and in many ways replace the now familiar concept of Category featuring in the 'old' EN 954-1.

In 2008 IEC finished the second edition of IEC TS 62046, a specification providing guidelines on the use of safety sensors for machinery protection applications.

This is a novelty the impact of which will be felt worldwide. Moreover, a third edition is under development.

Looking nearer home in Europe, the new Machinery Directive 2006/42/EC is effective starting from December 29, 2009.

These and other developments are covered by the exacting and up-to-date introduction to this edition of our Safety Guide.

EUROPEAN DIRECTIVES

The aim of the EC Directives is to harmonize the national legislation of the Member States so as to have common regulations concerning technical, economic, social aspects, etc. and to facilitate the free circulation of goods, service and people within the European Union.

In particular, where the safety of workers is concerned, the harmonization of legal provisions has resulted in the formulation and approval of Directives and Standards of great importance.

DIRECTIVES Define the objectives to be achieved.

STANDARDS Define the means and methods by which to achieve the objectives established by the Directives.
A product/service that complies with the harmonized Standards is presumed to conform to the Directives.

Stages for the realization of a Standard:

- Creation of a Working Group (WG) made by experts of the subject to be treated, which represent the Member States
- Preparation of a draft version of the Standard (prEN) to be examined by the various national Committees involved, for comments, proposals and the subsequent final approval
- Drafting of the definitive formulation of the text of the Standard (EN), official publication, and acceptance by the individual Member States.

The Directives concerning the protection of workers are:

- 89/391/EC "Health and safety at work - Framework directive"
- 2009/104/EC "Use of work equipment" and amendments / additions

The Directives governing safety components are:

- 2006/42/EC "Machinery directive"
- 2006/95/EC "Low Voltage Directive"
- 2004/108/EC "Electromagnetic Compatibility Directive"

SAFETY IN THE WORKING ENVIRONMENT

SOCIAL DIRECTIVES

"Social Directives" 2009/104/EC and 89/391/EC, are aimed at the improvement of safety in working environment.

The Directives:

- Determine the preventive measures to be adopted in the working environment.
- Supply information on:
  - risk analysis
  - program of prevention and achievement of compliance of the machines
  - procedures concerning the compliance of machines
  - responsibilities of the employer
  - education and training of the people in charge of system operation.
- Imposes the adaptation of existing machinery in compliance with the provisions of the Machinery Directive.

THE MACHINERY DIRECTIVE

The "Machinery Directive" 2006/42/EC is meant for the manufacturers of machines and safety components, and has the following objectives:

- The definition of safety and health protection requirements for the improvement of the degree of protection offered to the operators of hazardous machinery
- The design, construction and marketing in the European Union of safety machines and components complying with the minimum safety requirements laid down by the Directive itself
- The free circulation in the Member States of machines and safety components complying with the Directive

The Machinery Directive:

- It applies to all new machines and safety components that are sold, lent or hired, and to used machinery in the event of sale, rental or loan
- It sets forth the essential safety requirements relating to the design and construction of machines and safety components and it defines the respective certification procedures
- It is mandatory for machines and for safety components. Only products conforming to the Directive can be marketed or commissioned in the European Union.

Certification procedures

The Directive:

- Lays down stringent procedures for safety components and highly hazardous machines which are listed in Annex 4
- Lays down simplified procedures for low and medium risk machines not included in annex 4
- Requires that manufacturers prepare a technical dossier for each product stating the safety principles adopted in the design, manufacture, transport, use and maintenance of the machine or the safety component.

Declaration of conformity

In order to certify the conformity of a product to the Directive, the manufacturer must:

- Affix the CE mark to the product
- Attach the CE declaration of conformity attesting compliance to the Directive.

SAFETY IN THE WORKING ENVIRONMENT

The Machinery Directive 2006/42/EC

MAIN OBJECTIVES OF THE REVISION

Clarity

- The list of products covered by the Directive is more explicit
- New product classes have been added
- Borderline relative to other Directives have been clarified
- Definitions have been improved.

Legal certainty

- The fourth Proviso states: “In order to ensure legal certainty for users, the scope of this Directive and the concepts relating to its application should be defined as precisely as possible”.

Improved applicability

- The criteria used for the nomination of Notified Bodies are more rigorous
- Market surveillance. The obligations of the Member States are defined more accurately
- Rules have been added for the withdrawal of dangerous products.

The conformity evaluation procedures have been revised

- It will no longer be possible to submit a technical file to a notified body without undergoing any verification of the content by the latter
- Internal inspection of manufacturing process (Annex VIII) is required for all conformity evaluation procedures. Responsibility for inspection lies with the manufacturer.

Note on the annexes listing dangerous machinery and safety-related components
Annex 4 - which lists dangerous machinery and safety-related components – also includes safety-related logic blocks (e.g. programmable control units, PLCs, etc.).
Annex 5 includes a non-exhaustive list of safety-related components.

SAFETY IN THE WORKING ENVIRONMENT

Certifications

- CE type examination certificates issued by notified bodies must be updated
- The CE type certificates is valid for 5 years (Annex IX para. 9.3), the five-year period starting from the revision date of the certificate.

LOW VOLTAGE DIRECTIVE

2006/95/EC is aimed at:

ensuring that electrical materials are designed and manufactured so as to guarantee the protection of people against any risk of injury arising from the use of such materials. This Directive applies to all electrical materials meant for use at a nominal voltage of between:

- 50V and 1000V for alternating current
- 75V and 1500V for direct current.

The last revision of the directive is in force starting from 16/01/2007.

ELECTROMAGNETIC COMPATIBILITY DIRECTIVE

The aim of "Electromagnetic Compatibility Directive" 2004/108/EC is to ensure that electrical devices are designed and manufactured so that:

- Electromagnetic emissions are limited and low enough to permit other electrical devices to operate according to their intended purpose
- The level of built-in immunity to external disturbances enables them to operate according to their intended purpose.

This Directive applies to all electrical and electronic devices able to cause electromagnetic disturbances and whose operation can be affected by external factors.

The last revision of the directive is in force starting from 20/01/2005

ATEX DIRECTIVE

Atex DIRECTIVE 94/9/EC applies to all products for use in explosive atmosphere.
The Directive specifies minimum safety requirements for electrical devices used in environments classified as dangerous regarding the aspect of risk of explosion from gas or dust.
The risk of explosion consists of three levels:

- Category 1 : maximum risk level (areas 0 and 20)
- Category 2 : high risk level (areas 1 and 21)
- Category 3 : risk level defined as "normal" (areas 2 and 22).

The ATEX Directive is in force since 1/07/2003.

SAFETY IN THE WORKING ENVIRONMENT

ACCREDITED BODIES

In each Member State, the role of the accredited Bodies is to assess and verify the compliance and the application of the Directives concerning machines and safety components.

Each State is responsible for the appointment and control of its own Bodies.

The Accredited Bodies must have the expertise and the resources which are necessary to perform their activities of inspection, analysis, technical support, measuring, etc.

NOTIFIED BODIES

Notified Bodies are authorized to examine and certify machines and safety components in compliance with the applicable Directives.

Each Member State of the European Union is required to:

- Appoint the Notified Bodies by specifying their tasks
- Submit a list of the Notified Bodies to the European Commission and to the other Member States.

The European Commission publishes a Directory of all the Notified Bodies on the Official Journal of the European Commission, together with a list of the services, the machines and/or the safety components on which they are authorised to intervene.

The Member States of the European Union must make sure that these Bodies respect specified ethical and technical criteria.

HARMONIZED STANDARDS

- They are technical Standards conceived to meet the essential requirements of the Directives
- They are written by the various technical committees on a mandate by the Commission of the European Union
- They are approved and adopted:
  - by the CEN (European Committee for Standardization)
  - or the CENELEC (European Committee for Electrotechnical Standardization)
- Then they are translated and published in the Official Journal of the European Committee and the Official Gazette of each Member State.

Status of the Standards

- **prEN...** a proposed standard (draft) which has not yet been definitely approved
- **EN...** an approved standard already in force
- **TS...** a technical specification.

The European Standards concerning safety are subdivided into 3 groups:

TYPE A STANDARDS
They specify the general design principles applying to all types of machine:
e.g... • **EN ISO 12100** Safety of machinery - General principles for design - Risk assessment and risk.

TYPE B STANDARDS
They are divided into two classes:
- type B1 Standards: concerning a specific aspect of safety
e.g... • **EN ISO 13855** Positioning of safeguards with respect to approach speeds of parts of the human body
• **EN ISO 13857 - 1** Safety distances for the protection of the upper limbs
• **EN 60204** Safety of machinery. Electrical equipment of machine
• **EN ISO 13849 - 1,2** Safety related parts of control systems.

SAFETY IN THE WORKING ENVIRONMENT

- type B2 Standards: concerning safety devices

e.g... • **EN 61496-1** Electro-sensitive protective equipment - general requirements and tests
- **EN 61496-2** Electro-sensitive protective equipment- Particular requirements for equipment using active optoelectronic protective devices (i.e. light curtains)
- **EN 61496-3** Electro sensitive protective equipment-Particular requirements for Active Optoelectronic Devices responsive to diffuse reflection (i.e. laser scanner)
- **EN ISO 13850** Emergency stop - Principles for design

TYPE C STANDARDS

They concern specific types of machine:

e.g... • **EN 692** Mechanical presses
- **EN 693** Hydraulic presses
- **EN 415** Packaging machines
- **EN 415-4** Palletising and de-palletising systems

- A type C Standard takes priority over type A and B Standards.
- If no C type Standards exist, compliance with the Directive can be attained on the basis of type A and type B Standards.

What is IEC TS 62046 – Application and integration of electrosensitive protection devices

IEC TS 62046 Ed. 2 - 2008, specifies recommendations for the installation and use of Electro-sensitive Protective Equipment (ESPE).
It applies mainly to Light Curtains, Laser Scanners, Borders and pressure–sensitive mats. Its purpose is to meet machinery manufacturers' and users' needs.
IEC TS 62046 specifies the precise positioning of electrosensitive devices relative to the machine and their correct interfacing with the machine rather than their construction. Its goal is to ensure that the risk for the operator is minimized through a correct selection and application of protection devices.
IEC TS 62046 details crucial aspects linked to the use of ESPEs, such as selection criteria, use, integration with the machine control system and also provides information on special functions of safety light curtains including Muting and Blanking.


NORTHERN AMERICAN STANDARD AND TEST BODIES

The Body overseeing health and safety in the workplace in the USA is the **Occupational Health and Safety Administration (OSHA)**. Individual States may have their own safety regulatory organizations which may enforce stricter regulations than OSHA.

OSHA oversees the application of laws and regulations in force at the Federal level, and in turn issues safety standards covering the use and construction of safety devices and/or machine tools.
An important example of such activity is Standard OSHA 1910.217 – Mechanical Power Presses.

The **American National Standard Institute (ANSI)** issues standards on the safety of machine tools or particular aspects of their construction or operation. For the preparation of these standards ANSI often relies on the contribution of non-profit organizations such as the **Robotic Industry Association (RIA)**, or the **Association for Manufacturing Technology (AMT)**.

Examples of major ANSI standards:

B11 standards, including:
B11.1 - Mechanical Power Presses
B11.2 - Hydraulic Power Presses
B11.3 - Power Press Brakes
B11.4 - Shears
B11.19 - Performance Criteria for the Design, Construction, Care and Operation of Safeguarding When Referenced by other B11 Machine Tool Safety Standards (design, construction, maintenance and operation criteria for protection devices specified in Std. B11 covering machine tools)

SAFETY IN THE WORKING ENVIRONMENT

Other ANSI standards:

B20.1 - Conveyor Belts
ANSI/RIA R15.06 - Safety Requirements for Industrial Robots.

Contrary to Europe, North America does not accept a certificate of conformity as an approval to sell and install electrical equipment.

Prior to installation the device or system in question must be inspected by the Authorities Having Jurisdiction (AHJ).
If the device in question is already listed by a Nationally Recognized Testing Laboratory (NRTL), the competent authority is dispensed from inspecting the product. The mark of a NRTL assures product conformity to safety standards in force.

Although not mandatory in North America, certification facilitates marketing as retailers, inspectors, users and local authorities readily approve any product bearing a NRTL mark. Certified installations enjoy advantages in terms of insurance benefits and freedom from potential industrial disputes, as workers unions might prevent members from operating non-certified, and therefore possibly dangerous, machinery.

OSHA is the body authorized to approve NRTLs.
NRTLs shall obtain approval for all national and foreign facilities for all products for which they are authorized to award certification. To obtain accreditation, the applicant shall also, but not only, prove to be independent of any users, suppliers or retailers of the products for which certification is sought.
NRTLs may develop and apply for approval of its own developed standards or adopt standards produced by other NRTLs.
Each NRTL has its own unique mark.

Underwriters Laboratories Inc. (UL) is a leading NRTL among those authorized to issue certification of electrical systems and equipment.

UL is a non-profit organization listing industrial components which have been tested and proven to be safe and reliable in terms of electrical safety and fire resistance.

UL Listed Certification Mark means that the product in question was tested and verified to be in line with USA safety requirements.
UL Listed General Mark certifies conformance to fire resistance and electrical safety requirements.

UL certification also includes components such as safety light curtains which are covered by Std. UL 61496-1 and Std. UL 61496-2 derived from international Std. **IEC 61496-1,2**. Systems incorporating safety software can be also certified as per Std. ANSI/UL 1998. Safety light curtains (ESPE) are covered by a specific marking certifying compliance with the appropriate product standard and with Std. **ANSI/1998**. Reer safety curtains are in line with all these requirements and bear the associated mark of approval.

UL may also certify conformity to CSA Canadian Standards (through C-UL mark or C-UL-US mark for products to be marketed in Canada and in the USA).

The **Canadian Standard Association (CSA)** is the main Canadian standardization body and acting certification authority competent for verification of conformance of safety components to Canadian regulations.
As Nationally Recognized Test Laboratory (NRTL) for the USA, CSA is authorized to verify conformance of all products under OSHA jurisdiction and award the CSA mark of NRTL/C, equivalent to C-US UL, which applies for example to safety light curtains.

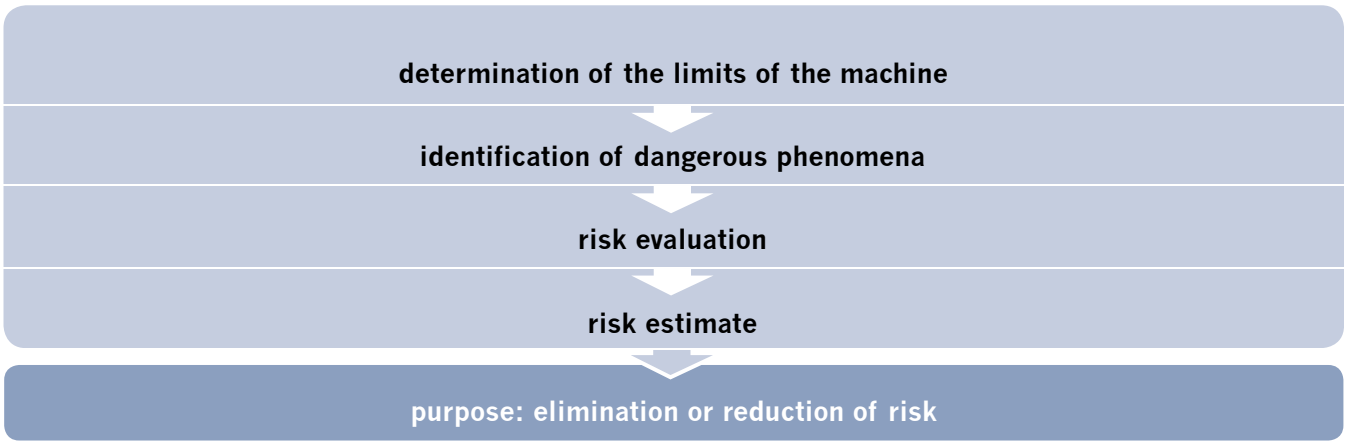
SAFETY IN THE WORKING ENVIRONMENT

RISK ASSESSMENT

The European Standard **EN ISO 12100** puts forward a systematic procedure for the examination of the hazards associated with machinery with the aim of selecting and adopting the most suitable safety measures to reduce or eliminate the risks.

For USA an equivalent procedure is described in the **ANSI Technical Report B11.TR3**.

The risk assessment can thus be broken down into 4 stages:



1. Determination of the limits of the machine
Consists in the examining of the intended use and of all the reasonably foreseeable misuses in relation to the level of training, experience and attitude of the user.

2. Identification of the hazards
Consists in the listing of:
- The risks and the hazardous elements (mechanical, electrical, chemical, etc.)
- Hazardous situations (manual loading-unloading, access to the system, etc.)
- Events that might cause damages (machine failures or anomalies).

During all phases of the machine life cycle up to the decommissioning and dismantling.

3. Risk estimation
Each hazardous situation identified is derived from a combination of the following elements:
- Severity of injuries or damage to health (reversible, irreversible, fatal)
- Probability of occurrence of that injury, which is a function of frequency and duration of exposure to danger
- Possibility of avoiding danger with reference to:
  - rapidity of occurrence of the event,
  - possibility by the operator to perceive hazards and react promptly,
  - possibility to escape.

4. Risk evaluation
Following the risk estimation a risk evaluation is required to determine if a risk reduction is necessary or whether safety has been achieved. If risk reduction is required, the protective measures selected and applied shall be evaluated to determine if an adequate risk reduction has been achieved.

SAFETY IN THE WORKING ENVIRONMENT

SAFETY-RELATED CONTROL SYSTEM FOR MACHINERY

Where safety is based on the proper operation of the machine control system, it shall be designed so that to ensure a minimal probability of functional errors. Otherwise, any errors shall not lead to the loss of the safety function.
In Europe, to meet these requirements it is highly recommended to use the harmonized standards developed by mandate of the European Commission (assumption of conformity).
In the event of an accident, using the harmonized standards saves extra time and costs where proof of conformity of the safety-related control system to the essential requirements of the Machinery Directive shall be demonstrated.
Given hereunder are the basic concepts of the new standards ISO 13849-1 and IEC 62061 which supersede EN954-1 as regulatory instruments covering machine control systems.

The old EN 954-1 Safety Related Parts of Control Systems, Part 1: General principles for design.

Up to December 31, 2011, safety-related parts of the machine control system designed according to Std. EN 954-1 shall be acceptable. As from 31st December 2011, compliance with Std. ISO 13849-1 or IEC 62061 will be mandatory.

Standard **EN 954-1** is harmonized since 1996. The safety-related control system is classified in five Categories.

Safety categories

For different parts of the machine the risk evaluation may lead to different levels. Therefore, the degree (category) of safety actions to be taken shall depend on the actual risk involved in each part.

To select the optimum category in relation to actual risk, use shall be made of the well-known risk graph.

Selection of the Categories

S Severity of injury
S1 Slight injury (usually reversible).
S2 Serious injury (usually irreversible) or death.

F Frequency and duration of exposure to hazard
F1 Seldom to more often and/or short exposure.
F2 Frequent to continuous and/or long exposure duration.

P Possibility of Avoiding hazard
P1 Possible under certain conditions (escape or action by others).
P2 Hazard almost unavoidable (occurs quickly).

■ Suitable category
□ Oversize category
▪ Possible category, but together with additional protection

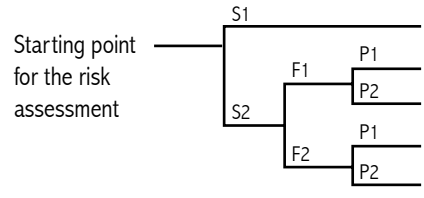


TABLE FOR CATEGORY SELECTION

Categories				
B	1	2	3	4
▪	■	□	□	□
▪	■	■	□	□
	▪	■	■	□
	▪	▪	■	□
	▪	▪	▪	■

For Cat. B and Cat.1 the ability to resist failure is due to robustness of components (avoid failures as far as possible).
For Cat. 2,3,4 the ability to resist failure is due to the system structure (control of the failure).
Failure is controlled through cycle monitoring for Cat.2, redundancy for Cat.3 , redundancy plus monitoring for Cat.4.

Operational requirements are specified for each Category.
The failure modes of the electric components are defined and listed.
The relationship among Categories and the safety performance of the control system in case of failure is well defined (deterministic approach).

Note: Categories are not necessarily totally hierarchical.

SAFETY IN THE WORKING ENVIRONMENT

CATEGORY	REQUIREMENTS	BEHAVIOUR	SAFETY PRINCIPLES
B	Devices designed, manufactured and combined in compliance with the reference Standards so as to be able to cope with foreseeable events.	A fault may result in the loss of the safety functions.	Use of selected components.
1	Same requirements as for category B, but with the use of reliable and well-tested safety principles and components.	A fault may result in the loss of the safety functions, but with lower probability than in category B.	
2	The requirements of category 1 apply. Moreover: the safety function of the device is based on cyclic control managed by the control system of the machine.	A fault may result in the momentary loss of the safety function. The fault is detected when performing the test before starting the next working cycle, and the start of a new machine cycle is disabled.	Use of structures and safety circuits able to detect the fault and stop the machine.
3	The requirements of category 1 apply. Moreover: a single fault shall not lead to the loss of the safety function. Whenever possible, the individual fault must be detected.	Not all faults can be detected. When an individual fault occurs, the safety function is always active. The build up of undetected faults may result in the loss of the safety function.	
4	The requirements of category 1 apply. Moreover: a single fault shall not result in the loss of the safety function. An individual fault is detected before or at the time of the request for the safety function. If this is not possible, the build up of faults shall not lead to the loss of the safety function.	Fault detection shall occur in time to prevent the loss of the safety function.	

Restricted use of EN 954-1

System behavior upon failure cannot be the only way to assess the performance of the safety-related control system.
Other factors, such as component reliability, may have an important, even crucial, role.
Such concept is recognized in Std. EN 954-1 stating that (Annex B) “component reliability and the technology used in the application concerned may result in deviation from the Category envisaged.”
The Category selection process should be as follows:

- Identify the nominal or reference Category based on risk analysis (through risk graph)
- Modify selection of Category based on component reliability, technology used, etc.

SAFETY IN THE WORKING ENVIRONMENT

Phase two of the process is mainly empirical, and little information is given in the Standard.
Category is almost invariably selected referring to the risk graph disregarding changes due to other factors, or the changes introduced are subjective to the point where proving system safety becomes difficult.

Also, the extensive use of programmable electronics in the field of machine control systems has further highlighted the shortcomings of the deterministic model, impracticable for complex control systems, i.e. systems which use PLCs, communication lines, variable-speed actuators and programmable sensors.
To evaluate the safety-related performance of a complex system it is better to estimate its probability of being able to provide protection when needed. Or, in other words, estimate the probability of occurrence of a dangerous failure in a given period of time considering component reliability.

The new Standards

To offset the applicability limitations of Std. EN 954-1 two new standards were adopted, namely ISO 13849-1:2006 and IEC 62061:2005 which combine probability and known deterministic concepts to cope with technological progress in the field of industrial machinery.

Both these standards are harmonized to Directive 2006/48/EC regarding the following mandatory safety requirement:

Annex I : 1.2 Controls systems

The two Standards exhibit a number of differences and overlaps, especially as regards the application criteria.

ISO 13849-1 may be used regardless of the type of technology and power used, i.e. mechanical, hydraulic, pneumatic, electric.
It applies only to the five designated architectures.

IEC 62061 applies only to electric powered control systems.
Subsystem reliability calculation formulas are given only for the four types of architecture specified therein and considered typical of industrial machinery, but may be applied also to other architectures.
It allows the integration of subsystem designs in line with the requirements of ISO 13849-1: 1999 (EN 954-1).

ISO 13849-1 Safety Related Parts of Control Systems, Part 1: General principles for design.

ISO 13849-1 is a revised version of EN 954-1

The complex mathematical formulas of the system reliability theory were replaced with pre-calculated tables.

Some concepts of EN 954 were retained, i.e. categories, redundancy, monitoring.

A number were modified, i.e. risk graph, selection of Categories.

The role of Categories is no longer crucial as in EN 954-1.

To assess the resistance to dangerous failure, the Category concept is replaced by Performance Level (PL) as the ability of the safety-related machine control system (hereinafter called SRP/CS) to assure protection in specified operating conditions.

The parameter used to evaluate the PL of the safety-related system is the Average probability of dangerous failure/hour.
A failure is considered to be dangerous where it inhibits the system protection function if undetected.

There are 5 levels, PLa to PLe.

SAFETY IN THE WORKING ENVIRONMENT

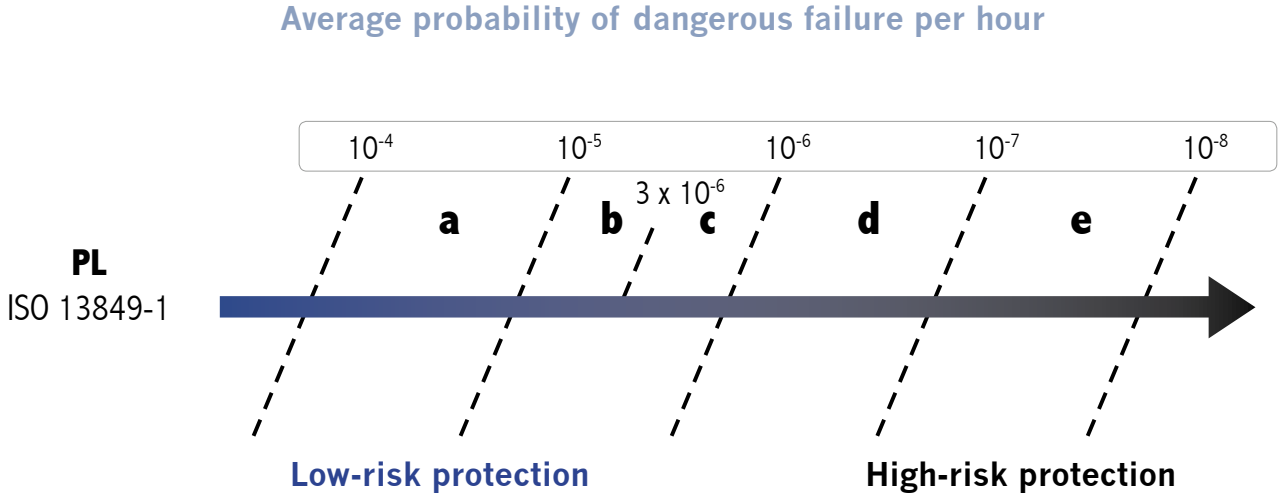


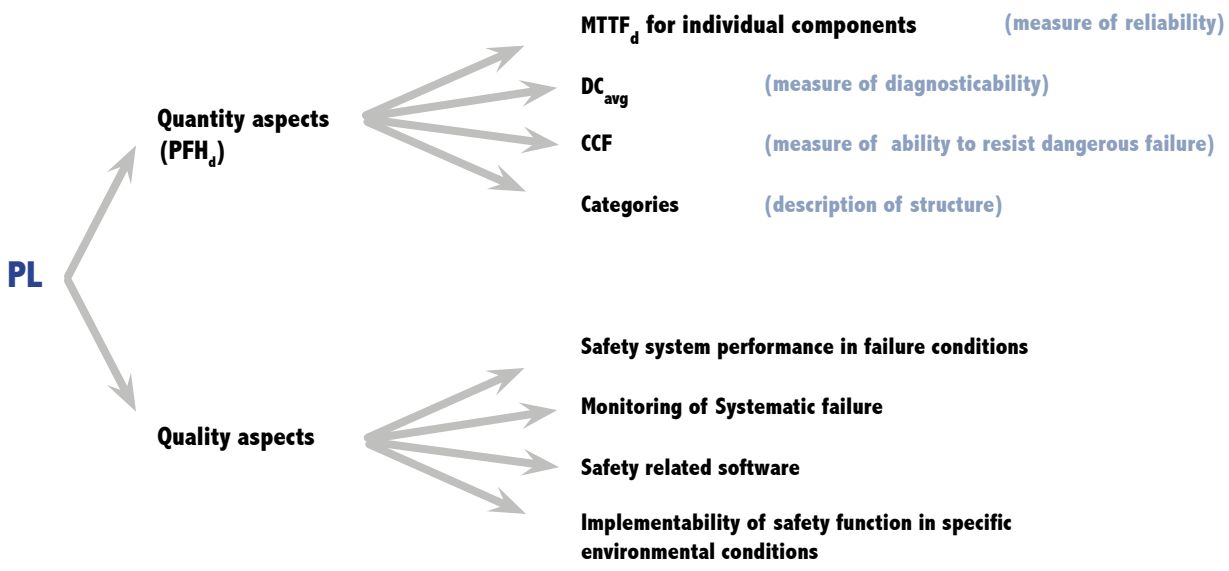
Table 3 of ISO 13849-1

The greater the contribution to reducing risk the lower the **Average probability of dangerous failure/hour**.

PL is a function of control system architecture, component reliability, ability to promptly detect internal failure potentially affecting the safety function and quality of the design.

The table below summarizes mandatory qualitative and quantitative requirements to be met for safe control system design to ISO 13849-1.

See also glossary on page 26



SAFETY IN THE WORKING ENVIRONMENT

To claim a given PL, in addition to evaluating the Average probability of dangerous failure/hour for the control system in question, it will also be necessary to prove compliance with quality requirements specified by the standard.

The claimed PL must be validated using ISO 13849-2 Safety Related Parts of Control Systems - Validation defining procedures tests andanalysis, for the assessment of:
- Safety function provided
- Category attained
- Performance level reached.

IMPORTANT!

Average Probability of Dangerous Failure/Hour is only one of the parameters contributing to assignment of PL.
To obtain a PL rating, it is also mandatory to prove and substantiate having considered and complied with all requirements, including:
- Monitoring of systematic failures
- Using robust and reliable components (in line with Product Standards if available)
- Working according good engineering practice
- Considering environmental conditions in which the safety-related system will operate
- In the case of new software, adopting all organizational aspects of V-type development model shown in Figure 6 of the Standard ISO 13849-1 and meeting development requirements for applications and built-in SW.

Design of an SRP/CS as per ISO 13849-1 may be summarized in the following eight steps

1 – Identification of safety-related function through risk analysis
2 – Assignment of Performance Level requested (PLr) through risk graph
3 – Selection of system structure (architectures) and self-diagnostic techniques
4 – Technical development of control system
5 – Calculation of $MTTF_d$, DCavg and verification of CCF
6 – Calculation of PL using Table 5
7 – Verification of PL (if calculated PL is below PLr return to Step 3)
8 – Validation.

Identification of safety related item and assignment of Performance Level required - PLr

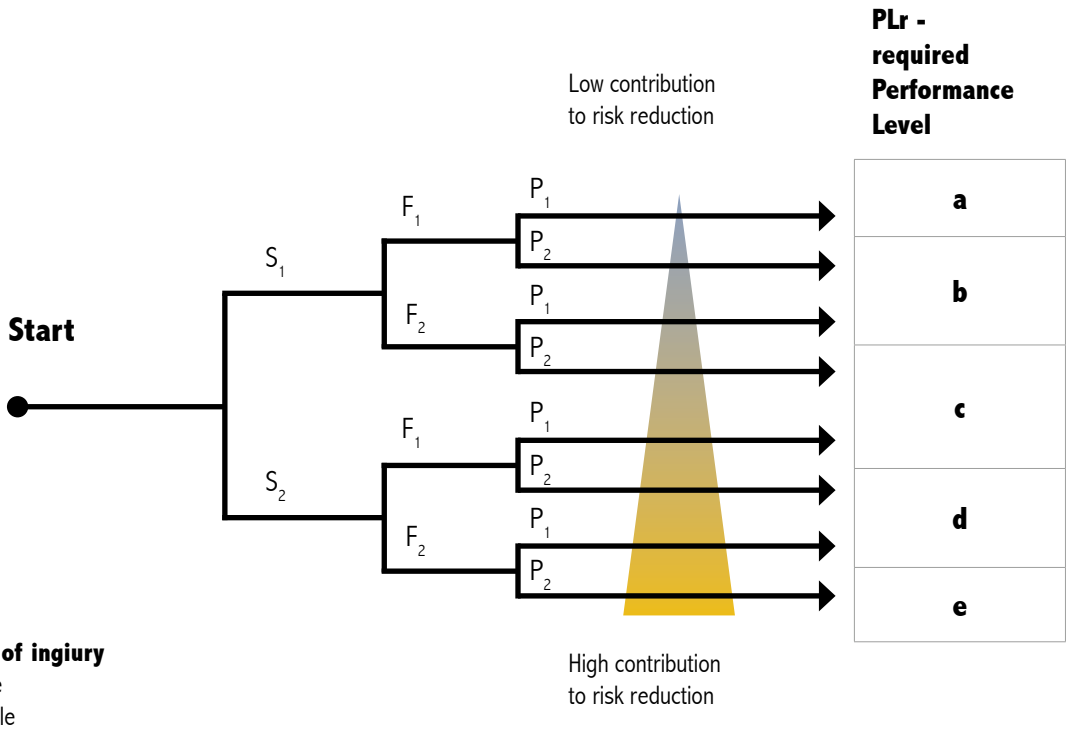
Identification of the safety function and assignment of the Performance level required- PLr.
For each safety-related function identified the designer of the SRP/CS decides the contribution to reduction of risk to be provided, i.e. PLr.
This contribution does not cover overall machine risk but only the part of risk related to the application of the safety function in question.

Parameter PLr represents the Performance Level required for the safety-related function in question.
Parameter PL represents the Performance Level of implementation hardware.
PL of hardware must be equal to or higher than specified PLr.

A tree type graph of decisions is used to find the contribution to risk reduction that must be provided by the safety-related function, leading to univocal identification of PLr.

If more than one safety-related function are identified, PLr shall be identified for each of them.

SAFETY IN THE WORKING ENVIRONMENT



S severity of ingiury
S1 reversible
S2 irreversible

F frequency or time exposure to hazard
F1 rare / short
F2 continuous / prolonged

P avoidable risk or limitation of damage
P1 avoidable within given conditions
P2 almost unavoidable

Note: contrary to EN954-1 as regards Categories, here PLrs are totally "hierarchical".
PLr(e) provides the greatest contribution to risk reduction, whereas PLr(a) makes the lowest contribution.

Design of the safety related control system and evaluation of the PL

After deciding on the PLr needed, a suitable SRP/CS is designed, calculating the resulting PL and ensuring that it is higher than or equal to PLr.

Fig. 3 shows that, to obtain the PL, the Average probability of dangerous failure/hour of the SRP/CS designed must be calculated

The Average probability of dangerous failure/hour for a safety-related control system may be estimated in various ways.

Using such methods implies that for each components the following are known:

- Failure rate (λ)
- Percent distribution of failure rate for all component failure modes, (e.g. if for a positive action switch the failure modes are: the contact will not open when required = 20% of cases and the contact will not close when required = 80% of cases. Gives: will not open = λ x 0,2 will not close = λ x 0,8)
- The effect of each failure on safety-related system performance, (e.g. dangerous failure = λd, or non-dangerous failure = λs)
- Percent of dangerous failures detected (by automatic self-diagnostic techniques implemented) out of total dangerous failures: λdd = λd x DC.
- Percent of dangerous failures not detected (by automatic self-diagnostic techniques implemented) out of total dangerous failures: λdu = λd x (1-DC).

SAFETY IN THE WORKING ENVIRONMENT

ISO 13849-1 simplifies calculation by providing a table based on Markov modeling in which average probability of dangerous failure per hour is pre-calculated for various Category combinations and range values of $MTTF_d$ and DCavg which are in turn obtained using tables.

Denotations of $MTTF_d$	Range of $MTTF_d$
Low	3 years ≤ $MTTF_d$ < 10 years
Medium	10 years ≤ $MTTF_d$ < 30 years
High	30 years ≤ $MTTF_d$ < 100 years

Denomination DCavg	Range of values DC / DCavg
None	DC < 60%
Low	60% ≤ DC < 90%
Medium	90% ≤ DC < 99%
High	99% ≤ DC

The problem is thus reduced to: selecting the architecture, calculating DCavg in relation to self-diagnostic techniques implemented, calculating simplified $MTTF_d$ of circuit designed and verifying compliance with requirements for independent channel operation (CCF) for redundant architectures (Cat. 2, 3 and 4).

The combination of Category plus DCavg adopted, is shown in one of the seven columns of fig. 5 of ISO 13849-1. Calculated $MTTF_d$ determines which part of the column is to be considered. Corresponding PL is shown on the left of the table.

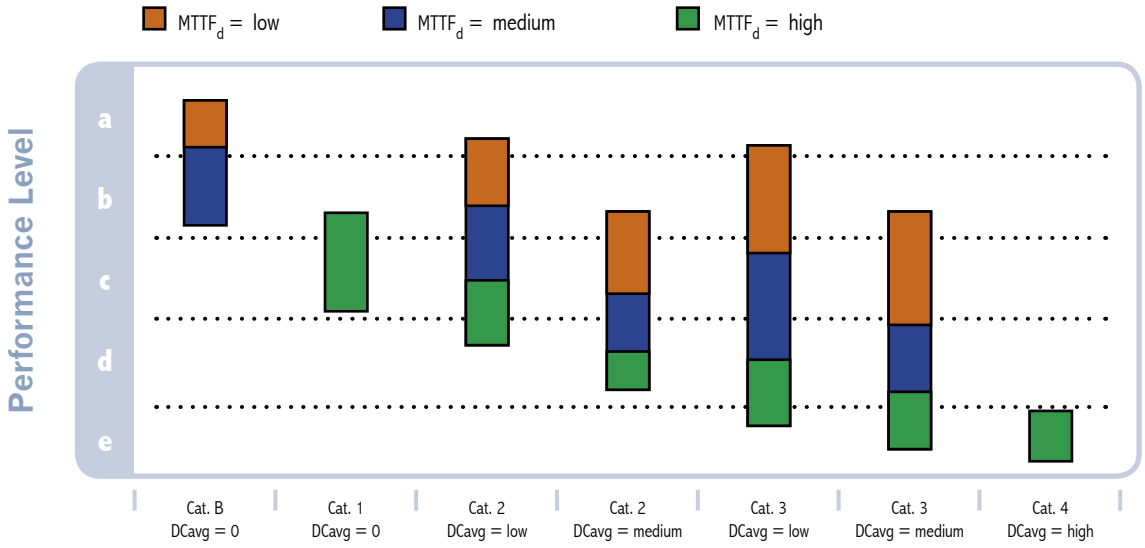


Fig. 5 of ISO 13849-1

The part of column selected may include two or three possible values of PL, e.g. for Cat. 3, DCavg = Medium and $MTTF_d$ = Low, the following three values are possible: PLb, PLc, PLd. In these cases, to obtain the correct PL use is made of Table K.1 of Annex K of the Standard (not shown) providing detailed values of Average probability of dangerous failure per hour and PL in relation to actual value of $MTTF_d$ and the combination Category-plus-DCavg implemented.

The Standard may be adopted only if the control system is designed using one (or more) of the five architectures specified.
Each architecture corresponds to one of the Categories defined in EN 954-1.

For systems designed to EN 954-1, category selection is directly linked to risk through the risk graph.
ISO 13849-1 is more flexible, as several options are available for each Performance Level specified.
An example is given in Table 5 where for a system having PL of "c" the following five alternatives are possible:

1. Category 3 with $MTTF_d$ = Low and DCavg medium.
2. Category 3 with $MTTF_d$ = Medium and DCavg low.
3. Category 2 with $MTTF_d$ = Medium and DCavg medium.
4. Category 2 with $MTTF_d$ = High and DCavg low.
5. Category 1 with $MTTF_d$ = High.

SAFETY IN THE WORKING ENVIRONMENT

Combination of several SRC/PS to achieve the overall PL

The safety-related function may include one or more SRP/CSs, and several safety-related function may use the same SRP/CSs.
Individual SRP/CSs could also be obtained using other architectures.
Where the safety-related function is obtained by a series connection of several SRP/CSs, e.g. safety light curtains, control logics, power output, and for each of these the PL is known, the Standard provides a simple method for calculating overall PL.

Locate the part with PL = PL low
Find the number of parts having PL = PL low
Enter data in the following table to obtain total PL

PL (low)	n (low)		PL
a	> 3	→	-
	≤ 3	→	a
b	> 2	→	a
	≤ 2	→	b
c	> 2	→	b
	≤ 2	→	c
d	> 3	→	c
	≤ 3	→	d
e	> 3	→	d
	≤ 3	→	e

The PL obtained using this table refers to reliability values at mid-position for each of the intervals in Table 3 of ISO 13849-1.

Example:

We have: **PL low = d** **N low = 1 (< 3)**

Therefore: **PL total = d**

and average probability of dangerous failure per hour for the entire system will be a number somewhere between 1 x 10^{-6} and 1 x 10^{-7} (see Table 3 of ISO 13849-1).

IEC 62061 Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control system.

IEC 62061 is derived from IEC 61508 – Functional safety of safety-related electric/electronic/programmable electronic control systems.

IEC 61508 is the international reference standard on functional safety of electric, electronic and programmable electronic systems. The Standard consists of seven sections. The first three sections specify the safety requirements for hardware and software, the rest are of an informative nature and offer support for the correct application of the former.

IEC 62061 retains the features of IEC 61508, but simplifies safety requirements (of both hardware and software) adapting them to the specific needs of industrial machinery.
Safety requirements are considered only for "high demand mode", i.e. request of the safety function more than once per year.

The standard is based on two basic concepts:

- Management of Functional Safety
- Safety Integrity Level.

SAFETY IN THE WORKING ENVIRONMENT

Management of Operational Safety

Specifies all design aspects needed to attain the required level of functional safety, from assignment of safety requirements to documentation, design management up to validation.

Each design shall have its own Functional Safety Plan properly written, documented and duly updated as necessary.

The Functional Safety Plan shall identify people, functions and resources needed for design and implementation of the safety system.

Safety Integrity Level (SIL)

Methodology and requirements is given for:

- specifying functional requirements of each safety-related function to be implemented
- assigning the Safety Integrity Level (SIL) for each safety-related function envisaged
- allow the design of a SRECS suitable for the safety-related function to be implemented
- validating the SRECS.

SIL assignment

For SIL assignment use the method of Annex A (although the Standard also accepts the techniques of IEC 61508-5).

For each risk identified the following must be assessed:

- Degree of severity (Se) of possible damage
- Frequency and time (Fr) of exposure to danger
- Probability of dangerous event (Pr) linked to machine operating mode
- Avoidability (Av) of danger. The more difficult to avoid danger the higher the number representing avoidability.

The following table, extracted from the form in Figure A.3 of the Standard IEC 62061, will help in obtaining the SIL to be assigned to the safety–related function.

Consequences	**Severity Se**	**Class Cl**					**Frequency and duration Fr**		**Probability of hazardous event Pr**		**Avoidance Av**	
		4	5-7	8-10	11-13	14-15						
Death, losing an eye or arm	4	**SIL 2**	**SIL 2**	**SIL 2**	**SIL 3**	**SIL 3**	≥ 1 hour	5	Very high	5		
Permanent: losing fingers	3		**OM**	**SIL 1**	**SIL 2**	**SIL 3**	< 1 hour - ≥ 1 day	5	Likely	4		
Reversible: medical attention	2			**OM**	**SIL 1**	**SIL 2**	< 1 day - ≥ 1 2 weeks	4	Possible	3	Impossible	5
Reversible: first aid	1				**OM**	**SIL 1**	< 1 2 weeks - ≥ 1 1 year	3	Rarely	2	Possible	3
							< 1 1 year	2	Negligible	1	Probable	1

OM (Other Measures) = The use of other parameters is recommended.

The sum of marks obtained for attributes of frequency, probability and avoidability provides the probability class of danger:

Cl = Fr + Pr + Av

To obtain the SIL align actual Cl to level of severity (Se) identified.

This is an iterative process. In fact, depending on the protective action undertaken, some parameters might change, e.g. Fr or Pr, in which case the SIL assignment process will have to be repeated using new values for changed parameters.

Three levels are envisaged: **SIL 1**, **SIL 2**, **SIL 3**.

SAFETY IN THE WORKING ENVIRONMENT

Average probability of serious failure per hour (PFH_d)

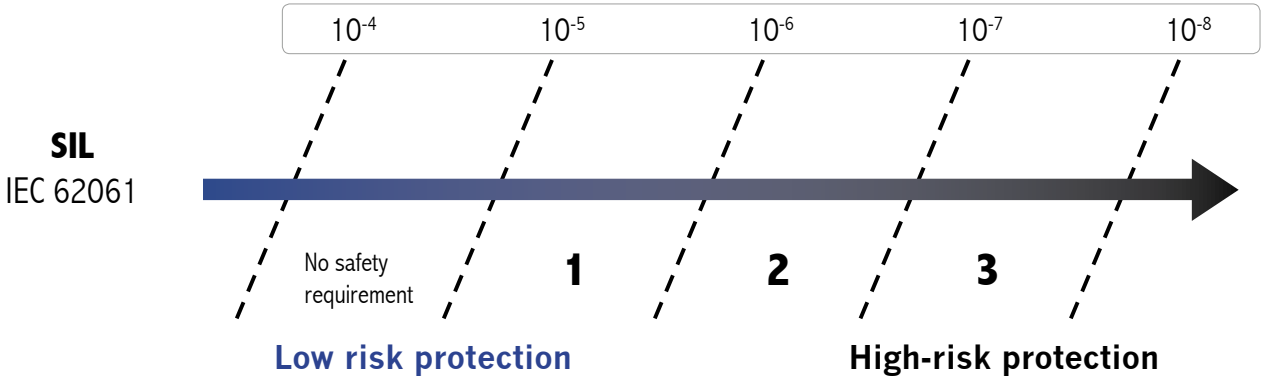


Table 3 of IEC 62061

Thus, the SIL represents the safety level to be assigned to a SRECS for attainment of its safety integrity in the operating conditions and all the way through the time specified .
The parameter used to define the SIL (Safety Integrity Level) is the probability of dangerous failure/hour (PFH_d).
The higher the SIL, the lower the probability of the SRECS not performing as safely as expected.

The SIL must be defined for each safety-related function resulting from risk analysis.

Development and design process

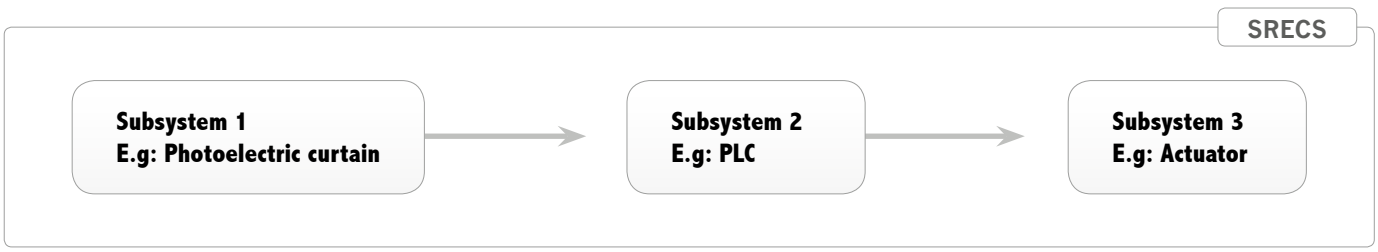
Each safety-related function identified through risk analysis shall be described in terms of:

- Operational requirements (mode of operation, cycle time, environmental conditions, response time, type of interface with other components or items, EMC level, etc.)
- Safety requirements (SIL).

Each safety-related function shall be broken down into functional blocks, e.g. functional block of input data, functional block of logic data processing, functional block of output data.

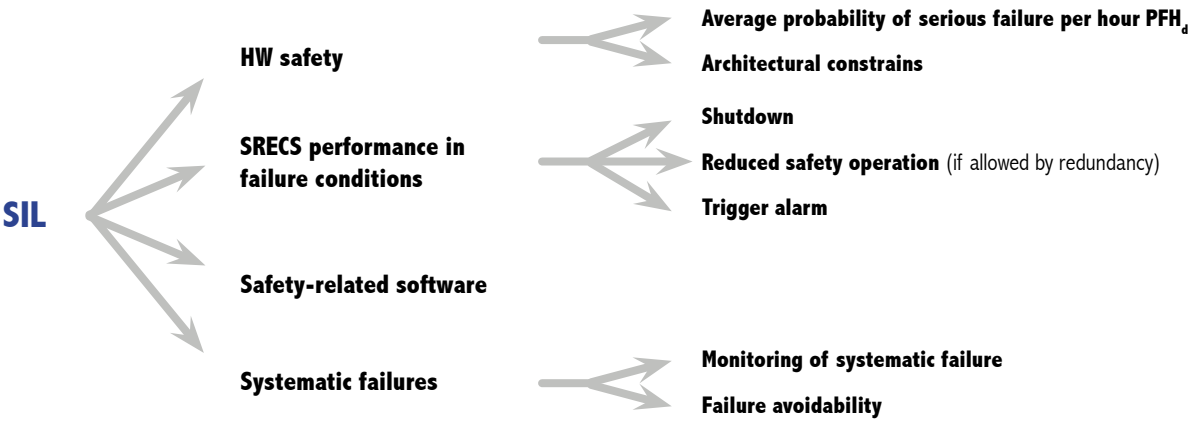
A subsystem is associated with each functional block.
In turn, subsystems will consist of electrical components interconnected with one another. Electrical components are known as subsystem elements.

Implementation of the SRECS technique will result in a typical architecture as shown (in this instance access control through photoelectric curtain)



SAFETY IN THE WORKING ENVIRONMENT

For SRECS to comply with identified operational and safety requirements, the following requirements shall be met:



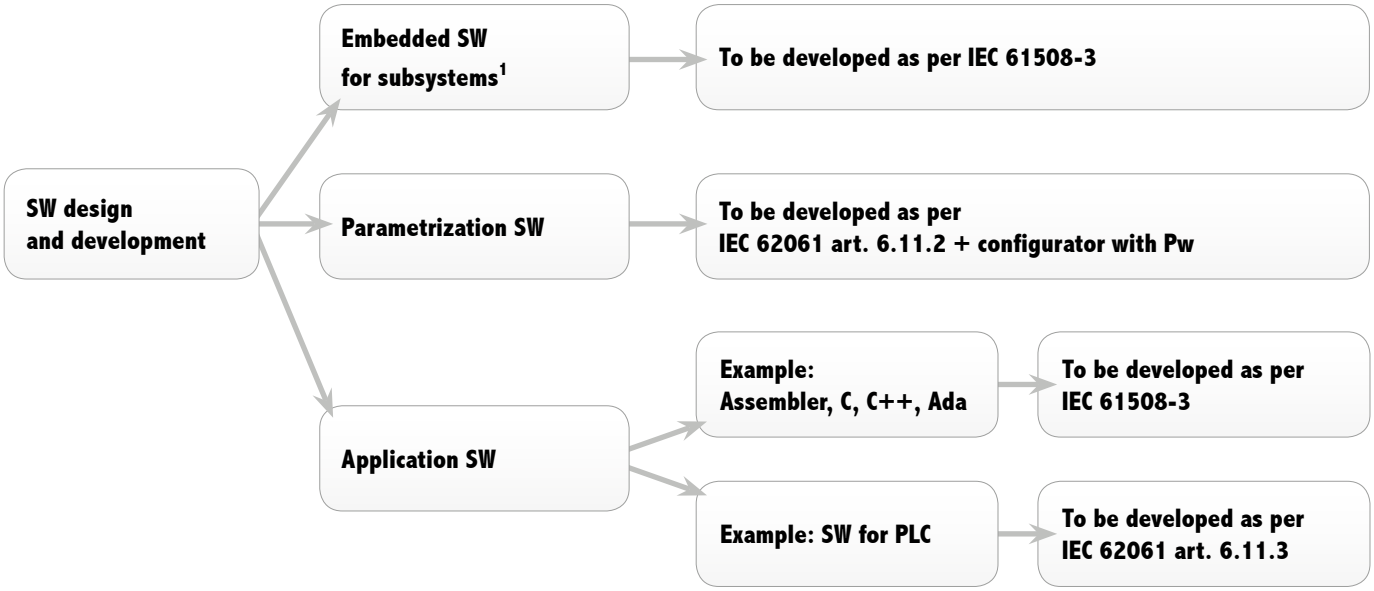
Each subsystem shall consist of electrical circuits suited to attain the required SIL.

The maximum SIL attainable by a subsystem is identified as SILCL (SIL claim).

Subsystem SILCLs depend on PFH_d, architecture constraints, performance under failure conditions and on the ability to control and avoid systematic failure.

Safety-related software

For software design, the code must be developed as per reference standards depending on the type of software in question as follows:



Nota 1: Safety-related PLCs, safety bus, actuators, safety light curtains and in general all complex safety-related devices with integral programmable logics and embedded software, if used to build a SRECS, shall comply with the requirements of the appropriate Product Standards (if applicable) and with IEC 61508 as regards functional safety.

SAFETY IN THE WORKING ENVIRONMENT

IMPORTANT!

The probability aspect is only one of the elements contributing to assignment of SIL.
To claim a specific SIL applicants must prove and document having:

- Adopted adequate management actions and techniques to attain the required level of operational safety
- In place a documented and up-to-date Operational Safety Plan
- Avoided systematic failure as far as possible
- Evaluated (through inspections and tests) safety system performance in actual environmental conditions
- Developed the software after adopting all organizational aspects required.

Calculation of subsystem PFH_d

To calculate subsystem PFH_d select first the type of architecture (structure). The Standard suggests four pre-defined architectures, providing a different simplified formula for each of them.
This calculation requires the use of the following parameters:

λ_d = Dangerous failure rate of each subsystem element. Obtained from its known failure rate λ, percent distribution of failure rate for all failure modes and analysis of subsystem performance after failure (Dangerous Failure = λd or Non-dangerous Failure = λs).

T1 = Proof Test. Proof test interval (external inspection and repair returning the system to as-new condition) for industrial machinery usually coincides with life time (20 years).

T2 = Test interval of the diagnostic functions. Depending on design or devices used the diagnostic functions can be executed by internal circuitry of the same SRECS or by other SRECSs..

DC = Diagnostic Coverage:
Parameter representing the percent of dangerous failures detected out of all possible dangerous failures.
DC depends on self-diagnostic techniques implemented.
Assuming that failure is always possible (otherwise there would be no point in defining λ), that mechanisms for detecting failures are not necessarily all equally effective and responsive (depending on type of failure some may take longer), that it is impossible to detect all failures, that suitable circuitry architectures and effective testing may permit detection of most dangerous failures, a DC parameter may be defined for estimating the effectiveness of implemented self-diagnostic techniques.
IEC 62061 does not provide data for obtaining DC in relation to implemented diagnostic techniques. However, data of IEC 61508-2 Annex A may be used.

β = Common cause failure factor. Provides a measure of the degree of independence of operation of redundant channel systems.

Having calculated subsystem PFH_d by means of the formulas from the IEC 62061, it is important to ensure that the associated SILCL obtained from Table 3 of IEC 62061 (see page 21) is compatible with the constraints imposed by the architecture as the maximum SILCL attainable by a given subsystem is restricted by the hardware fault tolerance of the architecture and by SFF as listed in the following table

Safe failure fraction (SFF)	Hardware fault tolerance		
	0	1	2
SFF < 60%	Not allowed	SIL 1	SIL 2
60% ≤ SFF < 90%	SIL 1	SIL 2	SIL 3
90% ≤ SFF < 99%	SIL 2	SIL 3	SIL 3
SFF ≥ 99%	SIL 3	SIL 3	SIL 3

Table 5 of IEC 62061

SAFETY IN THE WORKING ENVIRONMENT

Subsystem safety failure fraction (SFF) is, by definition, the fraction of overall failure rate not involving dangerous failure

$$SFF = (\Sigma\lambda s + \Sigma\lambda dd) / (\Sigma\lambda s + \Sigma\lambda dd + \Sigma\lambda du).$$

λdd (failure rate of detectable dangerous failures) and λdu (failure rate of undetectable dangerous failures) are obtained from known effectiveness of implemented diagnostic techniques.

If PFH_d and SILCL of each subsystem are known, it will be possible to calculate the overall SIL of SRECS.

The overall probability of dangerous failure/hour of SRECS will equal the sum of the probabilities of dangerous failure/hour of all subsytems involved and shall include, if necessary, also the probability of dangerous failure per hour (PTE) of any safety-related communication lines:

$$PFH_D = PFH_{D1} + \ldots + PFH_{DN} + P_{TE}$$

Known the PFH_d, the resulting SIL of the SRECS is obtained from Table 3.
The SIL shall than be compared to the SILCL of each subsystem, as the SIL that can be claimed for the SRECS shall be less or equal to the lowest value of the SILCL of any of the subsystems.

Example:

$$\mathbf{PFH_d(system) = PFH_d\ (ss1) + PFH_d\ (ss2) + PFH_d\ (ss3) + P_{TE} = 5{,}56x10^{-7}/h}$$

$$\mathbf{SIL = 2}$$

Where a subsystem involves two or more safety-related functions requiring different SILs, the highest SIL shall apply.

CONCLUSIONS

The procedures specified in ISO 13849-1 simplify the estimation of Average Probability of Dangerous Failure per Hour compared to IEC 61508, offering a pragmatic approach more in line with the needs of the machine tool industry.

By retaining Categories and other basic concepts, such as safety-related function and risk graph, seamless continuity with EN 954: 1996 is assured.

Maintaining a closely linear approach with EN 954-1:1996 however, shows the limits of ISO 13849-1 / EN 954-1. Where the adoption of complex technology is anticipated , e.g. programmable electronics, safety-related bus applications, different architectures, etc., it will be more appropriate to design to IEC 62061.

Where devices and/or subsystems designed in accordance with ISO EN 13849-1:1999 are used, Std. IEC 62061 shows how to integrate them in SRECS.

SAFETY IN THE WORKING ENVIRONMENT

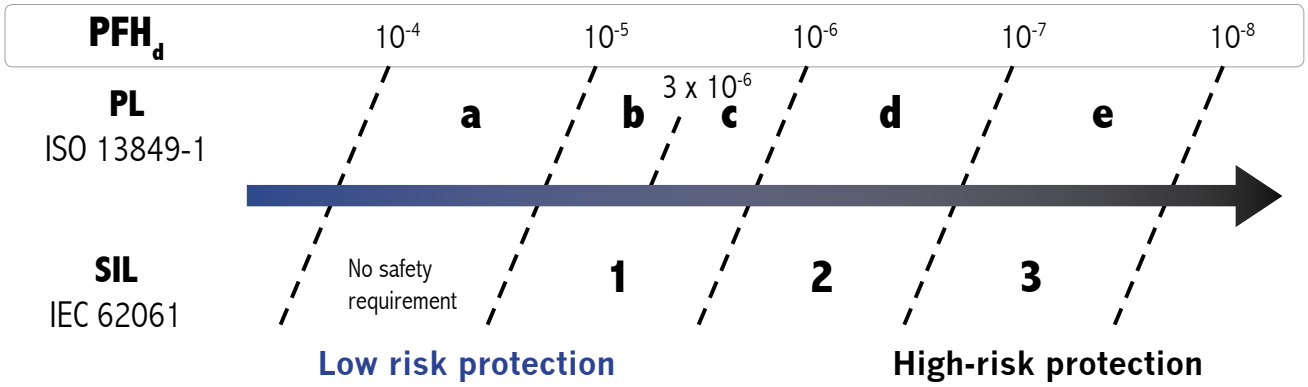
A precise bi-univocal equivalence between PL and SIL cannot be identified.
However, the probabilistic side of PL and SIL can be compared as they use the same concept, namely the Average Probability of Dangerous Failure per Hour, to define the extent to failure resistance.

Also, although the probability concept used in the two Standards is the same, the result may differ as the rigor of calculation is not the same. In fact, for evaluating PFH_d, IEC 62061 specifies a procedure based on formulas derived from the system reliability theory. The results may in some cases, e.g. reduced number of components, high-efficiency of self-diagnostic techniques implemented, turn out to be very low, i.e. very good. To simplify and speed up evaluation of Probability of Dangerous Failure per Hour, ISO 13849-1 uses approximation tables which must necessarily consider worst case scenarios, with consequently higher results, i.e. inferior to, than those calculated using IEC 62061.

Therefore, extra care must be exercised when calculating overall PL of a serial system such as the following:

If the resulting Probability of Dangerous Failure per Hour for the entire system is calculated as the sum of the PFH_d values of the parts computed by means of IEC 62061 and not using the calculation procedure as per ISO 13849-1, the limitations imposed to the parts by the categories which restrict max. PL attainable to that actually specified by ISO 13849-1 (see Table 5 of the Standard) must be taken into account.
Otherwise, a higher than actual system PL could result.

The following table may be used as a general guideline, noting that the ranges of Probability of Dangerous Failure per Hour should be compared, not the actual values of SIL and PL.



SAFETY IN THE WORKING ENVIRONMENT

Glossary

Initials	Definition	Standard	Description
β (Beta)	Common cause failure factor	IEC 62061	Degree of operational independence of channels of a multi-channel system. Ranging from 0.1 to 0.01 depending on CCF attained.
λ (Lambda)	Failure rate	IEC 62061	Random failure frequency. The time-random failure frequency of a component is usually known as Failure Rate, described as number of failures per unit of hour. Its inverse is known as Mean Time Between Failures (MTBF), expressed in hours. Random failures are the result of sudden stress accumulation above maximum design strength of a component. May occur at random intervals and entirely unexpectedly. Frequency of failure over sufficiently long periods is virtually constant. PFH_d calculation methods given in both Standards refer only to the assessment of random failures. The unit of measure for failure rate is FIT (Failure In Time) equivalent to one failure per billion of operating hours (F=1 means one failure every 109 hours).
λs	Safe failure rate	IEC 62061	Failure rate for non-dangerous failures. Non-dangerous failures which have no adverse safety-related effect on control system. The control system continues to ensure protection.
λd	Dangerous failure rate	IEC 62061	Failure rate of failures which may involve dangerous operation. Dangerous failures prevent the control system from continuing to provide protection.
λdd	Dangerous detected failure rate	IEC 62061	Failure rate for detectable dangerous failures. Detectable dangerous failures may be detected by automatic self-diagnostic systems.
λdu	Dangerous undetected failure rate	IEC 62061	Failure rate for undetectable dangerous failures. Undetectable dangerous failures cannot be detected by internal automatic self-diagnostic systems. They determine the value of PFH_d and, consequently, the value of SIL or PL.
Cat.	Category	ISO 13849-1	The Category is the main parameter to consider to attain a given PL. Describes the SRP/CS performance in relation to its ability to resist failure and resulting performance in failure conditions. Five Categories are envisaged depending on structural positioning of components.
CCF	Common Cause Failure	ISO 13849-1 IEC 62061	Failure resulting from common causes. Failure resulting from one or more events causing simultaneous malfunction of channels of a multi-channel system. Provides a measure of the degree of independence of redundant channel operation. Assessed by assigning marks. Maximum possible score is 100.
DC	Diagnostic Coverage	ISO 13849-1 IEC 62061	Reduced probability of dangerous hardware failure due to automatic self-diagnostic system operation. A measure of system effectiveness in promptly detecting its own possible malfunction. Expressed as 60% to 99%.
$MTTF_d$	Mean Time to dangerous Failures	ISO 13849-1	Average operating time, expressed in years, to potentially dangerous random failure (not generic failure). May refer to a single component, or to a single channel, or to the entire safety-related system.
PFH_d	Probability of dangerous Failure /Hour	IEC 62061	Average probability of dangerous failure per hour. Quantitative representation of risk reduction factor provided by the safety-related control system.
PL	Performance Level	ISO 13849-1	Level of performance. In ISO 13849-1, the extent to which failures are controlled is assessed using the Performance Level concept (PL). Represents SRP/CS ability to perform a safety-related function within predictable operating conditions. There are 5 levels, PLa to PLe. PLe represents the highest level of risk reduction, PLa the lowest level.

SAFETY IN THE WORKING ENVIRONMENT

Initials	Definition	Standard	Description
PLr	Performance Level required	ISO 13849-1	Level of performance required. Represents the contribution to risk reduction by each safety-related part implemented in SRP/CS. PLr is obtained using the risk curve.
SIL	Safety Integrity Level	IEC 62061	Level of integrity of a safety-related function. Discrete level (one of three) used to describe the ability of a safety-related control system to resist failure as per IEC 62061, where level 3 assures the highest protection and level 1 the lowest.
SILCL	SIL CLaim	IEC 62061	Max. SIL attainable by a subsystem in relation to architecture and ability to detect failure.
SRP/CS	Safety Related Parts of Control Systems	ISO 13849-1	Part of machine control system able to maintain or achieve machine safety status in relation to the status of certain safety-related sensors.
SRECS	Safety Related Electrical, electronic and programmable electronic Control System	IEC 62061	Electrical, electronic and programmable electronic control system the failure of which immediately increases the risk factor associated with machine operation.
T1	Proof test interval	IEC 62061	Interval of proof test. The Proof Test is an external manual inspection for detecting component failure and performance decay, undetectable by internal self-diagnostic systems. The unit of measure is time (months or, more usually, years).
T2	Diagnostic test interval	IEC 62061	Test interval of self-diagnostic functions. Time elapsed between one test for the detection of possible internal failure and the next. Tests are carried out in automatic mode by dedicated circuitry which may be internal to the SRECS in question or may belong to other SRECSs. The unit of measure is time (milliseconds to hours).
SFF	Safe Failure Fraction	IEC 62061	Fraction of overall failure rate which does not involve dangerous failure. Represents the percentage of non-dangerous failures relative to total number of failures of the safety-related control system.

PHOTOELECTRIC SAFETY LIGHT CURTAINS

CHARACTERISTIC ELEMENTS

Light curtains are electro sensitive devices using one or more light beams, emitted by an Emitter and received by a Receiver, to create an intangible controlled area. Fundamental characteristics are:

• Safety type

- defines the self-monitoring and safety principles contained in the device
- it must be chosen as a function of the risk level characterising the machine

When the chosen safety device is a photo-electric barrier (**AOPD** Active Optoelectronic Protective Device), the latter shall necessary belong to **TYPE 2** or **TYPE 4** as established by the International Standard **IEC 61496 1-2**.

NOTE: why "Type" and not "Category"?

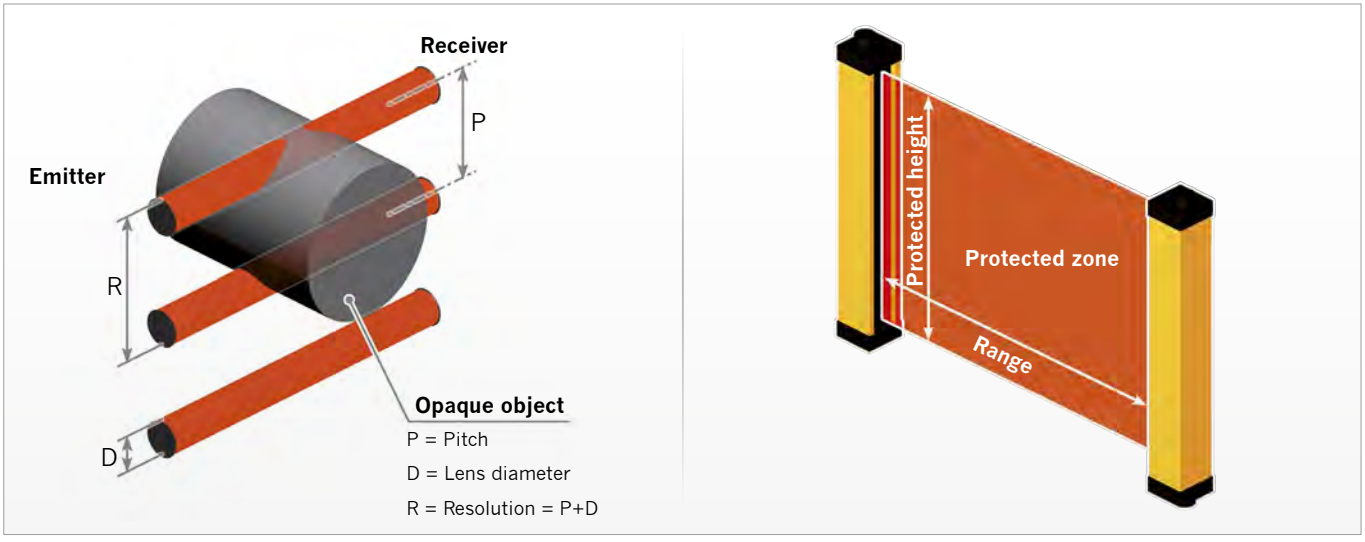
When talking about light curtains and laser scanners, we normally refer to their "safety type"; while for all other safety devices the term of choice is "safety category". This distinction is due to the International Standard IEC 61496, in which the term "type" is introduced to determine the safety level of optoelectronic protective equipment. In practice, "type" adds some optical requirements to the requirements which define categories for non-optical safety devices. Therefore, a type 2 light curtain is a light curtain which complies with the requirements for category 2 safety electronics and furthermore whose beams have certain characteristics, among which a given aperture angle, immunity to light interference and so on. The same applies for type 4 light curtains and type 3 laser scanners.
"Type" can be used in the same way as "category" is used to determine which device should fit into a given protection circuit. For example, a type 2 light curtain connected with a category 2 control system forms a category 2 protection circuit. If the control system is category 3, a type 2 light curtain will downgrade it to category 2, while a type 4 light curtain or a type 3 laser scanner will keep it in category 3. Only a type 4 light curtain will keep a category 4 safety circuit in category 4.

• Resolution

The resolution of a light curtain is the minimum size of an object that, placed into the controlled area, will obscure the controlled zone and hence stop the hazardous movement of the machine.

- Single beam light barriers: their resolution **R** is the same as the diameter of the lens
- Multibeam light curtains: their resolution **R** is the same as the sum of the lens diameter + the distance between two adjacent lenses.

R = D
R = P+D



• Protected height

This is the height controlled by the light curtain.
If it is positioned horizontally, this value shows the depth of the protected zone.

• Range

This is the maximum working distance that may exist between the emitter and the receiver. When deflection mirrors are used, it is necessary to take into account the attenuation factor introduced by each of them, which it is about 15%.

• Response time

This is the time it takes for the light curtain to transmit the alarm signal from the time the protected zone is interrupted.

PHOTOELECTRIC SAFETY LIGHT CURTAINS

ADVANTAGES OF LIGHT CURTAINS

- Effective protection in the event of fatigue or distraction of the operator.
- Increase in the productive capacity of the machine as the light curtain does not require the manual handling of physical guards or waiting for them to open.
- Faster machine loading/unloading operations.
- Reduced times of approach to the working areas.
- Elimination of the risk of tampering since any irregular intervention on the light curtain stops the machine.
- Simple and quick installation, with greater flexibility of adjustment on the machine, even in the case of subsequent repositioning.
- Possibility to build up large sized protections, either linear or along a perimeter, on several sides, at greatly reduced costs.
- Facilitated and fast maintenance of the machine, as there is no need to remove physical guards, such as grids, gates, etc.
- Improved appearance and ergonomic effectiveness of the machine.

CONDITIONS OF USE

For the photoelectric safety protections to be effective, it is necessary to verify that:

- It must be possible to electrically interface them to the control unit of the machine.
- It must be possible to stop the hazardous movements of the machine at once. In particular, it is important to know the machine stopping time to place the light curtain at the correct distance.
- The time taken to reach the hazardous point must be greater than the time necessary to stop the hazardous movement.
- The machine must not create secondary dangers due to the projection or fall from above of materials. If this danger exists, additional protections of a mechanical nature have to be provided.
- The minimum size of the object to be detected must be equal to or greater than the chosen light curtain resolution.

PHOTOELECTRIC SAFETY LIGHT CURTAINS

SELECTION CRITERIA OF A SAFETY LIGHT CURTAIN

1.Definition of the zone to be protected.

2. Definition of the parts of the body to be detected:
- fingers or hands
- approaching body of a person
- presence of a person in a hazardous area

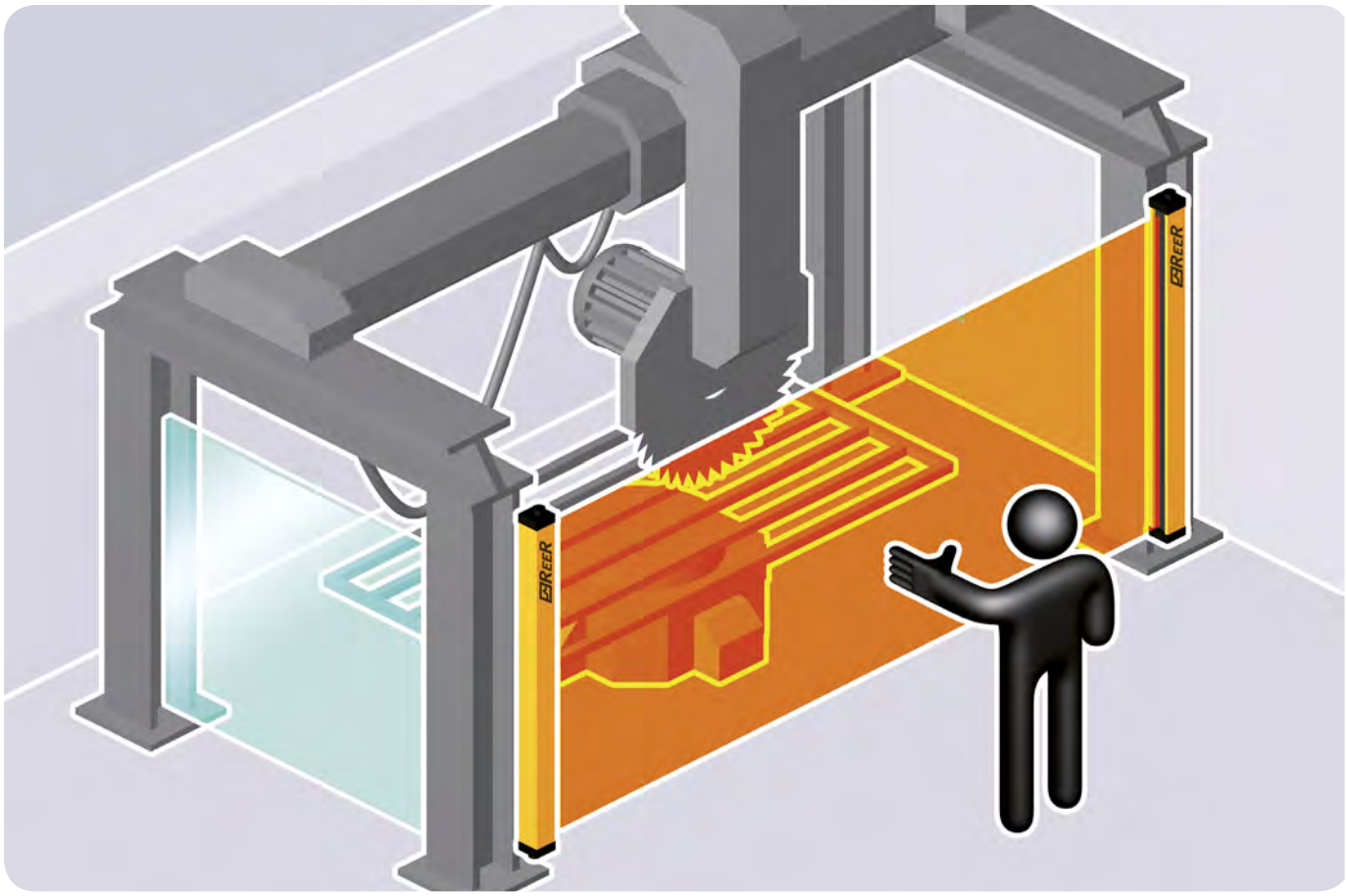
3. Definition of the safety distance between the light curtain and the hazardous point.

4. Definition of the safety category Level/Type to be adopted according to ISO 13849-1, IEC 62061, IEC 61496

Definition of the zone to be protected

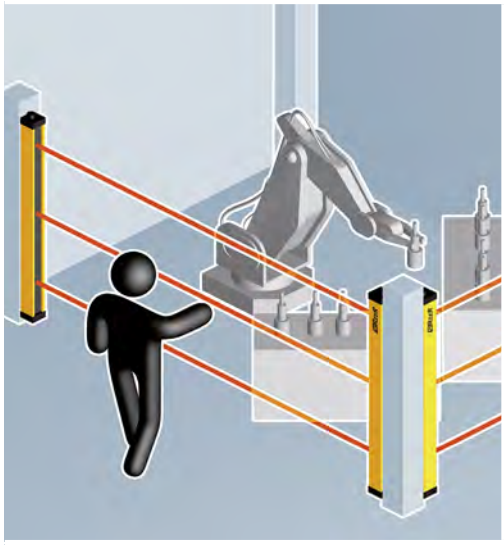
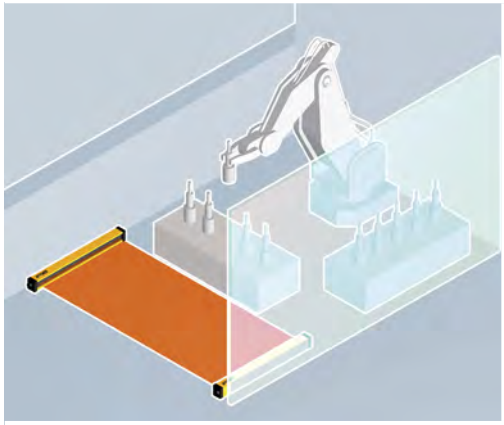
- Take into account the configuration of the zone:
  - shape and dimensions: width and height of the access area
  - positions of hazardous parts
  - possible access points
- The light curtain must be positioned so as to prevent the access to the dangerous area from above, from below, and from the sides without having intercepted the field protected by the light curtain.

It is possible to install one or more deflection mirrors in order to protect areas with access from several sides. This results in a considerable reduction in costs, as this solution eliminates the need of installing many separate light curtains.



PHOTOELECTRIC SAFETY LIGHT CURTAINS

DEFINITION OF TYPE OF DETECTION

	DETECTION	CHARACTERISTICS	ADVANTAGES
	**Finger or hand**	Detection necessary when the operator must work close to the danger. Barrier resolution must be less than or equal to 40 mm.	Possibility to lower the dimensions by reducing at the top the space between the protection and the dangerous zone. Short time for machine charging and discharging. Less operator fatigue, more productivity.
	**Body** (use as *trip device*)	Ideal detection for access control and protections of several sides, also for long scanning distances. The barrier must be placed at least at 850 mm from the danger. Barrier normally composed by 2-3-4 beams.	Protection costs reduced by the restricted number of beams. Possibility to protect zones with big dimensions by using deflection mirrors. See note below
	**Presence in a dangerous zone**	Detection realized by positioning the light curtains horizontally to control continuosly the presence of an object in a definite zone. The light curtains resolution depends on the height of the detection plane, anyway it cannot be higher than 116 mm.	Possibility to control zones not visible from where the machine's push button controls are located.

Note: Accidental start-up of the machine shall not be possible when anyone crosses the sensitive area and stays undetected in the dangerous area. Suitable ways of eliminating this type of risk include the following:

- Use of start / restart-interlock function positioning the command so that the dangerous area is in full view and so that the command cannot be reached by anyone from inside the dangerous area
- The Restart command has to be safe in compliance with IEC 61496-1
- Use of additional presence sensing detectors for the detection of the operator inside dangerous area
- Use of obstacles preventing the operator from remaining undetected in the space between the sensing zone of the protective device and the dangerous area.

PHOTOELECTRIC SAFETY LIGHT CURTAINS

DETERMINATION OF THE SAFETY DISTANCE

The effectiveness of the protection depends greatly on the correct positioning of the light curtain with respect to the danger.
The light curtain must be located at a distance greater than or equal to the minimum safety distance, S, so that reaching the dangerous point will be possible only when the dangerous action of the machine has been stopped.

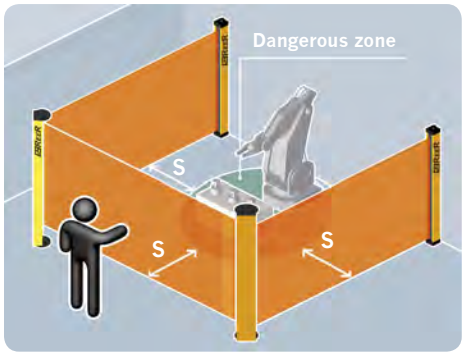
The light curtain must be positioned so that:
- It is impossible to reach the dangerous point without going through the zone controlled by the light curtain.
- A person cannot be present in the dangerous zone without his/her presence being detected. To this end, it might be necessary to resort to additional safety devices (i.e..: photoelectric light curtains arranged horizontally).

European Standard **EN ISO 13855** provides the elements for the determination of the safety distance.

If the machine in object is governed by a specific C type Standard, the latter shall be taken into due account.

If the distance **S** determined in this manner is too big, it is necessary:
a) to reduce the total stopping time of the machine,
b) to improve the detection capability (resolution) of the light curtain.

One-side protection



Three-side protection using deflection mirrors

GENERAL FORMULA FOR THE DETERMINATION OF THE MINIMUM SAFETY DISTANCE

$$S = K \times T + C$$

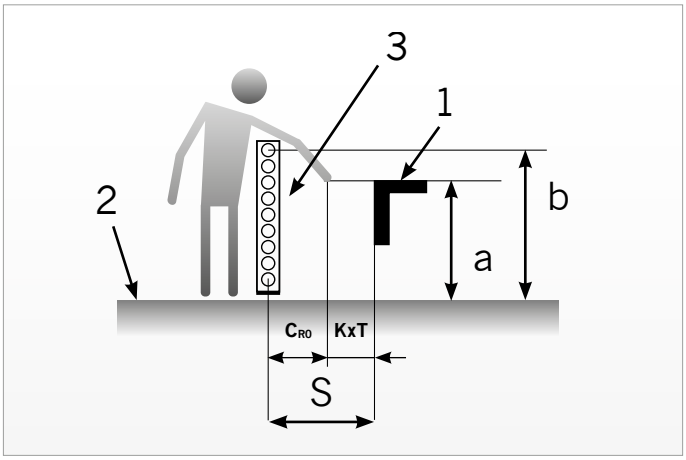
S	minimum safety distance between the protection and hazardous point, expressed in mm.
K	speed of approach of the body or parts of the body, expressed in mm / sec.
T	total stopping time of the machine, consisting of: t1 reaction time of the protective device in seconds t2 reaction time of the machine in seconds, until it stops the hazardous action.
C	additional distance in mm.

PHOTOELECTRIC SAFETY LIGHT CURTAINS

C takes into account:

1. Possible intrusion of parts of the body in the sensitive area before they are detected.
   In this case:
   - C = 8 x (d-14) If **D** (light curtain resolution) <= 40 mm
   - C = 850 If **D** (light curtain resolution) > 40 mm and for 2 - 3 - 4 beam light curtains
   - C = 1200 - (0,4 x H) for horizontal light curtains

2. Eventuality that the dangerous point is reached by leaning over the upper edge of the sensitive area of a vertical light curtain.
   In this case C is obtained from Table 2 of EN ISO 13855.



1 = Dangerous area **2** = Reference plane **3** = Light curtain

Height of Hazard zone **a**	Height **b** of upper edge of area protected by photoelectric curtain											
	900	1000	1100	1200	1300	1400	1600	1800	2000	2200	2400	2600
	Alternative distance **C_{RO}**											
2600	0	0	0	0	0	0	0	0	0	0	0	0
2500	400	400	350	300	300	300	300	300	250	150	100	-
2400	550	550	550	500	450	450	400	400	300	250	100	-
2200	800	750	750	700	650	650	600	550	400	250	-	-
2000	950	950	850	850	800	750	700	550	400	-	-	-
1800	1100	1100	950	950	850	800	750	550	-	-	-	-
1600	1150	1150	1100	1000	900	800	750	450	-	-	-	-
1400	1200	1200	1100	1000	900	850	650	-	-	-	-	-
1200	1200	1200	1100	1000	850	800	-	-	-	-	-	-
1000	1200	1150	1050	950	750	700	-	-	-	-	-	-
800	1150	1050	950	800	500	450	-	-	-	-	-	-
600	1050	950	750	550	-	-	-	-	-	-	-	-
400	900	700	-	-	-	-	-	-	-	-	-	-
200	600	-	-	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-	-	-	-

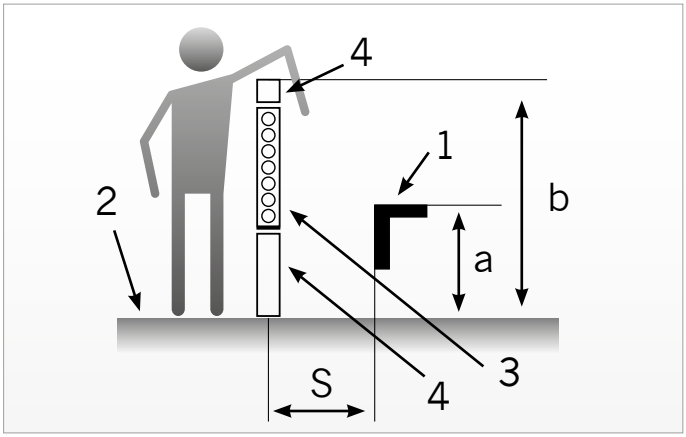
Table 2 of ISO 13855/EN 999

- Interpolation is not allowed
- If distances a, b or C fall between values listed in the table, use the higher
- C_{RO} (reaching over) calculated using Table 2 of EN ISO 13855 must be compared to C as conventionally calculated (see paragraph 1). Always select the higher value.

PHOTOELECTRIC SAFETY LIGHT CURTAINS

For combined mechanical and electrosensitive protections (as shown), calculate parameter C as per Table 1 (for low-risk applications) or Table 2 (for high-risk applications) of ISO 13857:2007, here not mentioned, because in this case it is possible to lean on to the mechanical protection.

1 = Dangerous area
2 = Reference plane
3 = Light curtain
4 = Mechanical protection



When calculating the safety distance, also consider installation tolerances, accuracy of the measured response time and possible decay of the brake system performance of the machine.

Where brake system decay is possible, use a stopping performance monitor device (SPM).

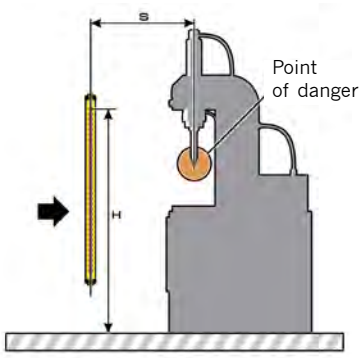
PHOTOELECTRIC SAFETY LIGHT CURTAINS

DETERMINATION OF THE SAFETY DISTANCE

DIRECTION OF APPROACH PERPENDICULAR TO THE PROTECTED PLANE WITH α=90° (± 5°)

Light curtains with resolution equal to or lower than 40 mm for the detection of hands and fingers

D≤40



S=2000xT+8x(D-14)

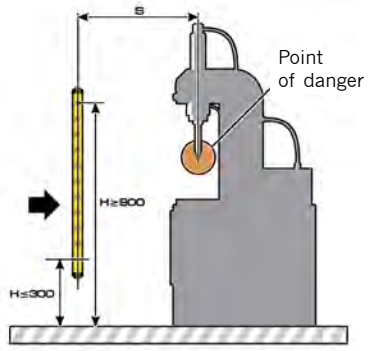
if **S**>500 then

S=1600xT+8x(D-14)

- The distance **S** must not be lower than 100 mm.
- If the distance **S** is greater than 500 mm it is possible to re-calculate the distance through the following formula.
- In these circumstances, the distance must in no case be lower than 500 mm.

Light curtains with a resolution greater than 40 mm and less than 70 mm for detection of arms and legs.

40<D≤70

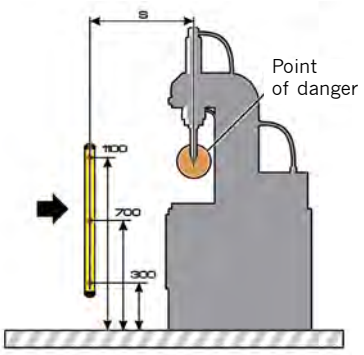


S= 1600xT+850

- The height of the lowermost beam must be equal to or lower than 300 mm.
- The height of the uppermost beam must be equal to or higher than 900 mm.

Light grids for body detection through access control with a resolution of over 70 mm.

D>70



S= 1600xT+850

Number and height of the beams

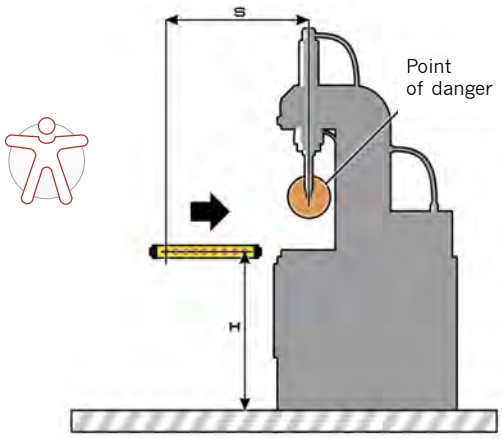
N.	Recommended height
2	400 - 900 mm
3	300 - 700 - 1100 mm
4	300 - 600 - 900 - 1200 mm

PHOTOELECTRIC SAFETY LIGHT CURTAINS

DETERMINATION OF THE SAFETY DISTANCE

DIRECTION OF APPROACH PARALLEL TO THE PROTECTED PLANE WITH α=0° (± 5°)

Horizontal light curtains for presence control in a dangerous area.

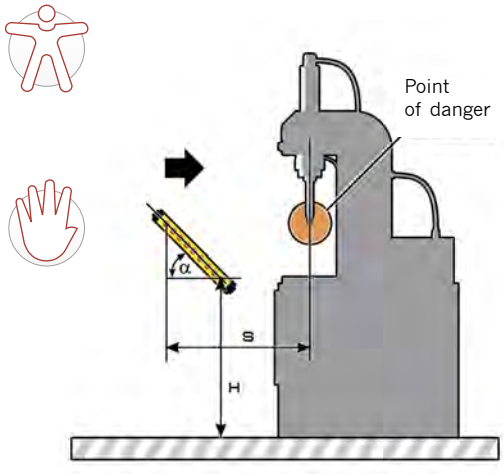


S=1600xT+(1200-0,4xH)

- 1200 - (0,4 x H) must be equal to or greater than 850 mm.
- The height H depends on the resolution D of the light curtains and is determined through the following formula:
  H = 15 x (D - 50)
- This can also be used to determine the maximum resolution that can be used at the different heights
  D = H / (15 + 50)
- Knowing that maximum height H must be 1000 mm, the maximum resolution limits will be:
  for H = 1000 mm D = 116 mm
  for H = 0 mm D = 50 mm
- If H is greater than 300 mm, at the stage of risk assessment it becomes necessary to take into consideration the possibility of access from beneath the beams.

DIRECTION OF APPROACH ANGLED TO THE PROTECTED PLANE WITH 5°<α<85°

Slanted light curtains to detect hands and arms and for presence control in the dangerous area.



- With angle α>30° refer to the case of approach perpendicular to the protected plane.
- With angle α <30° refer to the case of approach parallel to the protected plane.

With α>30°:
- The distance S refers to the beam farthest away from the hazardous point.
- The height of the beam farthest away from the hazardous point must not be greater than 1000 mm.
- For the determination of height H or resolution D apply the following formulas to the lower-most beam:
  H = 15 x (D - 50)
  D = H / (15 + 50)

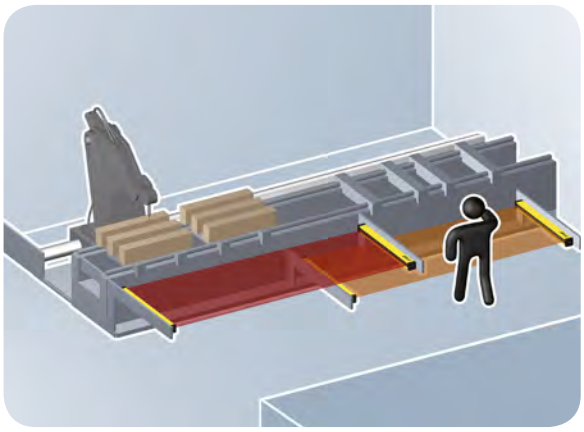
PHOTOELECTRIC SAFETY LIGHT CURTAINS

MUTING FUNCTION

The Muting function is the provisional and automatic cut-out of the light curtain protective function in relation to the machine cycle. Muting can only occur in a safety condition.

Two types of applications are envisaged:

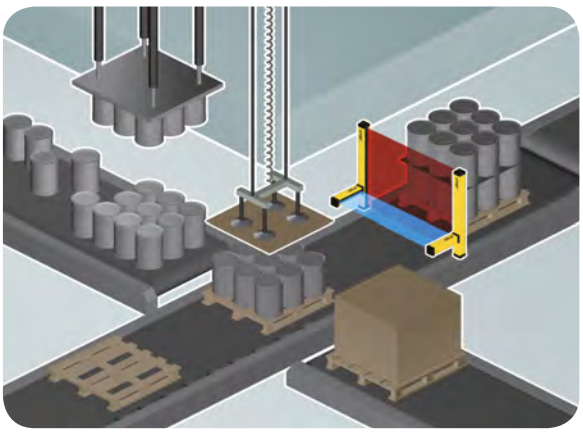
1- Enabling personnel access inside dangerous area during the non-dangerous part of machine cycle.



Example: Positioning or removal of workpiece

Depending on the position of the tool, which is the most dangerous part, one of the two curtains (the one facing the tool working area) is active whereas the other is in Muting mode to enable the operator to load/unload the workpiece. Muting mode of the light curtains is subsequently reversed when the tool works on the opposite side of the machine.

2- Enabling access to material and preventing access to personnel.



Example: Pallet exit from dangerous area.

The safety light curtain incorporates Muting sensors able to discriminate between personnel and materials. Only the material is authorized to pass through the monitored area.

The essential requirements regarding the Muting Function are described by the followings Standards:

IEC 61496-1 "Electro-Sensitive Protective Equipment"
EN 415-4 "Safety of the Machinery - automatic palletizing systems"
IEC TS 62046 "Application of the protective equipment to detect the presence of persons"

General Requirements:

- Muting is a temporary suspension of the safety–related function and it must be activated and de-activated automatically
- The safety integrity level of the circuit implementing the Muting function shall be equal to that of the safety function temporarily suspended, so that the protection performance of the entire system is not adversely affected
- Muting should be activated and de-activated only by means of two or more separate hardwired signals triggered by a correct time or space sequence.
- It shall not be possible to trigger Muting while the ESPE outputs are in the off state
- It shall not be possible to initiate Muting by turning the device off and then on again
- Muting shall be only activated in an appropriate point of the machine cycle, i.e. only when there is no risk for the operator
- Muting sensors shall be mechanically protected to prevent mismatch in case of impact.

PHOTOELECTRIC SAFETY LIGHT CURTAINS

MUTING: PALLETIZERS AND MATERIALS HANDLING SYSTEMS

Requirements for the monitoring of the openings:

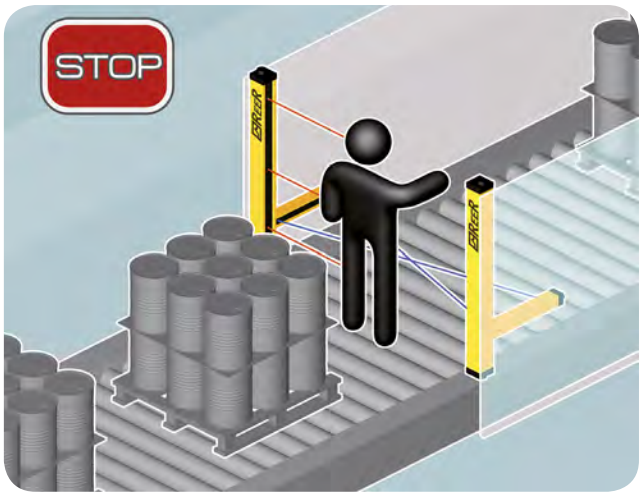
- Monitor the load, not the pallet, otherwise the operator might go into the hazardous zone beeing dragged by the pallet
- Muting time must be restricted to the actual time taken by the material to pass through the opening
- Configurations with Muting type L must have a particular operational logic
- Muting must be time-restricted
- Sensor mismatch with effect similar to their actuation shall not allow a condition of permanent Muting
- The configuration and positioning of the Muting sensors shall ensure reliable differentiation between personnel and material
- The layout of the opening, the positioning of the Muting sensors and the additional side protections shall prevent personnel access to the dangerous area for all the time the Muting function is activated and throughout the time the pallet crosses the opening.

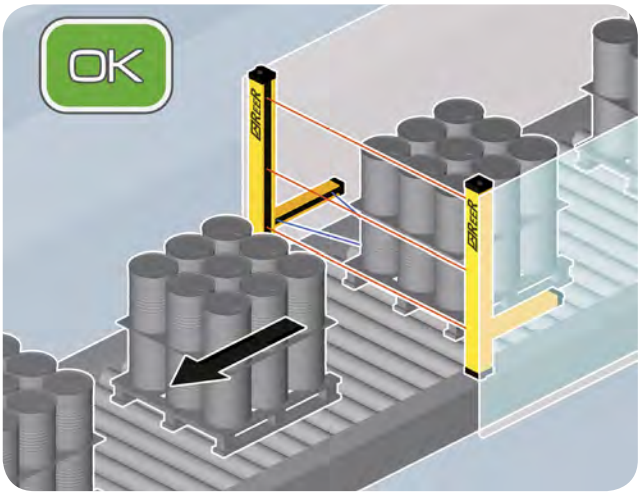
Therefore it is necessary to realise a safety system able to distinguish between:

- **authorized materials**
- **non authorized people**

to go through the light curtain

The Muting function can be present on both type 2 and type 4 safety light curtains.



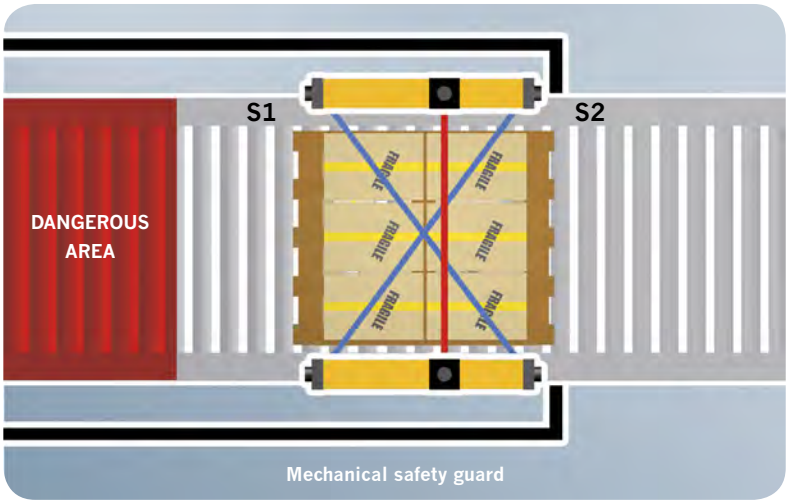


PHOTOELECTRIC SAFETY LIGHT CURTAINS

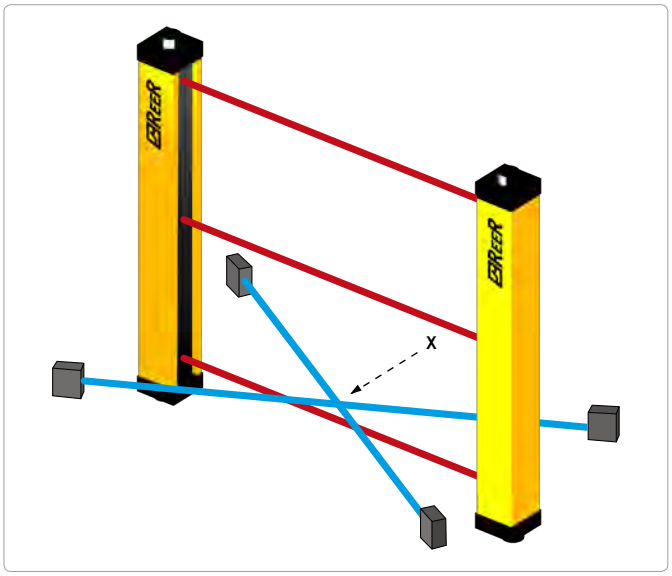
Common solutions for Muting sensor positioning

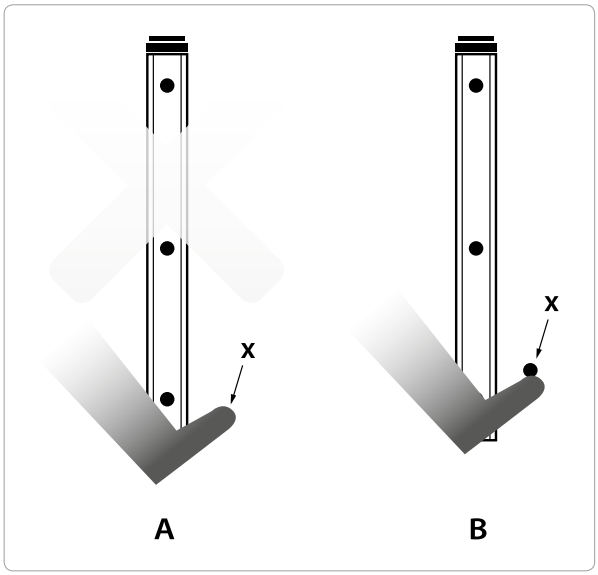
Muting with 2 crossed-beam sensors – Configuration type T with timing monitoring and two-way pallet operation:

- The point of intersection of the two beams shall lie in the segregated dangerous area beyond the light curtain
- A fail safe timer shall be provided to restrict Muting to the time needed for the material to cross the opening
- The Muting function shall be activated only if the Muting sensors are contemporaneously intercepted: **(t_2(S2) – t_1(S1) = 4 seconds max.)**
- The two beams shall be continuously interrupted by the pallet throughout the transit through the sensors
- A matt cylindrical object D=500 mm (simulating the size of a human body) shall not trigger the Muting function.



Muting sensor beam intersection shall be positioned the higher up or equal than level of the lower light curtain beam to avoid possible tampering or accidental triggering of Muting.

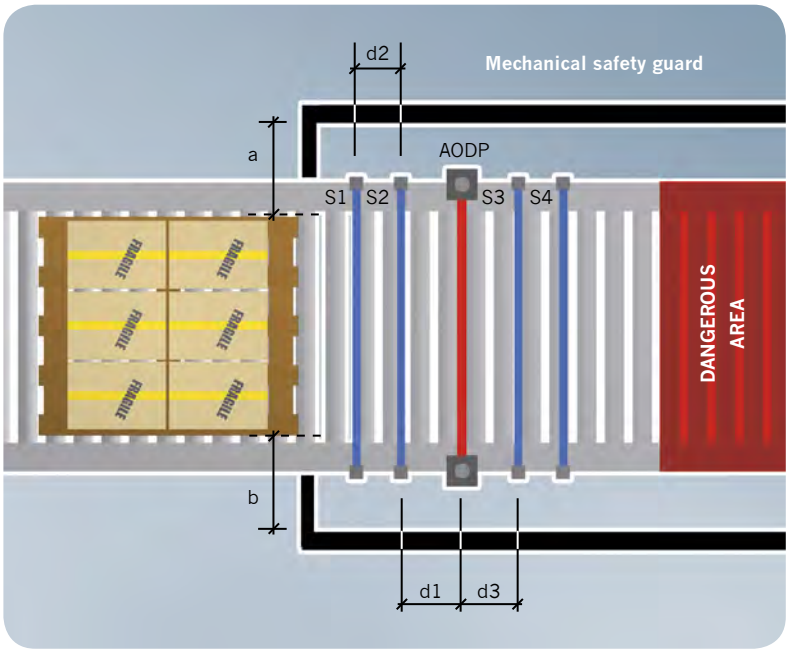




PHOTOELECTRIC SAFETY LIGHT CURTAINS

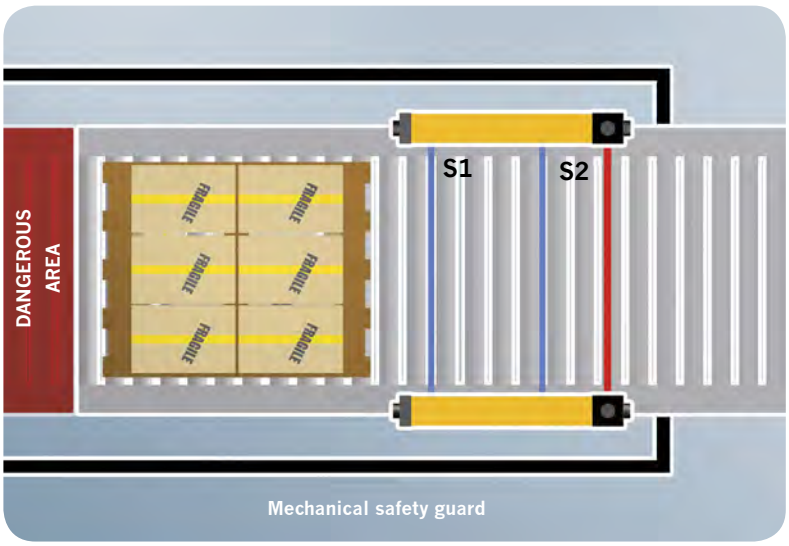
Muting with 4 parallel-beam sensors – Configuration type T with timing and/or sequence monitoring - Two-way pallet operation:

- The 4 Muting sensors shall be all actuated together for a brief moment (sequential actuation and de-activation of the 4 sensors)
- The distance between sensors and the sensing field of the light curtain shall be:
  - **d1 and d3 < 200 mm** to prevent undetected personnel access by preceding or following immediately after the pallet during Muting
  - **d2 > 250 mm** to prevent personnel limb, garment, etc. from enabling Muting by triggering two sensors simultaneously.



Muting with 2 crossed-beam or parallel-beam sensors – Configuration type L with timing monitoring and one-way only (exit from dangerous area) pallet operation:

- Muting sensors shall be positioned beyond the light curtain in the dangerous area
- Muting shall be disabled as soon as the light curtain is cleared and not later than 4 seconds max. from the instant the first of the two Muting sensor is cleared. The timer monitoring the 4 seconds shall be a safety-related item.



PHOTOELECTRIC SAFETY LIGHT CURTAINS

BLANKING FUNCTION

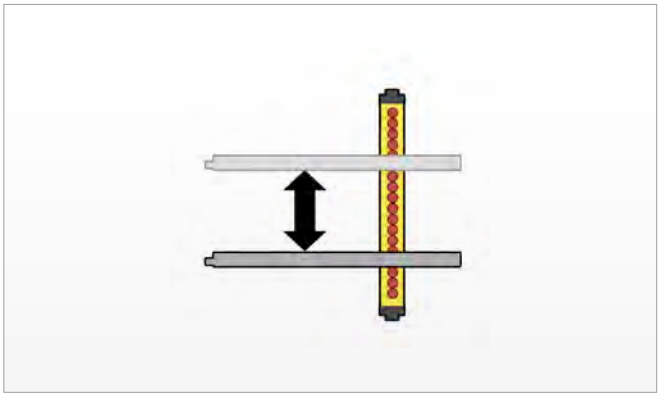
Blanking is an auxiliary function of safety light curtains for which the introduction of an opaque object inside parts of the light curtain's protection field is allowed without causing the stoppage of the machine. Blanking is only possible in the presence of determined safety conditions and in accordance with a configurable operating logic.
The blanking function is therefore particularly useful when the light curtain's protection field must be inevitably intercepted by the material being worked or by a fixed or mobile part of the machine. In practice, it is possible to keep the light curtain's safety outputs in an ON condition, and the machine working, even if a pre-determined number of beams within the protection fields are being intercepted.

Fixed Blanking allows a fixed portion of the protection field (i. e. a fixed set of beams) to be occupied, while all the other beams operate normally.

Floating Blanking allows the object to move freely inside the light curtain's protection field occupying a given number of beams, at the condition that the occupied beams are adjacent and that their number is not higher than the configured one.

Floating Blanking with compulsory object presence makes the light curtain work in a reverse way within the blanked portion of the protection field. That is, the blanked beams must be occupied during blanking and therefore the object has to be inside the protection field for the light curtain to remain in the ON state. In this case too the object can move freely within the protection field if the above conditions are respected.

Requirements for the blanking function can be found in the Technical Specification **IEC/TS 62046** describing additional means that may be required to prevent a person from reaching into the hazard through the blanked areas of the detection zone.



WARNING!

The use of the blanking function can be allowed depending on the characteristics of the application to be protected. Based on the risk analysis of your application, check whether the use of the blanking function is allowed for that particular application and with what features.

Reer SpA does not assume responsibility for the improper use of the blanking function nor for the possible damages deriving from it.

The use of the blanking function may need a recalculation of the safety distance due to the modified detection capability.

SAFETY LASER SCANNER

CHARACTERISTIC ELEMENTS

The Safety Laser Scanner is an electro-sensitive device for the protection of operators against the risk of accidents caused by industrial machines and plants with potentially dangerous moving parts and against possible collisions with Automatic Guided Vehicles (AGV).

For **EN 61496-3**, Laser Scanners must be certified in accordance to **type 3** or lower (**AOPDDR** Active Optoelectronic Protective Device responsive to Diffuse Reflection).
For **IEC 61508**, **IEC 62061**, **ISO 13849-1**, they must be certified as **SIL 2 - PLd** or lower.

Using the Safety Laser Sensor, precise **programmable horizontal protected areas** of variable shape can be created (i. e. semi-circular, rectangular or segmented), suitable for all applications with no need of a separate reflective or receiving element.

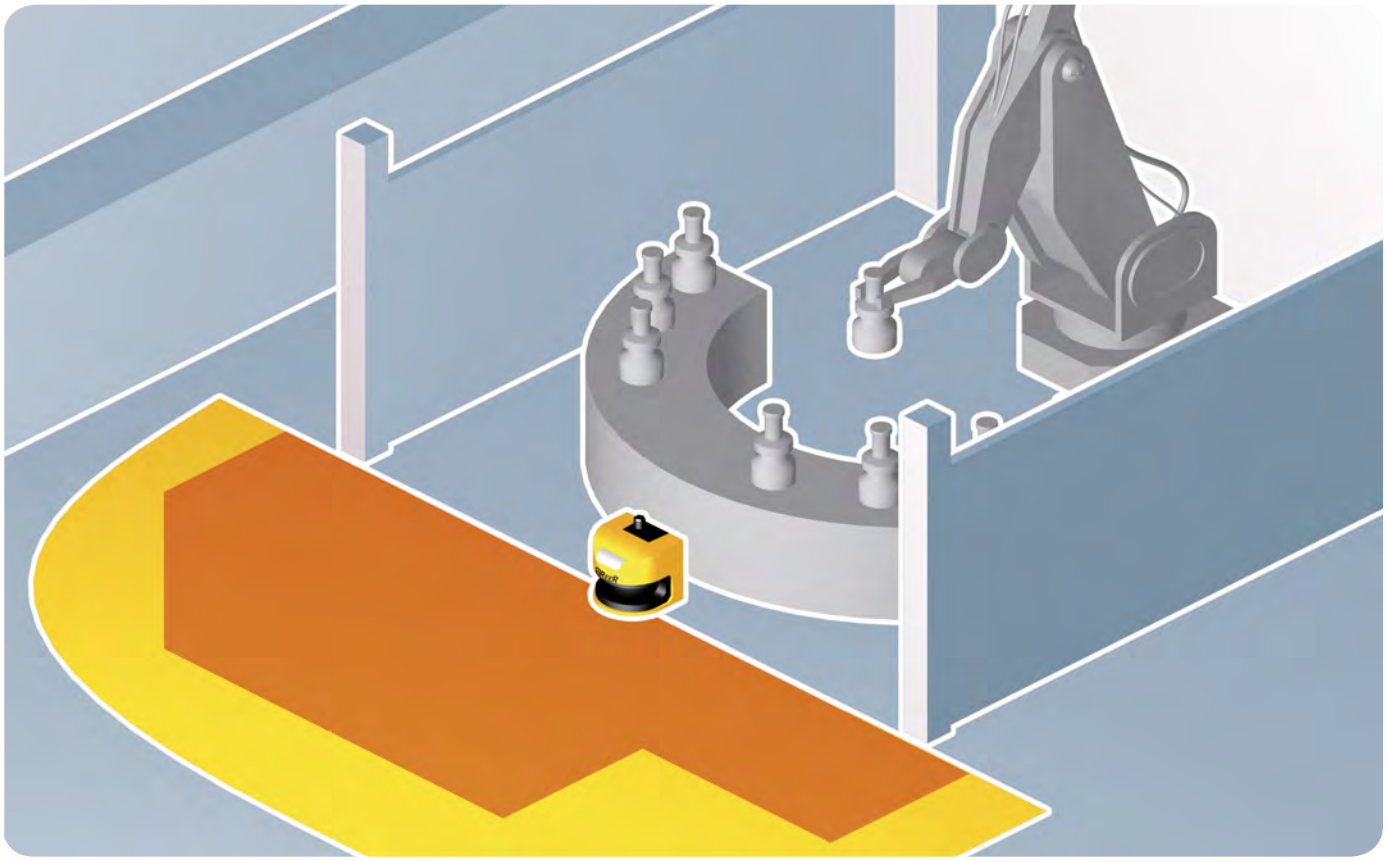
It is also possible to use the Laser Scanner in a **vertical** position for the access protection to a dangerous area, in that case detection of the edge of the gate is mandatory (**IEC TS 62046**).

Any person or object entering or remaining in the safety zone during survey causes, through the self-monitored static safety outputs of the device, an emergency stop command to the control system of the protected machine. The machine's hazardous movement will thus be interrupted.

If the warning zone is instead occupied, thanks to a non-safety dedicated solid state output, a signal is sent to the machine control system, which can be used to activate a light or a sound signal in order to prevent operators to break into the safety zone and stop the machine. Or, on an AGV application, the warning signal can be used to slow the vehicle down, so that a possible further break of the safety zone will not force it to stop abruptly, thus reducing the mechanical wear of the AGV.

The profiles of the controlled areas, as well as all the other configurable parameters, are programmable through a dedicated user interface software, installed on a laptop or pc and connected with the scanner via a serial interface.

The Laser Scanner is also able to automatically detect the controlled area by means the teach-in function.

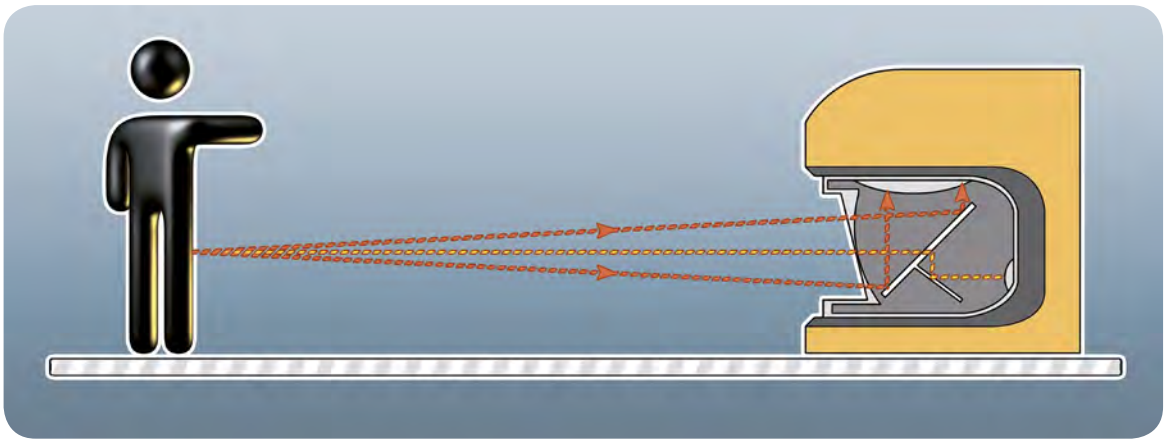


SAFETY LASER SCANNER

PRINCIPLE OF OPERATION

The Safety Laser Scanner emits ultra-short infrared laser light pulses. If the emitted beam hits an obstacle inside the controlled zone, then part of the light is reflected back towards the point of emission.

With its state-of-the-art technology, the Laser Scanner is able to measure the time (billionth of second) taken by the light to travel across the space between the sensor and the obstacle and back and to convert it into a distance with a precision of 3 cm.

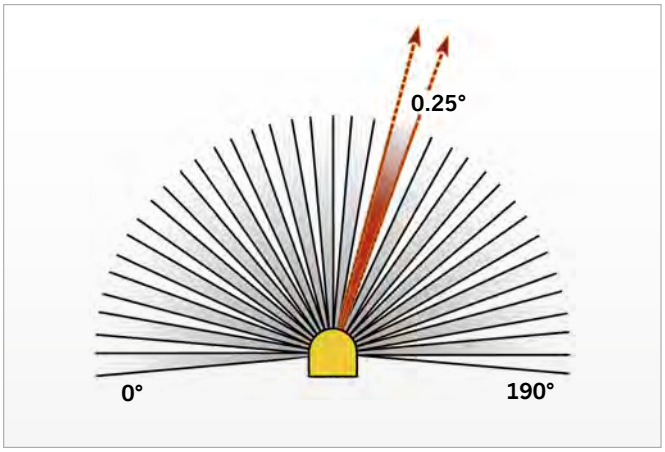


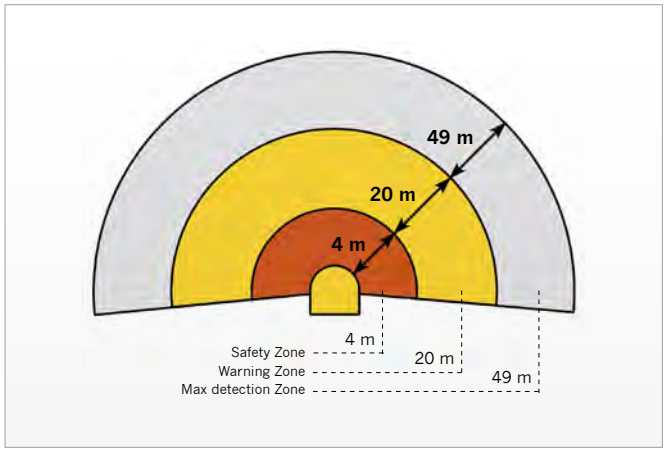
Using a rotating optical system, these measurements are made on a 190° semi-circular area every 0.25° for a total of 760 measurements per scan. The device performs 33 scans per second.

The Safety Laser Scanner creates a **controlled safety area with a maximum radius of 4 meters** and a **warning area with a maximum radius of 20 meters**. The safe detection of a person inside the safety zone is assured independently from the reflectivity of its clothes or skin.

The shape of the two controlled areas is fully programmable. Therefore, for each of the 760 measurements per scan, the laser scanner will compare the programmed distance to the measured distance.

If the measured distance is less than the programmed one, this means that an obstacle is inside the safety zone. A stop command will thus be sent to the machine.





SAFETY LASER SCANNER

CONTROLLED AREAS

SAFETY ZONE

This is the effective protection zone, in which the laser scanner assures the detection of any obstacle having a minimum reflectivity to infrared light of 1.8%. This means any human body in any possible clothing.
The occupation of this zone causes the switching of the two safety outputs that control the emergency stopping of the machine.
The shape of the zone can be programmed according to the application requirements.

WARNING ZONE

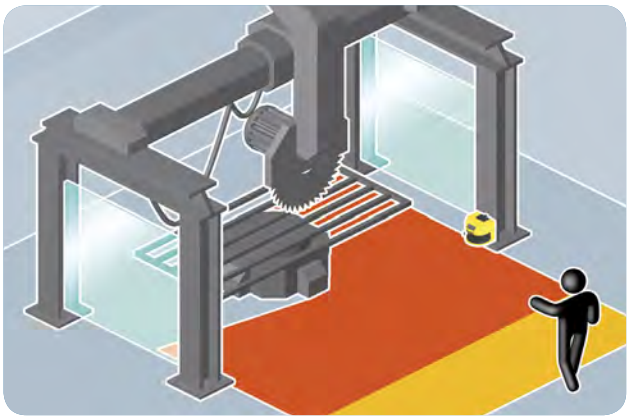
This is the zone in which the laser scanner is able to detect the presence of an obstacle approaching the safety zone.
The occupation of this zone causes the switching of the auxiliary output that can be used to activate light or sound signals or in order to slow down the hazardous movement. This zone is generally larger than the safety zone.
In this case also the shape of the zone can be programmed according to the application requirements.

ADVANTAGES OF THE LASER SCANNER

- No receiving and reflecting elements
- Simple programming of differently-shaped controlled areas
- Monitoring and protection of large areas
- Horizontal mount for the detection of the body in a dangerous area.
- Vertical mount for the detection of hands and arms or for the detection of the body in access control.
- Use on moving vehicles (AGVs)
- Measurement of object size, shape and position
- Fast and reliable installation

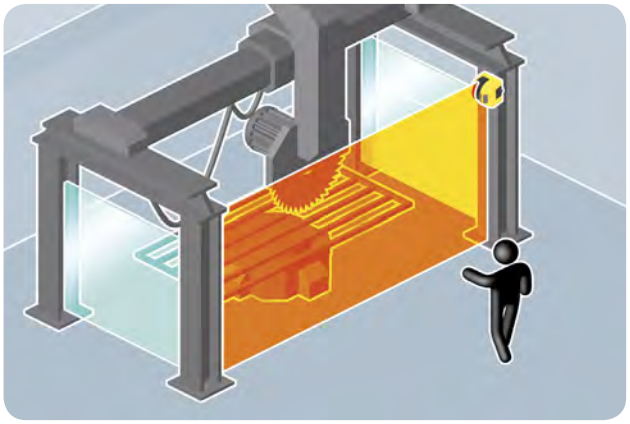
SAFETY LASER SCANNER

APPLICATIONS



Area control

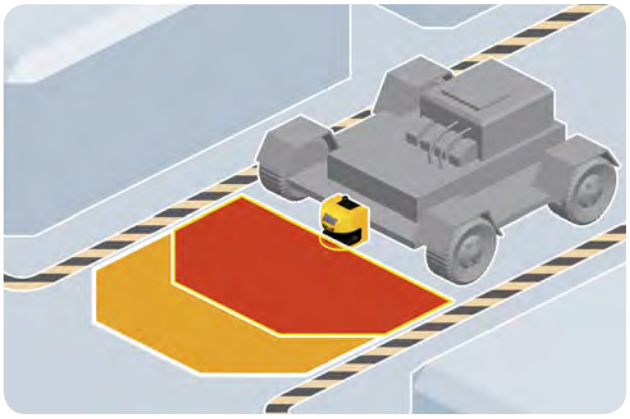
Example of an horizontally mounted protective field permanently monitored by Pharo. In this way a larger area can be monitored through the detection of the lower limbs of the body.



Access control

If the controlled plane is installed in a vertical position, even very large accesses can be protected. Hands, arms or the whole body can be detected, depending on the chosen resolution.

Note: the contour detection is mandatory for the vertical mount / access control applications.



Protection of Automatic Guided Vehicles (AGV)

The vast size of the controlled area allows the AGV to travel at higher speeds with respect to bumper protection.
The warning area permits speed reduction in the presence of obstacles. The data measured by the sensor can be sent to the vehicle on the serial interface and used as navigation aid.

Dimensional measurement
The sensor is first of all a measurement device. Therefore, the measurement data of the surrounding environment, which are always available during operation, can also be used for object profile, position and dimensions measurement in industrial automation.

INTEGRATION OF THE *ESPE*

As the ESPE will be integrated in the machine safety-related control system, the choice of its safety level will depend on the result of risk analysis and, consequently, on parameters such as PL, SIL or Category resulting from this analysis.

Product Standards (Type C) usually recommend the most suitable ESPE type for each safety-related function involved. If type C Standards are not available, adopt the recommendations of ISO 13849-1 and IEC 62061.

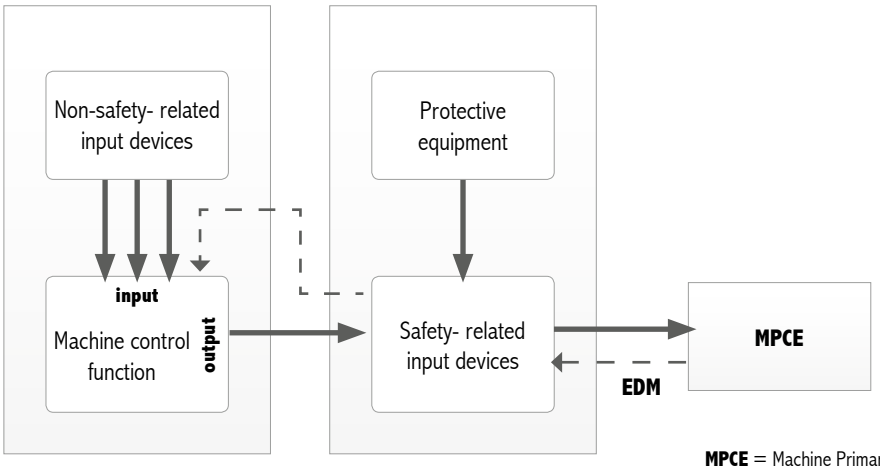
Also consider that the overall safety integrity of the serial connection: input – control unit – actuators, shall necessarily be equal to or lower than that of the weaker device.

RULES FOR CORRECT INTERCONNECTION OF PROTECTION DEVICES TO MACHINE CONTROL SYSTEM

The interconnections between safety outputs of ESPE (OSSD) and the machine primary control elements, the positioning and selection of reset push buttons shall not reduce or eliminate the extent of safety integrity assigned to the safety-related machine control system.

Figure 1 shows the most common example, i.e. where the machine control and monitoring system (e.g. the PLC) has no safety-related function. In this case, the safety-related control system monitoring the protective devices connected to it must operate autonomously and must be inserted between the machine control system and the machine primary control elements.

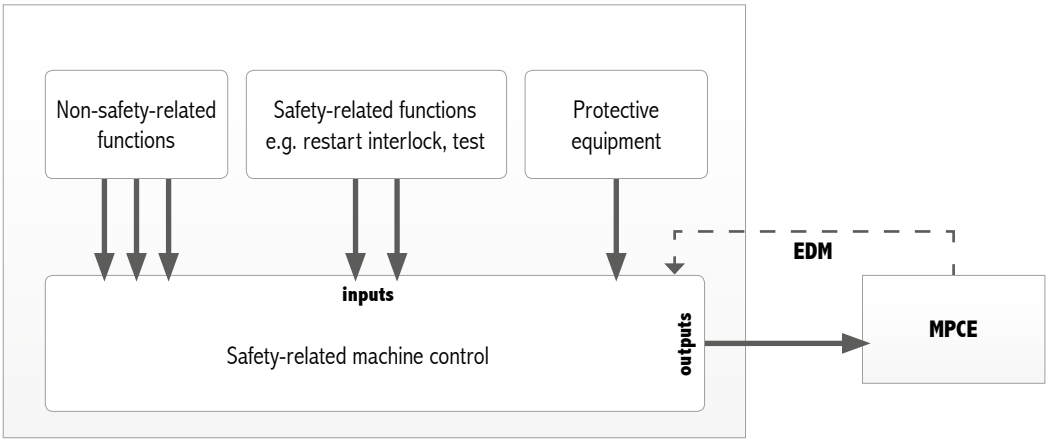
Figure 1



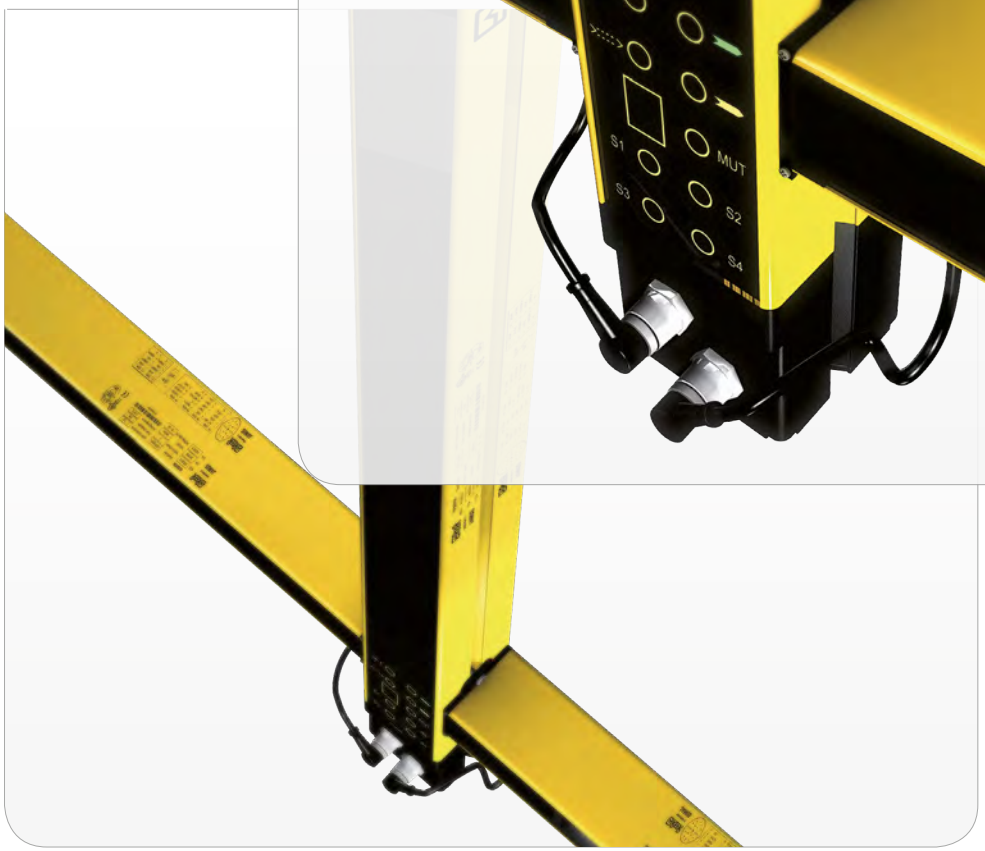
MPCE = Machine Primary Control Element

If the machine is equipped with an integrated safety-related control and management system (safety-related PLC), see figure 2, machine operational functions and safety-related functions should be governed through the centralized safety-related system.

Figure 2



SAFETY SENSORS



SAFETY SENSORS

	EOS 4 A	EOS 4 X	ADMIRAL AD	ADMIRAL AX	ADMIRAL AX BK
Sensor	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain
Safety level	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e
Resolution (mm)	14	14	14	14	14
Protected heights (mm)	160 - 1510	160 - 1510	160 - 1810	160 - 1810	160 - 1810
Max. range m	6	6	5	5	5
Start/Restart Interlock	-	yes	-	yes	-
EDM	-	yes	-	yes	-
Blanking	-	-	-	-	yes, floating
Master/Slave	-	yes (1/2 slave)	-	yes (1 slave)	yes, master

	EOS 4 A	EOS 4 X	ADMIRAL AD	ADMIRAL AX	ADMIRAL AX BK	JANUS M	JANUS J
Sensor	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain
Safety level	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e
Resolution (mm)	20-30-40	20-30-40	20-30-40	20-30-40	20- 40	30-40	40
Protected heights (mm)	160 - 1510	160 - 1510	160 - 1810	160 - 1810	160 - 1810	310 - 1810	610 - 1210
Max. range m	12 / 20	12 / 20	18	18	18	16 / 60	16 / 60
Start/Restart Interlock	-	yes	-	yes	-	yes	yes
EDM	-	yes	-	yes	-	yes	yes
Blanking	-	-	-	-	yes, floating	-	-
Muting	-	-	-	-	-	yes	-
Master/Slave	-	yes (1/2 slave)	-	yes (1 slave)	yes master	-	-
Long Range	-	-	-	-	-	yes (up to 60 m)	yes (up to 60 m)

SAFETY SENSORS

SELECTION GUIDE

It is advisable to break down the applications of optoelectronic safety devices into four groups

Finger detection

Detection of the presence of the body in a dangerous area

Hand detection

Detection of the body in access control

In the rest of the catalog, for each of the applications listed above, the appropriate solutions realized with the devices in the Reer range are presented.
Depending on the functions to be performed by the safety system, on the resolution required or on the maximum scanning distance, it is possible to select, among the different families of Reer's safety protective devices, the right tool for the safeguarding of dangerous machines.

PHARO	EOS 2 A	EOS 2 X	VISION V	VISION VX	VISION VXL	VISION MXL
Laser scanner	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain
Type 3 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d
30-40 selez.	30-40	30-40	20-30-40	20-30-40	30-40	30-40
-	160 - 1510	160 - 1510	160 ÷ 1810	160 - 1810	160 - 1810*	160 - 1810*
2,6 (radius)	12	12	16	18	8	8
yes	-	yes	-	yes	yes	yes
yes	-	yes	-	yes	yes	yes
-	-	-	-	-	-	-
-	-	-	-	-	-	yes
-	-	yes (1/2 slave)	-	yes (1 slave)	-	-
-	-	-	-	-	-	-

* VXL and MXL with 30 mm resolution: max. protected height 1210 mm

SAFETY SENSORS

	EOS 4 A	EOS 4 X	ADMIRAL AD	ADMIRAL AX	ADMIRAL AX BK	JANUS M	JANUS J
Sensor	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain
Safety level	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e
Resolution (mm)	50-90	50-90	50-90	50-90	40-90	40-90	40
Protected heights (mm)	160 - 1510	160 - 1510	310 - 1810	310 - 1810	310 - 1810	310 - 1810	610 - 1210
Max. range m	12 / 20	12 / 20	18	18	18	16 / 60	16 / 60
Start/Restart Interlock	-	yes	-	yes	-	yes	yes
EDM	-	yes	-	yes	-	yes	yes
Blanking	-	-	-	-	yes, floating	-	-
Muting	-	-	-	-	-	yes	-
Master/Slave	-	yes (1/2 slave)	-	yes (1 slave)	yes (master)	-	-
Long Range	-	-	-	-	-	yes (up to 60 m)	yes (up to 60 m)

	EOS 4 A	EOS 4 X	ADMIRAL AD	ADMIRAL AX	JANUS M	JANUS J	PHARO
Sensor	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain	Laser scanner
Safety level	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 4 SIL 3 – PL e	Type 3 SIL 2 – PL d
Number of beams	2-3-4	2-3-4	2-3-4	2-3-4	2-3-4	2-3-4	-
Resolution (mm)	-	-	-	-	-	-	150
Protected heights (mm)	510 - 910	510 - 910	510 - 910	510 - 910	510 - 910	510 - 910	-
Max. range m	12 / 20	12 / 20	18	18 / 60	16 / 60	16 / 60	4 (radius)
Start/Restart Interlock	-	yes	-	yes	yes	yes	yes
EDM	-	yes	-	yes	yes	yes	yes
Muting	-	-	-	-	yes, I, L and T models	-	-
Master/Slave	-	yes (1/2 slave)	-	yes (1 slave)	-	-	-
TRX versions with passive retroreflector elements	-	-	-	-	yes (6 m range)	yes (6 m range)	-
Long Range	-	-	-	yes (up to 60 m)	yes (up to 60 m)	yes (up to 60 m)	-

SAFETY SENSORS

PHARO	EOS 2 A	EOS 2 X	VISION V	VISION VX
Laser scanner	Light curtain	Light curtain	Light curtain	Light curtain
Type 3 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d
50-70 selez.	50-90	50-90	50-90	50-90
-	160 - 1510	160 - 1510	310 - 1810	310- 1810
4 (radius)	12	12	16	18
yes	-	yes	-	yes
yes	-	yes	-	yes
-	-	-	-	-
-	-	-	-	-
-	-	yes (1/2 slave)	-	yes (1 slave)
-	-	-	-	-

GLOSSARY:

Start/Restart interlock:
Interlock function (manual restart required) at machine start or restart.

EDM:
External Device Monitoring: controls the switching of external contactors via feedback input.

Master/Slave:
Two or three light curtains can be connected in cascade; all the outputs are managed by only one of these (Master).

Blanking:
The light curtain can be programmed to ignore a single object of defined dimensions that may also be greater than the resolution (see page 41).

Muting:
The protective function of the light curtain can be inhibited under certain safety conditions (see page 37).

I Models:
Models with connections for external Muting sensors.

L, T Models:
Models with built-in Muting sensors in pre-assembled kits for pallet outfeed only (L) or infeed/outfeed (T).

EOS 2 A	EOS 2 X	VISION V	VISION VX	VISION VXL	VISION MXL	ILION	ULISSE
Light curtain	Light curtain	Light curtain	Light curtain	Light curtain	Light curtain	Single beam	Single beam
Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d	Type 2 SIL 2 – PL d
2-3-4	2-3-4	2-3-4	2-3-4	2-3-4	2-3-4	1-2-3-4	1-2-3-4
-	-	-	-	-	-	-	-
510 - 910	510 - 910	510 - 910	510 - 910	510 - 910	510 - 910	-	-
12	12	16	18 / 60	8	8	8	6
-	yes	-	yes	yes	yes	yes [a), b)]	yes [a), b)]
-	yes	-	yes	yes	yes	yes [a), b)]	yes [a), b)]
-	-	-	-	-	yes	yes [b)]	yes [b)]
-	yes (1/2 slave)	-	yes (1 slave)	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	yes (up to 60 m)	-	-	-	a: with AUS X control unit b: with AUS XM control unit

EOS4

EOS4

EOS4 is a compact Type 4 light curtain with competitive performance and innovative features.

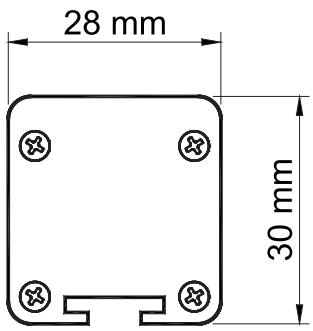
Its features include:

- Minimal cross section - 28 x 30 mm.
- No blind area on one side:
  the position of first beam ensures that the sensitive area extends to end of the light curtain.
- The solution with two L-mounted light curtains, e.g. Master-Slave, maintains 40 mm resolution in corner (models with resolution up to 40 mm).
- Minimal blind area on connector side.
- Easy connection and installation thanks to the M12 connectors and the use of unshielded cables up to 100 m.
- Integrated safety functions, including self-monitoring of static outputs, control of external contactors (EDM) and automatic/manual selectable Restart.
- Exceptional mechanical and electrical robustness are the result of extensive experience gained hands-on with all kinds of applications.
- Operating temperature range -10 to 55 °C.
- Protection rate: IP 65 and IP 67 at the same time
  High resistance to infiltration by dust and liquids in a highly compact light curtain.
- Models Master/Slave for cascade connection of two or three light curtains.
- 2 safety PNP static outputs.

Special versions with IP 69K watertight enclosure (WTF and WTHF), also suitable for Food & Beverage industry, available (see page 192).

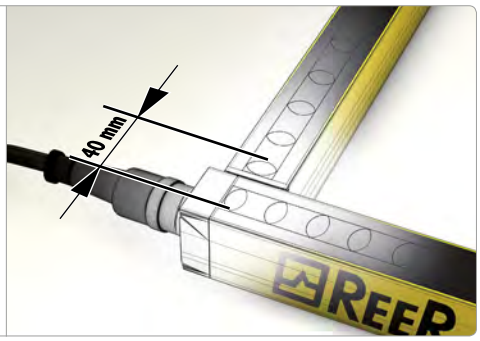
EOS4 light curtains may be connected to the dedicated safety interfaces series AD SR, or directly to contactors actuated and controlled by the light curtain, or to MOSAIC or to suitable commercial safety modules or safety PLCs.

Cross section



< of safety light curtain resolution = no blind zone

Two L-mounted light curtains maintain 40 mm resolution in the corner (models with resolution up to 40 mm)



Safety level: Type 4 – SIL 3 – SILCL 3 – PL e – Cat. 4

- 2006/42/CE "Machinery Directive"
- 2004/108/CE "Electromagnetic Compatibility (EMC)"
- 2006/95/CE "Low Voltage Directive (LVD)"
- IEC/EN 61496-1 Ed. 2.1, IEC/TS 61496-2 Ed. 2 "Safety of machinery - Electro-sensitive protective equipment- General requirements and tests"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems"
- IEC/TS 62046 Ed. 2 "Safety of machinery – Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada
- ANSI / UL 1998 "Safety Software in Programmable Components".

EOS4

THE EOS4 RANGE

EOS4 A

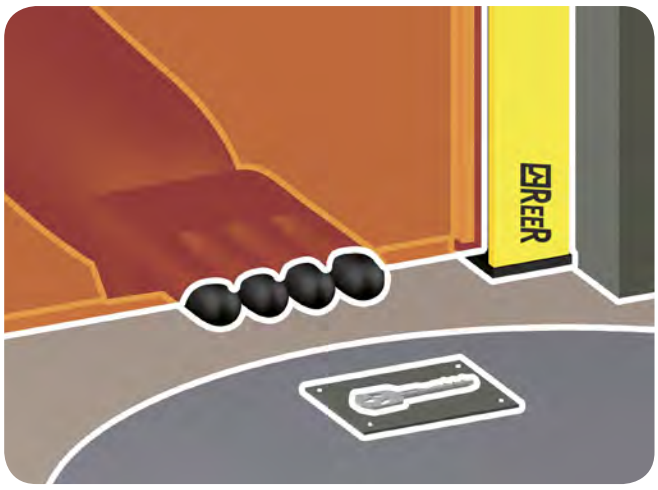
- Protected height range 160 to 1510 mm
- 7 types of detection:
  - Resolution 14 mm for finger detection
  - Resolution 20 - 30 - 40 mm for hand detection
  - Resolution 50 - 90 mm for detection of the body in a dangerous area
  - 2 - 3 - 4 beams for detection of the body in access control
- Max range 12 m and 20 m for H models (6 m for 14 mm resolution)
- 2 safety static outputs PNP with auto-test protected against short circuits and overloads
- Automatic Start/Restart
- M12 5-pole connectors.

The ideal light curtain for straightforward interfacing with safety modules or safety PLCs.

EOS4 X

- Protected height range 160 to 1510 mm
- 7 types of detection:
  - Resolution 14 mm for finger detection
  - Resolution 20 - 30 - 40 mm for hand detection
  - Resolution 50 - 90 mm for detection of the body in a dangerous area
  - 2 - 3 - 4 beams for detection of the body in access control
- Max range 12 m and 20 m for H models (6 m for 14 mm resolution)
- M12 5-pole connector for emitter and M12 8-pole for receiver
- Integrated, selectable manual or automatic Start/Restart
- Feedback input for external relay monitoring (EDM)
- Master and Slave models for series connection of two or three light curtains regardless of height or resolution.

An effective light curtain for directly controlling and monitoring machine circuits with no need of external safety modules.
Master/Slave models are also ideal for series connection of several light curtains and combined detection of hand and body or the protection of two different sides of a machine.



The protected area extends until the light curtain end maintaining the resolution

The resolution is maintained (up to 40 mm) in the junction between the 2 protected areas

EOS4 A

MAIN FEATURES

Automatic Start/Restart.
Two safety PNP static outputs, auto-controlled.
All connections and configurations through M12 5-pole connectors.
Unshielded cables up to 100 meter long.
Start/Restart interlock and EDM through external AD SR1 interface.
Muting function through external AD SRM interface.

TECHNICAL FEATURES

Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Protected heights (mm)	160 to 1510
Resolutions (mm)	14 – 20 – 30 – 40 – 50 – 90
Numbers of beams for body detection in access control	2 – 3 – 4
Max. range (m)	selectable 3 - 6 for 14 mm resolution for 20 – 30 – 40 – 50 – 90 mm resolution and 2 – 3 – 4 beams: selectable 10 – 20 for H models selectable 4 – 12 for standard models
Response time (ms)	2,5 – 20
Safety outputs	2 PNP – 400 mA at 24 VDC
Signaling	LEDs for light curtain's status and diagnostic
Start/Restart	automatic
Power supply (VDC)	24 ± 20%
Electrical connections	M12 - 5 poles
Max. cable lenght (m)	100
Operating temperature (°C)	-10 to 55
Protection rating	IP 65 and IP 67
Fastening modes	back slot
Cross section (mm)	28 x 30

Safety level:

Type **4**

SIL 3 – SILCL 3
PL e – Cat. 4

EOS4 A

Resolution 14 mm	EOS4 151 A	EOS4 301 A	EOS4 451 A	EOS4 601 A	EOS4 751 A	EOS4 901 A	EOS4 1051 A	EOS4 1201 A	EOS4 1351 A	EOS4 1501 A
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	15	30	45	60	75	90	105	120	135	150
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 20 mm	EOS4 152 AH	EOS4 302 AH	EOS4 452 AH	EOS4 602 AH	EOS4 752 AH	EOS4 902 AH	EOS4 1052 AH	EOS4 1202 AH	EOS4 1352 AH	EOS4 1502 AH
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	15	30	45	60	75	90	105	120	135	150
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 30 mm	EOS4 153 A	EOS4 303 A	EOS4 453 A	EOS4 603 A	EOS4 753 A	EOS4 903 A	EOS4 1053 A	EOS4 1203 A	EOS4 1353 A	EOS4 1503 A
–	EOS4 153 AH	EOS4 303 AH	EOS4 453 AH	EOS4 603 AH	EOS4 753 AH	EOS4 903 AH	EOS4 1053 AH	EOS4 1203 AH	EOS4 1353 AH	EOS4 1503 AH
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	8	16	23	31	38	46	53	61	68	76
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 40 mm	EOS4 154 A	EOS4 304 A	EOS4 454 A	EOS4 604 A	EOS4 754 A	EOS4 904 A	EOS4 1054 A	EOS4 1204 A	EOS4 1354 A	EOS4 1504 A
–	EOS4 154 AH	EOS 304 AH	EOS4 454 AH	EOS4 604 AH	EOS4 754 AH	EOS4 904 AH	EOS4 1054 AH	EOS4 1204 AH	EOS4 1354 AH	EOS4 1504 AH
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	6	11	16	21	26	31	36	41	46	51
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 50 mm	EOS4 155 A	EOS4 305 A	EOS4 455 A	EOS4 605 A	EOS4 755 A	EOS4 905 A	EOS4 1055 A	EOS4 1205 A	EOS4 1355 A	EOS4 1505 A
–	EOS4 155 AH	EOS4 305 AH	EOS4 455 AH	EOS4 605 AH	EOS4 755 AH	EOS4 905 AH	EOS4 1055 AH	EOS4 1205 AH	EOS4 1355 AH	EOS4 1505 AH
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	4	8	12	16	20	24	28	32	36	40
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 90 mm	EOS4 309 A	EOS4 459 A	EOS4 609 A	EOS4 759 A	EOS4 909 A	EOS4 1059 A	EOS4 1209 A	EOS4 1359 A	EOS4 1509 A
–	EOS4 309 AH	EOS4 459 AH	EOS4 609 AH	EOS4 759 AH	EOS4 909 AH	EOS4 1059 AH	EOS4 1209 AH	EOS4 1359 AH	EOS4 1509 AH
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510
Number of beams	4	6	8	10	12	14	16	18	20
Overall height (mm)	363	513	663	813	963	1113	1263	1413	1563

2-3-4-beams	EOS4 2B A	EOS4 3B A	EOS4 4B A
–	EOS4 2B AH	EOS4 3B AH	EOS4 4B AH
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	653	953	1053

• For accessories see page 64 • For ordering codes see page 215

EOS4 X

WITH BUILT-IN CONTROL FUNCTIONS

MAIN FEATURES

Built-in, selectable manual/automatic Start/Restart
Feedback input for external relays monitoring (EDM).
Two safety PNP static outputs, auto-controlled.
All connections and setting adjustments through M12 5-pole and 8-pole connectors.
Unshielded cables up to 100 meter long.
Master and Slave models for series connection of up to 3 light curtains.
Max. length of connections toward Slaves: 50 meters, through standard unshielded cables.

TECHNICAL FEATURES

Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Protected heights (mm)	160 to 1510
Resolutions (mm)	14 – 20 – 30 – 40 – 50 – 90
Numbers of beams for body detection in access control	2 – 3 – 4
Max. range (m)	selectable 3 - 6 for 14 mm resolution 20 – 30 – 40 – 50 – 90 mm resolution and 2 – 3 – 4 beams: selectable 10 – 20 for H models selectable 4 – 12 for standard models
Response time (ms)	2,5 – 20
Safety outputs	2 PNP – 400 mA at 24 VDC
Signaling	LEDs for light curtain's status and diagnostic
Start/Restart	selectable automatic or manual
External Device Monitoring	external device monitoring feedback input with selectable enabling
Power supply (VDC)	24 ± 20%
Electrical connections for EOS4 X and EOS4 X Master	M12 - 5 poles for emitter M12 - 8 poles for receiver
Electrical connections between Master and Slave	M12 - 5 poles for emitter and receiver
Max. cable lenght (m)	100 (50 between Master and Slave)
Operating temperature (°C)	-10 to 55
Protection rating	IP 65 and IP 67
Fastening modes	back slot
Cross section (mm)	28 x 30

Safety level:

Type **4**

SIL 3 – SILCL 3
PL e – Cat. 4

EOS4 X

WITH BUILT-IN CONTROL FUNCTIONS

Resolution 14 mm	EOS4 151 X	EOS4 301 X	EOS4 451 X	EOS4 601 X	EOS4 751 X	EOS4 901 X	EOS4 1051 X	EOS4 1201 X	EOS4 1351 X	EOS4 1501 X
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	15	30	45	60	75	90	105	120	135	150
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 20 mm	EOS4 152 XH	EOS4 302 XH	EOS4 452 XH	EOS4 602 XH	EOS4 752 XH	EOS4 902 XH	EOS4 1052 XH	EOS4 1202 XH	EOS4 1352 XH	EOS4 1502 XH
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	15	30	45	60	75	90	105	120	135	150
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 30 mm	EOS4 153 X	EOS4 303 X	EOS4 453 X	EOS4 603 X	EOS4 753 X	EOS4 903 X	EOS4 1053 X	EOS4 1203 X	EOS4 1353 X	EOS4 1503 X
–	EOS4 153 XH	EOS4 303 XH	EOS4 453 XH	EOS4 603 XH	EOS4 753 XH	EOS4 903 XH	EOS4 1053 XH	EOS4 1203 XH	EOS4 1353 XH	EOS4 1503 XH
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	8	16	23	31	38	46	53	61	68	76
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 40 mm	EOS4 154 X	EOS4 304 X	EOS4 454 X	EOS4 604 X	EOS4 754 X	EOS4 904 X	EOS4 1054 X	EOS4 1204 X	EOS4 1354 X	EOS4 1504 X
–	EOS4 154 XH	EOS 304 XH	EOS4 454 XH	EOS4 604 XH	EOS4 754 XH	EOS4 904 XH	EOS4 1054 XH	EOS4 1204 XH	EOS4 1354 XH	EOS4 1504 XH
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	6	11	16	21	26	31	36	41	46	51
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 50 mm	EOS4 155 X	EOS4 305 X	EOS4 455 X	EOS4 605 X	EOS4 755 X	EOS4 905 X	EOS4 1055 X	EOS4 1205 X	EOS4 1355 X	EOS4 1505 X
–	EOS4 155 XH	EOS4 305 XH	EOS4 455 XH	EOS4 605 XH	EOS4 755 XH	EOS4 905 XH	EOS4 1055 XH	EOS4 1205 XH	EOS4 1355 XH	EOS4 1505 XH
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	4	8	12	16	20	24	28	32	36	40
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 90 mm	EOS4 309 X	EOS4 459 X	EOS4 609 X	EOS4 759 X	EOS4 909 X	EOS4 1059 X	EOS4 1209 X	EOS4 1359 X	EOS4 1509 X
–	EOS4 309 XH	EOS4 459 XH	EOS4 609 XH	EOS4 759 XH	EOS4 909 XH	EOS4 1059 XH	EOS4 1209 XH	EOS4 1359 XH	EOS4 1509 XH
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510
Number of beams	4	6	8	10	12	14	16	18	20
Overall height (mm)	363	513	663	813	963	1113	1263	1413	1563

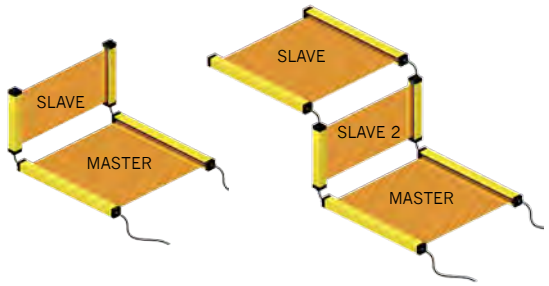
2-3-4-beams	EOS4 2B X	EOS4 3B X	EOS4 4B X
–	EOS4 2B XH	EOS4 3B XH	EOS4 4B XH
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	653	953	1053

• For accessories see page 64 • For ordering codes see page 215

EOS4

MASTER/SLAVE MODELS

Master/Slave models permit series connection of up to three light curtains and combined detection of hand and presence of a person or of more sides of the machine, with the following major benefits:
- A single pair of safety outputs
- No interference between light curtains installed adjacent to one another.

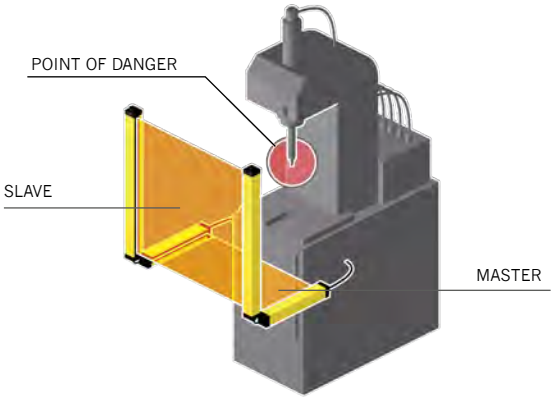


EXAMPLES OF SERIES CONNECTION OF MASTER AND SLAVE LIGHT CURTAINS

Any Master model can be used together with any Slave model.

All electrical connections are made using M12 5-pole connectors, except for Master receivers which necessitate the adoption of M12 8-pole connectors.

Pre-wired cables with twin connectors are available for the connection between Master and Slave.

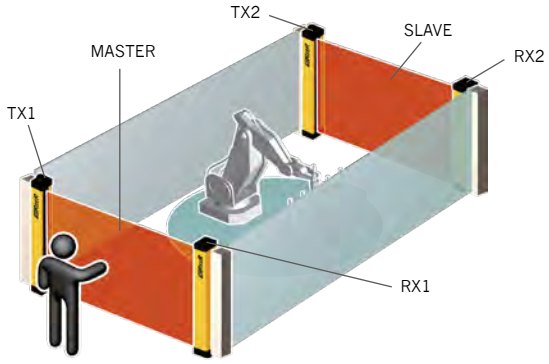


EXAMPLES OF SERIES CONNECTION OF MASTER AND SLAVE LIGHT CURTAINS

Master light curtain is placed horizontally for detection of the person and Slave light curtain is placed vertically to detect fingers or hands.

The arrangement can be reversed to have the Master light curtain vertical for finger and hand detection and the Slave light curtain horizontally for detecting the presence of a person.

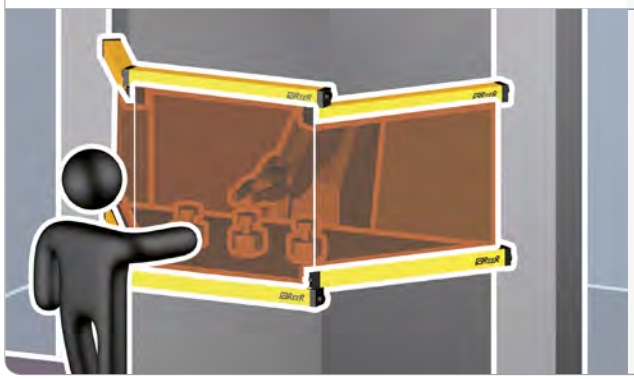
The application shown is one of the most common: horizontal curtains are used to prevent the operator from being undetected in the space between vertical light curtain and dangerous machine, upon system start-up or restarting.



EXAMPLE OF SERIES CONNECTION OF MASTER AND SLAVE LIGHT CURTAINS FOR PROTECTION OF TWO SIDES OF THE MACHINE

On EOS4 X the connecting cable across Master and Slave is a standard (unshielded) cable up to 50 meter long.

Thus, two series connected curtains may be located one at the front of the machine and the other at the rear, with a single connection to the machine power and control circuitry.



EXAMPLE OF SERIES CONNECTION OF ONE MASTER AND TWO SLAVE LIGHT CURTAINS FOR THE PROTECTION OF THREE SIDES OF THE MACHINE

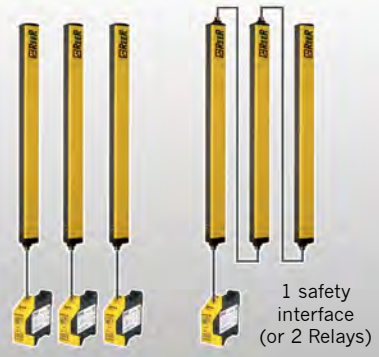
Benefit: unimpeded operator access to work area from front and sides.

Continues

EOS4

Follows

Series connections diagram



Benefit: with three standard curtains it will be necessary to use and wire up 3 safety interfaces or 6 contactors.

With the master/slave solution having 3 series light curtains it will be enough to use and wire up only 1 safety interface or 2 contactors.

MASTER/SLAVE MODELS

MASTER Resolution 14 mm		**EOS4 301 XM**	**EOS4 451 XM**	**EOS4 601 XM**	**EOS4 751 XM**	**EOS4 901 XM**	**EOS4 1051 XM**	**EOS4 1201 XM**	**EOS4 1351 XM**	**EOS4 1501 XM**
SLAVE Resolution 14 mm	**EOS4 151 XS**	**EOS4 301 XS**	**EOS4 451 XS**	**EOS4 601 XS**	**EOS4 751 XS**	**EOS4 901 XS**	**EOS4 1051 XS**	**EOS4 1201 XS**	**EOS4 1351 XS**	**EOS4 1501 XS**
SLAVE 2 Resolution 14 mm		**EOS4 301 XS2**	**EOS4 451 XS2**	**EOS4 601 XS2**	**EOS4 751 XS2**	**EOS4 901 XS2**	**EOS4 1051 XS2**	**EOS4 1201 XS2**	**EOS4 1351 XS2**	**EOS4 1501 XS2**
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	15	30	45	60	75	90	105	120	135	150
Overall height (mm)*	213	363	513	663	813	963	1113	1263	1413	1563

MASTER Resolution 30 mm		**EOS4 303 XM**	**EOS4 453 XM**	**EOS4 603 XM**	**EOS4 753 XM**	**EOS4 903 XM**	**EOS4 1053 XM**	**EOS4 1203 XM**	**EOS4 1353 XM**	**EOS4 1503 XM**
SLAVE Resolution 30 mm	**EOS4 153 XS**	**EOS4 303 XS**	**EOS4 453 XS**	**EOS4 603 XS**	**EOS4 753 XS**	**EOS4 903 XS**	**EOS4 1053 XS**	**EOS4 1203 XS**	**EOS4 1353 XS**	**EOS4 1503 XS**
SLAVE 2 Resolution 30 mm		**EOS4 303 XS2**	**EOS4 453 XS2**	**EOS4 603 XS2**	**EOS4 753 XS2**	**EOS4 903 XS2**	**EOS4 1053 XS2**	**EOS4 1203 XS2**	**EOS4 1353 XS2**	**EOS4 1503 XS2**
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	8	16	23	31	38	46	53	61	68	76
Overall height (mm)*	213	363	513	663	813	963	1113	1263	1413	1563

MASTER Resolution 40 mm		**EOS4 304 XM**	**EOS4 454 XM**	**EOS4 604 XM**	**EOS4 754 XM**	**EOS4 904 XM**	**EOS4 104 XM**	**EOS4 1204 XM**	**EOS4 1354 XM**	**EOS4 1504 XM**
SLAVE Resolution 40 mm	**EOS4 154 XS**	**EOS4 304 XS**	**EOS4 454 XS**	**EOS4 604 XS**	**EOS4 754 XS**	**EOS4 904 XS**	**EOS4 1054 XS**	**EOS4 1204 XS**	**EOS4 1354 XS**	**EOS4 1504 XS**
SLAVE 2 Resolution 40 mm		**EOS4 304 XS2**	**EOS4 454 XS2**	**EOS4 604 XS2**	**EOS4 754 XS2**	**EOS4 904 XS2**	**EOS4 1054 XS2**	**EOS4 1204 XS2**	**EOS4 1354 XS2**	**EOS4 1504 XS2**
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	6	11	16	21	26	31	36	41	46	51
Overall height (mm)*	213	363	513	663	813	963	1113	1263	1413	1563

EOS4 X

WITH BUILT-IN CONTROL FUNCTIONS

MASTER/SLAVE MODELS

MASTER Resolution 50 mm		**EOS4 305 XM**	**EOS4 455 XM**	**EOS4 605 XM**	**EOS4 755 XM**	**EOS4 905 XM**	**EOS4 105 XM**	**EOS4 1205 XM**	**EOS4 1355 XM**	**EOS4 1505 XM**
SLAVE Resolution 50 mm	**EOS4 155 XS**	**EOS4 305 XS**	**EOS4 455 XS**	**EOS4 605 XS**	**EOS4 755 XS**	**EOS4 905 XS**	**EOS4 1055 XS**	**EOS4 1205 XS**	**EOS4 1355 XS**	**EOS4 1505 XS**
SLAVE 2 Resolution 50 mm		**EOS4 305 XS2**	**EOS4 455 XS2**	**EOS4 605 XS2**	**EOS4 755 XS2**	**EOS4 905 XS2**	**EOS4 1055 XS2**	**EOS4 1205 XS2**	**EOS4 1355 XS2**	**EOS4 1505 XS2**
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1560
Number of beams	4	8	12	16	20	24	28	32	36	40
Overall height (mm)*	213	363	513	663	813	963	1113	1263	1413	1563

MASTER Resolution 90 mm	**EOS4 309 XM**	**EOS4 459 XM**	**EOS4 609 XM**	**EOS4 759 XM**	**EOS4 909 XM**	**EOS4 1059 XM**	**EOS4 1209 XM**	**EOS4 1359 XM**
SLAVE Resolution 90 mm	**EOS4 309 XS**	**EOS4 459 XS**	**EOS4 609 XS**	**EOS4 759 XS**	**EOS4 909 XS**	**EOS4 1059 XS**	**EOS4 1209 XS**	**EOS4 1359 XS**
SLAVE 2 Resolution 90 mm	**EOS4 309 XS2**	**EOS4 459 XS2**	**EOS4 609 XS2**	**EOS4 759 XS2**	**EOS4 909 XS2**	**EOS4 1059 XS2**	**EOS4 1209 XS2**	**EOS4 1359 XS2**
Protected heights (mm)	310	460	610	760	910	1060	1210	1360
Number of beams	4	6	8	10	12	14	16	18
Overall height (mm)*	363	513	663	813	963	1113	1263	1413

MASTER 2-3-4 beams	**EOS4 2B XM**	**EOS4 3B XM**	**EOS4 4B XM**
SLAVE 2-3-4 beams	**EOS4 2B XS**	**EOS4 3B XS**	**EOS4 4B XS**
SLAVE 2 2-3-4 beams	**EOS4 2B XS2**	**EOS4 3B XS2**	**EOS4 4B XS2**
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)*	653	953	1053

* On Master and Slave2, the total height of the light curtain is 24 mm greater due to the addition of a secondary connector

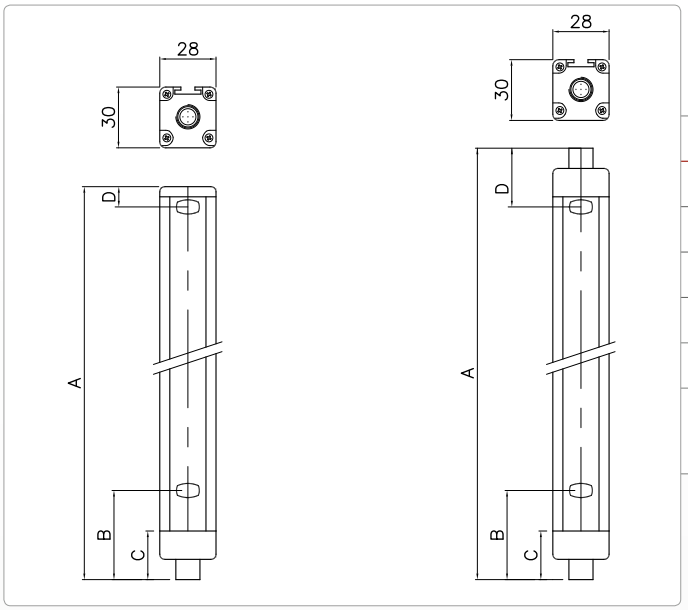
• For accessories see page 64 • For ordering codes see page 216

EOS4 X

WITH BUILT-IN CONTROL FUNCTIONS

DIMENSIONS (mm)

EOS4 SLAVE **EOS4 MASTER / SLAVE 2**



Model	2B	3B	4B
A	653	953	1053
A (Master/Slave2)	677	977	1077
B	102		
C	29.5		
D	51		
D (Master/Slave2) (with 2 connectors)	75		

Model	150	300	450	600	750	900	1050	1200	1350	1500
A	213	363	513	663	813	963	1113	1263	1413	1563
A (Master/Slave)	236.5	386.5	536.5	686.5	836.5	986.5	1136.5	1286.5	1436.5	1586.5
B	61.5									
C	29.5									
D	11									
D (Master/Slave 2) (with 2 connectors)	34.5									
Mounting	2 LE type brackets with 2 inserts							3 LE type brackets with 3 inserts		

WARNING!

- Where the light curtain is subjected to strong vibrations (presses, textile looms, etc.) always use vibrations dampers SAV E (available as accessories) in order to prevent damaging the light curtain
- Where protections are to be placed over long distances or on several sides using deflection mirrors, it is advisable to use laser alignment aid LAD 4 to ensure simple, quick and perfect alignment of light curtains.

EOS4

ORDERING INFORMATION (for ordering codes see page 215)

Each EOS4 light curtain comprises:
▪ Emitter and Receiver pair
▪ Brackets and inserts
▪ CD-ROM containing the multi-language instruction manual complete with CE declaration of conformity
▪ Quick installation guide

ACCESSORIES

EOS4 light curtains can be supplied with the following accessories, to be ordered separately:	
▪ AD SR Safety Relays	see page 180
▪ LAD laser alignment device	see page 210
▪ FMC floor mounting columns	see page 206
▪ SP deflection mirrors	see page 209
▪ SAV E vibrations dampers	see page 211
▪ SFB swivel fixing brackets	see page 212
▪ Connectors	see list hereunder:

CONNECTORS EOS4 (EOS4 A emitter and receiver EOS4 X emitter)

Model	**Description**
CD 5	M12 straight connector, 5 poles, pre-wired cable 5 m
CD 10	M12 straight connector, 5 poles, pre-wired cable 10 m
CD 15	M12 straight connector, 5 poles, pre-wired cable 15 m
CD 20	M12 straight connector, 5 poles, pre-wired cable 20 m
CD 25	M12 straight connector, 5 poles, pre-wired cable 25 m
CD 50	M12 straight connector, 5 poles, pre-wired cable 50 m
CD 95	M12 90° angle connector, 5 poles, pre-wired cable 5 m
CD 910	M12 90° angle connector, 5 poles, pre-wired cable 10 m
CD 915	M12 90° angle connector, 5 poles, pre-wired cable 15 m
CDM 9	M12 straight connector, 5 poles with screw terminal, PG9 cable gland
CDM 99	M12 angle connector, 5 poles with screw terminal, PG9 cable gland

CONNECTORS EOS4 X receivers

Model	**Description**
C8D 5	M12 straight connector, 8 poles, pre-wired cable 5 m
C8D 10	M12 straight connector, 8 poles, pre-wired cable 10 m
C8D 15	M12 straight connector, 8 poles, pre-wired cable 15 m
C8D 25	M12 straight connector, 8 poles, pre-wired cable 25 m
C8D 40	M12 straight connector, 8 poles, pre-wired cable 40 m
C8D 95	M12 90° angle connector, 8 poles, pre-wired cable 5 m
C8D 910	M12 90° angle connector, 8 poles, pre-wired cable 10 m
C8D 915	M12 90° angle connector, 8 poles, pre-wired cable 15 m
C8DM 11	M12 straight connector, 8 poles with screw terminal, PG9/11 cable gland
C8DM 911	M12 90° angle connector, 8 poles with screw terminal, PG9/11 cable gland

CONNECTION BETWEEN MASTER AND SLAVE

Model	**Description**
CDS 03	0,3 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 3	3 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 5	5 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 10	10 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 25	25 m pre-wired cable with 2 straight connectors, M12 5 poles

ADMIRAL

ADMIRAL

The Admiral Type 4 family of safety light curtains is the ideal solution for the protection of the majority of high-risk industrial applications.

Its features include:

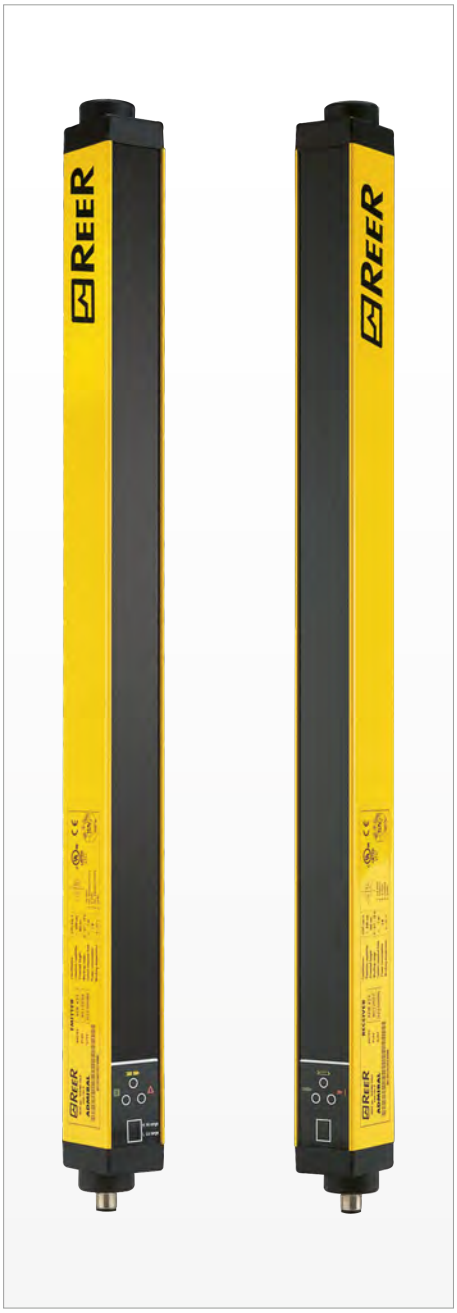
- Extremely easy connection and installation, thanks to the M12 connectors and the use of standard cables.
- Integration of the main safety functions, including self-monitoring of the safety circuits and, for the AX models, the external device monitoring (EDM) and the Start / Restart interlock functions.
- The utmost reliability in the field, thanks to the rugged construction and to the high level of immunity to external interference (optical, EMC, etc.).
- The breadth of the range, including Master / Slave models for cascade connection of two light curtains, models with floating blanking, and the widest variety of heights and resolutions.

Models with 2, 3 and beams Long Range, max. 60 meters available.

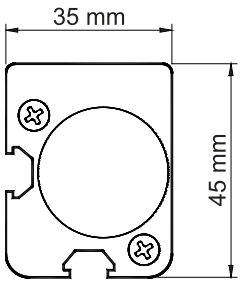
Special versions in WT/WTH watertight enclosure (see page 194) available on request.

Special models in conformity with the "ATEX Directive" 94/9/CE – Dust Zone 22 - Gas Zone 2 available on request.

Admiral light curtains may be connected to the dedicated safety interfaces series AD SR, or directly to contactors actuated and controlled by the light curtain, or to MOSAIC or to suitable commercial safety modules or safety PLCs.



Cross section



Safety level: Type 4 – SIL 3 – SILCL 3 – PL e – Cat. 4

- 2006/42/CE "Machinery Directive"
- 2004/108/CE "Electromagnetic Compatibility (EMC)"
- 2006/95/CE "Low Voltage Directive (LVD)"
- IEC/EN 61496-1 Ed. 2.1, IEC/TS 61496-2 Ed. 2 "Safety of machinery - Electro-sensitive protective equipment- General requirements and tests"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems"
- IEC/TS 62046 Ed. 2 "Safety of machinery – Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada
- ANSI / UL 1998 "Safety Software in Programmable Components".

ADMIRAL

THE ADMIRAL RANGE

ADMIRAL AD

- 7 types of detection:
  - resolution 14 mm for finger detection
  - resolution 20 - 30 - 40 mm for hand detection
  - resolution 50 - 90 mm for detection of the body in a hazardous area
  - 2 - 3 - 4 beams for detection of the body in access control
- 2 self-testing solid state PNP safety outputs protected against short circuits and overloads
- Automatic restart
- Electrical connections with 5-pole M12 connectors

The ideal light curtain for a simple interface with safety modules or PLC.

ADMIRAL AX

- 7 types of detection:
  - resolution 14 mm for finger detection
  - resolution 20 - 30 - 40 mm for hand detection
  - resolution 50 - 90 mm for detection of the body in a hazardous area
  - 2 - 3 - 4 beams for detection of the body in access control
- 2 self-testing solid state PNP safety outputs protected against short circuits and overloads
- Electrical connections with 5-pole M12 connector for emitter and 8-pole M12 connector for receiver
- Built-in manual or automatic restart, selectable
- Feedback input for control of external relays (EDM)
- Master and Slave models for serial connection of two light curtains even of different height and resolution

The ideal light curtain for directly controlling and monitoring the circuits of the machine, without the need for external safety modules.
The Master / Slave models are also the ideal solution for connecting two light curtains in series to perform a combined detection of the hand and of the presence of the person or of two different sides of the machine.

ADMIRAL AX LR Long Range

- 2 - 3 - 4 beams for detection of the body in access monitoring
- Max. range 60 m
- M12, 5-pole connector for emitter and M12, 8-pole for receiver
- Integrated, selectable manual or automatic Start/Restart
- Feedback input for external relay monitoring (EDM).

Ideal light grid for large size protection applications, also on several sides using deflection mirrors.

ADMIRAL AX LR DB NEW PRODUCT

This special version of the Admiral Long Range features an innovative Dual Beam System useful in outdoor applications or in harsh environments for decreasing the sensitivity of the light curtain to small objects that could interrupt the light link, i.e. birds or leaves but also heavy rain or snow.
Available models with 2 - 3 beams for detection of the body in access monitoring, max. range 80 m.
Available with heated IP 67 WTH case for outdoor use (see page 194).

ADMIRAL AX BK

- 4 types of detection:
  - resolution 14 mm for finger detection
  - resolution 20 and 40 mm for hand detection
  - resolution 90 mm for detection of the body in a hazardous area
- 2 self-testing solid state PNP safety outputs protected against short circuits and overloads
- Electrical connections with 5-pole M12 connectors for emitter and 8-pole M12 connectors for receiver
- Automatic restart
- Built-in functions of floating blanking with 5 selectable configurations
- Master and Slave models for serial connection of two light curtains even of different height and resolution

The ideal light curtain for protecting press brakes, automatic machines and robotised areas, where the material being processed or moving parts of the machine cross the field protected by the light curtain.
With the blanking models with 14 and 20 mm resolution, it is also possible to have the Master/Slave function (present only on Master models) in a protection system composed of two light curtains connected in series and to perform a combined detection of the hand and of the presence of the person or of two different sides of the machine.

ADMIRAL AD

MAIN FEATURES

Two self-testing solid state PNP safety outputs.
All connections and configurations by means of M12 connectors.
Use of unshielded cables up to 100 m.
Suppression of optical interference by means of range selection.
Start/Restart interlock and EDM via external AD SR1 interface.

TECHNICAL FEATURES

Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Protected heights (mm)	160 - 1810
Resolutions (mm)	14 - 20 - 30 - 40 - 50 - 90
Number of beams for body detection in access control	2 - 3 - 4
Max. range (m)	selectable 2 - 5 for 14 mm resolution selectable 6 – 18 for 20 – 30 – 40 – 50 – 90 mm resolutions and 2 – 3 - 4 beams
Response time (ms)	6 - 27
Safety outputs	2 PNP - 500 mA at 24 VDC
Signalling	seven-segment display and LEDs for light curtain's status and diagnostic
Start/Restart	automatic
Power supply (VDC)	24 ± 20%
Electrical connections	M12 - 5 poles for emitter and receiver
Max. cable length (m)	100
Operating temperature (°C)	0 to 55
Protection rating	IP 65
Fastening modes	3: back slot, side slot or to the top and lower end
Cross section (mm)	35 x 45

Safety level:

Type 4

SIL 3 – SILCL 3
PL e – Cat. 4

ADMIRAL AD

Resolution 14 mm	AD 151	AD 301	AD 451	AD 601	AD 751	AD 901	AD 1051	AD 1201	AD 1351	AD 1501	AD 1651	AD 1801
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	15	30	45	60	75	90	105	120	135	150	165	180
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 20 mm	AD 152	AD 302	AD 452	AD 602	AD 752	AD 902	AD 1052	AD 1202	AD 1352	AD 1502	AD 1652	AD 1802
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	15	30	45	60	75	90	105	120	135	150	165	180
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 30 mm	AD 153	AD 303	AD 453	AD 603	AD 753	AD 903	AD 1053	AD 1203	AD 1353	AD 1503	AD 1653	AD 1803
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	8	16	24	32	40	48	56	64	72	80	88	96
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 40 mm	AD 304	AD 454	AD 604	AD 754	AD 904	AD 1054	AD 1204	AD 1354	AD 1504	AD 1654	AD 1804
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	10	15	20	25	30	35	40	45	50	55	60
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 50 mm	AD 305	AD 455	AD 605	AD 755	AD 905	AD 1055	AD 1205	AD 1355	AD 1505	AD 1655	AD 1805
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	8	12	16	20	24	28	32	36	40	44	48
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 90 mm	AD 309	AD 459	AD 609	AD 759	AD 909	AD 1059	AD 1209	AD 1359	AD 1509	AD 1659	AD 1809
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	5	7	9	11	13	15	17	19	21	23	25
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

2-3-4 beams	AD 2B	AD 3B	AD 4B
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	711	1011	1111

• For accessories see page 77 • For ordering codes see page 217

ADMIRAL AX

WITH BUILT-IN CONTROL FUNCTIONS

MAIN FEATURES

Two self-testing solid state PNP safety outputs.
Built-in start/restart interlock, selectable.
Feedback input for external device monitoring (EDM).
All connections and configurations by means of M12 connectors.
Use of unshielded cables up to 100 m.
Suppression of optical interference by means of range selection.
Master and Slave models for serial connection of 2 light curtains.
Maximum length of the connections between Master and Slave: 50 meters, with unshielded cables.
Models with 2, 3 and 4 beams Long Range, max. 60 meters.
Dual Beam models with 2 and 3 beams, max. 80 m.

TECHNICAL FEATURES

Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Protected heights (mm)	160 - 1810
Resolutions (mm)	14 - 20 - 30 - 40 - 50 - 90
Number of beams for body detection in access control	2 - 3 - 4
Max. range (m)	selectable 2 - 5 for 14 mm resolution selectable 6 – 18 for 20 – 30 – 40 – 50 – 90 mm resolutions and 2 – 3 - 4 beams selectable 22 - 60 for 2 - 3 - 4 beams Long Range selectable 25 - 80 for 2 - 3 beams Long Range DB
Response time (ms)	6 - 27
Safety outputs	2 PNP auto-controlled – 500 mA at 24 VDC with short-circuit, overload, polarity reversal protection
Signalling	seven-segment display and LEDs for light curtain's status and diagnostic
Start/Restart	selectable automatic or manual
External Device Monitoring	external device monitoring feedback input with enabling, selectable
Power supply (VDC)	24 ± 20%
Electrical connections for AX and AX Master	M12 - 5 poles for emitter M12 - 8 poles for receiver
Electrical connections for Master and Slave	M12 - 5 poles for emitter and receiver
Max. cable length m	100 (50 between master and slave)
Operating temperature (°C)	0 to 55
Protection rating	IP 65
Fastening modes	3: back slot, side slot or to the top and lower end
Cross section (mm)	35 x 45

Safety level:

Type **4**

SIL 3 – SILCL 3
PL e – Cat. 4

ADMIRAL AX

WITH BUILT-IN CONTROL FUNCTIONS

Resolution 14 mm	AX 151	AX 301	AX 451	AX 601	AX 751	AX 901	AX 1051	AX 1201	AX 1351	AX 1501	AX 1651	AX 1801
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	15	30	45	60	75	90	105	120	135	150	165	180
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 20 mm	AX 152	AX 302	AX 452	AX 602	AX 752	AX 902	AX 1052	AX 1202	AX 1352	AX 1502	AX 1652	AX 1802
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	15	30	45	60	75	90	105	120	135	150	165	180
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 30 mm	AX 153	AX 303	AX 453	AX 603	AX 753	AX 903	AX 1053	AX 1203	AX 1353	AX 1503	AX 1653	AX 1803
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	8	16	24	32	40	48	56	64	72	80	88	96
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 40 mm	AX 304	AX 454	AX 604	AX 754	AX 904	AX 1054	AX 1204	AX 1354	AX 1504	AX 1654	AX 1804
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	10	15	20	25	30	35	40	45	50	55	60
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 50 mm	AX 305	AX 455	AX 605	AX 755	AX 905	AX 1055	AX 1205	AX 1355	AX 1505	AX 1655	AX 1805
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	8	12	16	20	24	28	32	36	40	44	48
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 90 mm	AX 309	AX 459	AX 609	AX 759	AX 909	AX 1059	AX 1209	AX 1359	AX 1509	AX 1659	AX 1809
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	5	7	9	11	13	15	17	19	21	23	25
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

2-3-4 beams	AX 2B	AX 3B	AX 4B	AX* 2B LR	AX* 3B LR	AX * 4B LR	AX** 2B LR DB	AX** 3B LR DB
Number of beams	2	3	4	2	3	4	2	3
Beam spacing (mm)	500	400	300	500	400	300	500	400
Protected heights (mm)	510	810	910	510	810	910	510	810
Overall height (mm)	711	1011	1111	711	1011	1111	711	1011

• For accessories see page 77 • For ordering codes see page 218

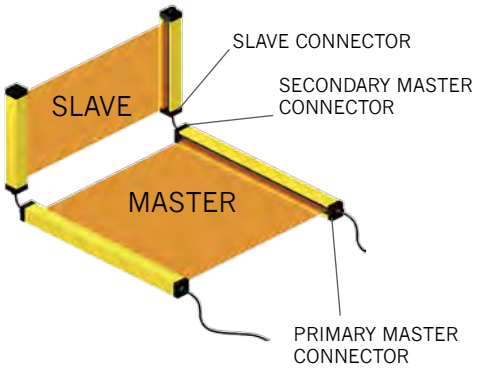
* Max. range 60 m
** Max. range 80 m

ADMIRAL AX

WITH BUILT-IN CONTROL FUNCTIONS

MASTER/SLAVE MODELS

Master/Slave models permit series connection of two light curtains achieving two main advantages:
- A single pair of safety outputs
- No interference between light curtains installed adjacent to one another.

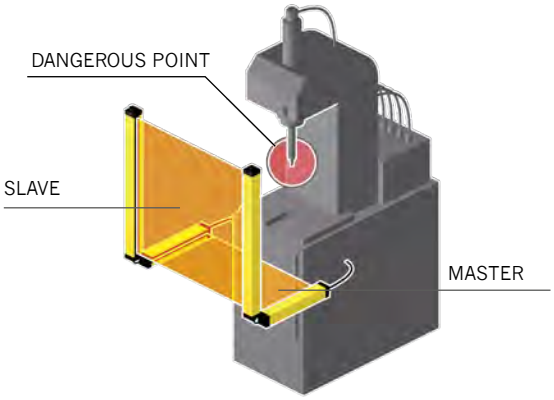


EXAMPLE OF SERIAL CONNECTION BETWEEN A MASTER LIGHT CURTAIN AND A SLAVE LIGHT CURTAIN

It is possible to combine any Master model with any Slave model.

All the electrical connections are made using 5-pole M12 connectors, except for the Master receiver, which requires an 8-pole M12 connector.

Pre-wired cables with twin connectors are available for the connection between Master and Slave.

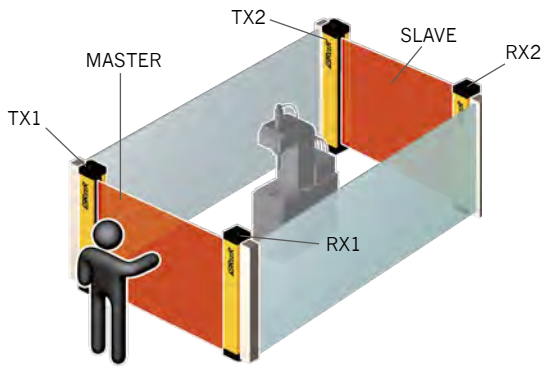


EXAMPLE OF SERIAL CONNECTION BETWEEN A MASTER LIGHT CURTAIN AND A SLAVE LIGHT CURTAIN

The Master light curtain is positioned horizontally for detecting the presence of the person while the vertical Slave light curtain detects fingers or hands.

However, it is possible to invert the combination and have the Master light curtain positioned vertically for protection of fingers or hands and the Slave light curtain horizontally for detecting the presence of the person.

The application illustrated is one of the most common: the horizontal light curtain is used for eliminating the possibility for the operator not to be detected between the vertical light curtain and the dangerous machine at the start or restart of the system.



EXAMPLE OF SERIAL CONNECTION BETWEEN A MASTER LIGHT CURTAIN AND A SLAVE LIGHT CURTAIN FOR PROTECTION OF 2 SIDES OF THE MACHINE

In the Admiral AX light curtains the connection cable between Master and Slave is a standard unshielded cable that can be up to 50 meters long.

This characteristic allows the application of 2 light curtains in series positioned on the front and on the back of the dangerous machine, with a single connection towards the power and control circuits of the machine.

ADMIRAL AX

WITH BUILT-IN CONTROL FUNCTIONS

MASTER/SLAVE MODELS

MASTER Resolution 14 mm		AX 301M	AX 451M	AX 601M	AX 751M	AX 901M	AX 1051M	AX 1201M	AX 1501M
SLAVE Resolution 14 mm	AX 151S	AX 301S	AX 451S	AX 601S	AX 751S	AX 901S	AX 1051S	AX 1201S	AX 1501S
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1510
Number of beams	15	30	45	60	75	90	105	120	150
Overall height (mm) *	261	411	561	711	861	1011	1161	1311	1611

MASTER Resolution 20 mm		AX 302M	AX 452M	AX 602M	AX 752M	AX 902M	AX 1052M	AX 1202M	AX 1502M
SLAVE Resolution 20 mm	AX 152S	AX 302S	AX 452S	AX 602S	AX 752S	AX 902S	AX 1052S	AX 1202S	AX 1502S
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1510
Number of beams	15	30	45	60	75	90	105	120	150
Overall height (mm) *	261	411	561	711	861	1011	1161	1311	1611

MASTER Resolution 30 mm		AX 303M	AX 453M	AX 603M	AX 753M	AX 903M	AX 1053M	AX 1203M	AX 1503M
SLAVE Resolution 30 mm	AX 153S	AX 303S	AX 453S	AX 603S	AX 753S	AX 903S	AX 1053S	AX 1203S	AX 1503S
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1510
Number of beams	8	16	24	32	40	48	56	64	80
Overall height (mm) *	261	411	561	711	861	1011	1161	1311	1611

MASTER Resolution 50 mm		AX 305M	AX 455M	AX 605M	AX 755M	AX 905M	AX 1055M	AX 1205M	AX 1505M
SLAVE Resolution 50 mm		AX 305S	AX 455S	AX 605S	AX 755S	AX 905S	AX 1055S	AX 1205S	AX 1505S
Protected heights (mm)		310	460	610	760	910	1060	1210	1510
Number of beams		8	12	16	20	24	28	32	40
Overall height (mm) *		411	561	711	861	1011	1161	1311	1611

MASTER 2-3 beams								AX 2BM	AX 3BM
SLAVE 2-3 beams								AX 2BS	AX 3BS
Number of beams								2	3
Beam spacing (mm)								500	400
Protected heights (mm)								510	810
Overall height (mm) *								711	1011

* In the Master models the total light curtain height is increased by 10 mm due to the presence of the secondary connector

• For accessories see page 77 • For ordering codes see page 218

ADMIRAL AX BK

WITH BLANKING FUNCTION

MAIN FEATURES

Two self-testing solid state PNP safety outputs.
Built-in floating blanking function with 5 configuration modes.
All connections and configurations by means of M12 connectors.
Use of unshielded cables up to 100 m.
Suppression of optical interference by means of range selection.
Master and Slave models for serial connection of 2 light curtains.
Maximum length of the connections between Master and Slave: 50 meters, with standard unshielded cable.
Start/Restart interlock and EDM via external AD SR1 interface.

TECHNICAL FEATURES

Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Protected heights (mm)	160 - 1810
Resolutions (mm)	14 - 20 - 40 - 90
Max. range (m)	selectable 2 - 5 for 14 mm resolution selectable 6 – 18 for 20 – 40 – 90 mm resolution
Response time (ms)	6 - 27
Safety outputs	2 PNP auto-controlled – 500 mA at 24 VDC with short-circuit, overload, polarity reversal protection
Signalling	seven-segment display and LEDs for light curtain's status and diagnostic
Start/Restart	automatic
Blanking	floating, selectable
Blanking configurations	5 modes: 1, 2 or 3 beams without compulsory object presence 1 or 2 beams with compulsory object presence
Power supply (VDC)	24 ± 20%
Electrical connections for AX and AX Master	M12 - 5 poles for emitter M12 - 8 poles for receiver
Electrical connections between Master and Slave	M12 - 5 poles for emitter and receiver
Max. cable length (m)	100 (50 between master and slave)
Operating temperature (°C)	0 to 55
Protection rating	IP 65
Fastening modes	3: back slot, side slot or to the top and lower end
Cross section (mm)	35 x 45

Safety level:

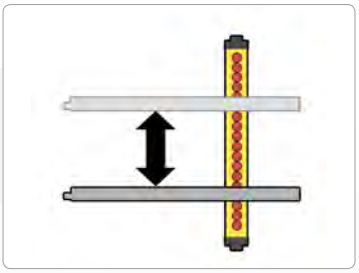
Type **4**

SIL 3 – SILCL 3
PL e – Cat. 4

ADMIRAL AX BK
WITH BLANKING FUNCTION

THE BLANKING FUNCTION

Information on the blanking function can be found on page 41 in the Safety Guide section.



The Floating Blanking function is available on the Admiral AX BK models. Floating Blanking allows the detected object to move freely inside the light curtain's protected field, under the condition that the intercepted beams are adjacent and that their number is not higher than the configured one.

CONFIGURATION MODES OF THE BLANKING FUNCTION IN THE ADMIRAL AX BK MODELS:

Mode	Type of blanking configuration	N° of beams in blanking	Detection characteristics
A1	1 beam without compulsory object presence	1	1 beam can be obstructed with the light curtain remaining in an ON condition
A2	2 beams without compulsory object presence	2	1 or 2 adjacent beams can be obstructed with the light curtain remaining in an ON condition
A3	3 beams without compulsory object presence	3	1, 2 or 3 adjacent beams can be obstructed with the light curtain remaining in an ON condition
B1	2 beams with compulsory object presence	1/2	at least 1 beam and no more than 2 adjacent beams must be obstructed for the light curtain to remaining in an ON condition
B2	3 beams with compulsory object presence	1/2/3	at least 1 beam and no more than 3 adjacent beams must be obstructed for the light curtain to remaining in an ON condition

WARNING!

The AX BK light curtains with blanking function do not have the feedback input (EDM); therefore, they cannot be combined with the AD SR0 and AD SR0A relay modules but they should be connected with the AD SR1 or AD SRM safety interfaces.
The use of the blanking function and the type of configuration selected depend on the characteristics of the application to be protected. You need to verify, based on the risk analysis of your application, whether the use of this function is permitted or not and what configuration it is possible to use.
ReeR SpA does not assume responsibility for the improper use of the blanking function and for any consequent damage.

The use of the blanking function may need a recalculation of the safety distance due to the modified detection capability

Resolution 14 mm	AX 151 BK	AX 301 BK	AX 451 BK	AX 601 BK	AX 751 BK	AX 901 BK	AX 1051 BK	AX 1201 BK	AX 1351 BK	AX 1501 BK	AX 1651 BK	AX 1801 BK
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	15	30	45	60	75	90	105	120	135	150	165	180
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 20 mm	AX 152 BK	AX 302 BK	AX 452 BK	AX 602 BK	AX 752 BK	AX 902 BK	AX 1052 BK	AX 1202 BK	AX 1352 BK	AX 1502 BK	AX 1652 BK	AX 1802 BK
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	15	30	45	60	75	90	105	120	135	150	165	180
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

ADMIRAL AX BK

WITH BLANKING FUNCTION

Resolution 40 mm	AX 304 BK	AX 454 BK	AX 604 BK	AX 754 BK	AX 904 BK	AX 1054 BK	AX 1204 BK	AX 1354 BK	AX 1504 BK	AX 1654 BK	AX 1804 BK
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	10	15	20	25	30	35	40	45	50	55	60
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 90 mm	AX 609 BK	AX 759 BK	AX 909 BK	AX 1059 BK	AX 1209 BK	AX 1359 BK	AX 1509 BK	AX 1659 BK	AX 1809 BK
Protected heights (mm)	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	9	11	13	15	17	19	21	23	25
Overall height (mm)	711	861	1011	1161	1311	1461	1611	1761	1911

MASTER MODELS WITH BLANKING

Resolution 14 mm	AX 301 BKM	AX 451 BKM	AX 601 BKM	AX 751 BKM	AX 901 BKM	AX 1051 BKM	AX 1201 BKM	AX 1501 BKM
Protected heights (mm)	310	460	610	760	910	1060	1210	1510
Number of beams	30	45	60	75	90	105	120	150
Overall height (mm)	421	571	721	871	1021	1171	1321	1671

Resolution 20 mm	AX 302 BKM	AX 452 BKM	AX 602 BKM	AX 752 BKM	AX 902 BKM	AX 1052 BKM	AX 1202 BKM	AX 1502 BKM
Protected heights (mm)	310	460	610	760	910	1060	1210	1510
Number of beams	30	45	60	75	90	105	120	150
Overall height (mm)	421	571	721	871	1021	1171	1321	1671

- The Master with Blanking models are combined with the Slave models of the Admiral series AX.
- The blanking function is only present on the Master models with resolution 14 and 20 mm.

• For accessories see page 77 • For ordering codes see page 219

ORDERING INFORMATION (for ordering codes see page 217)

Each Admiral light curtain comprises:
▪ Emitter and Receiver pair
▪ Mounting brackets and T-nuts
▪ CD-ROM containing the multi-language instruction manual complete with CE declaration of conformity
▪ Quick installation guide

ADMIRAL

ACCESSORIES

For Admiral light curtains the following accessories, to be ordered separately, are available:	
▪ AD SR Safety Relays	see page 180
▪ LAD laser alignment device	see page 210
▪ FMC floor mounting columns	see page 206
▪ SP deflection mirrors	see page 209
▪ SFB swivel fixing brackets	see page 212
▪ SAV vibrations dampers	see page 211
▪ Connectors	see list hereunder:

CONNECTORS FOR ADMIRAL (AD emitter and receiver / AX - AX BK emitter)

Model	**Description**
CD 5	M12 straight connector, 5 poles, pre-wired cable 5 m
CD 10	M12 straight connector, 5 poles, pre-wired cable 10 m
CD 15	M12 straight connector, 5 poles, pre-wired cable 15 m
CD 20	M12 straight connector, 5 poles, pre-wired cable 20 m
CD 25	M12 straight connector, 5 poles, pre-wired cable 25 m
CD 50	M12 straight connector, 5 poles, pre-wired cable 50 m
CD 95	M12 90° angle connector, 5 poles, pre-wired cable 5 m
CD 910	M12 90° angle connector, 5 poles, pre-wired cable 10 m
CD 915	M12 90° angle connector, 5 poles, pre-wired cable 15 m
CDM 9	M12 straight connector, 5 poles with screw terminal, PG9 cable gland
CDM 99	M12 angle connector, 5 poles with screw terminal, PG9 cable gland

CONNECTORS FOR ADMIRAL AX and AX BK receiver

Model	**Description**
C8D 5	M12 straight connector, 8 poles, pre-wired cable 5 m
C8D 10	M12 straight connector, 8 poles, pre-wired cable 10 m
C8D 15	M12 straight connector, 8 poles, pre-wired cable 15 m
C8D 25	M12 straight connector, 8 poles, pre-wired cable 25 m
C8D 40	M12 straight connector, 8 poles, pre-wired cable 40 m
C8D 95	M12 90° angle connector, 8 poles, pre-wired cable 5 m
C8D 910	M12 90° angle connector, 8 poles, pre-wired cable 10 m
C8D 915	M12 90° angle connector, 8 poles, pre-wired cable 15 m
C8DM 11	M12 straight connector, 8 poles with screw terminal, PG9/11 cable gland
C8DM 911	M12 angle connector, 8 poles with screw terminal, PG9/11 cable gland

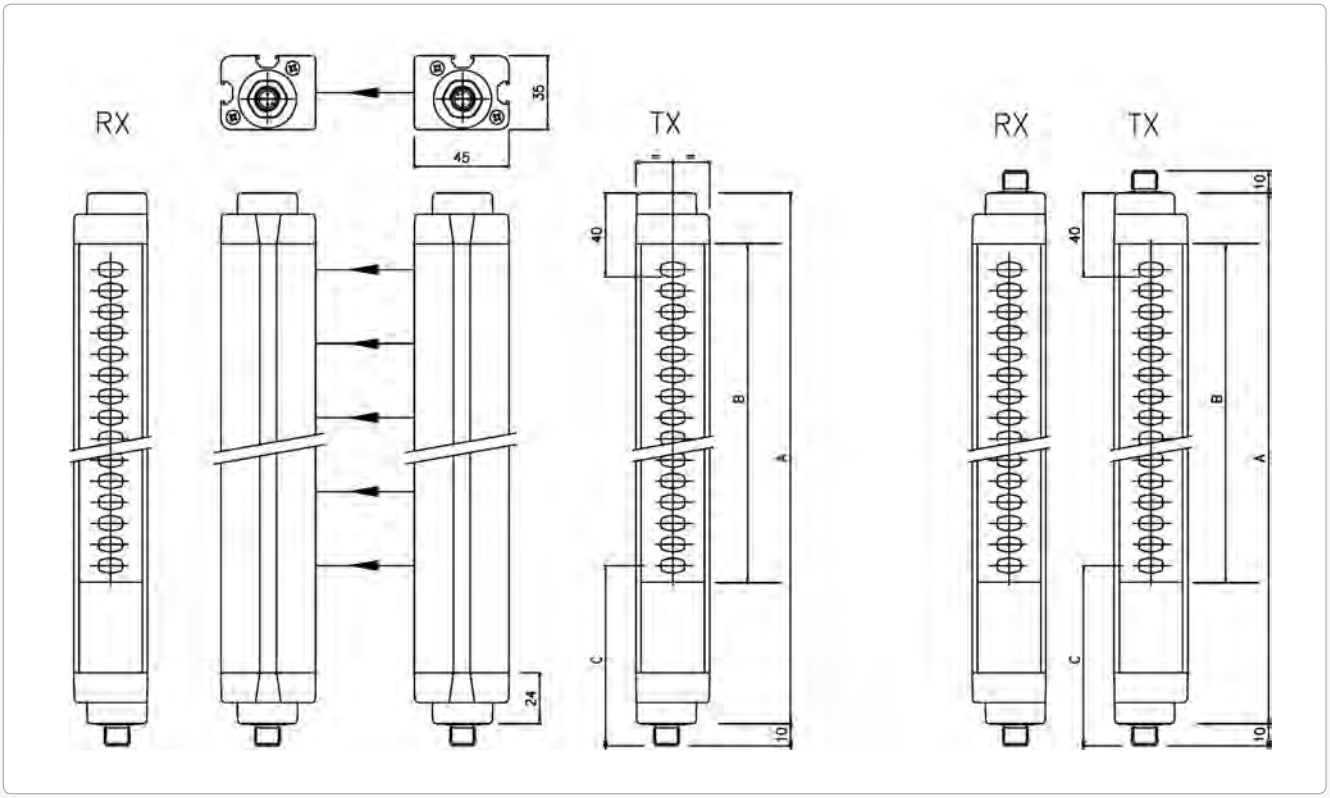
CONNECTION BETWEEN MASTER AND SLAVE

Model	**Descrizione**
CDS 03	0.3 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 3	3 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 5	5 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 10	10 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 25	25 m pre-wired cable with 2 straight connectors, M12 5 poles

ADMIRAL

DIMENSIONS (mm)

STANDARD AND SLAVE MODELS **MASTER MODELS**



Model	150	300	450	600	750	900	1050	1200	1350	1500	1650	1800
A	251	401	551	701	851	1001	1151	1301	1451	1601	1751	1901
B (protected height)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
C (1st beam position)	85											
Mounting	2 LS type brackets with 2 inserts							3 LS type brackets with 3 inserts				

Model	2B	3B	4B
A	701	1001	1101
B	510	810	910
C (1st beam position)	135		
Mounting	2 LS type brackets with 2 inserts		

WARNING!

- When the light curtain works in the presence of strong vibrations (presses, weaving machines etc.), in order to avoid damages to the light curtain it is necessary to use the vibration dampers SAV (available as accessories)
- When long range protections or perimeter protections employing mirrors have to be realised it is advisable to use the LAD laser pointer as an alignment aid, as well as the adjustable swivel fastening brackets SFB.

JANUS

JANUS

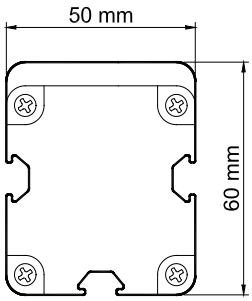
The Janus type 4 family of safety light curtains is the ideal solution for the protection of a vast number of high-risk industrial applications, in particular those requiring a high level of integration of the safety functions.

For example, in the models with built-in Muting function, Janus guarantees the independence of the light curtain from the control circuits of the system (often distant from the protected gate) and, where necessary, also the integration of the Muting sensors.

The features of the Janus range include:

- Settings of each function integrally performed via the main connector. No need of configuration via software.
- Integration of the main safety functions, including self-testing of the solid state outputs, external device monitoring (EDM) and the Start/Restart interlock function.
- Integration of the Muting function for the MI models and of the Muting sensors for the ML and MT models.
- The utmost reliability in the field, thanks to the rugged construction and to the high level of immunity to external interference (optical, EMC, etc.).
- Operating temperature range -10 to 55° C.
- Janus TRX with passive retro-reflector element also available for models with integrated Muting sensors.

Cross section



Safety level: Type 4 – SIL 3 – SILCL 3 – PL e – Cat. 4

- 2006/42/CE "Machinery Directive"
- 2004/108/CE "Electromagnetic Compatibility (EMC)"
- 2006/95/CE "Low Voltage Directive (LVD)"
- IEC/EN 61496-1 Ed. 2.1, IEC/TS 61496-2 Ed. 2 "Safety of machinery - Electro-sensitive protective equipment- General requirements and tests"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems"
- IEC/TS 62046 Ed. 2 "Safety of machinery – Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada
- ANSI / UL 1998 "Safety Software in Programmable Components".

JANUS M
WITH MUTING FUNCTION

THE JANUS RANGE

JANUS M and **JANUS M TRX** with **built-in Muting function**

- Janus MI and MI TRX with connectors for external sensors of any type
- Janus MI TRXL with single connector for all connections, including external sensors
- Janus ML and ML TRX and Janus MT and MT TRX featuring an innovative horizontal arm system with built-in Muting photoelectric sensors, prewired and prealigned
- Janus ML TRX G and Janus MT TRX G (Glass) with special built-in Muting sensors to optimize correct and consistent detection of glass and transparent materials in general.

JANUS J, JANUS J TRX, JANUS J TRX L

These models, without Muting function, have the same dimensional and electrical features of M versions with Muting.

They include:

- Janus J, 2 - 3 - 4 beams
- Janus J Long Range, 60 m, models with 2 - 3 - 4 beams and models with 40 mm resolution and protected height from 610 to 1210 mm
- Janus J TRX and J TRXL with 2 - 3 - 4 beams, consist of one active emitter/receiver element and one retro-reflecting passive element which does not need electrical connections.

ATEX Models

Special models in compliance with the "ATEX Directive" 94/9/CE – Dust Zone 22. - Gas Zone 2 available on request.

JANUS MJB Connection Box for JANUS Light grids

Connection boxes Janus MJB are accessory devices designed for quick, reliable connection of Janus light grids and to ensure that major operating controls needed for operation are available in the guarded area.

- Illuminated Restart pushbutton with green led for safety output status signaling
- Key selector switch for Override function
- Muting-on indicator light
- Dip-switch for light grid functions configuration
- 2 guided-contacts safety relays operated and controlled by the light grid
- Versions without restart and override controls for connection to Janus J light grids without Muting
- Special models complying with "Directive ATEX" 94/9/EC - Dust Zone 22 - Gas Zone 2 available on request.

JANUS M

WITH MUTING FUNCTION

MAIN FEATURES

Built-in Muting function in all the models.

Ideal for palletiser applications.

MI models with front M12 connectors for external Muting sensors, with operating logic with 2 or 4 sensors.

Patented ML and MT models with Muting sensors built into pre-wired and pre-aligned arms, adjustable in height and angle.
ML: pallet outfeed only. MT: pallet infeed and outfeed.

Broad flexibility of configuration for the Muting timeouts; two types of override selectable. Configuration is carried out via hardware by means of the main connector. Use of unshielded cables up to 100 m.

MI Long Range models available with range up to 60 m.

MJB Connection Box for quick connection of the light curtains and providing the main commands necessary for their operation close to the protected gate.

Special models in compliance with the "ATEX Directive" 94/9/CE – Dust Zone 22. - Gas Zone 2 available on request.

Safety level:

Type 4

SIL 3 – SILCL 3
PL e – Cat. 4

JANUS M
WITH MUTING FUNCTION

JANUS M

MI SERIES

The MI series features dedicated connections for connecting external Muting sensors of any type such as photocells, proximity sensors, limit switches, etc.; it can manage the Muting function in both two-way and one-way mode.

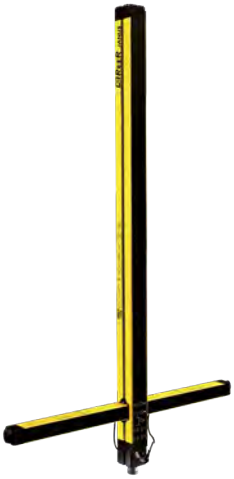
A wide range of models with protected height from 310 mm to 1810 mm with resolution of 30, 40, 90 mm and models with 2, 3, 4 beams provides the solution to any application problem.

ML SERIES

The ML series, with 2 or 3 beams for detecting the presence of a person, uses an original system of horizontal arms (one for the emitter and one for the receiver) with built-in pre-wired and pre-aligned photoelectric Muting sensors which do not require any adjustment.

The arms can be adjusted in height in order to create a detection plane that is more or less angled, with the purpose to achieve correct and constant detection of the material in transit and therefore reliable operation of the protection system.
This ensures the maximum speed and simplicity of installation.
The ML series manages the Muting function in one-way mode and is particularly suitable for protecting the outfeed gates of palletising systems.

The ML series also includes ML_S2 special models for the correct detection of transparent objects.



MT SERIES

The MT series features four horizontal arms (two for the emitter and two for the receiver) with built-in pre-wired and pre-aligned photoelectric Muting sensors that do not require any adjustment.
The arms can be adjusted in height in order to create a detection plane that is more or less angled, with the purpose to achieve correct and constant detection of the material in transit and therefore reliable operation of the protection system.
This ensures the maximum speed and simplicity of installation. The MT series manages the Muting function in two-way mode for the protection of the infeed/outfeed gates in palletising systems.

The MT series also includes MT_S4 special models for the correct detection of transparent objects.

Models ML and MT are quick and easy to install. Also, they are complying with regulatory requirements on Muting sensor geometry and all other safety-related parameters, as per IEC TS 62046 and other current standards.

JANUS M

WITH MUTING FUNCTION

GENERAL TECHNICAL DATA

Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Response time (ms)	7 - 30
Safety outputs	2 PNP auto-controlled – 500 mA at 24 VDC
Light curtain status indication and weak signal output	PNP – 100 mA at 24 VDC
Signalling	7-segment display and LEDs for self-diagnosis and light curtain status
Muting lamp output	24 VDC; 0,5 - 5 W
Start/Restart	selectable automatic or manual
External Device Monitoring	External device monitoring feedback input with enabling, selectable
Max. Muting timeout	30 sec or 90 min selectable (30 sec or infinite selectable only for MT_S4 and MI models with 4 sensors logic)
Override function	Built-in override function with 2 operating modes, selectable: - manual action with hold to run - automatic with pulse command
Max. Override Time-out (min)	15
Power supply (VDC)	24 ± 20%
Electrical connections MI-ML-MT models	Emitter M12 5-pole – receiver: M23 19-pole - Muting sensors: M12 5-pole
Max. length electrical connections (m)	100
Operating temperature (°C)	-10 to 55
Protection rating	IP 65
Cross-section dimensions (mm)	50 x 60
MI SERIES	
Protected heights (mm)	310 - 1810 for light curtains with 40 and 90 mm resolution 310 - 1210 for light curtains with 30 mm resolution
Resolutions available (mm)	30 – 40 - 90
Number of beams for access control	2 – 3 – 4
Max. range (m)	selectable 6 – 16
Max. range for Long Range models (m)	selectable 30 – 60
Muting logic	two-way with 2 or 4 sensors one-way with 2 sensors
Muting Sensors	External Muting sensors with relay or PNP output (dark-on logic)
ML SERIES	
Number of beams for access control	2 – 3
Operating range (m)	1 - 2,5 (0 - 2 for ML_S2)
Muting logic	one-way with 2 sensors
Muting Sensors	optoelectronic with 2 crossed or parallel beams built-in – pre-aligned – pre-wired, with adjustable height and angle
MT SERIES	
Number of beams for access control	2 – 3
Operating range (m)	1 - 2,5 (0 - 2 for MT_S4)
Muting logic	two-way with 2 sensors (models MT) two-way sequential with 4 sensors (models MT_S4)
Muting Sensors	optoelectronic with 2 crossed or 4 parallel beams built-in – pre-aligned – pre-wired, with adjustable height and angle

JANUS M
WITH MUTING FUNCTION

MI and MI LR 2 – 3 – 4 beams	MI 2B	MI 3B	MI 4B	MI 2B LR	MI 3B LR	MI 4B LR
Number of beams	2	3	4	2	3	4
Beam spacing (mm)	500	400	300	500	400	300
Protected heights (mm)	510	810	910	510	810	910
Overall height (mm)	776	1076	1176	776	1076	1176
Max. range. (m)	selectable 6-16			selectable 30-60		

ML 2 – 3 beams	ML 2B	ML 3B	ML 2B S2	ML 3B S2	MT 2 – 3 beams	MT 2B	MT 3B	MT 2B S4	MT 3B S4
Number of beams	2	3	2	3	Number of beams	2	3	2	3
Beam spacing (mm)	500	400	500	400	Beam spacing (mm)	500	400	500	400
Protected heights (mm)	510	810	510	810	Protected heights (mm)	510	810	510	810
Overall height (mm)	776	1076	776	1076	Overall height (mm)	776	1076	776	1076
Muting Sensors	2 crossed beams		2 parallel beams		Muting Sensors	2 crossed beams		4 parallel beams	
Operating range (m)	1 - 2,5		0 - 2		Operating range (m)	1 - 2,5		0 - 2	

MI Resolution 30 mm	MI 303	MI 453	MI 603	MI 753	MI 903	MI 1053	MI 1203
Protected heights (mm)	310	460	610	760	910	1060	1210
Number of beams	16	24	32	40	48	56	64
Overall height (mm)	476	626	776	926	1076	1226	1376
Max. range (m)	selectable 6 – 16						

MI Resolution 40 mm	MI 304	MI 454	MI 604	MI 754	MI 904	MI 1054	MI 1204	MI 1354	MI 1504	MI 1654	MI 1804
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	10	15	20	25	30	35	40	45	50	55	60
Overall height (mm)	476	626	776	926	1076	1226	1376	1526	1676	1826	1976
Max. range (m)	selectable 6 – 16										

MI Long Range Resolution 40 mm	MI 604 LR	MI 904 LR	MI 1204 LR
Protected heights (mm)	610	910	1210
Number of beams	20	30	40
Overall height (mm)	776	1076	1376
Max. range (m)	selectable 30 – 60		

MI Resolution 90 mm	MI 309	MI 459	MI 609	MI 759	MI 909	MI 1059	MI 1209	MI 1359	MI 1509	MI 1659	MI 1809
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	5	7	9	11	13	15	17	19	21	23	25
Overall height (mm)	476	626	776	926	1076	1226	1376	1526	1676	1826	1976
Max. range (m)	selectable 6 – 16										

• For accessories see page 106 • For ordering codes see page 220

JANUS M TRX

WITH BUILT-IN CONTROL FUNCTIONS AND PASSIVE RETRO-REFLECTOR ELEMENT

MAIN FEATURES

Built-in Muting function in all the models.

Ideal for palletiser applications.

Models with passive retroreflector element, MI TRX with front M12 connectors for external Muting sensors and operating logic with 2 or 4 sensors, and MI TRXL with single M23 connector and operating logic with 2 sensors, suitable for applications for access control with two, three and four beams.

Patented ML TRX and MT TRX models with passive retroreflector elements and reflex Muting sensors built into pre-wired and pre-aligned arms, adjustable in height and angle.
ML TRX: pallet outfeed only. MT TRX: pallet infeed and outfeed.

MM TRX models with two, three and four beams with modular system which permits to add pre-wired muting arms so that the light grid can be used either as one-way (ML TRX) or as entry/exit (MT TRX) system with a few simple steps. MM TRX can also be used with external Muting sensors, with 2 or 4 sensors logic.

Broad flexibility of configuration for the Muting timeouts; two types of override selectable.

Input Muting enable and Muting state output available.

Configuration is carried out via hardware by means of the main connector.

Unshielded cables up to 100 m long are used.

MJB Connection Box for quick connection of the light curtains and providing the main commands necessary for their operation close to the protected gate.

Special models in compliance with the "ATEX Directive" 94/9/EC – Dust Zone 22. - Gas Zone 2 available on request.

JANUS ML TRX

Safety level:

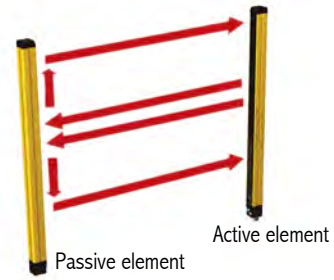
Type **4**

SIL 3 – SILCL 3
PL e – Cat. 4

JANUS M TRX

WITH BUILT-IN CONTROL FUNCTIONS AND PASSIVE RETRO-REFLECTOR ELEMENT

JANUS M TRX



JANUS MI TRX, MI TRXL

Janus MI TRX and MI TRXL is composed of an active element and of a passive retro-reflector element requiring no wiring.
It features dedicated connections for connecting external muting sensors of any type such as photo-cells, proximity sensors, limit switches, etc.
The MI series can manage the muting function in both two-way and one-way mode.

Models with 2 – 3 – 4 beams provide the solution to any application problem in access control.

JANUS MM TRX NEW PRODUCT

Janus MM TRX is a modular system with 2, 3 and 4 beams which permits to add pre-wired muting arms in order to get either a ML TRX (one way) or a MT TRX (entry/exit) model with a few simple steps.
Janus MM TRX can also be used with external Muting sensors, with 2 or 4 sensors logic.

SL TRX and ST TRX are the pre-wired muting arms and can be ordered separately. Muting logics for models MM TRX are one-way (only exit), together with SL TRX, and two-way (entry/exit) together with SL TRX and ST TRX.

MM TRX model provides solutions to any kind of applications in access control with a unique part number, reducing the article numbers to be kept on stock.

JANUS ML TRX, ML TRX G, ML TRX V

Janus ML TRX and ML TRX G, with 2 or 3 beams for detecting the presence of a person, uses an original system of horizontal arms (one for the emitter and one for the receiver) with built-in, pre-wired and pre-aligned, photoelectric muting sensors which do not require any adjustment.
Both the light grid and the sensor arms are composed of an active, emitter/receiver element and of a passive, retro-reflector element, requiring no wiring.
The sensor arms can be adjusted in height in order to create a detection plane that is more or less angled, with the purpose to achieve correct and constant detection of the material in transit and therefore reliable operation of the protection system.
This ensures the maximum speed and simplicity of installation.

The ML TRX series manages the muting function in one-way mode and is particularly suitable for protecting the outfeed gates of palletising systems.

ML TRX V models with longer built-in muting arms available for high-speed conveyors.

JANUS MT TRX, MT TRX G, MT TRX V

Janus MT TRX and MT TRX G features four horizontal arms (two for the emitter and two for the receiver) with built-in pre-wired and pre-aligned photoelectric muting sensors that do not require any adjustment.
Both the light grid and the sensor arms are composed of an active, emitter/receiver element and of a passive, retro-reflector element, requiring no wiring.
The arms can be adjusted in height in order to create a detection plane that is more or less angled, with the purpose to achieve correct and constant detection of the material in transit and therefore reliable operation of the protection system.
This ensures the maximum speed and simplicity of installation.

The MT TRX series manages the muting function in two-way mode for the protection of the infeed/outfeed gates in palletising systems.

MT TRX V models with longer built-in muting arms available for high-speed conveyors.

ML TRX and MT TRX models are quick and easy to install. Also, they are complying with regulatory requirements on Muting sensor geometry and all other safety-related parameters, as per IEC TS 62046 and other current standards.

JANUS M TRX

WITH BUILT-IN CONTROL FUNCTIONS AND PASSIVE RETRO-REFLECTOR ELEMENT

GENERAL TECHNICAL DATA

Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Response time (ms)	≤ 7
Safety outputs	2 PNP – 500 mA at 24 VDC
Light curtain status indication and weak signal output	PNP – 100 mA at 24 VDC
Muting status indication output	PNP – 100 mA at 24 VDC
Muting lamp output	24 VDC; 0,5 - 5W
Muting Enable input	Active Low - 24 VDC
Signalling	7-segment display and LEDs for self-diagnosis and light curtain status
Start/Restart	Automatic or manual restart selectable
External Device Monitoring	External device monitoring feedback input with enabling, selectable
Max. muting timeout	30 sec or 90 min selectable and (30 sec or infinite selectable only MT TRX and MI TRX models with 4 sensors logic)
Override function	Built-in override function with 2 operating modes, selectable: - manual action with hold to run - automatic with pulse command
Max. Override Time-out (min.)	15
Power supply (VDC)	24 ± 20%
Electrical connections MI TRX – ML TRX - MT TRX models	Main connector: M23 19-pole - muting sensors: M12 5-pole
Electrical connections MI TRXL	Active element: M23 19-pole
Max. length electrical connections (m)	100
Operating temperature (°C)	-10 to 55
Protection rating	IP 65
Cross-section dimensions (mm)	50 x 60
MI TRX / MI TRXL SERIES	
Number of beams	2 – 3 – 4
Max. range (m)	6
Muting Logic	MI TRX two-way with 2 or 4 sensors and one-way with 2 sensors MI TRXL two-way with 2 sensors
Muting Sensors	External muting sensors with relay or PNP output (dark-on logic)
MM TRX SERIES	
Number of beams	2 – 3 – 4
Max. range (m)	6 (3,5 when fitted with SL TRX and ST TRX)
Muting Logic	Two-way with 2 or 4 external sensors and one-way with 2 external sensors One way with 2 sensors with SL TRX muting arm Two way with 4 sensors together with SL TRX and ST TRX muting arms
Muting Sensors	External muting sensors with relay or PNP output (dark-on logic) Reflex optoelectronic with 2 parallel beams Built-in – pre-aligned – pre-wired, with adjustable height and angle with SL TRX Reflex optoelectronic with 4 parallel beams Built-in – pre-aligned – pre-wired, with adjustable height and angle with SL TRX and ST TRX
ML TRX / ML TRX G / ML TRX V SERIES	
Number of beams	2 – 3
Operating range ML TRX, ML TRX V (m)	0 - 3,5
Operating range ML TRX G (m)	0 - 2

JANUS M TRX

WITH BUILT-IN CONTROL FUNCTIONS AND PASSIVE RETRO-REFLECTOR ELEMENT

Muting Sensors	Reflex optoelectronic with 2 parallel beams Built-in – pre-aligned – pre-wired, with adjustable height and angle
MT TRX / MT TRX G / MT TRX V SERIES	
Number of beams	2 – 3
Operating range MT TRX, MT TRX V (m)	0 - 3,5
Operating range MT TRX G (m)	0 - 2
Muting logic	Two-way sequential with 4 sensors
Muting Sensors	Reflex optoelectronic with 4 parallel beams Built-in – pre-aligned – pre-wired, with adjustable height and angle

MI TRX – MI TRXL 2 – 3 – 4 beams	MI 2B TRX	MI 3B TRX	MI 4B TRX	MI 2B TRXL	MI 3B TRXL	MI 4B TRXL
Number of beams	2	3	4	2	3	4
Beam spacing (mm)	500	400	300	500	400	300
Protected heights (mm)	510	810	910	510	810	910
Overall height (mm)	776	1076	1176	741	1041	1141
Max. range. (m)	6					

MM TRX 2 – 3 – 4 beams	MM 2B TRX	MM 3B TRX	MM 4B TRX
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	776	1076	1176
Max. range. (m)	6 (3,5 when fitted with SL TRX and ST TRX)		

ML TRX – ML TRX G – ML TRX V 2 – 3 beams	ML 2B TRX/ ML 2B TRX V	ML 2B TRX G	ML 3B TRX/ ML 3B TRX V	ML 3B TRX G
Number of beams	2		3	
Beam spacing (mm)	500		400	
Protected heights (mm)	510		810	
Overall height (mm)	776		1076	
Muting Sensors	2 parallel beams	2 parallel beams (transparent material)	2 parallel beams	2 parallel beams (transparent material)
Operating range (m)	0 - 3,5	0 - 2	0 - 3,5	0 - 2

MT TRX – MT TRX G – MT TRX V 2 – 3 beams	MT 2B TRX/ MT 2B TRX V	MT 2B TRX G	MT 3B TRX/ MT 3B TRX V	MT 3B TRX G
Number of beams	2		3	
Beam spacing (mm)	500		400	
Protected heights (mm)	510		810	
Overall height (mm)	776		1076	
Muting Sensors	4 parallel beams	4 parallel beams (transparent material)	4 parallel beams	4 parallel beams (transparent material)
Operating range (m)	0 - 3,5	0 - 2	0 - 3,5	0 - 2

• For accessories see page 106 • For ordering codes see page 220

JANUS M – JANUS M TRX

MI – MI TRX – MI TRXL – MM TRX

Two-way Muting with 2 sensors

- Max. time between the 2 Muting activation signals: 4 sec
- Possibility of use with photocells, proximity sensors, and limit switches
- Max. Muting timeout time 30 sec. or 90 min. selectable
- Configuration usable with light curtains with resolution 30, 40, 90 mm with protected height from 310 to 1810 mm, with light grids with 2, 3, 4 beams and light grids with 2, 3 or 4 beams with passive retroreflector element
- Muting enable input available (TRX models only).

Characteristics

- Suitable for the most common pallet infeed/outfeed applications
- Muting enable input allows to start a Muting sequence only when needed by the machine cycle (TRX models only), i.e. Muting enabled only when the conveyor is moving.

MI – MI TRX – MM TRX

Two-way sequential Muting with 4 sensors

- Max. time between the Muting activation signals: 4 sec. or infinite, selectable
- Possibility to use with photocells, proximity sensors, and limit switches
- Max. Muting timeout time 30 sec. or infinite, selectable
- Configuration usable with light curtains with resolution 30, 40, 90 mm with protected height from 310 a 1810 mm, with light grids with 2, 3, 4 beams and light grids with 2, 3 or 4 beams with passive retroreflector element
- Muting enable input available (TRX models only).

Characteristics

- Correct Muting sequence even in the presence of pallets with reduced width and/or length or not centred with respect to the conveyor
- Possibility of two-way transit of the pallets and simultaneous protection in the two directions against unauthorised access of personnel
- Muting enable input allows to start a Muting sequence only when needed by the machine cycle (TRX models only), i.e. Muting enabled only when the conveyor is moving.

MI – MI TRX – MM TRX

One-way Muting with 2 sensors

- Max. time between the 2 Muting activation signals: 4 sec
- Possibility to use with photocells, proximity sensors, and limit switches
- Max. Muting timeout time: 30 sec. or 90 min. selectable
- Configuration usable with light curtains with resolution 30, 40, 90 mm with protected height from 310 to 1810 mm, with light grids with 2, 3, 4 beams and light grids with 2 or 3 beams with passive retroreflector element.

Characteristics

- The light curtain only enables the pallet outfeed
- The Muting function can only be activated from inside the protected zone. No possibility to activate a Muting sequence from the outside
- Elimination of bulk outside the protected area, as the Muting sensors are only present inside the area
- Correct Muting sequence even in the presence of a pallet with reduced width and/or length or not centred with respect to the conveyor
- Muting enable input allows to start a Muting sequence only when needed by the machine cycle (TRX models only), i.e. Muting enabled only when the conveyor is moving.

JANUS M – JANUS M TRX

ML

One-way Muting with 2 sensors

Built-in Muting sensors with crossed beams

- 2 photoelectric Muting sensors with intersecting beams, built-in pre-wired and pre-aligned
- Max. time between the 2 Muting activation signals: 4 sec
- Operating range 1 - 2.5 metres
- Muting sensor elements adjustable in height and angle
- Max. Muting timeout time: 30 sec. or 90 min. selectable
- Versions with 2 or 3 beams.

Characteristics

- Reduced installation time and costs
- Sensors positioned in compliance with the regulations regarding the geometry of Muting sensors (IEC TS 62046) and all the other safety parameters; this makes it possible to avoid dangers arising from positioning errors and from possible tampering
- The light curtain only allows pallet outfeed
- The Muting function can only be activated from inside the protected zone. No possibility to activate a Muting sequence from the outside
- Elimination of bulk outside the protected area, as the Muting sensors are only present inside the area
- Correct Muting sequence even in the presence of a pallet with reduced width and/or length or not centred with respect to the conveyor.

ML_S2 – ML TRX – ML TRX G – ML TRX V – MM TRX with SL TRX

One-way Muting with 2 sensors

Built-in Muting sensors with parallel beams

- Max. time between the 2 Muting activation signals: 4 sec.
- Operating range: 0 - 2 meters for ML_S2 and ML TRX G models, 0 - 3,5 for ML TRX model
- Muting sensor elements adjustable in height and angle
- Max. Muting timeout time: 30 sec. or 90 min. selectable
- Versions with 2 or 3 beams
- Muting enable input available (TRX models only).

Characteristics

- Reduced installation time and costs
- The light curtain only allows pallet outfeed
- The Muting function can only be activated from inside the protected zone. No possibility to activate a Muting sequence from the outside
- Elimination of bulk outside the protected area, as the Muting sensors are only present inside the area
- Correct Muting sequence even in the presence of a pallet with reduced width and/or length or not centered with respect to the conveyor
- ML TRX G models especially designed for transparent material, ideal solution for glass and bottling industry
- ML TRX V models for high-speed conveyors
- Muting enable input allows to start a Muting sequence only when needed by the machine cycle (TRX models only), i.e. Muting enabled only when the conveyor is moving.

JANUS M

MT

Two-way Muting with 2 sensors

Built-in Muting sensors with crossed beams

- 2 photoelectric Muting sensors with intersecting beams, built-in pre-wired and pre-aligned
- Max. time between the 2 Muting activation signals: 4 sec
- Operating range: 1 - 2.5 metres
- Muting sensor elements adjustable in height and angle
- Max. Muting timeout time: 30 sec. or 90 min. selectable
- Versions with 2 or 3 beams.

Characteristics

- Reduced installation time and costs
- Standard solution for the most common pallet infeed/outfeed applications.

MT_S4 – MT TRX – MT TRX G – MT TRX V – MM TRX with SL TRX and S TRX

Two-way sequential Muting with 4 sensors

Built-in Muting sensors with parallel beam

- Max. time between the Muting activation signals: 4 sec or infinite, selectable
- Operating range: 0 - 2 meters for MT_S4. and 0 - 3.5 meters for MT TRX models
- Muting sensor elements adjustable in height and angle
- Max. Muting timeout time: 30 sec or infinite, selectable
- Versions with 2 or 3 beams and 2 or 3 beams with passive retroreflector elements
- Muting enable input available (TRX models only).

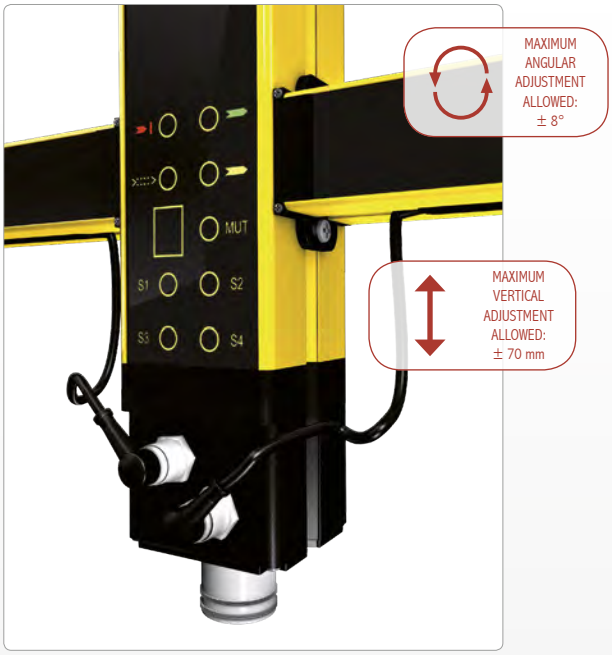
Characteristics

- Reduced installation time and costs
- Correct Muting sequence even in the presence of a pallet with reduced width and/or length or not centered with respect to the conveyor
- Possibility of two-way transit of the pallets and simultaneous protection in the two directions against unauthorized access of personnel
- MT TRX G models especially designed for transparent material, ideal solution for glass and bottling industry
- MT TRX V models for High-speed conveyors
- Muting enable input allows to start a Muting sequence only when needed by the machine cycle (TRX models only), i.e. Muting enabled only when the conveyor is moving.

JANUS M – JANUS M TRX

WITH MUTING FUNCTION

SENSOR ELEMENT ADJUSTMENT - ML and MT versions

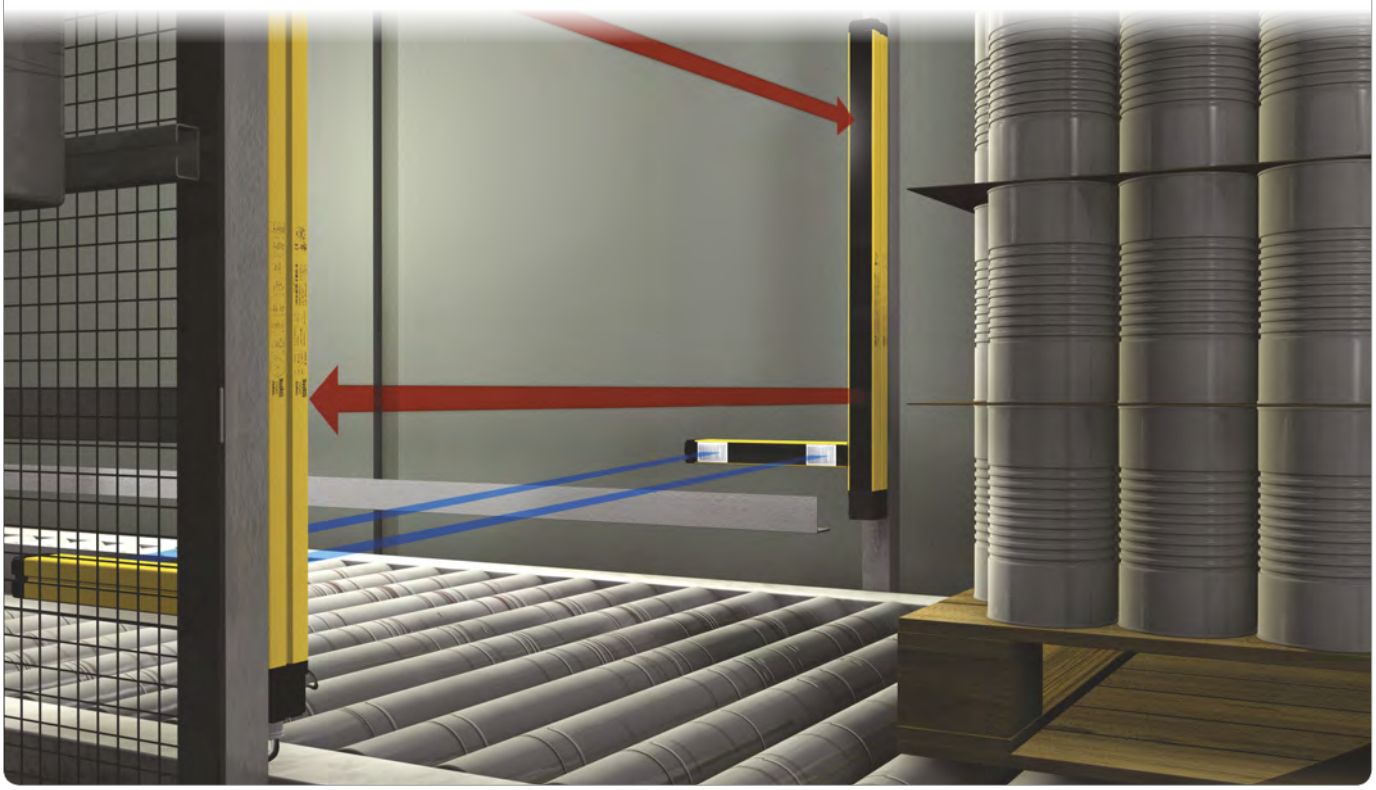


The sensor elements present in all Janus ML and MT versions are adjustable in height and angle.

This important and unique feature enables:

- the inclination of the detection plane of the sensors to obtain correct and constant detection of irregular materials in transit.
- the variation of the intensity of the sensor signal for better detection of semitransparent objects.

Example of application of Janus ML TRX light curtain for protection of palletiser outfeed zone



JANUS J

WITH BUILT-IN CONTROL FUNCTIONS

MAIN FEATURES

Two self-testing solid state PNP safety outputs.
Built-in Start/Restart interlock, selectable.
Feedback input for control of external relays (EDM).
All configuration via hardware by means of main connector.
Use of unshielded cables up to 100 m long.

J Long Range models available, with range up to 60 m, for access control with 2-3-4 beams or with resolution 40 mm, also ideal for perimeter protection with the use of deflection mirrors.

MJ Box for quick connection of the light curtains and availability of the Restart command in the area of the protected gate.

Special models in conformity with the "ATEX Directive" 94/9/EC – Dust Zone 22 – Gas Zone 2 available on request.

NEW PRODUCT

Janus J LRH M12 models with 2, 3 and 4 beams max. range up to 80 meters with a M12 5-pole connector for the emitter and a M12 8-pole connector for the receiver.
Also available with integrated laser pointer (J LRH M12 ILP).

TECHNICAL FEATURES

Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Protected heights (mm)	510 - 1210
Resolutions (mm)	40 (long range only)
Number of beams for body detection in access control	2 - 3 - 4
Max. range (m)	selectable 6 – 16 selectable 30 – 60 for long range models selectable 40 – 80 for extra long range models
Response time (ms)	7 - 28,5

Safety level:

Type 4

SIL 3 – SILCL 3
PL e – Cat. 4

JANUS J

WITH BUILT-IN CONTROL FUNCTIONS

Safety outputs	2 PNP – 500 mA at 24 VDC
Light curtain status indication and weak signal output	PNP – 100 mA at 24 VDC
Signalling	Seven-segment display and LEDs for light curtain's status and diagnostic
Start/Restart	Automatic or manual restart selectable
External Device Monitoring	External device monitoring feedback input with enabling, selectable
Power supply (VDC)	24 ± 20%
Electrical connections	M12 – 5 poles for emitter and M23 – 19 poles for receiver M12 – 5 poles for emitter and M12 – 8 poles for receiver for J LRH M12 models
Max. cable length (m)	100
Operating temperature (°C)	-10 to 55
Protection rating	IP 65
Cross section (mm)	50 x 60

J 2 – 3 – 4 beams	J 2B	J 3B	J 4B
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	736	1036	1136
Max. range. (m)		selectable 6-16	

J Long Range 2 – 3 – 4 beams	J 2B LR	J 3B LR	J 4B LR
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	736	1036	1136
Max. range. (m)		selectable 30-60	

J LRH M12 2 – 3 – 4 beams	J 2B LRH M12 J 2B LRH M12 ILP	J 3B LRH M12 J 3B LRH M12 ILP	J 4B LRH M12 J 4B LRH M12 ILP
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	736	1036	1136
Max. range. (m)		Selectable 40 - 80	

J Long Range Resolution 40 mm	J 604 LR	J 904 LR	J 1204 LR
Protected heights (mm)	610	910	1210
Number of beams	20	30	40
Overall height (mm)	736	1036	1336
Max. range. (m)		selectable 30-60	

• For accessories see page 106 • For ordering codes see page 220

JANUS J TRX – J TRX L

WITH BUILT-IN CONTROL FUNCTIONS AND PASSIVE RETROREFLECTOR ELEMENT

MAIN FEATURES

Passive retroreflector element.
Two self-testing solid state PNP safety outputs.
Built-in Start/Restart interlock, selectable.
Feedback input for control of external relays (EDM).
All configuration via hardware by means of main connector. No need of configuration via software.
Use of unshielded cables up to 100 m long.
Electrical connection by means M12, 8-pole connectors for J TRX model and M23, 19-pole for J TRXL model.

MJ Box for quick connection of the light curtains and availability of the Restart command in the area of the protected gate (only for model J TRX L).

Janus J TRX and J TRXL are safety light grids with 2 – 3 – 4 beams consisting of an active element (emitter/receiver) and a retroreflector passive element which does not require electrical connections.

JANUS series J TRX and TRXL are the simplest and quickest installation solutions for detection of a person in access control in hazardous areas, and the ideal solutions for all applications in which it is difficult or costly to cable electrical lines.

Special models in conformity with the "ATEX Directive" 94/9/EC – Dust Zone 22 – Gas Zone 2 available on request.

Safety level:

Type 4

SIL 3 – SILCL 3
PL e – Cat. 4

JANUS J TRX

WITH BUILT-IN CONTROL FUNCTIONS AND PASSIVE RETROREFLECTOR ELEMENT

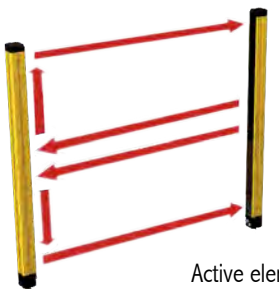
TECHNICAL FEATURES

Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Number of beams for body detection in access control	2 – 3 – 4
Max. range (m)	6
Response time (ms)	≤ 7
Safety outputs	2 PNP auto-controlled – 500 mA at 24 VDC with short-circuit, overload, polarity reversal protection
Signalling	seven-segment display and LEDs for light curtain's status and diagnostic
Start/Restart	automatic or manual, selectable
External Device Monitoring	external device monitoring feedback input with enabling selectable
Power supply (VDC)	24 ± 20%
Electrical connections	M23-19 poles – J TRXL models M12-8 poles – J TRX model
Max. cable length (m)	100
Operating temperature (°C)	-10 to 55
Protection rating	IP 65
Cross section (mm)	50 x 60

J TRX/J TRXL 2-3-4 beams	J 2B TRX	J 3B TRX	J 4B TRX	J 2B TRXL	J 3B TRXL	J 4B TRXL
Number of beams	2	3	4	2	3	4
Beam spacing (mm)	500	400	300	500	400	300
Protected heights (mm)	510	810	910	510	810	910
Overall height (mm)	736	1041	1141	741	1041	1141
Connector	M12-8 poles	M12-8 poles	M12-8 poles	M23-19 poles	M23-19 poles	M23-19 poles
Max. range (m)	6					

• For accessories see page 106

• For ordering codes see page 220



Active element

Passive element

JANUS MJB

CONNECTION BOX FOR JANUS SAFETY LIGHT CURTAINS

Connection boxes Janus MJB are accessory devices designed for quick, reliable connection of Janus light grids and to ensure that major operating controls needed for operation are available in the guarded area.

MAIN FEATURES

- Lighted button for light curtain Start/Restart with green LED for indicating output status and weak signal
- Key selector controlling the override function
- Indicator lamp for Muting function active
- Connector for connection to the light curtain
- Dipswitches for configuration of light curtain functions
- Built-in safety relay with guided contacts driven and controlled by the light curtain
- Internal terminal blocks for cable connections
- Selector for connection of external Muting lamp
- Selector for internal or external relay control
- Electrical connection through cable gland
- Versions without Start/Restart and Override commands for connection with Janus J light curtain without Muting
- Special models complying with "Directive ATEX" 94/9/EC - Dust Zone 22 - Gas Zone 2 available on request.

Complying with:
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- UL (C+US) mark for USA and Canada.

TECHNICAL FEATURES

MODELS	MJB 1	MJB 2	MJB 3	MJB 4
Start/Restart button	yes	yes	yes	yes
Override command	yes	no	yes	no
Built-in Muting lamp	yes	no	yes	no
Safety relay output	2 NO 2A 250 VAC	2 NO 2A 250 VAC	2 NO + 1 NC* 2A 250 VAC	2 NO + 1 NC* 2A 250 VAC
Connectors	M23 - 19 poles for receiver / light curtain connection M12 - 5 poles for emitter / light curtain connection			
Dimensions - h x w x d (mm)	110 x 180 x 110			

** in MJB 3 and MJB 4 boxes each NO safety output line is interrupted twice by the two relays*

MJB 1 - MJB 3 - MJB 1 A**

MJB 2 - MJB 4

- All MJB connection boxes can work with any kind of Janus light curtain (with or without Muting)
- Using Janus M, not TRX light curtains with MJB2 and MJB4 models is necessary to connect an external Muting lamp.

**** Please contact Reer for the connection to the main safety buses**

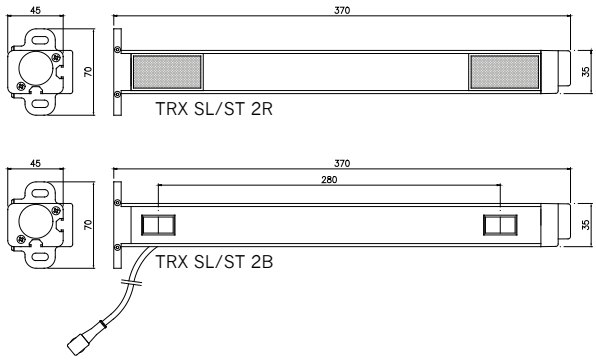
JANUS SL TRX and ST TRX

ACCESSORY MUTING SENSOR ELEMENTS FOR JANUS MM

MAIN FEATURES

Janus SL TRX muting arm, with active and passive retro-reflector elements, in combination with Janus MM TRX models form a one-way access control system with L logic (only exit).

Together with Janus SL TRX and ST TRX muting arms, Janus MM TRX models become a two-way access control system with T logic (entry/exit).



TECHNICAL FEATURES

MODELS	SL TRX	ST TRX
Optoelectronic sensors	2 parallel beams	2 parallel beams
Operative range (m)	0 – 3,5	0 – 3,5

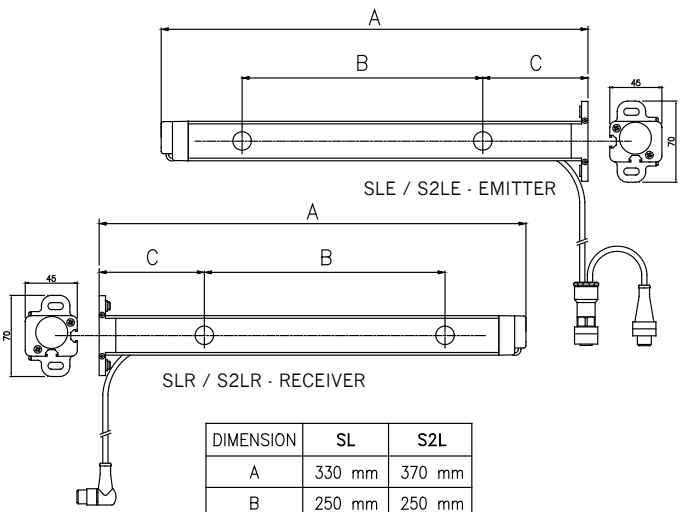
JANUS SL

ACCESSORY MUTING SENSOR ELEMENTS FOR JANUS MI

MAIN FEATURES

The SL series accessory Muting sensor elements (arms) can be combined with the Janus MI light curtain model, making it possible to create an "L" barrier with built-in sensors with 30, 40, 90 mm resolution and protected height from 310 to 1810 mm.

The SL and S2L models have 2 built-in sensors, pre-wired and pre-aligned, with crossed or parallel beams.



DIMENSION	SL	S2L
A	330 mm	370 mm
B	250 mm	250 mm
C	25 mm	60 mm

TECHNICAL FEATURES

MODELS	SL	S2L
Optoelectronic sensors	2 crossed beams	2 parallel beams
Operative range (m)	1 - 2,5	0 - 2

JANUS

DIMENSIONS (mm)

"J" Models

DIMENSION	16 m range			Long Range					
	2B	3B	4B	600	900	1200	2B	3B	4B
A (TX-RX)	736	1036	1136	736	1036	1336	736	1036	1136
B (protected heigth)				610	910	1210			
C (1st beam position)	120			76					

"MI" Models

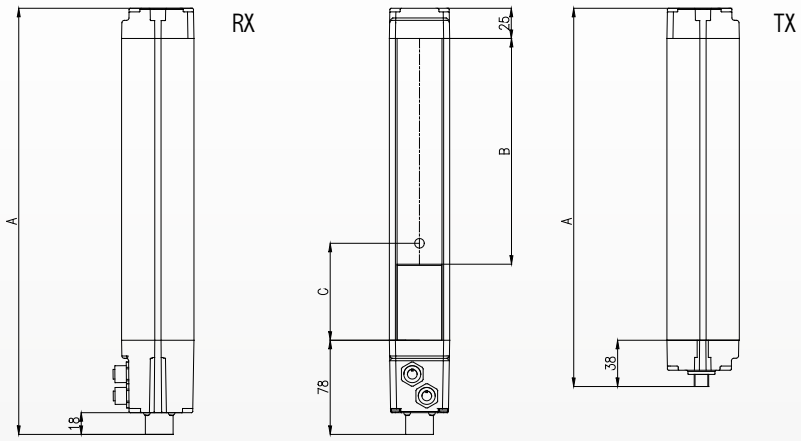
DIMENSION	16 m range														Long Range		
	300	450	600	750	900	1050	1200	1350	1500	1650	1800	2B	3B	4B	2B	3B	4B
A (TX)	436	586	736	886	1036	1186	1336	1486	1636	1786	1936	736	1036	1136	736	1036	1136
A (RX)	476	626	776	926	1076	1226	1376	1526	1676	1826	1976	776	1076	1176	776	1076	1176
B (protected heigth)	310	460	610	760	910	1060	1210	1360	1510	1660	1810	-	-	-	-	-	-
C (1st beam position)	72											120			76		

"ML", "MT" Models

DIMENSION	2B	3B
A (TX-RX)	776	1076
C (1st beam position)	120	

JANUS MI

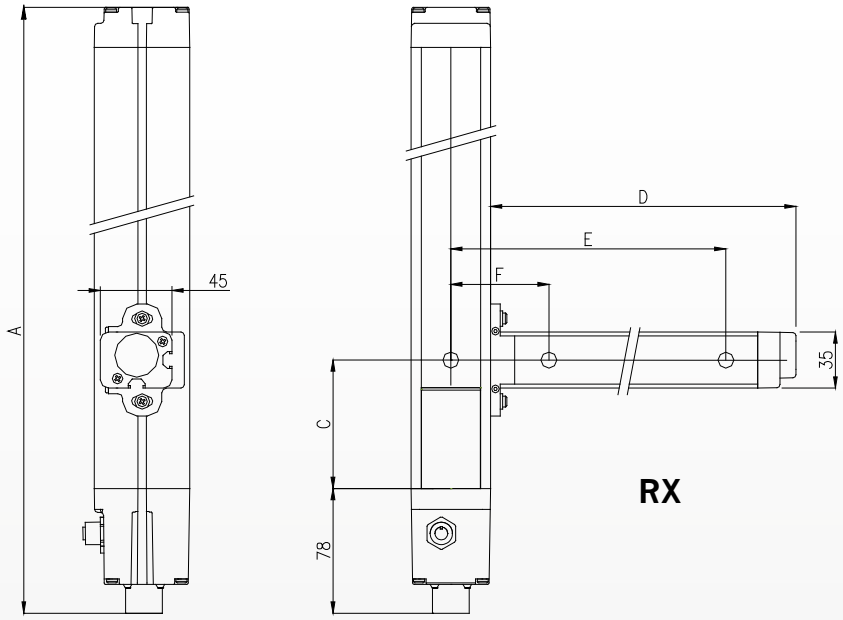
Mounting:
Models with A ≤ 1050 2 LL brackets with 2 inserts
Models with A ≥ 1200 3 LL brackets with 3 inserts



C: position of the 1st active beam

JANUS

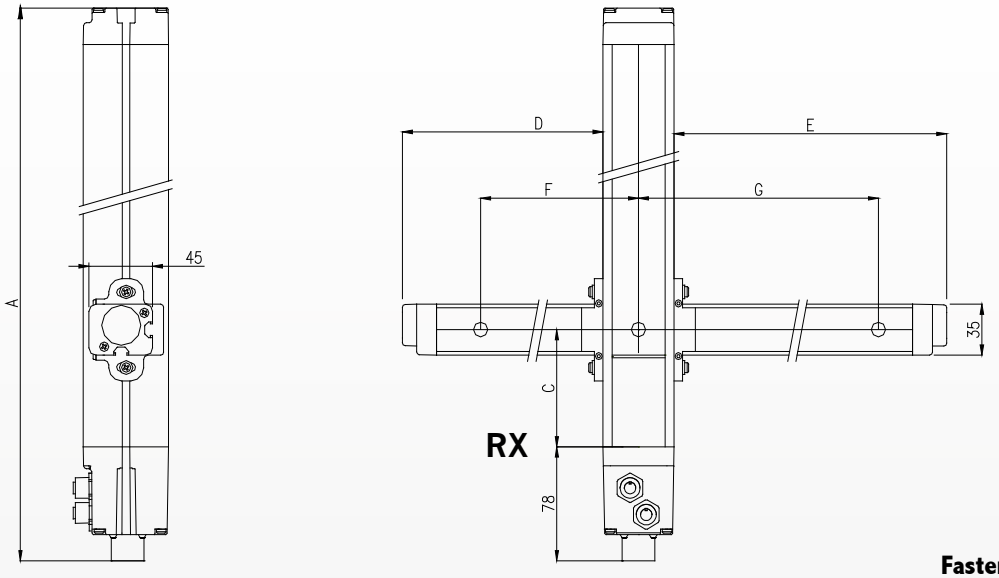
JANUS ML



DIMENSIONS	ML
D	330
E	300
F	50

Fastening:
2 LL brackets with 2 inserts

JANUS MT



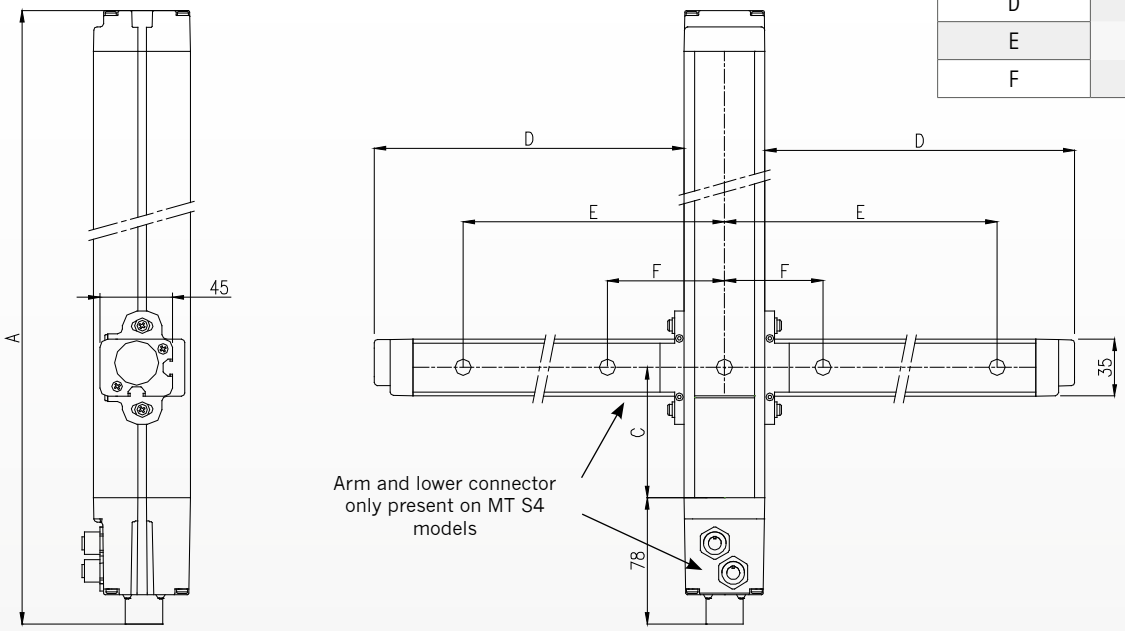
DIMENSIONS	MT
D	230
E	330
F	200
G	300

Fastening:
2 LL brackets with 2 inserts

JANUS

JANUS “ML S2” - “MT S4”

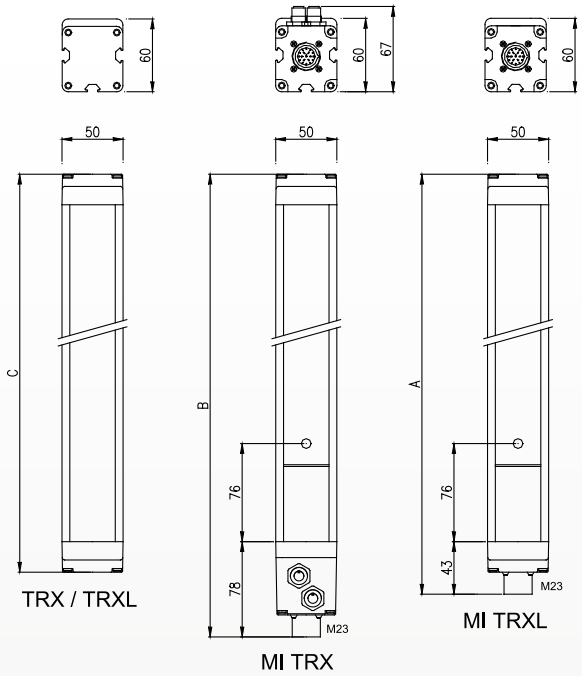
DIMENSIONS	ML S2 / MT S4
D	370
E	334
F	84



Fastening:
2 LL brackets with 2 inserts

JANUS MI TRX – MI TRX L – MM TRX

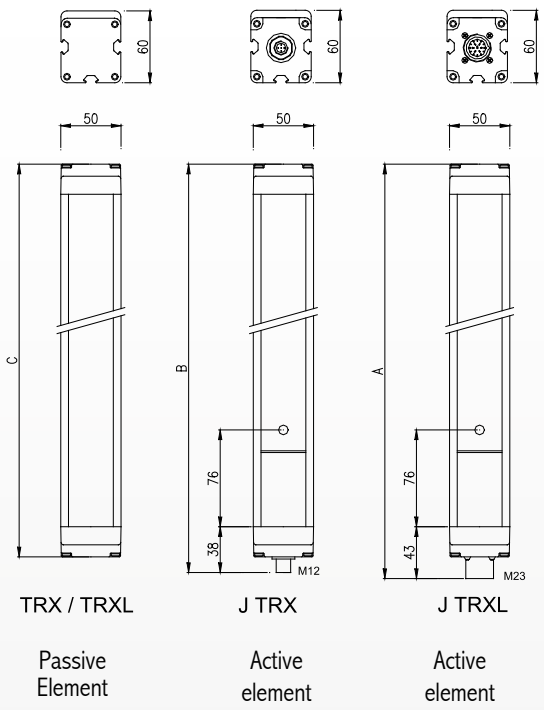
DIMENSIONS	2B	3B	4B
A	741	1041	1141
B	776	1076	1176
C	723	1023	1123



Fastening:
1 LH Type brackets with 3 inserts

JANUS

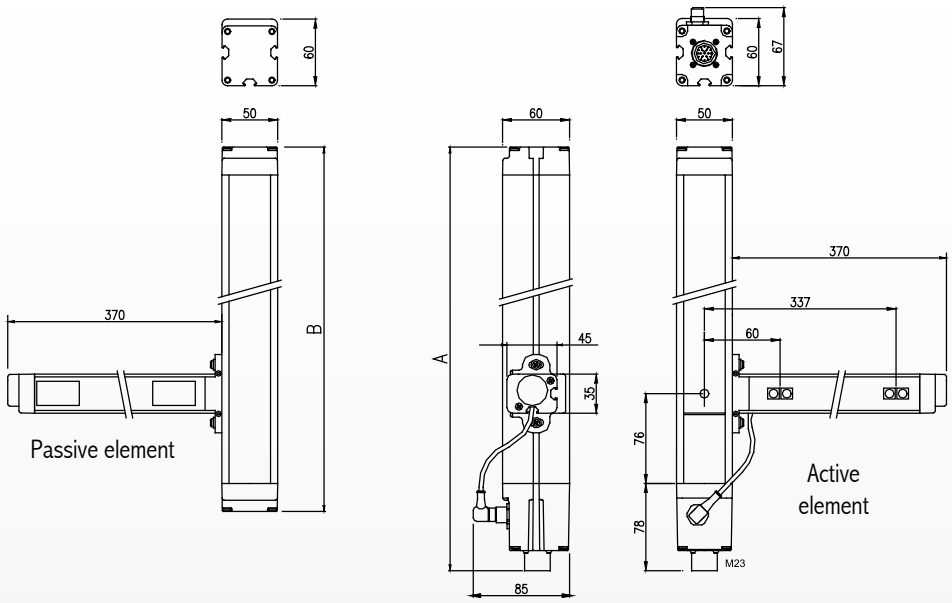
JANUS J TRX – J TRXL



DIMENSIONS	2B	3B	4B
A	741	1041	1141
B	776	1076	1176
C	723	1023	1123

Fastening:
1 LH Type brackets with 3 inserts

JANUS ML TRX – ML TRX G

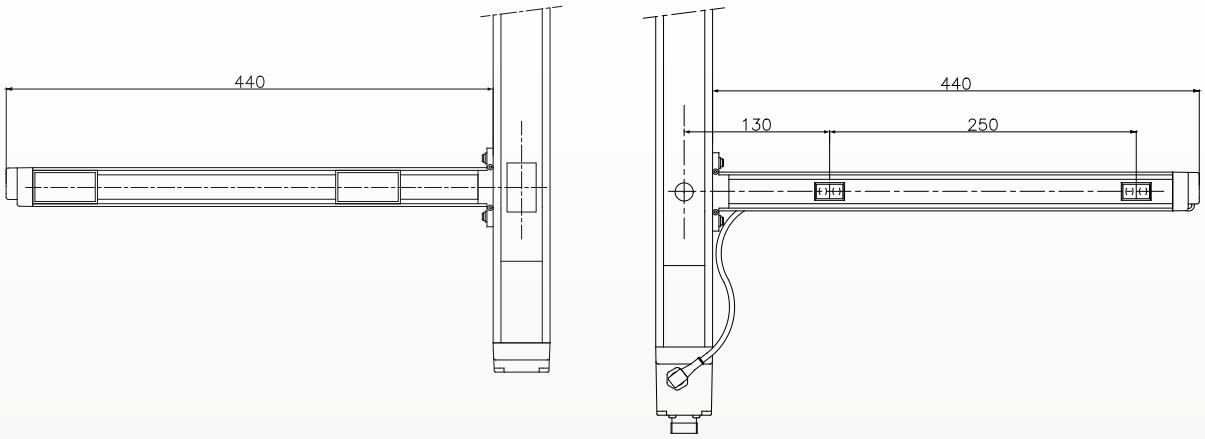


DIMENSIONS	2B	3B
A	776	1076
B	723	1023

Fastening:
1 LH Type brackets with 3 inserts

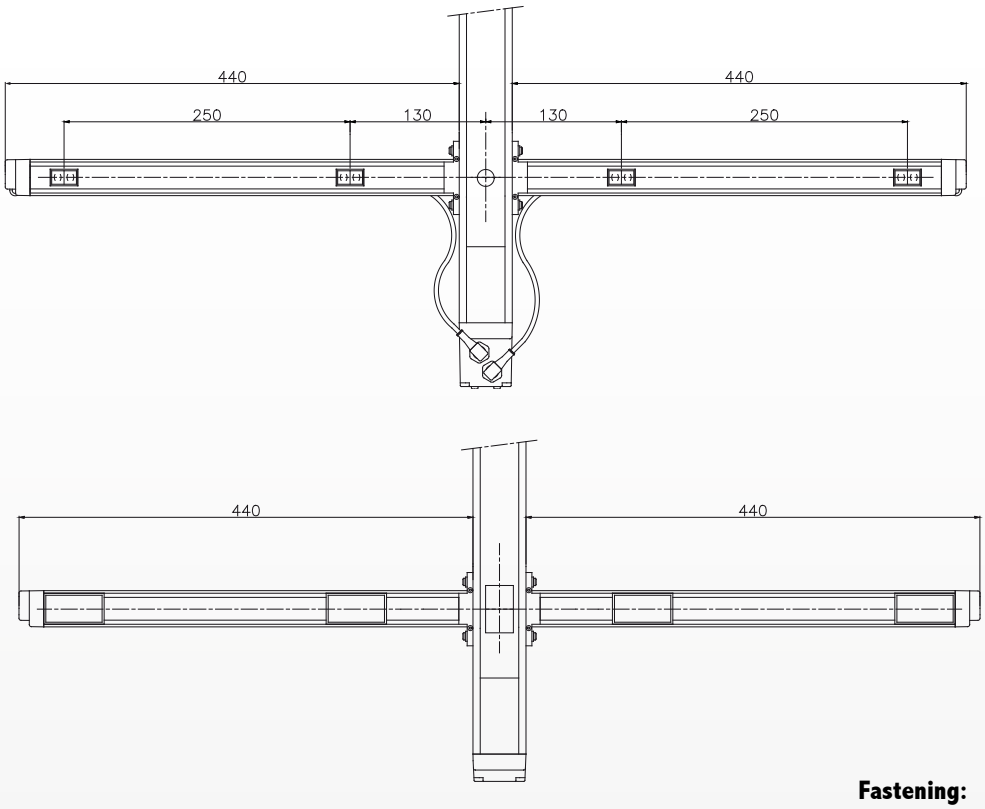
JANUS

JANUS ML TRX V



Fastening:
1 LH Type brackets with 3 inserts

JANUS MT TRX V

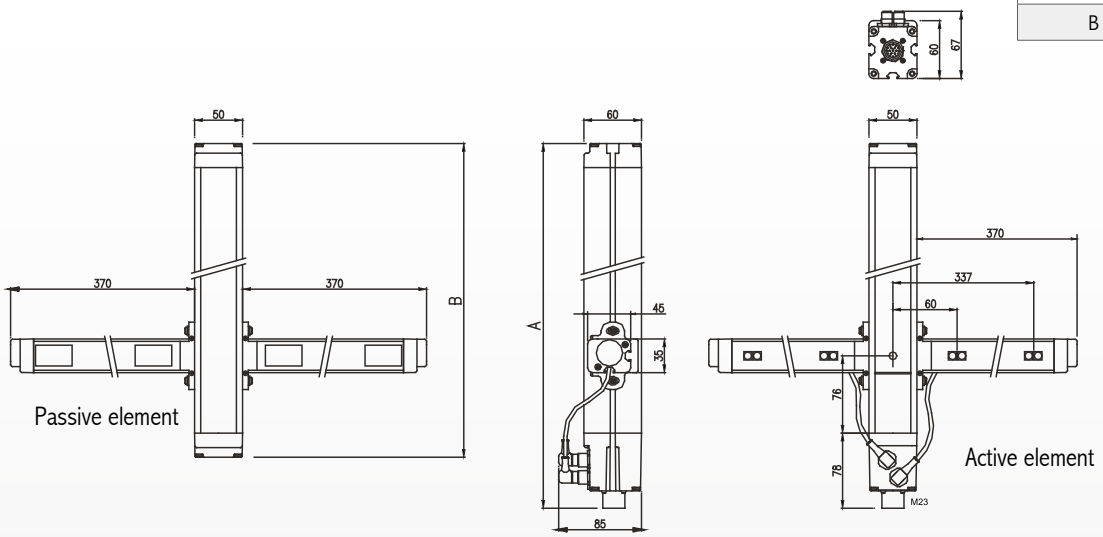


Fastening:
1 LH Type brackets with 3 inserts

JANUS

JANUS MT TRX – MT TRX G

DIMENSIONS	2B	3B
A	776	1076
B	723	1023



Fastening:
1 LH Type brackets with 3 inserts

WARNING!

- In perimeter and/or long-range applications and with the use of deflection mirrors, we recommend using the LAD laser alignment device to obtain a simple, quick, and correct alignment of the light curtains
- In perimeter and/or long-range applications and with the use of deflection mirrors, we recommend using the FMC adjustable floor mounting columns
- If the light curtain system is subject to strong vibrations (applications on presses, etc.), it is necessary to use the special SAV vibration dampers, available as accessories, to prevent mechanical damage to the light curtain elements.

ORDERING INFORMATION (ordering codes on page 220)

Each Janus light curtain comprises:
▪ Emitter and Receiver pair, including integrated sensor (only for L and T models)
▪ Emitter / Receiver active element + passive reflector element (only for models M_TRX and J_TRX)
▪ Mounting brackets and T-nuts
▪ CD-ROM containing the multi-language instruction manual complete with CE declaration of conformity
▪ Quick installation guide

JANUS

ACCESSORIES

For Janus light curtains the following accessories, to be ordered separately, are available:	
AD SR Safety Relays	see page 180
LAD laser alignment device	see page 208
FMC floor mounting columns	see page 204
SP deflection mirrors	see page 207
SAV vibrations dampers	see page 209
MJB	see page 210
SL	see page 99
Connectors	see below:
Model	**Description**
CONNECTORS FOR RECEIVERS / TRX MODELS ACTIVE ELEMENTS	
CJ 3	M23 straight connector, 19 poles, pre-wired cable 3 m
CJ 5	M23 straight connector, 19 poles, pre-wired cable 5 m
CJ 10	M23 straight connector, 19 poles, pre-wired cable 10 m
CJ 15	M23 straight connector, 19 poles, pre-wired cable 15 m
CJ 20	M23 straight connector, 19 poles, pre-wired cable 20 m
CJ 20L2	M23 straight connector, 19 poles, pre-wired cable 20 m with 2 m long secondary cable for muting lamp
CJ 30	M23 straight connector, 19 poles, pre-wired cable 30 m
CJ 30L2	M23 straight connector, 19 poles, pre-wired cable 30 m with 2 m long secondary cable for muting lamp
CJM 23	M23 straight connector, 19 poles, cable gland (to be soldered)
CONNECTORS FOR EMITTERS	
CD 5	M12 straight connector, 5 poles, pre-wired cable 5 m
CD 10	M12 straight connector, 5 poles, pre-wired cable 10 m
CD 15	M12 straight connector, 5 poles, pre-wired cable 15 m
CD 20	M12 straight connector, 5 poles, pre-wired cable 20 m
CD 25	M12 straight connector, 5 poles, pre-wired cable 25 m
CD50	M12 straight connector, 5 poles, pre-wired cable 50 m
CDM 9	M12 straight connector, 5 poles, with screw terminal, cable gland
CABLES WITH 2 CONNECTORS FOR JANUS RECEIVERS / TRX MODELS ACTIVE ELEMENT AND MJB BOXES CONNECTION	
CJBR 3	3 m pre-wired cable with 2 straight connectors, M23, 19 poles
CJBR 5	3 m pre-wired cable with 2 straight connectors, M23, 19 poles
CJBR 10	10 m pre-wired cable with 2 straight connectors, M23, 19 poles
CABLES WITH 2 CONNECTORS FOR JANUS EMITTERS AND MJB BOXES CONNECTION	
CJBE 3	3 m pre-wired cable with 2 straight connectors, M12, 5 poles
CJBE 5	3 m pre-wired cable with 2 straight connectors, M12, 5 poles
CJBE 10	10 m pre-wired cable with 2 straight connectors, M12, 5 poles
CJBE 25	25 m pre-wired cable with 2 straight connectors, M12, 5 poles
CONNECTORS FOR MUTING SENSORS - JANUS MI SERIES	
CJ 95	M12 90° angled male connector, 5 poles, pre-wired cable 5 m
CJM 9	M12 90° angled male connector, 5 poles, with screw terminal, cable gland PG9
CONNECTORS FOR J 2B TRX MODEL ACTIVE ELEMENT	
C8D 5	M12 straight connector, 8 poles, pre-wired cable 5 m
C8D 10	M12 straight connector, 8 poles, pre-wired cable 10 m
C8D 15	M12 straight connector, 8 poles, pre-wired cable 15 m

JANUS

For Janus light curtains the following accessories, to be ordered separately, are available:	
C8D 25	M12 straight connector, 8 poles, pre-wired cable 25 m
C8D 40	M12 straight connector, 8 poles, pre-wired cable 40 m
C8D 95	M12 90° angle connector, 8 poles, pre-wired cable 5 m
C8D 910	M12 90° angle connector, 8 poles, pre-wired cable 10 m
C8D 915	M12 90° angle connector, 8 poles, pre-wired cable 15 m
C8DM 11	M12 straight connector, 8 poles with screw terminal, PG9/11 cable gland
C8DM 911	M12 angle connector, 8 poles with screw terminal, PG9/11 cable gland

PHARO

PHARO

The PHARO Safety Laser Scanner is an optoelectronic protection device for accident prevention.
PHARO is suitable for the protection of personnel exposed to risks deriving from both machines and systems with dangerous organs as well as from possible collisions with automatic guided vehicles (AGVs).

With the PHARO Safety Laser Scanner it is possible to create programmable protected horizontal or vertical areas of variable shape suitable to all applications without the need to use a separate reflector or receiver.

The device does not require an external control unit because all the safety functions are built-in.

The PHARO Safety Laser Scanner features a Configuration Memory Module built into the removable connector, which stores the data related to the protected zones programmed and to the operating parameters set.
This module enables the user to replace a faulty sensor with a new device without the need for reconfiguration and therefore maintaining the pre-existing configuration, without the possibility of errors or tampering.
The stored data can only be modified by authorised personnel.

Each sensor can create 2 independently programmable controlled zones:
- 2 safety zones with maximum radius of 4 metres
- 2 warning zones with maximum radius of 20 metres.

Model:	PHR 332
Protective (safety) fields:	2
Warning zones:	2
Configuration Memory Module:	Yes

Certified by TÜV Rheinland Product Safety GmbH

c UL us LISTED ESPE

Safety level: Type 3 – SIL 2 – SILCL 2 – PL d – Cat. 3

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- IEC/EN 61496-1 Ed. 2 e IEC/TS 61496-3 "Safety of machinery - Electro-sensitive protective equipment- General requirements and tests"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems"
- IEC/TS 62046 Ed. 2 "Safety of machinery – Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada
- ANSI / UL 1998 "Safety Software in Programmable Components".

MAIN FEATURES

Scanning area: 190° / 4 m radius.
Resolution configurable from 30 mm to 150 mm:
from hand detection to access control.
Configuration software via RS232 serial port
2 safety zones and 2 warning zones, programmable.
Programming by means of:
1. graphic user interface
2. teach-in
3. data transfer from file (from PC or from another laser scanner).

Configuration Memory Module for easy re-installation.
Detailed self-diagnosis via display and remote serial output.
Built-in start/restart interlock, selectable.
Feedback input for control of external relays (EDM).

PHARO

GENERAL TECHNICAL DATA

Safety level	Type 3 according to IEC/TS 61496-3 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 3 according to ISO 13849-1
Light source	laser diode wavelength 905 nm
Laser source class	1 - according to EN 60825-1
Scanning angle	190°
Angular resolution	0,25° / 0,50°
Response time (ms)	configurable 60 / 120 (with 2 scans)
Start/Restart	automatic - timed automatic - manual reset (selectable via software)
Serial interface - configuration	RS 232
Serial interface - data transmission	RS 422
Configuration and operating parameter setting	via configuration software (UCS)
Configuration Memory Module	built into the main connector
Signalling	display indications in 7 segments and LEDs for self-diagnosis and sensor status
Power supply (VDC)	24 -30% +20%
External relay control	feedback input with enabling, selectable
Main connection	connector with screw terminals (13-pole cable)
Serial interface connection for configuration	cable pre-wired with 2 connectors: M8 4-pole / subD 9-pole
Electrical connections	max. cable length 30 m, cross-section 0.5 mm²
Protection rating	IP 65
Operating temperature (°C)	-10 to 50

SAFETY ZONE

Max. range (m)	4
Resolution (mm)	30 - 40 - 50 - 70 - 150 configurable
Min. target reflectivity	1,8%
Safety outputs	2 PNP self-testing - 500 mA at 24 VDC

WARNING ZONE

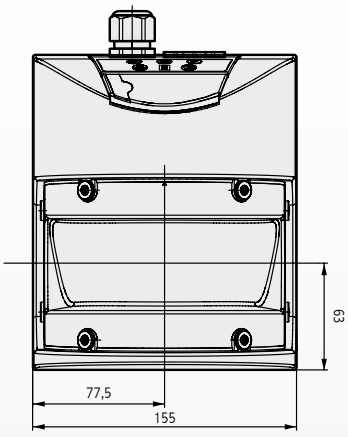
Max. range (m)	20 (for objects with 20% reflectivity)
Resolution (mm)	depending on the distance of the obstacle
Min. target reflectivity	20% at 20 m
Signalling outputs	1 PNP – 200 mA at 24 VDC

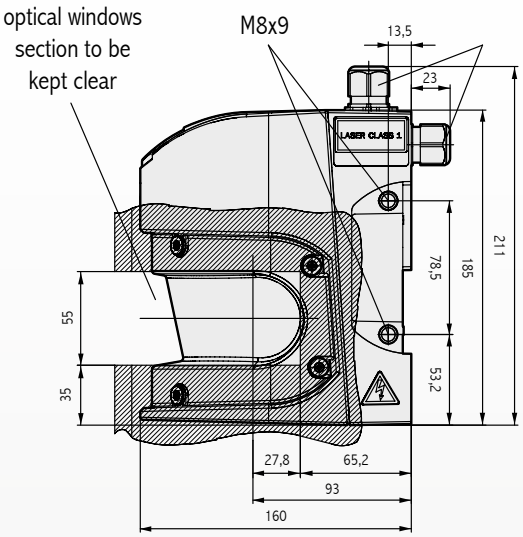
MEASUREMENT ZONE

Max. range (m radius)	49
Resolution (mm)	depending on the distance of the target
Signalling output	1 PNP – 200 mA at 24 VDC

PHARO

DIMENSIONS (mm)

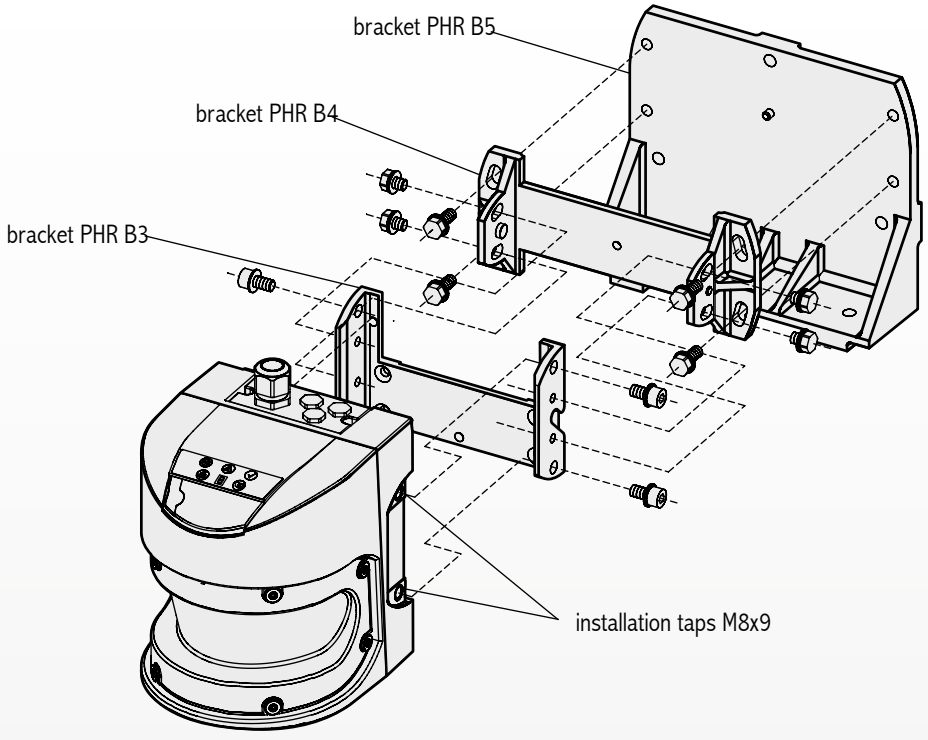




INSTALLATION ACCESSORIES

Special installation brackets are available for Pharo:

- Fixed bracket PHR B3
- Adjustable bracket PHR B4
- Floor mounting bracket PHR B5



ORDERING INFORMATION (ordering codes on page 221)

Each Pharo Laser Scanner includes:
PHR 332 Laser Scanner
CD-ROM containing configuration software in English and Italian and multi-language instruction manual complete with CE declaration of conformity

ACCESSORIES

The following accessories are available for Pharo, to be ordered separately:

Model	**Description**
PHR C3L5	30-pole connector pre-wired with 13-wire cable 5 m long Built-in Configuration Memory Module
PHR CSL2	cable for serial connection between Pharo sensor and PC for configuring M8 4-pole / subD 9-pole connector, length 2 m
PHR B3	fixed attachment bracket
PHR B4	adjustable attachment bracket
PHR B5	floor mounting bracket

WARNING!

- For the main connection of the Pharo sensor, it is necessary to provide a 13-wire cable with 0.56 mm^2 cross-section. This cable is supplied with the PHR C3L5 main connector.
- To use the PHR B4 adjustable bracket it is also necessary to order the PHR B3 fixed bracket.
- To use the PHR B5 floor mounting bracket it is also necessary to order the PHR B3 fixed bracket and the PHR B4 adjustable bracket.
- AD SR0 and AD SR0A relay modules can be used for interfacing the safety output of Pharo Laser Scanner.

EOS2

EOS2

EOS2 is a compact Type 2 light curtain with competitive performance and innovative features.

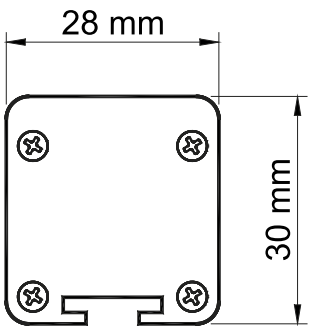
Its features include::

- Minimal cross section - 28 x 30 mm.
- No blind area on one side:
  The position of first beam ensures that the sensitive area extends to end of the light curtain.
- The solution with two L-mounted light curtains, e.g. Master-Slave, maintains 40 mm resolution in corner (models with resolution 30 and 40 mm).
- Minimal blind area on connector side.
- Easy connection and installation thanks to the M12 connectors and the use of unshielded cables up to 100 m.
- Integrated safety functions, including self-monitoring of static outputs, control of external contactors (EDM) and automatic/manual selectable Restart.
- Built-in auto-test function, every 0.5 sec.
- Exceptional mechanical and electrical robustness are the result of extensive experience gained hands-on with all kinds of applications.
- Operating temperature range -10 to 55 °C.
- Protection rate: IP 65 and IP 67 at the same time.
- High resistance to infiltration by dust and liquids in a highly compact light curtain.
- Models Master/Slave for cascade connection of two or three light curtains.
- 2 safety PNP static outputs.

Special versions with IP 69K watertight enclosure (WTF and WTHF), also suitable for Food & Beverage industry, available (see page 192).

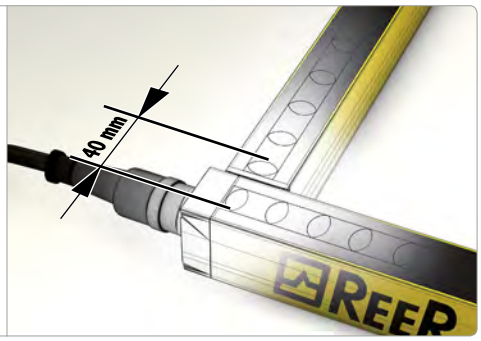
EOS2 light curtains may be connected to the dedicated safety interfaces series AD SR, or directly to contactors actuated and controlled by the light curtain, or to MOSAIC or to suitable commercial safety modules or safety PLCs.

Cross section



< of safety light curtain resolution
=
no blind zone

Two L-mounted light curtains maintain 40 mm resolution in the corner (models with resolution 30 and 40 mm)



Safety level: **Type 2 – SIL 2 – SILCL 2 – PL d – Cat. 2**

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- IEC/EN 61496-1 Ed. 2.1, IEC/TS 61496-2 Ed. 2 " Safety of machinery - Electro-sensitive protective equipment- General requirements and tests"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems"
- IEC/TS 62046 Ed. 2 "Safety of machinery – Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada
- ANSI / UL 1998 "Safety Software in Programmable Components".

EOS2

THE EOS2 RANGE

EOS2 A

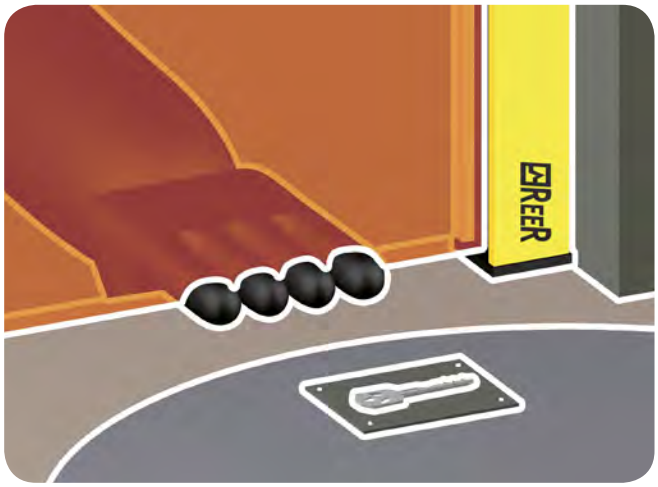
- Protected height range 160 to 1510 mm
- 5 types of detection:
  - Resolution 30 - 40 mm for hand detection
  - Resolution 50 - 90 mm for detection of the body in a dangerous area
  - 2 - 3 - 4 beams for detection of the body in access control
- Max. range 12 m
- 2 safety static outputs PNP with auto-test protected against short circuits and overloads
- Automatic Start/Restart
- M12 5-pole connectors

The ideal light curtain for straightforward interfacing with safety modules or safety PLCs.

EOS2 X

- Protected height range 160 to 1510 mm
- 5 types of detection:
  - Resolution 30 - 40 mm for hand detection
  - Resolution 50 - 90 mm for detection of the body in a dangerous area
  - 2 - 3 - 4 beams for detection of the body in access control
- Max. range 12 m
- M12 5-pole connector for emitter and M12 8-pole for receiver
- Integrated, selectable manual or automatic Start/Restart
- Feedback input for external relay monitoring (EDM)
- Master and Slave models for series connection of two or three light curtains regardless of height or resolution.

An effective light curtain for directly controlling and monitoring machine circuits with no need of external safety modules.
Master/Slave models are also ideal for series connection of several light curtains and combined detection of hand and body or the protection of two different sides of a machine.



The protected area extends until the light curtain end maintaining the resolution

The resolution is maintained (up to 40 mm) in the junction between the 2 protected areas

EOS2 A

MAIN FEATURES

Automatic Start/Restart.
Two safety PNP static outputs, auto-controlled.
All connections and configurations through M12 5-pole connectors.
Unshielded cables up to 100 meter long.
Start/Restart interlock and EDM through external AD SR1 interface.
Muting function through external AD SRM interface.
Autotest every 0,5 sec.

TECHNICAL FEATURES

Safety level	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1
Protected heights (mm)	160 – 1510
Resolutions (mm)	30 – 40 – 50 – 90
Numbers of beams for body detection in access control	2 – 3 – 4
Max. range (m)	4 – 12 selectable
Response time (ms)	2,5 – 18,5
Safety outputs	2 PNP – 400 mA at 24 VDC
Signaling	LEDs for light curtain's status and diagnostic
Start/Restart	automatic
Power supply (VDC)	24 ± 20%
Electrical connections	M12 - 5 poles for emitter and receiver
Max. cable lenght (m)	100
Operating temperature (°C)	-10 to 55
Protection rating	IP 65 and IP 67
Fastening modes	back slot
Cross section (mm)	28 x 30

Safety level:

Type 2

SIL 2 – SILCL 2
PL d – Cat. 2

EOS2 A

Resolution 30 mm	EOS2 153 A	EOS2 303 A	EOS2 453 A	EOS2 603 A	EOS2 753 A	EOS2 903 A	EOS2 1053 A	EOS2 1203 A	EOS2 1353 A	EOS2 1503 A
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	8	16	23	31	38	46	53	61	68	76
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 40 mm	EOS2 154 A	EOS2 304 A	EOS2 454 A	EOS2 604 A	EOS2 754 A	EOS2 904 A	EOS2 1054 A	EOS2 1204 A	EOS2 1354 A	EOS2 1504 A
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	6	11	16	21	26	31	36	41	46	51
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 50 mm	EOS2 155 A	EOS2 305 A	EOS2 455 A	EOS2 605 A	EOS2 755 A	EOS2 905 A	EOS2 1055 A	EOS2 1205 A	EOS2 1355 A	EOS2 1505 A
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	4	8	12	16	20	24	28	32	36	40
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 90 mm	EOS2 309 A	EOS2 459 A	EOS2 609 A	EOS2 759 A	EOS2 909 A	EOS2 1059 A	EOS2 1209 A	EOS2 1359 A	EOS2 1509 A
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510
Number of beams	4	6	8	10	12	14	16	18	20
Overall height (mm)	363	513	663	813	963	1113	1263	1413	1563

2-3-4-beams	EOS2 2B A	EOS2 3B A	EOS2 4B A
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	653	953	1053

• For accessories see page 126

• For ordering codes see page 221

EOS2 X

WITH BUILT-IN CONTROL FUNCTIONS

MAIN FEATURES

Built-in, selectable manual/automatic Start/Restart
Feedback input for controlling external relays (EDM).
Two safety PNP static outputs, auto-controlled.
All connections and setting adjustments through M12 5-pole and 8-pole connectors.
Unshielded cables up to 100 meter long.
Master and Slave models for series connection of up to 3 light curtains.
Max. length of connections toward Slaves: 50 meters, through standard unshielded cable.
Self test every 0,5 sec.

TECHNICAL FEATURES

Safety level	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1
Protected heights (mm)	160 – 1510
Resolutions (mm)	30 – 40 – 50 – 90
Numbers of beams for body detection in access control	2 – 3 – 4
Max. range (m)	4 – 12 selectable
Response time (ms)	2,5 – 18,5
Safety outputs	2 PNP – 400 mA at 24 VDC
Signalling	LEDs for light curtain's status and diagnostic
Start/Restart	selectable automatic or manual
External Device Monitoring	external device monitoring feedback input with enabling, selectable
Power supply (VDC)	24 ± 20%
Electrical connections for EOS2 X and EOS2 X Master	M12 - 5 poles for emitter M12 - 8 poles for receiver
Electrical connections between Master and Slave	M12 - 5 poles per emitter and receiver
Max. cable lenght (m)	100 (50 between Master and Slave)
Operating temperature (°C)	-10 to 55
Protection rating	IP 65 and IP 67
Fastening modes	back slot
Cross section (mm)	28 x 30

Safety level:

Type 2

SIL 2 – SILCL 2
PL d – Cat. 2

EOS2 X

WITH BUILT-IN CONTROL FUNCTIONS

Resolution 30 mm	EOS2 153 X	EOS2 303 X	EOS2 453 X	EOS2 603 X	EOS2 753 X	EOS2 903 X	EOS2 1053 X	EOS2 1203 X	EOS2 1353 X	EOS2 1503 X
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	8	16	23	31	38	46	53	61	68	76
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 40 mm	EOS2 154 X	EOS2 304 X	EOS2 454 X	EOS2 604 X	EOS2 754 X	EOS2 904 X	EOS2 1054 X	EOS2 1204 X	EOS2 1354 X	EOS2 1504 X
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	6	11	16	21	26	31	36	41	46	51
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 50 mm	EOS2 155 X	EOS2 305 X	EOS2 455 X	EOS2 605 X	EOS2 755 X	EOS2 905 X	EOS2 1055 X	EOS2 1205 X	EOS2 1355 X	EOS2 1505 X
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	4	8	12	16	20	24	28	32	36	40
Overall height (mm)	213	363	513	663	813	963	1113	1263	1413	1563

Resolution 90 mm	EOS2 309 X	EOS2 459 X	EOS2 609 X	EOS2 759 X	EOS2 909 X	EOS2 1059 X	EOS2 1209 X	EOS2 1359 X	EOS2 1509 X
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510
Number of beams	4	6	8	10	12	14	16	18	20
Overall height (mm)	363	513	663	813	963	1113	1263	1413	1563

2-3-4-beams	EOS2 2B X	EOS2 3B X	EOS2 4B X
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	653	953	1053

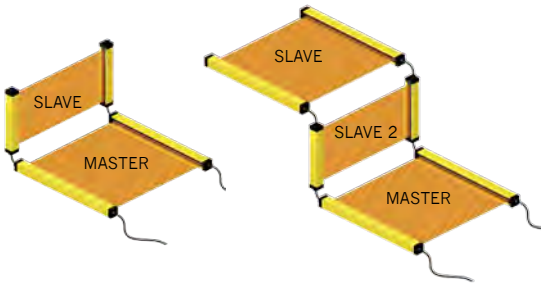
• For accessories see page 126

• For ordering codes see page 221

EOS2

MASTER/SLAVE MODELS

Master/Slave models permit series connection of up to three safety light curtains and combined detection of hand and presence of a person or of more sides of the machine, with the following major benefits:
- A single pair of safety outputs
- No interference between light curtains installed adjacent to one another.

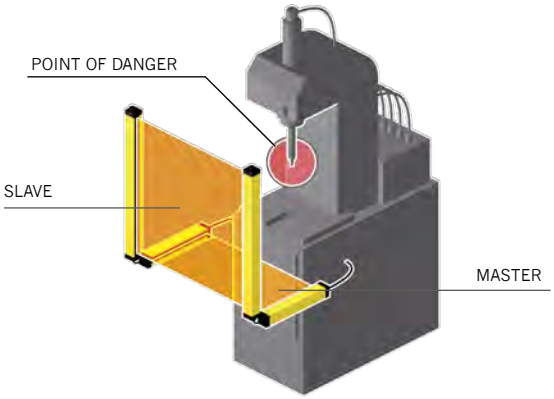


EXAMPLES OF SERIES CONNECTION OF MASTER AND SLAVE LIGHT CURTAINS

Any Master model can be used together with any Slave model.

All electrical connections are made using M12 5-pole connectors, except for Master receivers which necessitate the adoption of M12 8-pole connectors.

Pre-wired cables with twin connectors are available for the connection between Master and Slave.

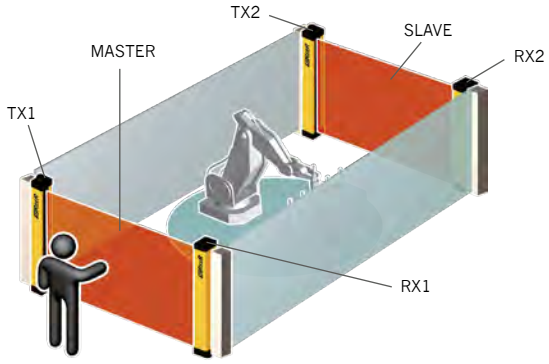


EXAMPLES OF SERIES CONNECTION OF MASTER AND SLAVE LIGHT CURTAINS

Master light curtain is placed horizontally for detection of the person and Slave light curtain is placed vertically to detect fingers or hands.

The arrangement can be reversed to have the Master light curtain vertical for finger and hand detection and the Slave light curtain horizontally for detecting the presence of a person.

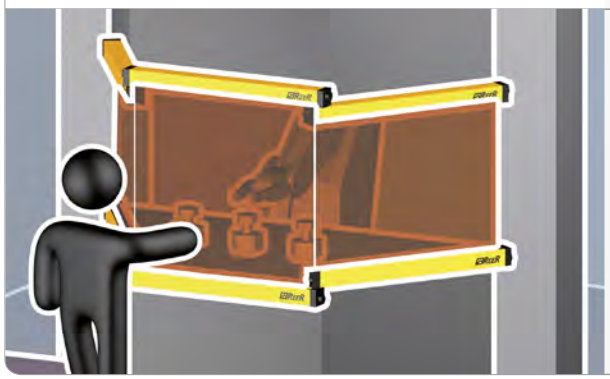
The application shown is one of the most common: horizontal curtains are used to prevent the operator from being undetected in the space between vertical light curtain and dangerous machine, upon system start-up or restarting.



EXAMPLE OF SERIES CONNECTION OF MASTER AND SLAVE LIGHT CURTAINS FOR PROTECTION OF TWO SIDES OF THE MACHINE

On EOS2 X the connecting cable across Master and Slave is a standard (unshielded) cable up to 50 meter long.

Thus, two series connected curtains may be located one at the front of the machine and the other at the rear, with a single connection to the machine power and control circuitry.



EXAMPLE OF SERIES CONNECTION OF ONE MASTER AND TWO SLAVE LIGHT CURTAINS FOR THE PROTECTION OF THREE SIDES OF THE MACHINE

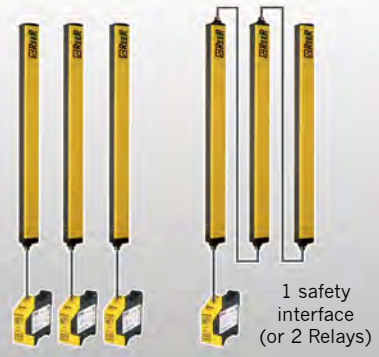
Benefit: unimpeded operator access to work area from front and sides.

Continues

EOS2

Follows

Series connections diagram



Benefit: with three standard curtains it will be necessary to use and wire up 3 safety interfaces or 6 contactors.

With the master/slave solution having 3 series light curtains it will be enough to use and wire up only 1 safety interface or 2 contactors.

MASTER/SLAVE MODELS

MASTER Resolution 30 mm		**EOS2 303 XM**	**EOS2 453 XM**	**EOS2 603 XM**	**EOS2 753 XM**	**EOS2 903 XM**	**EOS2 1053 XM**	**EOS2 1203 XM**	**EOS2 1353 XM**	**EOS2 1503 XM**
SLAVE Resolution 30 mm	**EOS2 153 XS**	**EOS2 303 XS**	**EOS2 453 XS**	**EOS2 603 XS**	**EOS2 753 XS**	**EOS2 903 XS**	**EOS2 1053 XS**	**EOS2 1203 XS**	**EOS2 1353 XS**	**EOS2 1503 XS**
SLAVE 2 Resolution 30 mm		**EOS2 303 XS2**	**EOS2 453 XS2**	**EOS2 603 XS2**	**EOS2 753 XS2**	**EOS2 903 XS2**	**EOS2 1053 XS2**	**EOS2 1203 XS2**	**EOS2 1353 XS2**	**EOS2 1503 XS2**
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	8	16	23	31	38	46	53	61	68	76
Overall height (mm) *	213	363	513	663	813	963	1113	1263	1413	1563

MASTER Resolution 40 mm		**EOS2 304 XM**	**EOS2 454 XM**	**EOS2 604 XM**	**EOS2 754 XM**	**EOS2 904 XM**	**EOS2 104 XM**	**EOS2 1204 XM**	**EOS2 1354 XM**	**EOS2 1504 XM**
SLAVE Resolution 40 mm	**EOS2 154 XS**	**EOS2 304 XS**	**EOS2 454 XS**	**EOS2 604 XS**	**EOS2 754 XS**	**EOS2 904 XS**	**EOS2 1054 XS**	**EOS2 1204 XS**	**EOS2 1354 XS**	**EOS2 1504 XS**
SLAVE 2 Resolution 40 mm		**EOS2 304 XS2**	**EOS2 454 XS2**	**EOS2 604 XS2**	**EOS2 754 XS2**	**EOS2 904 XS2**	**EOS2 1054 XS2**	**EOS2 1204 XS2**	**EOS2 1354 XS2**	**EOS2 1504 XS2**
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	6	11	16	21	26	31	36	41	46	51
Overall height (mm) *	213	363	513	663	813	963	1113	1263	1413	1563

• For accessories see page 126 • For ordering codes see page 221

EOS2 X

WITH BUILT-IN CONTROL FUNCTIONS

MASTER/SLAVE MODELS

MASTER Resolution 50 mm		EOS2 305 XM	EOS2 455 XM	EOS2 605 XM	EOS2 755 XM	EOS2 905 XM	EOS2 105 XM	EOS2 1205 XM	EOS2 1355 XM	EOS2 1505 XM
SLAVE Resolution 50 mm	EOS2 155 XS	EOS2 305 XS	EOS2 455 XS	EOS2 605 XS	EOS2 755 XS	EOS2 905 XS	EOS2 1055 XS	EOS2 1205 XS	EOS2 1355 XS	EOS2 1505 XS
SLAVE 2 Resolution 50 mm		EOS2 305 XS2	EOS2 455 XS2	EOS2 605 XS2	EOS2 755 XS2	EOS2 905 XS2	EOS2 1055 XS2	EOS2 1205 XS2	EOS2 1355 XS2	EOS2 1505 XS2
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510
Number of beams	4	8	12	16	20	24	28	32	36	40
Overall height (mm) *	213	363	513	663	813	963	1113	1263	1413	1563

MASTER Resolution 90 mm	EOS2 309 XM	EOS2 459 XM	EOS2 609 XM	EOS2 759 XM	EOS2 909 XM	EOS2 1059 XM	EOS2 1209 XM	EOS2 1359 XM
SLAVE Resolution 90 mm	EOS2 309 XS	EOS2 459 XS	EOS2 609 XS	EOS2 759 XS	EOS2 909 XS	EOS2 1059 XS	EOS2 1209 XS	EOS2 1359 XS
SLAVE 2 Resolution 90 mm	EOS2 309 XS2	EOS2 459 XS2	EOS2 609 XS2	EOS2 759 XS2	EOS2 909 XS2	EOS2 1059 XS2	EOS2 1209 XS2	EOS2 1359 XS2
Protected heights (mm)	310	460	610	760	910	1060	1210	1360
Number of beams	4	6	8	10	12	14	16	18
Overall height (mm) *	363	513	663	813	963	1113	1263	1413

MASTER 2-3-4 beams	EOS2 2B XM	EOS2 3B XM	EOS2 4B XM
SLAVE 2-3-4 beams	EOS2 2B XS	EOS2 3B XS	EOS2 4B XS
SLAVE 2 2-3-4 beams	EOS2 2B XS2	EOS2 3B XS2	EOS2 4B XS2
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)*	653	953	1053

* On master and slave models 2 the total height of curtain is 24 mm greater owing to the addition of a secondary connector

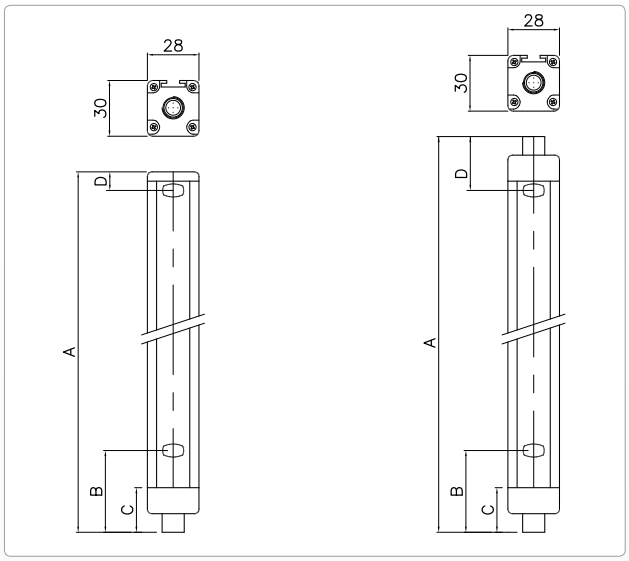
• For accessories see page 126 • For ordering codes see page 221

EOS2 X

WITH BUILT-IN CONTROL FUNCTIONS

DIMENSIONS (mm)

EOS2 SLAVE **EOS2 MASTER / SLAVE 2**



Model	150	300	450	600	750	900	1050	1200	1350	1500
A	213	363	513	663	813	963	1113	1263	1413	1563
A (Master/Slave)	236.5	386.5	536.5	686.5	836.5	986.5	1136.5	1286.5	1436.5	1586.5
B	61.5									
C	29.5									
D	11									
D (Master/Slave 2) (with 2 connectors)	34.5									
Mounting	2 LE type brackets with 2 inserts							3 LE type brackets with 3 inserts		

WARNING!

- Where the light curtain is subjected to strong vibrations (presses, textile looms, etc.) always use vibrations dampers SAV E (available as accessories) in order to prevent damaging the light curtain
- Where protections are to be placed over long distances or on several sides using deflection mirrors, it is advisable to use laser alignment aid LAD 4 to ensure simple, quick and perfect alignment of light curtains.

EOS2

ORDERING INFORMATION (for ordering codes see page 221)

Each EOS2 light curtain comprises:
▪ Emitter and Receiver pair
▪ Brackets and inserts
▪ CD-ROM containing the multi-language instruction manual complete with CE declaration of conformity
▪ Quick installation guide

ACCESSORIES

EOS2 curtains can be supplied with the following accessories, to be ordered separately:	
▪ AD SR Safety Relays	see page 180
▪ LAD laser alignment device	see page 210
▪ FMC floor mounting columns	see page 206
▪ SP deflection mirrors	see page 209
▪ SAV E vibrations dampers	see page 211
▪ SFB swivel fixing brackets	see page 212
▪ Connectors	see list hereunder:

CONNECTORS EOS2 (EOS2 A emitter and receiver / EOS2 X emitter)

Model	**Description**
CD 5	M12 straight connector, 5 poles, pre-wired cable 5 m
CD 10	M12 straight connector, 5 poles, pre-wired cable 10 m
CD 15	M12 straight connector, 5 poles, pre-wired cable 15 m
CD 20	M12 straight connector, 5 poles, pre-wired cable 20 m
CD 25	M12 straight connector, 5 poles, pre-wired cable 25 m
CD 50	M12 straight connector, 5 poles, pre-wired cable 50 m
CD 95	M12 90° angle connector, 5 poles, pre-wired cable 5 m
CD 910	M12 90° angle connector, 5 poles, pre-wired cable 10 m
CD 915	M12 90° angle connector, 5 poles, pre-wired cable 15 m
CDM 9	M12 straight connector, 5 poles with screw terminal, PG9 cable gland
CDM 99	M12 angle connector, 5 poles with screw terminal, PG9 cable gland

CONNECTORS EOS2 X receivers

Model	**Description**
C8D 5	M12 straight connector, 8 poles, pre-wired cable 5 m
C8D 10	M12 straight connector, 8 poles, pre-wired cable 10 m
C8D 15	M12 straight connector, 8 poles, pre-wired cable 15 m
C8D 25	M12 straight connector, 8 poles, pre-wired cable 25 m
C8D 40	M12 straight connector, 8 poles, pre-wired cable 40 m
C8D 95	M12 90° angle connector, 8 poles, pre-wired cable 5 m
C8D 910	M12 90° angle connector, 8 poles, pre-wired cable 10 m
C8D 915	M12 90° angle connector, 8 poles, pre-wired cable 15 m
C8DM 11	M12 straight connector, 8 poles with screw terminal, PG9/11 cable gland
C8DM 911	M12 90° angle connector, 8 poles with screw terminal, PG9/11 cable gland

CONNECTION BETWEEN MASTER AND SLAVE

Model	**Description**
CDS 03	0,3 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 3	3 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 5	5 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 10	10 m pre-wired cable with 2 straight connectors, M12 5 poles
CJBE 25	25 m pre-wired cable with 2 straight connectors, M12 5 poles

VISION

VISION

The Vision Type 2 family of safety light curtains is the ideal solution for the protection of the majority of industrial applications in Category 2.

Its features include:

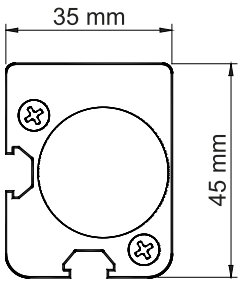
- Extremely easy connection and installation, thanks to the M12 connectors and the use of standard cables.
- Integration of the main safety functions, including self monitoring of the safety circuits and, for the VX / VXL / MXL models, external device monitoring (EDM) and the Start / Restart interlock function.
- The built-in auto-test function, activated automatically and periodically, without interruption of the operation of the machine being controlled.
- The breadth of the range, including Master / Slave models for cascade connection of two light curtains, the VXL models, with the lowest cost/performance ratio and the MXL models with built-in Muting function.
- The utmost reliability in the field, thanks to the rugged construction and to the high level of immunity to external disturbances (optical, EMC, etc.).

Special versions in WT/WTH watertight housing (see page 194) available on request.

Special models in conformity with the "ATEX Directive" 94/9/CE – Dust Zone 22 - Gas Zone 2 available on request.

Vision light curtains may be connected to the dedicated safety interfaces series AD SR, or directly to contactors actuated and controlled by the light curtain, or to MOSAIC or to suitable commercial safety modules or safety PLCs.

Cross section



Safety level: Type 2 – SIL 2 – SILCL 2 – PL d – Cat. 2

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- IEC/EN 61496-1 Ed. 2.1, IEC/TS 61496-2 Ed. 2 " Safety of machinery - Electro-sensitive protective equipment- General requirements and tests"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems"
- IEC/TS 62046 Ed. 2 "Safety of machinery – Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada
- ANSI / UL 1998 "Safety Software in Programmable Components".

VISION

THE VISION RANGE

VISION V

- 6 types of detection:
- resolution 20 - 30 - 40 mm for hand detection
- resolution 50 - 90 mm for detection of the body in a hazardous area
- 2 - 3 - 4 beams for detection of the body in access control
- 2 self-testing solid state PNP safety outputs protected against short circuits and overloads
- Automatic Start/Restart
- Electrical connections with M12 5-pole connectors

The ideal Type 2 safety light curtain for a simple interface with safety modules or PLC.

VISION VX

- 6 types of detection:
- resolution 20 - 30 - 40 mm for hand detection
- resolution 50 - 90 mm for detection of the body in a the hazardous area
- 2 - 3 - 4 beams detection of the body in access control
- 2 self-testing solid state PNP safety outputs protected against short circuits and overloads
- Electrical connections with M12 5-pole connectors for emitter and M12 8-pole connectors for receiver
- Built-in manual or automatic Start/Restart selectable
- Feedback input for control of external relays (EDM)
- Master and Slave models for serial connection of two light curtains even of different height and resolution

The ideal Type 2 safety light curtain for directly controlling and monitoring the circuits of the machine, without the need for external safety modules. The Master / Slave models are also the ideal solution for connecting two light curtains in series and constituting a combined detection of the hand and of the presence of a person or of two different sides of the machine.

VISION VX LR Long Range

- 2 - 3 - 4 beams for detection of the body in access monitoring
- Max. range 60 m
- M12 5-pole connector for emitter and M12 8-pole for receiver
- Integrated, selectable manual or automatic Start/Restart
- Feedback input for external relay monitoring (EDM).

The ideal safety light curtain for protection applications with a long range, also on several sides using deflection mirrors.

VISION VXL

- 3 types of detection:
- resolution 30 - 40 mm for hand detection
- 2 - 3 - 4 beams for detection of the body in access control
- 2 self-testing solid state PNP safety outputs protected against short circuits and overloads
- Electrical connections with M12 5-pole connectors for emitter and M12 8-pole connectors for receiver
- Built-in manual or automatic Start/Restart selectable
- Feedback input for control of external relays (EDM)

Vision VXL, similar to the VX models but available in a limited number of versions and with max. range of 8 meters; especially conceived to satisfy the most frequent application needs at a very competitive price.

VISION MXL

- Built-in Muting function with 2 sensors operating logic
- 3 types of detection:
- resolution 30 - 40 mm for hand detection
- 2 – 3 - 4 beams for detection of the body in access control
- 2 self-testing solid state PNP safety outputs protected against short circuits and overloads
- Electrical connections with M12 5-pole connectors for emitter and M16 12-pole connectors for receiver
- Built-in manual or automatic Start/Restart selectable
- Feedback input for control of external relays (EDM)

Vision MXL - following the same approach as the VXL series – can offer a complete range of essential functions and satisfy the most common application needs where the Muting function is required, together with a very competitive price.

VISION V

MAIN FEATURES

Two self-testing solid state PNP safety outputs.
Periodic auto-test every 0.5 sec.
All connections and configuration by means of M12 connectors.
Use of unshielded cables up to 100 m.
Suppression of optical interference by means of range selection.
Start/Restart interlock and EDM via external AD SR1 interace.

TECHNICAL FEATURES

Safety level	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1
Protected heights (mm)	160 – 1810
Resolutions (mm)	20 - 30 - 40 - 50 - 90
Number of beams for body detection in access control	2 - 3 - 4
Max. range (m)	6 for V…L models 16 for V…H models
Response time (ms)	5,5 – 28
Safety outputs	2 PNP auto-controlled – 500 mA at 24 VDC with short-circuit, overload, polarity reversal protection
Signalling	LEDs for light curtain's status and diagnostic
Restart	automatic
Power supply (VDC)	24 ± 20%
Electrical connections	M12 - 5 poles for emitter and receiver
Max. cable length (m)	100
Operating temperature (°C)	0 to 55
Protection rating	IP 65
Fastening modes	3: back slot, side slot or to the top and lower end
Cross section (mm)	35 x 45

Safety level:

Type 2

SIL 2 – SILCL 2
PL d – Cat. 2

VISION V

Resolution 20 mm	V 152	V 302	V 452	V 602	V 752	V 902	V 1052	V 1202	V 1352	V 1502	V 1652	V 1802
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	15	30	45	60	75	90	105	120	135	150	165	180
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911
Max. range. (m)	6 (V...L models) - 16 (V...H models)											

Resolution 30 mm	V 153	V 303	V 453	V 603	V 753	V 903	V 1053	V 1203	V 1353	V 1503	V 1653	V 1803
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	8	16	24	32	40	48	56	64	72	80	88	96
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911
Max. range. (m)	6 (V...L models) - 16 (V...H models)											

Resolution 40 mm	V 304	V 454	V 604	V 754	V 904	V 1054	V 1204	V 1354	V 1504	V 1654	V 1804
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	10	15	20	25	30	35	40	45	50	55	60
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911
Max. range. (m)	6 (V...L models) - 16 (V...H models)										

Resolution 50 mm	V 305	V 455	V 605	V 755	V 905	V 1055	V 1205	V 1355	V 1505	V 1655	V 1805
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	8	12	16	20	24	28	32	36	40	44	48
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911
Max. range. (m)	6 (V...L models) - 16 (V...H models)										

Resolution 90 mm	V 309	V 459	V 609	V 759	V 909	V 1059	V 1209	V 1359	V 1509	V 1659	V 1809
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	5	7	9	11	13	15	17	19	21	23	25
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911
Max. range. (m)	6 (V...L models) - 16 (V...H models)										

2-3-4 beams	V 2B	V 3B	V 4B
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	711	1011	1111
Max. range. (m)	6 (V...L models) - 16 (V...H models)		

• For accessories see page 148 • For ordering codes see page 223

VISION VX

WITH BUILT-IN CONTROL FUNCTIONS

MAIN FEATURES

Two self-testing solid state PNP safety outputs.
Periodic auto-test every 0.5 sec.
Built-in Start/Restart interlock, selectable.
Feedback input for control of external relays (EDM).
All connections and configuration by means of M12 connectors.
Use of unshielded cables up to 100 m.
Suppression of optical interference by means of range selection.
Master and Slave models for serial connection of 2 light curtains.
Maximum length of the connections between Master and Slave: 50 metres, with unshielded cable.
Models with 2, 3 and 4 beams Long Range, max. 60 meters.

TECHNICAL FEATURES

Safety level	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1
Protected heights (mm)	160 – 1810
Resolutions (mm)	20 - 30 - 40 - 50 - 90
Number of beams for body detection in access control	2 - 3 - 4
Max. range (m)	Selectable 6 - 18 22 - 60 for 2 - 3 - 4 beams Long Range
Response time (ms)	5,5 – 28
Safety outputs	2 PNP auto-controlled – 500 mA at 24 VDC with short-circuit, overload, polarity reversal protection
Signalling	seven-segment display and LEDs for light curtain's status and diagnostic
Start/Restart	automatic or manual, selectable
External Device Monitoring	feedback input
Power supply (VDC)	24 ± 20%
Electrical connections for VX and VX Master	M12 - 5 poles for emitter M12 - 8 poles for receiver
Electrical connections between Master and Slave	M12 - 5 poles for emitter and receiver
Max. cable length (m)	100 (50 between master and slave)
Operating temperature (°C)	0 to 55
Protection rating	IP 65
Fastening modes	3: back slot, side slot or to the top and lower end
Cross section (mm)	35 x 45

Safety level:

Type 2

SIL 2 – SILCL 2
PL d – Cat. 2

VISION VX

WITH BUILT-IN CONTROL FUNCTIONS

Resolution 20 mm	VX 152	VX 302	VX 452	VX 602	VX 752	VX 902	VX 1052	VX 1202	VX 1352	VX 1502	VX 1652	VX 1802
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	15	30	45	60	75	90	105	120	135	150	165	180
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 30 mm	VX 153	VX 303	VX 453	VX 603	VX 753	VX 903	VX 1053	VX 1203	VX 1353	VX 1503	VX 1653	VX 1803
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	8	16	24	32	40	48	56	64	72	80	88	96
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 40 mm	VX 304	VX 454	VX 604	VX 754	VX 904	VX 1054	VX 1204	VX 1354	VX 1504	VX 1654	VX 1804
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	10	15	20	25	30	35	40	45	50	55	60
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 50 mm	VX 305	VX 455	VX 605	VX 755	VX 905	VX 1055	VX 1205	VX 1355	VX 1505	VX 1655	VX 1805
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	8	12	16	20	24	28	32	36	40	44	48
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

Resolution 90 mm	VX 309	VX 459	VX 609	VX 759	VX 909	VX 1059	VX 1209	VX 1359	VX 1509	VX 1659	VX 1809
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	5	7	9	11	13	15	17	19	21	23	25
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

2-3-4 beams	VX 2B	VX 3B	VX 4B	VX* 2B LR	VX* 3B LR	VX* 4B LR
Number of beams	2	3	4	2	3	4
Beam spacing (mm)	500	400	300	500	400	300
Protected heights (mm)	510	810	910	510	810	910
Overall height (mm)	711	1011	1111	711	1011	1111

• For accessories see page 148

• For ordering codes see page 223

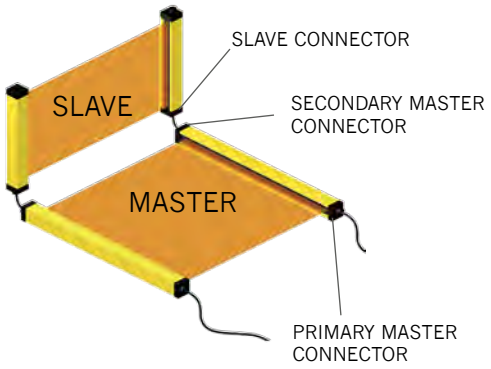
* 60 m range

VISION VX

WITH BUILT-IN CONTROL FUNCTIONS

MASTER/SLAVE MODELS

Master/Slave models permit series connection of two safety light curtains achieving two main advantages:
- A single pair of safety outputs
- No interference between light curtains installed adjacent to one another.

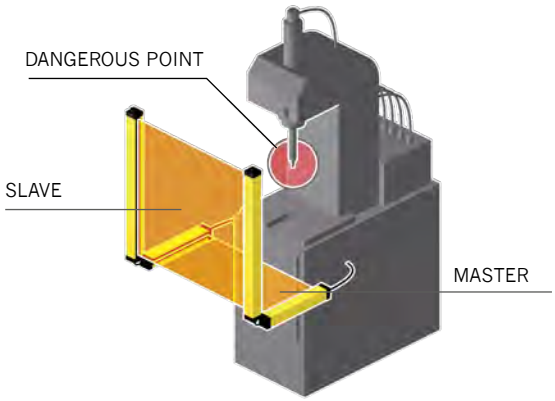


EXAMPLE OF SERIAL CONNECTION BETWEEN MASTER AND SLAVE LIGHT CURTAINS

It is possible to combine any Master model with any Slave model.

All the electrical connections are made using 5-pole M12 connectors, except for the Master receiver, which requires an 8-pole M12 connector.

Pre-wired cables with 2 connectors are available for the connection between Master and Slave.

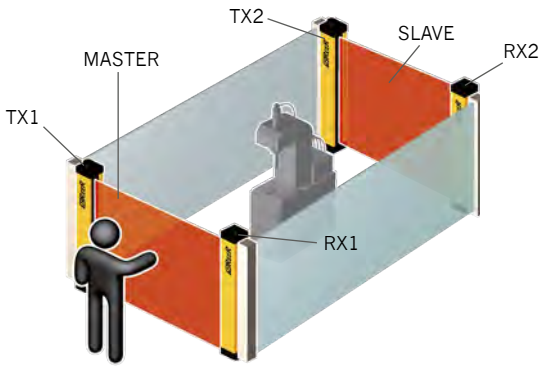


EXAMPLE OF SERIAL CONNECTION BETWEEN MASTER AND SLAVE LIGHT CURTAINS

The Master light curtain is positioned horizontally for detecting the presence of the person while the vertical Slave light curtain detects finger or hand.

However, it is possible to invert the combination and have the Master light curtain positioned vertically for hand protection and the Slave light curtain horizontally for detecting the presence of the person.

The application illustrated is one of the most common: the horizontal light curtain is used for eliminating the possibility for the operator not to be detected between the vertical light curtain and the dangerous machine at the start or restart of the system.



EXAMPLE OF SERIAL CONNECTION BETWEEN MASTER AND SLAVE LIGHT CURTAINS FOR THE PROTECTION OF 2 SIDES OF THE MACHINE

In the Vision VX light curtains, the length of the connection cable between Master and Slave can be up to 50 metres.

This characteristic enables the application of 2 light curtains in series positioned on the front and back of the dangerous machine, with a single connection towards the power supply and control circuits of the machine.

VISION VX

WITH BUILT-IN CONTROL FUNCTIONS

MASTER/SLAVE MODELS

MASTER Resolution 30 mm	VX 153M	VX 303M	VX 453M	VX 603M	VX 753M	VX 903M	VX 1053M	VX 1203M	VX 1503M
SLAVE Resolution 30 mm	VX 153S	VX 303S	VX 453S	VX 603S	VX 753S	VX 903S	VX 1053S	VX 1203S	VX 1503S
Protected heights (mm)	160	310	460	610	760	910	1060	1210	1510
Number of beams	8	16	24	32	40	48	56	64	80
Overall height (mm) *	261	411	561	711	861	1011	1161	1311	1611

MASTER Resolution 40 mm		VX 304M	VX 454M	VX 604M	VX 754M	VX 904M	VX 1054M	VX 1204M	VX 1504M
SLAVE Resolution 40 mm		VX 304S	VX 454S	VX 604S	VX 754S	VX 904S	VX 1054S	VX 1204S	VX 1504S
Protected heights (mm)		310	460	610	760	910	1060	1210	1510
Number of beams		10	15	20	25	30	35	40	50
Overall height (mm) *		411	561	711	861	1011	1161	1311	1611

MASTER Resolution 50 mm		VX 305M	VX 455M	VX 605M	VX 755M	VX 905M	VX 1055M	VX 1205M	VX 1505M
SLAVE Resolution 50 mm		VX 305S	VX 455S	VX 605S	VX 755S	VX 905S	VX 1055S	VX 1205S	VX 1505S
Protected heights (mm)		310	460	610	760	910	1060	1210	1510
Number of beams		8	12	16	20	24	28	32	40
Overall height (mm) *		411	561	711	861	1011	1161	1311	1611

MASTER 2-3 beams								VX 2BM	VX 3BM
SLAVE 2-3 beams								VX 2BS	VX 3BS
Number of beams								2	3
Beam spacing (mm)								500	400
Protected heights (mm)								510	810
Overall height (mm) *								711	1011

* In the Master models, the total light curtain height is increased by 10 mm due to the presence of the secondary connector.

• For accessories see page 148 • For ordering codes see page 224

VISION VXL

WITH BUILT-IN CONTROL FUNCTIONS

MAIN FEATURES

Two self-testing solid state PNP safety outputs.
Periodic auto-test every 0,5 sec.
Built-in Start/Restart interlock, selectable.
Feedback input for control of external relays (EDM).
All connections and configuration by means of M12 connectors.
Use of unshielded cables up to 100 m

TECHNICAL FEATURES

Safety level	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1
Protected heights (mm)	160 – 1810
Resolutions (mm)	30 – 40
Number of beams for body detection in access control	2 - 3 - 4
Max. range (m)	8
Response time (ms)	2 – 25
Safety outputs	2 PNP auto-controlled – 500 mA at 24 VDC
Signalling	LEDs for light curtain's status and diagnostic
Start/Restart	automatic or manual, selectable
External Device Monitoring	feedback input
Power supply (VDC)	24 ± 20%
Electrical connections	M12 - 5 poles for emitter M12 - 8 poles for receiver
Max. cable length (m)	100
Operating temperature (°C)	0 to 55
Protection rating	IP 65
Fastening modes	3: back slot, side slot or to the top and lower end
Cross section (mm)	35 x 45

Safety level:

Type 2

SIL 2 – SILCL 2
PL d – Cat. 2

VISION VXL

WITH BUILT-IN CONTROL FUNCTIONS

Resolution 30 mm	VXL 153	VXL 303	VXL 453	VXL 603	VXL 753	VXL 903	VXL 1053	VXL 1203
Protected heights (mm)	160	310	460	610	760	910	1060	1210
Number of beams	8	16	24	32	40	48	56	64
Overall height (mm)	261	411	561	711	861	1011	1161	1311

Resolution 40 mm	VXL 304	VXL 454	VXL 604	VXL 754	VXL 904	VXL 1054	VXL 1204	VXL 1354	VXL 1504	VXL 1654	VXL 1804
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	10	15	20	25	30	35	40	45	50	55	60
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911

2-3-4 beams	VXL 2B	VXL 3B	VXL 4B
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	711	1011	1111

• For accessories see page 148

• For ordering codes see page 224

VISION MXL

VISION MXL

WITH MUTING FUNCTION

Vision MXL is a range of safety light curtains for the protection of dangerous systems with Muting function.
Models MXL L and MXL T are available with integrated Muting sensors.

MXL features include the following:

- Extremely easy connection and installation, through the use of standard connectors and unshielded cables up to 100 m.
- Integration of the main safety functions including auto-control of static outputs, control of external contactors (EDM) and Start/Restart interlock
- Integrated auto-test, activated automatically and periodically, without discontinuity to the operation of the machine being controlled
- Integrated Muting function and Muting sensors on models MXL L and MXL T
- Set-up of each function can be done through main connector. No need of software configuration
- Excellent field reliability, assured by robust construction and high-level immunity from external interference (optical, EMC, etc.)
- Comprehensive range, offering outstanding cost effectiveness.

Special models in conformity with the "ATEX Directive" 94/9/CE – Dust Zone 22 - Gas Zone 2 available on request.

- For Vision MXL light curtains is available a range of specific accessories including prewired cable and MXJB Connection Boxes, complete with Restart and Override controls, plus Muting lamp and integrated safety relays for straightforward, quick and reliable interfacing of the safety light curtains with the machine being controlled.

THE VISION MXL RANGE

Vision MXL range includes the following:

- Series MXL, with external Muting sensor connectivity of any type (photocells, proximity switches, limit switches, etc.).

- Series MXL L and series MXL T, with Muting sensors built into pre-wired and pre-aligned arms, adjustable in height and angle.

Vision MXL offer a cost-effective solution for the most common palletized applications.

Safety level: Type 2 – SIL 2 – SILCL 2 – PL d – Cat. 2

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- IEC/EN 61496-1 Ed. 2.1, IEC/TS 61496-2 Ed. 2 " Safety of machinery - Electro-sensitive protective equipment- General requirements and tests"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems"
- IEC/TS 62046 Ed. 2 "Safety of machinery – Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada
- ANSI / UL 1998 "Safety Software in Programmable Components".

VISION MXL

WITH MUTING FUNCTION

MAIN FEATURES

Integrated Muting function with two-sensors bi-directional or mono-directional logic.

High flexibility in terms of interface configurations, Muting logics and timeout.
Selectable overrides (two types).

Muting enable input.

Each configuration is implemented via hardware through main M16, 12-pole connector.
No need for software configuration via PC.

Unshielded cables up to 100 m.

Two safety PNP static outputs, auto-controlled.

Periodic self test every 0.5 sec.

Integrated selectable Start/Restart interlock.

Feedback input for controlling external relays (EDM).

Models MXL L and MXL T with integrated Muting sensors, prealigned, adjustable for height and angle.

Interconnection box MXJB for quick connection of light curtains and availability of the main controls needed for operation close to the gate to be protected.

Safety level:

Type 2

SIL 2 – SILCL 2
PL d – Cat. 2

VISION MXL

WITH MUTING FUNCTION

THE VISION MXL RANGE

MXL and MXL U SERIES

Both have two dedicated inputs on the M16 connector for connection of external Muting sensors of any type such as photocells, proximity switches, limit switches, etc.
A wide range of models featuring 160 mm to 1810 mm protected height for 30 and 40 mm resolution and of 2 - 3 - 4 beam models provide the optimum solution for any application.

The MXL series is recommended for Muting applications:

- Where personnel is supposed to access the area under control during the non-dangerous part of the machine cycle (e. g. manual load/unload of product).
- For two-way transit of material through the gate to be controlled by the light curtain (e.g. palletizers).

The MXL U series is recommended for Muting applications:
For one-way transit (exit only) of material through the gate to be controlled by the light curtain (e.g. palletizers).

SERIE MXL L

The MXL L series, with 2 or 3 beams for access control, uses an original system of 2 horizontal arms (one for the emitter and one for the receiver) with built-in, pre-wired and pre-aligned photoelectric Muting sensors.

The arms can be adjusted in height and angle in order to create a detection plane that is more or less angled, with the purpose to achieve correct and constant detection of the material in transit and therefore reliable operation of the protection system.

This ensures the maximum speed and simplicity of installation.
The MXL L series manages the Muting function in one-way mode and is particularly suitable for protecting the outfeed gates of palletising systems.

SERIE MXL T

The MXL T series, with 2 or 3 beams for access control, features four horizontal arms (two for the emitter and two for the receiver) with built-in, pre-wired and pre-aligned photoelectric Muting sensors.

The arms can be adjusted in height and angle in order to create a detection plane that is more or less angled, with the purpose to achieve correct and constant detection of the material in transit and therefore reliable operation of the protection system.

This ensures the maximum speed and simplicity of installation.
The MXL T series manages the Muting function in two-way mode for the protection of the infeed/outfeed gates in palletising systems.

With the MXL L and MXL T models, system installation is fast and simple; moreover, compliance with the standards requirements regarding the geometry of the Muting sensors and all the other safety parameters is guaranteed (IEC/TS 62046).

VISION MXL
WITH MUTING FUNCTION

GENERAL TECHNICAL DATA

Safety level	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1
Response time (ms)	4 – 37
Safety outputs	2 PNP auto-controlled – 500 mA at 24 VDC
Muting lamp output	24 VDC – 0,5 to 5 W
Entry Muting abilitation	0 – 24 VDC (active high)
Signalling	LEDs for light curtain's and Muting sensors status and diagnostic
Start/Restart	automatic or manual, selectable
External Device Monitoring	External device monitoring feedback input with enabling selectable
Max. Muting timeout	30 sec., 90 min. or infinite selectable
Override function	Built-in override function with 2 operating modes, selectable: - manual action with hold to run - automatic with pulse command
Max. Override Time-out (min)	15
Power supply (VDC)	24 ± 20%
Electrical connections	M12 - 5 poles for emitter M16 - 12 poles for receiver
Max. cable length (m)	100
Operating temperature (°C)	0 to 55
Protection rating	IP 65
Cross section (mm)	35 x 45

MXL and MXL U SERIES

Protected heights (mm)	160 – 1210 for 30 mm Resolution 160 – 1810 for 40 mm Resolution
Resolutions available (mm)	30 – 40
Number of beams for access control	2 – 3 – 4
Max. range (m)	8
MXL Muting logic	two-way with 2 sensors, for personnel access control and two way material transit
MXL U Muting logic	one-way with 2 sensors, for material exit only
Muting Sensors	External Muting sensors with relay or PNP output (dark-on logic)

MXL L SERIES

Number of beams	2 – 3
Operating range (m)	1 – 2,5
Muting logic	one-way with 2 sensors
Muting Sensors	optoelectronic with 2 crossed beams built-in – pre-aligned – pre-wired, with adjustable height and angle

MXL T SERIES

Number of beams	2 – 3
Operating range (m)	1 – 2,5
Muting logic	two-way with 2 sensors
Muting Sensors	optoelectronic with 2 crossed beams built-in – pre-aligned – pre-wired, with adjustable height and angle

VISION MXL

WITH MUTING FUNCTION

MXL MXL U Resolution 30 mm	MXL MXL U 153	MXL MXL U 303	MXL MXL U 453	MXL MXL U 603	MXL MXL U 753	MXL MXL U 903	MXL MXL U 1053	MXL MXL U 1203
Protected heights (mm)	160	310	460	610	760	910	1060	1210
Number of beams	8	16	24	32	40	48	56	64
Overall height (mm)	261	411	561	711	861	1011	1161	1311
Max. range (m)	8							

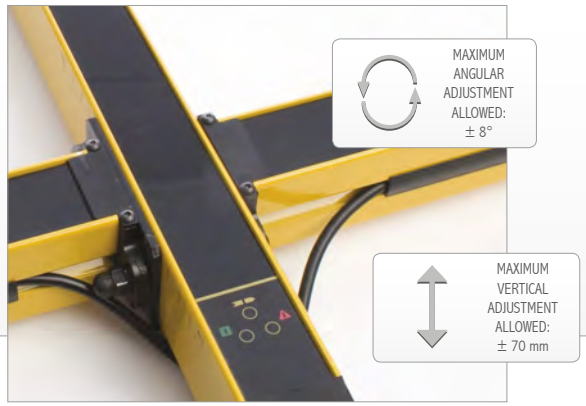
MXL MXL U Resolution 40 mm	MXL MXL U 304	MXL MXL U 454	MXL MXL U 604	MXL MXL U 754	MXL MXL U 904	MXL MXL U 1054	MXL MXL U 1204	MXL MXL U 1354	MXL MXL U 1504	MXL MXL U 1654	MXL MXL U 1804
Protected heights (mm)	310	460	610	760	910	1060	1210	1360	1510	1660	1810
Number of beams	10	15	20	25	30	35	40	45	50	55	60
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1861	1911
Max. range (m)	8										

MXL MXL U 2-3-4-beams	MXL MXL U 2B	MXL MXL U 3B	MXL MXL U 4B
Number of beams	2	3	4
Beam spacing (mm)	500	400	300
Protected heights (mm)	510	810	910
Overall height (mm)	711	1011	1111
Max. range (m)	8		

MXL L 2–3 beams	MXL L 2B	MXL L 3B
Number of beams	2	3
Beam spacing (mm)	500	400
Protected heights (mm)	510	810
Overall height (mm)	711	1011
Muting Sensors	2 crossed beams	
Operative range (m)	1 - 2,5	

MXL T 2–3 beams	MXL T 2B	MXL T 3B
Number of beams	2	3
Beam spacing (mm)	500	400
Protected heights (mm)	510	810
Overall height (mm)	711	1011
Muting Sensors	2 crossed beams	
Operative range (m)	1 - 2,5	

SENSOR ELEMENT ADJUSTMENT - MXL L and MXL T versions



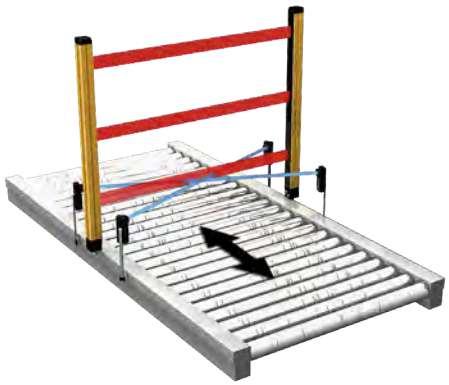
The sensor elements present in the Vision MXL L and MXL T versions are adjustable in height and angle.

This important and unique feature enables the inclination of the detection plane of the sensors to obtain correct and constant detection of irregular materials in transit.

• For accessories see page 148 • For ordering codes see page 225

VISION MXL
WITH MUTING FUNCTION

MXL



Two-way Muting with 2 sensors. Entry/Exit

- 30 and 40 mm resolution, 2 - 3 - 4 beams
- Max. time between the 2 Muting activation signals: 4 sec.
- Possible use with any type of external Muting sensors such as photocells, proximity switches, limit switches, etc.
- Muting Time-out 30 sec, 90 min or infinite, selectable
- Muting Enable input.

Characteristics

- Suitable solution for the most common entry/exit pallet applications
- Muting enable input allows to start a Muting sequence only when needed by the machine cycle. I.e. Muting enabled only when the conveyor is moving.

MXL series is recommended also in those applications where personnel is allowed to access the monitored area during the non-dangerous part of the machine cycle. (i.e. manual material loading/unloading) *See page 37.*

MXL U

One-way Muting with 2 sensors – Exit only

- 30 and 40 mm resolution, 2 - 3 - 4 beams
- Max. time between the 2 Muting activation signals: 4 sec
- Possible use with any type of external Muting sensors such as photocells, proximity switches, limit switches, etc.
- Muting Time-out 30 sec, 90 min or infinite, selectable
- Muting Enable input.

Characteristics

- The light curtain only allows pallet outfeed
- The Muting function can only be activated from inside the protected zone. No possibility to activate a Muting sequence from the outside
- Elimination of bulk outside the protected area, as the Muting sensors are only present inside the area
- Correct Muting sequence even in the presence of a pallet with reduced width and/or length or not centered with respect to the conveyor
- Muting enable input allows to start a Muting sequence only when needed by the machine cycle. I.e. Muting enabled only when the conveyor is moving.

VISION MXL

WITH MUTING FUNCTION

MXL L

One-way Muting with 2 sensors – Exit only

2 integrated photoelectric sensors with crossed beams

- 2 - 3 beams models
- Max. time between the 2 Muting activation signals: 4 sec
- Operating range: 1 - 2,5 meters
- Muting sensor elements adjustable in height and angle
- Muting Time-out 30 sec, 90 min or infinite, selectable
- Muting Enable input.

Characteristics

- Reduced installation time and costs
- With MXL L models, sensors are positioned in compliance with the regulations regarding the geometry of Muting sensors (IEC TS 62046) and all the other safety parameters; this makes it possible to avoid dangers arising from positioning errors and from possible tampering
- The light curtain only allows pallet outfeed
- The Muting function can only be activated from inside the protected zone. No possibility to activate a Muting sequence from the outside
- Elimination of bulk outside the protected area, as the Muting sensors are only present inside the area
- Correct Muting sequence even in the presence of a pallet with reduced width and/or length or not centered with respect to the conveyor
- Muting enable input allows to start a Muting sequence only when needed by the machine cycle. I.e. Muting enabled only when the conveyor is moving.

MXL T

Two-way Muting with 2 sensors – Entry/Exit

2 integrated photoelectric sensors with crossed beams

- 2 - 3 beams models
- Max. time between the 2 Muting activation signals: 4 sec
- Operating range: 1 - 2,5 meters
- Muting sensor elements adjustable in height and angle
- Muting Time-out 30 sec, 90 min or infinite, selectable
- Muting Enable input.

Characteristics

- Reduced installation time and costs
- With MXL T models, sensors are positioned in compliance with the regulations regarding the geometry of Muting sensors (IEC TS 62046) and all the other safety parameters; this makes it possible to avoid dangers arising from positioning errors and from possible tampering
- Standard solution for the most common entry/exit pallet applications
- Muting enable input allows to start a Muting sequence only when needed by the machine cycle. I.e. Muting enabled only when the conveyor is moving.

MXJB

CONNECTION BOX FOR VISION MXL LIGHT CURTAINS

Connection boxes MXJB are accessory devices designed for quick, reliable connection of Vision MXL light curtains and to ensure that major operating controls needed for operation are available in the guarded area.

MAIN FEATURES

- Start/Restart push button
- Key selector switch for Override control function
- Muting-on indicator lamp
- Dip-switch for light curtain functions configuration
- 2 guided-contacts safety relays operated and controlled by the light curtain
- Internal terminal blocks for cable connections.
- Selector for connection of external Muting lamp.
- Selector for internal or external relay control
- Connection for Muting enable input
- Connection with cable gland for cable passage in output towards the machine
- Special models complying with "Directive ATEX" 94/9/EC - Dust Zone 22 - Gas Zone 2 available on request.

MXJB is pre-set as manual Restart. By means the dedicated 5 meters cable CJBR5A, available as accessory, it is possible to make it work as automatic Restart.

Complying with:
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- UL (C+US) mark for USA and Canada.

TECHNICAL FEATURES

MODELS	MXJB 1	MXJB 3
Start/Restart button	yes	yes
Override command	yes	yes
Built-in Muting-lamp	yes	yes
Safety relay output	2 NO 2A 250 VAC	2 NO + 1 NC * 2A 250 VAC
Connectors	M23 - 19 poles for receiver connection M12 - 5 poles for emitter connection	
Dimensions - h x w x d (mm)	110 x 180 x 110	

** in MXJB 3 and MXJB 4 boxes each NO safety output line is interrupted twice by the two relays*

MXJB 1 – MXJB 3

VISION

ORDERING INFORMATION (for ordering codes see page 223)

Each Vision light curtain comprises:

- Emitter and Receiver pair, including integrated sensor (only for L and T models)
- Mounting brackets and T-nuts
- CD-ROM containing the multi-language instruction manual complete with CE declaration of conformity
- Quick installation guide

ACCESSORIES

For Vision light curtains the following accessories, to be ordered separately, are available:

▪ AD SR Safety Relays	see page 180
▪ LAD laser alignment device	see page 210
▪ FMC floor mounting columns	see page 206
▪ SP deflection mirrors	see page 209
▪ SFB swivel fixing brackets	see page 212
▪ SAV vibrations dampers	see page 211
▪ Connectors	see below:

Model	Description
CONNECTORS FOR VISION V emitter and receiver / VX – VXL - MXL emitter	
CD 5	M12 straight connector, 5 poles, pre-wired cable 5 m
CD 10	M12 straight connector, 5 poles, pre-wired cable 10 m
CD 15	M12 straight connector, 5 poles, pre-wired cable 15 m
CD 20	M12 straight connector, 5 poles, pre-wired cable 20 m
CD 25	M12 straight connector, 5 poles, pre-wired cable 25 m
CD 50	M12 straight connector, 5 poles, pre-wired cable 50 m
CD 95	M12 90° angle connector, 5 poles, pre-wired cable 5 m
CD 910	M12 90° angle connector, 5 poles, pre-wired cable 10 m
CD 915	M12 90° angle connector, 5 poles, pre-wired cable 15 m
CDM 9	M12 straight connector, 5 poles with screw terminal, PG9 cable gland
CDM 99	M12 angle connector, 5 poles with screw terminal, PG9 cable gland
CONNECTORS FOR VISION VX – VXL - receiver	
C8D 5	M12 straight connector, 8 poles, pre-wired cable 5 m
C8D 10	M12 straight connector, 8 poles, pre-wired cable 10 m
C8D 15	M12 straight connector, 8 poles, pre-wired cable 15 m
C8D 25	M12 straight connector, 8 poles, pre-wired cable 25 m
C8D 40	M12 straight connector, 8 poles, pre-wired cable 40 m
C8D 95	M12 90° angle connector, 8 poles, pre-wired cable 5 m
C8D 910	M12 90° angle connector, 8 poles, pre-wired cable 10 m
C8D 915	M12 90° angle connector, 8 poles, pre-wired cable 15 m
C8DM 9	M12 straight connector, 8 poles with screw terminal, PG9 cable gland
C8DM 99	M12 angle connector, 8 poles with screw terminal, PG9 cable gland
C8DM 11	M12 straight connector, 8 poles with screw terminal, PG9/11 cable gland
C8DM 911	M12 angle connector, 8 poles with screw terminal, PG9/11 cable gland

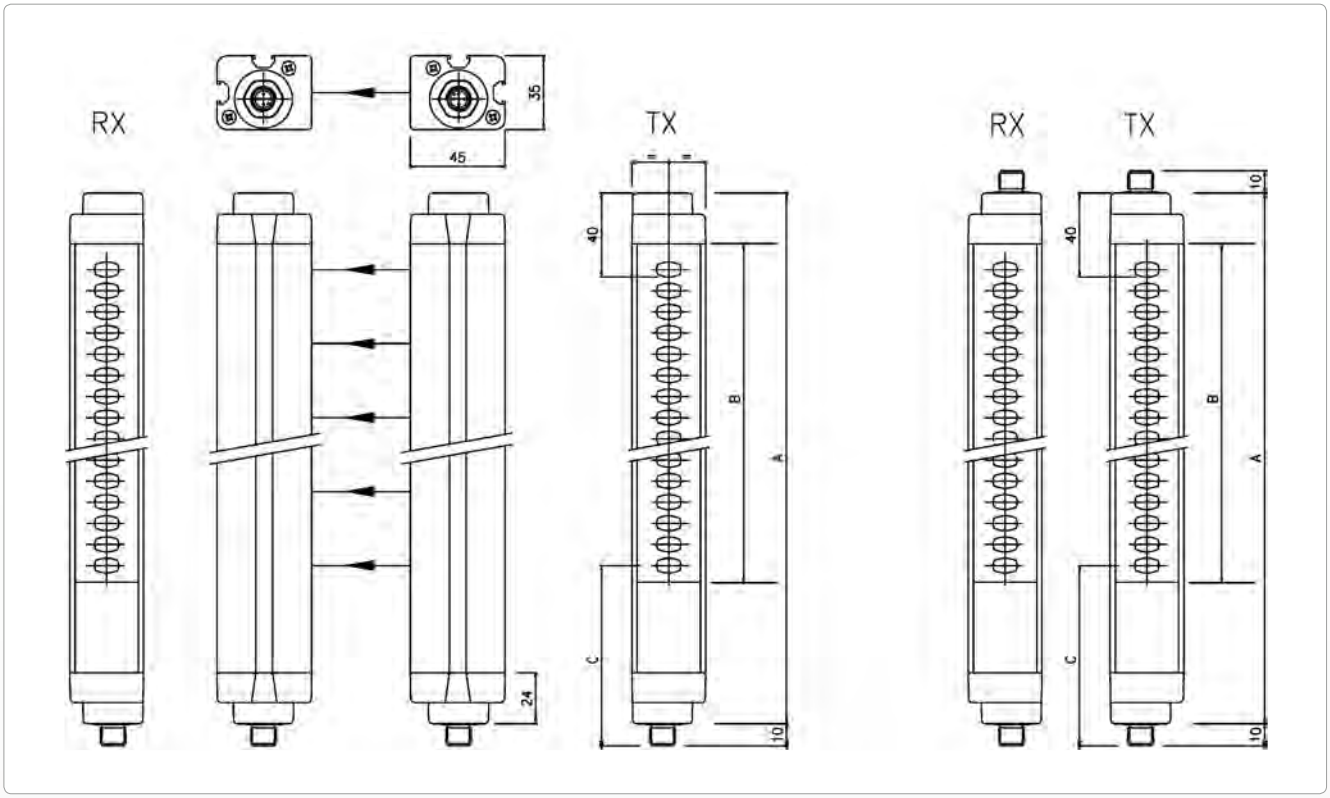
ACCESSORIES

For Vision light curtains the following accessories, to be ordered separately, are available:	
CONNECTORS FOR VISION MXL - RECEIVER	
C12D 3	M16 straight connector, 12 poles, pre-wired cable 3 m
C12D 5	M16 straight connector, 12 poles, pre-wired cable 5 m
C12D 10	M16 straight connector, 12 poles, pre-wired cable 10 m
C12D 15	M16 straight connector, 12 poles, pre-wired cable 15 m
C12D 25	M16 straight connector, 12 poles, pre-wired cable 25 m
CM 16	M16 straight connector, 12 poles, solder terminal connector
CABLES WITH 2 CONNECTORS FOR VISION MXL EMITTERS AND MXJ Box	
CJBE 3	3 m pre-wired cable with 2 straight connectors, M12, 5 poles
CJBE 5	5 m pre-wired cable with 2 straight connectors, M12, 5 poles
CJBE 10	10 m pre-wired cable with 2 straight connectors, M12, 5 poles
CABLES WITH 2 CONNECTORS FOR VISION MXL RECEIVERS AND MXJ Box	
CMBR 3	3 m pre-wired cable with 1 straight connector, M16, 12 poles and 1 straight connector, M23, 19 poles
CMBR 5	5 m pre-wired cable with 1 straight connector, M16, 12 poles and 1 straight connector, M23, 19 poles
CMBR 5 A	5 m pre-wired cable with 1 straight connector, M16, 12 poles and 1 straight connector, M23, 19 poles for automatic Restart
CMBR 10	10 m pre-wired cable with 1 straight connector, M16, 12 poles and 1 straight connector, M23, 19 poles
CONNECTION BETWEEN MASTER AND SLAVE	
CDS 03	0.3 m pre-wired cable with 2 straight connectors, M12, 5 poles
CJBE 3	3 m pre-wired cable with 2 straight connectors, M12, 5 poles
CJBE 5	5 m pre-wired cable with 2 straight connectors, M12, 5 poles
CJBE 10	10 m pre-wired cable with 2 straight connectors, M12, 5 poles
CJBE 25	25 m pre-wired cable with 2 straight connectors, M12 5 poles

VISION

DIMENSIONS (mm)

STANDARD AND SLAVE MODELS **MASTER MODELS**



Model	150	300	450	600	750	900	1050	1200	1350	1500	1650	1800
A	251	401	551	701	851	1001	1151	1301	1451	1601	1751	1901
B (protected area)	160	310	460	610	760	910	1060	1210	1360	1510	1660	1810
C	85											
Mounting	2 LS type brackets with 2 inserts							3 LS type brackets with 3 inserts				

Model	2B	3B	4B
A	701	1001	1101
B	510	810	910
C	135		
Mounting	2 LS type brackets with 2 inserts		

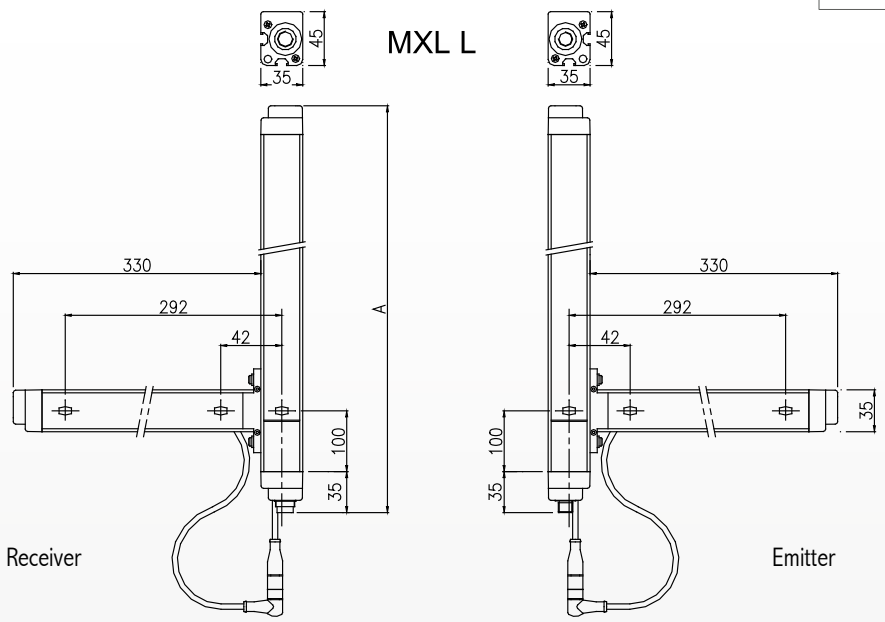
WARNING!

- When the light curtain works in the presence of strong vibrations (presses, weaving machines etc.), in order to avoid damages to the light curtain it is necessary to use the anti-vibration dampers SAV (available as accessories)
- When long range protections or perimeter protections employing mirrors have to be realised it is advisable to use the LAD laser pointer as an alignment aid, as well as the adjustable swivel fastening brackets SFB.

VISION

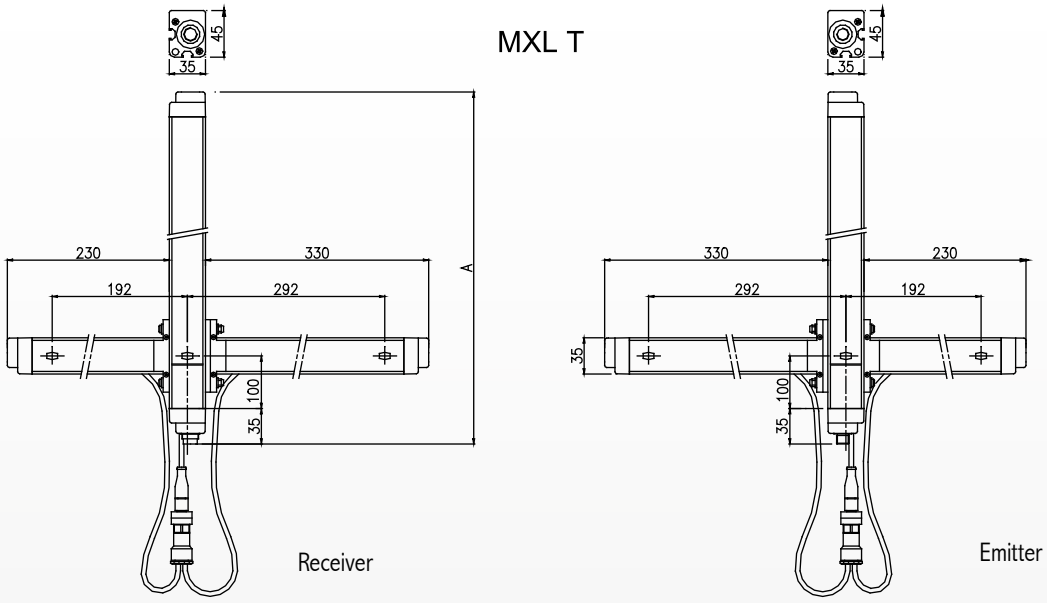
VISION MXL L

DIMENSIONS	2B	3B
A	711	1011



VISION MXL T

DIMENSIONS	2B	3B
A	711	1011



ILION

ULISSE

ILION

MAIN FEATURES

ILION is a Type 2 safety photocell with M18 cylindrical metal body and M12 4-pole connector.
The protection system can be composed of 1, 2, 3 or 4 single beam photocells connected to an AU SX or AU SXM control unit with Muting (for details on the interface see AU SX and AU SXM control units at pages 186 and 187).

The compact size of the photocells makes it possible to fit the protection system into very small spaces, while the possibility to use more photocells provides the maximum flexibility in positioning the protective beams.

PHOTOELECTRIC SENSOR TECHNICAL DATA

Model	IL 10	IL 20
Safety level (with control unit AUS X or AUS XM)	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1	
Minimum detectable object (mm)	12	
Max. range (m)	8	20
Number of photocells per control unit	from 1 to 4	
Response time for each photocell (ms)	7	
Output	2 PNP – 100 mA	
Signalling	status led	
Power supply (VDC)	24 ± 20%	
Electrical connections	M12 - 4 poles for emitter and receiver	
Max. cable length (m)	50 (between sensor and control unit)	
Operating temperature (°C)	0 to 55	
Protection rating	IP 67	
Dimensions (mm)	Ø 18 x 85	

Safety level:

Type 2

SIL 2 – SILCL 2
PL d – Cat. 2

ILION

ORDERING INFORMATION (for ordering codes see page 225)

Each Ilion photocell includes:

- Emitter and Receiver pair
- Multi-language instruction manual complete with CE declaration of conformity

CONNECTORS

The following connectors are available for the Ilion photocells, to be ordered separately:

Connectors for Ilion emitter and receiver

Model	Description
CD 5	M12 straight connector, 5 poles, pre-wired cable 5 m
CD 10	M12 straight connector, 5 poles, pre-wired cable 10 m
CD 15	M12 straight connector, 5 poles, pre-wired cable 15 m
CD 20	M12 straight connector, 5 poles, pre-wired cable 20 m
CD 25	M12 straight connector, 5 poles, pre-wired cable 25 m
CD 50	M12 straight connector, 5 poles, pre-wired cable 50 m
CD 95	M12 90° angle connector, 5 poles, pre-wired cable 5 m
CD 910	M12 90° angle connector, 5 poles, pre-wired cable 10 m
CDM 915	M12 90° angle connector, 5 poles, pre-wired cable 15 m
CDM 9	M12 straight connector, 5 poles with screw terminal, PG9 cable gland

ADJUSTABLE FIXING BRACKET

Model	Description
IL FB	Set of 2 adjustable brackets

The IL FB bracket permits both vertical and horizontal adjustment of the optical axis of the photocell.

ULISSE

MAIN FEATURES

ULISSE is a Type 2 safety photocell with metal body and 3-pole M8 connector.
The protection system can be composed of 1, 2, 3 or 4 single beam photocells connected to an AU SX standard or AU SXM control unit with Muting (for details on the interface see AU SX and AU SXM control units at pages 186 and 187).

Thanks to the very small size, the anodised aluminium case and the glass lenses free from electrostatic dust attraction, ULISSE is the ideal solution for the protection of weaving machines as well as of other applications characterised by high levels of mechanical stress or very restricted spaces.

PHOTOELECTRIC SENSOR TECHNICAL DATA

Model	**UPC**
Safety level (with control unit AUS X or AUS XM)	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1
Minimum detectable object (mm)	8
Max. range (m)	6
Number of photocells per control unit	from 1 to 4
Response time for each photocell (ms)	7
Output	PNP 100 mA
Signalling	status led
Power supply (VDC)	24 ± 20%
Electrical connections	M8 - 3 poles for emitter and receiver
Max. cable length (m)	50 (between sensor and control unit)
Operating temperature (°C)	0 to 55
Protection rating	IP 65
Dimensions - h x w x d (mm)	58 x 15 x 25

Safety level:

Type 2

SIL 2 – SILCL 2
PL d – Cat. 2

ULISSE

ORDERING INFORMATION (for ordering codes see page 225)

Each Ulisse photocell includes:

- Emitter and Receiver pair
- Multi-language instruction manual complete with CE declaration of conformity

CONNECTORS

The following connectors are available for the Ulisse photocells, to be ordered separately:

Connectors for Ulisse emitter and receiver

Model	Description
C 85	M8 straight connector, 3 poles, pre-wired cable 5 m
C 815	M8 straight connector, 3 poles, pre-wired cable 15 m
C 895	M8 90° angle connector, 3 poles, pre-wired cable 5 m

MAGNUS


50/10
TÜV approved
Made in Germany
MAGNUS
MG S M
REER
32 Via Carcano
10153 - Torino - Italy
www.reer.it
MAGNUS
MG S 20
Safety sensor
TÜV approved
Made in Germany
50/10


REER
02/11
MAGNUS
MG B M
TÜV approved
Made in Germany
REER
50/10
MAGNUS
MG B 20
Safety sensor
TÜV approved
Made in Germany


REER
MAGNUS
MG M M
02/11

MG S - RECTANGULAR COMPACT HOUSING

MAIN FEATURES

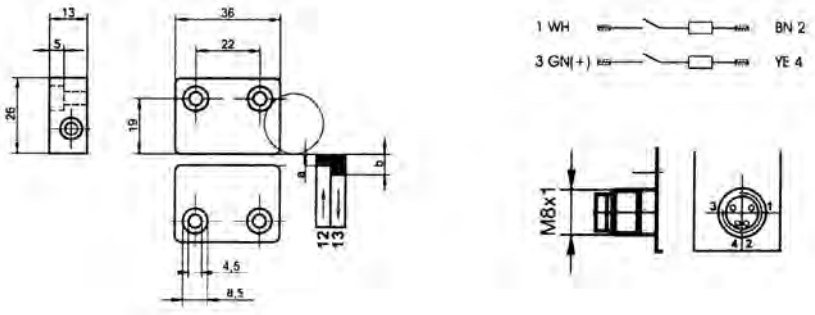
- Compact and robust thermoplastic enclosure (PBT): 22 mm fixing
- IP67 rating
- Operating temperature -25 to +75°C
- Coded magnetic operation – Tamper resistant
- Switching distance: 3 - 10 mm
- Sensor with 4 wires: 2 NO contacts
- M8 4-pole connector

Can be connected to Mosaic safety configurable controller (PL e) or to the dedicated safety control unit MG d1 (PL d).
MG S switches connected to Mosaic safety controller form a certified PL e safety system.

NEW PRODUCT

TECHNICAL FEATURES

Model	MG S 20
Safety Level	PL e together with Mosaic – Up to PL d together with MG d1
Operating voltage (VDC)	24
Switching current (mA)	max. 100
Series resistance (Ohm)	22
Switching power (W)	3
Shock resistance (Hz/g)	10 - 2000/35
Protection rating	IP 67
Temperature range (°C)	-25 to +75
Housing material	PBT
Possible actuation magnets	MG S M



Gaps (operating distance) for safe switching function in mm:	
MIN	0,5
ON	3
OFF	10

MIN = minimum gap

ORDERING INFORMATION (for ordering codes see page 225)

Each MG S safety magnetic switch includes:

- Multi-language operating instructions complete with CE declaration of conformity

MG B - RECTANGULAR HOUSING

MAIN FEATURES

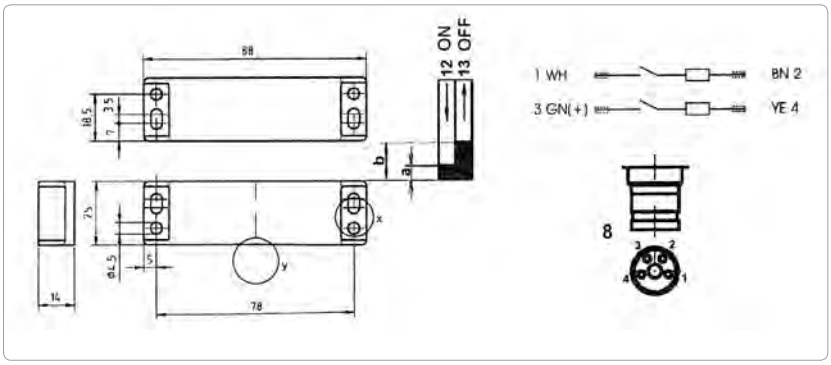
- Robust thermoplastic enclosure: 78 mm fixing
- IP67 rating
- Operating temperature -25 to +75°C
- Coded magnetic operation – Tamper resistant
- Switching distance: 4 - 16 mm; 7 - 18 mm with magnet MG B M+
- Sensor with 4 wires: 2 NO contacts
- M8 4-pole connector

Can be connected to Mosaic safety configurable controller (PL e) or to the dedicated safety control unit MG d1 (PL d).
MG B switches connected to Mosaic safety controller form a certified PL e safety system.

NEW PRODUCT

TECHNICAL FEATURES

Model	MG B 20
Safety Level	PL e together with Mosaic – Up to PL d together with MG d1
Operating voltage (VDC)	24
Switching current (mA)	max. 100
Series resistance (Ohm)	22
Switching power (W)	3
Shock resistance (Hz/g)	10 - 2000/35
Protection rating	IP 67
Temperature range (°C)	-25 to +75
Housing material	PBT
Possible actuation magnets (only use reinforced actuation magnets if a gap of more than 4 mm is unavoidable)	MG B M MG B M+ (reinforced)



Gaps (operating distance) for safe switching function in mm:		
MIN	normal with + magnet	0,5 3
ON	normal with + magnet	4 7
OFF	normal with + magnet	16 18

+ = reinforced MIN = minimum gap

ORDERING INFORMATION (for ordering codes see page 225)

Each MG B safety magnetic switch includes:

• Multi-language operating instructions complete with CE declaration of conformity

MG M - M30 HOUSING

MAIN FEATURES

- Robust cylindrical thermoplastic enclosure: 30mm diameter
- IP67 rating
- Operating temperature -25 to +75°C
- Coded magnetic operation – Tamper resistant
- Switching distance: 4 - 16 mm; 7 - 20 mm with magnet MG M M+
- Sensor with 4 wires: 2 NO contacts
- M8 4-pole connector

Can be connected to Mosaic safety configurable controller (PL e) or to the dedicated safety control unit MG d1 (PL d).
MG M switches connected to Mosaic safety controller form a certified PL e safety system.

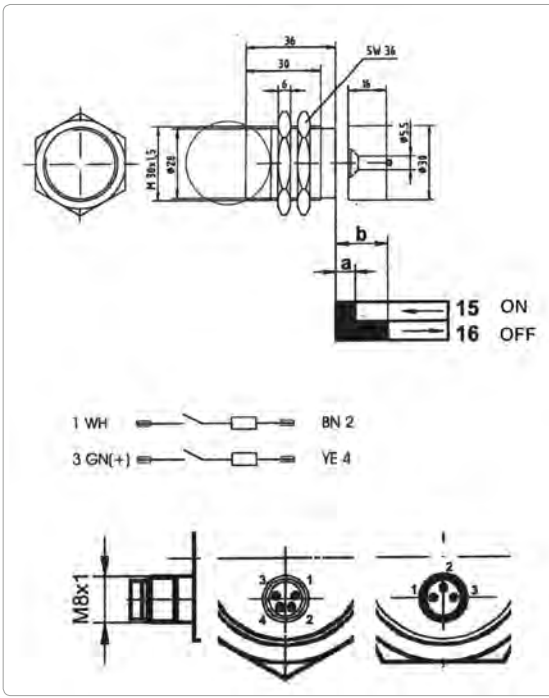
NEW PRODUCT

TECHNICAL FEATURES

Model	MG M 30
Safety Level	PL e together with Mosaic – Up to PL d together with MG d1
Operating voltage (VDC)	24
Switching current (mA)	max. 100
Series resistance (Ohm)	22
Switching power (W)	3
Shock resistance (Hz/g)	10 - 2000/35
Protection rating	IP 67
Temperature range (°C)	-25 to +75
Housing material	PBT
Possible actuation magnets (only use reinforced actuation magnets if a gap of more than 4 mm is unavoidable)	MG M M MG M M+ (reinforced)

Gaps (operating distance) for safe switching function in mm:		
MIN	normal with + magnet	0,5 3
ON	normal with + magnet	4 7
OFF	normal with + magnet	16 20

+ = reinforced MIN = minimum gap



ORDERING INFORMATION (for ordering codes see page 225)

Each MG M safety magnetic switch includes:

- Multi-language operating instructions complete with CE declaration of conformity

MAGNUS

CONNECTORS FOR MAGNUS

The following connectors are available for Magnus magnetic safety switches	
Model	**Description**
C8 G3	M8 straight connector, 4-pole, 3 m cable
C8 G93	M8 angled connector, 4-pole, 3 m cable
C8 G5	M8 straight connector, 4-pole, 5 m cable
C8 G95	M8 angled connector, 4-pole, 5 m cable

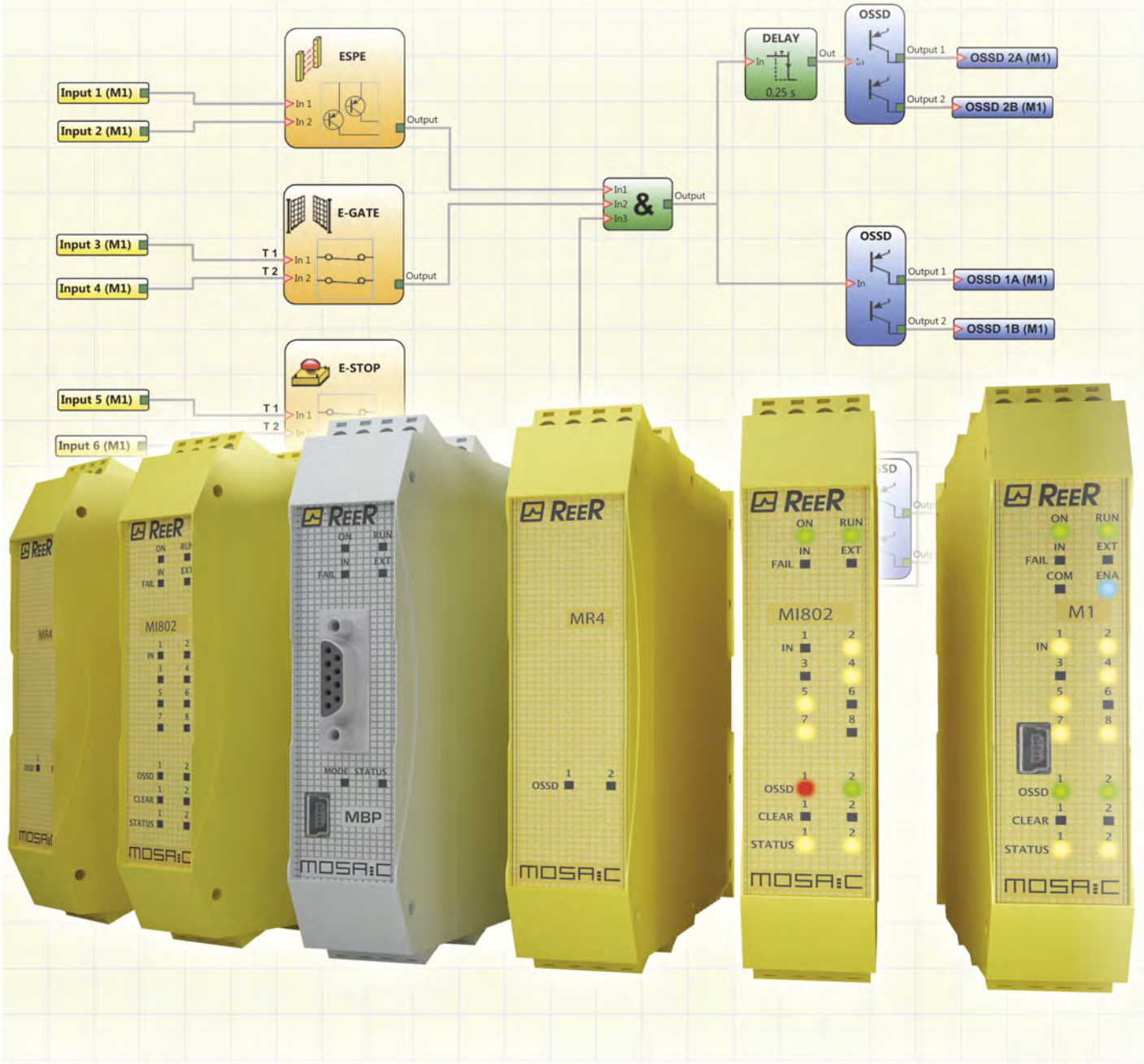
Magnus magnetic switches together with Mosaic comprise a PL e certified system according to ISO 13849-1.

Certified by

Magnus magnetic switches together with the MG d1 control unit comprise a PL d certified system according to ISO 13849-1.

Certified by

MOSAIC


Input 1 (M1)
Input 2 (M1)
ESPE
In 1
In 2
Output
Input 3 (M1)
Input 4 (M1)
E-GATE
T 1
T 2
In 1
In 2
Output
Input 5 (M1)
Input 6 (M1)
E-STOP
T 1
T 2
In1
In2
In3
&
Output
DELAY
In
Out
0,25 s
OSSD
In
Output 1
Output 2
OSSD 2A (M1)
OSSD 2B (M1)
OSSD
In
Output 1
Output 2
OSSD 1A (M1)
OSSD 1B (M1)
REER
MOSAIC
MI802
MR4
MBP
M1
ON
RUN
IN
EXT
FAIL
COM
ENA
OSSD
CLEAR
STATUS
MODE

MOSAIC

INTRODUCTION

Mosaic is a modular, configurable safety controller for protecting machines or plants. Mosaic is capable of monitoring several safety sensors and commands, such as safety light curtains, laser scanners, photocells, mechanical switches, mats, emergency stops, two-hand controls, concentrating management of these in a single, flexible device. Thanks to MCT modules, parts of the Mosaic System can be decentralized in remote cabinets with respect to the master unit M1.

Mosaic offers numerous advantages compared with safety solutions based on traditional components, such as relay type safety modules, as it:

- Reduces the number of components and therefore footprint and wiring
- Promotes faster electrical cabinet construction
- Affords the necessary logical configuration using a single, simple programming software, facilitating modifications by machine designers
- Makes it possible to set up tamper-proof safety systems
- Simplifies machine maintenance through the MCM memory card, which can be used to transfer the configuration program to a new Mosaic in just a few simple steps.

Mosaic is certified to the highest safety levels established by industrial safety standards: SIL 3, SILCL 3, PL e, Cat. 4.

SYSTEM DESCRIPTION

Mosaic comprises a master unit (M1) configurable via the MSD (Mosaic Safety Designer) graphic interface – provided with each Master unit at no extra cost – and a maximum of 14 expansion units connectable to M1 via the MSC proprietary bus.
The **M1 master unit**, which can also be used in stand-alone mode, features 8 safety inputs and 2 separate, programmable dual channel solid state outputs. Available expansion units include: MI8O2 with inputs and outputs, MI8, MI12T8 and MI16 with inputs only, MO2 and MO4 with outputs only, MR2 and MR4 with guided contact safety relays.
Expansion units are also available that permit connection for diagnostics purposes to the most common industrial Fieldbus systems: MBP (Profibus DP), MBC (CANopen), MBD (DeviceNET), MBEI (Ethernet IP), MBEC (EtherCAT), MBEP (PROFINET), MBU (Universal Serial Bus).
The Mosaic system can be equipped with a maximum of 128 inputs and 16 OSSD pairs. The master module and expansion units communicate via the 5-way MSC (Mosaic Safety Communication) bus (ReeR proprietary), physically located on the back of each module.
Through the **MCT** bus-transfer it is possible to remote the I/O expantion units.
The **Mosaic Safety Designer (MSD)** software, installed on a PC, can be used to create complex logical conditions using logical operators and safety functions, such as muting, timer, counters, memories, etc. via an easy, intuitive graphic configuration interface.
Configuration data are transferred to the M1 unit via a USB link. An application held on M1 can be saved on the MCM proprietary memory card (optional) for fast transfer of the configuration data to other M1 modules.

Safety Level: SIL 3 – SILCL 3 – PL e – Cat. 4 – Type 4

Safety level:
SIL 3
SIL 3 – SILCL 3
PL e – Cat. 4

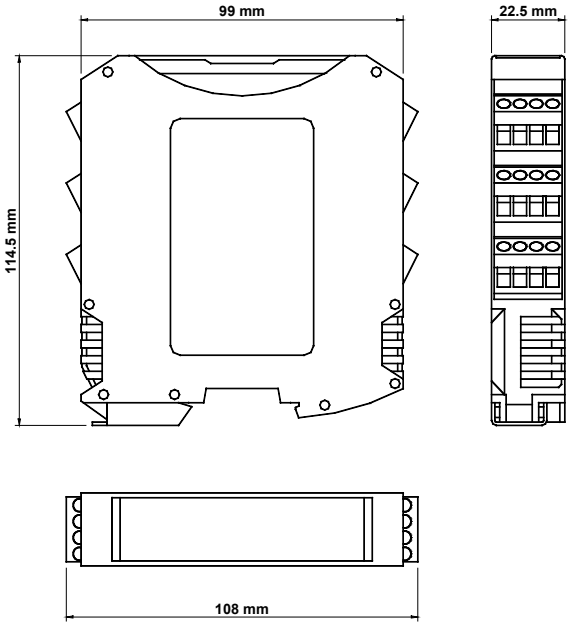
Complies with the following Directives and standards:

- 2006/42/EC "Machinery Directive"
- 2004/108/EC "Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- CEI EN 61131-2: "Programmable Controllers, part 2: Equipment requirements and tests"
- EN ISO 13849-1: "Safety of machinery: Safety-related parts of control systems – Part 1: General principles for design"
- EN ISO 13849-2: "Safety of machinery: Safety-related parts of control systems – Part 2: Validation"
- EN 954-1: "Safety of machinery – Safety-related parts of control systems – General principles for design"
- IEC/EN 61496-1: "Safety of machinery: Electro-Sensitive Protection Equipment, Part 1: General requirements and tests"
- IEC/EN 62061 "Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508-1: "Functional safety of electrical, electronic and programmable electronic safety-related systems – Part 1: General requirements"
- IEC 61508-2: "Functional safety of electrical, electronic and programmable electronic safety-related systems – Part 2: Requirements for electrical, electronic and programmable electronic safety-related systems"
- IEC 61508-3: " Functional safety of electrical, electronic and programmable electronic safety-related systems – Part 3: Software requirements"
- IEC 61784-3: "Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions"
- IEC/TS 62046 Ed. 2 "Safety of machinery - Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada.

MOSAIC

Main system features

- Compact design: single module dimensions 22.5 x 99 x 114.5 mm
- Removable terminal blocks, screw contacts
- Can be used with the main safety sensors and commands
- Easy, intuitive graphic configuration software (MSD - Mosaic Safety Designer) provided with the M1 at no extra cost
- Wide range of software-configurable safety functions and logical operators
- Removable memory card for saving configuration data (MCM - Mosaic Configuration Memory)
- Communication between units on proprietary high-speed bus (MSC - Mosaic Safety Communication)
- Max. 14 expansion units in addition to the M1 Master, excluding relay modules
- Max. 128 inputs and 16 OSSD pairs
- Digital safety inputs, programmable individually or in pairs, with the possibility of monitoring via dedicated output signals
- Possibility of programming filters and delays for each single input
- Possibility of programming output activation and de-activation delays
- Possibility of independent control of pairs of outputs
- Programmable diagnostic output signals
- Simple diagnostics via front led signalling, configuration software, bus expansion modules



Description of Master module M1

- Main unit, also usable as a stand-alone device, able to control any other expansion units
- Configurable from PC via USB interface using MSD software
- 8 digital inputs
- 2 OSSD pairs with 400mA output current
- 4 test outputs for sensor monitoring
- 2 programmable digital signal outputs
- 2 inputs for Start/Restart interlock and external device monitoring (EDM)
- MCM configuration memory card (optional)
- LOG file containing the last 5 configuration modifications in chronological order, with date of modification
- 24 connectors in 22.5 mm
- Possible connection with ReeR MSC rear bus for connection with other expansion units

The Mosaic M1 master is equipped with a USB 2.0 serial bus for the connection to a PC on which the MSD (Mosaic Safety Designer) configuration software is held.

USB CONNECTOR

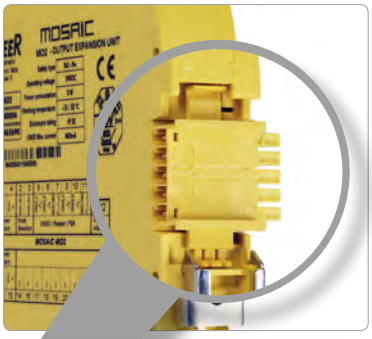
Mosaic Configuration Memory – MCM

Mosaic MCM is a proprietary removable memory card that can be used to save Mosaic configuration data for subsequent transfer to a new device without using a PC.
The configuration in the MCM overwrites any other configuration present on M1, replacing this with that contained in MCM.
This configuration replacement function can be disabled on M1 via the MSD (Mosaic Safety Designer) configuration software.
Overwrite operations are recorded in chronological order in the MOSAIC M1 LOG file.

MOSAIC

Mosaic Safety Communication – MSC

Mosaic MSC permits communication between the various units through a proprietary 5-way high-speed bus.
The MSC modular connectors can be used to connect the various expansion units to M1.
The connectors are physically located on the back of each unit and are housed in the rail guide of the electrical cabinet
The M1 master unit does not include the MSC connector (not necessary if expansion units are not used). To connect the M1 to the first expansion unit, one MSC connector must be ordered.
Each expansion unit is supplied with its own MSC connector



Description of the expansion units

MOSAIC MI8O2

- I/O expansion unit
- 8 digital inputs
- 2 OSSD pairs with 400mA output current
- 4 test outputs for sensor monitoring
- 2 programmable digital signal outputs
- 2 inputs for Start/Restart interlock and external device monitoring (EDM)
- 24 terminal points in 22.5 mm
- Connectable to M1 via MSC proprietary bus

MOSAIC MI8 – MI16

- Input expansion unit:
  - MI8 – 8 digital inputs
  - MI16 – 16 digital inputs
- 4 test outputs for sensor monitoring
- 16/24 terminal points in 22.5 mm
- Connectable to M1 via MSC proprietary bus

MOSAIC MI12T8

- Input expansion unit: 12 digital inputs
- 8 test outputs for sensor monitoring: can control up to four 4-wire safety mats
- 24 terminal points in 22.5 mm
- Connectable to M1 via MSC proprietary bus

MOSAIC MO2 – MO4

- Output expansion units:
  - MO2 - 2 OSSD pairs
  - MO4 - 4 OSSD pairs
- Output current - 400mA
- 2/4 programmable digital signal outputs
- 2/4 inputs for Start/Restart interlock and external device monitoring (EDM)
- 16/24 terminal points in 22.5 mm
- Connectable to M1 via MSC proprietary bus

MOSAIC

MOSAIC MR2 – MR4

- Safety relay modules:
  - MR2 - 2 relays – 2 NO + 1 NC Connectable to 1 OSSD pair
  - MR4 - 4 relays – 4 NO + 2 NC Connectable to 2 independent OSSD pairs
- 2/4 safety relays with 6A 250 VAC guided contacts
- 1/2 NC contacts for external device monitoring (EDM)
- 16/24 terminal points in 22.5 mm

Each NO contact is interrupted twice by 2 safety relays.
Mosaic MR2 and MR4 are passive units that can also be used separately from the Mosaic system.
The MR expansion units do not require MSC as they are wired directly to the selected OSSD.

MOSAIC MB

Expansion unit for the connection to the most common industrial Fieldbus systems for diagnostics and data communication:

- MBP – **Profibus DP**
- MBD – **DeviceNET**
- MBC – **CANopen**
- MBEI – **Ethernet IP**
- MBEC – **EtherCAT**
- MBEP – **PROFINET**
- MBU – **Universal Serial Bus**

The MB units can be connected to M1 via MSC proprietary bus.

MOSAIC MCT NEW PRODUCT

- Mosaic MSC-bus transfer
- Easy connection by terminals
- Up to 100 mt connection lenght (with RS 485 compatible shielded cable)
- 16 terminals in 22.5 mm

MOSAIC

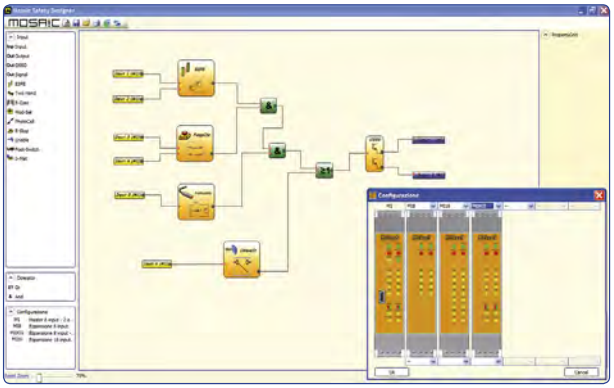
TECHNICAL FEATURES

Module	M1	MI8O2	MI8 - MI16	MI12T8	MO2 - MO4	MR2 - MR4	MCT	MBx
Description	Programmable Master unit	I/O Expansion unit	Input Expansion units	Input Expansion units	Output Expansion units	Guided contact relay output Expansion units	Bus Transfer Expansion units	Expansion units for diagnostics on bus
USB	yes	-	-	-	-	-	-	yes
Housing for MCM	yes	-	-	-	-	-	-	-
Connection with MSC bus	yes	yes	yes	yes	yes	-	yes	yes
MSC connector provided	no	yes	yes	yes	yes	-	yes	yes
Safety Level	SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1					-	-	-
Safety inputs	8	8	8 – 16	12	-	-	-	-
Safety outputs (OSSD)	2 pairs PNP - 400 mA	2 pairs PNP - 400 mA	-	-	2 – 4 pairs PNP 400 mA	-	-	-
Programmable signal outputs	2 PNP - 100 mA	2 PNP - 100 mA	-	-	2 – 4 PNP - 100 mA	-	-	-
Test outputs	4	4	4	8	-	-	-	-
Safety relay outputs	-	-	-	-	-	2 NO + 1 NC 6A 250 VAC 4 NO + 2 NC 6A 250 VAC	-	-
Start/Restart inputs and external device monitoring (EDM)	2	2	-	-	2 – 4	-	-	-
Led signalling	input/output status and fault diagnostics					output status	output status	diagnostics
Power supply (VDC)	24 ± 20%							
Electrical connections	removable terminal blocks, screw contacts							
Operating temperature (°C)	-10 to 55							
Storage temperature (°C)	- 20 to 85							
Protection rating	IP 20 for housing IP 2X for terminal block							
Fastening	rail fastening according to EN 50022-35 standard							
Dimensions h x w x d (mm)	99 x 22,5 x 114							

MOSAIC

Mosaic Safety Designer - MSD

MSD (Mosaic Safety Designer) is the easy-to-use, intuitive MOSAIC configuration software.



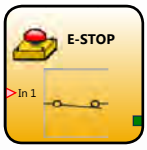
MSD main features:

- "Drag&Drop" configuration of all safety functions
- Functional validation of design included
- 2-level password management for the prevention of unauthorised accesses and therefore of incidental modifications or tampering with system configuration
- Configuration of parameters of function blocks,, for example:
  - single- or double-channel NO or NC inputs
  - test outputs for monitoring of electro-mechanical sensors and photocells and related electrical connections
  - automatic, manual and monitored manual restart
  - concurrency control of two channels
  - contact anti-rebound filters and timers
  - start-up test
- Single or bi-directional 2 or 4 sensor muting function blocks
- Real-time monitoring of I/O status
- Runs on PC. Minimum system requirements:
  - RAM: 256 MB
  - Hard disk: free space > 100Mbyte
  - USB connector: 1.1 or 2.0
  - Windows XP SP3 / Vista / Windows 7
  - Microsoft Framework 3.5 (or Higher)

MAIN FUNCTION BLOCKS

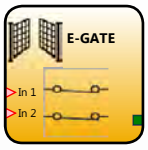
INPUT OBJECTS

E STOP – EMERGENCY STOP



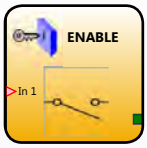
E-STOP checks the status of the inputs connected to an emergency stop device.
Test outputs may be used.
Configurable inputs for contacts: 1 NC or 2 NC.

E-GATE – DEVICE FOR MOVABLE GUARDS



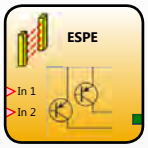
E-GATE checks the status of the inputs connected to a device for movable guards, such as doors and gates.
Test outputs may be used.
Configurable inputs for contacts: 2 NC or 1 NC + 1 NO.

ENABLE – ENABLE KEY



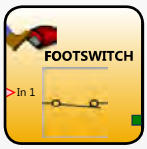
ENABLE checks the status of the inputs connected to a key type manual control device.
Test outputs may be used.
Configurable inputs for contacts: 1 NO or 2 NO.

ESPE - OPTO-ELECTRONIC SAFETY BARRIER OR SAFETY LASER SCANNER



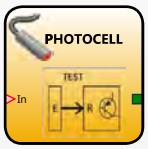
ESPE checks the status of the inputs of a safety light curtain or safety laser scanner with two self-monitored static outputs.

FOOTSWITCH



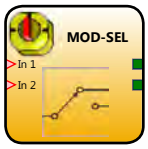
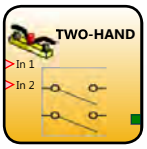
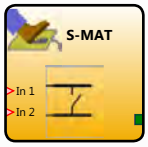
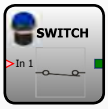
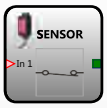
FOOTSWITCH checks the status of the inputs connected to a safety footswitch.
Test outputs may be used.
Configurable inputs for contacts: 1 NC or 1 NO or 2 NC or 1 NO + 1 NC.

SAFETY PHOTOCELL

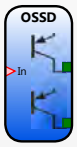


PHOTOCELL checks the status of the inputs connected to one or to a series of two non self-monitored safety photocells.
Test outputs must be used.

MOSAIC

MOD-SEL – SAFETY SELECTOR		TWO-HAND SAFETY CONTROL	
	MOD-SEL checks the status of the inputs connected to a functioning mode selector (up to 4 inputs). Configurable inputs for two, three or four position selectors.		TWO-HAND checks the status of the inputs connected to a two-hand safety control device. Test outputs may be used Configurable inputs for contacts: 2 NC or 2 NO + 2 NC.
S-MAT – SAFETY MAT		**ENABLING GRIP SWITCH**	
	S-MAT checks the status of the inputs connected to a safety mat or safety edge. Test outputs must be used Cannot be used with 2-wire safety mats with terminal resistance.		ENABLING GRIP SWITCH checks the status of the inputs connected to an enabling (aka deadman) switch. Tests output may be used. Configurable inputs for contacts: 2 NO + 1 NC
SWITCH		**SENSOR**	
	SWITCH checks the status of the input connected to a non-safety button or switch A test output may be used.		SENSOR checks the status of the input connected to a non-safety sensor. A test output may be used.

OUTPUT OBJECTS

OSSD (safety outputs)		STATUS (programmable signal output)	
	OSSD is a pair of solid state PNP safety outputs. For each OSSD output, it is possible, via a dedicated input, to obtain manual or automatic reset and EDM control of external relays.		Through the STATUS programmable non safety output, it is possible to monitor any point of the logical scheme of the application.

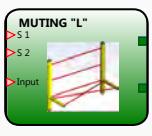
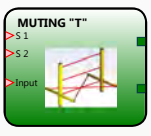
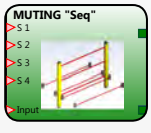
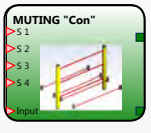
OPERATOR FUNCTION BOX

MUTING OPERATORS

The Muting function permits the automatic, temporary and safe disabling of the ESPE at certain stages in the machine cycle.
There are two main types of applications:

1 - To permit access to the hazardous area by personnel during the non-hazardous part of the machine cycle.
2 - To permit the passage of materials and prevent access by personnel. For example: palletiser applications.

The following parameters for the various Muting functions can be configured via the MSD:
- Sensors time: regulation of concurrency control of sensor activation.
- Timeout: the time, in seconds, within which the Muting cycle must be completed.
- Muting Enable: permits enabling of the Muting function only when necessary (for example, only when the conveyor is moving).
- Direction: in the case of bi-directional Muting, a compulsory direction of transit can be set.
- End Muting: in the case of 4-sensor Muting, it is possible to select whether Muting must end when the ESPE or the sensors are cleared.
- Blind Time: if muting is terminated by the ESPE, a muting closing delay can be activated. For example, in case of objects that protrude from the pallet.
- End of Muting time: in the case of "L" logic muting, this parameter can be used to set an end of muting time limit after the first sensor is cleared.
- Override function with 2 operating modes: a) manual action with hold to run; b) automatic with pulse command. In both cases the timeout can be parameterized.

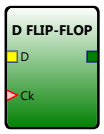
"L" logic 2-sensor muting for one-way transit, output only		"T" logic 2-sensor muting for bi-directional transit	
	"L" logic MUTING permits muting via 2 external sensors (S1 and S2). Muting is activated if the two sensors are interrupted at the same time. Clearing of the ESPE determines end of muting.		"T" logic MUTING permits muting via 2 external sensors (S1 and S2). Muting is activated if the two sensors are interrupted at the same time.
"T" logic 4-sensor "sequential" muting for bi-directional transit		**"T" logic 4-sensor "concurrent" muting for bi-directional transit**	
	"Sequential" logic MUTING permits muting via 4 external sensors (S1, S2, S3 and S4). The logical sequence of occupation of the sensors is checked.		"Concurrent" logic MUTING permits muting via 2 pairs of external sensors (S1, S2 and S3, S4). Concurrent occupation of the sensors of the single pairs is checked.

MOSAIC

MEMORY OPERATORS

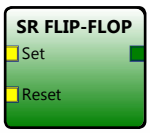
MEMORY type operators allow the user to memorise signals coming from the objects forming the application. The MEMORY operators are:

D FLIP FLOP



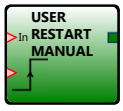
D FLIP FLOP permits memorisation on the Q output of the status present at D input on the rising edge of the Ck input.

SR FLIP FLOP



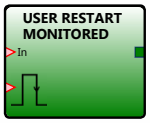
SR FLIP FLOP permits memorisation on the Q output of the status set via Set and Reset.

MANUAL USER RESTART



MANUAL USER RESTART makes it possible to memorise the Restart signal on a rising edge of the Res input.

MONITORED USER RESTART



MONITORED USER RESTART makes it possible to memorise the Restart signal on a rising edge followed by a falling edge of the Res input.

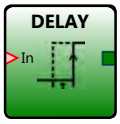
TIMER OPERATORS

TIMER type operators permit generation of a signal for the set time.

CLOCKING

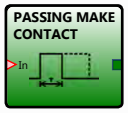
CLOCKING outputs a signal with the set period if the input is high (1).

DELAY



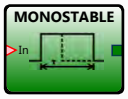
DELAY makes it possible to apply a delay to a signal, switching the output after the set time if the signal on the input changes status.

PASSING MAKE CONTACT



PASSING MAKE CONTACT provides an output that replicates the signal present on the input. When the input signal remains high (1) for longer than the set time, the output goes low (0).

MONOSTABLE

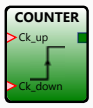


MONOSTABLE outputs a signal starting from the rising edge on the input, lasting for the set time.

COUNTER OPERATOR

The COUNTER type operator permits generation of a signal on reaching the set number.

COUNTER



The output will be high (1) if all the inputs are high (1).

FUNCTIONS

SINGLE-BREAK/DOUBLE-BREAK function allows the cyclical operation to be performed through an interruption of the controlled field.

SINGLE-BREAK / DOUBLE-BREAK

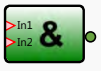
SINGLE BREAK: the machine cycle restarts when the protected field has been interrupted and released once.
DOUBLE BREAK: the machine cycle restarts when the protected field has been interrupted and released twice.

LOGICAL OPERATORS

AND

The output will be high (1) if all the inputs are high (1).

NAND

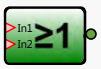


The output will be low (0) if all the inputs are high (1).

OR

The output will be high (1) if at least one of the inputs is high (1)

NOR

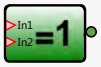


The output will be low (0) if at least one of the inputs is high (1).

XOR

The output will be low (0) if all the inputs are in the same logical status.

XNOR

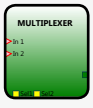


The output will be high (1) if all the inputs are in the same logical status.

NOT

NOT inverts the logical status of the input.

MULTIPLEXER



MULTIPLEXER permits the transfer to the output of one of the input signals according to the corresponding active selection input.

MOSAIC

Application Example 1

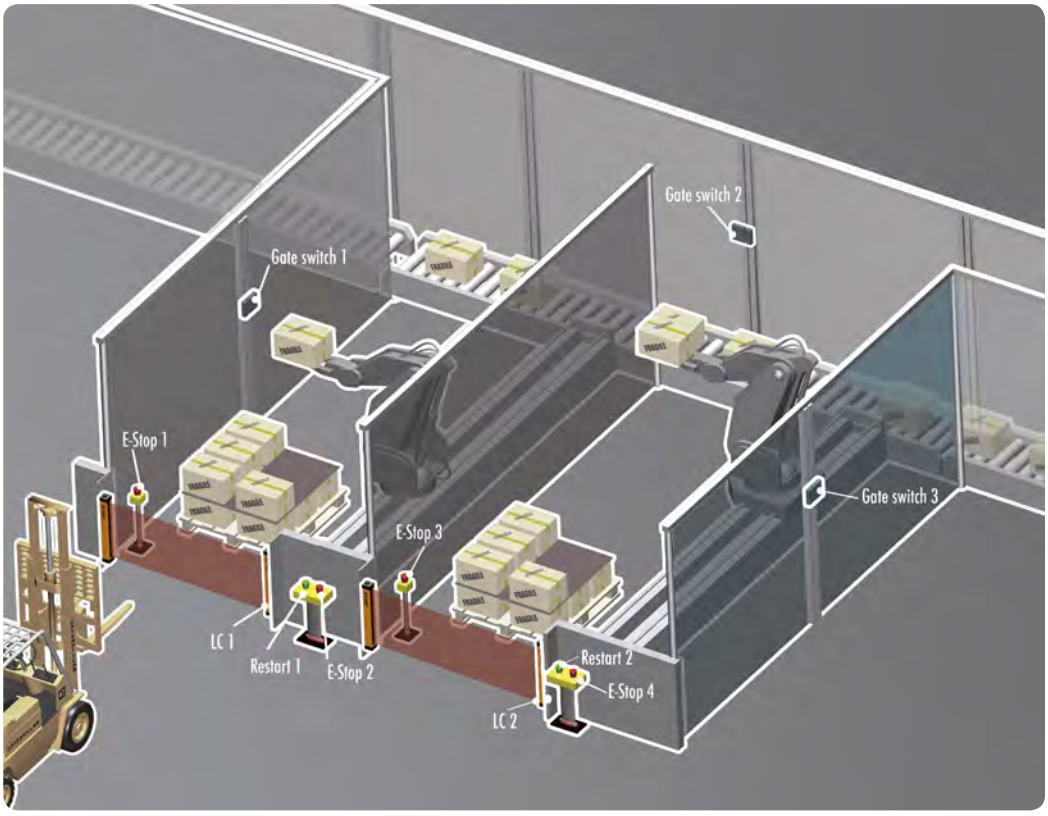
SAFETY MANAGEMENT OF A PALLETISING SYSTEM WITH TWO ROBOTIC CELLS

The system comprises a conveyor that transports boxes to two robotic palletisation cells.

The machine is completely protected by a fence with three access gates (one for each robotic cell and one for the conveyor area) equipped with a safety switch. When the gate of the robotic cell is opened, the corresponding robot stops. When the conveyor area gate is opened the entire plant stops.

The completed pallets are collected by a forklift truck through the access gate which is protected by a safety light curtain. The related manual restart control is located close to each light curtain.
Occupation of each light curtain causes the related robot to stop.
Passing through a safety light curtain without stopping the working process is only permitted when the corresponding robot is stopped.

The system is equipped with four emergency push buttons.



Total safety devices:
- 2 safety light curtains
- 2 restart buttons for the safety light curtains
- 3 safety gate switches
- 4 emergency push buttons

Using conventional components – safety relay modules – to build up the safety circuit, it would be necessary to use at least six safety modules, wired to each other in order to perform the required functions:
- 2 safety relays for the light curtains
- 3 safety relays for the gate switches
- 1 safety relay for the emergency stop

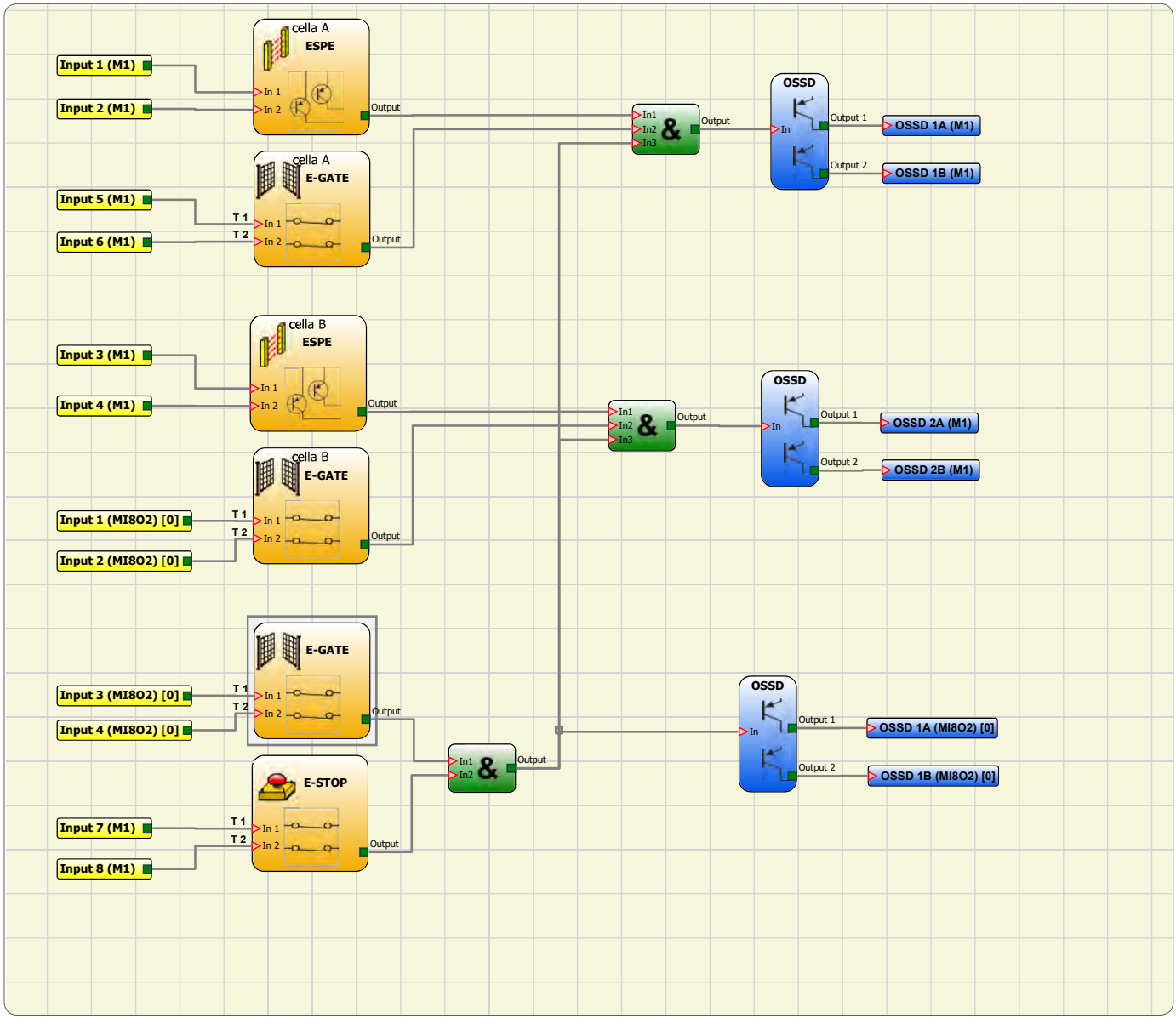
MOSAIC

SOLUTION WITH MOSAIC

Using Mosaic to build up the safety circuit, it is sufficient to use:

- 1 main unit M1
- 1 expansion unit MI8O2

which provide a total of: 16 inputs, 4 OSSD pairs, 8 test outputs, 4 signal outputs.



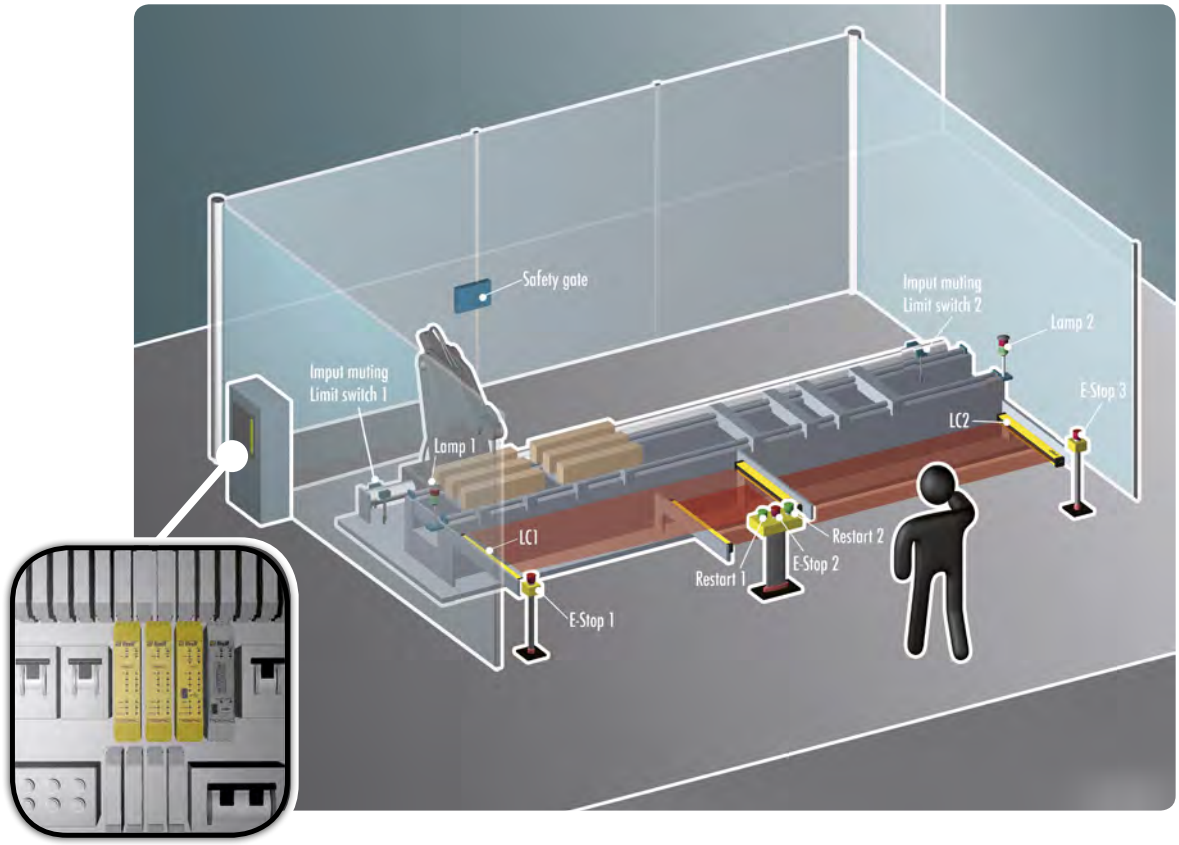
MOSAIC

Application Example 2

SAFETY MANAGEMENT OF A MACHINING CENTRE WITH ALTERNATE LOAD / UNLOAD

The operator is required to load and unload the workpiece.

The machine is protected by two horizontal safety light curtains. In this case, each light curtain must be equipped with the muting function so as to permit access to the hazardous area by personnel during the non-hazardous part of the machine cycle..
Depending on the position of the tool, which is the hazardous element, one of the two light curtains (the one facing the tool working area) is active, while the other is muted so that the operator can load/unload the workpiece. The Muting condition of the two safety light curtains will then be inverted when the tool is required to operate on the opposite side of the machine.
The machine is completely protected by a fence with an access gate equipped with a safety switch. When the gate is opened, the machine stops.
The related manual restart control is located close to each safety light curtain.
The system is equipped with three emergency push buttons which, if activated, stop the machine.



Total safety components:
- 2 safety light curtains
- 2 restart buttons for the safety light curtains
- 1 safety gate switch
- 3 emergency push buttons

Using conventional components – safety relay modules – to build up the safety circuit, four safety modules would be necessary:
- 2 safety modules for the safety light curtains with muting function
- 1 safety module for the gate switch
- 1 safety module for the emergency stop

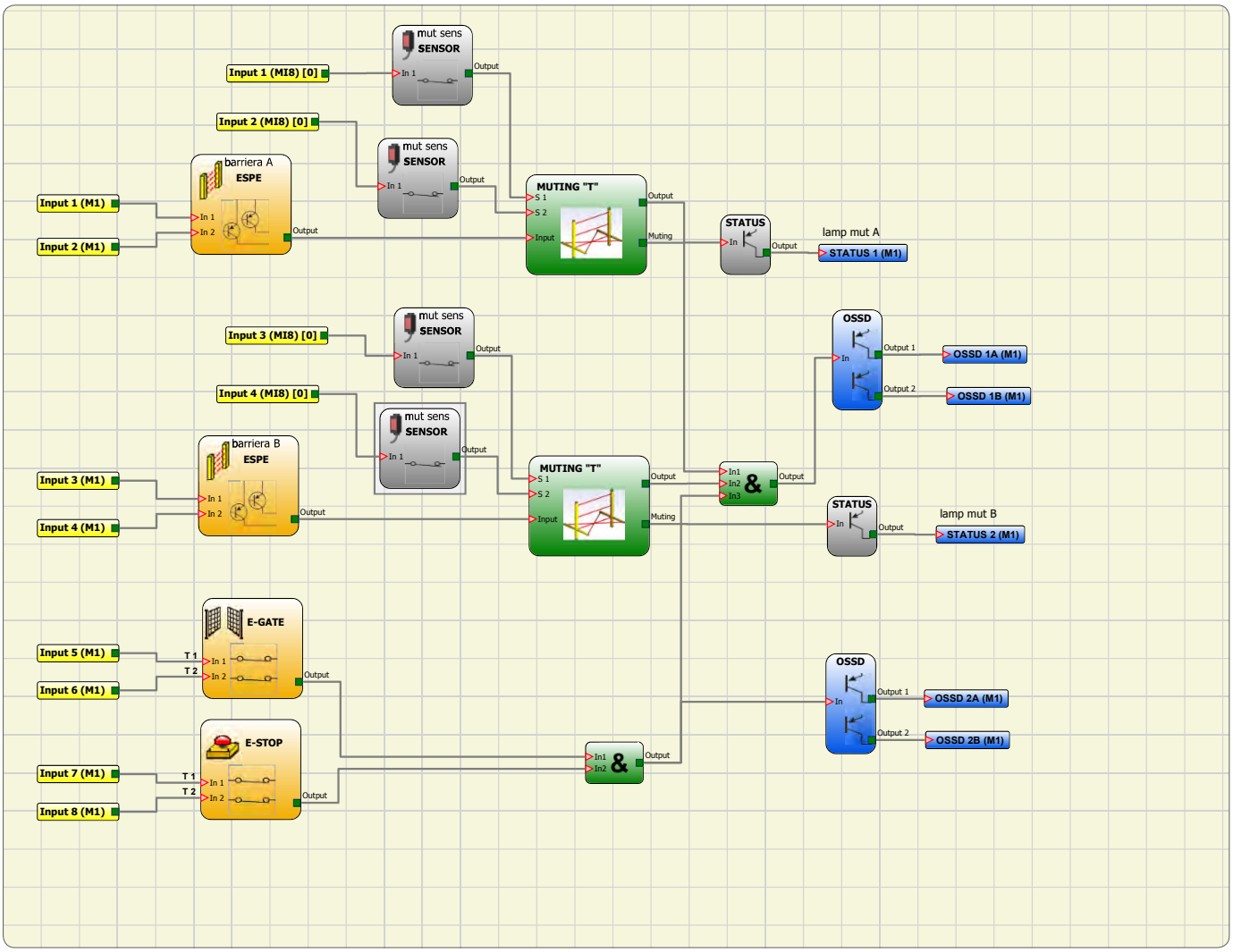
MOSAIC

SOLUTION WITH MOSAIC

Using Mosaic to build up the safety circuit, it is sufficient to use:

- 1 main unit M1
- 1 expansion unit MI8

which provide a total of: 16 inputs, 2 OSSD pairs, 8 test outputs, 2 signal outputs.



Comments:

Using MOSAIC, all the safety logic circuitry is implemented using the graphic interface and not by hard-wiring the outputs of the relay modules to each other. Correct functioning of the logic circuitry is checked during the design phase by the VALIDATION function and can be tested with the MONITOR function during installation. During the design phase, safety functions can be easily added or removed, for example adding other sensors or zones.
Start up tests can be inserted in order to detect any attempt of by-passing the safety system, which is always a possibility with traditional relay modules..
The two-level password provides protection against unauthorised modification of system configuration.

Conclusions:

The two examples have been intentionally simplified. In reality, it is often necessary to implement a great number of functions such as delays, filters or more complex safety logics that combine signals from several sources. This would entail the use of numerous relay modules, thereby further complicating implementation of the logic circuitry, wiring and final cost. MOSAIC provides designers with all the logical safety functions and these can be immediately combined using only the MSD graphic interface.

MOSAIC

ORDERING INFORMATION (for ordering codes see page 226)

Each M1 unit is supplied with:

- A CD Rom containing the MSD configuration software, multi-language instruction manual and CE declaration of conformity

The M1 master unit does not include the MSC connector (not necessary if expansion units are not used). To connect the M1 to the first expansion unit, one MSC connector must be ordered.

Each expansion unit is supplied with its own MSC connector.

The MR2 and MR4 safety relay modules are only connected to the other units via hard-wiring and do not therefore require the MSC connector.

SAFETY INTERFACES AND RELAYS

AD SR1

MAIN FEATURES

Interface module between the safety light curtains EOS4 A, EOS2 A, Admiral AD, Admiral AX BK, Vision V and the machine control circuits.

With guided-contact safety relays, 2 NO contacts and PNP output for relay status signaling.

- Start/Restart interlock
- EDM Feedback input for extra external contactors monitoring

TECHNICAL FEATURES

Model	AD SR1
Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Two-channel inputs for safety light curtains	1
Safety relay outputs	2 NO - 2 A 250 VAC
Response time (ms)	≤ 20
Start/Restart*	manual or automatic Start/Restart selectable on terminal block
External Device Monitoring	external relay control feedback input, selectable
Signalling	LED indication of input/output status and diagnosis
Power supply (VDC)	24 ± 20%
Electrical connections	on terminal blocks
Operating temperature (°C)	0 to 55
Protection rating	IP 20 for housing IP 2X for terminal blocks
Fastening	rail fastening according to EN 50022-35 standard
Dimensions - h x w x d (mm)	99 x 22,5 x 114

ORDERING INFORMATION (for ordering codes see page 226)

Each AD SR1 safety interface includes:

- Multi-language instruction manual complete with CE declaration of conformity

Safety level: Type 4 – SIL 3 – SILCL 3 – PL e – Cat. 4

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- IEC/EN 61496-1 Ed. 2.1 and IEC/TS 61496-2 Ed. 2 " Safety of machinery - Electro-sensitive protective equipment- General requirements and tests"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems"
- IEC/TS 62046 Ed. 2 "Safety of machinery – Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada.

* Safe Start/Restart command according to IEC 61496-1

AD SRM

MAIN FEATURES

Interface module between the safety light curtains EOS4, EOS2, Admiral, Vision, the safety laser PHARO and the machine control circuits, with 2-sensor logic integrated Muting.

With guided contact safety relays, 2 NO contacts and PNP output for relay status signaling.

- Start/Restart interlock
- EDM Feedback input for extra external contactors monitoring
- Muting Timeout selectable, 30 sec, 90 min or infinite
- Integrated Override with selectable 2-mode operation
- Muting Enable input.

TECHNICAL FEATURES

Model	AD SRM
Safety level	Type 4 according to IEC/TS 61496-2 SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 PL e – Cat. 4 according to ISO 13849-1
Two-channel inputs for safety light curtains	1
Inputs for Muting sensors	2 - 24 VDC – PNP or relay – dark-on
Muting Enable input	24 VDC – PNP or relay
Safety relay outputs	2 NO - 2A 250 VAC
Safety system status indicator output	PNP – 100 mA at 24 VDC
Muting lamp output	24 VDC; 0.5-5 W
Response time (ms)	≤ 20
Start/Restart*	manual or automatic Start/Restart selectable on terminal block
External Device Monitoring	external relay control feedback input, selectable
Signalling	LED indications of input/output status, Muting sensor inputs, diagnosis
Muting timeout	30 sec. or infinite, selectable
Override	2 operating modes selectable : - manual action with hold to run - automatic with pulse command
Override timeout min	15.
Power supply (VDC)	24 ± 20%
Electrical connections	On terminal block
Operating temperature (°C)	0 to 55
Protection rating	IP 20 for housing - IP 2X for terminal block
Fastening	rail fastening according to EN 50022-35 standard
Dimensions - h x w x d (mm)	99 x 35 x 114

ORDERING INFORMATION (for ordering codes see page 226)

Each AD SRM safety interface includes:
▪ Multi-language instruction manual complete with CE declaration of conformity

Safety level:

Type **4**

SIL 3 – SILCL 3
PL e – Cat. 4

* Safe Start/Restart command according to IEC 61496-1

AD SRT

MAIN FEATURES

Safety relays for two-hand control.

With 2 NO + 1 NC guided-contact safety relays.

EDM Feedback input for external contactors monitoring.

The AD SRT can be used up to Cat. 4, PL e.

It is certified as Type III C according to the EN 574 standard and monitors the simultaneity between the two inputs (< 0.5 sec).

TECHNICAL FEATURES

Model	AD SRT
Safety level	PL e, Cat. 4 according to ISO 13849-1
Safety relay outputs	3 NO + 1 NC – 5 A 240 VAC
Min switching current at 24 VDC (mA)	6
Response time (ms)	≤ 30
External Device Monitoring	yes
Signalling	LED indicators for status and supply diagnostic: power, channel 1 and channel 2
Power supply (VDC)	24 (-15 +10%)
Simultaneity (s)	< 0.5 for EN 574 Type III C
Electrical connection	on terminal block
Operating temperature (°C)	- 25 to 55
Protection rating	IP 40 for housing - IP 2X for terminal block
Fastening	rail fastening according to EN 50022-35 standard
Dimensions h x w x d (mm)	99 x 22,5 x 114

ORDERING INFORMATION (for ordering codes see page 226)

Each AD SRT safety realy includes:

- Multi-language instruction manual complete with CE declaration of conformity

Safety level: Cat. 4

PL e – Cat. 4
Type III C (EN 574)

Safety level: PL e – Cat. 4 – Type III (EN 574)

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- UL (C+US) mark for USA and Canada.

AD SRE4 – AD SRE4C

MAIN FEATURES

Safety relays for monitoring emergency stop buttons, safety switches.

With 3 NO + 1 NC guided-contact safety relays.

- The Start/Restart can be either Automatic/Manual with the AD SRE4 or Manual Monitored with the AD SRE4C.
- EDM Feedback input for external contactors monitoring.

Both models can be used up to safety category 4, PL e according to EN ISO 13849-1

TECHNICAL FEATURES

Model	AD SRE 4	AD SRE 4C
Safety level	up to PL e, Cat. 4 according to EN ISO 13849-1	
Safety relay outputs	3 NO + 1 NC – 5 A 240 VAC	
Min switching current at 24 VDC (mA)	6	
Response time (ms)	≤ 50	
Start/Restart	Automatic/Manual	Manual - Monitored
External Device Monitoring	Yes	
Signalling	LED indicators for status and supply diagnostic: power, channel 1 and channel 2	
Power supply (VDC)	24 (±10%)	
Electrical connection	on terminal block	
Operating temperature (°C)	- 25 to 55	
Protection rating	IP 40 for housing - IP 2X for terminal block	
Fastening	rail fastening according to EN 50022-35 standard	
Dimensions h x w x d (mm)	99 x 22,5 x 114	

ORDERING INFORMATION (for ordering codes see page 226)

Each AD SRE4 and AD SRE4C safety interface includes:

- Multi-language instruction manual complete with CE declaration of conformity

Safety level: Cat. 4

PL e – Cat. 4

Safety level: PL e – Cat. 4

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- UL (C+US) mark for USA and Canada.

AD SRE3 – AD SRE3C

MAIN FEATURES

Safety relays for monitoring emergency stop buttons, safety switches.

With 2 NO + 1 NC guided-contact safety relays.

- The Start/Restart can be either Automatic/Manual with the AD SRE3 or Manual Monitored with the AD SRE3C.
- EDM Feedback input for external contactors monitoring.

Both models can be used up to safety category 3, PL d according to EN ISO 13849-1.

TECHNICAL FEATURES

Model	AD SRE 3	AD SRE 3C
Safety level	up to PL d, Cat. 3 according to EN ISO 13849-1	
Safety relay outputs	2 NO – 6 A 240 VAC	
Min switching current at 24 VDC (mA)	6	
Response time (ms)	≤ 50	
Start/Restart	Automatic/Manual	Manual - Monitored
External Device Monitoring	yes	
Signalling	LED indicators for status and supply diagnostic: power, channel 1 and channel 2	
Power supply (VDC)	24 (-15 +10%)	
Electrical connection	on terminal block	
Operating temperature (°C)	- 25 to 55	
Protection rating	IP 40 for housing - IP 2X for terminal block	
Fastening	rail fastening according to EN 50022-35 standard	
Dimensions h x w x d (mm)	99 x 22,5 x 114	

ORDERING INFORMATION (for ordering codes see page 226)

Each AD SRE3 and AD SRE3C module includes:

- Multi-language instruction manual complete with CE declaration of conformity

Safety level:

Cat. 3

PL d - Cat. 3

Safety level: PL d - Cat. 3

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- UL (C+US) mark for USA and Canada.

MG d1

MAIN FEATURES

MG d1 is a safety control unit for monitoring up to 8 Magnus safety switches in series (see page 159).

It features a two positively mechanically linked contacts and EDM (External Device Monitoring).

TECHNICAL FEATURES

Model	MG d1
Safety level	up to PL d – SILCL 2
Safety relay outputs	2 NO – 3 A – 250 VAC
Response time (ms)	< 20
Start/Restart	automatic/manual
External Device Monitoring	yes
Signalling	LED indicators for status and diagnostic
Power supply (VDC)	24 (±10%)
Electrical connection	on terminal block
Operating temperature (°C)	0 to 55
Protection rating	IP 40 for housing - IP 2X for terminal block
Fastening	rail fastening according to EN 50022-35 standard
Dimensions h x w x d (mm)	75 x 25 x 94

ORDERING INFORMATION (for ordering codes see page 226)

Each MG d1 module includes:
• Multi-language instruction manual complete with CE declaration of conformity

Safety level:

PL d

PL d – SILCL 2 – Cat. 3

Safety level: PL d - SILCL 2 - Cat. 3

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems".

AU SX

MAIN FEATURES

Control unit for safety photocells ILION and ULISSE, which can be combined to form a Type 2 safety system.
Up to 4 photocells may be connected.
With guided-contact safety relays, 2 NO contacts and PNP output for status signaling.
Start/Restart interlock.
EDM Feedback input for external contactors monitoring.

Self test every 5 seconds.

TECHNICAL FEATURES

Model	AU SX
Safety level	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1
Number of photocells	1 – 4
Safety relay outputs	2 NO - 2 A 250 VAC
Safety system status indicator output	PNP – 100 mA at 24 VDC
Response time (ms)	≤ 30
Start/Restart*	manual or automatic Start/Restart selectable on terminal block
External Device Monitoring	external relay control feedback input, selectable
Signalling	LED indication of input/output status and diagnosis
Power supply (VDC)	24 ± 20%
Electrical connections	on terminal block
Operating temperature (°C)	0 to 55
Protection rating	IP 20 for housing - IP 2X for terminal block
Fastening	rail fastening according to EN 50022-35 standard
Dimensions - h x w x d (mm)	99 x 22,5 x 114

ORDERING INFORMATION (for ordering codes see page 226)

Each AU SX module includes:

• Multi-language instruction manual complete with CE declaration of conformity

Safety level: Type 2 – SIL 2 - SILCL 2 - PL d - Cat. 2
(with ILION or ULISSE photocells)

- 2006/42/EC "Machinery Directive"
- 2004/108/EC " Electromagnetic Compatibility (EMC)"
- 2006/95/EC "Low Voltage Directive (LVD)"
- IEC/EN 61496-1 Ed. 2.1 and IEC/TS 61496-2 Ed. 2 " Safety of machinery - Electro-sensitive protective equipment- General requirements and tests"
- EN ISO 13849-1 "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"
- IEC/EN 62061 "Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems"
- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems"
- IEC/TS 62046 Ed. 2 "Safety of machinery – Application of protective equipment to detect the presence of persons"
- UL (C+US) mark for USA and Canada.

* Safe Start/Restart command according to IEC 61496-1

AU SXM

MAIN FEATURES

In addition to specifications of model AU SX, this unit is equipped with integrated Muting functions:

- 2-sensor Muting logics
- Muting Timeout selectable, 30 sec, 90 min or infinite
- Integrated Override with selectable 2-mode operation
- Muting Enable input.

Only the combined use of ILION or ULISSE photocells with AU SX or AU SXM control units provides the specified safety level.

Self test every 5 seconds.

TECHNICAL FEATURES

Model	AU SXM
Safety level	Type 2 according to IEC/TS 61496-2 SIL 2 – SILCL 2 according to IEC 61508 - IEC 62061 PL d – Cat. 2 according to ISO 13849-1
Number of photocells	1 – 4
Inputs for Muting sensors	2 - 24 VDC – PNP or relay – dark-on
Muting Enable input	24 VDC – PNP or relay
Safety relay outputs	2 NO - 2A 250 VAC
Safety system status indicator output	PNP – 100 mA at 24 VDC
Muting lamp output	24 VDC; 0,5 - 5 W
Muting timeout	30 sec. or infinite, selectable
Override	2 operating modes selectable : - manual action with hold to run - automatic with pulse command
Override timeout (min)	15
Response time (ms)	≤ 30
Start/Restart*	manual or automatic Start/Restart selectable on terminal block
External Device Monitoring	external relay control feedback input, selectable
Signalling	LED indications of input/output status, Muting sensor inputs, diagnosis
Power supply (VDC)	24 ± 20%
Electrical connections	on terminal blocks
Operating temperature (°C)	0 to 55
Protection rating	IP 20 for housing - IP 2X for terminal blocks
Fastening	rail fastening according to EN 50022-35 standard
Dimensions - h x w x d (mm)	99 x 35 x 114

ORDERING INFORMATION (for ordering codes see page 226)

Each AU SXM module includes:
• Multi-language instruction manual complete with CE declaration of conformity

Safety level:

Type 2

SIL 2 – SILCL 2
PL d – Cat. 2

* Safe Start/Restart command according to IEC 61496-1

AD SR0 – AD SR0A

MAIN FEATURES

Interface relay modules for safety light curtains with feedback input for EDM, such as EOS4 X, Admiral AX, EOS2 X, Vision VX/VXL/MXL and Janus.

With guided-contact safety relays, 2 NO + 1 NC (AD SR0) or 2 NO contacts (AD SR0A).

Additional NC contact line for the monitoring by light curtain (EDM).

TECHNICAL FEATURES

Model	AD SR0	AD SR0A
Safety relay outputs	2 NO + 1 NC- 2 A 250 VAC *	2 NO - 2 A 250 VAC
Two-channel inputs for safety light curtains	1	
Response time (ms)	≤ 20	
Power supply (VDC)	24 ± 20%	
Electrical connections	on terminal block	
Operating temperature (°C)	0 to 55	
Protection rating	IP 20 for housing - IP 2X for terminal block	
Fastening	rail fastening according to EN 50022-35 standard	
Dimensions - h x w x d (mm)	101 x 35 x 120	

* In AD SR0 safety relay each NO safety output line is interrupted twice by the two relays

ORDERING INFORMATION (for ordering codes see page 226

Each AD SR0 / AD SR0A Safety interface includes:

- Multi-language instruction manual complete with CE declaration of conformity

WARNING!

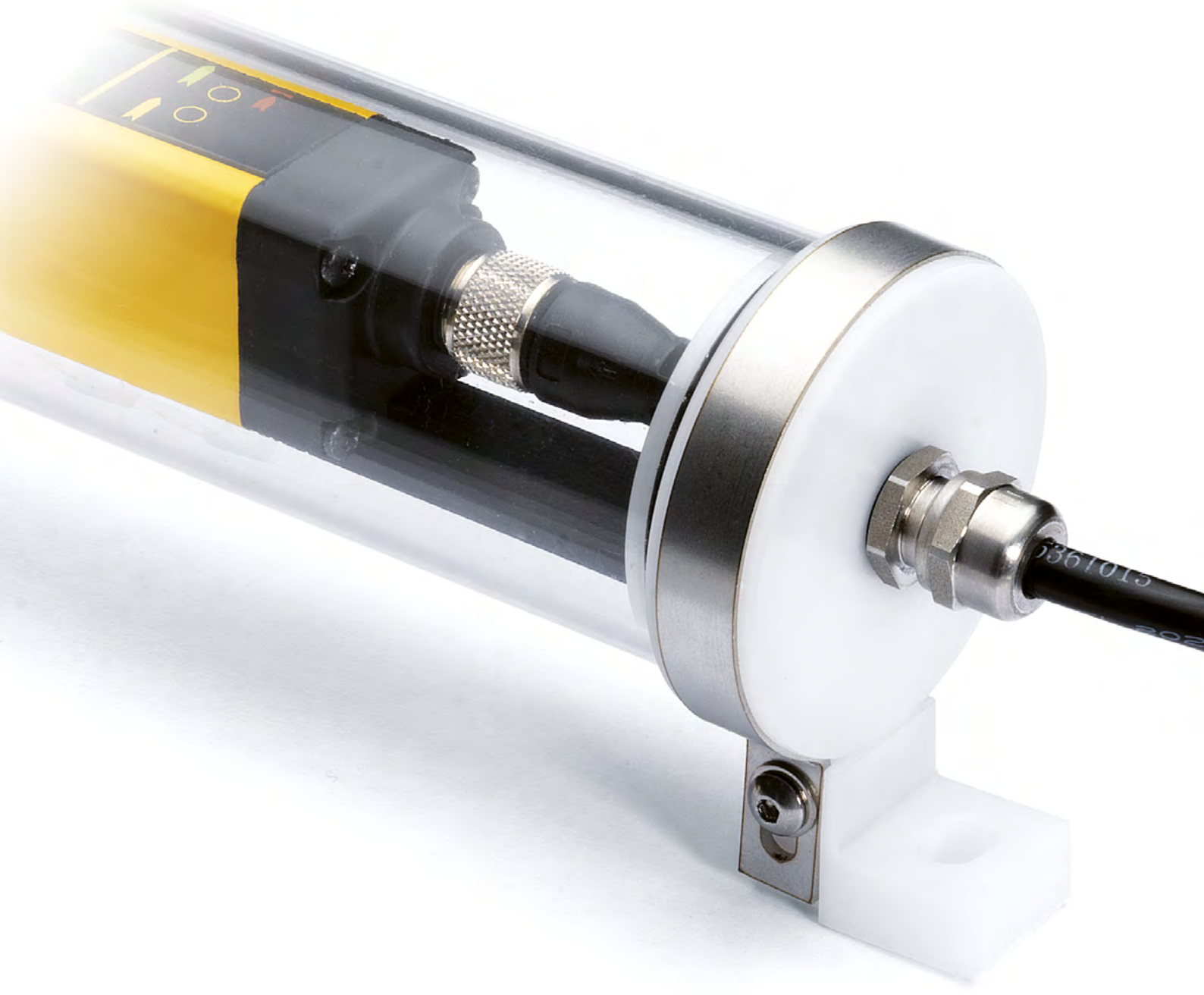
AD SR0 and AD SR0A modules can only be connected to safety sensors equipped with feedback input for monitoring external relays (EDM): EOS4 X, EOS2 X, Janus, Admiral AX (excluding AX BK models with Blanking), Pharo and Vision VX, VXL and MXL ranges.

Please contact ReeR for any other type of application.

SAFETY BUS INTERFACES

Please contact ReeR for the connection with the main safety buses

WATERTIGHT ENCLOSURES



EOS4 and EOS2 WTF and WTHF versions

IP 69K WATERTIGHT ENCLOSURE, WITH OR WITHOUT HEATING SYSTEM

MAIN CHARACTERISTICS

Watertight enclosures allow light curtains and light grids to be used in a harsh working environments with exposure to water and steam.

Thanks to its inert (non-toxic) components, no residuals are left when the light curtains are washed down or when they come directly in contact with food. This makes WTF and WTHF enclosures suitable for the Food & Beverage industry.

The watertight enclosure is made of:
- PMMA (polymethyl methacrylate) transparent enclosure
- POM-C (acetal resin – DELRIN®) sealing caps
- Anti-condensation system trough integrated GORE™ valve
- POM-C and Stainless steel fastening brackets (AISI 304)

The small EOS WTF and WTHF cylindrical enclosure (only 56mm diameter) is IP 69K protection rate tested and can withstand up to 80 bar of water jets pressure at the temperature of 80°C.
Enclosure incorporates a valve to drain humidity and avoid condensation.
WTHF version (Heated) has a thermostatically-controlled heating system and can work down to – 25° C.

Available models:

EOS4 X WTF/WTHF
- protected height 160 to 1510 mm and 2-3-4 beams
- resolution 14 mm, max range 5 m
- resolution 30 mm and 2-3-4 beams, max range 17 m

EOS4 technical features can be found at page 58

EOS2 X WTF/WTHF
- protected height 160 to 1510 mm and 2-3-4 beams
- resolution 30 mm and 2-3-4 beams, max range 10 m

EOS2 technical features can be found at page 120

The safety light curtain/grid is delivered already enclosed into its watertight tube with a 10m long prewired cable and the related fastening brackets.

NEW IP69K

TECHNICAL FEATURES

Model		WTF	WTHF
Protection rating		IP 69K	
Operating temperature (°C)		0 to 55	- 25 to 50
Max. water pressure jets		80 - 100 bar at 80° C (± 5° C)	
Max. range (m)	**EOS4 X (14 mm resolution)**	2 – 5 selectable	
Max. range (m)	**EOS4 XH**	8 – 17 selectable	
Max. range (m)	**EOS2**	3 – 10 selectable	
Resolution (mm)	**EOS4**	14 – 30	
Resolution (mm)	**EOS2**	30	
Nr. Beams	**EOS4, EOS2**	2 - 3 - 4	
Protected height (mm)	**EOS4, EOS2**	160 to 1510	
Electrical connections		10-metre cable pre-wired with cable gland	
WTHF heated power consumption		-	24 VDC - 20 W x Protected height (m)
Fastening mode		2 x M6 staniless steel screws (not included)	

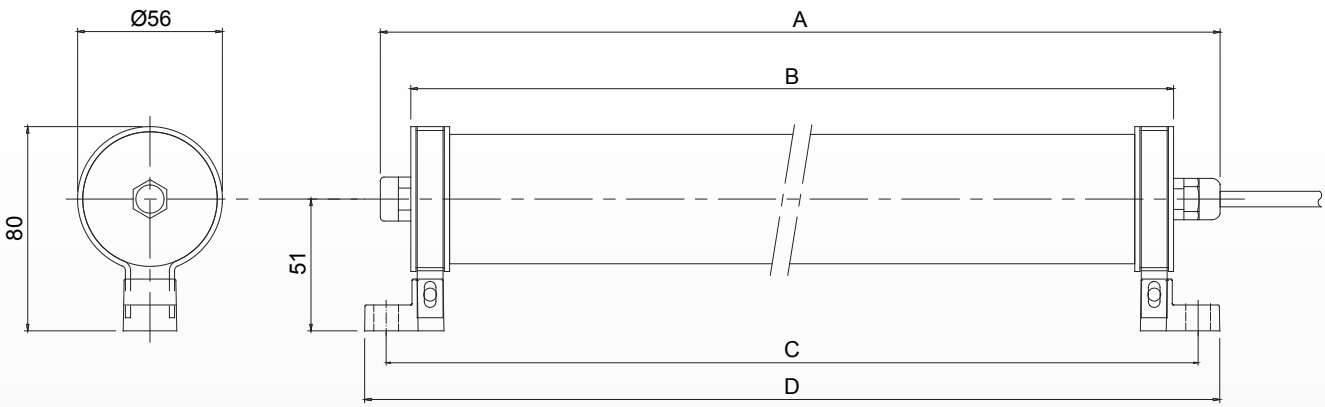
EOS4 and EOS2 WTF and WTHF versions

IP 69K WATERTIGHT ENCLOSURE, WITH OR WITHOUT HEATING SYSTEM

STANDARD MODELS

EOS4	Resolution 14 - 30 mm	and	2 - 3 - 4 beams
EOS2	Resolution 30 mm	and	2 - 3 - 4 beams

DIMENSIONS (mm)



MODEL	150	300	450	600	750	900	1050	1200	1350	1500	2B	3B	4B
Dimension "A" mm	325	475	625	775	925	1075	1225	1375	1525	1675	765	1065	1165
Dimension "B" mm	295	445	595	745	895	1045	1195	1345	1495	1645	735	1035	1135
Dimension "C" (± 3mm)	314	464	614	764	914	1064	1214	1364	1514	1664	754	1054	1154
Dimension "D" mm	330	480	630	780	930	1080	1230	1380	1530	1680	770	1070	1170

ORDERING INFORMATION (for ordering codes see page 217)

Each EOS light curtain comprises:

- Emitter and Receiver pair
- Mounting brackets
- CD-ROM containing the multi-language instruction manual complete with CE declaration of conformity
- Quick installation guide

Safety level:

Compliance according to the corresponding light curtains models

ADMIRAL AX and VISION VX WT and WTH versions

IP 67 WATERTIGHT ENCLOSURE, WITH OR WITHOUT HEATING SYSTEM

MAIN CHARACTERISTICS

- Models for light curtains with 2-3-4 beams and 1660 and 1810 mm protected height and 30 mm resolution
- IP 67 protection rate
- Valve to drain humidity and avoid condensation
- Tightness to 40 bar water jet pressure
- Electrical connections by 10 m prewired cable
- Polycarbonate transparent housing
- PVC sealing caps

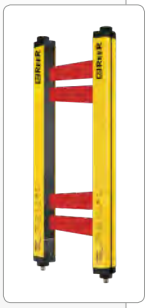
Available models:

ADMIRAL AX, AX LR; VISION VX, VX LR WT/WTH

- protected height 1660 and 1810 mm and 30 mm resolution, 2-3-4 beams
- max range 15 m for AX and VX models, 50 m for Long Range versions

ADMIRAL AX LR DB WTH NEW PRODUCT

This special version of the Admiral Long Range features an innovative Dual Beam System useful in outdoor applications or in harsh environments for decreasing the sensitivity of the light curtain to small objects that could interrupt the light link, i.e. birds or leaves but also heavy rain or snow.
Available models with 2 - 3 beams for detection of the body in access monitoring and heated IP 67 WTH case for outdoor use, max. range 60 m.



The safety light curtain/grid is delivered already enclosed into its watertight tube with a 10m long prewired cable and the related fastening brackets.

TECHNICAL FEATURES

Model		WT	WTH
Protection rating		IP 67	
Operating temperature (°C)		0 to 55	- 25 to 50
Max. water pressure jets		40 bar – (between 10° and 40° C)	
Max. range (m)	**AX, VX**	5 – 15 selectable	
Max. range (m)	**AX LR, VX LR**	18 – 50 selectable	
Max. range (m)	**AX LR DB**	-	20 – 60 selectable
Resolution (mm)	**AX, VX**	30	
Nr. Beams	**AX LR, VX LR**	2 - 3 - 4	
Nr. Beams	**AX LR DB**	-	2 - 3
Protected height (mm)	**AX, VX**	1660 and 1810	
Electrical connections		10 metres cable pre-wired with cable gland	
WTH heated power consumption		-	24 VDC - 20 W x Protected Height (m)

ADMIRAL AX and VISION VX WT and WTH versions

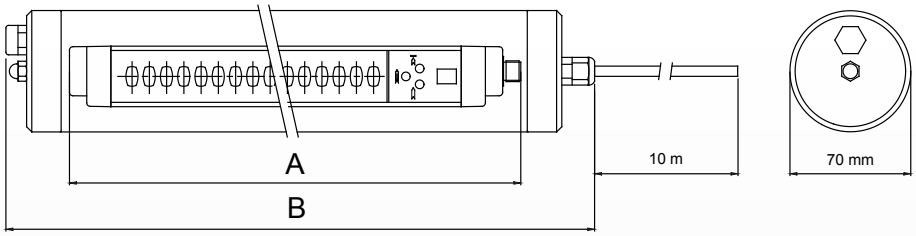
IP 67 WATERTIGHT ENCLOSURE, WITH OR WITHOUT HEATING SYSTEM

STANDARD MODELS

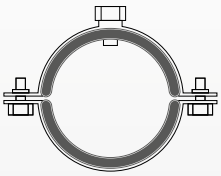
AX	Resolution 30 mm	protected height 1660 and 1810 mm
AX LR	2 - 3 - 4 beams	
AX LR DB	2 - 3 beams	
VX	Resolution 30 mm	protected height 1660 and 1810 mm
VX LR	2 - 3 - 4 beams	

- Admiral AX, AX LR technical features can be found at page 70
- Vision VX, VX LR technical features can be found at page 132

DIMENSIONS (mm)



B = A (Overall height) + 130 mm



WFB ring brackets (included)

ORDERING INFORMATION (for ordering codes see pages 219 and 224)

Each Admiral/Vision light curtain comprises:
▪ Emitter and Receiver pair
▪ Mounting brackets
▪ CD-ROM containing the multi-language instruction manual complete with CE declaration of conformity
▪ Quick installation guide

Safety level:

Compliance according to the corresponding light curtains models

METRON


REER
REER s.p.a. TORINO (Italy)
www.reer.it
METRON
MOD.
MER 752 B
P/N
8015711
S/N
061601120
Lens pitch
Number of beams
Working range
Measuring time
Power consumption
Working temperature
IN
IN

METRON

MAIN FEATURES

Light curtains for industrial and civil applications where it is necessary to detect, measure, and recognise objects.
Depending on the number and position of the beams engaged by an object, METRON can provide real time information to a PLC or PC in order to:

- Detect the presence or absence of objects
- Perform a count
- Detect a position
- Detect a shape or a profile
- Measure dimensions

Models A equipped with 4 programmable solid state outputs.
Models B equipped with 2 programmable solid state outputs and an RS-485 serial interface.
Models C equipped with two antivalent solid state outputs.

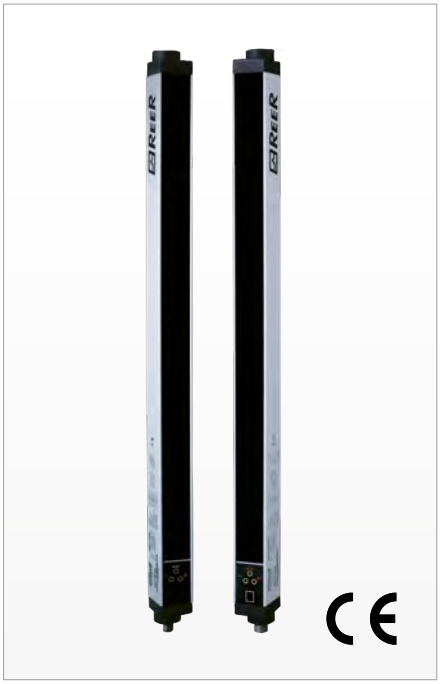
The Metronconf Configuration software for PC, with graphic user interface, is supplied with each light curtain (models A and B only).

Beam spacing available from 5 mm to 75 mm.
Protected height from 140 mm to 2525 mm.
Max. range 16 m (10 mm and 30 mm models).

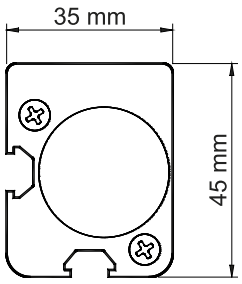
Connections with M12 and M16 connectors. Up to 50 m of electrical connections with unshielded cables.

Possibility of connection of up to 8 Metron B light curtains as nodes of an RS-485 serial line for simultaneous detection of multiple dimensions and complex measurements.

Special models in conformity with the "ATEX Directive" 94/9/EC – Dust Zone 22 - Gas Zone 2 available on request.



Cross section



THE METRON RANGE

METRON A

4 solid state outputs 0/24V with programmable functions
Solution providing simple on/off information related to the occurrence of the programmed conditions
Ideal for object recognition, quality control, detection of dimensional limits

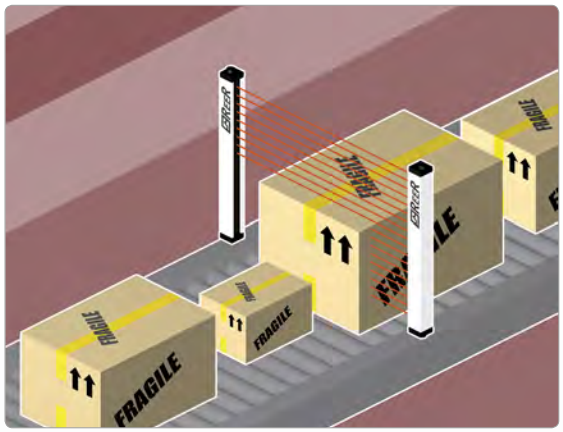
METRON B

RS-485 serial line + two solid state outputs 0/24V with programmable functions
Solution providing complete and detailed information on the status of each beam via the RS-485 serial line and, by means of the two solid state outputs, further on/off information related to the occurrence of the programmed conditions
Ideal for dimensional measurement, detection of object profile and position

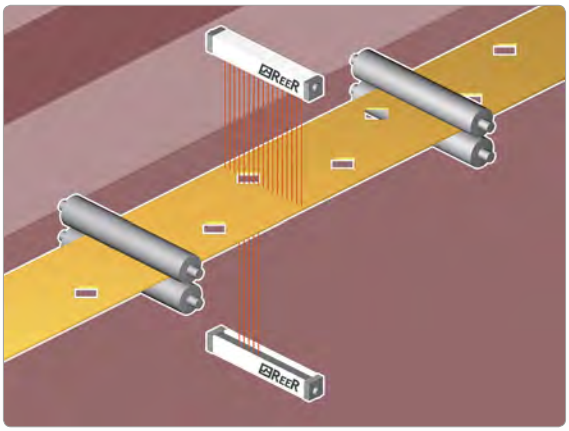
METRON C

Two solid state antivalent outputs 0/24V without the need for programming
Solution providing simple on/off information related to the status of the controlled area
Ideal for piece counting and detection of object presence/absence in the controlled field

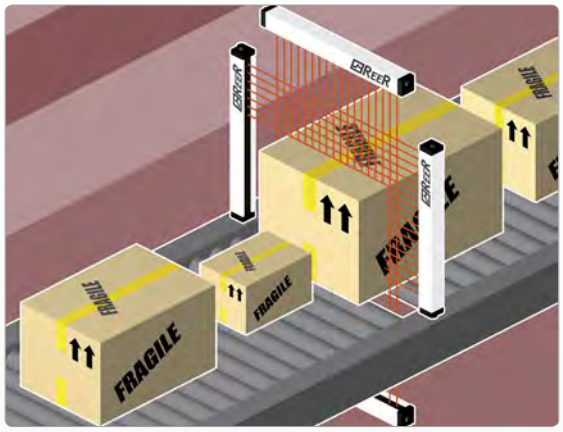
APPLICATION EXAMPLES



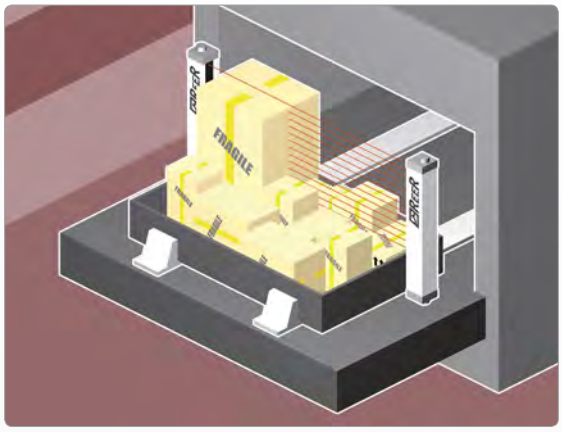
Measurement of the height of objects in transit on conveyor systems



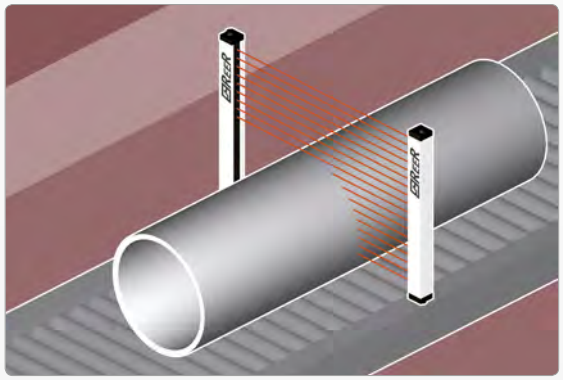
Quality control: verification of presence / absence / position of holes



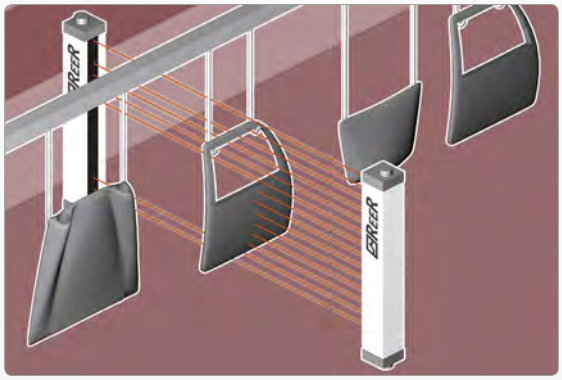
Two-dimensional detection of objects in transit on conveyor systems with use of 2 light curtains. If necessary, the calculation of the volume can be made by means of a third horizontal light curtain, or considering the transit speed



Automatic warehouses: detection of maximum height of the objects present in the boxes for efficient management of the machine's capacity



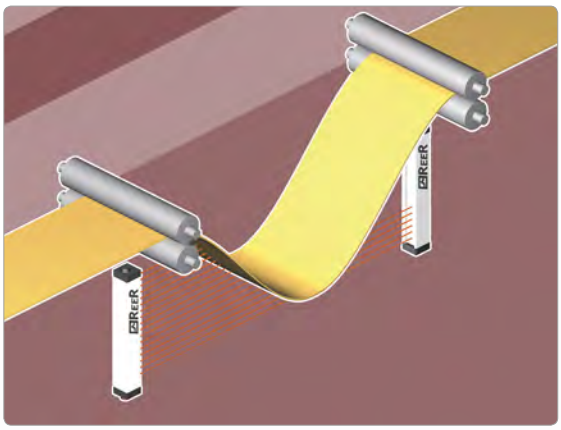
Measurement and identification of cylinders of various sizes



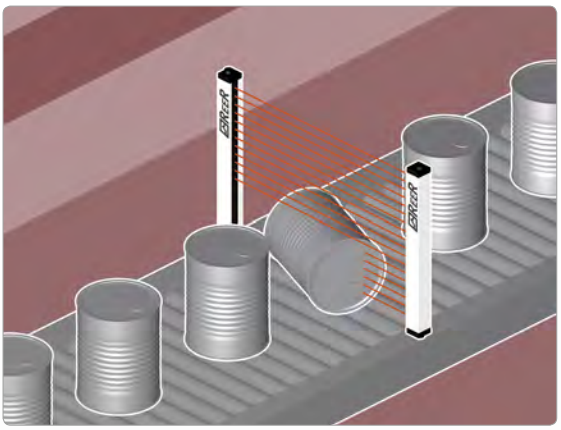
Detection of position and profile of pieces in automatic painting systems

METRON

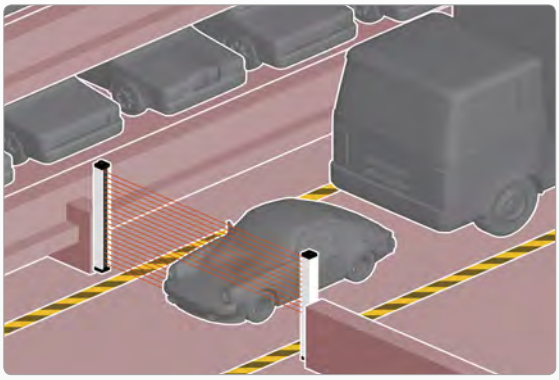
APPLICATION EXAMPLES



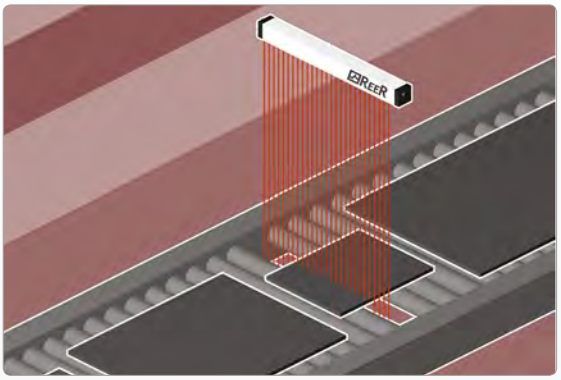
Loop control



Quality control: verification of correct positioning of objects



Detection of overall dimensional limits of vehicles for vehicle handling in automatic parking garages



Measurement of the width and position of panels or sheets of material in transit on roller units or conveyor belts

Special customised models available on request.

Special models in conformity with the "ATEX Directive" 94/9/EC – Dust Zone 22 - Gas Zone 2 available on request.

METRON

TECHNICAL FEATURES

Controlled heights (mm)		140 - 2525
Beam spacing (mm)		5 - 10 - 25 - 30 - 50 - 75
Max. range (m)		2 – for models with beam spacing 5 mm 6 - for models with beam spacing 25 - 50 - 75 mm 16 - for models with beam spacing 10 - 30 mm
Measurement time		(2.25 ms + 70 µs x n beams) x 2
Outputs	**Metron A**	4 - solid state 0 / 24V programmable - PNP 100 mA at 24VDC
	Metron B	RS-485 Serial line (up to 8 nodes) 2 - solid state 0 / 24V programmable - PNP 100 mA at 24VDC
	Metron C	2 - solid state 0 / 24V antivalent - PNP 100 mA at 24VDC
Inputs (on receiver) (Metron A and B only)		1 - digital with programmable functions - 0/24V
Metron A and B programming		via Metronconf configuration software
Metron A and B programming interface		RS-232 serial line
Synchronisation between emitter and receiver		Optical or via cable, selectable
Electrical connections	**Metron A e B**	1 connector M12 8-pole (emitter) 1 main connector M16 12-pole (receiver) 1 secondary connector M8 3-pole for RS-232 line for programming (receiver)
	Metron C	M12 5-pole connectors (emitter and receiver)
Signalling		7-segment display and LEDs for operating status and light curtain self-diagnosis
Power supply (VDC)		24 ± 20%
Max. length connection cables between light curtain and interface (m)		50
Operating temperature (°C)		0 to 55
Protection rating		IP 65
Fastening mode		3: back slot, side slot, or to the top and lower end
Cross-section dimensions (mm)		35 x 45

CHARACTERISTICS OF METRONCONF CONFIGURATION SOFTWARE

Possibility for on-line display on PC screen during operation (via RS-232)	Status of each individual beam and solid state outputs
Configurable parameters	Operating logic (conditions for output activation), parameters of the RS-485 serial line (transmission method, baud rate, parity, start-stop characters, binary, hex, ascii format, etc.)

METRON

MODELS

Beam spacing 5 mm	ME 150	ME 300	ME 450	ME 600	ME 750	ME 900	ME 1050	ME 1200
Protected heights (mm)	145	295	445	595	745	895	1045	1195
Number of beams	30	60	90	120	150	180	210	240
Overall height (mm)	261	411	561	711	861	1011	1161	1311

Beam spacing 10 mm	ME 151	ME 301	ME 451	ME 601	ME 751	ME 901	ME 1051	ME 1201	ME 1351	ME 1501	ME 1651	ME 1801	ME 1951	ME 2101	ME 2251	ME 2401
Protected heights (mm)	140	290	440	590	740	890	1040	1190	1340	1490	1640	1790	1940	2090	2240	2390
Number of beams	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240
Overall height (mm)	261	411	561	711	861	1011	1161	1311	1461	1611	1761	1911	2061	2211	2361	2511

Beam spacing 25 mm	ME 302	ME 452	ME 602	ME 752	ME 902	ME 1052	ME 1202	ME 1352	ME 1502	ME 1652	ME 1802	ME 1952	ME 2102	ME 2252	ME 2402	ME 2552
Protected heights (mm)	275	425	575	725	875	1025	1175	1325	1475	1625	1775	1925	2075	2225	2375	2525
Number of beams	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911	2061	2211	2361	2511	2661

Beam spacing 30 mm	ME 303	ME 453	ME 603	ME 753	ME 903	ME 1053	ME 1203	ME 1353	ME 1503	ME 1653	ME 1803	ME 1953	ME 2103	ME 2253	ME 2403	ME 2553
Protected heights (mm)	270	420	570	720	870	1020	1170	1320	1470	1620	1770	1920	2070	2220	2370	2520
Number of beams	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85
Overall height (mm)	411	561	711	861	1011	1161	1311	1461	1611	1761	1911	2061	2211	2361	2511	2661

Beam spacing 50 mm	ME 455	ME 605	ME 755	ME 905	ME 1055	ME 1205	ME 1355	ME 1505	ME 1655	ME 1805	ME 1955	ME 2105	ME 2255	ME 2405	ME 2555
Protected heights (mm)	400	550	700	850	1000	1150	1300	1450	1600	1750	1900	2050	2200	2350	2500
Number of beams	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51
Overall height (mm)	561	711	861	1011	1161	1311	1461	1611	1761	1911	2061	2211	2361	2511	2661

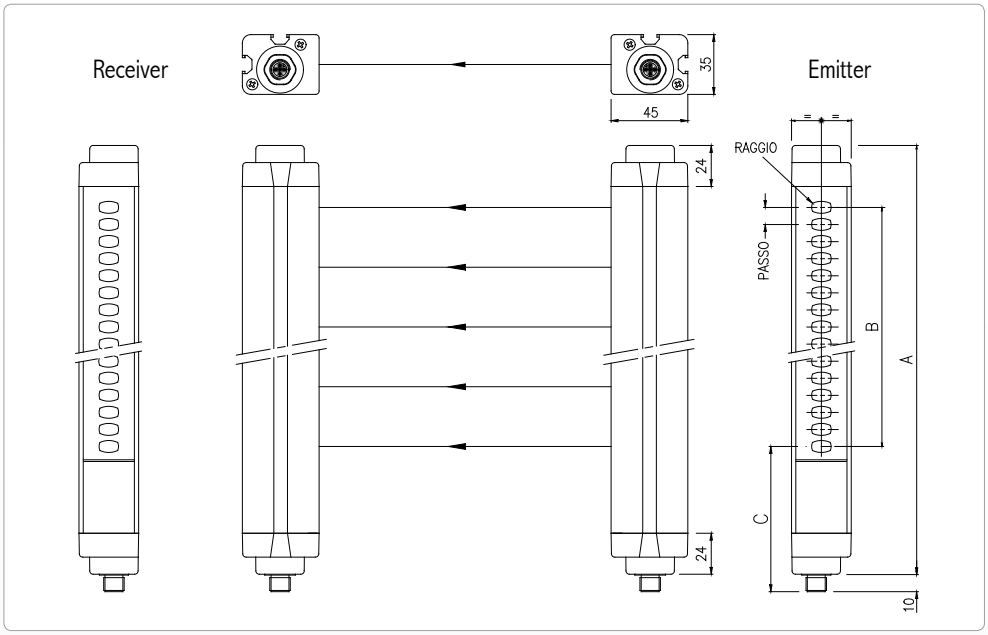
Beam spacing 75 mm	ME 607	ME 757	ME 907	ME 1057	ME 1207	ME 1357	ME 1507	ME 1657	ME 1807	ME 1957	ME 2107	ME 2257	ME 2407	ME 2557
Protected heights (mm)	525	675	825	975	1125	1275	1425	1575	1725	1875	2025	2175	2325	2475
Number of beams	8	10	12	14	16	18	20	22	24	26	28	30	32	34
Overall height (mm)	711	861	1011	1161	1311	1461	1611	1761	1911	2061	2211	2361	2511	2661

• For accessories see page 204 • For ordering codes see page 222

WARNING!

- When the light curtain works in the presence of strong vibrations (presses, weaving machines etc.), in order to avoid damages to the light curtain it is necessary to use the vibration dampers SAV (available as accessories)
- When long range protections or perimeter protections employing mirrors have to be realised it is advisable to use the LAD 2 laser pointer as an alignment aid, as well as the adjustable swivel fastening brackets SFB.

DIMENSIONS (mm)



Model ME	150	300	450	600	750	900	1050	1200
A	251	401	551	701	851	1001	1151	1301
B (controlled height)	B = (number of beams -1) x beam spacing (with cable synchronisation) B = (number of beams -2) x beam spacing (with optical synchronisation)*							
C (1st beam position)	85 (for 10 - 30 models) - 93 (for 25–50-75 models)							
Mounting	2 LS type brackets with 2 inserts							

Model ME	1350	1500	1650	1800	1950	2100	2250	2400	2550
A	1451	1601	1751	1901	2051	2201	2351	2501	2651
B (controlled height)	B = (number of beams -1) x beam spacing (with cable synchronisation) B = (number of beams -2) x beam spacing (with optical synchronisation)*								
C (1st beam position)	85 (for 10 - 30 models) - 93 (for 25–50-75 models)								
Mounting	3 LS type brackets with 3 inserts								

* *In the case of optical synchronism, the beam adjacent to the upper end cap cannot be used for measurement, as it constitutes the synchronism beam.*

ORDERING INFORMATION (for ordering codes see page 226)

In addition to the height and beam spacing, to uniquely define a Metron light curtain the model must also be indicated A, B or C:	
Models A	4 outputs with programmable functions (e.g.: ME 1801 A)
Models B	RS-485 serial line + 2 solid state outputs 0/24V with programmable functions (e.g.: ME 1801 B)
Models C	2 solid state outputs 0/24V antivalent (without the need for programming) (e.g.: ME 1801 C)
Each type of Metron light curtain includes:	▪ Emitter and Receiver pair ▪ Mounting brackets and T-nuts ▪ CD-ROM containing the “Metronconf” programming software and the multi-language instruction manual

METRON

ACCESSORIES

For Metron light curtains the following accessories, to be ordered separately, are available:	
▪ LAD laser alignment device	see page 210
▪ FMC floor mounting columns	see page 206
▪ SP deflection mirrors	see page 209
▪ SFB swivel fixing brackets	see page 212
▪ SAV vibrations dampers	see page 211
▪ Connectors	see below:

CONNECTORS FOR METRON A and B emitter

Model	Description
C8D 5	M12 straight connector, 8 poles, pre-wired cable 5 m
C8D 10	M12 straight connector, 8 poles, pre-wired cable 10 m
C8D 15	M12 straight connector, 8 poles, pre-wired cable 15 m
C8D 25	M12 straight connector, 8 poles, pre-wired cable 25 m
C8D 40	M12 straight connector, 8 poles, pre-wired cable 40 m
C8D 95	M12 90° angle connector, 8 poles, pre-wired cable 5 m
C8D 910	M12 90° angle connector, 8 poles, pre-wired cable 10 m
C8D 915	M12 90° angle connector, 8 poles, pre-wired cable 15 m
C8DM 9	M12 straight connector, 8 poles with screw terminal, PG9 cable gland
C8DM 99	M12 angle connector, 8 poles with screw terminal, PG9 cable gland
C8DM 11	M12 straight connector, 8 poles with screw terminal, PG9/11 cable gland
C8DM 911	M12 angle connector, 8 poles with screw terminal, PG9/11 cable gland

CONNECTORS FOR METRON A and B receiver

Model	Description
C12D 3	M16 straight connector, 12 poles, pre-wired cable 3 m
C12D 5	M16 straight connector, 12 poles, pre-wired cable 5 m
C12D 10	M16 straight connector, 12 poles, pre-wired cable 10 m
C12D 15	M16 straight connector, 12 poles, pre-wired cable 15 m
C12D 25	M16 straight connector, 12 poles, pre-wired cable 25 m
CSL 3	3 meters cable, for connecting light curtain and PC for system configuration, equipped with one M8, 3 poles connector and one DB9 connector

CONNECTORS FOR METRON C emitter and receiver

Model	Description
CD 5	M12 straight connector, 5 poles, pre-wired cable 5 m
CD 10	M12 straight connector, 5 poles, pre-wired cable 10 m
CD 15	M12 straight connector, 5 poles, pre-wired cable 15 m
CD 20	M12 straight connector, 5 poles, pre-wired cable 20 m
CD 25	M12 straight connector, 5 poles, pre-wired cable 25 m
CD 50	M12 straight connector, 5 poles, pre-wired cable 50 m
CD 95	M12 90° angle connector, 5 poles, pre-wired cable 5 m
CD 910	M12 90° angle connector, 5 poles, pre-wired cable 10 m
CD 915	M12 90° angle connector, 5 poles, pre-wired cable 15 m
CDM 9	M12 straight connector, 5 poles with screw terminal, PG9 cable gland

ACCESSORIES

FMC

Support columns for ReeR safety light curtains and deflection mirrors, designed to provide secure fastening to the floor, fast installation, and a simple and precise adjustment of the optical alignment of the system.

MAIN FEATURES

- Steel base with springs for a perfect adjustment of the column vertical axis.
- Columns made by aluminium extrusion poles, with adjustable angular orientation.
- Easy assembling and disassembling of the light curtain.
- Easy adjustment of the first beam's height.
- FMC B models for light curtains.
- FMC B_R models for light curtains complete with PG11 rear union for light curtain cable sheath.
- FMC S models with pre-assembled deflector mirrors to realize perimeter protections up to 4 sides.
- FMC-SB models with pre-installed independent adjustable deflection mirrors for safety light grids with 2, 3 and 4 beams. **NEW PRODUCT**
- Optical power reduction factor 15% (for each mirror).
- Special models equipped with mirror with protective anti-fragmentation film available on request.
- Steel foundation inserts included with the product.
- Built-in spirit level for a correct positioning of the vertical axis.

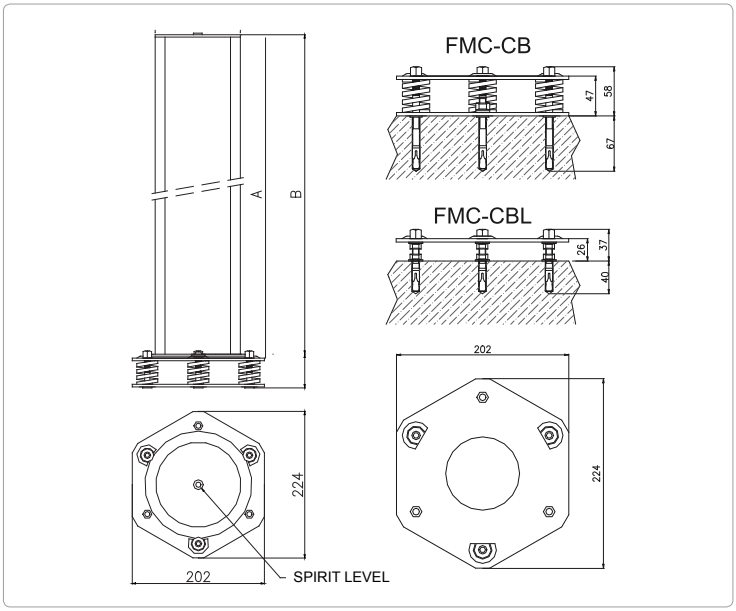
Can be used with the following light curtains:
- EOS
- ADMIRAL
- JANUS
- VISION
- METRON

TECHNICAL FEATURES AND DIMENSIONS (mm)

COLUMNS FOR LIGHT GRIDS / CURTAINS					
Standard models	**FMC-B2/EB2**	**FMC-B3**	**FMC-B4/EB4**	**FMC-B1700/EB1700**	**FMC-B2000/EB2000**
Models with PG11 rear union for cable sheath	**FMC-B2R/EB2R**	**FMC-B3R**	**FMC-B4R/EB4R**	**FMC-B1700R/EB1700R**	**FMC-B2000R/EB2000R**
Overall height with base (mm)	1055	1255	1385	1725	2025
For light grids/curtains with	2 beams	3 beams	4 beams	controlled height up to 1360 mm	controlled height up to 1660 mm

COLUMNS WITH DEFLECTION MIRROR					
MODELS	**FMC-S2 FMC-SB2**	**FMC-S3 FMC-SB3**	**FMC-S4 FMC-SB4**	**FMC-S1700**	**FMC-S2000**
Overall height with base (mm)	1055	1255	1385	1725	2025
For light grids/curtains with	2 beams	3 beams	4 beams	controlled height up to 1360 mm	controlled height up to 1660 mm

BASE FOR COLUMNS	
Model	**FMC-CB / FMC-CBL**
One base must be ordered for each column	



Model	A	B
COLUMNS FOR LIGHT GRIDS / CURTAINS		
FMC-B2/EB2	1000	1055
FMC-B3	1200	1255
FMC-B4/EB4	1330	1385
FMC-B1700/EB1700	1670	1725
FMC-B2000/EB2000	1970	2025
COLUMNS WITH DEFLECTION MIRROR		
FMC-S2/SB2	1000	1055
FMC-S3/SB3	1200	1255
FMC-S4/SB4	1330	1385
FMC-S1700	1670	1725
FMC-S2000	1970	2025
BASE FOR COLUMNS		
FMC-CB	202 x 224 x 55 h	
FMC-CBL	202 x 224 x 37 h	

Each floor mounting columns includes multi-language instruction manual.

For ordering codes see page 228

WARNING!

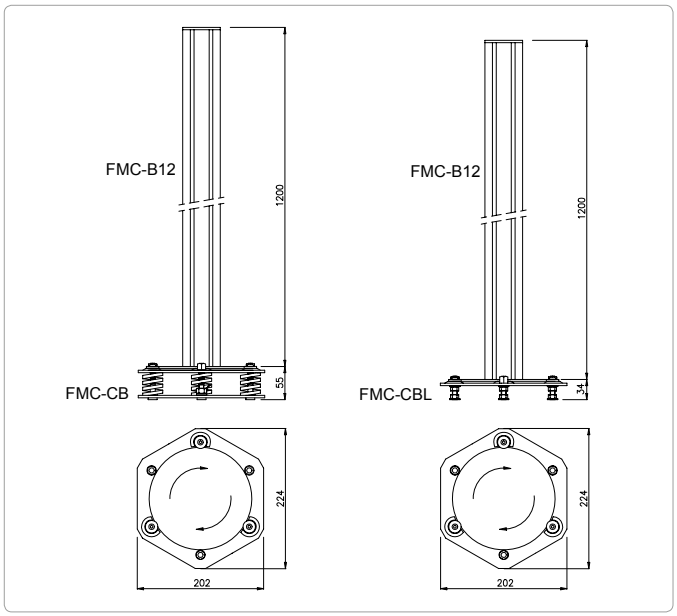
The following rules should be taken into consideration when using deflector mirrors:

- the working distance (range) is given by the sum of the lengths of all the sides giving access to the protected area.
- for each mirror used the maximum working range between the Emitter and the Receiver is reduced by 15%.
- place the mirrors in order to ensure compliance with the minimum safety distance on each side from which the danger zone can be accessed.
- when light curtains and grids are working with long distance or with deflector mirrors, it is recommendable to use the LAD laser pointer for a quick and reliable alignment of the system.

FMC-B12

MAIN FEATURES

Simplified version for 2 - 3 - 4 beams light grids, it permits the use with light grids with integrated Muting sensors:
Janus MT and ML and Vision MXL L and MXL T.
FMC-B12 can also be used with:
Admiral, Vision, EOS4 and EOS2, Metron.



TECHNICAL FEATURES AND DIMENSIONS (mm)

COLUMNS FOR LIGHT CURTAINS	
Model	**FMC-B12**
Overall height with base (mm)	1255
For light grids/curtains with	2 - 3 - 4 beams (controlled height up to 910 mm)

- Each FMC-B12 column includes: multi-language instruction manual.

For ordering codes see page 228

SP

The SP deflection mirrors make it possible to create perimeter protection of areas with access points on multiple sides, with a considerable reduction of costs. This solution eliminates the need to use more than one safety light curtain.

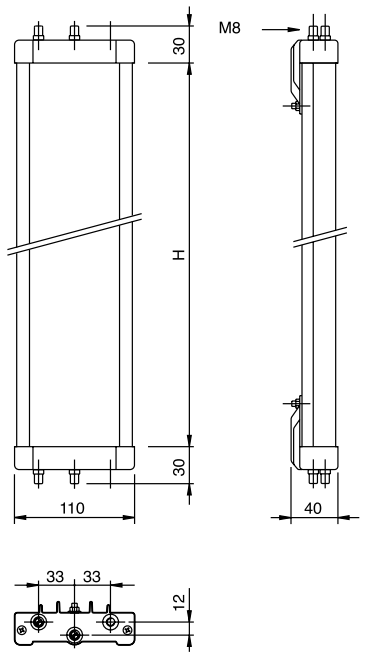
MAIN FEATURES

- Extruded aluminium section bar.
- Mirror pre-fitted with heights from 250 to 1900 mm.
- Angular orientation adjustable using supplied brackets.
- Optical power reduction factor 15% (for each mirror).
- Special models equipped with mirror with protective anti-fragmentation film available on request.
- Can be used to realise perimeter protection up to 4 sides.

DIMENSIONS (mm)

Model	H
SP 100 S	250
SP 300 S	400
SP 400 S	540
SP 600 S	715
SP 700 S	885
SP 900 S	1060
SP 1100 S	1230
SP 1200 S	1400
SP 1300 S	1450
SP 1500 S	1600
SP 1600 S	1750
SP 1800 S	1900

- Each mirror is supplied with two adjustable fixing brackets
- Each SP Mirror includes: multi-language instruction manual.
- For ordering codes see page 228



MODELS AND MIRROR-LIGHT CURTAIN COMBINATIONS

Model specchio	For light grids/ curtains with protected height (mm)	For light grids with:
SP 100 S	160	
SP 300 S	310	
SP 400 S	460	
SP 600 S	610	2 beams
SP 700 S	760	
SP 900 S	910	3 beams
SP 1100 S	1060	4 beams
SP 1200 S	1210	
SP 1300 S	1360	
SP 1500 S	1510	
SP 1600 S	1660	
SP 1800 S	1810	

WARNING!

The following rules should be taken into consideration when using deflector mirrors:

- the working distance (range) is given by the sum of the lengths of all the sides giving access to the protected area.
- for each mirror used the maximum working range between the Emitter and the Receiver is reduced by 15%.
- place the mirrors in order to ensure compliance with the minimum safety distance on each side from which the danger zone can be accessed.
- when light curtains and grids are working with long distance or with deflector mirrors, it is recommendable to use the LAD laser pointer for a quick and reliable alignment of the system.

LAD

MAIN FEATURES

The LAD laser alignment device makes it possible to obtain a fast and reliable optical alignment of the ReeR safety light curtains of the EOS4 and EOS2, Admiral, Vision, Metron and Janus series; they are also compatible with the use of the FMC floor mounting columns.

The LAD devices emit a laser beam with visible red light with useful range up to 100 m.

Their use is recommended for aligning light curtains that operate over long distances or multiple sides with the use of deflection mirrors.

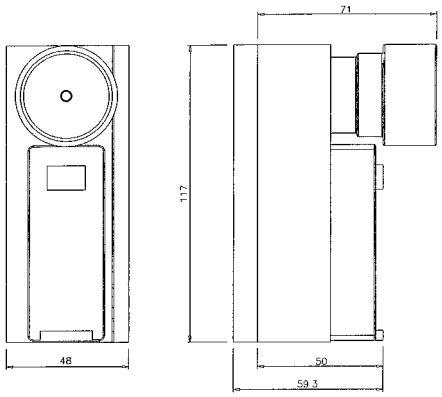
TECHNICAL FEATURES

Light source	laser diode – wavelength 650 nm
Class light source	II – EN 60825-1
Range m	100
Beam divergence (mrd)	< 0,5
Max. power (mW)	1
Power supply (VDC)	3 (2 AAA batteries)
Fastening	quick fastening to the light curtains
Dimensions (h x w x d) mm	117 x 48 x 80 - LAD 2 - LAD 4 70 x 78 x 70 - LAD 3

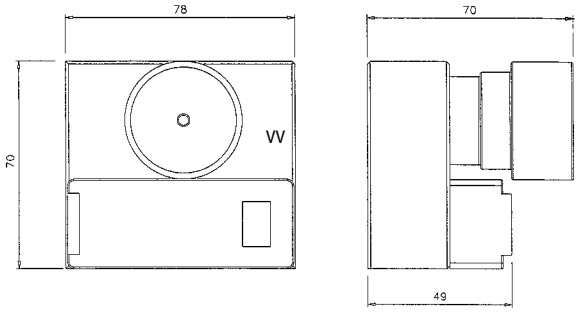
Model	for:
LAD 2	Admiral - Vision - Metron
LAD 3	Janus
LAD 4	EOS4 - EOS2

DIMENSIONS (mm)

LAD 2 - LAD 4



LAD 3



Each LAD model includes multi-language instruction manual.

For ordering codes see page 228

SAV

MAIN FEATURES

The SAV vibration dampers have been designed to avoid mechanical damage to the light curtains installed in those applications which have a high level of vibrations.
The unprotected light curtains might resent the vibrations produced by e.g. presses, weaving machines, etc.
In these cases, the use of SAV vibration dampers is highly recommended.

- SAV 4E-8E-12E dampers are to be used with EOS4/EOS2 light curtains
- SAV 1 and SAV 2 dampers are to be used with Janus light curtains
- SAV 3 and SAV 4 dampers are to be used with Admiral, Vision and Metron.

TECHNICAL FEATURES

Model	Description	for light grids/curtains with protected height mm / beams
SAV 1	set 4 vibrations dampers	310 – 1060 / 2 – 3 – 4
SAV 2	set 6 vibrations dampers	1210 – 1810
SAV 3	set 2 vibrations dampers	160 – 1060 / 2 – 3 – 4
SAV 4	set 3 vibrations dampers	1210 – 1810
SAV 4E	set 4 vibrations dampers	150
SAV 8E	set 8 vibrations dampers	300 – 1050
SAV 12E	set 12 vibrations dampers	1200 – 1500
For EOS4 and EOS2 1 set must be ordered for each light curtain. For Janus, Admiral, Vision and Metron 2 sets must be ordered for each light curtain (1 set for the emitter + 1 for the receiver).		
For ordering codes see page 228		

PROTECTIVE SCREEN FOR EOS

MAIN FEATURES

PSE features a polycarbonate protective screen that preserves the light curtain's front screen from damages due to welding sparks or due to the presence of acids in the workspace.
Once no more usable the protective screen can be quickly replaced thanks to its fast and easy stainless steel clamping system.

The protective screens are available for any protected heights of the EOS range.

Each kit comprises 1 set of stainless steel clamps for one safety light curtain (emitter and receiver) plus 4 protective screens.

For ordering codes see page 224

SFB – SFBE – SFB180E

MAIN FEATURES

The SFB/SFBE/SFB180E swivel brackets allow the rotation of the light curtain around its longitudinal axis, as well as the adjustment of its vertical and horizontal position.

The use of the SFB/SFBE/SFB180E swivel brackets is recommended to align those light curtains which are employed in applications having a long range or using deflector mirrors.

SFB are to be used with Admiral, Vision and Metron.
SFBE/SFB180E are to be used with EOS4 and EOS2.


SFBE

TECHNICAL FEATURES

Model	Description
SFB	set of 4 swivel brackets
SFB 4E	set of 4 swivel brackets for EOS4/EOS2
SFB 6E	set of 6 swivel brackets for EOS4/EOS2
SFB180E	set of 4 swivel brackets for EOS4/EOS2
One set must be ordered for each pair of light curtain (emitter + receiver)	
For ordering codes see page 228	

TEST ROD

MAIN FEATURES

The test rod is an opaque cylinder used after the installation of a safety light curtain to check that no beams are bypassed due to the presence of reflecting surfaces.

The test is carried out by slowly moving the test rod (Ø = Resolution) in the centre and then along each side of the protected area. During this procedure the Green led on the Receiver must always remain in the off state.

TECHNICAL FEATURES

Model	Diameter
TR 14	ø 14 mm
TR 20	ø 20 mm
TR 30	ø 30 mm
TR 40	ø 40 mm
TR 50	ø 50 mm
For ordering codes see page 228	

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DISCLAIMER

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The catalogue does not therefore constitute any obligation for the manufacturer at the moment of purchase regarding the availability and the characteristics of the products described in it.

The law and Standard requirements can vary in their turn. All the information concerning applications is given as a pure indication and ReeR does not assume any responsibility in that sense: concerning your application, refer only to its detailed risk analysis; concerning the use of ReeR products, refer to their user manual and contact the manufacturer directly in any case of doubt.

EOS4 A page 56	
model	ordering code
EOS4 151 A	1310000
EOS4 301 A	1310001
EOS4 451 A	1310002
EOS4 601 A	1310003
EOS4 751 A	1310004
EOS4 901 A	1310005
EOS4 1051 A	1310006
EOS4 1201 A	1310007
EOS4 1351 A	1310008
EOS4 1501 A	1310009
EOS4 152 AH	1310150
EOS4 302 AH	1310151
EOS4 452 AH	1310152
EOS4 602 AH	1310153
EOS4 752 AH	1310154
EOS4 902 AH	1310155
EOS4 1052 AH	1310156
EOS4 1202 AH	1310157
EOS4 1352 AH	1310158
EOS4 1502 AH	1310159
EOS4 153 A	1310200
EOS4 303 A	1310201
EOS4 453 A	1310202
EOS4 603 A	1310203
EOS4 753 A	1310204
EOS4 903 A	1310205
EOS4 1053 A	1310206
EOS4 1203 A	1310207
EOS4 1353 A	1310208
EOS4 1503 A	1310209
EOS4 153 AH	1310250
EOS4 303 AH	1310251
EOS4 453 AH	1310252
EOS4 603 AH	1310253
EOS4 753 AH	1310254
EOS4 903 AH	1310255
EOS4 1053 AH	1310256
EOS4 1203 AH	1310257
EOS4 1353 AH	1310258
EOS4 1503 AH	1310259
EOS4 154 A	1310300
EOS4 304 A	1310301
EOS4 454 A	1310302
EOS4 604 A	1310303
EOS4 754 A	1310304
EOS4 904 A	1310305
EOS4 1054 A	1310306
EOS4 1204 A	1310307
EOS4 1354 A	1310308
EOS4 1504 A	1310309
EOS4 154 AH	1310350
EOS4 304 AH	1310351
EOS4 454 AH	1310352
EOS4 604 AH	1310353
EOS4 754 AH	1310354
EOS4 904 AH	1310355
EOS4 1054 AH	1310356
EOS4 1204 AH	1310357
EOS4 1354 AH	1310358
EOS4 1504 AH	1310359
EOS4 155 A	1310400
EOS4 305 A	1310401
EOS4 455 A	1310402
EOS4 605 A	1310403
EOS4 755 A	1310404
EOS4 905 A	1310405
EOS4 1055 A	1310406
EOS4 1205 A	1310407
EOS4 1355 A	1310408
EOS4 1505 A	1310409
EOS4 155 AH	1310450
EOS4 305 AH	1310451
EOS4 455 AH	1310452
EOS4 605 AH	1310453
EOS4 755 AH	1310454
EOS4 905 AH	1310455
EOS4 1055 AH	1310456
EOS4 1205 AH	1310457
EOS4 1355 AH	1310458
EOS4 1505 AH	1310459
EOS4 309 A	1310501
EOS4 459 A	1310502
EOS4 609 A	1310503
EOS4 759 A	1310504
EOS4 909 A	1310505
EOS4 1059 A	1310506
EOS4 1209 A	1310507
EOS4 1359 A	1310508
EOS4 1509 A	1310509
EOS4 309 AH	1310551
EOS4 459 AH	1310552
EOS4 609 AH	1310553
EOS4 759 AH	1310554
EOS4 909 AH	1310555
EOS4 1059 AH	1310556
EOS4 1209 AH	1310557
EOS4 1359 AH	1310558
EOS4 1509 AH	1310559
EOS4 2B A	1310600
EOS4 3B A	1310601
EOS4 4B A	1310602
EOS4 2B AH	1310650
EOS4 3B AH	1310651
EOS4 4B AH	1310652

EOS4 X page 58	
model	ordering code
EOS4 151 X	1310010
EOS4 301 X	1310011
EOS4 451 X	1310012
EOS4 601 X	1310013
EOS4 751 X	1310014
EOS4 901 X	1310015
EOS4 1051 X	1310016
EOS4 1201 X	1310017
EOS4 1351 X	1310018
EOS4 1501 X	1310019
EOS4 152 XH	1310160
EOS4 302 XH	1310161
EOS4 452 XH	1310162
EOS4 602 XH	1310163
EOS4 752 XH	1310164
EOS4 902 XH	1310165
EOS4 1052 XH	1310166
EOS4 1202 XH	1310167
EOS4 1352 XH	1310168
EOS4 1502 XH	1310169
EOS4 153 X	1310210
EOS4 303 X	1310211
EOS4 453 X	1310212
EOS4 603 X	1310213
EOS4 753 X	1310214
EOS4 903 X	1310215
EOS4 1053 X	1310216
EOS4 1203 X	1310217
EOS4 1353 X	1310218
EOS4 1503 X	1310219
EOS4 153 XH	1310260
EOS4 303 XH	1310261
EOS4 453 XH	1310262
EOS4 603 XH	1310263
EOS4 753 XH	1310264
EOS4 903 XH	1310265
EOS4 1053 XH	1310266
EOS4 1203 XH	1310267
EOS4 1353 XH	1310268
EOS4 1503 XH	1310269

EOS4 154 X	1310310
EOS4 304 X	1310311
EOS4 454 X	1310312
EOS4 604 X	1310313
EOS4 754 X	1310314
EOS4 904 X	1310315
EOS4 1054 X	1310316
EOS4 1204 X	1310317
EOS4 1354 X	1310318
EOS4 1504 X	1310319
EOS4 154 XH	1310360
EOS4 304 XH	1310361
EOS4 454 XH	1310362
EOS4 604 XH	1310363
EOS4 754 XH	1310364
EOS4 904 XH	1310365
EOS4 1054 XH	1310366
EOS4 1204 XH	1310367
EOS4 1354 XH	1310368
EOS4 1504 XH	1310369
EOS4 155 X	1310410
EOS4 305 X	1310411
EOS4 455 X	1310412
EOS4 605 X	1310413
EOS4 755 X	1310414
EOS4 905 X	1310415
EOS4 1055 X	1310416
EOS4 1205 X	1310417
EOS4 1355 X	1310418
EOS4 1505 X	1310419
EOS4 155 XH	1310460
EOS4 305 XH	1310461
EOS4 455 XH	1310462
EOS4 605 XH	1310463
EOS4 755 XH	1310464
EOS4 905 XH	1310465
EOS4 1055 XH	1310466
EOS4 1205 XH	1310467
EOS4 1355 XH	1310468

EOS4 1505 XH	1310469
EOS4 309 X	1310511
EOS4 459 X	1310512
EOS4 609 X	1310513
EOS4 759 X	1310514
EOS4 909 X	1310515
EOS4 1059 X	1310516
EOS4 1209 X	1310517
EOS4 1359 X	1310518
EOS4 1509 X	1310519
EOS4 309 XH	1310561
EOS4 459 XH	1310562
EOS4 609 XH	1310563
EOS4 759 XH	1310564
EOS4 909 XH	1310565
EOS4 1059 XH	1310566
EOS4 1209 XH	1310567
EOS4 1359 XH	1310568
EOS4 1509 XH	1310569
EOS4 2B X	1310610
EOS4 3B X	1310611
EOS4 4B X	1310612
EOS4 2B XH	1310660
EOS4 3B XH	1310661
EOS4 4B XH	1310662
EOS4 301 XM	1310021
EOS4 451 XM	1310022
EOS4 601 XM	1310023
EOS4 751 XM	1310024
EOS4 901 XM	1310025
EOS4 1051 XM	1310026
EOS4 1201 XM	1310027
EOS4 1351 XM	1310028
EOS4 1501 XM	1310029
EOS4 301 XS	1310031
EOS4 451 XS	1310032

EOS4 601 XS	1310033
EOS4 751 XS	1310034
EOS4 901 XS	1310035
EOS4 1051 XS	1310036
EOS4 1201 XS	1310037
EOS4 1351 XS	1310038
EOS4 1501 XS	1310039
EOS4 301 XS2	1310041
EOS4 451 XS2	1310042
EOS4 601 XS2	1310043
EOS4 751 XS2	1310044
EOS4 901 XS2	1310045
EOS4 1051 XS2	1310046
EOS4 1201 XS2	1310047
EOS4 1351 XS2	1310048
EOS4 1501 XS2	1310049
EOS4 303 XM	1310221
EOS4 453 XM	1310222
EOS4 603 XM	1310223
EOS4 753 XM	1310224
EOS4 903 XM	1310225
EOS4 1053 XM	1310226
EOS4 1203 XM	1310227
EOS4 1353 XM	1310228
EOS4 1503 XM	1310229
EOS4 153 XS	1310230
EOS4 303 XS	1310231
EOS4 453 XS	1310232
EOS4 603 XS	1310233
EOS4 753 XS	1310234
EOS4 903 XS	1310235
EOS4 1053 XS	1310236
EOS4 1203 XS	1310237
EOS4 1353 XS	1310238
EOS4 1503 XS	1310239
EOS4 303 XS2	1310241
EOS4 453 XS2	1310242
EOS4 603 XS2	1310243

EOS4 753 XS2	1310244
EOS4 903 XS2	1310245
EOS4 1053 XS2	1310246
EOS4 1203 XS2	1310247
EOS4 1353 XS2	1310248
EOS4 1503 XS2	1310249
EOS4 304 XM	1310321
EOS4 454 XM	1310322
EOS4 604 XM	1310323
EOS4 754 XM	1310324
EOS4 904 XM	1310325
EOS4 1054 XM	1310326
EOS4 1204 XM	1310327
EOS4 1354 XM	1310328
EOS4 1504 XM	1310329
EOS4 154 XS	1310330
EOS4 304 XS	1310331
EOS4 454 XS	1310332
EOS4 604 XS	1310333
EOS4 754 XS	1310334
EOS4 904 XS	1310335
EOS4 1054 XS	1310336
EOS4 1204 XS	1310337
EOS4 1354 XS	1310338
EOS4 1504 XS	1310339
EOS4 304 XS2	1310341
EOS4 454 XS2	1310342
EOS4 604 XS2	1310343
EOS4 754 XS2	1310344
EOS4 904 XS2	1310345
EOS4 1054 XS2	1310346
EOS4 1204 XS2	1310347
EOS4 1354 XS2	1310348
EOS4 1504 XS2	1310349
EOS4 305 XM	1310421
EOS4 455 XM	1310422
EOS4 605 XM	1310423
EOS4 755 XM	1310424

EOS4 905 XM	1310425
EOS4 1055 XM	1310426
EOS4 1205 XM	1310427
EOS4 1355 XM	1310428
EOS4 1505 XM	1310429
EOS4 155 XS	1310430
EOS4 305 XS	1310431
EOS4 455 XS	1310432
EOS4 605 XS	1310433
EOS4 755 XS	1310434
EOS4 905 XS	1310435
EOS4 1055 XS	1310436
EOS4 1205 XS	1310437
EOS4 1355 XS	1310438
EOS4 1505 XS	1310439
EOS4 305 XS2	1310441
EOS4 455 XS2	1310442
EOS4 605 XS2	1310443
EOS4 755 XS2	1310444
EOS4 905 XS2	1310445
EOS4 1055 XS2	1310446
EOS4 1205 XS2	1310447
EOS4 1355 XS2	1310448
EOS4 1505 XS2	1310449
EOS4 309 XM	1310521
EOS4 459 XM	1310522
EOS4 609 XM	1310523
EOS4 759 XM	1310524
EOS4 909 XM	1310525
EOS4 1059 XM	1310526
EOS4 1209 XM	1310527
EOS4 1359 XM	1310528
EOS4 1509 XM	1310529
EOS4 309 XS	1310531
EOS4 459 XS	1310532
EOS4 609 XS	1310533
EOS4 759 XS	1310534
EOS4 909 XS	1310535

EOS4 1059 XS	1310536
EOS4 1209 XS	1310537
EOS4 1359 XS	1310538
EOS4 1509 XS	1310539
EOS4 309 XS2	1310541
EOS4 459 XS2	1310542
EOS4 609 XS2	1310543
EOS4 759 XS2	1310544
EOS4 909 XS2	1310545
EOS4 1059 XS2	1310546
EOS4 1209 XS2	1310547
EOS4 1359 XS2	1310548
EOS4 1509 XS2	1310549
EOS4 2B XM	1310620
EOS4 3B XM	1310621
EOS4 4B XM	1310622
EOS4 2B XS	1310630
EOS4 3B XS	1310631
EOS4 4B XS	1310632
EOS4 2B XS2	1310640
EOS4 3B XS2	1310641
EOS4 4B XS2	1310642

EOS4 WTF / WTHF
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model	ordering code
EOS4 151 X WTF	1110030
EOS4 301 X WTF	1110031
EOS4 451 X WTF	1110032
EOS4 601 X WTF	1110033
EOS4 751 X WTF	1110034
EOS4 901 X WTF	1110035
EOS4 1051 X WTF	1110036
EOS4 1201 X WTF	1110037
EOS4 1351 X WTF	1110038
EOS4 1501 X WTF	1110039

EOS4 153 XH WTF	1110280
EOS4 303 XH WTF	1110281
EOS4 453 XH WTF	1110282
EOS4 603 XH WTF	1110283
EOS4 753 XH WTF	1110284
EOS4 903 XH WTF	1110285
EOS4 1053 XH WTF	1110286
EOS4 1203 XH WTF	1110287
EOS4 1353 XH WTF	1110288
EOS4 1503 XH WTF	1110289
EOS4 2B XH WTF	1110670
EOS4 3B XH WTF	1110671
EOS4 4B XH WTF	1110672
EOS4 151 X WTHF	1110040
EOS4 301 X WTHF	1110041
EOS4 451 X WTHF	1110042
EOS4 601 X WTHF	1110043
EOS4 751 X WTHF	1110044
EOS4 901 X WTHF	1110045
EOS4 1051 X WTHF	1110046
EOS4 1201 X WTHF	1110047
EOS4 1351 X WTHF	1110048
EOS4 1501 X WTHF	1110049
EOS4 153 XH WTHF	1110290
EOS4 303 XH WTHF	1110291
EOS4 453 XH WTHF	1110292
EOS4 603 XH WTHF	1110293
EOS4 753 XH WTHF	1110294
EOS4 903 XH WTHF	1110295
EOS4 1053 XH WTHF	1110296
EOS4 1203 XH WTHF	1110297
EOS4 1353 XH WTHF	1110298
EOS4 1503 XH WTHF	1110299
EOS4 2B XH WTHF	1110675
EOS4 3B XH WTHF	1110676
EOS4 4B XH WTHF	1110677

CONNECTORS FOR EOS
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model	ordering code
CD 5	1330950
CD 10	1330956
CD 15	1330952
CD 20	1330957
CD 25	1330949
CD 50	1330965
CD 95	1330951
CD 910	1330958
CD 915	1330953
CDM 9	1330954
CDM 99	1330955
C8D 5	1330980
C8D 10	1330981
C8D 15	1330982
C8D 25	1330967
C8D 40	1330966
C8D 95	1330983
C8D 910	1330984
C8D 915	1330985
C8DM 11	1330978
C8DM 911	1330979
CDS 03	1330990
CJBE 3	1360960
CJBE 5	1360961
CJBE 10	1360962
CJBE 25	1360963

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model	ordering code
AD 151	1330000
AD 301	1330001
AD 451	1330002
AD 601	1330003
AD 751	1330004

AD 901	1330005
AD 1051	1330006
AD 1201	1330007
AD 1351	1330008
AD 1501	1330009
AD 1651	1330010
AD 1801	1330011
AD 152	1330100
AD 302	1330101
AD 452	1330102
AD 602	1330103
AD 752	1330104
AD 902	1330105
AD 1052	1330106
AD 1202	1330107
AD 1352	1330108
AD 1502	1330109
AD 1652	1330110
AD 1802	1330111
AD 153	1330200
AD 303	1330201
AD 453	1330202
AD 603	1330203
AD 753	1330204
AD 903	1330205
AD 1053	1330206
AD 1203	1330207
AD 1353	1330208
AD 1503	1330209
AD 1653	1330210
AD 1803	1330211
AD 304	1330301
AD 454	1330302
AD 604	1330303
AD 754	1330304
AD 904	1330305
AD 1054	1330306
AD 1204	1330307
AD 1354	1330308

AD 1504	1330309
AD 1654	1330310
AD 1804	1330311
AD 305	1330401
AD 455	1330402
AD 605	1330403
AD 755	1330404
AD 905	1330405
AD 1055	1330406
AD 1205	1330407
AD 1355	1330408
AD 1505	1330409
AD 1655	1330410
AD 1805	1330411
AD 309	1330501
AD 459	1330502
AD 609	1330503
AD 759	1330504
AD 909	1330505
AD 1059	1330506
AD 1209	1330507
AD 1359	1330508
AD 1509	1330509
AD 1659	1330510
AD 1809	1330511
AD 2B	1330600
AD 3B	1330601
AD 4B	1330602

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model	ordering code
AX 151	1334000
AX 301	1334001
AX 451	1334002
AX 601	1334003
AX 751	1334004
AX 901	1334005

AX 1051	1334006
AX 1201	1334007
AX 1351	1334008
AX 1501	1334009
AX 1651	1334010
AX 1801	1334011
AX 152	1334100
AX 302	1334101
AX 452	1334102
AX 602	1334103
AX 752	1334104
AX 902	1334105
AX 1052	1334106
AX 1202	1334107
AX 1352	1334108
AX 1502	1334109
AX 1652	1334110
AX 1802	1334111
AX 153	1334200
AX 303	1334201
AX 453	1334202
AX 603	1334203
AX 753	1334204
AX 903	1334205
AX 1053	1334206
AX 1203	1334207
AX 1353	1334208
AX 1503	1334209
AX 1653	1334210
AX 1803	1334211
AX 304	1334301
AX 454	1334302
AX 604	1334303
AX 754	1334304
AX 904	1334305
AX 1054	1334306
AX 1204	1334307
AX 1354	1334308
AX 1504	1334309

AX 1654	1334310
AX 1804	1334311
AX 305	1334401
AX 455	1334402
AX 605	1334403
AX 755	1334404
AX 905	1334405
AX 1055	1334406
AX 1205	1334407
AX 1355	1334408
AX 1505	1334409
AX 1655	1334410
AX 1805	1334411
AX 309	1334501
AX 459	1334502
AX 609	1334503
AX 759	1334504
AX 909	1334505
AX 1059	1334506
AX 1209	1334507
AX 1359	1334508
AX 1509	1334509
AX 1659	1334510
AX 1809	1334511
AX 2B	1334600
AX 3B	1334601
AX 4B	1334602
AX 2B LR	1334603
AX 3B LR	1334604
AX 4B LR	1334605
AX 2B LR DB	1334606
AX 3B LR DB	1334607
AX 301M	1334021
AX 451M	1334022
AX 601M	1334023
AX 751M	1334024

AX 901M	1334025
AX 1051M	1334026
AX 1201M	1334027
AX 1501M	1334029
AX 151S	1334040
AX 301S	1334041
AX 451S	1334042
AX 601S	1334043
AX 751S	1334044
AX 901S	1334045
AX 1051S	1334046
AX 1201S	1334047
AX 1501S	1334049
AX 302M	1334121
AX 452M	1334122
AX 602M	1334123
AX 752M	1334124
AX 902M	1334125
AX 1052M	1334126
AX 1202M	1334127
AX 1502M	1334129
AX 152S	1334140
AX 302S	1334141
AX 452S	1334142
AX 602S	1334143
AX 752S	1334144
AX 902S	1334145
AX 1052S	1334146
AX 1202S	1334147
AX 1502S	1334149
AX 303M	1334221
AX 453M	1334222
AX 603M	1334223
AX 753M	1334224
AX 903M	1334225
AX 1053M	1334226
AX 1203M	1334227
AX 1503M	1334229

AX 153S	1334240
AX 303S	1334241
AX 453S	1334242
AX 603S	1334243
AX 753S	1334244
AX 903S	1334245
AX 1053S	1334246
AX 1203S	1334247
AX 1503S	1334249
AX 305M	1334421
AX 455M	1334422
AX 605M	1334423
AX 755M	1334424
AX 905M	1334425
AX 1055M	1334426
AX 1205M	1334427
AX 1505M	1334429
AX 305S	1334441
AX 455S	1334442
AX 605S	1334443
AX 755S	1334444
AX 905S	1334445
AX 1055S	1334446
AX 1205S	1334447
AX 1505S	1334449
AX 2BM	1334620
AX 3BM	1334621
AX 2BS	1334640
AX 3BS	1334641

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model	ordering code
AX 151BK	1334060
AX 301BK	1334061
AX 451BK	1334062

AX 601BK	1334063
AX 751BK	1334064
AX 901BK	1334065
AX 1051BK	1334066
AX 1201BK	1334067
AX 1351BK	1334068
AX 1501BK	1334069
AX 1651BK	1334070
AX 1801BK	1334071
AX 152BK	1334160
AX 302BK	1334161
AX 452BK	1334162
AX 602BK	1334163
AX 752BK	1334164
AX 902BK	1334165
AX 1052BK	1334166
AX 1202BK	1334167
AX 1352BK	1334168
AX 1502BK	1334169
AX 1652BK	1334170
AX 1802BK	1334171
AX 304BK	1334361
AX 454BK	1334362
AX 604BK	1334363
AX 754BK	1334364
AX 904BK	1334365
AX 1054BK	1334366
AX 1204BK	1334367
AX 1354BK	1334368
AX 1504BK	1334369
AX 1654BK	1334370
AX 1804BK	1334371
AX 609BK	1334563
AX 759BK	1334564
AX 909BK	1334565
AX 1059BK	1334566
AX 1209BK	1334567
AX 1359BK	1334568
AX 1509BK	1334569

AX 1659BK	1334570
AX 1809BK	1334571
AX 301BKM	1334081
AX 451BKM	1334082
AX 601BKM	1334083
AX 751BKM	1334084
AX 901BKM	1334085
AX 1051BKM	1334086
AX 1201BKM	1334087
AX 1501BKM	1334089
AX 302BKM	1334181
AX 452BKM	1334182
AX 602BKM	1334183
AX 752BKM	1334184
AX 902BKM	1334185
AX 1052BKM	1334186
AX 1202BKM	1334187
AX 1502BKM	1334189

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model	ordering code
AX 1653 WT	1134210
AX 1803 WT	1134211
AX 2B LR WT	1134603
AX 3B LR WT	1134604
AX 4B LR WT	1134605
AX 1653 WTH	1139210
AX 1803 WTH	1139211
AX 2B LR WTH	1139603
AX 3B LR WTH	1139604
AX 4B LR WTH	1139605
AX 2B LR DB WTH	1139606
AX 3B LR DB WTH	1139607

CONNECTORS FOR ADMIRAL page 77	
model	ordering code
CD 5	1330950
CD 10	1330956
CD 15	1330952
CD 20	1330957
CD 25	1330949
CD 50	1330965
CD 95	1330951
CD 910	1330958
CD 915	1330953
CDM 9	1330954
CDM 99	1330955
C8D 5	1330980
C8D 10	1330981
C8D 15	1330982
C8D 25	1330967
C8D 40	1330966
C8D 95	1330983
C8D 910	1330984
C8D 915	1330985
C8DM 11	1330978
C8DM 911	1330979
CDS 03	1330990
CJBE 3	1360960
CJBE 5	1360961
CJBE 10	1360962
CJBE 25	1360963
JANUS M page 82	
model	ordering code
MI 2B	1360660
MI 3B	1360661
MI 4B	1360662
MI 2B LR	1360670
MI 3B LR	1360671
MI 4B LR	1360672
MI 2B TRX	1360680
MI 2B TRXL	1360681
MI 3B TRX	1360682
MI 3B TRXL	1360683
MI 4B TRX	1360684
MI 4B TRXL	1360685
MI 303	1360241
MI 453	1360242
MI 603	1360243
MI 753	1360244
MI 903	1360245
MI 1053	1360246
MI 1203	1360247
MI 304	1360375
MI 454	1360376
MI 604	1360377
MI 754	1360378
MI 904	1360379
MI 1054	1360380
MI 1204	1360381
MI 1354	1360382
MI 1504	1360383
MI 1654	1360384
MI 1804	1360385
MI 604 LR	1360388
MI 904 LR	1360390
MI 1204 LR	1360392
MI 309	1360541
MI 459	1360542
MI 609	1360543
MI 759	1360544
MI 909	1360545
MI 1059	1360546
MI 1209	1360547
MI 1359	1360548
MI 1509	1360549
MI 1659	1360550
MI 1809	1360551
ML 2B	1360020
ML 3B	1360021
ML 2B S2	1360024
ML 3B S2	1360025
ML 2B TRX	1360040
ML 3B TRX	1360041
ML 2B TRX G	1360042
ML 3B TRX G	1360043
ML 2B TRX V	1360044
ML 3B TRX V	1360045
MT 2B	1360030
MT 3B	1360031
MT 2B H	1360032
MT 3B H	1360033
MT 2B S4	1360034
MT 3B S4	1360035
MT 2B TRX	1360050
MT 3B TRX	1360051
MT 2B TRX G	1360052
MT 3B TRX G	1360053
MT 2B TRX V	1360054
MT 3B TRX V	1360055
MM 2B TRX	1360690
MM 3B TRX	1360691
MM 4B TRX	1360692
JANUS J page 94	
model	ordering code
J 2B	1360640
J 3B	1360641
J 4B	1360642
J 2B LR	1360630
J 3B LR	1360631
J 4B LR	1360632
J 2B LRH M12	1360637
J 3B LRH M12	1360638
J 4B LRH M12	1360639
J 2B LRH M12 ILP	1360646
J 3B LRH M12 ILP	1360647
J 4B LRH M12 ILP	1360648
J 604 LR	1360363
J 904 LR	1360365
J 1204 LR	1360367
J 2 TRX	1360650
J 3B TRX	1360656
J 4B TRX	1360655
J 2B TRXL	1360651
J 3B TRXL	1360652
J 4B TRXL	1360653
ACCESSORIES FOR JANUS Page 98	
model	ordering code
MJB 1	1360930
MJB 2	1360931
MJB 3	1360932
MJB 4	1360933
SL	1360060
S2L	1360061
SL TRX	1360965
ST TRX	1360966
CONNECTORS FOR JANUS page 106	
model	ordering code
CJ 3	1360950
CJ 5	1360951

CJ 10	1360952
CJ 15	1360953
CJ 20	1360954
CJ 20L2	1360959
CJ 30	1360964
CJ 30L2	1360979
CJ M23	1360955
CD 5	1330950
CD 10	1330956
CD 15	1330952
CD 20	1330957
CD 25	1330949
CD 50	1330965
CDM 9	1330954
CJBR 3	1360970
CJBR 5	1360971
CJBR 10	1360972
CJBE 3	1360960
CJBE 5	1360961
CJBE 10	1360962
CJBE 25	1360963
CJ M9	1360982
CJ 95	1360983

CONNECTORS FOR JANUS J TRX page 106	
model	ordering code
C8D 5	1330980
C8D 10	1330981
C8D 15	1330982
C8D 25	1330967
C8D 40	1330966
C8D 95	1330983
C8D 910	1330984
C8D 915	1330985
C8DM 11	1330978
C8DM 911	1330979

PHARO page 110	
model	ordering code
PHR 332	1350041
PHR C3L5	1350061
PHR CSL2	1350070
PHR B3	1350050
PHR B4	1350051
PHR B5	1350052

EOS2 A page 118	
model	ordering code
EOS2 153 A	1320200
EOS2 303 A	1320201
EOS2 453 A	1320202
EOS2 603 A	1320203
EOS2 753 A	1320204
EOS2 903 A	1320205
EOS2 1053 A	1320206
EOS2 1203 A	1320207
EOS2 1353 A	1320208
EOS2 1503 A	1320209
EOS2 154 A	1320300
EOS2 304 A	1320301
EOS2 454 A	1320302
EOS2 604 A	1320303
EOS2 754 A	1320304
EOS2 904 A	1320305
EOS2 1054 A	1320306
EOS2 1204 A	1320307
EOS2 1354 A	1320308
EOS2 1504 A	1320309
EOS2 155 A	1320400
EOS2 305 A	1320401
EOS2 455 A	1320402
EOS2 605 A	1320403
EOS2 755 A	1320404
EOS2 905 A	1320405
EOS2 1055 A	1320406
EOS2 1205 A	1320407
EOS2 1355 A	1320408
EOS2 1505 A	1320409
EOS2 309 A	1320501
EOS2 459 A	1320502
EOS2 609 A	1320503
EOS2 759 A	1320504
EOS2 909 A	1320505
EOS2 1059 A	1320506
EOS2 1209 A	1320507
EOS2 1359 A	1320508
EOS2 1509 A	1320509
EOS2 2B A	1320600
EOS2 3B A	1320601
EOS2 4B A	1320602

EOS2 X page 120	
model	ordering code
EOS2 153 X	1320210
EOS2 303 X	1320211
EOS2 453 X	1320212
EOS2 603 X	1320213
EOS2 753 X	1320214
EOS2 903 X	1320215
EOS2 1053 X	1320216
EOS2 1203 X	1320217
EOS2 1353 X	1320218
EOS2 1503 X	1320219
EOS2 154 X	1320310
EOS2 304 X	1320311
EOS2 454 X	1320312
EOS2 604 X	1320313
EOS2 754 X	1320314
EOS2 904 X	1320315
EOS2 1054 X	1320316
EOS2 1204 X	1320317
EOS2 1354 X	1320318
EOS2 1504 X	1320319
EOS2 155 X	1320410
EOS2 305 X	1320411
EOS2 455 X	1320412
EOS2 605 X	1320413
EOS2 755 X	1320414
EOS2 905 X	1320415
EOS2 1055 X	1320416
EOS2 1205 X	1320417
EOS2 1355 X	1320418
EOS2 1505 X	1320419
EOS2 309 X	1320511
EOS2 459 X	1320512
EOS2 609 X	1320513
EOS2 759 X	1320514
EOS2 909 X	1320515
EOS2 1059 X	1320516
EOS2 1209 X	1320517
EOS2 1359 X	1320518
EOS2 1509 X	1320519
EOS2 2B X	1320610
EOS2 3B X	1320611
EOS2 4B X	1320612
EOS2 303 XM	1320221
EOS2 453 XM	1320222
EOS2 603 XM	1320223
EOS2 753 XM	1320224
EOS2 903 XM	1320225
EOS2 1053 XM	1320226
EOS2 1203 XM	1320227
EOS2 1353 XM	1320228
EOS2 1503 XM	1320229
EOS2 153 XS	1320230

EOS2 303 XS	1320231
EOS2 453 XS	1320232
EOS2 603 XS	1320233
EOS2 753 XS	1320234
EOS2 903 XS	1320235
EOS2 1053 XS	1320236
EOS2 1203 XS	1320237
EOS2 1353 XS	1320238
EOS2 1503 XS	1320239
EOS2 303 XS2	1320241
EOS2 453 XS2	1320242
EOS2 603 XS2	1320243
EOS2 753 XS2	1320244
EOS2 903 XS2	1320245
EOS2 1053 XS2	1320246
EOS2 1203 XS2	1320247
EOS2 1353 XS2	1320248
EOS2 1503 XS2	1320249
EOS2 304 XM	1320321
EOS2 454 XM	1320322
EOS2 604 XM	1320323
EOS2 754 XM	1320324
EOS2 904 XM	1320325
EOS2 1054 XM	1320326
EOS2 1204 XM	1320327
EOS2 1354 XM	1320328
EOS2 1504 XM	1320329
EOS2 154 XS	1320330
EOS2 304 XS	1320331
EOS2 454 XS	1320332
EOS2 604 XS	1320333
EOS2 754 XS	1320334
EOS2 904 XS	1320335
EOS2 1054 XS	1320336
EOS2 1204 XS	1320337
EOS2 1354 XS	1320338
EOS2 1504 XS	1320339
EOS2 304 XS2	1320341

EOS2 454 XS2	1320342
EOS2 604 XS2	1320343
EOS2 754 XS2	1320344
EOS2 904 XS2	1320345
EOS2 1054 XS2	1320346
EOS2 1204 XS2	1320347
EOS2 1354 XS2	1320348
EOS2 1504 XS2	1320349
EOS2 305 XM	1320421
EOS2 455 XM	1320422
EOS2 605 XM	1320423
EOS2 755 XM	1320424
EOS2 905 XM	1320425
EOS2 1055 XM	1320426
EOS2 1205 XM	1320427
EOS2 1355 XM	1320428
EOS2 1505 XM	1320429
EOS2 155 XS	1320430
EOS2 305 XS	1320431
EOS2 455 XS	1320432
EOS2 605 XS	1320433
EOS2 755 XS	1320434
EOS2 905 XS	1320435
EOS2 1055 XS	1320436
EOS2 1205 XS	1320437
EOS2 1355 XS	1320438
EOS2 1505 XS	1320439
EOS2 305 XS2	1320441
EOS2 455 XS2	1320442
EOS2 605 XS2	1320443
EOS2 755 XS2	1320444
EOS2 905 XS2	1320445
EOS2 1055 XS2	1320446
EOS2 1205 XS2	1320447
EOS2 1355 XS2	1320448
EOS2 1505 XS2	1320449
EOS2 309 XM	1320521
EOS2 459 XM	1320522

EOS2 609 XM	1320523
EOS2 759 XM	1320524
EOS2 909 XM	1320525
EOS2 1059 XM	1320526
EOS2 1209 XM	1320527
EOS2 1359 XM	1320528
EOS2 1509 XM	1320529
EOS2 309 XS	1320531
EOS2 459 XS	1320532
EOS2 609 XS	1320533
EOS2 759 XS	1320534
EOS2 909 XS	1320535
EOS2 1059 XS	1320536
EOS2 1209 XS	1320537
EOS2 1359 XS	1320538
EOS2 1509 XS	1320539
EOS2 309 XS2	1320541
EOS2 459 XS2	1320542
EOS2 609 XS2	1320543
EOS2 759 XS2	1320544
EOS2 909 XS2	1320545
EOS2 1059 XS2	1320546
EOS2 1209 XS2	1320547
EOS2 1359 XS2	1320548
EOS2 1509 XS2	1320549
EOS2 2B XM	1320620
EOS2 3B XM	1320621
EOS2 4B XM	1320622
EOS2 2B XS	1320630
EOS2 3B XS	1320631
EOS2 4B XS	1320632
EOS2 2B XS2	1320640
EOS2 3B XS2	1320641
EOS2 4B XS2	1320642

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model	ordering code
EOS2 153 X WTF	1120230
EOS2 303 X WTF	1120231
EOS2 453 X WTF	1120232
EOS2 603 X WTF	1120233
EOS2 753 X WTF	1120234
EOS2 903 X WTF	1120235
EOS2 1053 X WTF	1120236
EOS2 1203 X WTF	1120237
EOS2 1353 X WTF	1120238
EOS2 1503 X WTF	1120239
EOS2 2B X WTF	1120620
EOS2 3B X WTF	1120621
EOS2 4B X WTF	1120622
EOS2 153 X WTHF	1120240
EOS2 303 X WTHF	1120241
EOS2 453 X WTHF	1120242
EOS2 603 X WTHF	1120243
EOS2 753 X WTHF	1120244
EOS2 903 X WTHF	1120245
EOS2 1053 X WTHF	1120246
EOS2 1203 X WTHF	1120247
EOS2 1353 X WTHF	1120248
EOS2 1503 X WTHF	1120249
EOS2 2B X WTHF	1120625
EOS2 3B X WTHF	1120626
EOS2 4B X WTHF	1120627

CONNECTORS FOR EOS2
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model	ordering code
CD 5	1330950
CD 10	1330956
CD 15	1330952
CD 20	1330957

CD 25	1330949
CD 50	1330965
CD 95	1330951
CD 910	1330958
CD 915	1330953
CDM 9	1330954
CDM 99	1330955
C8D 5	1330980
C8D 10	1330981
C8D 15	1330982
C8D 25	1330967
C8D40	1330966
C8D 95	1330983
C8D 910	1330984
C8D 915	1330985
C8DM 11	1330978
C8DM 911	1330979
CDS 03	1330990
CJBE 3	1360960
CJBE 5	1360961
CJBE 10	1360962
CJBE 25	1360963
VISION V page 130	
model	ordering code
V 152L	1340100
V 302L	1340101
V 452L	1340102
V 602L	1340103
V 752L	1340104
V 902L	1340105
V 1052L	1340106
V 1202L	1340107
V 1352L	1340108
V 1502L	1340109
V 1652L	1340110
V 1802L	1340111

V 152H	1340120
V 302H	1340121
V 452H	1340122
V 602H	1340123
V 752H	1340124
V 902L	1340125
V 1052H	1340126
V 1202H	1340127
V 1352H	1340128
V 1502H	1340129
V 1652H	1340130
V 1802H	1340131
V 153L	1340200
V 303L	1340201
V 453L	1340202
V 603L	1340203
V 753L	1340204
V 903L	1340205
V 1053L	1340206
V 1203L	1340207
V 1353L	1340208
V 1503L	1340209
V 1653L	1340210
V 1803L	1340211
V 153H	1340220
V 303H	1340221
V 453H	1340222
V 603H	1340223
V 753H	1340224
V 903L	1340225
V 1053H	1340226
V 1203H	1340227
V 1353H	1340228
V 1503H	1340229
V 1653H	1340230
V 1803H	1340231
V 304L	1340301
V 454L	1340302
V 604L	1340303

V 754L	1340304
V 904L	1340305
V 1054L	1340306
V 1204L	1340307
V 1354L	1340308
V 1504L	1340309
V 1654L	1340310
V 1804L	1340311
V 304H	1340321
V 454H	1340322
V 604H	1340323
V 754H	1340324
V 904H	1340325
V 1054H	1340326
V 1204H	1340327
V 1354H	1340328
V 1504H	1340329
V 1654H	1340330
V 1804H	1340331
V 305L	1340401
V 455L	1340402
V 605L	1340403
V 755L	1340404
V 905L	1340405
V 1055L	1340406
V 1205L	1340407
V 1355L	1340408
V 1505L	1340409
V 1655L	1340410
V 1805L	1340411
V 305H	1340421
V 455H	1340422
V 605H	1340423
V 755H	1340424
V 905H	1340425
V 1055H	1340426
V 1205H	1340427
V 1355H	1340428
V 1505H	1340429

V 1655H	1340430
V 1805H	1340431
V 309L	1340501
V 459L	1340502
V 609L	1340503
V 759L	1340504
V 909L	1340505
V 1059L	1340506
V 1209L	1340507
V 1359L	1340508
V 1509L	1340509
V 1659L	1340510
V 1809L	1340511
V 309H	1340521
V 459H	1340522
V 609H	1340523
V 759H	1340524
V 909H	1340525
V 1059H	1340526
V 1209H	1340527
V 1359H	1340528
V 1509H	1340529
V 1659H	1340530
V 1809H	1340531
V 2BL	1340600
V 3BL	1340601
V 4BL	1340602
V 2BH	1340610
V 3BH	1340611
V 4BH	1340612
VISION VX page 132	
model	ordering code
VX 152	1344100
VX 302	1344101
VX 452	1344102
VX 602	1344103

VX 752	1344104
VX 902	1344105
VX 1052	1344106
VX 1202	1344107
VX 1352	1344108
VX 1502	1344109
VX 1652	1344110
VX 1802	1344111
VX 153	1344200
VX 303	1344201
VX 453	1344202
VX 603	1344203
VX 753	1344204
VX 903	1344205
VX 1053	1344206
VX 1203	1344207
VX 1353	1344208
VX 1503	1344209
VX 1653	1344210
VX 1803	1344211
VX 304	1344301
VX 454	1344302
VX 604	1344303
VX 754	1344304
VX 904	1344305
VX 1054	1344306
VX 1204	1344307
VX 1354	1344308
VX 1504	1344309
VX 1654	1344310
VX 1804	1344311
VX 305	1344401
VX 455	1344402
VX 605	1344403
VX 755	1344404
VX 905	1344405
VX 1055	1344406
VX 1205	1344407
AX 1355	1344408

VX 1505	1344409
VX 1655	1344410
VX 1805	1344411
VX 309	1344501
VX 459	1344502
VX 609	1344503
VX 759	1344504
VX 909	1344505
VX 1059	1344506
VX 1209	1344507
VX 1359	1344508
VX 1509	1344509
VX 1659	1344510
VX 1809	1344511
VX 2B	1344600
VX 3B	1344601
VX 4B	1344602
VX 2B LR	1344603
VX 3B LR	1344604
VX 4B LR	1344605
VX 153M	1344220
VX 303M	1344221
VX 453M	1344222
VX 603M	1344223
VX 753M	1344224
VX 903M	1344225
VX 1053M	1344226
VX 1203M	1344227
VX 1503M	1344229
VX 153S	1344240
VX 303S	1344241
VX 453S	1344242
VX 603S	1344243
VX 753S	1344244
VX 903S	1344245
VX 1053S	1344246
VX 1203S	1344247
VX 1503S	1344249

VX 304M	1344321
VX 454M	1344322
VX 604M	1344323
VX 754M	1344324
VX 904M	1344325
VX 1054M	1344326
VX 1204M	1344327
VX 1504M	1344329
VX 304S	1344341
VX 454S	1344342
VX 604S	1344343
VX 754S	1344344
VX 904S	1344345
VX 1054S	1344346
VX 1204S	1344347
VX 1504S	1344349
VX 305M	1344421
VX 455M	1344422
VX 605M	1344423
VX 755M	1344424
VX 905M	1344425
VX 1055M	1344426
VX 1205M	1344427
VX 1505M	1344429
VX 305S	1344441
VX 455S	1344442
VX 605S	1344443
VX 755S	1344444
VX 905S	1344445
VX 1055S	1344446
VX 1205S	1344447
VX 1505S	1344449
VX 2BM	1344620
VX 3BM	1344621
VX 2BS	1344640
VX 3BS	1344641

VISION VXL
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model	ordering code
VXL 153	1344700
VXL 303	1344701
VXL 453	1344702
VXL 603	1344703
VXL 753	1344704
VXL 903	1344705
VXL 1053	1344706
VXL 1203	1344707
VXL 304	1344711
VXL 454	1344712
VXL 604	1344713
VXL 754	1344714
VXL 904	1344715
VXL 1054	1344716
VXL 1204	1344717
VXL 1354	1344723
VXL 1504	1344719
VXL 1654	1344724
VXL 1804	1344725
VXL 2B	1344720
VXL 3B	1344721
VXL 4B	1344722

VISION VX WT / WTH
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model	ordering code
VX 1653 WT	1244210
VX 1803 WT	1244211
VX 2B LR WT	1244603
VX 3B LR WT	1244604
VX 4B LR WT	1244605
VX 1653 WTH	1249210
VX 1803 WTH	1249211

VX 2B LR WTH	1249603
VX 3B LR WTH	1249604
VX 4B LR WTH	1249605
VISION MXL page 140	
model	ordering code
MXL 153	1344800
MXL 303	1344801
MXL 453	1344802
MXL 603	1344803
MXL 753	1344804
MXL 903	1344805
MXL 1053	1344806
MXL 1203	1344807
MXL 304	1344811
MXL 454	1344812
MXL 604	1344813
MXL 754	1344814
MXL 904	1344815
MXL 1054	1344816
MXL 1204	1344817
MXL 1354	1344823
MXL 1504	1344819
MXL 1654	1344824
MXL 1804	1344825
MXL 2B	1344820
MXL 3B	1344821
MXL 4B	1344822
MXL U 153	1344850
MXL U 303	1344851
MXL U 453	1344852
MXL U 603	1344853
MXL U 753	1344854
MXL U 903	1344855
MXL U 1053	1344856
MXL U 1203	1344857

MXL U 304	1344861
MXL U 454	1344862
MXL U 604	1344863
MXL U 754	1344864
MXL U 904	1344865
MXL U 1054	1344866
MXL U 1204	1344867
MXL U 1354	1344868
MXL U 1504	1344869
MXL U 1654	1344870
MXL U 1804	1344871
MXL U 2B	1344880
MXL U 3B	1344881
MXL U 4B	1344882
MXL L2B	1344830
MXL L3B	1344831
MXL T2B	1344840
MXL T3B	1344841
ACCESSORIES FOR VISION MXL page 148	
model	ordering code
MXJB 1	1360934
MXJB 3	1360935
CONNECTORS FOR VISION page 148	
model	ordering code
CD 5	1330950
CD 10	1330956
CD 15	1330952
CD 20	1330957
CD 25	1330949
CD 50	1330965
CD 95	1330951
CD 910	1330958
CD 915	1330953

CDM 9	1330954
CDM 99	1330955
C8D 5	1330980
C8D 10	1330981
C8D 15	1330982
C8D 25	1330967
C8D 40	1330966
C8D 95	1330983
C8D 910	1330984
C8D 915	1330985
C8DM 9	1330986
C8DM 99	1330987
C8DM 11	1330978
C8DM 911	1330979
C12D 3	1330991
C12D 5	1330992
C12D 10	1330993
C12D 15	1330996
C12D 25	1330948
CM 16	1330997
CMBR 3	1360975
CMBR 5	1360976
CMBR 5A	1360978
CMBR 10	1360977
CDS 03	1330990
CJBE 3	1360960
CJBE 5	1360961
CJBE 10	1360962
CJBE 25	1360963
ILION page 154	
model	ordering code
IL 10	1200201
IL 20	1200202
IL FB	1200090

CONNECTORS FOR ILION page 155	
model	ordering code
CD 5	1330950
CD 10	1330956
CD 15	1330952
CD 20	1330957
CD 25	1330949
CD 50	1330965
CD 95	1330951
CD 910	1330958
CD 915	1330953
CDM 9	1330954
CDM 99	1330955
ULISSE page 156	
model	ordering code
UPC	1200300
CONNECTORS FOR ULISSE page 157	
model	ordering code
C 85	1200217
C 815	1200219
C 895	1200216
MAGNUS page 160	
model	ordering code
MG S 20	1291000
MG S M	1291001
MG B 20	1291010
MG B M	1291011
MG B M+	1291012
MG M 20	1291020
MG M M	1291021
MG M M+	1291022

CONNECTORS FOR MAGNUS page 163	
model	ordering code
C8 G3	1291070
C8 G93	1291071
C8 G5	1291072
C8 G95	1291073

MOSAIC page 177	
model	ordering code
M1	1100000
MI8O2	1100010
MI8	1100020
MI16	1100021
MI12T8	1100022
MO2	1100030
MO4	1100031
MR2	1100040
MR4	1100041
MBP	1100050
MBD	1100051
MBC	1100052
MBEC	1100053
MBEI	1100054
MBEP	1100055
MBU	1100056
MCM	1100060
MSC	1100061
CSU	1100062

SAFETY INTERFACES page 180	
model	ordering code
AD SR1	1330900
AD SRM	1330904
AD SR0	1330902
AD SR0A	1330903

AU SX	1201710
AU SXM	1201711
AD SRT	1330915
AD SRE4	1330913
AD SRE4C	1330914
AD SRE3	1330911
AD SRE3C	1330912
MG d1	1291050

METRON page 196	
model	ordering code
ME 150 A	1380500
ME 300 A	1380501
ME 450 A	1380502
ME 600 A	1380503
ME 750 A	1380504
ME 900 A	1380505
ME 1050 A	1380506
ME 1200 A	1380507
ME 150 B	1380520
ME 300 B	1380521
ME 450 B	1380522
ME 600 B	1380523
ME 750 B	1380524
ME 900 B	1380525
ME 1050 B	1380526
ME 1200 B	1380527
ME 150 C	1380540
ME 300 C	1380541
ME 450 C	1380542
ME 600 C	1380543
ME 750 C	1380544
ME 900 C	1380545
ME 1050 C	1380546
ME 1200 C	1380547

ME 151 A	1380000
ME 301 A	1380001
ME 451 A	1380002
ME 601 A	1380003
ME 751 A	1380004
ME 901 A	1380005
ME 1051 A	1380006
ME 1201 A	1380007
ME 1351 A	1380008
ME 1501 A	1380009
ME 1651 A	1380010
ME 1801 A	1380011
ME 1951 A	1380012
ME 2101 A	1380013
ME 2251 A	1380014
ME 2401 A	1380015
ME 151 B	1380020
ME 301 B	1380021
ME 451 B	1380022
ME 601 B	1380023
ME 751 B	1380024
ME 901 B	1380025
ME 1051 B	1380026
ME 1201 B	1380027
ME 1351 B	1380028
ME 1501 B	1380029
ME 1651 B	1380030
ME 1801 B	1380031
ME 1951 B	1380032
ME 2101 B	1380033
ME 2251 B	1380034
ME 2401 B	1380035
ME 151 C	1380040
ME 301 C	1380041
ME 451 C	1380042
ME 601 C	1380043
ME 751 C	1380044
ME 901 C	1380045
ME 1051 C	1380046
ME 1201 C	1380047

ME 1351 C	1380048
ME 1501 C	1380049
ME 1651 C	1380050
ME 1801 C	1380051
ME 1951 C	1380052
ME 2101 C	1380053
ME 2251 C	1380054
ME 2401 C	1380055
ME 302 A	1380101
ME 452 A	1380102
ME 602 A	1380103
ME 752 A	1380104
ME 902 A	1380105
ME 1052 A	1380106
ME 1202 A	1380107
ME 1352 A	1380108
ME 1502 A	1380109
ME 1652 A	1380110
ME 1802 A	1380111
ME 1952 A	1380112
ME 2102 A	1380113
ME 2252 A	1380114
ME 2402 A	1380115
ME 2552 A	1380116
ME 302 B	1380121
ME 452 B	1380122
ME 602 B	1380123
ME 752 B	1380124
ME 902 B	1380125
ME 1052 B	1380126
ME 1202 B	1380127
ME 1352 B	1380128
ME 1502 B	1380129
ME 1652 B	1380130
ME 1802 B	1380131
ME 1952 B	1380132
ME 2102 B	1380133
ME 2252 B	1380134
ME 2402 B	1380135
ME 2552B	1380136

ME 302 C	1380141
ME 452 C	1380142
ME 602 C	1380143
ME 752 C	1380144
ME 902 C	1380145
ME 1052 C	1380146
ME 1202 C	1380147
ME 1352 C	1380148
ME 1502 C	1380149
ME 1652 C	1380150
ME 1802 C	1380151
ME 1952 C	1380152
ME 2102 C	1380153
ME 2252 C	1380154
ME 2402 C	1380155
ME 2552 C	1380156
ME 303 A	1380201
ME 453 A	1380202
ME 603 A	1380203
ME 753 A	1380204
ME 903 A	1380205
ME 1053 A	1380106
ME 1203 A	1380207
ME 1353 A	1380108
ME 1503 A	1380209
ME 1653 A	1380210
ME 1803 A	1380211
ME 1953 A	1380212
ME 2103 A	1380213
ME 2253 A	1380214
ME 2403 A	1380215
ME 2553 A	1380216
ME 303 B	1380221
ME 453 B	1380222
ME 603 B	1380223
ME 753 B	1380224
ME 903 B	1380225
ME 1053 B	1380226
ME 1203 B	1380227
ME 1353 B	1380228

ME 1503 B	1380229
ME 1653 B	1380230
ME 1803 B	1380231
ME 1953 B	1380232
ME 2103 B	1380233
ME 2253 B	1380234
ME 2403 B	1380235
ME 2553 B	1380236
ME 303 C	1380241
ME 453 C	1380242
ME 603 C	1380243
ME 753 C	1380244
ME 903 C	1380245
ME 1053 C	1380246
ME 1203 C	1380247
ME 1353 C	1380248
ME 1503 C	1380249
ME 1653 C	1380250
ME 1803 C	1380251
ME 1953 C	1380252
ME 2103 C	1380253
ME 2253 C	1380254
ME 2403 C	1380255
ME 2553 C	1380256
ME 455 A	1380302
ME 605 A	1380303
ME 755 A	1380304
ME 905 A	1380305
ME 1055 A	1380306
ME 1205 A	1380307
ME 1355 A	1380308
ME 1505 A	1380309
ME 1655 A	1380310
ME 1805 A	1380311
ME 1955 A	1380312
ME 2105 A	1380313
ME 2255 A	1380314
ME 2405 A	1380315
ME 2555 A	1380316

ME 455 B	1380322
ME 605 B	1380323
ME 755 B	1380324
ME 905 B	1380325
ME 1055 B	1380326
ME 1205 B	1380327
ME 1355 B	1380328
ME 1505 B	1380329
ME 1655 B	1380330
ME 1805 B	1380331
ME 1955 B	1380332
ME 2105 B	1380333
ME 2255 B	1380334
ME 2405 B	1380335
ME 2555 B	1380336
ME 455 C	1380342
ME 605 C	1380343
ME 755 C	1380344
ME 905 C	1380345
ME 1055 C	1380346
ME 1205 C	1380347
ME 1355 C	1380348
ME 1505 C	1380349
ME 1655 C	1380350
ME 1805 C	1380351
ME 1955 C	1380352
ME 2105 C	1380353
ME 2255 C	1380354
ME 2405 C	1380355
ME 2555 C	1380356
ME 607 A	1380403
ME 757 A	1380404
ME 907 A	1380405
ME 1057 A	1380406
ME 1207 A	1380407
ME 1357 A	1380408
ME 1505 A	1380409
ME 1657 A	1380410
ME 1807 A	1380411
ME 1957 A	1380412

ME 2107 A	1380413
ME 2257 A	1380414
ME 2407 A	1380415
ME 2557 A	1380416
ME 607 B	1380423
ME 757 B	1380424
ME 907 B	1380425
ME 1057 B	1380426
ME 1207 B	1380427
ME 1357 B	1380428
ME 1505 B	1380429
ME 1657 B	1380430
ME 1807 B	1380431
ME 1957 B	1380432
ME 2107 B	1380433
ME 2257 B	1380434
ME 2407 B	1380435
ME 2557 B	1380436
ME 607 C	1380443
ME 757 C	1380444
ME 907 C	1380445
ME 1057 C	1380446
ME 1207 C	1380447
ME 1357 C	1380448
ME 1507 C	1380449
ME 1657 C	1380450
ME 1807 C	1380451
ME 1957 C	1380452
ME 2107 C	1380453
ME 2257 C	1380454
ME 2407 C	1380455
ME 2557 C	1380456

CONNECTORS FOR METRON
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model	ordering code
C8D 5	1330980
C8D 10	1330981
C8D 15	1330982

C8D25	1330967
C8D40	1330966
C8D 95	1330983
C8D 910	1330984
C8D 915	1330985
C8D 9	1330986
C8D 99	1330987
C8DM 11	1330978
C8DM 911	1330979
C12D 3	1330991
C12D 5	1330992
C12D 10	1330993
C12D 15	1330996
C12D 25	1330948
CSL 3	1330994
CD 5	1330950
CD 10	1330956
CD 15	1330952
CD 20	1330957
CD 25	1330949
CD50	1330965
CD 95	1330951
CD 910	1330958
CD 915	1330953
CDM 9	1330954
CDM 99	1330955

ACCESSORIES FMC
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model	ordering code
FMC-CB	1200500
FMC-CBL	1200501
FMC-B2	1200610
FMC-B3	1200611
FMC-B4	1200612
FMC-B1700	1200618
FMC-B2000	1200616
FMC-EB2	1207814
FMC-EB4	1207815
FMC-EB1700	1207816
FMC-EB2000	1207817
FMC-B2R	1200613
FMC-B3R	1200614
FMC-B4R	1200615
FMC-B1700R	1200617
FMC-B2000R	1200619
FMC-EB2R	1207824
FMC-EB4R	1207825
FMC-EB1700R	1207826
FMC-EB2000R	1207827
FMC-B12	1200502
FMC-S2	1200620
FMC-S3	1200621
FMC-S4	1200622
FMC-S1700	1200625
FMC-S2000	1200623
FMC-SB2	1200645
FMC-SB3	1200646
FMC-SB4	1200647

ACCESSORIES SP
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model	ordering code
SP 100 S	1201805
SP 300 S	1201806
SP 400 S	1201801
SP 600 S	1201811
SP 700 S	1201802
SP 900 S	1201812
SP 1100 S	1201803
SP 1200 S	1201810
SP 1300 S	1201807
SP 1500 S	1201808
SP 1600 S	1201813
SP 1800 S	1201809

ACCESSORIES LAD
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model	ordering code
LAD 2	1220301
LAD 3	1220302
LAD 4	1310975

ACCESSORIES SAV
page 209

model	ordering code
SAV-1	1200084
SAV-2	1200085
SAV-3	1200088
SAV-4	1200089
SAV 4E	1310972
SAV 8E	1310973
SAV 12E	1310974

ACCESSORIES PSE
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model	ordering code
SFS E	1310981
PSE 150	1310982
PSE 300	1310983
PSE 450	1310984
PSE 600	1310985
PSE 750	1310986
PSE 900	1310987
PSE 1050	1310988
PSE 1200	1310989
PSE 1350	1310990
PSE 1500	1310991

ACCESSORIES SFB
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model	ordering code
SFB	1330974
SFB 4E	1310976
SFB 6E	1310977
SFB E180	1310980

ACCESSORIES TEST ROD
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model	ordering code
TR 14	1330960
TR 20	1330961
TR 30	1330962
TR 40	1330963
TR 50	1330964

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