

**CARLO GAVAZZI**  
Automation Components



## *Technology for Safety*

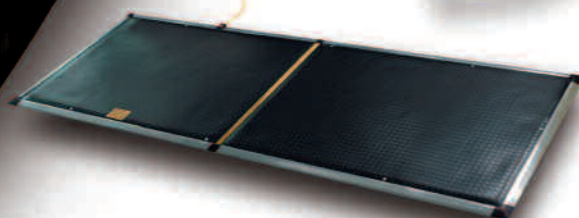
*Safety Light Curtains*

*Safety Mats*

*Safety Modules*

*Safety Bus*

*Safety Switches and Accessories*



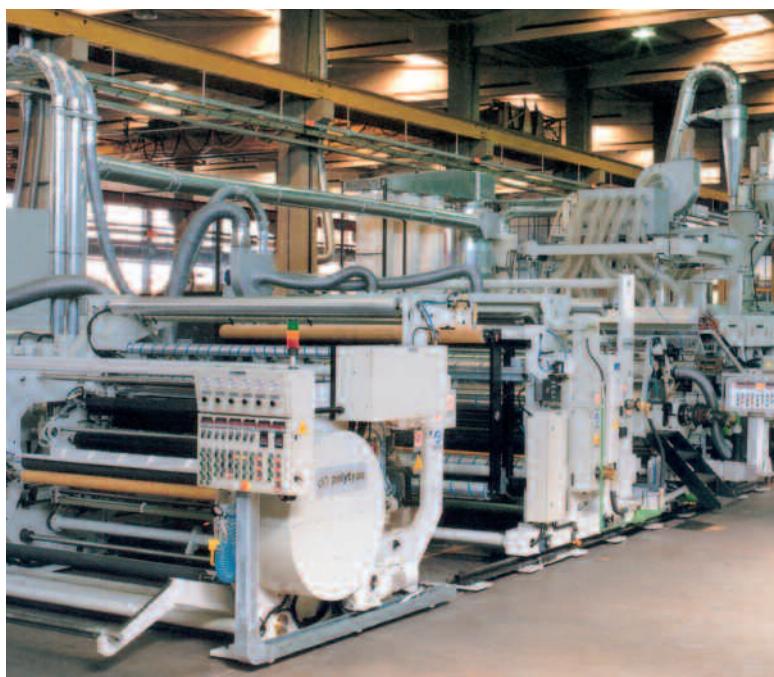
**Safety**





## *Safety in Automation*

In the industrial automation division, safety is a real philosophy in machine development, not just a generic concept to make sure that operators and all the people around the machine are safe. The milestones about safety are the European Directives and especially the Machinery Directive (EMD 98/37/CE). Including safety devices in any new project, while developing a new machine, is therefore key to reduce risks.



## *Providing Solutions for Your Safety*

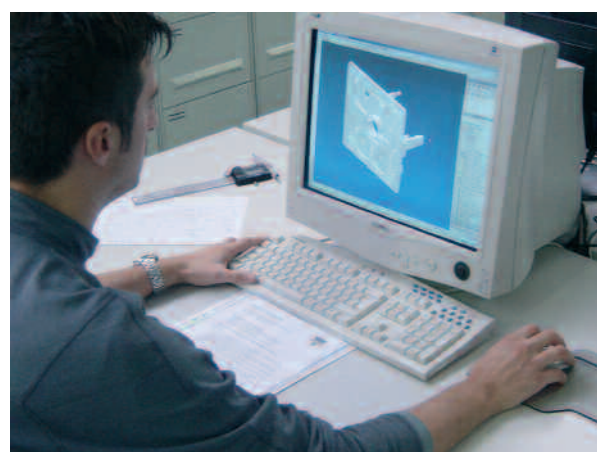
In our opinion, the implementation of safety components is not just a way to comply with rules and obtain approval certificates.

Carlo Gavazzi's safety devices are studied to meet user's requirements, considering the place where they will be used. Carlo Gavazzi's products ensue from ideas, they are not a simple connection of components.

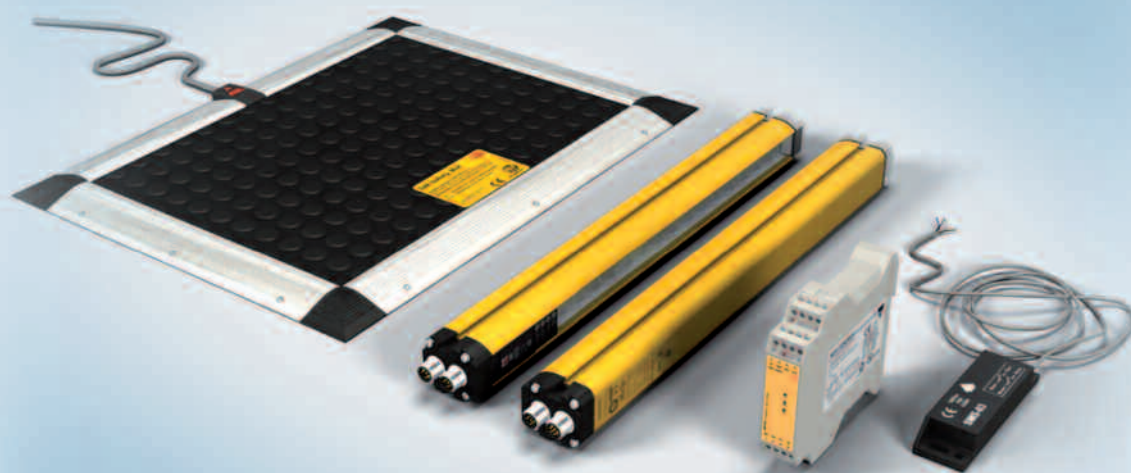
Our solutions are studied to allow the end-user to forget about the safety issue, because we are always there to assure the highest safety standard. Carlo Gavazzi proposes integrated solutions: our products can be combined to work as the machine safety backbone, with simple and immediate connection procedures.

The effectiveness of our devices is assured by our 75-years experience in the safety market and by our ability to always introduce the latest technology and solutions in our products.

The long term relationship with our users – based on listening, communication and reliability – adds value to Carlo Gavazzi's safety devices.



## *Risk Reduction Safety Devices from Carlo Gavazzi*



### ***Safety Limit Switches***

Our PS Series safety limit switches manage to provide information on the status of mobile safety gates, that have to be used to allow access to a dangerous area. If the switches are dirty (i.e.: by food and beverage) or when the application requires the machine to be cleaned up, Carlo Gavazzi's safety magnetic switches provide clean and reliable information on the door status.

### ***Safety Light Curtains***

When the opening and closing of the door appears to be too difficult, our SB Series safety light curtains provide a wide range of solutions. Devices with different resolutions and sizes succeed in detecting someone entering the dangerous area.

### ***Safety Mats***

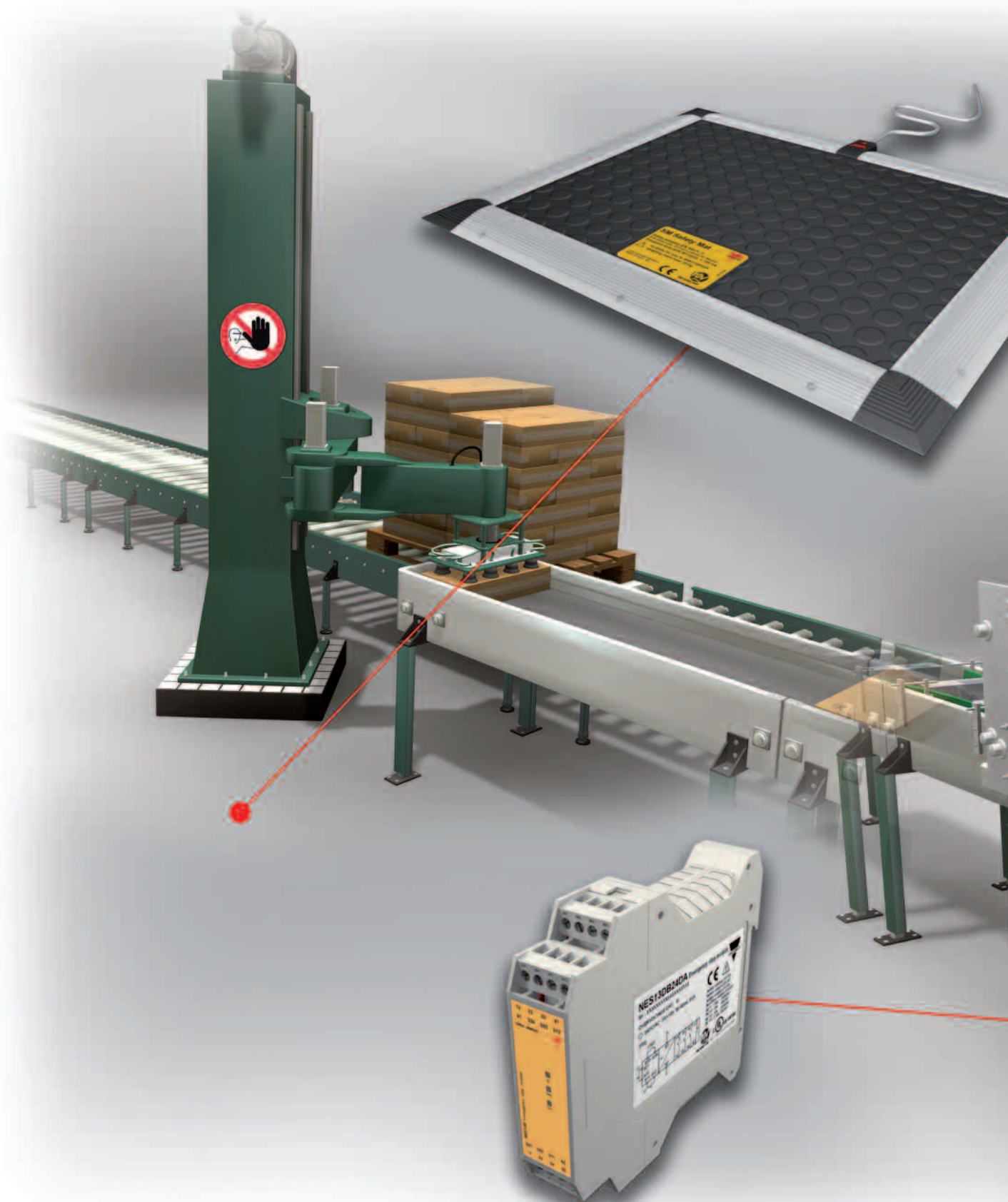
Sometimes, especially in ceramics or wood applications, the dust does not allow the proper working of light curtains. This problem can be solved by Carlo Gavazzi's SM Series safety mats, which cover the floor below the dangerous area, detect the presence and then can stop the machine. All this information is conveyed to the machine, through our safety modules, ruling the machine's functioning.

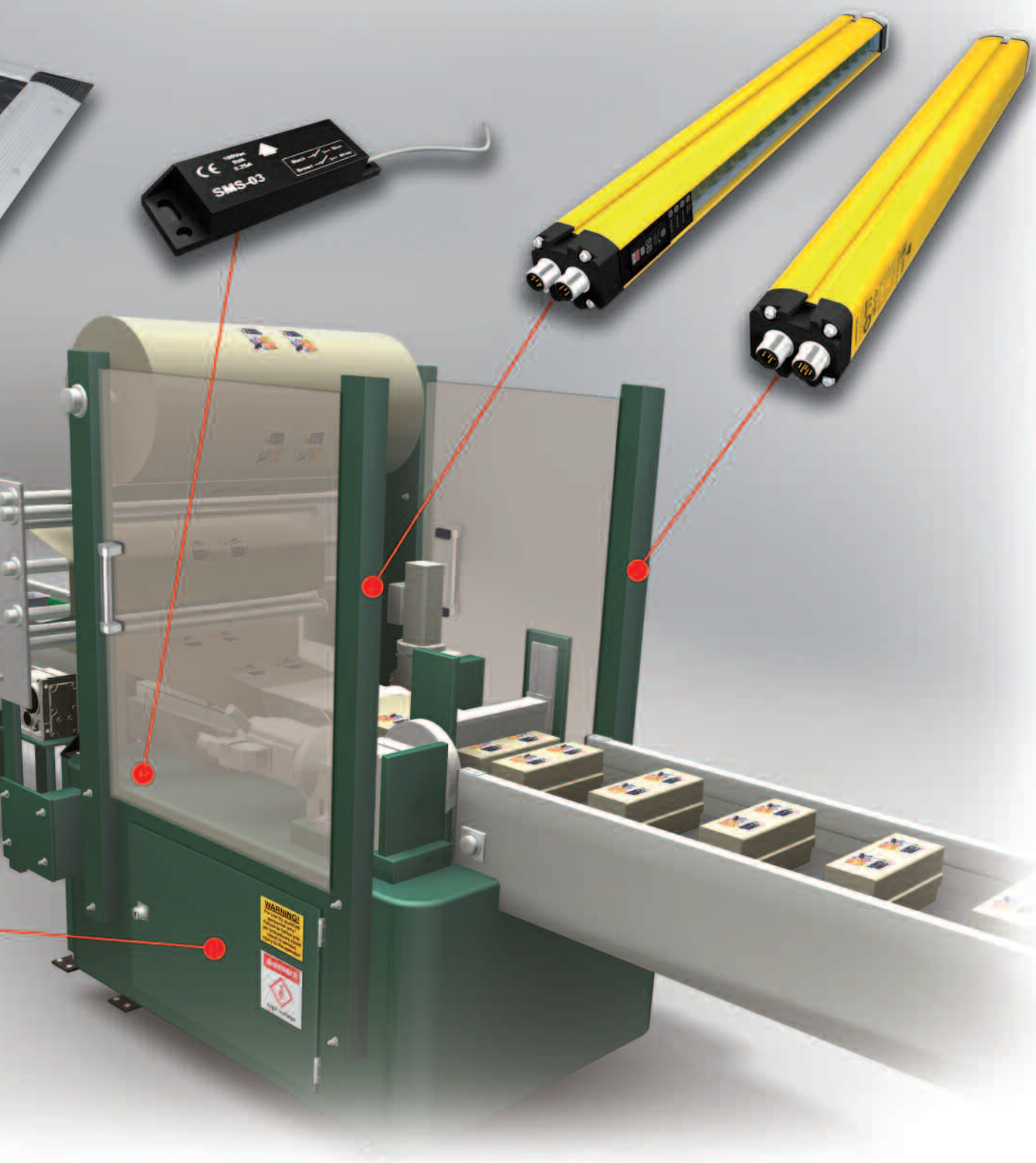






## *Integrated Solutions for Safety in Automation*



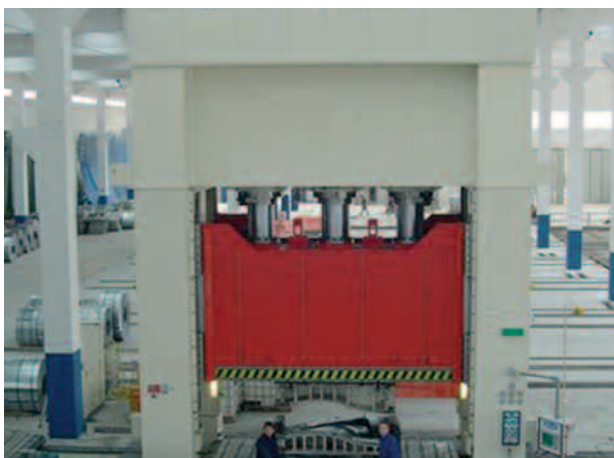






## ***Our Safety Devices at Work***

### ***Light curtains on presses***



Safety light curtains are widely used in order to protect the working area of presses and punching machines. The Master- Slave cascade connection of the SB4M-SB4N Series provides protection in the dangerous areas and detects presence of operator. All the electronics for Slave unit monitoring (SB4N) are included into the Master (SB4M). Thanks to Carlo Gavazzi's solutions, mounting, wiring and set-up become really quicker and safe.

### ***Light curtains in packaging machines***



The safeguarding of packaging applications often requires that objects such as feed stock, work pieces etc. pass through the sensing field, without the activation of any stop signal. Carlo Gavazzi's SB4B Series light curtains allow up to three adjacent beams to be interrupted at any location along the sensing field. This system operates without triggering any safety output, such as floating or blanking. Quick and safe setting is ensured, thanks to the integrated DIP-switches.

### ***Safety mats on woodworking machines***



The use of safety mat layouts may be required when woodworking machines, such as CNC work centres and routers, must be protected. In fact, safety mats split into several sections allow obtaining different system response according to machine head position and/or operation. SM Series safety mats are designed to comply with stringent reliability and quality principles in order to deliver the safety function anytime, even after millions of operations. Obtaining the needed layout is always possible and simple, thanks to the wide range of accessories and to the modular design.

### ***Safety gates***



Machines provided with mobile protections to prevent access to dangerous areas need safety switches, to guarantee immediate shut down in case of gate opening during the working cycle. The SMS Series encoded safety magnetic sensors can be used in this application and provide the highest level of reliability, thanks to the housing's high level of sealing. Contactless technology allows ease of mounting, no wear and a life span of over a hundred million of operations.

## Our Safety Devices at Work

### Managing safety gates on a plastic machine



Generally, safety gates need a safety system guaranteeing top reliability and durability. In plastic machines, the main gate must be often opened – i.e. when the moulded part is not correctly released or at the end of each use – and safety must not be a problem. NES02 and NES13 simply solve the problem allowing the opening of the press motor mains, when the gates are open.

### Starting a press



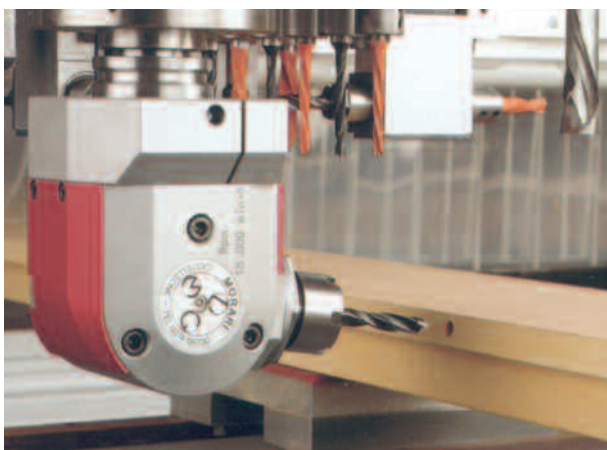
Presses are really dangerous machines, because no gate or light curtain can be used. The only way to guarantee safety is to make sure the operator has both hands busy when the machine works. Safety category III C, complying with EN 574, allows ND12D to be used in the most demanding applications.

### Stopping car-wash systems in presence of danger



In the working area of car-wash machines, there are several emergency stop buttons. If a dangerous situation arises, the operator or whoever is nearby the safety button must be able to stop the machine. The NES02 provides the means for connection of multiple E-stop buttons in series. In this way, the needed safety category for the whole machine is assured.

### Standstill motor for electrical lock release



If a fast rotating tool is used – for instance to drill wood or glass – the access to the dangerous area must be allowed only when the tool is immobile. In this event, an electrical lock is released and the operator can access. The MF1C performs this function according to category 3 (EN 954-1). The great advantage of this safety device is that no external mechanical sensor or wiring is required.





## Safety Light Curtains

Safety light curtains are widely used to protect dangerous points of operation and to safeguard the access. Whenever at least one of the infrared beams generated between emitter and receiver is interrupted, the safety outputs of our device activate, stopping the dangerous motion.

Flexibility, ease-of-use and minimum impact on machine productivity make this choice much more effective than mobile material protections.

Resolution, operating distance and safety category are the main parameters to be determined when assessing the application requirements.



## Main Advantages

Carlo Gavazzi's commitment in offering a reliable and comprehensive range of safety solutions continues with the new series of safety light curtains. This new set of devices is designed to satisfy each protection issue, thanks to our knowledge of the applications and standard requirements. Carlo Gavazzi can provide the right products and every type of accessory, assuring an easy and effective installation. The safety solutions offered include low risk installations up to complex applications requiring maximum protection and integrated functionalities.





### SBA2.../ SBM2...

Type 2 safety light curtains are available in two different resolutions: for hand (30 mm) and for presence control protection (90 mm). The main features of this series are the built-in control circuits and the integrated test function, automatically running every 500 ms. The operating distance is 15 m. The SBA2 Series (automatic Start/Reset) or the SBM2 Series (manual Start/Reset) can solve a wide range of industrial applications. Extremely compact dimensions (31x32 mm), protected height between 187 and 1510 mm, easy installation and total reliability, supported by a three year warranty, assure absolute operator safety.



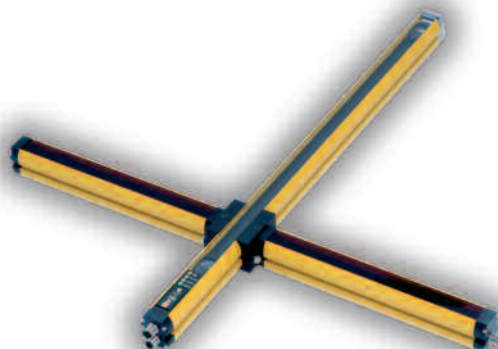
### SB4E.../ SB4B.../ SB4M...

The new series of type 4 safety light curtains, for finger and hand protection, is characterized by integrated advanced functions. Thanks to the **EDM** function – available on all versions – the light curtain is able to verify the integrity of all external switching devices. A Fixed or Floating **Blanking** – on the SB4B and SB4M Series – succeeds in deactivating a part of the sensing, allowing material passages or mechanical obstacle presences, with no machine interruption. The SB4M Series also has a **Cascade** feature to combine multiple light curtains (master and slave), which can be positioned in different areas. Integrated dip-switches guarantee an instant and safe configuration.



### SB4T.../ SB4L.../ SB4S...

Type 4 safety devices for body protection are well suited for applications that require material passage through a dangerous area, such as palettisers or depalettisers. Installation and alignment really become easy and fast, thanks to pre-assembled, pre-cabled and pre-aligned Muting sensors. Available models include 'T' shaped versions for bidirectional Muting, 'L' versions for unidirectional Muting and a linear family version, without integrated Muting sensors. Muting arms are adjustable for the highest flexibility. The integrated DIP-switches guarantee a quick and safe setting of Start mode, Muting mode, muting time and EDM function.



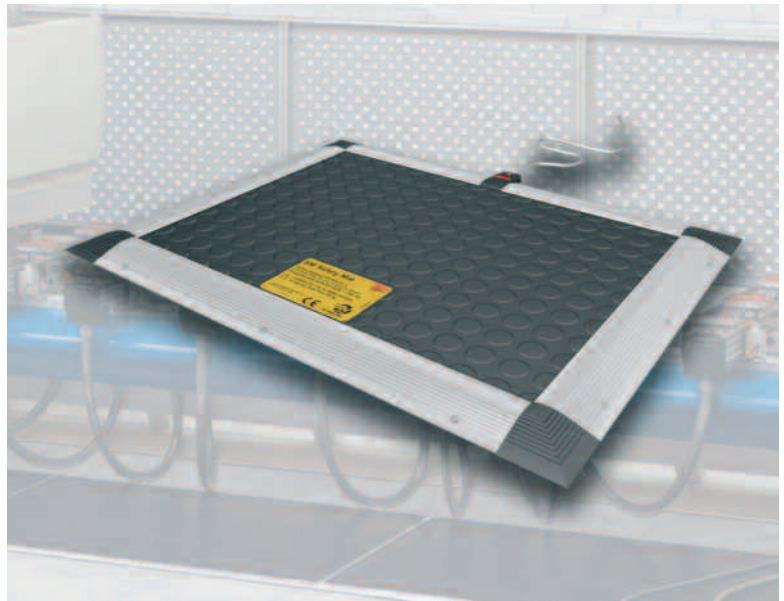


## Safety Mats

The safety mats are safeguarding devices designed for the protection and surveillance of potentially hazardous areas, such as the surroundings of industrial machineries.

SM simple structure, matched with a special soldering process - which ensures total sealing of the layers - make SM safety mats also suitable for heavy-duty applications in damp and dusty environments, where almost no other safety devices could be used.

In conjunction with safety control unit NT12D, SM safety mats constitute a reliable and effective solution for area monitoring, in compliance with Safety Category 3 requirements.



## Main Advantages

Carlo Gavazzi's safety mats guarantee the control of a whole restricted area and not just of a perimeter. This feature is very important, especially when dangerous areas (not visible from the machine control points) must be protected. Safety mats offer customers the opportunity to have integrated solutions, delivering unbeatable reliability and durability, with no maintenance. Therefore, complex shapes and layouts can be put together with the variety of available accessories.





## Features

SM safety mats are electrical pressure-sensitive devices, activated by pressure (usually the operator's body weight) and utilized for presence control. The external structure of the mat consists of two generously sized PVC layers, containing two inner conductive surfaces separated by an appropriate insulating material. The special soldering process guarantees the total sealing of the outer shells. The new external fixing trim ensures a firm anchoring to the floor and protects cable routine. The cable connection monitoring is provided by the NT12D safety control module.

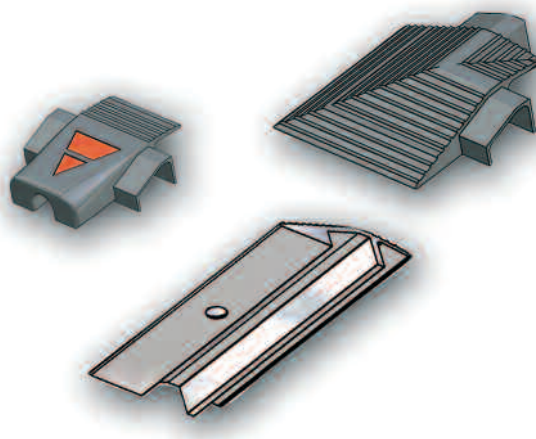
The simple and robust construction delivers extreme dependability and a life span of more than one million cycles.



## Accessories

The concept of modularity was the inspiration for Carlo Gavazzi's new safety mat accessories, designed for easy and safe installation.

The range includes internal and external angular joints, with sections dedicated to cable routine, and linear joints with cable outlet for a quick mounting and a full protection of wirings. The 'H' section joining trim is designed to combine more safety mat segments together. The resulting achievement is the desired layout, ensuring sensitivity along the joint side, too. Dedicated coloured adhesive tapes are also available for visible mat section delimitations.

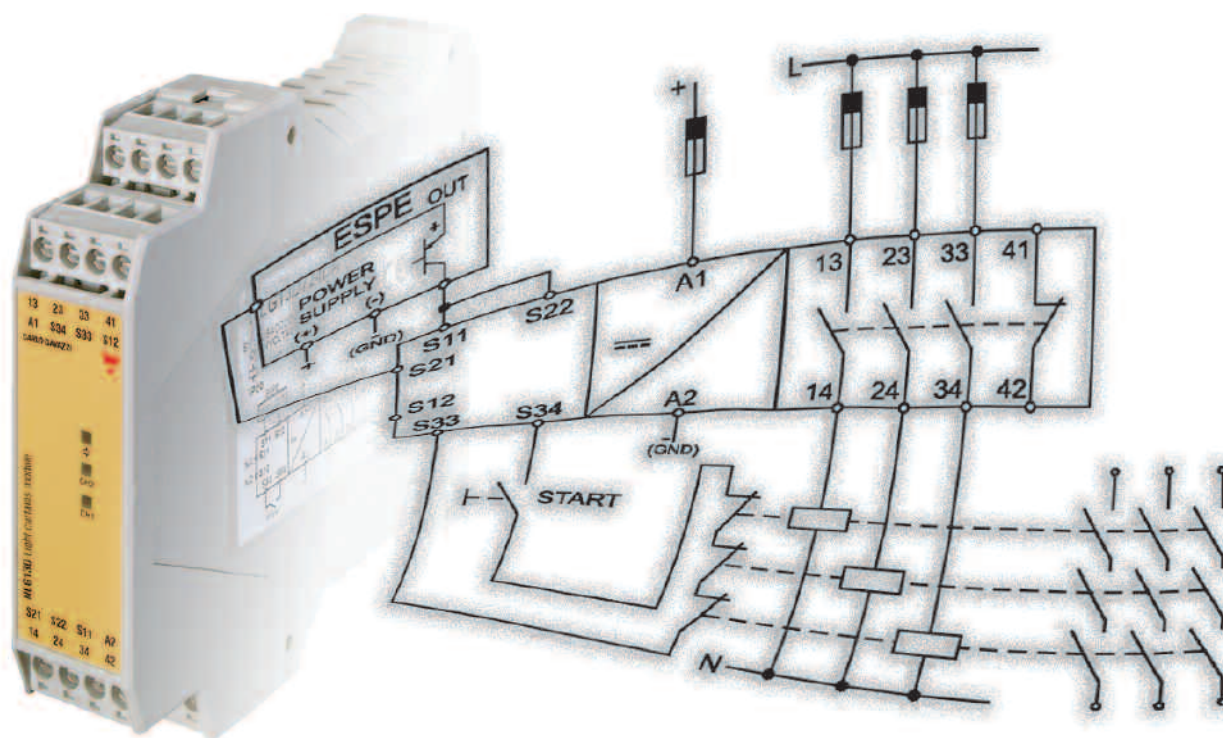




## Safety Modules

Safety modules play their role in the risk reduction phase of the machine development process. If, for instance, the installation of a fixed gate appears to be impossible, but a moving gate has to be opened to load and unload the appliance, the machine has to be safely stopped when the gate is open. This is what Carlo Gavazzi's safety gate modules are designed for.

The same can be said when we have to manage emergency stop buttons, light curtains, two hand controls, or safety mats. Carlo Gavazzi provides easy installation, simple working mode and immediate fault detection, in conjunction, with the usual Carlo Gavazzi reliability, of course.





### NES02D... / NSC13D...



If the safety input device is a mechanical safety switch (like our PS21S safety limit switch for safety gates or the emergency stop button EMPB) the NES02 and NES13 are the ideal solution to operate up to safety category 4, in compliance with EN954. If the input device is a safety magnetic switch like our SMS Series, NSO02 and NSO13 are the ideal counterpart. If one of the contacts is normally closed, the NSC02 and NSC13 are the most effective solution.

### NLG02D... / NLG13D ...



The NLG02 and NLG13 allow stopping dangerous activities when the operator enters a risky area. These Carlo Gavazzi devices assure absolute safety, accepting the transistor output of our SB Series light curtains and providing a safety relay output.

### NT12D



Being the natural completion of our SM Series safety mats, the NT12D provides a category 3 certified safety system, complying with EN954. This device protects the dangerous area from operator's accesses, while working.

### MF1C



Measuring the regenerated voltage on a motor's coils, is the best way to figure out if the tool on a motor's shaft is moving. Of course this operation must be performed safely in order to comply with safety category 3. The MF1C provides this function, allowing for the opening of the lock of a safety gate, only when the motion of a motor has comes to a complete stop.

### ND12D



Two-hand systems are indispensable when there is no way to keep the operator away from the dangerous area. The ND12D two hand module of category IIIC in compliance with to EN 574, is connected to a 2-hand safety buttons system. This special device allows the machine to function only if both buttons are pressed simultaneously.

### NE14D



In some cases, several safety pieces of information are required to deliver the machine's operation. The NE14D provides four safety outputs keeping, of course, the safety category of the system.





## Safety Bus

### **Keep up production and make your plant safer**

The trend is clear: big advantages can be achieved using bus communication in safety related systems. Compared to the traditional serial wiring of normally closed safety switches, the diagnostics are vastly improved. The immediate indication of causes for production interruptions makes it possible to significantly reduce downtime, especially on large machines and plants. Furthermore, a bus solution is safer, because the risk of undetected bridges over normally closed safety contacts is considerably reduced.

### **A unique set of features**

DuplineSafe is based on the Dupline® fieldbus, a system used in more than 120.000 installations worldwide in the harshest industrial environments. Dupline® is particularly known for its reliability, simplicity and ability to transmit signals over long distances. All the features of this Gavazzi's system are especially demanded in safety related systems.

### **Approved by TÜV complying to EN61508-SIL3 and EN954-1 Cat. 4**

The development of the DuplineSafe products has been carried out in close cooperation with TÜV Rheinland Group.

### **Configurable Safety Relay**

Thanks to the handheld DuplineSafe configuration unit, the user can define the addresses of the input modules, in order to monitor them with the safety relay. In operation mode, the safety relay will trip if one or more of these input contact does not send a valid "contact closed" signal or if any fault on the bus is detected. Several relay output modules can be connected to the same bus, and each of them can be configured to monitor any input module. Thereby it is possible to stop several machines in different locations, activating a single emergency stop switch.

### **Bus-powered input modules**

Bus-powered input modules provide the interface to the safety switches, which may be emergency stop palm buttons, pull-cord switches or other devices with NC contact. The small-dimension IP67-rated housing makes it possible to install the input modules inside or nearby the safety switches, even in rough environmental conditions.

### **Diagnostics via PLC, PC or Text Display**

DuplineSafe Gateways for Profibus-DP and Modbus RTU make it possible to read out the DuplineSafe diagnostics information via a PLC, PC or Text Display.

#### **Features**

Up to 63 safety signals on a single two-wire cable

Bus-powered Input Modules

Immediate and precise safety diagnostics

Up to 5 km transmission distance without Repeater

High noise immunity and reliability

Easy to design, install and commission a system

Several safety relays can read the same input modules

Free topology and no requirement for special cable

Safety signals and standard digital/analogue I/O's allowed on the same bus

#### **Benefits**

Reduced wiring cost compared to parallel wired system

No need for local power supplies

Machine stops can be fixed faster, leading to higher production efficiency

No need for special modules or special handling when long distances are involved

High system availability - false trips avoided

Reduced risk for human error, steep learning curve, no dependence on specialists, and time savings

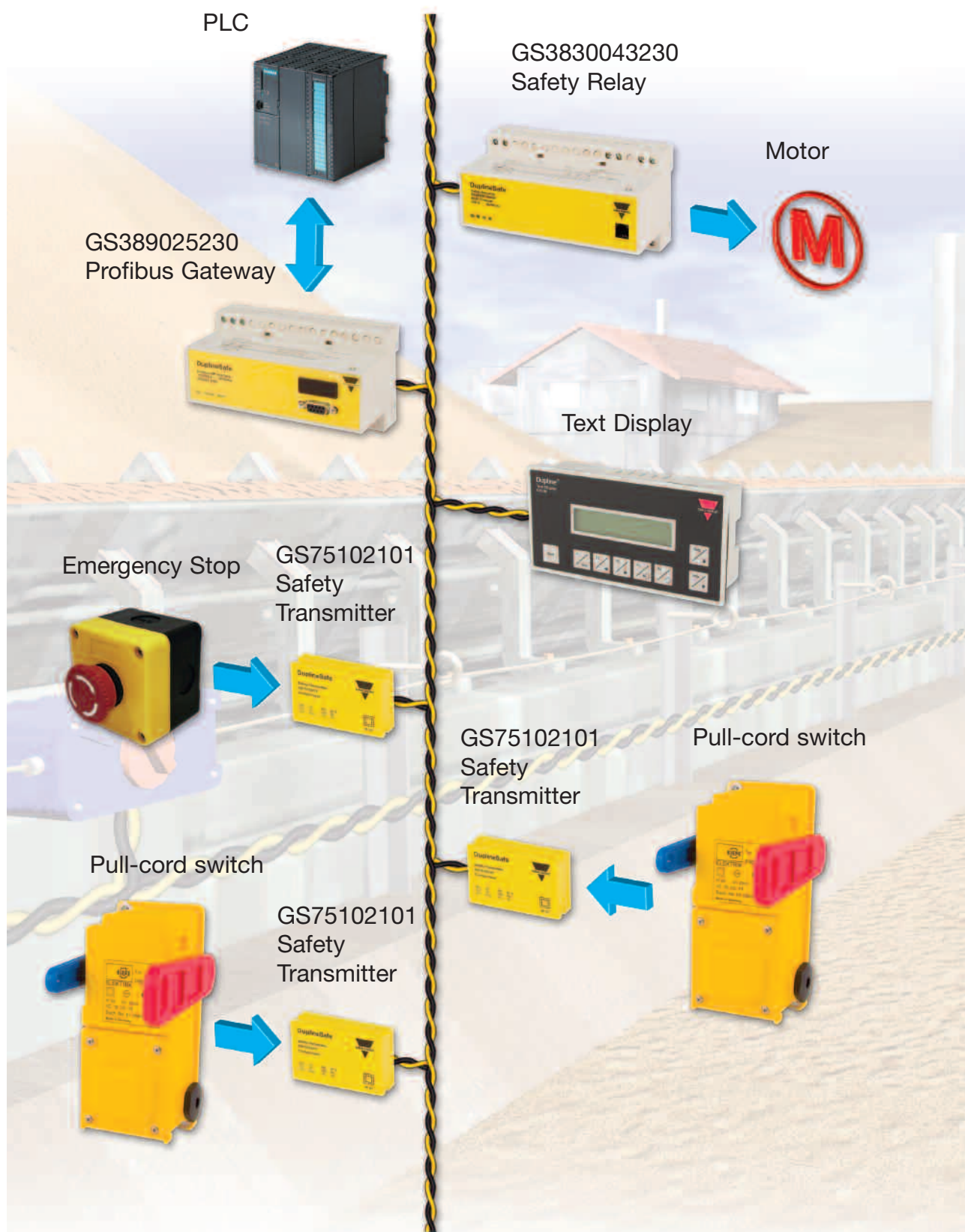
Easy to use where one safety input can be used to stop several machines at different locations

Easy and flexible wiring with possibility to use existing cables

One bus can handle all signals, and safety functions can be added to existing Dupline systems









## Safety Magnetic Sensors

The SMS Series encoded safety magnetic sensors are designed to monitor the position of hinged, sliding or removable guards of industrial applications.

Carlo Gavazzi's safety sensors – connected to a monitoring safety module – provide a method to stop or disconnect the dangerous motions, if the mobile protections are opened or displaced.

The multiple flux coding ensures the correct activation of the sensor with dedicated magnetic units only. This system – in conjunction with redundancy frames used in the design – makes the SMS Series suitable for safety gates applications up to safety category 4, complying with EN 954-1.



## Main Advantages

Carlo Gavazzi's safety magnetic sensors are the right answer, in the presence of harsh industrial environments with damp and dusty conditions, or in case of applications where high hygiene standards are needed.

The SMS Series is the solution wherever stringent hygienic standards need to be maintained, thanks to the dirt and water resistant sealed body, and to its shape, which has no dust collecting cavities. These easy to clean units provide high security performances. Contactless technology means tremendous durability and allows concealed assembling on non-magnetic materials: this feature avoids many proper problems which affect mechanical switches. Multiple flux coding and redundancy ensure safe and protected installations, preventing incidental access.





## The Range

Thanks to our long experience on designing magnetic-based sensors, Carlo Gavazzi is able to offer an extensive range of safety magnetic sensors, covering a large variety of safety gate applications in different industrial contexts.

The wide range of products includes versions with rectangular or cylindrical housings, made in thermoplastic material. The whole series is characterised by multiple flux coding, activation with the

dedicated magnetic unit only (CLS series), long life (contactless), sealed to IP67, excellent tolerances to misalignment, insensitiveness to dirt and suitability for concealed assembling. A very important feature is the unbeatable durability and reliability of all Carlo Gavazzi's devices.



### Rectangular series

Several models are available, ranging from single to double channel, 1NO, 2NO or 1NO + 1NC contacts.

Gavazzi offers versions with signalling auxiliary outputs, LED indication and pig-tail output connection with M12 connector. The safety rating is included between 2 and 4, in compliance with EN954-1. The devices can be operated with CLS magnetic unit series.

### Cylindrical series

The M18 or M30 versions range from single to double channel, 1NO, 2NO or 1NO + 1NC contacts. Versions with LED indication, pig-tail output connection with M12 connector are available. Safety is included between 1 to 4 in compliance with EN954-1. The devices can be operated with CLSA magnetic unit series.





## Safety Limit Switches

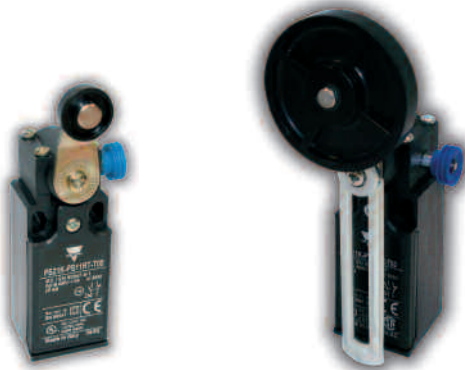
Safety Limit Switches supervise security of industrial machines, that often cannot rely upon secure working areas because an inadequate down-time does not occlude access.

Carlo Gavazzi's Safety Limit Switches assure the control of the hazardous areas access points, intervening on the control circuit. In particular, the operators' safety is granted by the fact that the machine immediately comes to a complete stop in case of the mobile protector (covers, cases, doors, grids, etc.) is opened or a rope is just pulled.



## Safety Limit Switches with Pull Button Reset

These devices are studied in order to be used for the detection and monitoring of faults in hoisting machines, electric lifts, freight elevators, escalators, conveyor belts, etc. The Limit Switches protect the operators working on dangerous machines, by opening the control circuit. The normally closed safety contacts remain in the open position, after having completed a control device and having overshooted the latching point. The return to the initial operating state can take place only by voluntary action on the pull button reset.



## Main Advantages

The limit switches are available in different sizes and materials. They are developed in reinforced UL-V0 thermoplastic fiber-glass, zinc alloy (Zamak) or aluminium body. IP65 (thermoplastic) and IP66 (metal) assures a high degree of protection, that allows use of the limit switches in different kinds of environments. The contact block, Zb type, is consistent with the safety requirements of the IEC 947-5-1 with NC contact with Positive Opening Operation.

Others main advantages are:

- Minimum Actuation Force/Torque
- Minimum Force to achieve Positive Opening Operation
- Precise operating points (consistency)
- Immune to electromagnetic disturbances



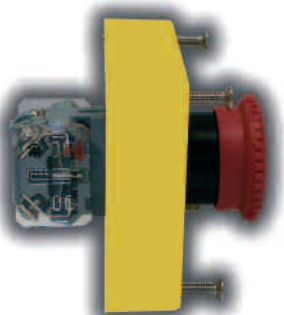


## Emergency Stop Push Button

The emergency stop switches are devices that users employ to initiate the complete shutdown of a machine, system, or process. Pushbuttons are relatively large devices that open or close a switch, when pressed.

Usually a double-pole, single-throw (DPST) contact block is used to turn off the power.

The twist-to-reset switches require users to twist a button, in order to reset the switch and resume operation.



## Main Features

The emergency stop push button must be pressed, in order to be locked. Then, the device has to be twisted clockwise, in order to be released.

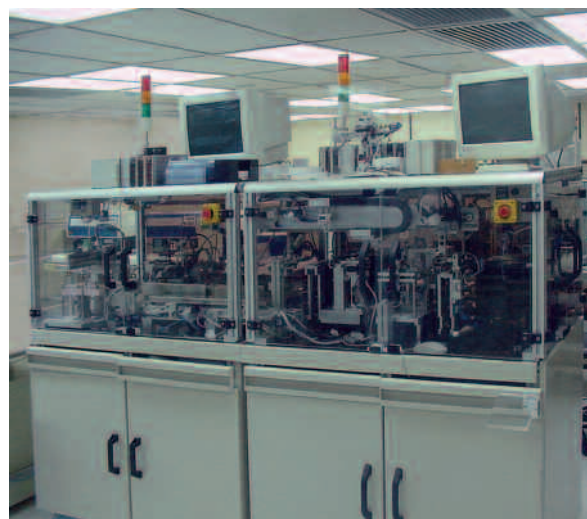
The high degree of protection (IP65) makes this device effective in different kinds of environment. Five different ways of cable entry (PG13.5 / M20) offer different solutions of installation.

Others main advantages are:

- 4 captive screws
- Double insulation
- Contact block with forced opening NC contact

## Applications

It is designed to protect operators working on dangerous machines, by opening the control circuit. In compliance with the EN418 (safety of machinery – emergency stop), it allows switching off the electric power by pushing the RED Emergency Stop Push Button.



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Kaunas - **LITHUANIA**

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Controls Division  
Belluno - **ITALY**

Carlo Gavazzi Controls SpA  
Sensors Division  
Castel Maggiore (BO) - **ITALY**

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