Catalog 2014

ABB Canada Safety Handbook
Machine Safety – Jokab Standard Products

Power and productivity
for a better world™

ABB Canada Safety Handbook
Machine Safety – Jokab Standard Products

Introduction

We develop innovative products and solutions for machine safety

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We make it simple to build safety systems. Developing innovative products and solutions for machine safety has been our business idea since the company Jokab Safety, now ABB AB, was founded in Sweden in 1988. Our vision is to become "Your partner for machine safety – globally and locally".

Many industries around the world, have discovered how much easier it has become to build protection and safety systems with our components and guidance.

Experience

We have great experience of practical application of safety requirements and standards from both authorities and production. We represent Sweden in standardisation organisations for machine safety and we work daily with the practical application of safety requirements in combination with production requirements. You can use our experience for training and advice.

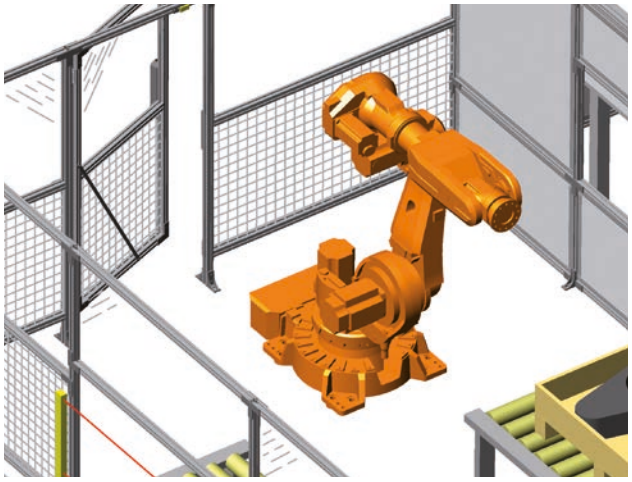
Mats Linger and Torgny Olsson founded Jokab Safety AB in Sweden in 1988, together with Gunnar Widell

Systems

We deliver everything from a safety solution to complete safety systems for single machines or entire production lines. We combine production demands with safety demands for production-friendly solutions.

Products

We market a complete range of safety products, which makes it easy to build safety systems. We develop these innovative products continuously, in cooperation with our customers Our extensive program of products, safety solutions and our long experience in machine safety makes us a safe partner.



Standards and regulations

We help to develop standards

Directives and standards are very important to machinery and safety component manufacturers. We therefore participate in several international committees that develop standards, for among other things industrial robots, safety distances and control system safety features. This is experience that we absorb so that the standards will present requirements that benefit production efficiency allied to a high level of safety. We are happy to share our knowledge of standards with our customers.

Notes

Safety history

Developments of the 70's

...of the 70's

Our background in safety started in the seventies when there was a significant focus on the safety of manually operated presses, the most dangerous machine in those days. The probability of losing a finger or hand while working with these machines was very high. New safety solutions for both safety devices as well as for the control systems for presses were developed and introduced on both old and new machines. We were directly involved in this work through the design of Two-Hand devices, control systems for presses, making safety inspections for the Health and Safety authorities and writing regulations for safety of these machines. This work provided an excellent base for our knowledge in machinery safety.

We protected people from losing fingers or/and hands in dangerous machines.

The numbers of accidents involving presses decreased significantly during these years however there is still room for new ideas to enable safety equipment to become more practical and ergonomic.

Developments of the 80's

...of the 80's

During the eighties, industrial robots (Irb's) started to become commonplace in the manufacturing industry. This meant that workers were outside of the dangerous areas during production but had at certain times to go inside the machine in order to e.g. adjust a product to the correct position, inspect the production cycle, troubleshoot and to program the Irb. New risks were introduced and new safety methods required. It was for example hard to distinguish whether production machines had stopped safely or simply waiting for the next signal, such as a sensor giving a start signal while a product was being adjusted into the correct position. Mistakes in safety system design resulting in serious accidents were made, such as the omission of safety devices to stop the Irb, unreliable connection of safety devices and unreliable safety inputs on the Irb.

In the mid eighties the standards committee for safety in Industrial Robot Systems EN 775/ISO 775 was started. This was the first international standard for machine safety. In order to give the correct inputs to the standard, work around Irb's was closely studied in order to meet production integrated safety requirements. The introduction of a production oriented safety stop function was made, using for example, software to stop machines smoothly and then safety relays/contactors to disconnect the power to the machines actuators after the machine had stopped. This technique allows easy restart of production after a stop situation by the machine safeguards.

Three-position enabling devices were also introduced for safety during programming.

There were a lot of discussions as to whether one could have both safety and practical requirements in a standard, such as a safe stop function, which allowed an easy restart of the machine. Three-position enabling devices were also introduced for safety during programming, testing and trouble shooting of Irb's and other equipment. In the robot standard the three-position enabling function was first defined by only allowing for hazardous machinery functions in the mid switch position. Releasing or pressing the three-position push button in panic leading to a stop signal.

Developments of the 90's

...of the 90's

In Europe, during the nineties, the machinery directive was the start of a tremendous increase in co-operation across borders to get European standards for safety for machinery and safety devices. The experience from different European countries has led to a wide range of safety standards and this has made work in safety much easier. With the integration of Europe it is now only necessary for a safety company such as ourselves to get one approval for our components for all of Europe instead of one per country.

European standards for safety for machinery and safety devices.

Developments 2000 –

...2000 –

Internationally the work on safety has now been intensified within ISO. The objective is to have the same structure of safety requirements and standards within ISO as within EN. ABB Jokab Safety is active both internationally and nationally in different standard working groups. The co-operation between countries is leading to better safety solutions, making it much easier to create safe working environments around the world.

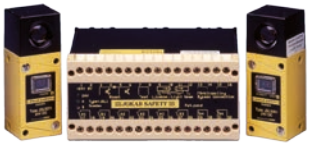
Jokab Safety's developments

...of the 80's

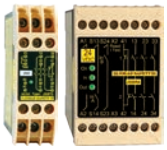
Jokab Safety's first safety relay

Jokab Safety's first steel fencing system

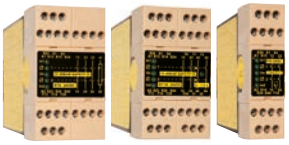
...of the 90's



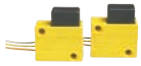
Timer reset and first light beam



Smallest safety relays JSBT5 and JSBR4



RT series universal relays



Three-position switch for robots

3-position devices

Safeball - ergonomic control device

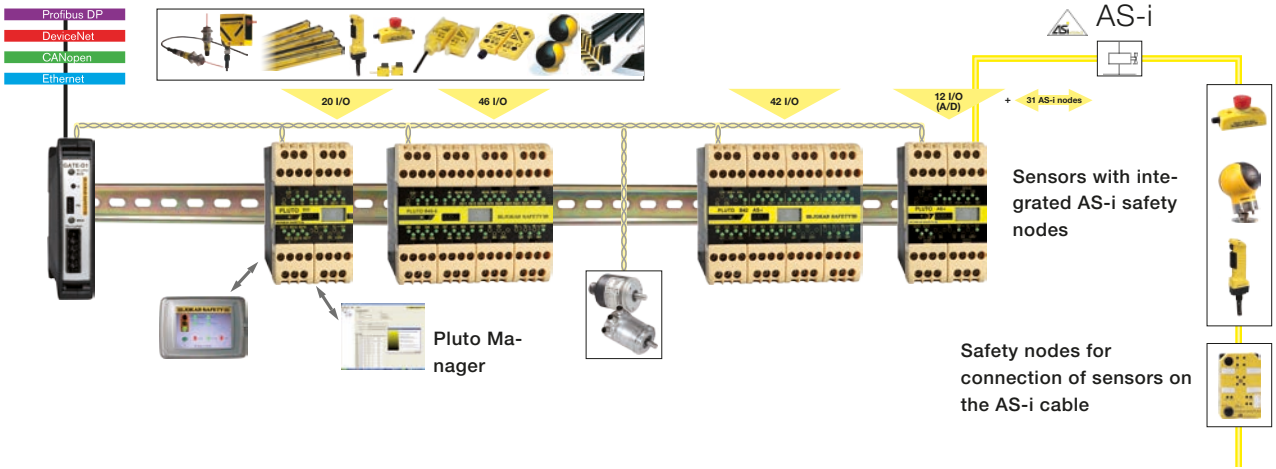
Stop time measurement

SafeCad for Quick-Guard

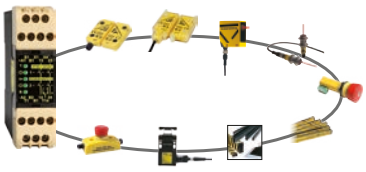
Quick-Guard aluminium fencing system

...2000 –

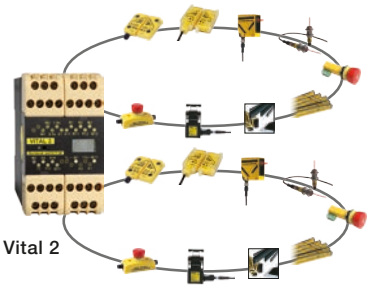
Pluto All-Master safety PLC



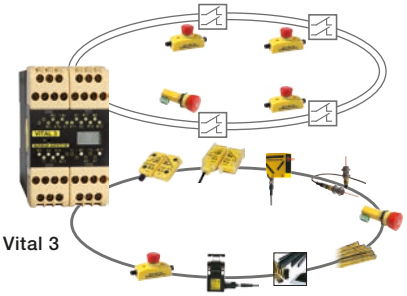
Vital with dynamic safety circuits



Vital 1

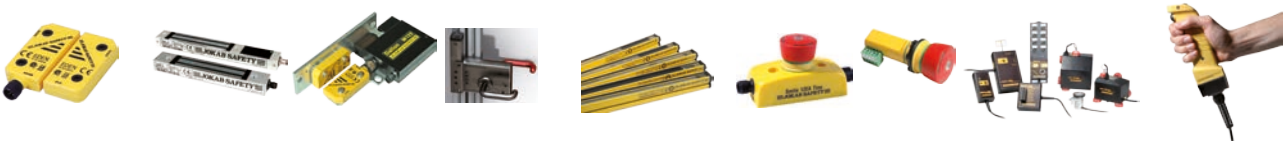


Vital 2



Vital 3

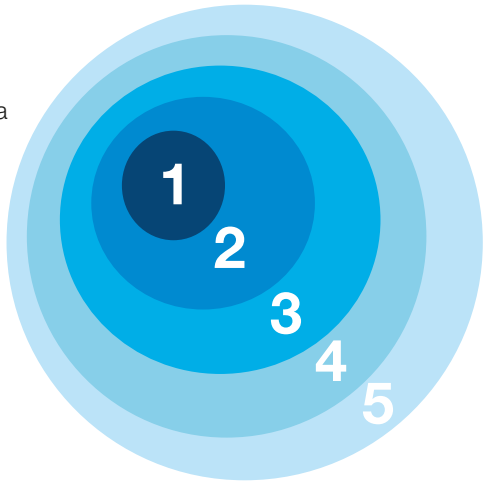
Non-contact sensor Eden, guard locks, Focus light beam, E-stops Inca and Smile, Smart for machine diagnosis and three-position device with hand detection



Notes

Protection or warning?

How is it possible to choose safety measures that are production friendly and in every way well balanced? The Machinery Directive gives an order of priority for the choice of appropriate methods to remove the risks. Here it is further developed in a five step method.



Prioritize safety measures according to the five step method

1. Eliminate or reduce risks by design and construction
2. Move the work tasks outside the risk area
3. Use guards/safety devices
4. Develop safe working routines/information/education
5. Use warnings such as pictograms, light, sound etc.

The further from middle of the circle, the greater the responsibility for the safety is put onto the user of the machine. If full protection is not effectively achieved in one step, one has to go to the next step and find complementary measures.

What is possible is dependant on the need for accessibility, the seriousness of the risk, appropiate safety measures etc.

Example on prioritizing according to the 5-step-method

Priority	Example of hazard and safety measure taken	
1. Make machine safe by design and construction	Hazard:	Cuts and wounds from sharp edges and corners on machinery
	Safety measure:	Round off sharp edges and corners.
2. Move the work tasks outside the risk area	Hazard:	Crushing of fingers from machine movements during inspection of the production inside the risk area
	Safety measure:	Installation of a camera.
3. Use guard/safety devices	Hazard:	Crushing injuries because of unintended start during loading of work pieces in a mechanical press
	Safety measure:	Install a light curtain to detect operator and provide safe stop of the machinery.
4. Safe working routines/ information	Hazard:	Crushing injuries because the machine can tip during installation and normal use.
	Safety measure:	Make instructions on how the machine is to be installed to avoid the risks. This can include requirements on the type of fastening, ground, screw retention etc.
5. Warnings	Hazard:	Burns because of hot surfaces in reach
	Safety measure:	Warning signs

The possibilities will increase to achieve a well thought-through safety system if each risk is handled according to the described prioritizing.

Combine the five step method with production friendly thinking. This can give you e.g.

- fast and easy restart of machines after a stop from a safety device
- enough space to safely program a robot
- places outside the risk area to observe the production
- electrically interlocked doors, instead of guards attached with screws, to be able to take the necessary measures for removing production disturbances
- a safety system that is practical for all types of work tasks, even when removing production disturbances

Examples of regularly used EN/ISO standards

EN ISO 12100 (replaces EN ISO 12100-1/-2 and EN ISO 14121-1)	Safety of machinery - General principles for design - Risk assessment and risk reduction	Part 1: This standard defines basic terminology and methodology used in achieving safety of machinery. The provisions stated in this standard are intended for the designer. Part 2: This standard defines technical principles to help designers in achieving safety in the design of machinery.
EN ISO 13857	Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs	This standard establishes values for safety distances to prevent danger zones being reached by the upper limbs. The distances apply when adequate safety can be achieved by distances alone.
EN 349 (ISO 13854)	Safety of machinery – Minimum gaps to avoid crushing of parts of the human body	The object of this standard is to enable the user (e.g. standard makers, designers of machinery) to avoid hazards from crushing zones. It specifies minimum gaps relative to parts of the human body and is applicable when adequate safety can be achieved by this method.
EN ISO 13850	Safety of machinery – Emergency stop – Principles for design	This standard specifies design principles for emergency stop equipment for machinery. No account is taken of the nature of the energy source.
EN 574	Safety of machinery – Two-hand control devices – Functional aspects – Principles for design	This standard specifies the safety requirements of a two-hand control device and its logic unit. The standard describes the main characteristics of two-hand control devices for the achievement of safety and sets out combinations of functional characteristics for three types.
EN 953	Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards	This standard specifies general requirements for the design and construction of guards provided primarily to protect persons from mechanical hazards.
EN ISO 13849-1 (replaces EN 954-1)	Safety of machinery – Safety related parts of control systems – Part 1: General principles for design	This standard provides safety requirements and guidance on the principles for the design (see 3.11 of EN 292-1:1991) of safety-related parts of control systems. For these parts it specifies categories and describes the characteristics of their safety functions. This includes programmable systems for all machinery and for related protective devices. It applies to all safety-related parts of control systems, regardless of the type of energy used, e.g. electrical, hydraulic, pneumatic, mechanical. It does not specify which safety functions and which categories shall be used in a particular case.
EN ISO 13849-2	Safety of machinery. Safety-related parts of control systems. Validation	This standard specifies the procedures and conditions to be followed for the validation by analysis and testing of: • the safety functions provided, and • the category achieved of the safety-related parts of the control system in compliance with EN 954-1 (ISO 13849-1), using the design rationale provided by the designer.
EN 62061	Safety of machinery. Functional safety of safety-related electrical, electronic and programmable electronic control systems	The standard defines the safety requirements and guiding principles for the design of safety-related electrical/electronic/programmable parts of a control system.
EN ISO 13855 (replaces EN 999)	Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body	This standard provides parameters based on values for hand/arm and approach speeds and the methodology to determine the minimum distances from specific sensing or actuating devices of protective equipment to a danger zone.
EN 1088 and EN 1088/A1	Safety of machinery. Interlocking devices associated with guards. Principles for design and selection	This standard specifies principles for the design and selection - independent of the nature of the energy source - of interlocking devices associated with guards. It also provides requirements specifically intended for electrical interlocking devices. The standard covers the parts of guards which actuate interlocking devices.
EN 60204-1	Safety of machinery. Electrical equipment of machines. General requirements	This part of IEC 60204 applies to the application of electrical and electronic equipment and systems to machines not portable by hand while working, including a group of machines working together in a co-ordinated manner but excluding higher level systems aspects (i.e. communications between systems).

New standards for safety in control systems

Building a protection system that works in practice and provides sufficient safety requires expertise in several areas. The design of the safety functions in the protection system in order to ensure they provide sufficient reliability is a key ingredient. As help for this there is, for example, the EN ISO 13849-1 standard. The purpose of this text is to provide an introduction to the standard and its application in conjunction with our products.

Introducing the new standard

The generation change for standards on safety in control systems introduces new concepts and calculations for machine builders and machine users. The EN 954-1 standard has been phased out and is replaced by EN ISO 13849-1 (PL, Performance Level) and EN 62061 (SIL, Safety Integrity Level).

PL or SIL? What should I use?

The standard you should use depends on the choice of technology, experience and customer requirements.

Choice of technology

- PL (Performance Level) is a technology-neutral concept that can be used for electrical, mechanical, pneumatic and hydraulic safety solutions.
- SIL (Safety Integrity Level) can, however, only be used for electrical, electronic or programmable safety solutions.

Experience

EN ISO 13849-1 uses categories from EN 954-1 for defining the system structure, and therefore the step to the new calculations is not so great if you have previous experience of the categories. EN 62061 defines the structures slightly differently.

Customer requirements

If the customer comes from an industry that is accustomed to using SIL (e.g. the process industry), requirements can also include safety functions for machine safety being SIL rated.

We notice that most of our customers prefer PL as it is technology-neutral and that they can use their previous knowledge in the categories. In this document we show some examples of how to build safety solutions in accordance with EN ISO 13849-1 and calculate the reliability of the safety functions to be used for a particular machine. The examples in this document are simplified in order to provide an understanding of the principles. The values used in the examples can change.

What is PL (Performance Level)?

PL is a measure of the reliability of a safety function. PL is divided into five levels (a-e). PL e gives the best reliability and is equivalent to that required at the highest level of risk.

To calculate which level the PL system achieves you need to know the following:

- The system's structure (categories B, 1-4)
- The Mean Time To dangerous Failure of the component ($MTTF_d$)
- The system's Diagnostic Coverage (DC)

You will also need to:

- protect the system against a failure that knocks out both channels (CCF)
- protect the system from systematic errors built into the design
- follow certain rules to ensure software can be developed and validated in the right way

The five PL-levels (a-e) correspond to certain ranges of PFH_D-values (probability of dangerous failure per hour). These indicate how likely it is that a dangerous failure could occur over a period of one hour. In the calculation, it is beneficial to use PFH_D-values directly as the PL is a simplification that does not provide equally accurate results.

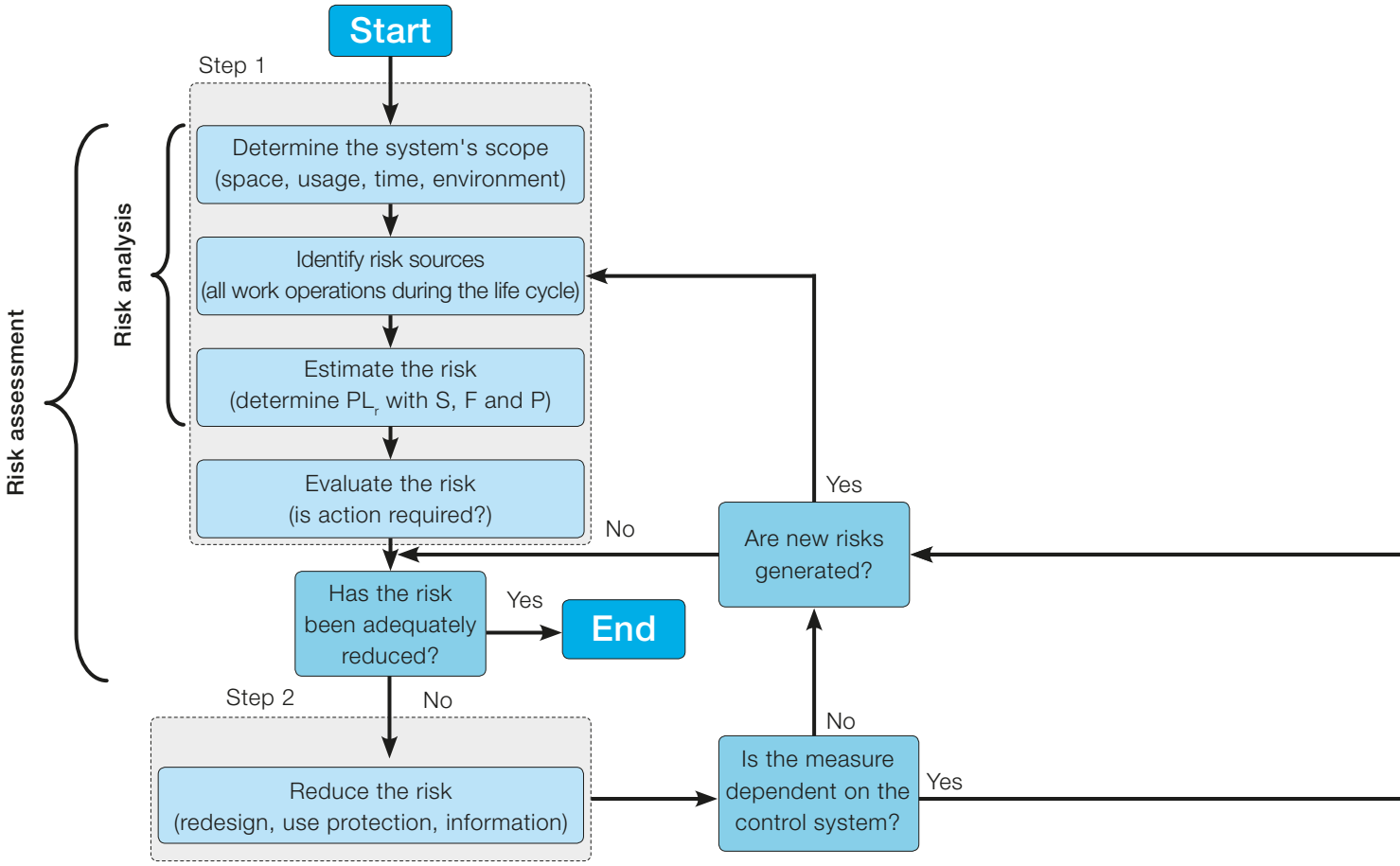
What is the easiest way of complying with the standard?

1. Use pre-calculated components.
As far as it is possible, use the components with pre-calculated PL and PFH_D-values. You then minimise the number of calculations to be performed. All ABB Jokab Safety products have pre-calculated PFH_D-values.

2. Use the calculation tool.
With the freeware application SISTEMA (see page 16) you avoid making calculations by hand. You also get help to structure your safety solutions and provide the necessary documentation.

3. Use Pluto or Vital
Use the Pluto safety PLC or Vital safety controller. Not only is it easier to make calculations, but above all it is easier to ensure a higher level of safety.

Working method as specified in EN ISO 13849-1



Risk assessment and risk minimisation

According to the Machinery Directive, the machine builder (anyone who builds or modifies a machine) is required to perform a risk assessment for the machine design and also include an assessment of all the work operations that need to be performed. The EN ISO 12100 standard (combination of EN ISO 14121-1 and EN ISO 12100-1/-2) stipulates the requirements for the risk assessment of a machine. It is this that EN ISO 13849-1 is based on, and a completed risk assessment is a prerequisite for being able to work with the standard.

Step 1 – Risk assessment

A risk assessment begins with determining the scope of the machine. This includes the space that the machine and its operators need for all of its intended applications, and all operational stages throughout the machine's life cycle.

All risk sources must then be identified for all work operations throughout the machine's life cycle.

A risk estimation is made for each risk source, i.e. indication of the degree of risk. According to EN ISO 13849-1 the risk is estimated using three factors: injury severity (S, severity), frequency of exposure to the risk (F, frequency) and the possibility you have of avoiding or limiting the injury (P, possibility). For each factor two options are given. Where the boundary between the two options lies is not specified in the standard, but the following are common interpretations:

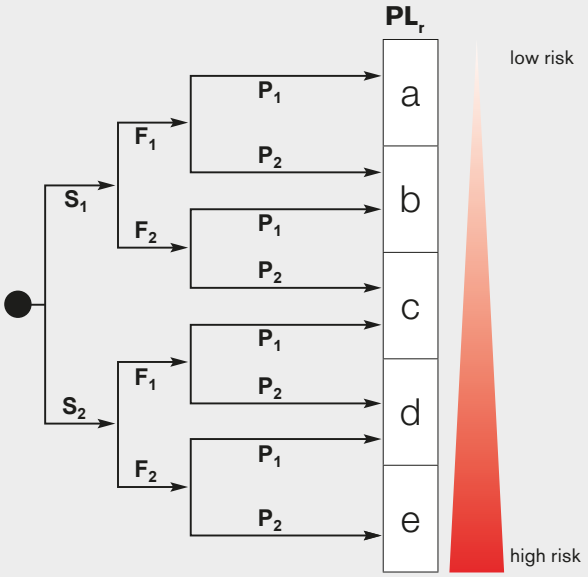
S1 **bruises, abrasions, puncture wounds and minor crushing injuries**
S2 **skeletal injuries, amputations and death**
F1 **less frequently than every two weeks**
F2 **more often than every two weeks**
P1 **slow machine movements, plenty of space, low power**
P2 **quick machine movements, crowded, high power**

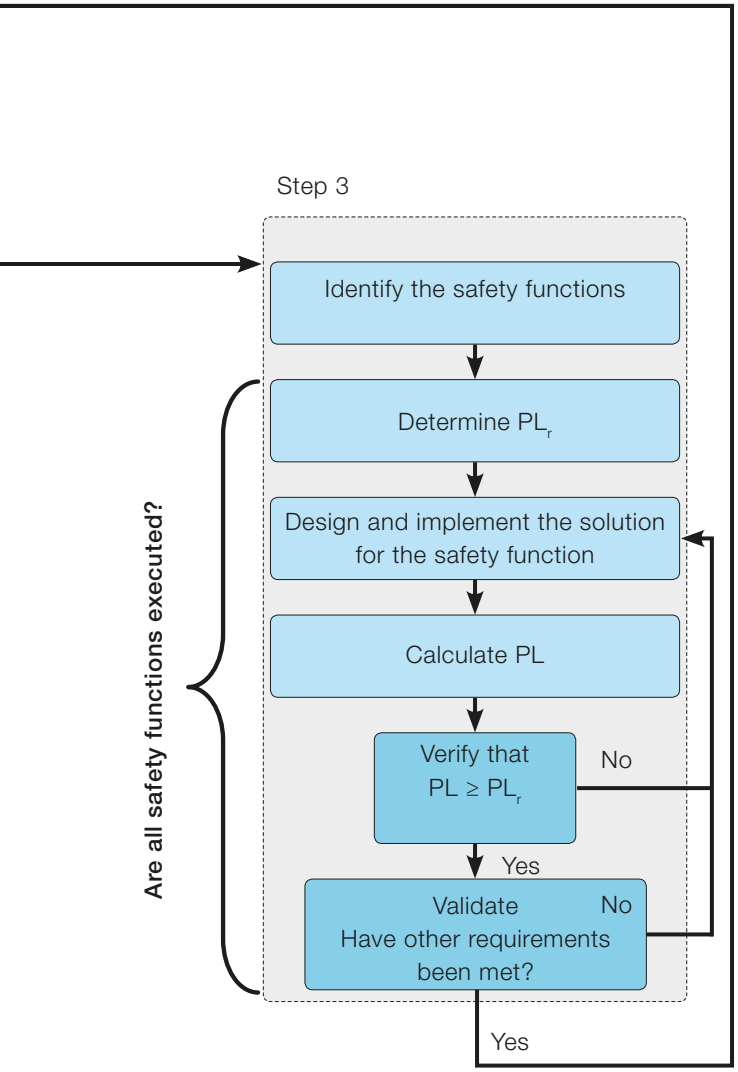
By setting S, F and P for the risk, you will get the PL_r Performance Level (required) that is necessary for the risk source.

Finally, the risk assessment includes a risk evaluation where you determine if the risk needs to be reduced or if sufficient safety is ensured.

Risk estimation
To calculate the performance level required (PL_r).

S	**Severity of injury**
S1	slight (normally reversible injury)
S2	serious (normally irreversible injury or death)
F	**Frequency and/or exposure to hazard**
F1	seldom to less often and/or exposure time is short
F2	frequent to continuous and/or exposure time is long
P	**Possibility of avoiding hazard or limiting harm**
P1	possible under specific conditions
P2	scarcely possible





Step 2 – Reduce the risk

If you determine that risk reduction is required, you must comply with the priority in the Machinery Directive in the selection of measures:

1. Avoid the risk already at the design stage.
(For example, reduce power, avoid interference in the danger zone.)

2. Use protection and/or safety devices.
(For example, fences, light grids or control devices.)

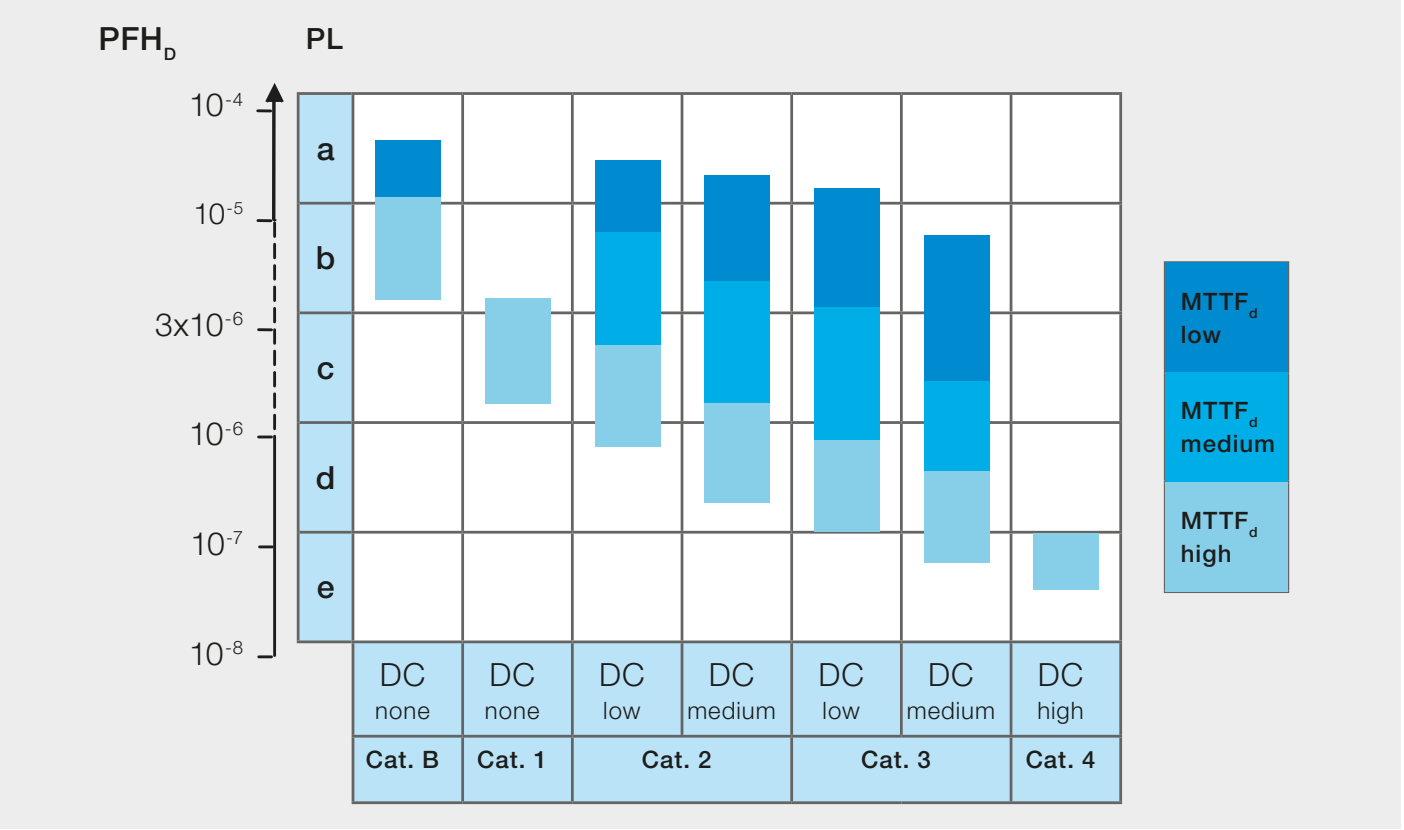
3. Provide information about how the machine can be used-safely. (For example, in manuals and on signs.)

If risk reduction is performed using safety devices, the control system that monitors these needs to be designed as specified in EN ISO 13849-1.

Step 3 - Design and calculate the safety functions

To begin with you need to identify the safety functions on the machine. (Examples of safety functions are emergency stop and monitoring of gate.)

For each safety function, a PL_r should be established (which has often already been made in the risk assessment). The solution for the safety function is then designed and implemented. Once the design is complete, you can calculate the PL the safety function achieves. Check that the calculated PL is at least as high as PL_r and then validate the system as per the validation plan. The validation checks that the specification of the system is carried out correctly and that the design complies with the specification.You will also need to verify that the requirements that are not included in the calculation of the PL are satisfied, that is, ensure that the software is properly developed and validated, and that you have taken adequate steps to protect the technical solution from systematic errors.



The relationship between categories, the DC_{avg}, $MTTF_d$ for each channel and PL. The table also shows the PFH_D-range that corresponds to each PL.

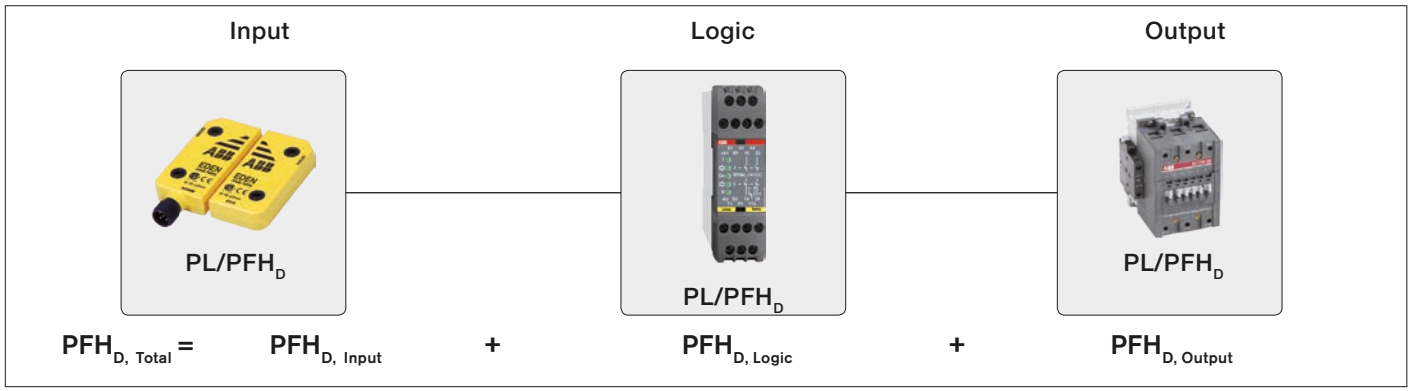
PL calculation in Step 3

When you calculate the PL for a safety function, it is easiest to split it into separate, well defined blocks (also called subsystems). It is often logical to make the breakdown according to input, logic and output (e.g. switch - safety relay - contactors), but there may be more than three blocks depending on the connection and the number of components used (an expansion relay could for example create an additional logic block).

For each block, you calculate a PL or PFH_D-value. It is easiest if you obtain these values from the component manufacturer, so you do not have to calculate yourself. The manufacturer of switches, sensors and logic devices often have PL and PFH_D-values for their components, but for output devices (such as contactors and valves) you do not usually specify a value as it depends on how often the component will be used. You can then either calculate yourself according to EN ISO 13849-1 or use the pre-calculated example solutions such as those from ABB Jokab Safety.

To calculate PL or PFH_D for a block, you need to know its category, DC and $MTTF_d$. In addition, you need to protect yourself against systematic errors and ensure that an error does not knock out both channels, and generate and validate any software used correctly. The following text gives a brief explanation of what to do.

Safety function (SF)



Category
The structure for the component(s) in the block is assessed to determine the category (B, 1-4) it corresponds to. For category 4, for example, individual failures do not result in any loss of the safety function.

In order to achieve category 4 with contactors, you need to have two channels - i.e., two contactors - that can cut the power to the machine individually. The contactors need to be monitored by connecting opening contacts to a test input on, for example a safety relay. For monitoring of this type to work, the contactors need to have contacts with positive opening operation.

Diagnostic Coverage (DC)
A simple method to determine DC is explained in Appendix E in EN ISO 13849-1. It lists various measures and what they correspond to in terms of DC. For example, DC=99 % (which corresponds to DC high) is achieved for a pair of contactors by monitoring the contactors with the logic device.

Mean Time To dangerous Failure ($MTTF_d$)
The $MTTF_d$-value should primarily come from the manufacturer. If the manufacturer cannot provide values, they are given from tables in EN ISO 13849-1 or you have to calculate $MTTF_d$ using the B_{10d}-value, (average number of cycles until 10% of the components have a dangerous failure). To calculate the $MTTF_d$, you also need to know the average number of cycles per year that the component will execute.

Calculation of the average number of cycles is as follows:

$$MTTF_d = \frac{B_{10d}}{0{,}1 \cdot n_{op}}$$

where

$$n_{op} = \frac{d_{op} \cdot h_{op} \cdot 3600}{t_{cycle}}$$

n_{op}	=	Number of cycles per year
d_{op}	=	Operation days per year
h_{op}	=	Operation hours per day
t_{cycle}	=	Cycle time (seconds)

Example: d_{op}= 365 days, hop= 24 hours and t_{cycle}= 1,800 seconds (2 times/hour) which gives n_{op}= 17,520 cycles. With a B_{10d}=2·106 this gives a $MTTF_d$=1,141 year which corresponds to $MTTF_d$=high.

Note that when you calculate $MTTF_d$ you have to calculate according to the total number of cycles the component will be working. A typical example of this is the contactors that frequently work for several safety functions simultaneously. This means that you must add the number of estimated cycles per year from all the safety functions that use the contactors.

When $MTTF_d$ is calculated from a B_{10d}-value, also consider that if the $MTTF_d$-value is less than 200 years, the component needs to be replaced after 10% of the $MTTF_d$-value (due to the T_{10d}-value). That is, a component with $MTTF_d$ = 160 years needs to be replaced after 16 years in order for the conditions for achieving PL to continue to be valid. This is because EN ISO 13849-1 is based on a “mission time” of 20 years.

Common Cause Failure (CCF)
In Appendix F of EN ISO 13849-1 there is a table of actions to be taken to protect against CCF, to ensure a failure does not knock out both channels.

Systematic errors
Appendix G of EN ISO 13849-1 describes a range of actions that need to be taken to protect against incorporating faults into your design.

PL for safety functions
PL is given in the table on the facing page. If you want to use an exact PFH_D-value instead, this can be produced using a table in Appendix K in EN ISO 13849-1.

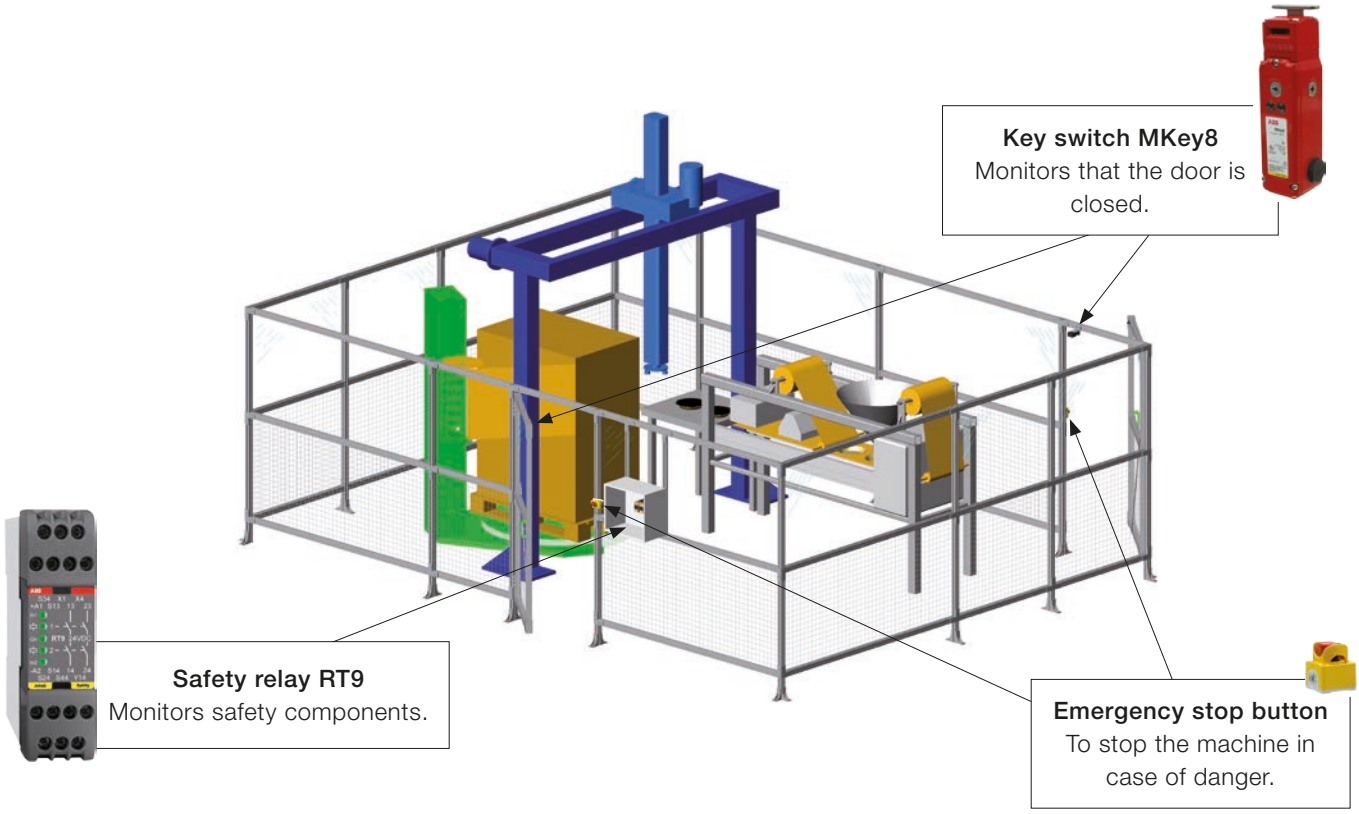
Once you have produced the PL for each block, you can generate a total PL for the safety function in Table 11 of EN ISO 13849-1. This gives a rough estimate of the PL. If you have calculated PFH_D for each block instead, you can get a total of PFH_D for the safety function by adding together all the values of the blocks. The safety function’s total PFH_D corresponds to a particular PL in Table 3 of EN ISO 13849-1.

Requirements for safety-related software
If you use a safety PLC for implementing safety functions, this places demands on how the software is developed and validated. To avoid error conditions, the software should be readable, understandable and be possible to test and maintain.

A software specification must be prepared to ensure that you can check the functionality of the program. It is also important to divide the program into modules that can be tested individually. Paragraph 4.6 and Appendix J of EN ISO 13849-1 specify requirements for safety related software.

The following are examples of requirements for software from EN ISO 13849-1:
- A development life cycle must be produced with validation measures that indicate how and when the program should be validated, for example, following a change.
- The specification and design must be documented.
- Function tests must be performed.
- Validated functional blocks must be used whenever possible.
- Data and control flow are to be described using, for example, a condition diagram or software flow chart.

Protection layout for a packaging machine with low risks.



Step 1 – Risk assessment

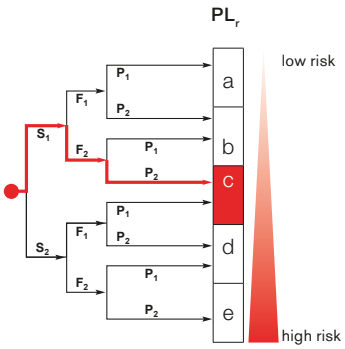
Food to be packaged is loaded into the cell manually through the rear door. A batch is prepared for the packing conveyor in the infeed hopper. The cell is reset and restarted. The packaging machine with conveyor belt only operates when both doors are closed and when the protection system has been reset.

In the risk assessment it was established that the machine is to be operated in three shifts (8 hours per shift) 365 days a year. It is assumed that operational disturbances were resolved in less than one minute in the danger zone. This can be carried out two times per hour (F2). Unexpected start-ups are not deemed to cause serious injury but rather minor healable injuries (S1). The operator is deemed not to have the possibility of avoiding injury as the machine moves quickly (P2).

The number of cycles for the safety function = 365 days/year • (3•8) hours/day • 2 cycles/hour = 17,520 cycles/year
The assessment for the safety function required for access to the machine is PL_r= c (S1, F2, P2). In addition to this safety function, an emergency stop function is needed. This is also assessed as PL_r=c.

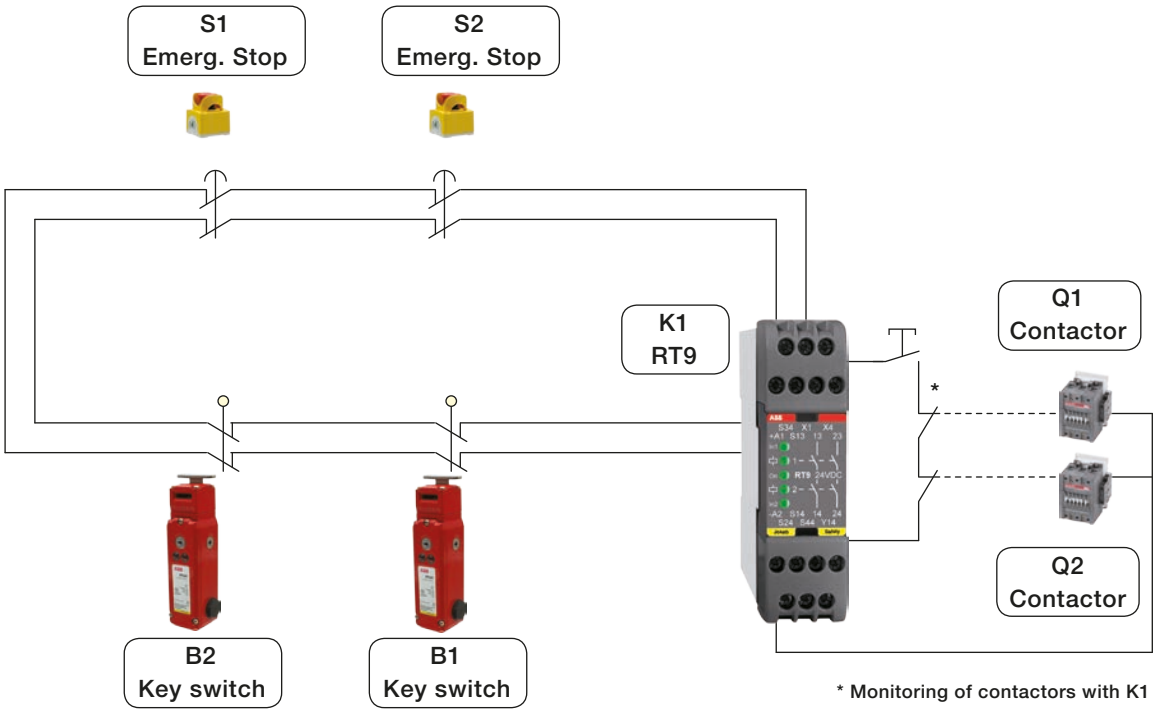
Step 2 – Reduce the risk

As protection, an interlocked door is selected with the key switch MKey8. Downtime is short enough for the dangerous movement to have stopped before the operator can access it. The emergency stop is placed within easy reach, on both sides of the cell near the locked doors.



Assessment of the PL_r necessary for the safety function with interlocked door for this example.

NOTE! The assessment needs to be made for each safety function.



Step 3 - Calculate the safety functions

The starting block that is composed of double unmonitored contactors has been calculated at $2.47 \cdot 10^{-8}$. The safety functions are represented by block diagrams.

Safety functions 1 and 2 are identical. Therefore, only safety function 1 is shown.

Safety functions 3 and 4 are identical. Therefore, only safety function 3 is shown.

How safe is a mechanical switch?

A mechanical switch must be installed and used according to its specifications in order to be reliable.

- Life expectancy only applies if correctly installed.
- The locking head must be fixed so that it will not loosen.
- The environment around the lock housing must be kept clean.
- Two mechanical switches on a door can also fail for the same reason.

Safety function 1

	Input	Logic	Output	Result
PL_r=c	**B1** Key switch MKey8 PL c	**K1** Safety relay RT9 PL e	**Q1/Q2** Redundant monitored contactors PL e	**PL c**

$PFH_{D, MKey8} + PFH_{D, RT9} + PFH_{D, Q1/Q2} = 1.14 \cdot 10^{-6} + 9.55 \cdot 10^{-9} + 2.47 \cdot 10^{-8} = 1.18 \cdot 10^{-6} \longrightarrow$ PL c

Safety function 3

	Input	Logic	Output	Result
PL_r=c	**S1** E-Stop button PL c	**K1** Safety relay RT9 PL e	**Q1/Q2** Redundant monitored contactors PL e	**PL c**

$PFH_D + PFH_{D, RT9} + PFH_{D, Q1/Q2} = 1.34 \cdot 10^{-6} + 9.55 \cdot 10^{-9} + 2.47 \cdot 10^{-8} = 1.37 \cdot 10^{-6} \longrightarrow$ PL c

The reason for not achieving more than PL c with this solution is that you use one key switch per door. PL d could be achieved by using two key switches per door, but further action on the monitoring of each switch will be required as well. Note: If the risk assessment had shown that a serious injury, S2, could occur, the outcome would have been PL_r= e. This would have meant that the above solution was inadequate. For the emergency stop function, PL d can be achieved provided that certain failure exclusions can be made. These safety functions can be downloaded from our website as a SISTEMA project, www.abb.com/jokabsafety.

What defines a safety function?

1

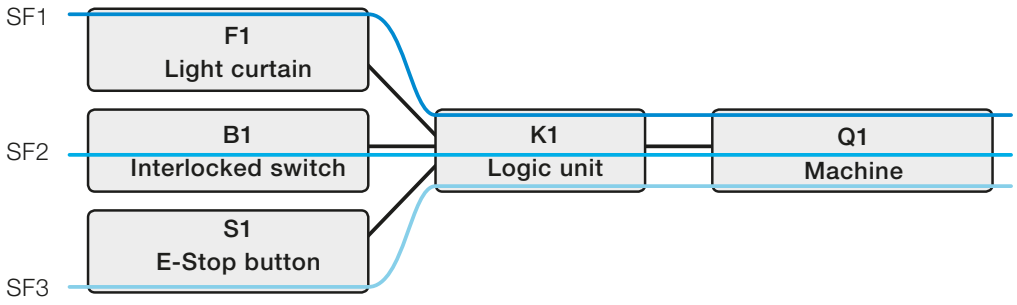
Calculating that you have achieved the PL_r that is required is not difficult, especially if you use "pre-calculated" safety devices and logic units. But what parts should then be included in each safety function?
This must be resolved before you start calculating phase. To summarise in simple terms you can say that each safety device gives rise to a safety function for each machine that is affected by the safety device in question. Three safety devices that all cut the power to three machines in a cell is therefore equal to nine safety functions. In the section that follows, we explain the background.

Multiple safety functions for a machine

Multiple safety devices are often used on a machine in order to provide satisfactory and practical protection for the operators. In the following example, the machine is protected by three safety devices connected to a logic device. The following figure illustrates this interconnection schematically.

Three safety functions (SF) are defined for the machine and are calculated as:

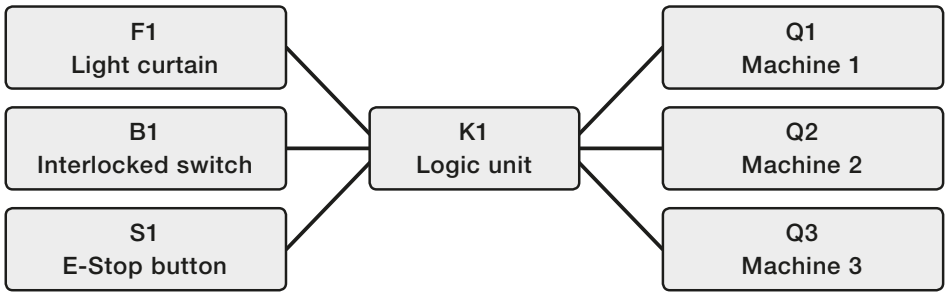
SF1: $PFH_{D,\,F1} + PFH_{D,\,K1} + PFH_{D,\,Q1} = PFH_{D,\,SF1}$
SF2: $PFH_{D,\,B1} + PFH_{D,\,K1} + PFH_{D,\,Q1} = PFH_{D,\,SF2}$
SF3: $PFH_{D,\,S1} + PFH_{D,\,K1} + PFH_{D,\,Q1} = PFH_{D,\,SF3}$



Multiple safety functions for multiple machines in a cell

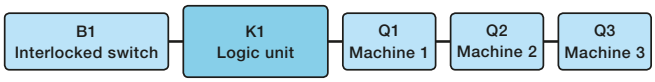
More commonly, several machines in a single cell/zone are to be protected by multiple safety devices. The following figure illustrates the interconnection schematically for an example. Each of the machines Q1 – Q3 is shut down separately and independently of K1.

If the operator enters the cell, he is exposed in this case to the same type of risk from all three machines. The power to all three machines must be cut when the operator enters the cell through the door interlocked by B1.



Theoretical approach for multiple machines

The theoretical approach to calculate the safety function is as follows:

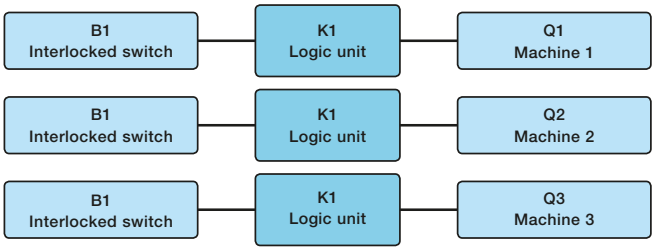


For the full safety function to be performed you require all the components to be working. Note that if B1 or K1 has a dangerous malfunction, the entire safety function is disabled. However, if for example machine Q1 has a dangerous malfunction, and is not shut down, machines Q2 and Q3 will still be shut down. One disadvantage in considering the safety function in this way is that you may have trouble achieving the PL_r required. But if you achieve the PL_r required, you can use the theoretical approach.

Sources:
www.dguv.de/ifa/de/pub/grl/pdf/2009_249.pdf
www.bg-metall.de/praevention/fachausschuesse/infoblatt/deutsch.html
(No 047, Date 05/2010)

Practical approach for multiple machines

A more practical approach is to divide the safety function into three parts, one for each of the three machines.



This is an approach that can provide a more accurate way of looking at the safety functions, especially where a different PL_r is required for the safety functions above. If machine Q1 is a robot and machine Q2 is a conveyor which is designed to have negligible risks, the different PL_r required to protect against risks from Q1 and Q2 will also be different. This practical approach is therefore the one recommended. The interpretation is based on information provided by IFA (Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung). For more information on this and other issues, see Sources.

Example of safety functions for multiple machines in a cell

For a cell with three machines (one robot, one hydraulic press and one pneumatic machining tool) a risk assessment is made resulting in different PL_r for the individual machines. The robot and the hydraulic press requires PL_r = e, while the pneumatic machining tool requires PL_r = d.

One of the safety functions is that a non-contact sensor (Eden) supervised by a safety PLC (Pluto) shall disconnect the energy to all three machines in the hazard zone:

- Eden B1 ($PFH_{D, B1} = 4.5 \cdot 10^{-9}$)
- Pluto K1 ($PFH_{D, K1} = 2 \cdot 10^{-9}$)
- Robot Q1 ($PFH_{D, Q1} = 5.79 \cdot 10^{-8}$)
- Hydraulic press Q2 ($PFH_{D, Q2} = 8 \cdot 10^{-8}$)
- Pneumatic machining tool Q3 ($PFH_{D, Q3} = 2 \cdot 10^{-7}$).

Practical approach

If you use the practical approach the safety functions are as follows:
Robot:

$PFH_{D, B1} + PFH_{D, K1} + PFH_{D, Q1} = 4.5 \cdot 10^{-9} + 2 \cdot 10^{-9} + 5.79 \cdot 10^{-8} = 6.44 \cdot 10^{-8} \longrightarrow$ PL e

Hydraulic press:

$PFH_{D, B1} + PFH_{D, K1} + PFH_{D, Q2} = 4.5 \cdot 10^{-9} + 2 \cdot 10^{-9} + 8 \cdot 10^{-8} = 8.65 \cdot 10^{-8} \longrightarrow$ PL e

Pneumatic machining tool:

$PFH_{D, B1} + PFH_{D, K1} + PFH_{D, Q3} = 4.5 \cdot 10^{-9} + 2 \cdot 10^{-9} + 2 \cdot 10^{-7} = 2.07 \cdot 10^{-7} \longrightarrow$ PL d

This is to be done in a similar way with other safety functions for the cell. For each safety device, you define the machines it affects, and establish the various safety functions according to this.

Theoretical approach

How would it have worked if you had used the theoretical approach? Would the safety function have achieved PL e?
All machines:

$PFH_{D, B1} + PFH_{D, K1} + PFH_{D, Q1} + PFH_{D, Q2} + PFH_{D, Q3}$
$= 4.5 \cdot 10^{-9} + 2 \cdot 10^{-9} + 5.79 \cdot 10\text{-}8 + 8 \cdot 10^{-8} + 2 \cdot 10^{-7} = 3.44 \cdot 10^{-7} \longrightarrow$ PL d

In this case, the safety function would therefore have not achieved a total PL e, which was required for the risks associated with the robot and hydraulic press.

Conclusions

- Use the practical approach.
- Use safety devices/logic units with high reliability (low PFH_D) to make it easy to achieve the PL_r required.
- With Vital or Pluto, it is easier to achieve the PL_r required.

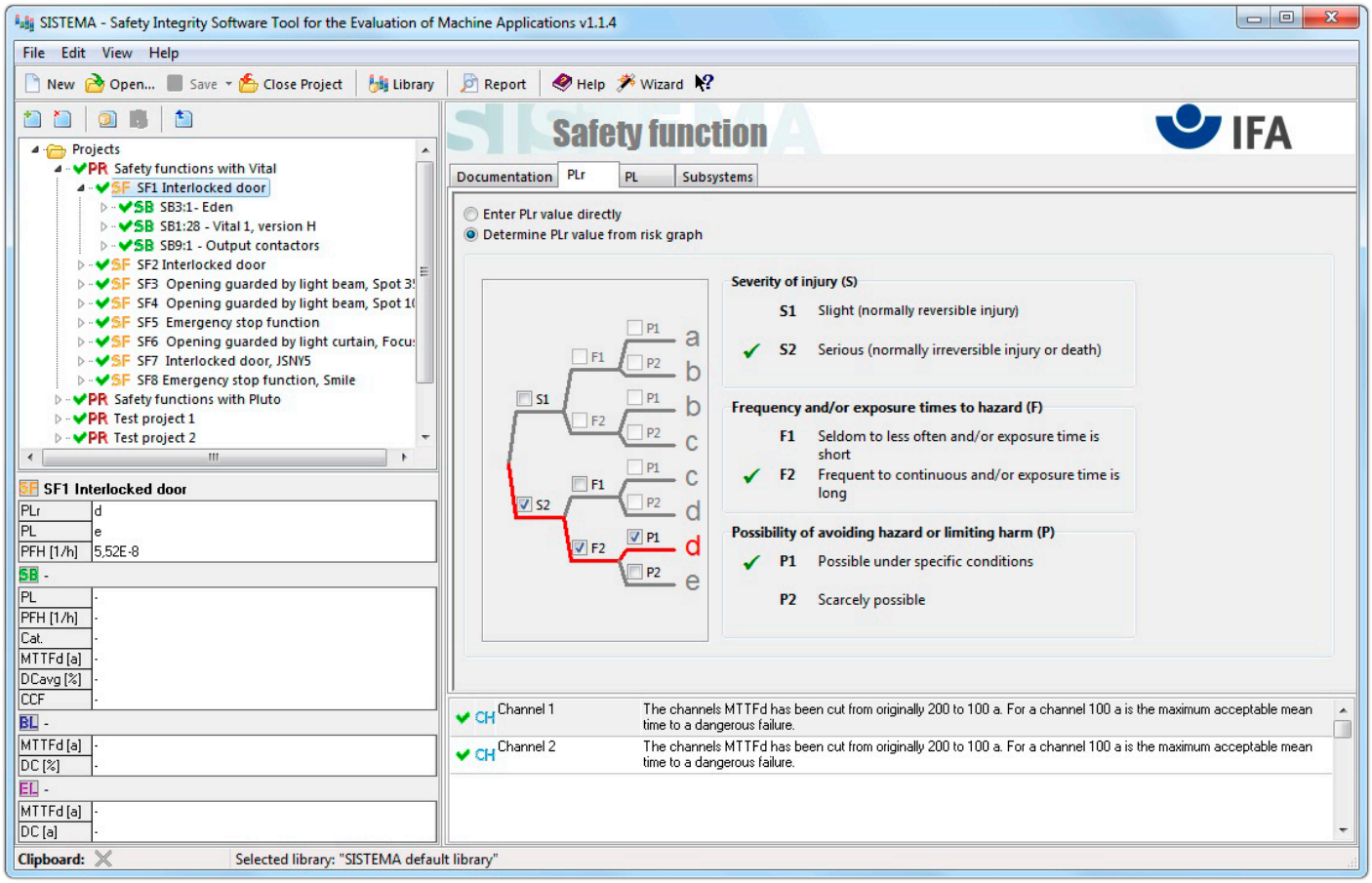
Please note that the examples on these pages are simplified in order to explain the principles. Values of products can also change.

SISTEMA
A tool for determining performance level (PL) and generating technical documentation

EN ISO 13849-1 requires calculations. To do this in a manageable way a software tool provides excellent help. ABB Jokab Safety has chosen to use SISTEMA, a software tool developed by BGIA, now called IFA, in Germany. The tool is freeware and can be downloaded from the IFA website, www.dguv.de/ifa. With SISTEMA it is possible to "build" safety functions, verify them and generate the technical documentation required.

To work with SISTEMA in a rational way, we have developed a library of our products for download from our website www.abb.com/jokabsafety. In order to have access to the latest version, visit this page periodically to check for updates and new releases.

To download SISTEMA go to www.dguv.de/ifa/en/pra/softwa/sistema/index.jsp or search the Internet for "sistema".



Screenshot from SISTEMA.

Notes

A mechanical switch does not give a safe function!

A mechanical switch does not give a safe function!

When it comes to mechanically operated interlocked switches, it has long been accepted a Category 1 switch is adequate for many installations, which is also supported by several standards. However some companies have now re-evaluated this and have instead started to demand two mechanical switches or non-contact switches/sensors, where they previously accepted single mechanical switches. Many reported incidents form the background to this. The requirements for switches to provide safe functioning are that they are mounted correctly and that their positions do not change during their life-cycle, in other words, ideal conditions. In many installations the location of hatches or doors changes over time. This has led to a switch not giving a stopping signal when an interlocked gate has opened. The reasons for this are many, but they can be summarized in mechanical deterioration or physical damage to a door/hatch. In turn this has led to an interlocked switch being affected by higher stress than the switch manufacturer's specifications. To avoid this type of malfunction it is more appropriate to use non-contact switches/sensors because mechanical deterioration does not affect the safety function, i.e. the stop signal is given directly if the position is wrong.

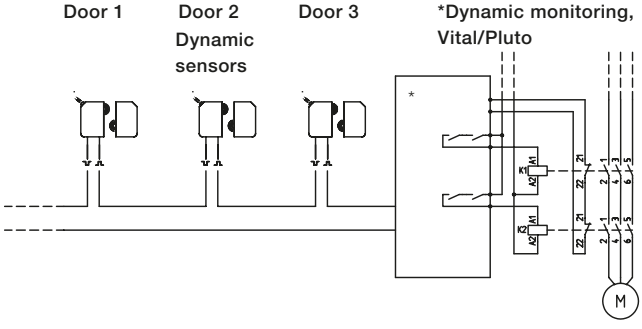
A non-contact switch/sensor does not have a guided function and is designed to fulfill the requirements in another way. The requirements are fulfilled either with dynamic sensors where the safety signal is monitored all the time and a fault directly leads to a stop signal or with a magnetic switch which has two independent contact elements which are monitored every time a gate opens. From the user's perspective the dynamic function is preferable because several sensors can be connected to a single safety module and still achieve PL e. Also the sensor's safety function is monitored without having to open a gate. For a magnetic switch the requirements for PL e are only fulfilled if one switch per monitoring unit is used and if the gate is opened regularly.

If PL e is to be achieved with electromechanical switches, maximum two switches can be connected to one safety relay. This means that it is only with Eden that several doors can be supervised with one safety module and achieve PL e.

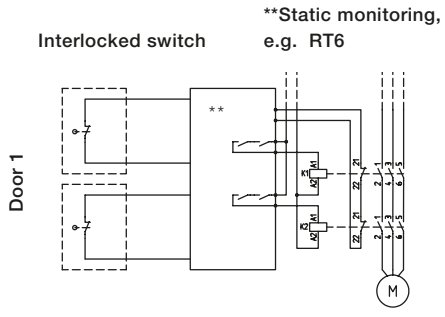
Since the standard EN 954-1 was written, development has progressed and the costs to fulfill category 4 have dropped dramatically. Generally mechanical switches are replaced with non-contact sensors to increase the reliability of production equipment. The same goes for the safety side. With electronic non-contact switches, with a transmitter and a receiver, one avoids the problems of deterioration and excessive stress which harm the sensor. For that kind of sensor dynamic monitoring is required to enable a safe function. This means that its function is constantly being monitored, hundreds of times per second. The reaction time for a safe stop will then be the same during a malfunction as during the activation of a stop (e.g. a gate opening). The monitoring frequency will also be astronomical compared to that of mechanical switches and magnetic switches, which are only monitored every time they are used. In the new EN ISO 13849-1, which has replaced 954-1, probability calculations are used together with different category levels to compare different "performance levels". Even when using EN ISO 13849-1 it can be so that one achieves reasonably high theoretical reliability with an electromechanical switch, although this presumes correct installation, proper use and otherwise ideal conditions. A non-contact switch instead provides high levels of both theoretical and practical reliability.

Our conclusion, use dynamic signals!

Our conclusion is that today it is more cost effective, safer and more reliable to work with dynamic signals to achieve category 4 for sensors and monitoring units. In that case it is also possible to fulfill the Machinery Directive, 1.2.7. requirement: "A fault in the control circuit logic, or failure of or damage to the control circuit, must not lead to dangerous situations". Also one does not have to discuss whether the correct safety category has been chosen!



Up to 30 doors (Eden sensors) can be connected to the dynamic monitoring maintaining category 4.



Maximum 1 door (2 interlocked switches) can be connected to the static monitoring for category 4 to be maintained for the entire system.

Product training

Training – ABB Jokab Safety products

Contact your local sales office with questions and your current training needs. Together with you, we will customize the training to your specific company requirements.

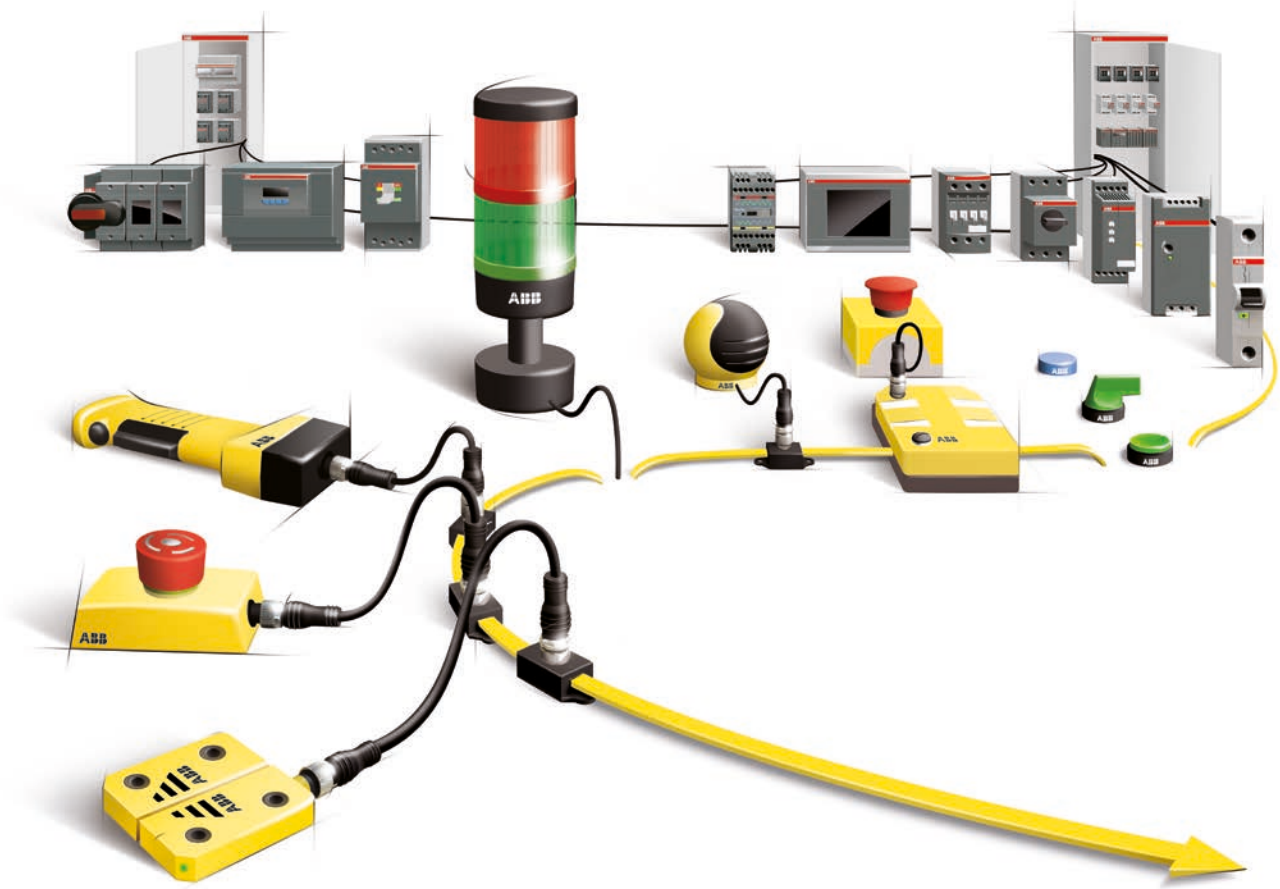



ABB
X1 13 33
+A1 S14 23 43
1
E1T 0s 24VDC
2
-A2 S24 24 44
X2 14 34
Safety
ABB
S53 X1 X4
+A1 S13 S14 S34
T0 T1 T2
13 23 43 53
In1
1
RT7A 230VAC
On
0-1,5 s
2
In2
-A2 S23 S24 S44
Y13 Y14 Y24
14 24 44 54
Y34 31 32
Safety

Safety Relays

Why should you use safety relays?

– to meet existing safety standards!

”A fault in the hardware or the software of the control system does not lead to hazardous situations”. This is the requirement in the EU’s Machinery Directive 2006/42/EC under the heading 1.2.1. Safety and reliability of control systems. The directive implies that no person should be put at risk if for example, a relay sticks or if a transistor or two electrical conductors short-circuit.

A safety relay will fulfill these requirements. A safety relay has, for example, inputs that are checked for short-circuits and dual redundant circuits that are checked at each operation. This can be compared to the dual brake circuits in a car. If one of the circuits is faulty the other will stop the car. In a safety relay there is an additional function which only allows a machine to start if both circuits are ok.

The standard for safety related parts of the control system describes various safety categories depending on the level of risk and application. One single universal relay with selectable safety categories solves this.

– to supervise safety devices!

Light beams

Light curtains/Light grids

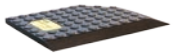
Three position devices

Safety interlock switches

Two-hand devices

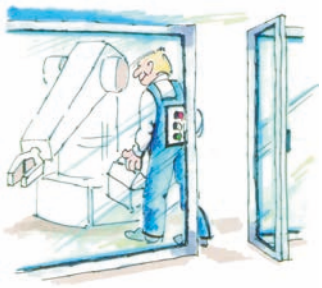
Emergency stop

Safety strips & Bumpers



Safety mats

– for safe stops and reliable restarts!



Dual stop signals when the gate is opened.
Entering or putting a hand or limb into a hazardous area must cause all machinery that can cause personal injury to stop safely. Many serious accidents occur when machinery is believed to have stopped but is in fact only pausing in its program sequence. The safety relay monitors the gate interlock switch and cables and gives dual stop signals.

Supervised reset when there can be a person within the risk area.
To make sure that nobody is within the restricted area when activating the reset button. A supervised reset button must be pressed and released before a reset can occur. Many serious accidents have been caused by an unintentional and unsupervised reset.

Timed reset when you cannot see the entire risk area.
Sometimes a double reset function is necessary to make sure that no one is left behind in the risk area. First, after ensuring no other person is inside the hazardous area, the pre-reset button must be activated, followed by the reset button outside the risk area within an acceptable time period e.g 10 seconds. A safety timer and a safety relay can provide this function.

Automatic reset for small hatches.
Where body entry is not possible through a hatch, the safety circuit can be automatically reset.

The safety relays are reset immediately when the hatch interlock switch contacts are closed.

The most flexible safety relays on the market!

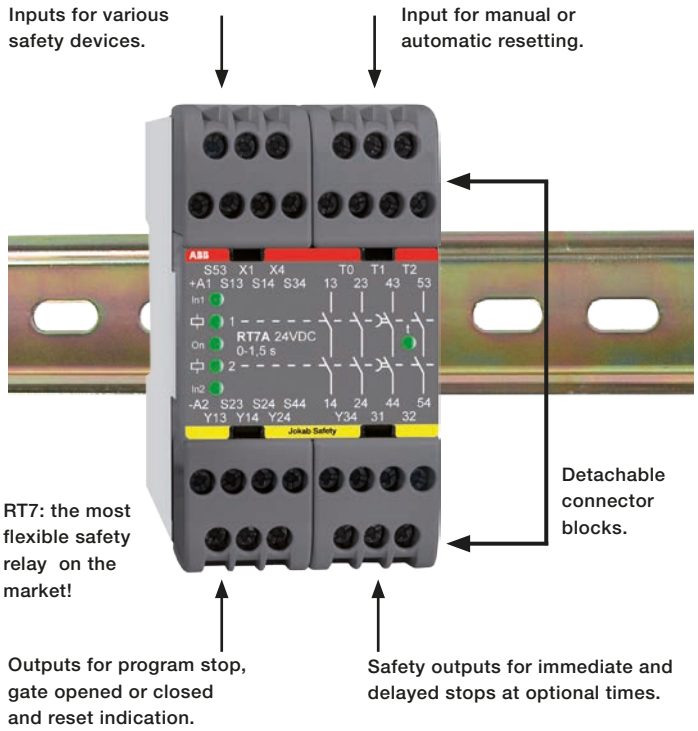
We have the most flexible safety relays on the market. Our first universal relay was developed in 1988. Nowadays, the flexibility is even greater and size has been reduced by 85 %.

A universal relay is a safety relay with various input options for various safety devices and risk levels.

Internally, the safety relay is of the highest safety level (PL e according to EN ISO 13849-1). A machine supplier can therefore, with one single safety relay, select the input configuration that best suits their customers' safety requirements. In addition, our safety relays have detachable connector blocks for ease of replacement and testing. As our universal relays incorporate all input options, they are compatible with all our previous safety relays as well as with other manufacturers' products.

Is a universal relay expensive? No, our latest patented construction is extremely simple and the number of major components is less compared to our previous universal relays. This means that the safety relays are even more reliable than before.

We also have a great deal of experience from safety solutions in our own system developments. It would be our pleasure to share these experiences with you! Please see the complete safety solutions in the section “Connection examples”. Please do not hesitate to contact us if you should require any other safety solutions.



Some of the advantages with ABB Jokab Safety’s safety relays

- Universal relays
- Excellent reliability
- Approved in Europe, USA, Canada
- Supervised reset
- Time reset
- Small and compact
- Detachable connector blocks
- Low power consumption
- Permits the use of long emergency stop cables
- EX compatibility
- Functions set by external hardwired links
- LED indication for inputs and outputs
- Powerful switching capacity

Summary Safety Relays

Which safety relay should you choose?

First of all, we would recommend the selection of one of our latest universal relays in the RT-series. These are both practical and cost effective.

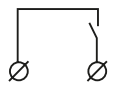
To facilitate the choice of safety relay or combinations of safety relays, please see:
- the table below dividing the safety relays into application fields
- the table on the opposite page showing possible input and output options
- the relevant data sheet giving comprehensive information about each specific safety relay
- the circuit diagram for various applications in the section “Connection examples”.

Note! All earlier types of relays that can now be replaced by those in this manual are still kept as stock items and can be supplied upon request.

Application fields

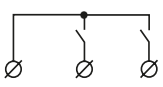
	Safety relays								Safety timers		Expansion relays			
	RT6	RT7	RT9	JSBRT11	JSBR4	JSBT4	JSBT5T, BT50T, BT51T	JSBT5, BT50, BT51	JSHT1A/B	JSHT2A/B/C	E1T	JSR1T	JSR2A	JSR3T
Interlocking switch/Gate/ Hatch	●	●	●	●	●	●	●	●						
Light curtains	●	●	●	●										
Light beams	●	●	●	●										
Safety mats	●	●	●		●	●								
Contact strips	●	●	●		●	●								
Two-hand control device					●									
Emergency stop	●	●	●	●	●	●	●	●						
Hold to run/enabling device	●	●	●	●	●	●				●				
Foot control device	●	●	●	●	●	●				●				
Area supervision	●	●	●	●	●	●								
Time resetting									●					
Time bypassing									●	●				
Inching										●				
Output expansion	●	●	●	●		●	●	●			●	●	●	
Delayed output		●					●				●	●		●

Input alternatives (see also technical data on the next page)



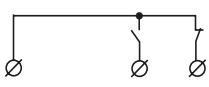
Single-channel, 1 NO from +24 V
Category 1, up to PL c

The input must be closed before the outputs can be activated. A stop signal is given when the input is opened.



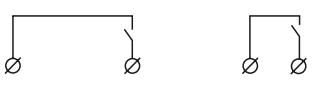
Two-channel, 2 NO from +24 V
Category 3, up to PL d

Both the inputs must be closed before the outputs can be activated. A stop signal is given if one or both of the inputs are opened. Both the inputs must be opened and reclosed before the outputs can be reactivated. A short-circuit between the inputs is not monitored by the safety relay. Category 4 can only be achieved if a safety device with short circuit monitored outputs is connected.



Two-channel, 1 NO & 1 NC from +24V Category 4, up to PL e

One input must be closed and one must be opened before the outputs can be activated. A stop signal is given if one or both of the inputs change position or if the inputs short-circuit. Both inputs must be put into their initial position before the outputs can be reactivated.



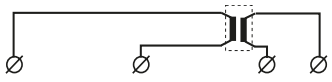
Two-channel, 1 NO from 0 V & Category 4, up to PL e

Both the inputs must be closed before the outputs can be activated. A stop signal is given if one or both of the inputs are opened. Both the inputs must be opened and reclosed before the outputs can be reactivated. A Stop signal is given if there is a short-circuit between the inputs.

Technical data

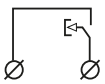
	Safety relays											Safety timers		Expansion relays			
	RT6	RT7	RT9	JSBRT11	JSBR4	JSBT4	JSBT5T	BT50T	BT51T	BT50	BT51	JSHT1A/B	JSHT2A/B/C	E1T	JSR1T	JSR2A	JSR3T
Safety category	1-4	1-4	1-4-	1-4	4	4	1-4°	1-4°	1-4°	1-4°	1-4°	1-4	1-4	1-4	1-4	1-4	1-4
Safety input																	
Single-channel, 1 NO from +24 V	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●
Two-channel, 2 NO from +24 V	●	●	●	●													
Two-channel, 1 NO & 1 NC from +24 V	●	●	●	●													
Two-channel, 1 NO from 0 V & 1 NO from + 24 V	●	●	●	●	●	●						●	●	●	●	●	●
Contact strips/Safety mats	●	●	●		●	●											
Reset & test input																	
Monitored manual	●	●	●	●	●	●											
Automatic/Unmonitored manual	●	●	●	●		●	●	●	●	●	●						
Testing of contactors, relays, valves, etc.	●	●	●	●	●	●	●	●	●	●	●	●	●				
Output																	
NO	3	2	2	7	3	3				3	4			4*	4*	4	
NO delayable		2					3†	3	4					4*	4*		2¤
NO impulse outputs												2¤	2¤				
NC info	1	1		2	1	1				1					1*	1	
NC info delayable							1†	1							1*		
Info. output	2	3	1					1	1								
Switching capacity (resistive load)	4	3	2	9	4	4	4	4‡	4‡	4	4			4	5		
6A/250VAC/1500VA/150W												2¤	2¤				2¤
4A/250VAC/1000VA/100W		2‡															
6A/250VAC/1380VA/138W																5	
Width (mm) 10A/250VAC/1840VA/192W	45	45	22.5	100	45	45	22.5	22.5	22.5	22.5	22.5	45	45	22.5	45	45	22.5
Supply voltage																	
12VDC							●										
24VDC	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
24VAC	●						●									●	●
115VAC	●	●		●	●											●	
230VAC	●	●		●	●											●	

* Indicates the possibility of selecting delayed outputs ¤ Indicates one relay contact per output (other relays having two contacts per output)
‡ delay-able ° Category 4 depending on connection (When used as expansion relay with Pluto Safety PLC, then Category 4) † fixed 0.5 s delay



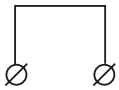
Contact strips/Safety mats
Category 3, up to PL d

For an unpressurised mat/strip, both the relay inputs must be closed for the outputs to be activated. In the case of an activated mat/strip and short-circuit input channels, the relay will be de-energized. Current limitation prevents the safety relay from being overloaded when the channels short-circuit.



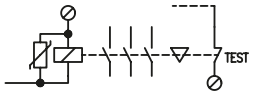
Monitored manual reset

A monitored reset means that the safety relay will not be reset if the reset button gets jammed when pressed in or if the input short-circuits. In order for the resetting to be complete, the input must be closed and opened before the outputs can close.



Automatic/unmonitored manual reset

Automatic reset means that the outputs are closed immediately when both the input conditions are satisfied and the test input is closed.



Testing of contactors, relays & valves

Can be carried out with both automatic and manual reset.

Safety relay
RT6

Approvals:

Safety relay for:

- Emergency stops
- Light curtains
- Three position devices
- Interlocked gates/hatches
- Magnetic switches
- Light beams
- Safety mats
- Contact strips
- Foot operated switches

Features:

- Five input options
- Single or dual channel input
- Manual supervised or automatic reset
- Test input for supervision of external contactors
- Width 45 mm
- LED indication of supply, inputs, outputs, short-circuit and low voltage level.
- 3 NO/1 NC relay outputs
- Two voltage free transistor information outputs
- Supply 24 VDC, 24, 115 or 230 VAC
- Quick release connector blocks

Would you like a single safety relay for all your safety applications?
Then choose the RT6 universal relay to supervise both your safety devices and the internal safety of your machinery. In addition you can select the safety level required for each installation. All this is possible because the RT6 has the most versatile input option arrangement available on the market. Many other relays can therefore be replaced by the RT6.

The relay also comes with other options such as manual or automatic reset. Manual supervised reset can be used for gates and other safety devices that can be by-passed. Automatic reset can be used for small hatches, if deemed acceptable from risk assessment.

The RT6 also has information outputs that follow the inputs and outputs of the relay. These outputs will for example indicate if a gate is open or closed and if the safety relay needs to be reset.

The RT6 is designed with a minimum amount of components thus keeping both production costs and component acquisitions to a minimum.

Choose the RT6 to simplify your safety circuits and reduce your costs.

RT6
Technical information

Inputs

The inputs from the safety devices must be connected according to one of the following options in order to fulfill the expected safety level and to avoid unsafe situations.

1. Single channel, 1NO contact from +24 VDC, category 1, up to PL c
2. Dual channel, 2NO contacts from +24 VDC, category 3, up to PL d
3. Dual channel 1NO, 1 NC contact from +24 VDC, category 4, up to PL e
4. Dual channel, 1NO contact from 0V and 1NO contact from +24 VDC, category 4, up to PL e
5. Safety mats/contact strips 1 'contact' from 0V and 1 'contact' from +24 VDC, category 3, up to PL d

When the input/inputs are activated and the test/supervised reset is complete, relays 1 and 2 are energized. Simultaneous activation is not required where there are dual channels. The two relays are de-energized when the input/inputs are de-activated in accordance with the input option chosen or in case of a power failure. Relays 1 and 2 must both be de-energized before the outputs can be activated again.

Transistor output status information

The RT6 has two voltage free transistor outputs that can be connected to a PLC, computer or other monitoring device. These outputs give the input and output status of the relay.

Reset and testing

The RT6 has two reset options; manual and automatic. The manual supervised reset is used when the RT6 is monitoring safety devices that can be bypassed, i.e. to ensure that the outputs of the safety relay do not close just because a gate is closed. The automatic reset should only be used if deemed an acceptable risk.

In addition, the RT6 can also test (supervise) whether, for example, contactors and valves etc are de-energized/de-activated before a restart is allowed.

Indication of low voltage

The 'On' LED will flash if the relay supply voltage falls below an acceptable level. This indication will also be given if a monitored safety mat/contact strip is actuated. See connection option 5.

Safety level

The RT6 has internal dual and supervised safety functions. A short-circuit, internal faulty component or external interference will not present a risk to options with the highest safety level. A manual reset requires that the reset input is closed and opened before the safety relay outputs are activated. A short-circuit or a faulty reset button is consequently supervised.

When the RT6 is configured for dual channel input, both the inputs are supervised for correct sequence operation before the unit can be reset.

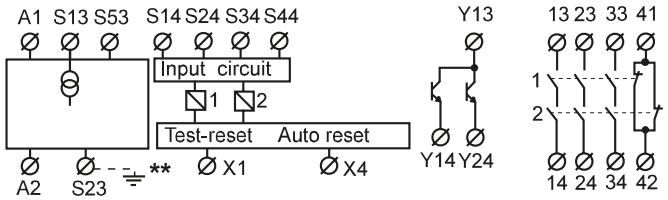
The input options 3 and 4 have the highest safety levels as all short-circuits and power failures are supervised. This in combination with internal current limitation makes the relay ideal for supervision of safety mats and contact strips.

Regulations and standards

The RT6 is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

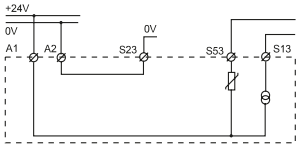
For examples of how our safety relays can solve various safety problems, see the section "Connection examples".



**Only for AC supply

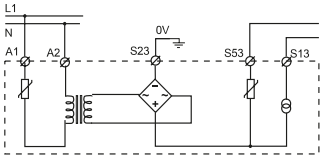
Connection of supply - RT6

DC supply



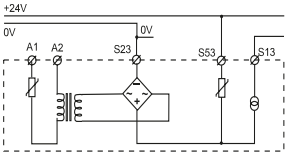
The RT6 DC option should be supplied with +24 V on A1 and 0 V on A2.

AC supply



The RT6 AC option should be supplied with the appropriate supply voltage via connections A1 and A2.
The S23/ ⏚ must be connected to protective earth.

DC-supply of AC-units



All AC-units can also be supplied by +24 VDC to S53 (0VDC to S23).

NOTE! With both DC and AC modules, if cable shielding is used this must be connected to an earth rail or an equivalent earth point.

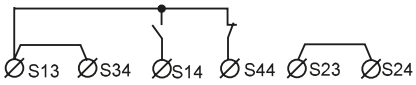
Connection of safety devices - RT6

1. SINGLE CHANNEL, 1 NO from +24V

The input (contact to S14) must be closed before the outputs can be activated. When the input contact is opened the relay safety output contacts open.

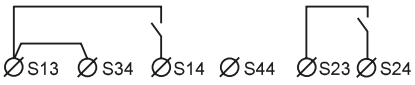
2. DUAL CHANNEL, 2 NO from +24V

Both input contacts (S14 and S34) must be closed before the relay outputs can be activated. The safety relay contacts will open if one or both of the input contacts are opened. Both the input contacts must be opened and reclosed before the relay can be reset. A short-circuit between inputs S14 and S34 can only be supervised if the device connected to the inputs has JOKAB Focus light curtains.



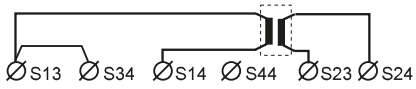
3. DUAL CHANNEL, 1 NO, 1 NC from +24V

One input contact must be closed (S14) and one opened (S44) before the relay outputs can be activated. The safety relay contacts will open if one or both of the inputs change state or in case of a short-circuit between S14 and S44. Both inputs must return to their initial positions before the relay outputs can be reactivated. Both 'contact' inputs from an inactivated safety mat/contact strip must be made in order to allow the RT6 relay outputs to be activated. When the safety mat/contact strip is activated or a short-circuit is detected.



4. DUAL CHANNEL, 1 NO from +24V, 1 NO to 0V

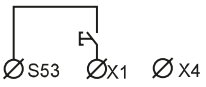
Relay functions as for option 2, but a short-circuit, in this case between inputs S14 and S24, is supervised (safety outputs are opened).



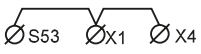
5. Safety mat/Contact strip

Both 'contact' inputs from a inactivated safety mat/contact strip must be made in order to allow the RT6 relay outputs to be activated. When the safety mat/contact strip is activated or a short-circuit is detected across S14-S23, the relay will de-energize (safety outputs open) and the 'ON' LED will flash. As output S13 has an internal current limit of 70 mA, the RT6 will not be overloaded when the mat/contact strip is activated or a short-circuit is detected.

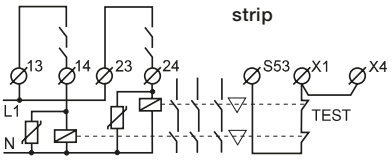
Manual supervised reset



Automatic reset



***connected to S13 for safety mat/contact strip**



Testing external contactor status

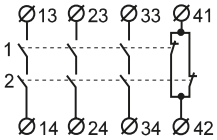
Reset connections - RT6

The manual supervised reset contact connected to input X1 must be closed and opened in order to activate the relay outputs

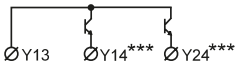
Automatic reset is selected when S53, X1 and X4 are linked. The relay outputs are then activated at the same time as the inputs.

Contactors, relays and valves can be supervised by connecting 'test' contacts between S53 and X1. Both manual supervised and automatic reset can be used.

Relay outputs



Transistor outputs



***Note These outputs are only for information purposes and must not be connected to the safety circuits of the machinery.

Output connections - RT6

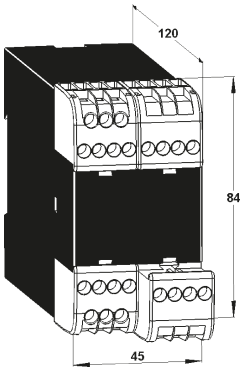
The RT6 has three (3 NO) safety outputs and 1 NC information output.
In order to protect the output contacts it is recommended that loads (inductive) are suppressed by fitting correctly chosen VDR's, diodes etc.
Diodes are the best arc suppressors, but will increase the switch off time of the load.
The RT6 has two(2) voltage free transistor outputs for information.
The transistor outputs are supplied with voltage to Y13, either from S53 (+24V) or an external 5-30 VDC supply. Y14 and Y24 follow the relay inputs and outputs as follows:

– Y14 becomes conductive when the relay input conditions are fulfilled.
– Y24 becomes conductive when both the output relays are activated.

Technical data - RT6

Article number	
RT6 24 VDC	2TLA010026R0000
RT6 115 VAC	2TLA010026R0400
Colour	Grey
Weight	335 g (24 VDC) 485 g (24-230 VAC)
Supply	
Voltage (A1-A2)	24 VDC +15/-20%, 24/115/230 VAC, +15/-10%, 50-60 Hz
Power consumption	
DC supply, nominal voltage	2.3 W
AC supply, nominal voltage	5.2 VA
Connection S13 Short-circuit protected voltage output, 70 mA ± 10% current limitation. Is used for the inputs S14, S34 and S44.	
Connection S53 Short-circuit protected voltage output, internal automatic fuse 270 mA. Is used for the reset and autoreset inputs X1 and X4	
Connection S23 0V connection for input S24	
Safety inputs	
S14 (+) input	20 mA
S24 (0V) input	20 mA
S34 (+) input	20 mA
S44 (+) input	30 mA
Reset input X1	
Supply for reset input	+ 24 VDC
Reset current	300 mA current pulse at contact, then 30 mA
Minimum contact closure time for reset	100 ms
Maximum external connection cable resistance at nominal voltage for	
S14, S24, S34	300 Ohm
S44, X1	150 Ohm
Response time	
At Power on DC/AC	<90ms/<220ms
When activating (input-output)	<20 ms
When deactivating (input–output)	<20 ms
At Power Loss	<150 ms
Relay outputs	
NO	3
NC	1
Maximum switching capacity	
Resistive load AC	6A/250 VAC/1500 VA
Inductive load AC	AC15 240 VAC 2A
Resistive load DC	6A/24 VDC/150 W
Inductive load DC	DC13 24 VDC 1A
Maximum total switching capacity	
Resistive load	12A distributed on all contacts
Minimum load	10mA/10 V (if load on contact has not exceeded 100 mA)
Contact material	Ag+Au flash
Fuses Output (External)	5A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Mechanical life	$>10^7$ operations

Transistor outputs	Short-circuit proof
External supply to Y13	+5 to +30 VDC
Y14	Indicates that the input conditions have been fulfilled
Y24	Indicates that the output relays are activated
Maximum load of Y14, Y24	15 mA /output
Maximum voltage drop at maximum load	2.4 V
LED indication	
On	Supply voltage OK, the LED is on. Flashing light in case of under-voltage or overload
In1 In2	Indicates that the input conditions are fulfilled.
1 2	Indicates that the output relays are activated.
Mounting	
Rail	35 mm DIN rail
Connection blocks (detachable)	
Maximum screw torque	1 Nm
Maximum connection area:	
Solid conductors	1x4 mm^2 / 2x1.5 mm^2 / 12AWG
Conductor with socket contact	1x2.5mm^2/2x1mm^2
Protection class	
Enclosure	IP40 IEC 60529
Connection blocks	IP20 IEC 60529
Operating temperature range	-10°C to + 55°C (with no icing or condensation)
Operating humidity range	35% to 85%
Impulse withstand Voltage	2.5kV
Pollution degree	2
Performance (max.) The relays must be cycled at least once a year.	PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005)PFH_D 1.35 E-08
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC, EN 62061:2005, EN ISO 13849-1:2008



Connector blocks are detachable (without cables having to be disconnected)

Safety relay
RT7

Approvals:

Safety relay for:

- Emergency stops
- Light curtains
- Three position devices
- Interlocked gates/hatches
- Magnetic switches
- Light beams
- Safety mats
- Contact strips
- Foot operated switches

Features:

- 4 NO / 1 NC relay outputs, 2 NO outputs can be delayed for soft stops
- Delay times RT7A 0; 0.5; 1.0; 1.5 s RT7B 0; 1.0; 2.0; 3.0 s
- Five input options
- Single or dual channel input
- Manual supervised or automatic reset
- Test input for supervision of external contactors
- Width 45 mm
- LED indication of supply, inputs, outputs, short-circuit and low voltage level
- Three voltage free transistor information outputs
- Supply 24 VDC, 115 or 230 VAC
- Quick release connector blocks

Universal relay with delayed outputs

The RT7 is a universal relay that can be used to supervise both safety devices and the internal safety of your machinery. In addition, you can select the safety level that is required for each installation. All this is possible because the RT7 has the most versatile input options arrangement available on the market. The RT7 can therefore replace many other relays.

The RT7 has four (4 NO) dual safety outputs of which two may be delayed for up to three seconds in order to achieve a safe and ‘soft’ stop. A ‘soft’ stop allows machinery to brake and stop gently before power is removed. A ‘soft’ stop has many benefits: the machinery life will be prolonged, processed products will not be damaged, and restarts from the stopped position are made possible and easier.

Another option with the RT7 is manual or automatic resetting. A manual supervised reset is used for gates and other safety devices that can be bypassed, while an automatic reset is used for small safety hatches if deemed appropriate from a risk point of view.

In addition, the RT7 has information outputs that follow the inputs and outputs of the relay. These outputs indicate if for example a gate is opened or closed, if there is a delay or if the relay needs to be reset.

Choose the RT7 to simplify your safety circuits and reduce your costs.

RT7 A/B
Technical information

Inputs

The RT7 can be configured to operate in either of the following input options:

1. Single channel, 1 NO contact from +24 VDC, safety category 1, up to PL c
2. Dual channel, 2 NO contacts from +24 VDC, category 3, up to PL d
3. Dual channel, 1 NO, 1 NC contact from +24 VDC, category 4, up to PL e
4. Dual channel, 1 NO contact from 0V and 1 NO contact from +24 VDC, category 4, up to PL e
5. Safety mats/contact strips, 1 'contact' from 0V and 1 'contact' from +24 VDC, category 3, up to PL d

When the input/inputs are activated and the test/supervised reset is complete, relays 1,2,3 and 4 are activated. Relays 1 and 2 are immediately de-energized when the inputs are deactivated in accordance with the input option selected. Relays 3 and 4 are either de-energized immediately or after the selected time delay. All the relays (1,2,3 and 4) must be de-energized before the RT7 can be reset.

Transistor output status information

The RT7 has three(3) voltage free transistor outputs that can be connected to a PLC, computer or other monitoring device. These outputs give the input and output status of the relay.

Reset and testing

The RT7 has two reset options; manual and automatic. The manual supervised reset is utilised when the RT7 is used to monitor safety devices that can be bypassed, i.e. to ensure that the outputs of the safety relay do not close just because the gate is closed.

The automatic reset should only be used if acceptable from a risk point of view. The RT7 can also test (supervise), if for example, contactors and valves etc are de-energized/de-activated before a restart is allowed.

Indication of low voltage

The 'On' LED will flash if the relay voltage falls below an acceptable level. This indication will also be given if a monitored safety mat contact strip is actuated. See connection option 5.

Safety level

The RT7 has internal dual and supervised safety functions. Power failure, an internal faulty component or external interference will not present a risk to options with the highest safety level. A manual reset requires that the reset input is closed and opened before the safety relay outputs are activated. A short-circuit or a faulty reset button is consequently supervised.

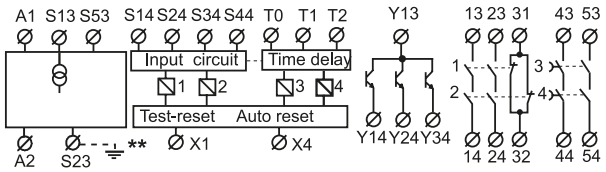
When the RT7 is configured for dual channel input, both the inputs are supervised for correct sequence operation before the unit can be reset. The input options 3 and 4 have the highest safety levels as all short-circuits and power failures are supervised. This in combination with internal current limitation makes the relay ideal for supervision of safety mats and contact strips.

Regulations and standards

The RT7 is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

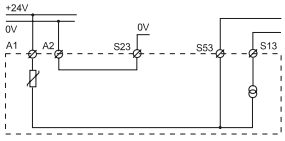
For examples of how our safety relays can solve various safety problems, see the section "Connection examples".



**Only for AC supply

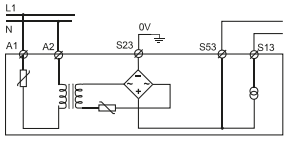
Connection examples – RT7

DC supply



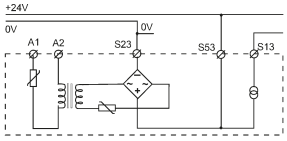
The RT7 DC option should be supplied with +24 V on A1 and 0 V on A2.

AC supply



The RT7 AC option should be supplied with the appropriate supply voltage via connections A1 and A2.
The S23/ ⏚ must be connected to protective earth

DC-supply of AC-units

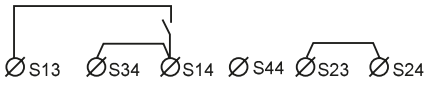


All AC-units can also supplied by +24 VDC to S53 (0 VDC to S23).

Connection of safety devices - RT7 A/B

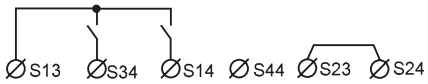
1. SINGLE CHANNEL, 1 NO from +24V

The input (contact to S14) must be closed before the outputs can be activated. When the input contact is opened the relay safety output contacts open.



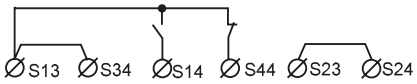
2. DUAL CHANNEL, 2 NO from +24V

Both input contacts (S14 and S34) must be closed before the relay outputs can be activated. The safety relay contacts will open if one or both of the input contacts are opened. Both the input contacts must be opened before the relay can be reset. A short-circuit between the inputs S14 and S34 can only be supervised if the device connected to the inputs has short-circuit supervised outputs, e.g. ABB Jokab Safety´s Focus light curtains.



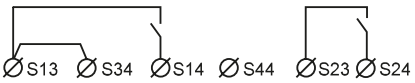
3. DUAL CHANNEL, 1 NO, 1 NC from +24V

One input contact must be closed (S14) and one opened (S44) before the relay outputs can be activated. The safety relay contacts will open if one or both of the inputs change state or in the case of a short-circuit between S14 and S44. Both inputs must be returned to their initial positions before the relay outputs can be reactivated.



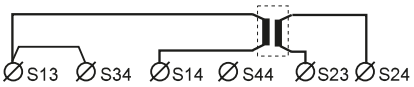
4. DUAL CHANNEL, 1 NO from +24V, 1 NO from 0V

Relay functions as option 2, but a short-circuit, in this case between inputs S14 and S24, is supervised (safety outputs are opened)



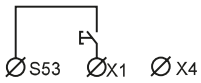
5. Safety mat/Contact strip

Both ‘contact’ inputs from an inactivated safety mat/contact strip, must be made in order to allow the RT7 relay outputs to be activated. When the safety mat/contact strip is activated or a short-circuit is detected across S14-S23, the relay will de-energize (safety outputs open) and the ‘ON’ LED will flash. As output S13 has an internal current limit of 70 mA, the RT7 will not be overloaded when the mat/contact strip is activated or a short circuit is detected.

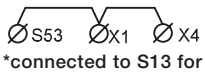


Reset connections - RT7 A/B

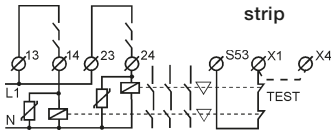
Manual supervised reset



Automatic reset



***connected to S13 for safety mat/contact strip**



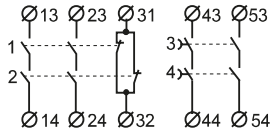
Testing external contactor status

The manual supervised reset contact connected to input X1 must be closed and opened in order to activate the relay outputs.

Automatic reset is selected when S53, X1 and X4 are linked. The relay outputs are then activated at the same time as the inputs.

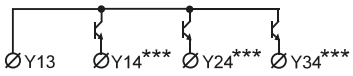
Contactors, relays and valves can be supervised by connecting ‘test’ contacts between S53 and X1. Both manual supervised and automatic reset can be used.

Output connections - RT7 A/B



Relay outputs

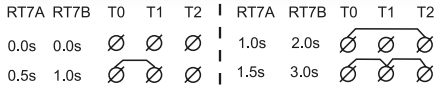
The RT7 has four (4 NO) safety outputs of which two can be delayed, and 1 NC information output.
In order to protect the RT7 output contacts it is recommended that loads (inductive) are suppressed by fitting correctly chosen VDR’s, diodes etc. Diodes are the best arc suppressors, but will increase the switch off time of the load.



Transistor outputs

The RT7 has three(3) voltage free transistor information outputs.
The transistor outputs are supplied with voltage to Y13 either from S53 (+24V) or externally from 5 to 30 VDC. Y14, Y24 and Y34 follow the inputs and outputs as follows:

- Y14 becomes conductive when the relay input conditions are fulfilled.
- Y24 becomes conductive when both the output relays are activated.
- Y34 becomes conductive when both the delay output relays are activated.



Time delay outputs

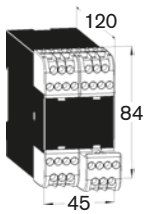
Time delays are selected by linking the appropriate T0, T1 and T2 connections.

When a stop signal is detected a program stop command is first given to the PLC/servo which brakes the dangerous machine operations in a ‘soft’ and controlled way.

The delayed relay safety outputs will then turn off the power to the motors, i.e. when the machinery has already stopped. It takes usually around 0.5 to 3 seconds for a dangerous action to be stopped softly.

Technical data - RT7 A/B

Article number		
RT7B	24 VDC 3 s	2TLA010028R1000
	115 VAC 3 s	2TLA010028R1400
RT7A	24 VDC 1.5 s	2TLA010028R2000
	115 VAC 1.5 s	2TLA010028R2400
Colour		Black and beige
Weight		405 g (24 VDC) 550 g (24-230 VAC)
Supply		
Voltage (A1-A2)		24 VDC +15/-20%, 115/230 VAC, ±15%, 50-60 Hz
Power consumption		
DC supply, nominal voltage		4.6 W
AC supply, nominal voltage		8.8 VA
Connection S13 Short-circuit protected voltage output, 70 mA ±10% current limitation. Is used for the inputs S14, S34 and S44.		
Connection S53 Short-circuit protected voltage output, internal automatic fuse, max 270 mA. Is used for the reset and autoreset inputs X1 and X4.		
Connection S23 0V connection for input S24.		
Safety inputs		
S14 (+) input		20 mA
S24 (0V) input		20 mA
S34 (+) input		20 mA
S44 (+) input		25 mA
Reset input X1		
Supply for reset input		+ 24VDC
Reset current		600 mA current pulse at contact closure, then 30 mA.
Minimum contact closure time for reset		100 ms
Maximum external connection cable resistance at nominal voltage for		
S14, S24, S34		300 Ohm
S44, X1		150 Ohm
Response time		
At Power on DC/AC		<90/<140 ms
When activating (input-output)		<20 ms
When deactivating (input–output)		<20 ms
At Power Loss		<80 ms
Delay time options		
RT7A		0; 0.5; 1.0; 1.5 secs
RT7B		0; 1.0; 2.0; 3.0 secs
Relay outputs		
NO direct (relays 1/2)		2
NO direct or delayed (relays 3/4)		2
NC (relays 1/2)		1
Maximum switching capacity		
Relays 1/2	Resistive load AC	6A/250 VAC/1500 VA
	Inductive load AC	AC15 240 VAC 2A
	Resistive load DC	6A/24 VDC/150 W
	Inductive load DC	DC13 24 VDC 1A
Relays 1/2 total		Max 9A distributed on all contacts
Relays 3/4	Resistive load AC	6A/230 VAC/1380 VA
	Inductive load AC	AC15 230 VAC 4A
	Resistive load DC	6A/24 VDC/144W
	Inductive load DC	DC13 24 VDC 2A
Relays 3/4 total		Max 6A distributed on all contacts
Contact material		$AgSnO_2$+ Au flash
Fuses output 1/2 (external)		5A gL/gG
Fuses output 3/4 (external)		3A gL/gG
Conditional short-circuit current (1 kA), each output		6A gG
Mechanical life		>10^7 operations
Transistor outputs		
External supply to Y13		+5 to +30 VDC
Y14		Indicates that the input conditions are fulfilled
Y24		Indicates that the output relays 1/2 are activated
Y34		Indicates that the delay output relays 3/4 are activated
Maximum load of Y14,Y24, Y34		15 mA /output
Maximum voltage drop at maximum load		2.4 V
LED indication		
On		Supply voltage OK, the LED is on. Flashing light in case of under-voltage or overload.
In1 In2		Indicates that the input conditions are fulfilled.
1 2		Indicates that the output relays 1/2 are activated.
t		Indicates that the delay output relays 3/4 are activated.
Mounting		
Rail		35 mm DIN rail
Connection blocks (detachable)		
Maximum screw torque		1 Nm
Maximum connection area:		
Solid conductors		1x4 mm^2 / 2x1,5 mm^2/12AWG
Conductor with socket contact		1x2.5 mm^2/ 2x1 mm^2
Protection class		
Enclosure		IP40 IEC 60529
Connection blocks		IP20 IEC 60529
Operating temperature range		
24 VDC		-10° C to + 55° C (with no icing or condensation)
24-230 VAC		-10° C to + 45° C (with no icing or condensation)
Operating humidity range		35% to 85%
Impulse withstand Voltage		2.5kV
Pollution degree		2
Performance (max.)		PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 1.86 E-08
The relays must be cycled at least once a year.		
Conformity		2006/42/EC, 2006/95/EC, 2004/108/EC EN 62061:2005 EN ISO 13849-1:2008



Connector blocks are detachable (without cables having to be disconnected)

Safety relay
RT9

Approvals:

Safety relay for:

- Emergency stops
- Light curtains
- Three position devices
- Interlocked gates/hatches
- Magnetic switches
- Light beams
- Safety mats
- Contact strips
- Foot operated switches

Features:

- Five input options
- Single or dual channel input
- Manual supervised or automatic reset
- Test input for supervision of external contactors
- Width 22.5 mm
- LED indication of supply, inputs and outputs, short-circuit and low voltage level
- 2 NO relay outputs
- One changeover relay with a double information output Supply 24 VDC
- Quick release connector blocks

Would you like a small safety relay for all your safety applications?
Then choose the compact RT9 universal relay to supervise both your safety devices and the internal safety of your machinery. In addition, you can select the safety level that is required for each installation. All this is possible due to the RT9 offering the most versatile input option arrangement available on the market. The RT9 can therefore replace many other relays.

Other RT9 options include selection of either manual supervised or automatic resetting. The manual supervised reset can be used for gates and other safety devices that can be bypassed. Automatic reset can be used for small safety hatches, if deemed acceptable from risk assessment.

In addition, the RT9 has a double information output that will indicate e.g if a gate is open or if the relay needs resetting.

The RT9 uses the latest component technology and modern assembly techniques to ensure a highly cost effective solution.

Choose the RT9 to simplify your safety circuits and reduce your costs.

RT9
Technical information

Inputs
The RT9 can be configured to operate in either of the following input options:

1. Single channel, 1 NO contact from +24 VDC, category 1, up to PL c
2. Dual channel, 2 NO contacts from +24 VDC, category 3, up to PL d
3. Dual channel, 1 NO, 1 NC contact from +24 VDC, category 4, up to PL e
4. Dual channel, 1 NO contact from 0V and 1 NO contact from +24 VDC, category 4, up to PL e
5. Safety mat/contact strips, 1 'contact' from 0V and 1 'contact' +24 VDC, category 3, up to PL d

When the input/inputs are activated and the test/supervised reset is complete, relays 1 and 2 are energised. These are de-energised when the input/inputs are de-activated in accordance with the input option chosen or in case of a power failure.

Relays 1 and 2 must both be de-energized before the RT9 can be reset.

Relay output status information
The RT9 has a changeover contact relay output that can be connected to a PLC, control lamp, computer or similar. The output gives information about the status of the relay.

Reset and testing
The RT9 has two reset options; manual and automatic. The manual supervised reset can be used when the RT9 is monitoring safety devices that can be bypassed, i.e. to ensure that the outputs of the safety relay do not close just because a gate is closed. The automatic reset option should only be used if appropriate from a risk point of view.

Due to special internal circuits the RT9 can be automatically reset regardless of the operational voltage rise time, this being an important factor when large loads are started up on the same power supplies at the same time.

In addition, the RT9 can also test (supervise), if for example, contactors and valves etc are de-energised/de-activated before a restart is made.

Indication of low voltage
The 'On' LED will flash if the relay supply voltage falls below an acceptable level. This indication will also be given if a monitored safety mat/contact strip is actuated. Please see Connection option 5.

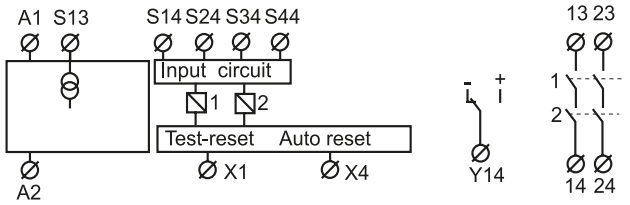
Safety level
The RT9 has internal dual and supervised safety functions. Power failure, an internal faulty component or external interference will not present a risk to options with the highest safety level. A manual reset requires that the reset input is closed and opened before the safety relay outputs are activated. A short-circuit or a faulty reset button is consequently supervised.

When the RT9 is configured for dual channel input, both the inputs are supervised for correct operation before the unit can be reset.

The input options 3 and 4 have the highest safety levels as all short-circuits and power failures are supervised. This in combination with an internal current limitation makes the relay ideal for supervision of safety mats and contact strips.

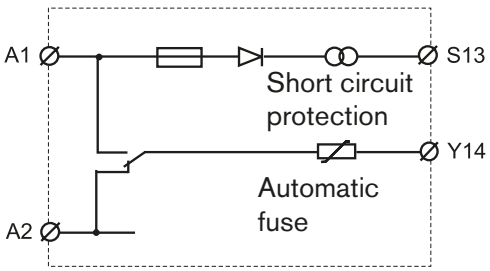
Regulations and standards
The RT9 is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples
For examples of how our safety relays can solve various safety problems, please see the section "Connection examples".



Connection of supply - RT9

DC supply



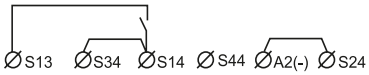
The RT9 should be supplied with +24 V on A1 and 0 V on A2.

NOTE! If cable shielding is used this must be connected to an earth rail or an equivalent earth point.

Connection of safety devices - RT9

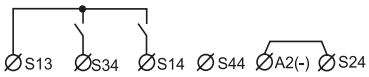
1. SINGLE CHANNEL, 1 NO from +24V

The input (contact to S14) must be closed before the outputs can be activated. When the input contact is opened, the relay safety output contacts open.



2. DUAL CHANNEL, 2 NO from +24V

Both input contacts (S14 and S34) must be closed before the relay outputs can be activated. The safety relay contacts will open if one or both of the input contacts are opened. Both the input contacts must be opened and reclosed before the relay can be reset.

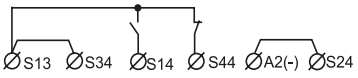


A short-circuit between inputs S14 and S34 can only be supervised if the device connected to the inputs has short-circuit supervised outputs, e.g. ABB Jokab Safety´s Focus light curtains

3. DUAL CHANNEL, 1 NO, 1 NC from +24V

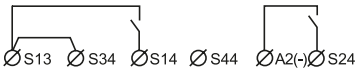
One input contact must be closed (S14) and one opened (S44) before the relay outputs can be activated.

The safety relay contacts will open if one or both of the inputs change state or in case of a short-circuit between S14 and S44. Both inputs must be returned to their initial status before the relay outputs can be reactivated.



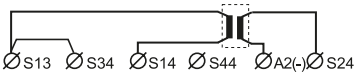
4. DUAL CHANNEL, 1 NO from +24V, 1 NO from 0V

Relay functions as option 2, but a short-circuit, in this case between inputs S14 and S24, is supervised (safety outputs are opened).

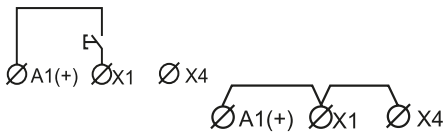


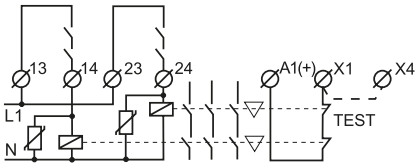
5. Safety mat/Contact strip

Both ‘contact’ inputs from a inactivated safety mat/contact strip must be made in order to allow the RT9 relay outputs to be activated. When the safety mat/contact strip is activated or a short-circuit is detected across S14-S23, the relay will de-energize (safety contacts open) and the ‘ON’ LED will flash. As output S13 has an internal current limit of 70 mA, the RT9 will not be overloaded when the mat/contact strip is activated or a short-circuit is detected.



Reset connections - RT9





Manual supervised reset

The manual supervised reset contact connected to input X1 must be closed and opened in order to activate the relay outputs.

Automatic reset

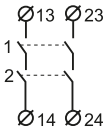
Automatic reset is selected when A1(+), X1 and X4 are linked. The relay outputs are then activated at the same time as the inputs.

Testing external contactor status

Contactors, relays and valves can be supervised by connecting ‘test’ contacts between A1(+) and X1. Both manual supervised and automatic reset can be used.

Output connections - RT9

Relay outputs



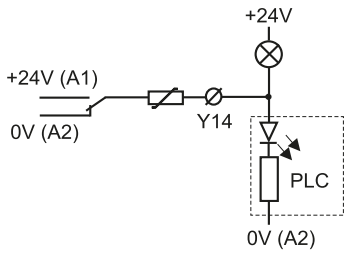
The RT9 has two (2 NO) safety outputs.

In order to protect the output contacts it is recommended that loads (inductive) are suppressed by fitting correctly chosen VDR’s, diodes etc. Diodes are the best arc suppressors, but will increase the switch off time of the load.

Information outputs

The RT9 has a single changeover contact information relay output.The relay output Y14 is connected internally to 0V and 24V in the following way:

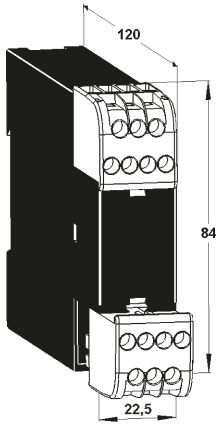
- Y14 is internally closed to 0V when the RT9 is not reset.
- Y14 is internally closed to +24V when the relay is reset.



Technical data – RT9

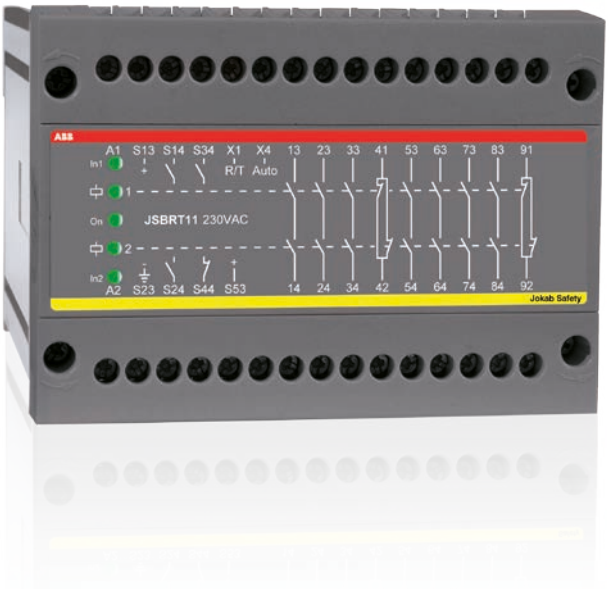
Article number RT9 24 VDC	2TLA010029R0000
Colour	Grey
Weight	210 g
Supply Voltage (A1-A2)	24 VDC ±20%
Power consumption Nominal voltage	2 W
Connection S13	Short-circuit protected voltage output 70 mA ± 10% current limitation. Is used for the inputs S14, S34 and S44.
Input currents (at nominal supply voltage) S14 (+) input S24 (0V) input S34 (+) input S44 (+) input	 30 mA 20 mA 20 mA 25 mA
Reset input X1 Supply for reset input Reset current Minimum contact closure time for reset Minimum contact closure time (at low limit voltage -20%)	 + 24 VDC 300 mA current pulse at contact closure, then 30 mA 80 ms 100 ms
Maximum external connection cable resistance at a nominal voltage for S14, S24, S34 S44, X1	 300 Ohm 150 Ohm
Response time At Power on When activating (input-output) When deactivating (input–output) At Power Loss	 <100 ms <20 ms <20 ms <80 ms
Relay outputs NO Maximum switching capacity Resistive load AC Inductive load AC Resistive load DC Inductive load DC Max. total switching capacity: Minimum load	 2 6A/250 VAC/1500 VA AC15 240 VAC 2A 6A/24 VDC/150 W DC13 24 VDC 1A 8A distributed on all contacts 10 mA/10V (if load on contact has not exceeded 100 mA)
Contact material	Ag+Au flash
Fuses output (External)	5A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Mechanical life	10^7 operations
Relay information output Y14 (Changeover contacts) -(0V) +(24V) Maximum load of Y14 Short-circuit protection for information output	 Indicates that RT9 is not reset. Indicates that RT9 is reset. 250 mA Internal automatic fuse

LED indication On In1 In2 1 2	 Supply voltage OK, the LED is on. Flashing light in case of under-voltage, overload or current limiting Indicates that the input conditions are fulfilled. Indicates that the output relays have been activated.
Mounting Rail	 35 mm DIN rail
Connection blocks (detachable) Maximum screw torque Maximum connection area: Solid conductors Conductor with socket contact	 1 Nm 1x4 mm² / 2x1.5 mm² / 12AWG 1x2.5 mm² / 2x1 mm²
Protection class Enclosure Connection blocks	 IP40 IEC 60529 IP20 IEC 60529
Operating temperature range	-10°C to + 55°C (with no icing or condensation)
Operating humidity range	35% to 85%
Impulse withstand Voltage	2.5kV
Pollution degree	2
Performance (max.) The relays must be cycled at least once a year.	PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005)PFH_D 9.55E-09
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC EN 62061:2005 EN ISO 13849-1:2008



Connector blocks are detachable (without cables having to be disconnected)

Safety relay
JSBRT11



Approvals:

Safety relay for:

- Emergency stops
- Light curtains
- Three position devices
- Interlocked gates/hatches
- Magnetic switches
- Light beams
- Safety mats
- Foot operated switches

Features:

- Selectable inputs and safety category
- Manual supervised or automatic reset
- Width 100 mm
- LED indication for supply, inputs and outputs
- 7 NO + 2 NC relay outputs
- Supply 24 VDC 115 or 230 VAC
- Quick release connector blocks

A flexible safety relay with many outputs

The JSBRT11 has been designed to provide the safety system circuit designer with the ability to select from both a range of input connection configurations and either automatic or supervised reset.

The unit can be hardwire configured to operate in either of the following input configurations:

- Mode 1: Single Channel (1 NO contact from +24 VDC), category 1 PL c
- Mode 2: Dual Channel (2 NO contacts from +24 VDC), category 3 PL d
- Mode 3: Dual Channel (1 NO, 1NC contacts from +24 VDC), category 4 PL e.
- Mode 4: Dual Channel (1 NO contact from 0 V and 1 NO contact from + 24 VDC), safety category 4.

In addition the unit can also be used to test that contactors and valves have fallen/returned to their 'reset' state before a new 'start' signal is given.

Safety level

The JSBRT11 has dual and monitored internal safety functions. Power failure, internal component failures or external interference (with the exception of short circuiting of input contact when used in a single channel input mode) do not result in a dangerous function.

When wired for supervised reset, should a short circuit appear across the reset input the relay will not automatically reset when the input/inputs are made. Only when the supervised reset input is made and broken will the relay reset.

The JSBRT11 provides detection of contact failure in the inputs when wired in dual channel mode. Both inputs have to be opened and closed in order to enable the reactivation of the relay. The highest safety level of the JSBRT11 is in configuration mode 3 and 4 because all short circuits are supervised i.e. a short circuit between the inputs leads to a safe state as the outputs drop out.

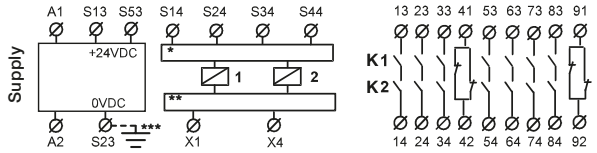
Regulations and standards

The JSBRT11 is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the section "Connection examples".

Technical description – JSBRT11



***Supervision circuit** **Test and Automatic reset circuit**
**** Only for AC-supply**

The supply voltage is connected across A1 and A2. The input connection configuration and type of reset required is set by connecting the unit as shown in the diagrams below

When the input/inputs and the test/supervised reset are made K1 and K2 energise. K1 and K2 will de-energize if the power is disconnected or a stop signal is given in accordance to the configuration mode wired. Both K1 and K2 have to be de-activated before the outputs of the JSBRT11 can be closed again.

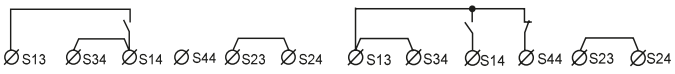
– **Configuration mode 1.**
When the single input opens both K1 and K2 relays are deactivated.
– **Configuration mode 2.**
Both inputs have to be closed in order to enable the unit to be activated. A stop signal is given if both or one input is opened. Both inputs have to be opened and reclosed in order to enable the reactivation of the unit. If the possibility of short circuits between the inputs cannot be excluded, configuration mode 3 or 4 should be used in order to reach the highest safety level.
– **Configuration mode 3.**
One input has to be closed and the other input has to be opened in order to enable the unit to be activated. A stop signal is given if both or one input change state. Both inputs have to change state in order to give a dual stop function and to allow a new start after stop.
– **Configuration mode 4.**
Operation as mode 2 but short circuits between the inputs leads to a safe state i.e. the relays inside the JSBRT11 will drop out.
– **Supervised reset connection.**
The input to X1 (see diagram below) has to be closed and opened in order to activate the unit, after input/inputs are made according to the configuration mode selected. This mode is selected when X1 - X4 is open-circuit.
– **Automatic reset connection.**
The input has to be closed in order to activate the unit after input/inputs are made according to the configuration mode selected. This mode is selected when a connection between X1 and X4 is made.
– **Test.**
Test contacts of contactors can be connected between S53 and X1 for supervision.

Technical data – JSBRT11

Article number JSBRT11 24 VDC JSBRT11 115 VAC	 2TLA010025R0000 2TLA010025R0400
Colour	Grey
Power supply A1 - A2	24 VDC ± 15% 115, 230 VAC ± 15%, 50-60 Hz
Power consumption	3.2 W/7.9 VA
Relay Outputs	7 NO and 2 NC
Max. switching capacity Resistive load AC Inductive load AC Resistive load DC Inductive load DC	 6A/250 VAC/1500 VA AC15 240 VAC 2A 6A/24 VDC/150 W DC13 24 VDC 1A
Max. total switching capacity	21A distributed on all contacts
Min. load	10mA/10 V (if load on contact has not exceeded 100 mA)
Contact material	$AgSnO_2$+ Au flash
Fuses Output (External)	6A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Max. Input wire res. at nom. voltage	200 Ohm (S14,S24,S34,X1,X4); 100 Ohm (S44)
Response time at deactivation (input-output)	<20 ms
Response time at activation (input-output)	<30 ms
Terminals (max. screw torque 1 Nm) Single strand: Conductor with socket contact:	 1x4 mm^2 / 2x1.5 mm^2 1x2.5 mm^2 / 2x1 mm^2
Mounting	35 mm DIN-rail
Protection class enclosure terminals	 IP40 IEC 60259 IP20 IEC 60259
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating temperature range	-10°C to +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
Function indication	Electrical Supply, Input 1 and 2, Output relays 1 and 2
Weight	610 g (24 VDC) 790 g (24-230 VAC)
Performance (max.) Functional test: The relays must be cycled at least once a year.	PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 1.69E-08
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC, EN 62061:2005 EN ISO 13849-1:2008

Electrical connection – JSBRT11

SINGLE CHANNEL *, 1 NO from +24V **DUAL CHANNEL*, 1 NO, 1 NC from +24V**



Safety relay
JSBR4

Approvals:

Safety relay for:

- Two-hand devices of type IIIc
- Emergency stop
- Three position devices
- Interlocked Gates/Hatches
- Contact strips
- Safety mats
- Foot operated switches

Features:

- Two channel with concurrency requirement of 0.5 s
- Supervised reset
- Test input
- Width 45 mm
- LED indication for supply, inputs and outputs
- 3 NO/1NC relay outputs
- Supply 24 VDC, 24, 115 or 230 VAC
- Quick release connector blocks

A universal relay for two-hand and many other safety devices

The JSBR4 has two inputs, which both have to be closed to keep the safety output contacts closed. A short-circuit across the inputs will cause the output contacts to open. The inputs can however be subjected to a continuous short-circuit without damaging the safety relay.

In order to make the safety outputs close the reset input must be closed and opened. In this way an unintentional reset is prevented in the case of a short-circuit in the reset button cable or if the button gets jammed in the actuated position. The reset input can also be used for test/supervision to ensure that contactors or valves have returned to their initial off/stop position before a new start can be allowed by the safety relay.

When the JSBR4 is used as a two-hand device relay, both buttons have to be pressed within 0.5 seconds of each other in order to close the outputs.

When the JSBR4 is used for Safety Mats and Safety Strips the ”stop” condition is given following detection of a short-circuit between input channels A and B. The safety mat, safety strip or the relay will not be damaged by a continuous short-circuit. This also gives the advantage that if there is a failure between the inputs in the installation, the safety relay will not be damaged.

Safety level

The JSBR4 has a twin supervised safety function. Component failure, short-circuit or external disturbance (e.g. loss of power supply) will not prevent the safe function of the relay. This is valid both for the inputs A and B as well as for the reset input. The JSBR4 operates at the highest safety level for safety relays (PL e according to EN ISO 13849-1).

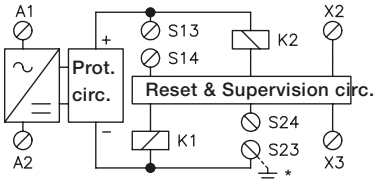
Regulations and standards

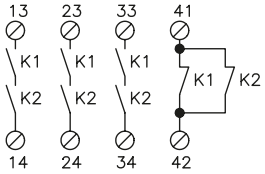
The JSBR4 is designed and approved in accordance with appropriate directives and standards. See technical data.The JSBR4 complies with the highest safety level for the connection of a two-hand device of type IIIc in accordance with EN 574.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the section “Connection examples”.

Technical description – JSBR4





*** Only for AC-supply**

The electrical supply is connected across A1 and A2. After Voltage reduction and Rectification (AC-versions) or reverse polarity protection (DC-version) there is an overload protection-circuit.

When the inputs S13-S14 and S23-S24 have closed and the reset is made, the relays K1 and K2 are activated. A dual stop signal is given when K1 and K2 drop, due to short circuiting between the inputs, opening of the inputs or power failure. If one input is opened the other input must also be opened for K1 and K2 to be activated again.

The monitoring circuit checks K1 and K2 and that the reset circuit to X2 is both closed and opened before K1 and K2 are energized. Both the stop and reset function therefore comply with the requirement that a component fault, short circuit or external interference do not result in a dangerous function.

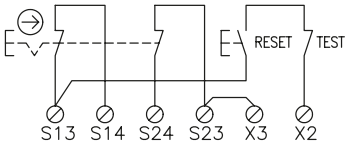
The safety outputs consist of contacts from K1 and K2 connected internally in series across terminals 13 - 14, 23 -24 and 33 - 34. These contacts are used to cut the power to components which stop or prevent hazardous movements/ functions. It is recommended that all switched loads are adequately suppressed and/or fused in order to provide additional protection for the safety contacts.

NOTE! Output 41-42 is intended for indication purposes only, e.g. gate opened.
No load between S14 and S24 allowed.

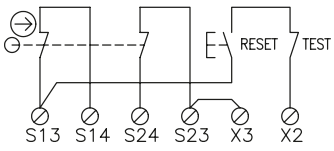
Technical data – JSBR4

Article number JSBR4 24 VDC JSBR4 115 VAC	 2TLA010002R0000 2TLA010002R0400
Colour	Black and beige
Power supply	24 VDC ± 15% 24/115/230 VAC ± 15%, 50 - 60 Hz
Power consumption	1.3 W/3.3 VA
Relay outputs	3 NO + 1 NC
Max. switching capacity Resistive load AC Inductive load AC Resistive load DC Inductive load DC	 6A/250 VAC/1500 VA AC15 240 VAC 2A 6A/24 VDC/150 W DC13 24 VDC 1A
Max. res. load total switching capacity	12A distributed on all contacts
Min. load	10mA/10 V (if load on contact has not exceeded 100 mA)
Contact material	Ag + Au flash
Fuses output (external)	5A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Max. Input wire res. at nom. voltage	300 Ohm (S13 - S14 and S23 - S24)
Response time at deactivation	< 20 ms (145 ms at power loss)
Terminals (max. screw torque 1 Nm) Single strand: Conductor with socket contact:	 1 x 2.5 mm^2 / 2 x 1 mm^2. 1 x 4 mm^2 / 2 x 1.5 mm^2.
Mounting	35 mm DIN-rail
Protection class	IP40 / IP20 IEC 60529
Operating temperature range	-10°C to +55°C (with no icing or condensation)
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating humidity range	35% to 85%
LED indication	Electrical Supply, Inputs, Outputs
Weight	350 g (24 VDC), 460 g (24-230 VAC)
Values (With Proof test interval 1 year)	Safety Category 4 according to EN 954-1, PL e, SIL 3, PFH_D 1.35E-08
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC,EN 62061:2005 EN ISO 13849-1:2008

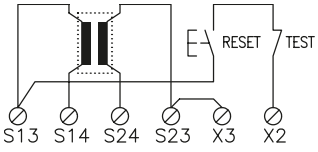
Electrical connection – JSBR4



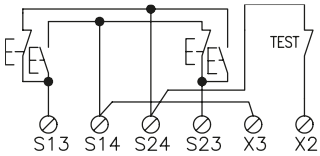
Emergency stop with manual resetting.



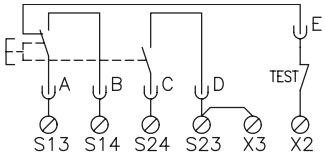
Interlocked gate with manual reset.



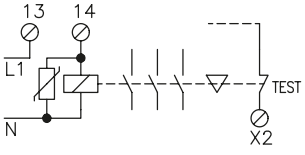
Contact mat/strip with manual reset.



Two hand device with buttons in separate or same enclosure. Buttons to be pressed in within 0.5 s of each other. Footpedal switches can be connected in the same configuration.



Enabling device, JSHD4. Stop condition is given in both top and bottom PB positions.



Control and supervision of external conductor, relay, valve or ABB Jokab Safety's expansion relays.

Safety relay
JSBT4

Approvals:

Safety relay for:

- Emergency stops
- Three position devices
- Interlocked Hatches
- Safety mats
- Contact strips
- Foot operated switches

Features:

- Dual input channels synchronism 0.5 s
- Test input
- Width 45 mm
- LED indications for power on, inputs and outputs
- 3 NO/1NC relay outputs
- Supply 24 VDC
- Quick release connector blocks

Safety relay with synchronised dual input channels (within 0.5s)

The JSBT4 has two inputs, both of which have to be closed in order to keep the safety output contacts closed. A short circuit between inputs A and B will cause the output contacts to open. The inputs can be continuously short circuited without damaging the safety relay.

For the outputs to close, the test input must be closed. The test input is intended to monitor that contactors or valves have dropped/returned before a new start is permitted.

This test input must not be confused with the reset function required for gates that a person can walk through and where there is a high safety requirement (see JSBR4).

If the JSBT4 is used for safety Mats and safety Strips, the "stop" condition is given following detection of a short circuit. The safety mat, safety strip or the relay will not be damaged by a continuous short-circuit. This also provides the advantage that if there is a failure between inputs A and B in the installation, the safety relay will not be damaged.

Safety level

The JSBT4 has a twin supervised safety function. Component failure, short-circuit or external disturbance (e.g. loss of power supply) will not prevent the safe function of the relay. Safety category level 3 or 4, depending on use.

The true two-channel safety function has the advantage that the cabling installation demands for safety can be reduced, due to the fact that a short-circuit between the inputs will directly open the relay's safety outputs.

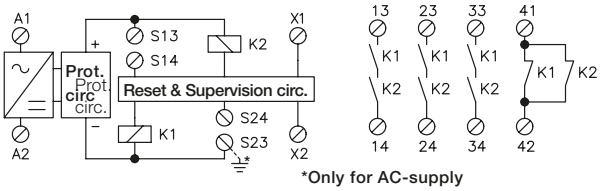
Regulations and standards

The JSBT4 is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the section “Connection examples”.

Technical description – JSBT4



The electrical supply is connected across A1 and A2. After Voltage reduction and Rectification (AC-versions) or reverse polarity protection (DC-version) there is an overload protection-circuit.

When the inputs S13-S14 and S23-S24 are closed within 0.5 seconds of each other the relays K1 and K2 are energized . A dual stop signal is given, K1 and K2 de-energize, when there is a short circuit between or an opening of the inputs or at power loss. If one input is opened the other one also has to be opened in order to activate K1 and K2 again. The test circuit, X1 - X2,has to be closed in order to activate the outputs, thereafter the test circuit can be opened or closed continously. If the test circuit is closed after the inputs there is no requirement to close them within 0.5 seconds of each other.

The internal supervision circuit monitors the two Inputs and relays K1, K2. The stop function then fulfils the requirement that one failure (short circuit, component, external disturbance) shall not prevent the safe function of the JSBT4.

The safety outputs consist of contacts from K1 and K2 connected internally in series across terminals 13 - 14, 23 -24 and 33 - 34. These contacts are used to cut the power to components which stop or prevent hazardous movements/ functions. It is recommended that all switched loads are adequately suppressed and/or fused in order to provide additional protection for the safety contacts.

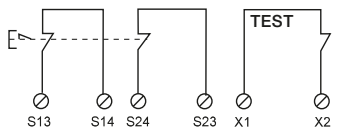
The NC output 41 - 42 should only be used for monitoring purposes e.g. Indication lamp or PLC input etc. The output contacts are closed until the module is reset.

NOTE! Output 41-42 is intended for indication purposes only, e.g. gate opened. No load between S14 and S24 allowed.

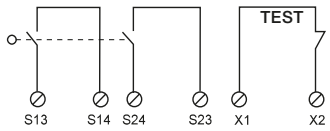
Technical data – JSBT4

Article number	
JSBT4 24 VDC	2TLA010004R0000
Colour	Grey
Power supply	24 VDC ±15%
Power consumption	BT50 1.4W/BT50T 1.8W
Relay outputs	3 NO + 1 NC
Max. switching capacity	
Resistive load AC	6A/250 VAC/1500 VA
Inductive load AC	AC15 240VAC 2A
Resistive load DC	6A/24 VDC/150 W
Inductive load DC	DC13 24VDC 1A
Max. res. load total switching capacity	12A distributed on all contacts
Min. load	10mA/10 V (if load on contact has not exceeded 100 mA)
Contact material	Ag + Au flash
Fuses output (external)	5A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Max. Input wire res. at nom. voltage	300 Ohm (S13 - S14 and S23 - S24)
Response time at deactivation	< 20 ms, 145 ms with switched supply/power loss
Terminals (max. screw torque 1 Nm)	
Single strand	1x4 mm^2 / 2x1.5 mm^2
Conductor with socket contact	1x2.5 mm^2 / 2x1 mm^2
Mounting	35 mm DIN-rail
Protection class	IP40 / IP20 IEC 60529
Operating temperature range	-10°C to +55°C (with no icing or condensation)
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating humidity range	35% to 85%
LED indication	Electrical Supply, Inputs, Outputs
Weight	350 g (24 VDC), 460 g (24-230 VAC)
Values (With Proof test interval 1 year)	Safety Category 4 according to, PL e, SIL 3, PFH_D 1.51E-08
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC, EN 62061:2005, EN ISO 13849-1:2008

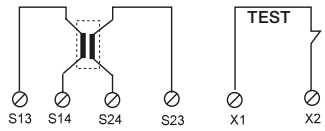
Electrical connection – JSBT4



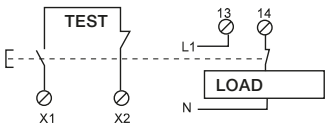
Emergency stop with automatic resetting.



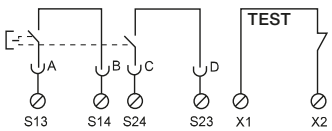
Interlocked hatch with automatic resetting.



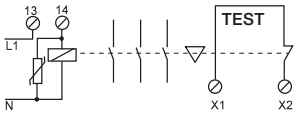
Contact mat/strip with automatic reset



Monitoring to ensure that the Start button cannot stick in pressed position. Short circuiting over the closing contact is not monitored. The RT-series and JSBR4 have built in short circuiting monitored resetting.



Enabling device, JSHD4. Stop condition is given in both top and bottom positions.



Control and supervision of external contactor, relay, valve or ABB Jokab Safety's expansion relays.

Safety relay/expansion relay
BT50(T)

Approvals:

Safety relay for:

- Emergency stop
- Interlocked hatch
- Expansion of Pluto

Features:

- Single and “dual” channel
- Test/”reset” input
- Width 22.5 mm
- LED indication
- 3 NO/1NC relay outputs
- Supply 24 VDC
- Quick release connector blocks
- BT50 - Additional power terminals
- BT50T - One changeover relay with a double information output (Y14)
- BT50T - Delay times selectable from 0 - 1.5 s

Safety relay/expansion relay to Pluto

The BT50 is designed to connect safety devices, such as emergency stops, directly in the voltage supply circuit to the relay. Despite a maximum built-in width of 22.5 mm the relay is very powerful.

With 3NO safety outputs, 1NC output (for monitoring purposes), a test input and complete internal supervision, the BT50 is quite unique. In addition, delayed outputs (BT50T) can be ordered.

In order for the safety outputs to close, the supply voltage, e.g. by means of an emergency stop button, must be connected to A1 and A2 and the test input closed. After actuation of the relay the test input can be opened again.

The test input is intended to supervise that contactors or valves have dropped/returned before a new start can be permitted.The test input can also be used for starting and the start button can be supervised (see the connection example on the next page).

More outputs

By connecting a BT50 to a safety relay/PLC it is easy to increase the number of safe outputs. This means that an unlimited number of dangerous machine operations and functions can be stopped by using just one safety-PLC.

Safety level

BT50 have an internal redundant and monitored safety function. Power failure, internal component faults or external interference cannot result in dangerous functions.

Input via A1 on its own is not protected from short circuiting, and therefore installation is critical for the safety level to be achieved. To achieve a higher safety level a screened cable can be used and/or connection made to both A1 and A2 (see the example on the next page).

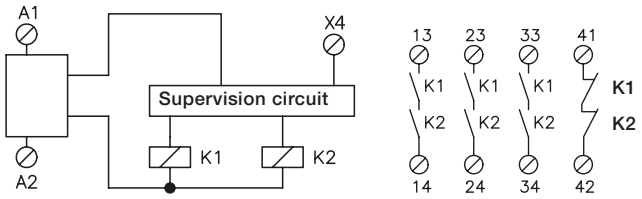
Regulations and standards

The BT50 is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the chapter “Connection examples”.

Technical description – BT50(T)



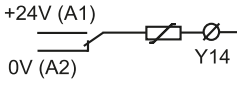
When supply voltage is connected to A1 and A2, relays K1 and K2 are activated. K1 and K2 drop if the supply voltage is disconnected. Both relays K1 and K2 must drop for them to be activated again. Another requirement is that the test circuit, A1 - X4, must be closed for the outputs to be activated. Thereafter A1 - X4 can either be open or constantly closed.

The supervising circuit ensures that both K1 and K2 have dropped before they can be reactivated. The stop function complies with the requirement that a component fault or external interference cannot lead to a dangerous function.

The safety outputs consist of contacts from K1 and K2 connected internally in series across terminals 13 - 14, 23 - 24, and 33 - 34. These contacts are used to cut the power to components which stop or prevent hazardous movements/functions. It is recommended that all switched loads are adequately suppressed and/or fused in order to provide additional protection for the safety contacts.

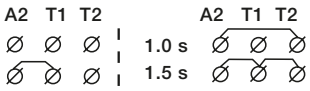
The NC output 41 - 42 should only be used for monitoring purposes e.g. indication lamp for emergency stop pressed.

BT50T - Info. output



Max load 250 mA

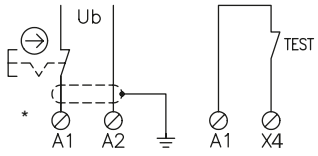
BT50T - Delay times



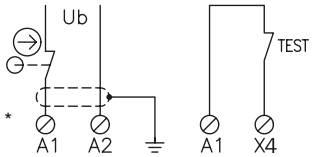
Technical data – BT50(T)

Article number BT50 BT50T	 2TLA010033R0000 2TLA010033R1000
Colour	Black and grey
Operational voltage	24 VDC + 15%/-25%
Power consumption	BT51 1.4W/BT51T
Relay outputs	3 NO + 1 NC
Max. switching capacity Resistive load AC Inductive load AC Resistive load DC Inductive load DC	 6A/250 VAC/1500 VA AC15 240 VAC 2A 6A/24 VDC/150 W DC13 24 VDC 1A
Max. res. load total switching capacity	12A distributed on all contacts
Min. load	10mA/10 V(if load on contact has not exceeded 100 mA)
Contact material	Ag + Au flash
Fuses output (external)	5A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Max Input wire res. at nom. voltage	200 Ohms
Response time at deactivation (input - output)	Version B <20 ms or delayed max 1500 ms (old version of BT50 <60 ms)
Terminals (max. screw torque 1 Nm) Single strand Conductor with socket contact	 2x1.5 mm^2 2x1 mm^2
Mounting	35 mm DIN-rail
Protection class enclosure/terminals	IP40 / IP20 IEC 60529
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating temperature range	-10°C to +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
LED indication	Electrical Supply, Relay and X4
Weight	200 g
Performance (max.) Functional test: The relays must be cycled at least once a year.	PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 1.22E-08

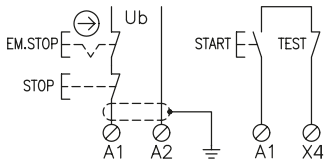
Electrical connection – BT50(T)



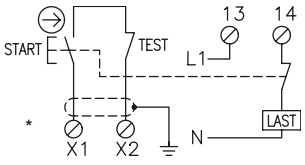
Emergency stop with reset when emergency button returns.



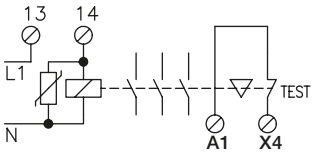
Hatch with automatic reset.



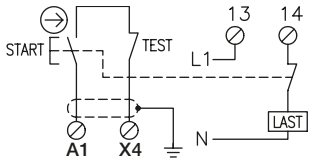
BT50 as emergency stop and control relay with Start and Stop function.



Emergency stop with dual connection direct to the supply voltage.



Controlled monitoring of external contactor, relay, valve or ABB Jokab Safety's expansion relays.



Monitoring to ensure that the On button is not stuck in pressed position. A short circuit over the closing contact is not monitored.

* BT50 has additional power terminals A1 and A2.

Safety relay/expansion relay
BT51(T)

Approvals:

Safety relay for:

- Emergency stop
- Interlocked hatch
- Expansion of Pluto

Features:

- Single and “dual” channel
- Test/”reset” input
- Width 22.5 mm
- LED indication
- 4 NO relay outputs
- Supply 24 VDC
- Quick release connector blocks
- BT51 - Additional power terminals
- BT51T - One changeover relay with a double information output (Y14)
- BT51T - Delay times selectable from 0 - 1.5 s

Safety relay/expansion relay to Pluto

The BT51 is designed to connect safety devices, such as emergency stops, directly in the voltage supply circuit to the relay. Despite a maximum built-in width of 22.5 mm the relay is very powerful.

With 4 NO safety outputs, test input and complete internal supervising, the BT51 is quite unique. In addition you can order delayed outputs (BT51T).

In order for the safety outputs to close, the supply voltage, e.g. by means of an emergency stop button, must be connected to A1 and A2 and the test input closed. After actuation of the relay the test input can be opened again.

The test input is intended to supervise that contactors or valves have dropped/returned before a new start can be permitted.The test input can also be used for starting and the start button can be supervised (see connection example on next page).

More outputs

By connecting BT51 to a safety relay/PLC it is easy to increase the number of safe outputs. This means that an unlimited number of dangerous machine operations and functions can be stopped from one safety relay/PLC.

Safety level

BT50 has an internal redundant and monitored safety function. Power failure, internal component faults or external interference cannot result in dangerous functions.

Input via A1 only is not protected from short circuiting, and therefore installation is critical for the safety level to be achieved. To achieve a higher safety level a screened cable can be used and/or connection made to both A1 and A2 (see example overleaf).

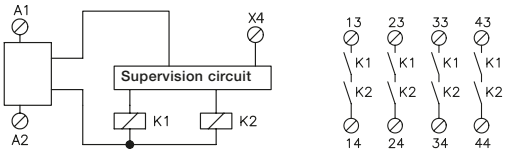
Regulations and standards

The BT51 is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the chapter “Connection examples”.

Technical description – BT51(T)

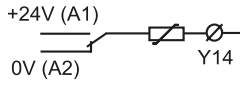


When supply voltage is connected to A1 and A2, relays K1 and K2 are activated. K1 and K2 drop if the supply voltage is disconnected. Both relays K1 and K2 must drop for them to be activated again. Another requirement is that the test circuit, A1 - X4, must be closed for the outputs to be activated. Thereafter A1 - X4 can either be open or constantly closed.

The supervising circuit ensures that both K1 and K2 have dropped before they can be reactivated. The stop function complies with the requirement that a component fault or external interference cannot lead to a dangerous function.

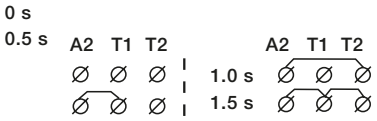
The safety outputs consist of contacts from K1 and K2 connected internally in series across terminals 13 - 14, 23 - 24, 33 - 34 and 43 - 44. These contacts are used to cut the power to components which stop or prevent hazardous movements/functions. It is recommended that all switched loads are adequately suppressed and/or fused in order to provide additional protection for the safety contacts.

BT51T - Info. output



Max load 250 mA

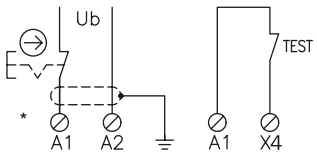
BT51T - Delay times



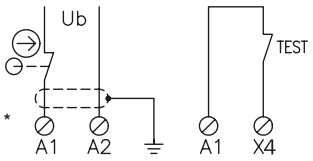
Technical data – BT51(T)

Article number BT51 BT51T	 2TLA010033R2000 2TLA010033R3000
Colour	Grey
Operational voltage	24 VDC + 15%/-25%
Power consumption	1.4 W/1.8 W
Relay Outputs	4 NO
Max. switching capacity Resistive load AC Inductive load AC Resistive load DC Inductive load DC	 6A/250 VAC/1500 VA AC15 240 VAC 2A 6A/24 VDC/150 W DC13 24 VDC 1A
Max. res. load total switching capacity	12 A distributed on all contacts
Min. load	10mA/10 V (if load on contact has not exceeded 100 mA
Contact material	Ag + Au flash
Fuses Output (External)	5A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Max Input Wire res. at nom. voltage	200 Ohms
Response time at deactivation	<20 ms or delayed max 1500 ms (BT51T)
Terminals (Max. screw torque 1 Nm) Single strand: Conductor with socket contact:	 2x1.5 mm² 2x1 mm²
Mounting	35 mm DIN-rail
Protection class enclosure/terminals	IP40 / IP20 IEC 60529
Impulse Withstand Voltage	2.5kV
Pollution Degree	2
Operating temperature range	-10°C to +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
LED indication	Electrical Supply, Relay and X4
Weight	200 g
Performance (max.) Functional test: The relays must be cycled at least once a year.	 PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 1.63E-08
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC, EN 62061:2005 EN ISO 13849-1:2008

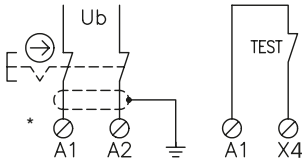
Electrical connection – BT51(T)



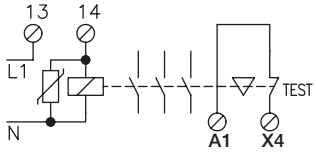
Emergency stop with reset when emergency button returns.



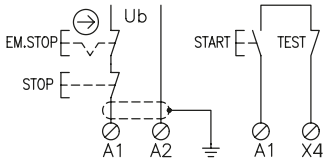
Hatch with automatic reset.



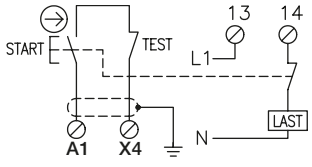
Emergency stop with dual connection direct to the supply voltage.



Controlled monitoring of external contactor, relay, valve or ABB Jokab Safety's expansion relays.



BT51 as emergency stop and control relay with Start and Stop function.



Monitoring to ensure that the On button is not stuck in pressed position. A short circuit over the closing contact is not monitored.

* BT51 has additional power terminals A1 and A2.

Safety relay
JSBT5(T)

Approvals:

CE TÜV NORD cSAus

Safety relay for:

- Emergency stop
- Interlocked hatch

Features:

- Single and “dual” channel
- Test/start input
- Width 22.5 mm
- LED indication
- 3 NO/1NC relay outputs
- (T) = delayed outputs 0.5 sec.
- Supply 12 VDC, 24 VDC/AC

Single channel safety relay

The JSBT5 is designed to connect safety devices, such as emergency stops, directly in the voltage supply circuit to the relay. Despite a maximum built-in width of 22.5 mm the relay is very powerful.

With 3 NO safety outputs, 1 NC, test input and complete internal supervising, the JSBT5 is quite unique. In addition you can order delayed outputs (JSBT5T).

In order for the safety outputs to close, the supply voltage, e.g. by means of an emergency stop button, must be connected to A1 and A2 and the test input closed. After actuation of the relay the test input can be opened again.

The test input is intended to supervise that contactors or valves have dropped/returned before a new start can be permitted.The test input can also be used for starting and the start button can be supervised (see connection example on next page).

Safety level

The JSBT5 has a twin and supervised internal safety function. Power failure, internal component faults or external interference cannot result in dangerous functions.

Input via A1 only is not protected from short circuiting, and therefore installation is critical for the safety level to be achieved. To achieve a higher safety level a screened cable can be used and/or connection made to both A1 and A2 (see example overleaf).

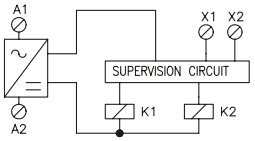
Regulations and standards

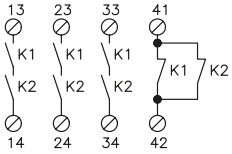
The JSBT5 is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the section “Connection examples”.

Technical description – JSBT5(T)



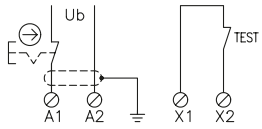


When supply voltage is connected to A1 and A2, relays K1 and K2 are activated. K1 and K2 drop if the supply voltage is disconnected. Both relays K1 and K2 must drop for them to be activated again. Another requirement is that the test circuit, X1 - X2, must be closed for the outputs to be activated. Thereafter X1 - X2 can either be open or constantly closed. The supervising circuit ensures that both K1 and K2 have dropped before they can be reactivated. The stop function complies with the requirement that a component fault or external interference cannot lead to a dangerous function.

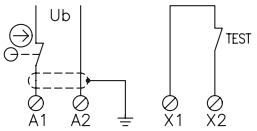
The safety outputs consist of contacts from K1 and K2 connected internally in series across terminals 13 - 14, 23 - 24, and 33 - 34. These contacts are used to cut the power to components which stop or prevent hazardous movements/functions. It is recommended that all switched loads are adequately suppressed and/or fused in order to provide additional protection for the safety contacts.

The NC output 41 - 42 should only be used for monitoring purposes e.g. indication lamp for emergency stop pressed.

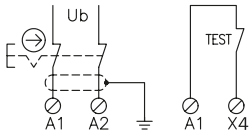
Electrical connection – JSBT5(T)



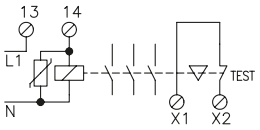
Emergency stop with automatic reset when emergency button returns.



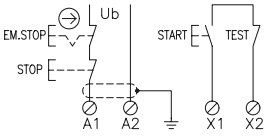
Hatch with automatic reset.



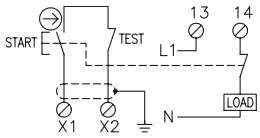
Emergency stop with dual connection direct to the supply voltage.



Controlled monitoring of external contactor, relay, valve or ABB Jokab safety's expansion relays.



JSBT5 as emergency stop and control relay with Start and Stop function.



Monitoring to ensure that the On button is not stuck in pressed position. A short circuit over the closing contact is not monitored. The JSBR4 has built in short circuit monitored resetting.

Technical data – JSBT5(T)

Article number JSBT5 24 VAC/VDC JSBT5T 24 VAC/VDC	 2TLA010005R0100 2TLA010005R1100
Colour	Grey
Operational voltage JSBT5: JSBT5T:	 24 VDC/AC + 15%–25%, 50–60 Hz 12 VDC, 24 VDC/AC + 15% – 25%, 50 - 60 Hz
Power consumption	1 W/1.9 VA
Relay Outputs	3 NO + 1 NC
Max. switching capacity Resistive load AC Inductive load AC Resistive load DC Inductive load DC	 6A/250 VAC/1500 VA AC15 240 VAC 2A 6A/24 VDC/150 W DC13 24 VDC 1A
Max. res. load total switching capacity:	9A distributed on all contacts
Min. load	10mA/10 V (if load on contact has not exceeded 100 mA)
Contact material	AgCuNi
Fuses Output (External)	5A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Max Input Wire res. at nom. voltage	200 Ohm
Response time at deactivation	<60 ms or delayed max 500 ms (JSBT5T)
Terminals (Max. screw torque 1 Nm) Single strand: Conductor with socket contact:	 2x1.5 mm^2 2x1 mm^2
Mounting	35 mm DIN-rail
Protection class enclosure/terminals	IP40 / IP20 IEC 60529
Impulse Withstand Voltage	2.5kV
Pollution Degree	2
Operating temperature range	-10°C to +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
Function indication	Electrical Supply
Weight	200 g
Performance (max.) Functional test: The relays must be cycled at least once a year.	PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 1.22E-08
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC, EN 62061:2005 EN ISO 13849-1:2008

Safety timer
JSHT1

Approvals:

CE TÜV NORD cSAus

Safety relay for:

- Time reset
- Time bypassing

Features:

- Hardwire time selection 5 – 40 s
- Selectable single or dual channel input
- Test input
- Width 45 mm
- LED indication for supply, inputs and outputs
- 1+1 NO relay outputs
- Supply 24 VDC
- Quick release connector blocks

The JSHT1A/B closes two independent relay outputs during a guaranteed maximum time when the inputs are opened.

Time reset

Time reset can prevent unintentional reset of safety systems when someone is still in the dangerous area of the machine. During a guaranteed maximum time, one or several PB´s for reset must be activated. The reset buttons should be sited in such a way that operatives have a clear overview of the whole area which is guarded. Time reset is made by the combination of a safety relay and the timer relay JSHT1A/B.

Time bypassing

The JSHT1 can also be used for time bypass of light beams for e.g. autotruck into a dangerous area.

Operation

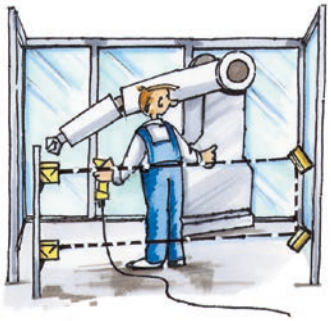
When the inputs open the output contacts close. The output contacts open when the inputs close or when the time period has expired. The time period is hardwire selectable on terminals T1, T2 and T3. The time given is the maximum time. One or two channel operation is also hardwire selectable.

Regulations and standards

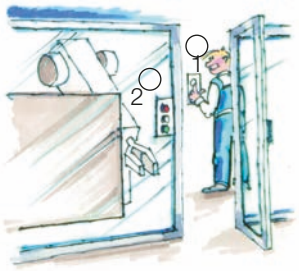
The JSHT1A/B is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the section “Connection examples”.

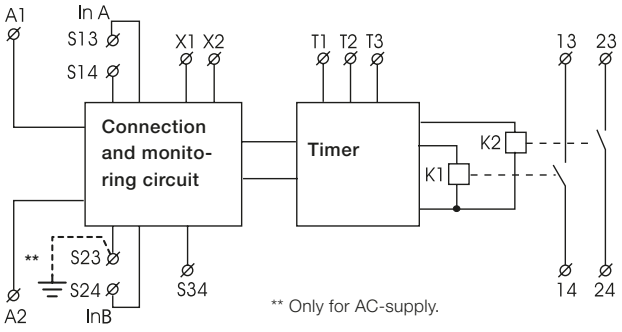


Light beam being bypassed for a maximum pre-set time e.g. 5 sec. by the jsht1 during entrance and exit with the JSHD4 Three Position Enabling device.



Time reset procedure. First push PB1, then exit dangerous area and close the door, then push PB2 (PB1 and PB2 must be pressed within the predetermined time period selected). After this procedure the machine can be safely restarted.

Technical description – JSHT1 A/B

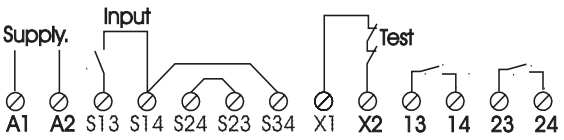


The electrical supply is connected across A1 and A2. The internal supervising circuit is activated directly when the supply is on. The inputs A and B must both be closed and then opened. Thereafter K1 and K2 are activated and the outputs close. K1 and K2 are activated for the hardwired selected time (set by connections on the terminals T1, T2 and T3). If there is a short circuit between the inputs or the inputs are closed again before the set time period has expired the outputs will open. In order to close the outputs again both the inputs have to be closed and both internal relays K1 and K2 deactivated (controlled by the supervising circuit) and the inputs again opened.

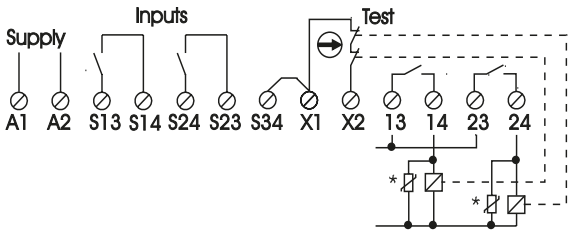
By external hardwire connections the JSHT1 can be made single or dual channel input. See figure below.

Electrical connection – JSHT1 A/B

Connection for single channel input

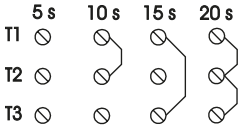


Connection for dual channel input

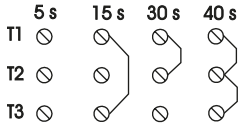


Selection of time by hardwire links

JSHT1A



JSHT1B



* It is recommended that all switched loads are adequately suppressed and/or fused in order to provide additional protection for the safety contacts. In the figure the monitoring of two contactors in the test input is shown.

Technical data – JSHT1 A/B

Article number	
JSHT1A 24 VDC	2TLA010011R0000
JSHT1B 24 VDC	2TLA010011R1000
Colour	Grey
Power supply	24 VDC ±15 %
Power consumption	1.8 W/3.7 VA
Max Input wire res. at nom voltage/ channel	100/200 Ohm (1 Channel/ 2 Channel)
Response time at activation	<30ms
Response time at deactivation	< 15 ms
Selectable time (± 15 % at nom. V.)	JSHT1A: 5-10-15-20 sec
	JSHT1B: 5-15-30-40 sec
Relay outputs	2 x 1 NO
Max. switching capacity resistive load AC	4A/250 VAC/1000 VA
Inductive load AC	AC15 250 VAC 3A
Resistive load DC	4A/24 VDC/100 W
Inductive load DC	DC13 24 VDC 2A
Max. total switching capacity:	8A distributed on all contacts
Min. load	10mA/10 V (if load on contact has not exceeded 100 mA)
Contact material	AgCuNi
Fuses output (external)	3A gL/gG or 4A fast
Conditional short-circuit current (1 kA)	6A gG
Max input wire res. at nom. voltage	100 Ohm
Terminals (max. screw torque 1 Nm)	
Single strand	1x4 mm^2, 2x1.5 mm^2
Conductor with socket contact	1x2.5 mm^2, 2x1 mm^2
Mounting	35 mm DIN-rail
Protection class enclosure/termi-nals	IP20 / IP40 IEC 60529
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating temperature range	–10°C to +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
LED indication	Electrical Supply, Inputs, Outputs
Weight	24 VDC: 330 g
	24/48/115/230 VAC: 430 g
Performance (max.)	
Functional test: The relays must be cycled at least once a year.	PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 4.42E-09
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC EN 62061:2005 EN ISO 13849-1:2008

Safety timer
JSHT2

Approvals:

CE TÜV NORD cULus

Safety relay for:

- Time bypassing
- Inching

Features:

- Hardwire time selection
- 0.2 – 40 s
- Selectable single or dual channel input
- Test input
- Width 45 mm
- LED indication for supply, inputs and outputs
- 1+1 NO relay outputs
- Supply 24 VDC
- Quick release connector blocks

The JSHT2A/B/C closes two independent relay outputs during a guaranteed maximum period of time when the inputs are closed.

Time bypassing

Sensors detect the autocarrier and are connected to the JSHT2 which supervises the sensors and bypasses the light beam for a maximum predetermined time.

Inching

Inching applications require safety outputs to be closed for a predetermined maximum period of time, allowing the machine to move only a short distance each time the inching control is activated. For each new motion the inching control e.g. PB or pedal must be released and activated again.

Operation

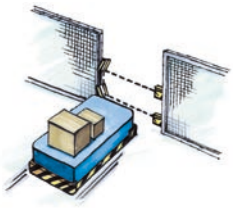
When the inputs close the output contacts close. The output contacts open when the input opens or when the time period has expired. The time is hardwire selectable on the terminals T1, T2 and T3. The time given is the maximum time. Single or dual channel operation is also hardwire selectable.

Regulations and standards

The JSHT2A/B/C is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

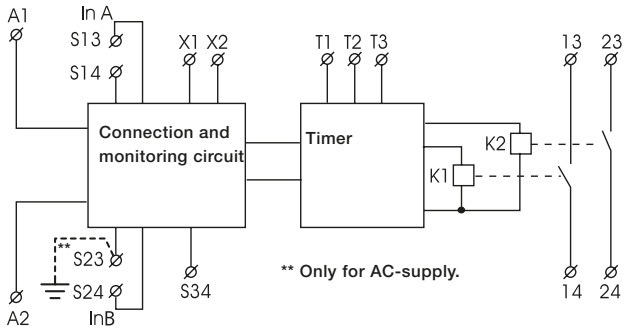
For examples of how our safety relays can solve various safety problems, please see the section “Connection examples”.



Light beam being bypassed only for the time it takes the autocarrier to pass.

Shaft only turns a small amount each time the PB is pressed.

Technical description – JSHT2 A/B/C

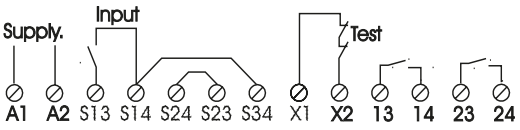


The electrical supply is connected across A1 and A2. The internal supervising circuit is activated directly when the supply is on. The inputs A and B must both be opened and then closed. Thereafter K1 and K2 are activated and the outputs close. K1 and K2 are activated for hardwired selected time (set by connections on the terminals T1, T2 and T3). If there is a short circuit between the inputs or the inputs are opened again before the set time period has expired the outputs will open. In order to close the outputs again both the inputs have to be opened and both internal relays K1 and K2 deactivated (controlled by the supervising circuit) and then the inputs closed again.

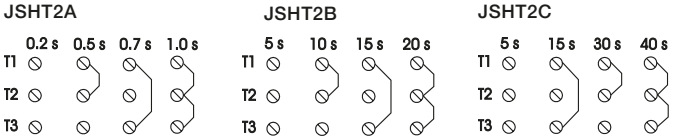
By external hardwire connectors the JSHT2 can be made to operate from either single or dual channel inputs. See figure below.

Electrical connection – JSHT2 A/B/C

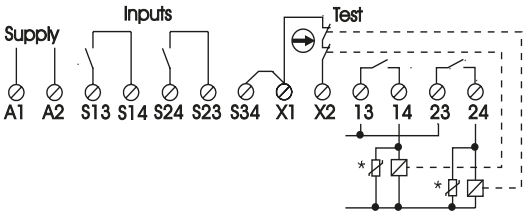
Connection for single channel input



Selection of time by hardwire links



Connection for dual channel input



* It is recommended that all switched loads are adequately suppressed and/or fused in order to provide additional protection for the safety contacts. In the figure the monitoring of two contactors in the test input is shown.

Technical data – JSHT2 A/B/C

Article number	
JSHT2A 24 VDC	2TLA010012R0000
JSHT2B 24 VDC	2TLA010012R1000
JSHT2C 24 VDC	2TLA010012R2000
Colour	Grey
Power supply	24 VDC ±15 %
Power consumption	1.8 W/3.8 VA
Max input wire res. at nom voltage/channel	100/200 Ohm (1 Channel/ 2 Channel)
Response time at activation	< 30 ms
Response time at deactivation	< 15 ms
Selectable time (± 15 % at nom. V.)	JSHT2A: 0.2 - 0.5 - 0.7 - 1.0 sec JSHT2B: 5 - 10 - 15 - 20 sec JSHT2C: 5 - 15 - 30 - 40 sec
Relay outputs	2 x 1 NO
Max. switching capacity	
Resistive load AC	4A/250 VAC/1000 VA
Inductive load AC	AC15 250VAC 3A
Resistive load DC	4A/24 VDC/100 W
Inductive load DC	DC13 24VDC 2A
Max. total switching capacity:	8A distributed on all contacts
Min. load	10mA/10 V (if load on contact has not exceeded 100 mA)
Contact material	AgCuNi
Fuses output (external)	3A gL/gG or 4A fast
Max input wire res. at nom. voltage	100 Ohm
Terminals (max. screw torque 1 Nm)	
Single strand:	1x4 mm^2 or 2x1.5 mm^2
Conductor with socket contact:	1x2.5 mm^2 or 2x1 mm^2
Mounting	35 mm DIN-rail
Protection class	IP20 / IP40 IEC 60529
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating temperature range	–10°C to +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
LED indication	Electrical Supply, Inputs, Outputs
Weight	24 VDC: 310 g 24/48/115/230 VAC: 410 g.
Performance (max.)	
Functional test: The relays must be cycled at least once a year.	PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 4.42E-09
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC EN 62061:2005 EN ISO 13849-1:2008

Expansion relay
E1T

Approvals:

Safety relay for:

- More safety outputs
- Delayed safety outputs

Features:

- Width 22.5 mm
- Supply 24 VDC
- LED output indication
- 4 NO relay outputs
- Single or dual channel operation option
- Quick release connector blocks

More outputs

By connecting expansion relays to a safety relay it is easy to increase the number of safe outputs. This means that an unlimited number of dangerous machine operations and functions can be stopped from one safety relay.

Safe soft stop

When a gate is opened a program stop is first given to the machine's PLC/servo which brakes the dangerous operations in a soft and controlled way. The safety outputs then break the power to the motors, that is, when the machine has already stopped. Normally between 0.5 and 1 second is needed to brake a dangerous machine operation softly.

Soft stop ensures many advantages:
- The machine lasts longer.
- Parts being processed are not damaged.
- Restart from stopped position is enabled and simplified.

A safe soft stop is achieved by means of a safety relay which gives the program stop, and an expansion relay, E1T, which gives safe delayed stop signals. See section "Connection examples". The drop time delay on a E1T can as standard be selected from 0 to 3 seconds. By connecting several E1T´s in series even longer times can be achieved.

When are delayed safe stops used?

Delayed safety stop signals can be used for emergency stops according to EN ISO 13850:2008 § 4.1.4. Stop category 1, i.e. a controlled stop with power to the actuator(s) available to achieve the stop and then removal of power when stop is achieved.

Stop category 1 may also be permitted when it is not possible to gain physical access to the machine before the safe stop is affected e.g:
- Gates, access time is normally over 1 sec.
- Covers and gates which are locked until dangerous operations and functions have been stopped.
- Long distances between a safety device and a dangerous machine function.

Safety level

The E1T has twin stop functions, that is, two relays with mechanically operated contacts. A monitored stop function is achieved by connecting the test output (terminals X1 and X2) to the test or reset input on the safety relay which is being expanded.

One condition for a safe delayed stop is that the delay time cannot increase in the event of a fault. The E1T complies with this requirement.

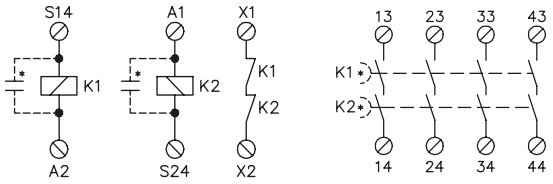
Regulations and standards

The E1T is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the section "Connection examples".

Technical description – E1T



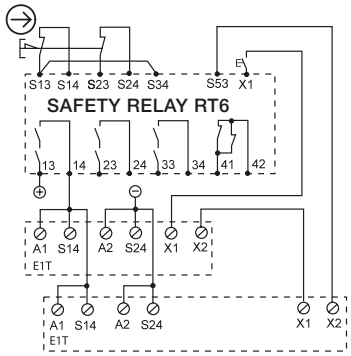
The E1T has to be connected to a safety relay in order to fulfill the necessary safety requirements (see connection examples below). The safety relay controls and monitors the E1T (The E1T can be connected for single or dual channel operation - see below). When the inputs S14 and S24 close, relays K1 and K2 are activated. A stop signal is given, K1 and K2 drop, if the inputs are opened or during power failure. K1 and K2 drop either directly or after a delay* (if incorporated). Delay time of module is fixed and shown on front panel of device. The delay circuit is so arranged that the design time cannot be exceeded.

To check that both the relays K1 and K2 drop during a stop signal they must be monitored. This is achieved by connecting X1 and X2 to the test or reset input on the safety relay which is expanded (see below). K1 and K2 are mechanically operated relays, therefore, if one of the output contacts should stick closed then the relay's contact in X1-X2 cannot be closed thus preventing a new ready signal being given to the safety relay.

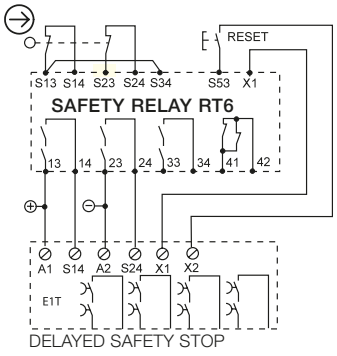
Inductive loads should be equipped with an arc suppressor to protect the output contacts.

Diodes are the best arc suppressors but will increase the switch off time of the load.

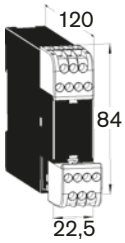
Electrical connection – E1T



Single channel expansion of outputs for a safety relay connected to an emergency stop.



Dual channel expansion with delayed safety outputs for a safety relay monitoring a gate.



Connector blocks are detachable (without cables having to be disconnected)

Technical data – E1T

Article number	
E1T 0 s 24 VDC	2TLA010030R0000
E1T 0.5 s 24 VDC	2TLA010030R1000
E1T 1 s 24 VDC	2TLA010030R2000
E1T 1.5 s 24 VDC	2TLA010030R3000
E1T 2 s 24 VDC	2TLA010030R4000
E1T 3 s 24 VDC	2TLA010030R5000
Colour	Grey
Operational voltage	24 VDC ± 15%
Power consumption	1.5 W
Relay Outputs	4 NO
Max. switching capacity	
Resistive load AC	6A/250 VAC/1500VA
Inductive load AC	AC15 240 VAC 2A
Resistive load DC	6A/24 VDC/150W
Inductive load DC	DC13 24 VDC 1A
Max. total switching capacity	12A distributed on all contacts
Min. switching load	10 mA/10 V (if load on contact has not exceeded 100 mA)
Contact material	Ag + Au flash
Fuses output (external)	5A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Maximum external resistance at a nominal voltage	150 Ohm (S14, S24)
Response time at deactivation (input - output)	< 0,020 s, 0,5 s, 1 s, 1,5 s, 2 s, 3 s, ± 20%
Response time at activation (input-output)	<30 ms
Terminals (max. screw torque 1 Nm)	
Single strand:	1x4 mm^2 / 2x1.5 mm^2
Conductor with socket contact:	1x2.5 mm^2 / 2x1 mm^2
Mounting	35 mm DIN-rail
Protection class	
enclosure	IP40 IEC 60529
terminals	IP20 IEC 60529
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating temperature range	-10°C – +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
LED indication	Output status
Weight	220 g
Performance (max.)	PL e/Cat. 4
Functional test: The relays must be cycled at least once a year.	(EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 1.55E-08
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC EN 62061:2005 EN ISO 13849-1:2008

Expansion relay
JSR1T

Approvals:

Safety relay for:

- More safe outputs
- Delayed safe outputs
- Information output

Features:

- Width 45 mm
- Supply 24 VDC
- LED function indication
- 4 NO/1 NC relay outputs
- Single and dual channel
- Quick release connector blocks

More outputs

By connecting expansion relays to a safety relay it is easy to increase the number of safe outputs. This means that an unlimited number of dangerous machine operations and functions can be stopped from one safety relay.

Safe soft stop

When a gate is opened a program stop is first given to the machine's PLC/servo which brakes the dangerous operations in a soft and controlled way. The safety outputs then break the power to the motors, that is, when the machine has already stopped. Normally between 0.5 and 1 second is needed to brake a dangerous machine operation softly.

Soft stop ensures many advantages:
- The machine lasts longer.
- Parts being processed are not damaged.
- Restart from stopped position is enabled and simplified.

A safe soft stop is achieved by means of a safety relay which gives the program stop, and an expansion relay, JSR1T, which gives safe delayed stop signals. See section "Connection examples". The drop time delay on a JSR1T can as standard be selected from 0 to 10 seconds. By connecting several JSR1T´s in series even longer times can be achieved.

When are delayed safe stops used?

Delayed safety stop signals can be used for emergency stops according to EN418 § 4.1.4 Stop category 1, i.e. a controlled stop with power to the actuator(s) available to achieve the stop and then removal of power when stop is achieved.

Stop category 1 may also be permitted when it is not possible to gain physical access to the machine before the safe stop is affected e.g:
- Gates, access time is normally over 1 sec.
- Covers and gates which are locked until dangerous operations and functions have been stopped.
- Long distances between a safety device and a dangerous machine function.

Safety level

The JSR1T has twin stop functions, that is, two relays with mechanically operated contacts. A monitored stop function is achieved by connecting the test output (terminals X1 and X2) to the test or reset input on the safety relay which is being expanded.

One condition for a safe delayed stop is that the delay time cannot increase in the event of a fault. The JSR1T complies with this requirement.

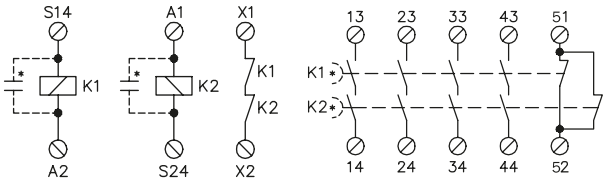
Regulations and standards

The JSR1T is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the section "Connection examples".

Technical description – JSR1T



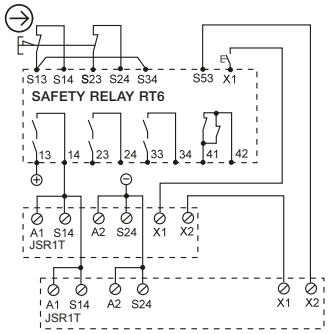
The JSR1T has to be connected to a safety relay in order to fulfill the necessary safety requirements (see connection examples below). The safety relay controls and monitors the JSR1T. (The JSR1T can be connected for single or dual channel operation - see below). When the inputs S14 and S24 close, relays K1 and K2 are activated. A stop signal is given, K1 and K2 drop, if the inputs are opened or during power failure. K1 and K2 drop either directly or after a delay* (If incorporated). Delay time of module is fixed and shown on front panel of device. The delay circuit is so arranged that the design time cannot be exceeded.

To check that both the relays K1 and K2 drop during a stop signal they must be monitored. This is achieved by connecting X1 and X2 to the test or reset input on the safety relay which is expanded (see below). K1 and K2 are mechanically operated relays, therefore, if one of the output contacts should stick closed then the relay's contact in X1-X2 cannot be closed thus preventing a new ready signal being given to the safety relay.

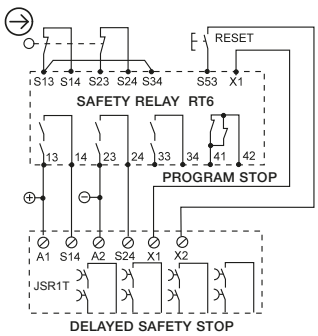
Inductive loads should be equipped with an arc suppressor to protect the output contacts.

Diodes are the best arc suppressors but will increase the switch off time of the load.

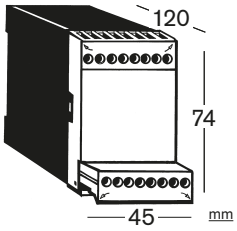
Electrical connection – JSR1T



Expansion of outputs for safety relay connected to emergency stop with automatic reset.



Dual-channel expansion with delayed safety outputs for safety relay monitoring a gate.



Connector blocks are detachable (without cables having to be disconnected)

Technical data – JSR1T

Article number	
JSR1T 0	2TLA010015R0000
JSR1T 1.5	2TLA010015R0500
JSR1T 8	2TLA010015R0600
JSR1T 0.5	2TLA010015R1000
JSR1T 10s	2TLA010015R2000
JSR1T 1	2TLA010015R3000
JSR1T 2	2TLA010015R4000
JSR1T 3	2TLA010015R5000
JSR1T 5	2TLA010015R6000
Colour	Grey
Power supply	24 VDC ±15%
Power consumption	1.2 W
Relay outputs	4 NO + 1 NC
Max. switching capacity Resistive load AC	6A/250 VAC/1500 VA
Inductive load AC	AC15 240 VAC 2A
Resistive load DC	6A/24 VDC/150 W
Inductive load DC	DC13 24 VDC 1A
Max. total switching capacity:	16A distributed on all contacts
Min. load	10mA/10 V (if load on contact has not exceeded 100 mA)
Contact material	Ag + Au flash
Fuses output (external)	5A gL/gG
Conditional short-circuit current (1 kA)	6A gG
Max. Input wire res. at nom. voltage	150 Ohm (S14, S24)
Response time at deactivation (input- output)	< 0.020 s, 0.5 s, 1 s, 1.5 s, 2 s, 3 s, 5 s, 8 s, 10 s ± 20 %
Terminals (max. screw torque 1 Nm)	
Single strand:	1x2.5 mm^2 / 2x1 mm^2
Conductor with socket contact:	1x4 mm^2 / 2x1.5 mm^2
Mounting	35 mm DIN-rail
Protection class enclosure/terminals	IP40 / IP20 IEC 60529
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating temperature range	-10°C to +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
LED indication	Output Relay Supplies
Weight	280 g
Performance (max.)	PL e/Cat. 4 (EN ISO 13849-1:2008)
Functional test: The relays must be cycled at least once a year	SIL 3 (EN 62061:2005) PFH_D 1.55E-08
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC EN 62061:2005 EN ISO 13849-1:2008

Expansion relay
JSR2A

Approvals:

Safety relay for:

- More safe outputs
- Greater current switching capacity
- Information output

Features:

- Switching capacity of up to 10 A/250V per output
- Width 45 mm
- LED function indication
- 4 NO/1 NC relay outputs
- 5 supply versions
- Supply 24 VDC/VAC, 115 and 230 VAC
- Quick release connector blocks

More outputs
The JSR2A expansion relay is used to provide increased switching capacity and number of safety outputs to a safety relay. This means that an unlimited number of dangerous machine operations and functions can be stopped from one safety relay.

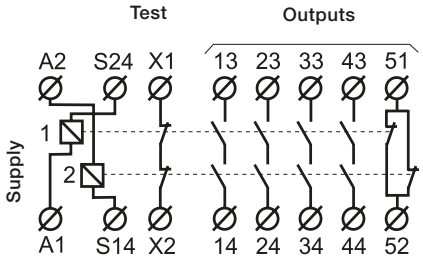
Greater current switching capacity
The JSR2A Expansion relay enables switching of up to 10 amps per output contact.

Safety level
The JSR2A has twin stop functions, that is, two relays with mechanically positively guided contacts. A monitored stop function is achieved by connecting the test output (terminals X1 and X2) to the test or reset input on the safety relay which is to be expanded.

Regulations and standards
The JSR2A is designed and approved in accordance with appropriate directives and standards. See technical data.

Connection examples
For examples of how our safety relays can solve various safety problems, please see the section “Connection examples”.

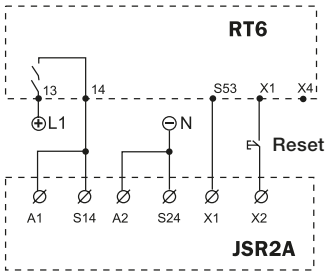
Technical description – JSR2A



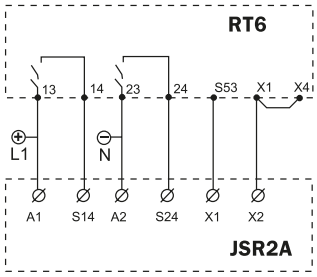
The JSR2A has to be connected to a suitable safety relay in order to fulfill the necessary safety requirements (see chapter “Connection examples”). The Safety Relay controls and monitors the JSR2A unit. (The JSR2A can be connected for single or dual channel operation - see Electrical connection diagrams below). When the inputs to S14 and S24 close, internal relays K1 and K2 are activated. A stop signal is given, K1 and K2 drop, if the inputs are opened or during power failure.

To check that both the K1 and K2 relays drop during a stop signal they must be monitored. This is achieved by connecting X1 and X2 to the test or reset input on the safety relay which is expanded. K1 and K2 have mechanically positively guided contacts, therefore, if one of the output contacts should stick closed then the relay’s contact in X1-X2 cannot be closed thus preventing a new ready signal being given to the safety relay.

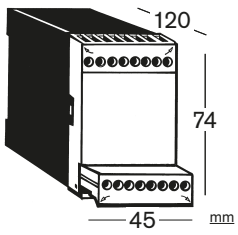
Electrical connection – JSR2A



One channel expansion of RT6 with JSR2A connected for manual reset.



Dual channel expansion of RT6 with JSR2A connected for automatic reset.



Connector blocks are detachable (without cables having to be disconnected)

Technical data – JSR2A

Article number	
JSR2A 10 A 24 VAC/VDC	2TLA010027R0100
JSR2A 10 A 115 VAC	2TLA010027R0400
Colour	Grey
Supply A1 - A2	24 VDC/AC, 115, 230 VAC + 15%, 50-60 Hz
Power consumption	2.7W/2.4–4 VA
Relay outputs	4 NO + 1 NC
Max. switching capacity	
Resistive load AC	8A/230 VAC/1840 VA 10A/115VAC/48VAC/24VAC/ 1840 VA
Inductive load AC	AC15 230 VAC 4A (NO-contact) 1.5A (NC-contact)
Resistive load DC	8A/24 VDC/192 W
Inductive load DC	DC13 24 VDC 1.2A (NO/NC-contact)
Max. total switching capacity:	16A distributed on all contacts
Min. load	10mA/10V/100mW (if load on contact has not exceeded 100 mA)
Contact material	AgSnO2 + Au flash
Fuses output (External)	6A gL (8A fast if short-circuit current >500A)
Conditional short-circuit current (1 kA)	10A gG
Max. Input wire res. at nom. voltage	24 VDC/VAC: 100 Ohm 48/115/230 VAC: 200 Ohm
Mechanical operational Life	>10^7 operations
Response time at	
deactivation (input- output)	<25 ms
activation (input - output):	<15 ms
Terminals (removable)	
Max. screw torque	1 Nm
Connection area (max.)	
Single strand	1x4 mm² or 2x1.5 mm² / 12AWG
Conductor with socket contact	1x2.5 mm² or 2x1 mm²
Mounting	35 mm DIN-rail
Protection class terminals	
Enclosure	IP40 IEC 60529
Terminals	IP20 IEC 60529
LED indication	
On	Supply voltage
1 2	Output relays 1 and 2
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating temperature range	-10°C to +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
Weight	313 g
Performance (max.)	PL e/Cat. 4
Functional test: The relays must be cycled at least once a year	(EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 1.55E-08
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC EN 62061:2005 EN ISO 13849-1:2008

Expansion relay
JSR3T

Approvals:

Safety relay for:

- Safe delay of stop signals with selectable value
- Delayed safe outputs

Features:

- Width 22.5 mm
- Supply 24V AC/DC
- Output indication
- 2 x 1 NO relay outputs
- Hardwire Selectable Delay 0.5 - 10.0 sec by hardwire links and Time trim potentiometer

Delayed outputs

By connecting the JSR3T expansion relay to a compatible Safety relay it is easy to obtain safe "delayed" outputs.

The JSR3T provides the system designer with the facility to hardwire selected time delays in steps between 0.5 and 10 seconds.

Use of delayed outputs

There are many applications where delayed outputs are necessary and permissible. For example delayed stop signals can be used for emergency stops according to EN ISO 13850:2008 § 4.1.4 Stop Category 1 (a controlled stop with power to the machine actuator(s) available to achieve the stop and then removal of power when stop is achieved). Stop Category 1 may also be permitted when it is not possible to gain physical access to the machine before the safe stop is effected e.g. by:

- Covers and Gates which are locked until dangerous operations and functions have been stopped.
- Long distances between a safety device and dangerous machine functions.
- Using this technique of stopping a machine provides many advantages i.e.:
- Machines last longer as they are not subjected to excessive loading etc when requested to stop.
- Parts being processed are not damaged.
- Restarting machines from stopped position is simplified.

A safe "Soft" stop is achieved by means of a safety relay giving a programme stop to the machine control system. e.g. when a gate is opened or emergency stop is activated. The output of the Safety relay is used to provide both a stop signal to the machine control system i.e. via a PLC which applies the necessary braking/stopping of the machine in a controlled way, and to switch a delayed expansion relay e.g JSR3T. The delayed safety outputs of the JSR3T expansion relay are then used to control the safe disconnection of the power to the actuators/motors etc. of the machine.

Safety level

The JSR3T has twin stop functions, using two positively guided contact relays.

In order to achieve the level of monitoring required the JSR3T must be used with a suitable Safety Relay e.g. JSBR4, or RT6. The JSR3T test output (terminals X1 and X2) must be connected to the test input of the Safety relay being expanded (see connection examples).

The JSR3T provides delay times that even in the event of an internal fault condition complies with the requirement that the set delay cannot increase in time.

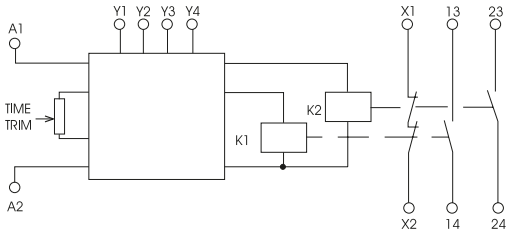
Regulations and standards

The JSR3T is designed and approved in accordance with appropriate directives and standards. Examples of such are 98/37/EC, EN ISO 12100-1/-2, EN 60204-1, EN 954-1/ EN ISO 13849-1.

Connection examples

For examples of how our safety relays can solve various safety problems, please see the section “Connection examples”.

Technical description – JSR3T

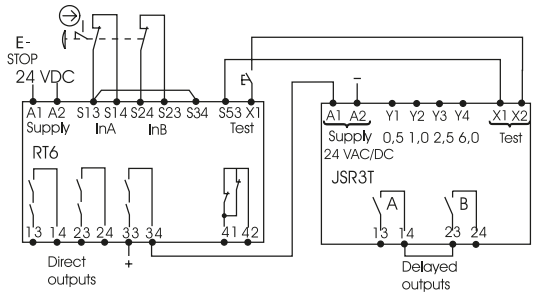


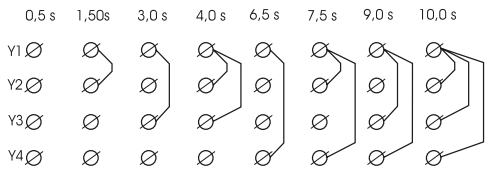
When supply voltage is connected to A1 and A2, relays K1 and K2 are activated. When the supply voltage is removed relays K1 and K2 remain energized for a time period determined by the hardwire link configuration chosen (set by connecting links on the terminals Y1, Y2, Y3 and Y4.) and the setting of the Time Trim potentiometer.

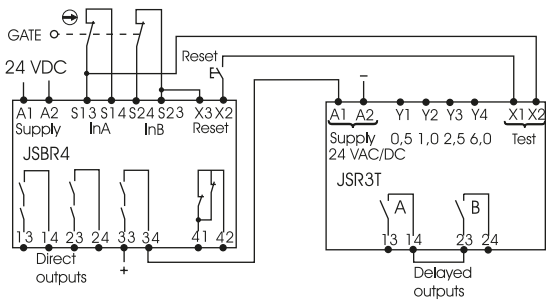
NOTE 1! Max. time set by hardwire links can only be reduced (up to approx. 30% reduction) by Time Trim potentiometer.

NOTE 2! Both the output contacts of K1 and K2 (13 - 14 and 23 - 24) must be used. Output contacts must be either connected in series (forming one safety output) or used in parallel circuits in order to obtain necessary redundancy.

Electrical connection – JSR3T







Technical data – JSR3T

Article number JSR3T 24 VAC/VDC	2TLA010017R0100
Colour	Grey
Power supply	24 VAC/VDC, 50 - 60 Hz
Power consumption	1.3 VA/W
Relay outputs	2 x 1 NO (See Connection examples)
Max. switching capacity Resistive load AC Inductive load AC Resistive load DC Inductive load DC	 4A / 250 VAC/1000 VA AC15 240 VAC 3A 4A / 24 VDC /100 W DC13 24 VDC 2A
Max. res. load total switching capacity:	6A distributed on all contacts
Min. load	10mA/10V (if load on contact has not exceeded 100 mA)
Contact material	AgNi
Fuses output (external)	3A gL/gG or 4A fast
Conditional short-circuit current (1 kA)	6A gG
Max Input wire res. at nom. voltage	100 Ohm
Response time at activation	<20ms
Response time at deactivation	<0.5 - 10.0 sec. at nom. voltage. Selected delay can be lowered by up to approx. 30% by means of preset potentiometer on front panel.
Terminals (max. screw torque 1 Nm)	Single strand: 2x1.5 mm^2 Conductor with socket contact: 2x1mm^2.
Mounting	35 mm DIN-rail
Protection class enclosure/terminals	IP40 / IP20 IEC 60529
Impulse withstand voltage	2.5kV
Pollution degree	2
Operating temperature range	–10°C to +55°C (with no icing or condensation)
Operating humidity range	35% to 85%
LED indication	Outputs
Weight	158 g
Performance (max.) Functional test: The relays must be cycled at least once a year.	PL e/Cat. 4 (EN ISO 13849-1:2008) SIL 3 (EN 62061:2005) PFH_D 3.67E-09
Conformity	2006/42/EC, 2006/95/EC, 2004/108/EC EN 62061:2005 EN ISO 13849-1:2008

Selection of time delay by hardwire links (Y1, Y2, Y3, Y4).

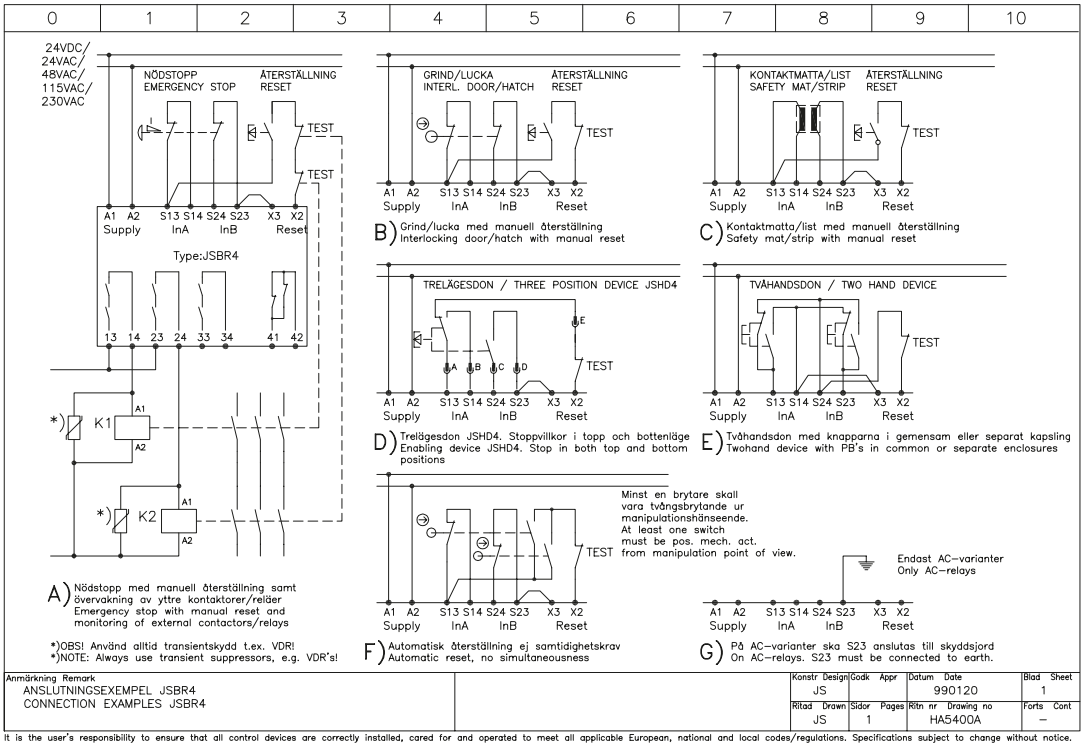
Selected delay can be lowered by up to approx. 30% by means of preset potentiometer on front panel.

It is recommended that all switched loads are adequately suppressed and/or fused in order to provide additional protection for the safety contacts.

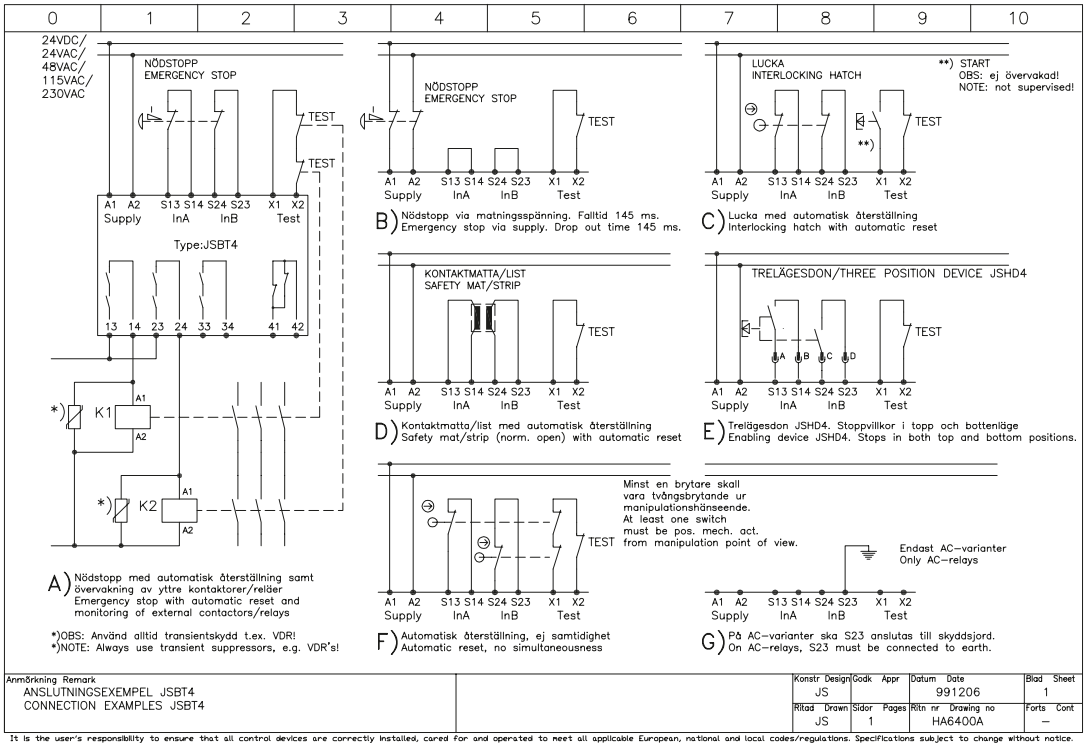
Connection examples

Connection examples

HA5400A Connection examples JSBR4

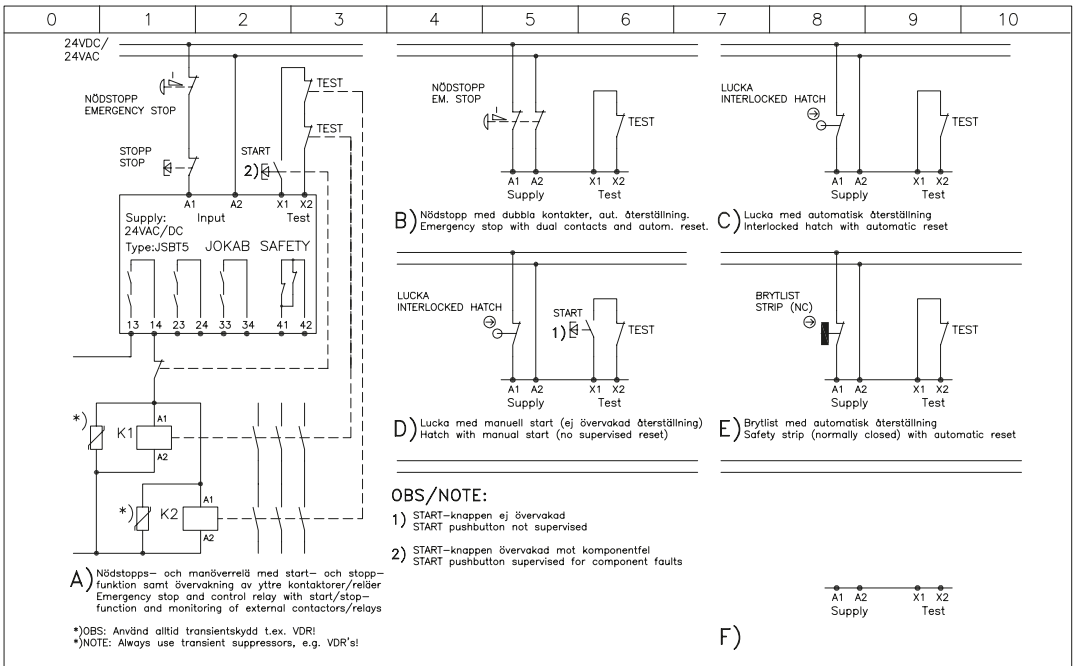


HA6400A Connection examples JSBT4



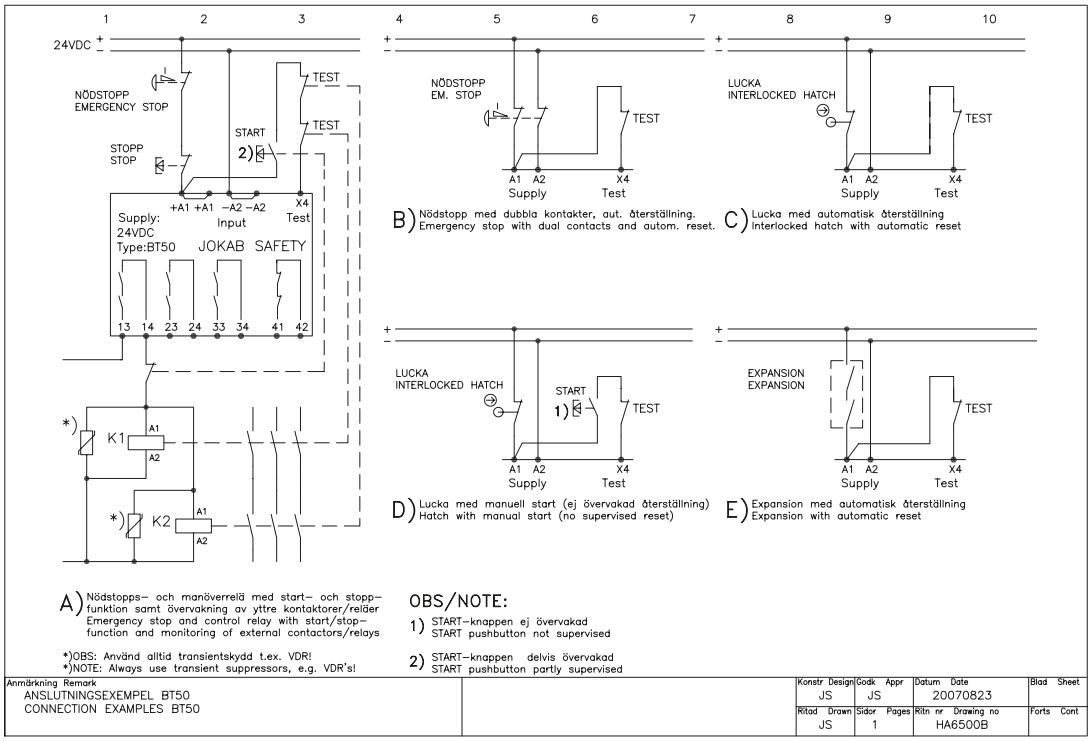
Connection examples

HA6500A Connection examples JSBT5



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

HA6500B Connection examples BT50



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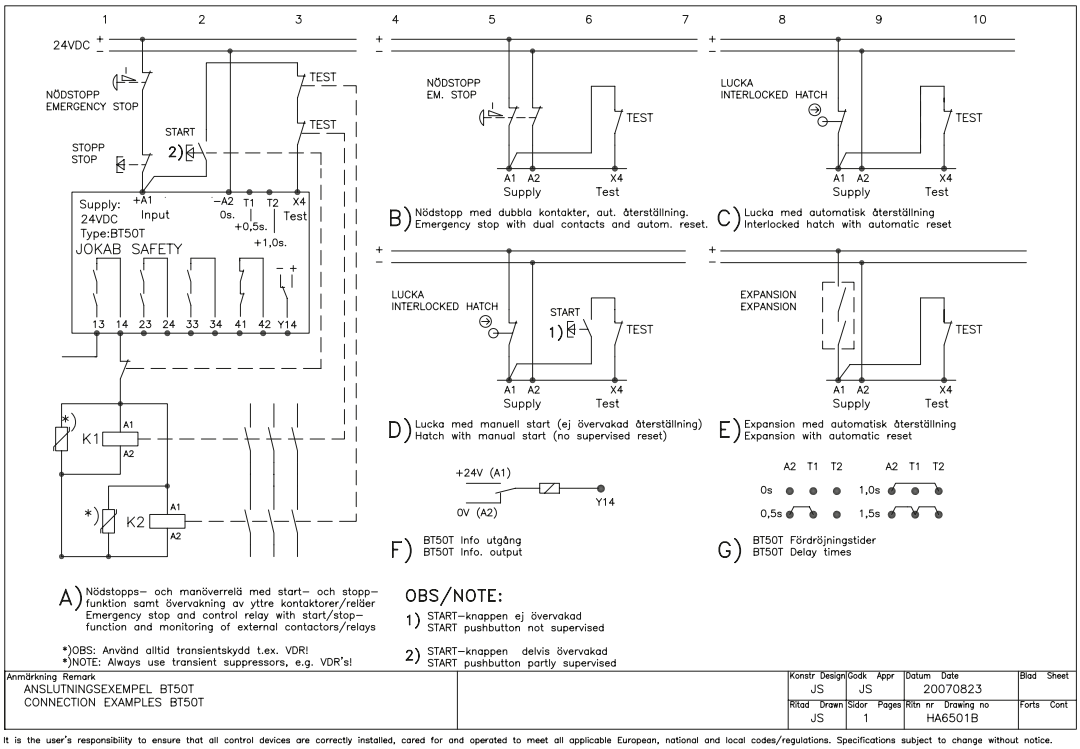
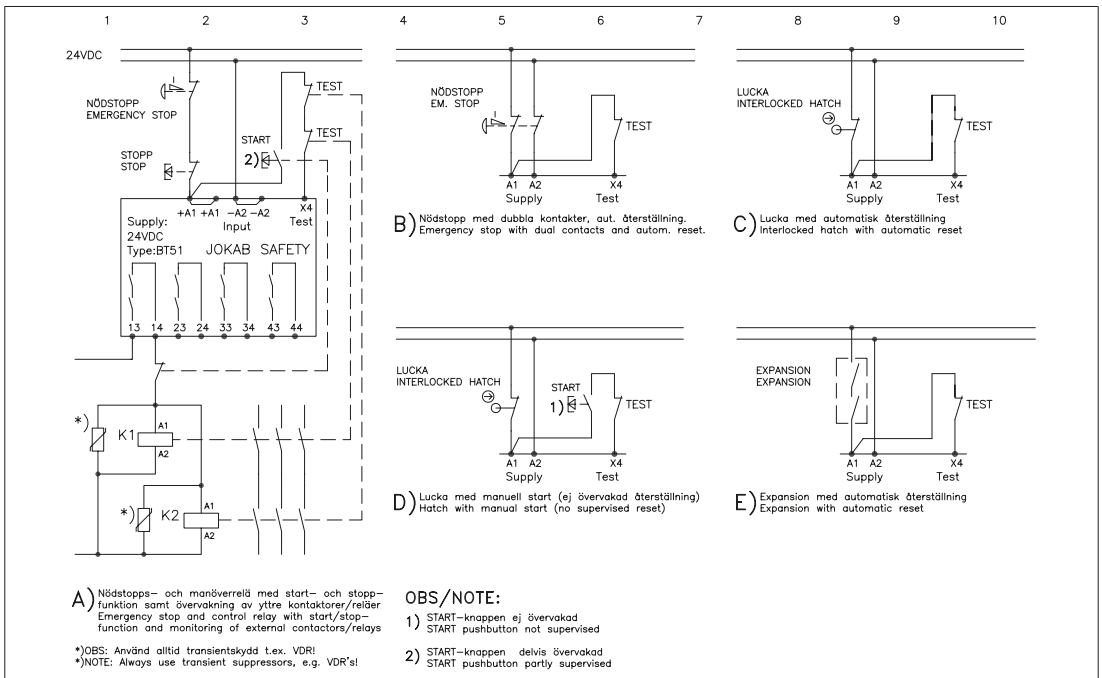
Connection examples

HA6501B Connection examples BT50T

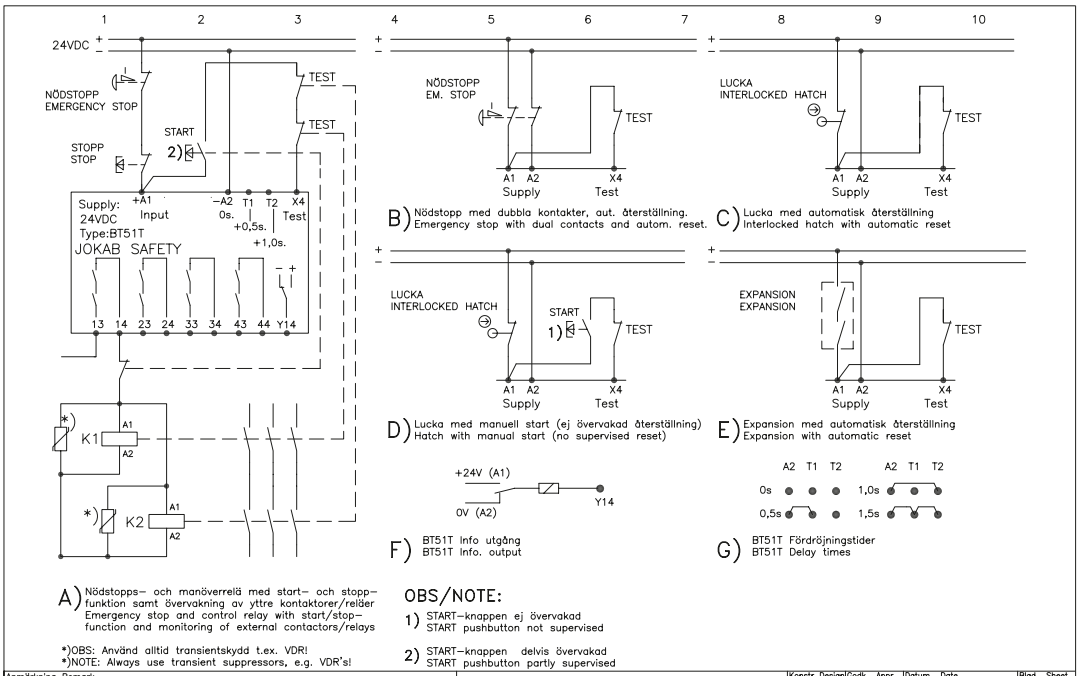


HA6500C Connection examples BT51



Connection examples

HA6501C Connection examples BT51T



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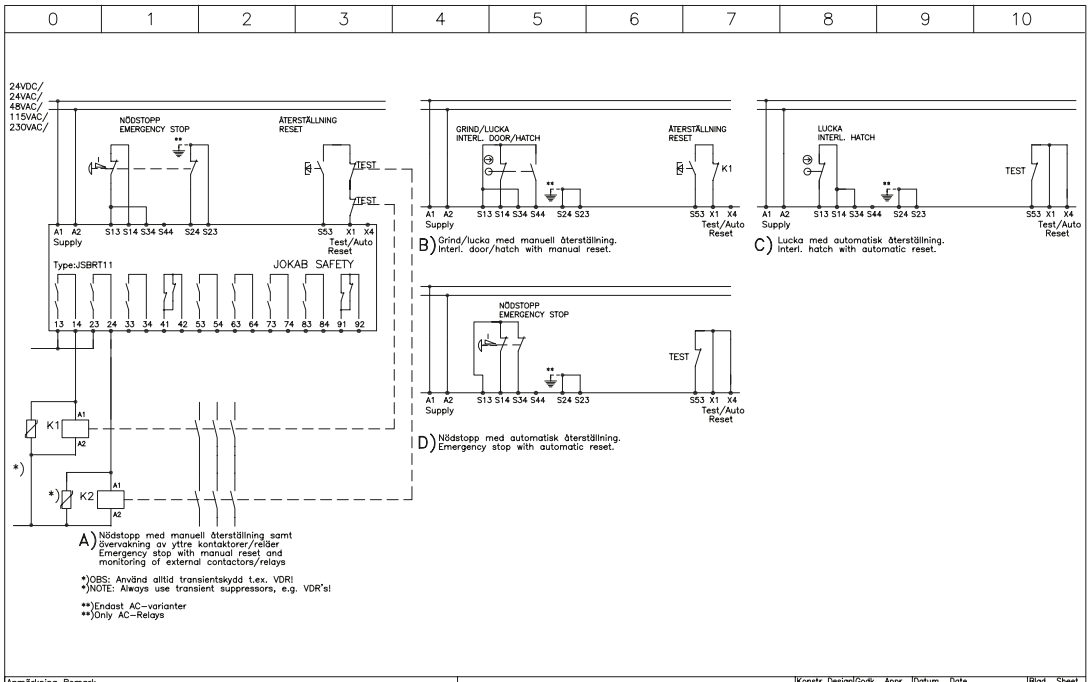
HA7100A Connection examples JSBRT11



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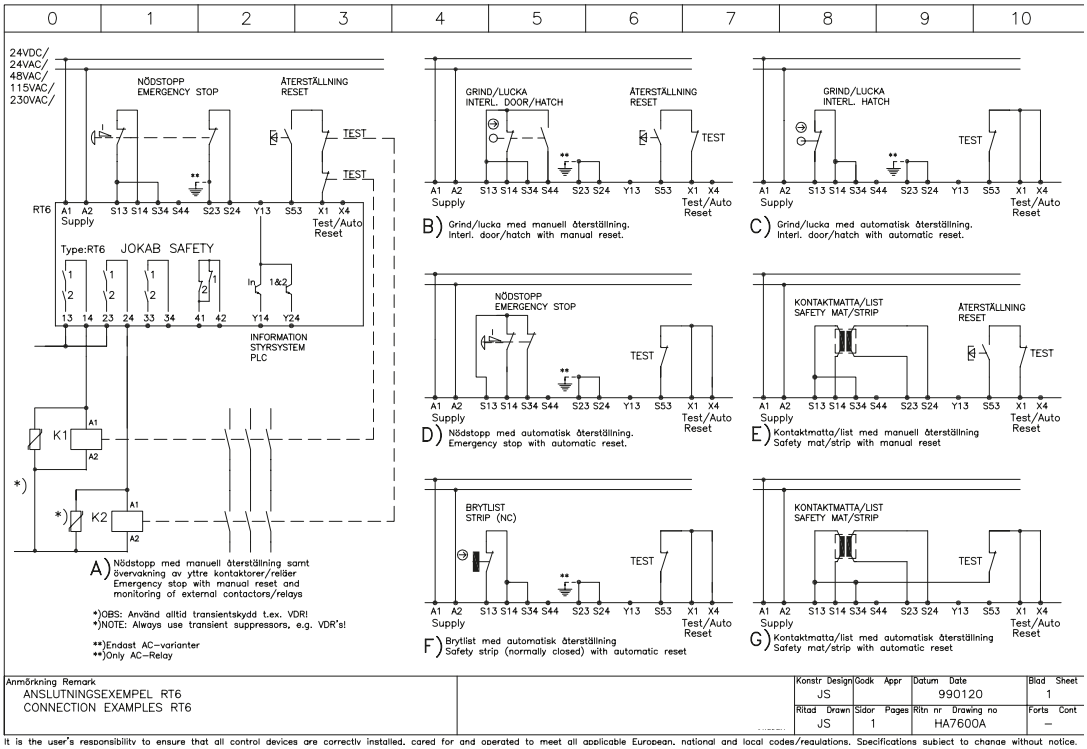
Connection examples

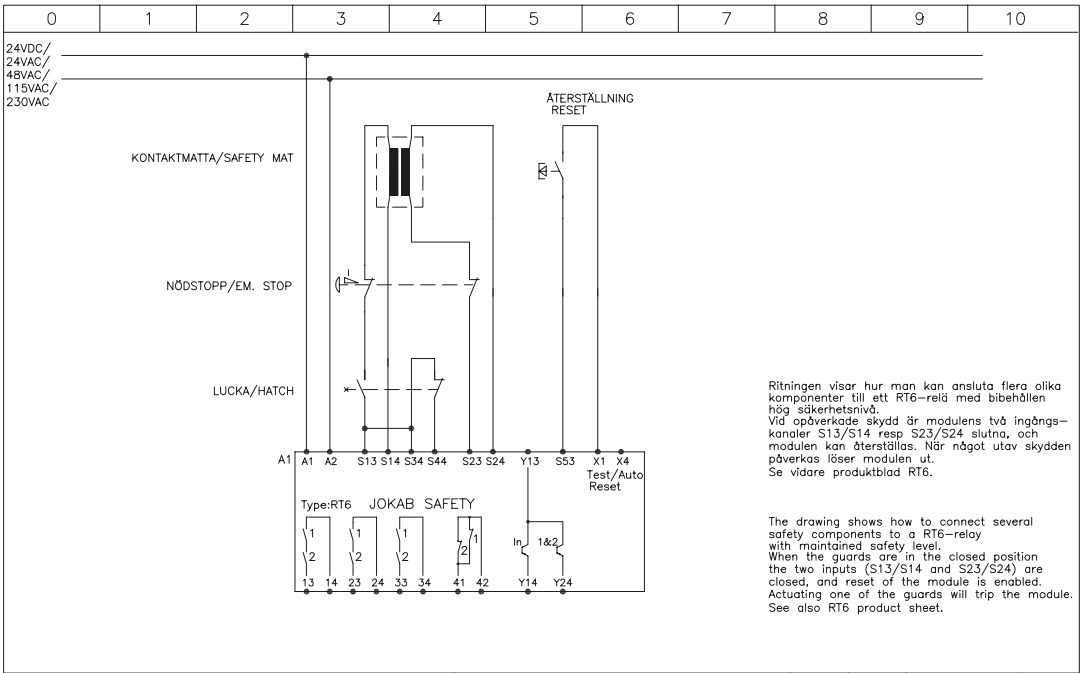
HA7600A Connection examples RT6



Anmärkning Remark		Konstr Design	Godk Appr	Datum Date	Blad Sheet
ANSLUTNINGSEXEMPEL RT6 CONNECTION EXAMPLES RT6		JS		990120	1
		Ritad Drawn	Sidor Pages	Ritn nr Drawing no	Forts Cont
		JS	1	HA7600A	–

It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

HA7600B Principle drawing RT6



Ritningen visar hur man kan ansluta flera olika komponenter till ett RT6-relä med bibehållen hög säkerhetsnivå.
Vid opåverkade skydd är modulens två ingångskanaler S13/S14 resp S23/S24 slutna, och modulen kan återställas. När något utav skydden påverkas löser modulen ut.
Se vidare produktblad RT6.

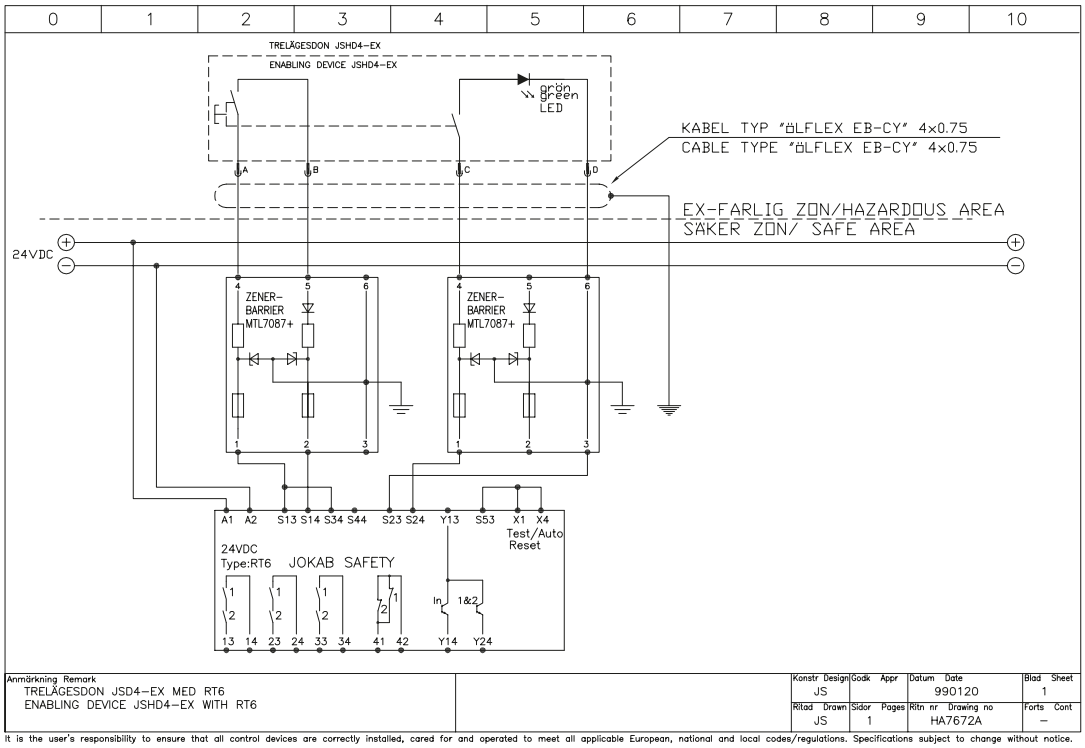
The drawing shows how to connect several safety components to a RT6-relay with maintained safety level.
When the guards are in the closed position the two inputs (S13/S14 and S23/S24) are closed, and reset of the module is enabled.
Actuating one of the guards will trip the module.
See also RT6 product sheet.

Anmärkning Remark		Konstr Design	Godk Appr	Datum Date	Blad Sheet
KONTAKTMATTA, NÖDSTOPP OCH LUCKA TILL RT6 SAFETY MAT, EM. STOP AND HATCH WITH RT6 PRINCIPRITNING/PRINCIPLE DRAWING		JS		990409	1
		Ritad Drawn	Sidor Pages	Ritn nr Drawing no	Forts Cont
		JS	1	HA7600B	–

It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

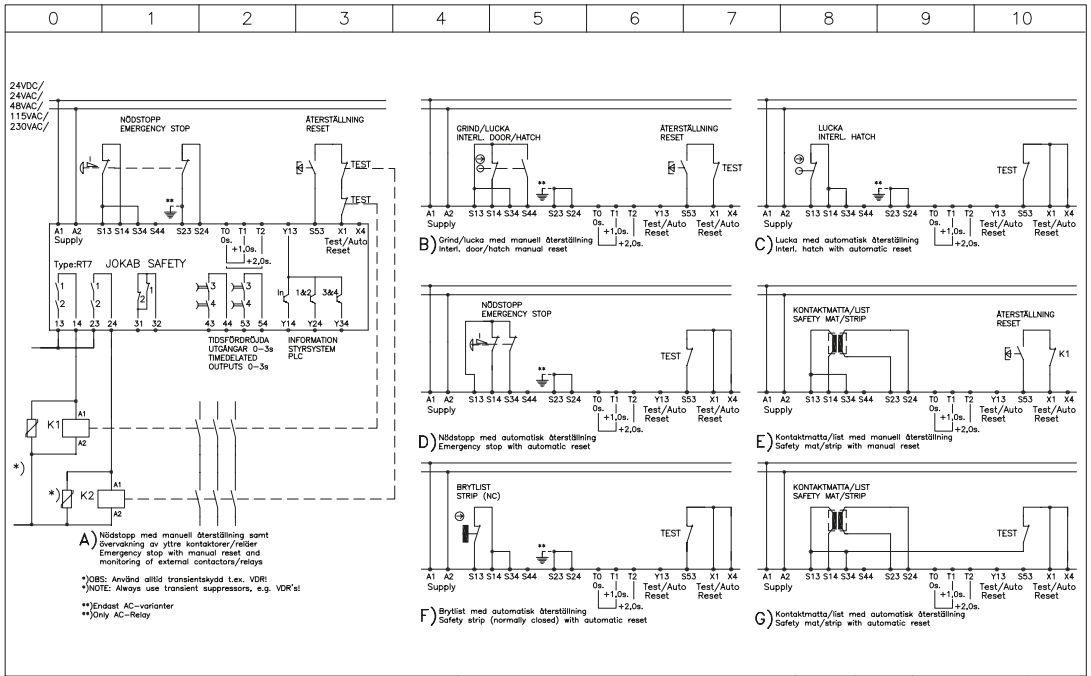
Connection examples

HA7672A Enabling device JSHD4 - EX with RT6



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

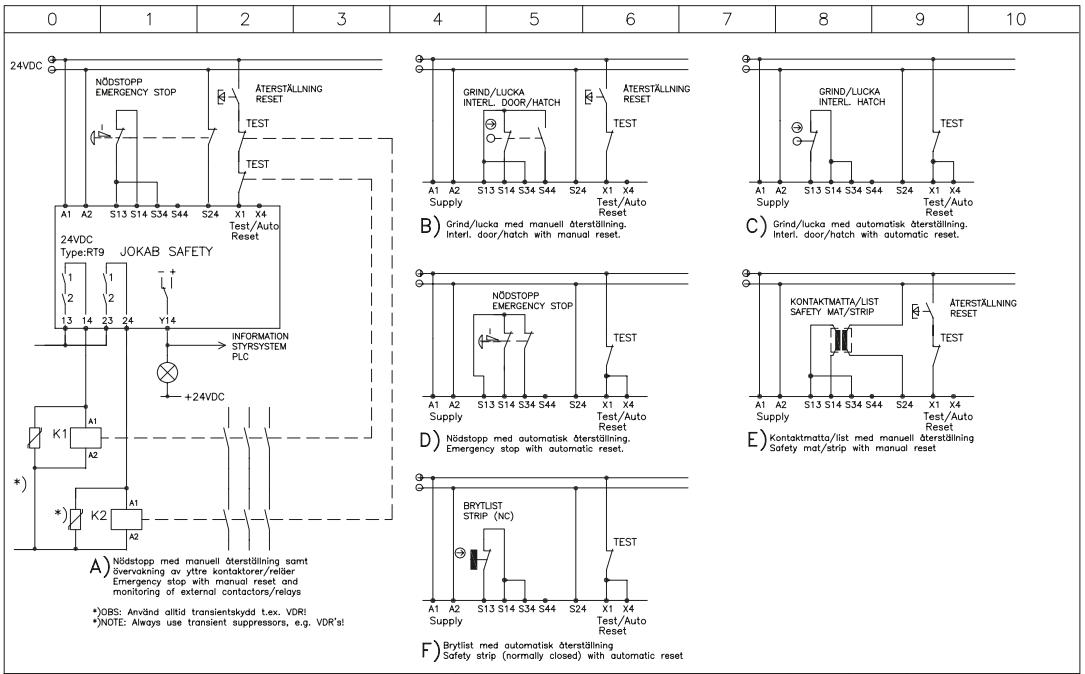
HA7700A Connection examples RT7



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

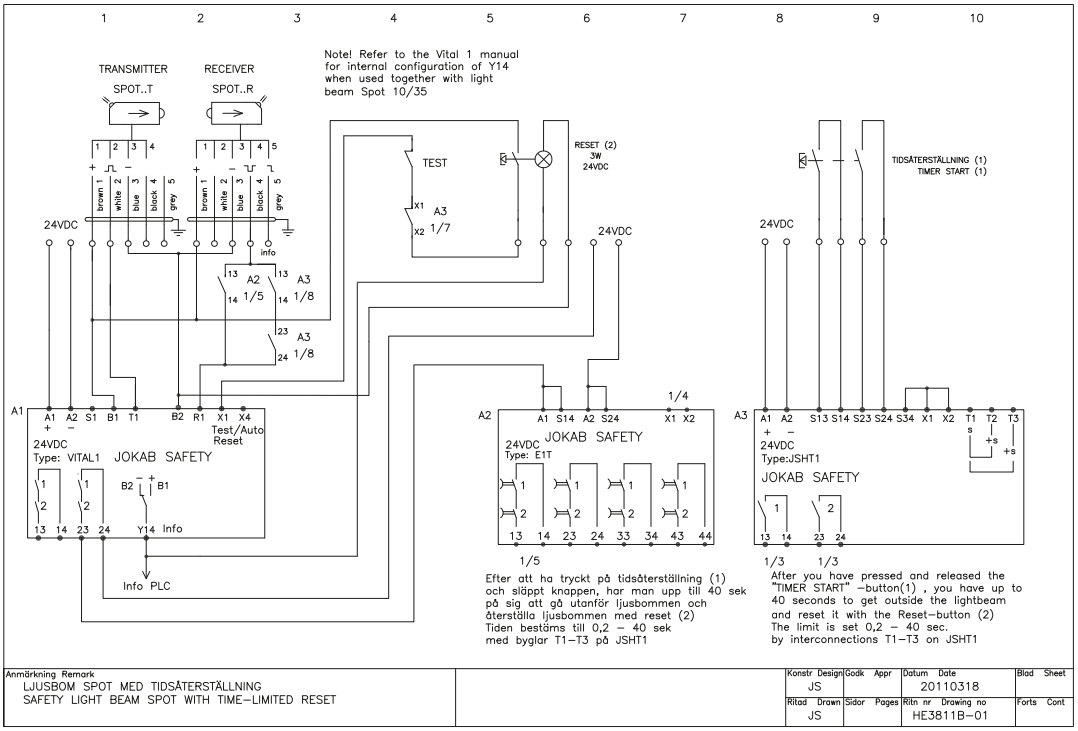
Connection examples

HA7900A Connection examples RT9



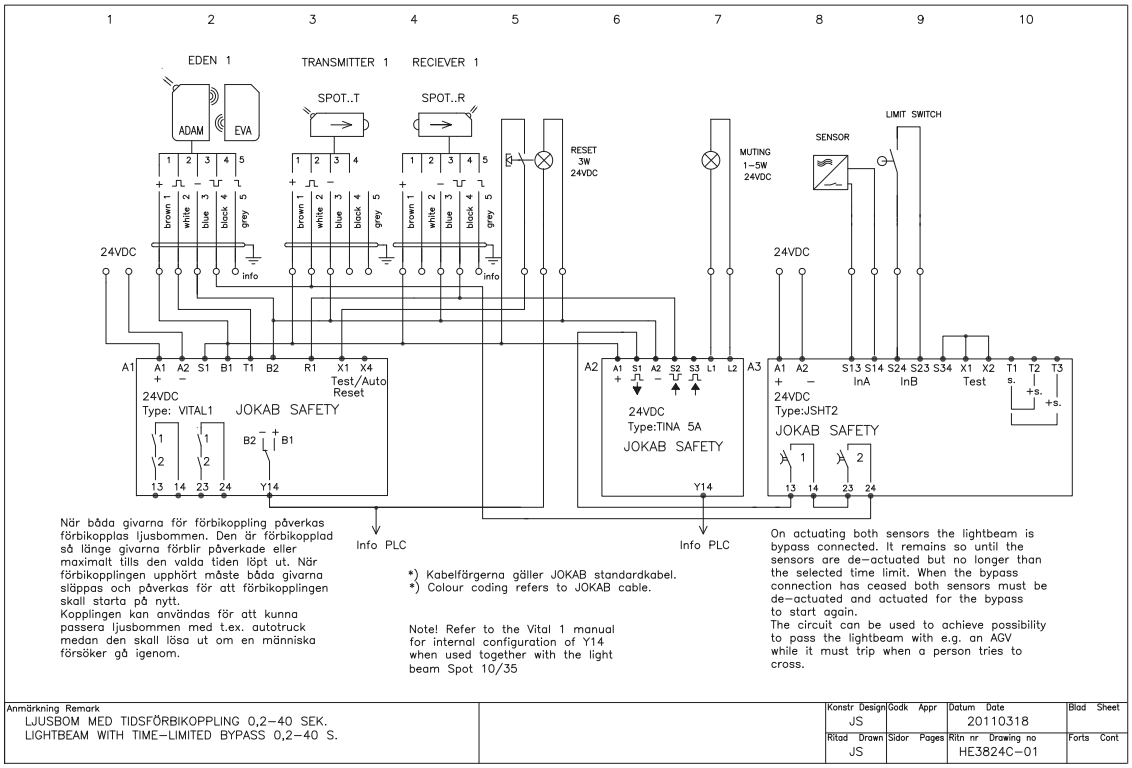
It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

HE3811B Safety Light Beam Spot with time-limited reset

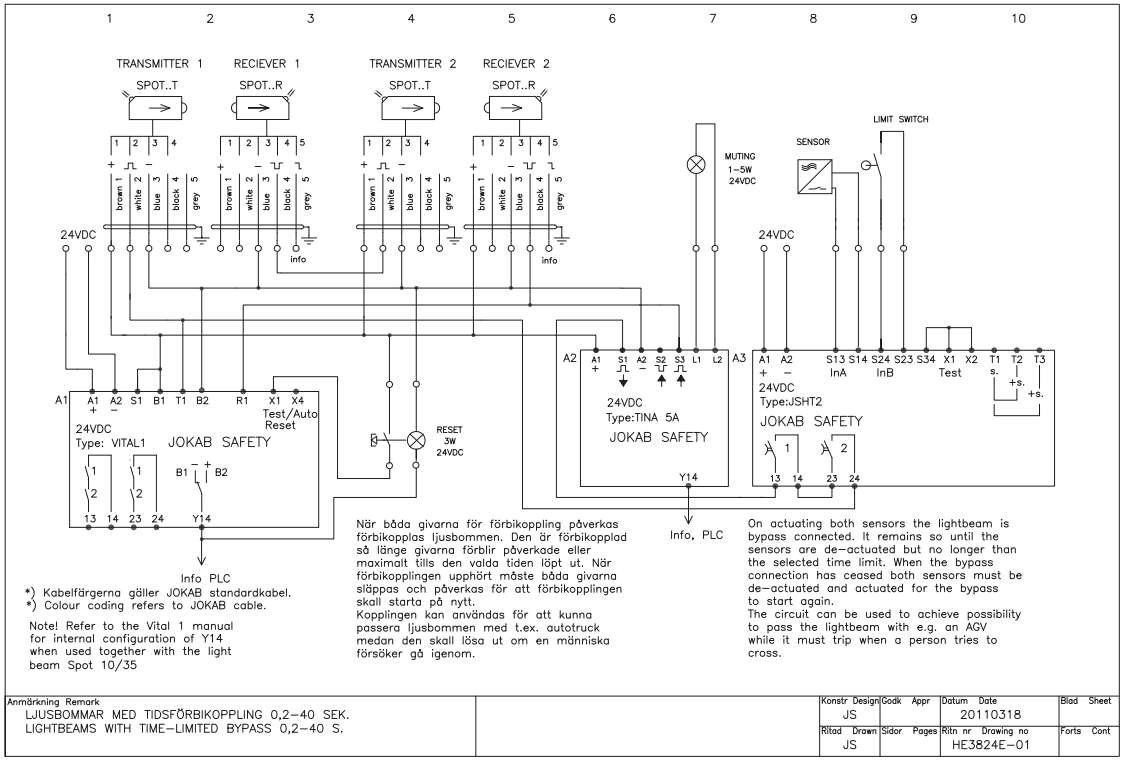


Connection examples

HE3824C-01 Lightbeam with time-limited muting 0.2–40 s

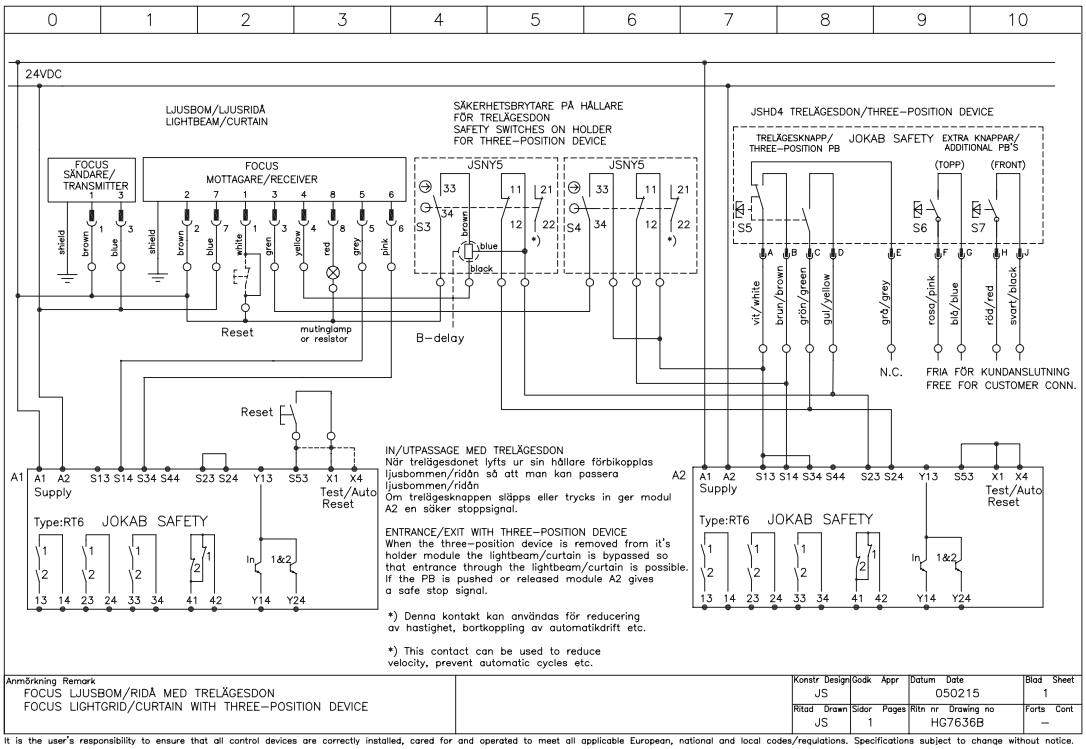


HE3824E-01 Lightbeams with time-limited muting 0.2–40 s



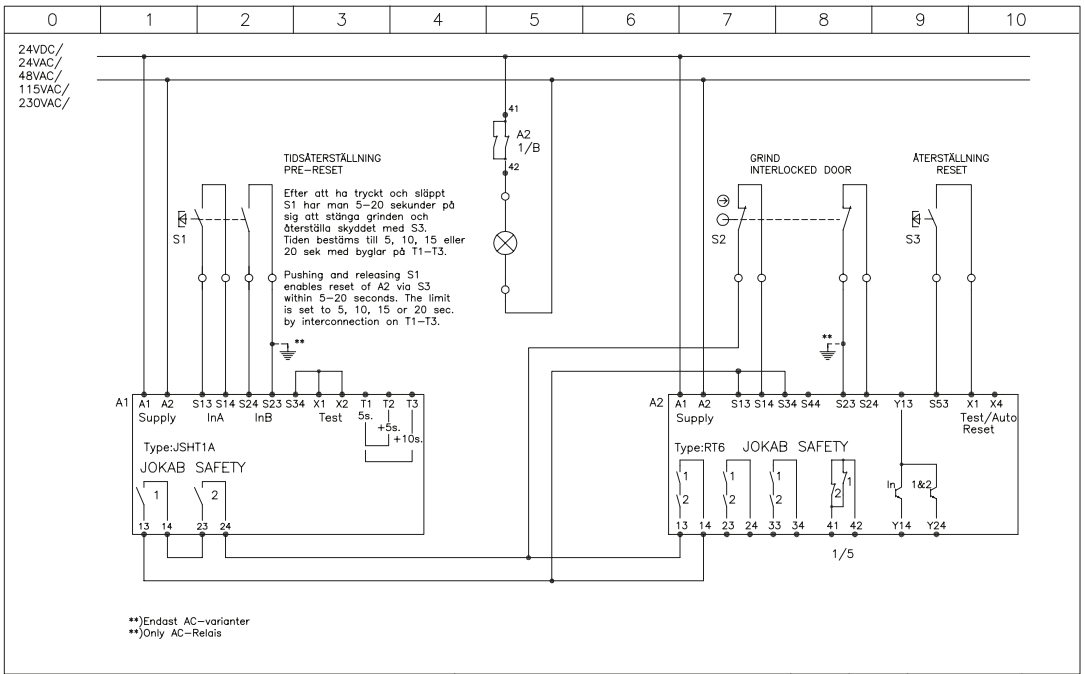
Connection examples

HG7636B Focus light grid/curtain with three-position device



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

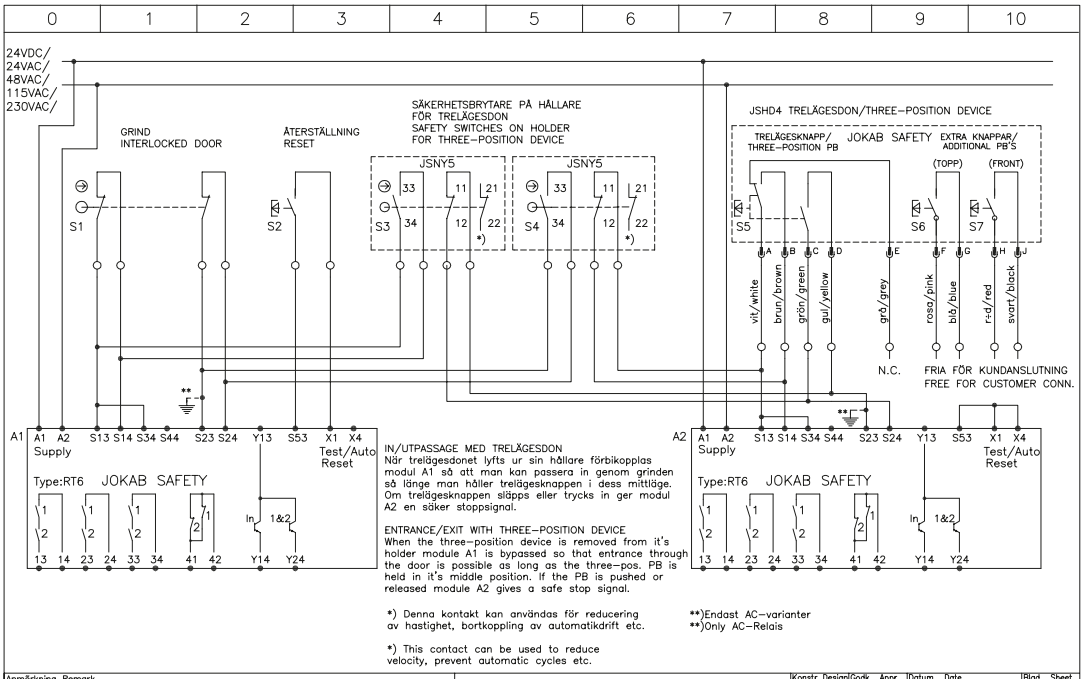
HG7611A Interlocked door with RT6 and pre-reset



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

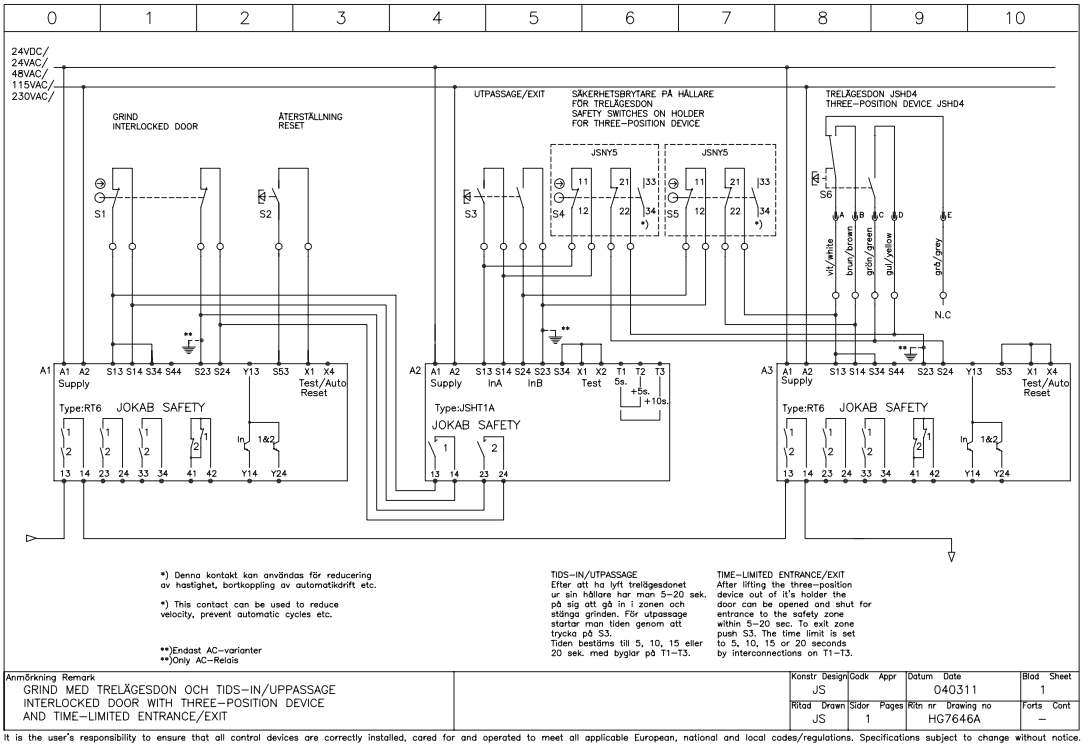
Connection examples

HG7636A Interlocked door with three-position device



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

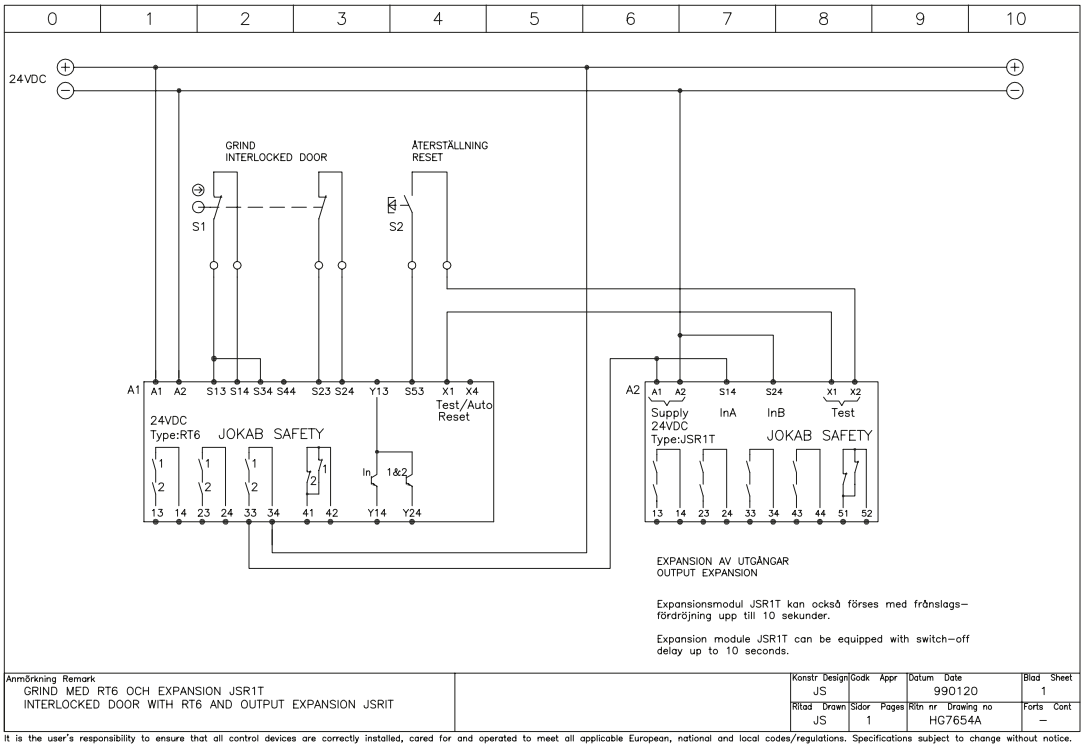
HG7646A Interlocked door with three-position device and time-limited entrance/exit



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

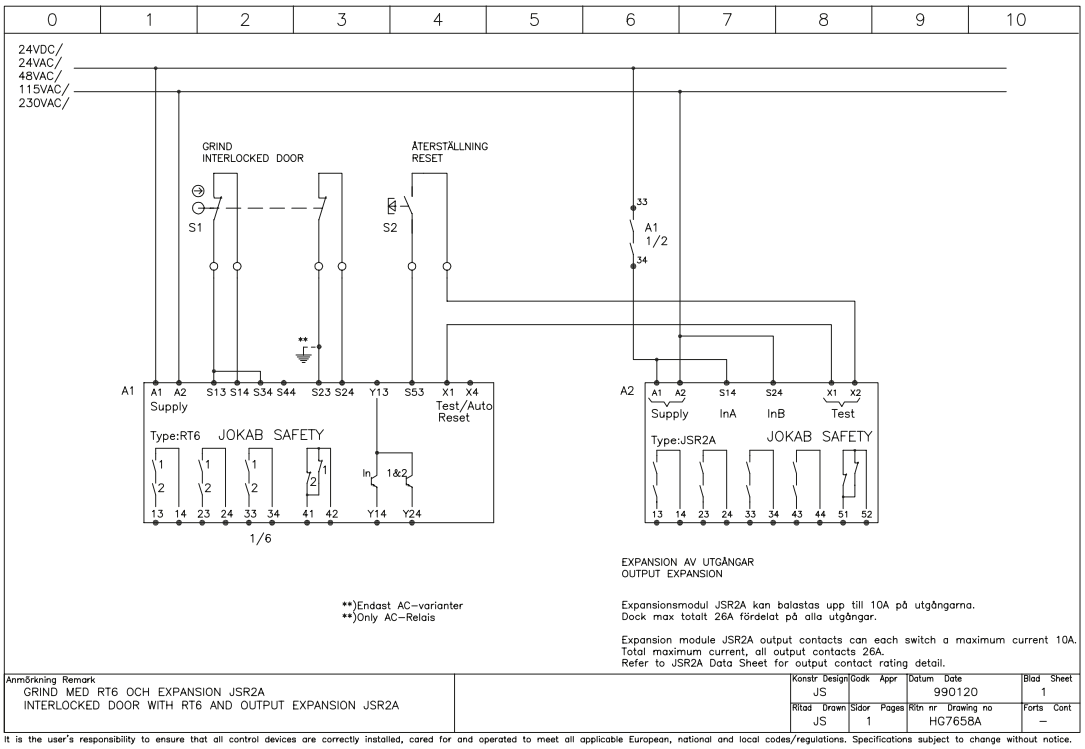
Connection examples

HG7654A Interlocked door with RT6 and output expansion JSR1T



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

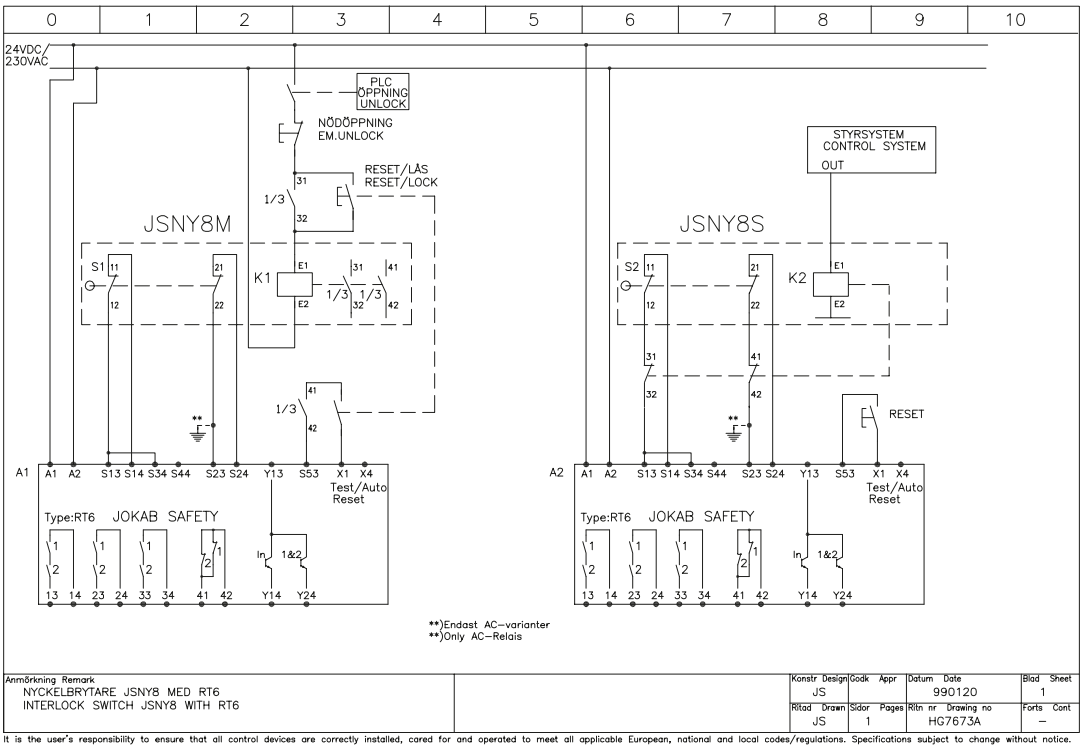
HG7658A Interlocked door with RT6 and output expansion JSR2A



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

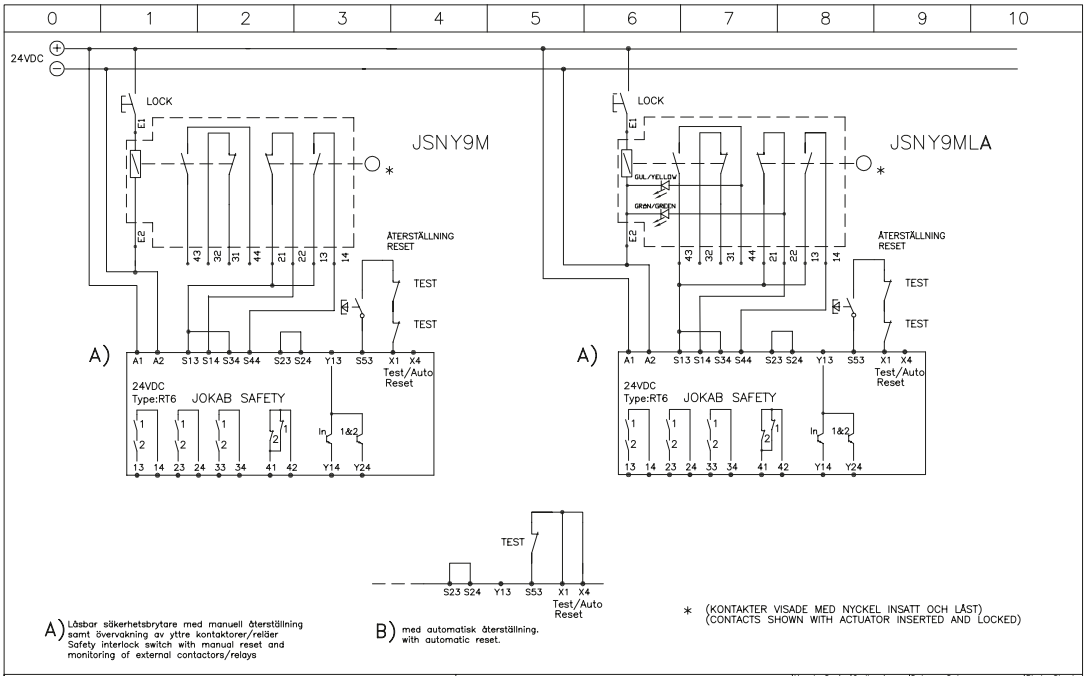
Connection examples

HG7673A Interlock switch Mkey8 with RT6



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

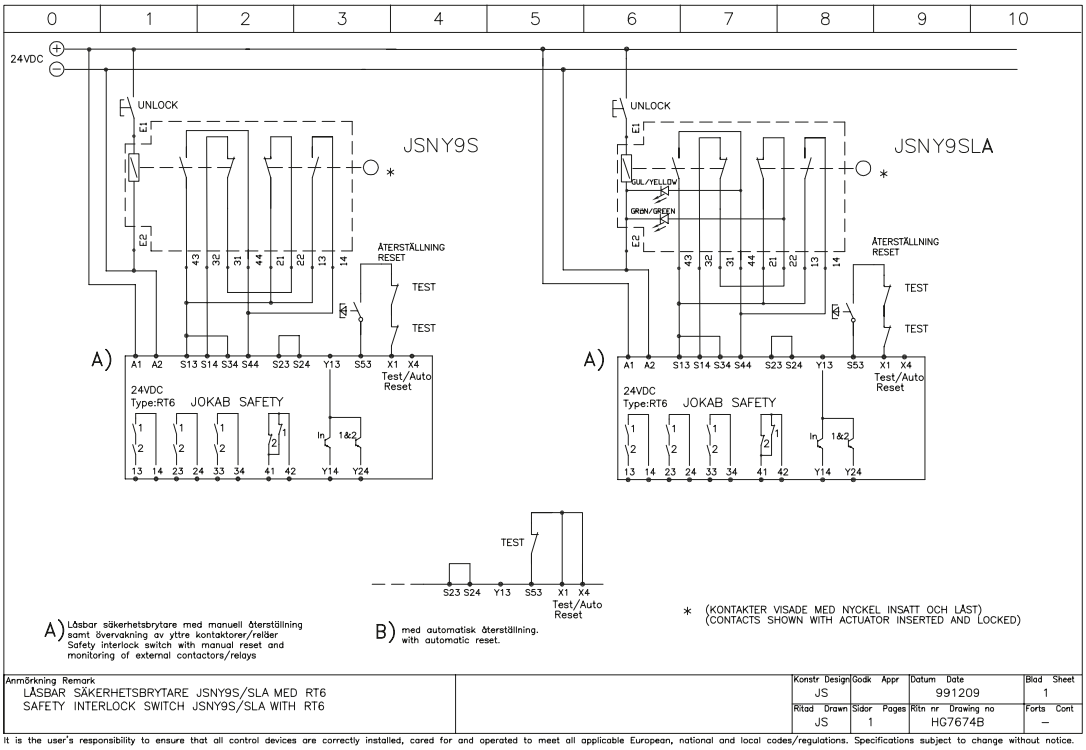
HG7674A Safety interlock switch Mkey9 M with RT6



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

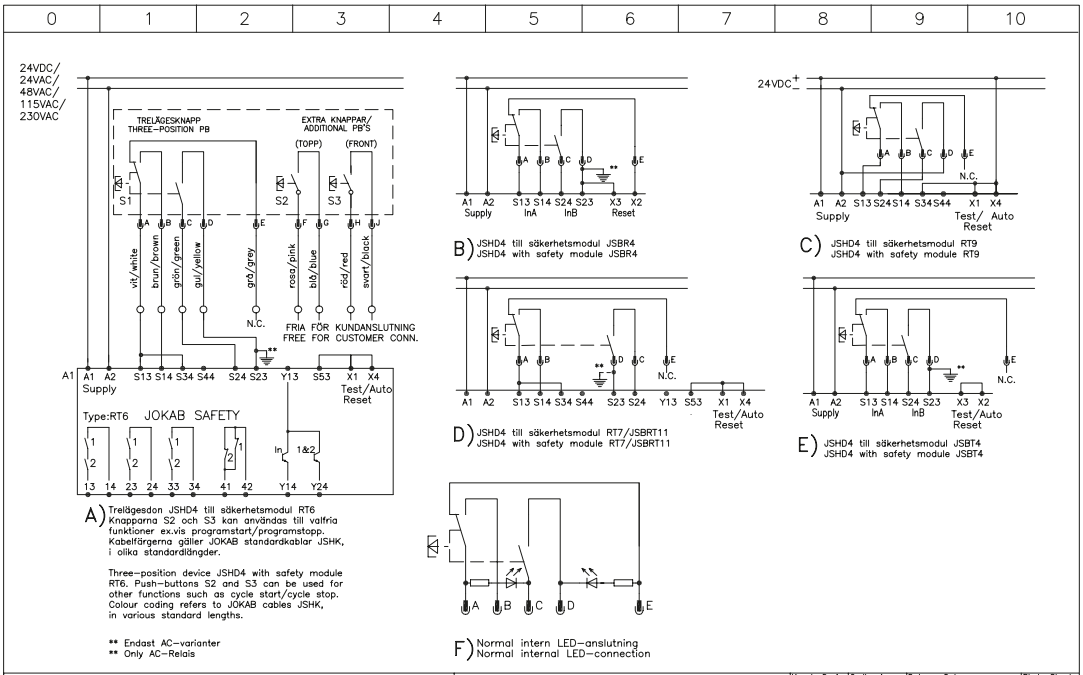
Connection examples

HG7674B Safety interlock switch Mkey9 with RT6



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

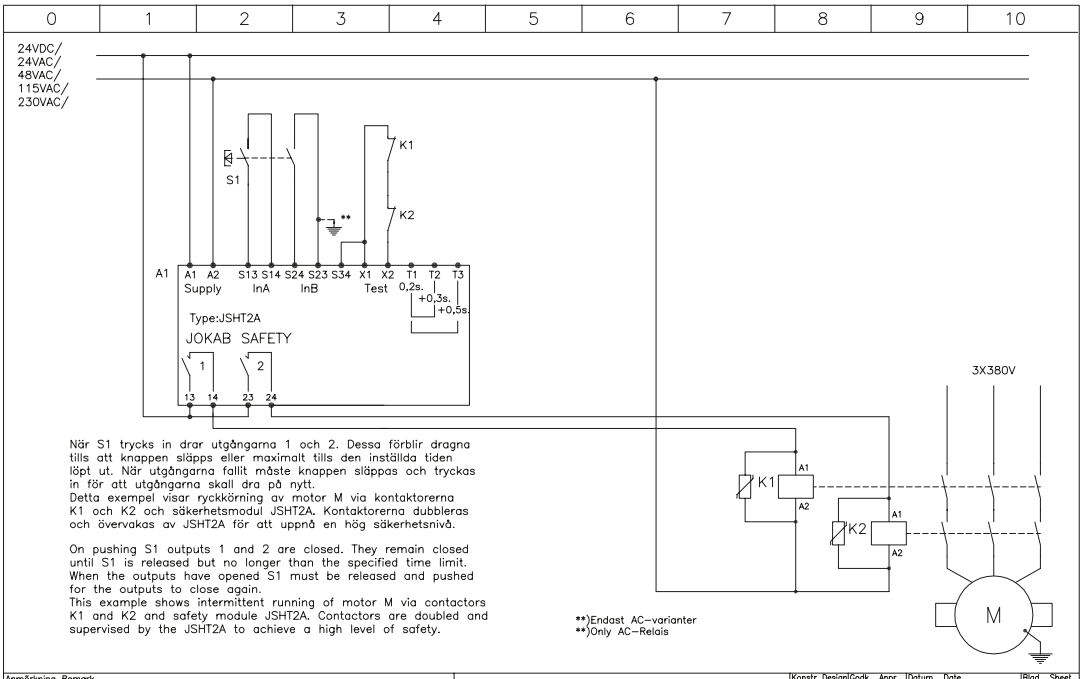
HH0000C Three-position device JSHD4 with various safety controllers



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

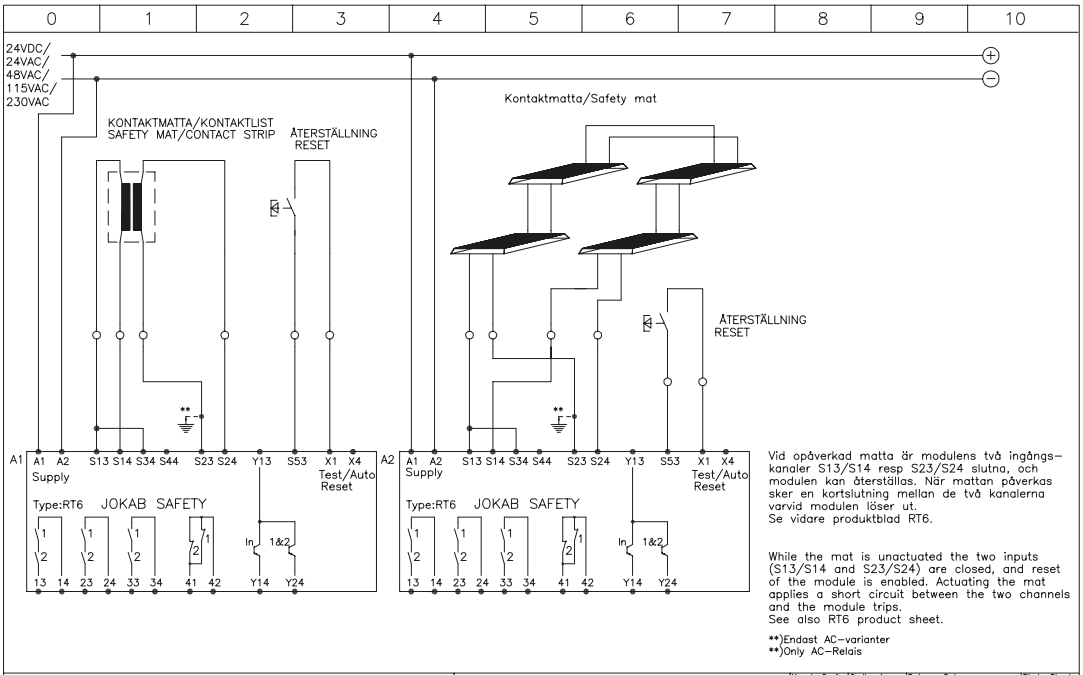
Connection examples

HI8552A Connection examples JSHT2 intermittent running



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

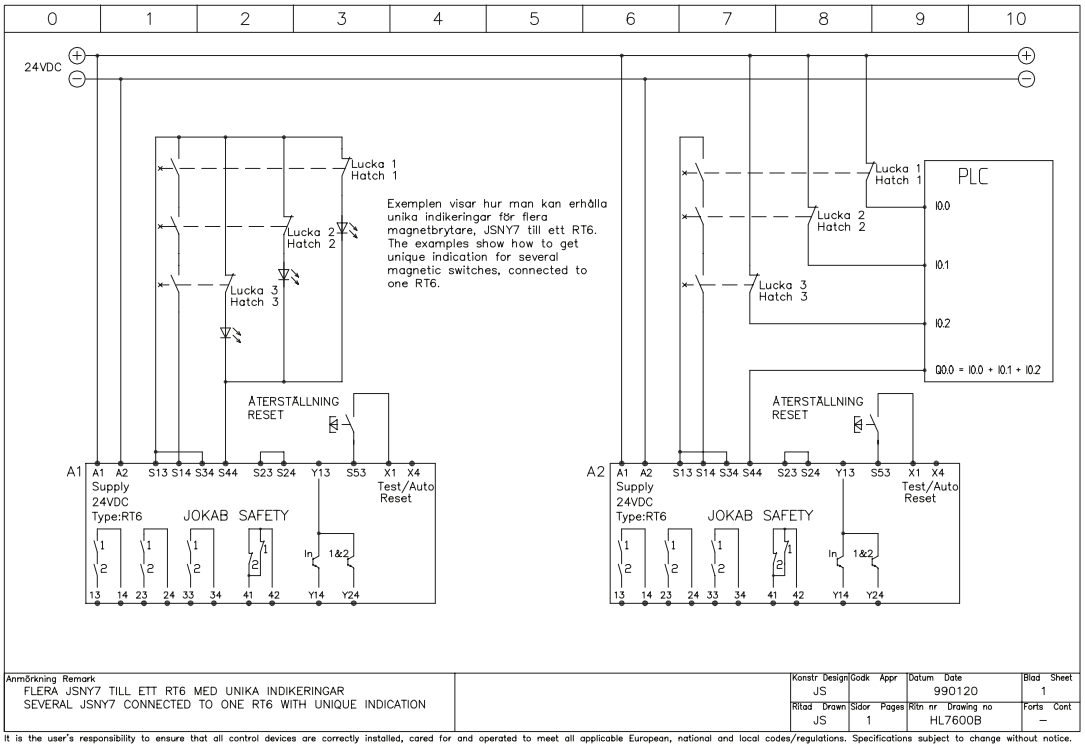
HK7600A Safety mat/Contact strip with RT6



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

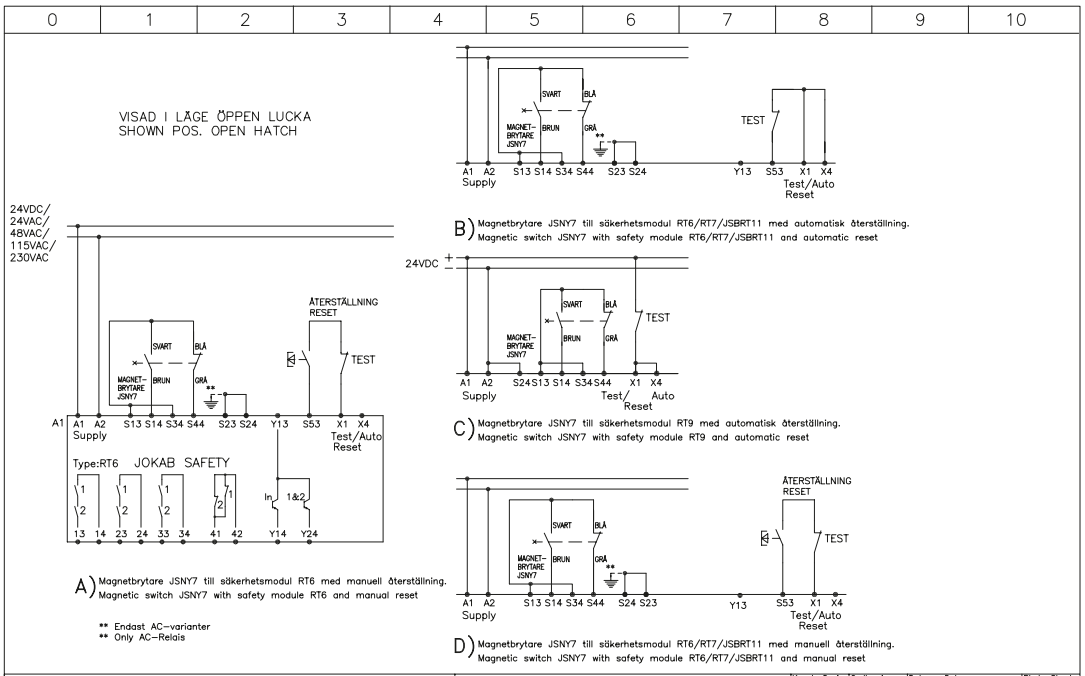
Connection examples

HL7600B Several Sens7 connected to one RT6 with unique indication



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

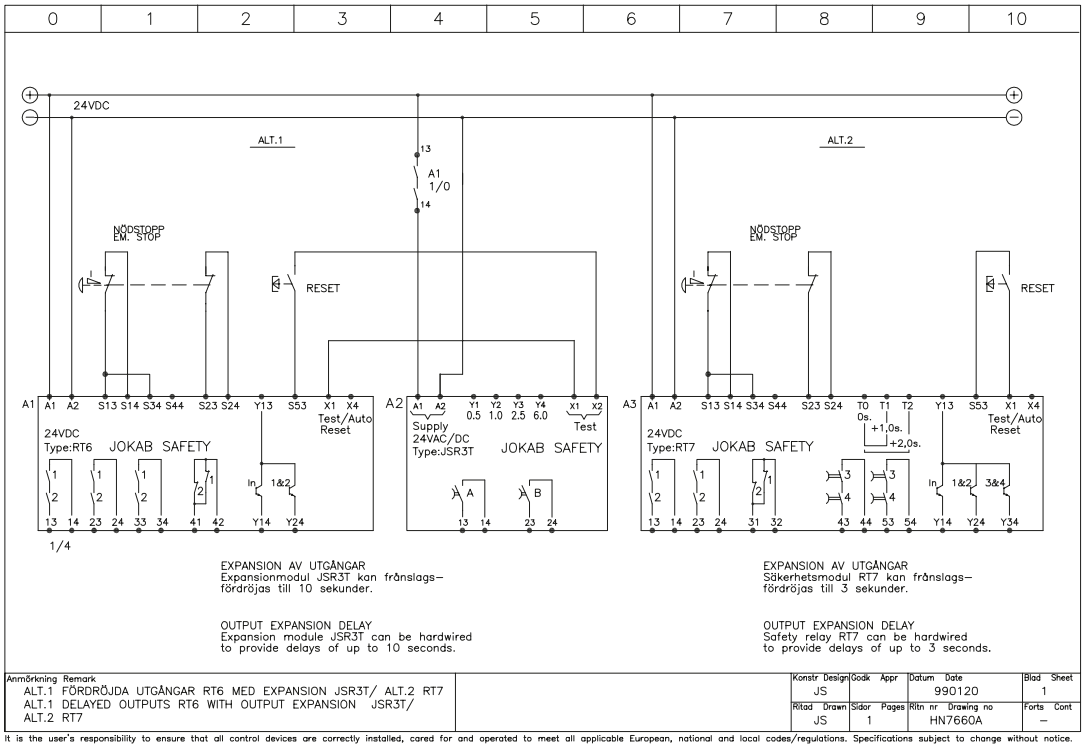
HM0000A Magnetic switch Sens7 with various safety controllers



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

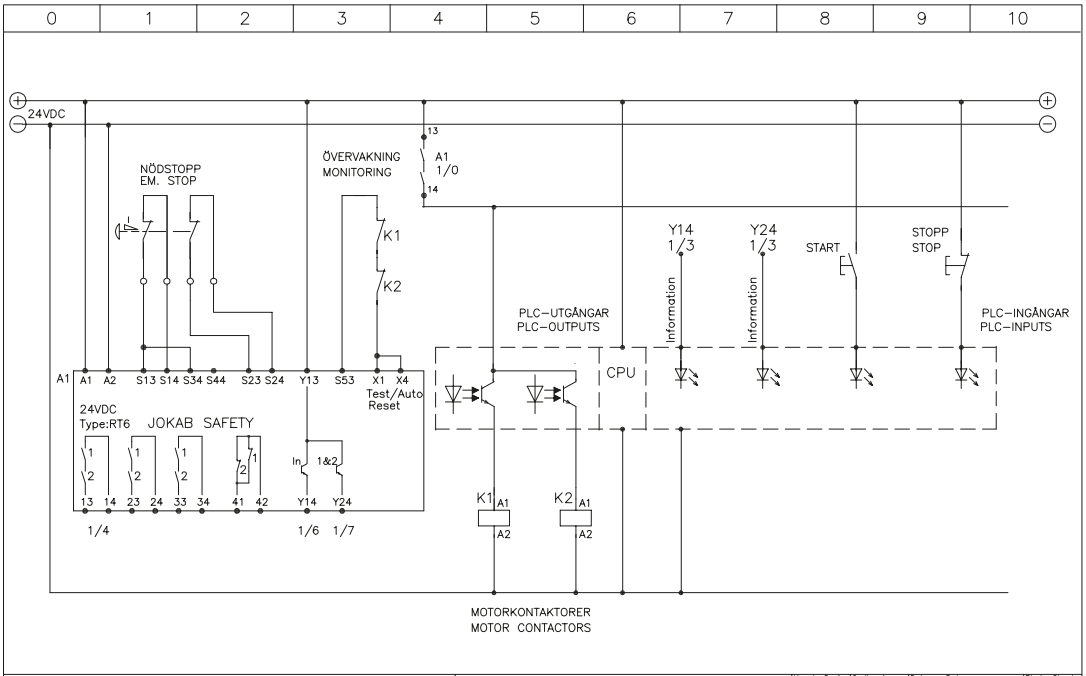
Connection examples

HN7660A Delayed outputs RT6 with output expansion JSR3T and RT7



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

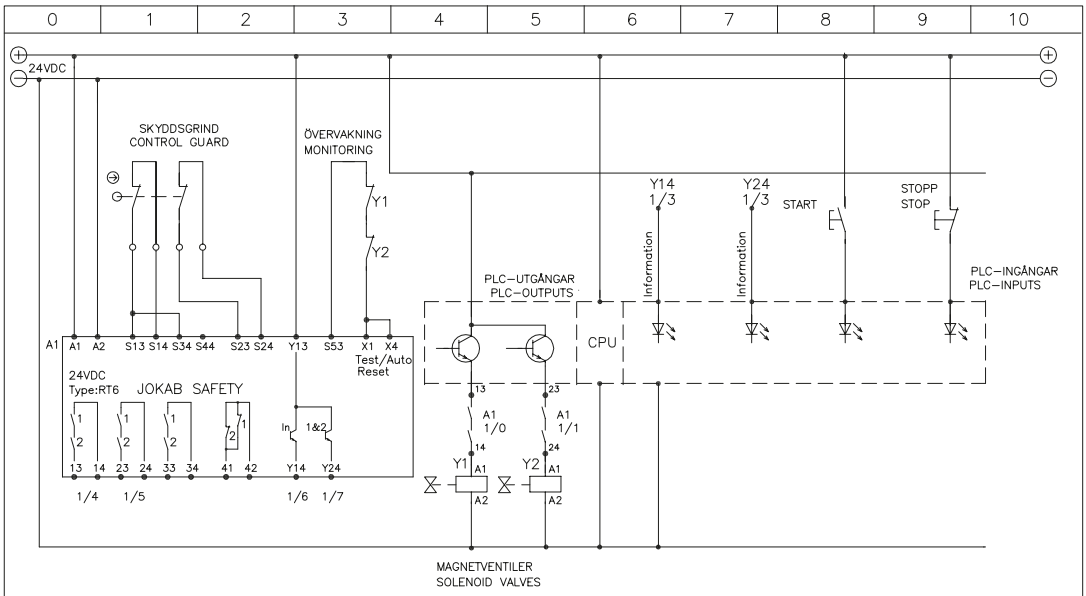
HP7600A Machine control - Isolation of PLC inputs and outputs



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

Connection examples

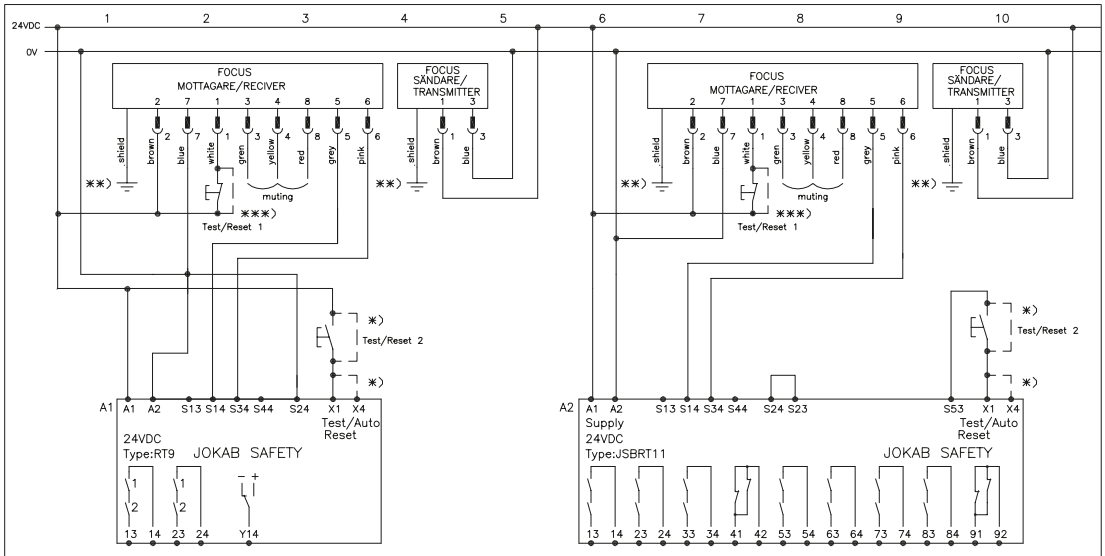
HP7600B Machine control-Isolation of PLC outputs



Högriskapplikation t.ex. manuellt betjänade pressar.
High risk application for example manually operated presses.

Anmärkning Remark		Konstr Design	Godk Appr	Datum Date	Blad Sheet
MASKINSTYRNING – BORTKOPPLING AV PLC–STYRDA UTGÅNGAR MACHINE CONTROL – ISOLATION OF PLC OUTPUTS		JS		990120	1
		Ritad Drawn	Sidor Pages	Ritn nr Drawing no	Forts Cont
		JS	1	HP7600B	–

HR7200B Focus light curtain/beam



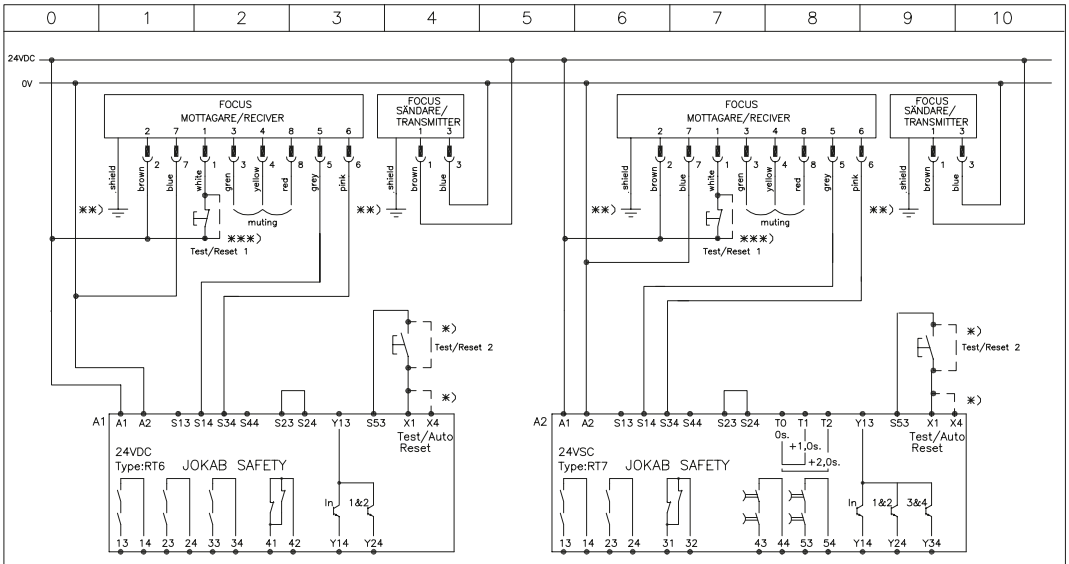
***)Återställning av ljusridå/ljusbom
För mer imformatiom se Focus manual
***)Reset of the Safety Light Curtain/Barrier
For more information se The Focus Manual

*)Automatisk återställning/Automatic reset (säkerhetsrelä/safetyrelays)
**)Skärmen jordas endast i skåpsänden.
**)The cable shield should only be connected at the cabinet end.

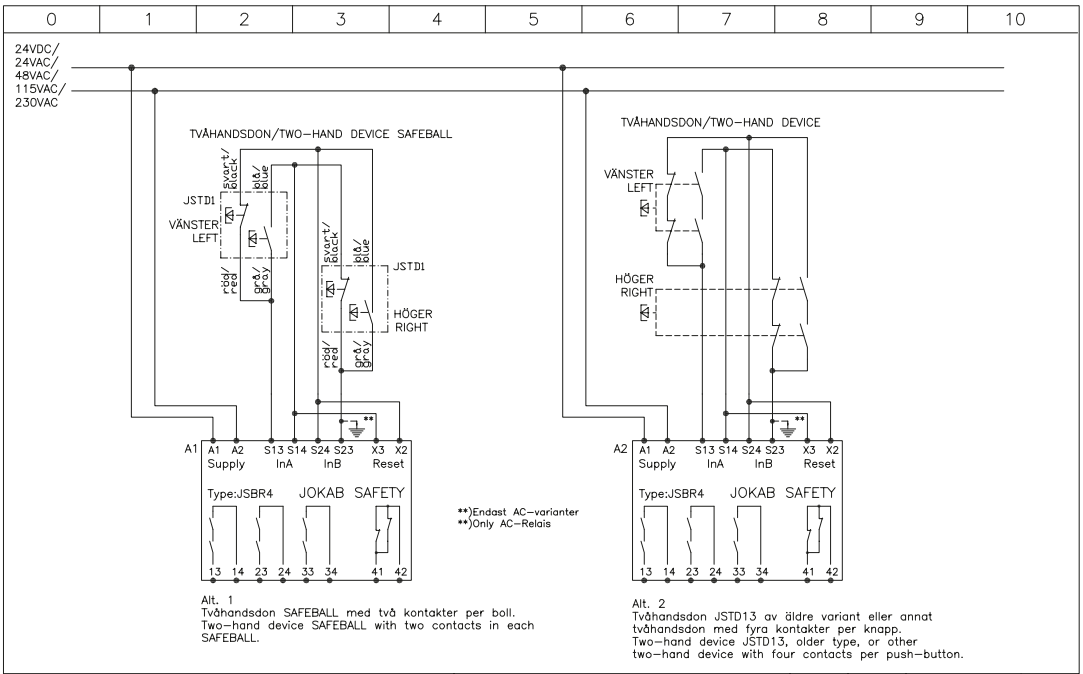
Anmärkning Remark		Konstr Design	Godk Appr	Datum Date	Blad Sheet
FOCUS LJUSRIDÅ/LJUSBOM FUCUS LIGHT CURTAIN/BEAM		JS		040311	
		Ritad Drawn	Sidor Pages	Ritn nr Drawing no	Forts Cont
		JS	1	HR7200B	

Connection examples

HR7800B Focus lightbeam/curtain

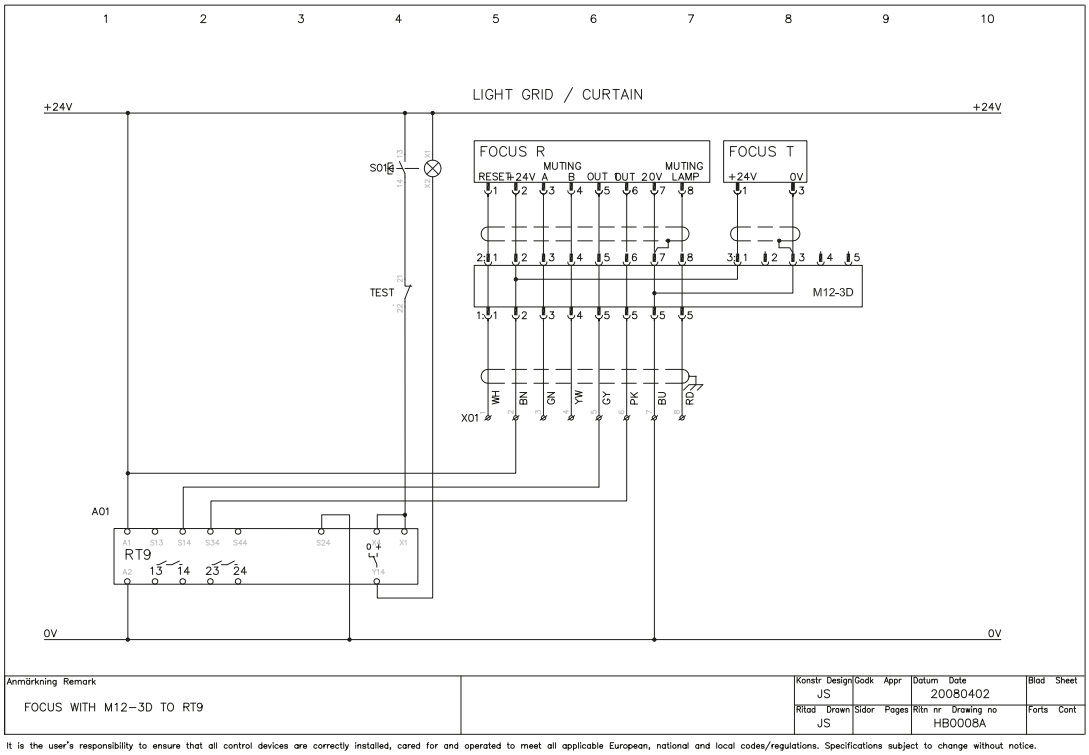


HT5400A Two-hand device with safety relay JSBR4



Connection examples

HB0008A Focus light curtain/light beam connected to an RT9 with the aid of an M12-3D



Light curtains, Light grids and Light beams

Light curtains, Light grids

Why use light grids and light curtains?

Light grids and light curtains are production friendly safety components that causes no physical obstruction for the machine operator. Light barrier protection is also a good safety component to use when goods are to be passed in and out of a hazardous area.

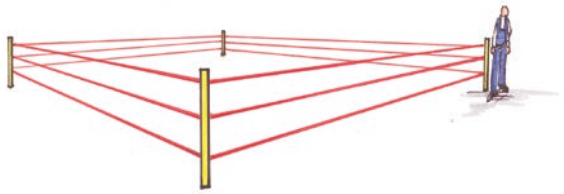
How does a light grid/light curtain work?

Both light grids and light curtains utilise optical transmitter and receiver units. From the transmitters beams of infrared light are sent to the receiver. When a light beam is interrupted a dual stop signal is given to the dangerous machines inside the light grid/curtain protected area.

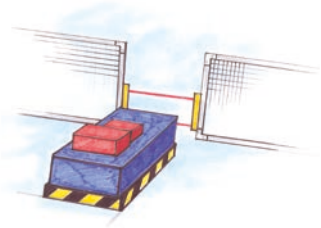
What is the difference between a light curtain and a light grid?

A light curtain has several beams that are placed closely together whereas a light grid consists of only one, two, three or four light beams. The beams are closest on a light curtain that is used for finger detection. Then the resolution is 14 mm. For light grids the beams are normally placed at a relative distance of 300 to 500 mm. The choice between light grid or light curtain is often a question of available safety distance, reach and price. Light curtains are often chosen for short safe/minimum distances. Light grids are chosen for longer safe/minimum distances, long range up to 40 m and for a low price.

Light grids for long distances



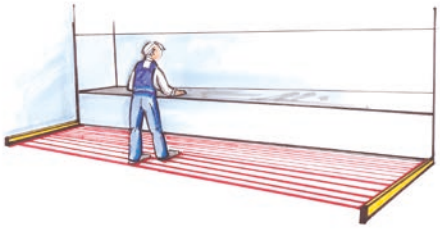
Light grids with monitored by-passing during material transport



Light curtain for short safe/minimum distances

Light curtain to protect during cycle initiation

Light curtain as area protection



Light curtain for inner area limiting

What safety requirements are there for a light protection device?

High safety demands are stated in the standard EN 61496-1 which deals with light protection. The main demands are on a safe stopping function and that light from light sources other than the transmitter or other disturbances do not affect the safety function.

Depending on how the safety function is built up there are safety components of type 2 and 4 to choose between. Type 2 and 4 relates in principle category 2/PL c and category 4/PL e according to EN ISO 13849-1.

Type 4 which has the highest safety level, states that a fault is not allowed to affect the safety function and that the fault shall be detected by the outputs falling immediately or that they do not re-connect after being disconnected. Maximum allowed scattering angle for the light is ±2.5°.

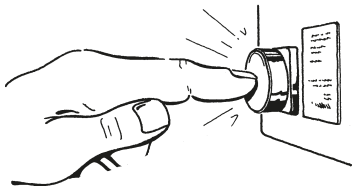
Type 2 states that a simple but monitored safety function is required, which means that the safety function shall be monitored through periodic tests which break the output when a fault occurs. Between the testing times there can though be faults which result in the safety component malfunctioning. The test function can either be built into the safety device or an external unit (e.g. the machine´s control system) can initiate a test. Maximum allowed scattering angle for the light is ±5°.

Light grids and light curtains are included among the products in the machine directive´s appendix 4, which means that an external certifying procedure with an officially recognised institution is called for.

Reset – 3 alternatives

Supervised manual reset

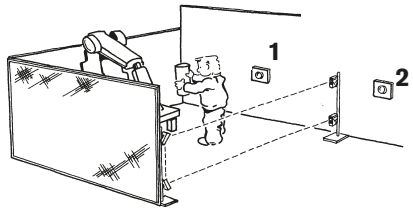
When a light curtain/grid is interrupted it will give a stop signal to dangerous machines within the hazardous area it protects and a reset-lamp can be lit. For a new start of the machine the light curtain/grid has to be reset. This is done with the reset button which is placed where the whole hazardous area can be supervised and can not be reached from within the area which it protects.. There are high requirements on the reset function - neither a short circuit nor a component fault shall give automatic reset. When the reset button has been set the outputs are activated and the reset-lamp is turned off.



Reset button with light indication.

Supervised time-reset

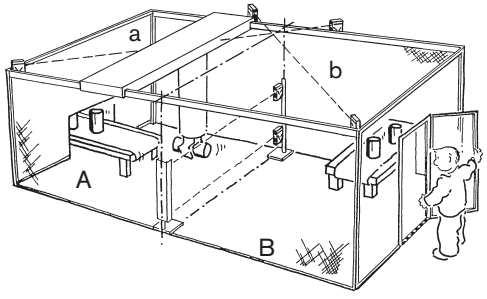
When supervised time-reset (pre-reset) is in use, its purpose is not to allow a reset from outside the protected area without first having confirmed that no-one is out of sight within the area. To reset the light beam (see figure) button 1 must first be pressed and afterwards button 2 within e.g. 5 seconds. This is especially important when one cannot see the entire area that is protected by the light beam.



Button 1 is pressed and afterwards, within a chosen time e.g. 5 seconds, button 2 is pressed for resetting the light beam.

Automatic reset

Automatic reset is used when the light beam is used for area monitoring. When the light beam is actuated this indicates that e.g. a robot is in the area. The robot is stopped if a person enters the same area e.g. through a gate. When the light beam is free again the control unit will be reset automatically.



A light beam b indicates that the robot is situated in area A. In this position it is possible to walk in through the gate to area B without stopping the robot.

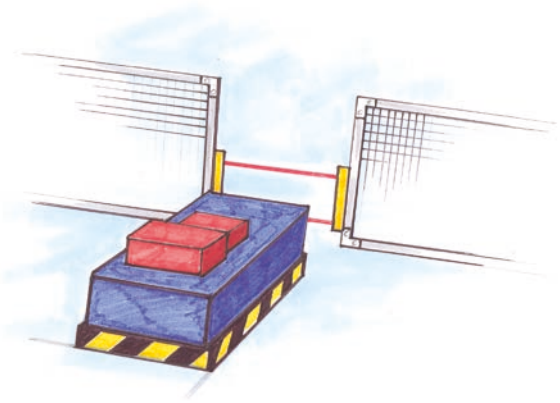
Muting (bypassing)

Bypassing may be needed for different reasons. One of the most common reasons for bypassing is during in and out feeding of material on a conveyor, Automated guided vehicle (AGV), etc. Another common application is bypassing while passing with a three-position device to the hazardous area.

Important aspects for bypassing is that it shall be safe, not be activated by mistake and be difficult to defeat. In other words it shall give a reliable bypassing when a loading carrier enters but not allow a human to pass. To achieve the highest safety level a dual and supervised bypassing system is needed (usually with at least two independent signals). If this is done with sensors, it is recommended they be of different kinds, because of the probability of them both malfunctioning for the same reason e.g. common cause failure. An example of a solution is to use a mechanical limit switch and a photo-cell sensor.

To avoid deliberate defeating/manipulation of the bypassing sensors/signals a safety relay or a safety-PLC is connected thereby monitoring that the sensors are both activated and deactivated in every bypassing cycle.

The number of variations in bypassing systems are almost infinite. This depends on the specific requirements of each plant/machine. For Focus II there are a number of bypassing possibilities prepared.



Automatic bypassing of light grid when an Automated guided vehicle passes.

Blanking

Blanking means permanent switching off of a number of beams in the detection zone of a light curtain. This is a function that is permitted and used when an object that is larger than the resolution of the light curtain is permanently located in the detection zone, without deactivating the safety outputs (OSSD). If the object is removed from the detection zone, the safety outputs are deactivated.

Blanking function has different tolerance settings that allow movement or vibration of the objects that obscure the detection zone.

One tolerance setting can be called ”Floating blanking”, that means that the part of the zone which is intentionally blocked can be moved around in the detection zone while the machinery is operating. Other beams are active and providing normal protection, but often with reduced resolution.

When a “blanking” function is used, it is very important that the light curtain provides protection and can detect objects, as small as a finger or hand, depending on the resolution, anywhere outside the zone that is rendered inactive because the object is there. Blanking may require an additional fixed guard and may require additonal minimum distance to the dangerous movment.

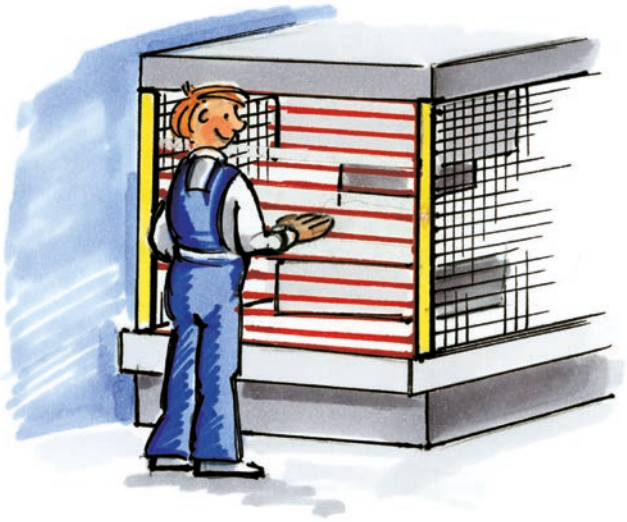
It must not be possible to select the “blanking function” without using a key, tool or similar unlocking device.

Light curtain for short safety distance

A light curtain can be used in a machine or a production plant in the same way as a hatch. There is a great difference though when it comes to the risk situation. When one has a light curtain installed with a short minimum distance in front of a dangerous machine, there is a high risk for spontaneous engagement into the machine, often called after-grasp. If the dangerous machine movement does not stop during such an engagement, one has a small chance of avoiding injury.

Therefore it is of great importance that the whole chain in the stopping circuit is dual and supervised. Even valves and contactors which ultimately control dangerous movements normally have to be doubled up and supervised.

Regulations concerning safety distances are given in specific C-standards such as EN 692 for mechanical presses. If no specific C-standard is available, EN ISO 13855 is used.



Hand resolution

Automatic machines

For light curtains on automatic machines there shall be a reset function which is active when the machine is set for automatic production whether or not it is a passable protection. After affecting a light curtain, one must first use a reset function then the restart of the cycle shall be made with a separate starting device. The same reset applies for machines with semi-automatic drive.

Operator protection during manually serviced machines

Manually operated machines where one or more operators pick in and out parts between every cycle are the most risky light curtain applications. This because of the number of engagements into the machine´s hazardous area is often several times per minute.

Finger resolution

Light curtains on presses

Light curtains have traditionally been a common protection method among press applications and there has since long existed detailed information on the usage of light curtains on presses. (see next spread for “Cycle initiation with light curtain”). Only light curtains of type 4 are accepted on presses.

Reset

On the servicing side i.e. the side or sides where there is an operator that picks in and out parts, there shall be a separate reset function for the light curtain, usually a button. If there are several light curtains e.g. on the front and back there shall be one for each. If the light curtain is actuated during a dangerous movement the press shall not be able to restart without being reset. During engagement after the end of the cycle no reset is needed.

Notes

Minimum distance for light protection according to EN ISO 13855

The distance 'S' is a minimum distance between a light curtain and a hazardous area. The distance shall prevent that a person is not able to reach a hazardous machine part before the machine movement has stopped. This is calculated with the formula from EN ISO 13855 - Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body.

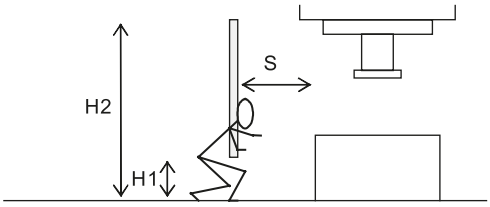
$$S = (K \times T) + C$$

S = minimum distance in mm
K = body/part of body (e.g. hand) speed in mm/s
T = T1 + T2
where
T1 = the safety device´s reaction time in seconds
T2 = the machine´s reaction time in seconds
C = additional distance in mm based upon the body´s intrusion towards the hazardous area before the safety device has been actuated.

Resolution for finger (≤14 mm) gives C = 0

NB If it is possible to reach the hazard zone by reaching over the light beam, an addition is made to the formula. In table 1 in EN ISO 13855 an alternative safety distance addition (C_{ro}) is given to the formula S = (K x T) + C. The greatest value out of C and C_{ro} is to be used to prevent reaching the hazard zone by reaching over the light curtain/grid.

Minimum distances for vertical and horizontal installed light curtains according to EN ISO 13855



S = minimum distance in mm
H1 = the lower beam may not be situated higher than 300 mm above the ground
H2 = the upper beam may not be situated lower than 900 mm above the ground

For S ≤ 500 mm the minimum distance for vertical installation is calculated with the following formula:

$$S = (2000 \times T) + 8 \times (d-14)$$

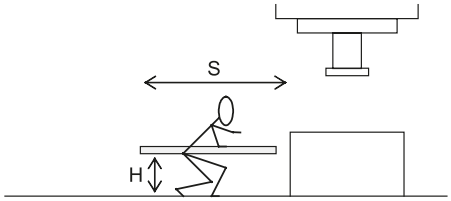
where d is the light curtain´s resolution in mm.

K here is 2000 mm/s which represents the speed of the hand. The expression (8 x (d-14)) may never be less than 0. Minimum distance S is 100 mm.

If the minimum distance according to the formula above gets larger than 500 mm one can instead use:

$$S = (1600 \times T) + 8 \times (d-14)$$

K is1600 mm/s which represents the speed of the body. Minimum distance according to this formula is 500 mm.



S = minimum distance in mm
H = the light curtain detection zone must be positioned between 0 and 1000 mm above the floor

The minimum distance for horizontal installation is calculated with the following formula:

$$S = (1600 \times T) + (1200 - 0.4 \times H)$$

where H is the height of the detection zone above the reference plane, e.g. the ground

(1200 – 0,4 x H) may not be less than 850 mm. Depending on the resolution, d, that the light curtain has, there is a minimum height that the detection zone may be placed. This is calculated with:
H = 15 x (d – 50).
H cannot be less than 0. With a resolution d =14 or 30 mm one can therefore install the light curtain from H = 0 and up. The higher it is situated, the shorter the minimum distance gets. The highest permissible height H of the detection zone is 1000 mm.

When you use a horizontal light curtain as entry protection, the depth of the light curtain shall be at least 750 mm to prevent people from inadvertently stepping over it. The estimated minimum distance is measured from the machine's hazardous section to the outermost beam of the horizontal light curtain (seen from the machine).

Minimum distance for light beams according to EN ISO 13855

For light beams the minimum distance is calculated from the following:

$$S = (1600 \times T) + 850 \text{ mm}$$

NOTE! The additional distance will in most cases be more than 850 mm due to the possibility to reach over a light beam. (C_{ro})

The formula applies whether one installs 2,3 or 4 beams. It is the risk assessment that decides the number of beams that are to be chosen. The following possibilities must be considered.

- to crawl under the lowest beam;
- to reach over the top beam;
- to reach in between two beams;
- that the body passes in between two beams.

To fulfill the requirements the beams shall be installed at the following heights:

Number of beams	Height over the reference plane, e.g. ground
4	300, 600, 900, 1200
3	300, 700, 1100
2	400, 900

Minimum distances for new and old presses

New presses

For new CE-marked presses there are specific requirements from the standards EN 692 Machine tools – Safety – Mechanical presses – Safety and EN 693 Machine tools – Safety – Hydraulic presses.

The same requirements apply for vertical installation on presses as with vertical installation on other machines with the difference that C is given according to the following:

Resolution, d, (mm)	Minimum distance addition, C (mm)	Cycle initiation
≤ 14	0	Permitted
>14 - 20	80	
>20 - 30	130	
>30 - 40	240	Not permitted
>40	850	

Other manually serviced machines

The rules for presses may well be applied to other machines which function in a similar way and that have the same risk situation. There is no other standard which is as detailed on the usage of light curtains.

For cycle initiation the light curtains resolution, d, must be ≤ 30 mm. This applies to both old and new (CE-marked) presses.

Old presses

"NB" For old presses there are different rules for each country.

The formula that applies here is:

$$S = (2500 \times T) + C$$

The minimum distance addition C for different resolutions of the light curtain is given in the following table

Resolution, d, (mm)	Minimum distance addition, C (mm)
<16	0
16	70
20	110
25	130
30	140
35	240
40	270
45	300
50	330
55	360
>55	850

Safety Light Grids and Safety Light Curtains
Focus II

Approvals:

Application:

- Optical protection in an opening or around a hazardous area

Features:

- Type 4 according to EN 61496
- Flexible assembly
- LED indication
- High protection class (IP65)
- Range 0.2-40 m
- Time reset
- Fixed / floating blanking
- Muting
- Single/Double Break funktion
- External Device Monitoring (EDM)
- Available with different resolutions
- Up to PL e according to EN ISO 13849-1

A light grid/light curtain with many possibilities

Focus II is a new version of our previous light grid/light curtain Focus. Features such as muting and override are standard in all Focus II light curtains and light grids. For light curtains, blanking and break functions are also standard. The optical sensors on Focus II also have variable coding. The Focus II units are light grids/curtains with safety functions intended for applications where it is of great importance to protect persons from a dangerous machine, robot or other automated systems where it is possible to access to a hazardous area.

Focus II creates a detection zone with infrared beams. If any beam is interrupted the safety mechanism is triggered and the dangerous machine is stopped. Focus II fulfills the requirements for non-contact safety equipment type 4 according to the international regulation standard EN 61496-1.

Units are available with safety heights between 150 and 2400 mm. All electronic control and monitoring functions are included in the light curtain profiles. External connection is made via a M12 connection at the end of the profile. Synchronization between transmitter and receiver is achieved optically. No electrical connection between the units is required. Control and monitoring of the beam transmission is carried out by two micro-processors which also give information on the status and alignment of the light curtain via several LEDs.

Muting and Override included in all Focus II

The ”Muting” and ”Override” functions are available on all Focus II light grids/curtains and is enabled directly when an indication lamp LMS is connected. Muting implies that one or more segments or the whole light curtain can be bypassed during in and out passage of material.

In the Focus II with muting enabled there is also an Override function which makes it possible to bypass the light grid/curtain i.e. activate the outputs if a machine start is necessary even if one or more light beams are interrupted. This is the case when the muting function is chosen and the A and B inputs are activated. If for example during the muting operation a loading pallet has stopped inside the detection zone after a voltage loss, the override function is used to enable the pallet to be driven clear.

Blanking
It is also possible to obtain the Focus II light curtains with blanking. Floating blanking is a tolerance setting that makes it possible to 'disconnect' a defined number of beams from the detection zone. The object is then free to move in the detection zone without the safety function being triggered. Other tolerance settings allows less movment of the interfering object. Blanking may require an additional fixed guard and may require additonal minimum distance to the dangerous movment.

Safety outputs OSSD1 and OSSD2
Focus II has two PNP outputs - OSSD1 and OSSD2. If the load to be switched is alternating current or requires a higher current than 500 mA then one should use a safety relay e.g. RT9, Pluto PLC or the FRM-1 unit (converts the outputs to relay contacts) from ABB Jokab Safety. The FMC-Tina and Tina 10A/10B/10C converts the outputs to a dynamic signal for connection to Pluto or Vital. Pluto can also work directly with the OSSD-outputs.

Single/Double Break function
This function is used for presses when the operator prepares or picks out a detail. With the Single Break function the light curtain allows operation after entry and withdrawal out of the curtain. Similarly, the Double Break function allows operation after entry and withdrawal twice.

External Device Monitoring (EDM)
In all light grids and light curtains an EDM function is available which allows Focus II to test if the external control element responds correctly. A test channel is connected through the respective contactor, in order to detect any faults and thereby prevent a reset.

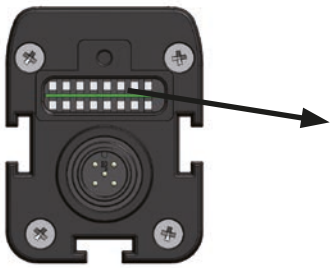
Reset
On every Focus II there are inputs for reset. The reset option is chosen through dual switches in the Focus II receiver. At delivery, Focus II is set to automatic reset.

- Automatic reset – When the detection zone is free the outputs are closed directly. (Setting when delivered).
- Manual reset – When the light field detection zone is free, the reset button has been actuated before the outputs are activated.
- Time reset – To reset the Focus II a pre-reset button must first be actuated and afterwards within 8 seconds a reset button outside the hazardous area must be actuated.

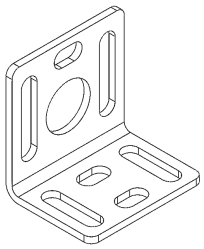
Focus II light curtain
Standard:
- Muting (bypassing) partly or completely
- Supervised output for muting lamp
- Override
- Manually supervised or automatic reset
- Time-reset
- Blanking
- Single/Double Break
- EDM

Focus II light grid
Standard:
- Muting (bypassing) of one, two, three or four beams
- Supervised output for muting lamp
- Override
- Manually supervised or automatic reset
- Time-reset.
- EDM

Option:
- Light grids for tough environments with parallel beams of light for improved reliability.

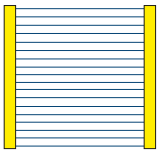
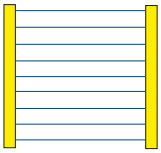
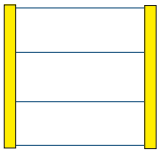
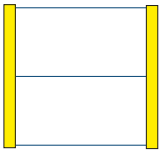
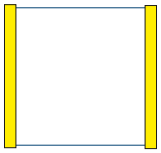


With the switches at the bottom of Focus II you can choose the function you desire.

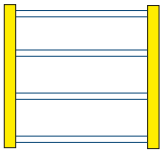
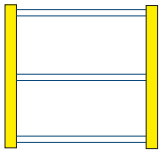
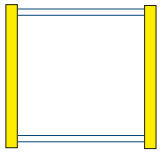
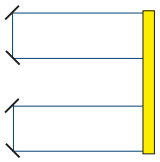
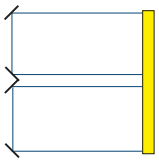
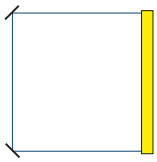


JSM 66
2TLA022090R1300
JSM 66 Bracket for Focus II

Focus II light curtain/grid, Type 4 (FII-4)
Summary

					
Model name	FII-4-14-zzzz	FII-4-30-zzzz	FII-4-K4-zzzz	FII-4-K3-800	FII-4-K2-500
Resolution	14	30			
Beam distance			300 / 400	400	500
Height (mm=zzzz)	150 300 450 600 750 900 1050 1200 1350 1500 1650 1800 1950 2100 2250 2400	150 300 450 600 750 900 1050 1200 1350 1500 1650 1800 1950 2100 2250 2400	900 / 1200	800	500
Range (m) SR LR	 0.2-3 3-6	 0.2-7 7-14	 0.5-20 20-40	 0.5-20 20-40	 0.5-20 20-40
Reaction time off (ms)	18-103	14-47	13	13	13
Reaction time on (ms)	138-104	141-119	142	142	142
Manual reset	•	•	•	•	•
Automatic reset	•	•	•	•	•
Pre reset	•	•	•	•	•
Muting inputs	•	•	•	•	•
Muting lamp supervision	•	•	•	•	•
Override	•	•	•	•	•
Muting T/L/X	• / • / •	• / • / •	• / • / •	• / • / •	• / • / •
Blanking 3 types	• / • / •	• / • / •	- / - / -	- / - / -	- / - / -
Single/Double break	• / •	• / •	- / -	- / -	- / -
EDM	•	•	•	•	•
Dyn. Adaption to Vital/Pluto	¤	¤	¤	¤	¤

• Standard ¤ With Tina 10A/10B/10C or FMC-Tina

							
FII-4-K4-zzzz D		FII-4-K3-800 D	FII-4-K2-500 D	FII-4-K2C-zzzz		FII-4-K2C-800	FII-4-K1C-500
300	400	400	500	300	400	400	500
900	1200	800	500	900	1200	800	500
0.5-20 20-40		0.5-20 20-40	0.5-20 20-40	0.5-7		0.5-8	0.5-12
13		13	13	13		13	13
142		142	142	142		142	142
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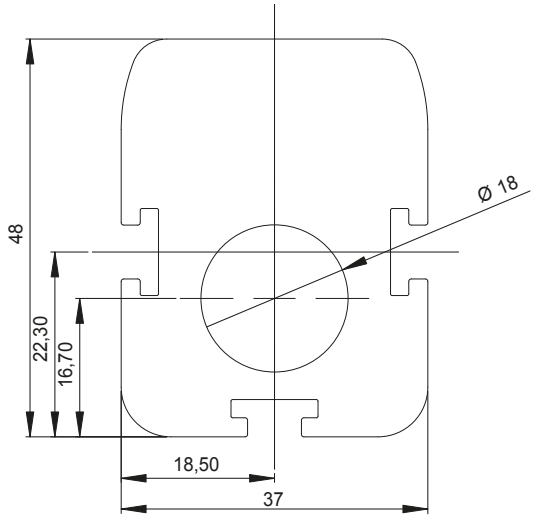
Technical data – Focus II

Article number	
Light curtains	
FII-4-14-150	2TLA022200R0000
FII-4-14-300	2TLA022200R1000
FII-4-14-450	2TLA022200R2000
FII-4-14-600	2TLA022200R3000
FII-4-14-750	2TLA022200R4000
FII-4-14-900	2TLA022200R5000
FII-4-14-1050	2TLA022200R6000
FII-4-14-1200	2TLA022200R7000
FII-4-14-1350	2TLA022200R8000
FII-4-14-1500	2TLA022200R9000
FII-4-14-1650	2TLA022201R0000
FII-4-14-1800	2TLA022201R1000
FII-4-14-1950	2TLA022201R2000
FII-4-14-2100	2TLA022201R3000
FII-4-14-2250	2TLA022201R4000
FII-4-14-2400	2TLA022201R5000
FII-4-30-150	2TLA022201R6000
FII-4-30-300	2TLA022201R7000
FII-4-30-450	2TLA022201R8000
FII-4-30-600	2TLA022201R9000
FII-4-30-750	2TLA022202R0000
FII-4-30-900	2TLA022202R1000
FII-4-30-1050	2TLA022202R2000
FII-4-30-1200	2TLA022202R3000
FII-4-30-1350	2TLA022202R4000
FII-4-30-1500	2TLA022202R5000
FII-4-30-1650	2TLA022202R6000
FII-4-30-1800	2TLA022202R7000
FII-4-30-1950	2TLA022202R8000
FII-4-30-2100	2TLA022202R9000
FII-4-30-2250	2TLA022203R0000
FII-4-30-2400	2TLA022203R1000
Light grids	
FII-4-K2-500	2TLA022204R0000
FII-4-K3-800	2TLA022204R1000
FII-4-K4-900	2TLA022204R2000
FII-4-K4-1200	2TLA022204R3000
FII-4-K2-500D	2TLA022204R4000
FII-4-K3-800 D	2TLA022204R5000
FII-4-K4-900 D	2TLA022204R6000
FII-4-K4-1200 D	2TLA022204R7000
FII-4-K1C-500	2TLA022204R8000
FII-4-K2C-800	2TLA022204R9000
FII-4-K2C-900	2TLA022205R0000
FII-4-K2C-1200	2TLA022205R1000
Supply voltage	24 VDC ±20%
Power consumption	
Transmitter	70 mA maximum
Receiver	100 mA maximum
Protective height	Light curtains: 150 mm - 2400 mm
	Light grids: 500 mm - 1200 mm
Object resolution	Light curtains: 14 mm and 30 mm

PFH_D	$2.5x10^{-9}$
Light source	Infrared Emitting LEDs, Wavelength 880 nm
Enclosure	Housing: Aluminium painted yellow Front: Polycarbonate Connector: Polyamide End cap: Polyamide
Profile dimensions	37 x 48 mm
Protection class	IP65
Operating temperature	-10 to +55° C
Storage temperature	-25 to +70° C
Safety outputs (OSSD)	Two PNP safety outputs, each sourcing 500 mA 24 VDC. Short circuit protection.
Response time ON to OFF	Maximum: 13-103 ms (depending on model)
Connection transmitter	M12 5-pin male
Connection receiver	M12 8-pin male
Indication	LED´s on transmitter and receiver indicating alignment, dirt, power supply and outputs
Safety level	
EN/IEC 61496	Type 4
EN ISO 13849-1	PL e/Cat. 4
IEC 61508	SIL 3
Conformity	EN ISO 12100-1:2010, EN ISO 13849-1:2008, EN 62061:2005, EN 60204-1:2007+A1:2009, EN 61496-1/AC:2010, EN 60664-1:2007, EN 61000-6-2:2005, EN 61000-6-4:2007



Focus II
Muting (bypassing)

Focus II muting types

– T-muting. Four NO muting sensors are used in two pairs (OR function), allowing bi-directional transport of material. Maximum muting time is 600 s. Muting A and Muting B need an activation time difference of 30 ms.
– L-muting. Two NO muting sensors works together with the light protection, allowing transport out from the hazardous area. Maximum muting time is 600 s. Muting A and Muting B need a activation time difference of 30 ms.
– X-muting. One NO and one NC muting sensor is like a cross through the light protection, allowing bi-directional transport of material. An alternative X-muting (only on Focus Light beams) with 2 NO muting sensor is also possible, but then with the condition of a 30 ms activation time difference on the muting sensors. Both solutions gives an infinite muting time.

Built-in muting for Focus II is available in three ways:

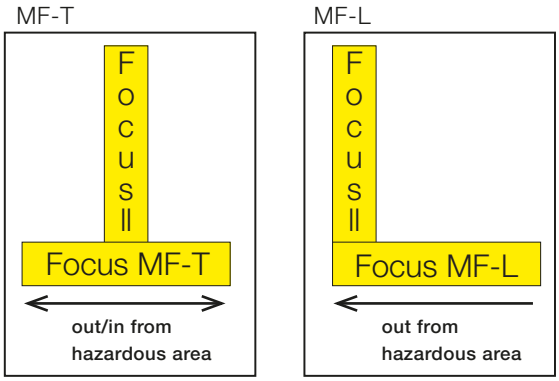
– Pre-made muting units MF-T and MF-L, which have integral photocells.
– Connection of muting sensors via a FMC.
– Separate connection of muting sensors (Mute R) directly to the Focus II receiver unit.

Muting-lamp

To the Focus II receiver unit it is also possible to directly connect a external muting-lamp. It is also possible to connect the muting-lamp via a FMC. During bypassing the muting-lamp is lit. Bypassing is only possible if the muting-lamp is functioning or a resistor of 220 Ohm is used in its place.

Muting with MF-T and MF-L units

MF-T and MF-L are muting units with integrated photocells built into a aluminum profile. They work with all Focus II light grid and curtain. No additional sensors are required because the muting units contain the required components. MF-T/MF-L is connected between the Focus II and the supervising unit (e.g safety relay, safety PLC). The cable between the Focus II and MF-T/MF-L is included with the muting unit.



M12 connection between Focus II and MF-T Reflex

MF-T (2TLA022040R2000)

The muting unit MF-T consist of a transmitter unit and a receiver unit with four photocells A1, B1, B2 and A2. A1 and A2 are connected in parallell and B1 and B2 connected in parallell. In this way the unit is configured for installations where material is transported into and/or out of a hazardous area.

MF-L (2TLA022040R3000)

The muting unit MF-L consist of a transmitter unit and a receiver unit with two photocells A1 and B1. The A1 and B1 sensor are actuated before the material is transported through the light grid/curtain. The light grid is an active part in upholding the muting function once A1 and B1 have been passed by the material. The light grid/curtain is being bypassed just as long as the material exiting. Unit MF-L is primarily intended for material transport out of a hazardous area.

MF-T Reflex (2TLA022040R4000)

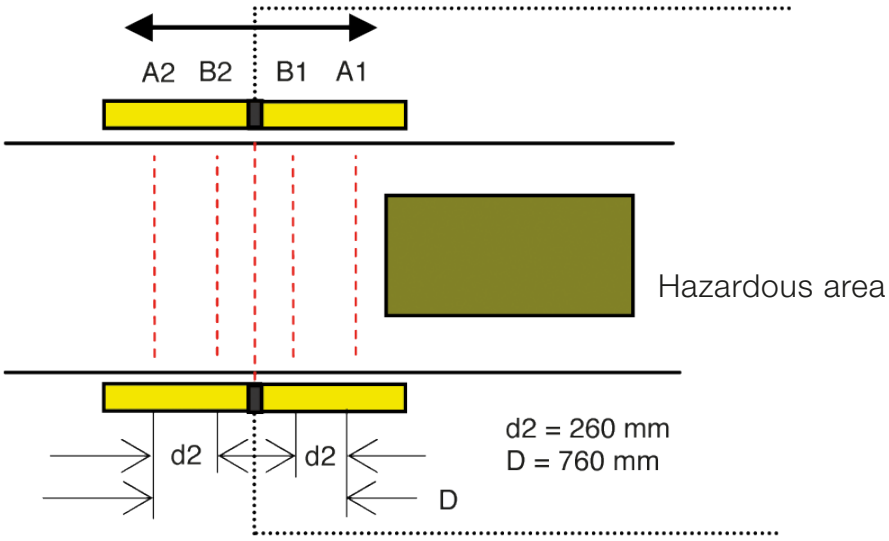
The muting unit MF-T Reflex consist of a transmitter/receiver side and a reflector unit. The active side contains four transmitters/receivers photocells. The MF-T Reflex works as the MF-T with a limited range (6m). These units, together with a light grid with one active and one passive side provides a good solution where electrical connections are only necessary on one side!

MF-L Reflex (2TLA022040R5000)

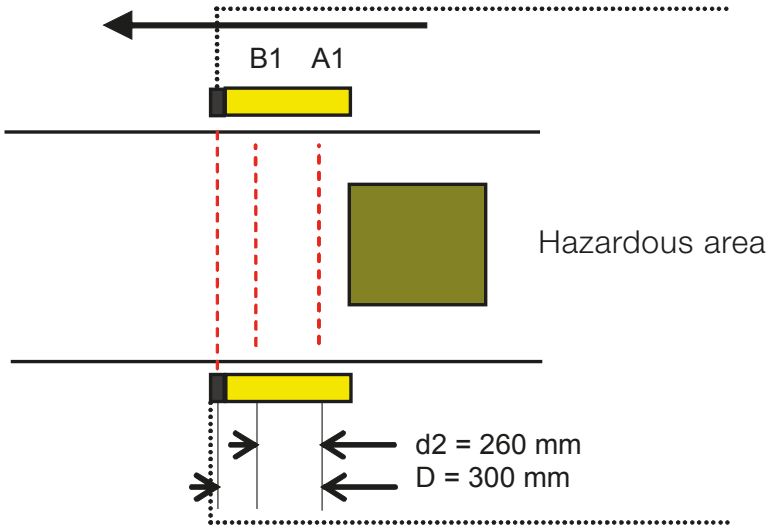
The muting unit MF-L Reflex consist of a transmitter/receiver unit and a reflector unit. The active side contains two transmitters/receivers photocells. The MF-L Reflex works as the MF-L with a limited range (6m). These units, together with a light grid with one active and one passive side provides a good solution where electrical connections are only necessary on one side!

Focus II
Muting with MF-T and MF-L

A solution with Focus Muting unit MF-T with integrated muting sensors.
Possible direction of movement - in/out of hazardous area.



A solution with Focus Muting unit MF-L with integrated muting sensors
This solution shall only be used for movement out from a hazardous area.



NOTE! The muting sensors A and B must be placed so that the sensor A is always activated at least 30 ms before sensor B.

D: indicates the minimum length of the material that is to actuate the muting sensors that must be maintained during the passage through the light grid/curtain.
d2: indicates the measurement between the two/four pre-assembled muting sensors within the MF-L and MF-T.

Muting sensors – Mute R
Retro-reflective with polarizing filters

Approvals:

CE

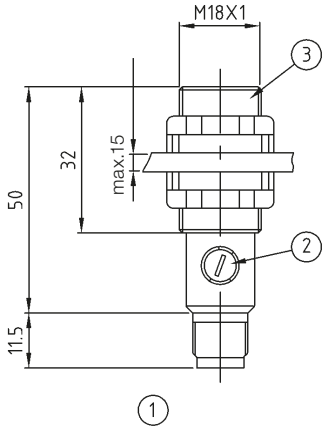
Features:

- Range adjustable
- Light reserve warning indictor
- Transistor output, PNP
- 1000 Hz switching frequency
- Short-circuit protection, reverse polarity protection and power-up output suppression
- Connector M12
- EMC tested according to IEC 801 and EN50081-1/ EN 50082-2

Technical data

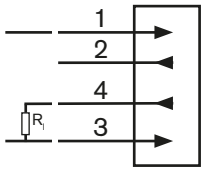
Article number Mute R (FSTR-1)	2TLA022044R0000
Output	PNP, dark on
Connection	Connector M12
Range adjustment	Yes
Range	0.15... 2.5 m (with reflector FZR 1) 0.15...5m (with reflector FZR 2A)
Light source	Visible-red, 660 nm, pulsed with polarizing filter
Supply voltage	10...30 VDC
Allowable ripple	± 10% of Us
Current consumption (without load)	<15 mA
Max. load current	100 mA
Residual voltage	<1.6 V
Max. switching frequency	1000 Hz
Protection class	IP67
Temperature (operating and storage)	-25 to +65° C
Weight	approx. 15 g

All technical data at 25° C and 24V.



1. Connector M12
2. Range adjustment and function indicator
3. Plastic housing

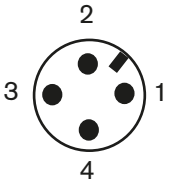
PNP output



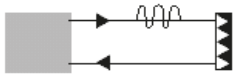
1 (+) Supply voltage 10...30 V
4 Dark-on output
3 (-) Supply voltage

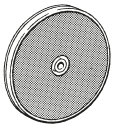
Dark-on output
The output is activated when an object interrupts the light.

Connector M12

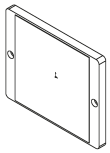


10...30 VDC
PNP
Dark-on output





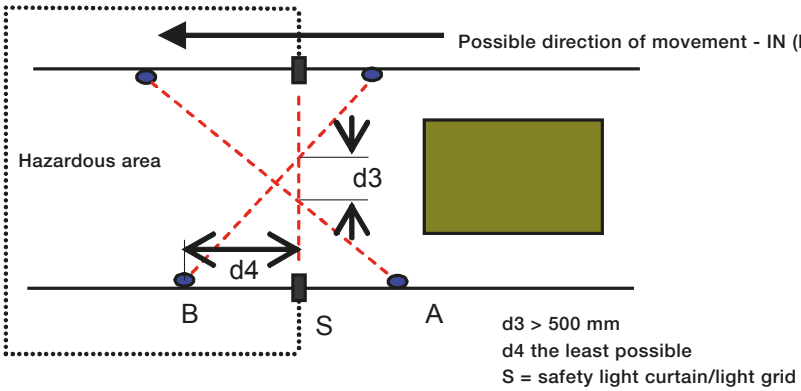
FZR 1 2TLA022044R0100
Reflector Ø 80 mm incl.screw MC6S M5 x 14 + Locking nut M5.



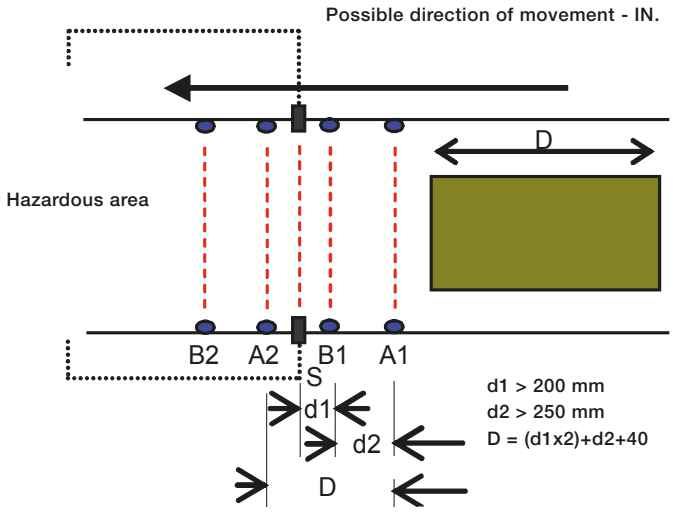
FZR 2A 2TLA022044R0400
Reflector 100 x 100 mm incl. screw MC6S M5 x 14 + Locking nut M5.

Muting with Mute R

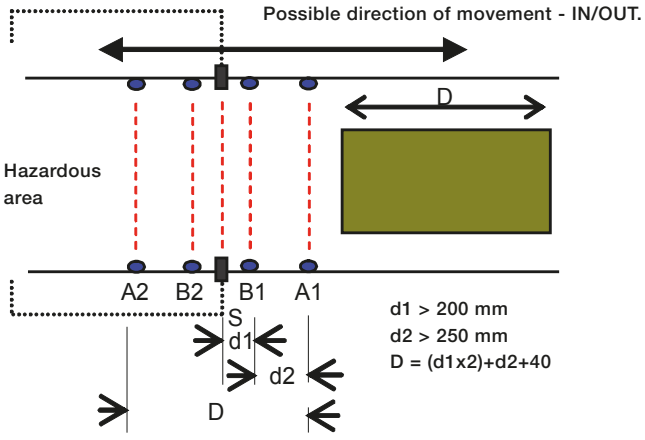
A solution with two sensors and one movement direction for material transport:



A solution with four sensors and one movement direction for material transport:



A solution with four sensors and two movement directions for material transport:



D: indicates the minimum length on the material that is to actuate the muting sensors that must be maintained during the passage through the light grid/curtain.

d1 must be as short as possible, and definitely less than 200 mm
d2: indicates the distance between A1 and B1

Muting accessories
FMC and FMI units

Approvals:

CE

Application:

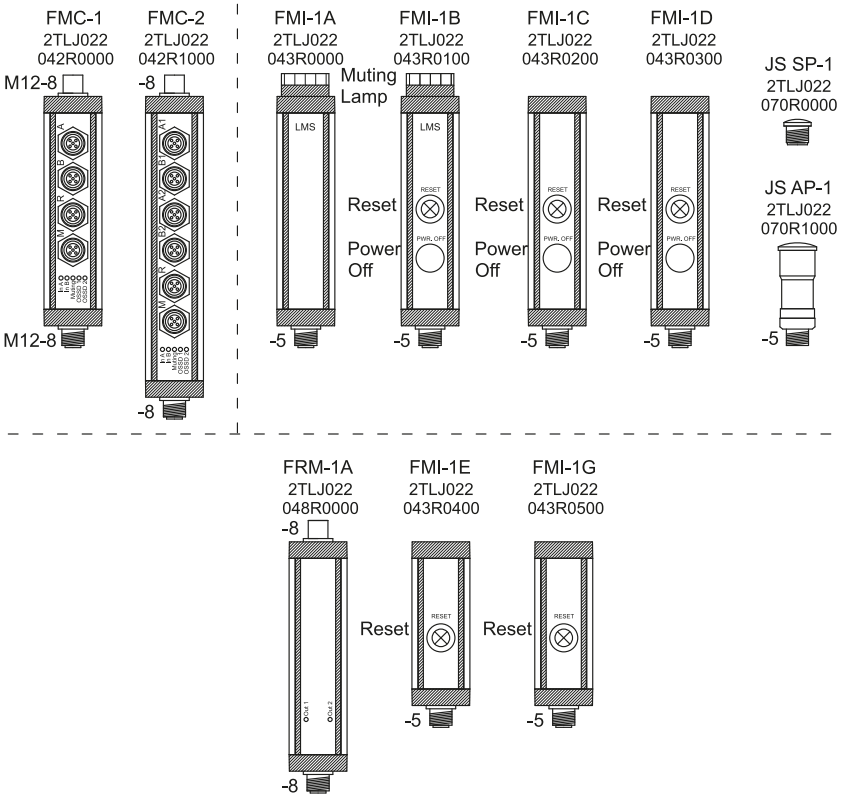
- FMC: Muting connection box
- FMI: Muting Indicator

Features:

- Small
- Easy to connect

Various FMC, FMI, FRM- versions

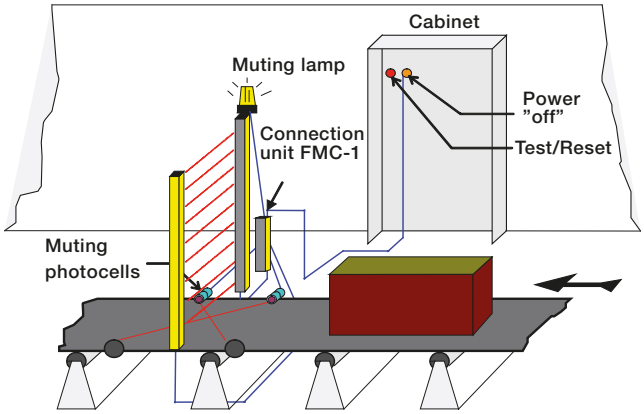
Model	Description
FMC-1(2)	with connectors for muting sensors (A+B), reset, power off and muting lamp (R) and muting lamp (M).
FMI-1A	with muting lamp only.
FMI-1B	with reset, power off and muting lamp.
FMI-1C	with reset and power off.
FMI-1D	with reset, power off and internal resistor for the muting lamp.
FMI-1E	as pre reset connected to connector A (A2) on FMC-1(2) (Tina).
FMI-1G	with reset, and internal resistor for the muting lamp.
FRM-1A	translates the two OSSD outputs to relay outputs (and power supply).
JS SP-1	protection plug for not used connectors.
JS AP-1	adaptor for FMC units to use instead of FMI-1B or -1D on the (R) connector including muting resistor.



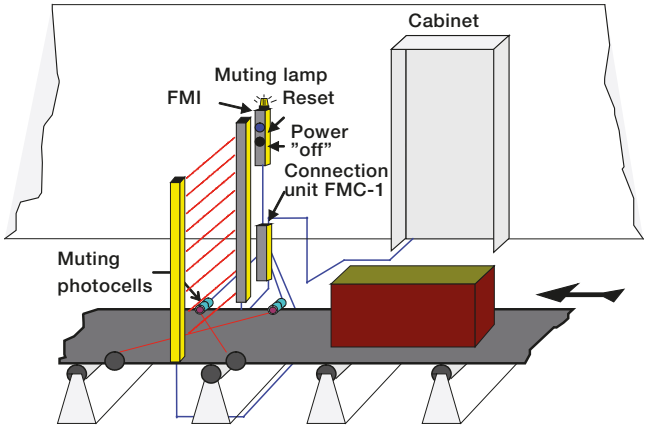
Muting with FMI and FMC

Connection of Focus II and muting components as FMC and FMI

Ex 1. Connection of light curtain with connection block FMC-1, test/reset button and switch for supply voltage placed in (by) the control cabinet.

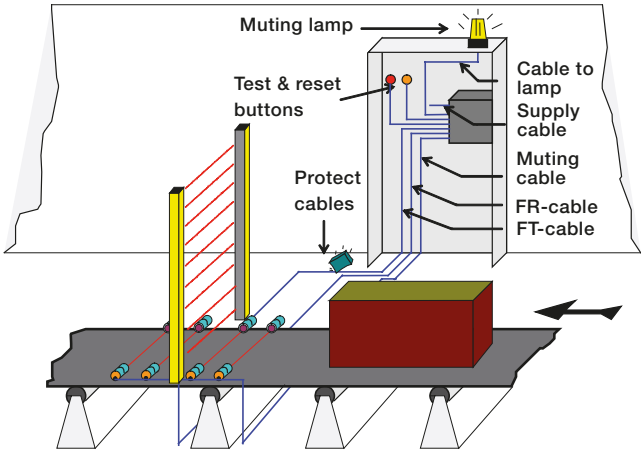


Ex 2. Connection of light curtain with connection block FMC-1. The Reset unit FMI must be placed out of reach from the hazardous area.



Connection of Focus II and muting components directly to the control cabinet

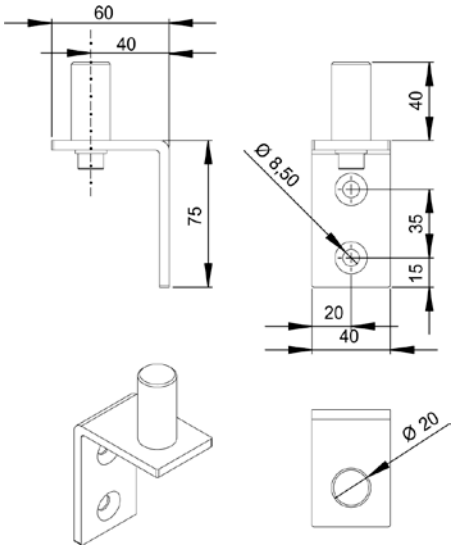
- The TEST /RESET button shall be placed so the operator can see the protected area during reset, testing, and bypassing. It shall not be possible to reach the button from within the hazardous area.
- The LMS lamp for indication of muting and bypassing shall be placed so that it can be seen from all directions from where it is possible to access the hazardous area.
- If photocells are used as muting sensors then the sensor receivers shall be assembled on the light curtain´s transmitter side to minimise the interference risk.
- The system is protected against dangerous functions caused by damage on the transmitter cable and/or the receiver cable. However, we recommend that the cables be protected so that physical damage to them can be minimised.



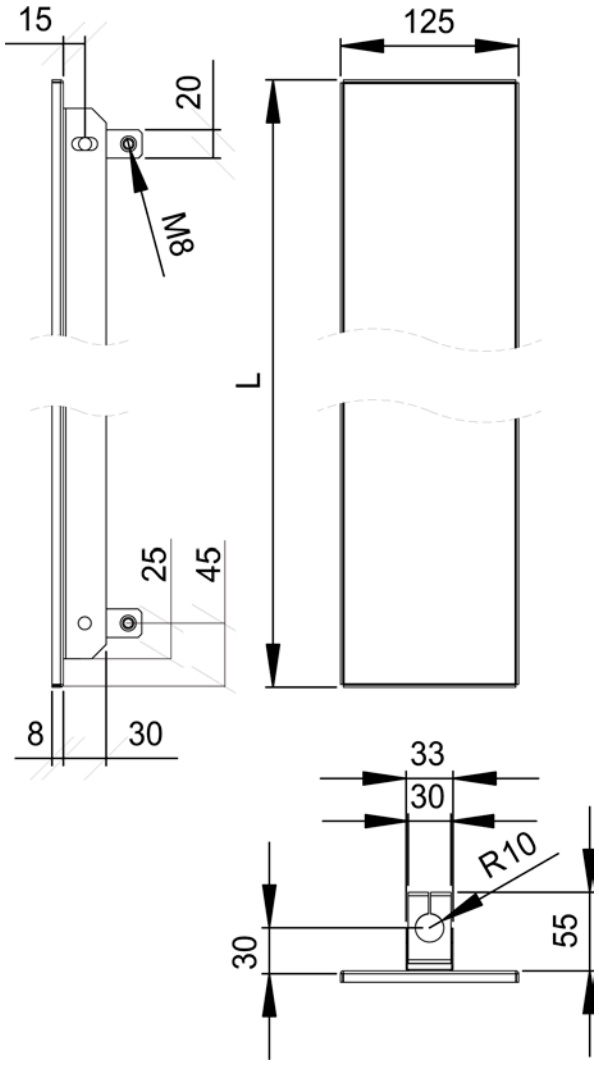
Accessories
MFII mirrors for light curtain

Technical data – Mirrors

Type	Article No	Height mirror glass, mm	Height total, mm
MFII-300	2TLA022041R0200	356	361
MFII-450	2TLA022041R0300	506	511
MFII-600	2TLA022041R0400	653	658
MFII-750	2TLA022041R0500	796	801
MFII-900	2TLA022041R0700	953	958
MFII-1050	2TLA022041R1200	1103	1108
MFII-1200	2TLA022041R0800	1253	1258
MFII-1350	2TLA022041R1300	1403	1408
MFII-1500	2TLA022041R0900	1546	1551
MFII-1650	2TLA022041R1000	1703	1708
Bracket for MFII mirrors.	2TLA022041R2000		

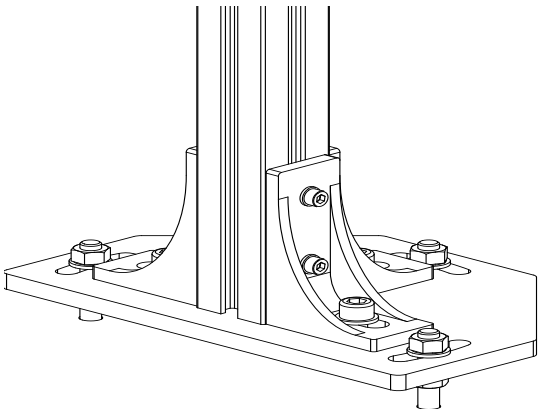


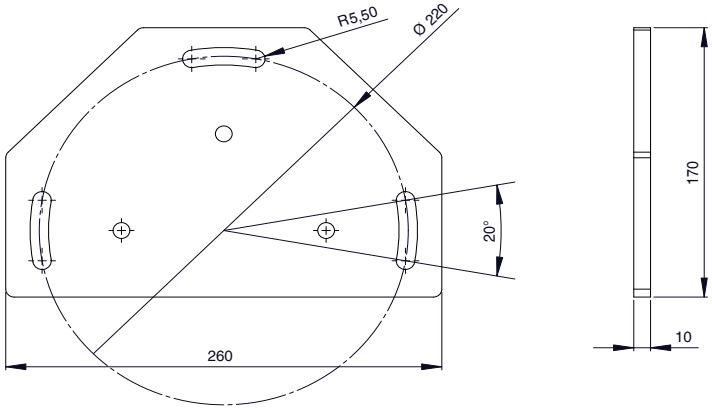
Bracket for MFII mirrors. 2 pcs needed for each mirror.



Adjustment plate

JSM 70, 2TLA040001R1500.
Plate for easy adjustment on uneven floors.





Light protection stand
Bjorn

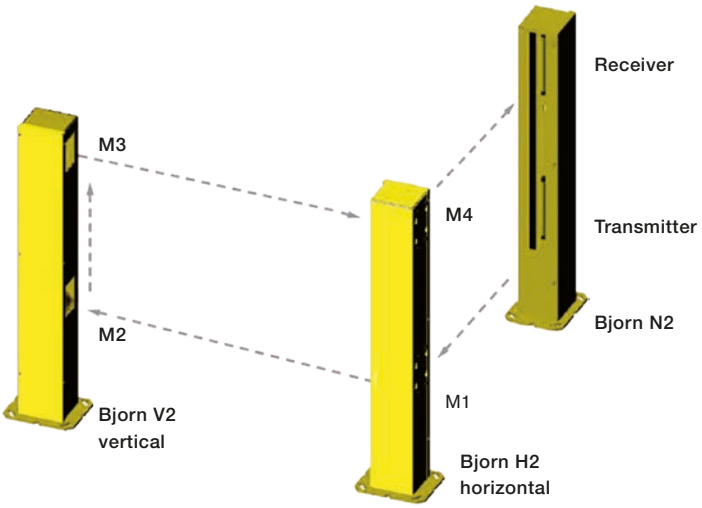
Application:

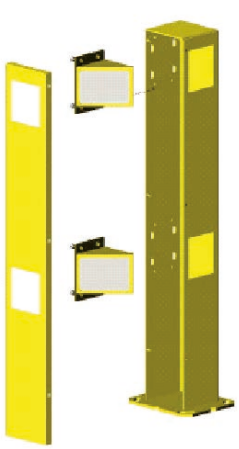
– Protects light curtain, light grids and mirror

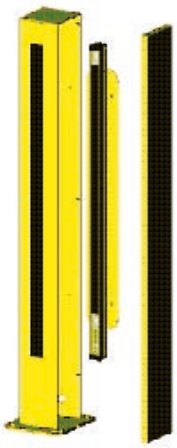
Features:

– Robust
– Adjustable

Bjorn is a very stable and flexible stand system in which Focus II safety light grids/ curtains and mirrors are mounted in the stand. The fixings for the mirrors in the stand can be turned to provide either vertical or horizontal angles. The robust material of the Bjorn protects Focus II units from direct collisions, and thus prevents unnecessary material damage and halts in production.

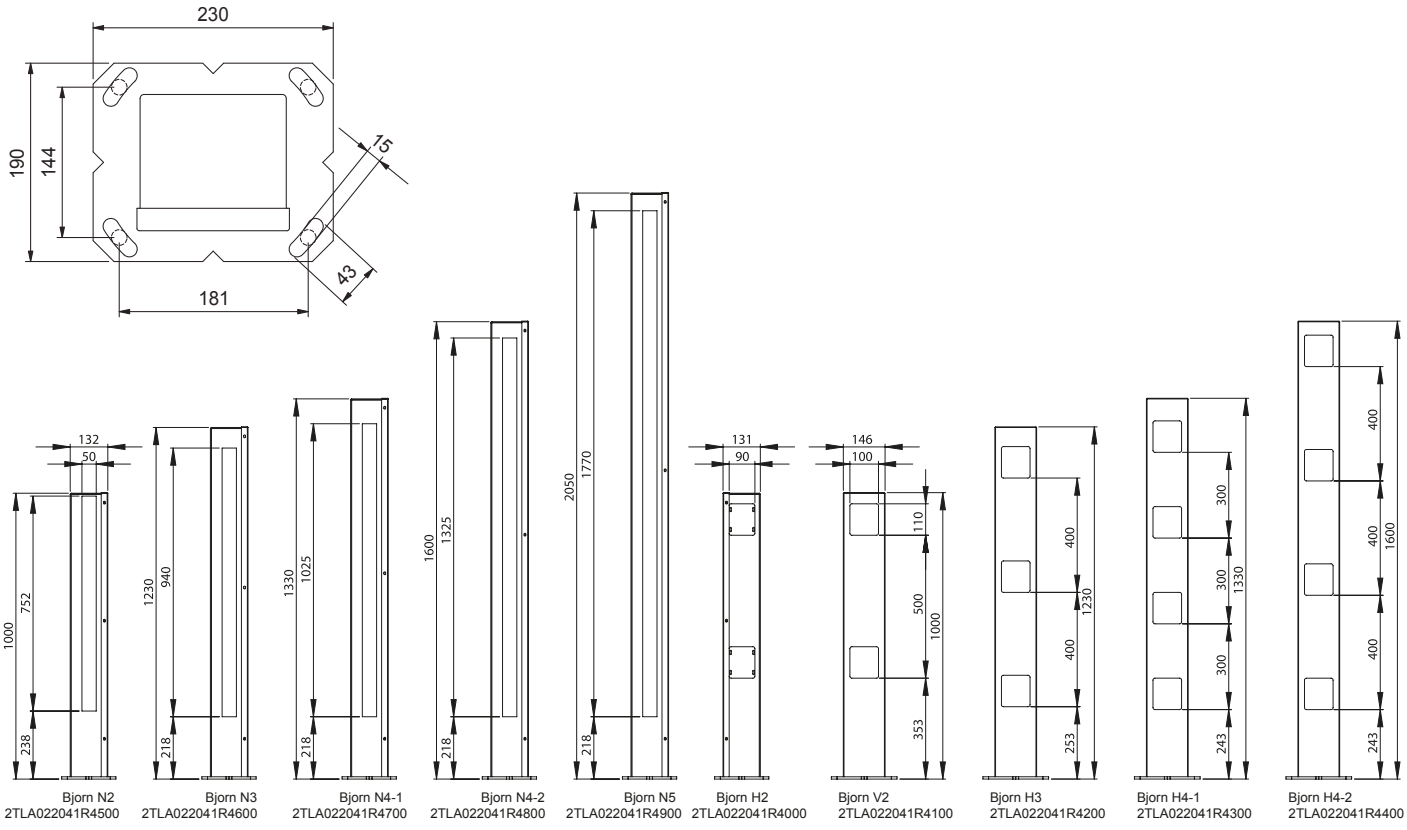






Technical data – Bjorn

Article number	
Bjorn H2	2TLA022041R4000
Bjorn V2	2TLA022041R4100
Bjorn H3	2TLA022041R4200
Bjorn H4-1	2TLA022041R4300
Bjorn H4-2	2TLA022041R4400
Bjorn N2	2TLA022041R4500
Bjorn N3	2TLA022041R4600
Bjorn N4-1	2TLA022041R4700
Bjorn N4-2	2TLA022041R4800
Bjorn N5	2TLA022041R4900
H = Horizontal reflection V = Vertical reflection N = For the light guard unit	
Colour	Yellow powder-coated (RAL 1018)
Material	3 mm steel
Dimensions	
Cross section	146 mm x 130 mm
Foot	230 mm x 190 mm
Weight	
N2	14 kg/piece
H2, V2	15 kg/piece
N3	17 kg/piece
H3, N4-1	18 kg/piece
H4-1	20 kg/piece
N4-2:	22 kg/piece
H4-2	24 kg/piece
N5	27 kg/piece
Mirror reduction	~10 % per mirror



Protection against water and dust
WET

Application:

– Protection in severe environments

Features:

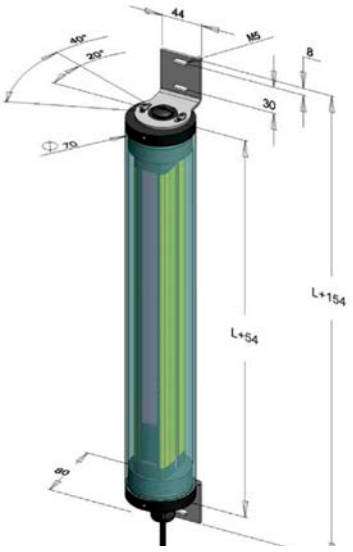
– Adjustable
– IP68

Technical data – WET

Article number	
WET-150 FII	2TLA022038R4000
WET-300 FII	2TLA022038R4100
WET-450 FII	2TLA022038R4200
WET-600 FII	2TLA022038R4300
WET-750 FII	2TLA022038R4400
WET-900 FII	2TLA022038R4500
WET-1050 FII	2TLA022038R4600
WET-1200 FII	2TLA022038R4700
WET-1350 FII	2TLA022038R4800
WET-1500 FII	2TLA022038R4900
WET-1650 FII	2TLA022038R5000
WET-1800 FII	2TLA022038R5100
WET-K-500 FII	2TLA022038R5200
WET-K-800 FII	2TLA022038R5300
WET-K-900 FII	2TLA022038R5400
WET-K-1200 FII	2TLA022038R5500
WET-L FII	2TLA022038R5600
WET-T FII	2TLA022038R5700
Colour	Transparent plastic
Length including lid	light curtain/light grid + 54 mm
Material	
Tube	PC
Lid	PEHD-300
Angle bracket	Stainless steel
Max. ambient temperature	+55°C
Installation adjustment	± 20°
Protection rating	IP68 (IP69K)

WET is used for protection against water (or dust) where extreme washing conditions are encountered. The protective encapsulation rating (IP68) now enables Focus II light curtains and light grids to be used for such applications as the food industry where the use of high pressure washing for cleaning machinery often occurs.

WET, with Focus II light curtains or light grids, is pre-assembled complete with cabling, on request. During installation on a machine a WET unit can be adjusted by ± 20° with the accompanying angle bracket.



Blanking programmer
BP-1

Application:

– Program blanking

Features:

– Easy to connect

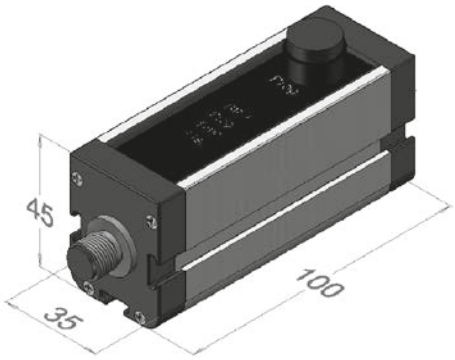
Technical data – BP-1 Blanking programmer

Article number	
BP-1 Blanking programmer	2TLA022090R2300
Colour	yellow and black

Programming blanking is made easy by using the Blanking programmer BP-1. The BP-1 is easily connected between the receiver unit of the light curtain and the cable otherwise connected to the receiver. The blanking object is placed in the light curtain detection zone and the button on the BP-1 is then pressed. 11 seconds later blanking is programmed for the object.

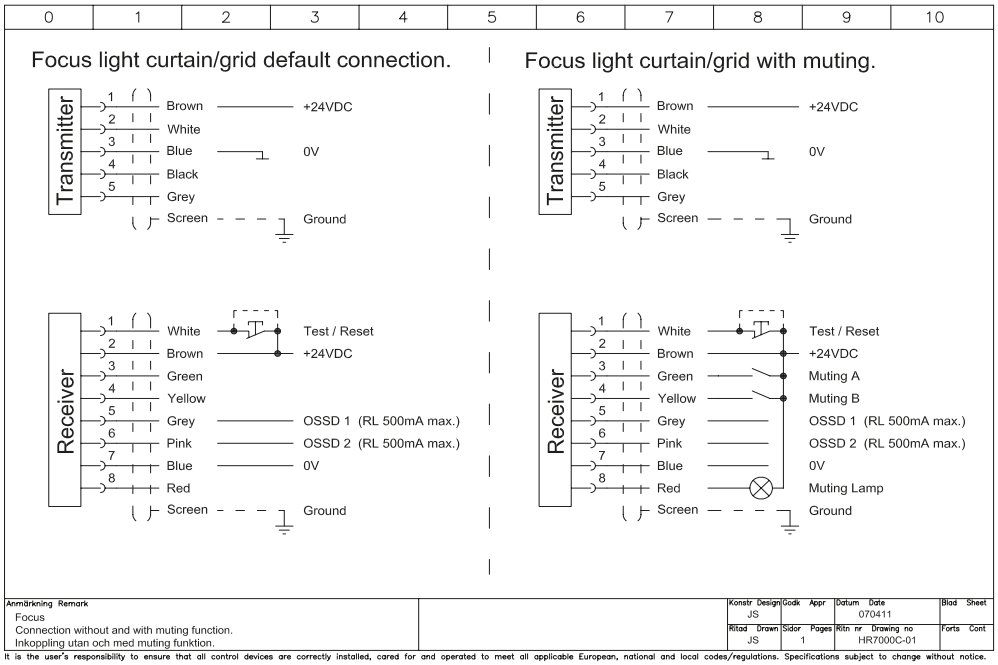
If the object needs to be changed a new programming is needed.

The unit can stay fitted during operation if required.

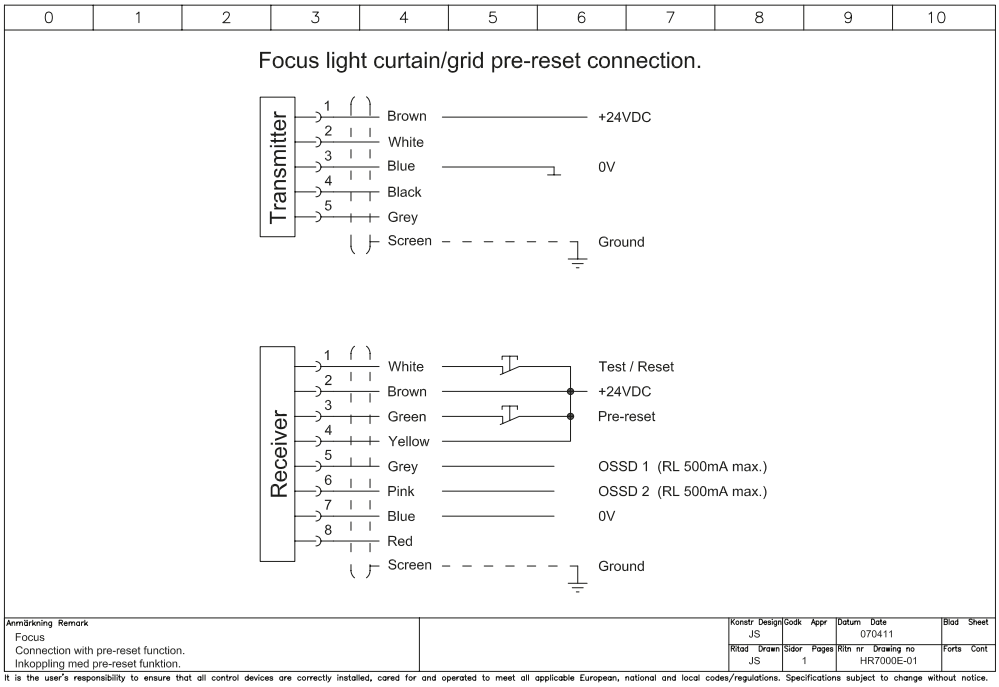


Connection examples

HR7000C-01 Focus II - Connection without and with muting function

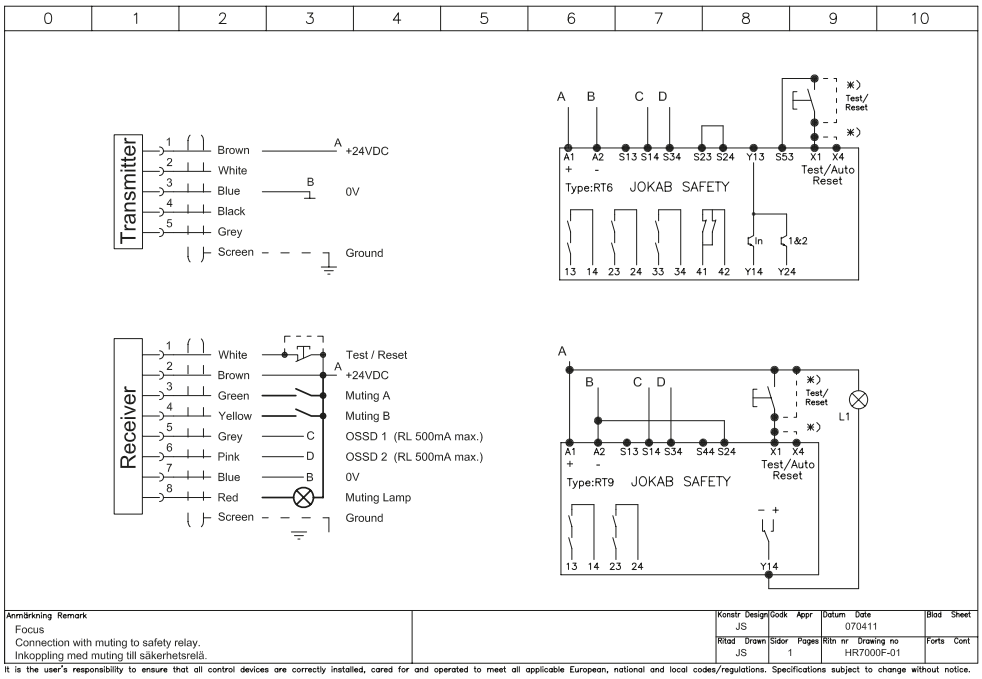


HR7000E-01 Focus II - Connection with pre-reset function



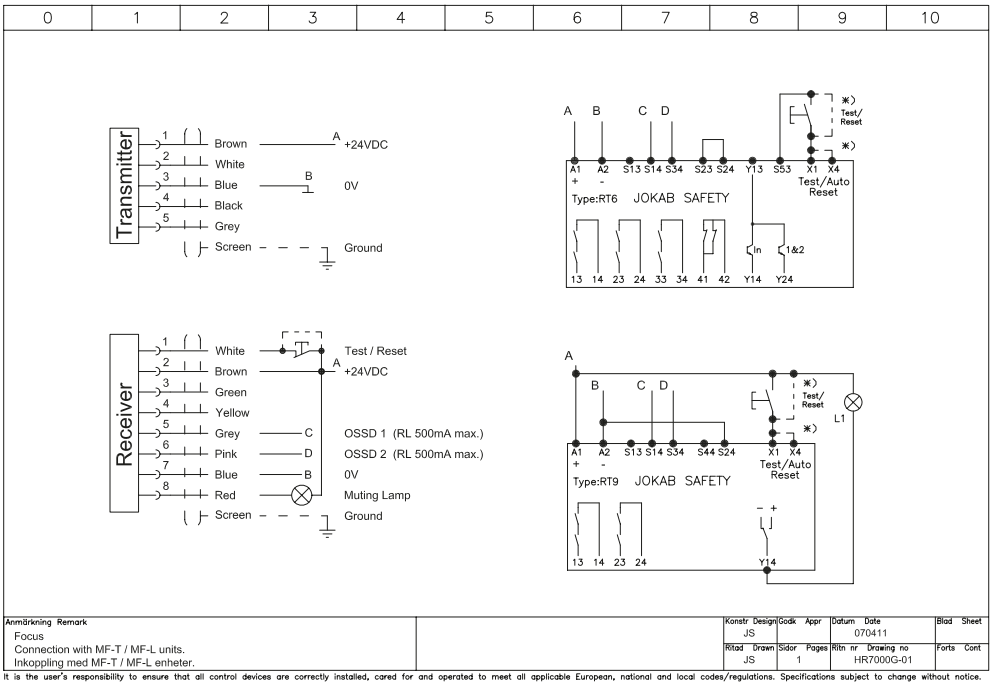
Connection examples

HR7000F-01 Focus II - Connection with muting to safety relay



It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

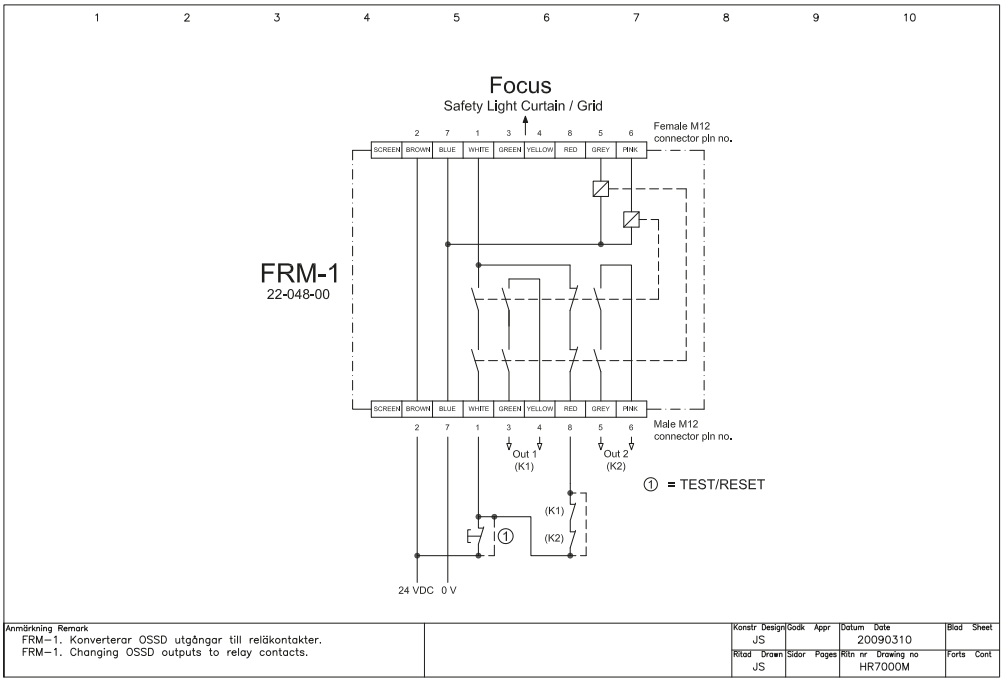
HR7000G-01 Focus II - Connection with MF-T/MF-L units



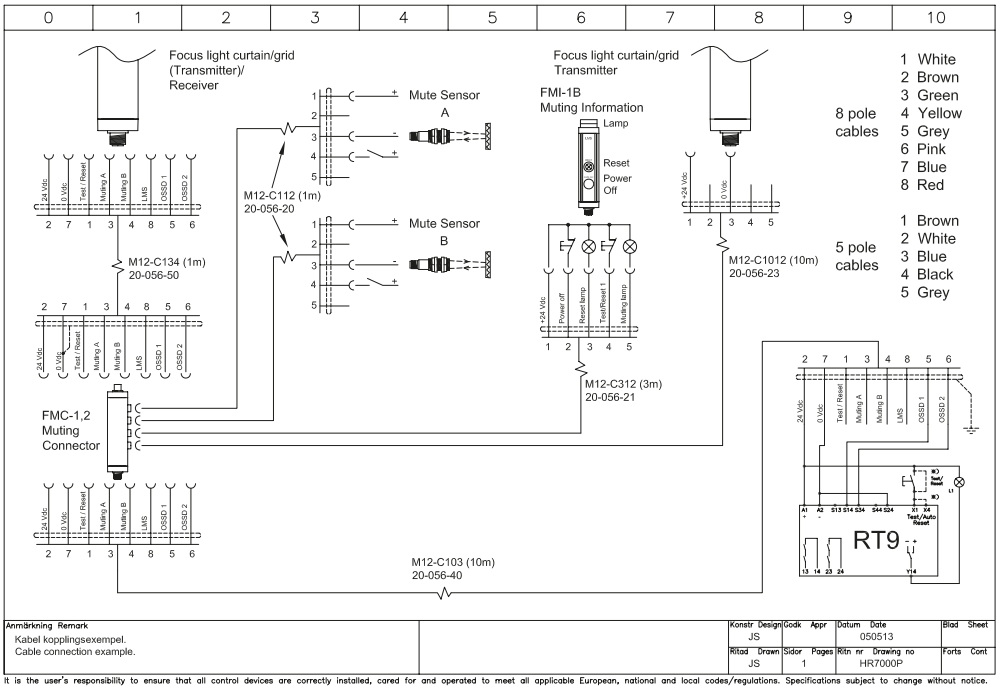
It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

Connection examples

HR7000M FRM-1 - Changing OSSD outputs to relay contacts

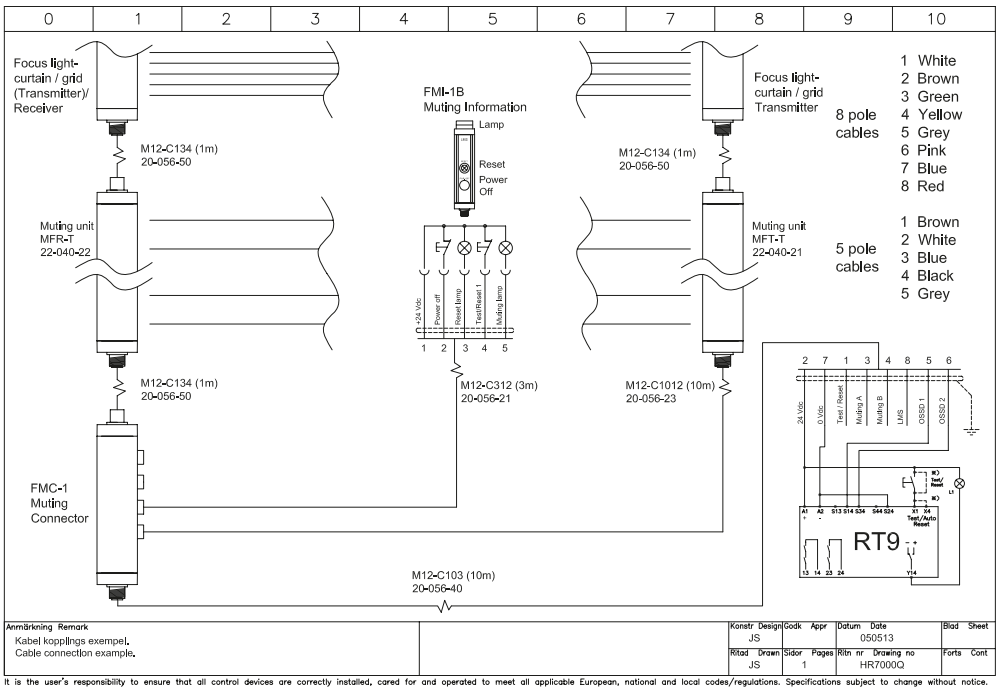


HR7000P Cable connection example



Connection examples

HR7000Q Cable connection example




Low battery
Off
On
Charge
Smart - SM3
Smart - SMS/1250
Smart - SMS/2500

Stopping time and machine diagnosis tool
Smart

Stopping time
Why measure stopping time?

— to find out which safety arrangements can be used in a certain area around a machine, and where they should be located.

Stopping time

The safety distance (how far away from the risk area a safety component must be placed) is based upon the machines stopping time. The basic idea is that a safety component should be placed so far from the risk area that it is not possible to enter the area before the machine has stopped.

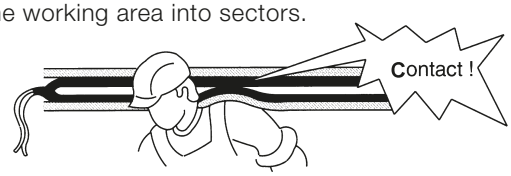
The stopping time for manually operated machines is especially important when light beams and light curtains are used as safety components. By reflex action the operator tries to grab or adjust if something has gone wrong in the machine tool, even if the machine has started. It is then imperative that the machine stops before the hand reaches the risk area. A short stopping distance is also of importance for getting good ergonomics.

Grabbing or adjusting is also common when using automatic machines. Usually this is done to prevent production downtime by quickly adjusting a work piece. The stopping time is also of great importance if someone trips and falls into the machine.

Stopping time, walking speed (1.6 m/s) and hand speed (2.0 m/s) is used for the calculation of safety distances. Sometimes a fixed minimum distance is also used. See the standard EN ISO 13855 for more details on the calculation of safety distances.

Stopping distance

For safety contact strips it is extra important that the stopping distance is monitored. An incorrect stopping distance could in many cases result in very high risks. The stopping distance is also needed during area limiting e.g. for robots when dividing the working area into sectors.



For door sensitive edges, it is important that the stopping distance is shorter than the soft part of the sensitive edge.

Regulations and standards

It is also important to measure the stopping time, to meet the requirements set by the machinery standards, directives and regulations. Here we can help, with our long experience in the practical application of regulations and standards, from the viewpoints of both the authorities and production. In addition we collaborate with the standardisation committees responsible for producing these standards. One example is

Where the safety distance is small, one can for example sit close to the machine and work, as in the picture on the left. If the safety distance is greater, it may be necessary to approach the machine to intervene, and also perhaps use additional protection to prevent starting when someone is within the protected distance.

EN ISO 13855, which deals with the placing of safety devices around a machine based on its stopping time. The standard is general for all types of machinery, although for some, where there is a harmonised C standard, the requirements for minimum distance and stopping time measurement will apply. In the case for example of mechanical press tools there is also a requirement in EN 692 for how stopping time measurements are to be performed, and in the case of hydraulic press tools this is in EN 693.

Annual checks

Wear in a machine is something that can affect braking and motors, which means that the stopping time of a machine can change with time. Certain other changes in a machine, such as changing the weight of a workpiece or alterations in pneumatic pressure, can also affect the stopping time. For these and other reasons it is important to perform an annual check on the stopping time.

How the stopping time affects the choice of protective equipment – an example

There was a case where we measured the stopping time of the rollers in a textile industry company. The company had planned to place light beams or a light curtain in front of the rollers to prevent the operators from being caught in the material and dragged in. The stopping time measurement showed that it took over one second for the rollers to stop. During this time the material was pulled in by almost two metres. In order to obtain sufficient protection distance, the light beams would have needed to be positioned almost three metres from the machinery, and a light curtain about two metres away. The factory did not have so much space, nor was it realistic. The solution became instead vertical sliding safety barriers.

Stopping time and Machine Diagnosis Tool Smart

Approvals:

CE

Smart shows graphs/ values for:

- Stopping time
- Stopping distance
- Speed
- Position of stopping signal

Features:

- Easy to use
- Measurements with or without electrical connection
- Ideal for machine performance diagnosis
- Calculation of correct safety distances

Smart is ideal for safety supervision and for diagnosis of machine operation

Smart has many valuable features for machine diagnosis:

- Graphic presentation of measurements
- Easy to analyse stopping characteristics and movement
- Gives parameters for safety design (e.g. stop time)
- Calculates minimum allowed safety distance
- Shows how the stop distance can be optimised
- Electrical reaction time and mechanical/hydraulic breaking can be identified and analysed
- Digital in/out signals and analogue inputs

Smart is perfect for periodic monitoring of safety parameters and other conditions for the maintenance and trouble-shooting of machines. Because Smart can compare old and new graphs, it becomes easy to find out the reasons for machine malfunctions. One can also supervise machines during operation and compare how they perform over time.

Stopping units and sensors

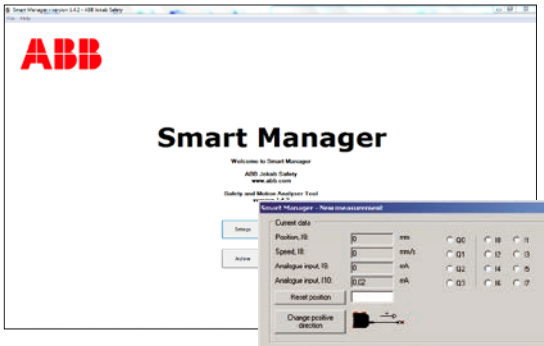
Smart is a further development of our well established JSSM1 Stopping Analyser. All the stopping units and sensors for the JSSM1 can also be used with Smart. The amount of connection possibilities have also increased. Smart has 9 digital I/O, one input for an incremental sensor (for position and speed) and two analogue inputs. This makes it easy to measure sequences in conjunction with motion lapse and other analogue values.

Smart Manager

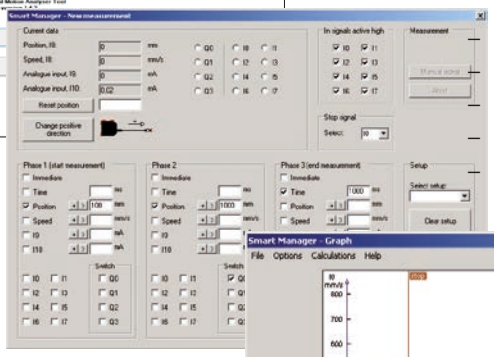
Smart is controlled in real time by a computer using the Smart Manager program. This performs measurements, and the measured data can be saved and analysed. The measurements are saved in an SQL database, with the ability to export data to Microsoft Excel if necessary. The program calculates the stopping time and protective distance, and can print out the results, together with a graph of the event sequence. Smart Manager is available in several languages: English, Swedish, Danish, German, French, Czech and Polish. Translation into other languages can easily be arranged as necessary. The program is free, and is available for downloading from our web site when purchasing equipment to measure stopping times.

Benefits:

- Simple program structure
- Shows the entire stop sequence
- Provides a machine movement “fingerprint”
- Compares measurements
- Calculates stopping time
- Saves measurements to a database
- Exports measured data to Excel
- Prints out a complete measurement report

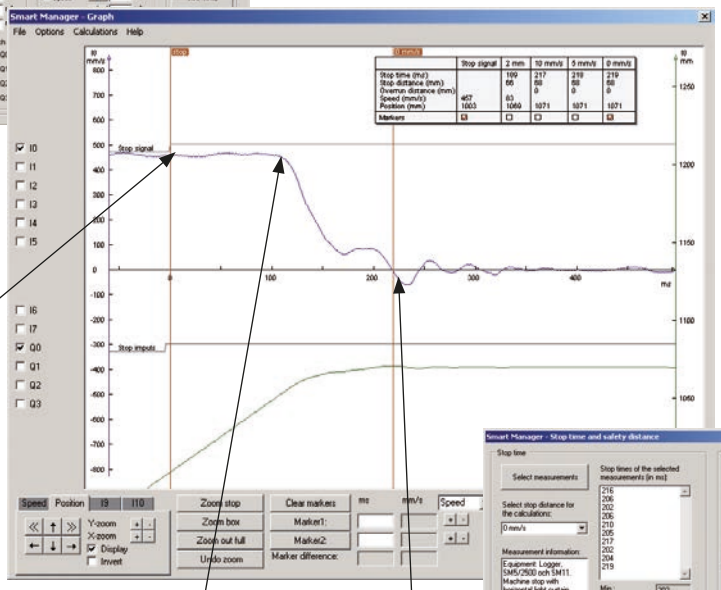


Start menu



Measuring form

- Current values from sensors and the system
- Start conditions
- Stop signal conditions
- Shutdown conditions
- Measuring settings can be saved



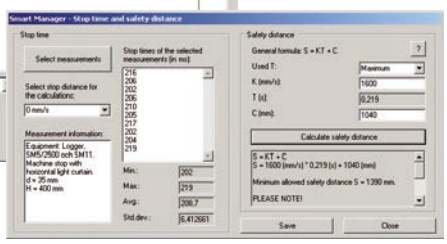
Measured result

- Stop time data
- Zoom control
- Own cursors

Stop signal given

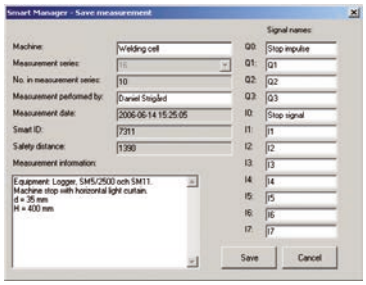
Relay contacts drop out

Machine stopped



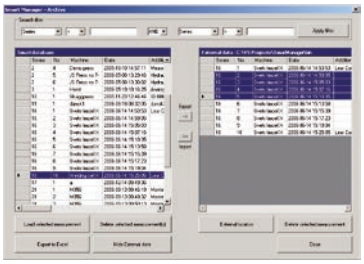
Calculations

- Min., max. and average value and standard deviation from a series of measurements
- Protective distance can be calculated



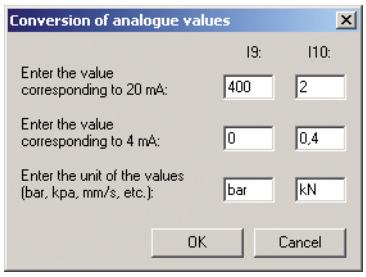
Saving

- Select measurement series
- State extra information, e.g. the conditions and special circumstances for the measurements.



Archiving

- Search filter
- Saved measurements
- Exported measurements



Conversion of analogue signals

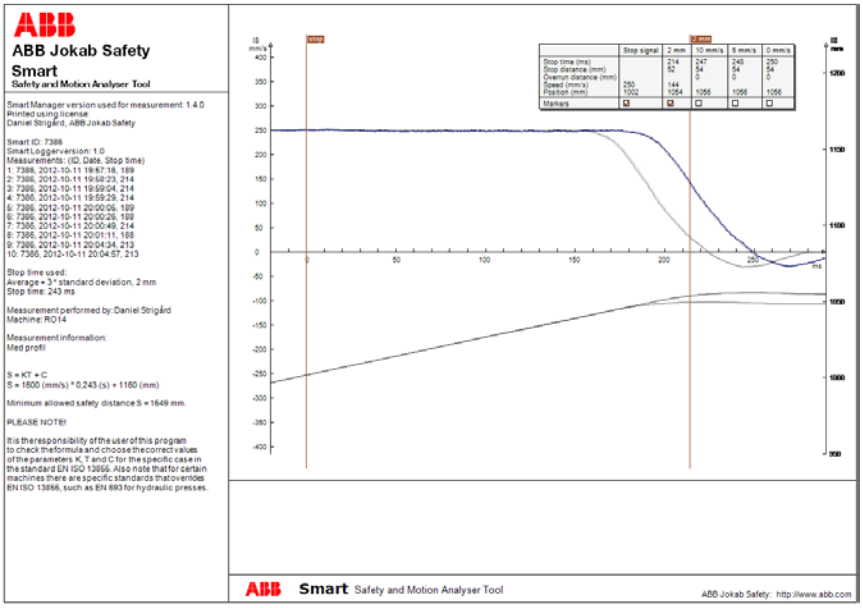
Smart can measure and show graphs for two different analogue sensors at the same time, with its inputs for 0/4-20 mA. Conversion of the measured current values can be done automatically by setting minimum and maximum values and the units for the inputs. In this way, for example, the results from an analogue pressure sensor can be shown and calculated as 0-400 bar instead of 4-20 mA, or an analogue load cell as 0-2 kN. This also means that if it is desired for the system to be triggered at a certain force, that force can be defined instead of needing to calculate the equivalent current value.

4

Printout

Printing out is one of the most important functions of the program. Here is shown all the vital information about the measurements that is needed for such items as annual checking or providing the basis for CE labelling of a machine. Since the entire measuring sequence is shown in graphical format, one can understand why the stopping time has a certain value and also, in some cases, see what needs to be done to minimise the stopping time. The graph also acts as a kind of “fingerprint” of the machine movements, which means that different measurements can be compared with each other to see how the stopping sequence varies from time to time, or from year to year. In this way the effects of e.g. worn brakes or the effect on the machine control system can be seen. In order to get a complete basis from a measurement it is also important to state what assumptions have been made and what conditions applied when deciding when and how the stop signal was given.

Among other things, the stop signal details the person measuring, the measuring equipment, the machinery, the calculations and the protective distance. The printout also has a replaceable company logo and a field for extra information.



Smart and accessories

Smart Logger

Article number	2TLA070300R0100
Dimensions	62 x 220 x 80 mm. (wxhxd)
Weight	0.5 kg
Protection class	IP67
Supply voltage	24 VDC
Response speed	max 1 ms
Positional accuracy	+/- 0.1 mm
Digital I/O	8 inputs, 4 outputs (NPN OC)
Analogue inputs	2 off, 0/4-20 mA
Encoder	1 connection for a pulse sensor

The Smart Logger is the principal unit for data collection. The logger has a USB connection to the PC and 8 M12 connections: one for the power supply to the I/O, one connection for an incremental sensor, two connections for analogue sensors and four connections for other I/O signals.
The Logger encapsulation is watertight, with M12 connections to prevent the entry of particles and fluids in the workshop environment. To prevent the Smart Logger from being damaged by incorrect currents and voltages from external equipment, all inputs and outputs, and external units, are electrically isolated from the processor in the Smart Logger by means of opto-couplers.

SM2 Button unit

Article number	2TLA070300R0200
Dimensions	Size: 50 x 100 x 25 mm. (wxhxd)
Weight	0.2 kg
Application area	Two-handed control unit, Emergency stop, etc.
Supply voltage	Fed from the Smart Logger

The SM2 is used in conjunction with the Smart Logger for measuring with a manual stop impulse, without an electrical connection to the machine. When an SM2 is, for example, pressed against an emergency stop button to stop the machine, the SM2 sends a signal to the Smart Logger to start the measurement. An LED on the SM2 lights when the desired stop position is reached. The SM2 is connected to the Smart Logger by an M12 connection.

SM3 Relay unit

Article number	2TLA070300R0300
Dimensions	85 x 72 x 49 mm. (wxhxd)
Weight	0.2 kg
Application area	Electrical connection providing a stop pulse.
Supply voltage	Fed from the Smart Logger
Relay outputs	2 NO, 2 NC, 6A/250 VAC.
Encoder	1 connection for a pulse sensor

The SM3 is used in conjunction with the Smart Logger for automatic stopping time measurements at the set position, or alternatively a manual stop pulse. When a stop signal comes from the Smart Logger a relay switches in the SM3.
The SM3 then sends a signal to the Smart Logger to start measuring, and also activates the relay outputs to stop the machine. The relay in the SM3 is reset via the software when a new measurement is to be made. The SM3 is connected to the Smart Logger by an M12 connection.

SM11 Flag unit

Article number	2TLA070300R1100
Dimensions	145 x 85 x 37 (wxhxd). Shaft ø3 x 45 mm
Weight	0.6 kg
Application area	Ligh curtain, light beam
Protection class	IP40
Batteries	10 rechargeable 1.2 V NiMH batteries. Total 12 V
Power	Max 1200 mAh (approx. 200 operations).
Temperature	0 to +45°C.
Installation	On a table or a standard ¼" camera tripod
Charger	SM14

The Smart Logger is used in conjunction with the SM11 for automatic measurements of the stopping time and stopping distance. The unit is located in a light curtain with the flag parallel to the beam. When the flag is activated, the light beam/light curtain is interrupted, and the machine stops. The SM11 is connected to the Smart Logger by an M12 connection.

SM5 1250/2500 Linear sensor

Article number		The SM5 is an incremental pulse sensor for connection to a Smart Logger. The sensor is protected by a robust enclosure. The sensor and end of the cable are secured to the machine by powerful magnets. The SM5 is connected to the Smart Logger by an M12 connection.	
SM5/1250 Linear sensor	2TLA070300R0400		
SM5/2500 Linear sensor	2TLA070300R0500		
Dimensions	1250: 106 x 88 x 100 mm (wxhxd) 2500: 114 x 125 x 116 mm (wxhxd)		
Weight	SM5/1250: 1 kg SM5/2500: 1.4 kg		
Application area	Linear movement, e.g. press tools		
Supply voltage	Fed from the Smart Logger		
Max length	1250 or 2500 mm		
Max speed	5 m/s		
Resolution	0.1 mm		

SM7 Rotation sensor

Article number	2TLA070300R0700	The SM7 is an incremental sensor for connection to a Smart Logger. The sensor detects rotational movement via a wheel rolling against a shaft. The stand secures the sensor with the aid of just one knob. The stand itself is secured to the machine by a powerful magnetic foot. The SM7 is connected to the Smart Logger by an M12 connection.	
Dimensions	Sensor size: 46 x 40 x 59 (wxhxd) Stand size: Extended, approx. 400 x 50 x 80 (wxhxd)		
Weight	1.7 kg including stand		
Application area	Rotating motion, e.g. lathes, rollers		
Supply voltage	Fed from the Smart Logger		
Max speed	5 m/s		
Resolution	0.1 mm		
Wheel circumference	125 mm		

SM13 Battery pack

Article number	2TLA070300R2300	SM13 is a battery pack for the Smart Logger, which makes the Smart a completely mobile measuring tool. With the SM13 you don't need to connect the Logger to a wall socket for power, and can easily move it from one machine to another when you are measuring. Since the SM13 battery pack is the same physical size as the SM11 flag unit, it fits snugly into the SM9 carrying case. The charger for the SM13 is called the SM14 and provides a charging time of about 3 hours 15 minutes (2100 mAh). The SM14 also acts as a fast charger for the SM11.	
Dimensions	145 x 85 x 37 mm (LxWxH)		
Weight	0.8 kg		
Protection class	IP40		
Connector	Negative pole at the centre of the charging connector		
Current rating	Maximum 0.9A		
Power	2100 mAh. With normal use lasts about 10-12 hours. (Higher capacity on request.)		
Batteries	20 rechargeable 1.2 V NiMH batteries of size AA (R06). Total 24 V		

SM9 Carrying case

Article number	2TLA070300R0900	The SM9 is a practical carrying case with pockets to suit the various Smart units. Part of the protective foam insert in the lid of the case can be removed to make room for a laptop computer, so that all the equipment required can be carried in a single case.	
Dimensions	535 x 155 x 430 mm (LxWxH)		
Weight	3.5 kg		

Other accessories

Name	Article number	Description
SM6	2TLA070300R0600	AC/DC converter for Smart
SM14	2TLA070300R2400	Charger for flag unit SM11 and battery pack SM13.
USB cable	2TLA070300R1500	USB cable for communication with computer
Extension cables		ABB Jokab Safety's extension cables with 5 conductors ideal for all Smart accessories

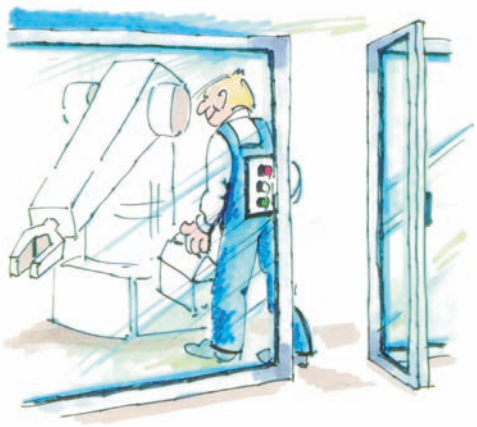

ABB
MKey8
ABB
MKey5
ABB
MAGNE

Sensors/Switches/Locks

Why should you use sensors/switches?

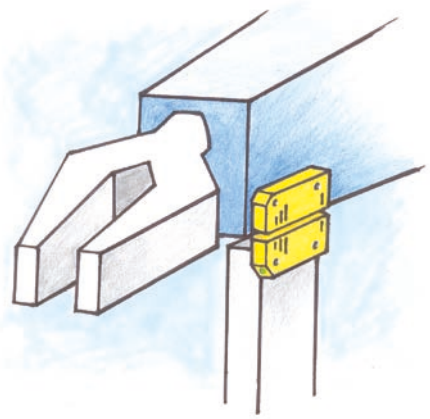
– to supervise doors and hatches around dangerous machines!

Assurance that a machine stops, when a door or a hatch is opened, can be solved by using different types of switches and sensors, which are monitored with a safety relay or a safety PLC. Switches and sensors are available both as non-contact (dynamic or magnetic) and various types of interlocking devices. Interlocking devices can be used when it is required, via a signal, to lock a gate during processes that cannot be stopped during certain operations. They are also used with machines that have a long stopping time to prevent someone from entering before the machine has stopped.



– to ensure that a position is reached!

The sensor monitors that the robot is standing still in a monitored position when someone enters the robot´s working area. The robot is then only stopped by the program , not by loss of power. If the robot leaves the position the power will be cut directly. This is used when the robot can not be stoped safely without resolving in restarting problems.



– to manage the safety in harsh environments!

Non-contact dynamic sensors have a long lifetime because they are not physically mechanically operated. They also endure very harsh environments, e.g. cold, heat, high-pressure wash-down which is important in the food industry for example. Because the sensors are small, they are very easy to position and can even be completely concealed in doors and hatches.

Safety Magnetic Switch
Sense7

Approvals:

Application:

- Gates
- Hatches
- Position control

Features:

- Small size
- Up to IP69K
- LED
- 2NC + 1NO
- Solid State outputs

5

Switch operational description
The coded non-contact switches Sense7 are designed to interlock hinged, sliding or removable guard doors. Its design makes it advantageous to operate in environments that require the highest level of safety.

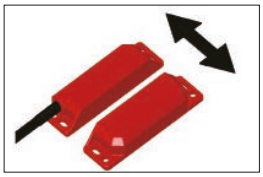
The magnetic switch is small in size which makes it easy to position and hide on gates and hatches. Sense7 is resistant to both dirt and water, and has no dust collecting cavities, which make it useful in environments where hygiene is paramount. The magnetic switch has a long working life since no mechanical contact is necessary for operation. Sensing distance of Sense7 is 14 mm and it has a high tolerance to misalignment. Actuator is always delivered with the non-contact switch.

Material
The Sense7 switch is available in UL approved polyester and in stainless steel 316. The stainless steel has a mirror polished finished (Ra4) suitable for CIP cleaning - food splash zones according to EHEDG guidelines.

Protection from unauthorised or incidental access
To avoid unauthorised operation of the Sense7 switch, it is only possible to actuate the coded magnetic switch with the coded magnet. Other magnets, screwdrivers and tools have no affect on the switch contacts.

Safety level
The Sense7 has two closing and one opening contact. Two contacts have to be monitored to achieve the highest level of safety regulations, PL e/Cat. 4 according to EN ISO13849-1 together with safety relay or Safety Pluto PLC.

Regulations and Standards
The Sense7 is designed and approved in accordance to relevant standards. Examples of relevant standards are EN1088, IEC/EN 60947-5-3, EN 60204-1, EN ISO 13849-1, EN 62061 and UL 508.



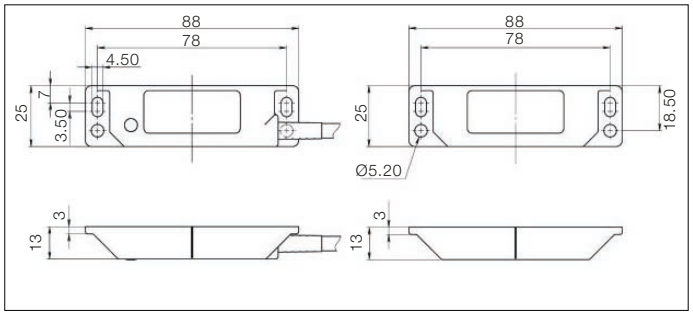
Sensing distance 14 mm

Quick connected version fitted with 250 mm cable and M12.

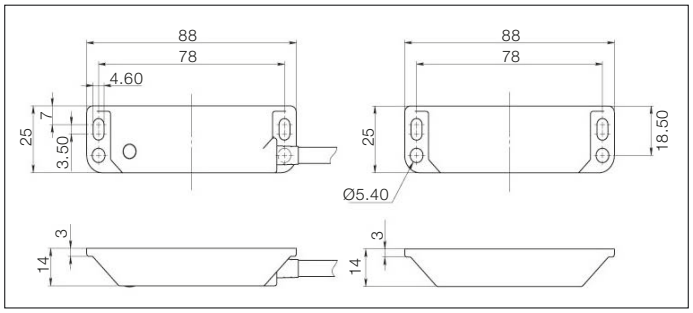
NOTE! Sense7 versions have 2NC and 1NO circuits. For all Sense7 switches the NC circuits are closed when the guard is closed and the actuator present.

Technical data – Sense7 series

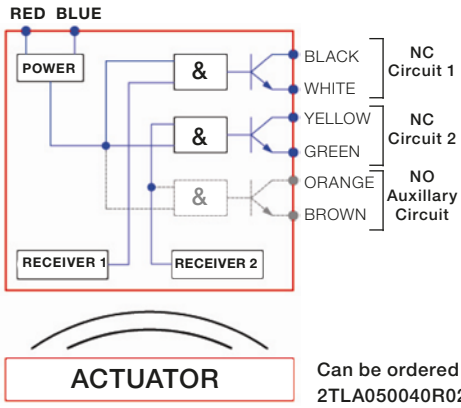
Article number	
Plastic	
Sense7 - 2 m cable	2TLA050056R4100
Sense7 - 5 m cable	2TLA050056R5100
Sense7 - 10 m cable	2TLA050056R6100
Level of Safety	
EN ISO 13849-1	Up to PL e/Cat. 4 depending upon system architecture
EN 62061	Up to SIL3 depending upon system architecture
Safety data	
PFH_D	2.52 x 10^{-8}
Switching reliability	3.3 x 10^6 operations at 100mA load
	47 years
Proof test interval (life)	470 years (8 cycles per hour/24
$MTTF_d$	hours per day/365 days)
Safety channel 1NC	24 VDC 0.2 A max. rating
Safety channel 2NC	24 VDC 0.2 A max. rating
Safety channel 3NO	24 VDC 0.2 A max. rating
Power supply	24 VDC ±10%
Minimum switched current	10 VDC 1mA
Dielectric withstand	250 VAC
Insulation resistance	100 MOhm
Recommended setting gap	5 mm
Switching distance (target to target)	Sao 10 mm close (on)
	Sar 20 mm open (off)
Tolerance to misalignment	5 mm in any direction from 5 mm setting gap
Switching frequency	1.0 Hz maximum
Approach speed	200 mm/m to 1000 mm/s
Vibration resistance	IEC 68-2-6, 10-55 Hz 1 mm
Shock resistance	IEC 68-2-27, 11 ms, 30 g
Enclosure protection	IP67 and IP69K
Cable type	PVC 8 core 6 mm O.D
Operating temperature	
Sense7	-25°C to +80°C
Sense7Z	-25°C to +105°C
Material	
Sense7	UL approved polyester
Sense7Z	Stainless steel 316
Colour	Red or stainless steel
Mounting position	Any
Mounting bolts (Tightening torque)	2 x M4
	(1.0 Nm)



Dimension Sense7

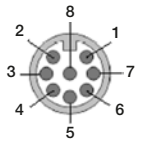


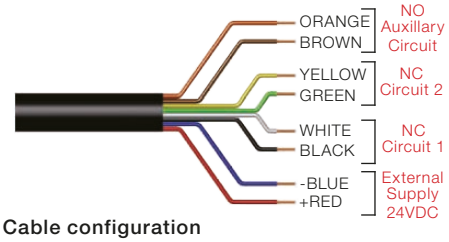
Dimension Sense7Z



Can be ordered separately – 2TLA050040R0211

Electrical connection

M12 8pol	Sense7 - 250 mm cable with M12 (Pin view from switch)	Colours
	1	White
	2	Red
	3	Blue
	4	Yellow
	5	Brown
	6	Green
	7	Black
	8	Orange



Cable configuration

Magnetic lock
Magne

Approvals:

Application:

- Electrical locking of doors and hatches for production applications that are sensitive to unintentional/unnecessary interruptions.

Features:

- No moving parts
- Strong Magnetic holding force: 1500N
- Can withstand and operate in harsh environments
- Locked/unlocked indication
- No current peaks on activation

Magnetic lock with indication

Magne is a electro-magnetic lock that is designed for industrial applications and that can withstand harsh environments. As it is designed with no moving parts, it is durable and long lasting. The unit is intended for use in preventing unnecessary process stoppages, i.e. it is not a safety lock. Magne, with its electro-magnet, keeps a door locked with a holding force up to 1500 N and magnetic material does not attach to the magnetic surface when the power is off.

Use of M12 connectors makes it easy to connect several Magne units and Eden sensors in series enabling control and monitoring by either a Pluto safety PLC or a Vital safety controller. Via the connection cable it is also possible to obtain an indication signal informing if the Magne unit is locked or not.

Accessories:

- Mounting kit for conventional door, with fitting and screws for assembly on ABB Jokab Safety Quick-Guard fencing system (5-15 mm door gap)
- Plastic handle
- Handle profile for mounting on a hinged door with ABB Jokab Safety's Quick-Guard fencing system (5-15 mm door gap).

Magne is easy to install, adjust and dismantle in and out of the T-slot of the Quick-Guard fencing system.

Magne
Models and accessories

Magne 1A with installation kit JSM D21B and JSM D27.

JSM D28 handle profile which cover Magne completely when the door is closed.

5

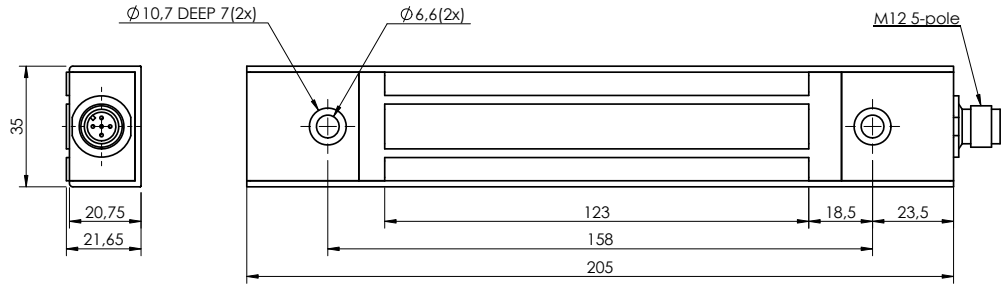
Models and ordering data

Magne 1A v2 1500N	2TLA042022R2100	Electro-magnet with 5-pole M12-contact. Anchor plate. Cell rubber.
Magne 1B v2 1500N	2TLA042022R2200	Electro-magnet with 5-pole M12-contact. Anchor plate with permanent magnet. Cell rubber.
JSMD28	2TLA042023R0100	Aluminum profile used as both door handle and mounting kit for Magne. Completely covers Magne unit when the door is closed.
JSM D21B	2TLA042023R0500	Mounting kit for Magne. For conventional door (5-15 mm door gap). Fits all Magne. Note: When used with Magne 2A/B,–2Ax/Bx a mounting kit for Eva is also required (JSM D24).
JSM D23	2TLA042023R0200	Mounting kit for Magne. For sliding door. Fits all Magne.
JSM D24	2TLA042023R0300	Mounting kit for Eva. For conventional door.
JSM D27	2TLA042023R1000	Handle/screw for JSM D21 Magne installation kit.
Magne cellular rubber	2TLA042023R3600	Spare part. Cellular rubber t=10 mm
Magne Anchor plate 32A	2TLA042023R1300	Spare part. Anchor plate A (without permanent magnet). Width 32 mm. Included with Magne 1/2
Magne Anchor plate 34A	2TLA042022R2300	Spare part. Anchor plate A (without permanent magnet). Width 34 mm.
Magne Anchor plate 32B	2TLA042023R0400	Spare part. Anchor plate B (with permanent magnet). Width 32 mm. Included with Magne 1/2
Magne Anchor plate 34B	2TLA042022R2400	Spare part. Anchor plate B (with permanent magnet). Width 34 mm.

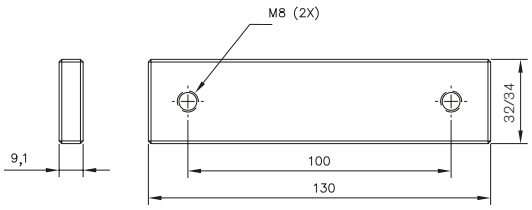
Technical data – Magne

Power supply	Magnet: 24 VDC +/- 15%
Power consumption	Magnet: 7 W (300 mA at 24VDC)
Operating temp. range	-20°C to +50°C
Protection class	IP67
Weight	Magne 1: 610 g, Anchor 32A: 290 g
Material	Anchor plate and magnet: steel Housing: Aluminium Potting: PUR, epoxy
Holding force	24 VDC: Min 1500 N 0 VDC: 0 N (Magne 1A 0 VDC: 30 N (Magne 1B
Contacts	Reed sensor (not safe)
Switch current max	100 mA
Mechanical life	$>10^7$ switch operations
Connector	M12 5-pole male connector (Magne 1A/B)
Connections	Magne 1A/B: (1) Brown: Locking, +24 VDC (2) White: Sensor supply (3) Blue: 0 VDC (4) Black: NO-contact (5) Grey: NC-contact
Conformity	EN ISO 12100-1:2010, EN ISO 13849-1:2008, EN ISO 13849-2:2008, EN 62061:2005, EN 60204-1:2006+A1:2009, EN 60664-1:2007, EN 61000-6-2:2005, EN 61000-6-4:2007, EN 60947-5-1:2004, EN 1088+A2:2008

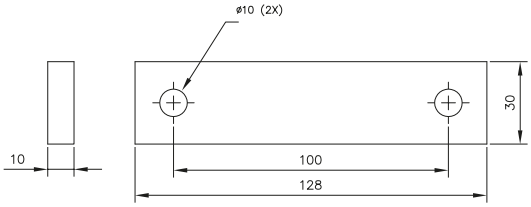
Magne
Dimensions



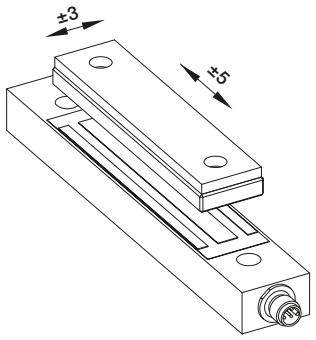
Dimensions Magne 1A/B



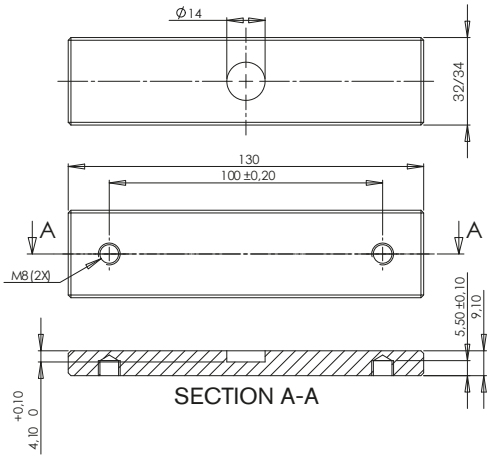
Dimensions Anchor plate 32A/34 (without permanent magnet)



Dimensions - cellular rubber



Installation tolerance (general)

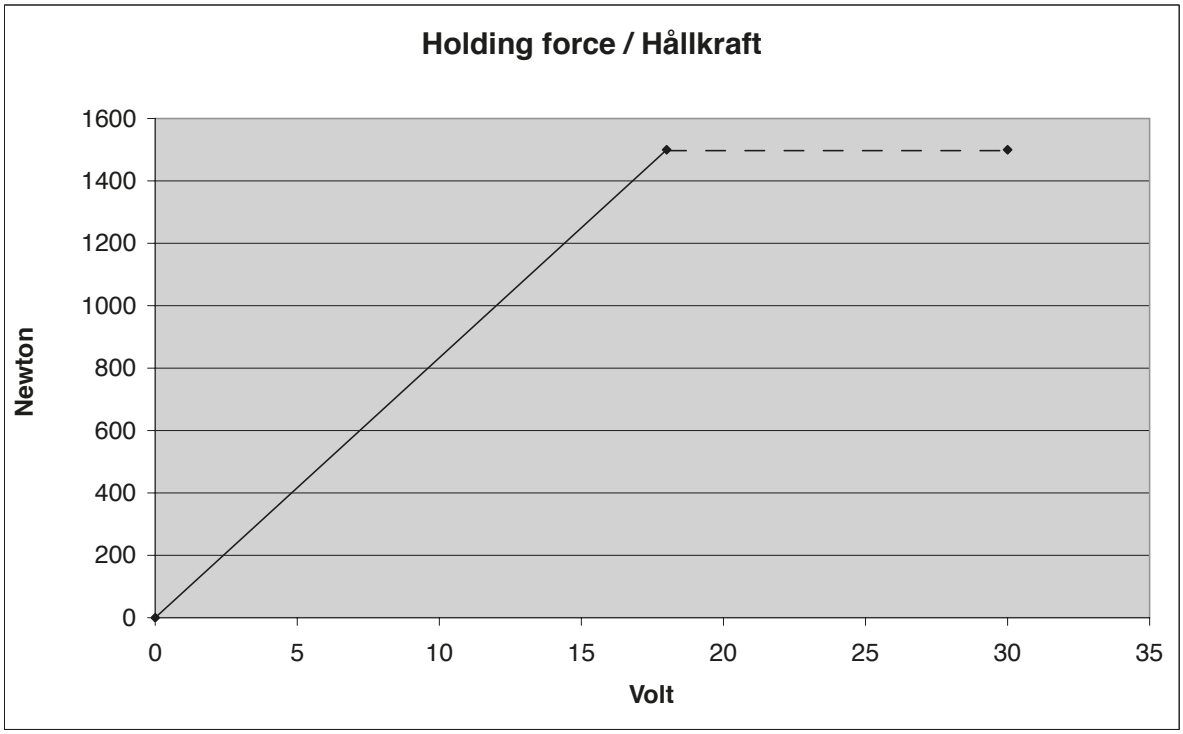


Dimensions Anchor plate 32B/34B (with permanent magnet)

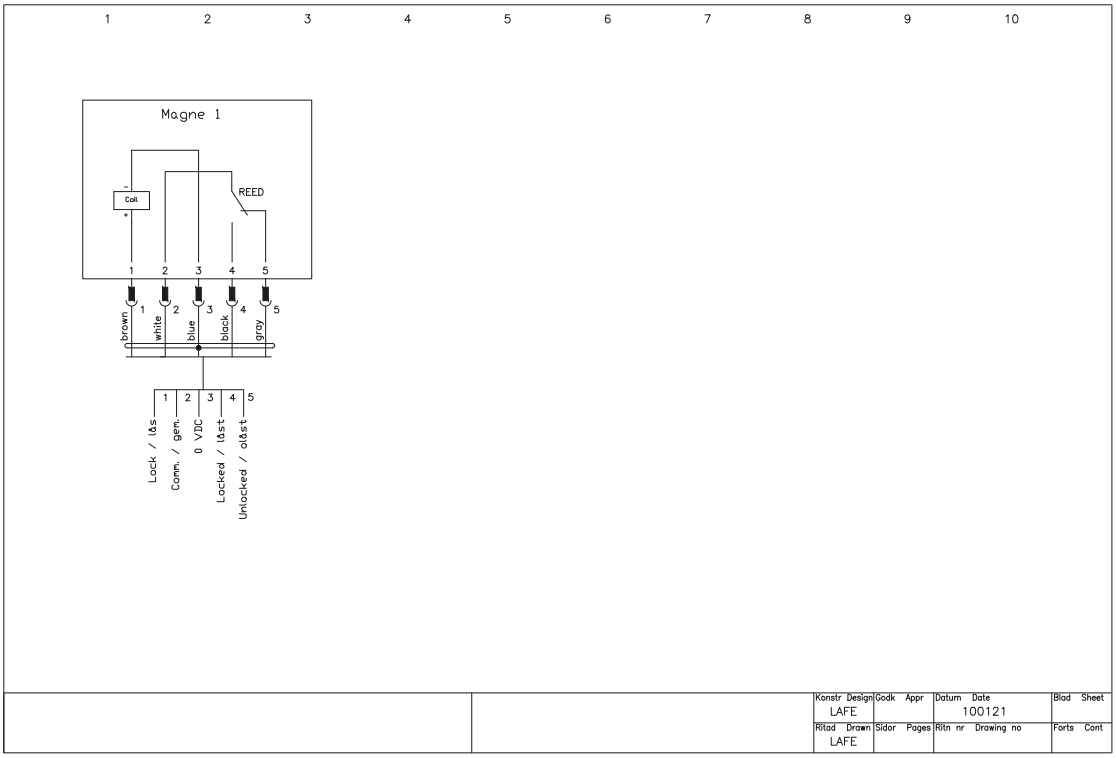
NOTE!
All dimensions are in mm

Magne
Connection examples

Holding force - Magne 1 and 2



Connection example - Magne 1



Notes

Safety Interlock Switch
MKey5

Approvals:

Application:

- Gates
- Hatches

Features:

- 2NC + 1NO (actuator in)
- 4 actuating positions
- Holding force 12 or 40N
- Up to PL e/Cat.4
- Plastic, Plastic with stainless steel head or stainless steel

5

Switch operational description

MKey5 Interlock switches are designed to provide position interlock detection for moving guards. They are designed to fit the leading edge of sliding, hinged or lift off machine guards. The actuator is fitted to the moving part of the guard and is aligned to the switch entry aperture.

The head can be rotated to provide four given actuator entry positions. When the actuator is inserted into the switch the safety contacts close and allow the machine start circuit to be enabled. MKey5 has two versions regarding holding force, 12N and 40N. MKey5 has several types of actuators as an option.

Material

Depending on the environment where the switch will be used, different material can be chosen on the Mkey5. The basic version is in a full plastic body (polyester) and in cases where the demands are higher on the interlock switch head, there is a version with a plastic body and with a stainless steel head. Both these types give the MKey5 interlock switch a rating of IP67.

In harsh applications as for food processing and chemical industry there is a MKey5Z Interlock switch with a total rugged stainless steel 316 body. This version has IP69K enclosure protection (maintained by a double seal lid gasket) and can be high pressure hosed with detergent at high temperature.

Positive forced disconnected contacts

A positive forced contact provides a forced disconnect of the safety contacts at the withdrawal of the actuator. The design of the MKey5 ensures that the contacts will not fail or be held in a normally closed position, due to failure of the spring mechanism or that welding/sticking of the contacts can occur.

Safety level

The positive forced disconnect contacts gives a high safety level and the interlock switch has an anti-tamper mechanism. By combining the MKey5 with one of our suitable safety control module, for example a safety relay from the RT-series, Pluto safety-PLC or Vital module, the requirements for both hatch and gate switch supervision can be fulfilled. To obtain the highest level of safety, two switches per gate are required.

Explosion Proof version (X)

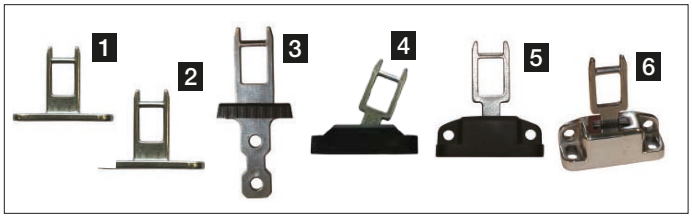
MKey5 also exist in versions with certified explosion proof contact block (X-versions). MKey5ZX is in stainless steel and can be used in European Zone 1, 2, 21,22 environments (Gas and Dust). Preassembled with 3 meter cable.

Regulations and Standards

The MKey5 is designed and approved in accordance to relevant standards. Examples of relevant standards are EN 1088, IEC/EN 60947-5-1, EN 60204-1, EN ISO 13849-1, EN 62061 and UL 508.

Technical data – MKey5 series

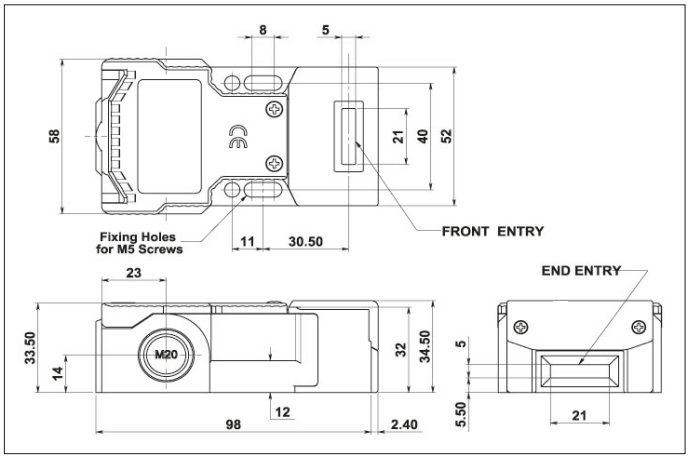
Article number	
Standard	
MKey5 - 12N STD Key	2TLA050003R1100
Level of safety	
EN ISO 13849-1	Up to PL e/Cat. 4 depending upon system architecture
EN 62061	Up to SIL3 depending upon system architecture
Safety data	
Mechanical reliability B_{10d}	2.5 x 10^6 operations at 100mA load
Proof test interval (life)	35 years
$MTTF_d$	356 years (8 cycles per hour/24 hours per day/365 days)
Utilisation category	AC15 A300 3A
Force/travel for positive opening	6 mm
Acuator entry mini. radius	175 mm Standard Key 100 mm Flexible Key
Max. approached/withdrawal speed	600 mm/s
Actuator	Stainless steel
Mechanical life	1 million switch operations
Rated insulation/withstand voltage	500VAC / 2500VAC
Vibration resistance	IEC 68-2-6, 10-55Hz+1Hz, excursion: 0.35 mm, 1 octave/min
Contacts (actuator key inserted)	2NC + 1NO (NC are direct opening action)
Thermal current (Ith)	10A
Enclosure protection	
MKey5	IP67
MKey5Z(X)	IP69K and IP67
Operating temperature	-25°C to +80°C
Conduit entries	3 X 1/2 NPT
Material	
MKey5	Polyester or/and stainless steel 316
MKey5Z(X)	Stainless steel 316
Colour	Red or stainless steel
Mounting position	Any
Mounting bolts	Body 2 x 3/16, actuator 2 x 3/16
Explosion Proof version (X)	
Classification	Ex d IIC T6 (-20°C ≤ Ta ≤ +60°C) Gb Ex tb IIIC T85°C (-20°C ≤ Ta ≤ +60°C) Db
Rated Voltage	250V AC/DC
Rated Current	2 pole 4A 4 pole 2.5A



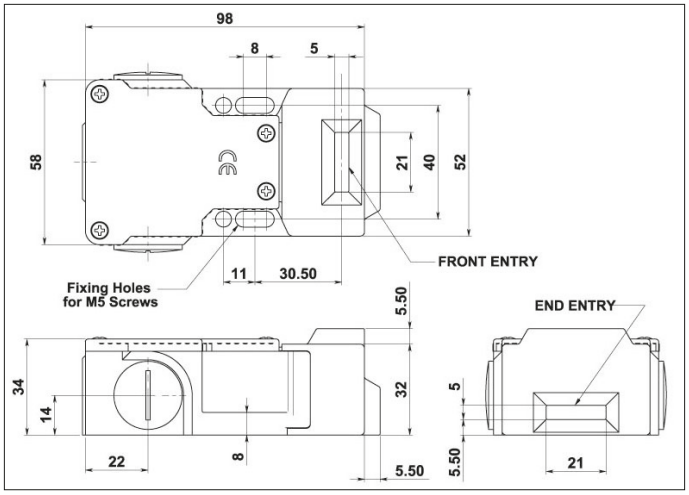
Actuator

1. Standard Key for plastic head	**2TLA050040R0201**
2. Standard Key for SS head	**2TLA050040R0202**
3. Flat Key	**2TLA050040R0220**
4. Flexible Key with plastic housing	**2TLA050040R0221**
5. Flexible Key with metal housing	**2TLA050040R0203**
6. Flexible Key with SS housing	**2TLA050040R0204**

(Key always in Stainless steel)

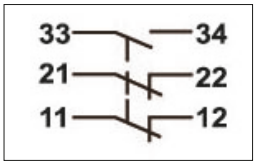


Dimension MKey5



Dimension MKey5Z

For all MKey the normally closed (NC) circuits are closed when the guard is closed (actuators inserted).



Contact block configuration 2NC, 1NO

2 NC 1 NC 6.80 6 0 mm

11/12	Open	
21/22	Open	
33/44		Open

Contacts at withdrawal of actuator

Safety Interlock Switch
MKey8

Approvals:

Application:

- Gates
- Hatches

Features:

- Robust design
- 8 actuating positions
- High holding force
- Up to PL e/Cat.4
- Painted metal or stainless steel
- LED status indication

Switch operational description

MKey8 interlock safety switches are design to provide position interlock detection and locking for moving guards.They are designed to fit the leading edge of sliding, hinged or lift off machine guards. The actuator is fitted to the moving part of the guard and is aligned to the switch entry aperture. The possibility to lock the switch in the protective position prevents unwanted access to machinery until dangerous operations have ceased.

The locking is useful when applications include:
- processes which cannot be interrupted, such as welding.
- machinery with a long stopping procedure, such as paper machinery that requires a long braking operation.
- prevention of unauthorised access to a particular area.

The head can be set in four positions, thus providing the safety device with eight different operating positions. The leading edges of the actuator key are reinforced and beveled in order to guide it properly into the hole. The MKey8 series have been developed with a high holding force of 2000N. MKey8 has several types of actuators as an option.

Material

Depending on the environment where the switch will be used, different material can be chosen for the Mkey8. The basic version has a rugged die cast housing with a rating of IP67.
In harsh applications as for food processing and chemical industry there is a MKey8 Interlock switch with a total rugged stainless steel 316 body. This version has IP69K enclosure protection (maintained by a double seal lid gasket and seals) and can be high pressure hosed with detergent at high temperature.

Two ways to interlock

The MKey8 is available in two basic versions, either with a spring lock or an electro-magnetic lock.

In the spring lock version, the locking mechanism moves into the locked position directly when the door is closed and the actuator key is pushed into the switch. The actuator key can only be released and the gate opened by supplying operational voltage to the solenoid (A1-A2). The MKey8 also has an emergency rear release ‘unlocking’ facility to enable the actuator key to be released without the energisation of the solenoid (A1-A2). This version is called MKey8ER.

MKey8M is the electro-magnetic lock version, the locking mechanism is only in the locked position when the solenoid (A1-A2) is supplied with operating voltage. Release of the actuator key is only possible when the operating voltage is removed from the solenoid (A1-A2). The solenoid voltage can be 24 VDC or 230 VAC depending on choice.

Safety level,

The MKey8 has double forced disconnection contacts connected to the actuator key and the locking mechanism. The actuator key is designed to protect against unauthorised access; no tools, magnets or similar allow that the MKey8 can be tampered with. To achieve highest safety level in connection with the machine control system, it is recommended that the MKey8 is monitored by an appropriate ABB Jokab Safety safety relay, Pluto safety-PLC or Vital system. To obtain the highest level of safety, two switches per gate are required.

MKey8, MKey8M and MKey8Z

MKey8 -Standard version with spring lock

The version of MKey8 with die cast housing and spring lock. The switch has a contact block configuration of 2NC + 2NC with positive force disconnection contacts. One pair closes when the actuator key is pushed into the head (2NC). The other pair closes when the locking mechanism is in the locked position (2NC). There are two NO auxiliary circuits, 1NO circuit with indication of guard open and another 1NO circuit with indication of lock status.

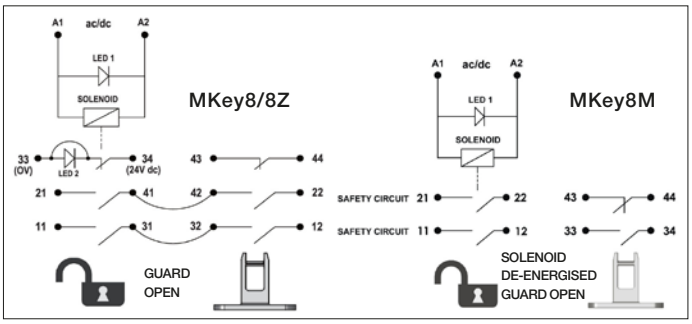
MKey8Z - Stainless Steel version with spring lock

The version of MKey8 with rugged stainless steel housing and spring lock. The switch has a contact block configuration of 2NC + 2NC with positive force disconnection contacts. One pair closes when the actuator key is pushed into the head (2NC). The other pair closes when the locking mechanism is in the locked position (2NC). There are two NO auxiliary circuits, 1NO circuit with indication of guard open and another 1NO circuit with indication of lock status.

MKey8M - Power to lock version with magnetic lock

The version of MKey8 with die cast housing and magnetic lock. The switch has a contact block configuration of 2NC + 1 (NC + NO) with positive force disconnection contacts. One pair closes when the actuator key is pushed into the head (1NC + 1NO). The other pair closes when the locking mechanism is in the locked position (2NC). A 1NO/1NC circuit gives an indication of actuator status.

MKey8 MKey8M MKey8Z



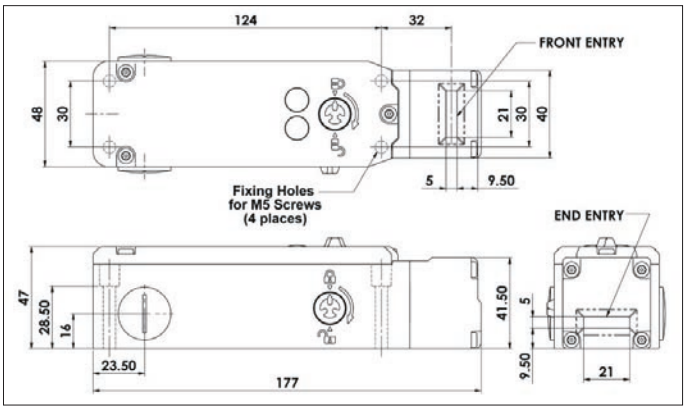
Schematic circuit: LED1 status of solenoid, LED2 status of lock (Terminals 33 - 34 are selectable to be used either as power feed to LED2 or as a voltage free auxiliary circuit to indicate lock status).

	6.0	5.0	0 mm
11/12	Open		
21/22	Open		
33/44		Open	
43/44		Open	

MKey8/8Z, Contacts at withdrawal of actuator.

	6.0	5.0	0 mm
11/12	Open	Solenoid energised	
21/22	Open	Solenoid energised	
33/34	Open	Tongue Inserted	
43/44		Open	Tongue Inserted

MKey8M, Contacts at withdrawal of actuator.



Dimensions MKey8, MKey8M and MKey8Z

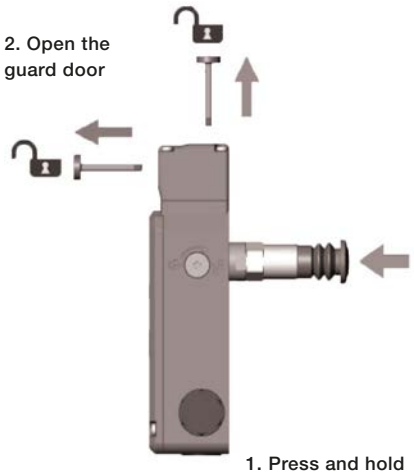
MKey8ER

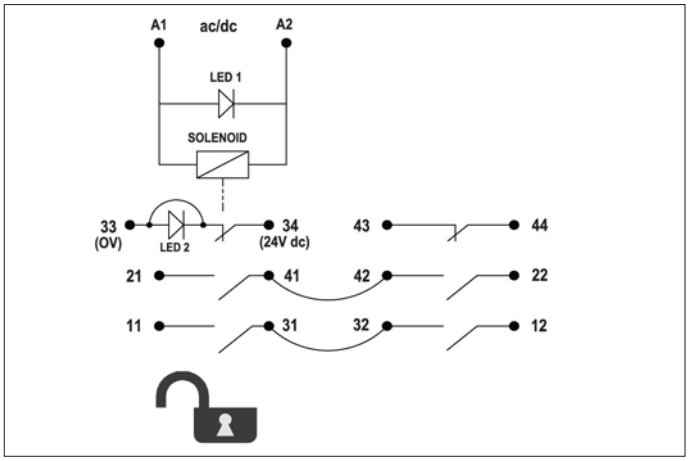
MKey8ER - Standard version with escape release

The version of MKey8 with die cast housing and spring lock with escape release. The switch has a contact block configuration of 2NC + 2NC with positive force disconnection contacts. One pair closes when the actuator key is pushed into the head (2NC). The other pair closes when the locking mechanism is in the locked position (2NC). There are two NO auxiliary circuits, 1NO circuit that indicates guard open and 1NO circuit that indicates lock status.

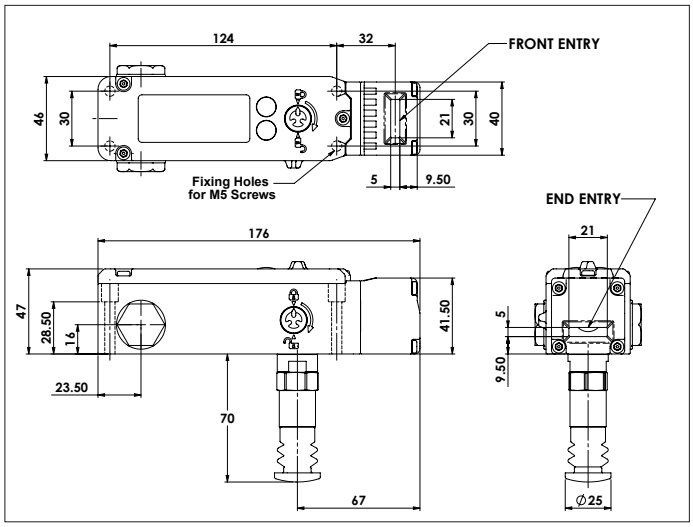
Features

The MKey8ER has manual release button at the rear of the housing. This can be used where the risk assessment for the application permit, a non latching manual escape of the switch lock in case of emergency. The switch must be mounted so that the release button is reachable from inside the active guard area. Press and holding the red button will release the lock mechanism and lock monitoring contacts while the guard can be pushed open.





LED1 status of solenoid LED2 status of lock (terminals 33-34 are selectable to be used either as power feed to LED2 or as a voltage free auxiliary circuit to indicate lock status).



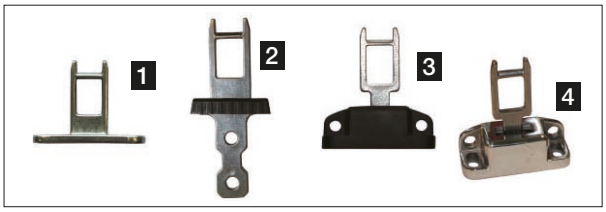
Dimensions MKey8ER

Technical data – MKey8 series

Article number	
MKey8 - Standard	
MKey8 - 24 STD Key	2TLA050011R1132
MKey8M - Power to Lock	
MKey8M - 24 VDC STD Key	2TLA050013R1132
MKey8ER - Escape release	
MKey8ER - 24 VDC STD Key	2TLA050015R1132
Level of safety	
EN ISO 13849-1	Up to PL e/Cat. 4 depending upon system architecture
EN 62061	Up to SIL3 depending upon system architecture
Safety data	
Mechanical reliability B_{10d}	2.5 x 10^6 operations at 100mA load
	35 years
Proof test interval (life)	356 years (8 cycles per hour/24
$MTTF_d$	hours per day/365 days)
Utilisation category	AC15 A300 3A
Solenoid voltage (by part number)	24 VDC or 230 VAC, +/- 10%
Solenoid power consumption	12 W (MKey8M inrush 50 W)
LED 2 supply voltage	24 VDC, +/- 10%
	(MKey8, MKey8ER, MKey8Z)
Travel for positive opening	10 mm
Actuator entry mini. radius	175 mm Standard Key
	100 mm Flexible Key
Max. approached/withdrawal speed	600 mm/s
Rated insulation/withstand voltages	600VAC / 2500VAC
Vibration resistance	IEC 68-2-6, 10-55 Hz+ 1 Hz
	excursion: 0.35 mm
	1 octave/min.
Thermal current (Ith)	5A
Enclosure protection	
MKey8/M/ER	IP67
MKey8Z	IP69K and IP67
Operating temperature	
MKey8	-25°C to +55°C
MKey8M	-25°C to +40°C
MKey8ER	-25°C to +55°C
MKey8Z	-25°C to +55°C
Conduit entries	3 x 1/2 NPT
Material	
MKey8/M/ER	Die cast painted red
MKey8Z	Stainless steel 316
Colour	Red or stainless steel
Mounting position	Any
Mounting bolts	4 x 3/16

Regulations and Standards

The MKey8 is designed and approved in accordance to relevant standards. Examples of relevant standards are EN 1088, IEC/EN 60947-5-1, EN 60204-1, EN ISO 13849-1, EN 62061 and UL 508.



Actuator

1. Standard Key for SS head	**2TLA050040R0202**
2. Flat Key	**2TLA050040R0220**
3. Flexible Key with metal housing	**2TLA050040R0203**
4. Flexible Key with SS housing (Key always in Stainless steel)	**2TLA050040R0204**

Manual release key for MKey8Z 2TLA050040R0400

Top or side manual release points (not on MKey8M)

8 actuators entry positions rotatable head

Safety Interlock Switch
MKey9

Approvals:

Application:

- Gates
- Hatches

Features:

- Compact and robust
- 8 actuating positions
- High holding force
- Up to PL e/Cat.4
- LED status indication

Switch operational description

The MKey9 interlock safety switches are design to provide position interlock detection and locking for moving guards. They are designed to fit the leading edge of sliding, hinged or lift off machine guards. The actuator is fitted to the moving part of the guard and is aligned to the switch entry aperture. The possibility to lock the switch in the protective position prevents unwanted access to machinery until dangerous operations have ceased.

The locking is useful when applications include:
- processes which cannot be interrupted, such as welding.
- machinery with a long stopping procedure, such as paper machinery, that requires a long braking operation.
- prevention of unauthorised access to a particular area.

The head can be set in four positions, thus providing the safety device with eight different operating positions. The leading edges of the actuator key are reinforced and bevelled in order to guide it properly into the hole. The safety switch is design to have a high holding force of 2000N. MKey9 has several types of actuators as an option.

Material

The MKey9 is made in a rugged polyester housing with a stainless steel head which give the switch a rating of IP67.

Two versions

The MKey9 is available in two basic versions, either with a spring lock or an electro-magnetic lock.

In the spring lock version, the locking mechanism moves into the locked position directly when the door is closed and the actuator key is pushed into the switch. The actuator key can only be released and the gate opened by supplying operational voltage to the solenoid (A1-A2).

MKey9M is the electro-magnetic lock version, the locking mechanism is in the locked position when the solenoid (A1-A2) is supplied with operating voltage. Release of the actuator key is only possible when the operating voltage is removed from the solenoid (A1-A2). The solenoid voltage is 24VDC.

Safety level

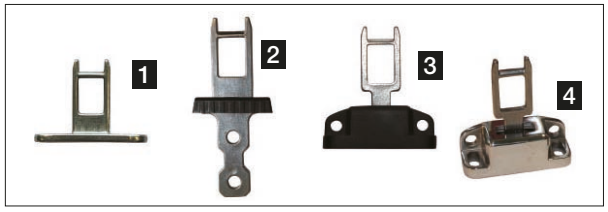
The MKey9 has double forced disconnection contacts to the actuator key and the locking mechanism. The actuator key is designed to protect against unauthorised access; no tools, magnets or similar allow that the MKey9 can be tampered with. To achieve maximum safety level in connection with the machine control system, it is recommended that the MKey9 is monitored by an appropriate ABB Jokab Safety safety relay, Pluto safety-PLC or Vital system. To obtain the highest level of safety, two switches per gate are required.

Regulations and Standards

The MKey9 is designed and approved in accordance to relevant standards. Examples of relevant standards are EN 1088, IEC/EN 60947-5-1, EN 60204-1, EN ISO 13849-1, EN 62061 and UL 508.

Technical data – MKey9 series

Article number	
MKey9 - 24VDC STD Key	2TLA050007R1112
MKey9M - 24VDC STD Key (power to lock)	2TLA050009R1112
Level of Safety	
EN ISO 13849-1	Up to PL e/Cat. 4 depending upon system architecture
EN 62061	Up to SIL3 depending upon system architecture
Safety data	
Mechanical reliability B_{10d}	2,5 x 10^6 operations at 100mA load
	35 years
Proof test interval (life)	356 years (8 cycles per hour/24 hours per day/365 days)
$MTTF_d$	
Utilisation category	AC15 A300 3A
Solenoid voltage	24 VDC or 230 VAC, +/- 10%
Solenoid power consumption	
MKey9	12 W
MKey9M	12 W (Inrush 50W)
LED 2 supply voltage	24 VDC, +/- 10%
Travel for positive opening	10 mm
Actuator entry mini. radius	175 mm Standard Key 100 mm Flexible Key
Max. approached/withdrawal speed	600 mm/s
Rated insulation/withstand voltages	600VAC / 2500VAC
Vibration resistance	IEC 68-2-6, 10-55 Hz+ 1 Hz excursion: 0.35 mm 1 octave/min.
Thermal current (Ith)	5A
Conduit entry	1 x 1/2 NPT
Enclosure classification	IP67
Operating temperature	
MKey9	-25°C to +55°C
MKey9M	-25°C to +40°C
Head/body material	Stainless steel 316/polyester
Colour	Red
Mounting position	Any
Mounting bolts	4 x 3/16

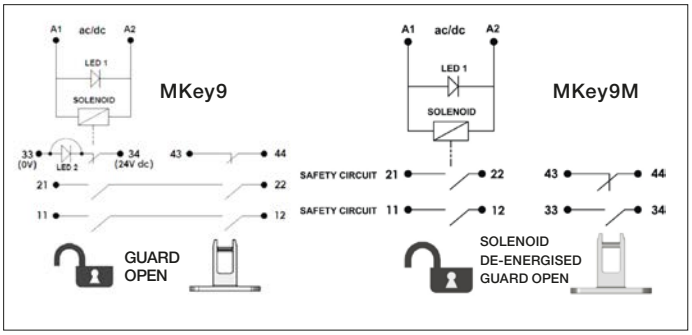


Actuator

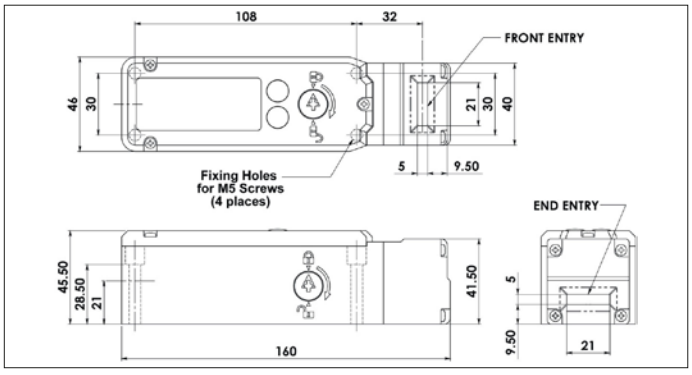
1. Standard Key for SS head	**2TLA050040R0202**
2. Flat Key	**2TLA050040R0220**
3. Flexible Key with metal housing	**2TLA050040R0203**
4. Flexible Key with SS housing	**2TLA050040R0204**
(Key always in Stainless steel)	

Top or side manual release points (not on MKey9M)

8 actuator entry positions rotatable head



Schematic circuit MKey9 LED1 status of solenoid LED2 status of lock (Terminals 33 - 34 are selectable to be used either as power feed to LED2 or as a voltage free auxiliary circuit to indicate lock status).



Dimensions MKey9 and MKey9M

	6.0	5.0	0 mm
11/12	Open		
21/22	Open		
33/34			Open
43/44			Open

MKey9, Contacts at withdrawal of actuator.

	6.0	5.0	0 mm
11/12	Open		Solenoid energised
21/22	Open		Solenoid energised
33/34	Open		Tongue Inserted
43/44		Open	Tongue Inserted

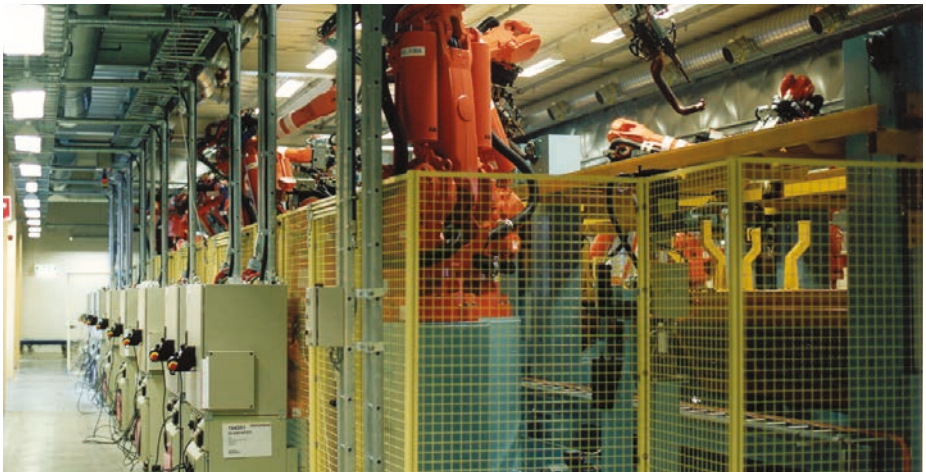
MKey9M, Contacts at withdrawal of actuator.


ABB
JSTD25H
ABB
JSHD4

Control devices

Why should Control Devices be used?

-for the machine operator to be able to directly start and stop dangerous machine movement.



Ergonomic three-position device, JSHD4 with double three-position button that gives a stop signal when released or fully pressed in.

In an emergency situation the operator can either press harder or release the three-position device to stop the machine.

Three-position device

Three-position devices, hold-to-run devices and enabling devices are used during trouble-shooting, programming and test running when no other safety components are possible or suitable. The device is held in the hand and the operator can in an emergency situation either press harder or entirely release the device to stop the machine.

Three-position devices in different versions

Three-position device fitted to a machine control unit.

Panel assembly of JSHD4H2 on a programming unit for robots.

Two-hand control device

A two-hand control device is used when it is necessary to ensure that the operator's hands will be kept outside the risk area. If there is a risk that someone else other than the operator can reach into the machine without the operator seeing it, the safety device must be supplemented by something more, e.g. a light beam.

To be able to operate the machine with the two-hand device, all the buttons on the device have to be operated within 0.5 seconds of each other. This is called concurrence. All the buttons also have to be returned to their initial position before one can start again. If any button is released during the machine movement the machine will be stopped. Using the stopping time one can calculate the necessary safety distance. A safety distance of less than 100 mm must not be used.

The highest safety level is assured by connecting the buttons of the two-hand device to a safety relay. The safety relay checks for concurrence and that all the buttons have returned to their initial position before a new start can be made. The safety relay also gives a stop signal if any of the buttons are released.

The two-hand device protects against "after-grasp"; if the operator by reflex tries to enter or reach into a machine during the dangerous machine movement.

Two-channel all the way out to the hand
Safeball is an ergonomic two-hand control device with four built-in buttons.

Foot operated switches

A foot operated switch is used when the operator has to hold the material during processing. The pedal must have a safety cover to prevent unintentional start. For seated work one must also have a foot support to facilitate the operator holding his foot in the pedal´s off position.

The highest safety level is secured by monitoring the pedal with a safety relay.

The foot operated switch is used when the operator has to hold the material with both hands during processing.

Safety foot operated switch with three-position function.

Three position device
JSHD4

Approvals:

Use:

- Troubleshooting
- Test running
- Programming

Features:

- Ergonomic
- LED information
- Adaptable
- Cheat Safe (option)
- Available for AS-i

The safest solution during trouble shooting, programming and testing

Why three-positions?

An operator who is under pressure must be able to give a stop signal, whether in panic he/she pushes harder on the button or just lets go of it.

Three-position devices, hold-in and acceptance devices can be used for trouble shooting, programming and test running in situations where no other protection is available or feasible. If the operator has to enter a risk area to trouble shoot or run a test, it is extremely important that he/she is able to stop the machinery without having to rely on someone else to stand by a stop button that is further away. In addition, no-one else should be able to start the machinery from the outside after it has been stopped by use of the three-position device.

Hold to run device or Acceptance device, what is the difference?

Hold to run device: The start signal is given when the button is pressed. The stop signal is given when the button is released or pushed fully in.
Acceptance device: The start signal for separate starting is given when the button is pressed. The stop signal is given when the button is released or pushed fully in. “Separate start” means, for example, that a program start signal is sent to the robot via a separate button in the acceptance device.

The three-position device is designed to be ergonomic

The device is ergonomic, both in respect of its shape, fitting to the hand, and the way the buttons are operated. It is easy to operate the three-position device using just the fingers, and the middle position provides a secure resting position. The device has LED indications that show the operational status, i.e. stop or ready signal. The two additional buttons can be used, for example, for start/stop, up/down or forward/back. Internally the device is duplicated. The three-position function itself is built up of two completely independent three-position buttons which are felt by the user to be one button.

Cheat Safe three-position device with hand recognition

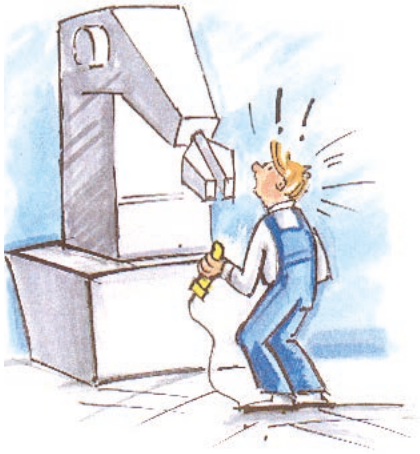
The three-position device JSHD4 has sensors which ensure that it is a human hand holding it. By using this, the safety level is increased, and the risk of manipulation or bypass of the safety function is reduced. It is no longer possible to expose the operator to danger by trying to lock the three-position device in run mode.

Three-position device adapted for AS-i

The three-position device JSHD4 also comes in a version adapted for direct attachment to the AS-i bus.

Highest safety level whether the button is pushed or released

When the three-position button is released you will obtain a dual stop. It is essential that the machine stops when you put aside the three-position device, for example during adjustment.



When the three position button is pushed all the way in you will obtain a dual stop. It is essential that the machine stops in an emergency situation.

How does a a three-position device work?

Safety level

A safe Enabling or “Hold to Run” device should function as follows:

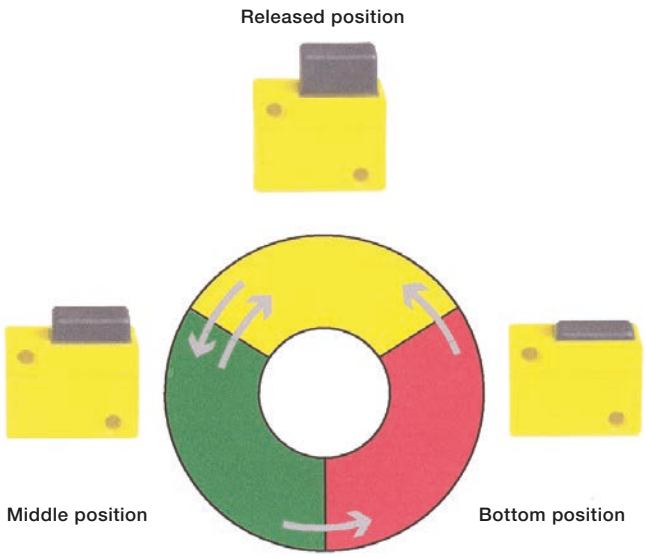
1.The Stop signal in released (top) and bottom position shall have the same safety level.

2. Provide a ‘Start’ or ‘Ready’ signal in a distinct middle position.

3. After a ‘Stop’ in the bottom position, a ‘Start’ signal or ‘Ready’ signal is not permitted until the three position push-buttons have been totally released and again pressed to the middle position. This function is achieved mechanically within the three position push-buttons in the device.

4. A Short or Open circuit in the connection cables shall not lead to a dangerous function e.g. ‘Start’ or ‘Ready’ signal.

In order to meet the above conditions, the three-position switch must be connected to a suitable safety relay with a two channel function, or Safety PLC, which can monitor that both three-position buttons are working and that there is no short or open circuit in the connection cable or the switch.



Regulations and standards

The JSHD4 is designed and approved in accordance with appropriate directives and standards. See technical data.

Design a three-position device for your needs

1. Choose between five different top units

JSHD4-1
2TLA020006R2100

JSHD4-2
2TLA020006R2200
- LEDs
- Front button
- Top button

JSHD4-3
2TLA020006R2300
- LEDs

JSHD4-4
2TLA020006R2400
- LEDs
- Front button

JSHD4-5
2TLA020006R2500
- LEDs
- Top button

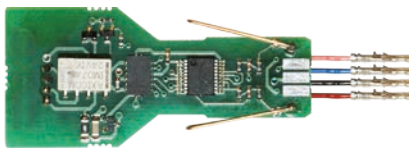
2. Choose a bottom part suitable for your assembly

AA 2TLA020005R1000 with cable gland
AH 2TLA020005R1700 with cable gland and PCB with 10 screw connections
AJ 2TLA020005R1800 with cable gland and PCB with 16 screw connections

AB 2TLA020005R1100 with Cannon connection

AC 2TLA020005R1200 with M12 connection (5 poles)
AD 2TLA020005R1300 with M12 connection (8 poles)

3. Choose hand recognition for making your three position device cheat protected (option)



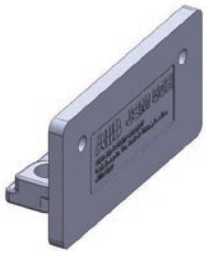
Anti-tamper PCB
2TLA020005R0900

4. Check the table if your combination is available

	JSHD4-1	JSHD4-2	JSHD4-3	JSHD4-4	JSHD4-5
AA without Cheat Safe	JSHD4-1-AA	–	–	–	–
AA with Cheat Safe	–	–	–	–	–
AB without Cheat Safe	–	JSHD4-2-AB	JSHD4-3-AB	JSHD4-4-AB	JSHD4-5-AB
AB with Cheat Safe	–	JSHD4-2-AB-A	JSHD4-3-AB-A	JSHD4-4-AB-A	JSHD4-5-AB-A
AC without Cheat Safe	JSHD4-1-AC	–	–	–	–
AC with Cheat Safe	–	–	–	–	–
AD without Cheat Safe	–	JSHD4-2-AD	JSHD4-3-AD	JSHD4-4-AD	JSHD4-5-AD
AD with Cheat Safe	–	JSHD4-2-AD-A	JSHD4-3-AD-A	JSHD4-4-AD-A	JSHD4-5-AD-A
AE without Cheat Safe	–	–	JSHD4-3-AE	–	–
AE with Cheat Safe	–	–	–	–	–
AH without Cheat Safe	–	JSHD4-2-AH	JSHD4-3-AH	JSHD4-4-AH	JSHD4-5-AH
AH with Cheat Safe	–	JSHD4-2-AH-A	JSHD4-3-AH-A	JSHD4-4-AH-A	JSHD4-5-AH-A
AJ without Cheat Safe	–	JSHD4-2-AJ	JSHD4-3-AJ	JSHD4-4-AJ	JSHD4-5-AJ
AJ with Cheat Safe	–	JSHD4-2-AJ-A	JSHD4-3-AJ-A	JSHD4-4-AJ-A	JSHD4-5-AJ-A

5. Choose a bottom plate (option)

JSM50G, bottom plate for Safety Interlock switch MKey5/JSNY5
2TLA020205R6300

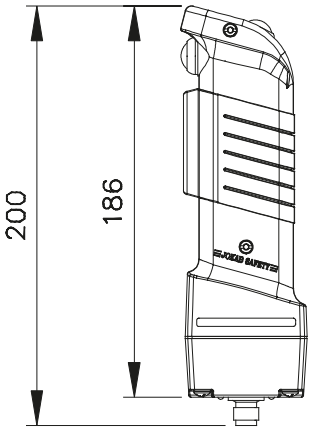


JSM50H, bottom plate for non-contact sensor Eden (Eva)
2TLA020205R6400

Technical data - JSHD4

Level of safety	
EN ISO 13849-1	PL e/Cat. 4
Electrical rating	
Three-position button	Maximum 30 VDC, 20mA
	(Minimum 10 VDC, 8mA)
Extra button	Maximum 50 VAC/VDC 0.2A
Protection class	IP65
Operating temperature	-10 to +50° C
Function indication	
Three-position buttons ready signal	`Yes´, green LED
	`No´, red LED
Material	
Handle	Polyamide and Noryl
Rubber	Neoprene
Operation force	Approx. 15 N for three-position buttons (ON)
	Approx. 45 N for three-position buttons (OFF)
	Approx. 25 N for top/front push button
Mechanical life	1 000 000 cycles to middle position
Conformity	EN ISO 1200-1:2010, EN ISO 13849-1:2008, EN 60204-1:2006+A1:2009

Cabel with Cannon connector		Cabel with M12 connector		
Pin	12 conductors	Pin	8 conductors	5 conductors
A	White	1	White	Brown
B	Brown	2	Brown	White
C	Green	3	Green	Blue
D	Yellow	4	Yellow	Black
E	Grey	5	Grey	Grey
F	Pink	6	Pink	-
G	Blue	7	Blue	-
H	Red	8	Red	-
J	Black			
K	Purple			
L	Grey and Pink			
M	Red and Blue			



Accessories

Cable, available in different lengths.

JSHD4 protection coat

Spiral cable, available in different lengths.

JSHK0 12 pole connector for JSHD4.

JSM5B Wall bracket for interlock switches and three-position device.

JSM55 Wall bracket for three-position device.

JSHD4
Models and accessories

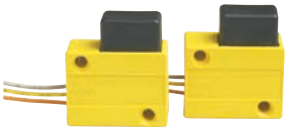
Accessories

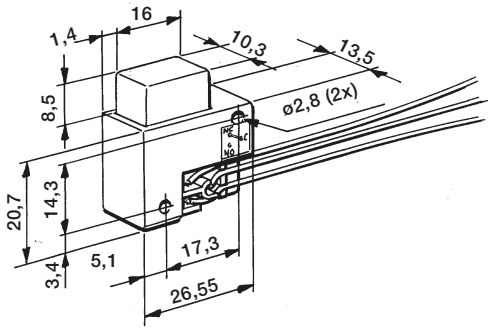
	Article number
Connectors:	
M12-C01 M12 5-pole female, straight	2TLA020055R1000
M12-C03 M12 8-pole female, straight	2TLA020055R1600
JSHK0 12-pole cannon female connector for JSHD4	2TLA020003R0300
Cable with 5 conductors:	
C5 Cable 5 x 0.34 cut to length (meters)	2TLA020057R0000
M12-C101 10 m cable and M12 female connector	2TLA020056R1000
M12-C201 20 m cable and cannon female connector	2TLA020056R1400
Cable with 8 conductors:	
C8 Cable 8 x 0.34 cut to length (meters)	2TLA020057R1000
M12-C103 10 m cable and M12 female connector	2TLA020056R4000
M12-C203 20 m cable and M12 female connector	2TLA020056R4100
Cable with 12 conductors:	
HKC12 Cable 12 x 0.25 cut to length (meters)	2TLA020003R5500
HK5 Cable 5 m and cannon female connector	2TLA020003R4700
HK10 Cable 10 m and connector	2TLA020003R4800
HK20 Cable 20 m and connector	2TLA020003R4900
HK16S4 spiral cable 1.6 m and cannon female connector	2TLA020003R5000
HK20S4 spiral cable 2.0 m and cannon female connector	2TLA020003R5100
HK32S4 spiral cable 3.2 m and cannon female connector	2TLA020003R5200
HK40S4 spiral cable 4.0 m and cannon female connector	2TLA020003R3500
HK60S4 spiral cable 6.0 m and cannon female connector	2TLA020003R3600
HK80S4 spiral cable 8.0 m and cannon female connector	2TLA020003R5300
Brackets:	
JSM55 Wall bracket for three position device	2TLA040005R0500
JSM5B Wall bracket for 2 MKey5/JSNY5	2TLA040005R0700
Others:	
JSHD4 protection coat	2TLA020200R4600

Three-position devices for different types of assembly

Three-position push button JSHD2C

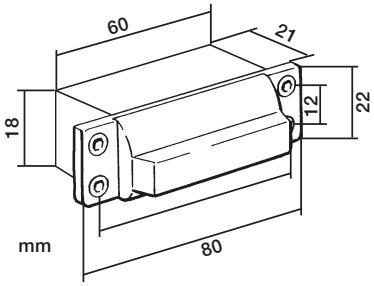
The button is the main component in a safe three-position solution. To achieve the highest safety level two buttons are used in a two-channel system.





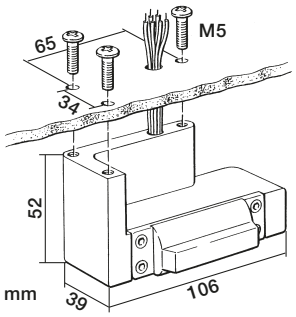
Panel assembly JSHD4H2

A panel assembly suitable for building into programming units or similar control boxes. Provides simultanous activation of both of the three-position buttons.



External assembly JSHD4H2A

The external assembly is similar to the panel assembly unit, although it is a 'handle' design making it suitable for assembly on the outside of a control box.



Standard versions

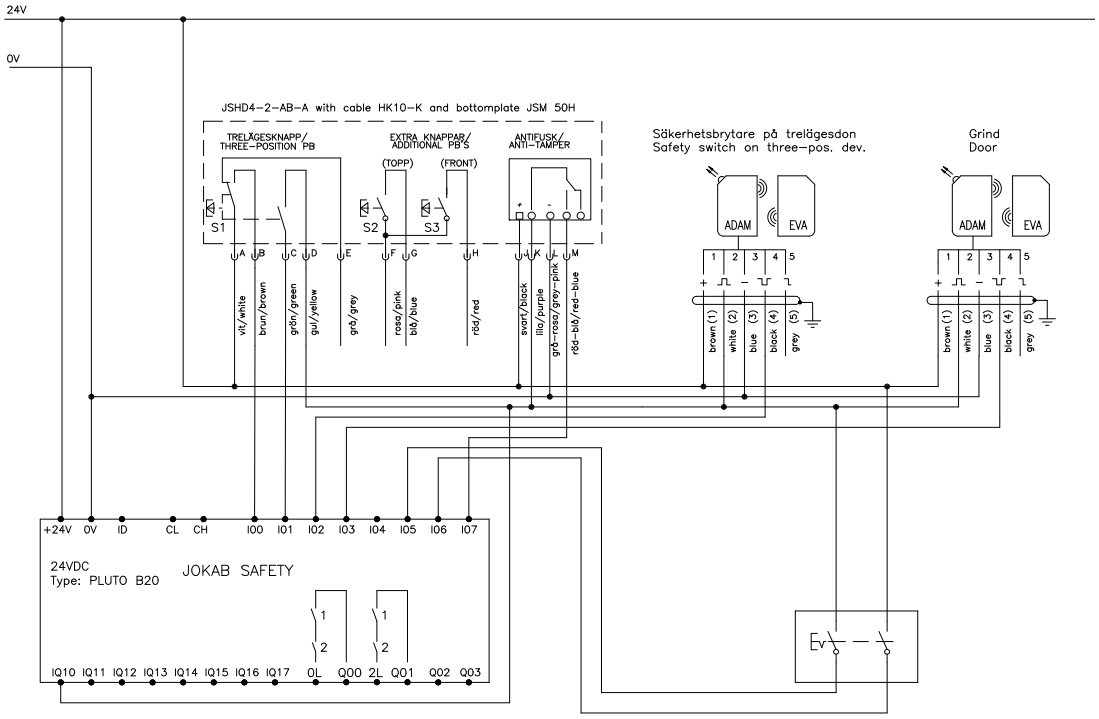
Article number	Model
2TLA020002R0200	JSHD4H2A Three-position device for external panel assembly
2TLA020002R3100	JSHD4H2 Three-position device for internal panel assembly
2TLA020001R1000	JSHD2C type E Three-position button
2TLA020001R1300	JSHD2C type K Three-position button
Complete JSHD4 with standard options are available to order separately	

JSHD4
Connection examples

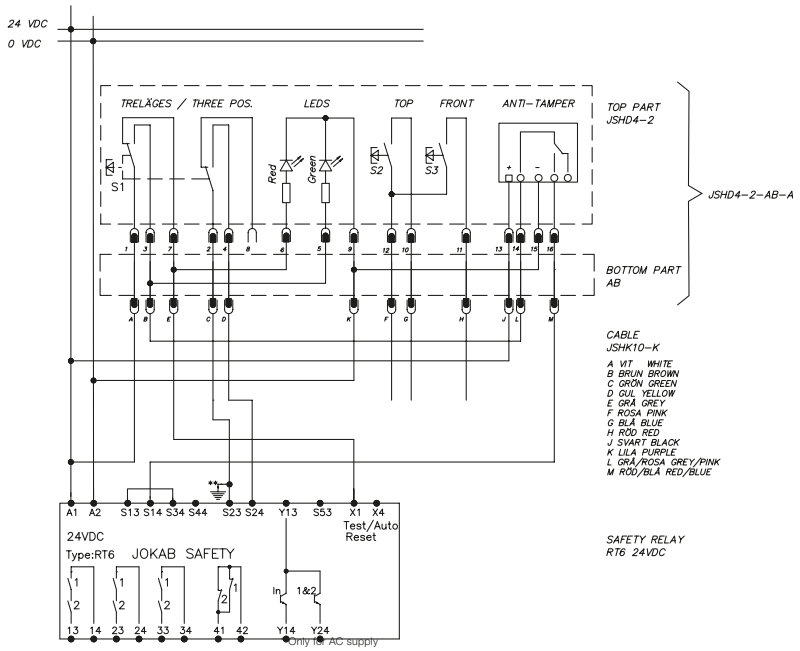
JSHD4 to Pluto

Time-limited entrance/exit

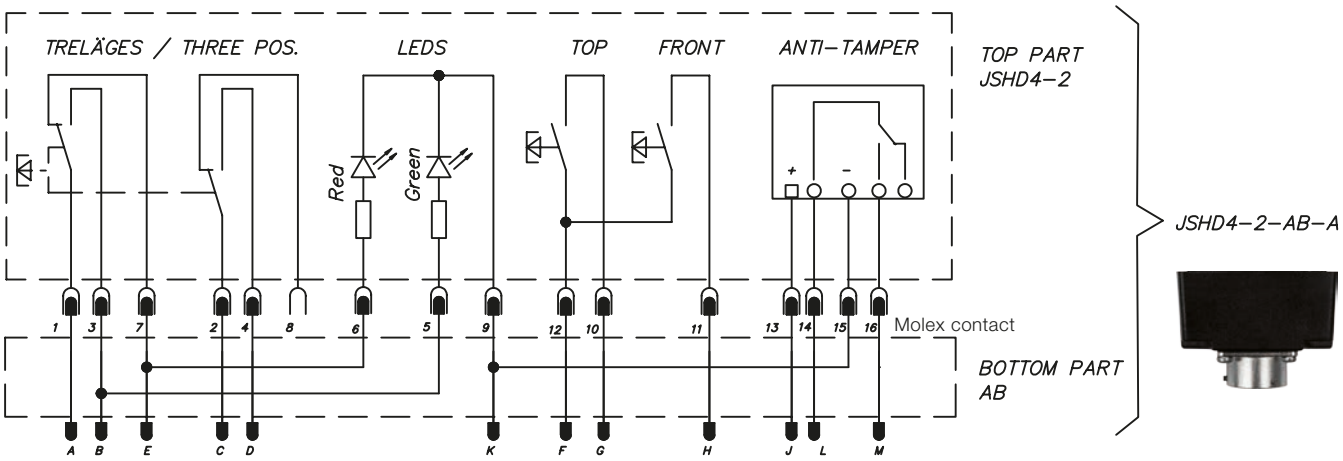
After lifting the three-position device out of it's holder the door can be opened and shut for entrance to the safety zone within X seconds. To exit zone press S3. The time is set in the Pluto programme. The device detects the operators hand and prohibits tampering.



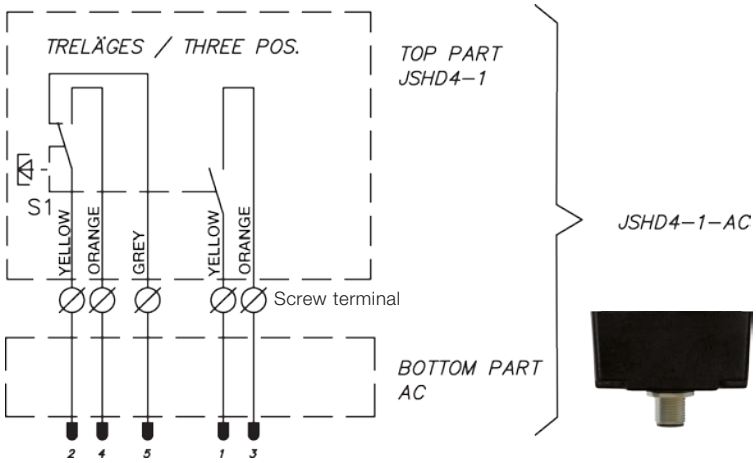
JSHD4 with various safety controllers



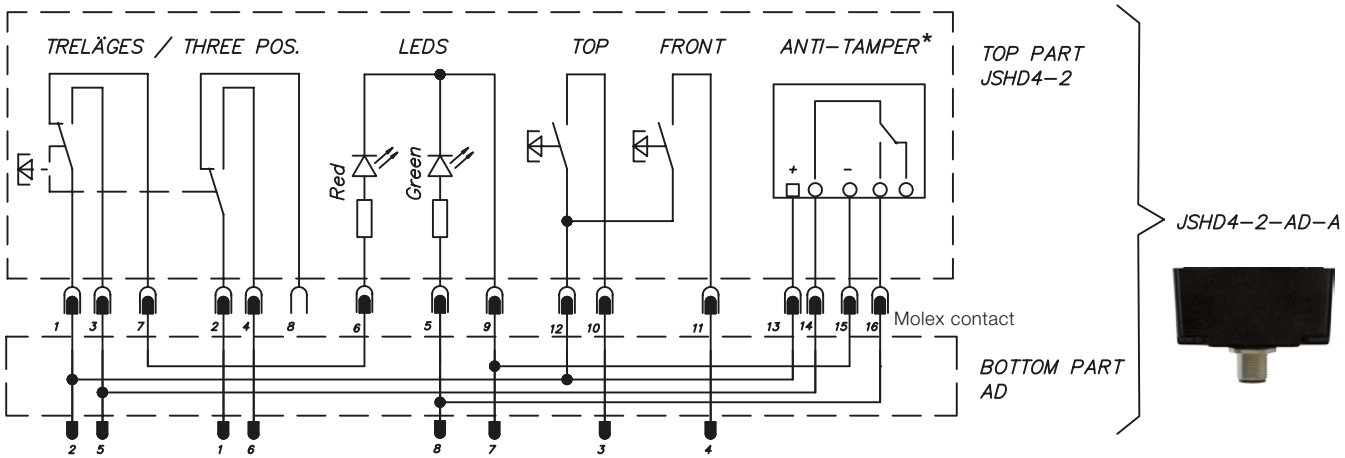
Connection with bottom parts AB



Connection with bottom parts AC

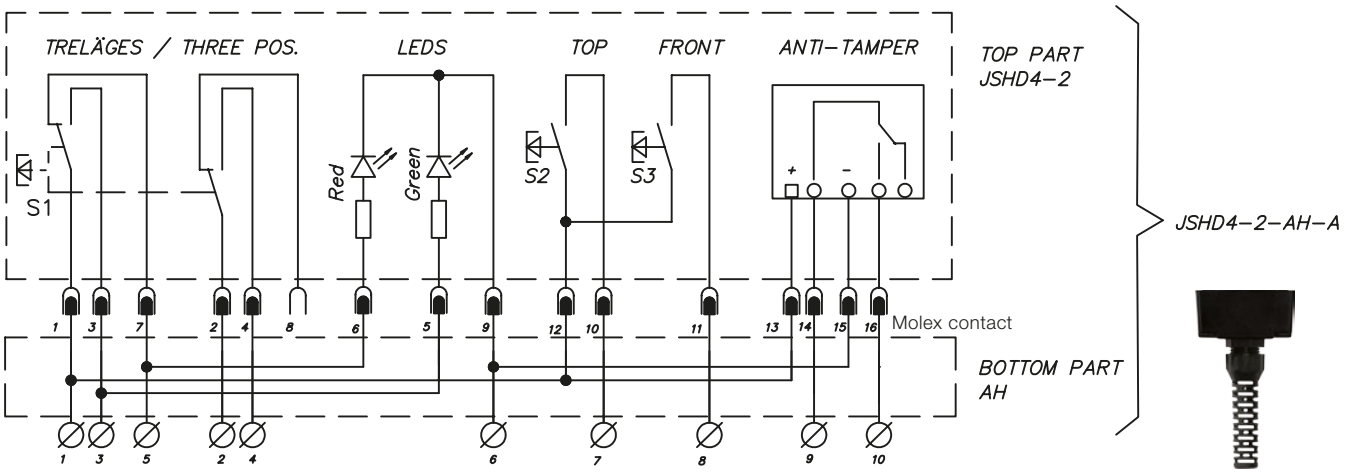


Connection with bottom parts AD

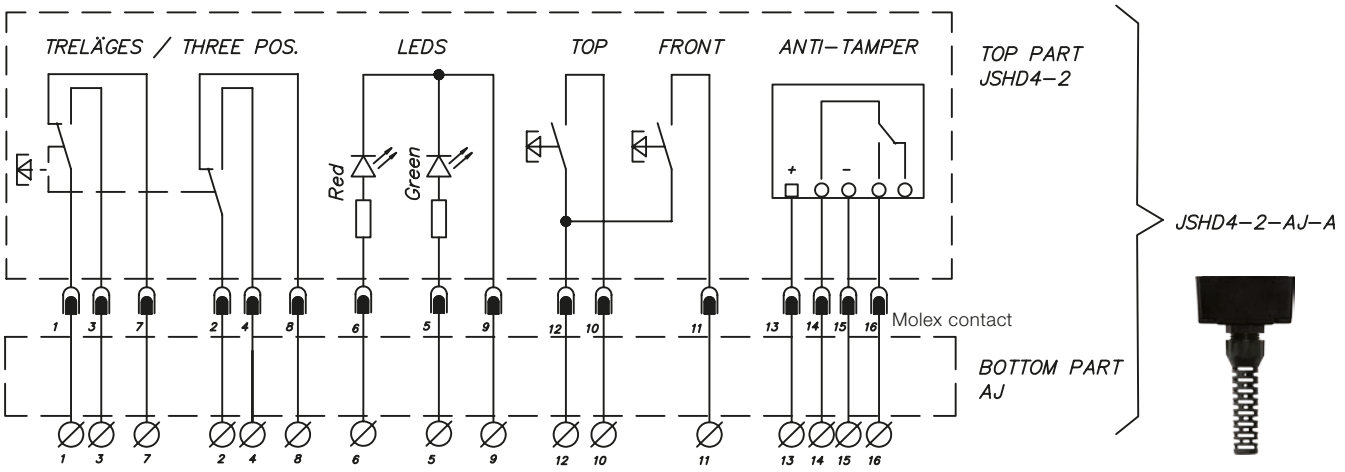


*A jump must be placed over pins 14-16 on the 2x8 Molex connector if an anti-tamper PCB is not used.

Connection with bottom parts AH



Connection with bottom parts AJ



One- and two-hand devices
Safeball™

A two-hand device which is comfortable and easy to use.

Approvals:

CE Inspecta cSAus

Safeball for:

- Presses
- Punches
- Fixtures
- Shearing machines

Features:

- Ergonomic
- Low activation force
- Flexible mounting
- Several grip possibilities
- Highest safety level
- Two channel switching in each hand

Safeball™ Unique World Wide Two-hand device

Safeball™ consists of a spherical ball containing two embedded pushbutton switches, one on each side of the ball. By using this pushbutton configuration, the risk of unintentional activation is minimised and the device is simple and ergonomic to use.

Safeball™ can be utilised for either One-hand (one Safeball™) or Two-hand (two Safeballs™) applications. In either application, and in order to meet the required level of safety, the Safeball™ switches are monitored by specified/certified ABB Jokab Safety Safety relays (see electrical connection).

In the case where Two-hand control is used, both Safeballs™ i.e. all four pushbuttons have to be activated within 0.5 seconds. If one or more pushbuttons are released a Stop signal is given to the machine. In order to provide the highest level of safety the Safeball™ design provides the operator with a dual switching function and short-circuit supervision in each hand.

Each Safeball™ is ergonomically designed and has both its cover and actuator made of environmentally-friendly polypropylene. The design allows for comfort of use for all hand sizes and operation from numerous gripping positions. Mounting of the Safeball™ is also very flexible allowing the device to be mounted in the most ergonomic position for the operator.

When can a Two-hand or One-hand control be used?

A Two-hand control can be used when it is necessary to ensure that the operator is outside and must be prevented from reaching into the hazardous area. If the operator decides, after the start signal has been given to the machine, to make an ‘after-grasp’ i.e. try to adjust the part that has been placed into the machine, then a dual stop signal is given to the machine.

A One-hand control device can be used when the operator cannot reach the hazardous area with his/her free hand or on less dangerous machines.

Highest Safety Level

The Safeball™ is certified by Inspecta in Sweden for use as a Two-hand control device, when used with a JSBR4 ABB Jokab Safety Safety relay or Pluto Safety-PLC, in accordance with the highest safety level in standard EN 574 (type IIIc).

Safeball
Function

Two-hand control device

The Two-hand control device is implemented by using two Safeballs™, each having two internal pushbuttons. The Safeballs™ must be mounted a minimum distance between each other (see Mounting description).

By utilising two pushbuttons in each device a double safety function is provided in each hand.

The highest safety level is achieved by connecting all four pushbuttons to the ABB Jokab Safety JSBR4 safety relay or Pluto Safety-PLC. The safety relay gives a dual and supervised safety function and requires input activation within 0.5 seconds in order to start the machine. It also checks that all four pushbuttons have returned to their deactivated positions before a new start is allowed. The JSBR4 safety relay also provides a stop signal if one or more pushbuttons are released.

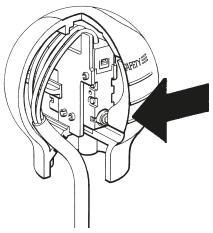
One-hand control device

Safeball™ is also a very practical method of providing a one-hand control device as it is very easy to find and activate by the machine operator. One-hand devices should only be used when the operator cannot reach into the hazardous area with his/her free hand or on less dangerous machines. Before fitting the necessary risk assessment must be made to determine suitability of this type of control. To achieve the highest safety level for One-hand control the Safeball™ must be connected to a safety control system (E.g. safety relay or safety PLC).

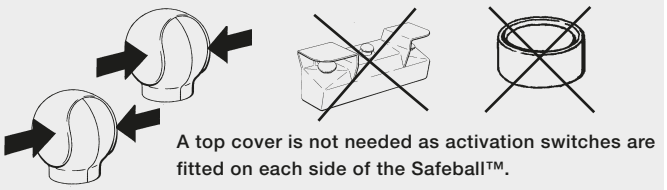
Versions

Safeball is available in several versions to meet different mounting requirements.

JSTD1-A - Safeball 1 NO + 1 NC with 2 m cable
JSTD1-B - Safeball 1 NO + 1 NC with 0.2 m cable
JSTD1-C - Safeball 1 NO + 1 NC with 10 m cable
JSTD1-E - Safeball 2 NO 0.2 m cable



Activation of a pushbutton.

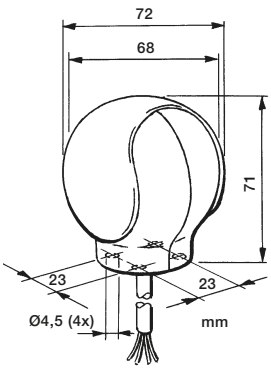


A top cover is not needed as activation switches are fitted on each side of the Safeball™.

Technical data - Safeball

Article number	
JSTD1-A	2TLA020007R3000
JSTD1-B	2TLA020007R3100
JSTD1-C	2TLA020007R3200
JSTD1-E	2TLA020007R3400
Material	Polypropylene
Colour	Yellow and black
Size	Height: approx. 71 mm Diameter, min.: 68 mm Diameter, max.: 72 mm Diameter, base: 42 mm
Weight	0.2 kg with 2 m cable 0.7 kg with 10 m cable 0.1 kg with 4x0.2 m wires
Level of Safety	
EN ISO 13849-1	Up to PL e/Cat. 4
Ambient temperature	-25°C to +50°C (operating)
Protection class	IP67. Not intended for use under water
Operating force	Approx. 2 N
Actuator travel	1.3 +/- 0.6 mm
Max switching load	30 V 2A DC, resistive load
Max current (resistive load)	2 A at 30 VDC (max) 20 mA at 24 VDC (recommended)
Min switching load	6V 10mA DC, resistive load
Contact resistance	100 mohm
Life, mechanical	> $1x10^6$ operations at max. 1 Hz
Life, electrical	Dependant upon electrical load characteristics
Connection cable	
JSTD1-A	2 m PVC-cable, 4 x 0.75mm^2
JSTD1-B, JSTD1-E	4 x 0.75 mm^2 wires, approx. 0.2 m
JSTD1-C	10 m PVC-cable, 4 x 0.75 mm^2
Conformity	EN ISO 12100:2010 EN 574+A1:2008

Chemical resistance at 20°C	
Chemical	Resistance
Alcohols	good
Paraffin oil	good
Milk	good
Silicon oil	good
Acetone	good
Please contact us for more information.	

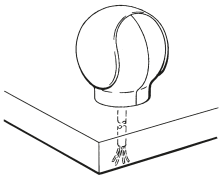


Safeball
Mounting

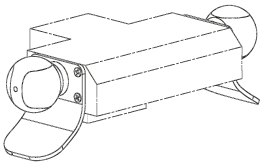
The Safeballs™ can be mounted in many different ways. They can be mounted on a table, a machine, on a support or wherever suitable for ergonomic reasons. The Safeball™ can be mounted in a fixed position or on a tilting and/or rotating support. This flexibility of mounting permits the Safeball™ to be fitted in the best ergonomic position for the ease of operation by the operator. The distance requirement between two Safeballs™ or between a Safeball™ and a wall or edge of a table depends on how the Safeball™ is mounted. Safeball™ can be mounted with four M5 screws or ST4.8 self-tapping screws.

NOTE! When Safeballs™ are mounted in such a way that the distance between them can be adjusted to less than the specified minimum, the mounting screws must be locked to ensure any changes in the distance between the two balls cannot be made.

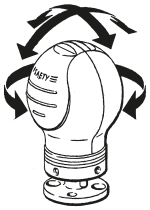
Alternative mounting methods



Mounting on a table.



Example of alternative mounting.



Mounting with ball joint, which can be rotated and angled.

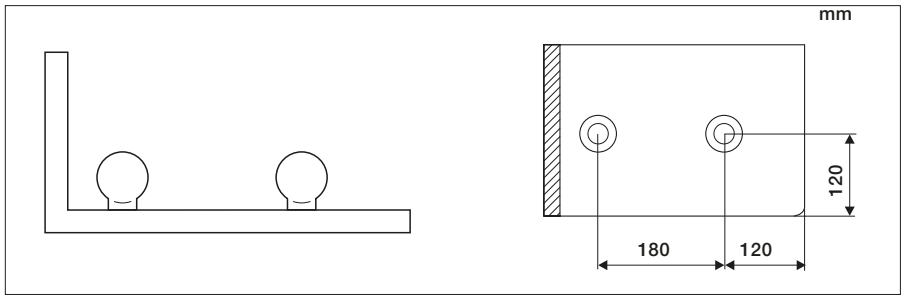
Approved Two-hand device

To be an approved Two-hand device, both Safeballs™ must be mounted a minimum distance apart in order to prevent operation of both balls with one hand. Safeballs™ must be fitted a minimum distance from the edges of tables or a wall. It is essential that Safeballs™ are correctly installed in order to prevent unintended activation of the devices with part of the body in combination for example with a wall.

Mounting distance -Safety distance - Safeball

Mounting distance

Table mounting of two Safeballs™.
In order to prevent cheating the distances shown are the minimum allowed.

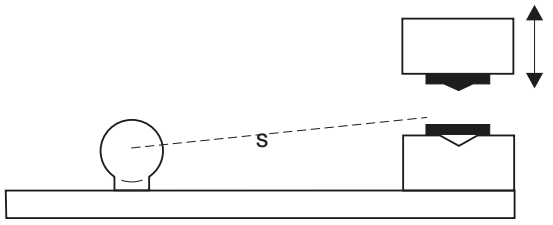


Safety distance

The Safety distance is the distance between the Safeballs™ and the dangerous machine movement. The safety distance requirement can be calculated using the following formula for Safeball™ in accordance with the approving authority and EN ISO 13855: S= KxT+C

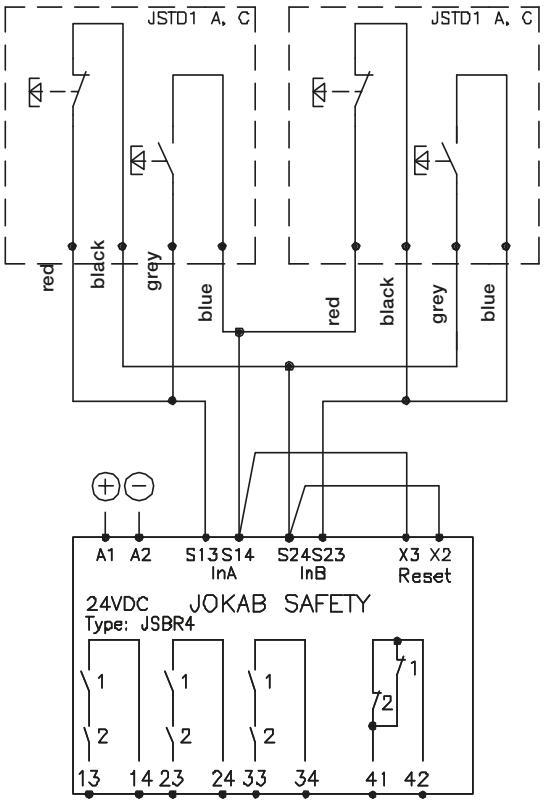
Where

S = safety distance in mm
K = hand speed, 1600 mm/s
T = total stopping time for the dangerous movement (including the response time of the safety relays in seconds)
C = Constant = 0 mm for Safeball.



The safety distance is the distance between the Safeballs™ and the dangerous machine movement. Note that S must never be less than 100 mm.

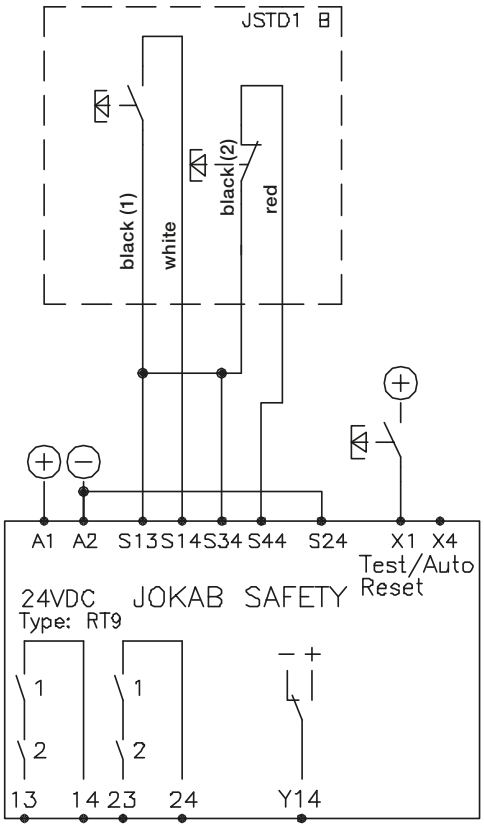
Safeball
Electrical connection



Two–hand device

Safeballs™ are designed to be connected to a ABB Jokab Safety JSBR4 Safety relay or Safety PLC to achieve the highest safety requirements for a Two-hand device.

Example of two devices connected to a ABB Jokab Safety JSBR4 safety relay. Response time on receiving a stop signal from JSTD1 < 15 ms.



One-hand device

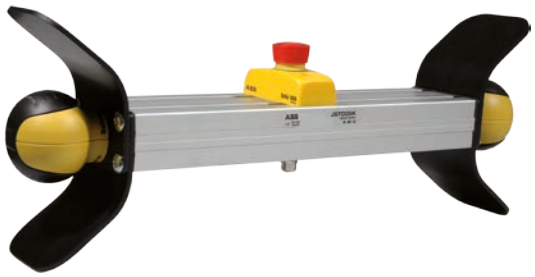
When used as a One-hand device the Safeball™ is designed to be connected to a ABB Jokab Safety RT6, RT7 or RT9 Safety relay in order to achieve the highest possible safety level for this type of control.

Example of a single Safeball™ connected to a ABB Jokab Safety relay RT9. The response time at ‘stop’ is < 20 ms.

Two-hand control station JSTD25 with Safeball

The JSTD25 replaces the traditional two-hand device. With the JSTD25 control station you have a prepared two-hand unit that is easy to install, while utilizing the good ergonomics of the Safeball. There are several versions to meet differing needs, all versions meet EN 574 and EN ISO 13849-1.

For mobile or fixed installation



JSTD25F/JSTD25H

Article number - 2TLA020007R6000/2TLA020007R6300
An ergonomic two-hand control unit with two Safeballs mounted on the ends of an aluminum profile. Both Safeballs are protected with shields for unintended press of the Safeball buttons. The device can be easily mounted with the aid of grooves in the aluminum profile and a quick connection is made to the M12 connector underneath the device. For mobile applications with repositioning of the two hand device this unit is very suitable because of its low weight.

JSTD25F is equipped with a 5-pole M12 male connector and the JSHD25H is equipped with an 8-pole M12 male connector.

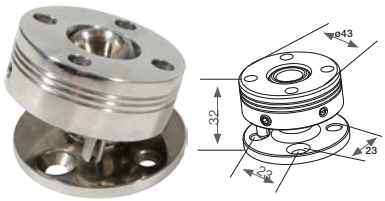
Both units can be equipped with an external emergency stop (Smile) and an Eden sensor for position control (ordered separately and assembled by the customer).

JSTD25K

Article number - 2TLA020007R6900
The JSTD25K is a fully equiped two-hand control device that is very similar and has all the advantages from the JSTD25F/JSTD25H.

JSTD25K just as JSTD25F/H, has two Safeballs mounted on the ends of an aluminum profile and the same length. The additional equipment is double protection shields protecting for unintended press from several directions and a Smile 10 EA emergency stop placed on the middle of the profile. Connection is made easily with a 8-pole M12 male connector underneath the device.

Accessories



JSM C5
Article number - 2TLA020007R0900
Angled ball joint for installation
of a Safeball on a table or a steel housing.

JSM C7
Article number - 2TLA020007R1200
Suspension shelf for JSTD25F/H/G/K

JSM C14
Article number - 2TLA020007R8000
Suspension shelf for JSTD25P-1

JSTK25S
Article number - 2TLA020007R6700
2.5 m long spiral cable for JSTD25P-1

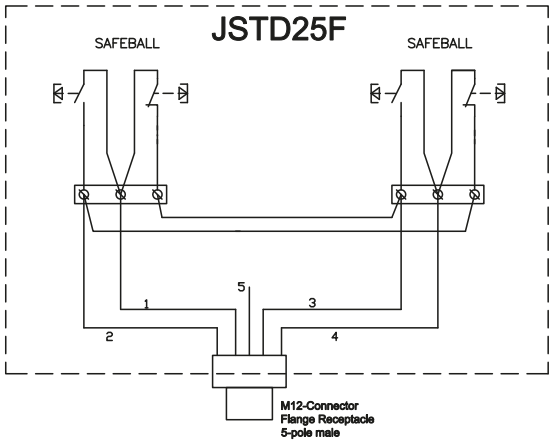
JSTK50S
Article number - 2TLA020007R6800
8 m long spiral cable for JSTD25P-1

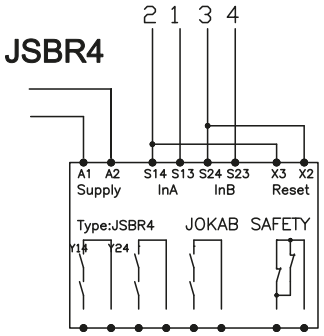
JSTK0-A
Article number - 2TLA020007R6600
Female connector for JSTD25P-1

Safeball protection coat
Article number - 2TLA020007R1900
Extra protection coat for Safeball.

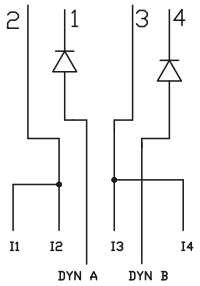
Connection examples

JSTD25F





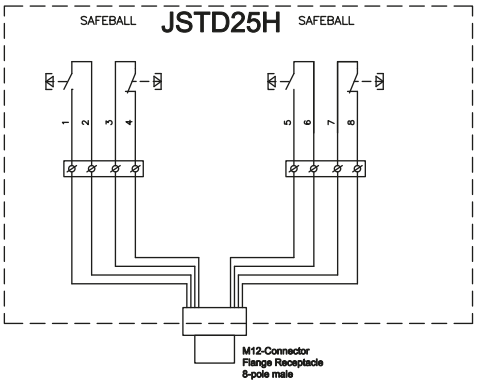
M12 5 Color-code
(not always used, verify!)
1 Brun Brown Braun Marron
2 Vit White Weiss Blanc
3 Blå Blue Blau Bleu
4 Svart Black Schwartz Noir
5 Not connected



1 Dyn A out
2 Pluto to evaluate A = OK, and test B (two inputs)
3 Pluto to evaluate B = OK, and test A (two inputs)
4 Dyn B out

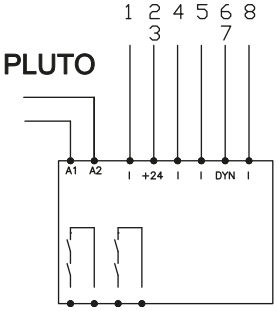
According to standard Pluto Twohand1 block:
I1: Right_NO
I2: Left_NC
I3: Right_NC
I4: Left_NO

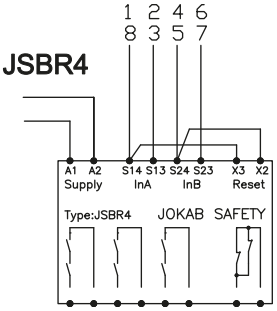
JSTD25H



M12-C03
Contact (plug) for self assembly. Female.
As seen from cable side (inside).
Ordered separately.

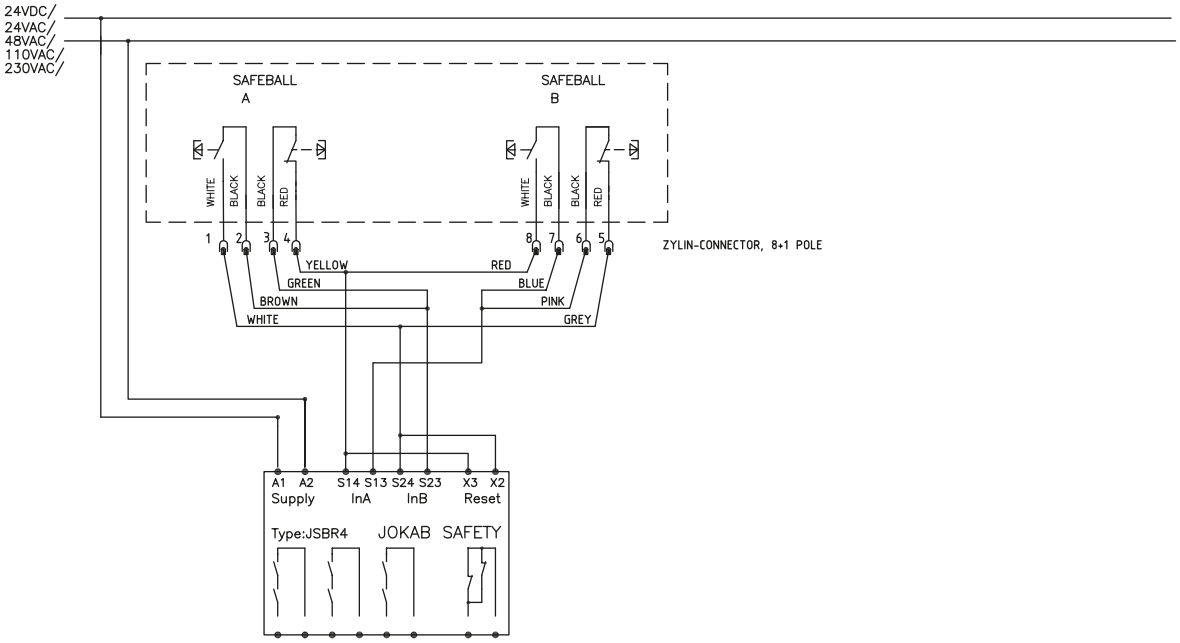
M12 8 Color-code
(not always used, verify!)
1 Vit White Weiss Blanc
2 Brun Brown Braun Marron
3 Grön Green Grün Vert
4 Gul Yellow Gelb Jaune
5 Grå Grey Grau Gris
6 Rosa Pink Rosa Rose
7 Blå Blue Blau Bleu
8 Röd Red Rot Rouge





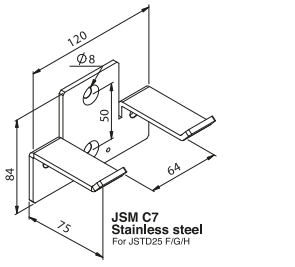
Connection examples

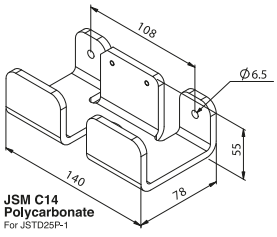
JSTD25P-1



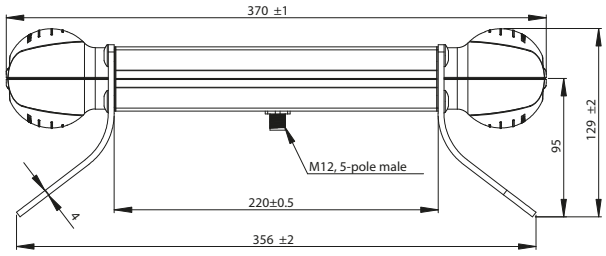
Dimensions

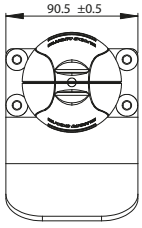
JSTD25

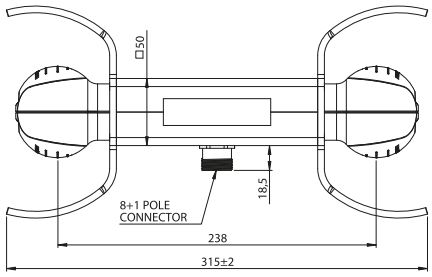


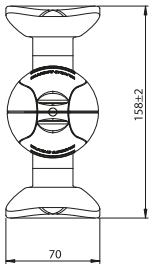


JSTD25F









JSTD25P-1


ABB SMILE
ABB SMILE
ABB SMILE
ABB
Linetrong

Emergency stops and Safety stops

Why do you need an Emergency stop?

— so that anyone shall be able to stop a machine during a machine break-down or if someone is in danger.

How do I recognise an E-stop?

E-stop buttons shall according to relevant standards be red with a yellow background. An emergency stop grab wire shall be red for high visibility. A sign that indicates the location of the E-stop shall be green with a white picture and possibly with text in the local country's language.

How shall an E-stop stop the machine?

An E-stop shall stop the machine as quickly as possible. To obtain a quick stop one either removes the power directly or one lets a frequency converter 'run down' and afterwards after a little delay, remove the power. An E-stop shall not create other hazards. Therefore a risk analysis must be made for the E-stop to be correctly connected.

From 2006/42/EC, clause 1.2.4.3

...
This device must:
- have clearly identifiable, clearly visible and quickly accessible control devices,
- stop the hazardous process as quickly as possible, without creating additional risks,
- where necessary, trigger or permit the triggering of certain safeguard movements.
...

Requirements for E-stops are stated in the following standards and regulations

2006/42/EC The Machinery Directive

Clause 1.2.4.3 in Annex 1 gives requirements for the emergency stop function for new machines). See also clause 1.2.2 Control devices. (see chapter “Standard and Regulations”)

Council Directive 89/655/EEC (with amendments) concerning the minimum safety and health requirements for the use of work equipment by workers at work

Clause 2.4 gives the requirements for the emergency stop function for older machines. See also clause 2.1. (see chapter “Standard and Regulations”)

EN ISO 13850 Safety of machinery – Emergency stop — Principles for design

A harmonized standard that gives technical specifications for the requirements in the Machinery Directive. Could also be used for older machinery.

EN 60204-1 Safety of Machinery - Electrical equipment of machines – Part 1: General requirements.

Harmonized standard that gives requirements for the electrical equipment of machinery including the emergency stop actuator/function. See clauses 9.2.2 and 9.2.5.4.2.

Emergency stop for enclosure installation
INCA 1

Approvals:

CE Inspecta cULus

Application:

– To stop a machine or a process

Features:

– Terminal blocks
– Emergency push button up to PL e/Cat. 4 acc. to EN ISO 13849-1
– Only 53 mm construction depth
– With LED info in push button
– Push button IP65, connector IP20
– Available as safety stop (black push button)

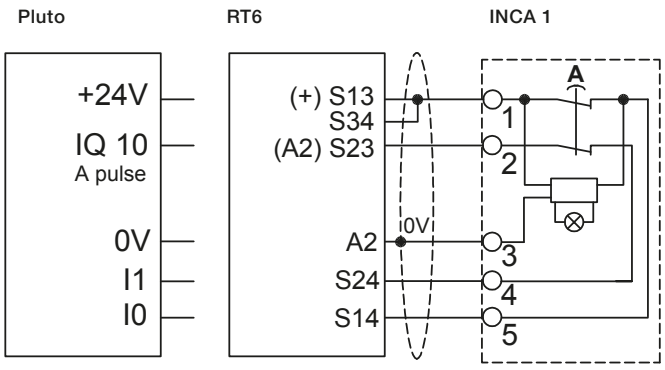
7

Description

INCA 1 is an emergency stop designed for installation in 22.5 mm holes on cabinets. INCA 1 has potential free contacts for connection to safety relays. The connection is made in cabinets via a removable terminal which also have excellent measuring points. Inca 1 is also available with a black pushbutton and used as a safety stop. See section on Safety stops.

In the emergency stop button there is a LED that displays current status on:

– Green = everything ok
– Red = this emergency push button has been pressed
– Off = a unit earlier in the circuit is affected



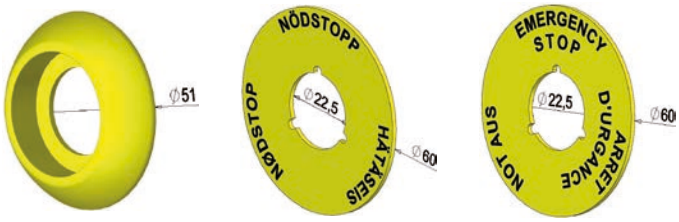
INCA 1S. See more information on section - Safety stop.

Notes

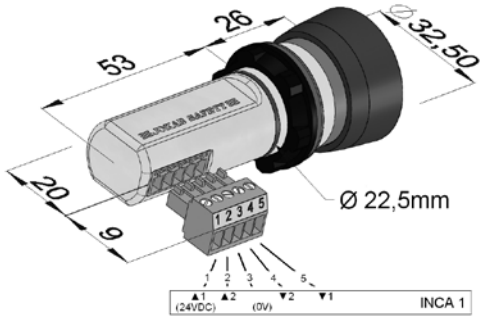
Technical data - INCA 1

Article number	
INCA 1	2TLA030054R0100
Impact resistance (half sinusoidal)	Max. 150m/s², pulse width 11 ms, 3-axis, acc. to EN IEC 60068-2-27
Vibration resistance (sinusoidal)	Max. 50 m/s² at 10 Hz…500 Hz, 10 cycles, 3 axis, acc. to EN IEC 60068-2-6
Climate resistance	
Damp heat, cyclical	96 hours, +25 °C / 97%, +55 °C / 93 % relative humidity, as per EN IEC 60068-2-30
Damp heat, sustained	56 days, +40 °C / 93 % relative humidity, as per EN IEC 60068-2-78
Dry heat	96 hours, +70 °C, as per EN IEC 60068-2-2
Cooling	96 hours, -40 °C, as per EN IEC 60068-2-1
Salt mist	96 hours, +35 °C in a chemical solution with NaCl as per EN IEC 60068-2-11
Level of safety	
EN ISO 13849-1	Up to PL e/Cat. 4 depending upon system architecture
EN 62061	SIL 3 depending upon system architecture
IEC/EN 61508-1...7	SIL 3
PFH_D	
INCA 1	PFH_D: 1.60×10^{-10}
Colour	Yellow, red and black
Weight	Approx. 45 grams
Size	See drawing
Material	Polyamide PA66, Macromelt, Polybutylenterephthalate PBT UL 94 V0
Temperature	-10°C to +55°C (operation), -30°C to +70°C (storage)
Protection class	Button: IP65, Connector: IP20
Installation	22.5 mm
Emergency stop LEDs	INCA 1: Green: Safety device OK. Not lit: A unit earlier in the circuit is affected. Red: This emergency stop has been pressed.
Operating voltage (LED)	INCA 1: 24 VDC
Current consumption (LED)	INCA 1: 15 mA
Actuating force	22 ± 4 N
Operating movement	Approx. 4 mm to locked position

Contact material	Gold-plated silver alloy
Minimum current	INCA 1: 10 mA, 10 VDC/10 VAC
Maximum current	INCA 1: 2 A 24 VDC
Mechanical life	> 50 000 operations
Accessories	
Front ring yellow for INCA	2TLA030054R0400
Emergency Stop Sign S DK FIN, 22.5 mm	2TLA030054R0500
Emergency Stop Sign EN F D, 22.5 mm	2TLA030054R0600
Emergency Stop Sign (blank) 22.5 mm	2TLA030054R0900
Conformity	EN ISO 12100:2010 EN ISO 13849-1:2008 EN 62061:2005 EN 60204-1:2006+A1:2009 IEC 60664-1:2007 EN 61000-6-2:2005 EN 61000-6-4:2007 EN 60947-5-5:2005 EN ISO 13850:2006



Yellow front ring and emergency stop signs for emergency stop.



Emergency stop with indication
Smile

Approvals:

Application:

– To stop a machine or a process

Features:

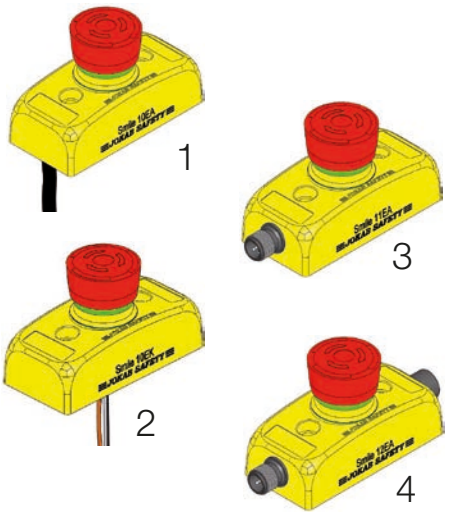
– Emergency push button up to PL e/Cat. 4 acc. to EN ISO 13849-1
– With LED info in push button
– Robust
– IP65
– Available as safety stop (black push button)

Smile - small and cost effective E-stop

In order to fulfill the need for a small and easy to install E-stop, Smile has been developed. The size of the device makes it possible to be installed wherever you want. With M12 connection/s or cable and centralised mounting holes Smile is very easy to install, especially on aluminium extrusions. Smile is available for E-stops in both dynamic and static safety circuits i.e. for interfacing to Vital/Pluto and Safety relays. Each version is available with either one or two M12 connections or cable. At the top of Smile, a LED shows the current status as: green = protection OK, red = this emergency stop has been pressed and if the LED is off, an emergency stop earlier in the circuit has been actuated. Smile is also available with black push button and is used as a safety stop. See section on safety stops.

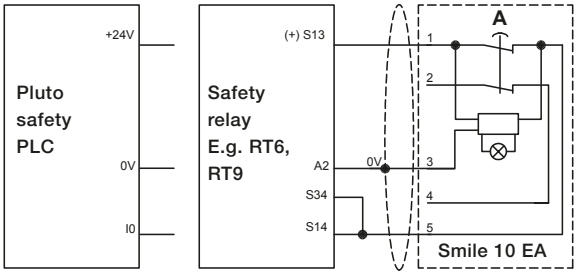
Smile emergency stop comes in five different versions:

1. Smile 10 EA has a 1 m cable connected through the base of the unit.
2. Smile 10 EK has four 1 m connecting leads through the base of the unit. No LED.
3. Smile 11 EA has a 5-pole M12 connector on one end of the unit.
4. Smile 12 EA has two 5-pole M12 connectors, one on each end of the unit.

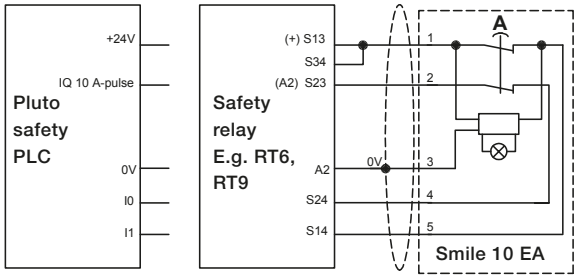


Smile
Connection examples

Smile 10 EA connected to either Pluto or a safety relay with LED indication. The connection cable exits from underneath.

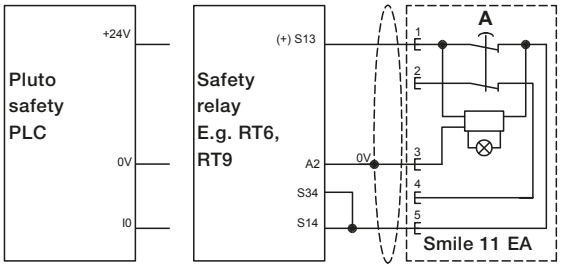


Single channel - Safety category 1.

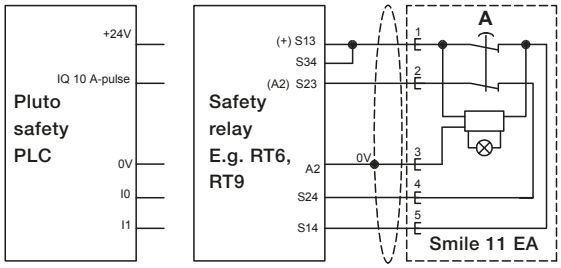


Dual channel - Safety category 4.

Smile 11 EA connected to either Pluto or a safety relay with LED indication. Connection via M12 connector.

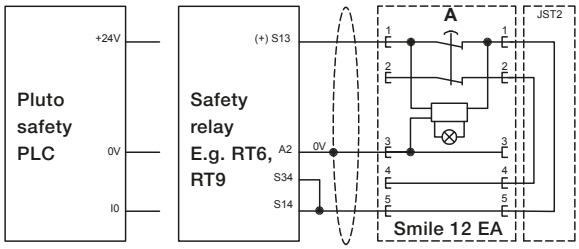


Single channel - Safety category 1.

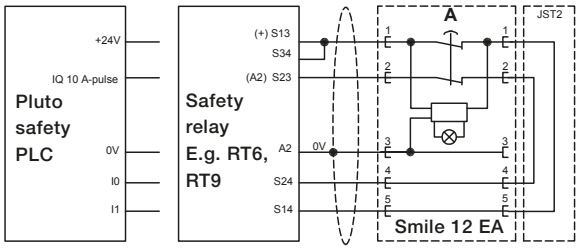


Dual channel - Safety category 4.

Smile 12 EA connected to either Pluto or a safety relay with LED indication. Connection via M12 connector + termination.

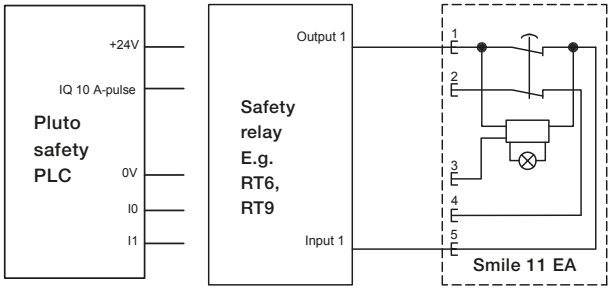


Single channel - Safety category 1.

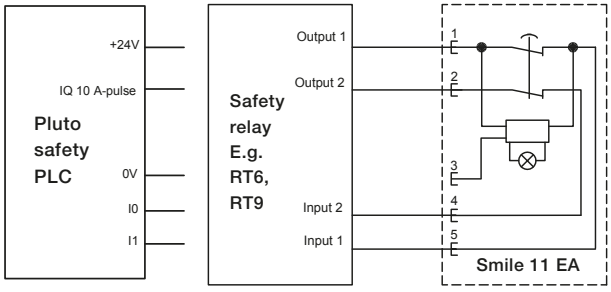


Dual channel - Safety category 4.

Smile 10 EA / 11 EA / 12 EA connected to either Pluto or a safety relay **without** LED indication.



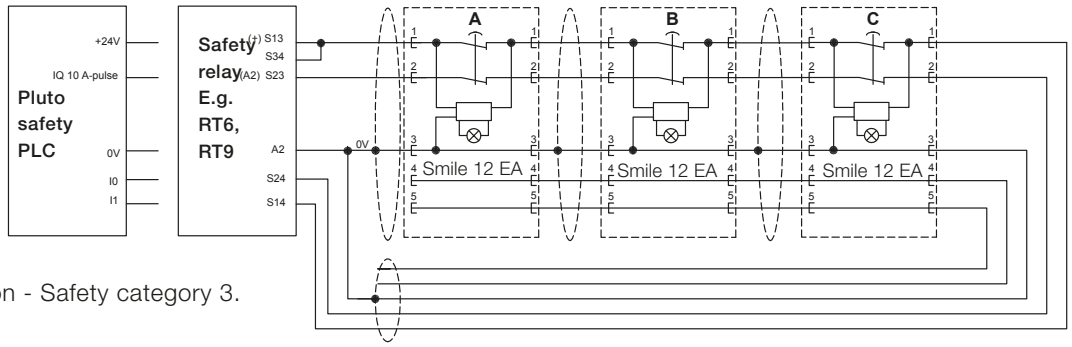
Single channel - Safety category 1.



Dual channel - Safety category 4.

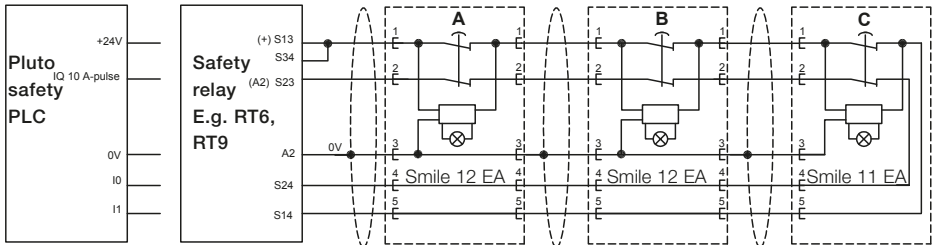
Smile
Connection examples

Smile 12 EA connected to either Pluto or a safety relay with LED indication. Connection via M12 connectors. Reconnection to the Pluto/safety relay is made via a separate cable. You can also use JST2 as a termination device after Smile12EA (C).



Dual channel series connection - Safety category 3.

Smile 12 EA and 11 EA connected to either Pluto or safety relay with LED indication. Connection via M12 connectors. Note that there is no termination connector as the Smile 11EA (C) completes the circuit without the need for a termination connector (JST2) or return cable.



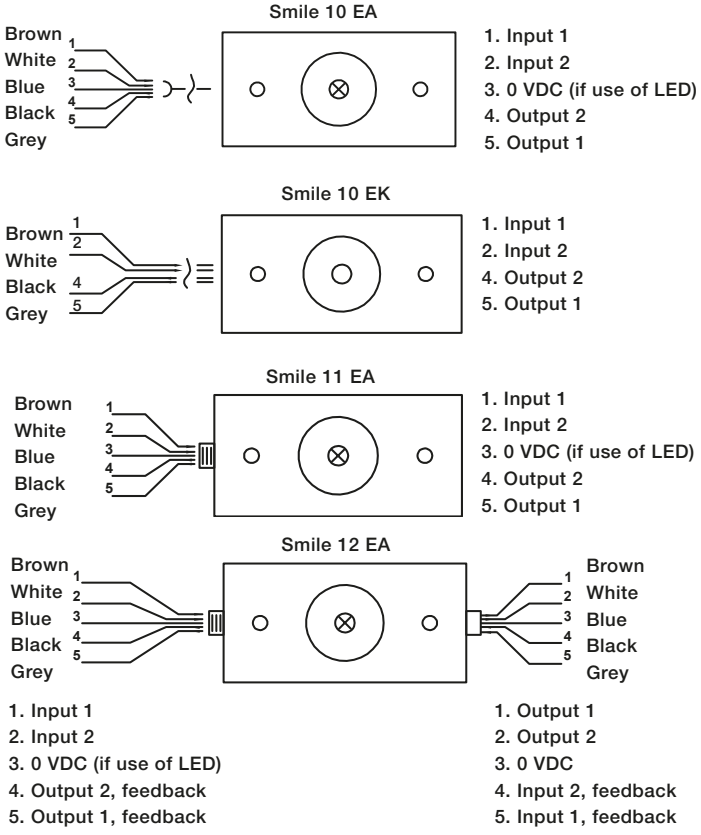
Dual channel series connection - Safety category 3.

LED Indication for the connection example above, where two Smile 12 EA and one Smile 11 EA are connected in series, is showed in the following table (applies for all Smile).

A = Smile 12EA
B = Smile 12EA
C = Smile 11EA

R = Released
P = Pressed
G = Green light
Rd = Red light
B = Blank, no light

E-Stop Button status				LED Indication		
A	B	C		A	B	C
R	R	R	↔	G	G	G
R	R	P	↔	G	G	Rd
R	P	R	↔	G	Rd	B
R	P	P	↔	G	Rd	B
P	R	R	↔	Rd	B	B
P	R	P	↔	Rd	B	B
P	P	R	↔	Rd	B	B
P	P	P	↔	Rd	B	B

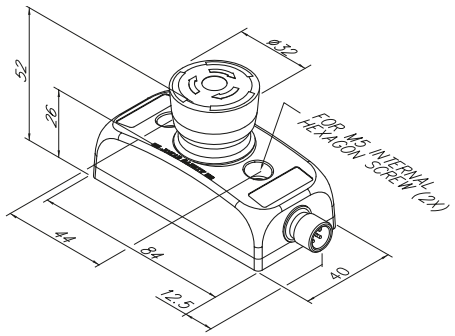


Technical data – Smile

Article number	
Smile 10 EA	2TLA030051R0400
Smile 10 EK	2TLA030051R0600
Smile 11 EA	2TLA030051R0000
Smile 12 EA	2TLA030051R0200
Impact resistance (half sinusoidal)	max. 150 m/s², pulse width 11 ms, 3-axis, as per EN IEC 60068-2-27
Vibration resistance (sinusoidal)	max. 50 m/s² at 10 Hz, 10 cycles, 3-axis, as per EN IEC 60068-2-6
Climate resistance	
Damp heat, cyclical	96 hours, +25 °C / 97%, +55 °C / 93 % relative humidity, as per EN IEC 60068-2-30
Damp heat, sustained	56 days, +40 °C / 93 % relative humidity, as per EN IEC 60068-2-78
Dry heat	96 hours, +70 °C, as per EN IEC 60068-2-2
Cooling	96 hours, -40 °C, as per EN IEC 60068-2-1
Salt mist	96 hours, +35 °C in a chemical solution with NaCl as per EN IEC 60068-2-11
Level of safety	
EN ISO 13849-1	Up to PL e/Cat. 4 depending upon system architecture
EN 62061	SIL 3 depending upon system architecture
IEC/EN 61508-1...7	SIL 3
PFH_D	1.60E-10
Colour	Yellow, red and black
Weight	Approx. 65 grams
Size	Length: 84 mm + M12 contact(s) (12.5 mm each) Width: 40 mm Height: 52 mm
Material	Polyamide PA66, Macromelt, Polybutylenterephthalate PBT, Polypropylene PP, UL 94 V0
Ambient temperature	-10°C to +55°C (operation), -30°C to +70°C (stock)
Protection class	IP65
Actuating force	22 ± 4 N
Actuator travel	Approx. 4 mm to latch
Mechanical life	> 50 000 operations
Mounting	Two M5 recessed hexagon head screws, L ≥25 mm. Hole cc: 44 mm

LED on E-Stop	Green: Safety device OK, Safety circuit OK Off: Safety circuit is previously interrupted. (When an E-Stop is depressed all following units in the circuit lose the LED function). Red: This button is pressed, and the safety circuit is interrupted.
Operating voltage (LED)	17-27 VDC ripple ±10% (LED supply voltage)
Current consumption (LED)	15 mA
Material, contacts	Silver alloy gold plated
Min current	10 mA 10 VDC/ 10 VAC
Max current	2 A 24 VDC
Accessories	
JST2 termination for Smile 12	2TLA030051R1300
Conformity	EN ISO 12100:2010, EN ISO 13849-1:2008, EN 62061:2005, IEC 60664-1:2007 EN 60204-1:2006+A1:2009, EN 61000-6-2:2005, EN 61000-6-4:2007, EN 60947-5-5:2005, EN ISO 13850:2006

Termination device JST2



Safety stop
INCA, Smile and Compact

Approvals:

Application:

– To make a safe stop of a machine or a process

Features:

– Safe machine stop with black push button
– With LED info in push button
– Up to IP69K

When should I use the safety stop?

Safety stops are used to stop the operation of a machine in a safe manner. It must not be used as an emergency stop, but only as a stop for an individual hazardous motion. This is indicated by black push button. Likewise, an emergency stop push button with red push button must not be used as a safety stop.

INCA machine stop for panel mounting

The INCA series is available with black push button and is called INCA 1S. The safety stop is identical to the corresponding emergency stop apart from the black push button. For technical data see the INCA emergency stop.

Smile machine stop with indication

The Smile emergency stop series is also available with black push button as safety stops. These stops are identical to the corresponding emergency stops apart from the button. The Smile with the black push button has a similar designation apart from an S in the name instead of E. For technical data see the Smile emergency stop.

The Compact Machine stop with an enclosure

This machine stop comes from the Compact range of ABB:s Pilot Devices, built on the ”All-in-one design”. The black machine stop complemented with a robust enclosure gives a high IP rating the fulfills the demands in severe and moist environments. The machine stop has one normal open and one normally closed contact (1NO+1NC). For technical data see the Compact emergency stop.

Model	Article number
Smile 11 SA	2TLA030051R0900
Smile 12 SA	2TLA030051R1000
Smile 11 SAR	2TLA030051R1100

Model	Article number
INCA 1S	2TLA030054R0300

Model	Article number
Machine stop and enclosure (CEP1-1002)	1SFA619811R1002
Machine stop with enclosure and shroud (CEP1-2002)	1SFA619811R2002

Reset button
Smile 11 R

Approvals:

Application:

- Reset push button

Features:

- With LED info in push button
- IP65

Smile push button box with a blue button are intended to be a reset button to safety circuits.

Smile 11 RA

The Smile 11 RA is an ”open” reset push button box with one circuit for connections though a normally open contact and one circuit for connection of the indication LED in the push button.

Technical data – Smile 11 RA/B

Article number	
Smile 11 RA	2TLA030053R0000
Color	
Base	yellow
Pushbutton	blue
Material	
Housing	Polyprobylene PP
Pushbutton contact	Au
Power Supply	
LED operating voltage	24 VDC (maximum 33 VDC)
LED current consumption	20 mA at 24 VDC
	30 mA at 33 VDC
Pushbutton operating voltage	Min: 5 V, max: 35 V
Pushbutton current consumption	Min: 1 MA, max 100 mA
Pushbutton rated power	Max: 250 mW
Ambient temperature	-25...+55°C
Humidity range	35 to 85% (with no icing or condensation)
Protection class	IP65
Connectors	5-pole male M12 connector
Size	84 x 40 x 36 (LxWxH) + 12 mm for M12 connector (L)
Weight	Approx. 60 g
Mechanical life	1.000.000 operations at 10 mA/24 VDC
Switching reliability	10 x 10^{-6} at 5 mA/24 VDC

Emergency Stop Grab Wire Safety Switches

Application

ABB Jokab Safety Emergency stop grab wire safety switches are designed to be mounted on machines and sections of conveyors which can not be protected by guards. In contrast to traditional mushroom head type Emergency stop buttons, Emergency stop grab wire safety switches can initiate the emergency command from any point along the installed wire length, and thereby provide robust emergency stop protection for exposed conveyors and machines.

The switches have a positive mechanical linkage between the switch contacts and the wire rope. The switches also include wire-breakage monitoring. This means, on pulling or breakage (tension loss) of the wire, the safety contacts are positively opened and the auxiliary contacts are closed. The switches are mechanically latched and can then only be returned to the operational condition by pressing the reset button as required according to EN ISO 13850 (EN 418).

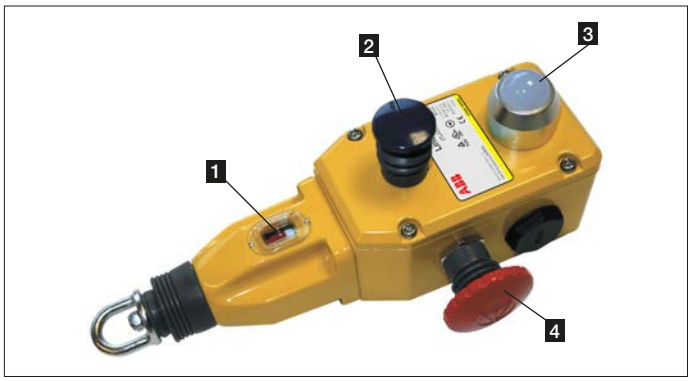
System set up

Wire support eyebolts must be fitted at 2.5-3 meters intervals along the hole wire length and the wire must be supported no more than 500 mm from the switch eyebolt or Safety Spring (if used). It is important that the first 500 mm are not used as part of the active protection coverage. When using one switch, the wire must be anchored at the other end using a Safety spring. When using a Safety spring, a maximum of one corner pulley may be used, to ensure that the complete length of the wire is visible to either the switch or the spring anchorage. The emergency stop switches are brought into the operational condition by pre-tensioning the wire by using a tensioner / gripper device which clamps the wire and then hooks to the switch eyebolts. Correct tension can be observed by viewing the tension indicator on the switch housing. Once tensioned, the switch contact blocks can be set to the operational condition (safety contacts closed, auxiliary contacts open) by pressing a blue reset button on the switch cover.

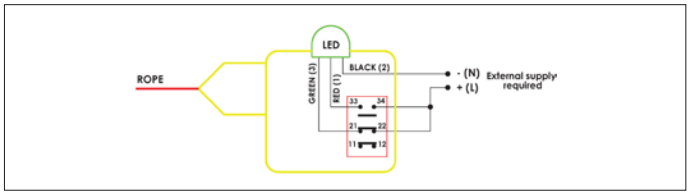
Safety level

All ABB Jokab Safety Emergency stop grab wire safety switches conform to European Standard EN ISO 13850 (EN 418) and IEC/EN 60947-5-5. They have a positive mechanical linkage between the switch contacts and the wire rope as per IEC/EN 60947-5-1.

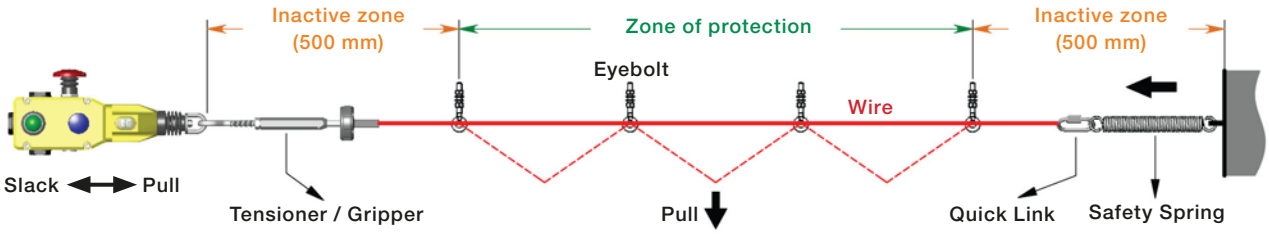
In combination with a dual channel safety monitoring relay (or safety PLC) an Emergency stop grab wire system can be used as emergency stop device monitored for up to PL e, Cat 4 according to EN ISO 13849-1.



1. Tension indicator -Ensures the system is easy to set up and maintain the correct wire tension.
2. Reset button -The blue button must be pushed to reset the switch following activation by pulling or slackening of the wire.
3. Indicator LED - red in the event of the wire being pulled-switch activated, or illuminate steady green to indicate a reset switch in machine 'Run' state. Visible from long distances.
4. Mushroom type Emergency stop button -Can be installed or repositioned left or right after installation.



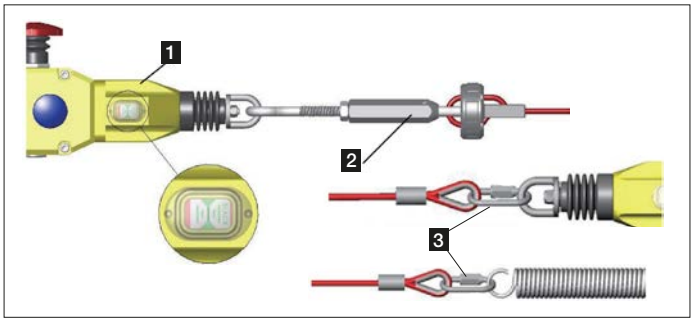
Wiring diagram for LED



Reliable connectivity

When setting up an Emergency stop grab wire system from ABB Jokab Safety it is recommended to do the tensioning of the wire by using of ABB Jokab Safety Tensioner / Gripper accessory. Traditional grab wire systems normally need turn-buckle and clamps, which are difficult to tension and adjust, and also normally require frequent re-tensioning.

For greater reliability and ease, of installation the Tensioner / Gripper accessory significantly reduces the installation time. This by offering an eyehook, tensioner thimble and wire strength gripper in one assembly which enables rapid connection to the switch eyebolts and fast and accurate tensioning of the wire. Thanks to the switch viewing window, systems can be accurately and quickly tensioned. The double clamp mechanism prevents wire slippage and significantly reduces machine 'down time' which can occur with traditional turn-buckle systems.



1. Tension to mid position as indicated by the green arrows in the viewing window of each switch.
2. The tensioner thimble allows immediate accurate and final tensioning of the wire, whilst viewing the tension marker through the viewing window on the switch.
3. For systems up to 50 meter Quick Link termination is provided for easy connection to either a Safety spring or Switch eyebolt. (Note for systems above 50 meters a Tensioner / Gripper is required each side).

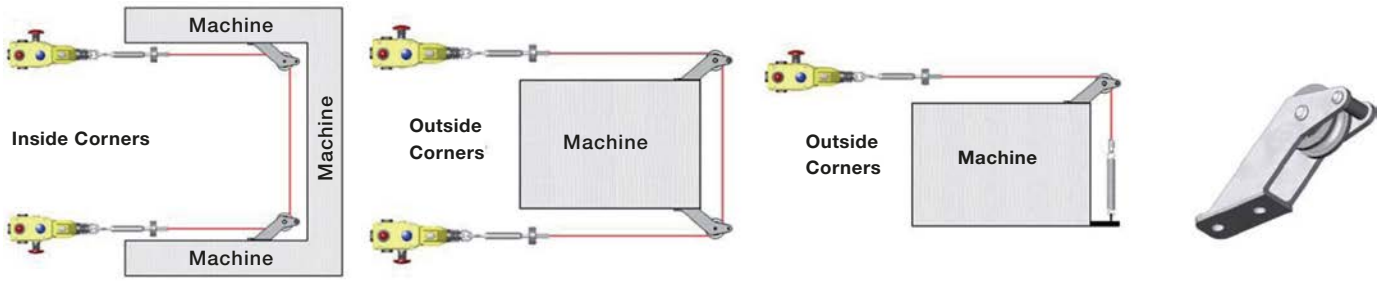
Wire Tensioner / Gripper, Stainless Steel article no: 2TLA050210R4020, Wire Tensioner / Gripper, Galvanized article no: 2TLA050210R4030.

Tensioner / Gripper installation

The end of the safety wire is fed through a central hole in a cone shaped guide which protrudes from the main housing. After being fed through the guide hole, the wire enters the main housing by going through a feed hole and then is looped back through 180 degrees and is fed through a second feed hole on the opposite side of the mechanism. The wire is then pulled for maximum tension and is locked in position by a locking bar inside the main housing which is moved by turning an Allen type locking bolt.

Navigating Corners

Because of the added friction on the eyebolts and wire when navigating corners, a corner pulley can be used to navigate inside or outside corners without causing damage to the wire. They are stainless steel and can be rigidly mounted.



Examples of using the corner pulley

Emergency Stop Grab Wire Safety Switch
LineStrong1

Approvals:

Application:

- Machines
- Transportation lines

Features:

- Easily accessible
- Forced contacts
- Double switching in both directions of travel
- Up to 50 m Wire length
- IP67
- 2NO + 2NC

Switch operational description

LineStrong1 is an emergency stop grab wire safety switch used for easy reach of an emergency stop along machines, conveyors and processes. LineStrong1 is a compact and small, yet robust switch that can handle wires up to 30 meters on a single switch (up to 50 meters on two switches).

A grab wire emergency stop is easier to install than a system of several emergency stop buttons along a carriage path. LineStrong1 can be used as protection, for example along conveyors with low risks where the wire can be installed at waist height in front of the conveyor, which provides an emergency stop if someone walks or falls towards the conveyor. LineStrong1 has double switching in both directions of the wire. So if someone pulls the wire or if the wire is broken, the switch goes to a safe state, e.g. the machine is emergency-stopped. After a safe state the LineStrong1 needs to be reset to be able to run again and this is made on the local reset button. LineStrong1 is equipped with an indication of how taut the wire is, which makes the installation or adjustment easy.

Material

The LineStrong1 is made of a rugged die cast housing with a rating of IP67.

Positive forced disconnected contacts

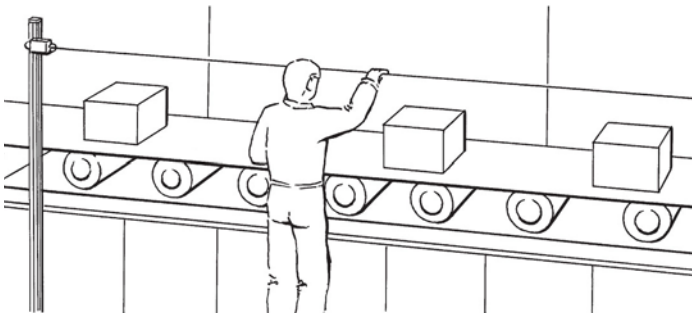
A positive forced contact provides a forced disconnect of the safety contacts when the wire is being pulled or broken. The design of the LineStrong1 ensures that the contacts will not fail or be held in a normally closed position, due to failure of the spring mechanism or that welding/sticking of the contacts can occur. The LineStrong1 switch has 2NC and 2NO contacts.

Safety level

The forced disconnected contacts provide a high level of safety. To achieve a maximum safety level in connection with the machine control system, it is recommended that the LineStrong1 is monitored by an appropriate ABB Jokab Safety safety relay, Pluto safety-PLC or a Vital system.

Regulations and Standards

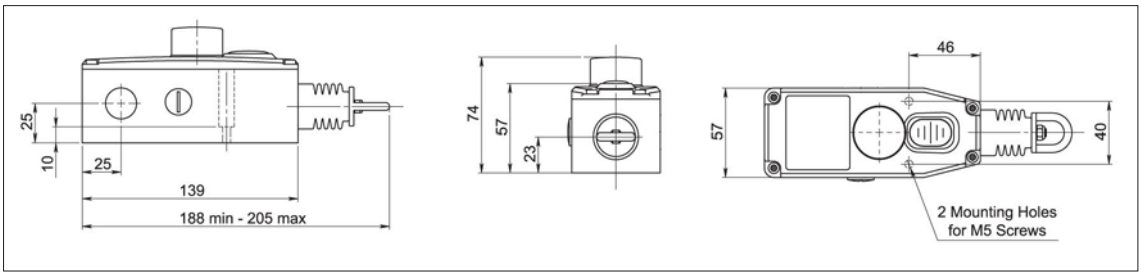
The LineStrong1 is designed and approved in accordance to relevant standards. Examples of relevant standards are IEC/EN 60947-5-1, IEC/EN 60947-5-5, EN 62061, UL 508, EN ISO 13850 and EN ISO 13849-1.



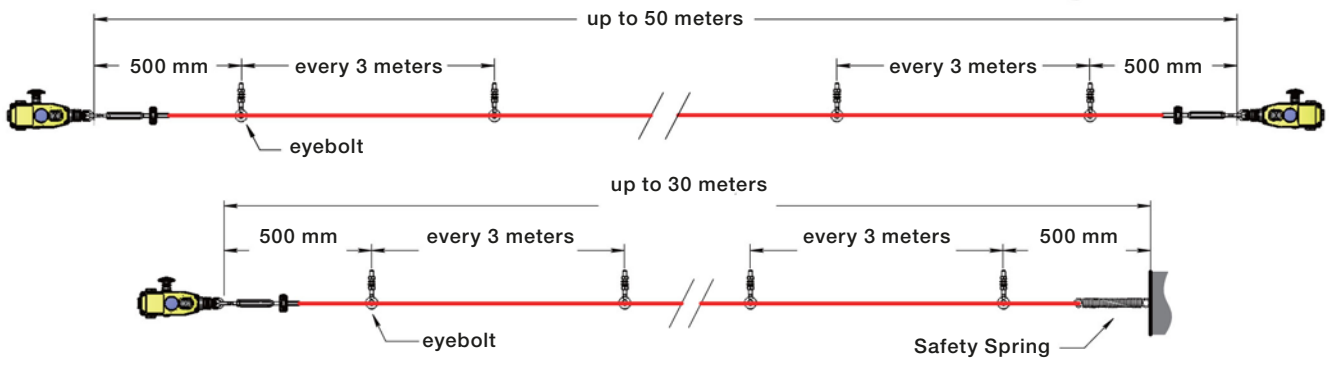
Emergency stop grab wire easily accessible during normal work operation along a machine.

Technical data – LineStrong1 series

Article number	
LineStrong1	2TLA050200R1030
Level of Safety	
EN ISO 13849-1	Up to PL e /Cat. 4 depending upon system architecture
EN 62061	Up to SIL3 depending upon system architecture
Safety data	
Mechanical reliability B_{10d}	1.5 x 10^6 operations at 100mA load 21 years
Proof test interval (life) $MTTF_d$	214 years (8 cycles per hour/24 hours per day/365 days)
Wire span	up to 50 m
Wire tension device	Tensioner / Gripper- Quick Fixing
Wire type	PVC sheath steel wire 4.0 mm outside diameter
Torque settings	Mounting M5 4.0Nm, Lid T20 Torx M4 1.5Nm, Terminals 1.0Nm
Termination	Clamp up to 2.5 mm^2 conductors
Tension force (typical mid setting)	130N
Tension operating force (wire pulled)	< 125N < 300 mm deflection
Short circuit overload protection	Fuse externally 10 A (FF)
Rated insulation/withstand voltages	500 VAC / 2500 VAC
Utilisation category	AC15 A300 3A
Vibration resistance	10-500 Hz 0.35 mm
Shock resistance	15 g 11 ms
Thermal current (Ith)	10A
Contact type	IEC/EN 60947-5-1 double break Typ Zb snap action
Contact material	Silver
Conduit entries	1/2 NPT
Enclosure classification	IP67
Ambient temperature	-25°C to +80°C
Enclosure material/cover	Die cast painted yellow
Mounting position	Any
Mounting bolts	4 x M5



Dimension LineStrong1



Emergency Stop Grab Wire Safety Switch
LineStrong2

Approvals:

Application:

- Machines
- Transportation lines

Features:

- Duplicate extraction in two directions
- Up to 100 m length
- Up to IP69K
- Integrated emergency stop button
- 2NO + 2NC
- EX version

Switch operational description

LineStrong2 is an emergency stop grab wire safety switch used for easy reach of an emergency stop along machines, conveyors and processes. LineStrong2 is a robust switch that can handle wires up to 80 meters on a single switch (up to 100 meters on two switches). A grab wire emergency stop is easier to install than a system of several emergency stop buttons along a carriage path. LineStrong2 can be used as protection, for example along conveyors with low risks, where the wire can be installed at waist height in front of the conveyor, which provides an emergency stop if someone walks or falls towards the conveyor. LineStrong2 has double switching in both directions of the wire. If someone pulls the wire or if the wire is broken, the switch goes to a safe state, e.g. the machine is emergency-stopped. After a safe state the LineStrong2 needs to be reset to be able to run again and this is made with the local reset button. Additional features on the LineStrong2 are a "normal" emergency stop that is fitted on the side of the grab wire safety switch and also a two coloured LED for indication. LineStrong2 is equipped with an indication of how taut the wire is, which makes the installation and adjustment easy.

Material

Depending on the environment where the switch will be used, different material can be chosen for the LineStrong2. The basic version has a rugged yellow die cast housing with a rating of IP67. In severe applications as for food processing and chemical industry there is a LineStrong2Z with a total rugged stainless steel 316 body. This version has IP69K enclosure protection (maintained by a double seal lid gasket and seals) and can be high pressure hosed with detergent at high temperature.

Positive forced disconnected contacts

A positive forced contact provides a forced disconnect of the safety contacts when the wire is being pulled or broken. The design of the LineStrong2 ensures that the contacts will not fail or be held in a normally closed position, due to failure of the spring mechanism or that welding/sticking of the contacts can occur. The LineStrong2 switch has 2NC and 2NO contacts.

Safety level

The forced disconnected contacts provide a high level of safety. To achieve a maximum safety level in the connection with the machine control system, it is recommended that the LineStrong2 is monitored by an appropriate ABB Jokab Safety safety relay, Pluto safety-PLC or a Vital system.

Explosion Proof version (X)

LineStrong2 also exists in versions with certified explosion proof contact block (X-versions). LineStrong2ZX have a stainless steel body and can be used in European Zone 1, 2, 21, 22 enviroments (Gas and Dust). Preassembled with 3 meter cable.

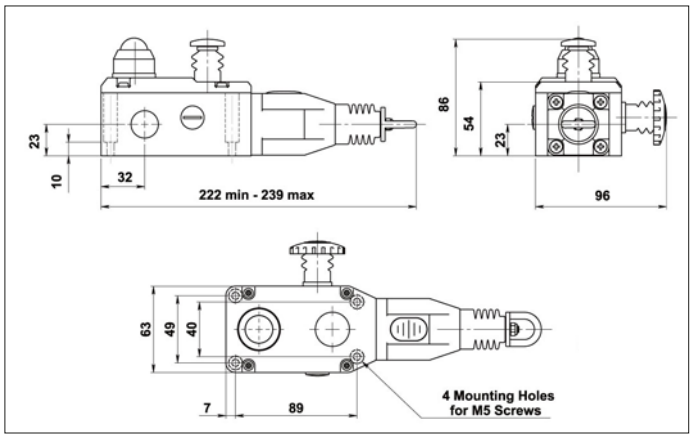
Regulations and Standards

The LineStrong2 is designed and approved in accordance to relevant standards. Examples of relevant standards are IEC/EN 60947-5-1, IEC/EN 60947-5-5, EN 62061, UL 508, EN ISO 13850 and EN ISO 13849-1.

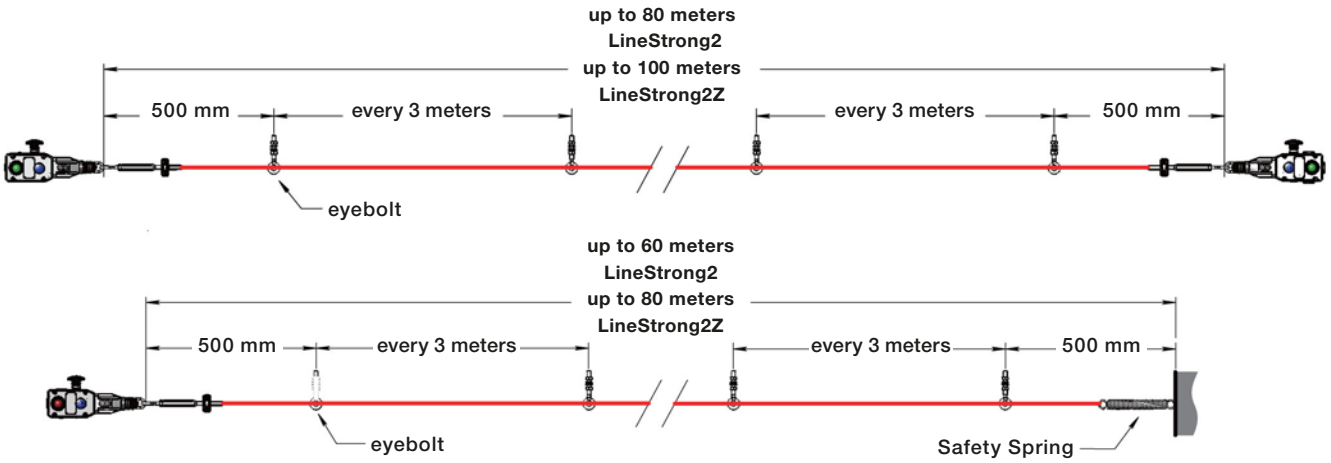
Technical data – LineStrong2 series

Article number	
LineStrong2	2TLA050202R1030
LineStrong2Z	2TLA050202R1332
Level of Safety	
EN ISO 13849-1	Up to PL e/Cat. 4 depending upon system architecture
EN 62061	Up to SIL3 depending upon system architecture
Safety data	
Mechanical Reliability B_{10d}	1.5 x 10^6 operations at 100mA load
Proof test interval (life)	21 years
$MTTF_d$	214 years (8 cycles per hour/24 hours per day/365 days)
Wire span	
LineStrong2	Up to 80 m
LineStrong2Z(X)	Up to 100 m
Wire tension device	Tensioner / Gripper- Quick Fixing
Wire type	PVC sheath steel wire 4.0 mm outside diameter
Torque settings	Mounting M5 4.0Nm lid T20 Torx M4 1.5Nm terminals 1.0Nm
Termination	Clamp up to 2.5 mm^2 conductors
Tension force (typical mid setting)	130N
Tension operating force (wire pulled)	< 125N < 300 mm deflection
Short circuit overload protection	Fuse extenally 10A (FF)
Rated insulation/withstand voltages	500VAC / 2500VAC
Utilisation category	AC15 A300 3A
Vibration resistance	10-500Hz 0.35 mm
Shock resistance	15 g 11 ms
Thermal current (Ith)	10A
LED	24 VDC

Contact type	IEC/EN 60947-5-1 double break Typ Zb snap action
Contact material	Silver
Conduit entries	1/2 NPT
Enclosure classification	
LineStrong2	IP67
LineStrong2Z(X)	IP69K and IP67
Ambient temperature:	
LineStrong2	-25°C to +80°C
LineStrong2Z(X)	-25°C to +80°C (100°C cleaning)
Enclosure material/cover	
LineStrong2	Die cast painted yellow
LineStrong2Z(X)	Stainless steel 316
Mounting position	Any
Mounting bolts	4 x M5
Explosion Proof version (X)	
Classification	Ex d IIC T6 (-20°C ≤ Ta ≤ +60°C) Gb Ex tb IIIC T85°C (-20°C ≤ Ta ≤ +60°C) Db
Rated Voltage	250V AC/DC
Rated Current	2 pole 4A 4 pole 2.5A



Dimensions LineStrong2 and LineStrong2Z



Emergency Stop Grab Wire Safety Switch LineStrong3

Approvals:

Application:

- Machines
- Transportation lines

Features:

- Duplicate extraction in two directions
- Up to 250 m length
- Up to IP69K
- Integrated emergency stop button
- 4NC + 2NO
- EX version

Switch operational description

LineStrong3 is an emergency stop grab wire safety switch used for easy reach of an emergency stop along machines, conveyors and processes. LineStrong3 is a quite robust switch that can handle long wires, up to 250 meters on a single switch. A grab wire emergency stop is easier to install than a system of several emergency stop buttons along a carriage path. LineStrong3 can be used as protection, for example along conveyors, with low risks where the wire can be installed at waist height in front of the conveyor, which provides an emergency stop if someone walks or falls towards the conveyor.

LineStrong3 has double switching in both directions of the wire. If someone pulls the wire or if the wire is broken, the switch goes to a safe state, e.g. the machine is stopped.

After a safe state the LineStrong3 needs to be reset to be able to run again and this is made on the local reset button. Additional features on the LineStrong3 are a "normal" emergency stop fitted on the top of the grab wire safety switch and also a two coloured LED for indication.

LineStrong3 is equipped with an indication of how taut the wire is, which makes the installation and adjustment easy.

Material

Depending on the environment where the switch will be used, different materials can be chosen for the LineStrong3. The basic version has a rugged yellow die cast housing with a rating of IP67. In severe applications as for food processing and chemical industry, there is a LineStrong3Z with a total rugged stainless steel 316 body. This version has IP69K enclosure protection (maintained by a double seal lid gasket and seals) and can be high pressure hosed with detergent at high temperature.

Positive forced disconnected contacts

A positive forced contact provides a forced disconnect of the safety contacts when the wire is being pulled or broken. The design of the LineStrong3 ensures that the contacts will not fail or be held in a normally closed position, due to failure of the spring mechanism or that welding/sticking of the contacts can occur. The LineStrong3 switch has 4NC and 2NO.

Safety level

The forced disconnected contacts provide a high level of safety. To achieve a maximum safety level in the connection with the machine control system, it is recommended that the LineStrong3 is monitored by an appropriate ABB Jokab Safety safety relay, Pluto safety-PLC or a Vital system.

Explosion Proof version (X)

LineStrong3 also exists in versions with certified explosion proof contact block (X-versions). LineStrong3LZX/RZX/DZX have a stainless steel body and can be used in European Zone 1, 2, 21, 22 enviroments (Gas and Dust). Preassembled with 3 meter cable.

Regulations and Standards

The LineStrong3 is designed and approved in accordance to relevant standards. Examples of relevant standards are IEC/EN 60947-5-1, IEC/EN 60947-5-5, EN 62061, UL 508, EN ISO 13850 and EN ISO 13849-1.

Single Wire
LineStrong3L/3R and LineStrong3LZ/3RZ

LineStrong3L/3R - Standard version

The Linestrong3L/3R are two different versions depending on installation.

L - "Left hand" - is the version of LineStrong3 where the placement of the grab wire switch is to the left in the installation.
R - "Right hand" - is the version of LineStrong3 where the placement of the grab wire switch is to the right in the installation.

Both versions have die-cast housings and are robust to severe indoor or outdoor use. LineStrong3L/3R are designed to protect a length up to 100 meters on a single switch. If two switches are used together, up to 125 meters. A two colour LED ensures switch status can be seen easily from a distance. They have 4NC and 2NO contacts to ensure flexibility with all modern control application.

Left hand

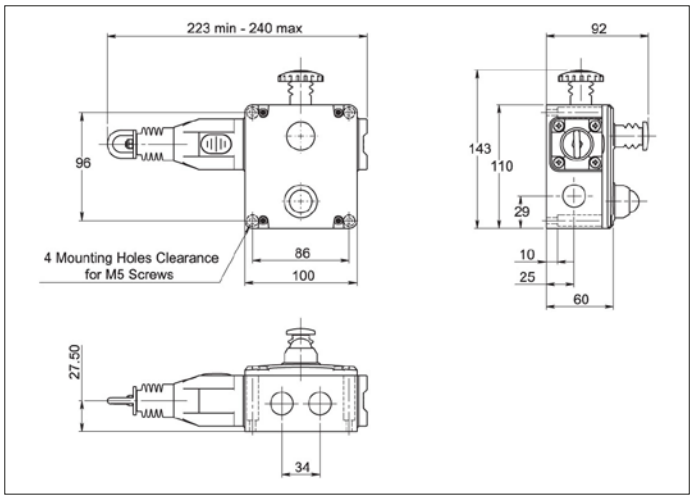
Right hand

LineStrong3LZ/3RZ - Stainless steel version

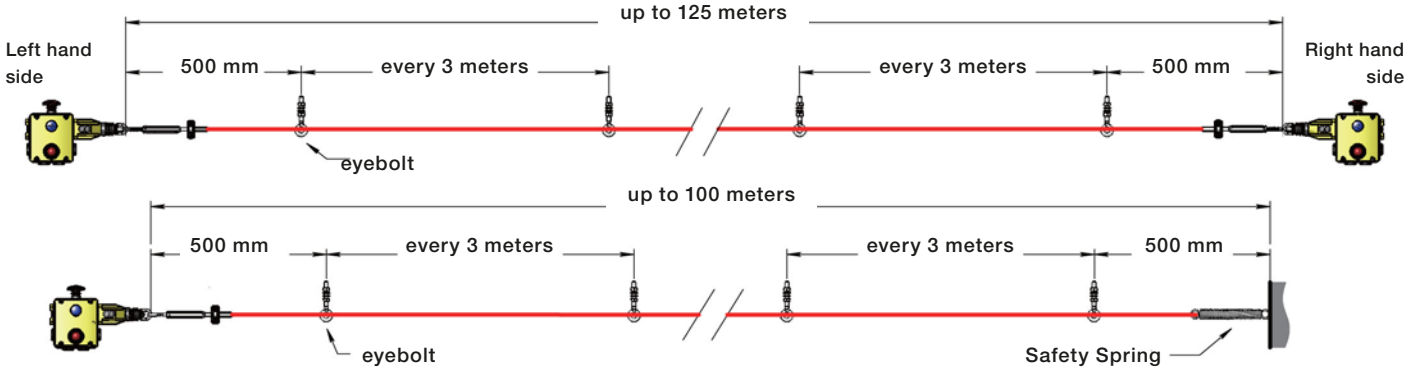
The Linestrong3LZ/3RZ are two stainless steel switches with different installations possibilites.

L - "Left hand" - is the version of LineStrong3Z where the placement of the grab wire switch is to the left in the installation.
R - "Right hand" - is the version of LineStrong3Z where the placement of the grab wire switch is to the right in the installation.

Both versions are in stainless steel 316 housings and are designed specifically to withstand the tough environments found in the food and pharmaceutical industries. LineStrong3LZ/3RZ are designed to protect a length up to 100 meters on a single switch. If two switches are used together, up to 125 meters. A two colour LED ensures switch status can be seen easily from a distance. They have 4NC and 2NO contacts to ensure flexibility with all modern control application.



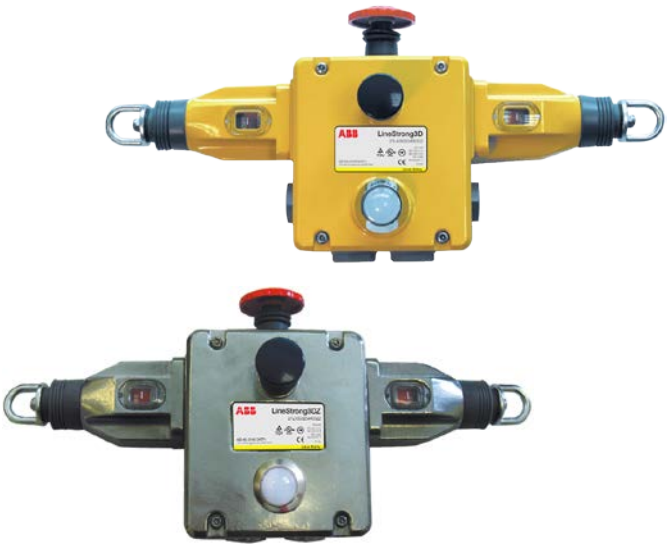
Dimensions LineStrong3L/R and LineStrong3LZ/RZ



Double Wire
LineStrong3D and LineStrong3DZ

LineStrong3D - Standard version

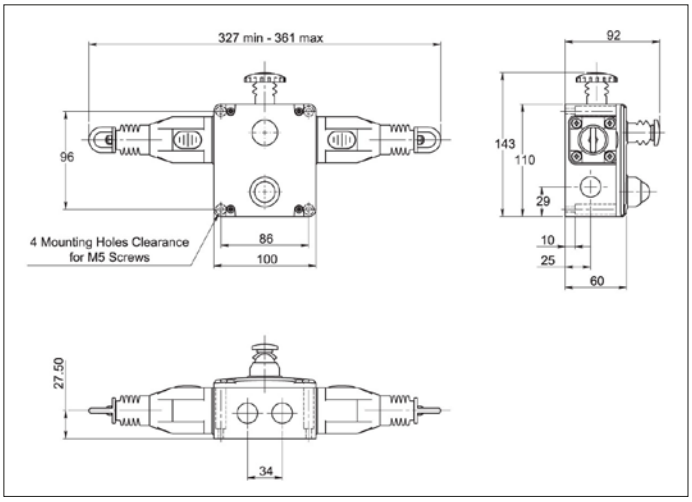
The Linestrong3D is a third version of the Linstrong3. With wire entries from both sides of the grab wire switch, LineStrong3D can be used for a long protection length. The LineStrong3D has a die-cast housing and is robust to manage severe indoor or outdoor use. LineStrong3D is designed to protect a length up to 200 meters on a single switch. If several switches are used together, it will be possible with a length up to 125 meters between the switches. A two colour LED ensures switch status can be seen easily from a distance. LineStrong3D have 4NC and 2NO contacts to ensure flexibility with all modern control application.



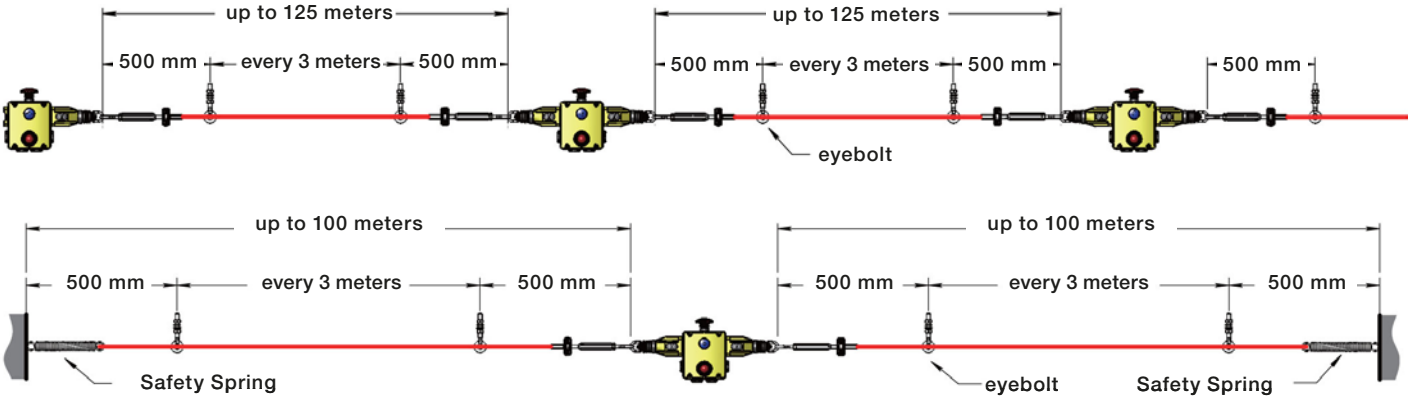
LineStrong3DZ - Stainless steel version

The Linestrong3DZ is a third version of the Linstrong3Z. As a stainless steel version with wire entries on both sides of the grab wire switch, LineStrong3DZ can be used for a long protection length.

The LineStrong3DZ has stainless steel 316 housing and is designed specifically to withstand the tough environments found in the food and pharmaceutical industries. LineStrong3DZ is designed to protect a length up to 200 meters on a single switch. If several switches are used together it will be possible with a length up to 125 meters between the switches. A two colour LED ensures switch status can be seen easily from a distance. LineStrong3DZ have 4NC and 2NO contacts to ensure flexibility with all modern control application.



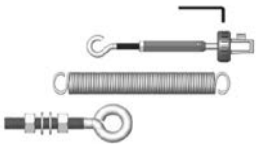
Dimensions LineStrong3D and LineStrong3DZ



Technical data – LineStrong3 series

Article number	
LineStrong3D	2TLA050204R1030
Level of Safety	
EN ISO 13849-1	Up to PL e, Cat. 4 depending upon system architecture
EN 62061	Up to SIL3 depending upon system architecture
Safety data	
Mechanical reliability B_{10d}	1.5 x 10^6 operations at 100mA load 21 years
Proof test interval (life) $MTTF_d$	214 years (8 cycles per hour/24 hours per day/365 days)
Wire span	
LIneStrong3D/DZ(X)	Up to 250 m
Wire tension device	Tensioner / Gripper- Quick Fixing
Wire type	PVC sheath steel wire 4.0 mm outside diameter
Torque settings	Mounting M5 4.0Nm, Lid T20 Torx M4 1.5Nm, Terminals 1.0Nm
Termination	Clamp up to 2.5 mm2 conductors
Tension force (typical mid setting)	130N
Tension operating force (wire pulled)	< 125N < 300 mm deflection
Short circuit overload Protection	Fuse extenally 10A (FF)
Rated insulation/withstand voltages	500VAC / 2500VAC
Utilisation category	AC15 A300 3A
Vibration resistance	10-500Hz 0.35 mm
Shock resistance	15 g 11 ms
Thermal current (Ith)	10A
LED	24 VDC
Contact type	IEC/EN 60947-5-1 double break Typ Zb snap action
Contact material	Silver
Conduit entries	4 X 1/2 NPT
Enclosure classification	
LineStrong3D/L/R	IP67
Ambient temperature:	
LineStrong3L/R/D	-25°C to +80°C
Enclosure material/cover:	
LineStrong3L/R/D	Die cast painted yellow
Mounting position	Any
Mounting bolts	4 X 3/16
Explosion Proof version (X)	
Classification	Ex d IIC T6 (-20°C ≤ Ta ≤ +60°C) Gb Ex tb IIIC T85°C (-20°C ≤ Ta ≤ +60°C) Db
Rated Voltage	250V AC/DC
Rated Current	2 pole 4A
	4 pole 2.5A

Emergency Stop Grab Wire Safety Switch
Accessories



Accessories

Type		Article number
Wire pull kit includes: Wire, Eyebolts, Tensioner /Gripper, Allen key		
Galvanized wire pull kits	10 m wire kit	2TLA050210R0130
	50 m wire kit	2TLA050210R0530
Stainless steel wire pull kits	10 m wire kit	2TLA050210R0120
	50 m wire kit	2TLA050210R0520
Wire only	10 m wire	2TLA050210R2120
	50 m wire	2TLA050210R2420
	100 m wire	2TLA050210R2620
Wire Tensioner / Gripper	Tensioner / Gripper, galvanized	2TLA050210R4030
	Tensioner / Gripper, stainless steel	2TLA050210R4020
Corner pulley	Corner pulley, galvanized	2TLA050210R6030
	Corner pulley, stainless steel	2TLA050210R6020
Eyebolt	Eyebolt, M8 x 1.25, galvanized	2TLA050210R8030
	Eyebolt, M8 x 1.25, stainless steel	2TLA050210R8020
General wire pull accessories	Safety spring, 220 mm long, stainless steel	2TLA050211R0004

Contact edges, Bumpers and Safety mats

When shall I use Safety contact edges, Safety bumpers and Safety mats?

Contact edges and Bumpers

Contact edges are used as protection against squeezing accidents, i.e. on moving machine parts and automatic doors and hatches. The strips come in customised lengths and various cross sections.

Bumpers are used as safety buffers to protect against remote control transport vehicles and other dangerous moving objects that require long stopping distances.

§

Standard: EN 1760-2 Safety of machinery - Pressure sensitive protective devices - Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars

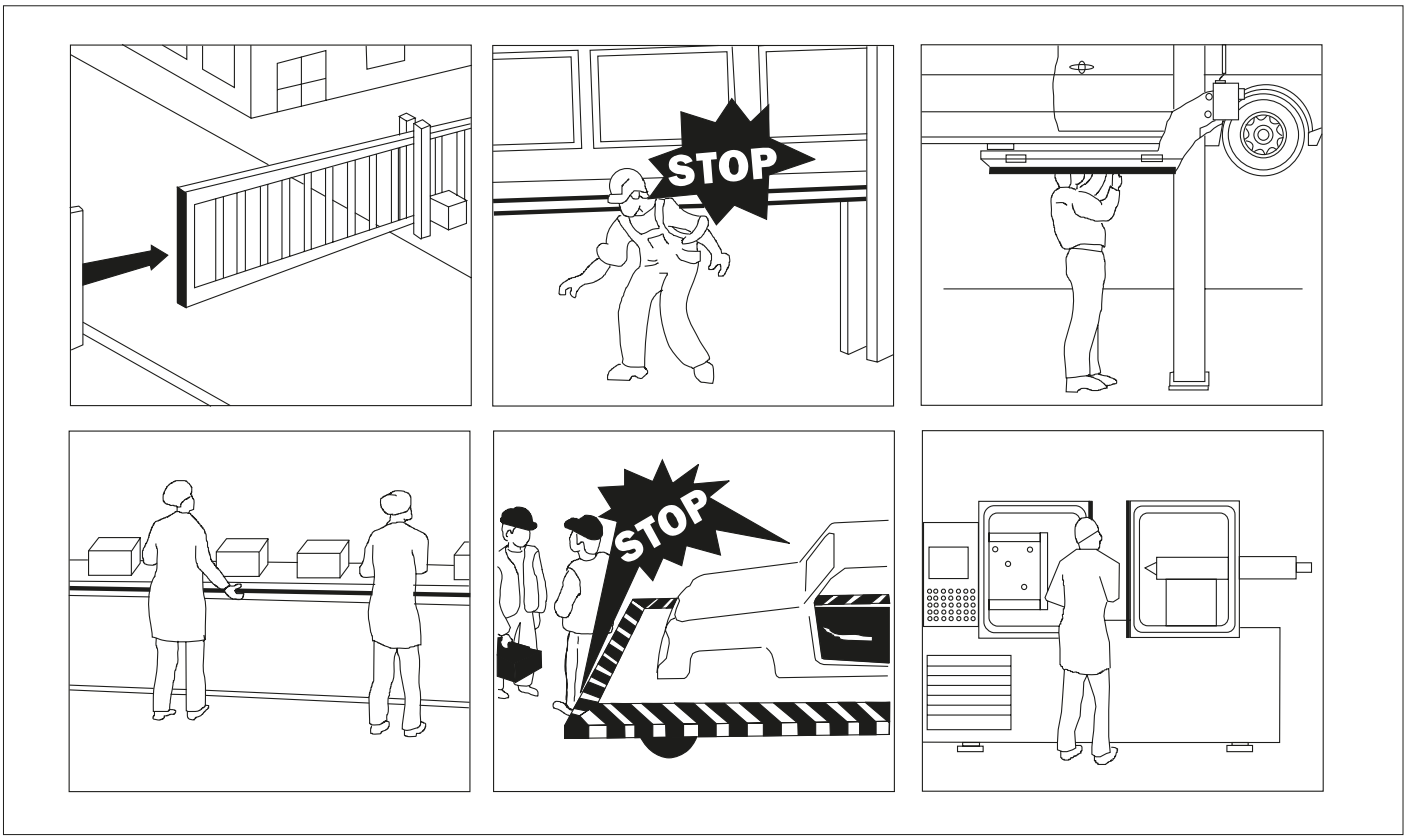
Safety mats

Safety mats are used for protection around hazardous machinery. They are well suited for monitoring an area used for loading and unloading of material to a machine.

§

Standard: EN 1760-1 Safety of machinery - Pressure sensitive protective devices - Part 1: General principles for the design and testing of pressure sensitive mats and pressure sensitive floors

Fields of Application



Safety contact edges

Approvals:

Application:

- Protection against squeezing accidents on moving machine parts and automatic doors.

Features:

- Can be connected to a safety relay, Vital or Pluto
- Supplied in customized lengths
- IP65
- Lengths up to 25 m.

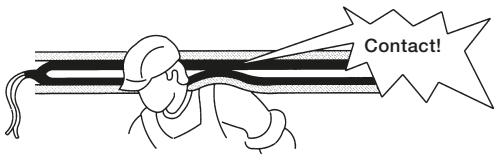
General
Safety contact edges are employed to guard closing edges at possible crushing or shearing points. They are used in gates, machines and handling facilities to protect people and equipment. They consist of an aluminium support profile, the contactor profile and the safety contact edge.

Contact edges with cast-in contact strips
The safety contact edges GE series consist of a rubber profile with a cast-in contact strip. In the ends there are special connection plugs and terminal caps (End caps) adapted according to the rubber profile. The end components are glued together with a certain two component glue. The contact edge is mounted on an aluminium C-profile. The GE series is available in EPDM design and can be supplied in lengths up to 25 m.

Contact edges with contact strips SKS 18
The safety contact edges GP series consists of a rubber profile with a separate safety contact strip (SKS 18) inside. The contact edge is mounted on an aluminium C-profile. The special design of profiles in EPDM or NBR rubber, protect the inner contact strip in the best way possible against damage and allows actuating angles to exceed 90°. GP series is normally supplied in lengths up to 6 m and is always delivered preassembled.

Material
EPDM design that has a good resistance to ozone and weather, especially against chemicals.
NBR has good resistance to oil and petrol.

Supervision
The Safety Contact edge must be connected to a suitable two input channel Safety Relay. e.g. ABB Jokab Safety type RT6/RT7/RT9 which provides all necessary monitoring of the contact edges activation and detection of cable faults.
The twin cable connection makes it possible to connect several contact edges in series.

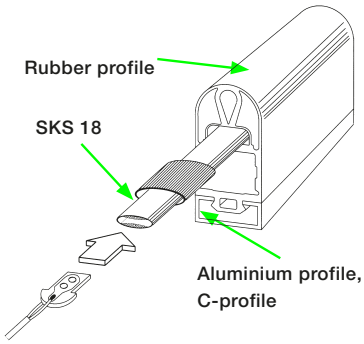


Contact edges GP - General

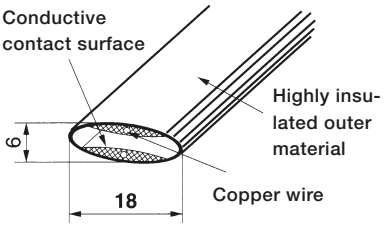
The safety contact edges GP series consist of a contact strip, SKS 18. This is the actual contactor that is located inside the safety contact edge. The safety contact strip consist of a homogeneous highly insulating outer EPDM material and has two internal conducting contact surfaces. The conducting elastomer contains two copper wires that provide low-resistance detection even in lengths exceeding 100 m. Because of the contact points, the safety contact edge has approximate 20 mm of inactive length at each end.

To provide protection against damage and to enable its proper use, the safety contact strip is inserted into the switching chamber of the rubber profile. The rubber profiles (EDPM or NBR) are then permanently sealed with a special elastic adhesive and end caps to make them watertight. The rubber profile is then mounted on the aluminium profile. The contact strip together with the rubber profile makes the GP safety contact edge.

Safety contact edge, construction



Safety contact strip SKS 18

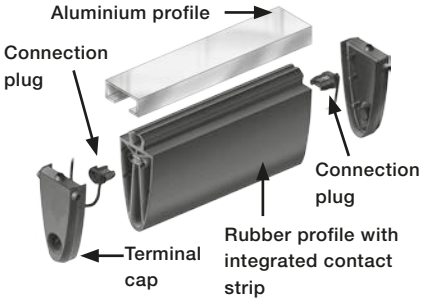


Technical data - SKS 18

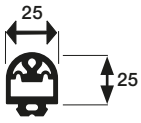
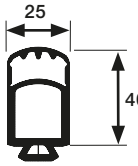
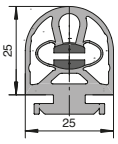
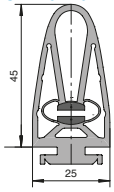
Outer material	EPDM, electrical insulation >30 Mohm
Inner material	EPDM, electrical elastomer with reinforce copper wire
Conductivity	60 ohm / 100 meters
Contact resistance	approx. 50 ohm
Max. electrical load	24 V / 100 mA
Max. applied pressure	6.5 N/cm2
Dimensions	18 x 6 mm

Contact edges GE - General

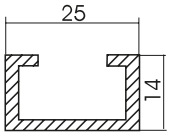
Inside the GE contact edge there is a cast-in contact strip that consists of two conductive alternating surfaces on the inside and a highly-effective insulating shell. There are two conductive wires in the contact surfaces that allow for low ohm measurements even when the contact edge has an extended length. The cast-in contact strip is protected against damage by the surrounding chamber. The cast end plugs ensure a permanent contact from the conductive surfaces in the contact strip. A special flexible adhesive is used to make the connector ring watertight.



Technical data - Rubber profiles

Type		GP 25-25	GP 25-40	GE 25-25	GE 25-45
					
Fixing Profile		AL 25-14	AL 25-14	Al 25-14	Al 25-14
Material		EPDM/NBR	EPDM/NBR	EPDM	EPDM
Length max (m)	(1)	6(10)	6(10)	25	25
Weight (g/m)		370	480	510	770
Weight incl. C-Profile (g/m)		690	800	820	1080
Activation force (N)	(2)	34/37	39/52	64,1	69,1
Actuating distance (mm)	(3)	8.0/7.5	9.4/9.7	4,7	6,73
Braking distance (mm)	(3)	7.2/5.9	10.2/9.5	6.48	20.73
Max. actuating (°)	(4)	2x 45°	2x 60°	2x20°	2x20°

(1) 10 m lengths of GP edges on request
(2) Measured with (Ø 80 mm test specimen),10 mm/s
(3) Measuring speed 10 mm/s
(4) Not including DIN 31006-2 (GS - BE - 17)



The selected contact profile should be mounted using a suitable aluminium C profile.

NOTE! Contact us for other profile sizes.

Technical data - Contact edges

GP – Contact edges	
GP 25-25 EPDM	Complete RFQ form on page 8/8
GP 25-25 NBR	Complete RFQ form on page 8/8
GP 25-40 EPDM	Complete RFQ form on page 8/8
GP 25-40 NBR	Complete RFQ form on page 8/8
Article number GE – Contact edges	
GE 25-25 EPDM per meter	Complete RFQ form on page 8/7
GE 25-45 EPDM per meter	Complete RFQ form on page 8/7
Others	
Al 25-14 aluminum profile	2TLA076002R0200
Mechanical load max [1]	500 N
Actuating angle (DIN)[1]	2x 20°
Mechanical life[1]	10^5
Max. operate temp. range[2]	-20C° to +55°C
Max. temperature range	-25°C to +70°C
Protection classification	IP65
Max. electrical load	24 VDC 100mA
Resistance	0.6 Ohm/m
Conductors	GP: 2x 0.38 mm^2 GE: 2x 0.34 mm^2
Conductors insulation material	GP: PVC GE: PUR matte black

[1] According to DIN 31006-2 (GS - BE - 17)
[2] Not including DIN 31006-2 (GS - BE - 17)

Ordering Contact edges

GP

When ordering a Contact edge, the best way is to complete the GP RFQ form on page 8/8 and submit it to lvp.rfq@ca.abb.com.

GE

When ordering a Contact edge, the best way is to complete the GE RFQ form on page 8/7 and submit it to lvp.rfq@ca.abb.com.

Jokab Safety Edge RFQ – Type GE

Please email this completed form to lvp.rfq@ca.abb.com
Toll Free: 1-800-567-0283

Company:..... Project Reference:.....

Contact:..... Email:..... Phone:.....

Select desired GE Edge profile

Available

- ☐ GE125TT-2
- ☐ GE125TTLi2
- ☐ GE225TB-2
- ☐ **GE225TK-2** (Standard)
- ☐ GE225TKLL2
- ☐ **GE245TK-2** (Standard)
- ☐ GE245TKLL2
- ☐ GE365CK-2
- ☐ GE365CKLL2

Edge Length:.....inches (max 82 feet)

Cable 1:.....inches (std is 8ft 2in)

Cable 2:.....inches (std is 8ft 2in)

Field Wireable Connector: ☐ Yes ☐ No

Metal Mount Channel: ☐ Yes ☐ No

Plastic Mount Channel: ☐ Yes ☐ No
(Available for all GE225, GE245 only)

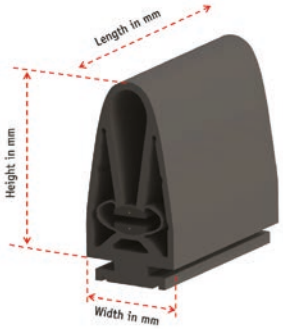
Clips-Base

T-Base

Li

LL

GE Edge details



GE Edge Part Number Breakdown

GE x xx x x xx x x L=x.x

Safety Contact Edge

GE Profile Width
1: 15mm
2: 25mm
3: 35mm
4: 42mm
F: Flexible

Profile Height in mm

Base shape
C: Clips-base
T: T-base

Materials
K: EPDM
N: NBR
T: TPE
B: Fire-retardant

Sealing Lips (For Doors)
– None
Li: Single sided inwards
La: Single sided outwards
LL: Double sided outwards

Type of the edge
2: Connecting edge
4: Connecting edge with 1x plug M8 plus 1 x clutch plug M8

With/without Aluminum
M: With Aluminum-C-Profile

Edge length in inches
Max 82 feet

Jokab Safety Edge RFQ – Type GP

Please email this completed form to lvp.rfq@ca.abb.com
Toll Free: 1-800-567-0283

Company: ..... Project Reference: .....

Contact: ..... Email: ..... Phone: .....

Select desired GP Edge profile

Available

- ☐ GP25-25CK-2
- ☐ GP25-40CK-2
- ☐ GP25-65CKLi2
- ☐ GP35-60CK-2
- ☐ GP35-80CK-2
- ☐ GP35-105CKLi2

If edge will be in contact with oil, these are the choices

- ☐ GP25-25CN-2
- ☐ GP25-40CN-2
- ☐ GP25-65CNLi2
- ☐ GP35-60CN-2

Edge Length: ..... inches (max 82 feet)

Cable 1: ..... inches (std is 8ft 2in)

Cable 2: ..... inches (std is 8ft 2in)

Field Wireable Connector: ☐ Yes ☐ No

Metal Mount Channel: ☐ Yes ☐ No

Plastic Mount Channel: ☐ Yes ☐ No
(Available for all GP25-25, G25-40 and GP25-65 only)

Clips-Base

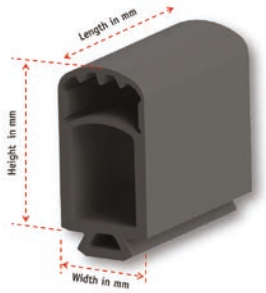
T-Base

Li

LL

GP Edge details

GP Edges typically are installed on European machines or ordered as replacement parts for European machines.



GP Edge Part Number Breakdown

GP xx -xx x x xx x x L=x.x

Safety Contact Edge

GP Profile Width

Profile Height in mm

Base shape
C: Clips-base
T: T-base

Materials
K: EPDM
N: NBR
T: TPE
B: Fire-retardant

Sealing Lips (For Doors)
– None
Li: Single sided inwards
La: Single sided outwards
LL: Double sided outwards

Type of the edge
2: Connecting edge
4: Connecting edge with 1x plug M8 plus 1 x clutch plug M8

With/without Aluminum
M: With Aluminum-C-Profile

Edge length in inches
Max 82 feet

Safety bumpers

Approvals:

CE

Application:

– Protection against squeezing accidents on moving machine parts and automatic doors.

Features:

– Can be connected to a safety relay, Vital or Pluto
– Customized lengths
– Customized shape
– IP65
– Lengths up to 3 m

Safety bumpers

Safety bumpers are safety equipment on transport vehicles, FTS vehicles, high-reach forklifts, freely moving systems, and everywhere where the safety systems require larger form alterations. When running against an obstacle, the short response time of the bumper initiates an immediate controller stop, while the bumper's soft foam core provides a long braking and run out path. This provides optimum protection for individuals and materials. The exterior surface is available as PU or NBR rubber. Standard colours for the PU exterior are either black or black with yellow stripes. The NBR rubber exterior is black on which yellow stripes can be applied.

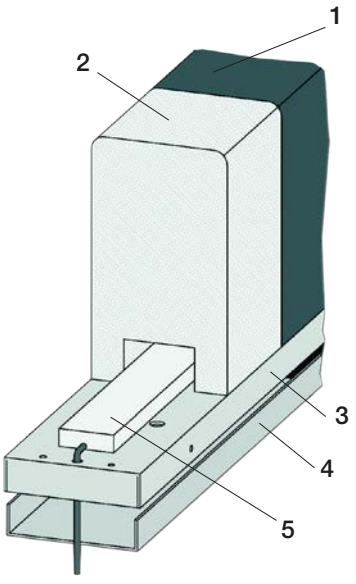
The principle

The contact function of the ABB Jokab Safety bumper consists of the safety contact strip SKS 18 being actuated by a special mechanical construction. This construction, which is protected by a large foam cushion, is inserted and glued to the carrier aluminum profile. The foam rubber is covered with a polyurethane or NBR skin. By utilising this construction the bumper gives a stop signal when impacted from all directions with soft sides. The bumpers are delivered mounted to the carrier profile in ordered lengths (0.2 m – 3 m).

Supervision

The Safety bumper must be connected to a suitable two input channel Safety Relay. e.g. ABB Jokab Safety type RT6/RT7/RT9 which provides all necessary monitoring of the bumpers activation and detection of cable faults. The twin cable connection makes it possible to connect several bumpers in series.

1. Polyurethane exterior
2. Foam core
3. Carrier profile
4. Mounting profile
5. Sensing element



Technical data - Bumpers ASB

Article number	
53/100 black	Complete Bumper RFQ form on page 8/11 and submit it to lvp.rfq@ca.abb.com
100/200 black	Complete Bumper RFQ form on page 8/11 and submit it to lvp.rfq@ca.abb.com
150/300 black	Complete Bumper RFQ form on page 8/11 and submit it to lvp.rfq@ca.abb.com
200/400 black	Complete Bumper RFQ form on page 8/11 and submit it to lvp.rfq@ca.abb.com
53/100 black/yellow	Complete Bumper RFQ form on page 8/11 and submit it to lvp.rfq@ca.abb.com
100/200 black/yellow	Complete Bumper RFQ form on page 8/11 and submit it to lvp.rfq@ca.abb.com
150/300 black/yellow	Complete Bumper RFQ form on page 8/11 and submit it to lvp.rfq@ca.abb.com
200/400 black/yellow	Complete Bumper RFQ form on page 8/11 and submit it to lvp.rfq@ca.abb.com
Dimensions	in accordance with the illustration, or special dimensions
Actuating distance	~20% of height
Braking distance	>50% of height
Actuating force [N]	<150 N with round body 80 mm <300 N with test object 45 x 400 mm
Mechanical life	$>10^5$
Protection class	IP65
Ambient temperature	0° to +60°
Chemical resistance	
Oil, grease	good
10% acid	resistant
10% alkaline (caustic) solutions	resistant
Connection	8’ 2” cable with 4 wires

Ordering Safety bumpers

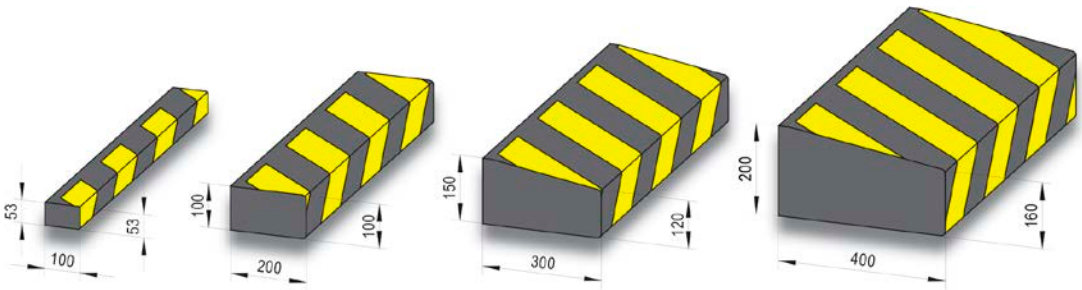
When ordering a Safety contact bumper, the best way is to complete the RFQ form on page 8/11 and submit it to lvp.rfq@ca.abb.com.

Lengths and Connection

The ASB Safety bumper is available in lengths up to 3,000 mm. Wiring outputs are located at each end of the bumper. Special designs available on request.

X = Bumper hight, Y = Bumper width, Z = Bumper length

Dimensions/Shapes



Special designs and special available on request

Jokab Safety Bumper RFQ

Please email this completed form to lvp.rfq@ca.abb.com
Toll Free: 1-800-567-0283

Company: ..... Project Reference: .....

Contact: ..... Email: ..... Phone: .....

Select desired Bumper profile

Available

- ☐ ASB53-100U2
- ☐ ASB100-200U2
- ☐ ASB150-300U2
- ☐ ASB200-400U2

Bumper Length: ..... inches (max 120 inches)

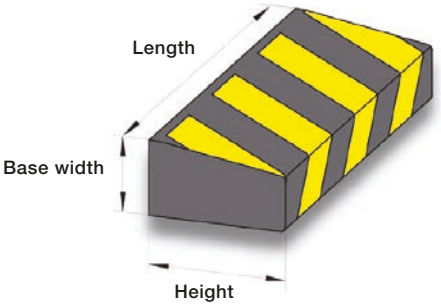
Cable 1: ..... inches (std is 8ft 2in)

Cable 2: ..... inches (std is 8ft 2in)

Color: ☐ Black ☐ Black/Yellow

Field Wireable Connector: ☐ Yes ☐ No

Safety Bumpers info



ASB xxx xxx x x L=x.x

Safety Contact Bumper

Base width of bumper in mm

Height of bumper in mm

Materials
U: Polyurethane
N: NBR rubber

Bumper type
2: Connection bumper

4: Bumper for serial connection
1x male plug M8
plus 1 x female plug M8

Bumper length in inches

Notes

Safety mats

Approvals:

Safety mats for

- Personal protection within the dangerous areas around presses, robots, production lines, machines etc.

Features:

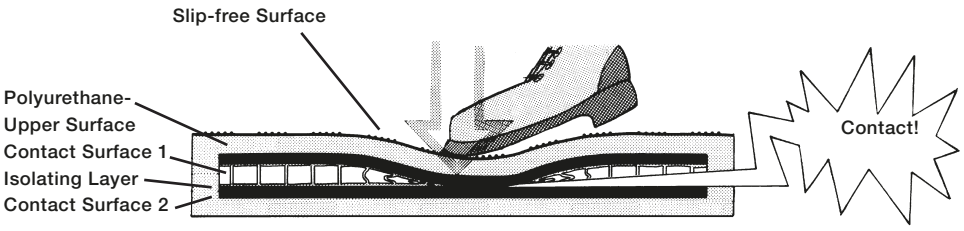
- Can be connected to a safety relay, Vital or Pluto
- Very durable
- IP65

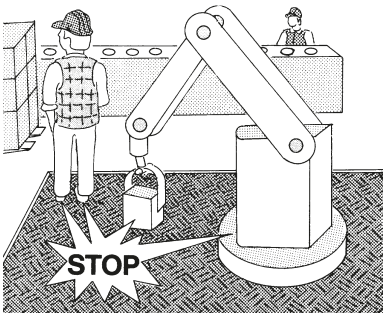
Personal protection within dangerous areas

The ASK Safety mat is used for safeguarding sections within the dangerous areas around presses, robots, production lines, machines and other types of active equipment. When connected to a suitable monitoring system, stepping on the Safety Mat will immediately be detected causing dangerous machine movements to be stopped. This is made possible by the detection of electrical contacts closing within the sandwich construction of the mat. The safety mats offered by ABB Jokab Safety are available in two version, with or without a cast-in moulded ramp rail. Custom made size or shapes of the Safety mats can also be offered. Mounting to the floor can be realized with optional aluminum ramp rails RS14 (for mats without moulded ramp rail).

Mat construction

The basic construction of the Safety mat is made up of a sandwich construction. The pressure contact switch consists of two conducting plates which are separated from each other by a proprietary isolating layer. The internal switching plates are cast into a durable polyurethane material to protect against moisture, and are then covered with a top layer of slip-free rubber. This surface provides excellent resistance against oil, water and grease.





Safety distance - Safety mat as per EN ISO 13855

If a safety mat is used as entry protection, the smallest permitted safety distance between the hazardous area and the outer edge of the mat (seen from the hazard) is calculated using the formula from EN ISO 13855.

S = (K * T) + C

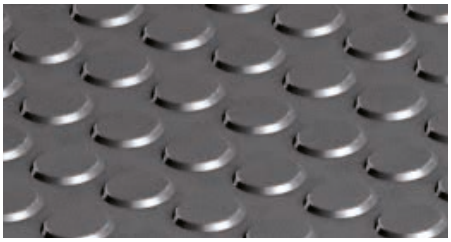
S = smallest permitted safety distance in mm
K = body speed (velocity of propagation 1600 mm/s)
C = additional distance in mm based on the intrusion of the body into the risk zone before the protection device is actuated (1200 mm applies for safety mats).

i.e.

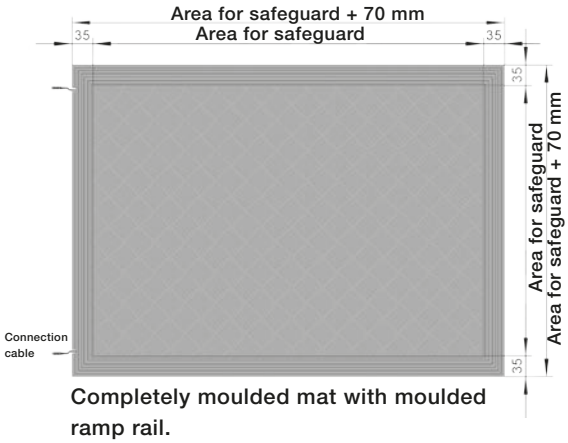
S = (1600 * T) + 1200

Surface layer - Safety mats

Safety mats are normally supplied with a dotted polyurethane non-slip surface layer that withstands tough conditions very well (oil, acid or caustic substances) and has anti-slip properties. If required, other patterns can be supplied, or for special requirements even other materials, such as NBR rubber or diamond plating.

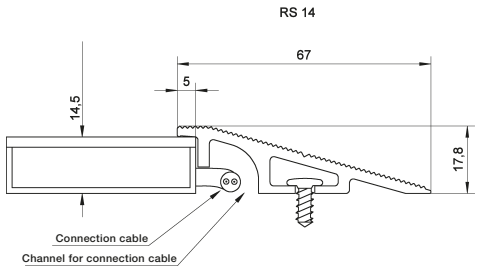


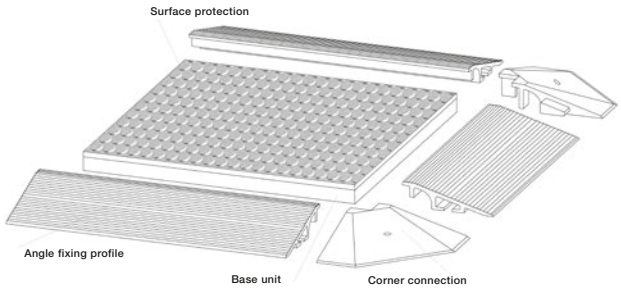
Edge Trim - Safety mats



Completely moulded mat with moulded ramp rail.

Completely moulded mat without moulded ramp rail. Ramp rail in aluminum profile (RS14).





Edge trim RS14

Eliminates vertical edges and attaches the Safety mat to the floor. Also provides protection and channel for connection cables.

Profile BS14

Best for use on the side nearest the machine. Permits a shorter distance from, for example a wall.

Corner trim

Can be used between two RS 14 profiles as an alternative to mitre cutting of profiles.

Technical Data - Safety mats

Article number Standard	
Safety Mat WO Trim 24” X 36”	2TLA858002R4000
Safety Mat WO Trim 24” X 48”	2TLA858002R4200
Safety Mat WO Trim 24” X 60”	2TLA858002R4300
Safety Mat WO Trim 30” X 30”	2TLA858002R4400
Safety Mat WO Trim 30” X 42”	2TLA858002R4600
Safety Mat WO Trim 36” X 48”	2TLA858002R5000
Safety Mat WO Trim 36” X 60”	2TLA858002R5100
Safety Mat W Trim 24” X 30”	2TLA858002R5700
Safety Mat W Trim 24” X 36”	2TLA858002R5800
Safety Mat W Trim 36” X 48”	2TLA858002R6800
Custom made	Complete the RFQ form on page 8/16 and submit it to lvp.rfq@ca.abb.com
Accessories	
Edge trim RS14	2TLA076300R0500
Corner trim	2TLA076300R0900
Maximum area	One mat = 4 ft X 5 ft Several mats = 108 sq ft
Minimum size	6 inch X 6 inch
Height	max 14.5 mm with slip-free surface
Inactive area	Nominally 10 mm from Mat edge
Switching force	150N (Round body 80 mm)
Maximum pressure	2000 N over ø 80 mm
Material	NP - Euro dot surface, other colours on request
Protection class	IP65
Ambient air temperature	0°C to +60°C
Chemical resistance	
Oil, grease	good
10% acid	resistant
10% alkaline (caustic) solutions	resistant
Connection	8’ 2” cable with 4 wires
Mechanical life	> $1.5x10^6$ load shifting

Ordering custom made Safety mats

When ordering a custom made mat, a signed off drawing will be required with the purchase order, to ensure that what is received is correct as they will be non returnable. Complete the Safety Mat RFQ form on page 8/16 and submit it to lvp.rfq@ca.abb.com.

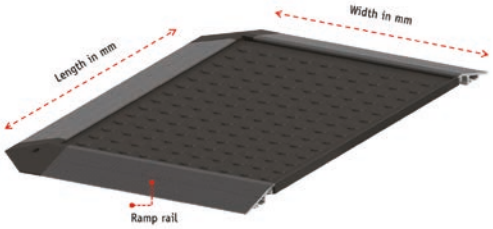
Jokab Safety Mat RFQ

Please email this completed form to lvp.rfq@ca.abb.com
Toll Free: 1-800-567-0283

Company: ..... Project Reference: .....

Contact: ..... Email: ..... Phone: .....

Indicate Mat options



Safety Mat: ASK Safety Mat

Mat Type: ☐ ASK-T: Integrated Ramping (Add 35mm/side for Integrated Ramp)

☐ ASK-U: Square Edge (Add 65mm/side for Aluminum Ramp)

Number of zones: 1 Zone

Mat Color: ☐ Black ☐ Yellow

Mat Finish: ☐ Euro Dot ☐ Diamond Plate

Cable Type: 1 Cable, 4 Conductors ☐ **Cable Connector:** M12-C02 (2TLA020055R1100)

Cable Length: ☐ 10 meters (32.8 ft) ☐ **Optional Length** .....

Mat Dimensions: ..... inches x ..... inches (Max 48 inches x 60 inches)
(Max 108 sq ft)
(For Several Mats) ..... mm x ..... mm (Max 1219.2 mm x 1828.8 mm)

Quantity: .....

Not to scale – Also indicate with an “x” the approximate cable exit. Minimum 4” from end of protection zone

Electrical connections
Safety contact edges, Safety bumpers and Safety mats

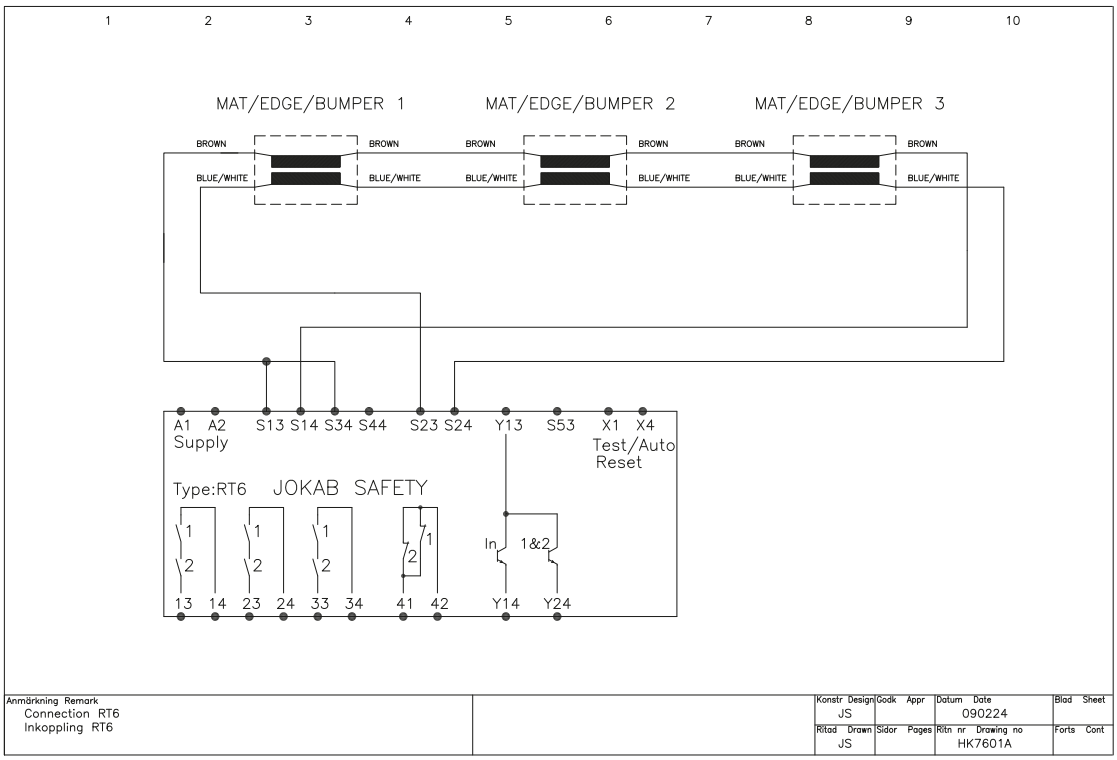
Contact edge, bumper or safety mat should be used with a suitable monitoring unit (e.g. ABB Jokab Safety safety relays RT6, RT7A/B, RT9, Vital with Tina 6A or Pluto safety-PLC).

The monitoring unit monitors the functionality of the contact protection and detects any breaks or short-circuits in the lines. Several crush protection units can be connected in series while still retaining the same level of safety.

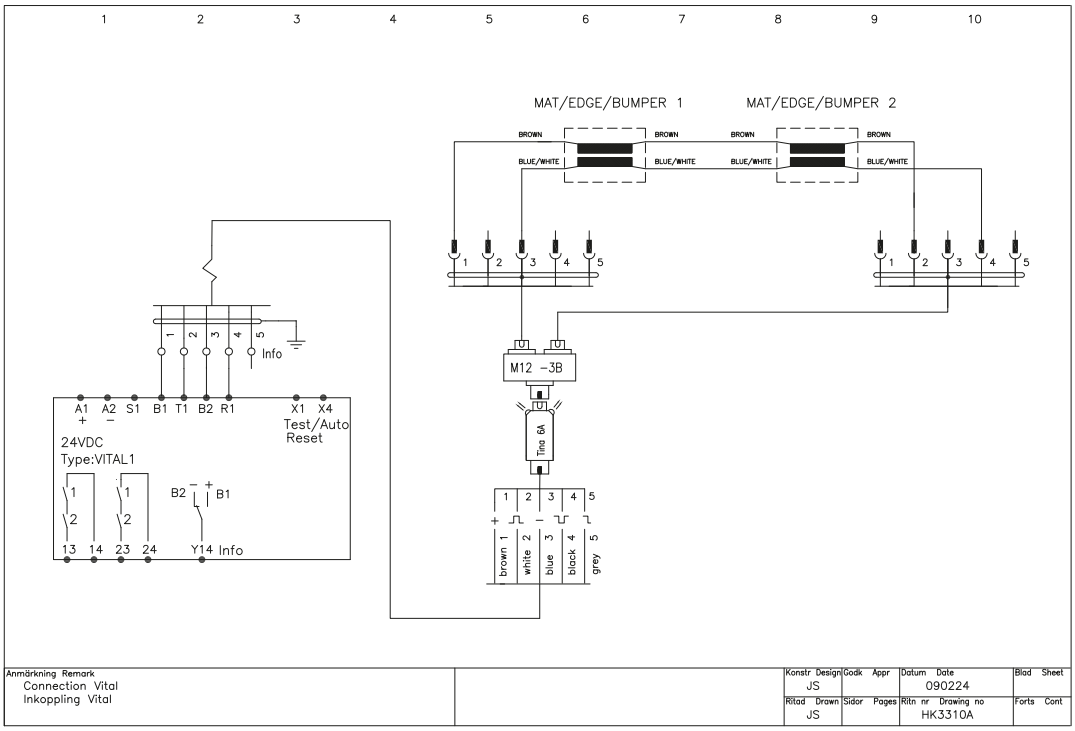
When pressure is applied, the active surface of the contact area in the contact protection is closed and the safety output on the monitoring unit trips. A stop signal will be sent to the machine's safety circuits preventing any dangerous movements.

NOTE! If alternative units are used rather than the recommended ABB Jokab Safety relays, it is essential that the user checks their suitability with ABB Jokab Safety before use. Failure to do so may result in incorrect operation and/or damage to the safety bumpers and invalidate the warranty.

HK7601A – Connection contact protection for safety relay RT6



HK3310A – Connection contact protection for safety controller Vital 1



HK0001A – Connection contact protection for safety PLC Pluto

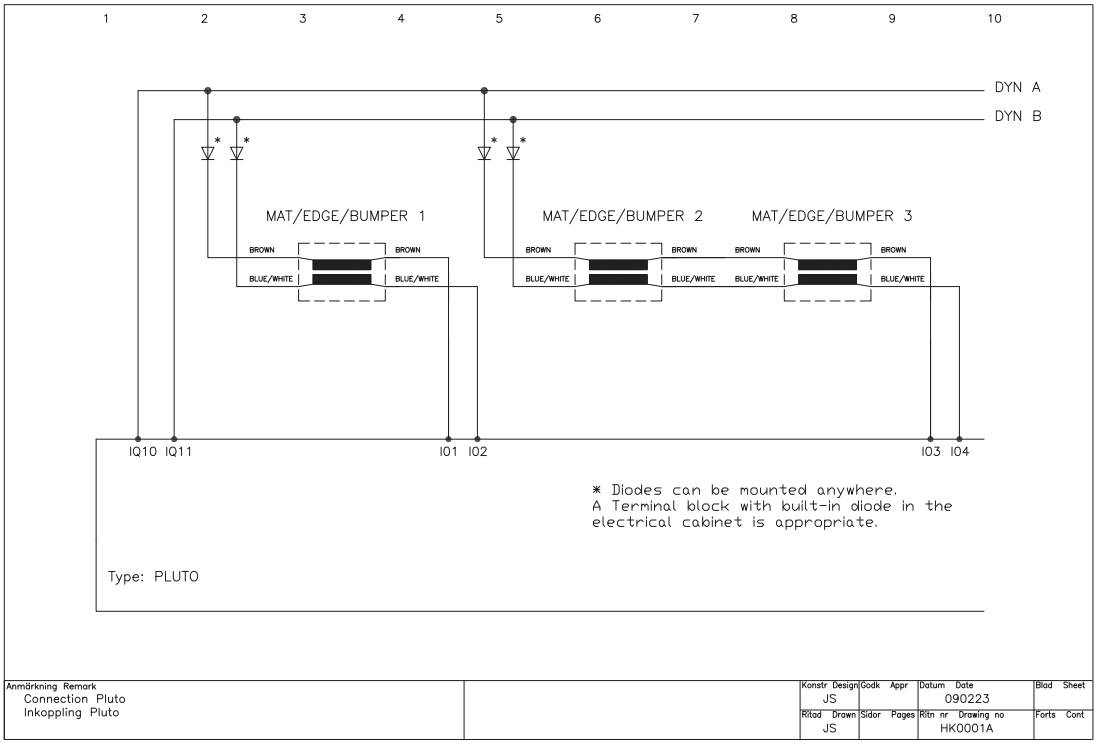



ABB
SAFETY PRODUCTS
Jokab Safety

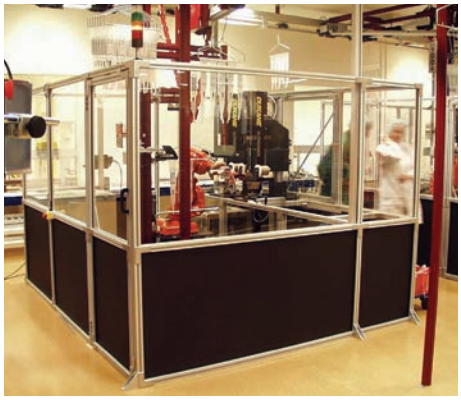
Fencing system
Mechanical Guarding

Components

Mechanical Guarding

Fencing system

Standard assembled with mesh.



Standard with black and transparent Polycarbonate in-fill panels as used for medical applications.

Express with few components and easy to angle at up to 45°.

Assembly

Due to our patented screw-lock system, we can supply all brackets pre-mounted with fixing screws and nuts. No holes need to be drilled in the profiles and all cutting is straight. This makes assembly and modification very easy.

Two versions of the Guarding fencing system

The Guarding fencing system is available in two versions, Guarding (Standard) and Express Guarding which also can be combined. The fencing systems are also easy to adjust when production equipment is modified and/or moved.

Proposal and ordering

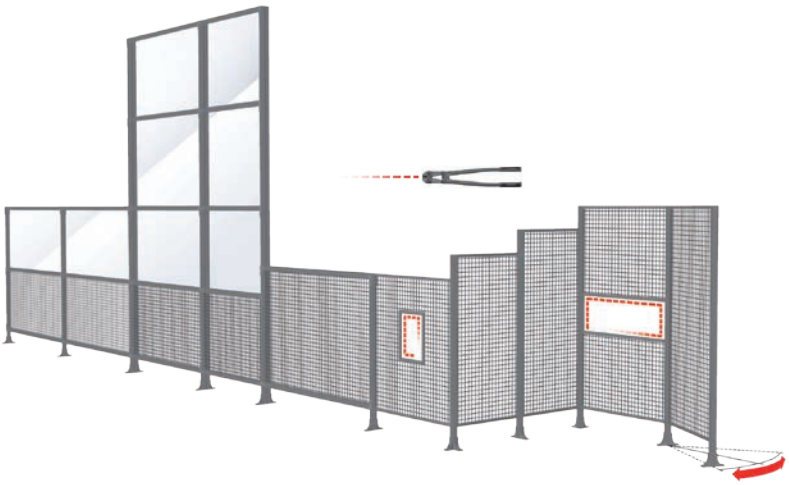
By utilising our AutoCAD-based SafeCAD application we are able to make system designs in 3D very quickly. Drawings, cutting lists, etc. are generated from SafeCAD and the drawings can also be used for installation purposes.

Our policy - To create systems that are environmentally friendly and provide ergonomic working conditions

Guarding is environmentally friendly. All components in the fencing System can easily be disassembled and reused. All materials in the fencing system are 100% recyclable. Guarding can also provide a pleasing ergonomic working environment.

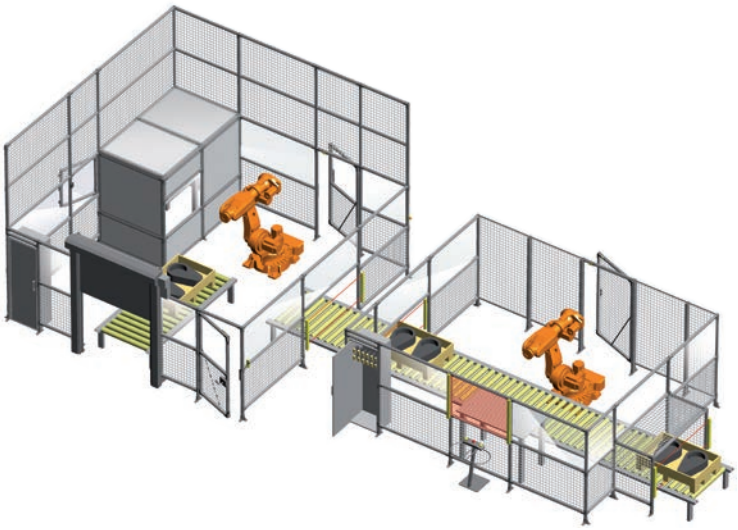
A flexible and stable fencing system which is easy to install

Fixings with pre-assembled screws and nuts mean easy assembly



Width, length and height adapted and easily changed according to needs

Choose from a large selection of hatches and doors



Mesh Plastic

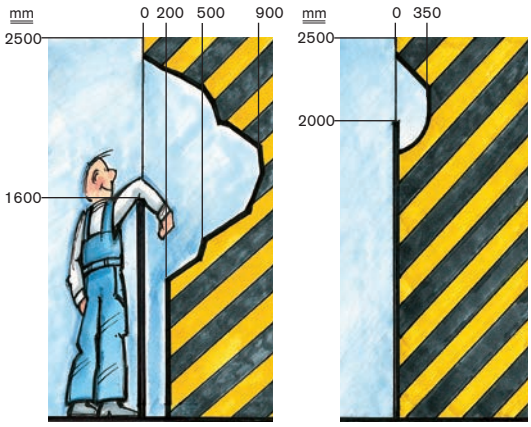
What does the standard say?

EN ISO 13857 applies as safety distance for the risk zones. The standard includes the dimensions that apply for safety distances in various risk situations. The adjacent figure shows examples of dimensions for safety distances for two different fence heights where the risk of injury is relatively small when you reach in.

With respect to mesh, you specify a minimum distance of 200 mm for opening size 40 x 40 mm. For shorter distances and for noise reduction we use solid panels. When the fence is to protect a robot cell, for example, the fence protection should be placed at a minimum distance of 500 mm between the fence protection and the moving machine part that reaches furthest out (as per EN 349). When test running or programming there must be a space between the fencing and any moving parts to ensure the operator does not become wedged between them.

For protection that needs to be mounted and removed again, for example for maintenance, the Machinery Directive requires that fasteners remain in place on the protection. We normally deal with this using interlocked doors/gates for faster and safer access.

Feel free to consult us about the requirements in regulations and standards.



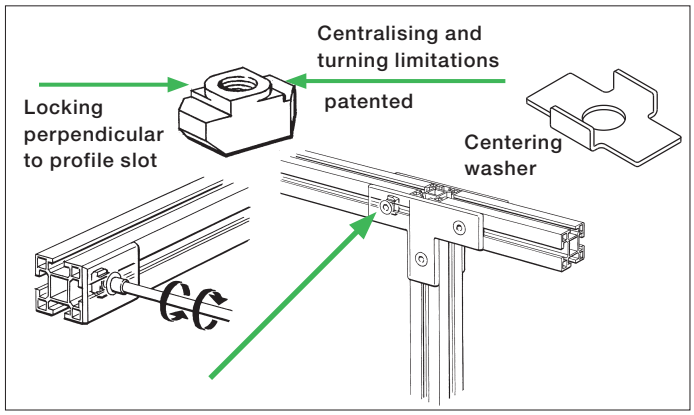
Safety distance for 1600 mm guarding with standard mesh. Safety distance for 2000 mm guarding with solid screens (e.g. polycarbonate sheet).

Safety distance for 1600 mm guarding with standard mesh. Safety distance for 2000 mm guarding with solid screens (e.g. polycarbonate sheet).

Patented assembly function

The ABB Jokab Safety patented guide and locking method makes it simple to assemble and dismantle the fencing system. The nut has several advantages, it can easily be located into the profile and automatically positions itself when the screw is turned 90 degrees clockwise. When in this position on the bracket being fixed can be adjusted as required and locked by turning the screw further clockwise. To remove the bracket the fixing screw is turned anti-clockwise until the nut is in line with the profile slot.

All fittings are supplied pre-assembled. Fittings that do not have a cast-in tab can be provided with a centering washer.



Mount the fixtures by first slackening the screw 3/4 turn anti-clockwise. Then tighten the screw clockwise in the usual way. The nut will then automatically mechanically lock the fixture into the profile.

Easy to adjust the position of fittings

The T-slot and patented nut makes it easy to attach fittings to the fencing profiles

Mechanical Guarding

Supplied in three ways

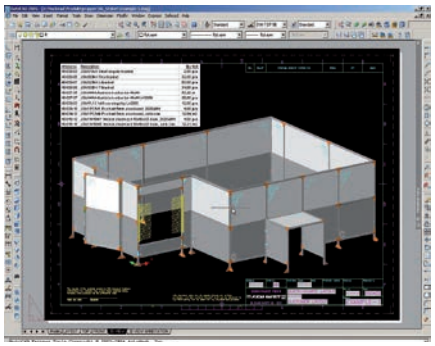
1. To be designed on site

You can order basic component as well as pre cut lengths of post and build as needed at your location.

To be designed on site.

2. Cut to size according to drawing

You give us a simple sketch or an AutoCAD® file of how you want the fencing system to look. We input this information into SafeCAD and design the fence in 3D. From this drawing, cutting and component lists and a quotation are generated automatically.



Cut to size according to drawing.

3. Pre-mounted

We can deliver partially pre assembled fencing systems to make assembly on site easier.

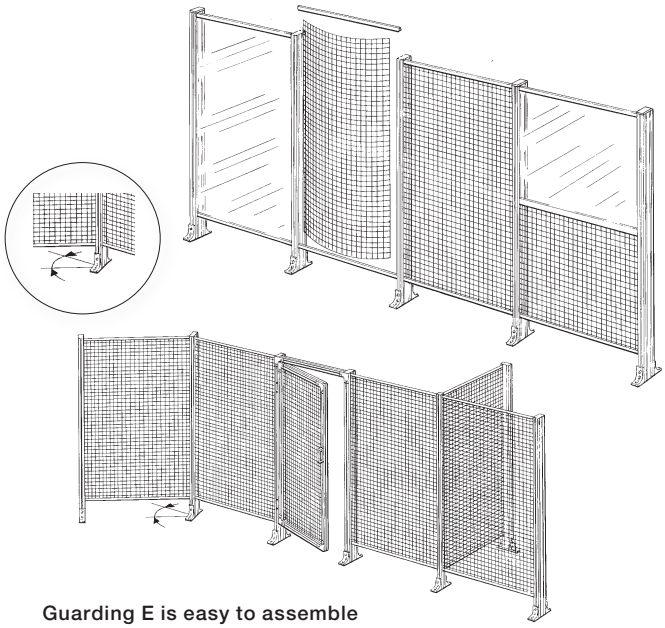
Pre-mounted or assembled on site.

Express Guarding
- design directly on site

Guarding E is installed quickly and cost effectively because it only consists of patented net-locks, welded mesh, panels of polycarbonate, u-profiles and fence posts (profiles with floor-brackets). All parts for Guarding and pre-assembled doors are delivered immediately from stock. The few components of the fencing system make it easy for you to custom build and install the fencing system yourselves.

The strength of the fencing system originates from the fact that the welded mesh and/or panels of polycarbonate are 'locked' into the profile. The outer wire of the mesh is locked by uniquely designed 'netlocks' into the profile making the fixing virtually as strong as being welded. The polycarbonate panels are locked in with specially designed infill-locks which, according to our tests, have been as strong as the mesh net-lock system. If you want more stable fencing posts, you can choose a sturdier profile measuring 44 x 88 mm instead of the standard 44 x 44 mm profile.

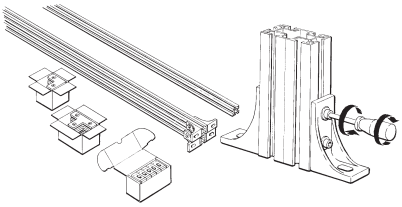
It is always easy to combine Guarding E with Guarding standard to achieve a complete system. It is also easy to adjust and modify the guarding system when production equipment is modified and/or moved.



Guarding E is easy to assemble and to angle 45°.

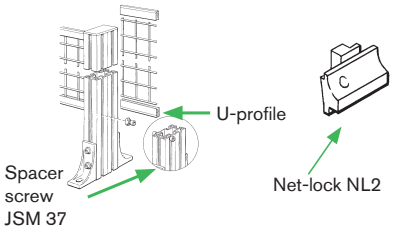
Assembly of Guarding Express

1.



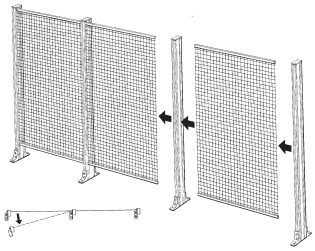
Premount floor fixtures on vertical posts. Mount fixtures by first slackening the screw anti-clockwise. Then tighten the screw clockwise in the usual way, the nut will then automatically locate into the correct position and mechanically lock the fixture into the profile. Make sure that the nut has turned correctly.

2.



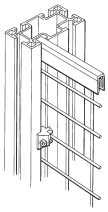
1. Mount a spacer screw 180 mm from the floor in the posts.
2. Attach the lower U-profile and mesh lock JSM NL2 to the mesh.
3. Push the mesh into the profile and fix the mesh with NL2 netlocks.
4. Fix top u-profile in place either before or after inserting the mesh.

3.



Assemble the next section. The distance between the posts can be adjusted some mm after the mesh is locked in with the Net-locks. The mesh can be angled up to 45° without using hinges (JSM 35-K).

4.



Lock the top of the mesh using NL3 netlocks; this way the mesh is secured, stabilised and electrically grounded. Grounding is needed when electrical devices or cables are assembled on the mesh.

Notes

Mechanical Guarding and SafeCAD®

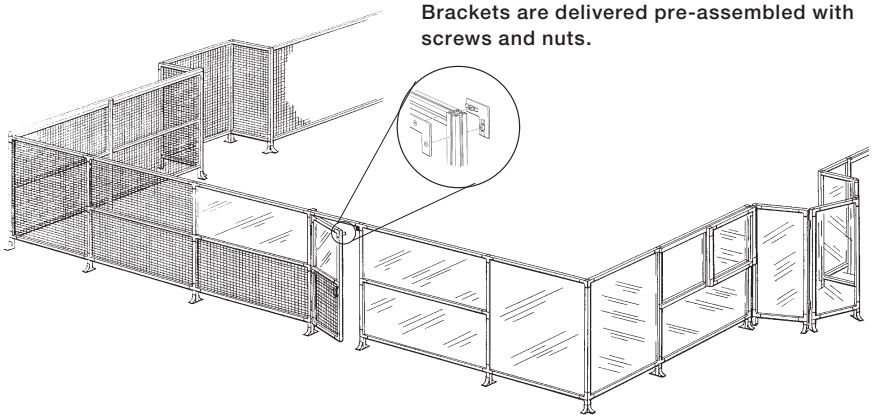
Order cut to length in accordance with drawing, pre-assembled or fitted on site.

Guarding consists of a minimum of different components, such as aluminum profiles, patented assembly parts, net-locks, mesh, solid or noise reduction panels. Furthermore the cost for assembly and modification of the system is low. Thanks to our patented screw-lock system, we can supply all brackets pre-mounted with fixing screws and nuts. No holes need to be drilled in the profiles and all cuts are made straight. Assembly and modification is therefore very easy.

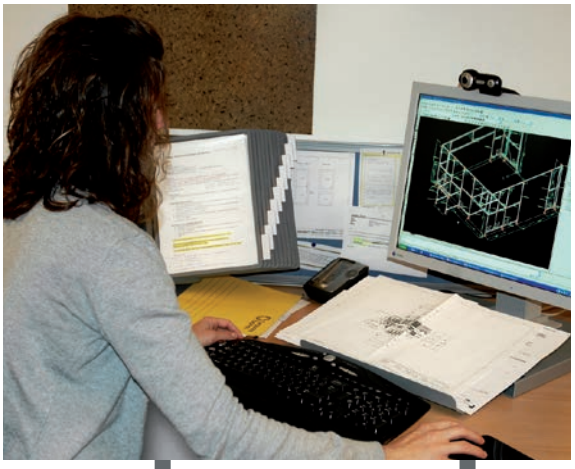
To be able to quickly and easily custom design practical safety solutions, we have developed a computer programme, SafeCAD. This is a 'plug-in' program for AutoCAD®. A simple sketch of the guarding system that is required is used as the program input. The positions of doors and hatches, choice of mesh, polycarbonate, aluminum/steel sheet or noise reduction panels are typed in. The program automatically generates 3D drawings along with component and cutting lists. These drawings are also used as the basis for assembly/installation.

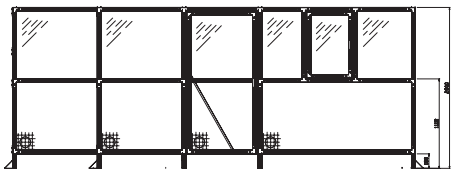
It is always easy to combine Guarding Express with Guarding to achieve a complete system. It is also easy to adjust and modify when the production equipment is modified and/or moved.

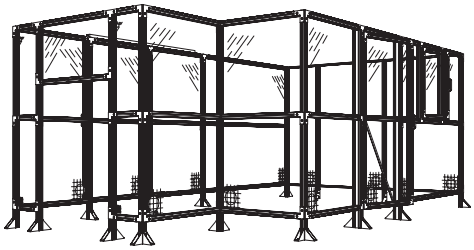
Brackets are delivered pre-assembled with screws and nuts.

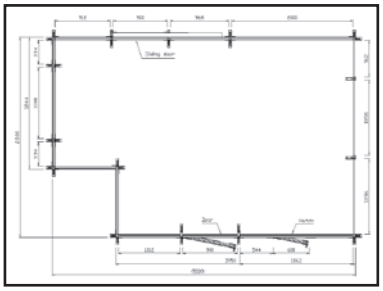


With SafeCAD® we can easily tailor your protection solution together









Example of component and cutting list print-outs from SafeCad.

Quote

Article no	Description	Qty	Unit
40-030-06	JSM 30B-K Floorbracket	26,00	pcs
40-030-07	JSM 32B-K L-bracket	72,00	pcs
40-030-08	JSM 33B-K T-bracket	18,00	pcs

Cutlist Polycarbonate

Article no	Description	Qty	Length	Width	Sum m²
40-039-10	JSM YPC5A1 Pc sheet 5mm uncoloured 2020x864	1	864	2020	1,75
40-039-12	JSM YPC5A9 Pc sheet 5mm uncoloured, cut to size	1	532	1020	0,54
40-039-12	JSM YPC5A9 Pc sheet 5mm uncoloured, cut to size	1	756	504	0,38

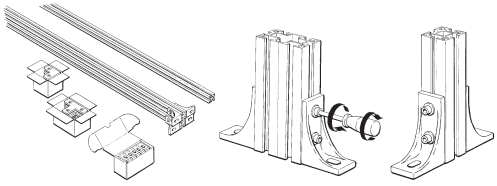
Cutlist Welded Mesh

Article no	Description	Qty	Length	Width	Sum m²
40-040-13	JSM YN40W1 Welded steelmesh 40x40x3,5 black, 2020x864	1	864	2020	1,75
40-040-14	JSM YN40W2 Welded steelmesh 40x40x3,5 black, 1074x1816	2	1820	1074	3,91
40-040-16	JSM YN40W9 Welded steelmesh 40x40x3,5 black, cut to size	2	864	354	0,61
40-040-16	JSM YN40W9 Welded steelmesh 40x40x3,5 black, cut to size	1	864	804	0,69
40-040-16	JSM YN40W9 Welded steelmesh 40x40x3,5 black, cut to size	1	864	920	0,79
40-040-16	JSM YN40W9 Welded steelmesh 40x40x3,5 black, cut to size	2	864	932	1,61

Guarding® Assembly
- standard version

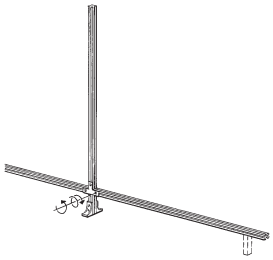
Assembly of the Guarding fencing system is very easy. All components are very light in weight and ergonomic in design. This enables, in most cases, one person to be able to assemble both simple and complex structures with ease using very few different types of fixing components. All fixtures can be mounted easily from “outside” by using the specially designed “locking nut” which can be located anywhere in the extrusion channel. The fixture components, by means of integral locating keys, ensure that correct angles are achieved and enable the number of bolts/nuts to be reduced to half the number that would otherwise be required.

1.



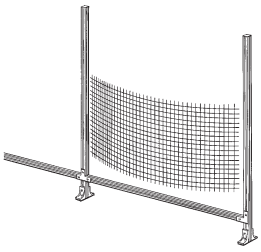
Premount floor fixtures by first slackening the screw anti-clockwise. Then tighten the screw clockwise in the usual way. The nut will then automatically locate into the correct position and mechanically lock the fixture into the profile.

2.



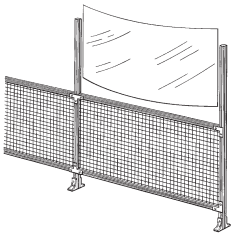
Attach lower horizontal extrusion between vertical posts. Use a spacer block to ensure the correct distance from the floor.

3.



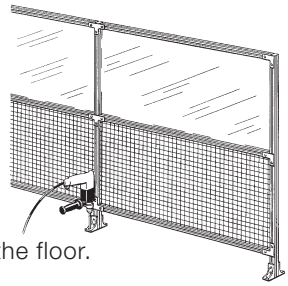
Insert infill panel and fix middle horizontal profile. The distance between the profiles is the width of the infill minus 20 mm.

4.



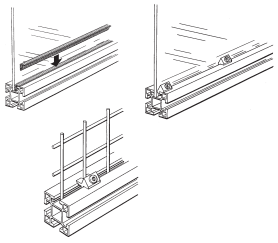
Insert top infill panel. Fix top profile with fittings on the top on both sides.

5.



Fix the poles to the floor.

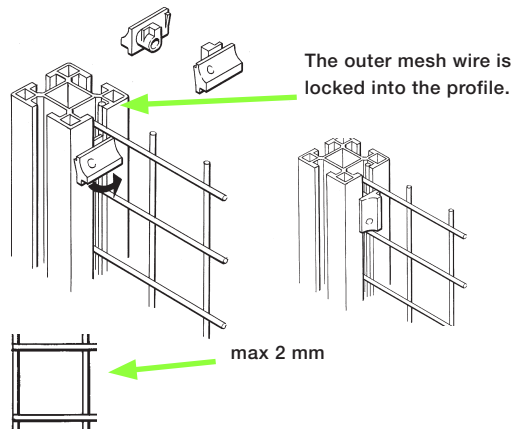
6.



Secure infill sheet with plastic strip or Net-lock fixings. Easy, fast and quick. See more under Assembly of netlocks. If there is a risk of the robot striking the polycarbonate, JSM PL3 panel locks must be used.

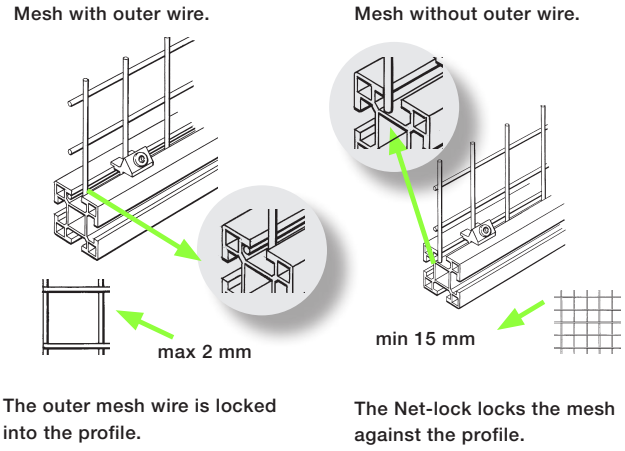
Assembly using NL2 and NL3 Net-locks on welded mesh

NL2 Net-lock



When assembling the Net-lock NL2 it is first put into the profile as the drawing shows. Then the Net-lock is turned 90°. When cutting the welded mesh the wire ends should not be longer than two (2) mm.

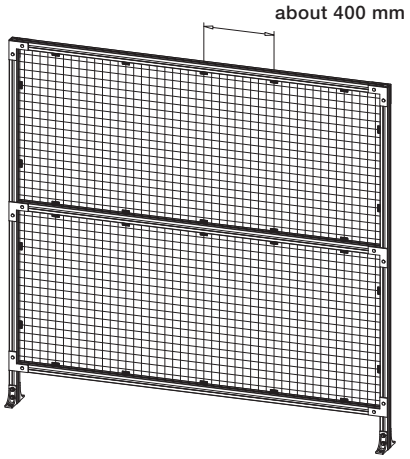
NL3 Net-lock



When assembling the Net-lock NL3 it is first put into the profile with the tabs on each side of the mesh wire. The screw is then tightened. When cutting the welded mesh the wire ends should be at least 15 mm to fit into the profile. NL3 must be used to lock the mesh into the slot.

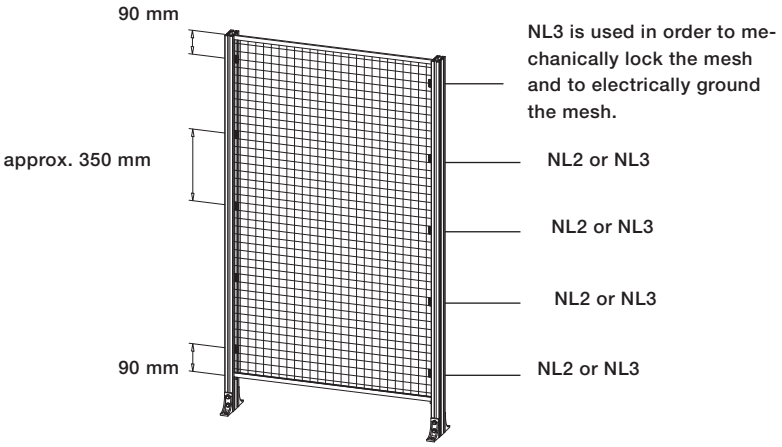
Number of Net-locks Guarding standard version

On Guarding standard version NL3 is recommended as it can be used for mesh with or without an outer wire.



Number of Net-locks Guarding Express

On Guarding Express both Net-lock NL2 and NL3 can be used. For mesh edges without outer wire NL3 must be used instead of NL2.

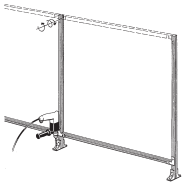


NOTE! On welded mesh without an outer wire NL3 must be used.

NOTE! On both Guarding Standard and Guarding E at least two NL3 should be used in order to mechanically lock the mesh and to electrically ground the mesh. NL3 should only be used on doors.

Fixing posts to the floor when mesh is required to be fitted at a later date.

Right

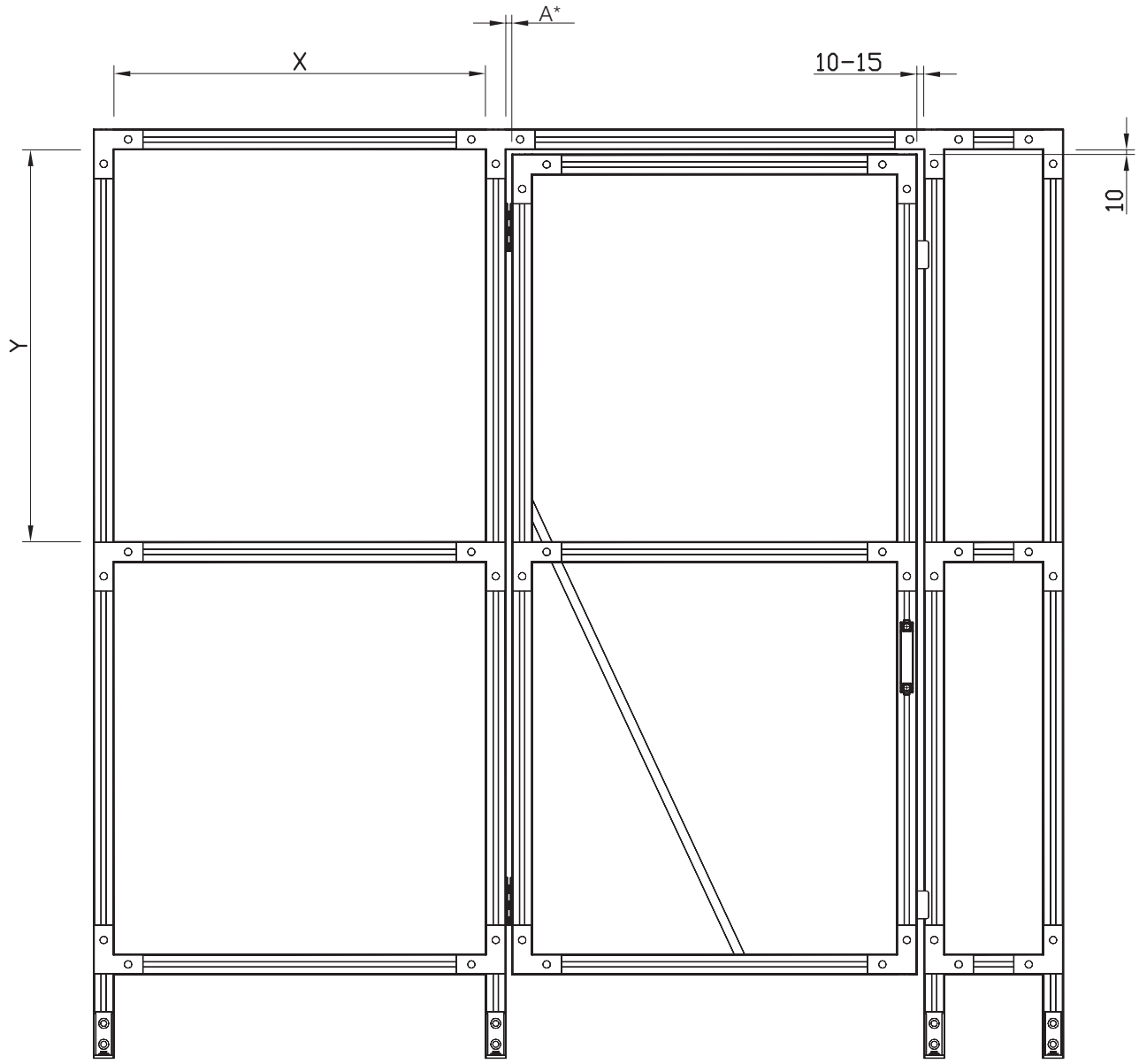


Wrong

Temporarily mount at least two middle profiles before drilling and fixing posts to the floor. This method is used when infill mesh or panels are to be fitted at a later date.

Note! Never attempt to fix the posts to the floor without first connecting at least two middle profiles to ensure the posts are parallel to each other and vertical.

Dimensions
Aluminum profile lengths and infill materials



*A=13 (JSM D1A), A=1 (JSM D1C)

Material	Width	Height
Polycarbonate	X+20 mm	Y+20 mm
Welded mesh	X+20 mm	Y+20 mm
Double Pc	2 pcs. X-7	2 pcs. Y-7
JSM AS2 Profile for 2x5 mm pc sheet	2 pcs. L=X	2 pcs. L=Y-33

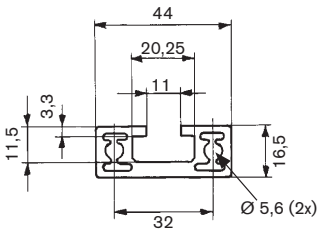
Aluminum profiles

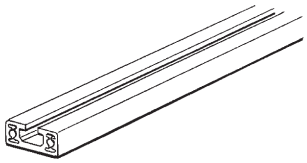
A wide range of aluminium profiles are available and include, fencing profile, guide rails, and cable ducting. The cable ducting is available in three sizes, and can be delivered with or without mounting holes. The cable ducting is easy to open and can be provided with end caps. Cover strips of plastic are also available, including fencing profiles making the entire groove cross section utilisable as 'installation conduit' for cables. The Aluminium profiles have integral "V" grooves to aid in centering any drilling that may be necessary.

Alloy: 6063 and 6060F22. Natural anodized aluminium 10µm

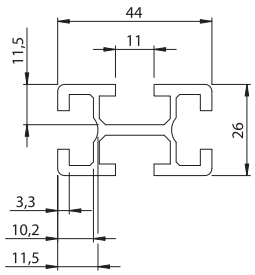
Fencing Profile

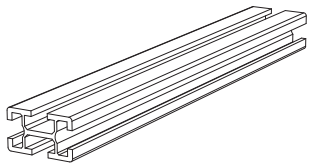
Designation	JSM A4416
Article numbers	2TLA040037R7000 (L = 2000 MM)
Material	Natural anodized aluminium
Dimensions	16.5 x 44 mm



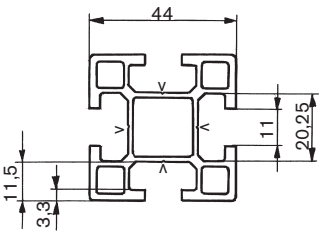


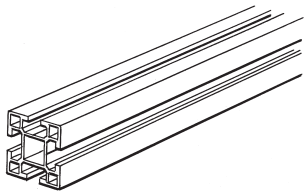
Designation	JSM A4426
Article numbers	2TLA040037R8000 (L = 2000 MM)
Material	Natural anodized aluminium
Dimensions	44 x 26 mm



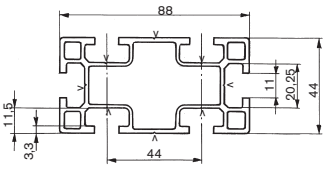


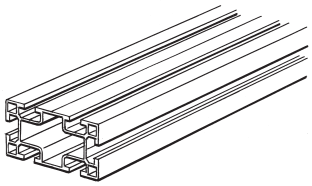
Designation	JSM A44A
Article numbers	2TLA040037R3700 (L=2000) 2TLA040037R4100 (L=6000)
Material	Natural anodized aluminium
Dimensions	44 x 44 mm



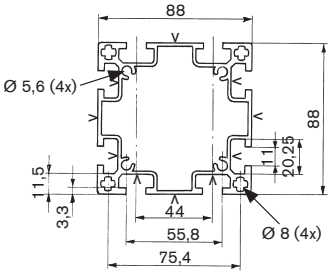


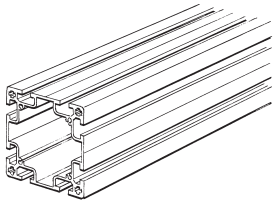
Designation	JSM A4488A
Article numbers	2TLA040037R4300 (L=2000) 2TLA040037R4500 (L=6000)
Material	Natural anodized aluminium
Dimensions	44 x 88 mm





Designation	JSM A8888
Article numbers	2TLA040037R7900 (L=6000)
Material	Natural anodized aluminium
Dimensions	88 x 88 mm



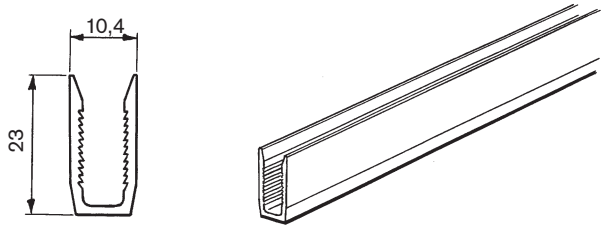


Technical data – fencing profile

		Angular moment		Flexural resistance	
Typ	Vikt (kg/m)	Ix (mm^4x10^4)	Iy (mm^4x10^4)	Wx (mm^3x10^3)	Wy (mm^3x10^3)
JSM A4416	1.040	1.1	7.6	1.19	3.43
JSM A4426	1.023	3.2	7.4	2.47	3.36
JSM A44A	1.504	12.4	12.4	5.64	5.64
JSM A4488A	2.379	79.6	21.6	18.1	9.8
JSM A8888	3.632	143.0	143.0	32.5	32.5

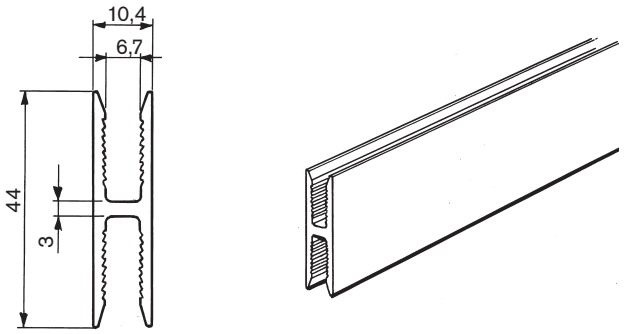
U-Profile

Designation	JSM A12
Article numbers	2TLA040037R4700 (L=2000)
Material	Natural anodized aluminium
Weight	0.230 kg/m



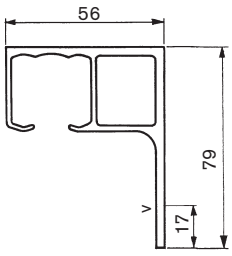
H-profile

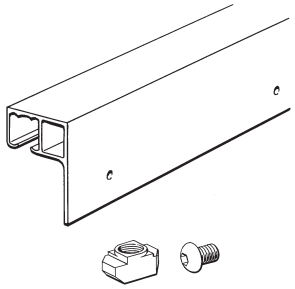
Designation	JSM A13
Article numbers	2TLA040037R5300 (L=2020)
Material	Natural anodized aluminium
Weight	0.452 kg/m



Guiding Rail

Designation	JSM A56
Article number	2TLA040037R0800 (L=2000) 2TLA040037R4800 (L=6000) Screw S8E 1 each per 450mm
Required mounting hardware purchase separately	2TLA041019R0100 Nut JSM M8B 1 each per 450mm 2TLA040035R0600
Material	Natural anodized aluminium
Holes	C/c = 450 mm, ø = 8.5 mm
Standard Length	2.0; 6.0 m
Weight	1.585 kg/m

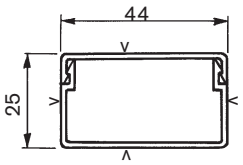


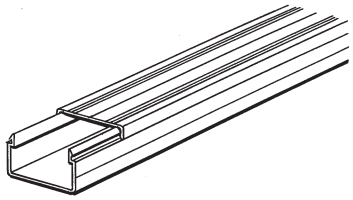


9

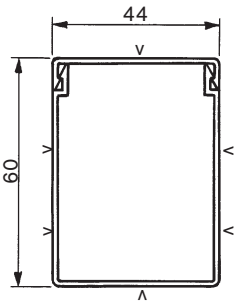
Cable Ducting

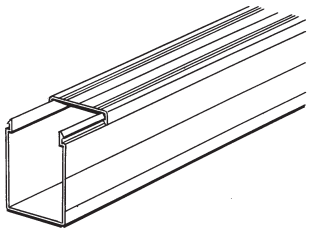
Designation	JSM A25_
Article numbers	2TLA040037R1300 (JSM A25A)
	2TLA040037R1400 (JSM A25B)
Material	Natural anodized aluminium
Dimensions	44 x 25 mm
Standard Length	2.0 m
JSM A25A	with holes C/c= 500 mm ø= 5 mm
JSM A25B	without holes
Weight	0.545 kg/m JSMA25A
	0.567 kg/m JSMA25B



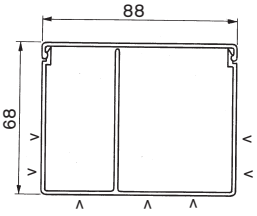


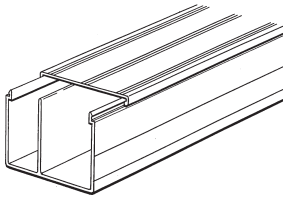
Designation	JSM A60_
Article numbers	2TLA040037R1500 (JSM A60A)
	2TLA040037R1600 (JSM A60B)
Material	Natural anodized aluminium
Dimensions	44 x 60 mm
Standard Length	2.0 m
JSM A60A	with holes C/c = 500 mm ø = 5 mm
JSM A60B	without holes
Weight	0.923 kg/m JSMA60A
	0.950 kg/m JSMA60B





Designation	JSM A88
Article number	2TLA040037R3300
Material	Natural anodized aluminium
Dimensions	88x68 mm
Standard Length	2.0 m
Weight	1.844 kg/m





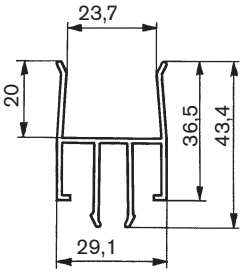
Cable tie

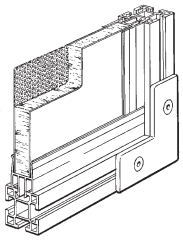
Designation	JSM X1
Article number	2TLA040033R4300
Pre-assembled with	Screws and Nuts
Material	Nylon 6/6 black

Profiles for installation of sound absorbing panels

Profile for 25 mm sound absorbing panel, JSM YLA25A_

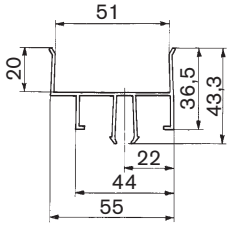
Designation	JSM AS1
Article numbers	2TLA040037R0900 (L=2000)
	Natural anodized aluminium
Material	29 x 43 mm
Dimensions	0.545 kg/m
Weight	

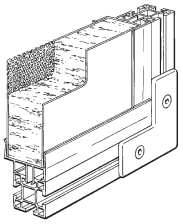




Profile for 50 mm sound absorbing panel, JSM YLA50A

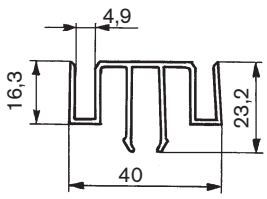
Designation	JSM AS3
Article numbers	2TLA042021R8100 (L=6000)
Material	Natural anodized aluminium
Dimensions	43 x 56
Weight	0.694 kg/m

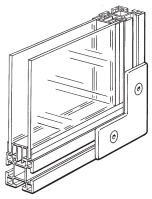




Profile for double 5mm Polycarbonate panel, JSM YPC5_

Designation	JSM AS2
Article numbers	2TLA040037R1000 (L=2000)
Material	Natural anodized aluminium
Dimensions	40 x 23 mm
Weight	0.510 kg/m



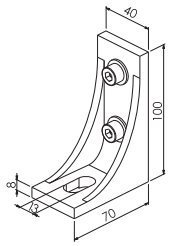


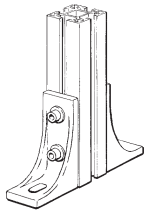
Fittings

ABB Jokab Safety's fencing system is put together with various types of fittings. Uprights are anchored to the floor with floor angle fittings. With a small angle fitting it is possible to hang an electrical enclosure and strengthen the corners of free-standing walls. Corners and joints are constructed with the aid of T, L and I fittings. If angles different to 90° between the fence sections are required, a JSM D1C angle fitting can be used. This hinge has a distance between centres of 45 mm, which means that the gap between uprights will always be less than 20 mm. According to EN ISO 13857, the minimum permitted protection distance is 120 mm for a gap narrower than 20 mm.

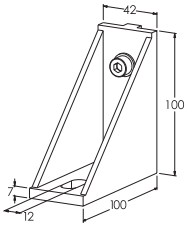
Floor/Angle fitting

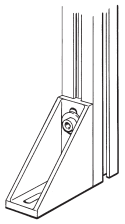
Designation	JSM 39-K
Article numbers	2TLA040030R1400
Pre-assembled with	Screw JSM S8C (x 2), Washer 9 x 18 x 1.5 (x 2), Nuts JSM M8B (x 2)
Material	Aluminium
Order unit	10 pcs/box



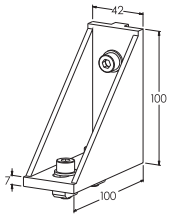


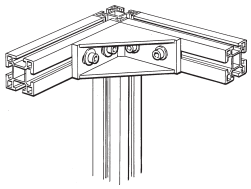
Designation	JSM 30B-K
Article number	2TLA040030R0600
Pre-assembled with	Screw JSM S8C (x 2), Washer 9 x 18 1.5 (x 2) Nut JSM M8B (x2)
Material	Aluminium
Order Unit	10 pcs/box





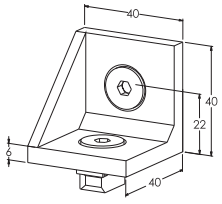
Designation	JSM 30B-K1
Article numbers	2TLA040030R1100
Pre-assembled with	Screws JSM S8C (x 4), Washers 9 x 18 x 1.5 (x 4) Nuts JSM M8B (x 4), Washers JSM B8B (x 2)
Material	Aluminium
Order unit	10 pcs/box

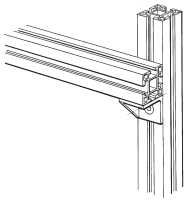




Small Angle fitting, e.g. Electrical cabinet fitting

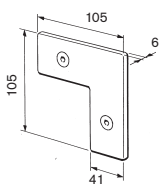
Designation	JSM 31B-K , Two counter sunk holes JSM 31A1-K, One counter sunk hole
Article number	2TLA040030R1300 (JSM 31B-K) 2TLA040030R0400 (JSM 31A1-K)
Pre-assembled with	Screw JSM M8C, Nut JSM M8B
Material	Aluminium
Order unit	10 pcs/box

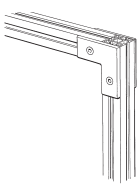




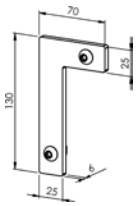
L-bracket

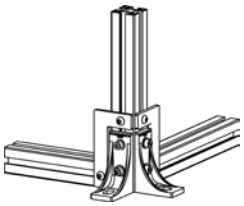
Designation	JSM 32B-K
Article number	2TLA040030R0700
Pre-assembled with	Screw JSM S8A, Nut JSM M8B
Material	Aluminium
Order Unit	10 pcs/box





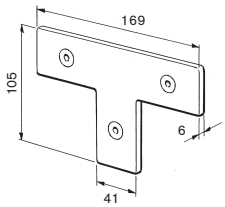
Designation	JSM 42
Article number	2TLA042020R3200
Pre-assembled with	Screw K6S M8x16 Steel, zinc-plated (2TLJ041017R0100) Nut JSM M8B (2TLA040035R0600)
Material	Aluminium
Order Unit	1 pcs

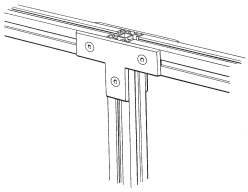




T-bracket

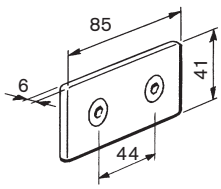
Designation	JSM 33B-K
Article number	2TLA040030R0800
Pre-assembled with	Screw JSM S8A, Nut JSM M8B
Material	Aluminium
Order Unit	10 pcs/box

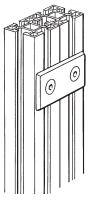




I-bracket

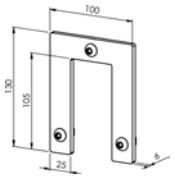
Designation	JSM 34B-K
Article number	2TLA040030R1500
Pre-assembled with	Screw JSM S8A, Nut JSM M8B
Material	Aluminium
Order Unit	10 pcs/box

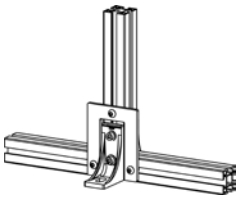




U-bracket

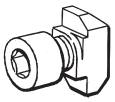
Designation	JSM 43
Article number	2TLA042020R3100
Pre-assembled with	Screw K6S M8 x 16 Steel, zinc-plated (2TLJ041017R0100) Nut JSM M8B (2TLA040035R0600)
Material	Aluminium
Order Unit	1 pcs

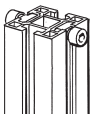




Distance screw

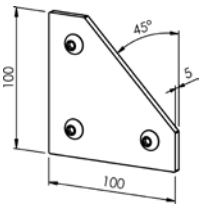
Designation	JSM 37
Article number	2TLA040033R3100
Material	Zinc-plated steel
Order unit	100 pcs/box

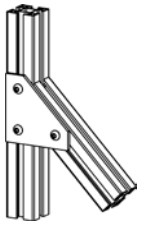




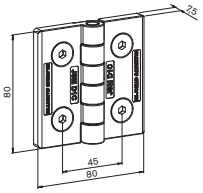
Angle bracket

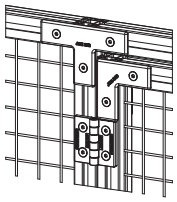
Designation	JSM 40
Article number	2TLA042021R5600
Pre-assembled with	Screw K6S M8x16 Steel, zinc-plated (2TLJ041017R0100) Nut JSM M8B (2TLA040035R0600)
Material	Steel, zinc-plated
Order unit	1 pcs





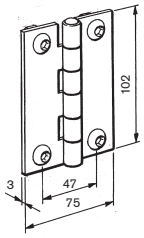
Designation	JSM D1C Hinge
Article number	2TLA040033R4800
Pre-assembled with	JSM M8B, JSM B8C, JSM S8A
Material	Polyamide, glass fibre reinforced
Colour	Black
Order unit	2 pcs/bag, 10 pcs/box

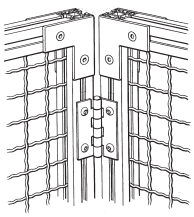




Designation	JSM 35-K
Article number	2TLA040033R1400
Pre-assembled with	Screw JSM S6A, Nut JSM M6B
Material	Zinc-plated steel
Hole	C/c =47 mm
Order unit	2 pcs/box

NOTE! The JSM 35-K must only be used for making fence angles.

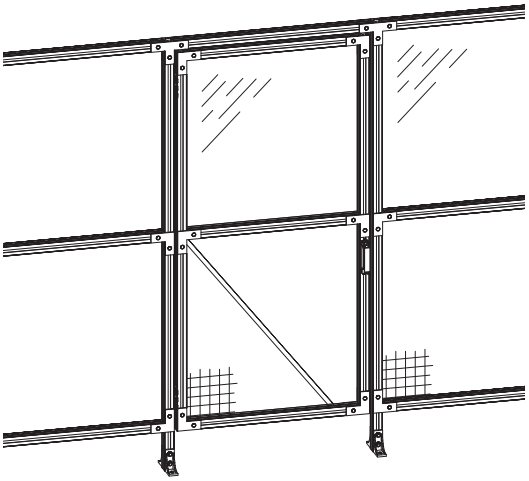




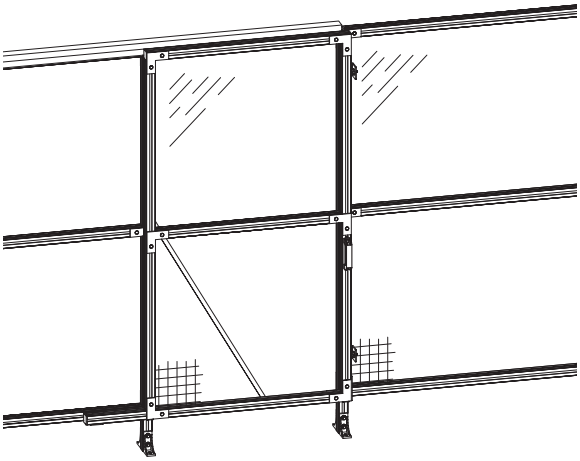
Door components

To mount conventional doors a hinge is available which permits an opening angle of 180°. For mounting a sliding door, guide rails and suspension wheels are utilised. Other sliding elements make it possible to build different types of hatches. Guide rollers, for wide and heavy doors, door closers, fittings for sensors/switches etc are also available.

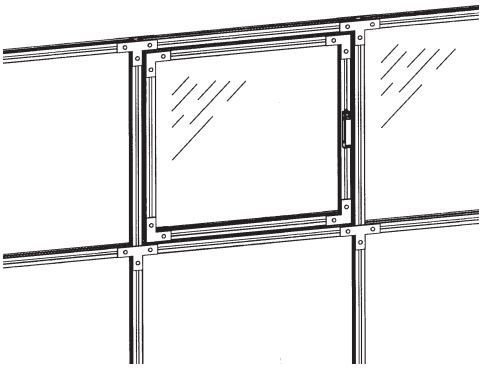
Conventional Door



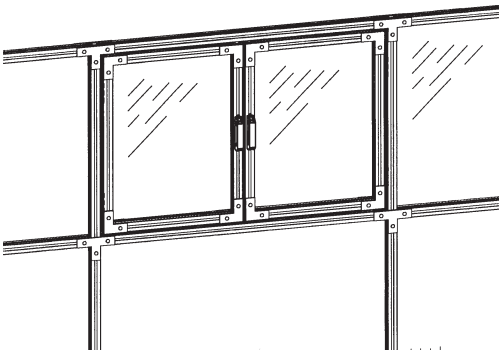
Sliding Door



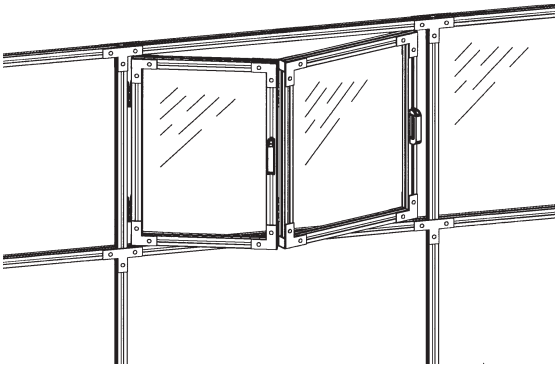
Hatch



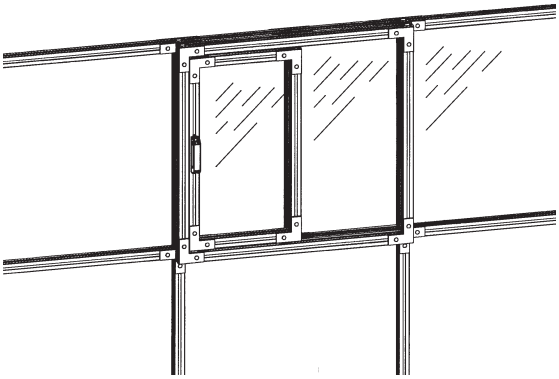
Double Hatch



Folding Hatch



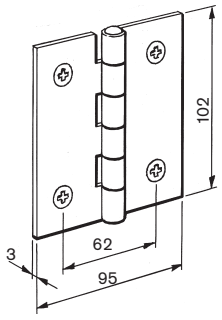
Sliding Hatch

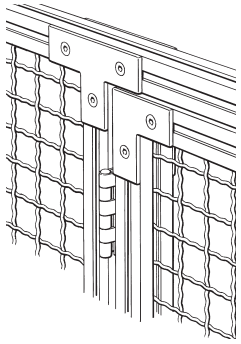


Hinge kit

Designation	JSM D1A Hinge
Article number	2TLA040033R1500
Pre-assembled with	Screw JSM S6A,Nut JSM M6B
Material	Zinc-plated steel
Fixing Holes	C/c = 62 mm
Order Unit	2 pcs/box

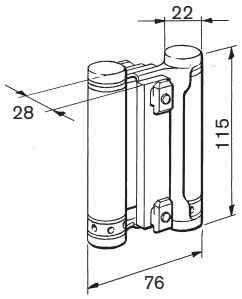
NOTE! JSM D1A must not be used as a fencing angle fitting because its gap can exceed 20 mm.

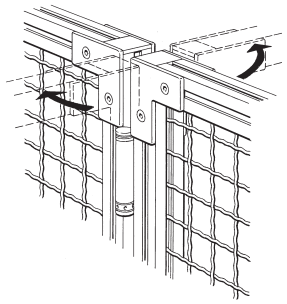




Designation	JSM D1B Spring hinge
Article numbers	2TLA042020R4700
Material	Zinc-plated steel
Pre-assembled with	Spacer plate, screws and nuts

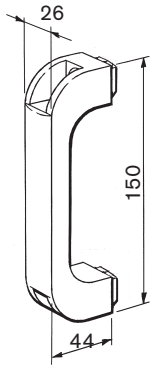
NOTE! The door gap will be 28 mm when installed.

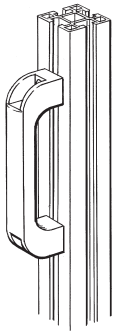




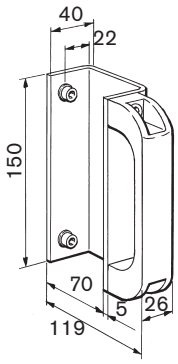
Handle

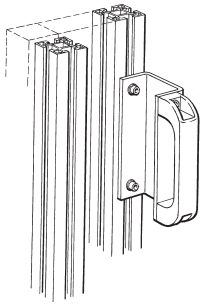
Designation	JSM D2 Handle
Article number	2TLA040033R0100
Pre-assembled with	Screw JSM S8D, Nut JSM M8B
Material	Thermoplastic, black





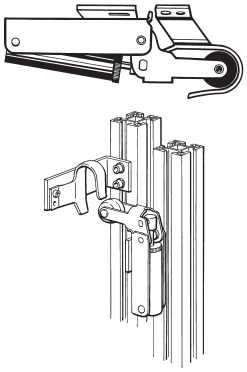
Designation	JSM D18 Handle
Article number	2TLA042020R5000
Material	Handle: Thermoplastic, black Fittings: Aluminum
Pre-assembled with	Screws and Nuts
Suitable for sliding door on the inside of the fence.	

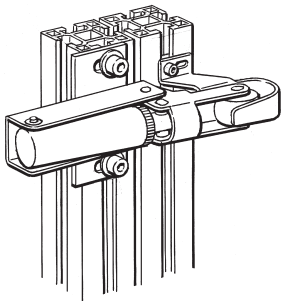




Door closer

Designation	JSM D3 (conventional door)
Article number	2TLA040033R0200
Pre-assembled with	Screws and Nuts
Material	Door closer: Steel Bracket: Aluminium
Designation	JSM D19 (sliding door)
Article number	2TLA042020R5600
Material	Zinc-plated steel
Pre-assembled with	Screws and Nuts

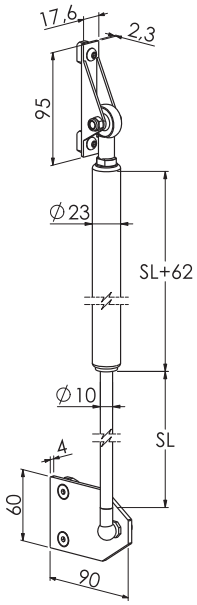


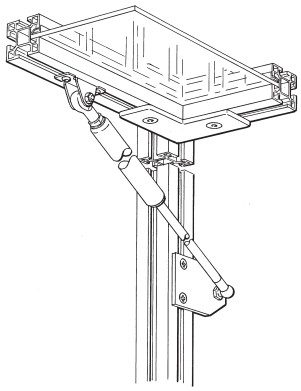


Gas spring

Designation	JSM D22 Gas spring with fittings
Article number	2TLA042024R1000
Stroke (SL)	300 mm
Pre-assembled with	Screws and Nuts
Material	Steel
Designation	JSM D22A Gas spring with fittings
Article number	2TLA042024R1100
Stroke (SL)	350 mm
Pre-assembled with	Screws and Nuts
Material	Steel
Fittings included	Bracket with ballcup (2TLA042021R2700) U-bracket with ball joint (2TLA042021R2800)

NOTE! Specify required force (100-1200N) when ordering.

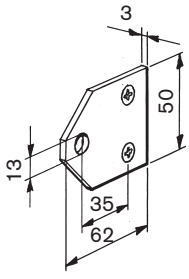


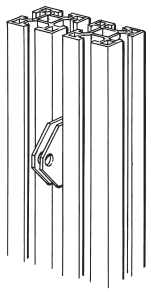


Bracket for padlock

Designation	JSM D17 Bracket for Padlock
Article number	2TLA040020R2200
Pre-assembled with	Screws and Nuts
Material	Zinc-plated steel

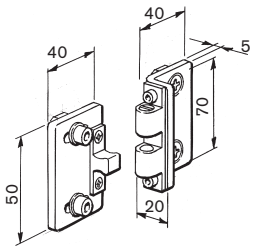
NOTE! Two pieces are required for one complete unit.

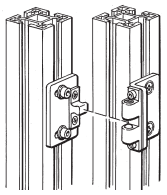




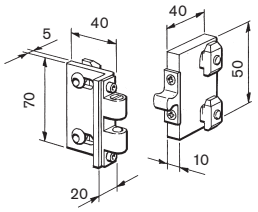
Ball Catch

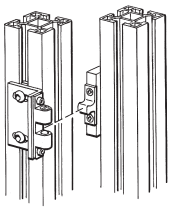
Designation	JSM D11B (conventional door)
Article number	2TLA040033R4100
Pre-assembled with	Screws and Nuts
Material	Brackets: Aluminium Ball Catch: Nickel-plated brass



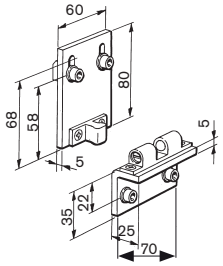


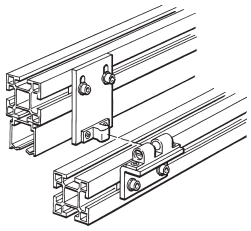
Designation	JSM D11C (sliding door)
Article number	2TLA040033R4200
Pre-assembled with	Screws and Nuts
Material	Aluminium Brackets: Aluminium Ball catch: Nickel-plated brass





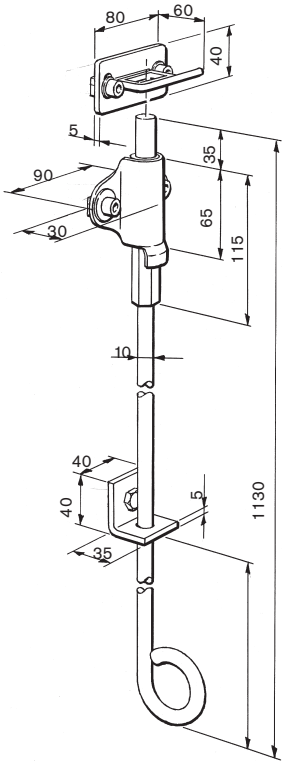
Designation	JSM D11D (folding door)
Article number	2TLA042020R5200
Pre-assembled with	Screws and Nuts
Material	Aluminium Brackets: Aluminium Ball catch: Nickel-plated brass

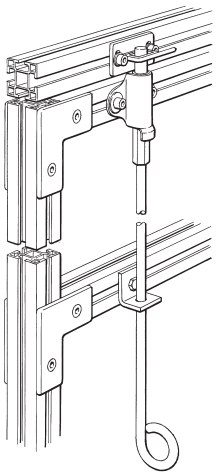




Upper Door bolt

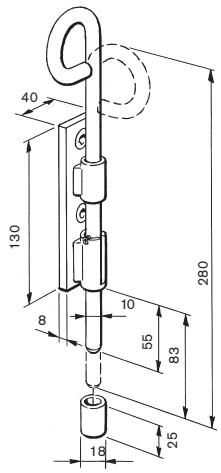
Designation	JSM D10A
Article number	2TLA040033R2100
Pre-assembled with	Screws and Nuts
Material	Rod: Stainless steel Brackets: Zinc-plated steel

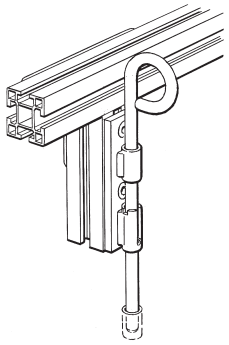




Lower Door bolt

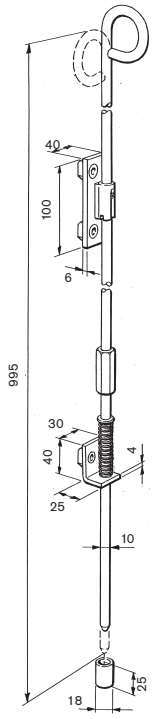
Designation	JSM D10
Article number	2TLA040033R2000
Pre-assembled with	Screws and Nuts
Material	Rod: Stainless steel Brackets: Zinc-plated steel

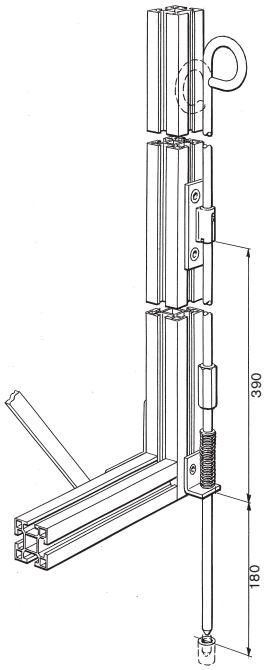




Lower Door bolt

Designation	JSM D10B
Article number	2TLA040033R3800
Pre-assembled with	Screws and Nuts
Material	Rod: Stainless steel Brackets: Zinc-plated steel





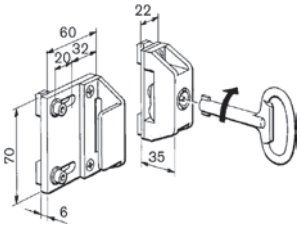
Cam lock

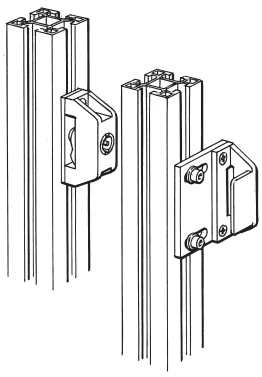
Designation	JSM D15
Article number	2TLA040033R3900
Pre-assembled with	Screws and Nuts
Material	Lock unit: Polyamide, black Brackets: Aluminium

NOTE! Delivered without key.

Key to cam lock

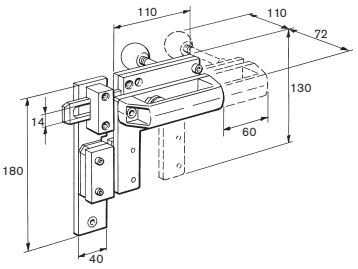
Designation	JSM D16
Article number	2TLA040033R4400
Material	Zinc, black

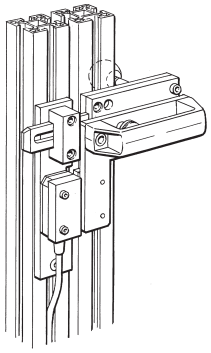




Sliding bolt for Eden

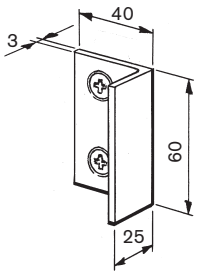
Designation	JSM D20 (for hinged door)
Article numbers	2TLA020302R1000
Material	Steel, painted yellow
Note! Supplied without Eden For installation on hinged doors	

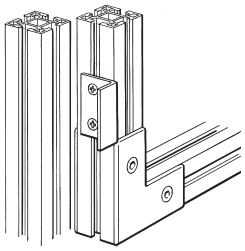




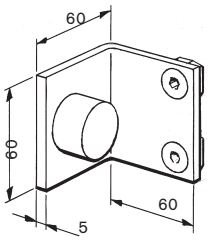
Door stop

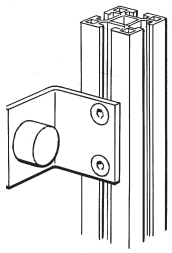
Designation	JSM D13A
Article number	2TLA040033R2600
Pre-assembled with	Screws and Nuts
Material	Natural anodized aluminium



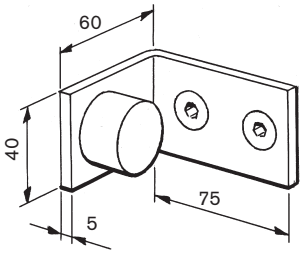


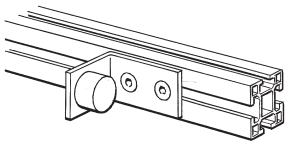
Designation	JSM D13
Article number	2TLA040033R2500
Pre-assembled with	Screws, Nuts and vibration damper
Material	Zinc-plated steel
NOTE! For mounting on vertical profiles.	





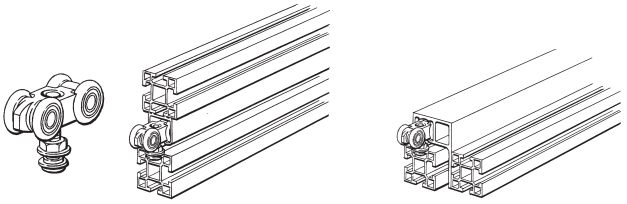
Designation	JSM D13B
Article number	2TLA040033R2700
Pre-assembled with	Screws, Nuts and vibration damper
Material	Zinc-plated steel
NOTE! For mounting on horizontal profiles.	





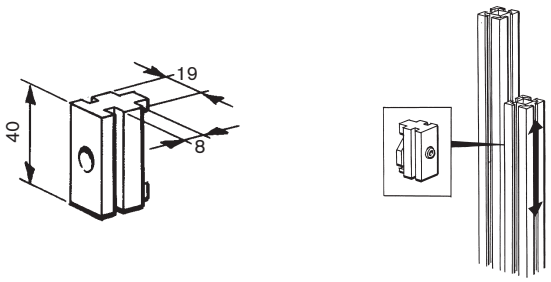
Suspension wheels

Designation	JSM D5
Article number	2TLA040033R0400
For aluminium guiding rails JSM A3130C and JSM A56	

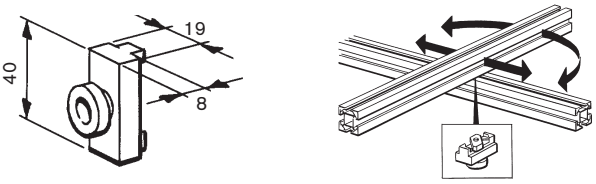


Sliding elements

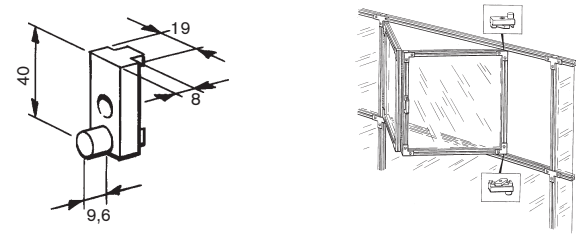
Sliding element, (rectangular)	
Designation	JSM D6
Article number	2TLA040033R0500
Pre-assembled with	Screw and Nut
Material	Polyamide, white



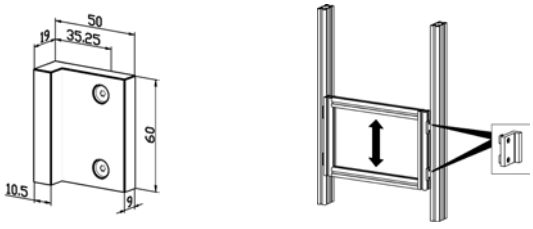
Sliding element, (round)	
Designation	JSM D7
Article number	2TLA040033R0600
Pre-assembled with	Screw and Nut
Material	Polyamide, white



Sliding element, (guide)	
Designation	JSM D8
Article number	2TLA040033R0700
Pre-assembled with	Screw and Nut
Material	Polyamide, white

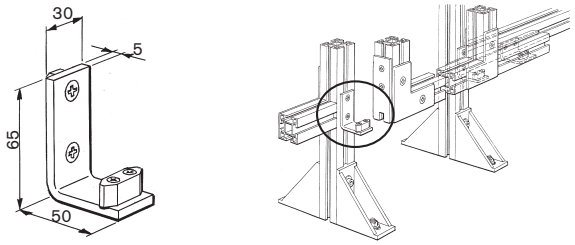


Sliding element, (guide)	
Designation	JSM D26
Article number	2TLA042020R3700
Pre-assembled with	Screw and Nut
Material	Robalon, black

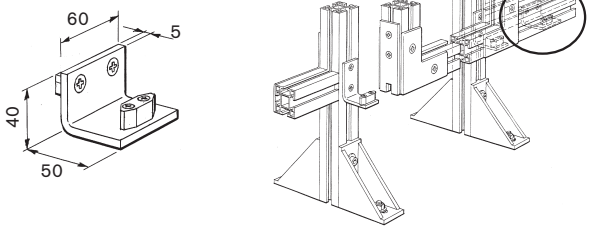


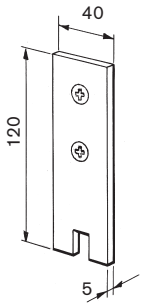
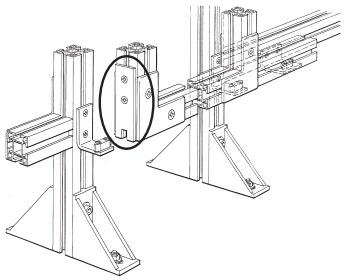
Guide Components for Sliding Door

Designation	JSM D12
Article number	2TLA040033R2200
Pre-assembled with	Screws and Nuts
Material	Aluminium and PA6-6
NOTE! For mounting on vertical profiles.	

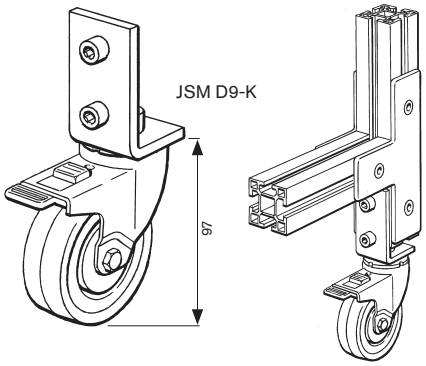
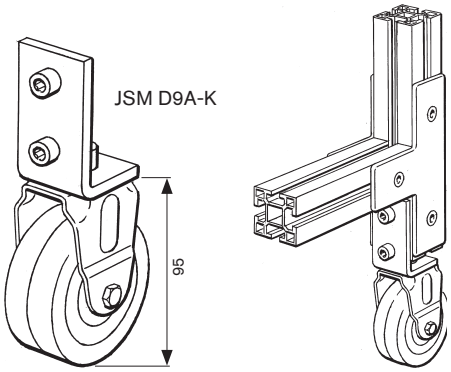


Designation	JSM D12A (Bracket)
Article number	2TLA040033R2300
Pre-assembled with	Screws and Nuts
Material	Aluminium and PA6-6
NOTE! For mounting on horizontal profiles.	

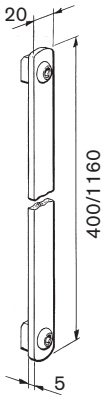
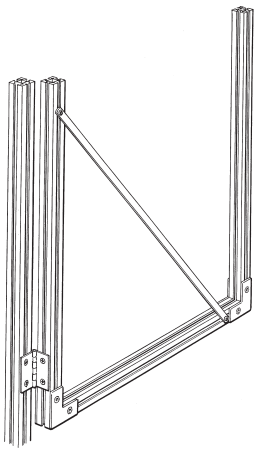


Designation Article number Pre-assembled with Material	JSM D12B 2TLA040033R2400 Screws and Nuts Aluminium	 

Guide roller

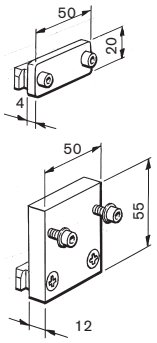
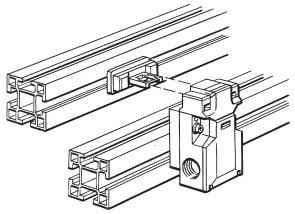
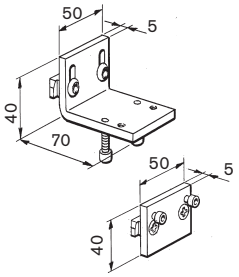
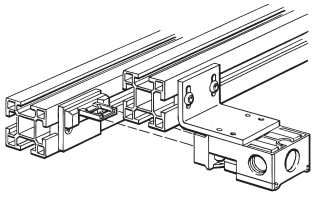
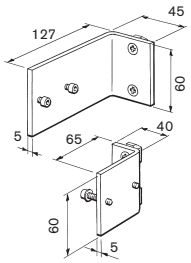
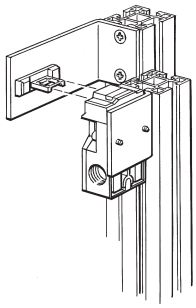
Swivel castor with total lock Designation Pre-assembled with angle bracket Article number Wheel diameter Max. load	 JSM D9-K 2TLA040033R1100 75 mm 60 kg	
Fixed castor Designation Article number Pre-assembled with angle bracket Wheel diameter Max. load	 JSM D9A-K 2TLA040033R1300 75 mm 70 kg	

Diagonal bar for door

Designation Article number Length Pre-assembled with Material Designation Article numbers Length Pre-assembled with Material	JSM D14 2TLA040033R2800 1160 mm Screws and Nuts Natural anodized aluminium JSM D14A 2TLA042021R7300 400 mm Screws and Nuts Natural anodized aluminium	 

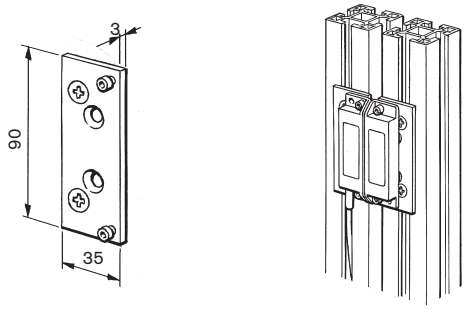
Fittings for switches

Fittings for Mkey 5 Interlock Switches

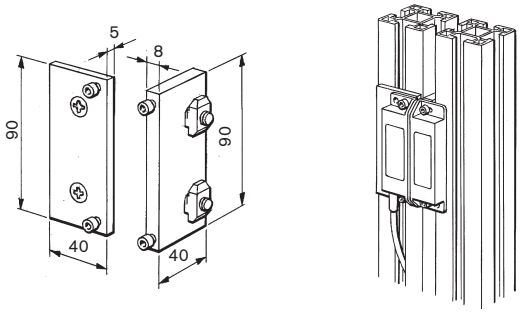
Fitting for conventional door/hatch Designation Article number Pre-assembled with Material	 JSM D4A 2TLA040033R0900 Screws and Nuts Zinc-plated steel		
Fitting for conventional door/hatch Designation Article number Pre-assembled with Material	 JSM D4AA 2TLA040033R3400 Screws and Nuts Zinc-plated steel		
Fitting for sliding door Designation Article number Pre-assembled with Material	 JSM D4B 2TLA040033R1000 Screws and Nuts Zinc-plated steel		

Fittings for Sense 7 Switches

Fitting for conventional door/hatch	
Designation	JSM D4E
Article number	2TLA040033R1800
Pre-assembled with	Screws and Nuts
Material	Aluminium
NOTE! Two fittings are needed for a complete JSNY7.	

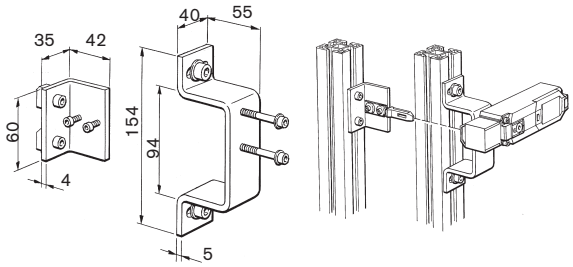


Fitting for sliding door	
Designation	JSM D4G
Article number	2TLA040033R3300
Pre-assembled with	Screws and Nuts
Material	Aluminium

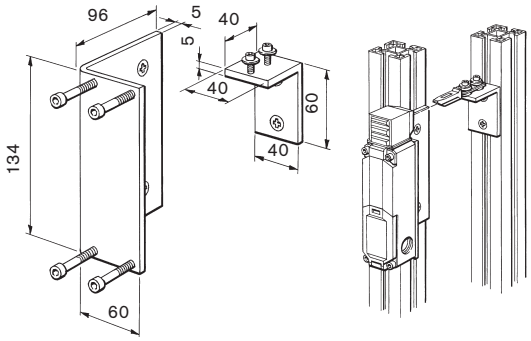


Fittings for Mkey 8/9 Switches

Fitting for Mkey 8/9, conventional door/ hatch	
Designation	JSM D4C
Article number	2TLA040033R1600
Pre-assembled with	Screws and Nuts
Material	Zinc-plated steel



Fitting for Mkey 8/9, sliding door	
Designation	JSM D4F
Article number	2TLA040033R3000
Pre-assembled with	Screws and Nuts
Material	Zinc-plated steel

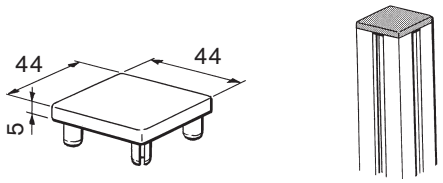


Terminal caps and strips

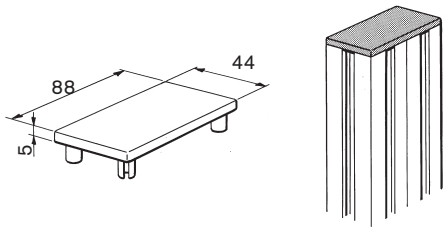
Terminal caps are available to cover profile ends, thus eliminating sharp edges. Strips are also available, both narrow and wide, to cover the slot of the fencing profile.

Terminal Caps

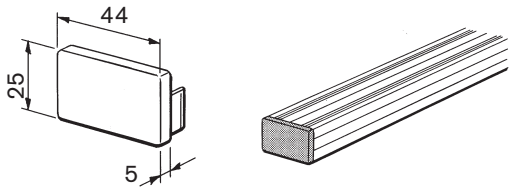
Terminal Cap for JSM A44A	
Designation	JSM L1A (yellow) JSM L1B (grey)
Article numbers	2TLA040034R0000 (JSM L1A) 2TLA040034R0300 (JSM L1B)
Material	Polyamide
Dimensions	44x44 mm



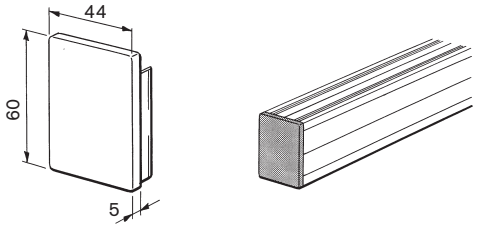
Terminal Cap for JSM A4488A	
Designation	JSM L4A (yellow) JSM L4B (grey)
Article numbers	2TLA040034R0400 (JSM L4A) 2TLA040034R0500 (JSM L4B)
Material	Polyamide
Dimensions	44x88 mm



Terminal Cap for JSM A25	
Designation	JSM L2
Article number	2TLA040034R0100
Material	Polyamide, grey
Dimensions	44x25 mm

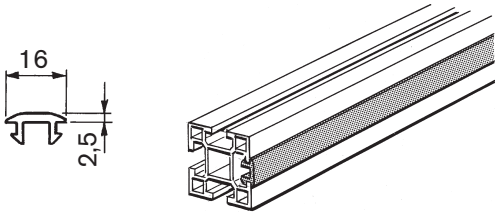


Terminal Cap for JSM A60	
Designation	JSM L3
Article number	2TLA040034R0200
Material	Polyamide, grey
Dimensions	44x60 mm

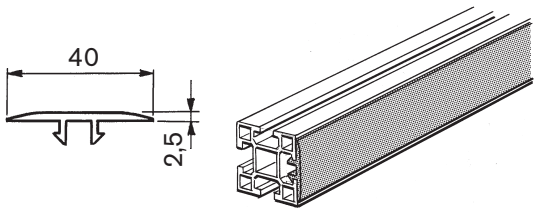


Cover Strip

Narrow Cover Strip, for Alt. 1: JSM A4416, -A4426, -A44A, -A4488A and -A8888 Alt.2: For fencing profiles with 11 mm slot	
Designation	JSM T3A (yellow) JSM T3B (grey)
Article numbers	2TLA040037R3100 (JSM T3A) 2TLA040037R3200 (JSM T3B)
Material	ABS
Dimensions	16 mm
Order Unit	2 m
NOTE! Other colours available upon request	

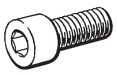
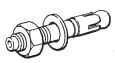
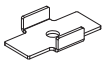
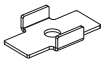
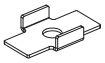
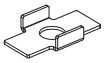


Wide Cover Strip, Alt. 1: JSM A4416, -A4426, -A44A, -A4488A and -A8888 Alt.2: For fencing profiles with 11mm slot	
Designation	JSM T2A
Article number	2TLA040037R1900
Material	PVC, yellow, soft material
Dimensions	40 mm
Order Unit	25 m/coil
NOTE! Other colours available upon request	



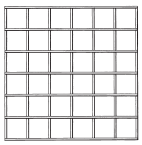
Accessories

All fittings and door components are delivered pre-assembled with screws, washers and nuts.
For cable ducting the screws, S5B, and nuts, M5B, have to be ordered separately (4 pcs/2m).

Designation	Image	Article number	Description	Dimension	Material	Order Unit
JSM S5B		2TLA041039R0100	Screw to cable ducting	M5x12	Zinc Plated Steel	100 pcs/box
JSM S6A		2TLA041039R0200	Screw for hinge cross-slotted Z (pozidrive)	M6x12	Zinc Plated Steel	100 pcs/box
JSM S8A		2TLA041019R0000	Fixing screw countersunk.	M8x16	Zinc Plated, Dacrolit	100 pcs/box
JSM S8C		2TLA041014R0200	Fixing screw for floor fitting and small angle	M8x20	Zinc Plated Steel	100 pcs/box
JSM S8D		2TLA041014R0100	Fixing screw	M8x16	Zinc Plated Steel	100 pcs/box
JSM S8E		2TLA041019R0100	Fixing screw for Guide rail JSM A56	M8x12	Zinc Plated Steel	100 pcs/box
JSM M4B		2TLA040035R0700	Locking nut	M4	Zinc Plated Steel	100 pcs/box
JSM M5B		2TLA040035R0400	Locking nut	M5	Zinc Plated Steel	100 pcs/box
JSM M6B		2TLA040035R0500	Locking nut	M6	Zinc Plated Steel	100 pcs/box
JSM M8B		2TLA040035R0600	Locking nut	M8	Zinc Plated Steel	100 pcs/box
JSM M10A		2TLA041069R0000	M10 Thread insert for JSM A44A	M10x21, Ø18.5/25	Steel, zinc-plated	1 pcs
JSM X1		2TLA040033R4300	Cable tie	2.5–7.8 mm	Nylon black UV-resistant	10 pcs/box
JSM X2		2TLA041900R4300	Expansion-shell bolt	M10x68	Zinc Plated Steel	50 pcs/box
JSM X5A		2TLA041810R0200	ABB Safety Products sign	220x40x1.5mm	Aluminium, Natural anodized	1 pcs
JSM X5B		2TLA041810R0300	ABB Safety Products sign, pre-assembled with screws	220x40x1.5mm	Aluminium, Natural anodized	1 pcs
JSM B4C		2TLA040035R5000	Centering washer steel	Ø4.2	Zinc Plated Steel	100 pcs/box
JSM B5C		2TLA040035R5100	Centering washer steel	Ø5.2	Zinc Plated Steel	100 pcs/box
JSM B6C		2TLA040035R5200	Centering washer steel	Ø6.2	Zinc Plated Steel	100 pcs/box
JSM B8C		2TLA040035R5300	Centering washer steel	Ø8.2	Zinc Plated Steel	100 pcs/box

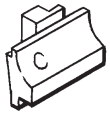
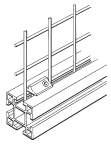
Infill materials

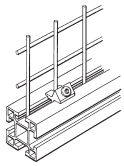
The choice of net and surfaces depends, among other things, on the protection distance. In the case of netting, a minimum distance of 200 mm (for anyone aged 14 or older) with a mesh size of 40x40 mm in accordance with EN ISO 13857. For closer protection distances and for noise reduction, solid panels are used. Panels are available in different materials. For protection of welding cells, polycarbonate welding transparencies are used.

Welded mesh		
	Designation	JSM YN40W_/WE_
	Square opening	40 x 40 mm
	Thread	ø 3.5 mm

Article number	Designation	Material	Dimensions	Type
2TLA040040R1400	JSM YN40W2	Steel, black RAL 9005 powder coated	1074 x 1816 mm	Welded
2TLA040040R2100	JSM YN40W5	Steel, black RAL 9005 powder coated	1474 x 1816 mm	Welded
2TLA040040R2800	JSM YN40W10	Steel, black RAL 9005 powder coated	1474 x 1216 mm	Welded
2TLA040040R2900	JSM YN40W11	Steel, black RAL 9005 powder coated	1074 x 1216 mm	Welded

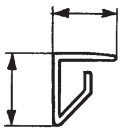
Other colours, hot-dip galvanized mesh or woven wire mesh netting supplied on request.

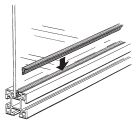
Net lock for welded mesh with outer wire			
Designation	JSM NL2		
Article numbers	2TLA040031R0600		
Material	PA/ABS		
Colour	Grey		
Order unit	100 pcs/box		

Net lock for welded or woven mesh			
Designation	JSM NL3		
Article numbers	2TLA040031R0800		
Pre-assembled with	Screw		
Material	Zinc		
Order unit	100 pcs/box		

Panel fixings

Designation:	JSM PL1_(for 5 mm panels) JSM PL2_(for 4 mm panels)
Material:	
JSM PL1:	PVC, black
JSM PL2:	PVC, black

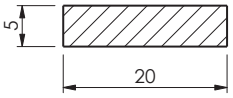


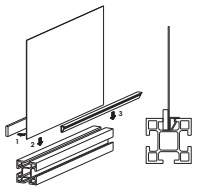


Article number	Designation	Length
2TLA040038R0300	JSM PL1C	2000 mm
2TLA040038R0900	JSM PL2C	2000 mm

Cellular rubber - To be used with e.g. 1.0 mm steel panel

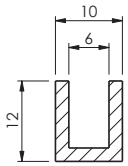
Designation:	JSM G2
Article numbers:	2TLA040038R0600
Material:	Cellular rubber, self-adhesive
Dimension:	5 x 20 mm
Standard package:	10 m/roll

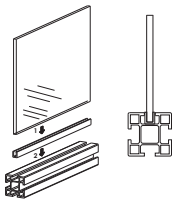




U-rubberstrip - To be used with e.g. 6.4 mm laminated glass

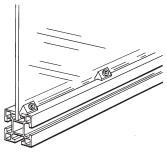
Designation:	JSM G3
Article numbers:	2TLA041930R0600
Material:	EPDM
Standard package:	50 m/roll





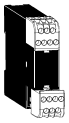
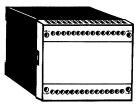
Panel lock

Designation:	JSM PL3
Article numbers:	2TLA040038R1100
Pre-assembled with:	Screw
Material:	Zinc

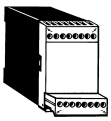
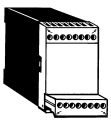
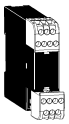
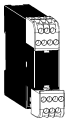


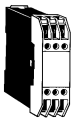
Product List

Safety relays - Safety relay - RT-series

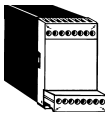
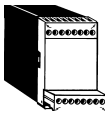
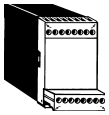
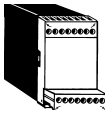
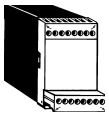
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**RT6 24 VDC** **Safety relay**	2TLA010026R0000	A universal safety relay for several safety applications. Relay outputs 3NO / 1NC.
	RT6 24 VAC **Safety relay**	2TLA010026R0200	A universal safety relay for several safety applications. Relay outputs 3NO / 1NC.
	RT6 115 VAC **Safety relay**	2TLA010026R0400	A universal safety relay for several safety applications. Relay outputs 3NO / 1NC.
	RT6 230 VAC **Safety relay**	2TLA010026R0500	A universal safety relay for several safety applications. Relay outputs 3NO / 1NC.
	**RT7A 1.5s 24 VDC** **Safety relay**	2TLA010028R2000	A universal safety relay for several safety applications. 2 delayed outputs of 1.5 sec. Relay outputs 2NO / 2NO / 1NC.
	RT7A 1.5s 24 VAC **Safety relay**	2TLA010028R2200	A universal safety relay for several safety applications. 2 delayed outputs of 1.5 sec. Relay outputs 2NO / 2NO / 1NC.
	RT7A 1.5s 115 VAC **Safety relay**	2TLA010028R2400	A universal safety relay for several safety applications. 2 delayed outputs of 1.5 sec. Relay outputs 2NO / 2NO / 1NC.
	RT7A 1.5s 230 VAC **Safety relay**	2TLA010028R2500	A universal safety relay for several safety applications. 2 delayed outputs of 1.5 sec. Relay outputs 2NO / 2NO / 1NC.
	**RT7B 3s 24 VDC** **Safety relay**	2TLA010028R1000	A universal safety relay for several safety applications. 2 delayed outputs of 3 sec. Relay outputs 2NO / 2NO / 1NC.
	RT7B 3s 24 VAC **Safety relay**	2TLA010028R1200	A universal safety relay for several safety applications. 2 delayed outputs of 3 sec. Relay outputs 2NO / 2NO / 1NC.
	RT7B 3s 115 VAC **Safety relay**	2TLA010028R1400	A universal safety relay for several safety applications. 2 delayed outputs of 3 sec. Relay outputs 2NO / 2NO / 1NC.
	RT7B 3s 230 VAC **Safety relay**	2TLA010028R1500	A universal safety relay for several safety applications. 2 delayed outputs of 3 sec. Relay outputs 2NO / 2NO / 1NC.
	**RT9 24 VDC** **Safety relay**	2TLA010029R0000	A universal safety relay for several safety applications. Relay outputs 2NO.
	**JSBRT11 24 VDC** **Safety relay**	2TLA010025R0000	A flexible safety relay with many outputs. Relay outputs 7NO / 2NC.
	JSBRT11 115 VAC **Safety relay**	2TLA010025R0400	A flexible safety relay with many outputs. Relay outputs 7NO / 2NC.
	JSBRT11 230 VAC **Safety relay**	2TLA010025R0500	A flexible safety relay with many outputs. Relay outputs 7NO / 2NC.

Safety relay – JSB-series

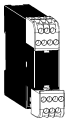
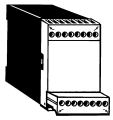
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**JSBR4 24 VDC** **Safety relay**	2TLA010002R0000	Safety relay for two hand device and many other safety products. Power supply 24 VDC. Relay outputs 3NO / 1NC.
	JSBR4 24 VAC **Safety relay**	2TLA010002R0200	Safety relay for two hand device and many other safety products. Power supply 24 VAC. Relay outputs 3NO / 1NC.
	JSBR4 115 VAC **Safety relay**	2TLA010002R0400	Safety relay for two hand device and many other safety products. Relay outputs 3NO / 1NC.
	JSBR4 230 VAC **Safety relay**	2TLA010002R0500	Safety relay for two hand device and many other safety products. Relay outputs 3NO / 1NC.
	**JSBT4 24 VDC** **Safety relay**	2TLA010004R0000	Safety relay with synchronised dual input channels Relay outputs 3NO / 1NC.
	**BT50 24 VDC** **Safety relay**	2TLA010033R0000	Safety relay/expansion relay. Relay outputs 3NO / 1NC.
	BT50T 24 VDC **Safety relay**	2TLA010033R1000	Safety relay/expansion relay. Time delay 0-1.5 sec. Relay outputs: 4NO.
	**BT51 24 VDC** **Safety relay**	2TLA010033R2000	Safety relay/expansion relay. Relay outputs 4NO.
	BT51T 24 VDC **Safety relay**	2TLA010033R3000	Safety relay/expansion relay. Time delay 0-1.5 sec. Relay outputs: 3NO / 1NC.

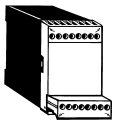
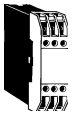
	**JSBT5 24 VAC/VDC** **Safety relay**	2TLA010005R0100	Single channel and "dual" channel safety relay. Relay outputs 3NO / 1NC.
	JSBT5 12 VDC **Safety relay**	2TLA010005R0700	Single channel and "dual" channel safety relay. Relay outputs 3NO / 1NC.
	JSBT5T 24 VAC/VDC **Safety relay**	2TLA010005R1100	Single channel and "dual" channel safety relay. Relay outputs 3NO / 1NC.

Safety timers

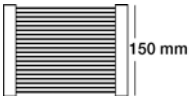
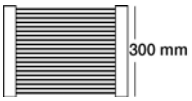
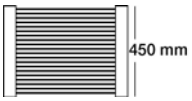
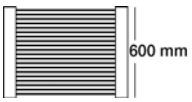
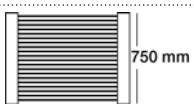
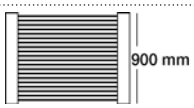
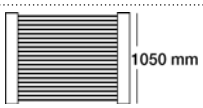
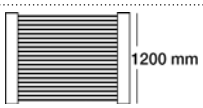
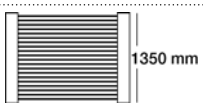
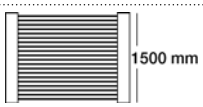
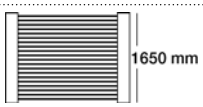
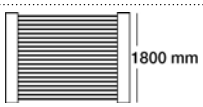
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**JSHT1A 24 VDC** **Time module**	2TLA010011R0000	Safety timer for time reset and time bypassing. Hardwired time selection 5-20 sec. Relay outputs 1NO + 1NO.
	**JSHT1B 24 VDC** **Time module**	2TLA010011R1000	Safety timer for time reset and time bypassing. Hardwired time selection 5-40 sec. Relay Outputs 1NO + 1NO.
	**JSHT2A 24 VDC** **Time module**	2TLA010012R0000	Safety timer for time bypassing and inching. Hardwired time selection 0.2-1 sec. Relay Outputs 1NO + 1NO.
	**JSHT2B 24 VDC** **Time module**	2TLA010012R1000	Safety timer for time bypassing and inching. Hardwired time selection 5-20 sec. Relay Outputs 1NO + 1NO.
	**JSHT2C 24 VDC** **Time module**	2TLA010012R2000	Safety timer for time bypassing and inching. Hardwired time selection 05-40 sec. Relay Outputs 1NO + 1NO.

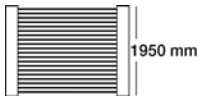
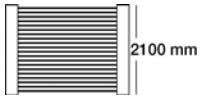
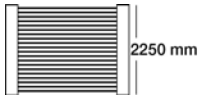
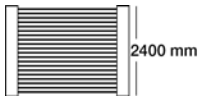
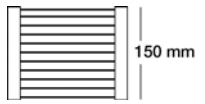
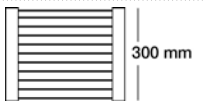
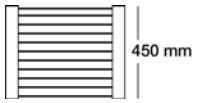
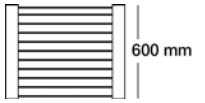
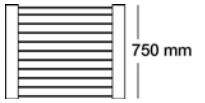
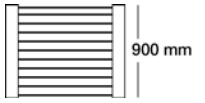
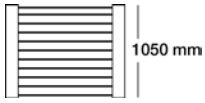
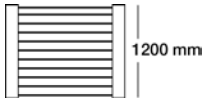
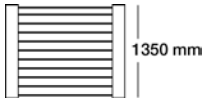
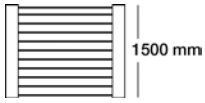
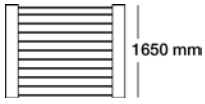
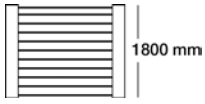
Expansion relays

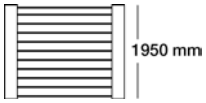
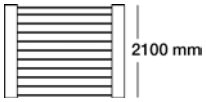
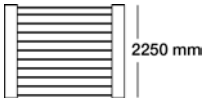
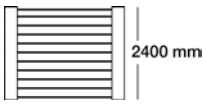
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**E1T 0s 24 VDC** **Expansion relay**	2TLA010030R0000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 0 sec. Relay outputs 4NO.
	E1T 0.5s 24 VDC **Expansion relay**	2TLA010030R1000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 0.5 sec. Relay outputs 4NO.
	E1T 1s 24 VDC **Expansion relay**	2TLA010030R2000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 1 sec. Relay outputs 4NO.
	E1T 1.5s 24 VDC **Expansion relay**	2TLA010030R3000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 1.5 sec. Relay outputs 4NO.
	E1T 2s 24 VDC **Expansion relay**	2TLA010030R4000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 2 sec. Relay outputs 4NO.
	E1T 3s 24 VDC **Expansion relay**	2TLA010030R5000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 3 sec. Relay outputs 4NO.
	**JSR1T 0s 24 VDC** **Expansion relay**	2TLA010015R0000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 0 sec. Relay outputs 4NO / 1NC.
	JSR1T 1.5s 24 VDC **Expansion relay**	2TLA010015R0500	Safety expansion relay - for expanding the outputs of safety relays. Time delay 1.5 sec. Relay outputs 4NO / 1NC.
	JSR1T 8s 24 VDC **Expansion relay**	2TLA010015R0600	Safety expansion relay - for expanding the outputs of safety relays. Time delay 8 sec. Relay outputs 4NO / 1NC.
	JSR1T 0.5s 24 VDC **Expansion relay**	2TLA010015R1000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 0.5 sec. Relay outputs 4NO / 1NC.
	JSR1T 10s 24 VDC **Expansion relay**	2TLA010015R2000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 10 sec. Relay outputs 4NO / 1NC.
	JSR1T 1s 24 VDC **Expansion relay**	2TLA010015R3000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 1 sec. Relay outputs 4NO / 1NC.
	JSR1T 2s 24 VDC **Expansion relay**	2TLA010015R4000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 2 sec. Relay outputs 4NO / 1NC.
	JSR1T 3s 24 VDC **Expansion relay**	2TLA010015R5000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 3 sec. Relay outputs 4NO / 1NC.
	JSR1T 5s 24 VDC **Expansion relay**	2TLA010015R6000	Safety expansion relay - for expanding the outputs of safety relays. Time delay 5 sec. Relay outputs 4NO / 1NC.

	**JSR2A 24 VAC/VDC Expansion relay**	2TLA010027R0100	Expansions relay for more outputs. Higher switching capacity. Up to 10 amps per output. Relay outputs 3NO / 1NC.
	JSR2A 115 VAC Expansion relay	2TLA010027R0400	Expansions relay for more outputs. Higher switching capacity. Up to 10 amps per output. Relay outputs 3NO / 1NC.
	JSR2A 230 VAC Expansion relay	2TLA010027R0500	Expansions relay for more outputs. Higher switching capacity. Up to 10 amps per output. Relay outputs 3NO / 1NC.
	**JSR3T 24 VAC/VDC Expansion relay**	2TLA010017R0100	Safety expansion relay for safe delayed outputs. Hardwire Selectable Delay 0.5 - 10.0 sec. Relay Outputs 1NO + 1NO.

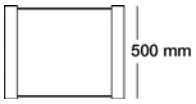
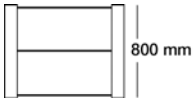
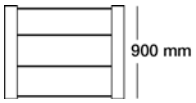
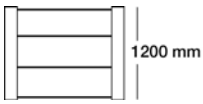
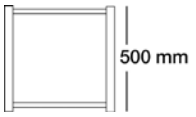
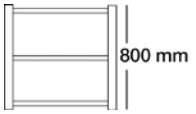
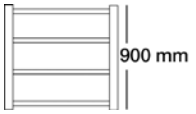
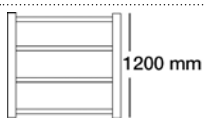
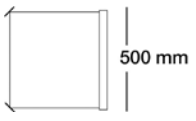
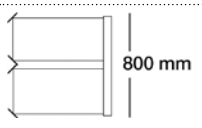
Optical Safety Devices - Light curtains Focus II

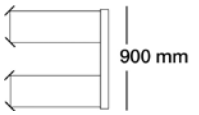
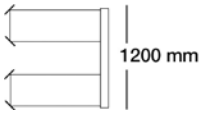
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**FII-4-14-150**	2TLA022200R0000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 150 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-300**	2TLA022200R1000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 300 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-450**	2TLA022200R2000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 450 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-600**	2TLA022200R3000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 600 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-750**	2TLA022200R4000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 750 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-900**	2TLA022200R5000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 900 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-1050**	2TLA022200R6000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 1050 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-1200**	2TLA022200R7000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 1200 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-1350**	2TLA022200R8000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 1350 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-1500**	2TLA022200R9000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 1500 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-1650**	2TLA022201R0000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 1650 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-1800**	2TLA022201R1000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 1800 mm detection zone, range 0.2-6 m, Type 4.

	**FII-4-14-1950**	2TLA022201R2000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 1950 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-2100**	2TLA022201R3000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 2100 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-2250**	2TLA022201R4000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 2250 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-14-2400**	2TLA022201R5000	Focus II Light Curtain Transmitter + Receiver, 14 mm resolution, 2400 mm detection zone, range 0.2-6 m, Type 4.
	**FII-4-30-150**	2TLA022201R6000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 150 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-300**	2TLA022201R7000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 300 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-450**	2TLA022201R8000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 450 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-600**	2TLA022201R9000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 600 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-750**	2TLA022202R0000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 750 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-900**	2TLA022202R1000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 900 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-1050**	2TLA022202R2000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 1050 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-1200**	2TLA022202R3000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 1200 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-1350**	2TLA022202R4000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 1350 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-1500**	2TLA022202R5000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 1500 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-1650**	2TLA022202R6000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 1650 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-1800**	2TLA022202R7000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 1800 mm detection zone, range 0.2-14 m, Type 4.

	**FII-4-30-1950**	2TLA022202R8000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 1950 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-2100**	2TLA022202R9000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 2100 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-2250**	2TLA022203R0000	Focus II Light Curtain Transmitter + Receiver, 30 mm resolution, 2250 mm detection zone, range 0.2-14 m, Type 4.
	**FII-4-30-2400**	2TLA022203R1000	Focus II Light Curtain, Transmitter + Receiver, 30 mm resolution, 2400 mm detection zone, range 0.2-14 m, Type 4.

Light grids Focus II

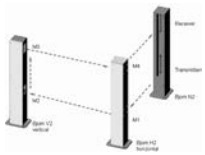
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**FII-4-K2-500**	2TLA022204R0000	Focus II Light Grid, Transmitter + Receiver, 2 Beams, 500 mm detection zone, range 0.5-40 m, Type 4.
	**FII-4-K3-800**	2TLA022204R1000	Focus II Light Grid, Transmitter + Receiver, 3 Beams, 800 mm detection zone, range 0.5-40 m, Type 4.
	**FII-4-K4-900**	2TLA022204R2000	Focus II Light Grid, Transmitter + Receiver, 4 Beams, 900 mm detection zone, range 0.5-40 m, Type 4.
	**FII-4-K4-1200**	2TLA022204R3000	Focus II Light Grid, Transmitter + Receiver, 4 Beams, 1200 mm detection zone, range 0.5-40 m, Type 4.
	**FII-4-K2-500D**	2TLA022204R4000	Focus II Light Grid, Transmitter + Receiver, 2+2 Beams (2 beams in parallel), 500 mm detection zone, range 0.5-40 m, Type 4.
	**FII-4-K3-800 D**	2TLA022204R5000	Focus II Light Grid, Transmitter + Receiver, 3+3 Beams (2 beams in parallel), 800 mm detection zone, range 0.4-40 m Type 4.
	**FII-4-K4-900 D**	2TLA022204R6000	Focus II Light Grid, Transmitter + Receiver, 4+4 Beams (2 beams in parallel), 900 mm detection zone, range 0.5-40 m Type 4.
	**FII-4-K4-1200 D**	2TLA022204R7000	Focus II Light Grid, Transmitter + Receiver, 4+4 Beams (2 beams in parallel), 1200 mm detection zone, range 0.5-40 m Type 4.
	**FII-4-K1C-500**	2TLA022204R8000	Focus II Light Grid, Transmitter/Receiver + Mirror, 2 Beams, 500 mm detection zone, range 0.5-12 m, Type 4.
	**FII-4-K2C-800**	2TLA022204R9000	Focus II Light Grid, Transmitter/Receiver + Mirror, 3 Beams, 800 mm detection zone, range 0.5-8 m, Type 4.

	**FII-4-K2C-900**	2TLA022205R0000	Focus II Light Grid, Transmitter/Receiver + Mirror, 4 Beams, 900 mm detection zone, range 0.5-7 m, Type 4.
	**FII-4-K2C-1200**	2TLA022205R1000	Focus II Light Grid, Transmitter/Receiver + Mirror, 4 Beams, 1200 mm detection zone, range 0.5-7 m, Type 4.

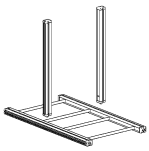
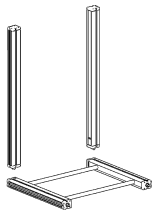
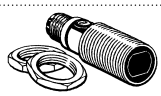
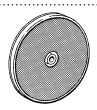
Wet

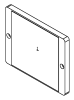
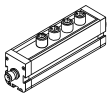
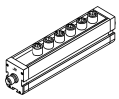
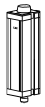
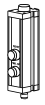
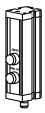
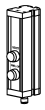
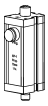
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**WET-MF-T**	2TLA022038R1700	Damp and dust protection for corresponding Focus I muting section.
	WET-MF-L	2TLA022038R1800	Damp and dust protection for corresponding Focus I muting section.
	Wet-150 FII	2TLA022038R4000	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-300 FII	2TLA022038R4100	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-450 FII	2TLA022038R4200	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-600 FII	2TLA022038R4300	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-750 FII	2TLA022038R4400	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-900 FII	2TLA022038R4500	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-1050 FII	2TLA022038R4600	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-1200 FII	2TLA022038R4700	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-1350 FII	2TLA022038R4800	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-1500 FII	2TLA022038R4900	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-1650 FII	2TLA022038R5000	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-1800 FII	2TLA022038R5100	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-K-500 FII	2TLA022038R5200	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-K-800 FII	2TLA022038R5300	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-K-900 FII	2TLA022038R5400	Damp and dust protection for corresponding Focus II light curtain/grid.
	Wet-K-1200 FII	2TLA022038R5500	Damp and dust protection for corresponding Focus II light curtain/grid.

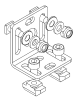
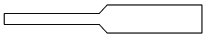
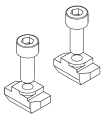
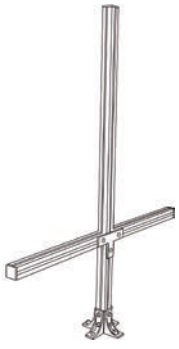
Bjorn

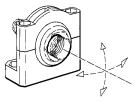
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**Bjorn H2**	2TLA022041R4000	Bjorn H2 mirror stand for Focus II. Horizontal reflection.
	Bjorn V2	2TLA022041R4100	Bjorn V2 mirror stand for Focus II. Vertical reflection.
	Bjorn H3	2TLA022041R4200	Bjorn H3 mirror stand for Focus II. Horizontal reflection.
	Bjorn H4-1	2TLA022041R4300	Bjorn H4-1 mirror stand for Focus II. Horizontal reflection.
	Bjorn H4-2	2TLA022041R4400	Bjorn H4-2 mirror stand for Focus II. Horizontal reflection.
	Bjorn N2	2TLA022041R4500	Bjorn N2 floor stand for Focus II.
	Bjorn N3	2TLA022041R4600	Bjorn N3 floor stand for Focus II.
	Bjorn N4-1	2TLA022041R4700	Bjorn N4-1 floor stand for Focus II.
	Bjorn N4-2	2TLA022041R4800	Bjorn N4-2 floor stand for Focus II.
	Bjorn N5	2TLA022041R4900	Bjorn N5 floor stand for Focus II.

Accessories for Optical Safety Devices

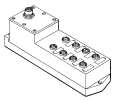
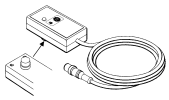
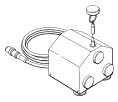
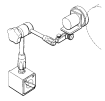
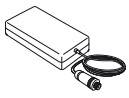
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**MFII-300 mirror**	2TLA022041R0200	Height mirror glass 356 mm, total height 361 mm, for Focus and Focus II lightcurtains/grids.
	MFII-450 mirror	2TLA022041R0300	Height mirror glass 506 mm, total height 511 mm, for Focus and Focus II lightcurtains/grids.
	MFII-600 mirror	2TLA022041R0400	MFII-600 mirror. Height mirror glass 653 mm, total height 658 mm, for Focus and Focus II lightcurtains/grids.
	MFII-750 mirror	2TLA022041R0500	Height mirror glass 796 mm, total height 801 mm, for Focus and Focus II lightcurtains/grids.
	MFII-900 mirror	2TLA022041R0700	Height mirror glass 953 mm,total height 958 mm, for Focus and Focus II lightcurtains/grids.
	MFII-1200 mirror	2TLA022041R0800	Height mirror glass 1253 mm, total height 1258 mm, for Focus and Focus II lightcurtains/grids.
	MFII-1350 mirror	2TLA022041R1300	Height mirror glass 1403 mm, total height 1408 mm, for Focus and Focus II lightcurtains/grids.
	MFII-1500 mirror	2TLA022041R0900	Height mirror glass 1546 mm, total height 1551 mm, for Focus and Focus II lightcurtains/grids.
	MFII-1650 mirror	2TLA022041R1000	Height mirror glass 1703 mm, total height 1708 mm, for Focus and Focus II lightcurtains/grids.
	**Bracket for MF-mirrors**	2TLA022041R2000	Bracket for MF-mirrors.
	MF-T	2TLA022040R2000	Muting kit for T-muting. Transmitter and receiver with 4 integrated photo-cells. Included are 1 pcs 8-pol cable and 1 pcs 5-pole cable for connection between safety light protection and MF-T. In Focus aluminum profile.
	MFT-T	2TLA022040R2100	Muting unit for T-muting. Transmitter with 4 integrated photo-cells. Included is 1 pcs 5-pol cable for connection between safety light protection and MFT-T. In Focus aluminum profile.
	**MFR-T**	2TLA022040R2200	Muting unit for T-muting. Receiver with 4 integrated photo-cells. Included is 1 pcs 8-pol cable for connection between safety light protection and MFR-T. In Focus aluminum profile.
	MF-T REFLEX	2TLA022040R4000	Muting kit for T-muting. Transmitter/receiver with 4 integrated photo-cells and reflector. Included is 1 pcs 8-pol cable for connection between safety light protection and MF-T REFLEX. In Focus aluminum profile.
	MFTR-T REFLEX	2TLA022040R4100	Muting unit for T-muting with reflector. Transmitter/Receiver unit with 4 integrated photo-cells. Included is 1 pcs 8-pol cable for connection between safety light protection and MFTR-T REFLEX. In Focus aluminum profile.
	M-T REFLEX	2TLA022040R4200	Muting unit for T-muting with reflector. Reflector unit.
	MF-L	2TLA022040R3000	Muting kit for L-muting. Transmitter and receiver with 2 integrated photo-cells. Included are 1 pcs 8-pol cable and 1 pcs 5-pole cable for connection between safety light protection and MF-L. In Focus aluminum profile.
	MFT-L	2TLA022040R3100	Muting unit for L-muting. Transmitter with 2 integrated photo-cells. Included is 1 pcs 5-pol cable for connection between safety light protection and MFT-L. In Focus aluminum profile.
	**MFR-L**	2TLA022040R3200	Muting unit for L-muting. Receiver with 2 integrated photo-cells. Included is 1 pcs 8-pol cable for connection between safety light protection and MFR-L. In Focus aluminum profile.
	MF-L REFLEX	2TLA022040R5000	Muting kit for L-muting. Transmitter/receiver with 2 integrated photo-cell and reflector. Included is 1 pcs 8-pol cable for connection between safety light protection and MF-L REFLEX. In Focus aluminum profile.
	MFTR-L REFLEX	2TLA022040R5100	Muting unit for L-muting with reflector. Transmitter/Receiver unit with 2 integrated photo-cells. Included is 1 pcs 8-pol cable for connection between safety light protection and MFTR-L REFLEX. In Focus aluminum profile.
	M-L REFLEX	2TLA022040R5200	Muting unit for L-muting with reflector. Reflector unit.
	**MUTE R (FSTR1)**	2TLA022044R0000	Mute R (FSTR 1) Retro-reflecting photo-cell M18/M12. Range with FZR1: 0.15-2.5 m. FZR2A: 0.15-5.1 m.
	**FZR1**	2TLA022044R0100	FZR1 Reflector Ø 80 mm incl. screw MC6S M4 × 16 + Locking nut M4.

	**FZR2**	2TLA022044R0400	FZR2A Reflector 100 × 100 mm incl. Screws, 2 pcs MC6S M4 × 16 + Locking nut M4.
	**FMC-1**	2TLA022042R0000	FMC-1 Focus muting connection unit with 4 connectors. With connectors for muting sensors (A+B), reset, power off and muting lamp (R) and muting lamp (M).
	**FMC-2**	2TLA022042R1000	FMC-2 Focus muting connection unit with 6 connectors. With connectors for muting sensors (A1, A2+B1, B2), reset, power off and muting lamp (R) and muting lamp (M).
	**FMI-1A**	2TLA022043R0000	FMI-1A muting lamp unit with M12 connector.
	**FMI-1B**	2TLA022043R0100	FMI-1B muting lamp unit with reset+lamp, power off button and with M12 connector.
	**FMI-1C**	2TLA022043R0200	FMI-1C unit with reset+lamp, power off button and M12 connector.
	**FMI-1D**	2TLA022043R0300	FMI-1D unit with reset+lamp, power off button, muting resistor and M12-connector.
	**FMI-1E**	2TLA022043R0400	FMI-1E (pre) reset button blue. FMI-1E unit with reset+lamp and M12-connector.
	FMI-1G	2TLA022043R0500	FMI-1G reset+lamp and muting resistor with M12 connector.
	**FRM-1A**	2TLA022048R0000	FRM-1A relay unit for Focus II with 8-pin M12-connectors.
	**BP-1**	2TLA022090R2300	Blanking programming unit for Focus II light curtains.
	**JSAP-1**	2TLA022070R1000	JSAP-1 Adapter plug including resistor and 2 jumpers.
	Bolt set to Focus II	2TLA022090R0000	Bolt set Focus II. 2 × M6 × 14 stainless steel bolts with washers, plastic washers and lock nuts.

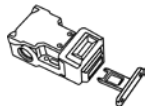
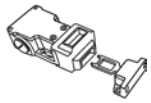
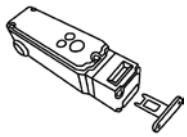
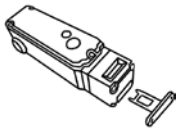
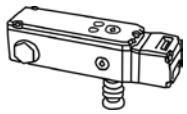
	**JSM 66**	2TLA022090R1000	JSM 66 Bracket 2.5 mm RF A2 painted black including, 2 pcs allen screw M6 × 12, 2 pcs T-nut M6 and 2 pcs washers.
		2TLA022090R1100	JSM 66 Bracket 2.5 mm RF A2 painted black incl. bolt set for Focus II.
		2TLA022090R1200	JSM 66 Bracket 2.5 mm RF A2 painted black incl. Bolt set for Focus II and 2 pcs allen screw M6 × 12, 2 pcs T-nut M6 and 2 psc washers.
		2TLA022090R1300	JSM 66 Bracket 2.5 mm RF A2 painted black.
	**JSM 68**	2TLA022090R1800	JSM 68 Focus test tool 14/30 mm.
	**JSM F1-K**	2TLA040043R0000	Mounting screw set for ABB Jokab Safety aluminium profile. Includes 1 pcs M6SF M6 x 12 and 1 pcs JSM M6B (T-nut).
	**JSM F2-K**	2TLA040044R0000	Mounting screw set for JSM64 to ABB Jokab Safety aluminium profile. Includes 2 pcs MC6S M6 x16 and 2 pcs JSM M6B (T-nut).
	**JSM F3-K**	2TLA040045R0000	Mounting screw set for ABB Jokab Safety aluminium profile. Includes 1 pcs MC6S M6 x 12, 1 pcs JSM M6B (T-nut) and 1 pcs washer.
	**JSMA44-L** **Post 1000 mm**	2TLA040001R0000	Aluminum post 44 × 44, 1000 mm with end cap.
	**JSMA44-L** **Post 1300 mm with feet brackets**	2TLA040001R1000	Aluminum post 44 × 44, 1300 mm with 3 pcs feet brackets and end cap.
	JSMA44A-L **Post 1100 mm with feet brackets**	2TLA040001R1100	Aluminum post 44 × 44, 1100 mm with 3 pcs feet brackets and end cap.
	**JSMA44A-LM** **Post 1100 mm for muting**	2TLA040001R1300	Aluminum post 44 x 44, 1100 mm, 2 pcs 500 mm with 3 pcs feet brackets, 2 pcs T-brackets and end cap.
	JSMA44A-LM **Post 1300 mm for muting**	2TLA040001R1400	Aluminum post 44 x 44, 1300 mm, 2 pcs 500 mm with 3 pcs feet brackets, 2 pcs T-brackets and end cap.
	**JSM60-L**	2TLA040003R0000	JSM60-L Bracket for JSM9 or JSM63. Includes screws for profile.
	**JSM62-L**	2TLA040004R0000	JSM62-L Bracket for JSM9 for horizontal angling around a machine. Includes screws for profile.
	**JSM7A** **Mirror medium**	2TLA040006R0500	Mirror for 0-20 m, adjustable mirror plate. Dimensions: 115 × 80 × 30 mm. Screws for bracket included.

	**JSM9** **Bracket for mirror**	2TLA040007R0000	JSM9 Bracket for mirror.
	**JSM63** **Bracket for lightbeam**	2TLA040007R0100	JSM63 Bracket for Spot 35 T/R light beam.
	**JSM64** **Bracket with angle possibility for M18**	2TLA040007R0200	Adjustable mounting bracket with rotational knuckle for 18 mm barrel style sensors. Example, Spot 10T/R or MUTE R (FSTR1).

Stopping time and machine diagnosis tool

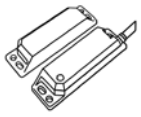
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**Smart Logger**	2TLA070300R0100	Safety and motion analyser tool. Analysis tool for moving machinery systems.
	**SM2 Stop unit**	2TLA070300R0200	Stop unit for Smart with pushbutton for interaction with emergency stops and other pushbuttons.
	**SM3 Stop unit**	2TLA070300R0300	Stop unit for Smart with relay for electrical connection to machinery system.
	**SM5/1250 Transducer**	2TLA070300R0400	Linear transducer for Smart with 1250 mm wire and wire damper.
	**SM5/2500 Transducer**	2TLA070300R0500	Linear transducer for Smart with 2500 mm wire and wire damper.
	**SM6 Mains unit** **115-230 VAC / 24 VDC**	2TLA070300R0600	Mains power supply unit for Smart. 115-230 VAC/24 VDC with detachable europlug.
	**SM7 Wheel transducer**	2TLA070300R0700	Wheel transducer for Smart, with stand.
	**SM9 Case**	2TLA070300R0900	Case for Smart equipment, capable of holding all Smart equipment and also room for a laptop computer.
	**SM11 Flag unit**	2TLA070300R1100	Stop unit for Smart with rotating flag for interaction with light curtains and other optical sensors.
	**SM13 Battery pack**	2TLA070300R2300	Battery pack for Smart.
	**SM14** **Charger for SM11/SM13**	2TLA070300R2400	Battery charger for SM11 and SM13 with detachable europlug, 110-240 VAC.
	**Computer cable for Smart**	2TLA070300R1500	USB cable for connecting Smart Logger to a computer.
	Smart kit with SM6, **Computer cable and SM9**	2TLA070300R4300	SM9 case with Smart Logger, SM6 power supply and USB cable.

MKey - Interlock Switch

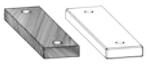
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**MKey4 - 12N**	2TLA050001R1100	Safety interlock switch, 2NC / 1NO, full plastic body, 3 x 1/2 NPT Conduits entries, 12N holding force, standard key.
	MKey5 - 12N	2TLA050003R1100	Safety interlock switch, 2NC / 1NO, full plastic body, 3X 1/2 NPT Conduits entries, 12N holding force, standard key.
	**MKey6Z+ - 12N**	2TLA050005R1130	Safety interlock switch, 2NC / 1NO, full plastic body, 3 X 1/2 NPT Conduits entries, 12N holding force, standard key.
	**MKey8 - 24 VDC**	2TLA050011R1132	Safety interlock switch, 2NC + 2NC, die cast housing and spring lock, 3 x 1/2 NPT Conduits entries, 24 VDC, standard key.
	**MKey8M - 24 VDC**	2TLA050013R1132	Safety interlock switch, 2NC + 2NC, die cast housing and magnetic lock, 3 x 1/2 NPT Conduits entries, 24 VDC, standard key.
	**MKey8ER - 24 VDC**	2TLA050015R1132	Safety interlock switch, 2NC + 2NC, die cast housing and spring lock with emergency release, 3 x 1/2 NPT Conduits entries, 24 VDC, standard key.
	**MKey9 - 24 VDC**	2TLA050007R1112	Safety interlock switch, rugged polyester housing and spring lock, stainless steel head, standard key, 1 x 1/2 NPT Conduits entries, 24 VDC.
	**MKey9M - 24 VDC (power to lock)**	2TLA050009R1112	Safety interlock switch, rugged polyester housing and electro-magnetic lock, stainless steel head, standard key, 1 x 1/2 NPT Conduits entries, 24 VDC.
	**MKey 4,5 Std. Key Plastic Head**	2TLA050040R0201	Standard key to Safety Interlock Switch 4 and 5 with a plastic head (around the key entrance). Stainless steel 316 key.
	MKey 4,5,6,8,9 Std. Key Metal Head	2TLA050040R0202	Standard key to Safety Interlock Switch 4, 5, 6, 8 and 9 with a stainless steel head (around the key entrance). Stainless steel 316 key.
	**MKey 4,5,6,8,9 Flat Key**	2TLA050040R0220	Flat key to Safety Interlock Switch 4, 5, 6, 8 and 9 with a stainless steel head (around the key entrance). Stainless steel 316 key, plastic shroud.
	**MKey 4,5,6 Flex Key Plastic**	2TLA050040R0221	Flexible key to Safety Interlock Switch 4, 5 and 6 with a plastic head (around the key entrance). Stainless steel 316 key, plastic housing.
	**MKey 4,5,6,8,9 Flex Key Metal**	2TLA050040R0203	Flexible key to Safety Interlock Switch 4, 5, 6, 8 and 9 with a stainless steel head (around the key entrance). Stainless steel 316 key, die cast metal housing.
	**MKey 6,8,9 SS Flex Key SS**	2TLA050040R0204	Flexible key to Safety Interlock Switch 4, 5, 6, 8 and 9 with a stainless steel head (around the key entrance). Stainless steel 316 key, stainless steel housing.

	Slide Lock Left	2TLA050040R0500	Slide Lock for MKey8,9 Left. Rugged metal construction that provide shearing forces up to 10,000N (1,000kg) on large hinged doors.
	Slide Lock Right	2TLA050040R0501	Slide Lock for MKey8,9 Right. Rugged metal construction that provide shearing forces up to 10,000N (1,000kg) on large hinged doors.
	Slide Lock Handle	2TLA050040R0510	Accessorie for Slide Lock MKey8,9. Rear handle where there is a requirement to move the handle from inside the guard area.
	Slide Lock S.catch	2TLA050040R0511	Accessorie for Slide Lock MKey8,9. Spring Loaded Catch to prevent accidental actuation after opening of the handle.

Sense - Magnetic Switch

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**Sense7** **5 m** cable	2TLA050056R5100	Safety Magnetic Switch, 2NC / 1NO, plastic, LED, 5 m cable.
	Sense7 **10 m** cable	2TLA050056R6100	Safety Magnetic Switch, 2NC / 1NO, plastic, LED, 10 m cable.
	Sense7Z **5 m** cable	2TLA050056R5120	Safety Magnetic Switch, 2NC / 1NO, stainless steel, LED, 5 m cable.
	Sense7Z **10 m** cable	2TLA050056R6120	Safety Magnetic Switch, 2NC / 1NO, stainless steel, LED, 10 m cable.

Magne – Magnetic process lock

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**Magne 1A v2 1500N**	2TLA042022R2100	Electro-magnet with 5-pole M12-contact. Anchor plate. Cell rubber.
	Magne 1B v2 1500N	2TLA042022R2200	Electro-magnet with 5-pole M12-contact. Anchor plate with permanent magnet. Cell rubber.
	**Handle profile for Magne**	2TLA042023R0100	Aluminum profile used as both door handle and mounting kit for Magne. Completely covers Magne unit when the door is closed.
	**JSM D21B**	2TLA042023R0500	Mounting kit for Magne. For conventional door (5–15 mm door gap). Fits all Magne.
	**JSM D23**	2TLA042023R0200	Mounting kit for Magne. For sliding door. Fits all Magne.
	**Magne Anchor Plate 32A**	2TLA042023R1300	Spare part. Anchor plate A (without permanent magnet). Width 32 mm. Included to Magne 1/2.
	Magne Anchor Plate 34A	2TLA042022R2300	Spare part. Anchor plate A (without permanent magnet). Width34 mm.
	Magne Anchor Plate32B	2TLA042023R0400	Spare part. Anchor plate B (with permanent magnet). Width 32 mm. Included to Magne 1/2.
	Magne Anchor Plate 34B	2TLA042022R2400	Spare part. Anchor plate B (with permanent magnet). Width 34 mm.
	**JSM D27** **Handle mounting kit**	2TLA042023R1000	Handle/screw for JSM D21 Magne installation kit.
	**Magne Anchor Plate cellular rubber**	2TLA042023R3600	Spare part. Cellular rubber t=10 mm.

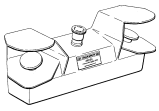
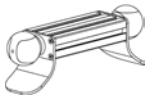
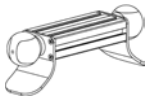
Accessories for process lock

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**M12-CT0214**	2TLA020060R0100	Transfer cable, 20 cm 8/5 × 0.34 mm² + screen with straight M12 8-pole female + 5-pole male connectors. Screen connected to pin7 (0VDC) on male connector. Can be used for connection of Dalton to URAX or Tina 4/8.
	M12-CT0212M	2TLA020060R0700	Transfer cable, 20 cm 5 × 0.34 mm² +screen with straight M12 5-pole male + 5-pole female connectors. Screen connected to pin3 (0VDC) on male connector. Can be used when connecting Magne 1 to a non-safe output on URAX.

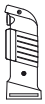
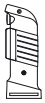
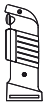
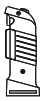
Control devices - Safeball – One hand devices

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**JSTD1-A** **Safeball 20 m cable**	2TLA020007R3000	JSTD1-A Safeballs each have 1NO & 1NC independent switches, maximum load of 30 VDC - 2A resistive. Ergonomic design with several grip possibilities and low activation force (approx. 2N) and flexible mounting options. Provides highest level of safety for use in two hand control applications when using two Safeballs in conjunction with a JSBR4 safety relay or Pluto Safety PLC. IP67 protection degree, plastic body, 2 meters molded cable.
	JSTD1-B **Safeball 200 mm cable**	2TLA020007R3100	JSTD1-B Safeballs each have 1NO & 1NC independent switches, maximum load of 30 VDC - 2A resistive. Ergonomic design with several grip possibilities and low activation force (approx. 2N) and flexible mounting options. Provides highest level of safety for use in two hand control applications when using two Safeballs in conjunction with a JSBR4 safety relay or Pluto Safety PLC. IP67 protection degree, plastic body, 0.2 m wires × 4 for direct connection into an enclosure.
	JSTD1-C **Safeball 10 m cable**	2TLA020007R3200	JSTD1-C Safeballs each have 1NO & 1NC independent switches, maximum load of 30 VDC - 2A resistive. Ergonomic design with several grip possibilities and low activation force (approx. 2N) and flexible mounting options. Provides highest level of safety for use in two hand control applications when using two Safeballs in conjunction with a JSBR4 safety relay or Pluto Safety PLC. IP67 protection degree, plastic body, 10 meters molded cable.
	JSTD1-E **Safeball 1NO+1NO** **200 mm cable**	2TLA020007R3400	JSTD1-E Safeballs each have 2NO independent switches, maximum load of 30 VDC - 2A resistive. Ergonomic design with several grip possibilities and low activation force (approx. 2N) and flexible mounting options. Provides highest level of safety for use in two hand control applications when using two Safeballs in conjunction with a JSBR4 safety relay or Pluto Safety PLC. IP67 protection degree, plastic body, 0.2 m wires × 4 for direct connection into an enclosure.

Safeball – Two hand devices

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**JSTD20A** **Twohand station**	2TLA020007R2000	Two-hand device with conventional operating buttons. Operating push buttons are 60 mm in diameter, black, 9N operating force, 1 NO + 1 NC contacts, rated current of 10A. Buttons are mounted in black painted steel housing designed for two-hand applications. IP65. Terminal blocks within housing for connection to buttons. Highest level of safety can be achieved when using in conjunction with a JSBR4 safety relay for two-hand buttons or a Pluto Safety PLC.
	**JSTD20B** **Twohand with** **Emergency Stop**	2TLA020007R2100	Two-hand device with conventional operating buttons and E-stop button. Operating push buttons are 60 mm in diameter, black, 9N operating force, 1NO + 1NC contacts, rated current of 10A. E-stop button diameter is 40 mm, 40N operating force, 2NC positive opening contacts, rated current of 10A. Buttons are mounted in black painted steel housing designed for two-hand applications, IP65. Terminal blocks within housing for connection to buttons. Highest level of safety can be achieved when using in conjunction with a JSBR4 safety relay for two-hand buttons and RT9/RT6 safety relay for e-stop button or a Pluto Safety PLC.
	**JSTD20C** **Twohand station** **housing**	2TLA020007R2200	Two-hand housing only. Steel and black painted. Accepts up to 60 mm operating buttons for two-hand device and 40 mm e-stop button.
	**JSTD25F** **Twohand station,** **5-pole M12 Male**	2TLA020007R6000	Two-hand device with JSTD1-B Safeballs. Buttons are side mounted 44 × 88 extruded aluminum profile designed for two hand applications. Pre-wired to a M12 5-pin connector with protective flanges of the safeballs. Highest level of safety can be achieved when used in conjunction with a JSBR4 safety relay or Pluto Safety PLC.
	JSTD25G **Twohand station,** **custom made**	2TLA020007R6200	Two-hand device with is custom made. Included are Safeballs with NO + NC or NO + NO. These are mounted on a 44 × 88 extruded aluminum profile with optional length and then there is protective flanges of the safeballs. Connection is made according to customer choice. Options is Smile E-Stop.
	**JSTD25H** **Twohand station,** **8-pole M12 Male**	2TLA020007R6300	Two-hand device with JSTD1-B Safeballs. Buttons are side mounted 44 × 88 extruded aluminum profile designed for two hand applications. Pre-wired to a M12 8-pin connector with protective flanges of the safeballs. Highest level of safety can be achieved when used in conjunction with a JSBR4 safety relay or Pluto Safety PLC.
	JSTK0-A	2TLA020007R6600	JSTK0-A Connector for JSTD25P-1.
	JSTK40S	2TLA020007R6700	JSTK40S Spiral cable 4 m for JSTD25P-1.
	JSTK80S	2TLA020007R6800	JSTK80S Spiral cable 8 m for JSTD25P-1.
	Universal shelf for **JSTD25P-1.**	2TLA020007R8000	Universal shelf for JSTD25P-1.

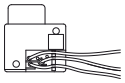
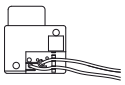
JSHD – Top units

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**JSHD4-1**	2TLA020006R2100	Three-position device.
	**JSHD4-2**	2TLA020006R2200	Three-position device incl. LEDs, front button and top button.
	**JSHD4-3**	2TLA020006R2300	Three-position device incl. LEDs.
	**JSHD4-4**	2TLA020006R2400	Three-position device incl. LEDs and front button.
	**JSHD4-5**	2TLA020006R2500	Three-position device incl. LEDs and top button.

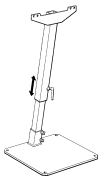
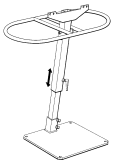
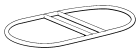
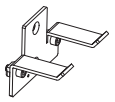
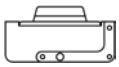
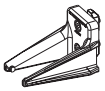
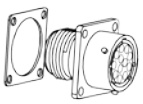
JSHD – Bottom part

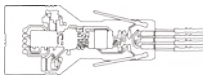
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**JSHD4 bottom part AA**	2TLA020005R1000	Bottom part with cable gland.
	**JSHD4 bottom part AB**	2TLA020005R1100	Bottom part with Cannon connection.
	**JSHD4 bottom part AC**	2TLA020005R1200	Bottom part with M12 connection (5 poles).
	**JSHD4 bottom part AD**	2TLA020005R1300	Bottom part with M12 connection (8 poles).
	**JSHD4 bottom part AH**	2TLA020005R1700	Bottom part with cable gland and PCB with 10 screw connections.
	**JSHD4 bottom part AJ**	2TLA020005R1800	Bottom part with cable gland and PCB with 16 screw connections.

JSHD – Three position device and button

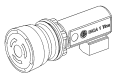
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**JSHD2C type A**	2TLA020001R1100	JSHD2C type A 3-position pushbutton, 3 cables 190 mm, Au, IP40.
	JSHD2C type E	2TLA020001R1000	JSHD2C type E 3-position pushbutton, 3 cables 200 mm, Au, IP54.
	JSHD2C type F	2TLA020001R1400	JSHD2C type F 3-position pushbutton, 3 cables 850 mm, Au, IP54.
	**JSHD2C type K**	2TLA020001R1300	JSHD2C type K 3-position pushbutton, 2 cables 290 mm, Ag, IP54.
	Fox 221	2TLA020160R4100	1 pedal safety foot switch with two positions. Robust metal housing.
	Fox 222	2TLA020160R4200	2 pedal safety foot switch with two positions. Robust metal housing.
	Fox 231	2TLA020160R3100	1 pedal safety foot switch with three positions. Reset function for buttom position. Robust metal housing.
	Fox 232	2TLA020160R3200	2 pedal safety foot switch with three positions. Reset function for buttom position. Robust metal housing.

Accessories for Control Devices

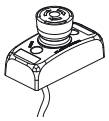
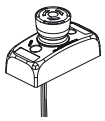
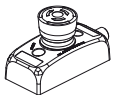
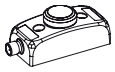
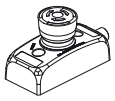
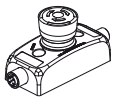
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**JSM C5**	2TLA020007R0900	Accessories Safeball. Ball & socket for flexible mount for mounting the Safeball to Enclosures, machines or table tops.
	**Safeball protection coat**	2TLA020007R1900	Extra protection coat for Safeball.
	**JSTS30**	2TLA020007R4000	Floor mount stand for JSTD20/25 two-hand devices. Black painted steel with adjustable height lever.
	**JSTS31**	2TLA020007R4100	Floor mount stand for JSTD20/25 two-hand devices. Black painted steel with adjustable height lever and distance ring.
	**JSTS32**	2TLA020007R4200	Distance ring for JSTS30 Floor mount stand.
	Protective plates	2TLA020007R6400	Protective plates for Safeball (kit) including fasteners.
	**JSM C7**	2TLA020007R1200	JSM C7 Suspension shelf for JSTD25 F/G/H.
	**JSHD4H2A**	2TLA020002R0200	JSHD4H2A Three-position control device for external panel mounting.
	JSHD4H2	2TLA020002R3100	JSHD4H2 Three-position control device for internal panel mounting.
	**JSM55**	2TLA040005R0500	JSM55 Wall bracket for three position device.
	**JSM5B**	2TLA040005R0700	JSM5B Wall bracket for 2 JSNY5 (ordered separately).
	**JSHD4 protection coat**	2TLA020200R4600	Extra protection coat for JSHD4.
	**JSHK0**	2TLA020003R0300	Accessories JSHD4. 12-pole female Cannon connector for cable mounting.
	JSHK1-B	2TLA020003R0900	Accessories JSHD4. 12-pole male Cannon connector for cable mounting.
	**JSHK1-A**	2TLA020003R0800	Accessories JSHD4. 12-pole female Cannon connector for cabinet mounting.
	JSHK1-C	2TLA020003R0700	Accessories JSHD4. 12-pole male Cannon connector for cabinet mounting.
	**HK5**	2TLA020003R4700	HK5 Cable 5 m and Cannon connection.
	HK10	2TLA020003R4800	HK10 Cable 10 m and Cannon connection.
	HK20	2TLA020003R4900	HK20 Cable 20 m and Cannon connection.

	**HK16S4**	2TLA020003R5000	HK16S4 spiral cable 1.6 m and Cannon connection.
	HK20S4	2TLA020003R5100	HK20S4 spiral cable 2.0 m and Cannon connection.
	HK32S4	2TLA020003R5200	HK32S4 spiral cable 3.2 m and Cannon connection.
	HK40S4	2TLA020003R3500	HK40S4 spiral cable 4.0 m and Cannon connection.
	HK3604	2TLA020003R3600	HK3604 spiral cable 6.0 m and Cannon connection.
	HK80S4	2TLA020003R5300	HK80S4 spiral cable 8.0 m and Cannon connection.
	**JSHD4 Anti-tamper PCBA**	2TLA020005R0900	Accessories JSHD4. Anti-tamper PCB. Works with top part JSHD4-2 to JSHD4-5, combined with botten part AB, AD, AF, AG, AH or AJ.
	**JSM 50G**	2TLA020205R6300	Accessories JSHD4. Big Bottom plate. Makes it possible to mount Safety Interlock Keys on the JSHD4 to ensure the tree-position device postition when not in use. Works with the bracket JSM5B.

Emergency stops and Pilot devices - INCA

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**INCA 1**	2TLA030054R0100	Emergency stop button for panel mounting, 22.5 mm holes, 2 × NC, Status LED in button, terminal blocks.
	INCA 1S	2TLA030054R0300	Machine stop (Black button) for panel mounting, 22.5 mm holes, 2 × NC, Status LED in button, terminal blocks.

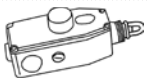
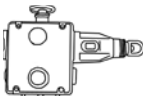
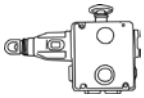
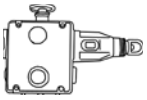
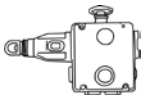
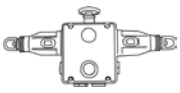
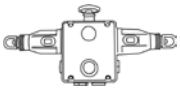
Smile

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**Smile 10 EA**	2TLA030051R0400	Emergency stop in Smile enclosure, 2 × NC, Status LED in button, 1 m 5-pole cable out of bottom.
	**Smile 10 EK**	2TLA030051R0600	Emergency stop in Smile enclosure, 2 × NC, 1 m 4-pole cable out of bottom.
	**Smile 11 EA**	2TLA030051R0000	Emergency stop in Smile enclosure, 2 × NC, Status LED in button, 1 × M12 5-pin male connector.
	**Smile 11 RA**	2TLA030053R0000	Reset button in Smile enclosure, 1 × NO button, 1 × Blue LED, 1 × M12 5-pin male connector.
	**Smile 11 SA**	2TLA030051R0900	Machine stop (Black button) in Smile enclosure, 2 × NC, Status LED in button, 1 × M12 5-pin male connector.
	**Smile 12 EA**	2TLA030051R0200	Emergency stop in Smile enclosure, 2 × NC, Status LED in button, 1 × M12 5-pin male connector and 1 × M12 5-pin female connector.
	Smile 12 SA	2TLA030051R1000	Machine stop (Black button) in Smile enclosure, 2 × NC, Status LED in button, 1 × M12 5-pin male connector and 1 × M12 5-pin female connector.

Accessories for Emergency stops and Pilot devices

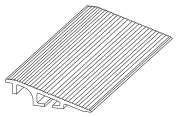
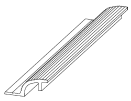
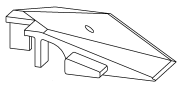
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**Yellow surround for Inca**	2TLA030054R0400	Elevated yellow surround for panel mounted emergency stop button.
	**JST2**	2TLA030051R1300	Termination for Smile 12, M12 5-pole connector, connects pin 1 with pin 5, and pin 2 with pin 4.

Emergency stop EStrongZ and Grab wire safety switche LineStrong

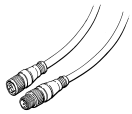
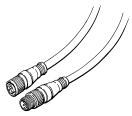
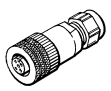
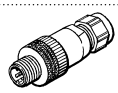
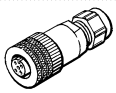
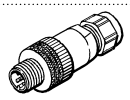
IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**EStrongZ**	2TLA050220R1020	Emergency stop, 2NC / 2NO, stainless steel 316 body, conduit entry 3 x 1/2 NPT.
	**EStrongZ (LED)**	2TLA050220R1222	Emergency stop, 2NC / 2NO, stainless steel 316 body, LED status indication, conduit entry 3 x 1/2 NPT.
	**LineStrong1**	2TLA050200R1030	Emergency stop grab wire safety switch, 2NC + 2NO, up to 50 m length, die cast housing, conduit entry 3 x 1/2 NPT.
	**LineStrong2**	2TLA050202R1332	Emergency stop grab wire safety switch, 2NC + 2NO, up to 80 m length, yellow die cast housing, LED status indication, conduit entry 3 x 1/2 NPT.
	**LineStrong2Z**	2TLA050202R1322	Emergency stop grab wire safety switch, 2NC + 2NO, up to 100 m length, stainless steel 316 body, LED status indication, conduit entry 3 x 1/2 NPT.
	**LineStrong3L**	2TLA050206R1332	Emergency stop grab wire safety switch, 4NC + 2NO, switch placement to the left, up to 125 m length, yellow die cast housing, LED status indication, conduit entry 3 x 1/2 NPT.
	**LineStrong3R**	2TLA05028R1332	Emergency stop grab wire safety switch, 4NC + 2NO, Switch placement to the right, up to 125 m length, yellow die cast housing, LED status indication, conduit entry 3 x 1/2 NPT.
	**LineStrong3LZ**	2TLA050206R1322	Emergency stop grab wire safety switch, 4NC + 2NO, switch placement to the left, up to 125 m length, stainless steel 316 housing, LED status indication, conduit entry 3 x 1/2 NPT.
	**LineStrong3RZ**	2TLA050208R1322	Emergency stop grab wire safety switch, 4NC + 2NO, switch placement to the right, up to 125 m length, stainless steel 316 housing, LED status indication, conduit entry 3 x 1/2 NPT.
	**LineStrong3D**	2TLA050204R1332	Emergency stop grab wire safety switch, 4NC + 4NO, entries from both sides of the grab wire switch, up to 250 m length, yellow die cast housing, LED status indication, conduit entry 3 x 1/2 NPT.
	**LineStrong3DZ**	2TLA050204R1322	Emergency stop grab wire safety switch, 4NC + 4NO, entries from both sides of the grab wire switch, up to 250 m length, stainless steel 316 housing, LED status indication, conduit entry 3 x 1/2 NPT.
	10 m Wire Kit, Galvanized	2TLA050210R0130	10 m galvanized wire pull kit. Includes 10 m wire (one end is terminated with thimble and permanent clamp), 5 pcs eyebolts, 1 pcs tensioner, 1 pcs allen key.
	50 m Wire Kit, Galvanized	2TLA050210R0530	20 m galvanized wire pull kit. Includes 50 m wire (one end is terminated with thimble and permanent clamp), 7 pcs eyebolts, 1 pcs tensioner, 1 pcs allen key.
	100 m Wire Kit, Galvanized	2TLA050210R0730	100 m galvanized wire pull kit. Includes 100 m wire, 37 pcs eyebolts, 2 pcs tensioner, 1 pcs allen key.
	50 m Wire Kit, Stainless steel	2TLA050210R0520	50 m stainless steel wire pull kit. Includes 50 m wire (one end is terminated with thimble and permanent clamp), 20 pcs eyebolts, 1 pcs tensioner, 1 pcs allen key.
	100 m Wire Kit, Stainless steel	2TLA050210R0720	100 m stainless steel wire pull kit. Includes 100 m wire, 37 pcs eyebolts, 2 pcs tensioner, 1 pcs allen key.

	**10 m Wire Only**	2TLA050210R2120	Plastic coated wire 10 m.
	50 m Wire Only	2TLA050210R2420	Plastic coated wire 50 m.
	100 m Wire Only	2TLA050210R2620	Plastic coated wire 100 m.
	**Wire Tensioner, Stainless Steel**	2TLA050210R4020	Wire tensioner/gripper for emergency pull wire switch systems, stainless steel.
	Wire Tensioner, Galvanized	2TLA050210R4030	Wire tensioner/gripper for emergency pull wire switch systems, galvanized.
	**Corner pulley, Stainless Steel**	2TLA050210R6020	Corner pulley for emergency pull wire switch systems, stainless steel. For navigating corners, both inside and outside.
	Corner pulley, Galvanized	2TLA050210R6030	Corner pulley for emergency pull wire switch systems, galvanized. For navigating corners, both inside and outside.
	**Eyebolt M8x1.25, Stainless Steel**	2TLA050210R8020	Eyebolt M8 x 1.25 for emergency pull wire switch systems, stainless steel (8pcs per pack).
	Eyebolt M8x1.25, Galvanized	2TLA050210R8030	Eyebolt M8 x 1.25 for emergency pull wire switch systems, galvanized.
	**Spring, 220mm, Stainless Steel**	2TLA050211R0004	Spring for emergency pull wire switch systems, 220 mm, stainless steel. When using one emergency pull wire switch the wire should be anchored at the other end using this spring.

Accessories for Safety Mats

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**RS14, Ramp rail**	2TLA076300R0500	Edge trimmed aluminum profile to eliminate vertical edges on the safety mat. Mainly for ASK-1U4 model.
	**BS14 Mounting rail**	2TLA076300R0800	Edge aluminum profile to keep the safety mat in place. Mainly for ASK-1U4 model.
	**Corner piece**	2TLA076300R0900	Corner piece for ramp rail RS14.

Accessories, connectors and cables

IMAGES	DESIGNATION	ARTICLE NUMBER	DESCRIPTION
	**M12-C61**	2TLA020056R0000	6 m cable 5 × 0.34 mm² + screen with straight M12 female connector.
	M12-C101	2TLA020056R1000	10 m cable 5 × 0.34 mm² + screen with straight M12 female connector.
	M12-C201	2TLA020056R1400	20 m cable 5 × 0.34 mm² + screen with straight M12 female connector.
	**M12-C61 V**	2TLA020056R0100	6 m cable 5 × 0.34 mm² + screen with angled M12 female connector.
	M12-C101 V	2TLA020056R1100	10 m cable 5 × 0.34 mm² + screen with angled M12 female connector.
	**M12-C62**	2TLA020056R0200	6 m cable 5 × 0.34 mm² + screen with straight M12 male connector. Screen connected to pin3 (0VDC) on male connector.
	M12-C102	2TLA020056R1200	10 m cable 5 × 0.34 mm² + screen with straight M12 male connector. Screen connected to pin3 (0 VDC) on male connector.
	**M12-C112**	2TLA020056R2000	1 m cable 5 × 0.34 mm² + screen with straight M12 female + male connectors. Screen connected to pin3 (0 VDC) on male connector.
	M12-C312	2TLA020056R2100	3 m cable 5 × 0,.34 mm² + screen with straight M12 female + male connectors. Screen connected to pin3 (0 VDC) on male connector.
	M12-C612	2TLA020056R2200	6 m cable 5 × 0.34 mm² + screen with straight M12 female + male connectors. Screen connected to pin3 (0 VDC) on male connector.
	M12-C1012	2TLA020056R2300	10 m cable 5 × 0.34 mm² + screen with straight M12 female + male connectors. Screen connected to pin3 (0 VDC) on male connector.
	M12-C2012	2TLA020056R2400	20 m cable 5 × 0.34 mm² + screen with straight M12 female + male connectors. Screen connected to pin3 (0 VDC) on male connector.
	**M12-C63**	2TLA020056R3000	6 m cable 8 × 0.34 mm² + screen with straight M12 female connector.
	M12-C103	2TLA020056R4000	10 m cable 8 × 0.34 mm² + screen with straight M12 female connector.
	M12-C203	2TLA020056R4100	20 m cable 8 × 0.34 mm² + screen with straight M12 female connector.
	**M12-C134**	2TLA020056R5000	1 m cable 8 × 0.34 mm² + screen with straight M12 female + male connector. Screen connected to pin7 (0 VDC) on male connector.
	M12-C334	2TLA020056R5100	3 m cable 8 × 0.34 mm² + screen with straight M12 female + male connectors. Screen connected to pin7 (0 VDC) on male connector.
	M12-CT0214	2TLA020060R0100	Transfer cable, 20 cm 8/5 × 0.34 mm² + screen with straight M12 8-pole female + 5-pole male connectors. Screen connected to pin7 (0 VDC) on male connector. Can be used for connection of Dalton to URAX or Tina 4/8.
	M12-CT134	2TLA020060R0300	Transfer cable, 1 m 8 × 0.34 mm² +screen with straight M12 8-pole male + 8-pole female connectors. Screen connected to pin7 (0 VDC) on male connector. Can be used when FMC need to direct muting signals to Pluto instead of Focus. Muting is then made in Pluto.
	**M12-CT0212**	2TLA020060R0400	Transfer cable, 20 cm 5 × 0.34 mm² + screen with straight M12 5-pole female + 5-pole male connectors. Screen connected to pin3 (0 VDC) on male connector. Can be used for connection of dynamic sensors to a Tina4/8 were the "info-pin" for each M12 connector works like a individual safe signal. Note! Only allowed when connected to a Pluto IQ input.
	M12-CT132	2TLA020060R0600	Transfer cable, 1 m 5/8 × 0.34 mm² +screen with straight M12 5-pole male + 8-pole female connectors. Screen connected to pin3 (0 VDC) on male connector. Can be used when connecting a Focus to a URAX-D1R.
	M12-CT0212M	2TLA020060R0700	Transfer cable, 20 cm 5 × 0.34 mm² +screen with straight M12 5-pole male + 5-pole female connectors. Screen connected to pin3 (0 VDC) on male connector. Can be used when connecting Magne 1 to a non-safe output on URAX.
	**M12-C01**	2TLA020055R1000	Straight M12 female connector with cable screw connection. Cable diameter range 2.5–6.5 mm. 5-pole.
	**M12-C02**	2TLA020055R1100	Straight M12 male connector with cable screw connection. Cable diameter range 2.5–6.5 mm. 5-pole.
	**M12-C03**	2TLA020055R1600	Straight M12 female connector with cable screw connection. Cable diameter range 2.5–6.5 mm. 8-pole.
	**M12-C04**	2TLA020055R1700	Straight M12 male connector with cable screw connection. Cable diameter range 2.5–6.5 mm. 8-pole.

	**M12, protection cap**	2TLA020055R2100	Protect the M12 male connector from dust.
	**JSSP-1**	2TLA022070R0000	JSSP-1 M12. Protection cap for female connector.
	**Safety nut M4**	2TLA020053R0400	Special safety nut to eliminate risk of manipulation. M4.
	Safety nut M5	2TLA020053R0500	Special safety nut to eliminate risk of manipulation. M5.
	**SBIT Safety bit**	2TLA020053R5000	Safety screwdriver bit SBITS.
	**Safety Screw Kit SM4 x 20 mm**	2TLA020053R6200	Special safety screw to eliminate risk of manipulation. Lenght adapted for Adam & Eva. 4 pcs M4 × 20 mm + 1 pcs Safety screw Bit.
	**Safety Screw Kit SM4 x 25mm**	2TLA020053R6300	Special safety screw to eliminate risk of manipulation. Lenght adapted for Adam & Eva, E-version. 4 pcs M4 × 25 mm + 1 pcs Safety screw Bit.

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