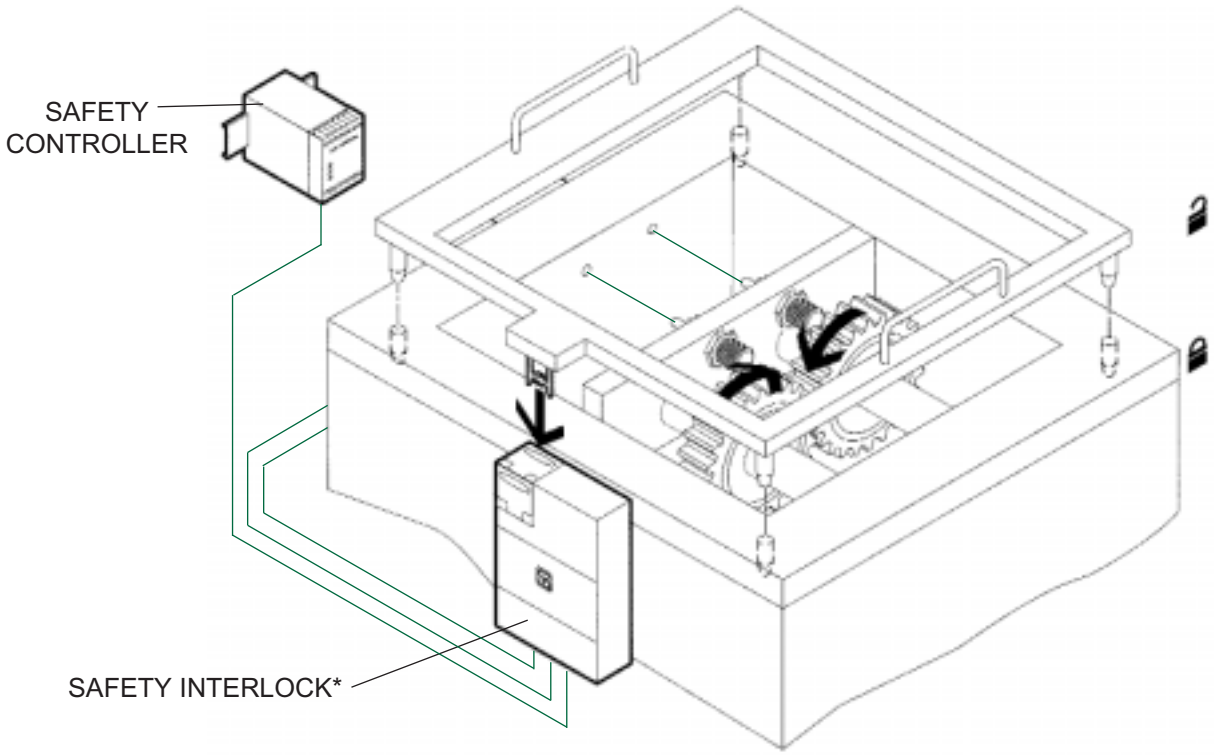
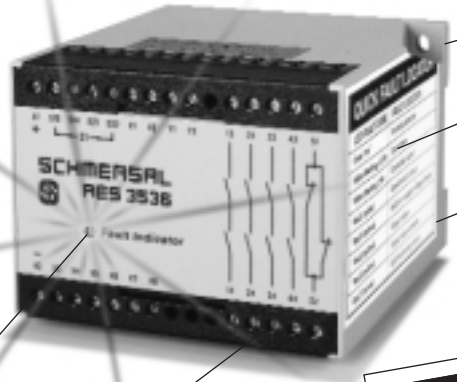
TYPICAL APPLICATIONS

MACHINE GUARDING SOLENOID-LATCHING SAFETY INTERLOCK*



FaultFinder® Series AES Safety Controller



Easy-to-install DIN-rail mounting

Quick Fault Locator … minimizes equipment downtime

Rugged, corrosion-resistant housing

Multi-color LED flashes pulse codes to identify fault type

Positive-guided relay outputs

QUICK FAULT LOCATOR	
LED FAULT CODE	FAULT LOCATION
GREEN "ON"	No faults detected and relay contacts closed
YELLOW PULSE @ 0.5 Hz	Guard open
YELLOW PULSE @ 2 Hz	Guard misaligned (or) Welded/stuck switch contact (or) No start signal (or) Start-up test required
RED (1 PULSE)	Guard switch circuit
RED (4 PULSES)	Capacitive/inductive interference on inputs
RED (5 PULSES)	Drop in supply voltage (or) Internal relay malfunction
RED (6 PULSES)	Welded/stuck internal relay contact
RED (7 PULSES)	AES monitoring circuit

EXCLUSIVELY FOR: AES 1236, 3336, 3536

*See inside back cover for more information about SCHMERSAL Safety Interlock Switches.

TABLE OF CONTENTS

ALPHANUMERIC PRODUCT INDEX

ABOUT SCHMERSAL

K.A. SCHMERSAL GmbH & Co. was founded as a family business in 1945. The firm initially focused on the design and manufacture of electromechanical switches for industrial applications.

Our first products included heavy-duty, cast-encapsulated limit switches for (post-war) civil engineering and construction applications. This program quickly expanded to include:

- grey cast iron limit switches
- light metal limit switches
- robust precision limit switches
- spindle limit switches
- gear motor switches
- elevator switch gears
- CENELEC position switches
- miniature snap-acting switches, and
- command devices for machine and crane control systems.

With this early post-war product program, the firm quickly established itself as a specialist in monitoring, switching, and controlling elevators, material handling systems, machine tools, and other industrial equipment.

Many of these initial products satisfied unique requirements for safety switches. Such products included:

- explosion-proof switches for gasoline pumps
- door contacts and locks for personnel/freight elevators
- cable monitoring switches for mountain cablecar systems, and
- snap-acting limit switches featuring positive-opening contacts for lignite diggers, construction cranes, and other machinery.

Today the product range has expanded to include a broad selection of non-contact electronic presence/position sensing sensors and switches. These are designed using state-of-the-art inductive, capacitive, magnetic and photoelectric technologies.

Armed with diverse electronic and electromechanical capabilities, the firm has continued to welcome unique customer-specific problems. Operating from their modern headquarters in Wuppertal, Germany, an industrial suburb of Dusseldorf with a population of 400,000, the firm's 400 employees maintain close contact with their worldwide customer base.

This close contact, coupled with a commitment to respond to the needs of their customers, continues to serve as a basis for continued new product development to meet the constantly changing market.

By 1953 the company had established a reputation as a leading producer of innovative safety switches.

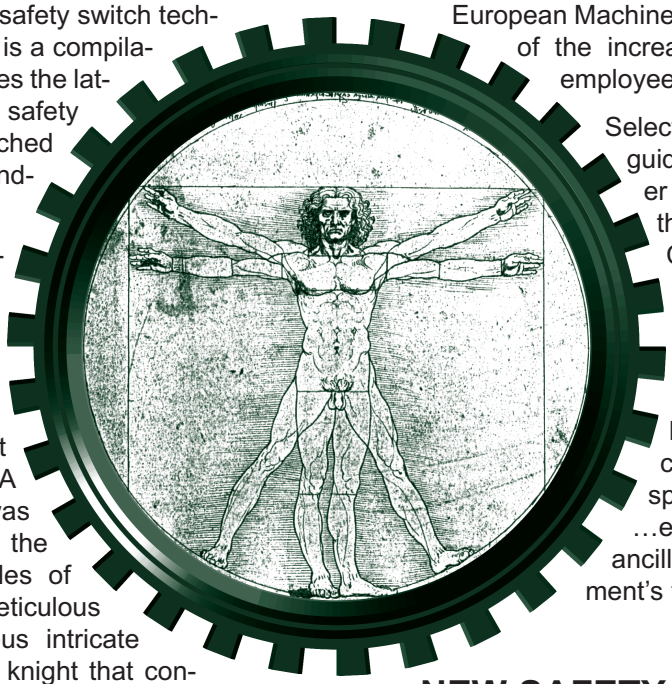
SYSTEM SAFETY: PROTECTION FOR MAN AND MACHINE

Recent trends for a safer workplace in many industries have led the company to give this field even greater attention. Newest product developments have focused on advanced safety switches which satisfy the stringent requirements of the harmonized European Economic Community and its regulatory agencies.

MAN-MACHINE SAFETY

THE SCHMERSAL SYSTEM: A 360° APPROACH

For more than 50 years SCHMERSAL has dedicated itself to understanding machine safety hazards. We have made it our mission to develop defeat-resistant, fail-to-safe solutions using advanced safety switch technology. This catalog-handbook is a compilation of information that addresses the latest and most stringent industry safety standards and regulations matched with a broad selection of dependable solutions.



The day-to-day study of modern workplace safety is filled with the minutiae of industry regulations and standards. But philosophically we look to a higher standard in the work of one of the world's greatest engineers, Leonardo da Vinci. A true Renaissance genius, he was a man whose fascination for the human body and the principles of physics resulted in his meticulous anatomical drawings, numerous intricate machines, and even a robotic knight that consisted of a system of cables and pulleys that controlled the movement of articulated limbs. Arguably the world's first ergonomic engineer, Leonardo truly understood man and his physiological relationship to machinery.

Like Leonardo, we at SCHMERSAL take a 360-degree approach to safety. We evaluate from every angle the potential for accidents and their prevention. We recognize the wide differences in each work station. We take into account specific guard design, as well as the environmental and physical considerations necessary to support machinery operation and provide maintenance. We even understand the frustrations and all-too-human temptation some machine operators feel to override (bypass) the safety system.

Different dynamics mean different solutions. Different markets are subject to different regulations. Our system of more than 350 interlock, magnetic and cable-pull switches has earned SCHMERSAL a world-wide reputation for reliability, flexibility, and dependable quality.

CHANGING MAN-MACHINE SAFEGUARDING RULES

Today worker safety is an issue of major concern to manufacturers worldwide. OSHA guidelines, more stringent ANSI standards, and the recently (1996) adopted European Machinery Directive (EMD) are evidence of the increased emphasis being given to employee safety in the workplace.

Selected industry standards and guidelines aimed at achieving higher levels of safety are reviewed in the section of this Handbook/Catalog entitled "Safety Standards." Each defines minimum safety requirements to which manufacturers and employees must comply.

In so doing, they present new challenges to the plant safety specialist and equipment designer …especially where safety guards ancillary to the production equipment's functional design are required.

NEW SAFETY CONCEPTS AND TECHNIQUES

The goal of these new and emerging guidelines is to provide heightened levels of protection to machine operators, helpers, and maintenance personnel. Toward this goal they have embraced several new safety system concepts including:

- positive-break contacts
- greater tamper-resistance
- positive-guided controllers
- fault detection
- single component failure control reliability

Conventional limit switches, proximity sensors, magnet switches and other classical position-sensing and control devices traditionally used as safety interlocks do not meet contemporary requirements. Consequently, when used in such applications, they are regarded as unsafe.

INTRODUCTION

SELECTING THE OPTIMAL CONTROLLER

Some form of safety controller is required to meet higher risk categories of the European safety standards, to meet OSHA/ANSI requirements for Control Reliability, and when using coded-magnet switches as safety interlocks. This guide is intended to help you properly select and apply Schmersal Safety Controllers.

It is common for all of us to want to look at safety issues in black and white terms ("Here is Application Number 116 and I can find the solution in my Safety Handbook under Solution Number 116"). Unfortunately, this is seldom possible. You are forced to look at safety issues in various shades of gray. For any given situation, there may be a number of correct solutions depending on total system design.

A safe machine is generally achieved through the combination of safety measures incorporated by design and taken by the machine operator. Ideally such measures should be addressed during the design phase. In addition proper training of machine operators and maintenance personnel is critical for safe operation.

While individual component suppliers can provide general guidance and technical information related to their products, it is the responsibility of the machine designer or retrofitter to ensure the safety system is designed to meet the appropriate standards.

To minimize the possibility of worker injury and address industry safety standards/guidelines, it is recommended that the machine designer follow these general steps:

1) Familiarize himself with the pertinent safety standards
2) Specify the limits of the machine
3) Identify the hazards and assess the risks
4) Remove the hazards or limit the risk by design
5) For remaining hazards, install necessary protective devices
6) Inform and warn the operator of any remaining risks/hazards.

In designing a machine guarding safety system, the following objectives should be considered:

- Design to suit the working environment
- Achieve the desired degree of protection
- Do not interfere with machine operation
- Do not encourage manipulation/bypassing
- Make it difficult to override
- Do not cause any additional dangers/hazards

It is impossible to correctly select and apply a Safety Controller without performing some type of quantitative risk assessment. "Guesstimating" a control category may lead to excessive expense and/or to an inadequate or unsafe system. There are a number of approaches to risk assessment, most of which use some form of decision tree to determine the appropriate safety control category. One such approach is discussed in the next section.

A simplistic approach that can initially point you in the right direction, but which must not be substituted for a formal risk assessment is:

- If a machine can cause an injury that will heal without permanent damage or disability, you most likely can satisfy your needs with a Category 1 safety control system.

- If a machine can cause permanent damage or disability, you probably require at least a Category 3 safety control system.

Note: For additional background material, you may wish to review Schmersal's "Man-Machine Safeguarding Requirements & Techniques." This tutorial booklet provides an overview of basic machine safeguarding concepts and terminology.

RISK ASSESSMENT

Different machines and processes have different levels of relative risk. Determining this relative risk level involves evaluating three major factors. These include:

(1) Severity of the potential injury.

(2) Frequency of exposure to the potential hazard.

(3) Possibility of avoiding the hazard if it occurs.

One approach to risk assessment provides guidelines for determining the safety control system requirements based upon five levels of risk. These levels range from the lowest risk (level B) in which the severity of injury is slight and/or there is relatively little likelihood of occurrence, to the highest risk (level 4) in which the likelihood of a severe injury (if the safety control system fails) is relatively high.

This particular method is depicted in Figure 1, in which the following qualitative definitions apply:

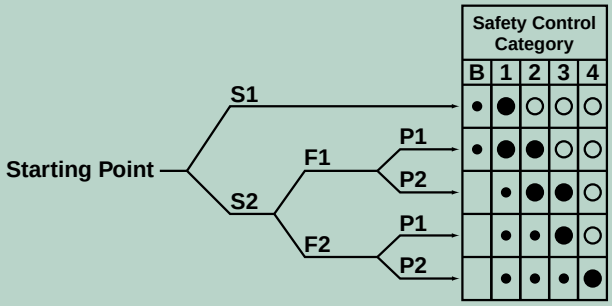
S: Severity of potential injury
S1: slight injury (bruise)
S2: severe injury (amputation or death)

F: Frequency of exposure to potential hazard
F1: infrequent exposure
F2: frequent to continuous exposure

P: Possibility of avoiding the hazard if it occurs (generally related to the speed/frequency of movement of hazard point and distance to hazard point)
P1: possible
P2: less possible

The levels of risk and related safety control system requirements are defined in Figure 2.

These safety control system categories are not to be regarded as a hierarchy. The goal is to reduce the ultimate risk of all machines to acceptable levels regardless of initial assessed risk.



Selection of the Safety Control Category:
A brief overview of these safety control categories is provided in Figure 2.

● Preferred categories

• Possible categories, which require additional measures

○ Excessive measures for the relevant risk

FIGURE 1

FIGURE 2

Safety Cat.	General Safety System Requirements	General Safety System Behavior
B	Safety system designed to meet operational requirements and withstand expected external influences. (This category is usually satisfied by selecting components compatible with the application conditions … e.g. temperature, voltage, load, etc.)	A single fault or failure in the safety system can lead to the loss of the safety function.
1	Safety system must meet the requirements of Category B, but must use "well-tried" safety principles and components. "Well-tried" principles and components include those which: • avoid certain faults … e.g. short circuits. • reduce probability of faults … e.g. over-rating selected components, over-dimensioning for structural integrity. • detect faults early … e.g. ground fault protection. • assure the mode of the fault … e.g. ensure an open circuit when it is vital that power be interrupted should an unsafe condition arise. • limit the consequences of the fault.	A single fault or failure in the safety system can lead to the loss of the safety function. However, the use of "well tried" safety principles and safety components results in a higher level of safety system reliability.
2	Safety system must meet the requirements of Category B. In addition the machine shall be prevented from starting if a fault is detected upon application of machine power, or upon periodic checking during operation. (This suggests the use of a safety relay module with redundancy and self-checking. Single-channel operation is permitted provided that the input devices … such as machine guard interlocks, E-stop pushbuttons, et al … are tested for proper operation on a regular basis.)	Here, too, a single fault or failure in the safety system can lead to the loss of the safety function between the checking intervals. However, periodic checking may detect faults and permit timely maintenance of the safety system.
3	Safety system must meet the requirements of Category B. In addition the safety control system must be designed such that a single fault will not lead to the loss of the safety function. And, where practical, the single fault will be detected. (This requires redundancy in the safety circuit monitoring module and the use of dual-channel monitoring of the input and output devices such as machine guard interlock switches, E-stop push-buttons, safety relays, etc.)	Here a single fault or failure in the safety system will not lead to the loss of the safety function and, where possible, will be detected.
4*	Safety system must meet the requirements of Category B. In addition the safety control system must be designed such that a single fault will not lead to the loss of the safety function and will be detected at or before the next demand on the safety system. If this is not possible, then the accumulation of multiple faults must not lead to the loss of the safety function. (This also requires redundancy in the safety circuit and the use of dual-channel monitoring of the input and output devices such as machine guard interlock switches, E-stop pushbuttons, safety relays, etc. Here the number of allowable faults will be determined by the application, technology used, and system structure.)	Here a single fault or failure in the safety system will not lead to the loss of the safety function, and it will be detected in time to prevent the loss of the safety function.

*Category/Level 4 safety requirements are usually associated with extremely high-risk applications. Since general machine design practice respects classic safety hierarchy, in which most machine hazards are either:
• designed out,
• guarded against (if they cannot be designed out), and,
• (as a last resort) warned against,
Level 4 requirements may arise relatively infrequently.

ACHIEVING “CONTROL RELIABILITY”

“Control Reliability” as defined by ANSI/OSHA essentially states that the safety system be designed, constructed and installed such that the failure of a single component within the device or system should not prevent normal machine stopping action from taking place — but shall prevent a successive machine cycle from being initiated until the failure is corrected.

Note that this definition closely follows the definitions of a safety control category 3 as defined by European machinery safety standard EN954-1.

It is helpful to break down the definition of Control Reliability in order to better understand how it might be achieved.

- Any single fault shall not lead to a loss of the safety function. This strongly implies redundancy in the safety circuit.
- Successive machine cycles shall be prevented until the fault is corrected. This means the fault must be detected. This is achieved by cross-monitoring of the redundant safety circuits.
- The device that is cross-monitoring (safety controller) must also be checked to prevent a loss of the safety system due to a fault in this device.

Thus the following are required to achieve “Control Reliability”:

- Redundancy
- Fault Detection
- Cross-Monitoring
- Self-checking of the monitoring device

Let’s look at a basic safety system and develop it to a control reliable level.

Assuming the components are selected with appropriate electrical ratings and agency approvals, this system will generally meet category B requirements per European standards.

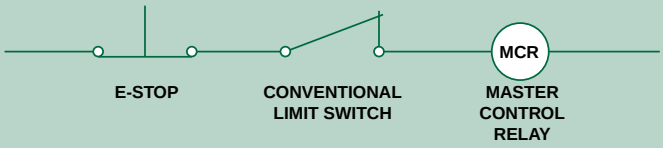


FIGURE 3
Basic Safety Control System (Category B)

We can improve the safety system reliability by using an E-Stop and a safety interlock switch with positive-break contacts. This will generally meet category 1 requirements per the referenced European standards. However, it does not yet meet the requirements for control reliability.

FIGURE 4:
Basic Safety Control System (Category 1)

To increase the reliability, let's next add additional positive-break contacts to our E-Stop and safety interlock switch (Figure 5).

We now have redundancy but still lack fault detection. To provide this fault detection, we must add additional devices.

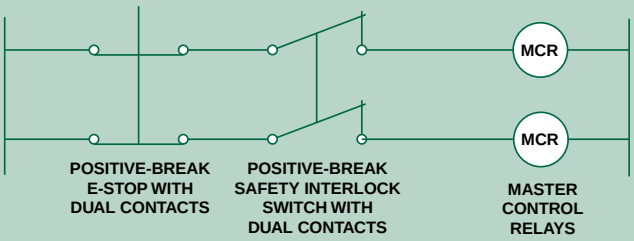


FIGURE 5:
Basic Safety Control System with Redundancy

This black box provides safety system fault detection as well as cross-monitoring and self-checking. While this can be achieved with a complex hard-wired circuit utilizing 3 positive-guided relays and over 40 wiring points, it is much simpler and less expensive to utilize a commercially available safety controller.

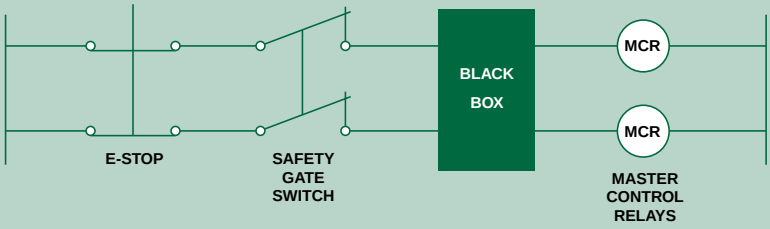


FIGURE 6:
Basic Safety Control System (Category 3 or 4) with Redundancy and Fault Detection

Figure 7 shows a typical example of a control reliable circuit utilizing a safety controller.

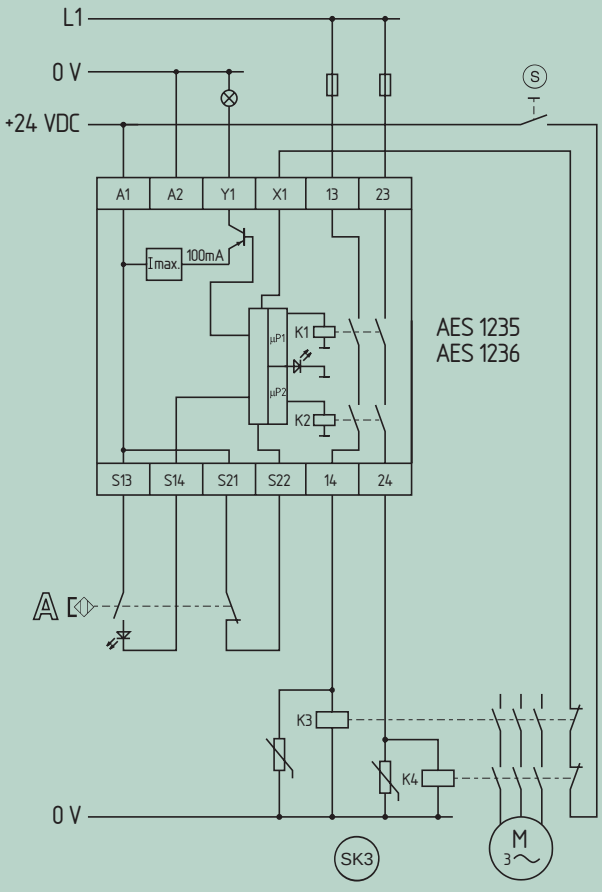


FIGURE 7

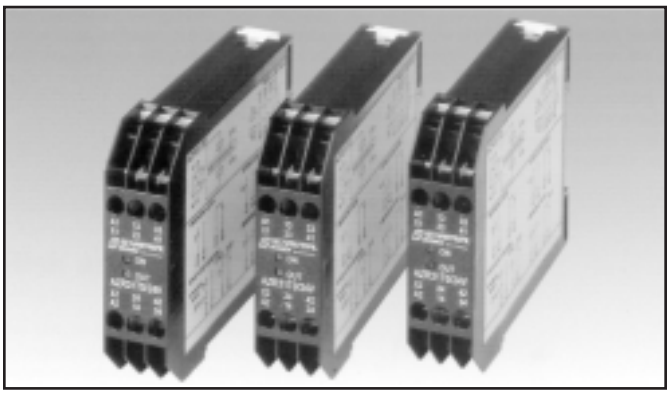
BASIC FUNCTION

The SCHMERSAL family of safety controllers includes two basic designs. One utilizes relay logic. The other uses solid-state (microprocessor) logic. Pioneered by SCHMERSAL, these “smart” safety controllers provide added features and capabilities unachievable with conventional safety relay modules.

Both designs feature redundant, dual-channel cross-monitoring logic circuits. These continuously check for, and detect, faults in the system’s safety circuit components and interconnection wiring. Modules also detect when a machine guard interlock/E-stop switch is actuated and, depending upon the model, are capable of detecting the following types of potential safety circuit faults:

- Welded interlock/E-stop switch contacts
- Misaligned guard
- Open circuits, short circuits or ground faults
- Welded/stuck contacts in module’s safety relays
- Fault in the module’s monitoring circuits
- Inadequate supply voltage to module
- Welded/stuck contacts in controlled output motor contactor/control relay
- Capacitive/inductive interference on module inputs

All controllers are designed to increase the level of safety in the machine guarding and/or E-stop control circuit.



SERIES SRB/AZR SAFETY CONTROLLERS

The SRB/AZR Series safety controllers are conventional electro-mechanical relay-based units. Many feature the latest relay technology utilizing only two internal relays to achieve cross-monitoring, self-checking and redundancy. This results in a smaller, highly cost-effective solution for up to safety control category 4 system performance per European standards.

Models are available to satisfy most safety application requirements. They offer a wide variety of important features including:

- 1 or 2 channel triggering
- Crossed wire detection
- STOP Category 0 & 1 modules
- Manual monitored reset
- Monitoring of non-potential free contacts
- Feature selection via base mounted dip switches
- Output expanders
- Special 12VDC for use on battery power
- Dual channel antivalent input circuits for humid environments

SERIES AES MICROPROCESSOR-BASED SAFETY CONTROLLERS

SCHMERSAL’s AES Series features microprocessor-based monitoring logic. In addition to performing the functions provided by traditional relay-based modules, the AES Series “smart” controllers provide added capabilities typically unavailable in relay-based designs. These include:

- Fault identification diagnostics … the AES provides a variety of flashing, colored LED patterns which indicate specific types of faults and their location (thus minimizing equipment downtime).
- Auxiliary semiconductor outputs … for alarm and/or signaling purposes.
- Modular component design … permitting realization of the most cost-effective monitoring solution.
- “Diverse redundancy” … use of different components and/or programs in the redundant monitoring circuits eliminates “common cause” failures and heightens module reliability.
- Multiple inputs.

While initially designed for use with Schmersal coded-magnet switches, most controllers can also be used with E-Stop or conventional machine guard safety interlock switches. These controllers are separated into several categories for ease of selection.

SELECTION CRITERIA

It helps the selection process to view a safety controller as having four basic characteristics, each determined by the application requirements. This approach can be applied to any safety controller.

FOUR BASIC SAFETY CONTROLLER CHARACTERISTICS

SUPPLY VOLTAGE REQUIREMENTS

Select your supply voltage. While many voltages are possible (24VDC, 24VAC, 24VAC/DC, 115VAC and 230VAC), 24 VDC gives the most flexibility since virtually all controllers are available in this voltage. Also, since a transformer and rectifier are not required, this unit generally is less expensive and smaller than a 115VAC model.

Regardless of supply voltage, it is always converted by the controller electronics to 24VDC for internal operation and for powering monitored input devices. Hence monitored devices only need to be rated for 24VDC.

INPUT MONITORING REQUIREMENTS

The first step is to determine whether you need single channel (up to control category 2) or dual channel (control category 3 & 4) operation.

Single-channel systems must monitor one NC positive-break contact. Dual-channel systems can monitor 1NO/1NC or 2NC contacts. Generally, these need to be isolated dry contacts since most controllers will view C-form contacts as a short circuit. Remember that 24VDC is supplied by the safety controller for monitoring these contacts.

Safety controllers are available for monitoring non-potential free contacts (such as PNP outputs from light curtains). Models are also available that allow users to field select the monitored contact configuration.

Another consideration is crossed wire detection (a short between channels). This requires special circuitry in the safety controllers and is required for category 4 safety control systems.

FEEDBACK & RESET CIRCUIT REQUIREMENTS

Safety controllers with feedback capability can also monitor control relays and motor contactors with positive-guided contacts. Such feedback is required for safety control category 3 & 4 systems. A NC auxiliary contact is wired into the feedback loop (with or without a reset (start) button) to detect welded contacts in these external control devices. The safety controller detects the existence of a weld when the relay shuts down due to a power loss or open machine guard and prevents a restart.

In order to reset the controller, the feedback loop must be closed (at least temporarily). If the NC auxiliary contact stays open due to a contact weld, the controller cannot be reset.

Reset can be automatic or be manual monitored/trailing edge. With automatic reset the controller will automatically reset (outputs close) when the machine guard is closed. A reset or start button can be added to the feedback loop if desired. The controller only needs to momentarily see a 24VDC signal at the feedback terminals to reset.

With a manual monitored/trailing edge reset, some type of manual pushbutton is required. The feedback loop circuitry is designed so that it needs to see a 24V to 0V transition (trailing edge) in order to reset. This method of reset is generally required when a person can actually get inside a machine guard (where they would be at risk if the equipment should automatically restart when the guard closes).

OUTPUT REQUIREMENTS

Determine the number and type of safety controller outputs required for machine control elements and signaling. Following are the types of safety controller outputs:

A. NO safety enable circuits — either instantaneous or timed.

B. NO or NC auxiliary relay contacts — these are not to be used for safety functions, but only for annunciation/signaling.

C. Semiconductor outputs for annunciation.

SAFETY CONTROLLER SELECTION GUIDE

The following selection charts have been created to help you select a safety controller that satisfies your application requirements. Unlike other selection methods that usually start with identifying the appropriate safety control category, this method begins with the application requirements and leads to a possible safety relay solution.

To begin, select the application category in the Master Index Chart below. This will direct you to the appropriate selection chart. Then starting at the top of the appropriate chart move through the application selection criteria until a safety controller(s) is suggested. This selection should then be examined to ensure it is adequate for the assessed level of risk.

Note:
- Models with 4 digits such as 1235 are part of the AES series.
- Models with a mixed number such as 31R2 are part of the AZR series.
- Models such as C.xx or MO are part of the SRB series.

Safety Controller Key

Maximum Recommended Safety Control category per EN954:

Safety Control Category 1/2 (CC1)

Safety Control Category 3 (CC3)

Safety Control Category 4 (CC4)

Under Stop Category 1, Safe Outputs are shown as

STOP 0 / STOP 1

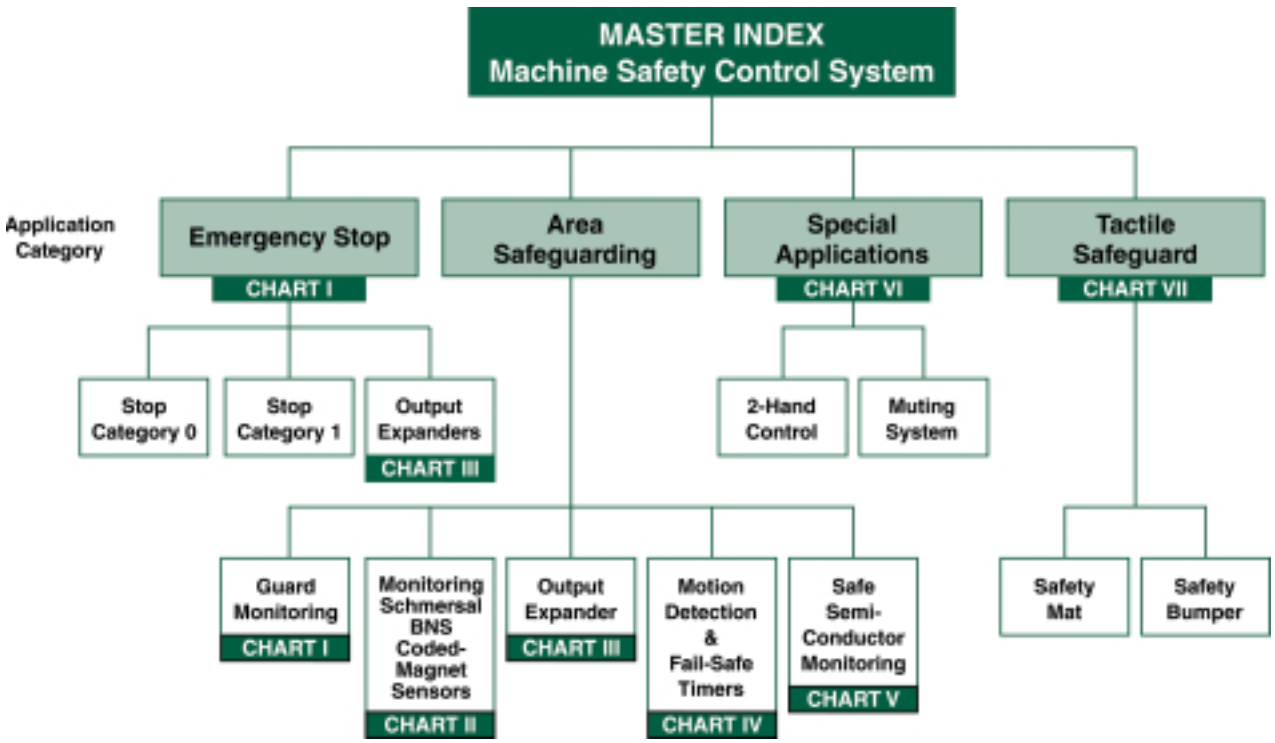


CHART I

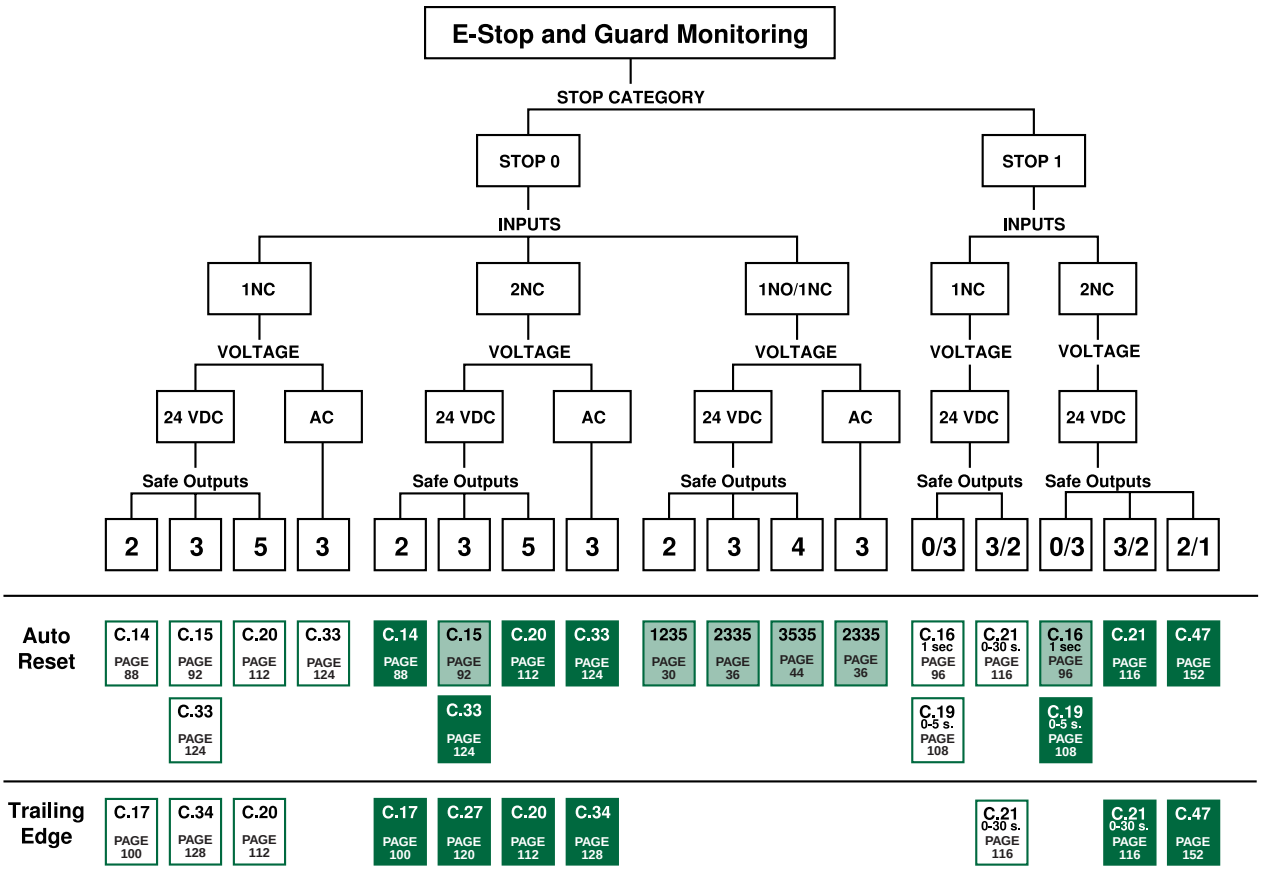


CHART II

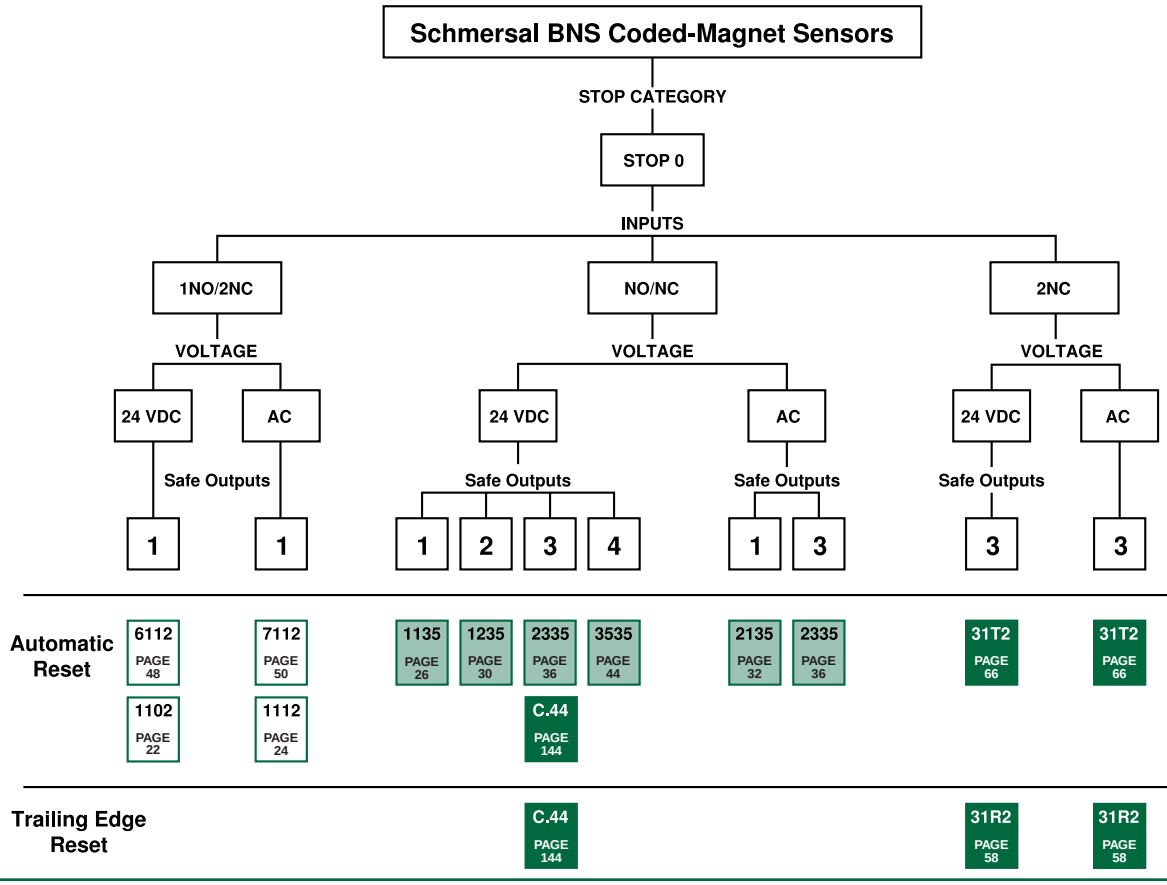


CHART III

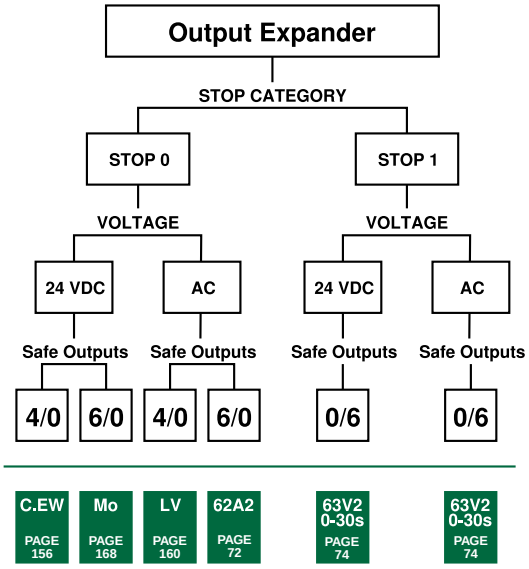


CHART IV

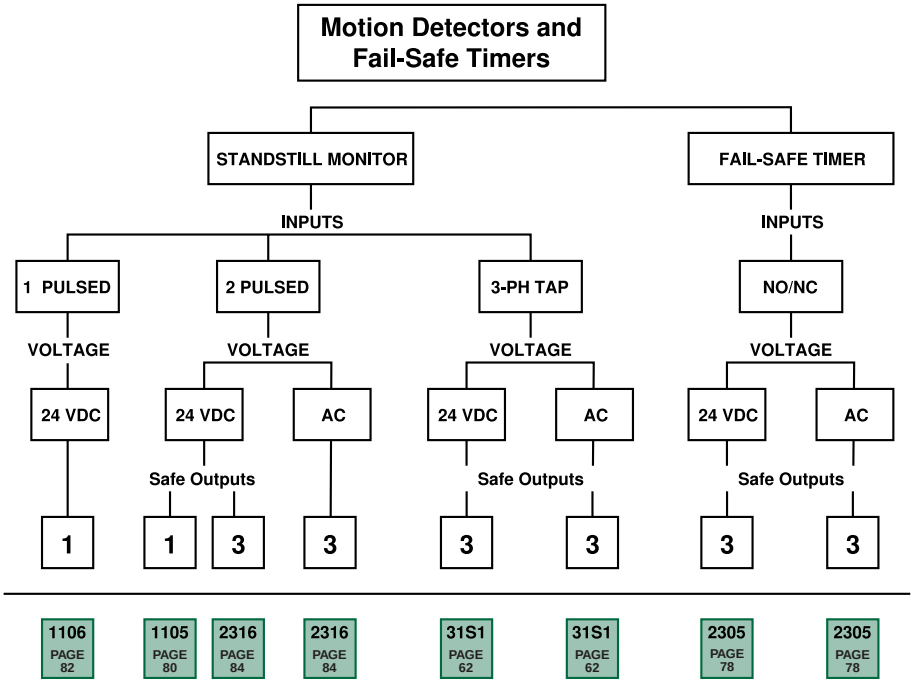
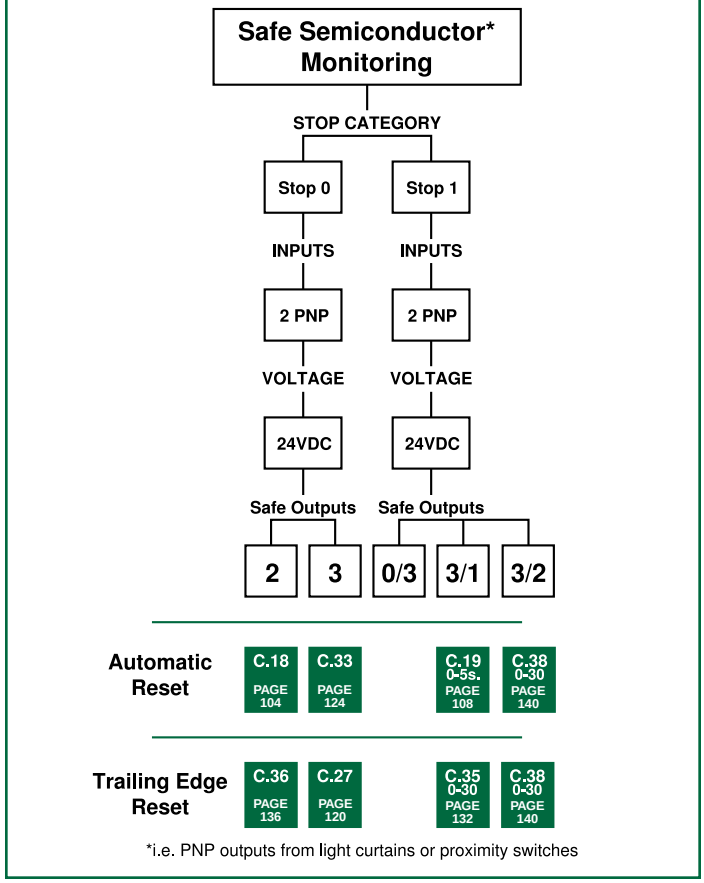


CHART V



*i.e. PNP outputs from light curtains or proximity switches

CHART VI

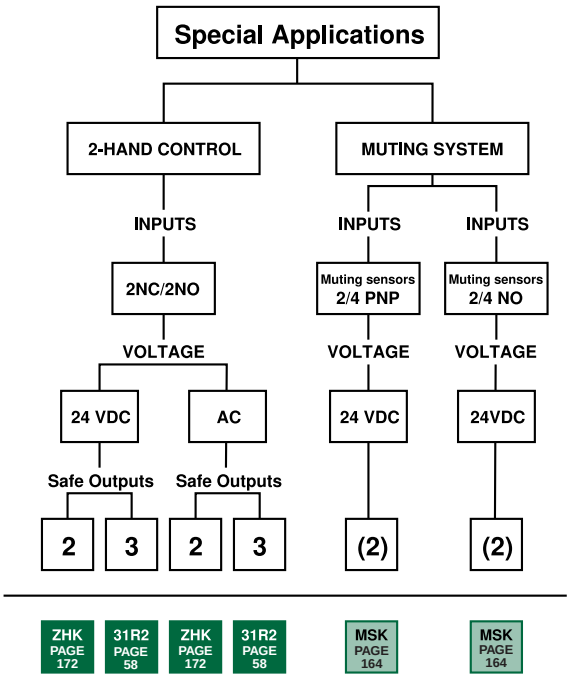
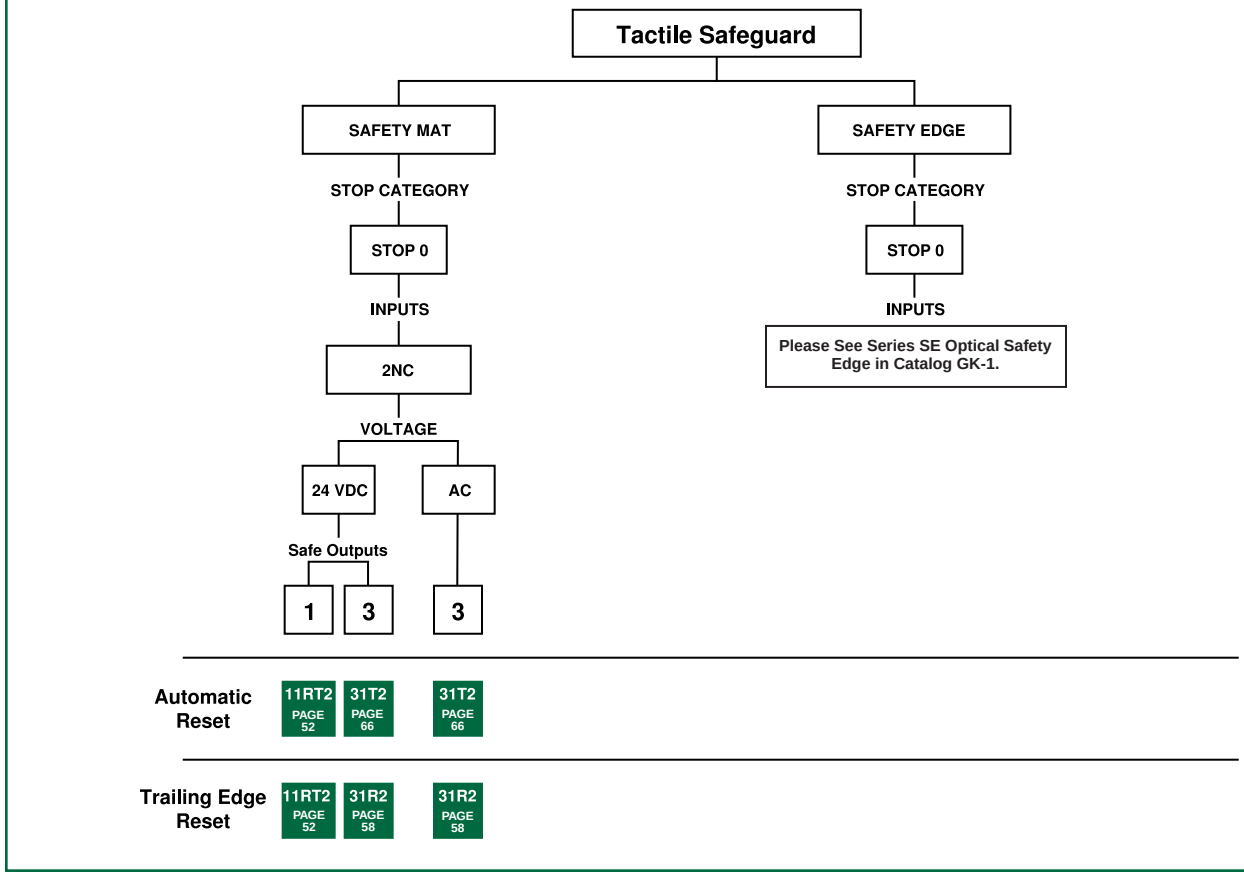


CHART VII



SAFETY CONTROLLER FAQ's

1 What are "safety controllers" and what are their functions?

Safety controllers (such as SCHMERSAL's AES and AZR Series) are connected between machine guarding interlock/E-Stop switches and the machine's stop control elements (such as a motor contactor or control relay).

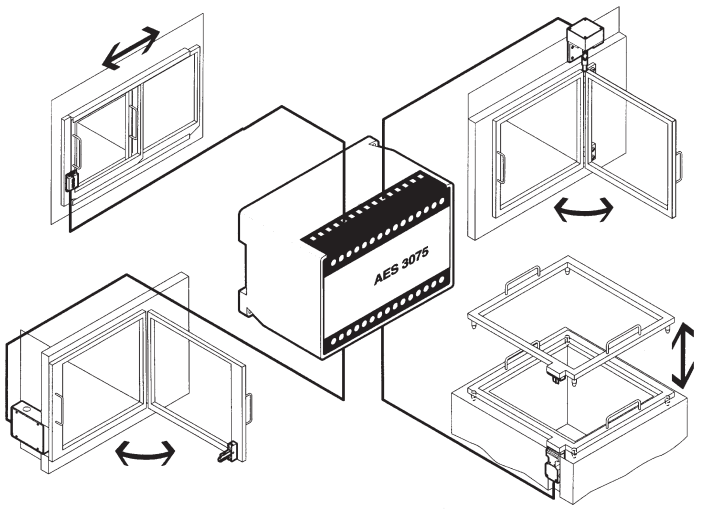
These controllers contain dual, self-checking safety system monitoring circuits and positive-guided output relays. Each is designed to monitor faults in the safety system's interlock/E-Stop switches, the safety circuit interconnection wiring, and their own internal monitoring circuits and output relays.

Detection of a fault in the machine's safety circuit or of an open machine guard, disables the module's output signal(s) facilitating machine stoppage, and/or prevents the restarting of the machine until the fault has been corrected.

In addition to detecting open guards and/or actuated E-Stop switches, safety controllers are capable of detecting the following types of safety system faults:

- Guard monitoring switch/sensor failure
- "Open-circuit" in interconnection wiring
- "Short-circuit" in interconnection wiring
- "Short-to-ground" in interconnection wiring
- Welded contact in controlled output device
- (such as positive-guided motor contactor)
- Failure of safety controller's positive-guided relay(s)
- Fault in safety system monitoring circuit
- Insufficient operating voltage.

Some microprocessor-based safety controllers, such as SCHMERSAL'S AES Series, also feature integrated system diagnostics with visual LED outputs which indicates fault type and location — thus minimizing machine downtime.



Safety controllers detect and locate system faults. Units are available for use with guard interlock switches, coded-magnet sensors, safety edges, light curtains, E-stops and emergency cable-pull switches to satisfy a broad range of application requirements.

2 Why should safety controllers be used with safety interlocks/E-Stops?

Safety controllers increase the reliability of the machine guarding safety system. Their ability to detect safety circuit faults, and shut down the machine until the fault is corrected, greatly heighten the safety level.

3 What is the difference between a single and dual-channel safety controller, and when should each be used?

A single-channel safety controller is capable of accepting only one (normally-closed) input. When used in safety circuits they are unable to detect a short-circuit failure in the interconnection wiring, or a failure of the monitored input to change state.

A dual-channel safety controller is capable of accepting two inputs; one to each of its two, redundant self-monitoring safety circuits. When used in safety circuits they are typically capable of detecting interconnection wiring faults (such as short-circuits, open circuits, and ground faults) or a failure of one of the monitored input(s) to change state. As such they provide a higher level of safety than single-channel units.

Single-channel safety controllers are suitable for relatively low levels of risk assessment (e.g. EN 954-1 Safety Categories B, 1 and 2). Dual-channel units are appropriate when designing “control reliable” safety systems — that is, systems in which a single component failure will not prevent normal machine stopping action from taking place, but will prevent a successive machine cycle from being initiated.

4 How do I decide which safety controller to use?

Safety controller selection is usually based on:

(1) the type of inputs being monitored (e.g. E-Stops, interlock switches, light curtains, coded-magnet sensors, et al).

(2) the number of inputs being monitored.

(3) the number and type of outputs required from the safety controller (e.g. number of parallel outputs from the module’s positive-guided relays and the number of auxiliary/signaling outputs).

(4) the need/desire to monitor the integrity of the positive-guided contacts in the controlled output device (e.g. motor contactor, control relay, et al).

(5) the level of safety desired (this is usually determined by a structured risk assessment).

These application parameters will normally narrow, and simplify, the choice of safety controller to one or two units.

5 When is it necessary to design a safety system to satisfy the requirements of EN 954-1 Category 4?

Category 4 safety requirements are usually associated with extremely high-risk applications. Consequently the safety system needed to satisfy these conditions can be quite complex and costly.

Since general machine design practice respects classic safety hierarchy, most extremely high-risk hazards — that is:

(a) those which the operator cannot avoid

(b) those in which the operator is exposed frequently or continuously, and

(c) those which could result in serious injury, amputation or death

are designed-out during machine development or are guarded against (if they cannot be designed-out).

Consequently for most applications it is generally not necessary to incur the cost/complexity of Category 4 safety system design. Many low-risk situations can be satisfied by safety systems that meet the requirements of Category B, 1 or 2 as defined by EN 954-1.

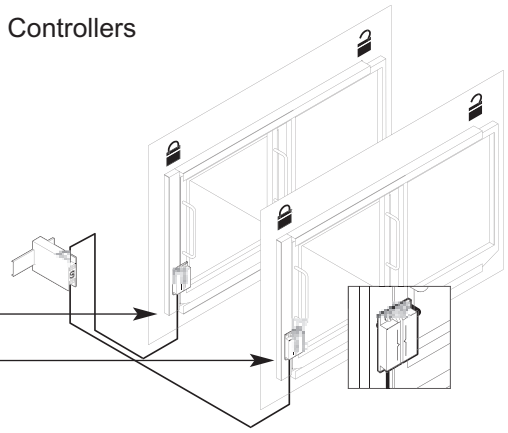
In most higher-risk situations, a suitable safety system (and one which meets ANSI's requirement for "control reliability") can be achieved with a system designed to meet the Category 3 requirements of EN 954-1.

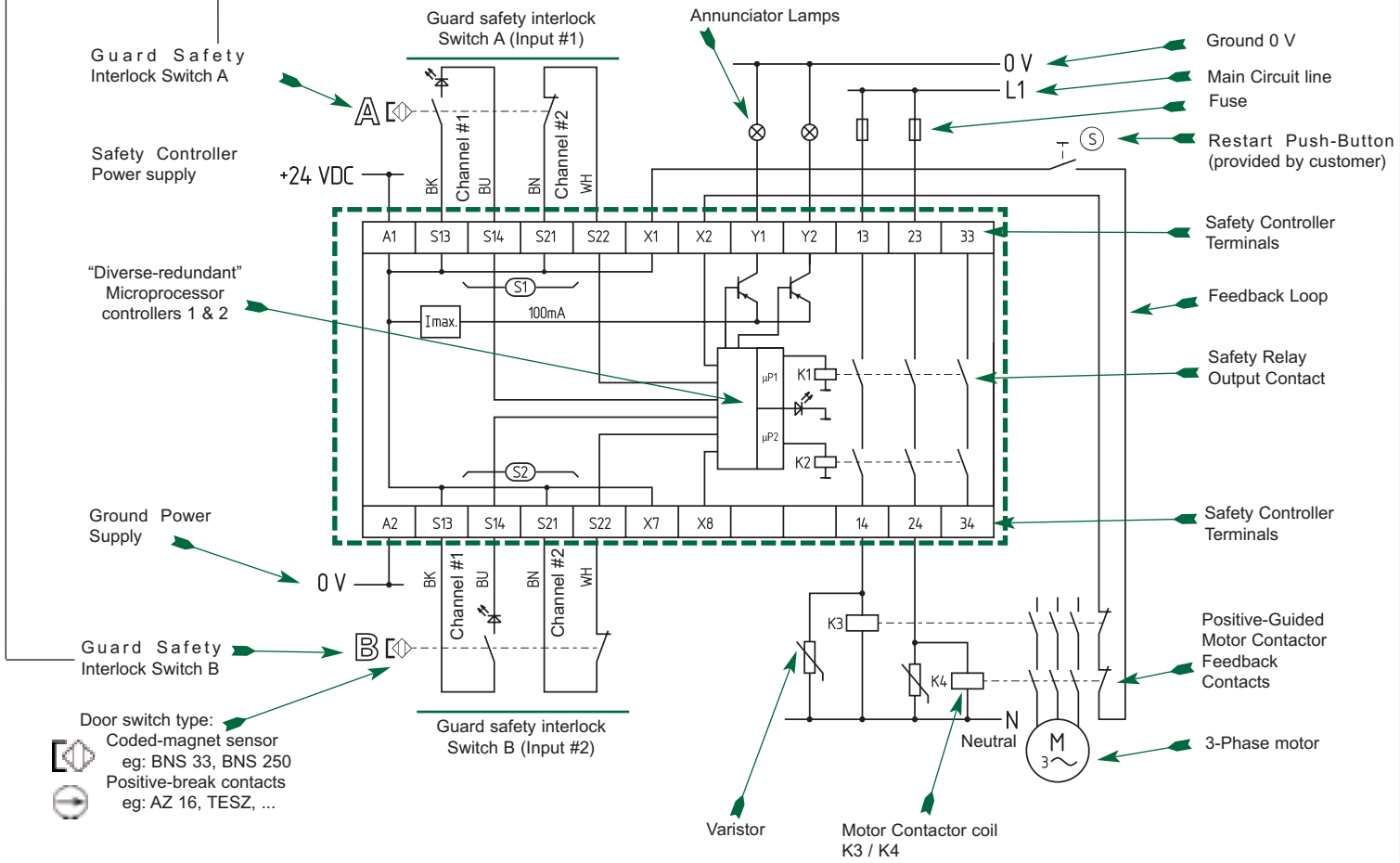
When needed, Category 4 requirements can be satisfied by proper selection from SCHMERSAL's wide range of CE-compliant safety interlocks and related safety controllers.

6 Can you please provide one or two typical wiring diagrams for a safety control category 3 or category 4 machine guarding system.

Example #1: Series AES 3365/3366 Safety Controllers

CC3 Safety Control Category 3

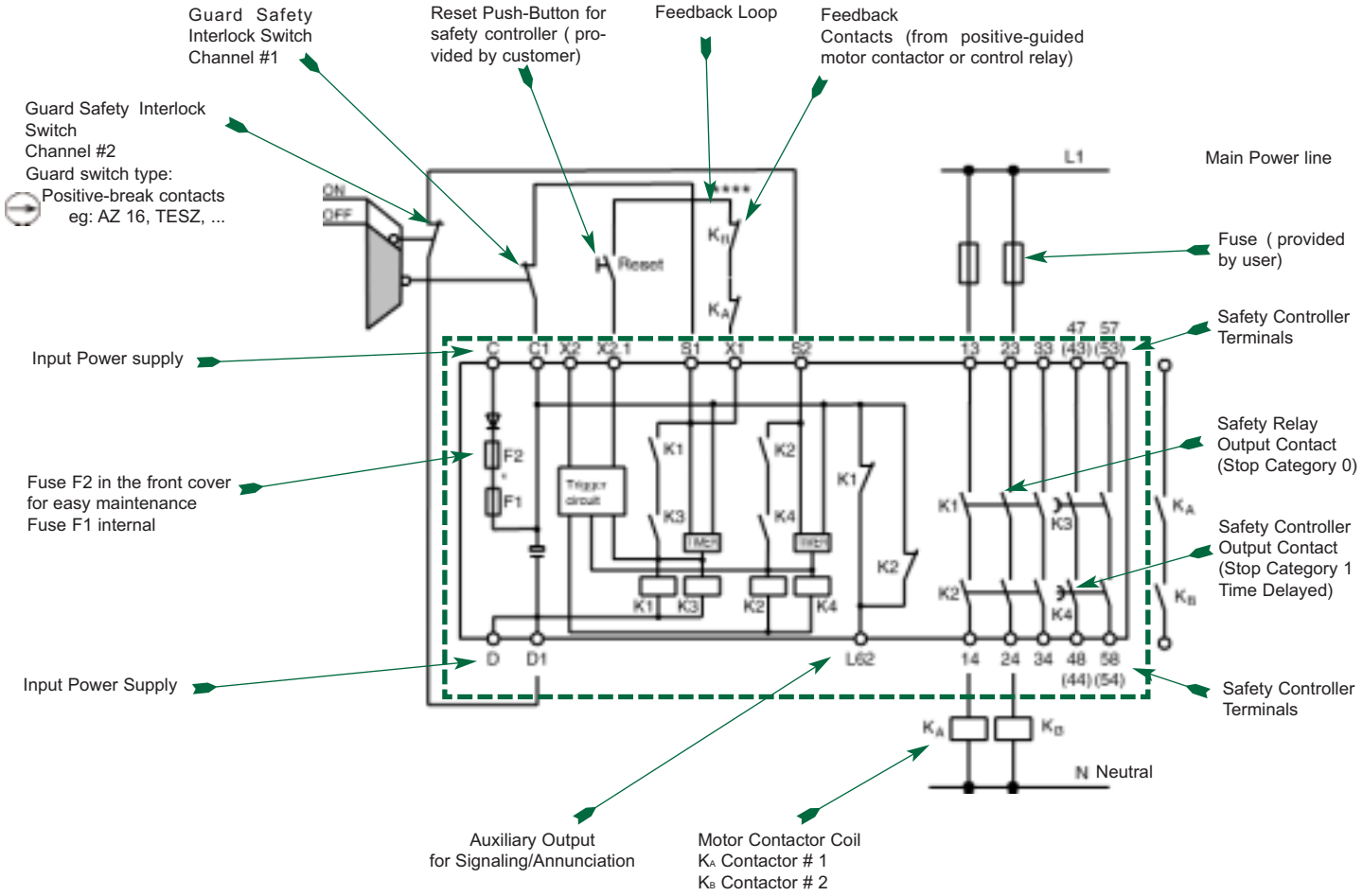




Contact arrangement is for the guards closed (e.g. key inserted into the interlock switch).All power lines are shown in the de-energized condition.

Example #2: Series SRB-NA-R-C.21 Safety Controller

CC4 Safety Control Category 4



Contact arrangement is for the guards closed (e.g. key inserted into the interlock switch). All power lines are shown in the de-energized condition.

KEY TO SYMBOLS USED IN THE CATALOG

Symbol	Description	Symbol	Description
	Guard device closed	S1	Dual channel Input (AES only)
	Guard device open		Proximity switch
	Machine Guard (Open-Close)		Magnetic safety sensor or electro-sensitive safety sensor
CC1	Control Category 1 to EN 954-1		Varistor
CC3	Control Category 3 to EN 954-1		Motor contactor coil
CC4	Control Category 4 to EN 954-1	K2	Positive guided relay & 2 safety outputs
0	Stop category 0 to IEC 60204-1		Ground
1	Stop category 1 to IEC 60204-1		Semiconductor
	Positive opening NC contact	µP1 µP2	Microprocessor
I O	On/Off switch		AC to DC transformer
E	Release interlock		Resistor
R	Reset push button		E-Stop Push Button
S	Start push button	S	Start Push Button
H1	After releasing interlock it is not essential to open the guard		Reset Push button
H2	Feedback circuit improves safety but does not increase Control Category		Annunciator Lamp
H7	Additional standstill signal required		Annunciator LED
UL	UL recognized		Fuse
SA	CSA listed		Normally-open contact
ISD	Integrated System Diagnostics		Normally-closed contact
Ue	Input Voltage		Normally-open contact (time-delayed)

Guard Door and E-Stop Safety Controllers

Safety Category (EN954-1): CC1

AES 1102 to Monitor Several Devices

Stop Category (EN60204-1): 0

Features

- Control Category 1 to EN 954-1
- 1 enabling path
- Monitoring of 1 or a number of guard devices
- Connection of BNS .. -12z magnetic safety sensors with 1 NO and 2 NC contacts
- LED function indicators
- Available for various operational voltages

Dimensions 22.5 x 75 x 110 mm

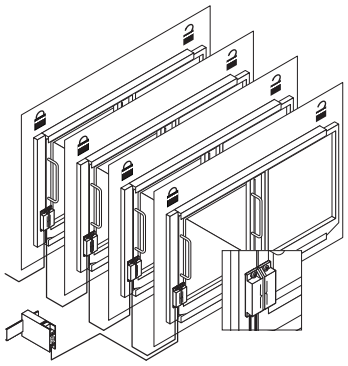
Note: Technical Specifications may be found on page 178

Model Designation	**AES 1102-24VDC**
	AES 1102-24VAC
	AES 1102-42VAC
	AES 1102-110VAC
	AES 1102-230VAC

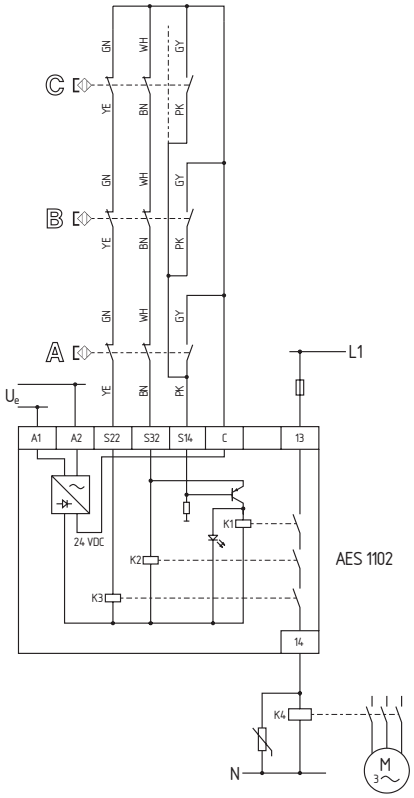
Approvals **BG UL CSA**

AES 1102 to Monitor Several Devices

Typical Application



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to secure a number of guard devices using series-parallel circuits for Control Category 1 to EN 954-1.
- Only suitable for the connection of magnetic safety sensors.
- Monitoring a number of guard devices using BNS 33..-12z-2187 range magnetic safety sensors with isolated contacts.
- The wiring diagram is with guard devices closed and shows the de-energized condition.
- Use with multiple “daisy-chained” inputs does not permit identification of which guard/coded-magnet sensor is in an open/fault condition

Circuit Options

- **Monitoring One Guard Device**
  Monitoring one guard device using a BNS .. -12z Series coded-magnet safety sensor.

Guard Door and E-Stop Safety Controllers

Safety Category (EN954-1): CC1

AES 1112 to Monitor Two Devices

Stop Category (EN60204-1): 0

Features

- Control Category 1 to EN 954-1
- 1 enabling path
- Monitoring of 1 or 2 guard devices or multiple devices using BNS .. -12z magnetic safety sensors with 1 NO and 2 NC contacts
- LED function indicators
- Designed to DIN VDE 0660-209
- Available for various operational voltages

Dimensions 22.5 x 75 x 110 mm

Note: Technical Specifications may be found on page 178

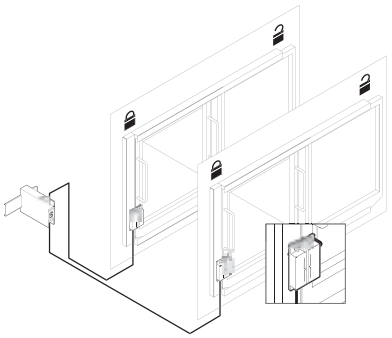
Model Designation

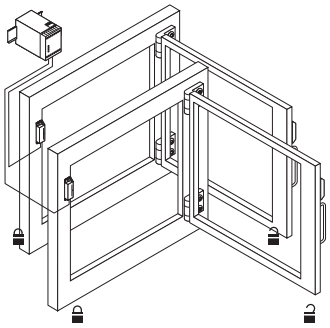
AES 1112-24VDC
AES 1112-24VAC
AES 1112-42VAC
AES 1112-110VAC
AES 1112-230VAC

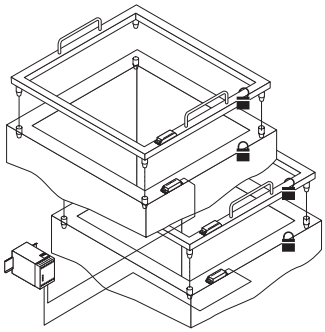
Approvals **BG UL CSA**

AES 1112 to Monitor Two Devices

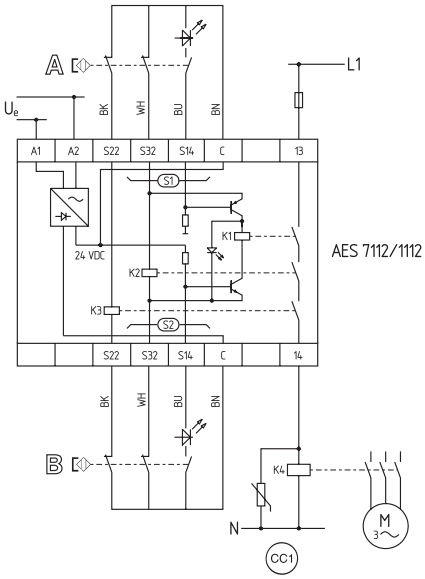
Typical Applications







Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to monitor a two guard devices for Control Category 1 to EN 954-1.
- Only suitable for the connection of magnetic safety sensors.
- Monitoring a number of two guard devices each fitted with one BNS 33..-12z range magnetic safety sensors.
- The wiring diagram is with guard devices closed and shows the de-energized condition.

Circuit Options

- **Monitoring One Guard Device**
  When only one magnetic safety sensor is connected, the terminals S22, S32, S14 and C of S1 are used and jumper connections must be wired between the terminals S22, S32 and C of S2.
- **Series-Parallel Circuits**
  Further guard devices can be monitored using BNS 33-12z-2187 Series coded-magnet safety sensor in series-parallel circuits.

Guard Door and E-Stop Safety Controllers

AES 1135, AES 1136, AES 1145 and AES 1146 to Monitor One Device

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 1 enabling circuit
- Enable delay time can be modified
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors or E-stops
- Can be used as emergency-stop controller for Category 0 to EN 60204-1
- Monitoring for short-circuit between connections with NO-NC contact combination
- Connection of input expansion modules possible

Dimensions 22.5 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 179

Model Designation

AES 1135-24VDC (For unit with optional start-up test specify **AES 1136-24VDC**)

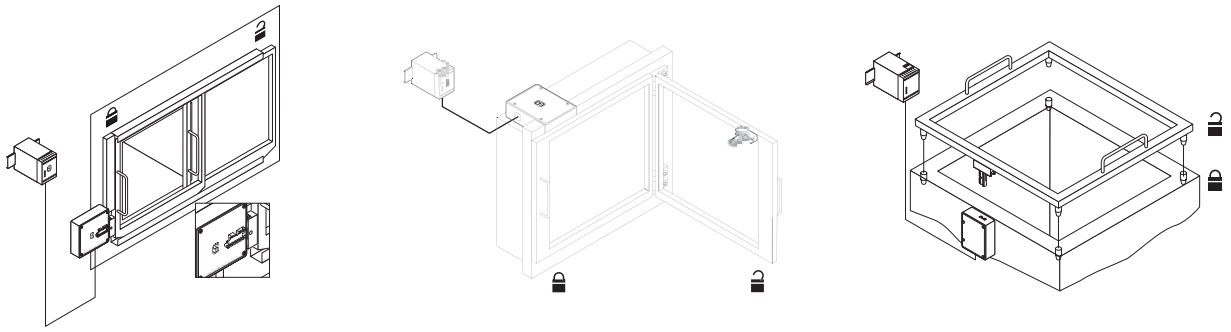
AES 1145-24VDC (For unit with optional start-up test specify **AES 1146-24VDC**)

Function Table		Additional semi-conductor output Y	Function of output Y	Switching Condition
	AES 1135/6	Y1 Y2	Enable No enable	Enable circuit closed Enable circuit open
	AES 1145/6	Y1 Y2	Guard device open Fault	Enable circuit open Enable circuit open

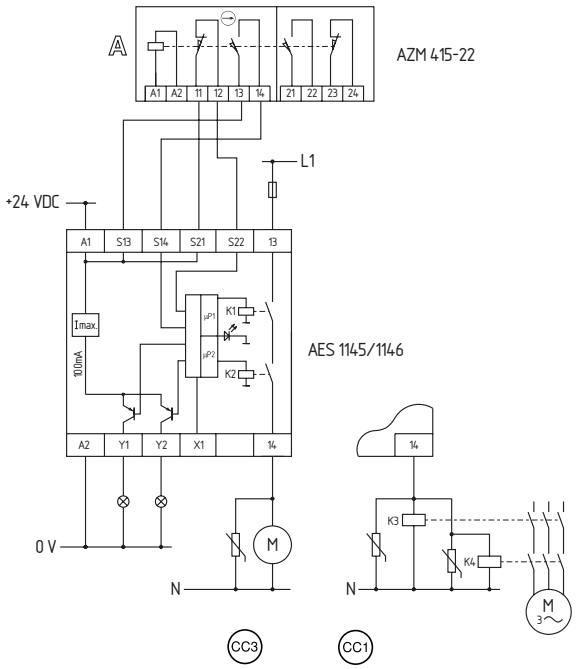
Approvals **BG UL CSA**

AES 1135, AES 1136, AES 1145 and AES 1146 to Monitor One Device

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



FaultFinder™

Application Notes

- AES to achieve up to Control Category 3.
- Monitoring a sliding, hinged or removable guard device using a solenoid interlock.
- The NC contact must have positive opening function when the guard device is opened.
- Control Category 3 to EN 954-1 can be achieved by substantiation and documentation of exclusion of "faults due to breakage or loosening of the actuator or in the solenoid interlock".
- If the load is directly switched by the AES, the complete system can be classified in Control Category 3 to EN 954-1. If one or two external relays or contactors are used to switch the load, the system can then only be classified in Control Category 3 to EN 954-1 if exclusion of the fault "Failure of the external contactors" can be substantiated and is documented, e.g. by using reliable de-rated contactors. A second contactor leads to an increase in the level of security by redundant switching of the load.
- The wiring diagram is with guard device closed and shows the de-energized condition.

Circuit Options

- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by changing the position of a jumper link connection under the cover of the unit.
- **Monitor 2 NC Contacts**
  Jumper A1 (24 VDC) to X1

Guard Door and E-Stop Safety Controllers

AES 1165 and AES 1166 to Monitor Two Devices

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 1 enabling circuit
- Enable delay time can be modified
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors or E-stops
- To monitor 2 guard devices for Control Category 3
- NO-NC contact combination can be connected
- Can be used as emergency-stop controller for Category 0 to EN 60204-1
- Monitoring for short-circuit between connections
- ISD Integral System Diagnostics
- Operational voltage 24 VDC
- Connection of input expansion modules possible

Dimensions 22.5 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 180

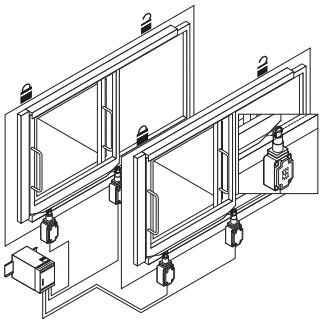
Model Designation **AES 1165-24VDC** (For unit with optional start-up test specify **AES 1166-24VDC**)

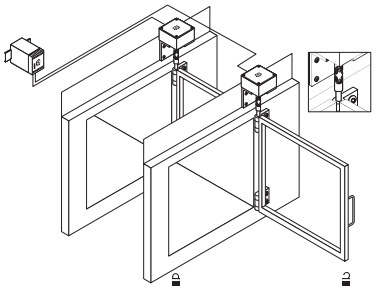
Approvals **BG UL CSA**

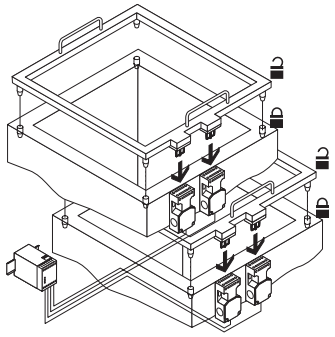
AES 1165 and AES 1166 to Monitor Two Devices

FaultFinder™

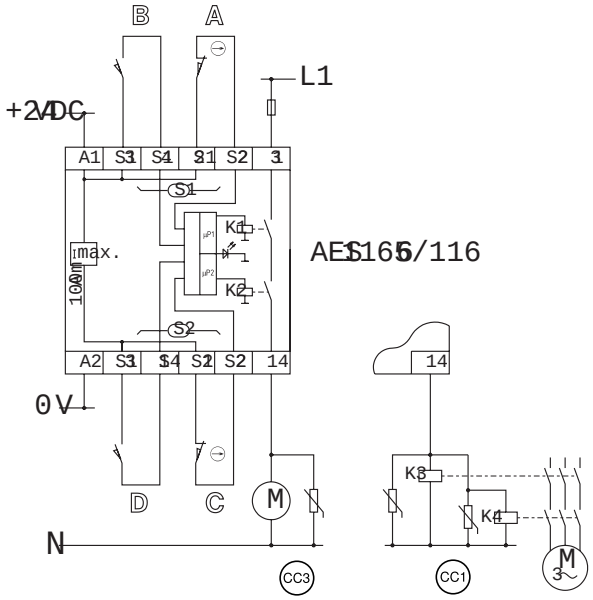
Typical Applications







Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to achieve up to Control Category 3 to EN 954-1.
- For the monitoring of two sliding guard devices, each with two position switches with safety function (A and B, C and D).
- Monitoring of two hinged guard devices, each with two hinge safety switches (A and B, C and D).
- Monitoring of two removable guard devices, each with two safety switches with separate actuators.
- The NC contacts must have positive opening function when the guard devices are opened.
- If the load is directly switched by the AES, the complete system can be classified in Control Category 3 to EN 954-1.
- If one or two external relays or contactors are used to switch the load, the system can then only be classified in Control Category 3 to EN 954-1 if exclusion of the fault "Failure of the external contactors" can be substantiated and is documented, e.g. by using reliable de-rated contactors. A second contactor leads to an increase in the level of security by redundant switching of the load.
- The wiring diagram is with guard devices closed and shows the de-energized condition.

Circuit Options

- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by changing the position of a jumper link connection under the cover of the unit.

Guard Door and E-Stop Safety Controllers

AES 1235 and AES 1236 to Monitor One Device

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 2 enabling circuits
- Enable delay time can be modified
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors or E-stops
- NO-NC contact combination can be connected
- Can be used as emergency-stop controller for Stop Category 0 to EN 60204-1
- Monitoring for short-circuit between connections with NO-NC contact combination
- ISD Integral System Diagnostics
- Short-circuit proof additional transistor output
- Feedback circuit to monitor external relays
- Start function
- Operational voltage 24 VDC
- Connection of input expansion modules possible
- Additional contact by means of output expansion modules

Dimensions 22.5 x 75 x 110 mm

ISD **The following faults are recognized by the safety controller and indicated by means of ISD**

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 179

Model Designation **AES 1235-24VDC** (For unit with optional start-up test specify **AES 1236-24VDC**)

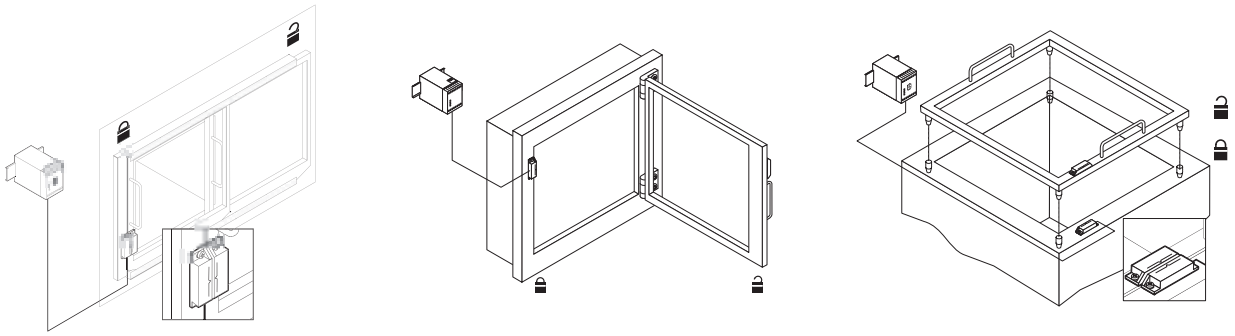
Function Table		Additional semi-conductor output Y	Function of output Y	Switching Condition
	AES 1235	Y1	Enable	Enable circuit closed

Approvals **BG UL CSA**

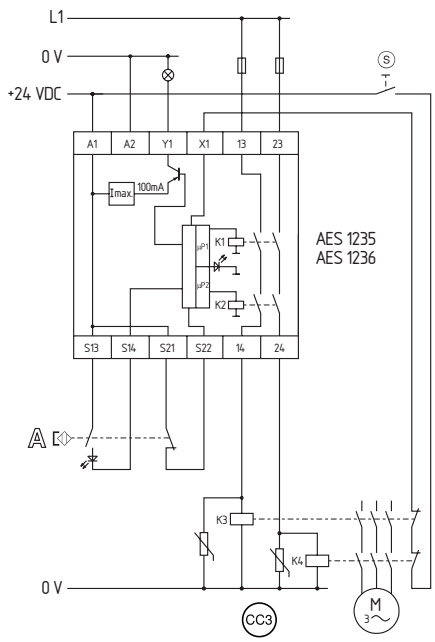
AES 1235 and AES 1236 to Monitor One Device

FaultFinder™

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES achieve Control Category 3 to EN 954-1.
- Monitoring a sliding, hinged or removable guard device, each using a coded magnet sensor A.
- The feedback circuit monitors positions of the contactors K3 and K4.
- If only one external relay or contactor is used to switch the load, the system can be classified in Control Category 3 to EN 954-1 if exclusion of the fault “Failure of the external contactor” can be substantiated and is documented, e.g. by using a reliable de-rated contactor. A second contactor leads to an increase in the level of security by redundant switching of the load.
- The wiring diagram is with guard devices closed and shows the de-energized condition.

Circuit Options

- **Start Pushbutton** Ⓢ
  A start pushbutton (NO) can optionally be connected to the inputs in the feedback circuit. With the guard device closed, the enabling circuits are then not closed until the start pushbutton has been operated.
- **Feedback Circuit**
  A feedback circuit is shown connected in the wiring diagram. If no feedback circuit is used, input X1 must be connected to 24 VDC supply or a jumper between output Y1 and input X1.
- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by changing the position of a jumper link connection under the cover of the unit.

Guard Door and E-Stop Safety Controllers

AES 2135 and AES 2136 to Monitor One Device

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 1 enabling circuit
- Enable delay time can be modified
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors or E-stops
- Can be changed from NO-NC to NC-NC contact combination
- Can be used as emergency-stop controller for Category 0 to EN 60204-1
- Monitoring for short-circuit between connections with NO-NC contact combination
- ISD Integral System Diagnostics
- Connection of input expansion modules possible

Dimensions 55 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 181

Model Designation

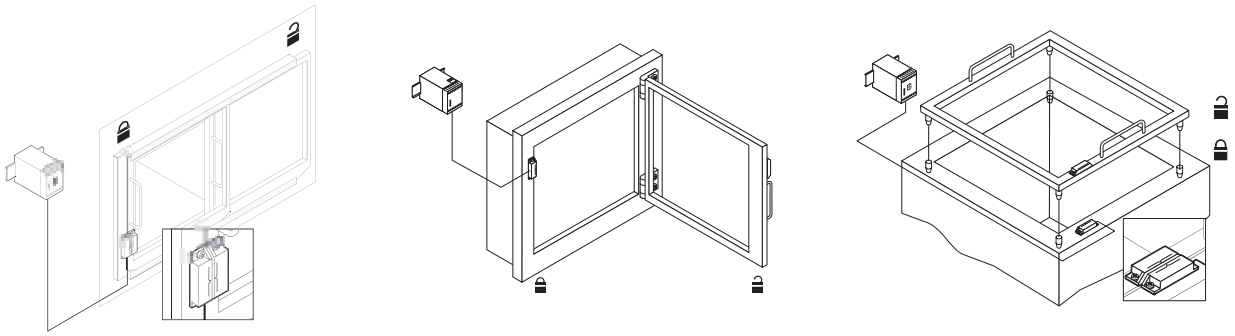
AES 2135-24VAC	(For unit with optional start-up test specify **AES 2136-24VAC**)
AES 2135-110VAC	(For unit with optional start-up test specify **AES 2136-110VAC**)
AES 2135-230VAC	(For unit with optional start-up test specify **AES 2136-230VAC**)

Approvals **BG UL CSA**

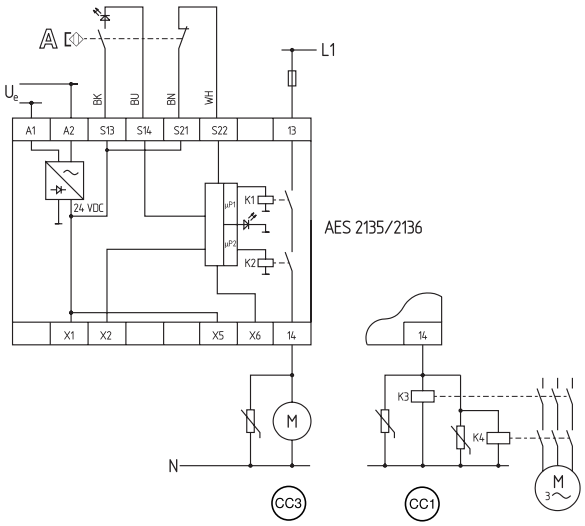
AES 2135 and AES 2136 to Monitor One Device

FaultFinder™

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to achieve Control Category 3 to EN 954-1.
- Monitoring a sliding, hinged or removable guard device, each using a safety coded magnet A.
- If the load is directly switched by the AES, the complete system can be classified in Control Category 3 to EN 954-1.
- If one or two external relays or contactors are used to switch the load, the system can then only be classified in Control Category 3 to EN 954-1 if exclusion of the fault "Failure of the external contactors" can be substantiated and is documented, e.g. by using reliable de-rated contactors. A second contactor leads to an increase in the level of security by redundant switching of the load.
- The wiring diagram is with guard devices closed and shows the de-energized condition.

Circuit Options

- **Modification for 2 NC Contacts**
  The controller can be modified to monitor two normally closed contacts by jumping between the terminals X1 and X2. The short circuit monitoring between connections then becomes inoperative.
- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by jumping between the terminals X5 and X6.

Guard Door and E-Stop Safety Controllers

Safety Category (EN954-1): CC3

AES 2165 and AES 2166 to Monitor Two Devices

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 1 enabling circuit
- Enable delay time can be modified
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors or E-stops
- To monitor 2 guard devices for Category 0 to EN 60204-1
- NO-NC contact combination can be connected
- Monitoring for short-circuit between connections
- ISD Integral System Diagnostics
- Connection of input expansion modules possible

Dimensions 55 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 183

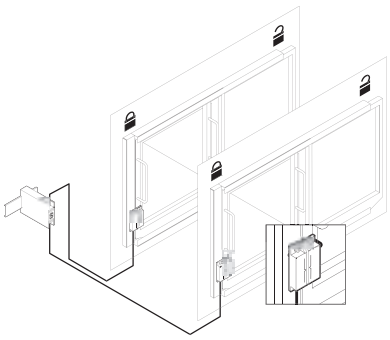
Model Designation

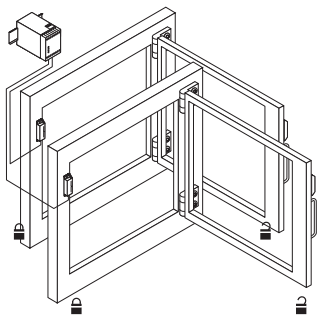
AES 2165-24VAC	(For unit with optional start-up test specify **AES 2166-24VAC**)
AES 2165-110VAC	(For unit with optional start-up test specify **AES 2166-110VAC**)
AES 2165-230VAC	(For unit with optional start-up test specify **AES 2166-230VAC**)

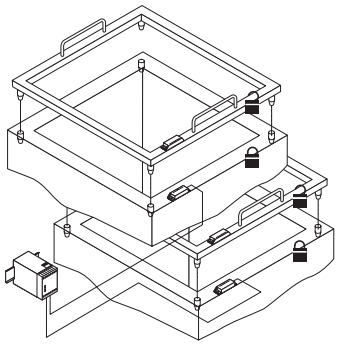
Approvals **BG UL CSA**

AES 2165 and AES 2166 to Monitor Two Devices

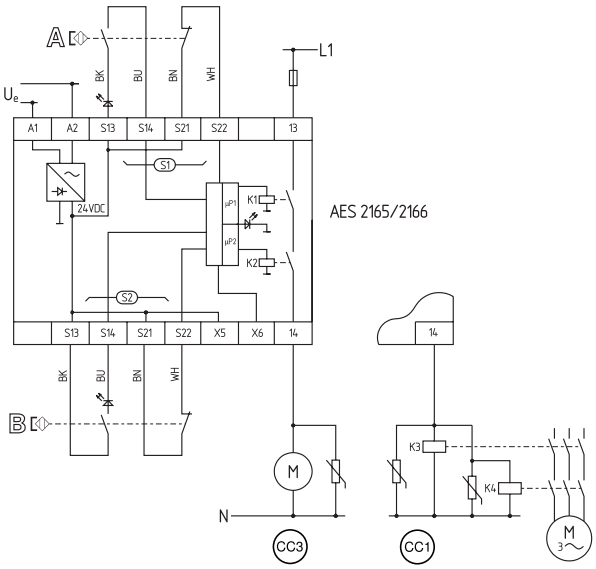
Typical Applications







Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to achieve Control Category 3 to EN 954-1.
- Monitoring of two guard devices, each with a coded magnet sensor (A and B).
- If the load is directly switched by the AES, the complete system can be classified in Control Category 3 to EN 954-1.
- If one or two external relays or contactors are used to switch the load, the system can then only be classified in Control Category 3 to EN 954-1 if exclusion of the fault "Failure of the external contactors" can be substantiated and is documented, e.g. by using reliable de-rated contactors. A second contactor leads to an increase in the level of security by redundant switching of the load.
- The wiring diagram is with guard devices closed and shows the de-energized condition.

Circuit Options

- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by a jumper between the terminals X5 and X6.

Guard Door and E-Stop Safety Controllers

AES 2335 and AES 2336 to Monitor One Device

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Dimensions 55 x 75 x 110 mm

ISD **The following faults are recognized by the safety controller and indicated by means of ISD**

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor
- Failure of or functional fault on the safety controller

Features

- Control Category 3 to EN 954-1
- 3 enabling circuits
- Enable delay time can be modified
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors or E-stops
- NO-NC contact combination can be connected
- Can be used as emergency-stop controller for Category 0 to EN 60204-1
- Monitoring for short-circuit between connections
- ISD Integral System Diagnostics
- Available for various operational voltages
- Short-circuit proof additional transistor outputs
- Feedback circuit to monitor external relays
- Start function
- Connection of input expansion modules possible
- Additional contact by means of output expansion modules

Note The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 181

Model Designation

AES 2335-24VDC	(For unit with optional start-up test specify **AES 2336-24VDC**)
AES 2335-110VAC	(For unit with optional start-up test specify **AES 2336-110VAC**)
AES 2335-230VAC	(For unit with optional start-up test specify **AES 2336-230VAC**)

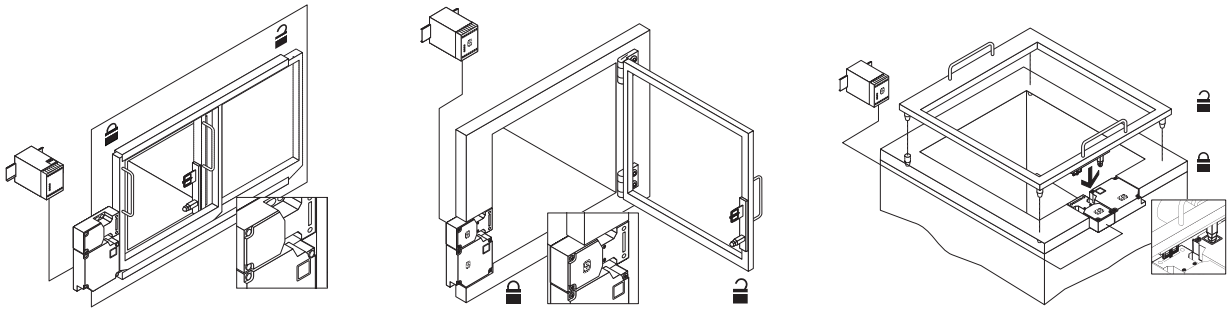
Function Table

	Additional semi-conductor output Y	Function of output Y	Switching Condition
AES 2335/6	Y1 Y2	Enable No enable	Enable circuit closed Enable circuit open

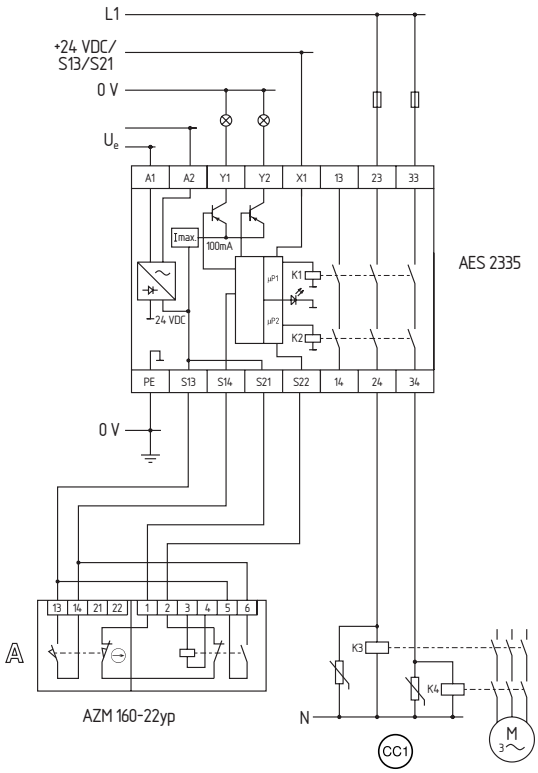
Approvals **BG UL CSA**

AES 2335 and AES 2336 to Monitor One Device

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- The wiring diagram shown achieves Control Category 1 to EN 954-1.
- Monitoring a sliding, hinged or removable guard device.
- To achieve Control Category 3 to EN 954-1, the feedback circuit must be connected.
- In addition, exclusion of faults due to breakage or loosening of the actuator or in the solenoid interlock is to be substantiated and documented.
- The NC contact A must have positive opening function when the guard device is opened.
- If only one external relay or contactor is used to switch the load, the system can be classified in Control Category 3 to EN 954-1 if exclusion of the fault “Failure of the external contactor” can be substantiated and is documented, e.g. by using a reliable de-rated contactor. A second contactor leads to an increase in the level of security by redundant switching of the load.
- The wiring diagram is with guard device closed and shows the de-energized condition.

Circuit Options

- **Start Pushbutton** Ⓢ
  A start pushbutton (NO) can optionally be connected to the inputs in the feedback circuit. With the guard device closed, the enabling circuits are then not closed until the start pushbutton has been operated.
- **Feedback Circuit**
  For this purpose, the positive-drive contacts of the external contactors can be connected to input X1. The power supply to this feedback circuit is either from semiconductor output Y2 or, if this is already used, with 24 VDC from terminal S13 or S21.

Guard Door and E-Stop Safety Controllers

AES 3335 and AES 3336 to Monitor One Device

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 3 enabling circuits
- Enable delay time can be modified
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors or E-stops
- Can be changed from NO-NC to NC-NC contact combination
- Can be used as emergency-stop controller for Category 0 to EN 60204-1
- Monitoring for short-circuit between connections with NO-NC contact combination
- Operational voltage of 24 VDC
- ISD Integral System Diagnostics
- Short-circuit proof additional transistor outputs
- Feedback circuit to monitor external contactors
- Start function
- Connection of input expansion modules possible
- Additional contact by means of output expansion modules

Dimensions 99.7 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 182

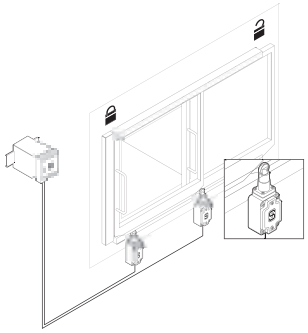
Model Designation **AES 3335-24VDC** (For unit with optional start-up test specify **AES 3336-24VDC**)

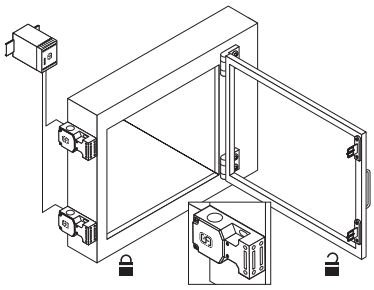
Function Table		Additional semi-conductor output Y	Function of output Y	X5 and X6
	AES 3335/6	Y1 Y2	Enable No enable	Without jumper Without jumper
		Y1 Y2	Door Open Fault	With jumper With jumper

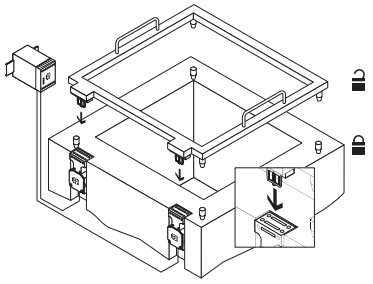
Approvals **BG UL CSA**

AES 3335 and AES 3336 to Monitor One Device

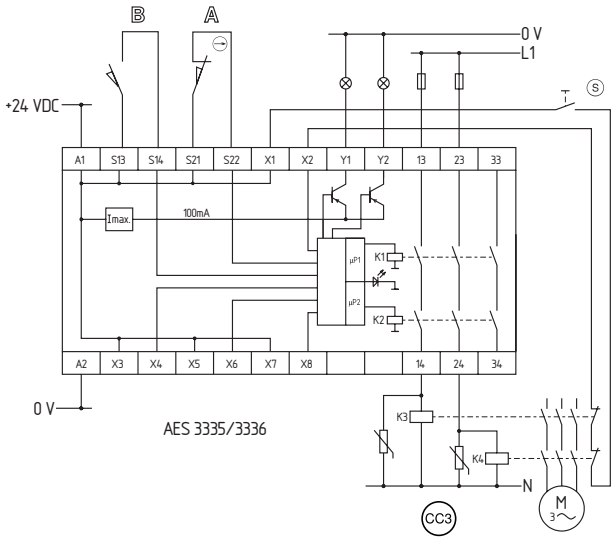
Typical Applications







Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to achieve up to Control Category 3 to EN 954-1.
- Monitoring a sliding guard door using two position switches with safety function (A and B).
- Monitoring a hinged or removable guard device using two safety switches with separate actuators (A and B).
- The NC contact A must have positive opening function when the guard device is opened.
- Control Category 3 to EN 954-1 can also be achieved using only one safety switch with one NO and one normally closed contact. Exclusion of faults due to breakage or loosening of the actuating element or the operating head as well as releasing, dismantling or sliding of the position switches is to be substantiated and documented.
- The feedback circuit monitors the positions of the positive-drive NC contacts on the contactors K3 and K4.
- Contactor K4 increases the level of security but is not essential
- The wiring diagram is with guard device closed and shows the de-energized condition.

Circuit Options

- **Start Pushbutton Ⓢ**
  A start pushbutton (NO) can optionally be connected into the feedback circuit. With the guard device closed, the enabling circuits are then not closed until the start pushbutton has been operated. If neither start button nor feedback circuit are connected, a jumper must be wired between X1 and X2.
- **Modification for 2 NC Contacts**
  The controller can be modified to monitor two normally closed contacts by a jumper between the terminals X3 and X4. The monitoring of short-circuit between connections then becomes inoperative.
- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by a jumper between the terminals X7 and X8.

Guard Door and E-Stop Safety Controllers

AES 3335 AC to Monitor One Device

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 3 enabling circuits
- Enable delay time can be modified
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors or E-stops
- Can be changed from NO-NC to NC-NC contact combination
- Can be used as emergency-stop controller for Category 0 to EN 60204-1
- 2 potential-free indication contacts (NO-NC)
- Monitoring for short-circuit between connections
- ISD Integral System Diagnostics
- Available in various operational voltages
- Feedback circuit to monitor external relays
- Start function
- Connection of input expansion modules possible
- Additional contact by means of output expansion modules

Dimensions 99.7 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 182

Model Designation

AES 3335-110VAC	(For unit with optional start-up test specify **AES 3336-110VAC**)
AES 3335-230VAC	(For unit with optional start-up test specify **AES 3336-230VAC**)

Function Table

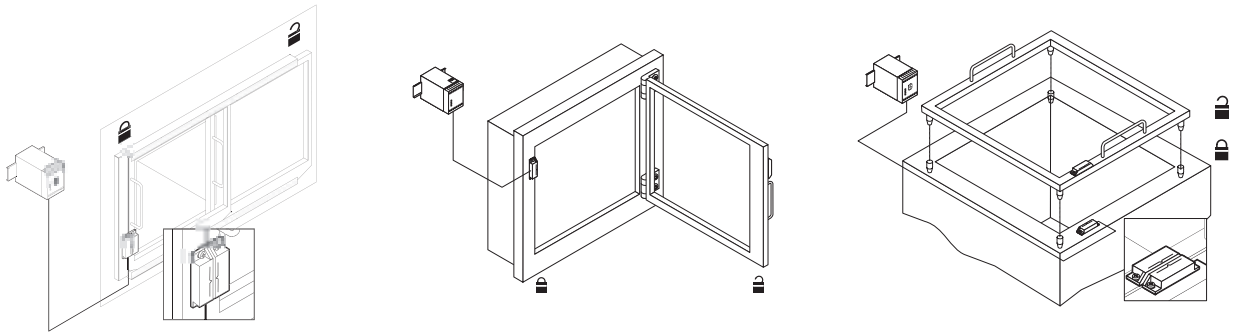
	Additional semi-conductor output Y	Function of output Y	X5 and X6
AES 3335/6	43/44 51/52	Enable No enable	Without jumper Without jumper
	43/44 51/52	Door open Door closed	With jumper With jumper

Approvals **BG UL CSA**

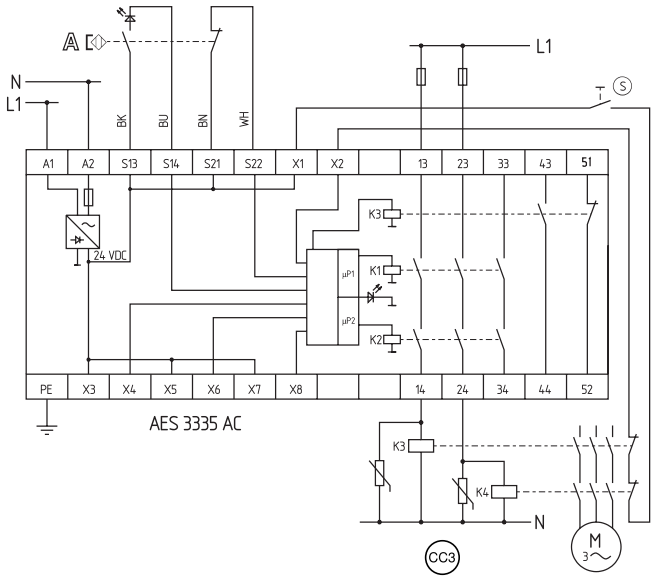
AES 3335 AC to Monitor One Device

FaultFinder™

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to achieve up to Control Category 3 to EN 954-1.
- Monitoring a sliding, hinged or removable guard device using a coded magnet sensor A.
- The feedback circuit monitors positions of the positive-drive NC contacts of the contactors K3 and K4.
- If only one external relay or contactor is used to switch the load, the system can be classified in Control Category 3 to EN 954-1 if exclusion of the fault “Failure of the external contactor” can be substantiated and is documented, e.g. by using a reliable de-rated contactor. A second contactor leads to an increase in the level of security by redundant switching of the load.
- The wiring diagram is with guard device closed and shows the de-energized condition.

Circuit Options

- **Start Pushbutton** Ⓢ
  A start pushbutton (NO) can optionally be connected into the feedback circuit. With the guard device closed, the enabling circuits are then not closed until the start pushbutton has been operated. If neither start button nor feedback circuit are connected, a jumper connection must be wired between X1 and X2.
- **Modification for 2 NC Contacts**
  The controller can be modified to monitor two normally closed contacts by placing a jumper between the terminals X3 and X4. The monitoring of short-circuit between connections then becomes inoperative.
- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by placing a jumper between the terminals X7 and X8.

Guard Door and E-Stop Safety Controllers

AES 3365 and AES 3366 to Monitor Two Devices

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 3 enabling circuits
- Enable delay time can be modified
- To monitor 2 guard devices for Control Category 3
- NO-NC contact combination can be connected
- Can be used as emergency-stop controller for Category 0 to EN 60204-1
- Monitoring for short-circuit between connections
- ISD Integral System Diagnostics
- Operational voltage 24 VDC
- Short-circuit proof additional transistor output
- Feedback circuit to monitor external relays
- Start function
- Connection of input expansion modules possible
- Additional contact by means of output expansion modules

Dimensions 99.7 x 75 x 110 mm

ISD **The following faults are recognized by the safety controller and indicated by means of ISD**

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 183

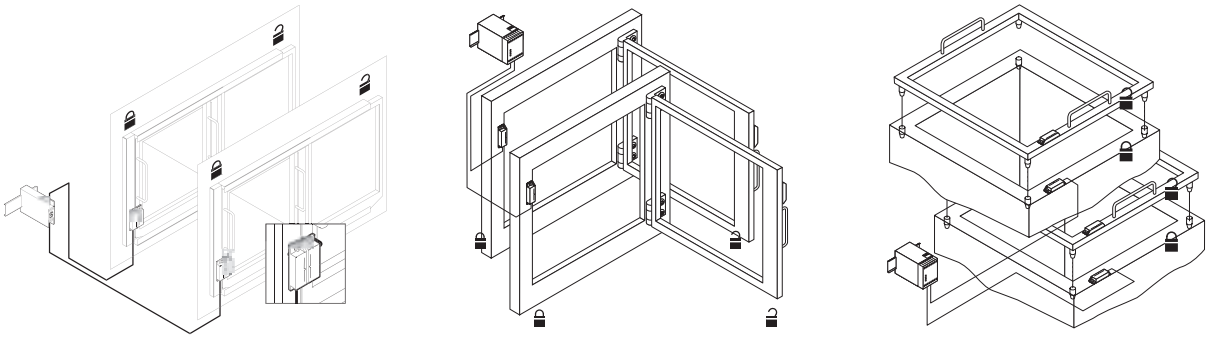
Model Designation **AES 3365-24VDC** (For unit with optional start-up test specify **AES 3366-24VDC**)

Function Table		Additional semi-conductor output Y	Function of output Y	Switching Condition
	AES 3365/6	Y1 Y2	Enable Fault	Enable circuit closed Enable circuit open

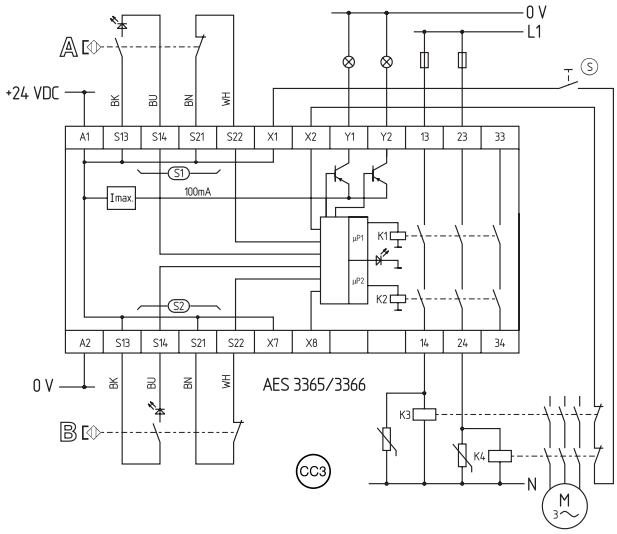
Approvals **BG UL CSA**

AES 3365 and AES 3366 to Monitor Two Devices

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to achieve Control Category 3 to EN 954-1.
- Monitoring of two guard devices, each with a coded magnet sensor of the BNS range (A and B).
- The feedback circuit monitors the positions of the positive-drive NC contacts on the contactors K3 and K4. If no feedback circuit is connected, a jumper must be placed between the inputs X1 and X2.
- If only one external relay or contactor is used to switch the load, the system can be classified in Control Category 3 to EN 954-1 if exclusion of the fault “Failure of the external contactor” can be substantiated and is documented, e.g. by using a reliable de-rated contactor. A second contactor leads to an increase in the level of security by redundant switching of the load.
- The wiring diagram is with guard device closed and shows the de-energized condition.

Circuit Options

- **Start Pushbutton** Ⓢ
  A start pushbutton (NO) can optionally be connected between the input X1 and X2 or in the feedback circuit. With the guard device closed, the enabling circuits are then not closed until the start pushbutton has been operated. If neither start button nor feedback circuit is used, a jumper must be placed between X1 and X2.
- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by placing a jumper between the terminals X7 and X8.

Guard Door and E-Stop Safety Controllers

AES 3535 and AES 3536 to Monitor One Device

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 4 enabling circuits
- Enable delay time can be modified
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors or E-stops
- Can be changed from NO-NC to NC-NC contact combination
- Can be used as emergency-stop controller for Category 0 to EN 60204-1
- 1 potential-free indication contact (NC)
- Monitoring for short-circuit between connections with NO-NC contact combination
- Operational voltage of 24 VDC
- ISD Integral System Diagnostics
- 2 short-circuit proof additional transistor outputs
- Feedback circuit to monitor external contactors
- Start function
- Available with or without start-up test
- Connection of input expansion modules possible
- Additional contact by means of output expansion modules

Dimensions 99.7 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 182

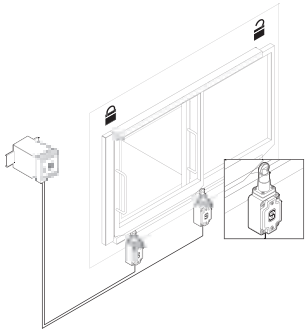
Model Designation **AES 3535-24VDC** (For unit with optional start-up test specify **AES 3536-24VDC**)

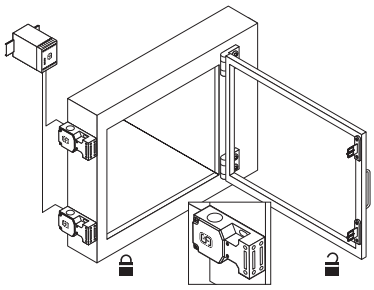
Function Table		Additional semi-conductor output Y	Function of output Y	X5 and X6
	AES 3335/6	Y1 Y2	Enable No enable	Without jumper Without jumper
		Y1 Y2	Door Open Fault	With jumper With jumper

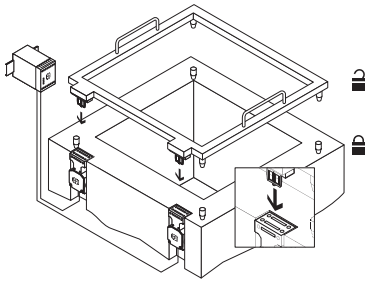
Approvals **BG UL CSA**

AES 3535 and AES 3536 to Monitor One Device

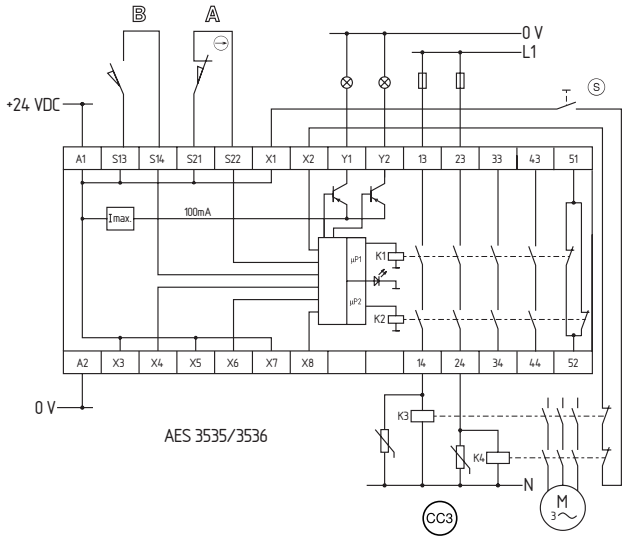
Typical Applications







Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to achieve up to Control Category 3 to EN 954-1.
- Monitoring a sliding guard door using two position switches with safety function (A and B).
- Monitoring a hinged or removable guard device using two safety switches with separate actuators (A and B).
- The NC contact A must have positive opening function when the guard device is opened.
- Control Category 3 to EN 954-1 can also be achieved using only one safety switch with one NO and one normally closed contact. Exclusion of faults due to breakage or loosening of the actuating element or the operating head as well as releasing, dismantling or sliding of the position switches is to be substantiated and documented.
- The feedback circuit monitors the positions of the positive-drive NC contacts on the contactors K3 and K4.
- Contactor K4 increases the level of security but is not essential
- The wiring diagram is with guard device closed and shows the de-energized condition.

Circuit Options

- **Start Pushbutton** Ⓢ
  A start pushbutton (NO) can optionally be connected into the feedback circuit. With the guard device(s) closed, the enabling circuits are then not closed until the start pushbutton has been operated. If neither start button nor feedback circuit are connected, a jumper must be placed between X1 and X2.
- **Modification for 2 NC Contacts**
  The controller can be modified to monitor two normally closed contacts by placing a jumper between the terminals X3 and X4. The monitoring of short-circuit between connections then becomes inoperative.
- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by a jumper between the terminals X7 and X8.

Guard Door and E-Stop Safety Controllers

AES 3565 and AES 3566 to Monitor Two Devices

Safety Category (EN954-1): CC3

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- 4 enabling circuits
- Enable delay time can be modified
- To monitor 2 guard devices for Control Category 3 to EN 954-1
- NO-NC contact combination can be connected
- Can be used as emergency-stop controller for Category 0 to EN 60204-1
- 1 potential-free indication contact (NC)
- Monitoring for short-circuit between connections with NO-NC contact combination
- ISD Integral System Diagnostics
- Operational voltage 24 VDC
- Short-circuit proof semiconductor outputs
- Feedback circuit to monitor external relays
- Start function
- Connection of input expansion modules possible
- Additional contact by means of output expansion modules

Dimensions 99.7 x 75 x 110 mm

ISD **The following faults are recognized by the safety controller and indicated by means of ISD**

- Failure of door contacts to open or close
- Short-circuits on or between the switch connections
- Interruption of the switch connections
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on the input circuits or on the relay control of the guard door monitor

Note The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 192.

Technical Specifications may be found on page 183

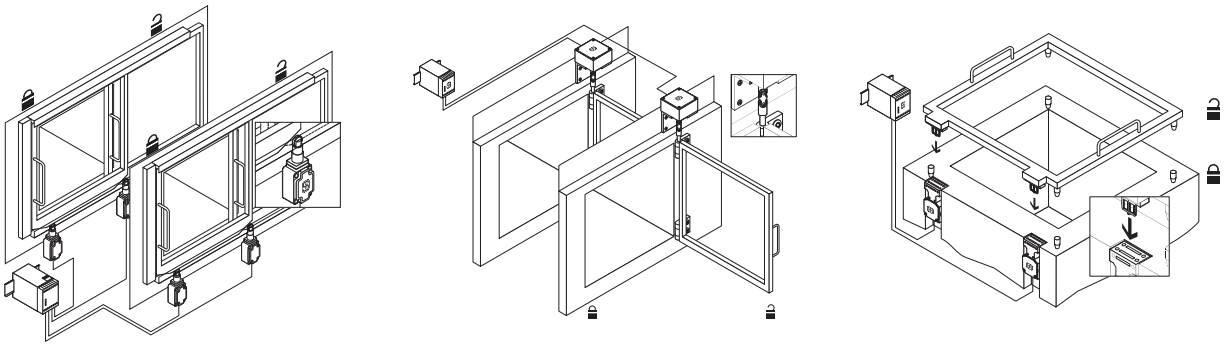
Model Designation **AES 3565-24VDC** (For unit with optional start-up test specify **AES 3566-24VDC**)

Function Table		Additional semi-conductor output Y	Function of output Y	Switching condition
	AES 3565/6	Y1 Y2	Enable Fault	Enable circuit closed Enable circuit open

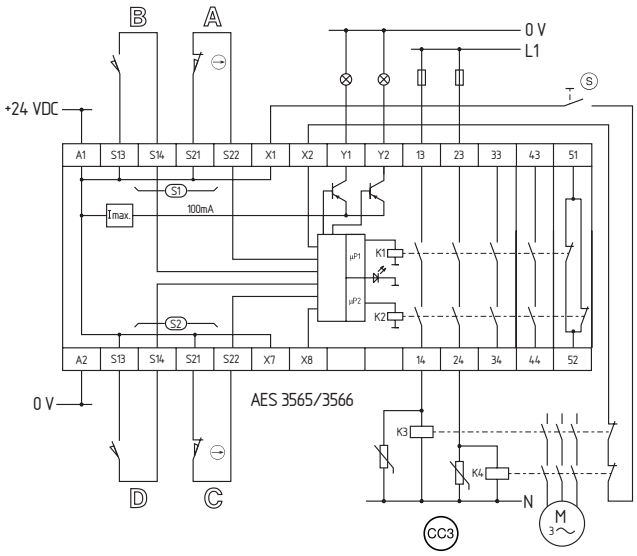
Approvals **BG UL CSA**

AES 3565 and AES 3566 to Monitor Two Devices

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to achieve Control Category 3 to EN 954-1.
- Control Category 3 to EN 954-1 can also be achieved without the second safety switches B and D. Exclusion of the faults “breakage or loosening of the actuating elements or actuator and loosening, dismantling or sliding of the safety switch” is to be substantiated and documented. For this purpose, both a NO and NC contact must be connected from each of the safety switches A and C.
- For the monitoring of two sliding guard devices, each with two position switches A and B, C with safety function (A and B, C and D).
- Monitoring of two hinged guard devices, each with two hinge safety switches (A and B, C and D).
- Monitoring of two removable guard devices, each with two safety switches with separate actuators.
- The NC contacts A and C must have positive opening function when the guard devices are opened.
- The feedback circuit monitors the positions of the positive-drive NC contacts on the contactors K3 and K4. If no feedback circuit is connected, a jumper must be placed between the inputs X1 and X2.
- If only one external relay or contactor is used to switch the load, the system can be classified in Control Category 3 to EN 954-1 if exclusion of the fault “Failure of the external contactor” can be substantiated and is documented, e.g. by using a reliable de-rated contactor. A second contactor leads to an increase in the level of security by redundant switching of the load.
- The wiring diagram is with guard devices closed and shows the de-energized condition.

Circuit Options

- **Start Pushbutton** Ⓢ
  A start pushbutton (NO) can optionally be connected between the input X1 and X2 or in the feedback circuit. With the guard device closed, the enabling circuits are then not closed until the start pushbutton has been operated. If neither start button nor feedback circuit is used, a jumper must be placed between X1 and X2.
- **Extension of Enable Delay Time**
  The enable delay time can be increased from 0.1 s to 1 s by placing a jumper between the terminals X7 and X8.

Guard Door and E-Stop Safety Controllers

Safety Category (EN954-1): CC1

AES 6112 to Monitor Several Devices

Stop Category (EN60204-1): 0

Features

- Control Category 1 to EN 954-1
- 1 enabling path
- Monitoring of 1 or a number of guard devices
- Connection of BNS .. -12z magnetic safety sensors with 1 NO and 2 NC contacts
- LED function indications
- Designed to DIN VDE 0660-209
- Operating voltage 24 VDC

Dimensions 48 x 96 x 58 mm

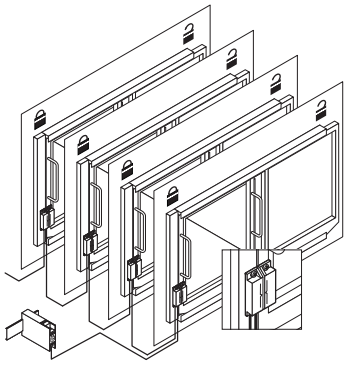
Note: Technical Specifications may be found on page 178

Model Designation AES 6112-24VDC

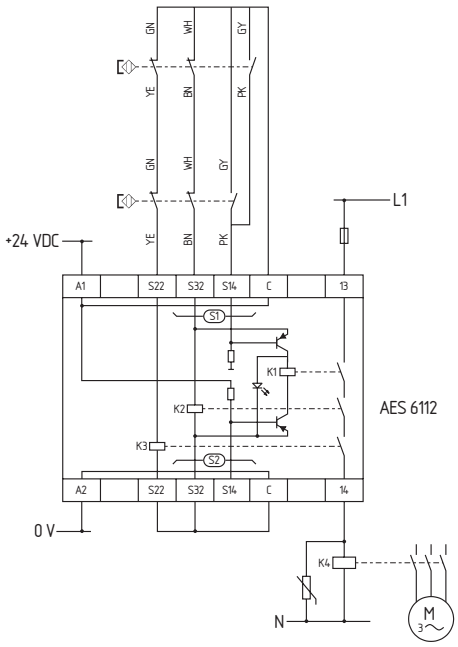
Approvals BG UL CSA

AES 6112 to Monitor Several Devices

Typical Application



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to monitor a number of guard devices using series-parallel circuits for Control Category 1 to EN 954-1.
- Only suitable for the connection of magnetic safety sensors.
- Monitoring a number of guard devices using BNS 33..-12z-2187 range magnetic safety sensors with isolated contacts.
- Monitoring one guard device using a BNS .. -12z range magnetic safety sensor.
- The wiring diagram is with guard devices closed and shows the de-energized condition.
- Use with multiple “daisy-chained” inputs does not permit identification of which guard/coded-magnet sensor is open/fault condition

Circuit Options

- **Monitoring of Further Devices**
  Further magnetic safety sensors can be connected to the terminals S22, S32, S14 and C of S2 in a similar way to those on S1.

Guard Door and E-Stop Safety Controllers

AES 7112 to Monitor Two Devices

Safety Category (EN954-1): CC1

Stop Category (EN60204-1): 0

Features

- Control Category 1 to EN 954-1
- 1 enabling path
- Monitoring of one or two guard devices
- Connection of BNS ..-12z magnetic safety sensors with 1 NO and 2 NC contacts
- LED function indications
- Designed to DIN VDE 0660-209
- Available for various operating voltages

Dimensions 105 x 96 x 58 mm

Note: Technical Specifications may be found on page 178

Model Designation

AES 7112-24VAC

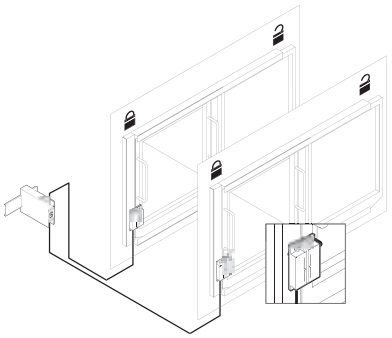
AES 7112-110VAC

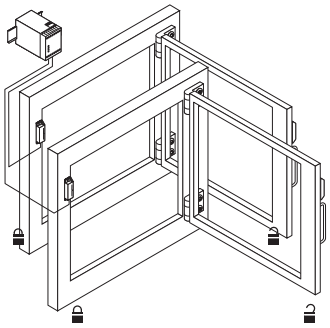
AES 7112-230VAC

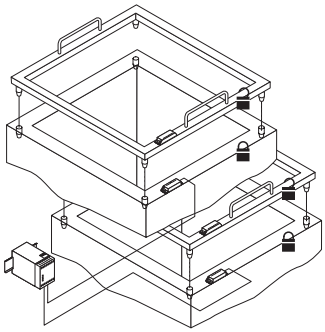
Approvals **BG UL CSA**

AES 7112 to Monitor Two Devices

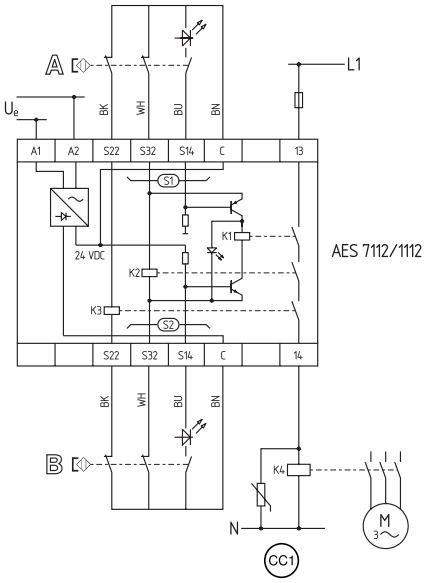
Typical Applications







Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- AES to monitor two guard devices for Control Category 1 to EN 954-1.
- Only suitable for the connection of magnetic safety sensors.
- Monitoring of two guard devices each fitted with one BNS .. -12z range magnetic safety sensor.
- The wiring diagram is with guard devices closed and shows the de-energized condition.

Circuit Options

- **Monitoring One Guard Device**
  When only one magnetic safety sensor is connected, the terminals S22, S32, S14 and C of S1 are used and jumper connections must be wired between the terminals S22, S32 and C of S2.
- **Series-Parallel Circuits**
  Further guard devices can be monitored using BNS 33..-12z-2187 range magnetic safety sensors by using series-parallel circuits.

Guard Door and E-Stop Safety Controllers

Safety Category (EN954-1): CC4

AZR 11 RT2 to Monitor One Device

Stop Category (EN60204-1): 0

Dimensions 22.5 x 82 x 98.8 mm

Features

- Control Category 4 to EN 954-1
- 1 enabling circuit
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors, switching mats or E-stops
- NO-NC contact combination can be connected
- Can be used as emergency-stop controller for stop Category 0 to EN 60204-1
- Monitoring for short-circuit between connections on 2 channel circuit
- 1 or 2 channel operation possible
- Manual or automatic reset function
- Additional short-circuit proof semiconductor output
- Operational voltage 24 VDC
- Start function
- Feedback circuit to monitor external relays
- 2 LED's to show operating conditions
- Additional outputs by means of output expansion modules

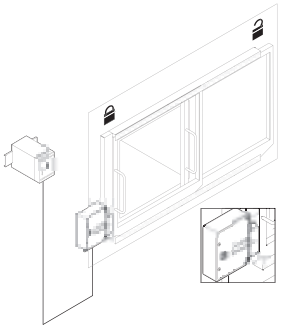
Note: Technical Specifications may be found on page 185

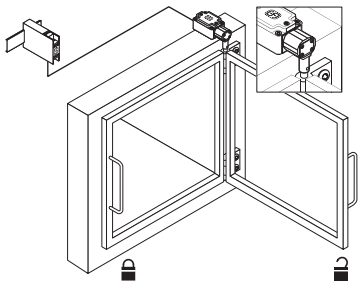
Model Designation AZR 11 RT2-24VDC

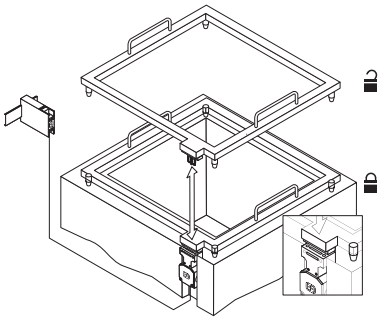
Approvals **BG UL CSA**

AZR 11 RT2 to Monitor One Device

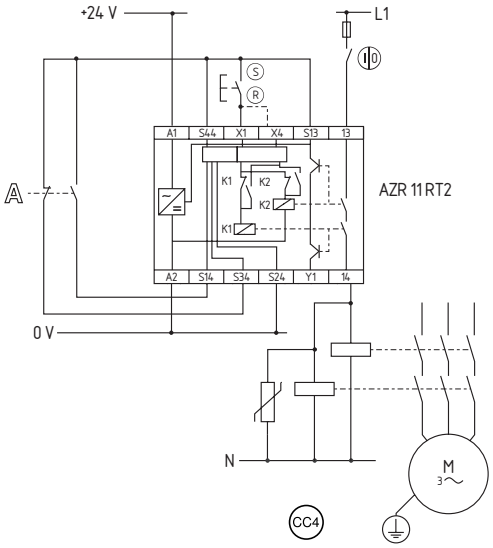
Typical Applications







Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

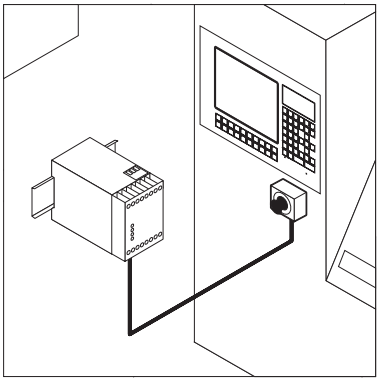
- AZR 11 RT2 to achieve up to Control Category 4 to EN 954-1.
- The wiring diagram shown is however only to Control Category 3 to EN 954-1.
- Monitoring of a sliding and hinged guard device with a safety switch or a removable guard cover with a safety switch with separate actuator A.
- The NC contact of A must have positive opening function when the guard device is opened.
- The wiring diagram is with guard devices closed and shows the de-energized condition, whereby the normally closed contacts connected must be closed.

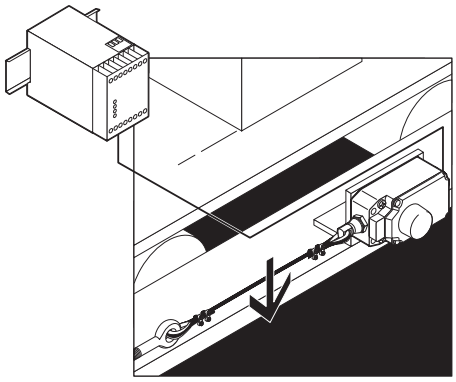
Circuit Options

- **Start Pushbutton** Ⓢ
  A start pushbutton (NO) can optionally be connected to the input X1. With the guard device(s) closed, the enabling circuits are then not closed until the start pushbutton has been operated.
- **Feedback Circuit**
  In the wiring diagram, a feedback circuit is connected. If the feedback circuit is not used, a jumper must be placed between input X1 and terminal S13.

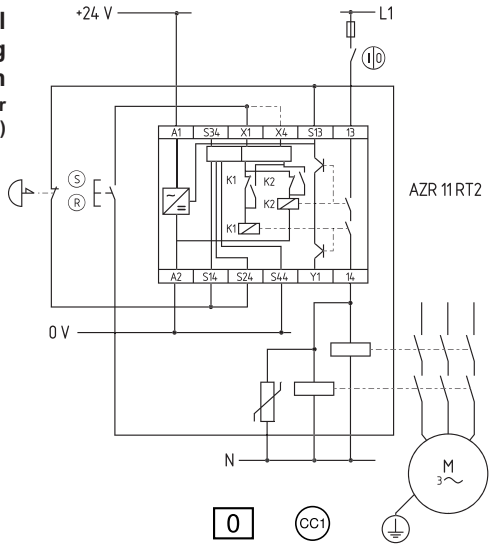
AZR 11 RT2 to Monitor One Device

Typical Applications





Typical Wiring Diagram
(See page 21 for symbol key)

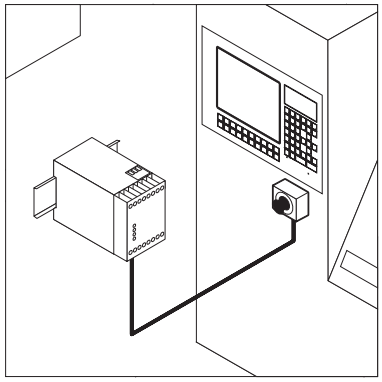


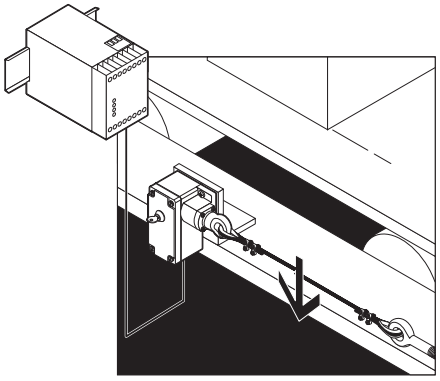
Application Notes

- The safety controller fulfills stop Category 0 to EN 60 204-1
- The wiring diagram shown only achieves Control Category 1 to EN 954-1, because it is only single channel.
- However, by using two-channel circuits, AZR 11 RT 2 can achieve Control Category 4.
- Without short-circuit monitoring between connections AZR safety controller being used for single-channel monitoring of an emergency-stop command device such as a switch or ZS range pull-wire unit and power contactors.
- The reset pushbutton Ⓡ must be operated to close the enabling circuits if a jumper is not placed between X1 and X4.
- The diagram is shown for the de-energized condition.

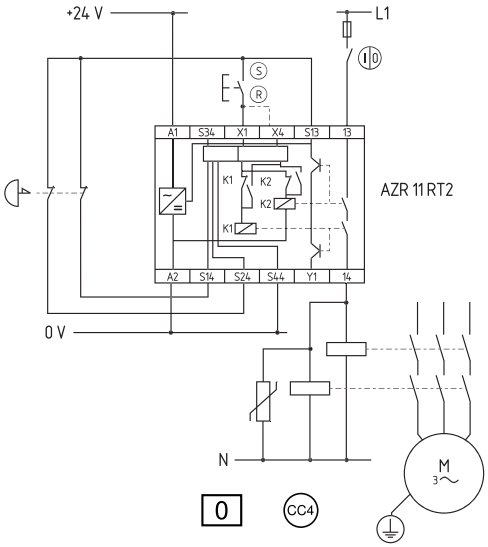
AZR 11 RT2 to Monitor One Device

Typical Applications





Typical Wiring Diagram
(See page 21 for symbol key)

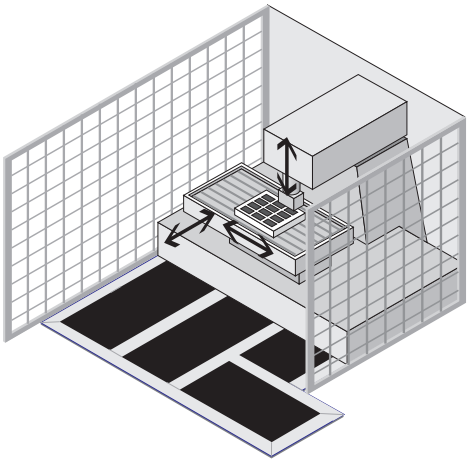


Application Notes

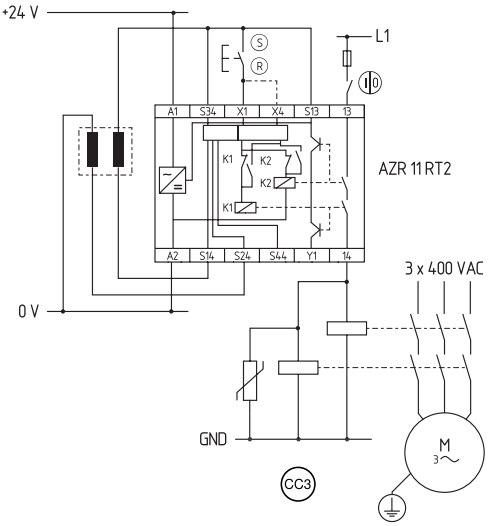
- The safety controller fulfills Category 0 to EN 60 204-1.
- Achieves Control Category 4 to EN 954-1.
- Without short-circuit monitoring between connections.
- AZR safety controller being used for two-channel monitoring of an emergency-stop command device such as a switch or ZS range pull-wire unit and power contactors.
- Reset pushbutton ®
- The diagram is shown for the de-energized condition.

Monitoring Safety Switching Mats Using AZR 11 RT2

Typical Application



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- Achieves Control Category 3 to EN 954-1
- Monitoring a safety switching mat and power contactors using the AZR safety controller with manual or automatic reset.
- The wiring diagram shows the de-energized condition and is without feedback circuit.

Circuit Options

- **Reset Ⓡ or Start Ⓢ Pushbutton**
  A reset or start pushbutton can be connected to terminals X1 and X4. If no pushbutton is connected, a jumper connection must be wired between X1 and X4.
- **Connection of Several Safety Switching Mats**
  For monitoring of a large area, using the modular mat system, the safety switching mats are connected in series.

FaultFinder™

Safer
by
Design

Guard Door and E-Stop Safety Controllers

AZR 31 R2 to Monitor One Device

Safety Category (EN954-1): CC4

Stop Category (EN60204-1): 0

Dimensions 45 x 73.2 x 121 mm

Features

- Control Category 4 to EN 954-1
- 3 enabling circuits
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors, switching mats and strips or E-stops
- 2 NC contacts can be connected
- Can be used as emergency-stop controller for stop Category 0 to EN 60204-1
- Is also suitable for use as safety controller for two-hand operation
- With monitored manual reset for increased security
- 1 auxiliary contact (NC)
- Cross-wire monitoring
- Removable terminal block
- Start-stop function
- Feedback circuit to monitor external contactors
- 4 LED's to show operating conditions

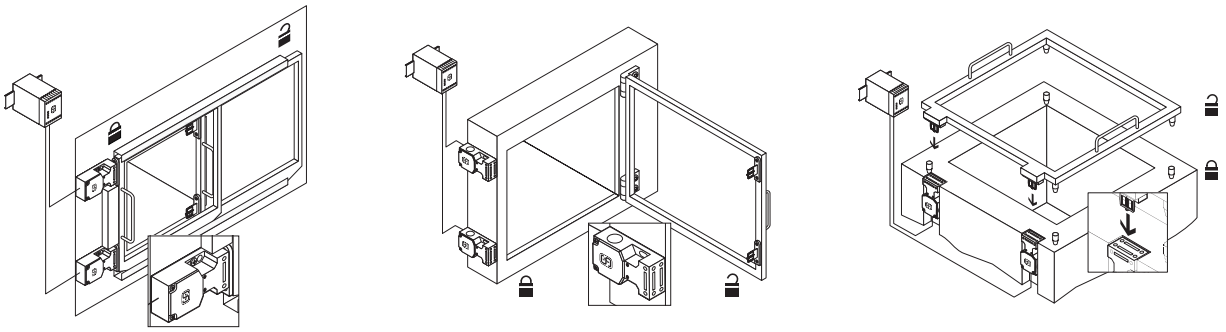
Note: Technical Specifications may be found on page 185

Model Designation	**AZR 31 R2-24VAC**
	AZR 31 R2-24VDC
	AZR 31 R2-110VAC
	AZR 31 R2-230VAC

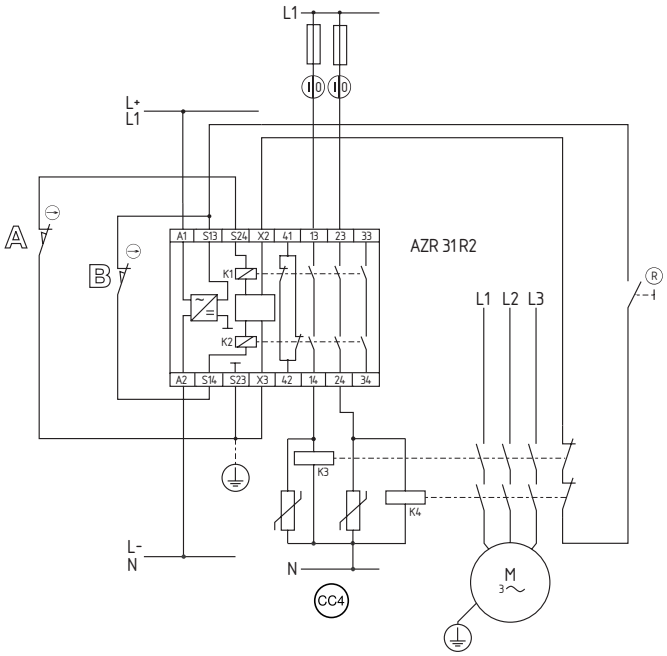
Approvals **BG UL CSA**

AZR 31 R2 to Monitor One Device

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

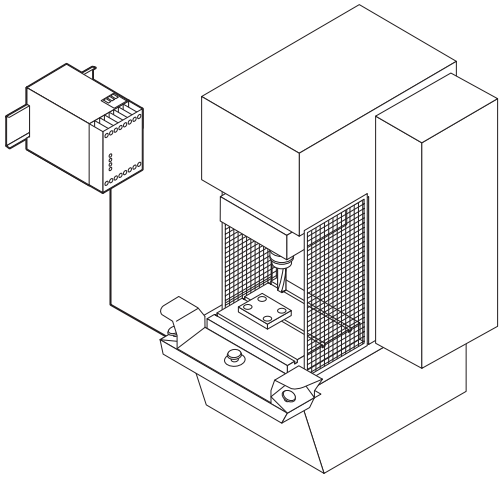
- NC contacts must have positive opening function when the guard device is opened.
- The feedback circuit monitors the positions of the positive-drive NC contacts on the contactors K3 and K4. If the feedback circuit is not needed, the reset button must be directly connected between the inputs X2 and S13.
- The wiring diagram is with guard devices closed and shows the de-energized condition, whereby the normally closed contacts connected must be closed.

Circuit Options

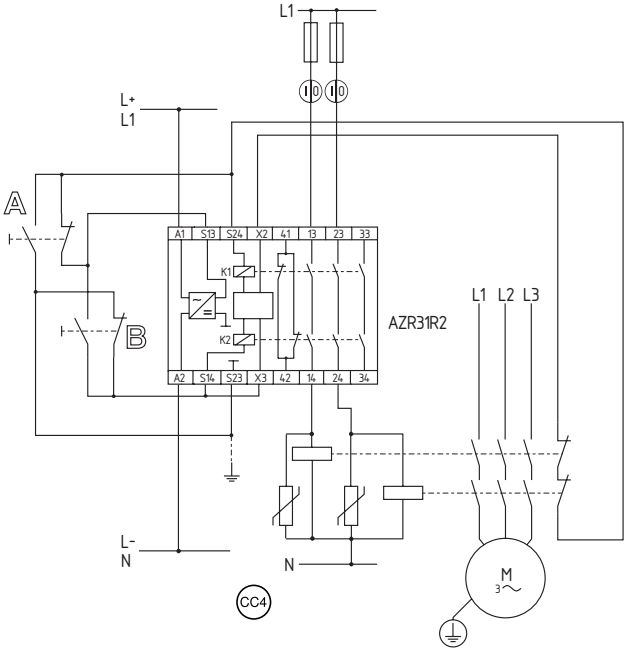
- **Reset Pushbutton ®**
  A reset pushbutton (NO) must be connected to the input X2 and terminal S13. With the guard device closed, the enabling circuits are not closed until the reset pushbutton has been operated.

Monitoring Two-Hand Operating Consoles Using AZR 31 R2

Typical Application



Typical Wiring Diagram
(See page 21 for symbol key)

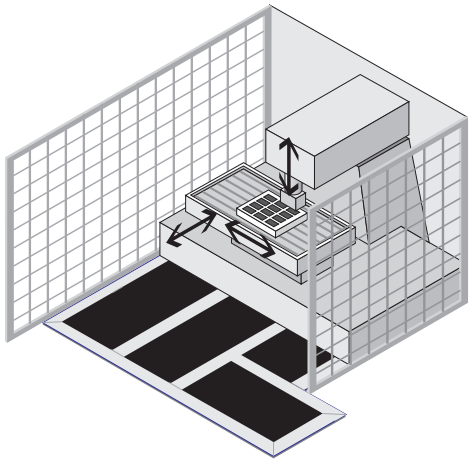


Application Notes

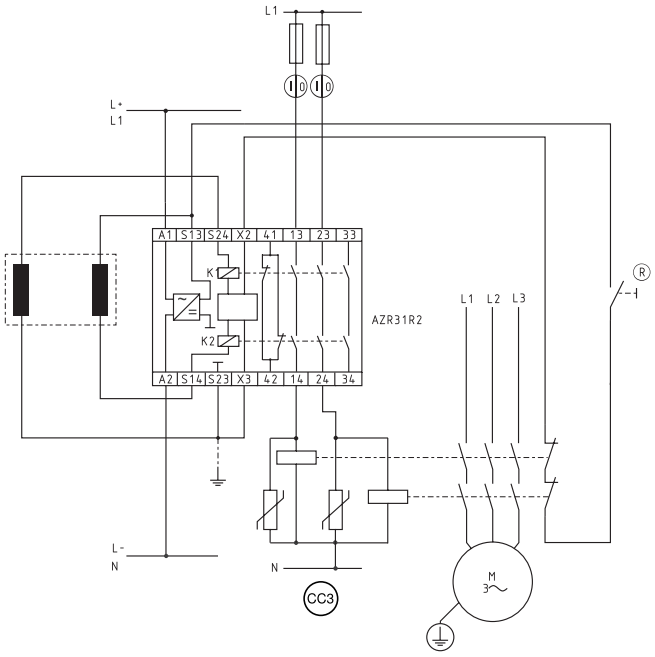
- To achieve Control Category 4 to EN 954-1
- Monitoring a two-hand operating console and power contactors using the AZR safety controller.
- Monitoring for simultaneous operation, i.e. both pushbuttons must be operated within 0.5s of each other, otherwise the enabling circuits are not closed.
- The wiring diagram shows the de-energized condition.

Monitoring Safety Switching Mats Using AZR 31 R2

Typical Application



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- To achieve Control Category 3 to EN 954-1
- Monitoring a safety switching mat and power contactors using the AZR safety controller with manual reset.
- The wiring diagram shows the de-energized condition.

Circuit Options

- **Connection of Several Safety Switching Mats**
  For monitoring of a large area, using the modular mat system, the safety switching mats are connected in series.
- **Reset Pushbutton** ®
  A reset pushbutton (NO) is connected in the feedback circuit.

Fail-to-Safe Standstill Monitors

Safety Category (EN954-1): CC4

AZR 31 S1

Features

- Sensor-free registration of standstill by monitoring e.m.f.
- Direct connection to three-phase motors
- Control Category 4 to EN 954-1
- 3 enabling circuits
- 1 auxiliary contact
- Available for various operational voltages
- Feedback circuit to monitor external relay
- 5 LED's to indicate operating conditions
- No required-value setting needed
- Removable terminal block
- Wire-breakage monitoring of measuring inputs
- Self-test with fault memory
- Cyclic self-monitoring

Dimensions 45 x 73.2 x 121 mm

The following faults are recognized by the safety controller and indicated by means of the LED's

- Wire-breakage monitoring of measurement inputs
- Error indication after 9 self-test cycles

Note: Technical Specifications may be found on page 190

Model Designation

AZR 31 S1-24VDC

AZR 31 S1-24VAC

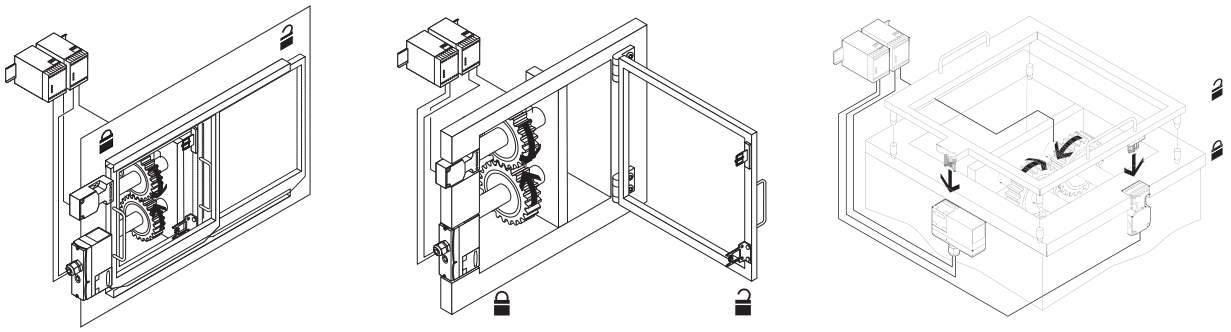
AZR 31 S1-110VAC

AZR 31 S1-230VAC

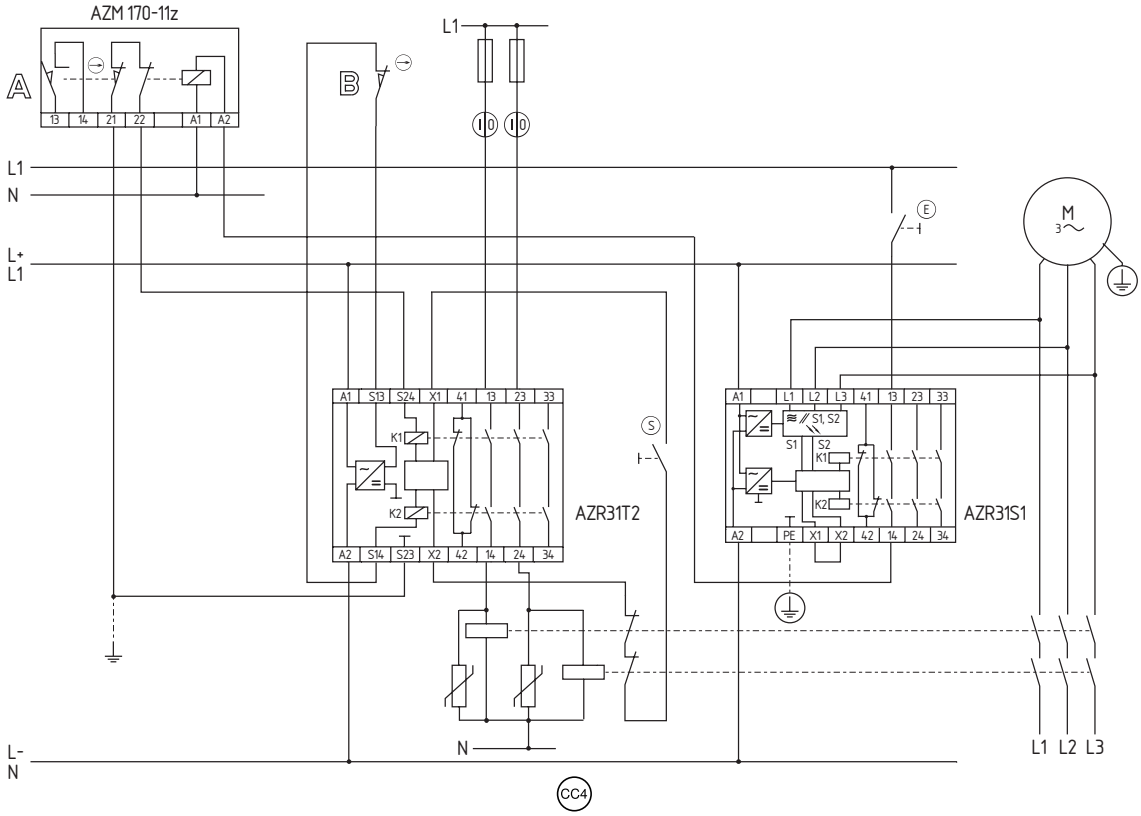
Approvals **BG UL CSA**

AZR 31 S1

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- The sensor-free standstill monitor checks the e.m.f. of the three-phase motor.
- Achieves Control Category 4 to EN 954-1
- AZR range guard door controller checks the position of the guard device.
- Monitoring of the guard device using a solenoid interlock and a safety switch with separate actuator.
- Release takes place by means of the normally open contact only when the run-down movement has come to an end.
- After release has taken place, the guard device must be opened.
- The wiring diagram is with the guard device closed and shows the de-energized condition.

Guard Door and E-Stop Safety Controllers

AZR 31 T0

Safety Category (EN954-1): CC1

Stop Category (EN60204-1): 0

Features

- Control Category 1 to EN 954-1
- Stop category 0 to EN 60 204-1
- 3 enabling circuits
- 1 auxiliary contact (NC)
- Operational voltage 24 V AC/DC
- Start-stop function
- Feedback circuit
- 2 LED's to show operating conditions
- Can be used as an output expansion module

Dimensions 22.5 x 82 x 98.8 mm

Note: Technical Specifications may be found on page 184

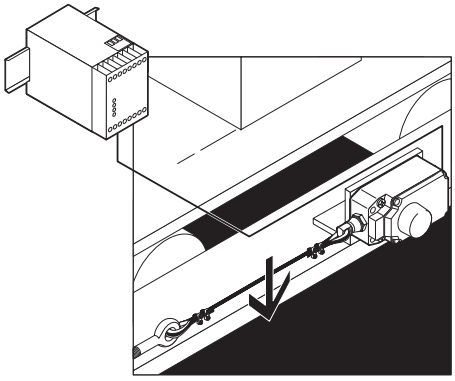
Model Designation	**AZR 31 T0-24VAC/DC**

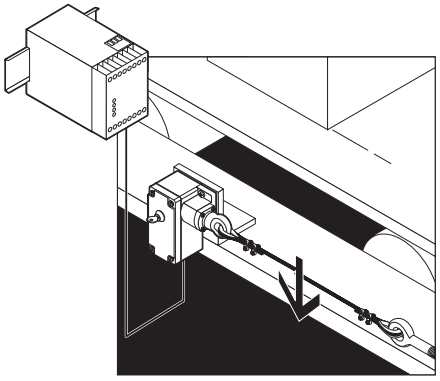
Approvals	**BG UL CSA**

AZR 31 T0

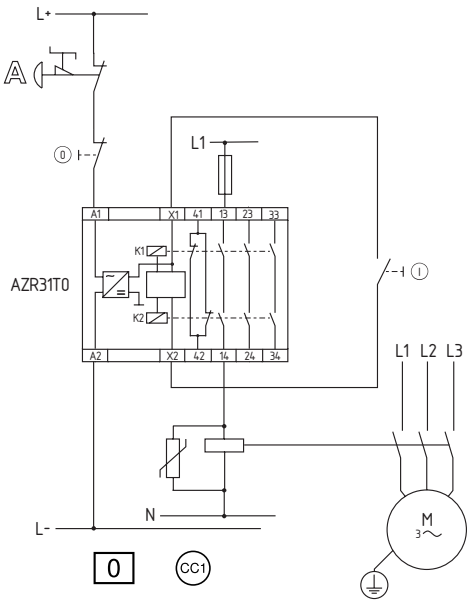
FaultFinder™

Typical Applications





Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- The safety controller fulfills stop Category 0 to EN 60 204-1.
- The wiring diagram shown achieves Control Category 1 to EN 954-1.
- AZR safety controller being used to monitor an emergency-stop.
- The diagram is shown for the de-energized condition.

Guard Door and E-Stop Safety Controllers

Safety Category (EN954-1): CC4

AZR 31 T2 to Monitor One Device

Stop Category (EN60204-1): 0

Features

- Control Category 4 to EN 954-1
- 3 enabling circuits
- Monitoring of mechanical position switches, safety switches, solenoid interlocks, coded magnet sensors, switching mats or E-stops
- 2 NC contacts can be connected
- Can be used as emergency-stop controller for stop Category 0 to EN 60204-1
- 1 auxiliary contact (NC)
- Cross-wire monitoring
- Automatic reset function
- Removable terminal block
- Start-stop function
- Feedback circuit to monitor external contactors
- 4 LED's to show operating conditions
- Additional contacts by means of output expansion

Dimensions 45 x 73.2 x 121 mm

Note: Technical Specifications may be found on page 185

Model Designation

AZR 31 T2-24VDC

AZR 31 T2-24VAC

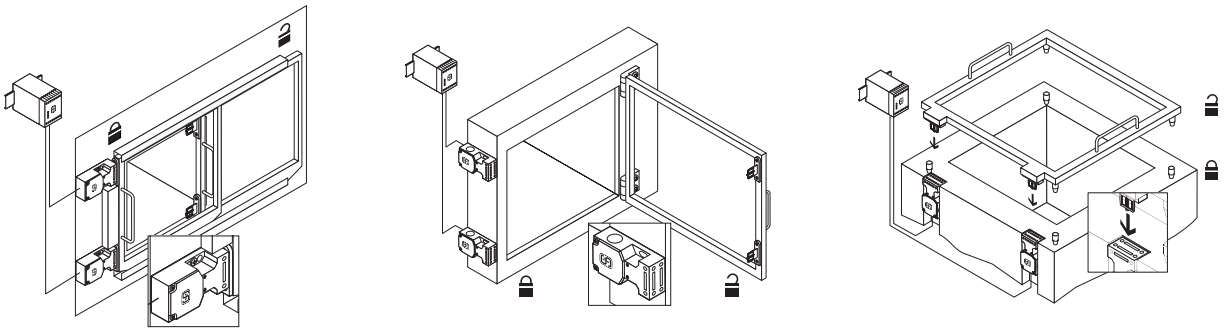
AZR 31 T2-110VAC

AZR 31 T2-230VAC

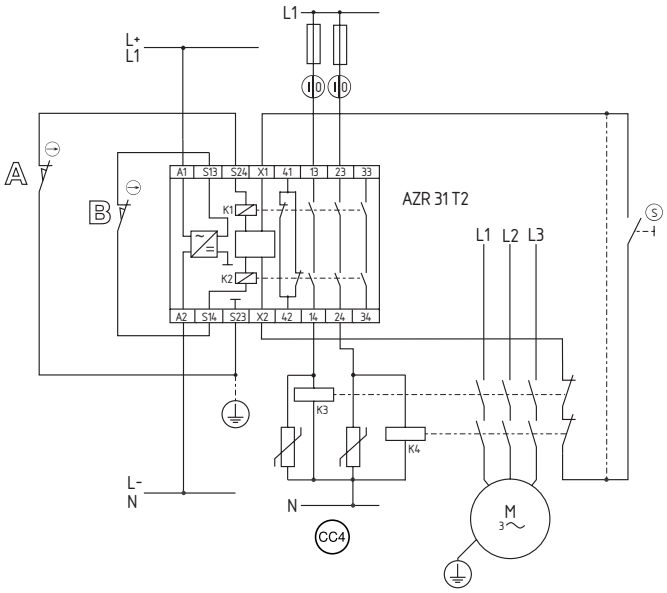
Approvals **BG UL CSA**

AZR 31 T2 to Monitor One Device

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

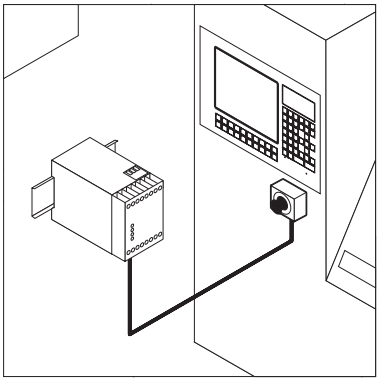
- NC contacts must have positive opening function when the guard device is opened.
- The feedback circuit monitors the positions of the positive-drive NC contacts on the contactors K3 and K4. If the feedback circuit is not needed, a jumper connection is to be fitted between the inputs X1 and X2.
- The wiring diagram is with guard devices closed and shows the de-energized condition, whereby the normally closed contacts connected must be closed.

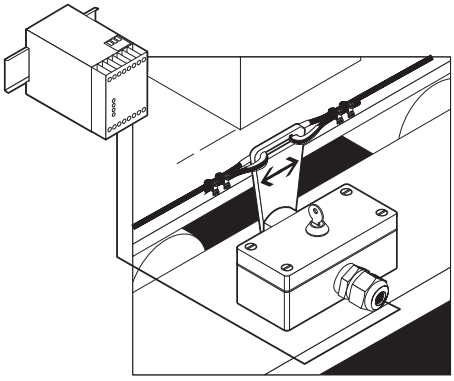
Circuit Options

- **Start Pushbutton Ⓢ**
  A start pushbutton (NO) can optionally be connected to the inputs X1 and X2. With the guard device(s) closed, the enabling circuits are then not closed until the start pushbutton has been operated. If neither start button nor feedback circuit are connected, a jumper must be wired between X1 and X2.

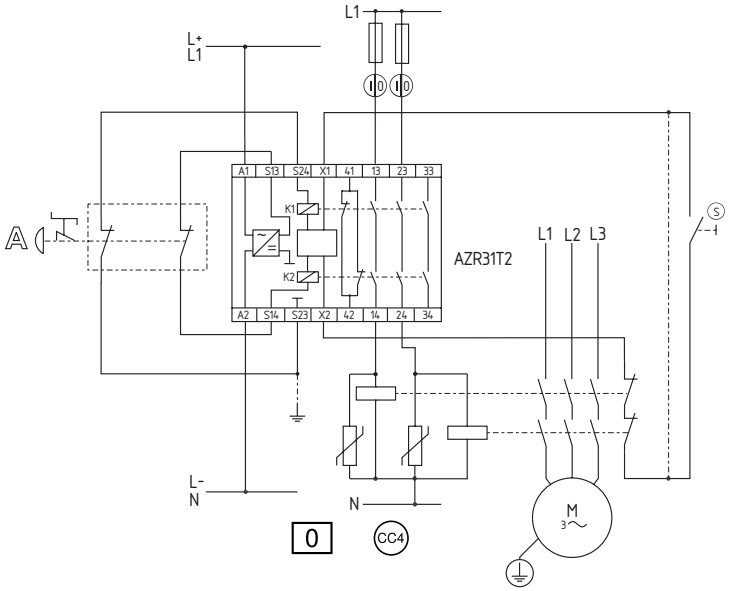
AZR 31 T2 to Monitor One Device

Typical Applications





Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

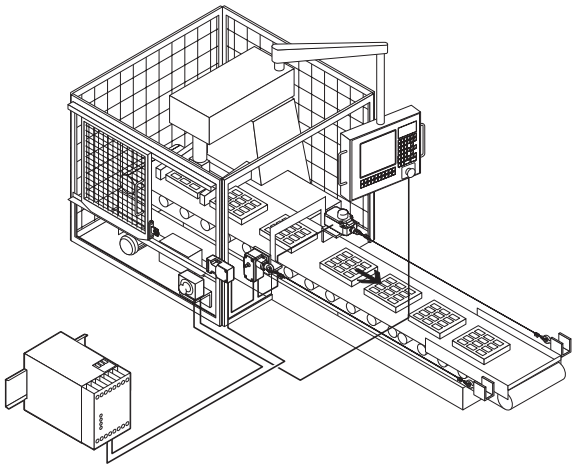
- The safety controller fulfills Category 0 to EN 60 204-1.
- Secures to Control Category 4 to EN 954-1.
- AZR safety controller being used to monitor an emergency-stop.
- The diagram is shown for the de-energized condition.

Circuit Option

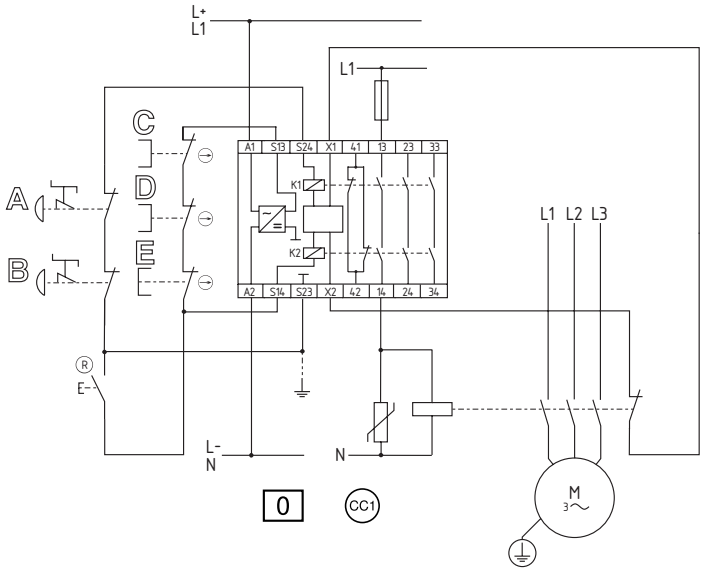
- **Start Pushbutton** Ⓢ
  A start pushbutton can optionally be connected between the terminals X1 and X2. If no start pushbutton is used, a jumper must be wired between X1 and X2.

AZR 31 T2 to Monitor One Device

Typical Application



Typical Wiring Diagram
(See page 21 for symbol key)

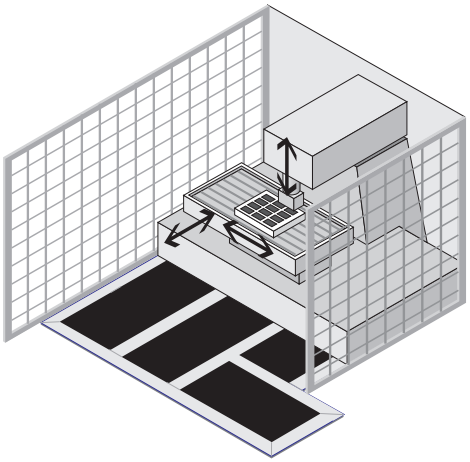


Application Notes

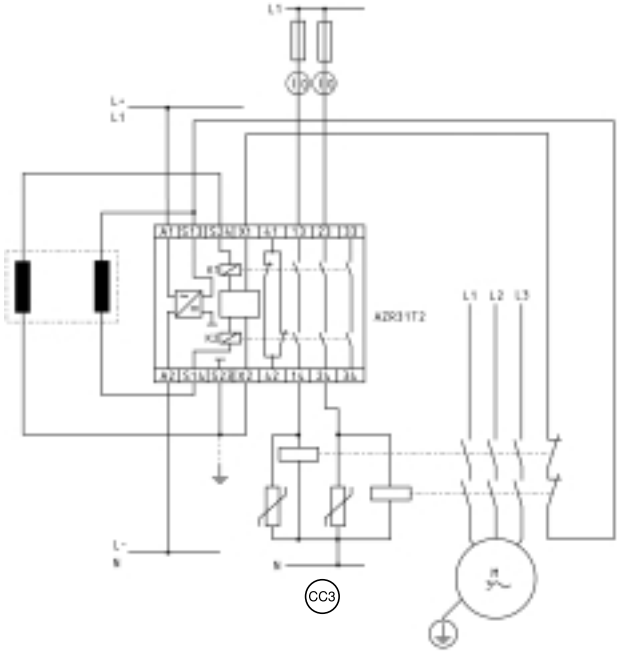
- The safety controller fulfills stop Category 0 to EN 60 204-1.
- The arrangement shown in the wiring diagram serves to achieve Control Category 1 to EN 954-1.
- AZR safety controller being used to monitor two emergency-stop switches (A and B), two ZS pull-wire switches (C and D) and a safety switch of the AZ 16 range with separate actuator (E) as well as a power contactor.
- The diagram is shown for the de-energized condition.

Monitoring Safety Switching Mats Using AZR 31 T2

Typical Application



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- To achieve Control Category 3 to EN 954-1
- Monitoring a safety switching mat and power contactors using the AZR safety controller with automatic reset.
- The wiring diagram shows the de-energized condition.

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Safety Controller Expansion Modules

Safety Category (EN954-1): CC4

AZR 62 A2 Output Expansion Module

Stop Category (EN60204-1): 0

Features

- Control Category 4 to EN 954-1
- Stop category 0 to EN 60 204-1
- 6 enabling circuits
- 2 auxiliary circuits:
  2 NC contacts in series
  2 NC contacts in parallel
- 1 or 2 channel operation
- Monitoring for short-circuit between connections
- LED indication of operating conditions
- Removable terminal block
- To provide additional contacts

Dimensions 100 x 73.2 x 121 mm

Note: Technical Specifications may be found on page 186

Model Designation

AZR 62 A2-24VDC

AZR 62 A2-24VAC

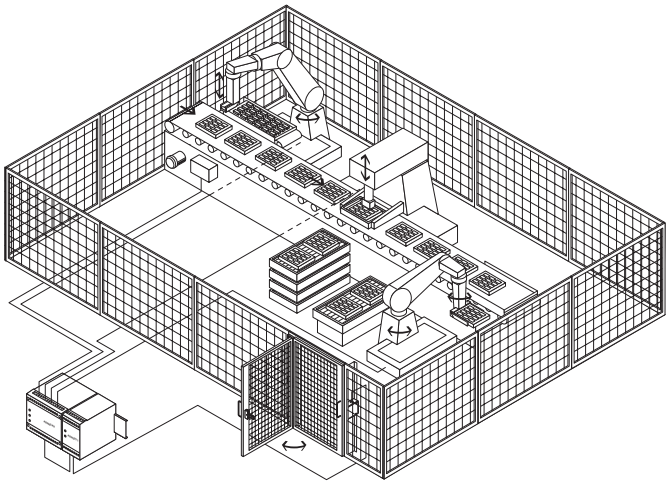
AZR 62 A2-110VAC

AZR 62 A2-230VAC

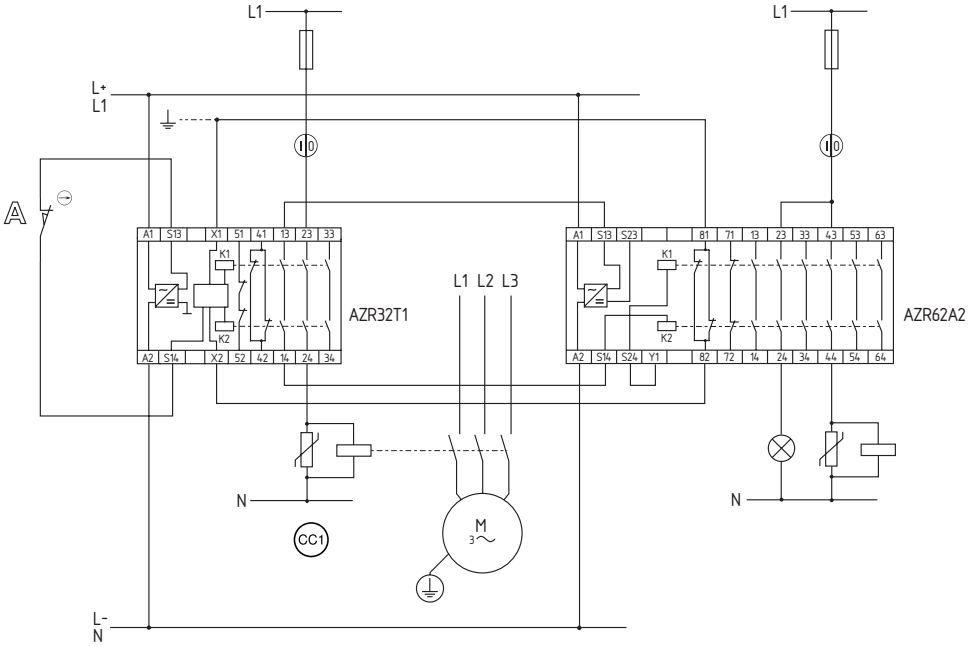
Approvals **BG**

AZR 62 A2 Output Expansion Module

Typical Application



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- The output expansion module is suitable to achieve Control Category 4 to EN 954-1 and stop Category 0 to EN 60 204-1.
- The wiring diagram shown achieves Control Category 1 to EN 954-1.
- AZR 62 A2 output expander to provide additional contacts for a guard door controller.
- The six enabling circuits serve to switch off machine processes and sequences.
- AZR 32 T1 guard door controller to secure a guard device using a safety switch.
- The normally closed contact of the safety switch (A) must have positive opening function when the guard device is opened.
- The wiring diagram is with the guard device closed and shows the de-energized condition.

Safety Controller Expansion Modules

Stop Category (EN60204-1): 1

AZR 63 V2 Output Expansion Module

Features

- Stop category 1 to EN 60 204-1
- 6 enabling circuits
- 3 auxiliary circuits:
  1 undelayed NO contact
  2 delayed NC contacts in series
  2 delayed NC contacts in parallel
- 1 or 2 channel operation
- Monitoring for short-circuit between connections
- LED indication of operating conditions
- Removable terminal block
- Off-delay can be set between 0 and 30s in 2 second steps

Dimensions 100 x 73.2 x 121 mm

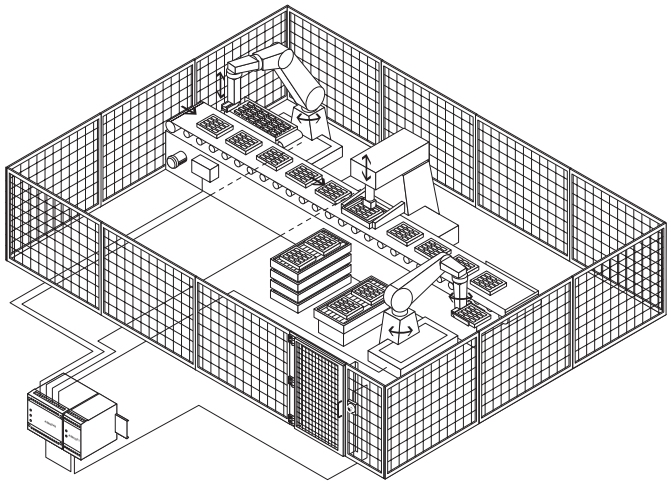
Note: Technical Specifications may be found on page 186

Model Designation	**AZR 63 V2-24VDC**
	AZR 63 V2-24VAC
	AZR 63 V2-110VAC
	AZR 63 V2-230VAC

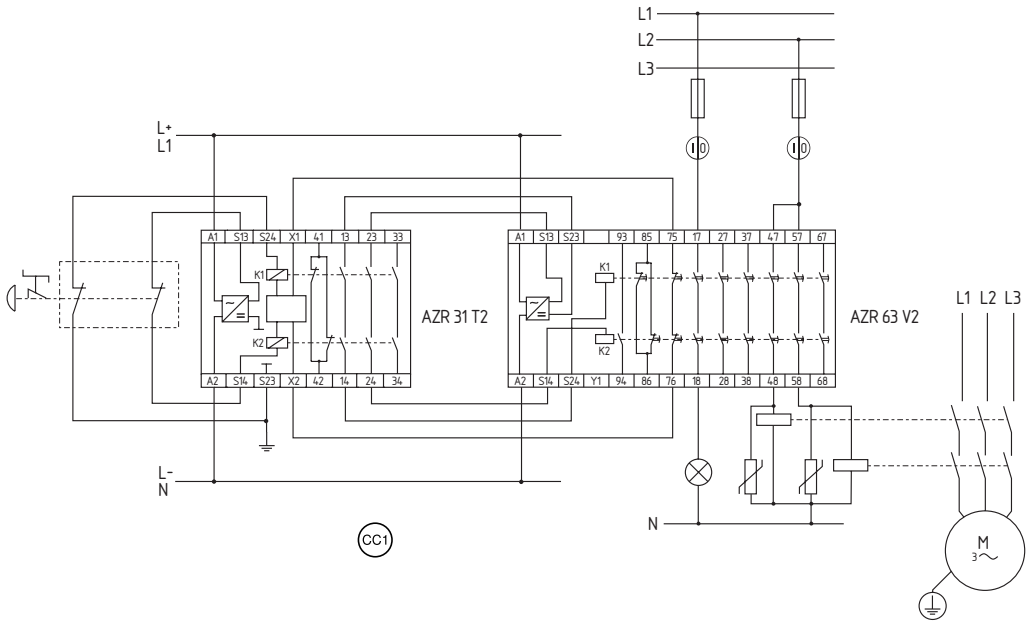
Approvals **BG**

AZR 63 V2 Output Expansion Module

Typical Application



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- The output expansion module is suitable for achieving stop Category 1 to EN 60 204-1.
- The wiring diagram shown achieves Control Category 1 to EN 954-1.
- AZR 63 V2 output extension to provide additional contacts for a safety controller for emergency stop applications.
- The six enabling circuits serve for the controlled switching off of machine processes and sequences.
- The enabling circuits remain active in accordance with the preset time.
- The normally open auxiliary contact 93/94 can be used for visual display of the beginning of the delay time.
- AZR 32 T2 safety controller to monitor a two channel emergency stop switch.
- The wiring diagram is with the guard device closed and shows the de-energized condition.

Guard Door and E-Stop Safety Controllers

Safety Category (EN954-1): CC3

Input Expander AES-E 3035 to monitor four guard devices

Stop Category (EN60204-1): 0

Features

- Control Category 3 to EN 954-1
- Monitor up to 4 guard devices
- Type of contact on inputs can be freely selected for each guard device: 2 NC or 1 NO + 1 NC contact
- Cross-wire monitoring
- Microprocessor control
- Start function
- 5 short-circuit proof additional transistor outputs for visual display of guard door positions
- Integral System Diagnostics (ISD)
- Enable delay time can be modified

Dimensions 99.7 x 75 x 110 mm

ISD

The following faults are recognised by the safety monitoring module and indicated by the ISD

- Failure of the door contacts open or close
- Cross-wire or short-circuit monitoring of the connections
- Interruption of the switch connections
- Failure of safety outputs to switch over
- Faults on input circuits of the safety monitoring module
- Short-circuit on or overloading of the additional transistor outputs

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 194

Technical specifications can be found on page 187.

Model Designation

AES-E 3035- 24Vdc

AES-E 3035- 110Vac

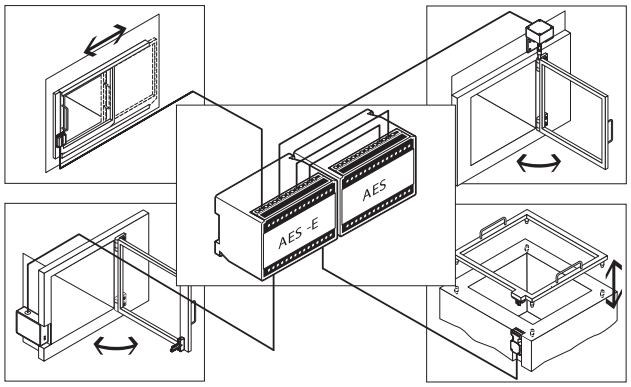
AES-E 3035- 230Vac

Function Table		Additional semi-conductor output Y	Function of output Y
	AES-E 3035	Y1	Guard Device 1 open
		Y2	Guard Device 2 open
		Y3	Guard Device 3 open
		Y4	Guard Device 4 open
		Y5	System O.K.

Approvals BG

Input Expander AES-E 3035 to monitor four guard devices

Typical Application



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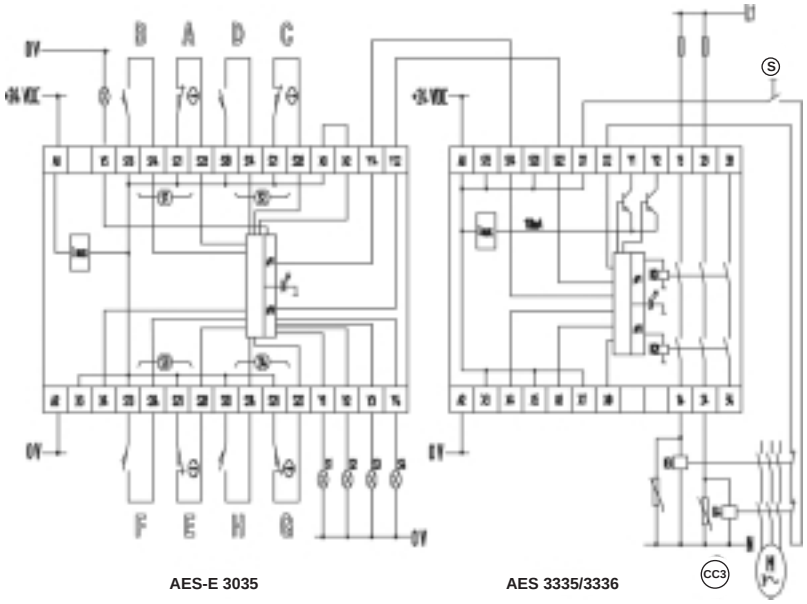
Typical Wiring Diagram
(See page 21 for symbol key)



AES-E 3035 AES 3335/3336

Application Notes

- AES-E 3035 to secure four independently operating guard devices for Control Category 3 to EN 954-1.
- Monitoring four guard devices with various safety switches (A to H) in combination with an AES Series guard door monitor.
- The NC contacts of A, C, E and G must have positive break when the guard device is opened. A for evaluation of the AES-E 3035.
- The feedback circuit of the AES range guard door monitor connected checks the positions of the positive-guided NC contacts on the contactors K3 and K4.
- Control Category 3 to EN 954-1 can also be achieved with only one safety switch per guard device (Inputs A, C, E and G). Exclusion of faults due to “Breakage or release of the actuating element or actuator; as well as release, dismantling or sliding of the position switch” is to be substantiated and documented.
- Any guard door monitor AES Series unit of Control Category 3 to EN 954-1 can be used for evaluation of the AES-E 3035.
- The wiring diagram shows the deenergised condition.

Circuit Options

- **Start push button** Ⓢ
  A start push button can be connected to the terminals X1 and X2 on the AES-E 3035. If no push button is connected, a jumper must be mounted between these terminals.
- **Extension of the enable delay time**
  The enable delay time can be increased from 0.1 s to 1 s by changing the position of a jumper under the cover of the unit.
- **Selection of monitoring**
  Monitoring of 1NO/1NC or 2 NC contacts is selectable by changing the position of a jumper under the cover of the unit.

Fail-to-Safe Timer

AZS 2305

Safety Category (EN954-1): CC3

Features

- Time can be set between 0.1s and 99min.
- To EN 1088
- Control Category 3 to EN 954-1
- 3 enabling circuits
- Recognition of short-circuit between connections
- 2 short-circuit proof additional transistor outputs
- Integral System Diagnostics (ISD)
- 2 channel microprocessor control

Dimensions 55 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Failure of the unit's internal safety relay to pull-in or drop-out
- Short-circuits between the input connections
- Interruption of the input connections
- Difference in time setting between channel I and channel II
- Faults on input or relay control circuits of the timer

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 195.

Technical Specifications may be found on page 188.

Model Designation

AZS 2305-24VDC

AZS 2305-110VAC

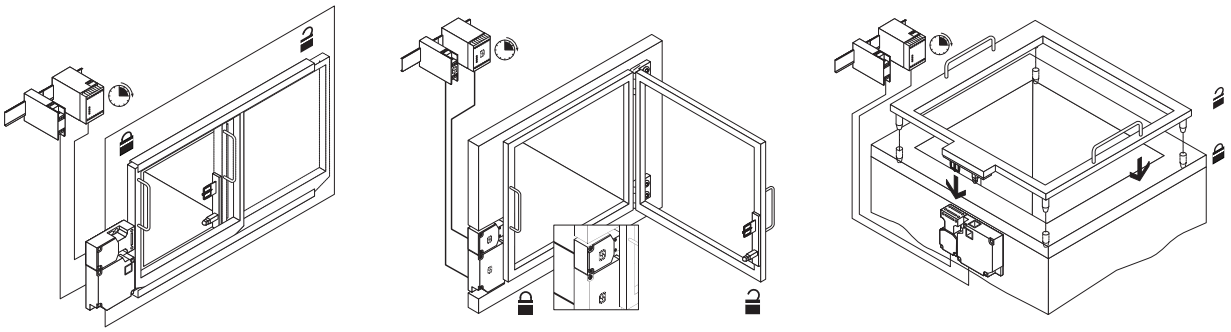
AZS 2305-230VAC

Function Table		Additional semi-conductor output Y	Function of output Y
	AZS 2305	Y1 Y2	Enable, enabling circuits closed No Enable, enabling circuits open

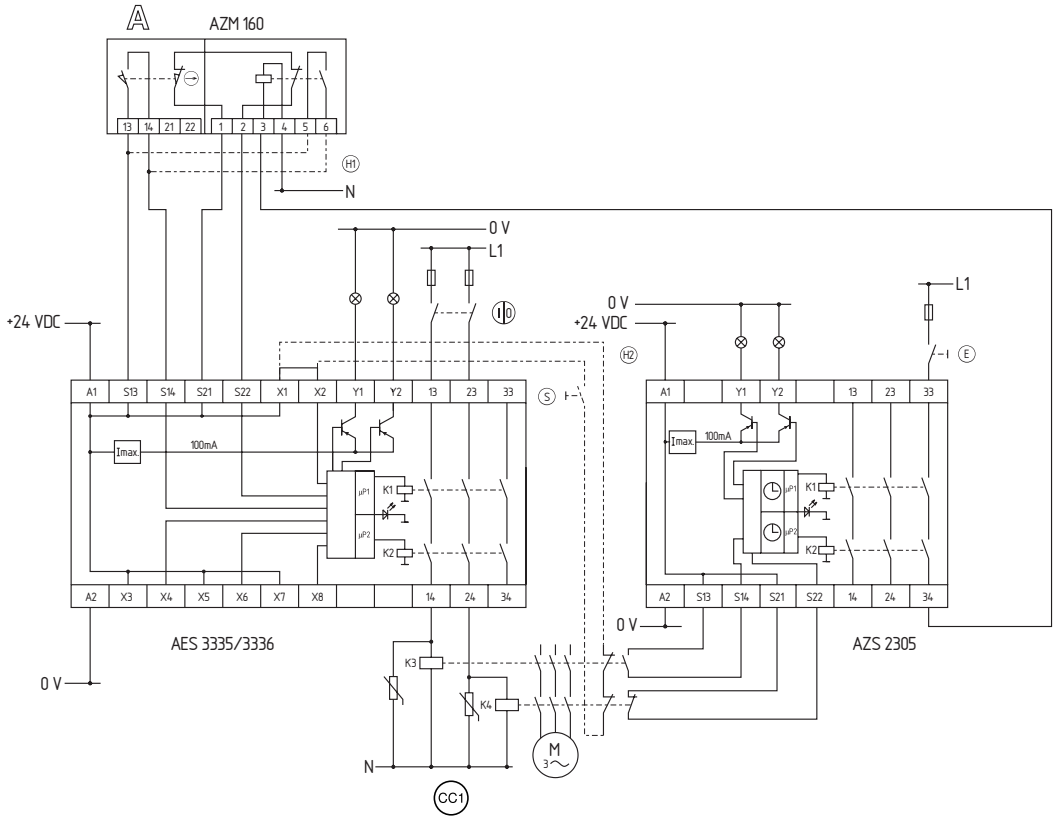
Approvals BG

AZS 2305

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- The arrangement in the wiring diagram fulfills Control Category 1 to EN 954-1.
- Control Category 3 can be achieved. Exclusion of faults due to “Breakage or release of the actuator, fault in the solenoid interlock” is to be substantiated and documented.
- Monitoring of a sliding, hinged or removable guard device using an AZM range solenoid interlock (A).
- The solenoid interlock releases the guard device only when the set time has elapsed. The time begins to run when the power contactors have dropped out.
- The AES range guard door controller checks the position of the guard device.
- The coil of the solenoid interlock is energized by operation of the push-button Ⓔ
- After release has taken place, the guard device must be opened if Ⓗ1 is not connected.
- The wiring diagram is with the guard device closed and shows the de-energized condition.

Fail-to-Safe Standstill Monitors

Safety Category (EN954-1): CC3

FWS 1105

Features

- Confirmation of standstill using 2 impulse sensors
- Control Category 3 to EN 954-1
- Operational voltage 24 VDC
- 1 enabling circuit
- Reset input
- 2 short-circuit proof semiconductor outputs
- Integral System Diagnostics (ISD)
- 2 channel microprocessor control
- Customer-specific standstill frequencies possible

Dimensions 22.5 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Interruption of the connections to one of the inductive proximity switches
- Failure of the proximity switches
- Failure of one channel being evaluated
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on input or relay control circuits of the safety controller

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 196.

Technical Specifications may be found on page 189

Model Designation

FWS 1105A-24VDC	(Execution A)
FWS 1105B-24VDC	(Execution B)
FWS 1105C-24VDC	(Execution C)

Standstill Frequencies

	Execution A	Execution B	Execution C
Input X1	1Hz	2Hz	1Hz
Input X2	2Hz	2Hz	1Hz

Function Table

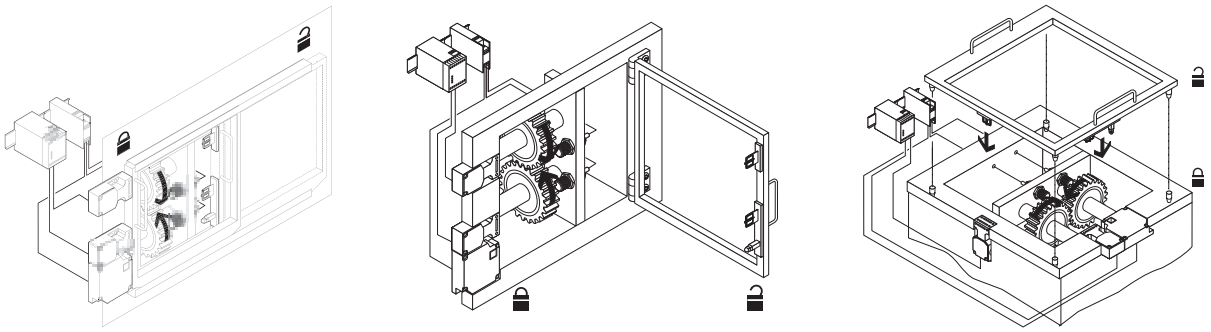
Additional transistor output Y	Function of output Y
Y1	Enable, Enabling circuits closed
Y2	Fault

Approvals **BG UL CSA**

FWS 1105

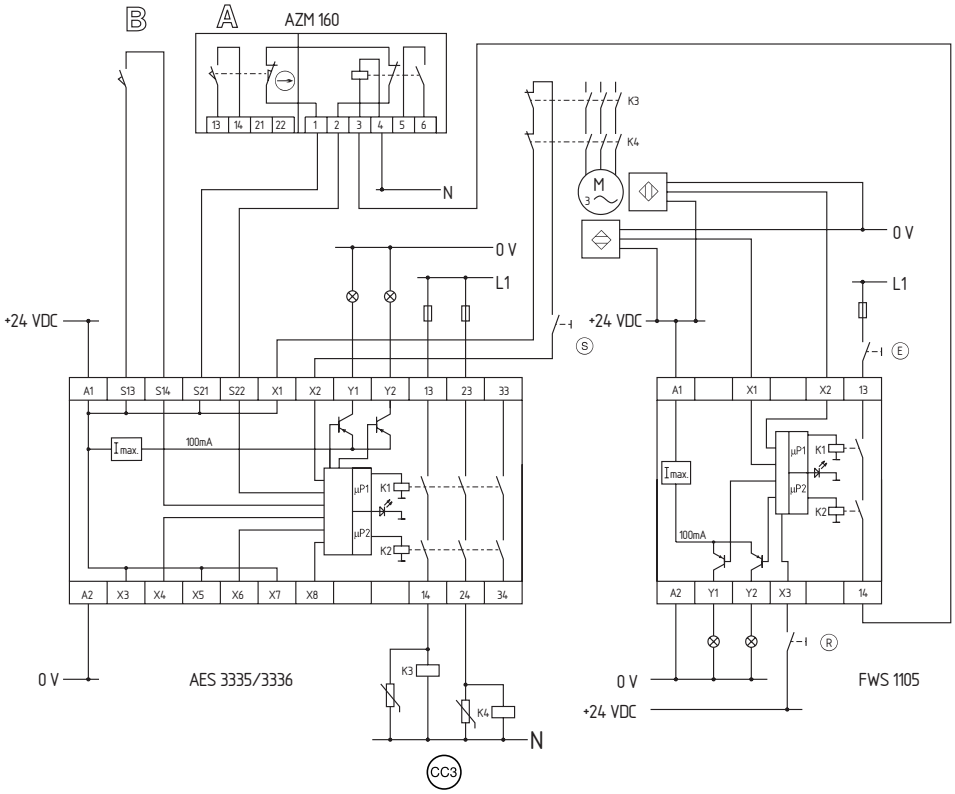
FaultFinder™

Typical Applications



Typical Wiring Diagram

(See page 21 for symbol key)



Application Notes

- The solenoid interlock can be opened when the FWS 1105 has registered standstill of the motor by means of the two PNP inductive proximity switches. The coil of the solenoid interlock is then energized by operation of the pushbutton Ⓔ
- The AES controller checks the position of the guard device.
- Monitoring of the guard device using a solenoid interlock and a safety switch with separate actuator.
- Control Category 3 can also be achieved without using the safety switch by connecting the NO and NC contacts of solenoid interlock to the guard door monitor. Exclusion of faults due to “Breakage or release of the actuator, fault in the solenoid interlock” is to be substantiated and documented.
- Release is only possible when the run-down movement has come to an end.
- After release has taken place, the guard device must be opened.
- The wiring diagram is with the guard device closed and shows the de-energized condition.

Fail-to-Safe Standstill Monitors

Safety Category (EN954-1): CC3

FWS 1106

Features

- Confirmation of standstill using only 1 or with 2 impulse sensors
- Uses additional standstill signal, e.g. PLC as second input channel
- Control Category 3 to EN 954-1
- Operational voltage 24 VDC
- 1 enabling circuit
- Reset input
- 2 short-circuit proof semiconductor outputs
- Integral System Diagnostics (ISD)
- 2 channel microprocessor control
- Customer-specific standstill frequencies possible

Dimensions 22.5 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Interruption of the connections to the inductive proximity switches
- Failure of the proximity switches
- Failure of one channel being evaluated
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on input or relay control circuits of the safety control unit

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 196.

Technical Specifications may be found on page 189

Model Designation

FWS 1106A-24VDC	(Execution A)
FWS 1106B-24VDC	(Execution B)
FWS 1106C-24VDC	(Execution C)

Standstill Frequencies

	Execution A	Execution B	Execution C*
Input X1	1Hz	2Hz	1Hz
Input X2	2Hz	2Hz	1Hz

*Recommended execution when using an impulse sensor. Other frequencies on request.

Function Table

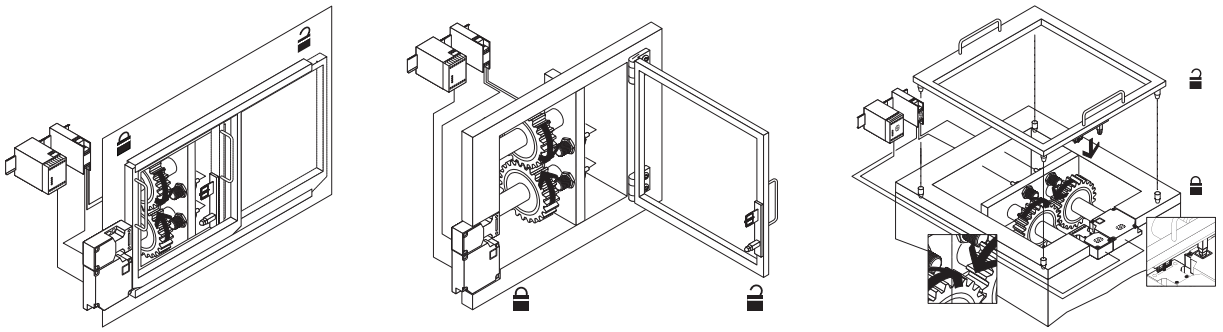
Additional transistor output Y	Function of output Y
Y1	Enable, Enabling circuits closed
Y2	Fault, high signal

Approvals **BG UL CSA**

FWS 1106

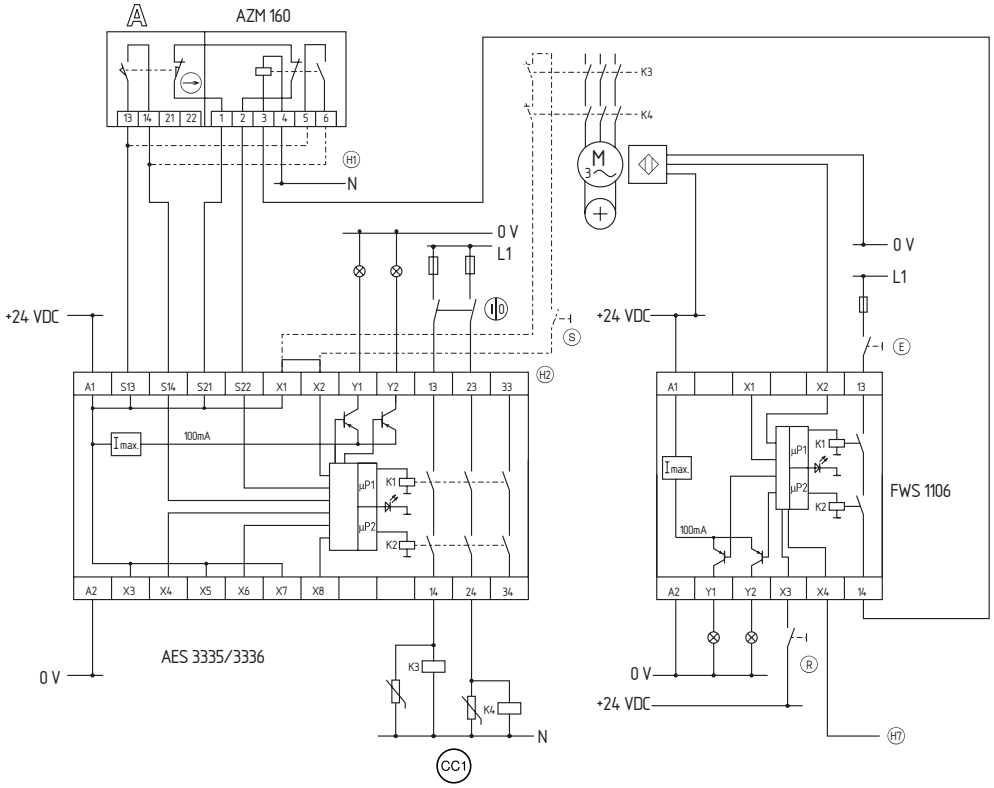
FaultFinder™

Typical Applications



Typical Wiring Diagram

(See page 21 for symbol key)



Application Notes

- The solenoid interlock can be opened when the FWS 1106 has registered standstill of the motor by means of the PNP inductive proximity switch and the additional standstill signal H7. The coil of the solenoid interlock is then energized by operation of the pushbutton E
- The AES controller checks the position of the guard device.
- Monitoring of the guard device using a solenoid interlock.
- To achieve Control Category 3 the exclusion of faults due to "Breakage or release of the actuator, fault in the solenoid interlock" is to be substantiated and documented.
- Release is only possible when the run-down movement has come to an end.
- After release has taken place, the guard device must be opened if H1 is not connected.
- The wiring diagram is with the guard device closed and shows the de-energized condition.

Fail-to-Safe Standstill Monitors

FWS 2316

Safety Category (EN954-1): CC3

Features

- Confirmation of standstill using 2 impulse sensors
- Control Category 3 to EN 954-1
- 3 enabling circuits
- Available for various operational voltages
- Short-circuit recognition by means of pulsed voltage supply to proximity switches
- Feedback circuit to monitor relays
- Reset input
- Short-circuit proof semiconductor output
- 1 auxiliary contact
- Integral System Diagnostics (ISD)
- 2 channel microprocessor control
- Customer-specific standstill frequencies possible

Dimensions 55 x 75 x 110 mm

ISD The following faults are recognized by the safety controller and indicated by means of ISD

- Interruption of the connections to the inductive proximity switches
- Short-circuit between connections
- Failure of the proximity switches
- Failure of one channel being evaluated
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on input or relay control circuits of the safety control unit

Note The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 196.

Technical Specifications may be found on page 189.

Model Designation

FWS 2316B-24VDC	(Execution B)	**FWS 2316C-24VDC**	(Execution C)
FWS 2316B-110VAC	(Execution B)	**FWS 2316C-110VDC**	(Execution C)
FWS 2316B-230VAC	(Execution B)	**FWS 2316C-230VDC**	(Execution C)

Standstill Frequencies

	Execution B	Execution C
Input X3	2Hz	1Hz
Input X5	2Hz	1Hz

Other frequencies on request.

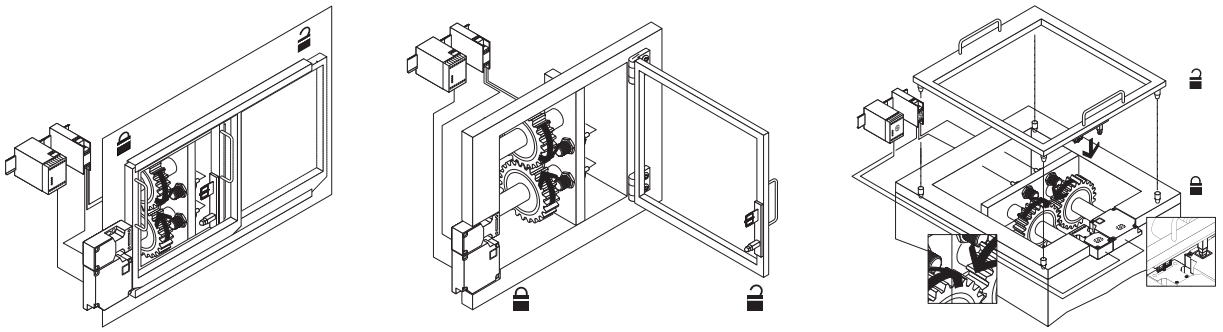
Function Table

Additional transistor output Y	Function of output Y
Y1	Enable, Enabling circuits closed

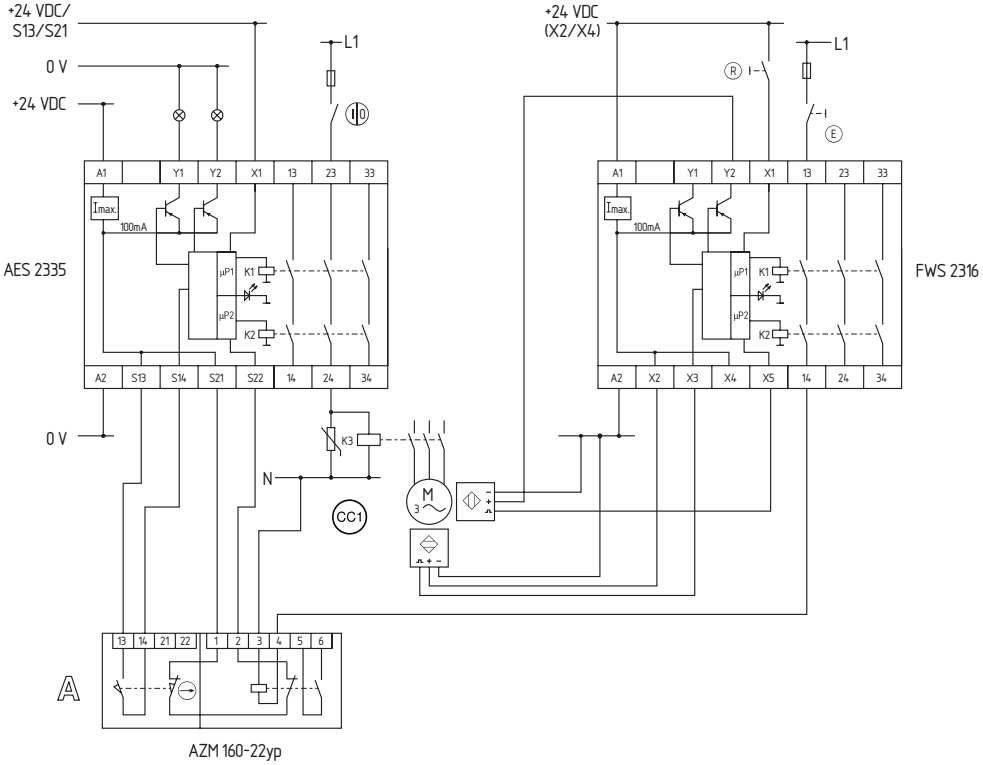
Approvals **BG UL CSA**

FWS 2316

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

- The solenoid interlock can be opened when the FWS 2316 has registered standstill of the motor by means of the two PNP inductive proximity switches. The coil of the solenoid interlock is then energized by operation of the pushbutton Ⓔ
- The AES guard door controller checks the position of the guard device.
- Monitoring of the guard device using a solenoid interlock.
- To achieve Control Category 3 the exclusion of faults due to "Breakage or release of the actuator, fault in the solenoid interlock" is to be substantiated and documented.
- Release is only possible when the run-down movement has come to an end.
- After release has taken place, the guard device must be opened.
- The wiring diagram is with the guard device closed and shows the de-energized condition.

Circuit Options

- **Feedback Circuit**
  A feedback circuit to monitor external contactors can be connected to input X1.

Fail-to-Safe Standstill Monitors

Safety Category (EN954-1): CC3

FWS 3505-2204

Features

- Confirmation of standstill using 2 impulse sensors
- Control Category 3 to EN 954-1
- Operational voltage 24 VDC
- 4 enabling circuit
- Reset input
- 2 short-circuit proof semiconductor outputs
- 1 auxiliary contact
- Integral System Diagnostics (ISD)
- 2 channel microprocessor control
- Customer-specific standstill frequencies possible

Dimensions 99.7 x 75 x 110 mm

ISD

The following faults are recognized by the safety controller and indicated by means of ISD

- Interruption of the connections to the inductive proximity switches
- Failure of the proximity switches
- Failure of one channel being evaluated
- Failure of the unit's internal safety relay to pull-in or drop-out
- Faults on input or relay control circuits of the safety control unit

Note

The ISD tables (Integral System Diagnostics) for analysis of the fault indications and their causes are shown on page 196.

Technical Specifications may be found on page 190

Model Designation FWS 3505-2204-24VDC

Standstill Frequencies

Input X2	1Hz
Input X4	1Hz

Other frequencies on request.

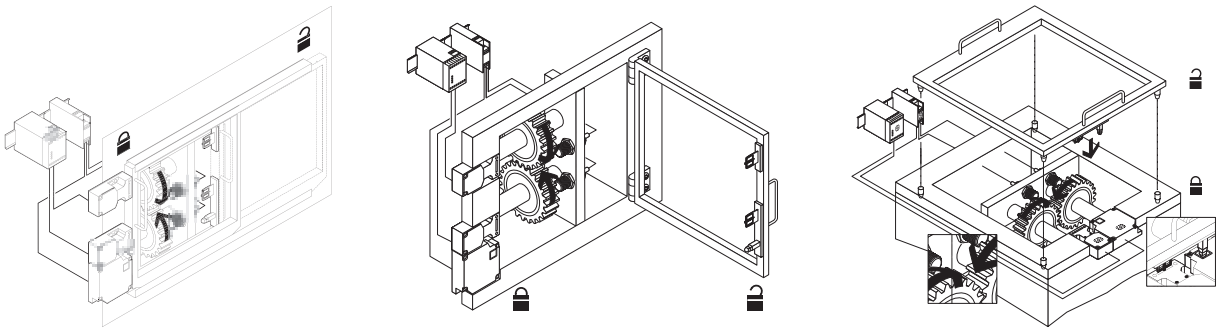
Function Table

Additional transistor output Y	Function of output Y
Y1	Enable, Enabling circuits closed
Y2	Fault

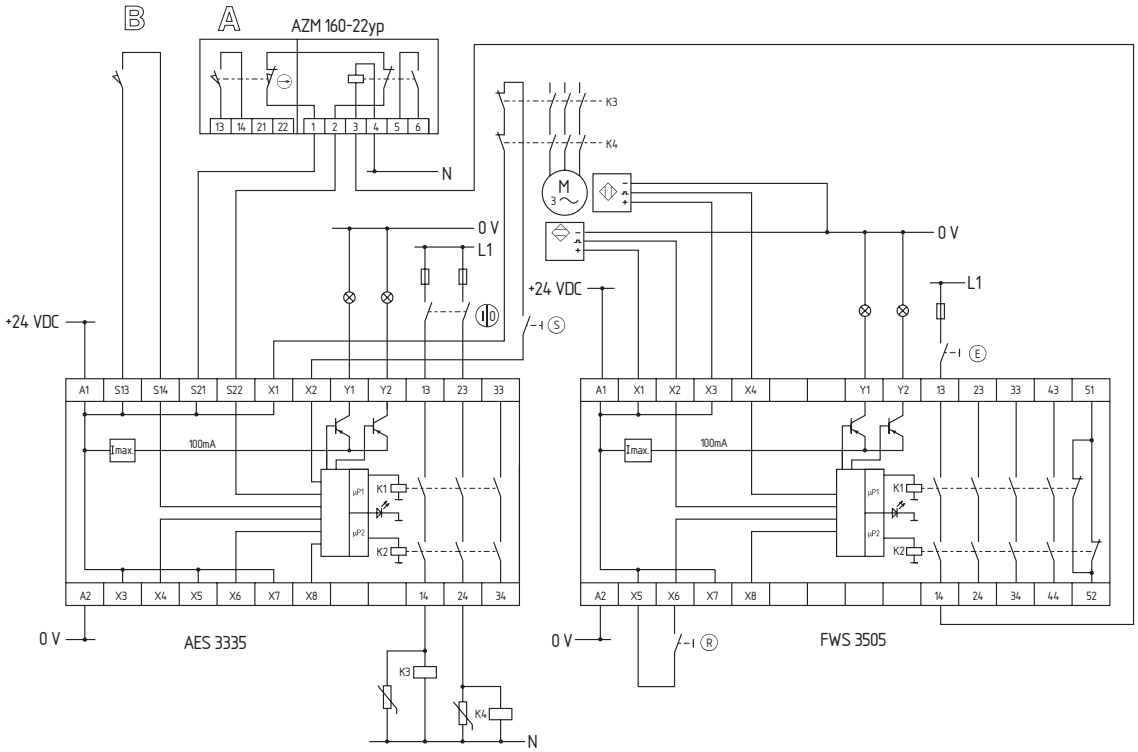
Approvals BG UL CSA

FWS 3505-2204

Typical Applications



Typical Wiring Diagram
(See page 21 for symbol key)



Application Notes

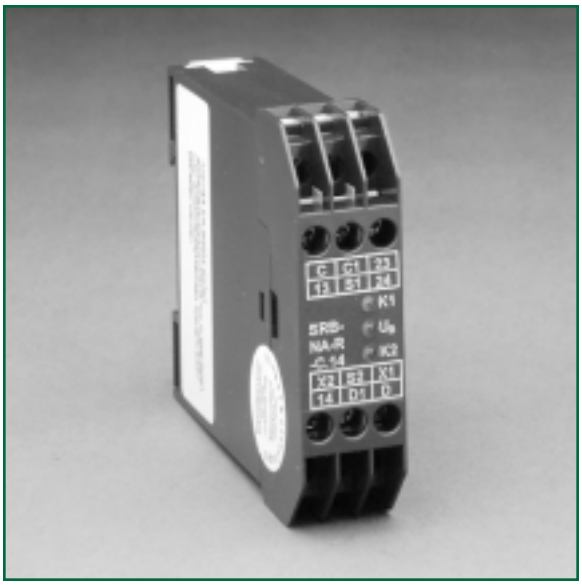
- The solenoid interlock can be opened when the FWS 3505-2204 has registered standstill of the motor by means of the PNP inductive proximity switches. The coil of the solenoid interlock is then energized by operation of the push-button Ⓔ
- The AES controller checks the position of the guard device.
- Monitoring of the guard device using a solenoid interlock and a safety switch with separate actuator.
- Control Category 3 can also be achieved without using the safety switch B. Exclusion of faults due to “Breakage or release of the actuator, fault in the solenoid interlock” is to be substantiated and documented.
- Release is only possible when the run-down movement has come to an end.
- After release has taken place, the guard device must be opened.
- The wiring diagram is with the guard device closed and shows the de-energized condition.

Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

SRB-NA-R-C.14

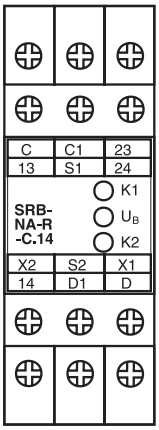
Stop Category (EN60204-1): 0



Features

- 2 NO relay outputs
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2, U_i
- Housing 22.5 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35
- Not for use with BNS Series coded magnet switches

Front View



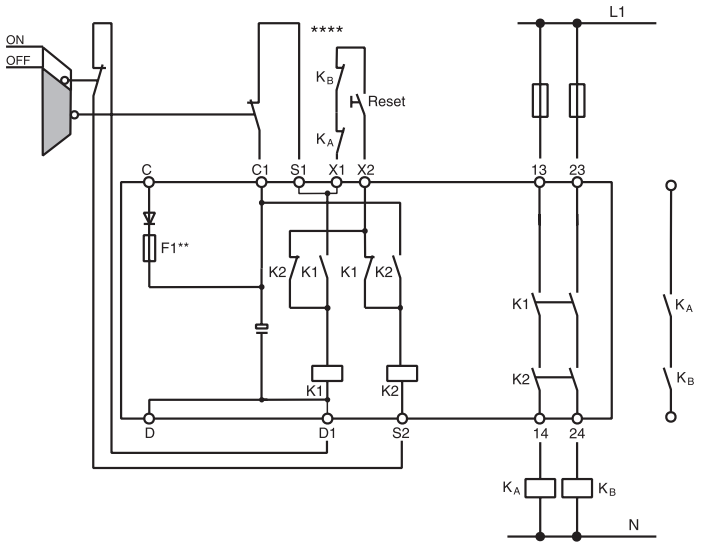
Dimensions 82 x 22.5 x 98.8 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.14-24VDC	2 NO	24VDC
SRB-NA-R-C.14-24VAC	2 NO	24VAC
SRB-NA-R-C.14/UC	2 NO	24VDC/VAC

Approvals **BG UL CSA**

SRB-NA-R-C.14

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

** Fuse M 0.5 A
(an external leading fuse M 0.25A is recommended)

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	M 0.25 A (internal M 0.5 A/250V)
Power Consumption	2.5 VA
Switching Capacity (Enabling Contacts)*	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 10 ms
Drop-Out Delay	≤ 30 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	82 mm / 22.5 mm / 98.8 mm
Weight	190 g
Ambient Operating Temperature	-25°C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part 2

* Unit available with 10A output (enabling) contacts. Order p/n SRB-PL 14/10A.

Guard Door and Emergency-Stop Safety Controllers

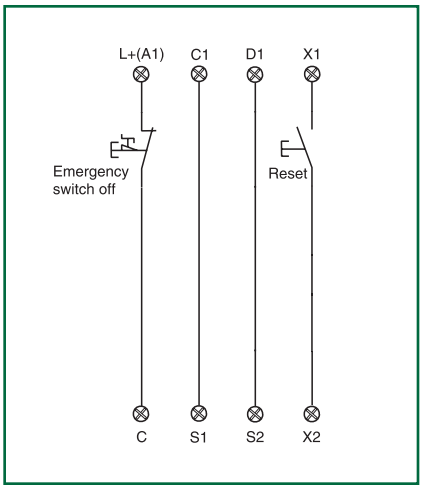
SRB-NA-R-C.14 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



Dual-channel Emergency-Stop switch in accordance with EN 60 204-1.

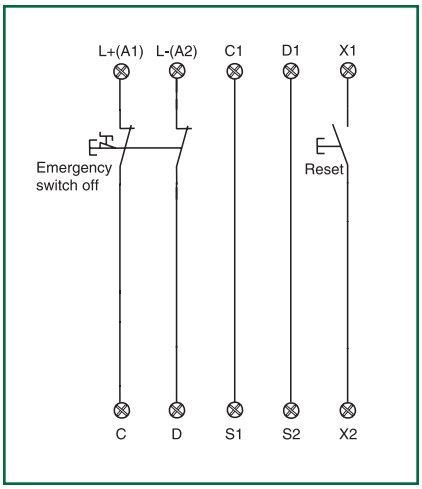
Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Earth leakage at input A2 is detected in non-grounded mains only!

Cross shorts in the E-stop circuits are detected.

With external reset button.

Safety category 3 in accordance with EN 954-1.



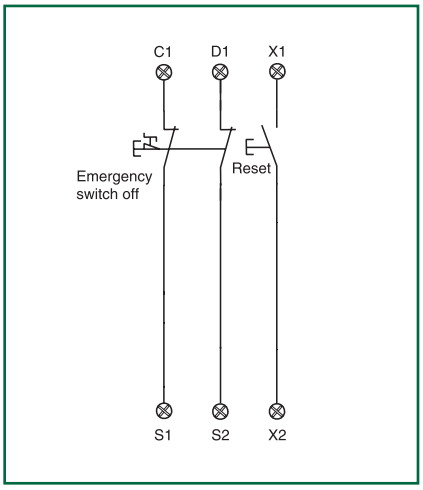
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

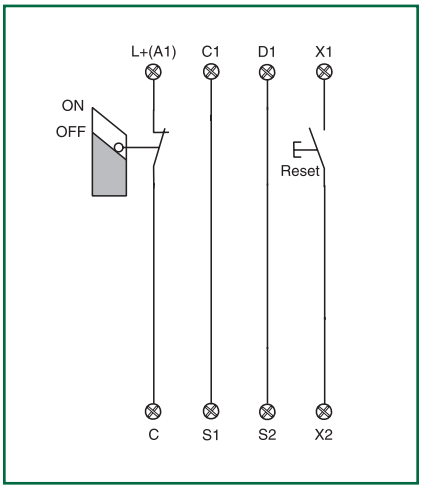


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.



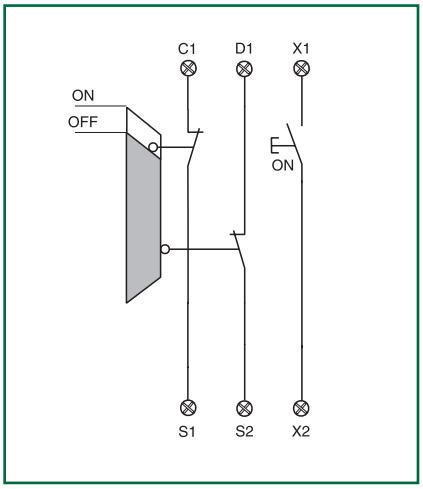
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.



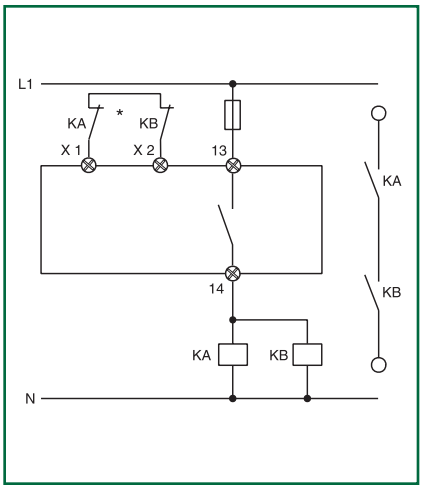
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.14 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

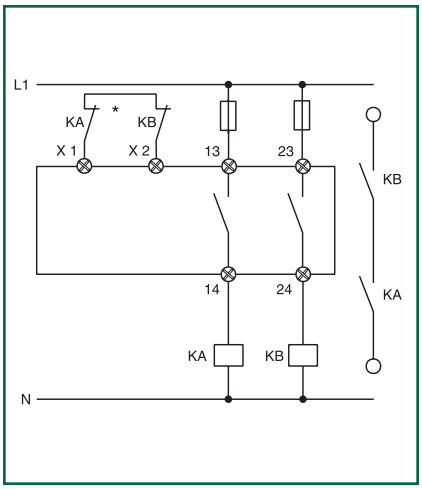
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

*Reset button wired in series to feedback loop.



Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC3

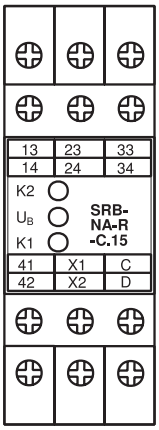
SRB-NA-R-C.15, SRB-NA-R-C.15/1

Stop Category (EN60204-1): 0

Features

- 3 NO relay outputs, 1 NC auxiliary output (NC auxiliary contact for monitoring only, must not be used in safety enabled circuits)
- Input for reset
- Feedback loop
- NC contacts for monitoring (SRB-NA-R-C.15/1: in series) (SRB-NA-R-C.15: in parallel)
- Input for E-stop or door monitoring
- LED's for K1, K2, U_B
- Housing 22.5 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35
- Not for use with BNS Series coded magnet switches

Front View



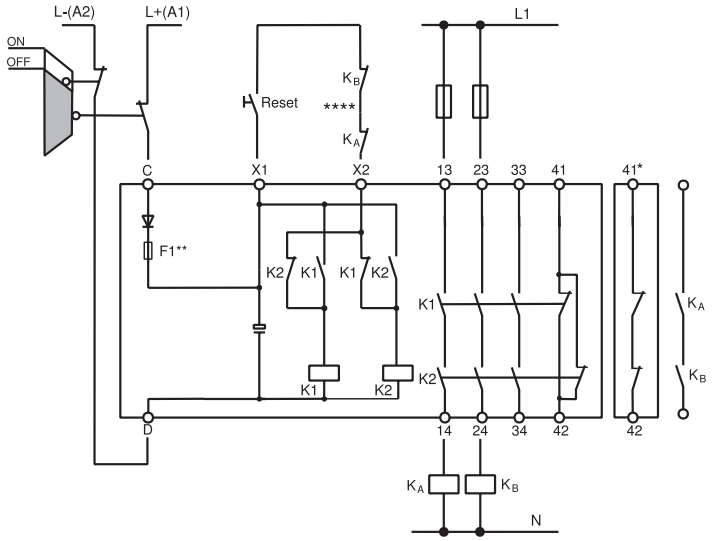
Dimensions 82 x 22.5 x 98.8 mm

Model Designation		Enabling Outputs	Operating Voltage
	SRB-NA-R-C.15-24VDC	3 NO / 1 NC	24VDC
	SRB-NA-R-C.15-24VAC	3 NO / 1 NC	24VAC
	SRB-NA-R-C.15/1-24VDC	3 NO / 1 NC	24VDC
	SRB-NA-R-C.15/UC	3 NO / 1 NC	24VDC/VAC

Approvals **BG UL CSA**

SRB-NA-R-C.15, SRB-NA-R-C.15/1

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

Earth leakage at input D is detected only in mains with insulation leakage monitoring.

* Monitoring contacts in series on SRB-NA-R-C.15/1

** Fuse M 0.5 A
(an external leading fuse M 0.25A is recommended)

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	M 0.25 A (internal M 0.5 A/250V)
Power Consumption	2.5 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blowing
Switching Capacity (Monitoring Contacts)	24V, 2 A resistive (inductive with suitable suppression)
Fuse (Monitoring Contacts)	2 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 10 ms
Drop-Out Delay	≤ 30 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	82 mm / 22.5 mm / 98.8 mm
Weight	190 g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part 2

Guard Door and Emergency-Stop Safety Controllers

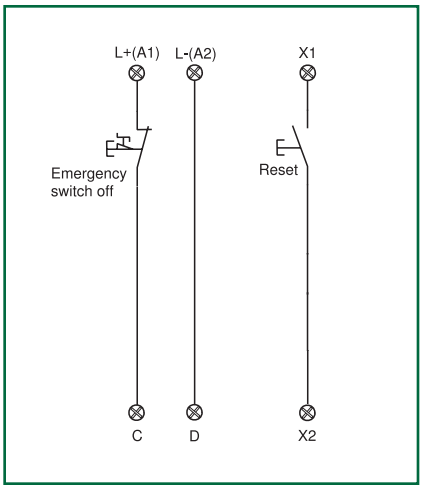
SRB-NA-R-C.15, SRB-NA-R-C.15/1 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



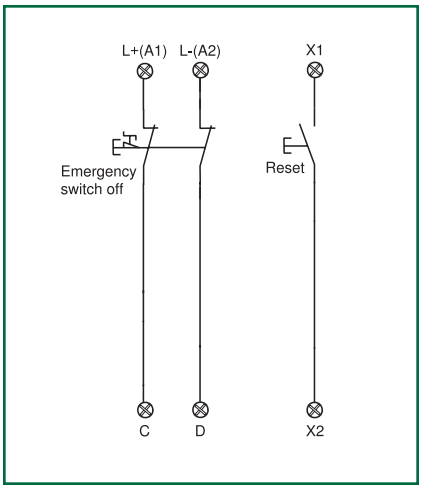
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 3 in accordance with EN 954-1.

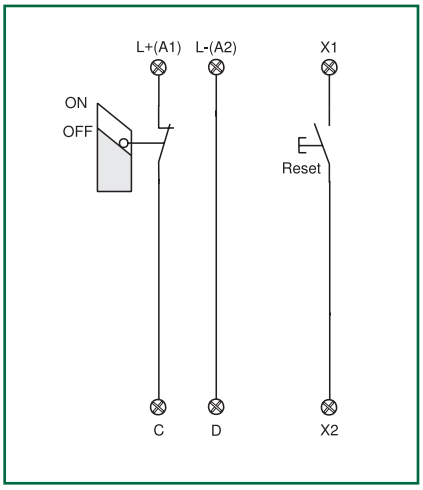


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.

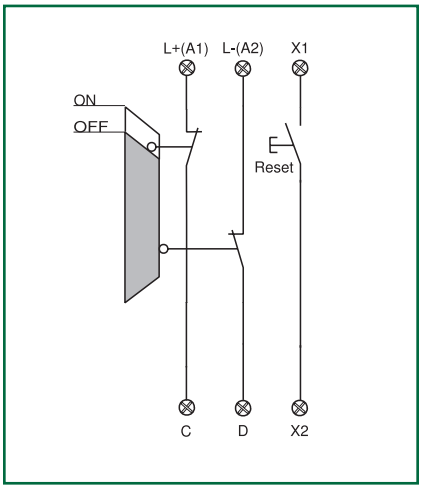


Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 3 in accordance with EN 954-1.



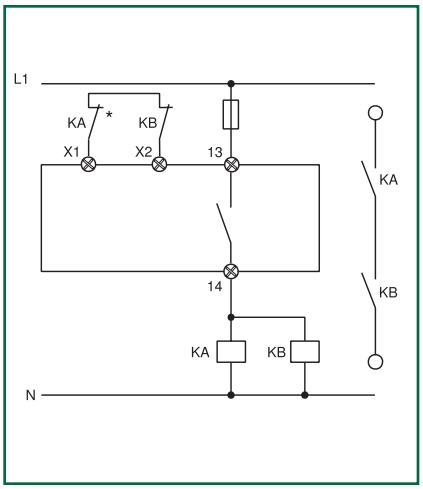
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.15, SRB-NA-R-C.15/1 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

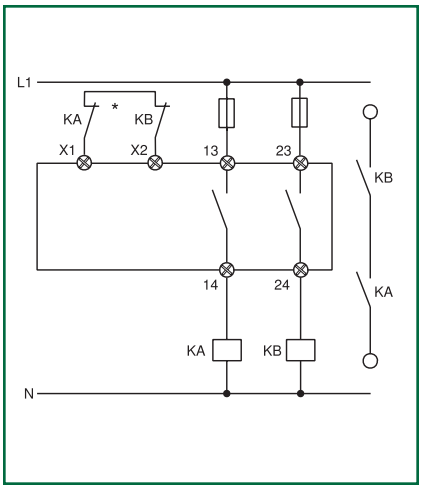
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

*Reset button wired in series to feedback loop.

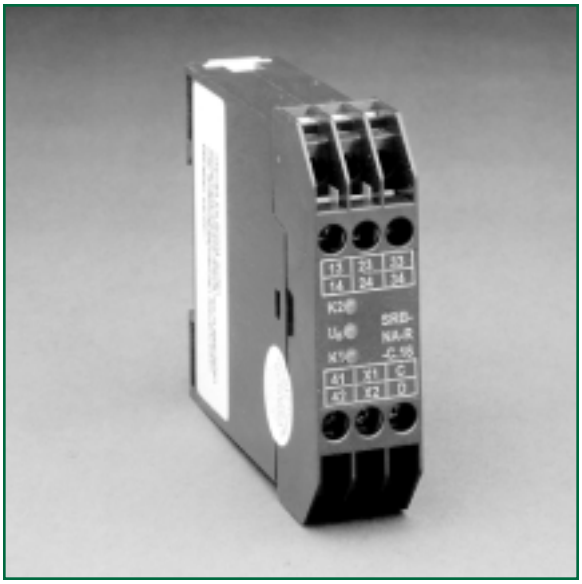


Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC3

SRB-NA-R-C.16, SRB-NA-R-C.16/1

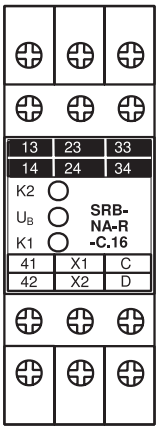
Stop Category (EN60204-1): 1



Features

- 3 NO relay outputs, 1 NC auxiliary output (NC auxiliary contact for monitoring only, must not be used in safety enabled circuits)
- Input for reset
- Feedback loop
- NC contacts for monitoring (SRB-NA-R-C.16/1: in series) (SRB-NA-R-C.16: in parallel)
- Input for E-stop or door monitoring
- LED's for K1, K2, U_B
- Housing 22.5 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35
- **Not for use with BNS Series coded magnet switches**

Front View



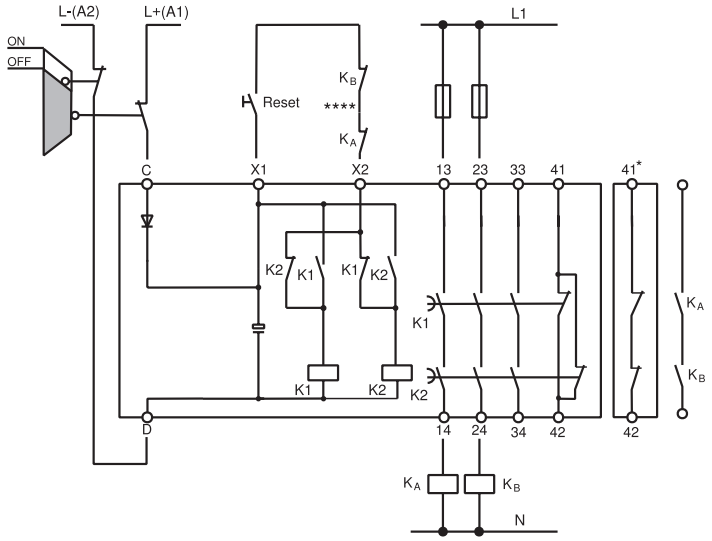
Dimensions 82 x 22.5 x 98.8 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.16-24VDC	3 NO / 1 NC	24VDC
SRB-NA-R-C.16/1-24VDC	3 NO / 1 NC	24VDC
SRB-NA-R-C.16-24VAC	3 NO / 1 NC	24VAC

Approvals **BG UL CSA**

SRB-NA-R-C.16, SRB-NA-R-C.16/1

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

Earth leakage at input D is detected only in mains with insulation leakage monitoring.

An external leading fuse 0.5A is recommended.

* Monitoring contacts in series on SRB-NA-R-C.16/1

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	M 0.25 A (internal M 0.5 A/250V)
Power Consumption	2.5 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Switching Capacity (Monitoring Contacts)	24V, 2 A resistve (inductive with suitable suppression)
Fuse (Monitoring Contacts)	2 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 10 ms
Drop-Out Delay	1,1 s -20% / +20% (for U_B = 24VDC)
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2(13-20 AWG)
Dimensions (H/W/D)	82 mm / 22.5 mm / 98.8 mm
Weight	190 g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part 2

Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.16, SRB-NA-R-C.16/1 Input Wiring Options

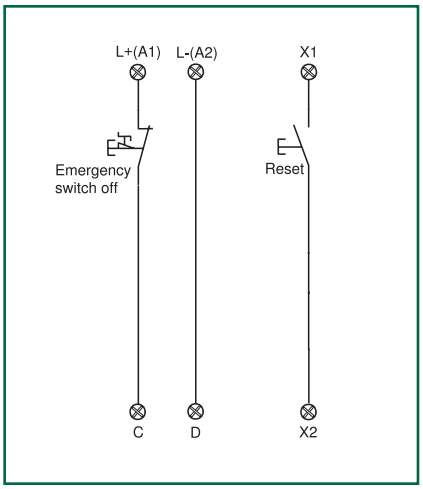
Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



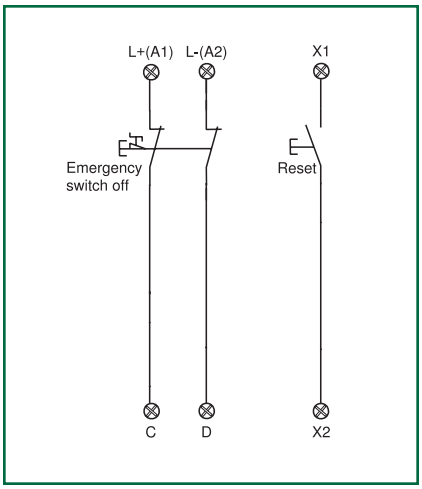
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 3 in accordance with EN 954-1.

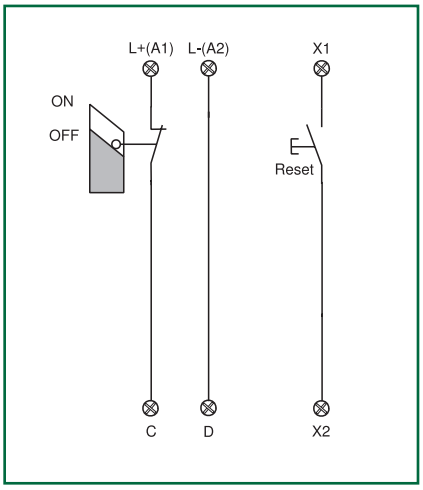


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.



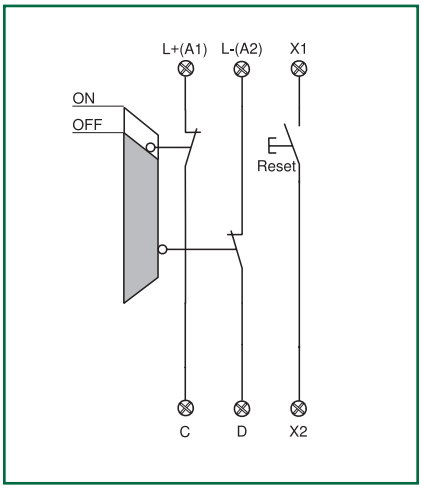
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 3 in accordance with EN 954-1.



Guard Door and Emergency-Stop Safety Controllers

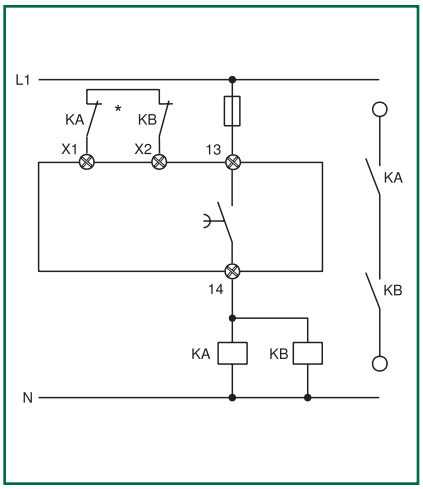
SRB-NA-R-C.16, SRB-NA-R-C.16/1 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

Drop-out delay: Safety category 1 in accordance with EN 954-1.

*Reset button wired in series to feedback loop.

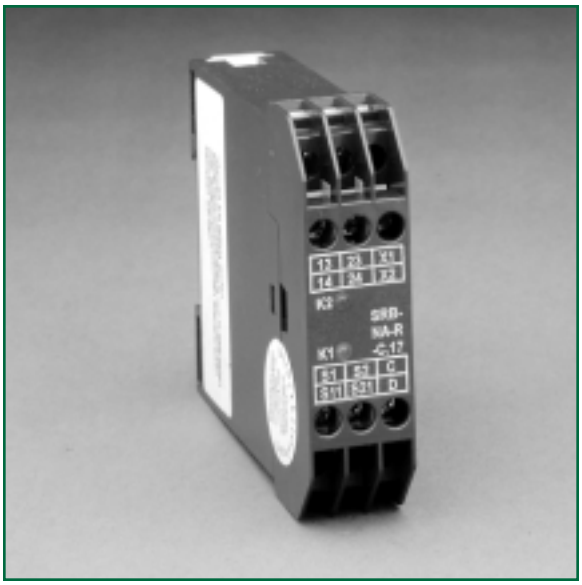


Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

SRB-NA-R-C.17

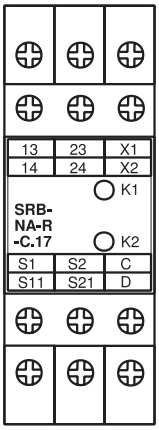
Stop Category (EN60204-1): 0



Features

- 2 NO relay outputs
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2
- Housing 22.5 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35
- **Not for use with BNS Series coded magnet switches**

Front View

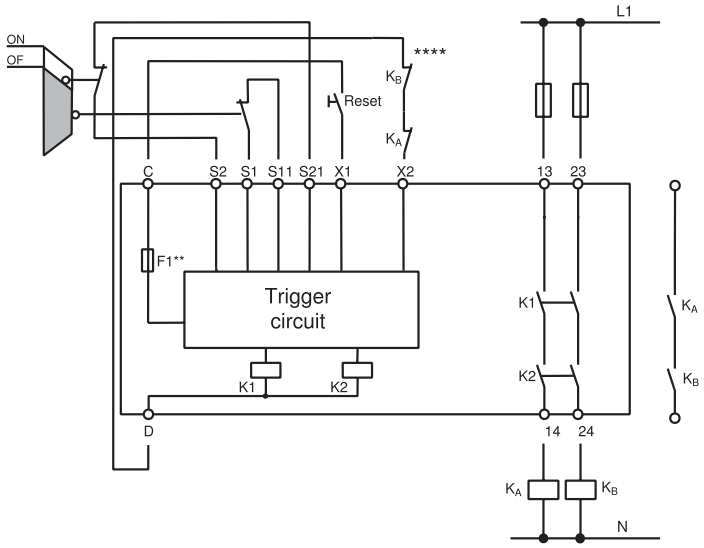


Dimensions 82 x 22.5 x 98.8 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.17-24VDC	2 NO	24VDC

Approvals **BG UL CSA**

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

** internal electronic fuse

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%
Fuse (Power Supply)	Internal electronic fuse, breaking current > 0.6 A, reset time approx. 1 second
Power Consumption	max. 2.5 VA
Switching Capacity (Enabling Contacts)	230 VAC, 4 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	4 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 50 ms
Drop-Out Delay	≤ 20 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2(13-20 AWG)
Dimensions (H/W/D)	82 mm / 22.5 mm / 98.8 mm
Weight	190 g
Ambient Operating Temperature	0 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part 2

Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.17 Input Wiring Options

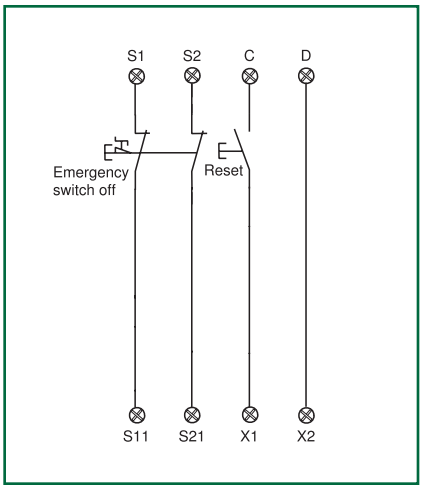
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



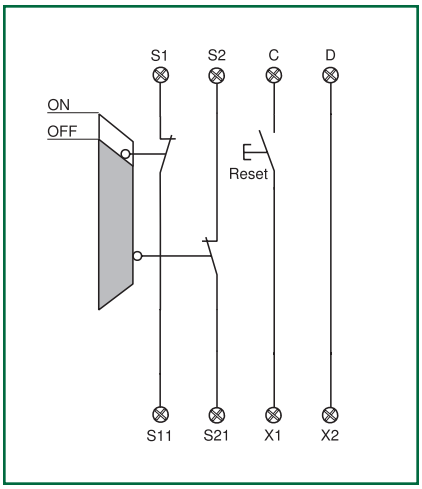
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button for increased safety requirements.

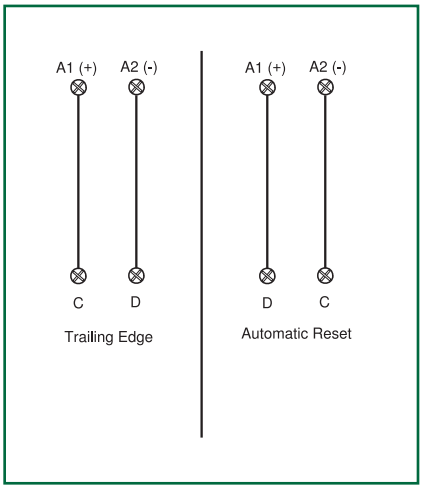
Safety category 3 or 4 in accordance with EN 954-1.



Advice:

Change over from mode “External Reset with trailing edge” to mode “Automatic Reset” is achieved by altering the polarity of the supply voltage.

In “Automatic Reset” the reset button is eliminated.



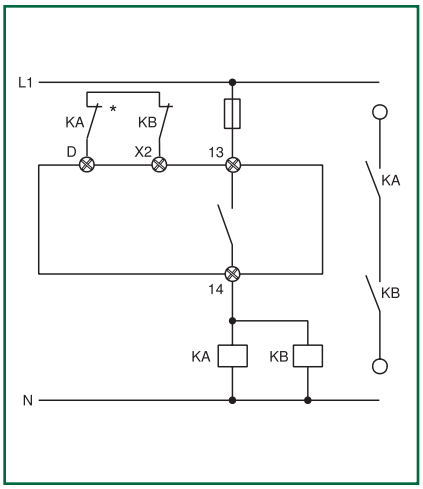
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.17 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

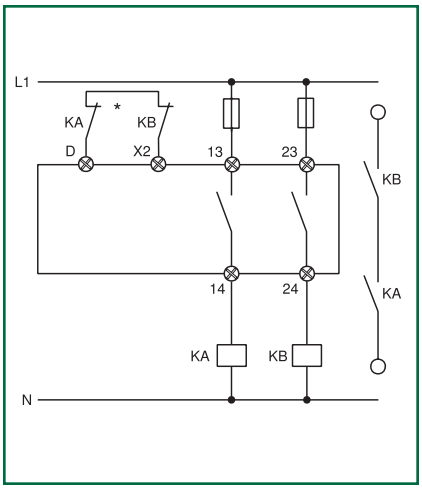
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

*Reset button wired in series to feedback loop.



Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

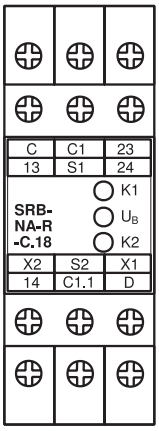
SRB-NA-R-C.18

Stop Category (EN60204-1): 0

Features

- 2 NO relay outputs
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2, U_B
- Housing 22.5 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35
- **Not for use with BNS Series coded magnet switches**

Front View



Dimensions 82 x 22.5 x 98.8 mm

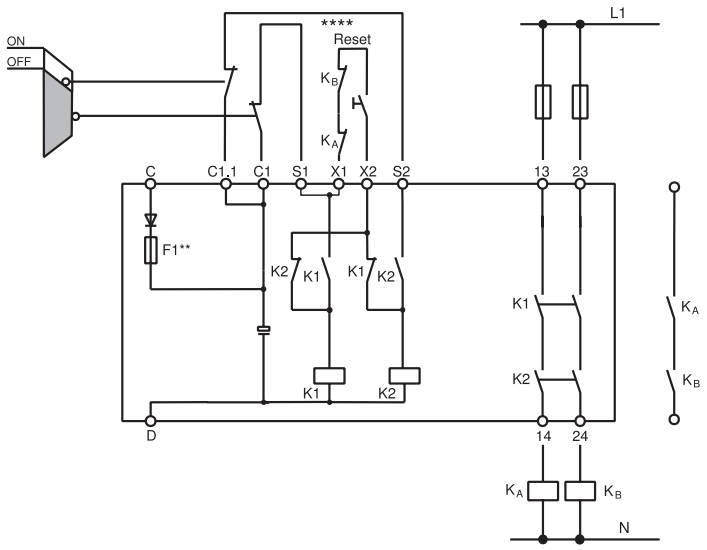
Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.18-24VDC	2 NO	24VDC
SRB-NA-R-C.18-24VAC	2 NO	24VAC

Approvals **BG UL CSA**

SRB-NA-R-C.18

FaultFinder™

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

** Fuse M 0.5 A
(an external leading fuse M 0.25A is recommended)

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	M 0.25 A (internal M 0.5 A/250V)
Power Consumption	2.5 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 10 ms
Drop-Out Delay	≤ 30 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2(13-20 AWG)
Dimensions (H/W/D)	82 mm / 22.5 mm / 98.8 mm
Weight	190 g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part 2

Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.18 Input Wiring Options

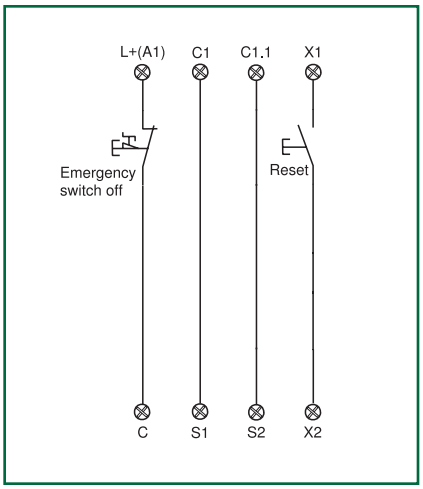
Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



Dual-Channel Emergency Stop switch according to EN 60 204-1.

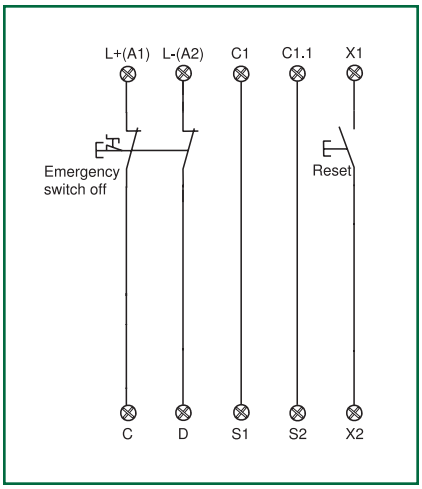
Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Earth leakage at input A2 is detected in non-grounded mains only.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 3 in accordance with EN 954-1.



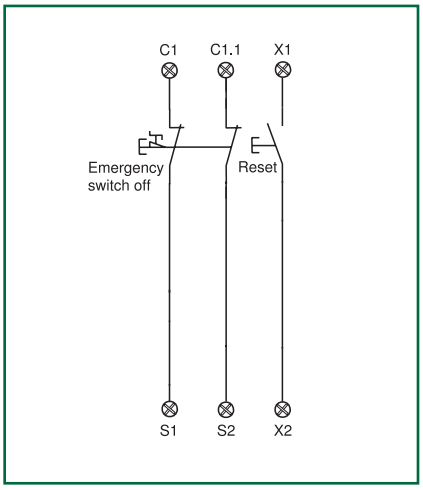
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

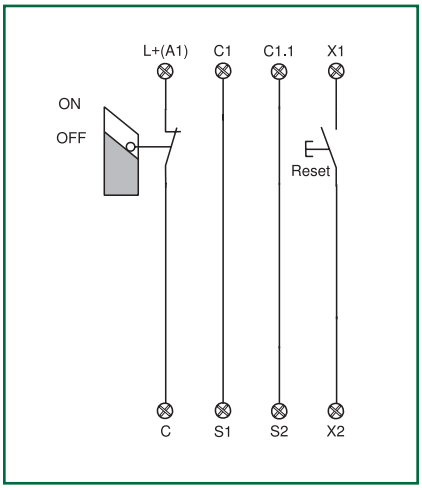


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.



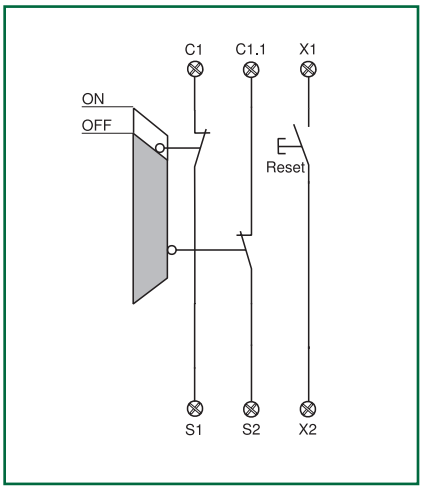
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.

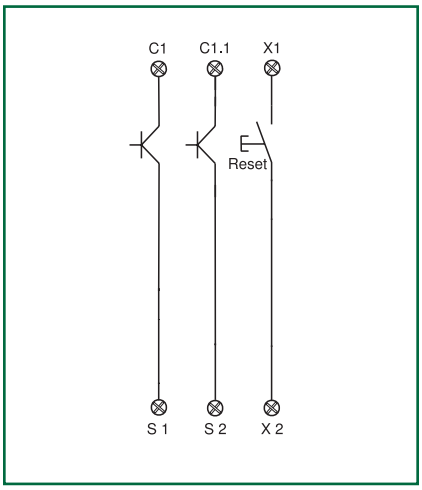


Dual-Channel triggering using P-switching semi-conductors.

Wire breakage and earth leakage in the monitoring circuits are detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



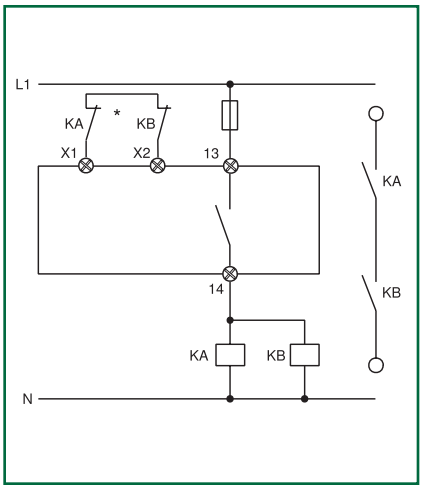
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.18 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

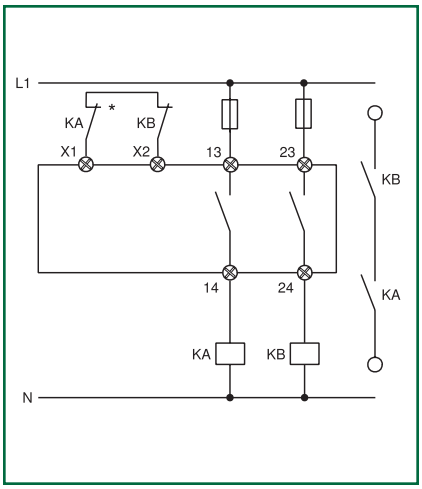
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

*Reset button wired in series to feedback loop.



Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

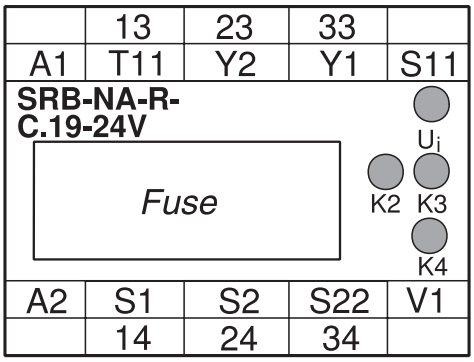
SRB-NA-R-C.19

Stop Category (EN60204-1): 1

Features

- 3 NO relay outputs
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2, K4, U_i
- Housing 45 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35 DIN EN 50 022
- **Not for use with BNS Series coded magnet switches**

Front View



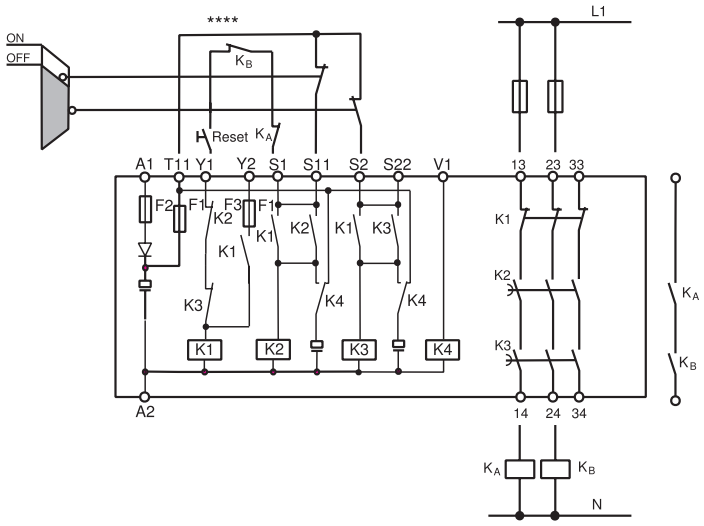
Dimensions 83 x 45 x 140 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.19-24VDC	3 NO	24VDC
SRB-NA-R-C.19-24VAC	3 NO	24VAC

Approvals **UL CSA BG**

SRB-NA-R-C.19

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are not detected.

With external Reset button

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	F2: M 0.25 A/250V (internal M 0.5 A/250V; F3: T 0.1 A/250V)
Power Consumption	max 3 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 100 ms
Drop-Out Delay	Refer to chart two pages further on
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.5 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 45 mm / 140 mm
Weight	390 g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 50 005 / DIN 50 013

Guard Door and Emergency-Stop Safety Controllers

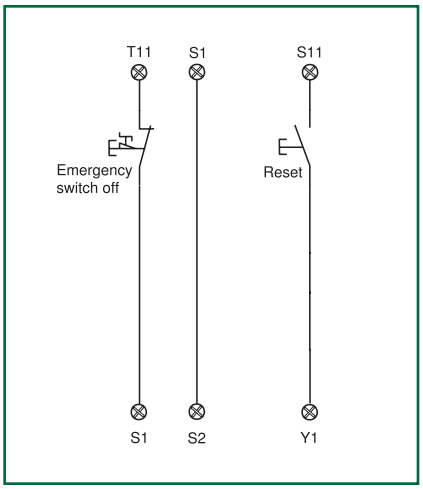
SRB-NA-R-C.19 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



Dual-Channel Emergency Stop switch according to EN 60 204-1.

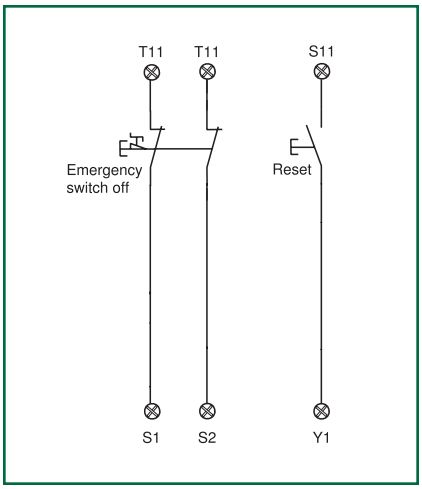
Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Earth leakage at input A2 is detected in non-grounded mains only!

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

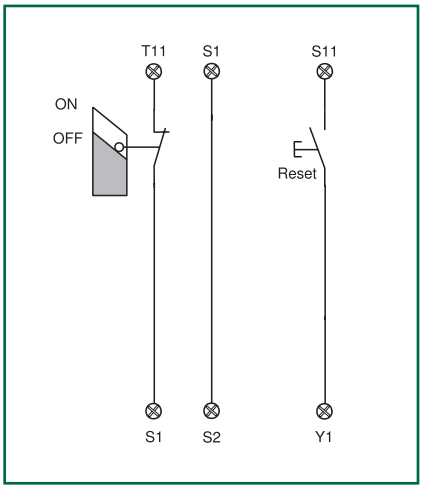


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



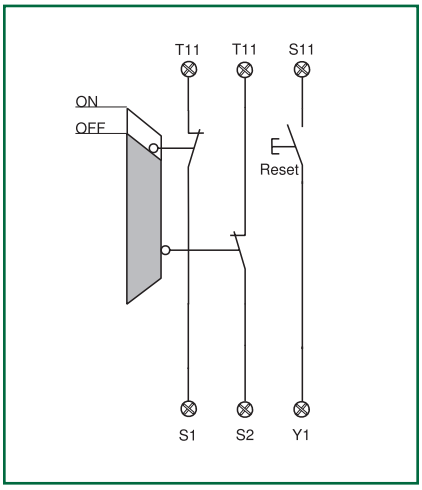
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are not detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.



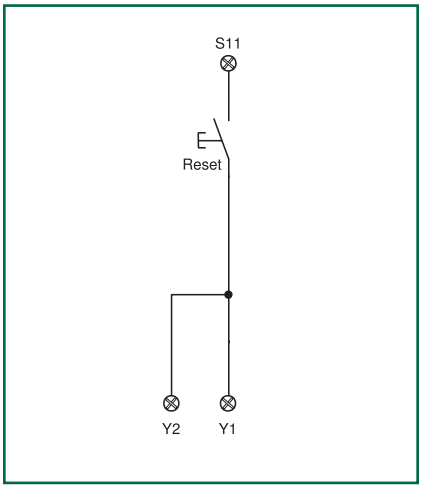
Advice:

For “Automatic Reset” apply jumper S11-Y1.

When using external Reset button (S11-Y2) and jumper Y1-Y2, unit is triggered by trailing edge function.

Reset button wired in series to feedback loop.

If the time between channel 1 and 2 exceeds ca. 20 msec. when connecting a Safety Limit Swith or Interlocking Device, a lock function can be achieved by triggering channel 2 (T11-S2) prior to channel 1 (T11-S1). The time difference is then extended to infinite.



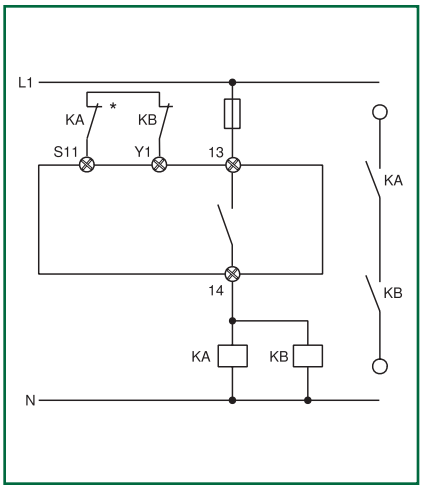
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.19 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

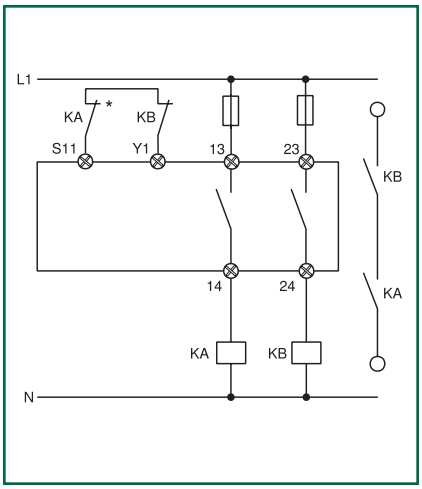
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

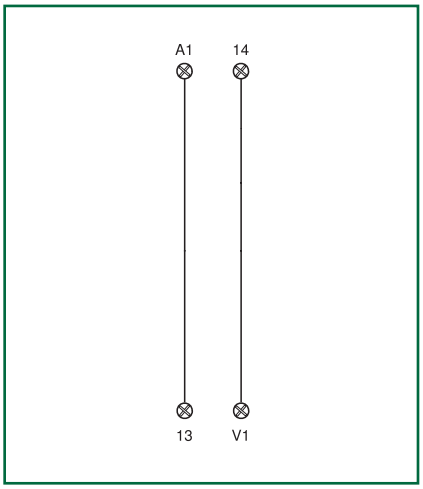
*Reset button wired in series to feedback loop.



Advice:

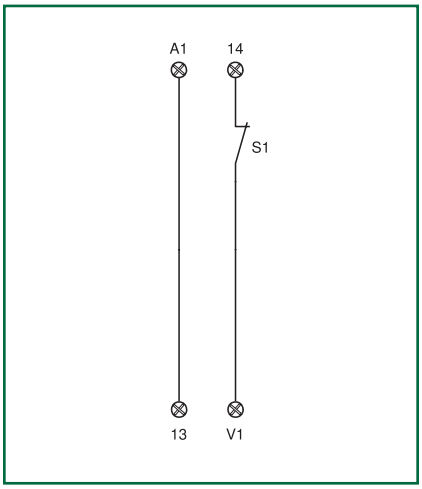
Enagling outputs 23/24 and 33/34 correspond to STOP-category 1 in accordance with EN 60 204-1.

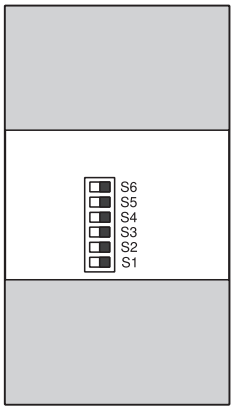
The safety relay module has no safety function if connector V1 is triggered externally.



Advice:

It is possible to shorten the drop-out delay time via an external NC between terminals 14 and V1.





Set to On	Time in Seconds
S1, S4	ca. 0.7
S2, S5	ca. 1.4
S1, S2, S4, S5	ca. 2.1
S3, S6	ca. 3.2
S1, S3, S5, S6	ca. 3.9
S2, S3, S5, S6	ca.4.6
S1, S2, S3, S4, S5, S6	ca. 5.3

Tolerance ± 30%

Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

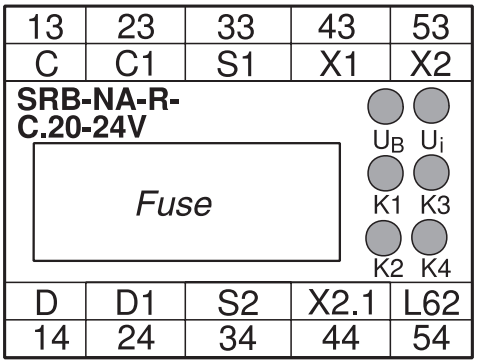
SRB-NA-R-C.20

Stop Category (EN60204-1): 0

Features

- 5 NO relay outputs, 1 NC auxiliary output (L62 terminal,NC for monitoring only, must not be used in safety enabled circuits)
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2, K3,K4, U_B, U_i
- Housing 45 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35
- Not for use with BNS Series coded magnet switches

Front View



Dimensions 83 x 45 x 140 mm

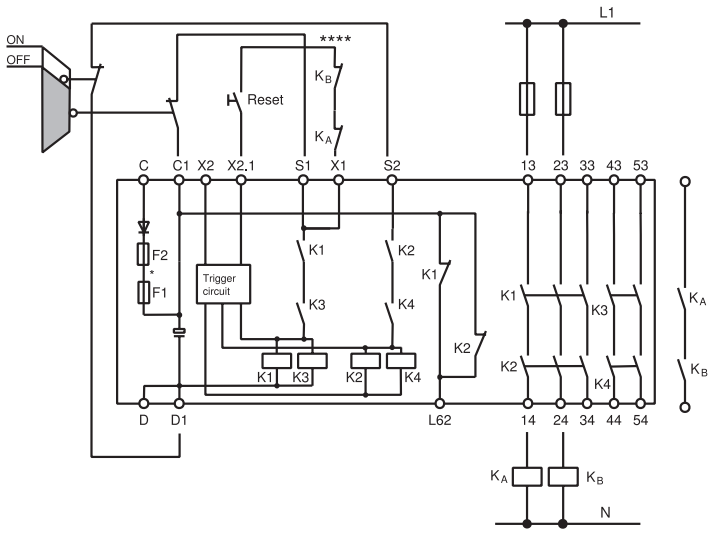
Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.20-24V	5 NO	24VAC/VDC

Approvals **BG UL CSA**

SRB-NA-R-C.20

FaultFinder™

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

* Fuse F2 (front cover) 1 A, Fuse F1 (internal) 1.25 A

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	T 1.0 A/250 V (internal T 1.25 A/250V)
Power Consumption	max 3 VA, plus monitoring output L62
Switching Capacity (Enabling Contacts)	230 VAC, 4 A resistive (inductive with suitable suppression) NO 43/44, 53/54: DC 13: 24 VDC/2 A; AC 15: 230 VAC/3 A
Fuse (Enabling Contacts)	4 A slow blow
Switching Capacity (Monitoring Contacts)	L62: max. 500 mA
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 30 ms
Drop-Out Delay	≤ 60 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.5 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 45 mm / 140 mm
Weight	460 g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part2

Guard Door and Emergency-Stop Safety Controllers

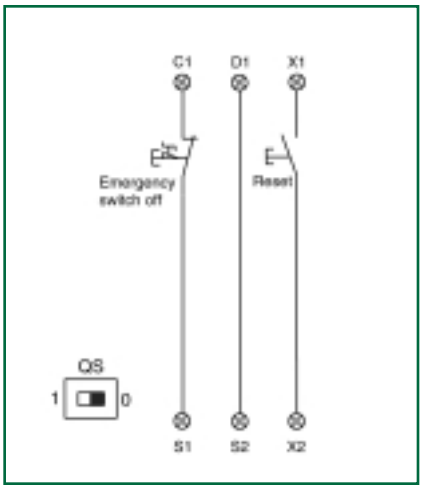
SRB-NA-R-C.20 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



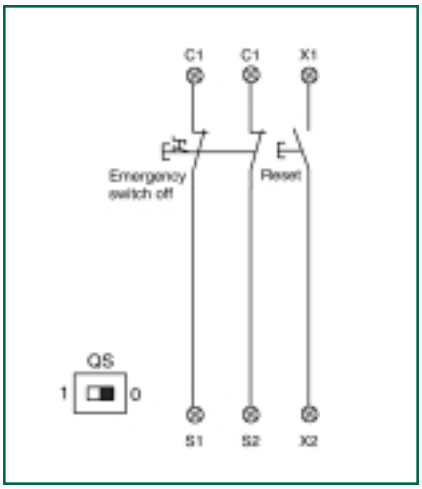
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



Dual-Channel Emergency Stop switch according to EN 60 204-1.

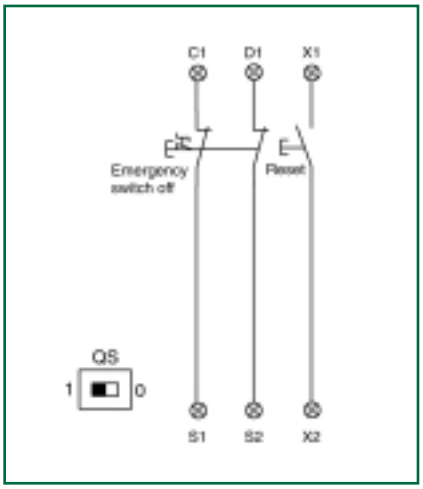
Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

To enable cross-short monitoring: Set switch QS (bottom of housing) to 1.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

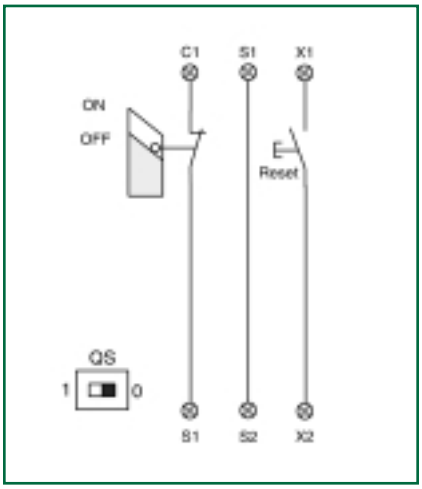


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 or 4 in accordance with EN 954-1.



Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

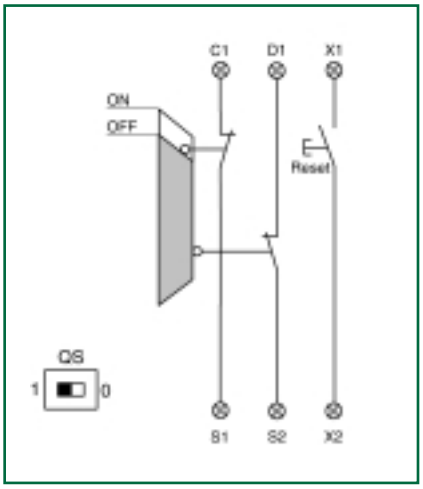
Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

To enable cross-short monitoring: Set switch QS (bottom of housing) to 1.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.



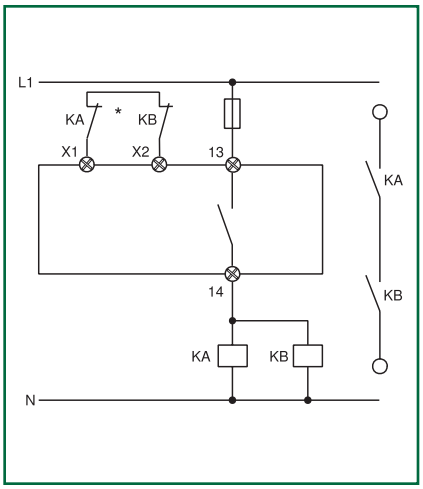
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.20 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

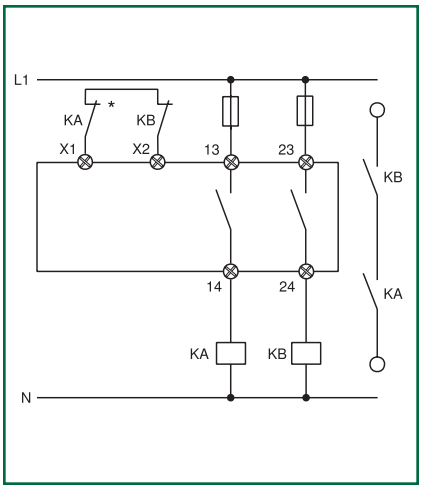
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

*Reset button wired in series to feedback loop.

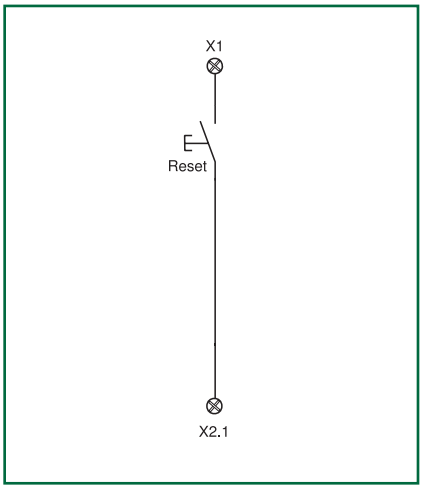


Advice:

For “Automatic Reset” apply jumper X1-X2.

When using external Reset button (connect to X1-X2.1), unit is triggered by trailing edge function.

Reset button wired in series to feedback loop.



Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

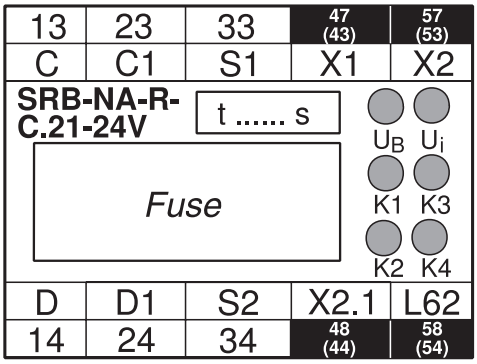
SRB-NA-R-C.21

Stop Category (EN60204-1): 1

Features

- 3 NO relay outputs, 2 NO time delayed contacts, 1 NC auxiliary output (L62 terminal, NC auxiliary contact for monitoring only, must not be used in safety enabling circuits)
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2, K3,K4, U_B, U_i
- Housing 45 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35 DIN EN 50 022
- **Not for use with BNS Series coded magnet switches**

Front View



Dimensions 83 x 45 x 140 mm

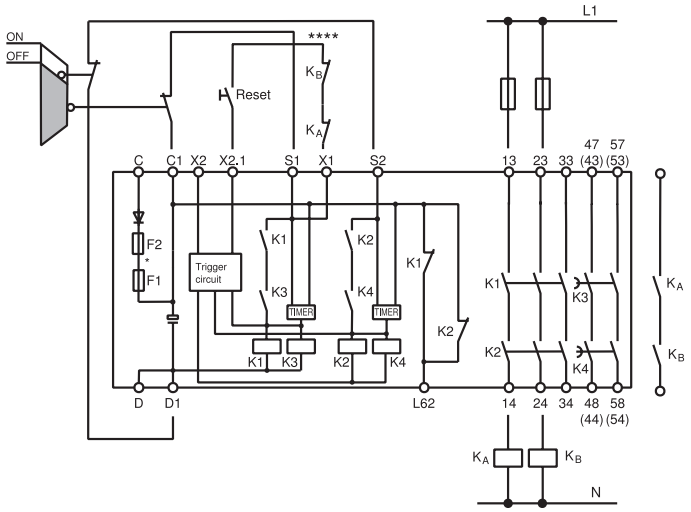
Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.21-24V	3 NO / 2NO / 1 NC	24VAC/VDC

Approvals **BG UL CSA**

SRB-NA-R-C.21

FaultFinder™

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

* Fuse F2 (front cover) 1 A, fuse F1 (internal) 1.25 A

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	T 1.0 A/250 V (internal T 1.25 A/250V)
Power Consumption	max 4 VA, plus monitoring output L62
Switching Capacity (Enabling Contacts)	230 VAC, 4 A resistive (inductive with suitable suppression) NO 43/44, 53/54: DC 13: 24 VDC/2 A; AC 15: 230 VAC/3 A
Fuse (Enabling Contacts)	4 A slow blow
Switching Capacity (Monitoring Contacts)	L62: max. 500 mA
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 30 ms
Drop-Out Delay	≤ 60 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 45 mm / 140 mm
Weight	480 g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part2

Guard Door and Emergency-Stop Safety Controllers

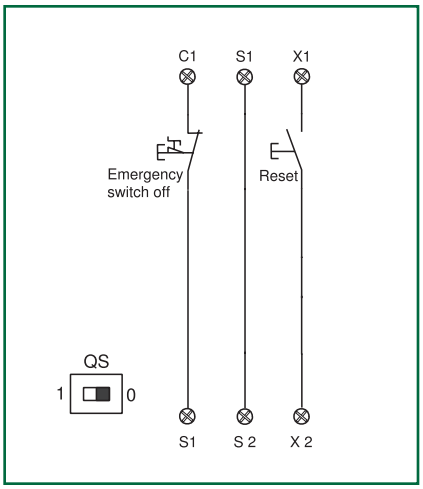
SRB-NA-R-C.21 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



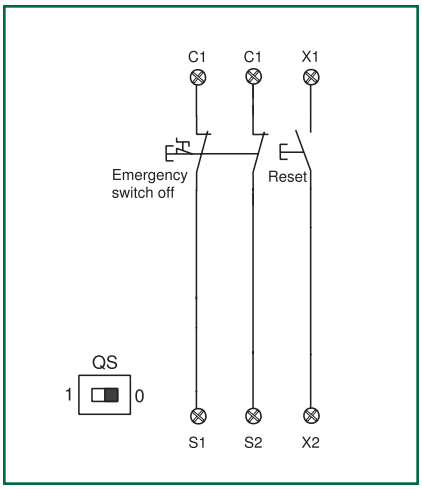
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



Dual-Channel Emergency Stop switch according to EN 60 204-1.

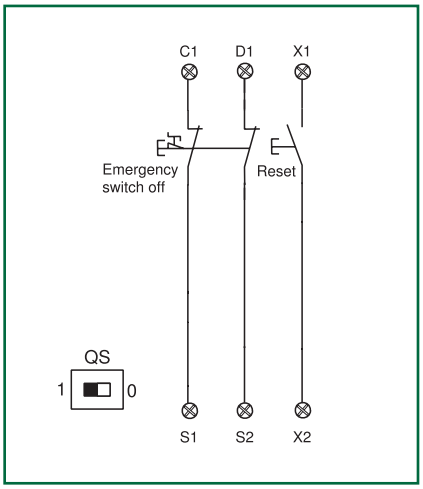
Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

To enable cross-short monitoring: Set switch “QS” (bottom of housing) to 1.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

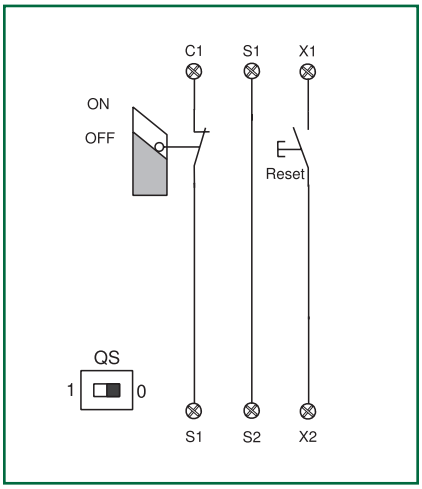


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 or 4 in accordance with EN 954-1.



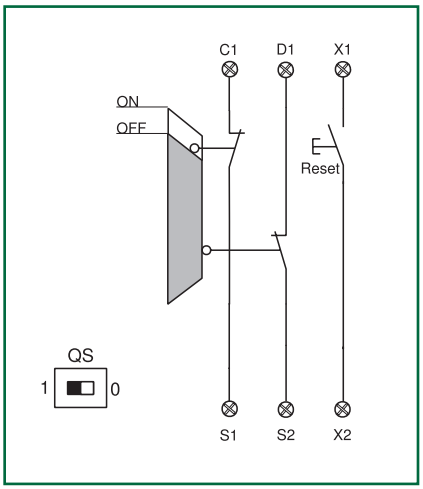
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.



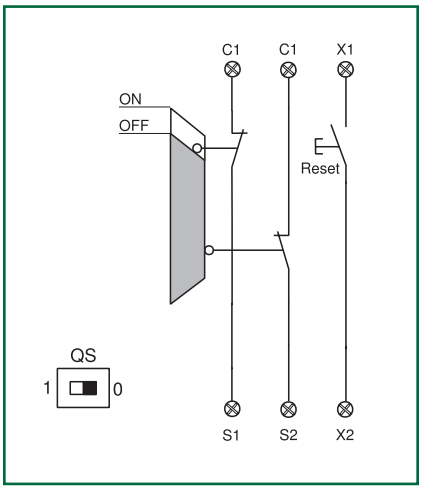
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.



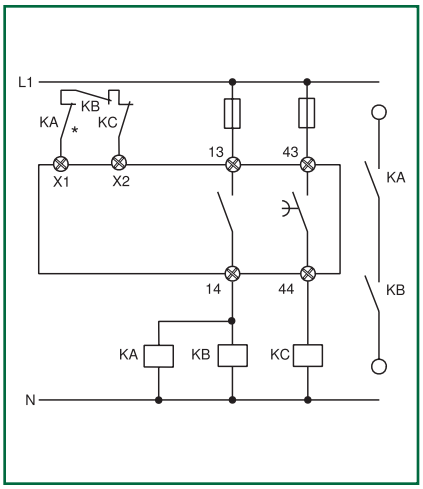
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.21 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

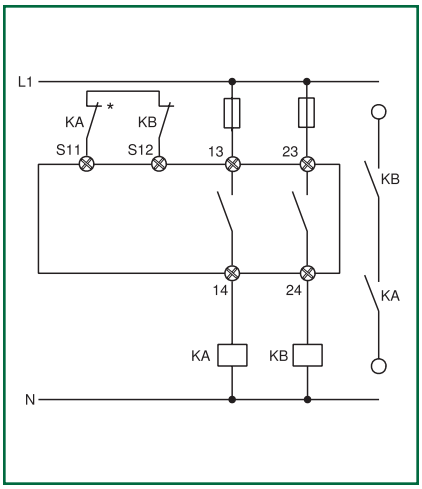
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

*Reset button wired in series to feedback loop.



Advice:

For “Automatic Reset” apply jumper X1-X2.

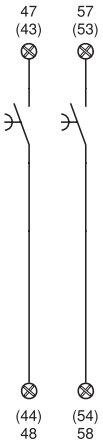
When using external Reset button (X1-X2.1), unit is triggered by trailing edge function.

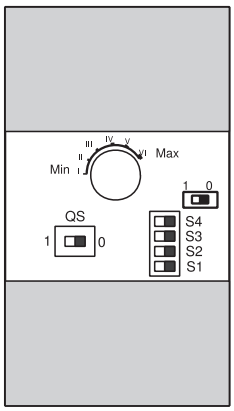
Reset button wired in series to feedback loop.

Advice:

Drop-out delay of the enabling outputs 43/44 and 53/54 correspond to STOP-category 1 in accordance with EN 60 204-1.

Enabling outputs 13/14, 23/24 and 33/34 correspond to STOP-category 1 in accordance with EN 60 204-1.





Time in Seconds	S1 = 1 S2 = 1 S3 = 1 S4 = 1	S1 = 0 S2 = 1 S3 = 0 S4 = 1	S1 = 1 S2 = 0 S3 = 1 S4 = 0	S1 = 0 S2 = 0 S3 = 0 S4 = 0
I	0.44	2.30	3.5	18
II	0.62	2.45	5.0	20
III	0.87	2.70	7.0	22
IV	1.05	2.85	8.5	23
V	1.27	3.05	10.2	25
VI	1.77	3.55	14.2	29

Tolerance ± 5%

Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

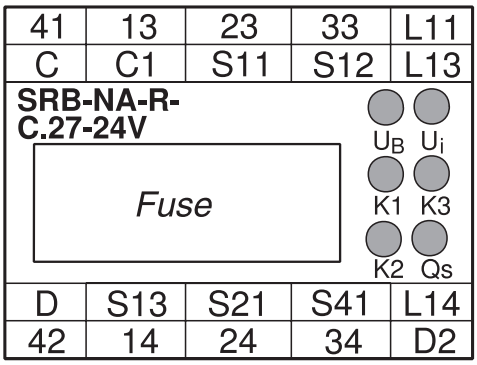
SRB-NA-R-C.27

Stop Category (EN60204-1): 0

Features

- 3 NO relay outputs, 1 NC auxiliary output (NC auxiliary contact for monitoring only, must not be used in safety enabled circuits)
- Monitoring outputs for K1, K2/K3
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2, K3, Q_S, U_B, U_i
- Housing 45 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35
- **Not for use with BNS Series coded magnet switches**

Front View



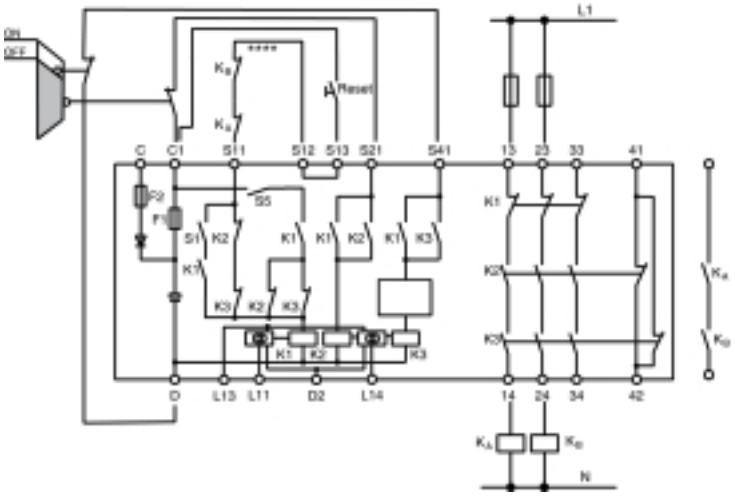
Dimensions 83 x 45 x 140 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.27-24V	3 NO / 1 NC	24VAC/VDC

Approvals **BG UL CSA**

SRB-NA-R-C.27

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%, 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	T 1.0 A/250 V (internal T 1.25 A/250V)
Power Consumption	max 7 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Switching Capacity (Monitoring Contacts)	41/42: 24VDC, 2 A; L11, L14: max. 100mA
Fuse (Monitoring Contacts	41/42: 2 A slow blow; L11, L14: 100mA slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 200 ms
Drop-Out Delay	≤ 30 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.5 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 45 mm / 140 mm
Weight	460 g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part2

Guard Door and Emergency-Stop Safety Controllers

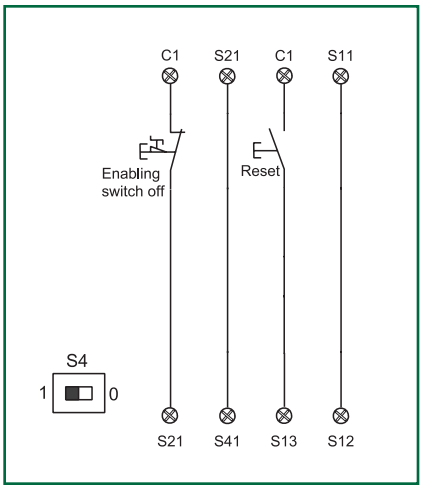
SRB-NA-R-C.27 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



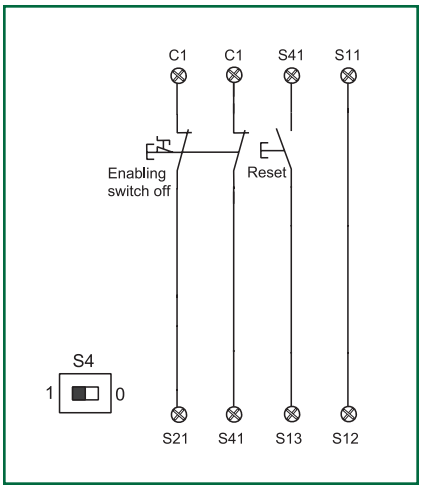
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



Dual-Channel Emergency Stop switch according to EN 60 204-1.

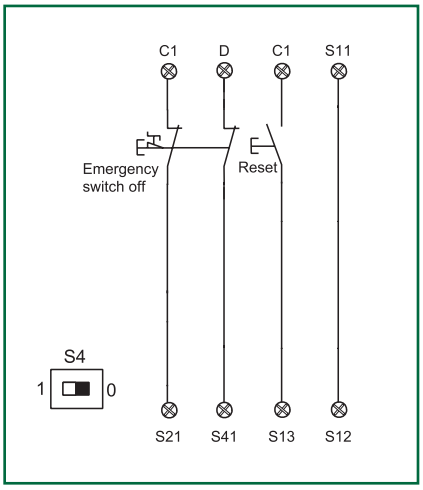
Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

To enable cross-short monitoring: Set switch QS (bottom of housing) to 1.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

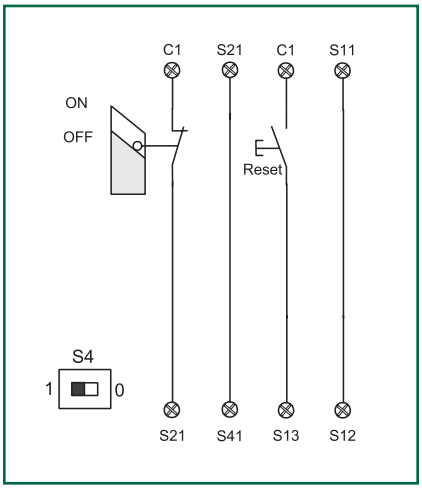


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.



Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

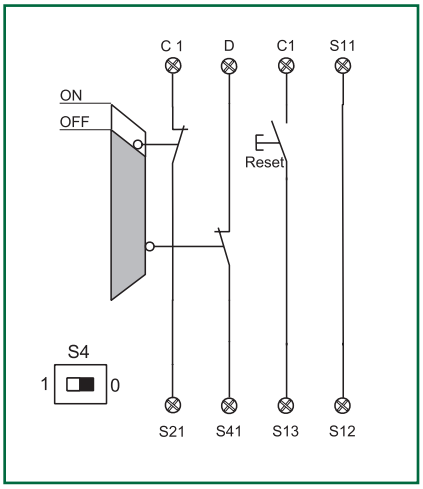
Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

To enable cross-short monitoring: Set switch QS (bottom of housing) to 1.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.



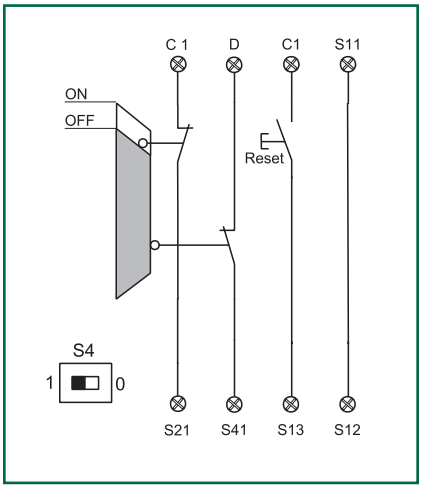
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are not detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.

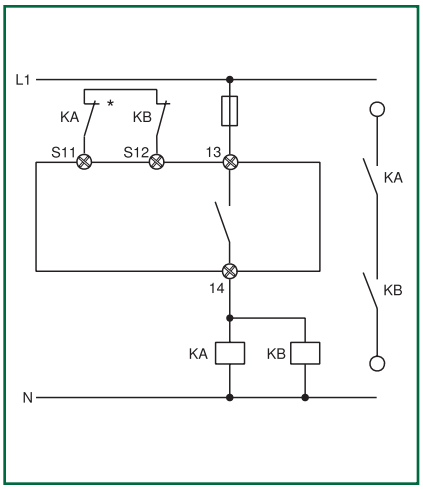


Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.27 Output Wiring Options

Single-Channel output.

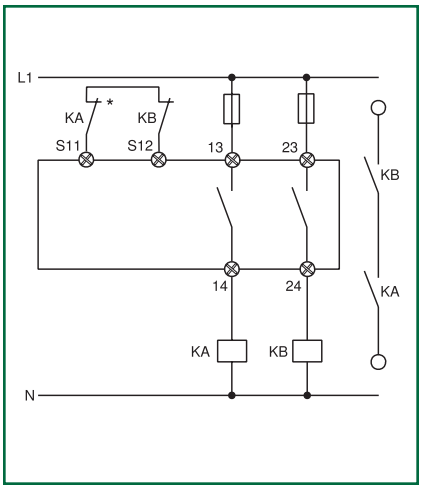
Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



*Feedback loop.

Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



*Feedback loop.

Advice:

For “Automatic Reset” apply jumper C1-S13.

When using external Reset button (switch S1 is set to “1”), unit is triggered by trailing edge function.

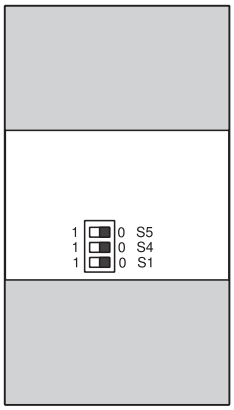
If the time difference between input channel 1 and 2 of the safety relay exceeds ca. 100 msec. when connecting a safety limit switch or interlocking device, a self-locking function can be achieved by setting switch S5 to “1”. The time difference is then extended to infinite.

Advice:

Semiconductor outputs L11 and L14 are galvanically separated from the other sections of the SRB-NA-R-C.27.

Provide power supply through inputs L13 and D2.

Semiconductor output L11 is linked to Relay K1 (Reset). Semiconductor output L14 is linked to Relays K2 and K3.



Setting

S1	ON = Trailing edge function off	OFF = Trailing edge function on
S4	ON = Cross-short recognition off	OFF = Cross-short recognition on
S5	ON = Time delay between input channel 1 and 2 infinite	OFF = Time delay between input channel 1 and 2 ca. 100 msec.

Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

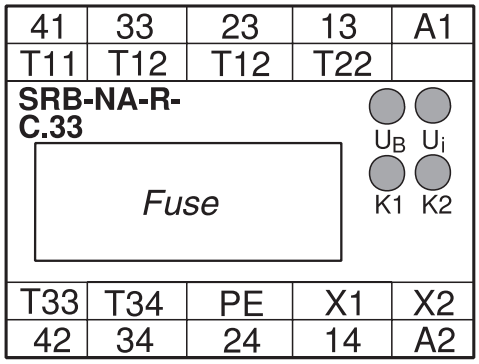
SRB-NA-R-C.33

Stop Category (EN60204-1): 0

Features

- 3 NO relay outputs, 1 NC auxiliary output (NC auxiliary contact for monitoring only, must not be used in safety enabled circuits)
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2, U_B, U_i
- Housing 45 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35
- Not for use with BNS Series coded magnet switches

Front View



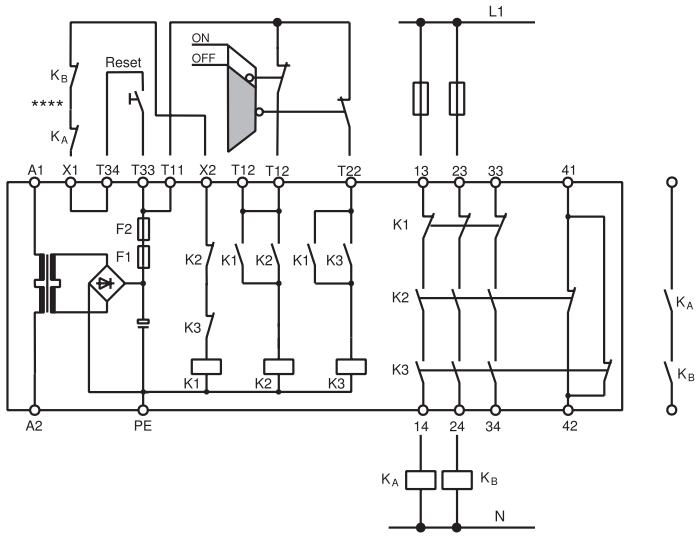
Dimensions 83 x 45 x 140 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.33-24V	3 NO / 1 NC	24VDC/VAC
SRB-NA-R-C.33-115VAC	3 NO / 1 NC	115VAC
SRB-NA-R-C.33-230VAC	3 NO / 1 NC	230VAC

Approvals **BG UL CSA**

SRB-NA-R-C.33

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10% 24 VAC, 48 VAC, 115 VAC, 230 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	F2: T 0.25 A/250 (internal F1: TM 0.25 A/250V)
Power Consumption	max. 2.5 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Switching Capacity (Monitoring Contacts)	24V, 2 A resistive (inductive with suitable suppression)
Fuse (Monitoring Contacts)	2 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 20 ms
Drop-Out Delay	≤ 50 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.5 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 45 mm / 140 mm
Weight	190 g (280g at 115 VAC and 230 VAC versions)
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 50 005 / DIN 50 013

Guard Door and Emergency-Stop Safety Controllers

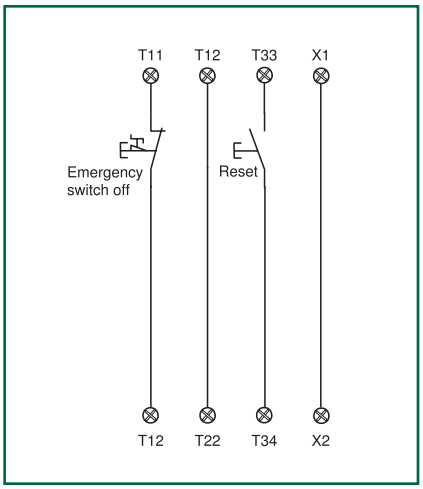
SRB-NA-R-C.33 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



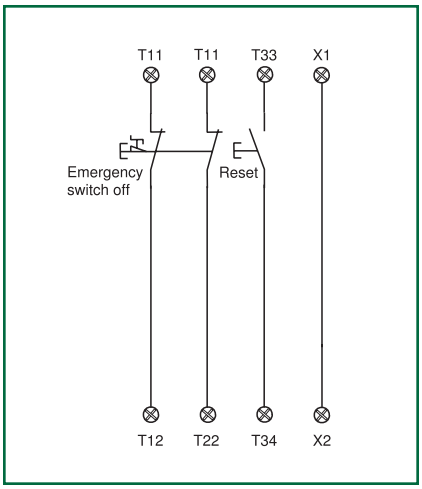
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

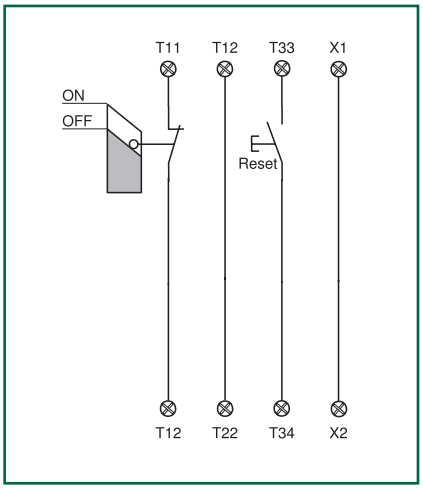


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.



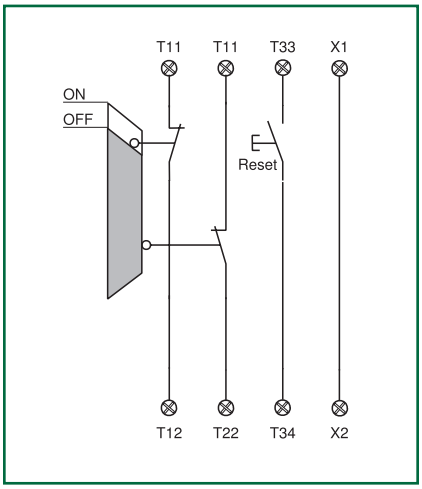
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are not detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.

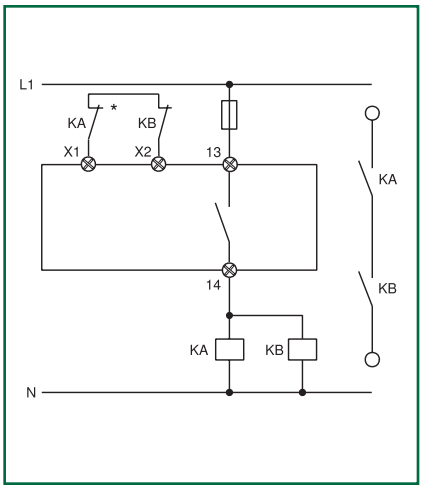


Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.33 Output Wiring Options

Single-Channel output.

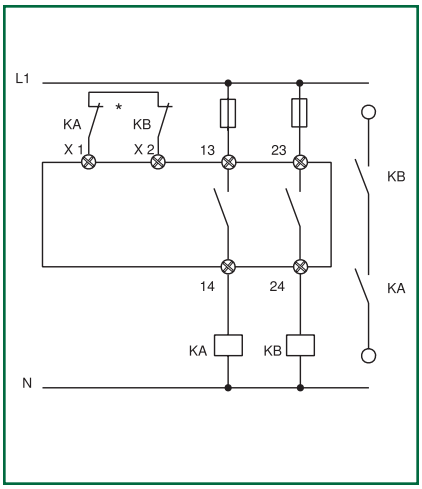
Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



*Feedback loop.

Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



*Feedback loop.

Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

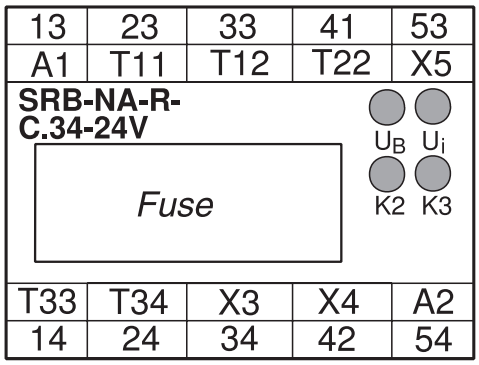
SRB-NA-R-C.34

Stop Category (EN60204-1): 0

Features

- 3 NO relay outputs, 2 NO/ NC auxiliary outputs (NO/NC auxiliary contacts for monitoring only, must not be used in safety enabling circuits)
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2, U_B, U_i
- Housing 90 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35 DIN EN 50 022
- **Not for use with BNS Series coded magnet switches**

Front View



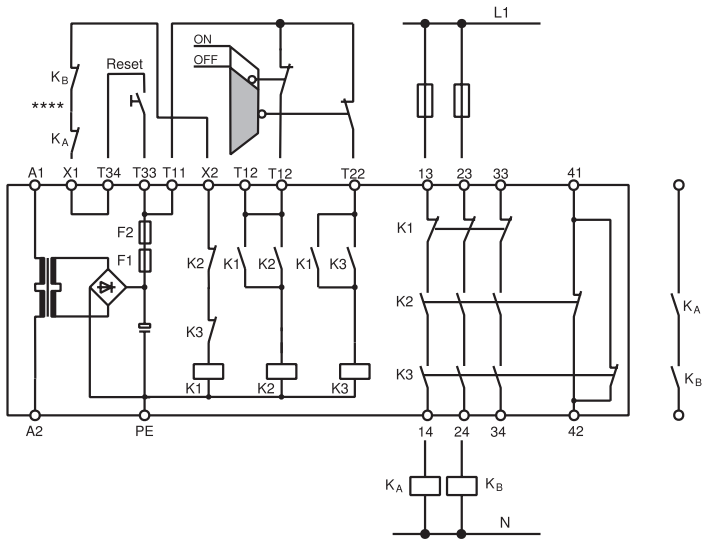
Dimensions 83 x 45 x 140 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.34-24V	3 NO / 1 NC / 1 NO	24VDC/VAC

Approvals **BG UL CSA**

SRB-NA-R-C.34

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	F2: T 0.25 A/250 (internal F1: T 0.5 A/250V)
Power Consumption	max. 5 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression) DC 13: 24 V/2 A; AC 15: 230 VAC/3 A
Fuse (Enabling Contacts)	6 A slow blow
Switching Capacity (Monitoring Contacts)	max. 24 VDC/2 A resistive (inductive with suitable suppression)
Fuse (Monitoring Contacts)	2 A slow blow; 0.5 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 20 ms
Drop-Out Delay	≤ 30 ms
Contact Materials / Contacts	AgCdO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.5 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 45 mm / 140 mm
Weight	200g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 50 005 / DIN 50 013

Guard Door and Emergency-Stop Safety Controllers

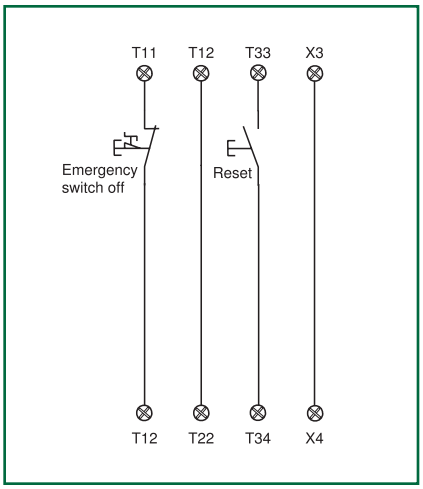
SRB-NA-R-C.34 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



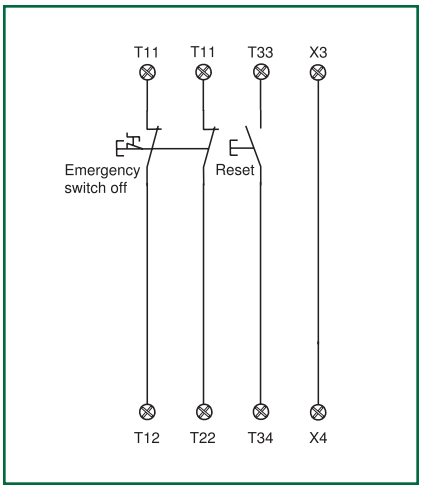
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

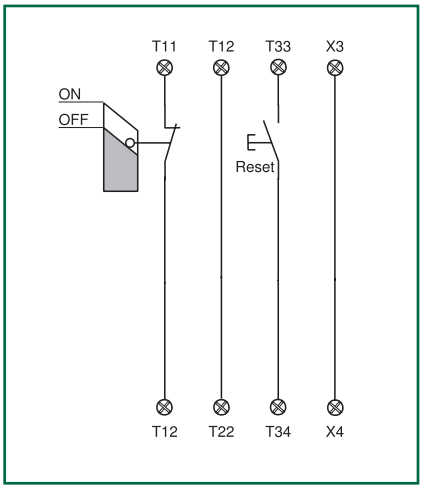


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.



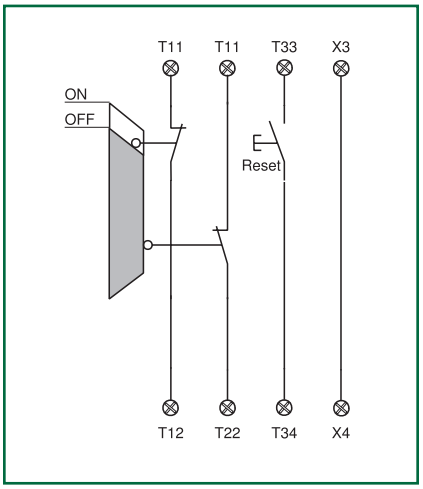
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button for increased safety requirements.

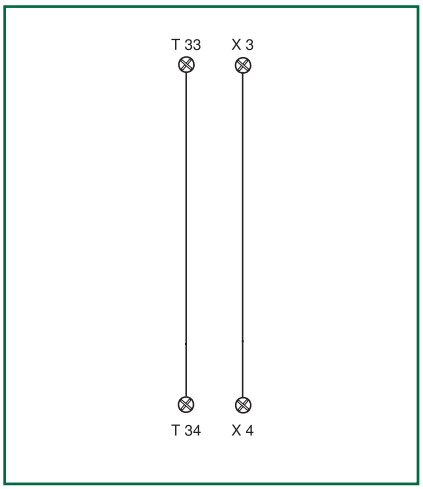
Safety category 3 or 4 in accordance with EN 954-1.



Advice:

Time window infinite channel 1 and channel 2 via cable link between X3/X4 and T33/T34.

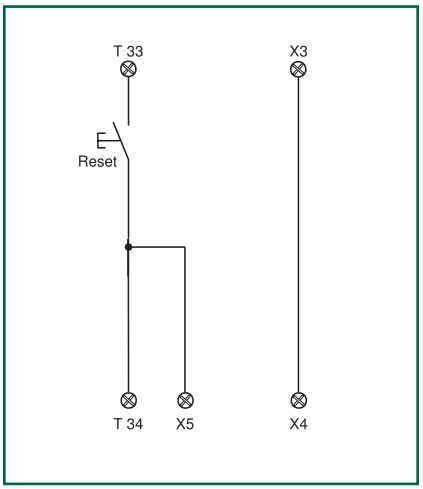
For external Reset connect Reset button to X3/X4.



Start with trailing edge function.

Module is activated after release of the Reset button.

This prevents tampering of the Reset button which could lead to an automatic reset.

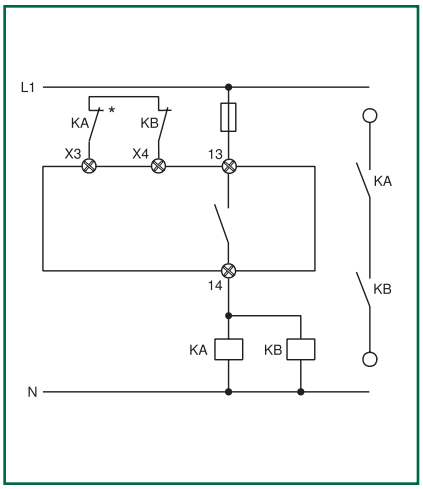


Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.34 Output Wiring Options

Single-Channel output.

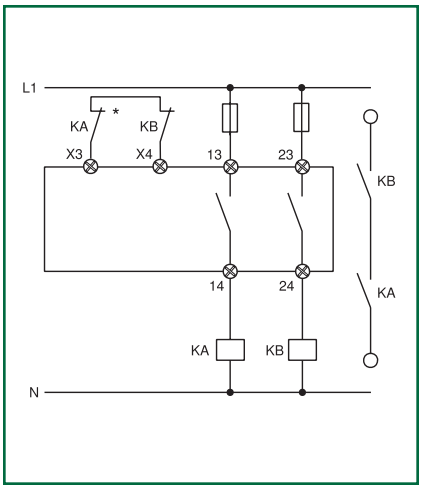
Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



*Feedback loop.

Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



*Feedback loop.

Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

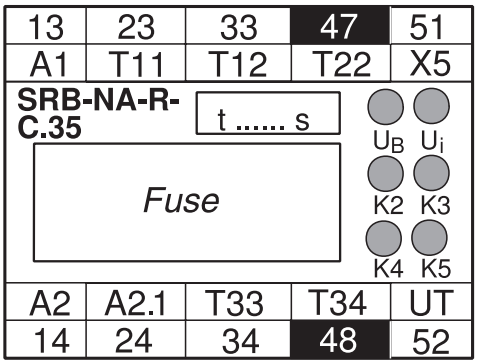
SRB-NA-R-C.35

Stop Category (EN60204-1): 1

Features

- 4 NO relay outputs, 1NC auxiliary output, 1 NO time-delayed output (NC auxiliary contact for monitoring only, must not be used in safety enabling circuits)
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K2, K3, K4, K5, U_B, U_i
- Housing 45 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35 DIN EN 50 022
- **Not for use with BNS Series coded magnet switches**

Front View



Dimensions 83 x 45 x 140 mm

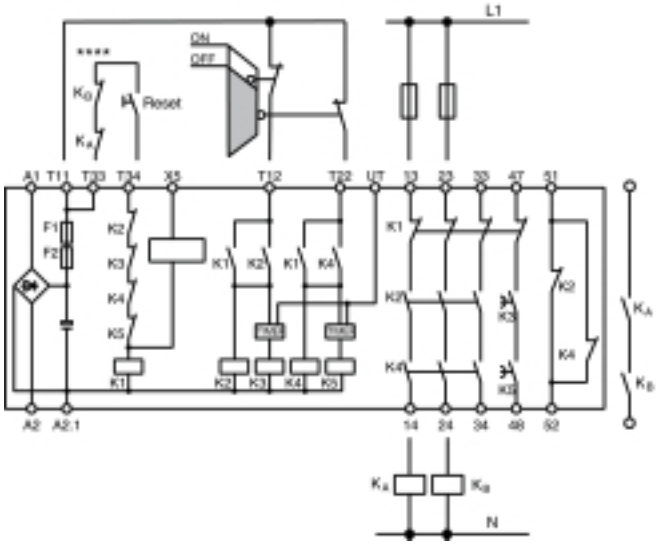
Model Designation		Enabling Outputs	Operating Voltage
	SRB-NA-R-C.35/WE-24V	3 NO / 1 NO / 1 NC	24VDC/VAC
	SRB-NA-R-C.35KE-24V	3 NO / 1 NO / 1 NC	24VDC/VAC

WE — Time setting at factory (recommended)
KE — Time setting by customer

Approvals **BG UL CSA**

SRB-NA-R-C.35

Typical Wiring Diagram for the SRB-NA-R-C.35 KE only.
Please see next page for SRB-NA-R-C.35 QS wiring diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	F2: T 0.25 A/250 (internal F1: T 0.5 A/250V)
Power Consumption	max. 5 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression) DC 13: 24 V/2 A; AC 15: 230 VAC/3 A
Fuse (Enabling Contacts)	6 A slow blow
Switching Capacity (Monitoring Contacts)	max. 24 VDC/2 A resistive (inductive with suitable suppression)
Fuse (Monitoring Contacts)	2 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 200 ms
Drop-Out Delay	≤ 30 ms
Contact Materials / Contacts	AgCdO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.5 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 45 mm / 140 mm
Weight	280g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 50 005 / DIN 50 013

Guard Door and Emergency-Stop Safety Controllers

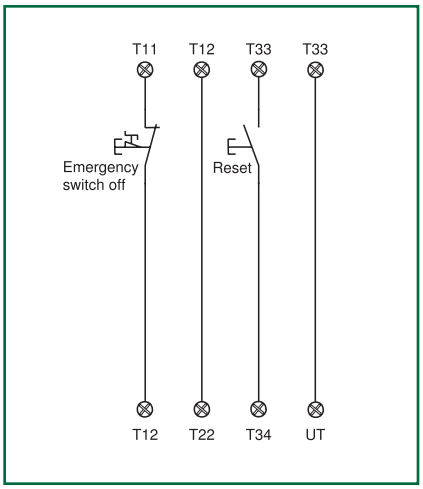
SRB-NA-R-C.35 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



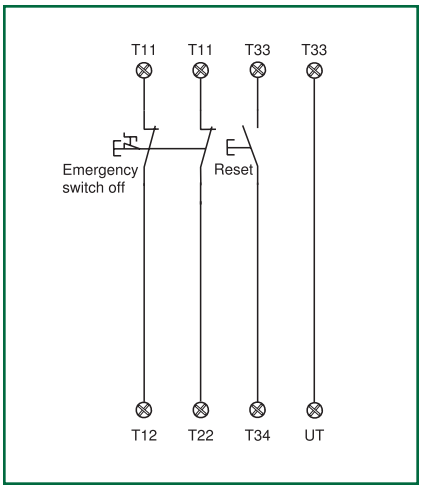
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

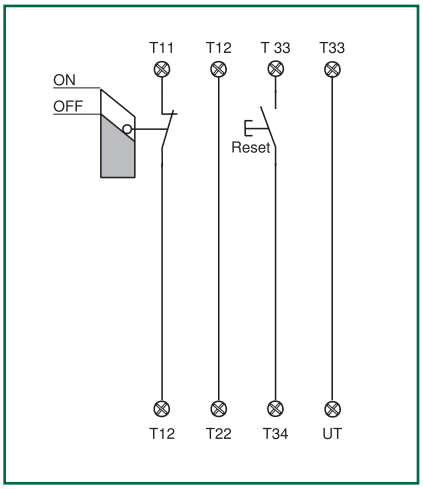


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.



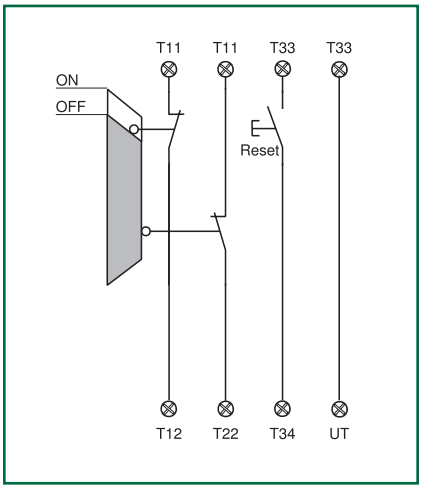
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are not detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.



(Type QS)

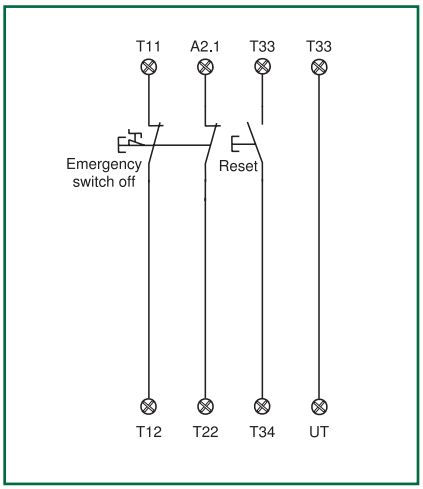
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



Wiring example: Input level (Type QS)

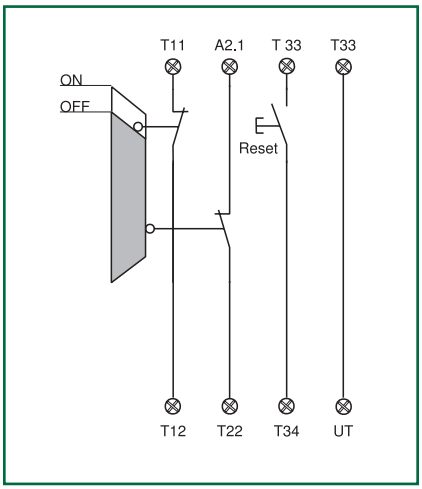
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.



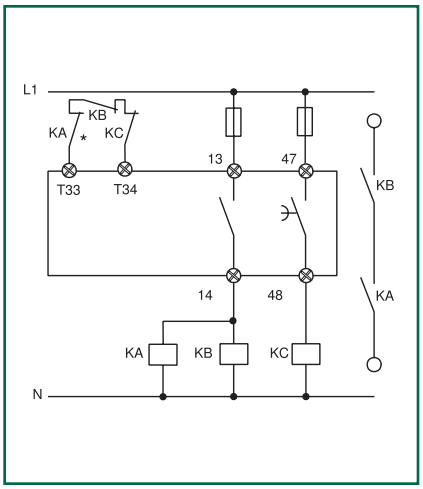
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.35 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

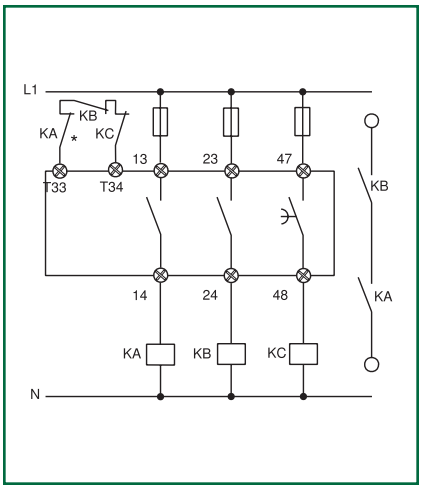
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

*Reset button wired in series to feedback loop.

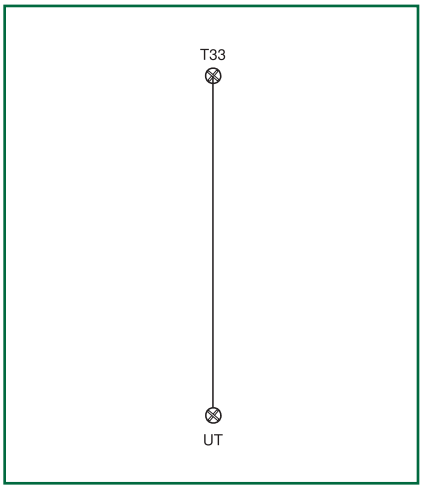


Advice:

The supply for the electronic timers of the delayed enabling output 47/48 is on terminal UT.

For a controlled operation in case of power loss, supply external power to terminal UT.

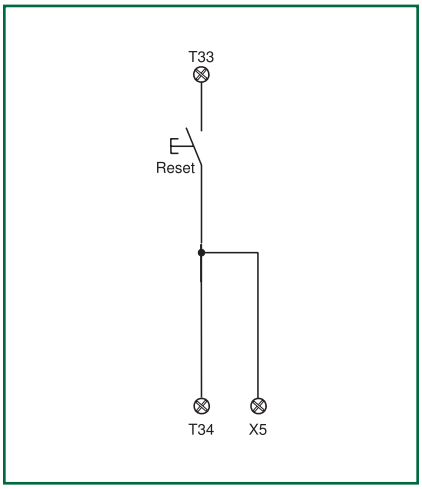
Warning: If external voltage (24V DC, no ripple) is applied on a terminal UT, a fuse 0.1 A quick blow shall be provided.



Start with trailing edge function.

Module is activated after release of the Reset button.

This prevents tampering of the Reset button which could lead to an automatic reset.

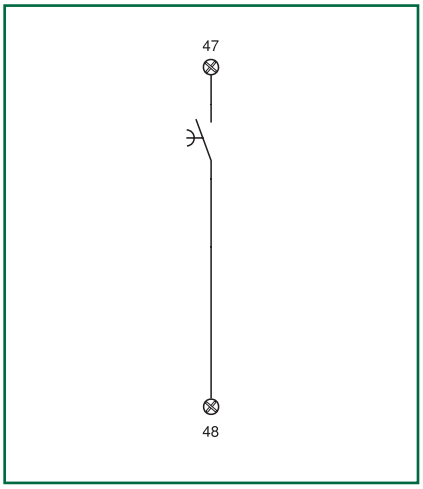


Advice:

Drop-out delay of the enabling output 47/48 adjustable 0…30 sec.

Enabling output 47/48 corresponds to Stop-category 1 in accordance with EN 60 204-1.

Enabling output 13/14, 23/24 and 33/34 corresponds to Stop-category 0 in accordance with EN 60 204-1.

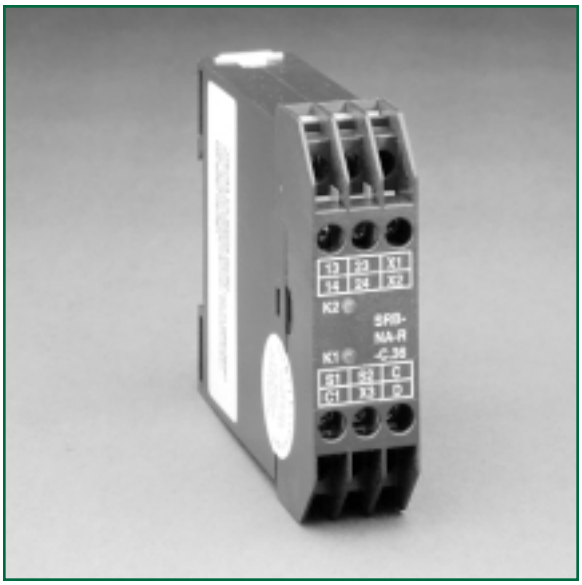


Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

SRB-NA-R-C.36

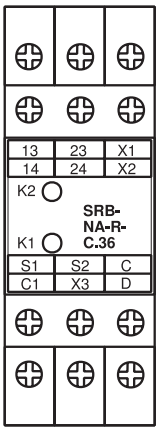
Stop Category (EN60204-1): 0



Features

- 2 NO relay outputs
- Input for reset
- Feedback loop
- No cross-short recognition
- Input for E-stop or door monitoring
- LED's for K1, K2
- Housing 22.5 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35
- **Not for use with BNS Series coded magnet switches**

Front View



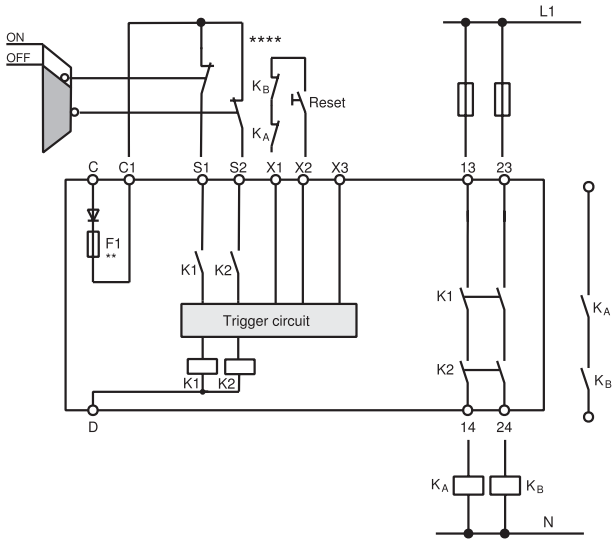
Dimensions 82 x 22.5 x 98.8 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.36-24VDC	2 NO	24VDC

Approvals **BG UL CSA**

SRB-NA-R-C.36

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

** internal electronic fuse

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%
Fuse (Power Supply)	Internal electronic fuse, breaking current > 0.6 A, reset time approx. 1 second
Power Consumption	max. 2.5 W
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 330 ms / 720 ms (reset / auto reset)
Drop-Out Delay	≤ 20 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	82 mm / 22.5 mm / 98.8 mm
Weight	190 g
Ambient Operating Temperature	0 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part 2

Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.36 Input Wiring Options

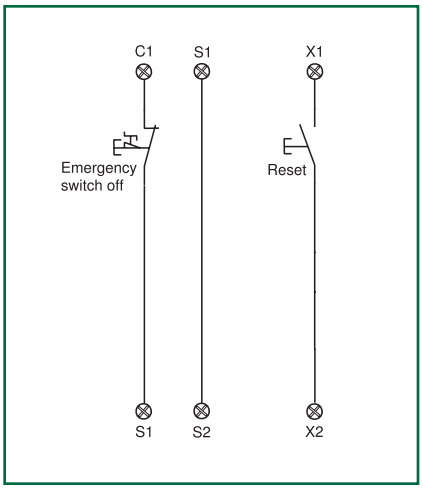
Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



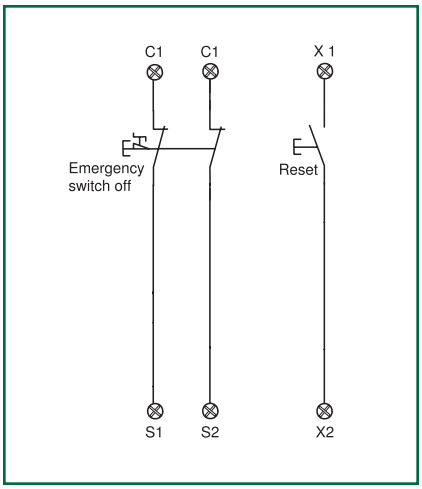
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

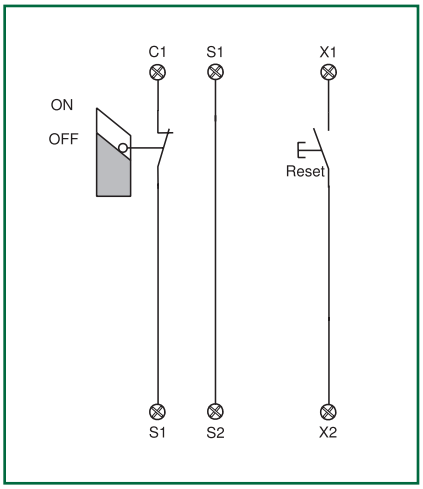


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.



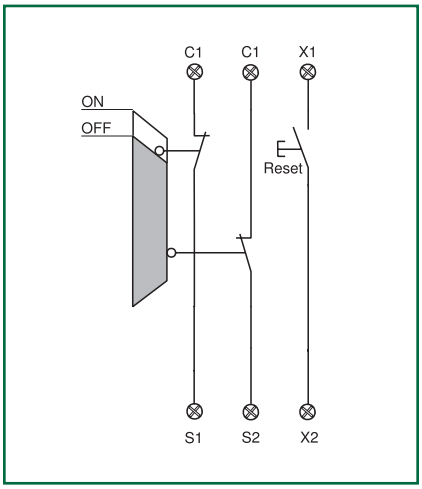
Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are not detected.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.

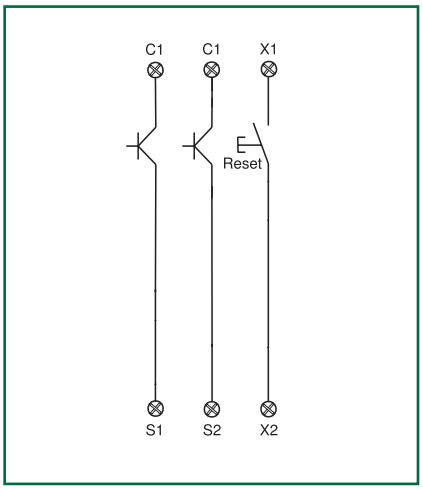


Dual-Channel triggering using P-switching semi-conductors.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset.

Safety category 3 or 4 in accordance with EN 954-1.

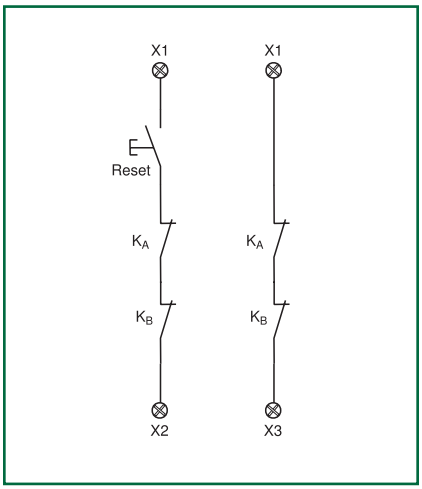


Advice:

For “Automatic Reset” apply jumper X1-X3.

When using external Reset button (connected to X1-X2), unit is triggered by trailing edge function.

Reset button wired in series to feedback loop.



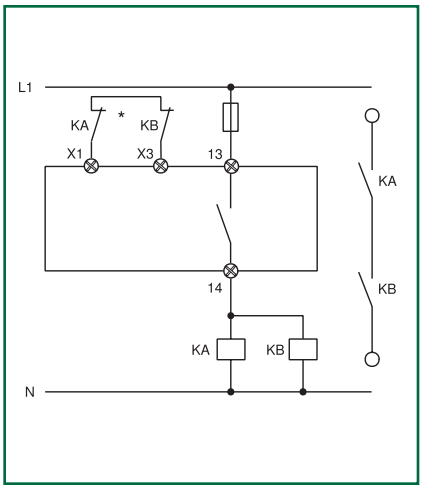
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.36 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

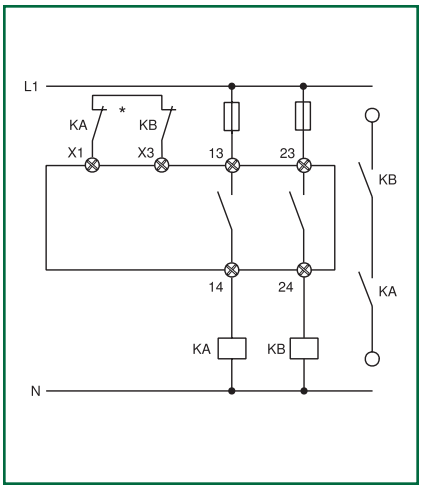
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

*Reset button wired in series to feedback loop.



Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

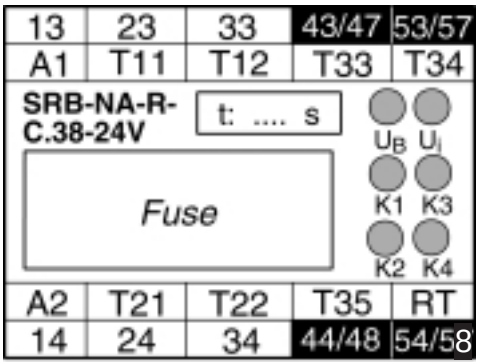
SRB-NA-R-C.38

Stop Category (EN60204-1): 1

Features

- 3 NO relay outputs, 2 NO time-delayed outputs
- Input for reset
- Feedback loop
- Input for E-stop or door monitoring
- LED's for K1, K2, K3,K4, U_B, U_i
- Housing 45 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35 DIN EN 50 022
- **Not for use with BNS Series coded magnet switches**

Front View



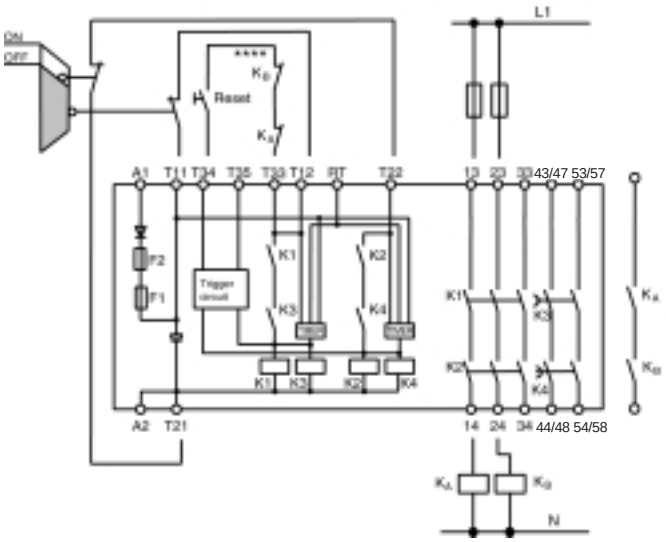
Dimensions 83 x 45 x 140 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.38-24V	3 NO / 2NO	24VAC/VDC

Approvals BG UL CSA

SRB-NA-R-C.38

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Dual-channel output, suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

* Fuse F2 (front cover) 1 A, fuse F1 (internal) 1.25 A

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	T 1.0 A/250 V (internal T 1.25 A/250V)
Power Consumption	max 4 VA
Switching Capacity (Enabling Contacts)	230 VAC, 4 A resistive (inductive with suitable suppression) NO 43/44, 53/54: DC 13: 24 VDC/2 A; AC 15: 230 VAC/3 A
Fuse (Enabling Contacts)	4 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 30 ms
Drop-Out Delay	≤ 60 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.5 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 45 mm / 140 mm
Weight	480 g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part2

Guard Door and Emergency-Stop Safety Controllers

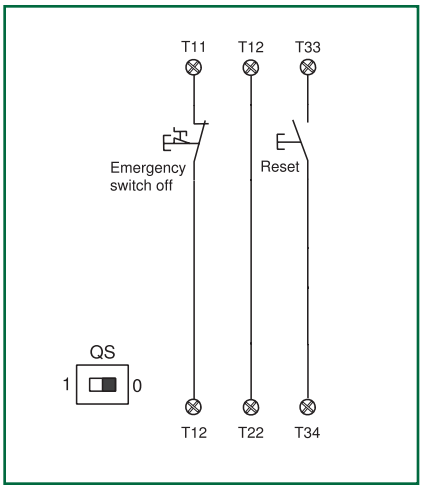
SRB-NA-R-C.38 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.



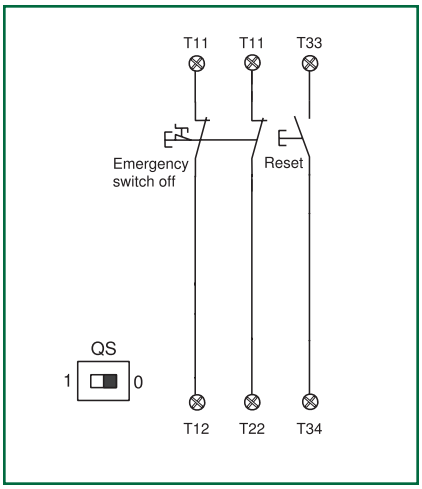
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

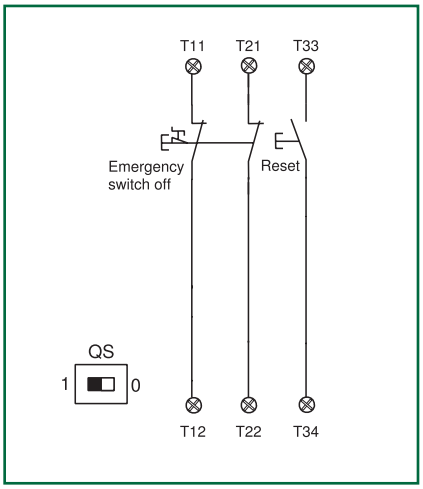
Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

To detect cross-short monitoring: Set switch “QS” (bottom of housing) to 1.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.

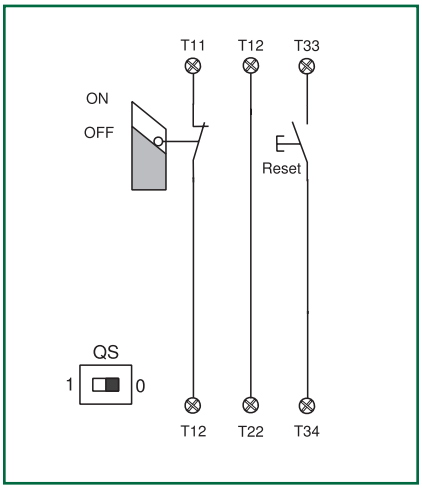


Single-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button for increased safety requirements.

Safety category 2 in accordance with EN 954-1.



Dual-Channel Door Monitoring according to EN 1088 one limit switch with positive opening contact.

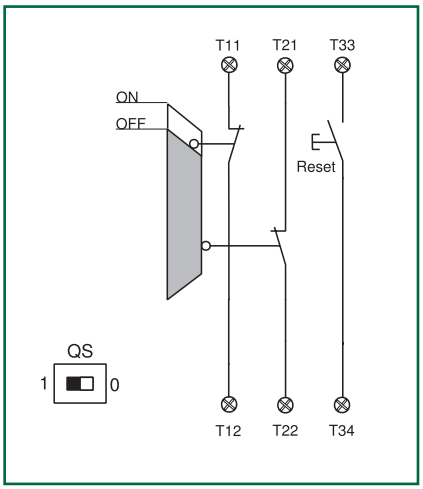
Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

To enable cross-short monitoring: Set switch “QS” (bottom of housing) to 1.

With external Reset button for increased safety requirements.

Safety category 3 or 4 in accordance with EN 954-1.



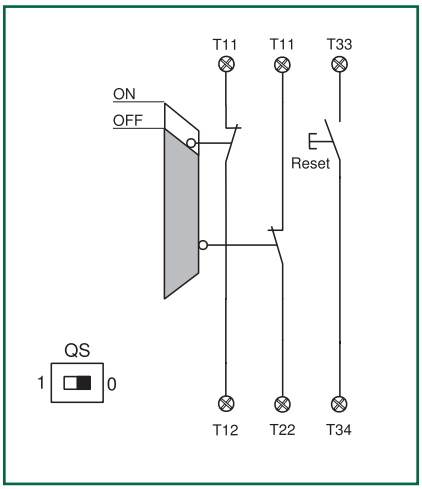
Dual-Channel Monitoring according to EN 1088 one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



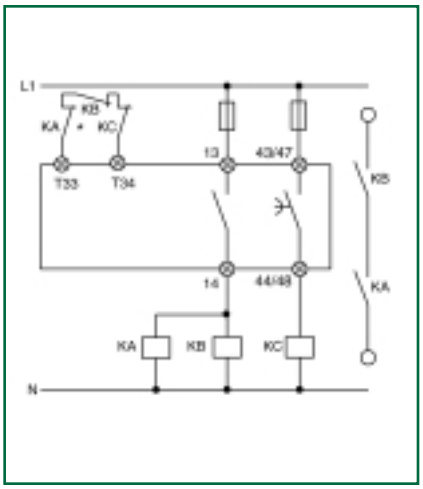
Guard Door and Emergency-Stop Safety Controllers

SRB-NA-R-C.38 Output Wiring Options

Single-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

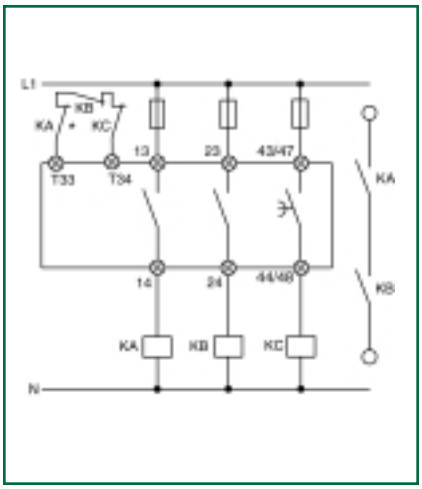
*Reset button wired in series to feedback loop.



Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.

*Reset button wired in series to feedback loop.

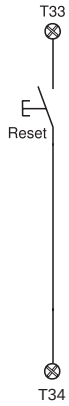


Advice:

For “Automatic Reset” apply jumper T33-T34.

When using external Reset button (T33-T34), unit is triggered by trailing edge function.

Reset button wired in series to feedback loop.

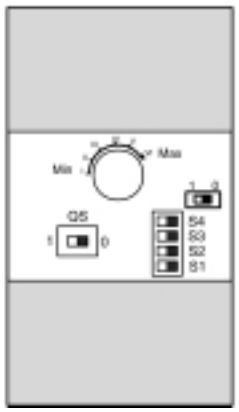


Advice:

Drop-out delay of the enabling outputs 47/48 and 53/54 adjustable from 0-30 sec.

Enabling outputs 43/44 and 57/58 correspond to STOP-category 1 in accordance with EN 60 204-1.

Enabling outputs 13/14, 23/24 and 33/34 correspond to STOP-category 1 in accordance with EN 60 204-1.



Time in Seconds	S1 = 1 S2 = 1 S3 = 1 S4 = 1	S1 = 0 S2 = 1 S3 = 0 S4 = 1	S1 = 1 S2 = 0 S3 = 1 S4 = 0	S1 = 0 S2 = 0 S3 = 0 S4 = 0
I	0.44	2.30	3.5	18
II	0.62	2.45	5.0	20
III	0.87	2.70	7.0	22
IV	1.05	2.85	8.5	23
V	1.27	3.05	10.2	25
VI	1.77	3.55	14.2	29

Tolerance ± 5%

Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

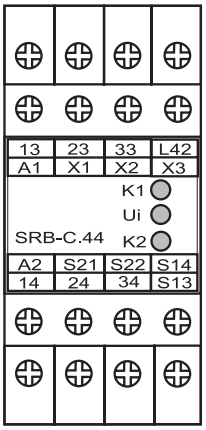
SRB-C.44

Stop Category (EN60204-1): 0

Features

- Suitable for E-Stop, door monitoring or **BNS Series coded magnet switches without LED**
- 3 enabling outputs and 1 monitoring output
- Current limitation at input circuits
- Voltage limitation at input circuits
- LED's for K1, K2, U_i
- Selectable trailing edge function and auto reset
- 22.5 mm housing

Front View



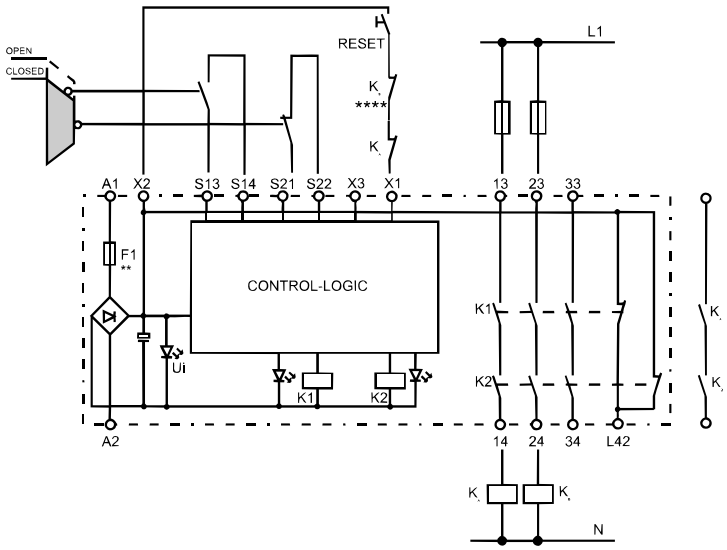
Dimensions 90 x 22.5 x 121 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-C.44	3 NO	24VAC/DC

Approvals **BG UL CSA**

SRB-C.44

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive-opening contacts) and external reset button.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

** Fuse M 0.5A (an external leading fuse M 0.25 A is recommended)

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%, 24 VAC -15% / +10%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	T 0.25 A/250V (internal TM 0.5 A/250V)
Power Consumption	max. 2 VA
Switching Capacity (Enabling Contacts)	230 VAC, 4 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	4 A slow blow
Switching Capacity (Monitoring Contacts)	24VDC, 100mA
Fuse (Monitoring Contacts)	100 mA slow blow
Current- & Voltage-Limitation of Input Circuits	26 VDC, 100 mA
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 120 ms / ≤ 30 ms (auto start, reset button)
Drop-Out Delay	≤ 20 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	90 mm / 2.25 mm / 121 mm
Weight	200g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 50 005 / DIN 50 013

Guard Door and Emergency-Stop Safety Controllers

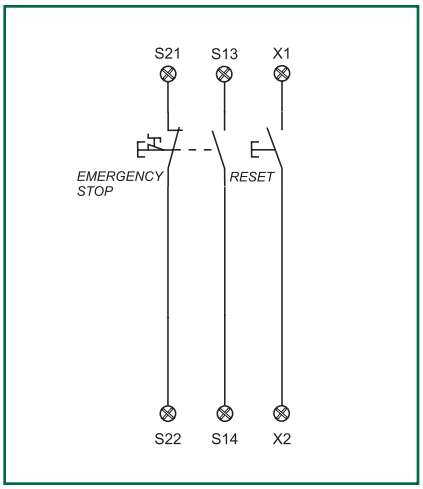
SRB-C.44 Input Wiring Options

Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency-Stop circuits are detected.

With external Reset button.

Safety category 3 or 4 according to EN 954-1.



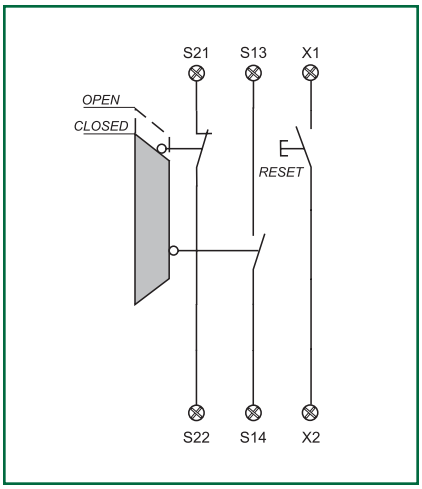
Dual Channel Door Monitoring according to EN 1088, one limit switch with positive-opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are detected.

With external Reset button.

Safety category 3 or 4 according to EN 954-1.

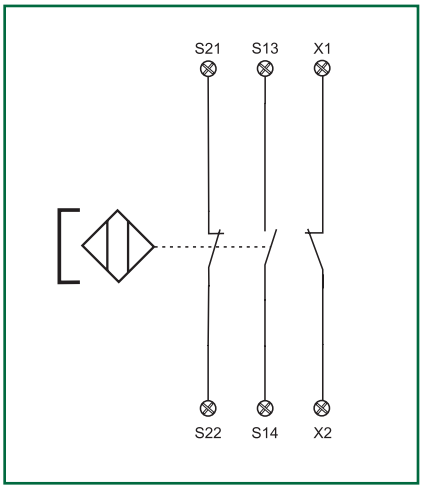


Dual Channel Door Monitoring with safety magnet switch and initial start test.

Wire breakage and earth leakage in the door Monitoring circuits are detected.

With external Reset button.

Safety category 3 or 4 according to EN 954-1.

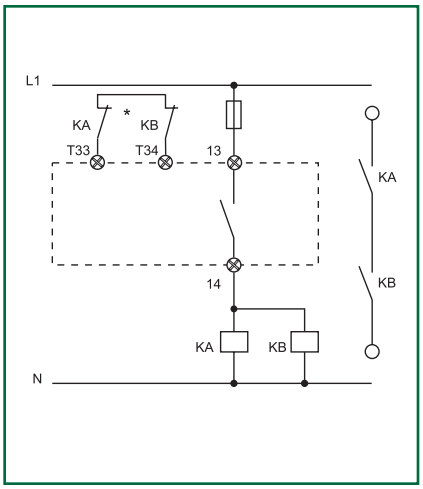


Guard Door and Emergency-Stop Safety Controllers

SRB-C.44 Output Wiring Options

Single-Channel output.

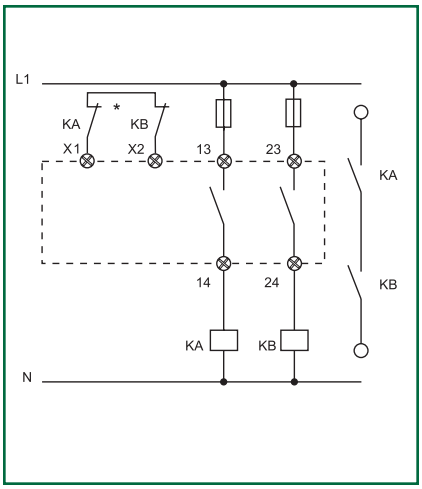
Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively-guided contacts.



*Feedback loop

Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively-guided contacts.

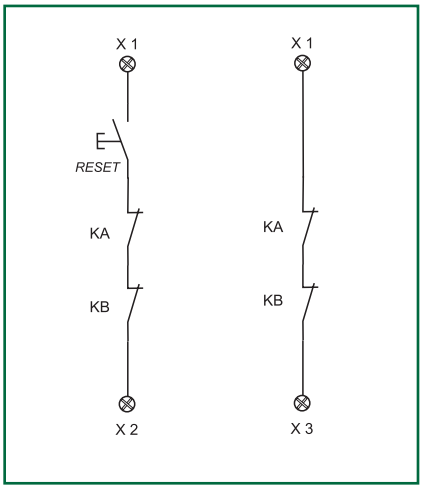


*Feedback loop

Advice:

For “Automatic Reset” contact feedback loop to X1-X3 or apply jumper X1-X3 if no feedback loop is used.

When using external Reset button (feedback loop connected to X1-X2), unit is triggered by trailing edge function.



Note: When operated at 24VAC only and when wired for trailing edge reset, loss of an internal capacitor will result in the reset function not being fail safe.

Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

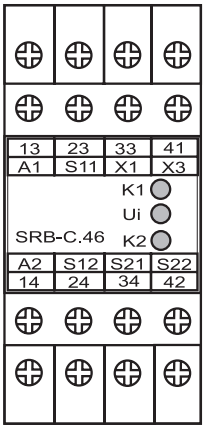
SRB-C.46

Stop Category (EN60204-1): 0

Features

- Suitable for E-Stop, door monitoring or safety magnet switched
- 3 enabling outputs and 1 monitoring output
- Suitable for monitoring semiconductor outputs
- With electronic short-circuit protection “Hybrid Fuse”
- Reset-feedback loop
- LED’s for K1, K2, U_i
- Selectable trailing edge function, auto reset and cross-short recognition
- 22.5 mm housing
- **Not for use with BNS Series coded magnet switches**

Front View

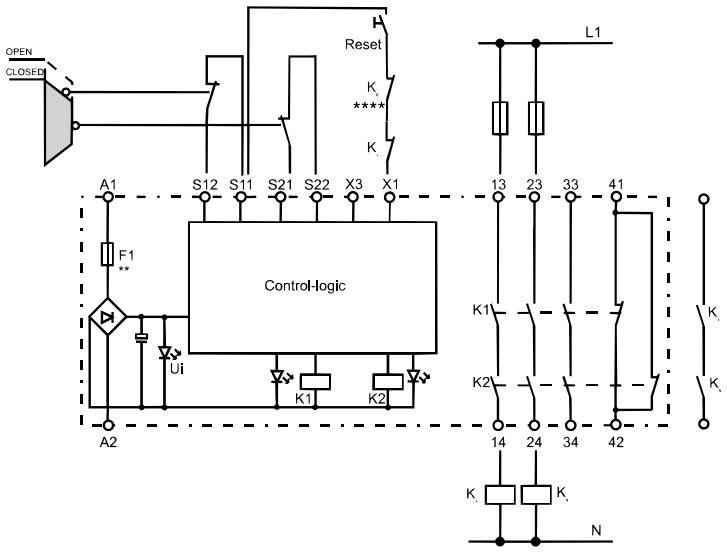


Dimensions 90 x 22.5 x 121 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-C.46	3 NO/1NC	24VAC/DC

Approvals BG UL CSA

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive-opening contacts) and external reset button.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively-guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

** Hybrid fuse – Electronic fuse, resets only when power is cycled.

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%, 24 VAC -15% / +10%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	Internal electronic fuse, triggering current > 0.6A, reset after power down
Power Consumption	max. 3.3 VA
Switching Capacity (Enabling Contacts)	230 VAC, 4 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	4 A slow blow
Switching Capacity (Monitoring Contacts)	24VDC, 2 A
Fuse (Monitoring Contacts)	2 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 120 ms / ≤ 30 ms (auto start, reset button)
Drop-Out Delay	≤ 20 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	90 mm / 22.5 mm / 121 mm
Weight	235g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 50 005 / DIN 50 013

Guard Door and Emergency-Stop Safety Controllers

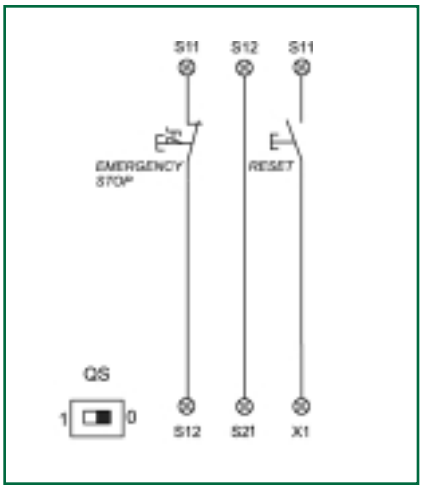
SRB-C.46 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.

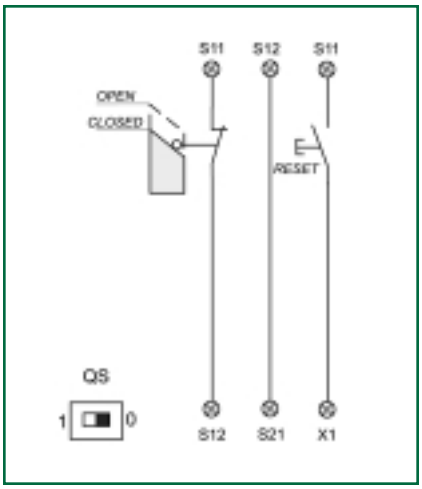


Single Channel Door Monitoring according to EN1088, one limit switch with positive-opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

With external Reset button.

Safety category 2 according to EN954-1.



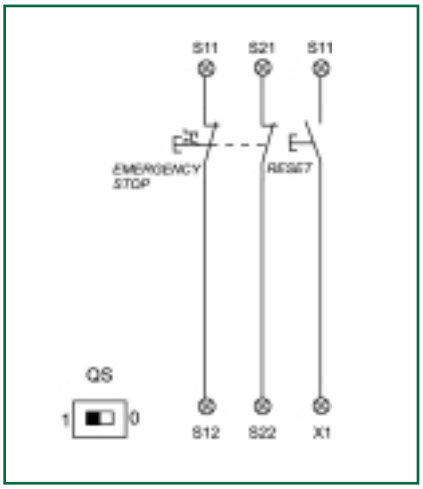
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



Dual Channel Door Monitoring according to EN1088, one limit switch with positive-opening contact.

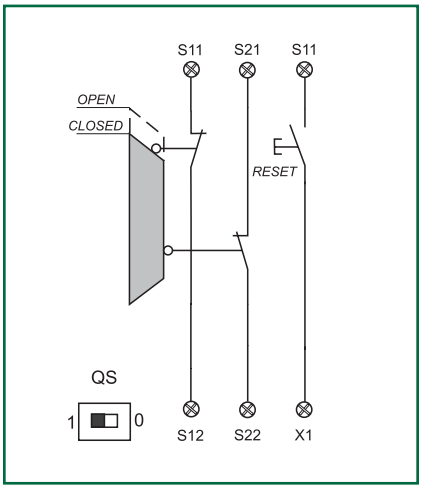
Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Cross-shorts in the Door Monitoring circuits are detected.

Activating Cross-Short monitoring: Set switch “QS” (bottom of housing) to “1”.

With external Reset button.

Safety category 3 or 4 according to EN954-1.



Dual-Channel Emergency Stop switch according to EN 60 204-1.

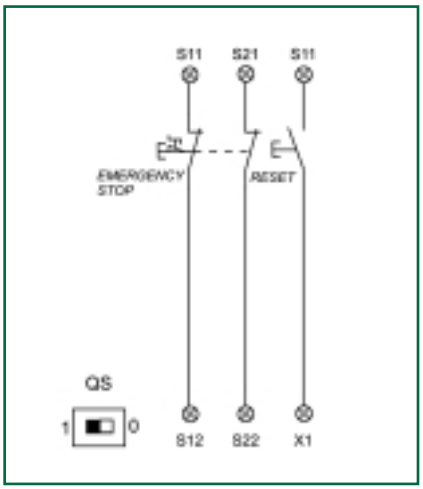
Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

Activating Cross-Short monitoring: Set switch “QS” (bottom of housing) to “1”.

With external Reset button.

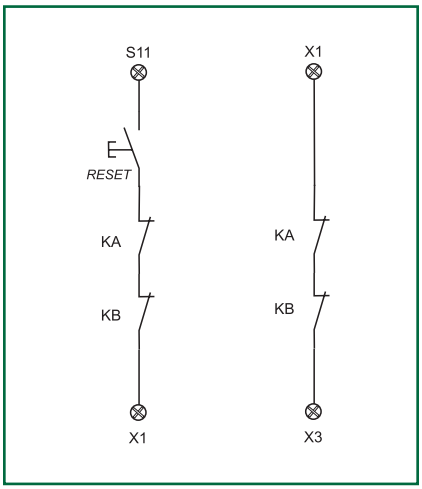
Safety category 3 or 4 in accordance with EN 954-1.



Advice:

For “Automatic Reset” connect feedback loop to X1-X3 or apply jumper X1-X3 if no feedback loop is used.

When using external Reset button (feedback loop connected to S11-X1) unit is triggered by trailing edge function.

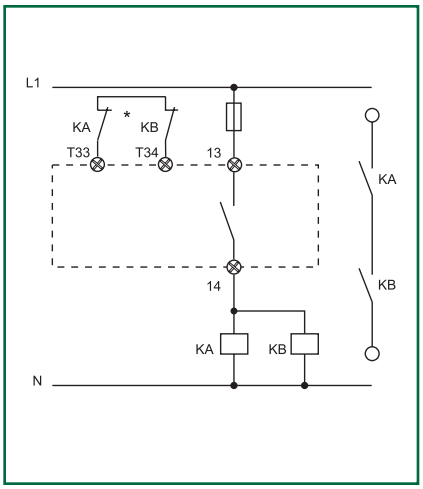


Guard Door and Emergency-Stop Safety Controllers

SRB-C.46 Output Wiring Options

Single-Channel output.

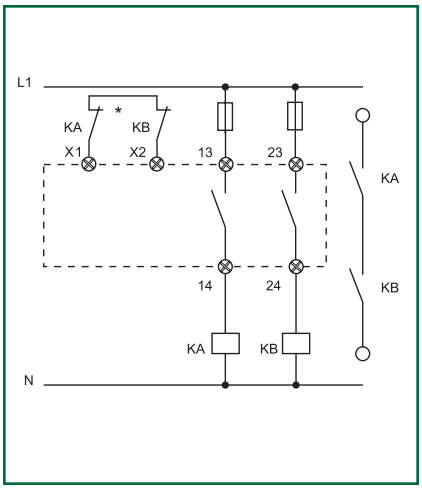
Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



*Feedback loop

Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



*Feedback loop

Note: When operated at 24VAC only and when wired for trailing edge reset, loss of an internal capacitor will result in the reset function not being fail safe.

Guard Door and Emergency-Stop Safety Controllers

Safety Category (EN954-1): CC4

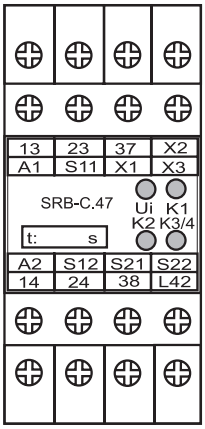
SRB-C.47

Stop Category (EN60204-1): 1

Features

- Suitable for E-Stop, door monitoring or safety magnet switched
- 3 enabling outputs, 1 drop out delayed: 1… 30 second
- Suitable for monitoring semiconductor outputs
- With electronic short-circuit protection “Hybrid Fuse”
- Reset-feedback loop
- LED’s for K1, K2, K3/K4, U_i
- Selectable trailing edge function, auto reset and cross-short recognition
- 22.5 mm housing
- **Not for use with BNS Series coded magnet switches**

Front View

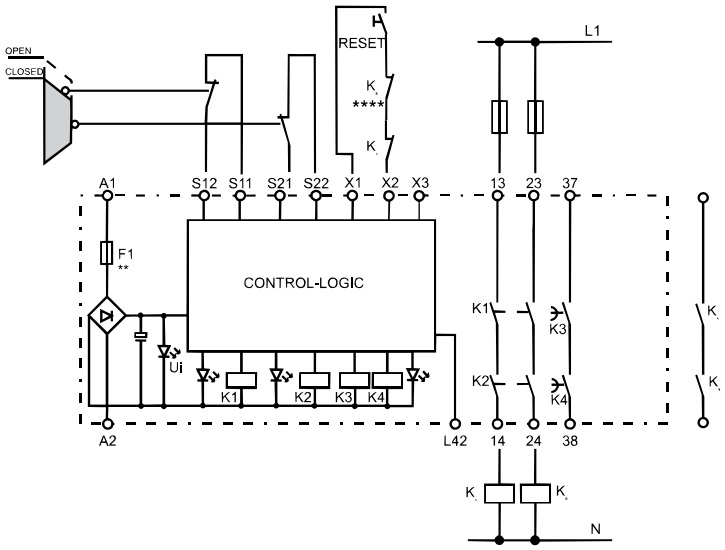


Dimensions 90 x 22.5 x 121 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-C.47	2 NO/1 NO Delayed	24VAC/DC

Approvals **BG UL CSA**

Typical Wiring Diagram
(See page 21 for symbol key)



Example for Dual Channel Door Monitoring using two limit switches (one with positive opening contacts) and external reset button.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.
**** = Feedback loop

Wiring breakage and earth leakage in the Monitoring circuits are detected.

** Hybrid fuse – Electronic fuse, however it resets only when power is cycled.

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%, 24 VAC -15% / +10%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	Internal electronic fuse, triggering current > 0.6A, reset after power down
Power Consumption	max. 4 W, plus output L42 (5.5VA)
Switching Capacity (Enabling Contacts)	230 VAC, 4 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	4 A slow blow
Switching Capacity (Monitoring Contacts)	L42: 24VDC, 100 mA
Fuse (Monitoring Contacts)	
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 120 ms / ≤ 30 ms (auto start, reset button)
Drop-Out Delay	≤ 20 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	90 mm / 2.25 mm / 121 mm
Weight	235g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 50 005 / DIN 50 013

Guard Door and Emergency-Stop Safety Controllers

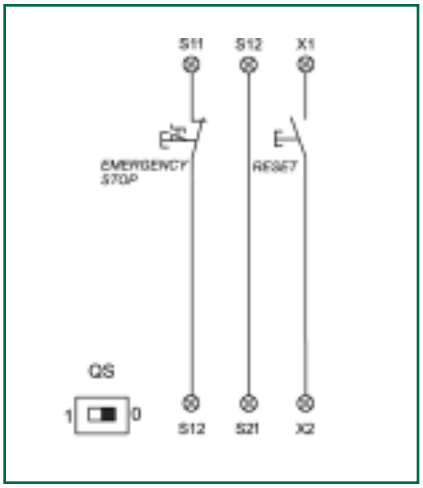
SRB-C.47 Input Wiring Options

Single-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency Stop circuits are detected.

With external Reset button.

Safety category 2 in accordance with EN 954-1.

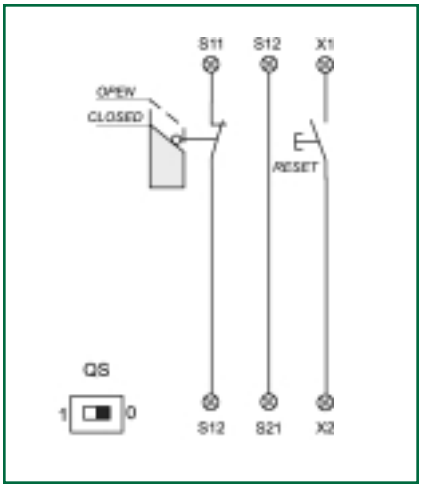


Single-Channel Door Monitoring according to EN 1088, one limit switch with positive opening contact.

Wire breakage and earth leakage in the Coor Monitoring circuits are detected.

With external Reset button.

Safety category 2 according to EN 954-1.



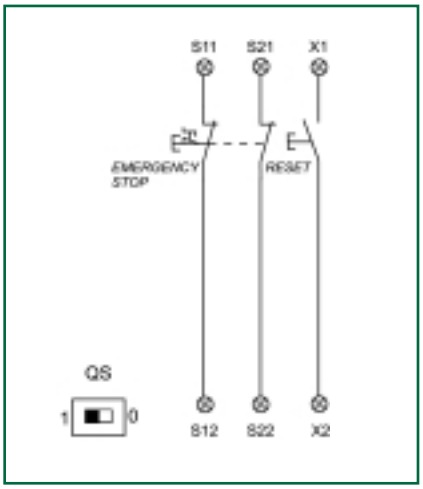
Dual-Channel Emergency Stop switch according to EN 60 204-1.

Wire breakage and earth leakage in the Emergency-Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are not detected.

With external Reset button.

Safety category 3 or 4 in accordance with EN 954-1.



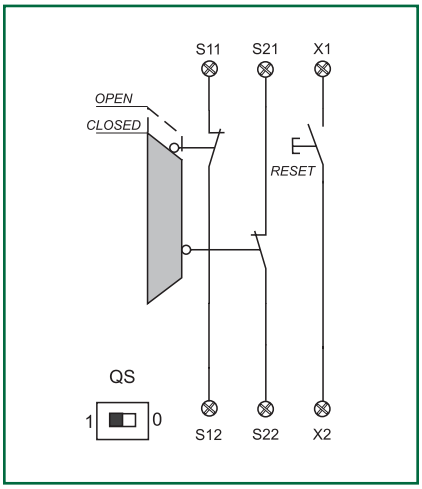
Dual-Channel Door Monitoring according to EN 1088, one limit switch with positive opening contact.

Wire breakage and earth leakage in the Door Monitoring circuits are detected.

Activating Cross-Short monitoring: Set switch “QS” (bottom of housing) to “1”.

With external Reset button.

Safety category 3 or 4 according to EN 954-1.



Dual-Channel Emergency Stop switch according to EN 60 204-1.

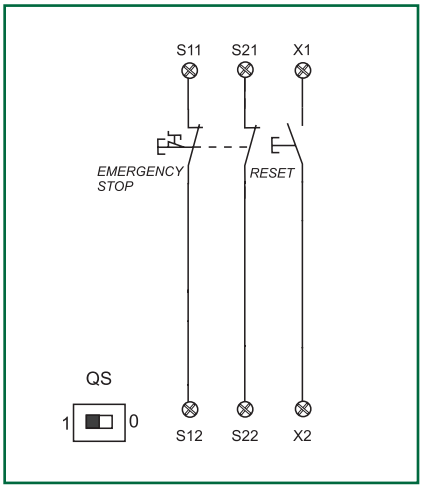
Wire breakage and earth leakage in the Emergency Stop circuits are detected.

Cross-shorts in the Emergency Stop circuits are detected.

Activating Cross-Short monitoring: Set switch “QS” (bottom of housing) to “1”.

With external Reset button.

Safety category 3 or 4 according to EN 954-1.

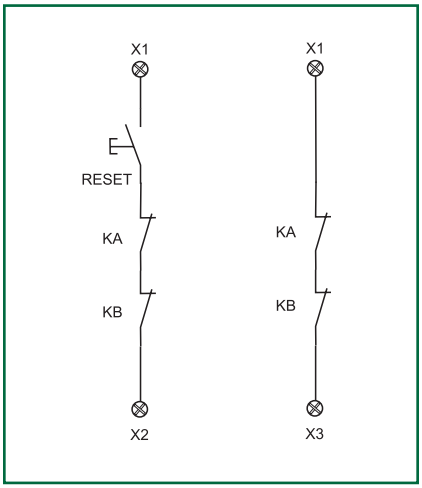


Advice:

For “Automatic Reset” connect feedback loop to X1-X3 or apply jumper X1-X3 if no feedback loop is used.

When using external Reset button (feedback loop connected to X1-X2) unit is triggered by trailing edge function.

When Cross-Short monitoring is deactivated (QS to 0) mark filed “Ohne QS” in front of housing.

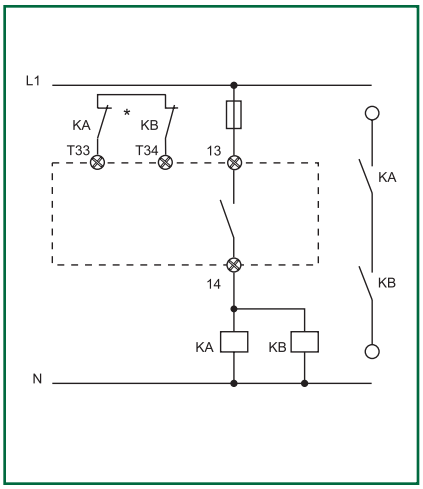


Guard Door and Emergency-Stop Safety Controllers

SRB-C.47 Output Wiring Options

Single-Channel output.

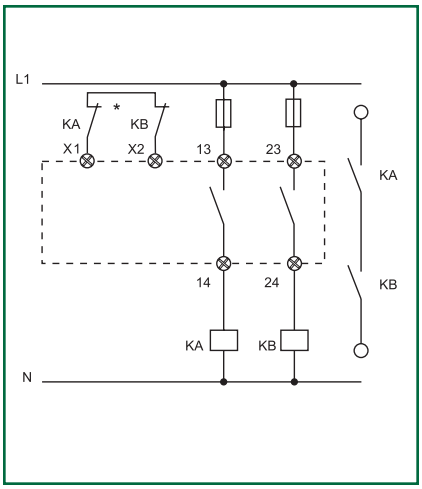
Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



*Feedback loop

Dual-Channel output.

Suitable for contact reinforcement or contact multiplication, using relays or contactors with positively guided contacts.



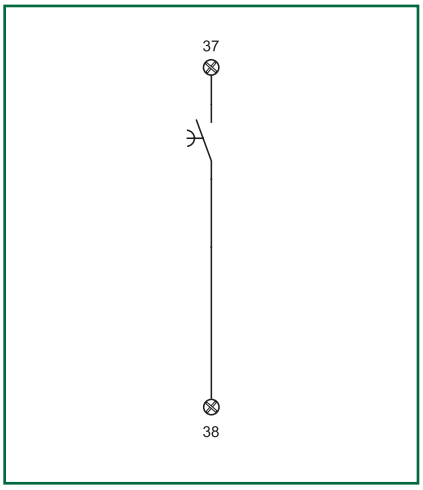
*Feedback loop

Advice:

The safety enabling contact 37/38 is drop out delayed. Delay time adjustable from 1 to 30 seconds.

The safety enabling contact 37/38 complies with Stop-category 1 according to EN 60 204-1.

The enabling contact 13/14 and 23/24 comply with Stop-category 0 according to En 60 204-1.

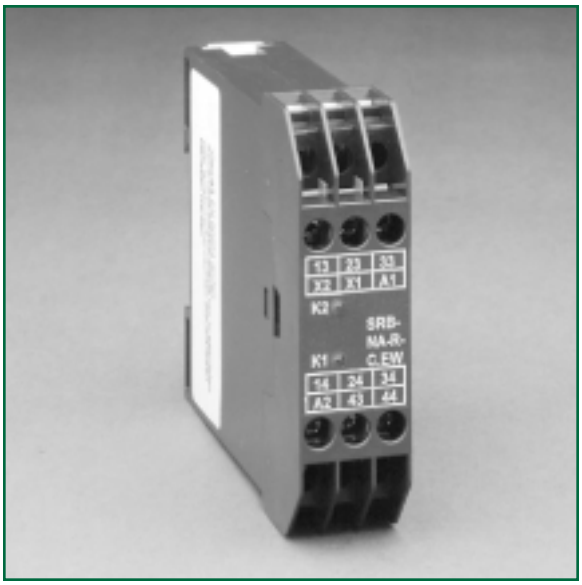


Note: When operated at 24VAC only and when wired for trailing edge reset, loss of an internal capacitor will result in the reset function not being fail safe.

Safety Controller Expansion Modules

Stop Category (EN60204-1): 0

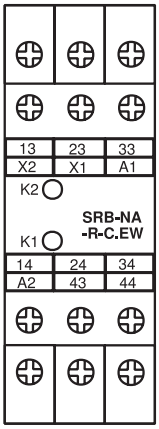
SRB-NA-R-C.EW Output Expansion Module



Features

- 4 NO relay outputs
- LED's for K1, K2
- Feedback circuit X1, X2
- Housing 22.5 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35

Front View



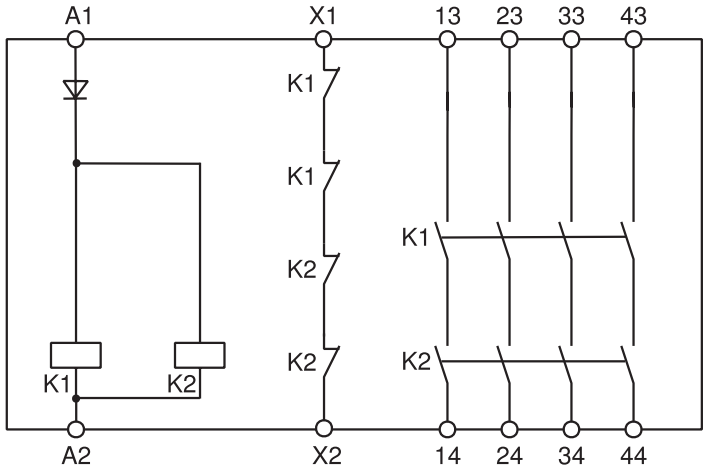
Dimensions 82 x 22.5 x 98.8 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-NA-R-C.EW-24V	4 NO	24VDC/VAC

Approvals **UL CSA BG**

SRB-NA-R-C.EW Output Expansion Module

Typical Wiring Diagram
(See page 21 for symbol key)



Technical Data

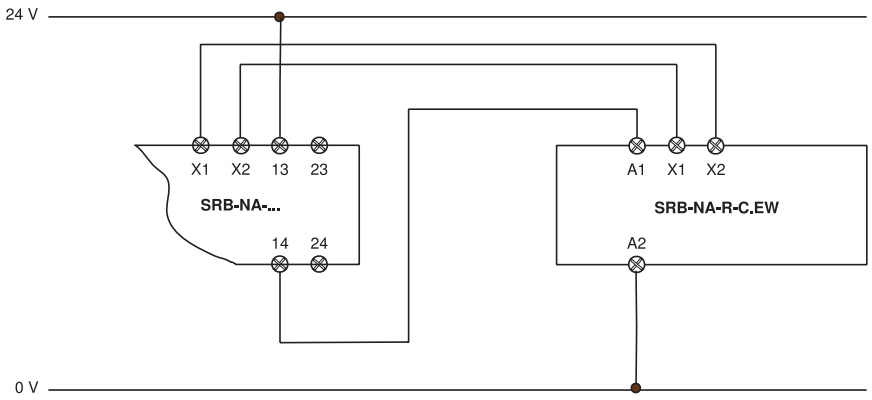
Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	M 0.25 A/250V
Power Consumption	max. 1.2 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 20 ms
Drop-Out Delay	≤ 35 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	82 mm / 22.5 mm / 98 mm
Weight	190g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part 2

SRB-NA-R-C.EW Output Expansion Module

Single-Channel control of the expansion module SRB-NA-R-C.EW via one enabling output of the base module.

A fault in the expansion module is not detected by the base module.

Connect terminals X1 and X2 to the feedback loop of the base module.



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Safety Controller Expansion Modules

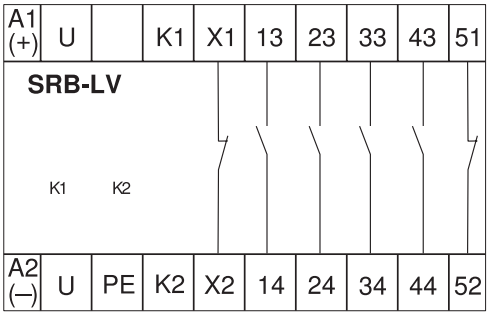
Stop Category (EN60204-1): 0

SRB-LV Output Expansion Module

Features

- 4 NO relay outputs, 1 NC auxiliary output (NC auxiliary contacts for monitoring only, must not be used in safety enabling circuits)
- LED's for K1, K2
- Feedback circuit X1, X2
- Housing 90 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35

Front View



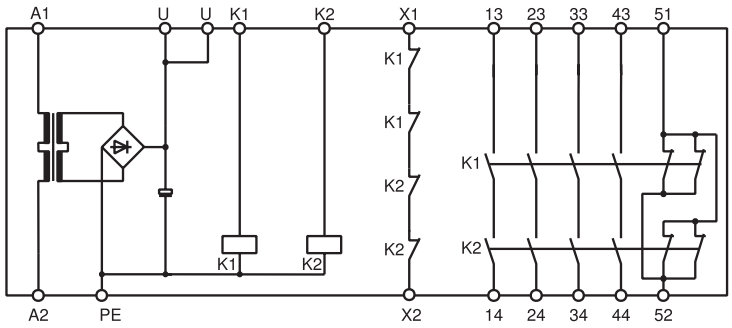
Dimensions 83 x 90 x 127 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-LV-24V	4 NO / 1 NC	24VDC/VAC
SRB-LV-115V	4 NO / 1 NC	115VAC
SRB-LV-230V	4 NO / 1 NC	230VDC

Approvals **UL CSA BG**

SRB-LV Output Expansion Module

Typical Wiring Diagram
(See page 21 for symbol key)



Technical Data

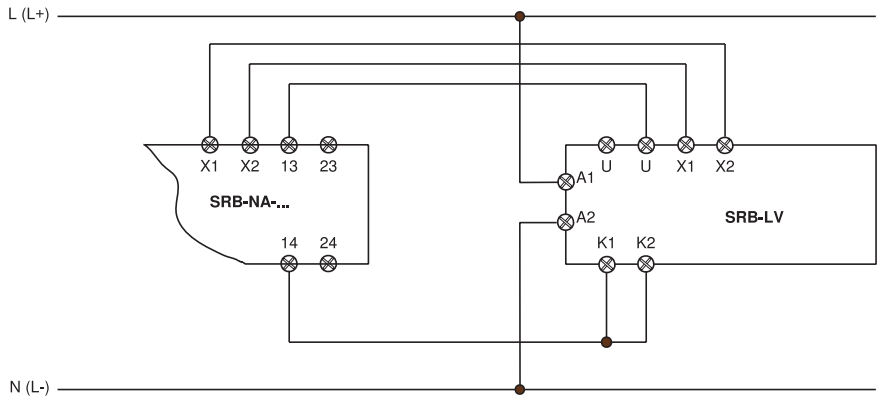
Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10% 24 VAC, 115 VAC, 230 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	M 0.25 A/250V
Power Consumption	max. 1.2 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Switching Capacity (Monitoring Contacts)	24VDC/ 2 A
Fuse (Monitoring Contacts)	2 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 20 ms
Drop-Out Delay	≤ 20 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 90 mm / 127 mm
Weight	420 g (500g at 115 VAC and 230 VAC versions)
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 60 445 / DIN 40 719 Part 2

SRB-LV Output Expansion Module Input Wiring Options

Single-Channel control of the expansion module SRB-LV via one enabling output of the base module.

A fault in the expansion module is not detected by the base module.

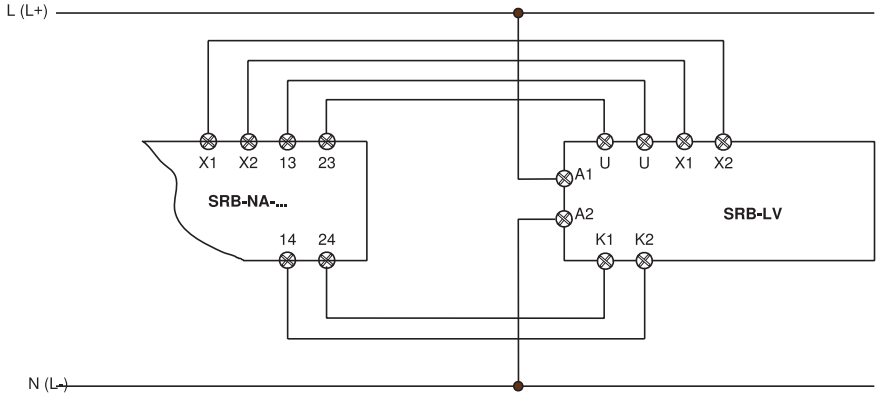
Connect terminals X1 and X2 to the feedback loop of the base module.



Dual-Channel control of the expansion module SRB-LV via two enabling outputs of the base module.

A fault in the expansion module is not detected by the base module.

Connect terminals X1 and X2 to the feedback loop of the base module.



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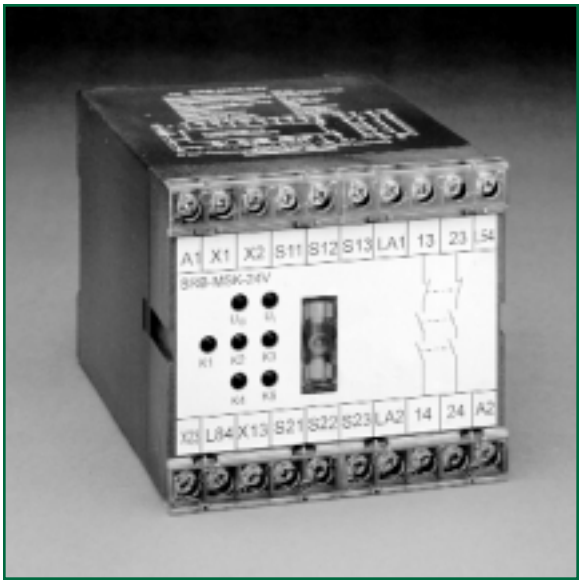
Safety Controller for Muting

SRB-MSK

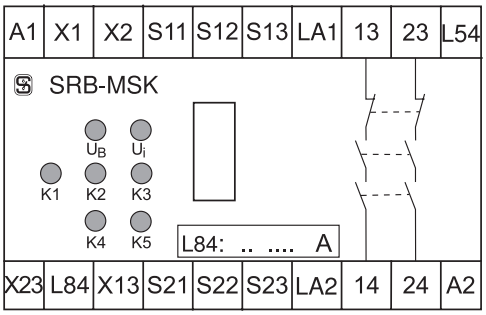
Safety Category (EN954-1): CC4



Features

- 2 muting outputs
- Monitored output for muting lamp function
- Output for monitoring the simultanety of muting sensors
- Integrated fuse
- Green LED's for K1, K2, K3, K4, K5, U_b and U_i

Front View



Dimensions 83 x 90 x 140 mm

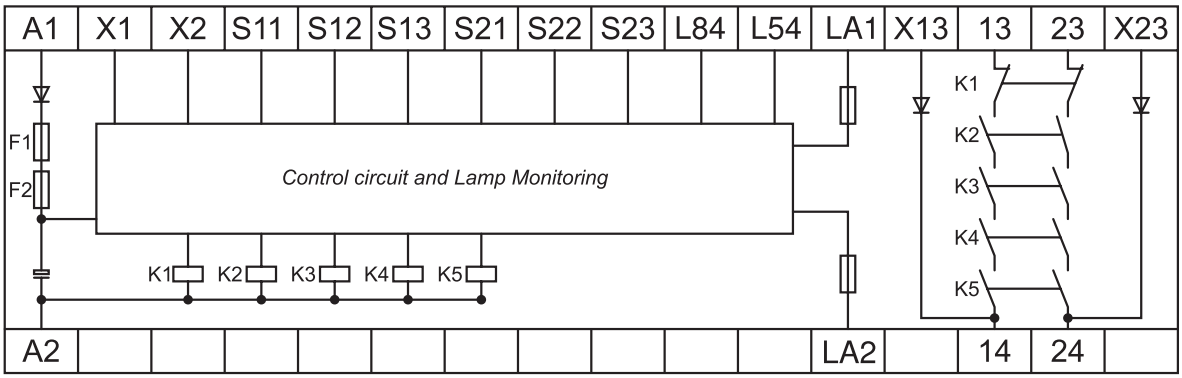
Model Designation		Enabling Outputs	Operating Voltage
	SRB-MSK-24VDC	2	24VDC
	SRB-MSK/QS-24VDC	2	24VDC

Approvals BG

Safety Controller for Muting

SRB-MSK

Typical Wiring Diagram
(See page 21 for symbol key)

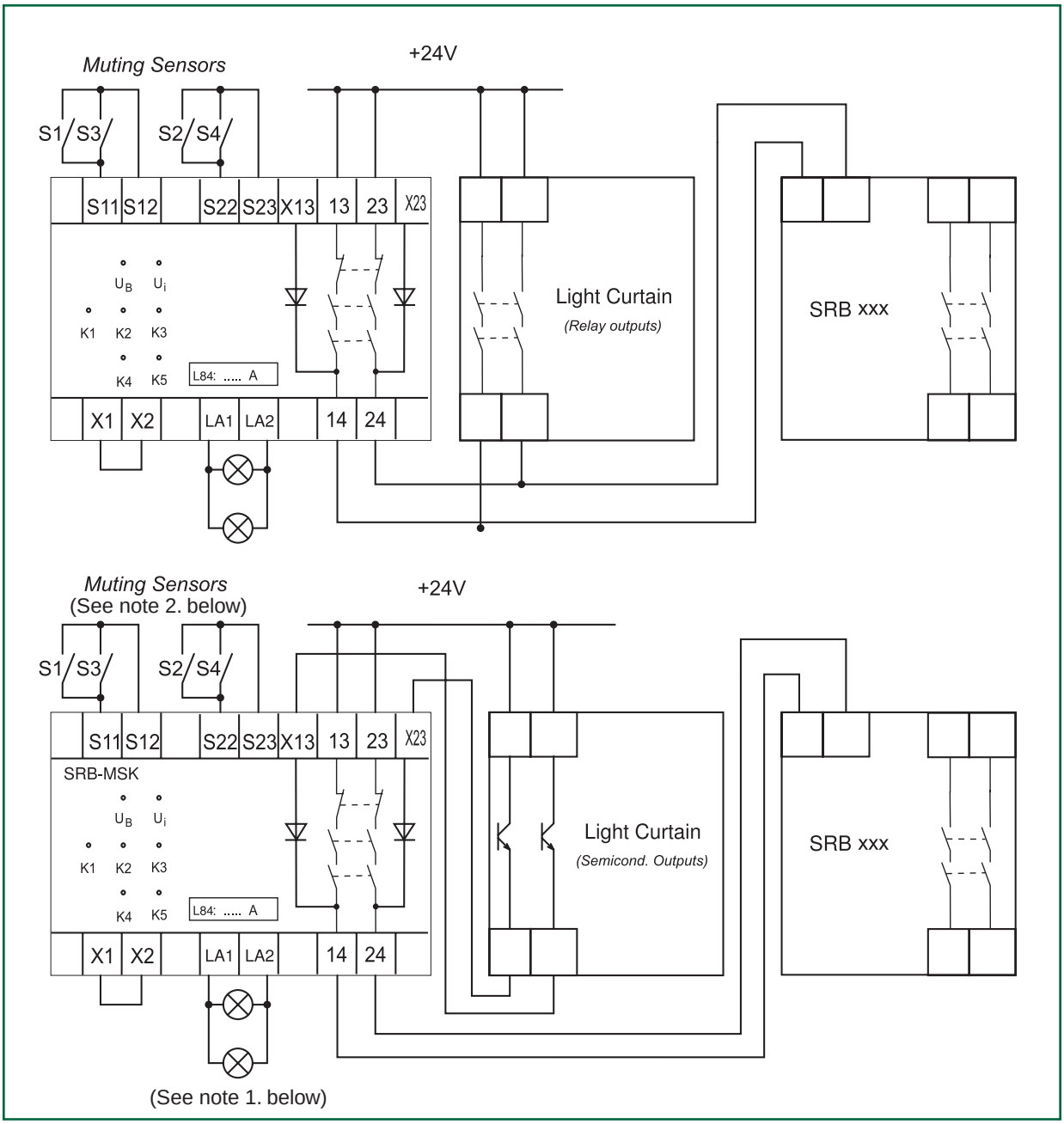


Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%
Fuse (Power Supply)	F2: T 1.0 A/250V (internal F1: T 1.25 A/250V)
Power Consumption	max. 3.2 W plus power consumption of sensors and muting lamps
Switching Capacity (Enabling Contacts)	230 VAC, 4 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	4 A slow blow
Switching Capacity (Auxiliary Contacts)	Y1/Y2: max. 250 mA; M1/M/2: 24V/250 mA - 2.5 A
Fuse (Auxiliary Contacts)	F2: T 1.0 A (internal F1: T 1.25 A); M1/M2; 2 x T 2.5 A (internal)
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 200 ms
Drop-Out Delay	≤ 20 ms
Contact Materials / Contacts	AgCdO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 90 mm / 140 mm
Weight	460g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	50 x 10^6 switching cycles

SRB-MSK Input Wiring Options

Wiring Example: Input Level MSK-QS



With SRB-MSK connect S2/S4 to S21 & S22

Note 1. The muting lamp circuit (LA1 & LA2) can be factory set from 150mA to 2.5A. If not otherwise specified, it is set at 150mA (for which a 160 ohm resistance is required). This resistance must be present for operation.

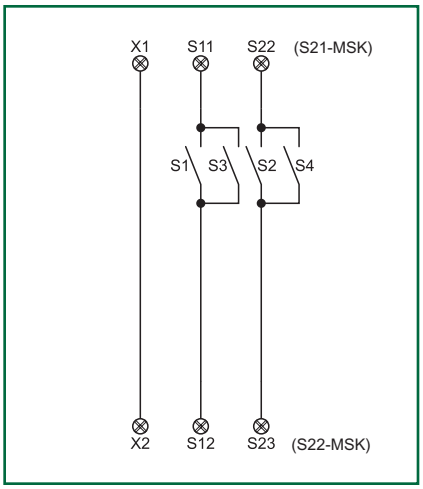
Note 2. Muting sensors S1 & S2 must operate within 1.5 seconds.

Safety Controller for Muting

SRB-MSK Input Wiring Options

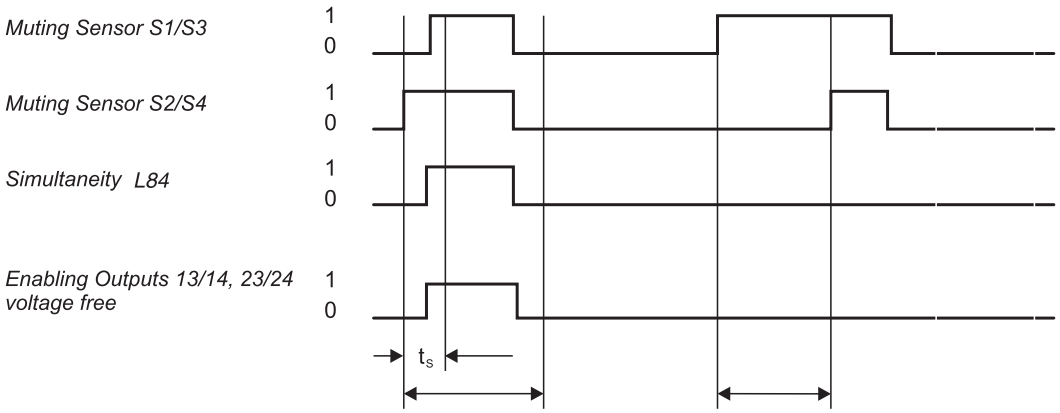
Wiring muting sensor.

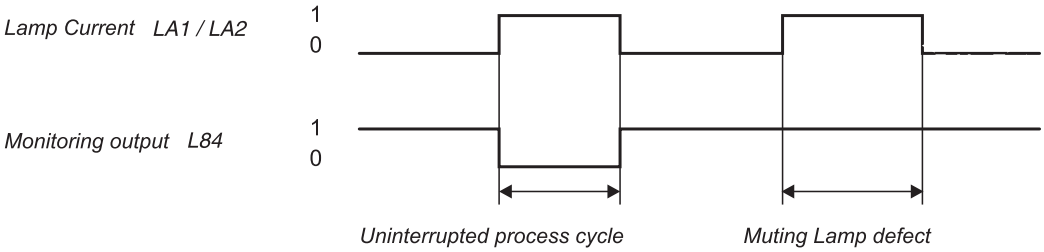
Detects wire breakage and earth leakage in the monitoring circuit.



MSK-QS

Time Charts





Safety Controller Expansion Modules

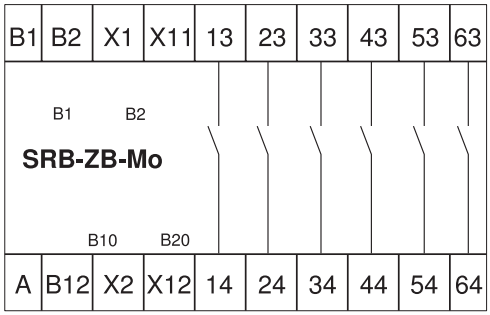
Stop Category (EN60204-1): 0

SRB-ZB-Mo Output Expansion Module

Features

- 6 NO relay outputs
- LED's for B1, B2, B10, B20
- Feedback circuit X1, X2 and X11, X12
- Housing 90 mm, made of thermoplastic in accordance with UL-94-V-0, red RAL 3000
- DIN rail mounting, DIN EN 50 022-35

Front View



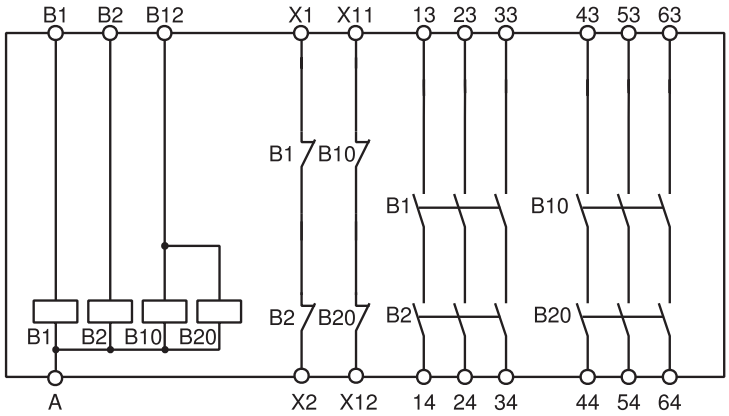
Dimensions 83 x 90 x 127 mm

Model Designation	Enabling Outputs	Operating Voltage
SRB-ZB-Mo-24VDC	6 NO	24VDC

Approvals **UL CSA BG**

SRB-ZB-Mo Output Expansion Module

Typical Wiring Diagram
(See page 21 for symbol key)



Technical Data

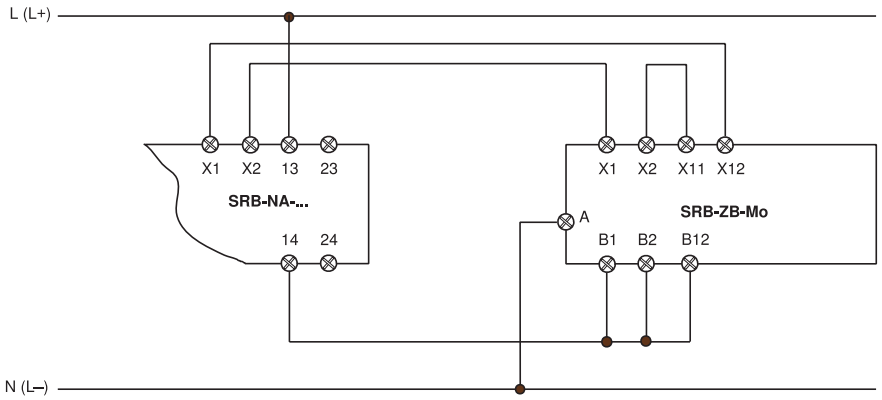
Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%
Fuse (Power Supply)	M 0.25 A/250V
Power Consumption	max. 2.4 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 30 ms
Drop-Out Delay	≤ 20 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.5 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	83 mm / 90 mm / 127 mm
Weight	870 g
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^7 switching cycles
Terminal Labeling	DIN EN 50 005 / DIN 50 113

SRB-ZB-Mo Output Expansion Module Input Wiring Options

Single-Channel control of the expansion module SRB-NA-R-C.EW via one enabling output of the base module.

A fault in the expansion module is not detected by the base module.

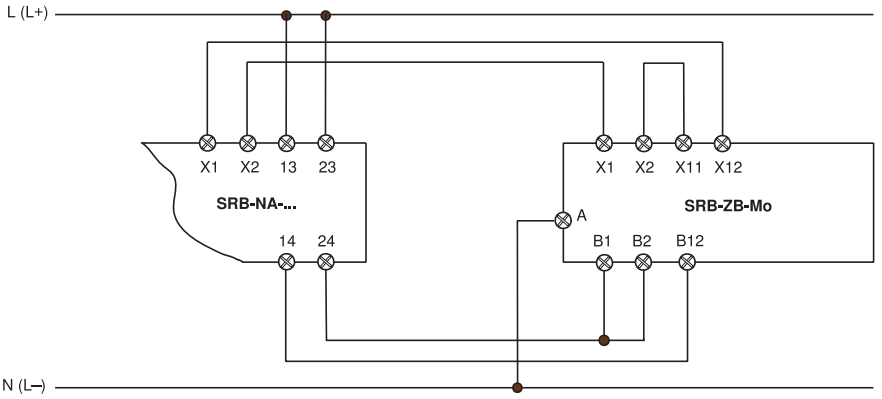
Connect terminals X1 and X2 to the feedback loop of the base module.



Dual-Channel control of the expansion module SRB-NA-R-C.EW via two enabling outputs of the base module.

A fault in the expansion module is not detected by the base module.

Connect terminals X1, X2 and X11, X12 to the feedback loop of the base module.



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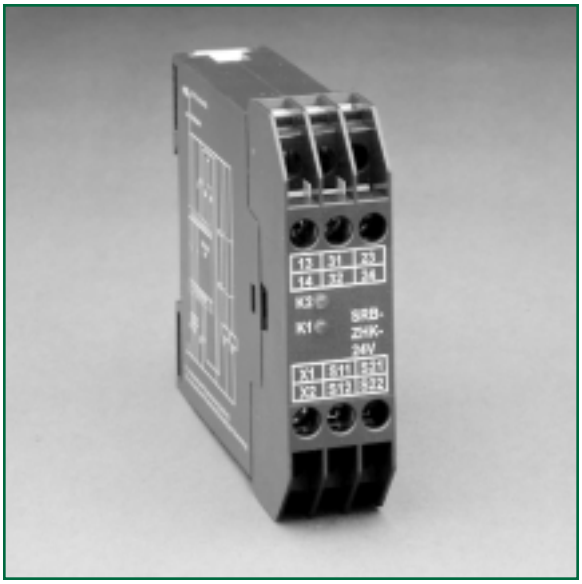
Two-Hand Control Safety Controller

SRB-ZHK

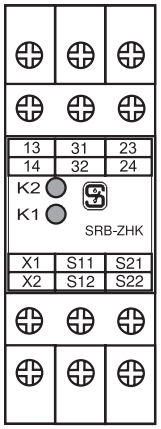
Safety Category (EN954-1): CC4



Features

- 2 enabling paths, 1 auxiliary contact
- Green LED's for K1 and K2

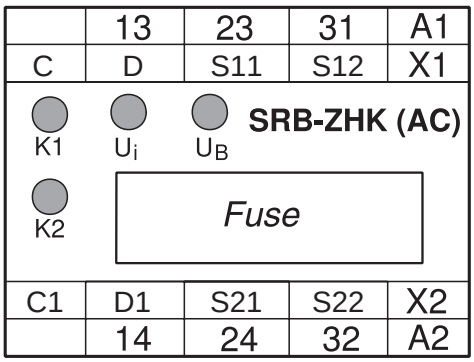
DC Model



Dimensions 82 x 22.5 x 98.8 mm DC
83 x 45 x 140 mm AC

Front Views

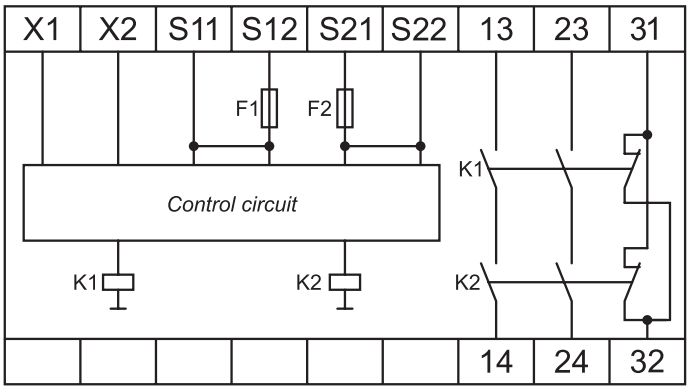
AC Model



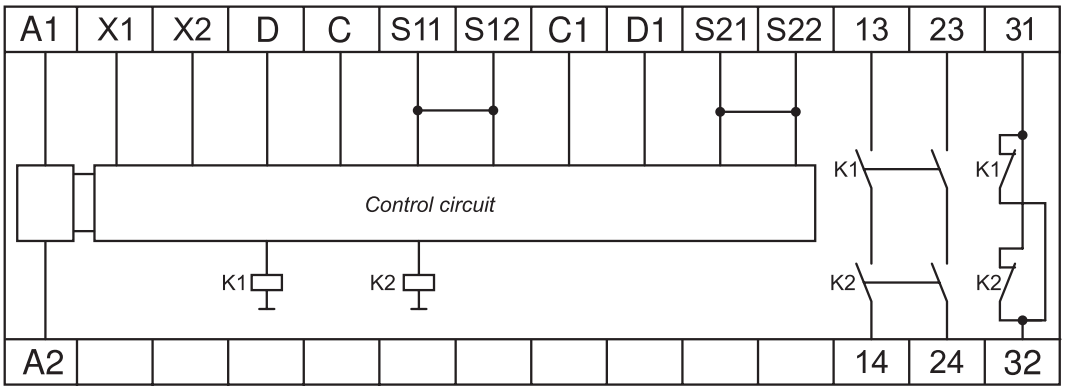
Model Designation	Enabling Outputs	Operating Voltage
SRB-ZHK-24VDC	2 NO/1 NC	24VDC
SRB-ZHK-115VAC	2 NO/1 NC	115VAC
SRB-ZHK-230VAC	2 NO/1 NC	230VAC
SRB-ZHK-24VAC	2 NO/1 NC	24VAC

Approvals **BG UL CSA**

Typical Wiring Diagram
(See page 21 for symbol key)



DC Model



AC Model

Technical Data

Operating Voltage	24 VDC -15% / +20%, residual ripple max. 10%; 24 VAC -15% / +6% 115/230 VAC -15% / +6%
Frequency	50/60 Hz (for AC operating)
Fuse (Power Supply)	M 0.25 A/250V (internal M 0.5 A/250V)
Power Consumption	max. 1.2 VA
Switching Capacity (Enabling Contacts)	230 VAC, 6 A resistive (inductive with suitable suppression)
Fuse (Enabling Contacts)	6 A slow blow
Switching Capacity (Monitoring Contacts)	24VDC/ 2 A resistive (inductive with suitable suppression)
Fuse (Monitoring Contacts)	2 A slow blow
Application Category	AC 15/DC 13, DIN VDE 0660 Part 200
Pick-Up Delay	≤ 10 ms
Drop-Out Delay	≤ 20 ms
Contact Materials / Contacts	AgSnO self cleaning, positively driven
Contact Resistance	max. 100 mOhm when new
Air and Creeping Distances	DIN VDE 0110 Part 1 and 2, 4 kV/2
Connections	Self lifting terminals min. 0.6 mm^2, max 2.5 mm^2 (13-20 AWG)
Dimensions (H/W/D)	82 mm / 22.5 mm / 98.8 mm (83 mm / 45 mm / 40 mm AC)
Weight	420 g (360 g AC)
Ambient Operating Temperature	-25 °C … +45 °C (derating curve available)
Mechanical Life	10^6 switching cycles

Two-Hand Control Safety Controller

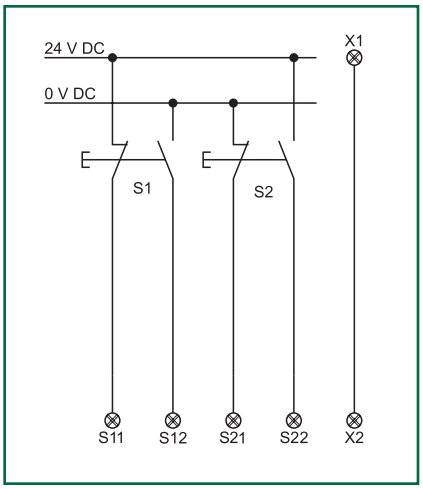
SRB-ZHK Input Wiring Options

Two-hand control according to EN 574 and EN 60 204-1.

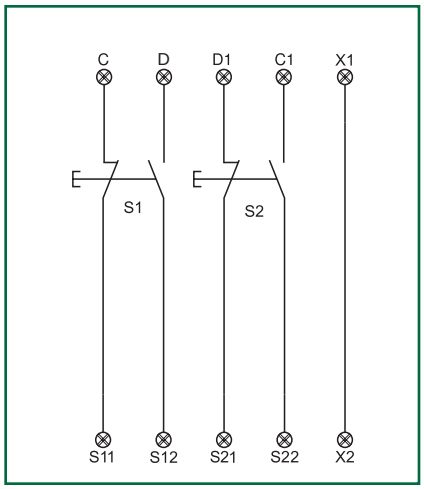
Faults in each pushbutton contact as well as earth faults and cross-shorts are detected.

Feedback circuit: The safety function of external positively driven contactors is monitored by a series connection of NC contacts with the terminals X1 and X2. This circuit must be closed in release state.

Safety category III/C according to EN 574.



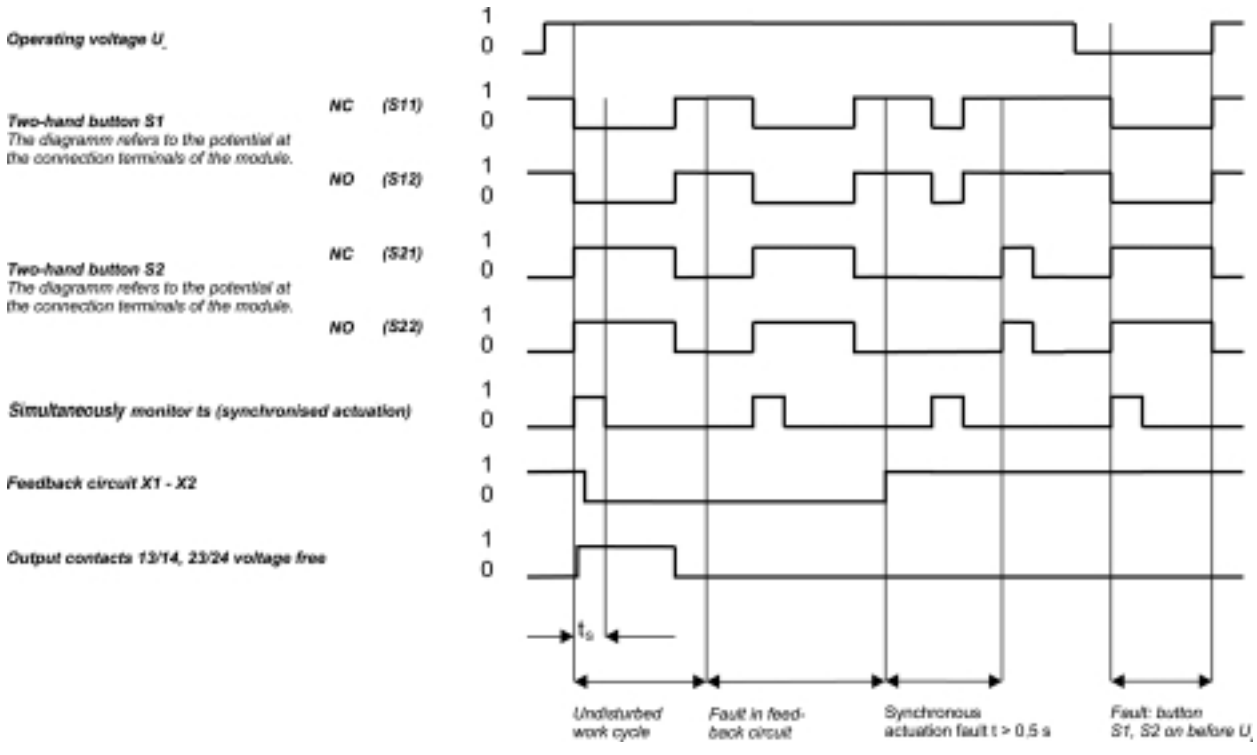
DC Model



AC Model

Time Chart

Note: Do not use pushbuttons with overlapping contacts.



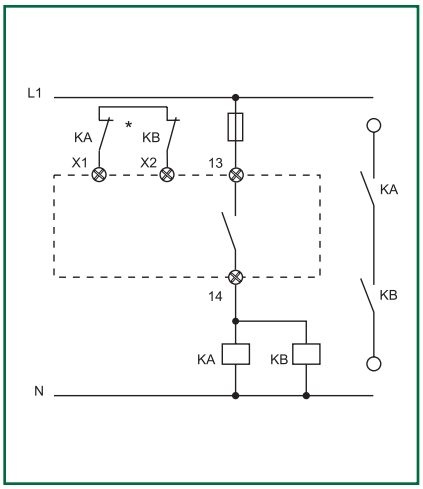
Two-Hand Control Safety Controller

SRB-ZHK Output Wiring Options

Single-Channel output.

Suitable for relays or contactors with positive guided contacts.

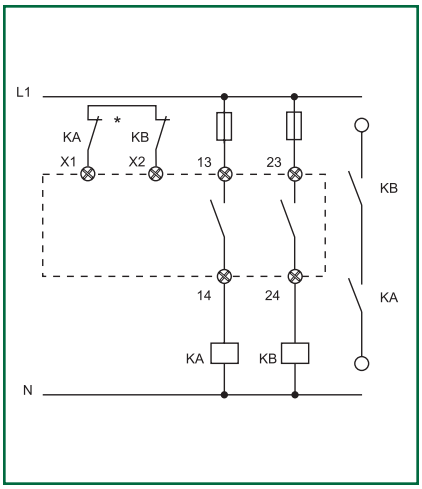
*Feedback loop



Dual-Channel output.

Suitable for relays or contactors with positive guided contacts.

*Feedback loop



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Contents

Guard Door and E-Stop Safety Controllers

Technical Data

	AES 6112/7112	AES 1102/1112
Standards:	IEC/EN 60204-1/VDE 0113 part 1; EN 1088; EN 954-1; DIN VDE 0660-209;	
	BG-GS-ET-14; BG-GS-ET-20	
Control Category:	1	
Start-up test:	No	
Enclosure material:	Glass-fibre reinforced plastic	
Fixing:	Snaps onto standard DIN rail to DIN EN 50022	
Screw terminals:	Max. 1.5 mm^2 (incl. conductor ferrules)	Max. 2.5 mm^2 (incl. conductor ferrules)
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC/EN 60529/DIN VDE 0470-1	
Operating voltage U_e:	AES 6112: 24 VDC ± 15 %;	AES 1102, AES 1112: 24 VDC ± 15 %
	AES 7112.1: 110 VAC;	AES 1102.1, AES 1112.1: 110 VAC
	AES 7112.2: 230 VAC;	AES 1102.2, AES 1112.2: 230 VAC
	AES 7112.3: 24 VAC	AES 1102.3, AES 1112.3: 24 VAC
		AES 1102.4, AES 1112.4: 42 VAC
Operating current I_e:	AES 6112: 0.1 A	AES 1102: 0.1 A
Power consumption:	AES 7112: 1.5 VA	AES 1112: 0.7 VA
Inputs:	C/S14/S22/S32:	
	auxiliary contacts	
Max. length of lead:	1000 m of 0.75 mm^2 conductor	
Outputs:	1 enabling path	
Utilization category:	AC-15; DC-13	
Rated operating		
current / voltage I_e / U_e:	–	–
Switching voltage:	Max. 250 VAC	
Load current:	Max. 5 A (cos φ = 1)	Max. 4 A (cos φ = 1)
Switching capacity:	Max. 1250 VA	Max. 1000 VA
Max. fuse rating:	5 A (quick blow)	4 A (quick blow)
Additional transistor outputs:	–	
Indications:	LED	
Immunity to noise:	To EMC guidelines	–
Max. switching frequency:	10 Hz	
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 … 55 Hz / amplitude 0.35 mm ± 15%	
Resistance to shock:	30 g / 11 ms	–
Ambient temperature:	0 °C … + 55 °C	
Storage and transport temp.:	– 25 °C … + 70 °C	

Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

CE

Technical Data

	AES 1235/1236	AES 1135/1136 / AES 1145/1146
Standards:	IEC/EN 60204-1/VDE 0113 part 1; EN 1088; EN 954-1; DIN VDE 0660-209;	
	DIN VDE 0801/-A1; BG-GS-ET-14; BG-GS-ET-20	
Control Category:	3	
Start-up test:	No/Yes	
Enclosure material:	Glass-fibre reinforced plastic	
Fixing:	Snaps onto standard DIN rail to DIN EN 50022	
Screw terminals:	Max. 2.5 mm^2 (incl. conductor ferrules)	
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC/EN 60529/DIN VDE 0470-1	
Operating voltage U_e:	24 VDC ± 15 %	
Operating current I_e:	0.2 A	
Inputs:	S14/S22, X1:	S1-S14/S22, X1:
Input resistance:	Approx. 2 kΩ to earth	
Input signal „1“:	10 … 30 VDC	
Input signal „0“:	0 … 2 VDC	
Max. length of lead:	1000 m of 0.75 mm^2 conductor	
Outputs:	13-14/23-24:	13-14:
	2 enabling paths	1 enabling path
Utilization category:	AC-15; DC-13	
Rated operating		
current / voltage I_e/U_e:	2 A/250 VAC; 2 A/24 VDC	
Switching voltage:	Max. 250 VAC	
Load current:	Max. 4 A (cos φ = 1)	
Switching capacity:	Max. 1000 VA	
Max. fuse rating:	4 A (quick blow)	
Additional transistor outputs:	Y1:U_e – 4 V; 100 mA,	Y1, Y2: AES 1145/1146 min. U_e – 4 V;
	short-circuit proof, switching p	Y1+Y2 = Max. 100mA, short-circuit proof, switching p
Indications:	ISD	
Immunity to noise:	To EMC guidelines	
Max. switching frequency:	5 Hz	
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 … 55 Hz / amplitude 0.35 mm ± 15% at the regulation point	
Resistance to shock:	30 g / 11 ms	
Ambient temperature:	0 °C … + 55 °C	
Storage and transport temp.:	– 25 °C … + 70 °C	

Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

CE

Guard Door and E-Stop Safety Controllers

Technical Data

	AES 1165 / 1166
Standards:	IEC/EN 60204-1/VDE 0113 part 1; EN 1088; EN 954-1; DIN VDE 0660-209;
	DIN VDE 0801/-A1; BG-GS-ET-14; BG-GS-ET-20
Control Category:	3
Start-up test:	No/Yes
Enclosure material:	Glass-fibre reinforced plastic
Fixing:	Snaps onto standard DIN rail to DIN EN 50022
Screw terminals:	Max. 2.5 mm^2 (incl. conductor ferrules)
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC/EN 60529/DIN VDE 0470-1
Operating voltage U_e:	24 VDC ± 15 %
Operating current I_e:	0.2 A
Power consumption:	–
Inputs:	S1-S14 / S22, S2-S14 / S22:
Input resistance:	Approx. 2 kΩ to earth
Input signal „1“:	10 … 30 VDC
Input signal „0“:	0 … 2 VDC
Max. length of lead:	1000 m of 0.75 mm^2 conductor
Outputs:	13-14:
	1 enabling path
Utilization category:	AC-15; DC-13
Rated operating	
current / voltage I_e / U_e:	2 A/250 VAC; 2 A/24 VDC
Switching voltage:	Max. 250 VAC
Load current:	Max. 4 A (cos φ = 1)
Switching capacity:	Max. 1000 VA
Max. fuse rating:	4 A (quick blow)
Additional transistor outputs:	
	–
Additional contacts:	–
Indications:	ISD
Immunity to noise:	To EMC guidelines
Max. switching frequency:	5 Hz
Overvoltage category:	II to DIN VDE 0110
Degree of pollution:	3 to DIN VDE 0110
Resistance to vibration:	10 … 55 Hz / amplitude 0.35 mm ± 15% at the regulation point
Resistance to shock:	30 g / 11 ms
Ambient temperature:	0 °C … + 55 °C
Storage and transport temp.:	– 25 °C … + 70 °C
Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.	

CE

Guard Door and E-Stop Safety Controllers

Technical Data

	AES 2335/2336	AES 2135/2136
Standards:	IEC/EN 60204-1/VDE 0113 part 1; EN 1088; EN 954-1; DIN VDE 0660-209;	
	DIN VDE 0801/-A1; BG-GS-ET-14; BG-GS-ET-20	
Control Category:	3	
Start-up test:	No/Yes	
Enclosure material:	Glass-fibre reinforced plastic	
Fixing:	Snaps onto standard DIN rail to DIN EN 50022	
Screw terminals:	Max. 4 mm^2 (incl. conductor ferrules)	
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC/EN 60529/DIN VDE 0470-1	
Operating voltage U_e:	AES 2335 / 2336: 24 VDC ± 15 %;	AES 2135.1 / 2136.1: 110 VAC
	AES 2335.1 / 2336.1: 110 VAC;	AES 2135.2 / 2136.2: 230 VAC
	AES 2335.2 / 2336.2: 230 VAC	AES 2135.3 / 2136.3: 24 VAC
Operating current I_e:	0.2 A (DC-Version)	–
Power consumption:	5.8 VA	5 VA
Inputs:	S13-14 / S21-22, X1:	S1-S14 / S22, X2, X4, X6:
Input resistance:	Approx. 2 kΩ to earth	
Input signal „1“:	10 … 30 VDC	
Input signal „0“:	0 … 2 VDC	
Max. length of lead:	1000 m of 0.75 mm^2 conductor	1000 m of 1.5 mm^2 conductor
Outputs:	13-14/23-24/33-34:	13-14:
	3 enabling paths	1 enabling path
Utilization category:	AC-15; DC-13	
Rated operating		
current / voltage I_e/U_e:	2 A/250 VAC; 2 A/24 VDC	
Switching voltage:	Max. 250 VAC	
Load current:	Max. 3 A (cos φ = 1)	Max. 4 A (cos φ = 1)
Switching capacity:	Max. 750 VA	Max. 1000 VA
Max. fuse rating:	3 A (quick blow)	4 A (quick blow)
Additional transistor outputs:	Y1, Y2: U_e – 4 V;	–
	Y1 + Y2 = Max. 100 mA short-circuit proof, switching p	
Indications:	ISD	
Immunity to noise:	To EMC guidelines	
Max. switching frequency:	5 Hz	1 Hz
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 … 55 Hz / amplitude 0.35 mm ± 15% at the regulation point	
Resistance to shock:	30 g / 11 ms	
Ambient temperature:	0 °C … + 55 °C	
Storage and transport temp.:	– 25 °C … + 70 °C	

Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

CE

Guard Door and E-Stop Safety Controllers

Technical Data

	AES 3535/6 / AES 3335/6	AES 3335/3336 AC-Versions
Standards:	IEC/EN 60204-1/VDE 0113 part 1; EN 1088; EN 954-1; DIN VDE 0660-209;	
	DIN VDE 0801/-A1; BG-GS-ET-14; BG-GS-ET-20	
Control Category:	3	
Start-up test:	No/Yes	
Enclosure material:	Glass-fibre reinforced plastic	
Fixing:	Snaps onto standard DIN rail to DIN EN 50022	
Screw terminals:	Max. 4 mm^2 (incl. conductor ferrules)	
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC/EN 60529/DIN VDE 0470-1	
Operating voltage U_e:	24 VDC ± 15 %	3335.1/3336.1:110 VAC; 3335.2/3336.2: 230 VAC
Operating current I_e:	0.3 A	–
Power consumption:	–	5.8 VA
Inputs:	S1-S14/S22, X2, X4, X6, X8	S14,S22, X2, X4, X6, X8
Input resistance:	Approx. 2 kΩ to earth	
Input signal „1“:	10 … 30 VDC	
Input signal „0“:	0 … 2 VDC	
Max. length of lead:	1000 m of 0.75 mm^2 conductor	
Outputs:	AES 3535 /3536: 13-14 / 23-24 /	–
	33-34 / 43-44: 4 enabling paths	
	AES 3335 / 3336:	AES 3335 / 3336 AC version:
	13-14 / 23-24 / 33-34: 3 enabling paths	13-14 / 23-24 / 33-34: 3 enabling paths
Utilization category:	AC-15; DC-13	
Rated operat. current / voltage I_e/U_e:	3 A/250 VAC; 2 A/24 VDC	
Switching voltage:	Max. 250 VAC	
Load current:	Max. 6 A (cos φ = 1)	
Switching capacity:	Max. 1500 VA	
Max. fuse rating:	6 A (quick blow)	
Additional outputs:	51-52:	43-44 / 51-52:
	NO and NC contacts not suitable for safety functions	
Utilization category:	–	AC-15; DC-13
Rated operat. current / voltage I_e/U_e:	–	2 A/250 VAC; 2 A/24 VDC
Load current:	–	Max. 2 A (cos φ = 1)
Switching capacity:	–	Max. 500 VA
Max. fuse rating:	–	2 A (quick blow)
Transistor-Additional outputs:	Y1, Y2: min. U_e – 4 V; Y1 + Y2 = Max. 100 mA	–
Indications:	ISD	
Immunity to noise:	To EMC guidelines	
Max. switching frequency:	5 Hz	
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 … 55 Hz / amplitude 0.35 mm ± 15 % at the regulation point	
Resistance to shock:	30 g / 11 ms	
Ambient temperature:	0 °C … + 55 °C	
Storage and transport temperature:	– 25 °C … + 70 °C	
Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.		

Guard Door and E-Stop Safety Controllers

Technical Data

	AES 3565/3566 / AES 3365/3366	AES 2165/2166
Standards:	IEC/EN 60204-1/VDE 0113 part 1; EN 1088; EN 954-1; DIN VDE 0660-209;	
	DIN VDE 0801/-A1; BG-GS-ET-14; BG-GS-ET-20	
Control Category:	3	
Start-up test:	No/Yes	
Enclosure material:	Glass-fibre reinforced plastic	
Fixing:	Snaps onto standard DIN rail to DIN EN 50022	
Screw terminals:	Max. 4 mm^2 (incl. conductor ferrules)	
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC/EN 60529/DIN VDE 0470-1	
Operating voltage U_e:	24 VDC ± 15 %	AES 2165.1/2166.1 110 VAC;
		AES 2165.2/2166.2 230 VAC;
		AES 2165.3/2166.3 24 VAC
Operating current I_e:	0.3 A	–
Power consumption:		5 VA
Inputs:	S1-S14 / S22, X2, X4, X6, X8:	S1-S14 / S22, S2-S14 / S22, X6:
Input resistance:	Approx. 2 kΩ to earth	
Input signal „1“:	10 … 30 VDC	
Input signal „0“:	0 … 2 VDC	
Max. length of lead:	1000 m of 0.75 mm^2 conductor	
Outputs:	AES 3565/3566 13-14 / 23-24 /	13 / 14:
	33-34 / 43-44: 4 enabling paths	1 enabling path
	51-52: NC contacts not suitable for safety function	
	AES 3365, AES 3366 13-14/23-24/33-34	–
	3 enabling paths	
Utilization category:	AC-15; DC-13	
Rated operating		
current / voltage I_e/U_e:	3 A/250 VAC; 2 A/24 VDC	2 A/250 VAC; 2 A/24 VDC
Switching voltage:	Max. 250 VAC	
Load current:	Max. 6 A (cos φ = 1)	Max. 4 A (cos φ = 1)
Switching capacity:	Max. 1500 VA	Max. 1000 VA
Max. fuse rating:	6 A (quick blow)	4 A (quick blow)
Additional transistor outputs:	Y1, Y2: U_e – 4 V;	–
	Y1 + Y2 = Max. 100 mA short-circuit proof, switching p	
Indications:	ISD	
Immunity to noise:	To EMC guidelines	
Max. switching frequency:	5 Hz	
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 … 55 Hz / amplitude 0.35 mm ± 15 % at the regulation point	
Resistance to shock:	30 g / 11 ms	
Ambient temperature:	0 °C … + 55 °C	
Storage and transport temp.:	– 25 °C … + 70 °C	
Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.		

CE

Guard Door and E-Stop Safety Controllers

Technical Data

	AZR 31 T0
Standards:	IEC 60204-1 / EN 60204-1 / VDE 0113 Part 1; EN 954-1; EN 1088; BG-GS-ET-20
Control Category:	4
Start-up test:	–
Enclosure material:	Polycarbonate
Fixing:	Snaps onto standard DIN rail to EN 50 022
Screw terminals:	Max. 1.5mm² (incl. end thimbles)
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC 60529 / EN 60529 / DIN VDE 0470-1
Operational voltage U_e:	24V AC / DC ± 15%
Operational current I_e:	–
Power consumption:	<2W
Inputs:	S13/S14/S23/S24
	Potential-free contact in lead to A1
	for 1 channel connection or 1 contact
	each in leads to A1 and A2 for
	2 channel connection max. 150 Ω;
	Feedback X1 and X2 potential free
Input resistance:	–
Input signal “1”:	–
Input signal “0”:	–
Max. length of lead:	–
Outputs:	3 enabling circuits
	1 signal circuit
	(2 relay NC contacts in parallel)
	2 NC contacts in series)
Utilization category:	AC 15; DC 13
Rated operational	
current / voltage I_e/U_e:	6A / 250V AC; 3A / 24V DC
Switching voltage:	Max. 400V AC
Load current:	Max. 6A (cos φ = 1)
Switching capacity:	1,500VA
Max. fuse rating:	6A (quick-acting)
Switch-on time:	<25ms
Switch-off time:	<150ms
Indications:	Green LED’s for control voltage and output
Immunity to noise:	To EMC guidelines
Max. switching frequency:	1Hz
Overvoltage category:	II to DIN VDE 0110
Degree of pollution:	3 to DIN VDE 0110
Resistance to vibration:	10 to 55Hz / Amplitude 0.35mm ± 15% at the regulation point
Resistance to shock:	30g / 11ms
Ambient temperature:	0°C to +50°C
Storage and transp. temp.:	–25°C to +70°C

CE

Guard Door and E-Stop Safety Controllers

Technical Data

	AZR 31 T2 / AZR 31 R2	AZR 11 RT2
Standards:	IEC/EN 60204-1/VDE 0113 part 1; EN 954-1; EN 1088; BG-GS-ET-20	
Control Category:	4	
Start-up test:	–	
Enclosure material:	Polycarbonate	
Fixing:	Snaps onto standard DIN rail to DIN EN 50022	
Screw terminals:	Max. 2.5 mm^2 (incl. conductor ferrules)	Max. 2 x 1.5 mm^2 (incl. conductor ferrules)
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC/EN 60529/DIN VDE 0470-1	
Operating voltage U_e:	24 VAC; 24 VDC; 110 VAC ± 15 %; 230 VAC ± 15 %	24 VDC ± 15 %
Operating current I_e:	0.15 A (DC version)	–
Power consumption:	< 3 W	< 0.5 W
Inputs:	S13 = 24V, S23 = GND, S14/S24 = Relay	–
	Max. current on short-circuit 85 mA (leads to drop-out),	
	Reset (AZR 31 R2): 24 VDC (from S13-S23),	
	Test (AZR 31 T2): Potential-free contact	
Input resistance:	Between S13-S14/S23-S24: 150Ω	–
Input signal „1“:	–	–
Input signal „0“:	–	–
Max. length of lead:	1000 m of 0.75 mm^2 conductor	–
Outputs:	13-14/23-24/33-34:	13-14:
	3 enabling paths	1 enabling path
	1 signal path (2 relay NC contacts in parallel)	1 signal path (Semi-conductor output)
Utilization category:	AC-15; DC-13	
Rated operating		
current / voltage I_e / U_e:	2.5 A/400 VAC; 3 A/24 VDC	2.5 A/250 VAC; 2.5 A/24 VDC
Switching voltage:	Max. 400 VAC	Max. 250 VAC
Load current:	Max. 6.2 A (cos φ = 1)	Max. 4 A (cos φ = 1)
Switching capacity:	Max. 1500 VA	Max. 1000 VA
Max. fuse rating:	6 A (slow blow)	4 A (slow blow)
Additional outputs:	–	Semi-conductor output: 24 VDC; 15 mA DC
Switch-on time:	< 80 ms	≤ 35 ms
Response time:	< 15 ms (< 130 ms on supply failure)	≤ 15 ms
Indications:	green LED’s for control voltage, inputs and outputs	green LED’s for control voltage and inputs
Immunity to noise:	To EMC guidelines	
Max. switching frequency:	1 Hz	
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 … 55 Hz / amplitude 0.35 mm ± 15% at the regulation point	
Resistance to shock:	30 g / 11 ms	
Ambient temperature:	0 °C … + 50 °C	
Storage and transport temp.:	– 25 °C … + 70 °C	
Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.		

CE

Safety Controller Expansion Modules

Technical Data

	AZR 62 A2	AZR 63 V2
Standards:	IEC 60204-1 / EN 60204-1 / VDE 0113 Part 1; EN 954-1; EN 1088; BG-GS-ET-20	
Control Category:	4	
Start-up test:	–	
Enclosure material:	Polycarbonate	
Fixing:	Snaps onto standard DIN rail to EN 50 022	
Screw terminals:	Max. 2.5mm² (incl. end thimbles)	
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC 60529 / EN 60529 / DIN VDE 0470-1	
Operational voltage Ue:	24V DC; 24V AC; 110V AC ± 15%; 230V AC ± 15%	
Operational current I_e:		
Power consumption:	<3W	
Inputs:	S 13/14 and S 23/24	
	Potential-free NC contacts	
Input resistance:	Max. 150Ω	
Input signal “1”:	–	
Input signal “0”:	–	
Max. length of lead:	1,000m of 0.75mm² conductor	
Outputs:	6 enabling circuits	6 enabling circuits, off delay,
	1 NC contact for feedback input to other	1 NC contact for feedback input to other
	safety control units; 1 NC aux. contact	safety control units and 1 NC aux. contact
		with off delay, 1 NO aux. contact without delay
Utilization category:	AC 15; DC 13	
Rated operational		
current / voltage I_e / U_e:	6A / 250V AC; 3A/ 24V DC	
Switching voltage:	Max. 400V AC	
Load current:	Max. 6A	
Switching capacity:	Max. 1,500VA	
Max. fuse rating:	6A (quick-acting)	
Switch-on time:	<30ms	<30ms to max. 3s
Switch-off time:	<150ms	<150ms to max. 15s
		(Setting 0 to 30s in 2 second steps)
Indications:	Green LED’s for control voltage, output	
Immunity to noise:	To EMC guidelines	
Max. switching frequency:	1Hz	
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 to 55Hz / Amplitude 0.35mm ± 15% at the regulation point	
Resistance to shock:	30g / 11ms	
Ambient temperature:	0°C to +55°C	
Storage and transport temperature:	–25°C to +70°C	

CE

Technical Data

AES-E 3035	
Standards:	IEC 60204-1 / EN 1088 / DIN VDE 0660-209 / EN 60204-1 /
	DIN VDE 0801 -A1 / BG-GS-ET-14 / BG-GS-ET-20 / EN 954-1
Control Category:	3
Start-up test:	-
Enclosure material:	Glass-fibre reinforced plastic
Fixing:	Snaps onto standard DIN rail to EN 50 022
Screw terminals:	Max. 4mm² (incl. end thimbles)
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC IEC 60529 / EN 60529
Operational voltage U_e:	24V DC ± 15%,115V AC, 230 V AC
Operational current I_e:	300 mA whitout additional outputs
Inputs:	X1,X2:S1-S4 (S14/S22)
Input Resistance	Approx. 2 k Ohms to ground
Input signal “1”:	10 ... 30 Vdc
Input signal “0”:	0 ... 2 Vdc
Max cable lenght:	1000 m of 0.75 mm² conductor
Transistor enabling outputs:	Y14,Y22
	700mA (DC) each, short-circuit proof
	100mA (DC) each, short-circuit proof
Addtional transistor outputs:	Y1 to Y5:
	Min. Ue - 4 V/ Max. 50 mA, short-circuit proof
	The maximum output current of 250 mA is divided between the 5 outputs (Y1 to Y5).
Indications:	ISD
EMC rating:	Conforming to EMC Directive
Max. switching frequency:	5Hz
Overvoltage category:	II to DIN VDE 0110
Degree of pollution:	3 to DIN VDE 0110
Resistance to vibration:	10 ... 55 Hz/amplitude 0.35 mm ±15% at the regulation point
Resistance to shock:	30g / 11ms
Ambient temperature:	0°C to +50°C
Storage and transp. temp.:	–25°C to +70°C

Note: Inductive loads (contactors, relays, etc.) are to be suppressed by a suitable circuit.

CE

Fail-to-Safe Timer

Technical Data

	AZS 2305	
Standards:	IEC 60204-1 / EN 60204-1 / VDE 0113 Part 1; EN 1088; EN 954-1;	
	DIN VDE 0801/-A1; BG-GS-ET-20	
Control Category:	3	
Start-up test:	–	
Enclosure material:	Glass-fibre reinforced plastic	
Fixing:	Snaps onto standard DIN rail to EN 50 022	
Screw terminals:	Max. 4mm² (incl. end thimbles)	
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC 60529 / EN 60529 / DIN VDE 0470-1	
Operational voltage U_e:	AZS 2305	24V DC ± 15%
	AZS 2305.1	110V AC
	AZS 2305.2	230V AC
Operational current I_e:	0.1A at 24V DC	
Power consumption:		
Inputs:	S1(S14), S1(S22):	
Input resistance:	Approx. 2kΩ to Earth	
Input signal “1”:	10 to 30V DC	
Input signal “0”:	0 to 2V DC	
Max. length of lead:	1,000m of 0.75mm² conductor	
Outputs:	13-14, 23-24, 33-34:	
	3 enabling circuits, each with 2 NO contacts in series	
Utilization category:	AC 15; DC 13	
Rated operational		
current / voltage I_e / U_e:	2A / 250V AC; 2A / 24V DC	
Switching voltage:	Max. 250V AC	
Load current:	Max. 3A	
Switching capacity:	Max. 750VA	
Max. fuse rating:	6A (quick-acting)	
Additional transistor outputs Y1, Y2:	Min. U_e - 4V; Y1 + Y2 = 100mA short-circuit proof, p-switching	
Time setting:		
Minimum time t_{min}:	0.1s	
Maximum time t_{max}:	99min	
Timing tolerance:	<2%	
Indications:	ISD	
Immunity to noise:	To EMC guidelines	
Max. switching frequency:	10Hz	
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 to 55Hz / Amplitude 0.35mm ± 15% at the regulation point	
Resistance to shock:	30g / 11ms	
Ambient temperature:	0°C to +55°C	
Storage and transport temperature:	–25°C to +70°C	

Note: Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by a suitable circuit.

CE

Fail-to-Safe Standstill Monitors

Technical Data

	FWS 2316	FWS 1105 / FWS 1106
Standards:	IEC 60204-1 / EN 60204-1 / VDE 0113 Part 1; EN 1088; EN 954-1; DIN VDE 0801/-A1; BG-GS-ET-20	
Control Category:	3	
Start-up test:	–	
Enclosure material:	Glass-fibre reinforced plastic	
Fixing:	Snaps onto standard DIN rail to EN 50 022	
Screw terminals:	Max. 4mm² (incl. end thimbles)	Max. 2.5mm² (incl. end thimbles)
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC 60529 / EN 60529 / DIN VDE 0470-1	
Operational voltage U_e:	24V DC ± 15%	
Operational current I_e:	0.3A	0.2A
Power consumption:		
Inputs:	X2, X4, X6, X8:	X1, X2
Input resistance:	Approx. 2kΩ to Earth	
Input signal “1”:	10 to 30V DC	
Input signal “0”:	0 to 2V DC	
Max. length of lead:	100m of 0.75mm2 conductor	
Standstill frequency:	Execution C: Input X2/X4: 1Hz/1Hz	Execution A: Input X1/X2: 1Hz/2Hz
	Other executions: On enquiry	Execution B: Input X1/X2: 2Hz/2Hz
		Execution C: Input X1/X2: 1Hz/1Hz
		Other executions: On enquiry
Hysteresis:	10% of standstill frequency	
Max. input frequency:	1000Hz	4000Hz
Min. pulse duration:	500µs	125µs
Outputs:	13/14; 23/24; 33/34; 43/44; 51/52: 13-14:	
Utilization category:	AC 15; DC 13	
Rated operational		
current / voltage I_e /U_e:	3A / 250V AC; 2A / 24V DC	2A / 250V AC; 2A / 24V DC
Switching voltage:	Max. 250V AC	
Load current:	Max. 6A (cos φ = 1)	Max. 4A (cos φ = 1)
Switching capacity:	Max. 1,500VA	Max. 1,000VA
Max. fuse rating:	6A (quick-acting)	4A (quick-acting)
Additional transistor	Min. Ue - 4V; Y1 + Y2 = 100mA short-circuit proof,	
outputs Y1, Y2:	open collector, p-switching	
Switch-on time:		
Switch-off time:		
Indications:	ISD	
Immunity to noise:	To EMC guidelines	
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 to 55Hz / Amplitude 0.35mm ± 15% at the regulation point	
Resistance to shock:	30g / 11ms	
Ambient temperature:	0°C to +55°C	
Storage and transp. temp.:	–25°C to +70°C	

CE

Fail-to-Safe Standstill Monitors

Technical Data

	AZR 31 S1	FWS 3505-2204
Standards:	IEC 60204-1 / EN 60204-1 / VDE 0113 Part 1;	IEC 60204-1 / EN 60 204-1 / VDE 0113 Part 1;
	EN 1088; EN 954-1; BG-GS-ET-20	EN 1088; EN 954-1; DIN VDE 0801/-A1; BG-GS-ET-20
Control Category:	4	3
Start-up test:	No	No
Enclosure material:	Polycarbonate	Glass-fibre reinforced thermoplastic
Fixing:	Snaps onto standard DIN rail to EN 50 022	
Screw terminals:	Max. 2.5mm² (incl. end thimbles)	Max. 4mm² (incl. end thimbles)
Protection class:	Terminals IP 20; Enclosure IP 40 to IEC 60529 / EN 60529 / DIN VDE 0470-1	
Operational voltage U_e:	24V DC; 24V AC; 110V AC ± 15%; 230V AC ± 15%	24V DC ± 15%
Operational current I_e:	–	0.3A
Power consumption:	<3W	–
Inputs:	Channel A, B: Terminals for 3 phase motor 400V AC	Inputs X2, X4, X6, X8
	Feedback X1/X2: Potential-free contact	
Input resistance:	–	Approx. 2kW to Earth
Input signal “1”:	–	10 to 30V DC
Input signal “0”:	–	0 to 2V DC
Max. length of lead:	–	100m of 0.75mm² conductor
Standstill frequency:	–	Execution C: Input X2/X4: 1Hz/1Hz
		Other executions: On enquiry
Hysteresis:	–	10% of standstill frequency
Max. input frequency:	–	1000Hz
Min. pulse duration:	–	500µs
Outputs:	13/14; 23/24; 33/34: 3 enabling circuits	13/14; 23/24; 33/34; 43/44; 51/52:
	1 signal circuit (2 relay NC contacts in parallel)	–
Utilization category:	AC 15; DC 13	
Rated operational current / voltage I_e/U_e:	6A / 250V AC; 3A / 24V DC	3A / 250V AC; 2A / 24V DC
Switching voltage:	Max. 400V AC	Max. 250V AC
Load current:	Max. 6A (cos φ = 1)	
Switching capacity:	Max. 1,500VA	
Max. fuse rating:	6A (quick-acting)	
Additional transistor outputs Y1, Y2:	–	Min. U_e - 4V; Y1 + Y2 = 100mA short-circuit proof, open collector, p-switching
Switch-on time:	<3s after motor comes to standstill	–
Switch-off time:	<15ms (<130ms on supply failure)	–
Indications:	Green LED’s for control voltage and output,	ISD
	red LED for fault, yellow LED’s for channels A and B	
Immunity to noise:	To EMC guidelines	
Overvoltage category:	II to DIN VDE 0110	
Degree of pollution:	3 to DIN VDE 0110	
Resistance to vibration:	10 to 55Hz / Amplitude 0.35mm ± 15% at the regulation point	
Resistance to shock:	30g / 11ms	
Ambient temperature:	0°C to +55°C	
Storage and transp. temp.:	–25°C to +70°C	

CE

FaultFinder™

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ISD - Integral System Diagnostics

AES 1135 to 1166, AES 1185, AES 1235/1236, AES 2135 to 2166, AES 2335 and AES 3335 to 3566

Indication	Explanation of switching conditions
LED on green	• Enabling circuits closed
LED flashing green	• Enable delay time running, enabling circuits open, only for AES 1185
LED flashing yellow (short pulses approx. 0.5Hz)	• Guard device open
LED flashing yellow (short pulses approx. 2Hz)	• Guard device closed but no enable. Possible cause: Faulty operation (only one contact actuated when opening the guard) • Voltage drop • Feedback circuit not closed • Start-up test not carried out, only for AES ...6

Indication (yellow)	**Explanation of switching conditions**	Only valid for: AES 1165/1166, AES 1185, AES 2165/2166 and AES 3365/3566
LED one pulse 	• Guard device 1 open	
LED two pulses 	• Guard device 2 open	
LED three pulses 	• Guard device 3 open, only for AES 1185	

ISD - Integral System Diagnostics

AES 1135 to 1166, AES 1185, AES 1235/1236, AES 2135 to 2166, AES 2335 and AES 3335 to 3566

Indication (orange)	Fault	Cause
LED one pulse 	• Inputs S1	• Incoming connection to switch defective • Switch defective or fitted incorrectly • Switch at least 5s only partially actuated* • Short-circuit between connections
LED two pulses 	• Inputs S2, only for AES 1165/1166, AES 2165/2166, AES 3365/3566 and AES 1185	• See fault inputs S1 • Defective incoming connection to relay or relay contact • Defective relay
LED three pulses 	• Inputs S1 + S2, only for AES 1165/1166, AES 2165/2166 and AES 3365/3566 • Inputs S3, only for AES 1185	• See fault inputs S2 • Defective incoming connection to relay or relay contact • Defective relay
LED four pulses 	• Fault signals on the inputs, no secure evaluation, not for AES 1185	• Excessive capacitive or inductive coupling on the switch leads or incoming power supply leads
LED five pulses 	• One or both relays not pulled in within a monitored time	• Operational voltage Ue too low • Defective relay
LED six pulses 	• Relay not dropped out on actuation of switch	• Welded relay contact
LED seven pulses 	• Dynamic monitoring of both channels (Cross-Monitoring) not operating correctly • Fault signals on the inputs, no secure evaluation, only for AES 1185	• Fault on one channel • Error in internal data transmission • Excessive capacitive or inductive coupling on input signal leads, only for AES 1185

* Partial actuation
Switch position in which only one contact has been actuated

Cancellation of fault indication
The fault indication is cancelled when its source has been eliminated and the connected switch has been actuated to check all functions
(Open and re-close guard device)

ISD - Integral System Diagnostics

AES-E 3035

Indication	Explanation of switching conditions
LED on green	• Enable Y14 “low”, Y22 “high”, only for AES-E 3035 • Enable Y14 and Y24 “high”, only for AES 3075
LED flashing green	• Enable delay time running
LED on yellow	• At least one guard device open
LED flashing yellow	• Feedback circuit is open • Enable input X4 is open, only for AES 3075

Indication (orange)	Fault	Cause
LED one pulse 	• Guard device 1	• Incoming connection to switch defective • Switch defective or fitted incorrectly • Switch at least 5s only partially actuated* • Short-circuit between connections
LED two pulses 	• Guard device 2	• Incoming connection to switch defective • Switch defective or fitted incorrectly • Switch at least 5s only partially actuated* • Short-circuit between connections
LED three pulses 	• Guard device 3	• Incoming connection to switch defective • Switch defective or fitted incorrectly • Switch at least 5s only partially actuated* • Short-circuit between connections
LED four pulses 	• Guard device 4	• Incoming connection to switch defective • Switch defective or fitted incorrectly • Switch at least 5s only partially actuated* • Short-circuit between connections
LED five pulses 	• Enable outputs Y14 and Y24, only for AES 3075 • Enable outputs Y14 and Y22, only for AES-E 3035	• Short-circuit between connections • Short-circuit
LED six pulses 	• Additional transistor outputs Y1 to Y5	• Short-circuit
LED seven pulses 	• Fault signals on the inputs, no secure evaluation	• Excessive capacitive or inductive coupling on the switch leads or incoming power supply leads
LED eight pulses 	• Feedback circuit, only for AES 3075	• Feedback of external contactors defective, incorrect wiring of feedback circuit

*** Partial actuation**

Switch position in which only one contact has been actuated

Cancellation of fault indication

The fault indication is cancelled when its source has been eliminated and the connected switch has been actuated to check all functions (Open and re-close guard device)

ISD - Integral System Diagnostics

AZS 2305

Indication	Explanation of switching conditions
LED on red	• Comparison of channel 1 and channel 2 time values faulty (setting of coding and DIP switches)
LED on green	• Enabling circuits are closed
LED flashing green (short pulses approx. 0.5Hz)	• Input signal in base position • Enabling circuits are not closed
LED flashing yellow	• Time measurement carried out, maximum remaining time value can be seen from table below

Number of pulses n	1	2	3	4	5	6
Minimum remaining time	T/2	T/4	T/8	T/16	T/32	T/64

Indication (orange)	**Fault**	**Cause**
LED one pulse 	• Input signal S14/S22 on S1	• Connection for signal input S1 defective • Fault occurred on signal change*
LED two pulses 	• Time processing	• Channel 1 time value too long
LED three pulses 	• Time processing	• Channel 2 time value too long
LED four pulses 	• Fault signals on the inputs, no secure evaluation	• Excessive capacitive or inductive coupling on the input signal leads or incoming power supply leads
LED five pulses 	• One or both relays not pulled in within the monitoring time	• Operational voltage Ue too low • Defective relay
LED six pulses 	• Relay not dropped out on signal change	• Welded relay contact
LED seven pulses 	• Dynamic monitoring (Cross-Monitoring) not operating correctly	• Fault on the internal data transmission

* The signal change occurred either only on one input or on both inputs with a time interval of more than 5 seconds

Cancellation of fault indication
The fault indication is cancelled when its source is eliminated and the input signal S1 has been switched to the base position to check all functions.

Legend T: Time setting

ISD - Integral System Diagnostics

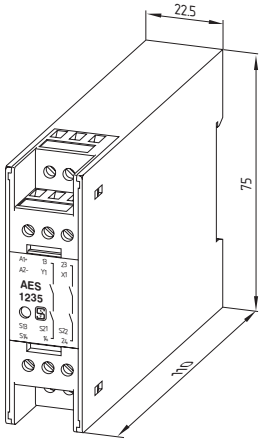
FWS 1105, FWS 1106, FWS 2316 and FWS 3505-2204

Indication	Explanation of switching conditions
LED on green	• The enabling circuits are closed
LED flashing yellow (short pulses approx. 2 Hz)	• Motor running, the limiting frequency is exceeded, the enabling circuits are open
LED flashing yellow (short pulses approx. 0.5 Hz)	• With two proximity switches connected, only one switch is below the limiting frequency, the enabling circuits are open

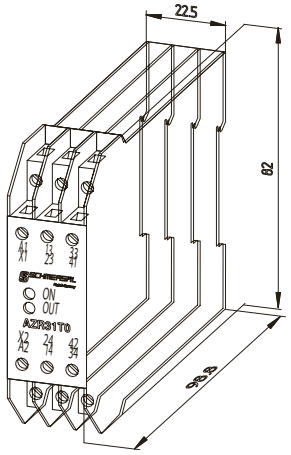
Indication (orange)	Fault	Cause
LED one pulse 	• Sensor 1 frequency too low • Input X1, only for AES 1105/1106 • Input X2, only for FWS 3505-2204 • Input X3, only for FWS 2316	• Defective incoming connection or defective proximity switch
LED two pulses 	• Sensor 2 frequency too low • Input X2, only for AES 1105/1106 • Input X4, only for FWS 3505-2204 • Input X5, only for FWS 2316	• Defective incoming connection or defective proximity switch • With only one proximity switch, jumper X1/X2 missing, only for FWS 1106
LED three pulses 	• Voltage X2/X4, only for FWS 3505-2204 • Short-circuit between connections, only for FWS 2316	• One or both proximity switches supply no output voltage: Proximity switch defective, not fitted or leads interrupted, only for FWS 2316, FWS 3505-2204 • Short-circuit between the output connections of the proximity switches, only for FWS 2316
LED four pulses 	• Fault signals on the inputs, no secure evaluation	• Excessive capacitive or inductive coupling on the inputs or incoming power supply leads
LED five pulses 	• One or both relays not pulled in within a monitored time	• Operational voltage Ue too low • Defective relay
LED six pulses 	• Relay not dropped out on actuation of switch	• Welded relay contact
LED seven pulses 	• Fault signals on internal data connections	• Fault on the internal data transmission due to excessive capacitive or inductive coupling on the internal data connections
LED eight pulses 	• Additional standstill signal, only for FWS 1106	• The condition of the additional standstill signal does not agree with the deduced frequencies, e.g. the additional signal shows standstill but the proximity switch indicates limiting frequency exceeded

Cancellation of fault indication

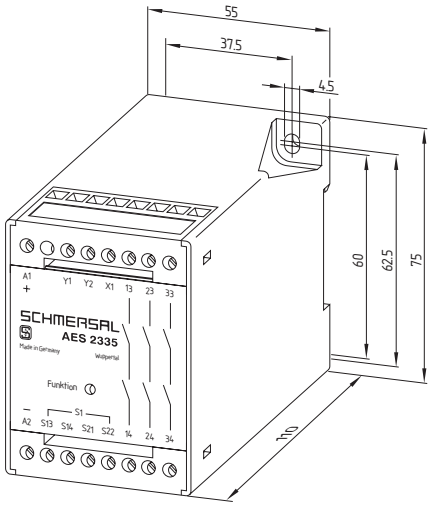
The fault indication is cancelled when its source has been eliminated and all input signals have been checked, e.g. whether machine turning. Operation of the Reset pushbutton also cancels all fault indications.



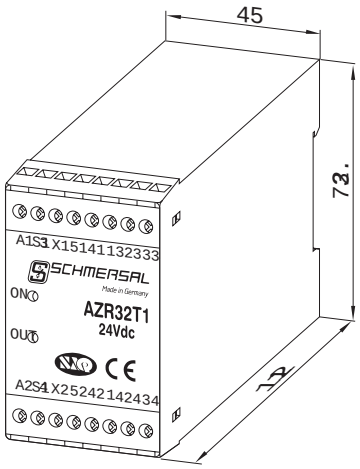
22.5 x 75 x 110 mm



22.5 x 82 x 96.8 mm



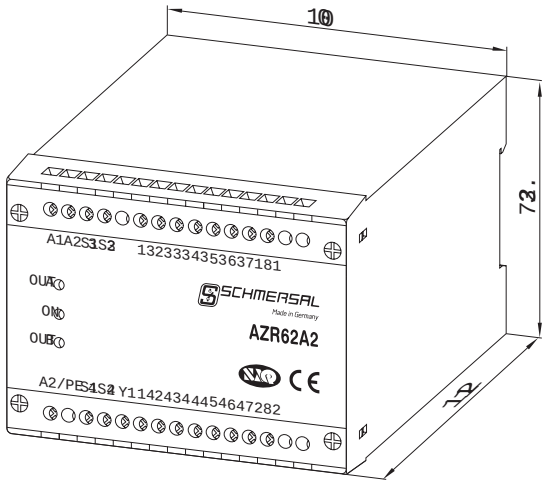
55 x 75 x 110 mm



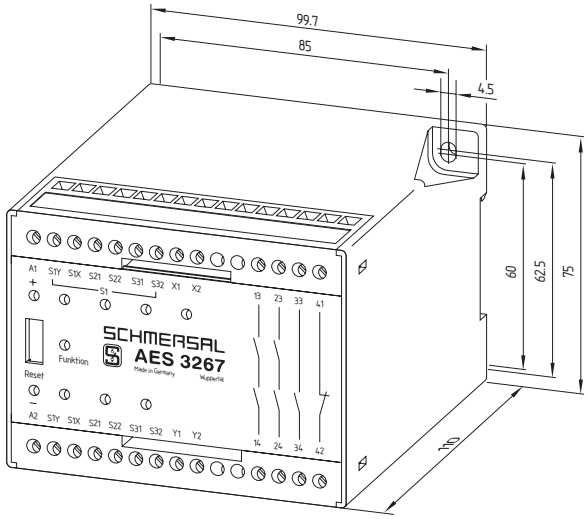
45 x 73.2 x 121 mm

Dimensional Drawings

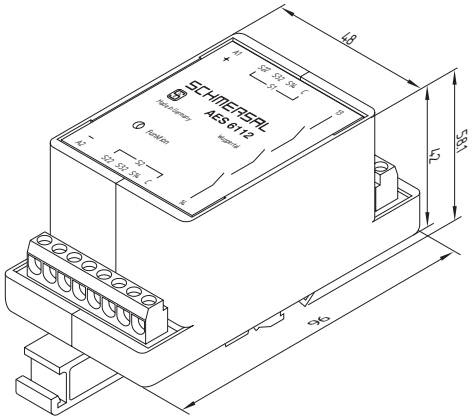
Safety Controllers



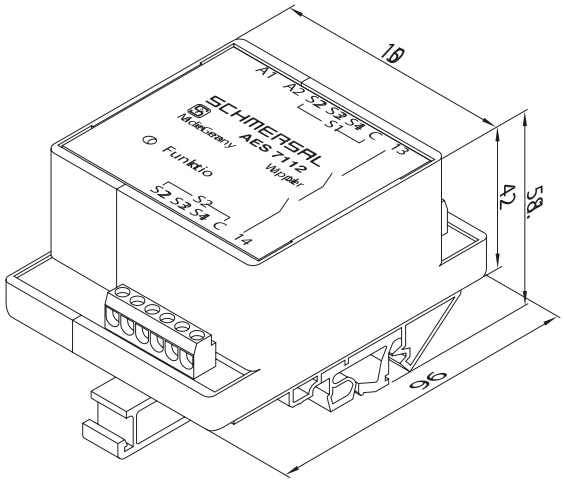
100 x 73.2 x 121 mm



99.7 x 75 x 110 mm



48 x 96 x 58.1 mm



105 x 96 x 58.1 mm

SELECTED MACHINE SAFEGUARDING TERMINOLOGY

Authorized Output: an output from a safety controller's positive-guided relays (used to "authorize" or "enable" a machine's start circuit when safety system conditions exist). Also known as "safety output."

Automatic Reset: a safety controller reset circuit that automatically resets the safety controller when safe system conditions (no system faults) exist. A manual reset button is optional.

Auxiliary output: a non-safety related contact closure or semiconductor output primarily used for signaling component or system status to a PLC, audible alarm or visual indicator (such as a stack light). Also called a "signaling contact" or "auxiliary monitoring contact".

ANSI (American National Standards Institute): an association of industry representatives who, working together, develop safety and other technical standards.

Auxiliary monitoring contact: See "auxiliary output".

BG (Berufgenossenschaft): an independent German insurance agency whose legislative arm recommends industry safety practices. One of many "notified bodies" authorized to certify that safety products comply with all relevant standards.

CE (Conformité Europeéne) mark: a symbol (CE) applied to finished products and machinery indicating it meets all applicable European Directives. For electrical and electronic "finished products", such as a safety relay module, these include the Low Voltage Directive and, where relevant, the Electromagnetic Compatibility (EMC) Directive.

Coded-Magnet Sensor: a two-piece position sensor consisting of an array of reed switches and a multiple magnet array-actuating element. Such devices will only deliver an output signal when the reed switch element is in the presence of a matched, multiple-magnetic field array. Coded-magnet sensors cannot be actuated using a simple magnet. Hence they are far more difficult to defeat/bypass than a simple magnetic switch or proximity sensor.

Control Reliability: A term applied to safety devices or systems which are designed constructed and installed such that the failure of a single component within the device or system does not prevent normal machine stopping action from taking place…but does prevent a successive machine cycle from being initiated.

CSA (Canadian Standards Association): an independent Canadian testing and standards-making organization similar to Underwriters Laboratories (UL) in the U.S. "CSA-certified" products meet relevant CSA electrical and safety standards.

Declaration of Conformity: a manufacturer's self-certified document, signed by a highly-positioned technical manager, which lists all the Standards and Directives to which a product conforms. A Declaration of Conformity is mandatory for all CE-marked products, and for machine components which, if they fail, could lead to a dangerous or hazardous situation on a machine.

Defined Area: a predetermined area scanned by a light beam within which the presence of an opaque object of specified minimum size will result in the generation of a control signal.

Direct-Action Contacts: See "positive-break" contacts.

Diverse Redundancy: the use of different components and/or different microprocessor instruction sets written by different programmers in the design and construction of redundant components/circuits. Its purpose is to increase system reliability by minimizing the possibility of common-mode failure (the failure of like components used in redundant circuits).

Dual-Channel Safety System: a safety control system characterized by two inputs; each connected to one of two independent safety circuits. Dual-channel systems are typically capable of detecting interconnection wiring faults such as open circuits, short-circuits and ground faults. As such they provide a higher level of safety than single-channel systems.

E-Stop (Emergency Stop): the stopping of a machine by actuation of an "emergency stop" switch (such as a safety interlock switch, emergency push button switch, rope-pull switch, foot switch, or other actuating device.

European Machinery Directive (EMD) 98/392/EEC: a set of machine safety design requirements which must be satisfied to meet the Essential Health and Safety standards established by the European Economic Community. This Directive, and other relevant European Directives (such as the Low Voltage Directive, EMC Directive, et al) must be satisfied for the machine to bear the CE mark.

Fail-to-Danger: a component or system failure which allows a machine to continue operating, exposing personnel to a hazardous or unsafe condition.

Fail-to-Safe: "Fail-to-Safe" safety devices are designed such that a component failure causes the device/system to attain rest in a safe condition.

Fault Detection: the monitoring of selected safety system components whose failure would compromise the functioning of the safety system. The detection of such failures is known as "fault detection." Examples are:

- a short-circuit in the safety circuit's interconnection wiring
- an open-circuit in the safety circuit's interconnection wiring
- a welded contact in the safety controller's positive-guided relays
- an open machine guard

Fault Exclusion: the ability to minimize known possible component failures ("faults") in a safety system by design criteria and/or component selection. Simple examples of "excluded faults" are:

- The use of an overrated contactor to preclude the possibility of contact welding.
- Design of a machine guard such that the safety interlock switch actuator cannot be damaged.
- Selection of a suitable safety interlock switch.
- Use of positive-break safety interlock switches together with a self-monitoring safety relay module, such that the possibility of a contact weld resulting in the loss of the safety function is eliminated.

The elimination of such faults are generally a compromise between the technical safety requirements and the theoretical probability of their occurrence. Design engineers are permitted to exclude such faults when constructing the machine's safety system. However, each "fault exclusion" must be identified, justified, and documented in the Technical File submitted to satisfy the European Machinery Directive.

Feedback Loop: an auxiliary input on a safety controller designed to monitor and detect a contact weld in the primary machine-controlled device (e.g. motor contactor, relay, et al) having positive-guided contacts.

Force-Guided Contacts: See "Positive-Guided Contacts".

Fixed Barrier Guard: See "Hard Guarding".

Guard: a barrier that prevents entry of an individual's hands or other body parts into a hazardous area.

Hard Guarding: the use of screens, fences, or other mechanical barriers to prevent access of personnel to hazardous areas of a machine. "Hard guards" generally allow the operator to view the point-of-operation.

Hazardous Area: an area of a machine or process which presents a potential hazard to personnel.

Interlock: an arrangement in which the operation of one device automatically brings about or prevents the operation of another device.

Interlocked Barrier Guard: a fixed or movable guard which, when opened, stops machine operation.

Machine Primary Control Element (MPCE): an electrically powered component which directly controls a machine's operation. MPCE's are the last control component to operate when a machine's motion is initiated or stopped.

Machine Secondary Control Element (MSCE): a machine control element (other than an MPCE) capable of removing power from the hazardous area (s) of a machine.

Manual Start-Up Test: a term applied to safety controllers designed such that at least one of the system's interlocked machine guards must be manually-opened and closed (after applying power) before machine operation is authorized. All SCHMERSAL'S even numbered Series AES microprocessor--based safety controllers (e.g. AES 1136, AES 1146, AES 1156, AES 3366, et al) are designed to require a manual start-up test.

Manually-monitored Reset: a safety controller reset circuit requiring the presence of a discrete "trailing-edge" signal (24V to 0V) to activate the controller's authorized outputs. A reset button is mandatory.

Muting: the ability to program a monitoring and/or control device to ignore selected system conditions.

Negative Mode Mounting: the mounting of a single-piece safety interlock switch (e.g. a limit switch) such that the force applied to open the normally closed (NC) safety contact is provided by an internal spring. (See Figure 1.)
In this mounting mode the NC contacts may not open when the safety guard is "open". Here welded/stuck contacts, or failure of a contact-opening spring, may result in exposing the machine operator to a hazardous/unsafe area.

When mounted in the "negative-mode", single-piece safety interlock switches can be easily circumvented/defeated by the operator…simply by taping down the switch actuator when the safety guard is open.

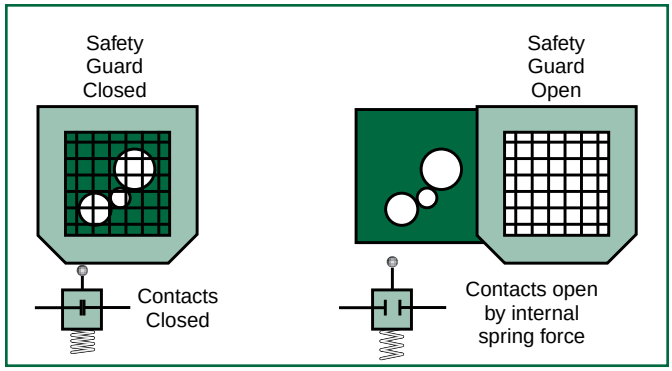


Figure 1
NEGATIVE-MODE INSTALLATION

OSHA (Occupational Safety Health Administration): a U.S. Department of Labor Federal agency responsible for monitoring and regulating workplace safety. OSHA enforcement may reference their own regulations, as well as those of other industry standards-making groups (e.g. ANSI, NFPA, UL, et al).

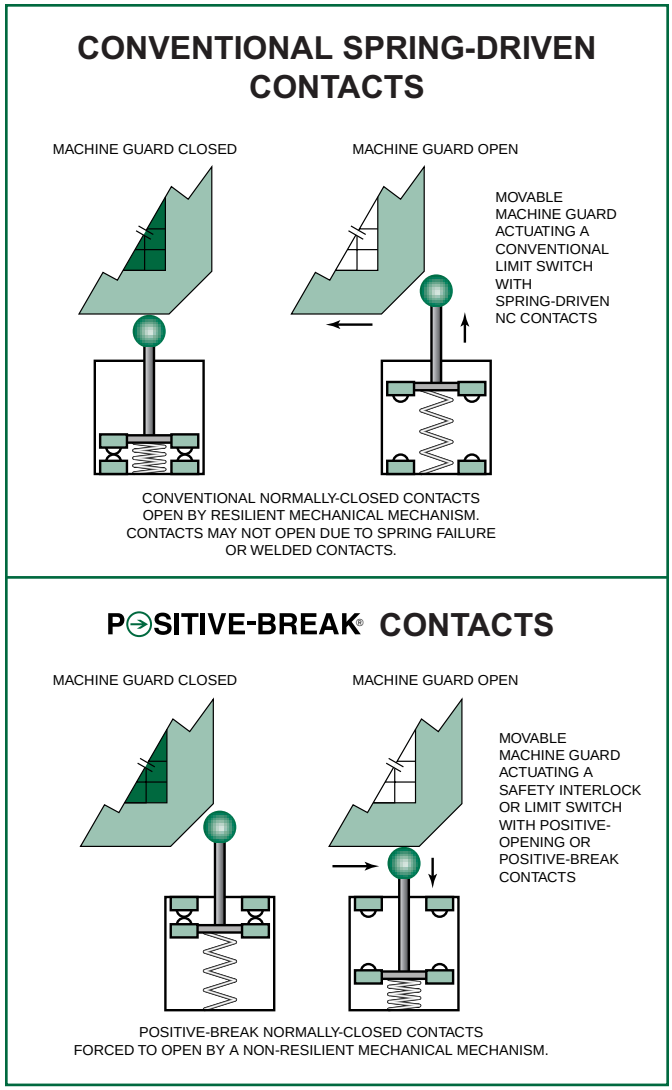


Figure 2
CONVENTIONAL VERSUS POSITIVE-OPENING CONTACTS

Point-of-Operation: the area(s) of a machine where material or the workpiece is positioned and a process is performed.
Point-of-Operation Guarding: a device or guard installed at the interface between the operator and the point-of-operation which is intended to protect personnel from hazardous areas.

Positive-Break Contacts: normally-closed (NC) contacts which, upon actuation, are forced to open by a non-resilient mechanical drive mechanism. Also called "positive-opening" or "direct-action" contacts. (See Figure 2.)

Positive-Guided Contacts: Normally-open (NO) and normally-closed (NC) contacts which operate interdependently such that the NO and NC contacts can never be closed at the same time. They are designed such that if one of the contacts welds/sticks closed, the other contacts cannot change state. (See Figure 3.)

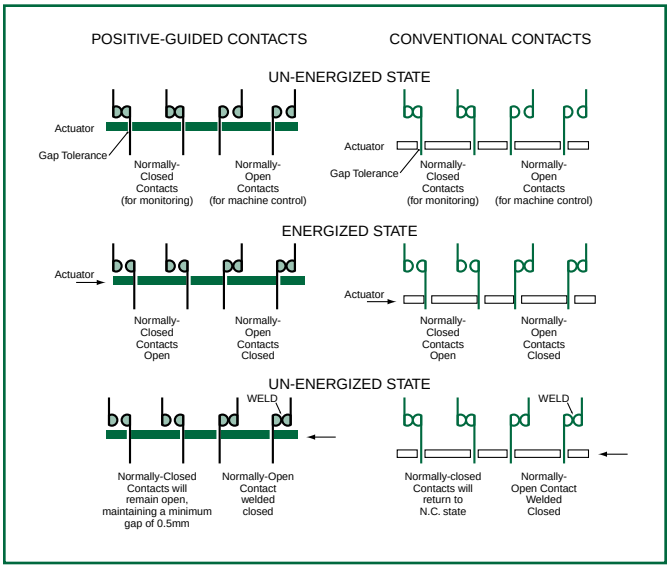


Figure 3

The interdependent operation between NO and NC contacts permits self-checking/monitoring of the functioning of relays and contactors featuring positive-guided contacts. Hence they are desirable in machine safety circuits where "fail-to-safe" or "control reliability" is desired. Also called "force-guided contacts".

Positive Linkage: a term applied to roller lever, rocking lever and other switch actuating members designed such that the integrity of the linkage between the actuator and the shaft is heightened (beyond a set screw on a smooth shaft) by its mechanical design. Examples of positive-linkages are pinned, square and serrated shafts. (See Figure 4.)

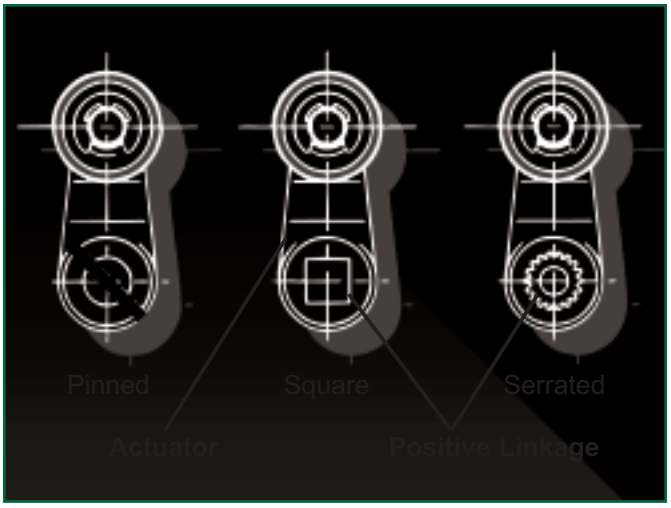


Figure 4

Positive-Mode Mounting: the mounting of a singe-piece safety interlock switch (e.g. a limit switch) such that the non-resilient mechanical mechanism which forces the normally-closed (NC) contacts to open is directly driven by the interlocked machine safety guard. In this mode (as opposed to "negative-mode mounting") the safety guard physically forces the NC contacts to open when the guard is opened. (See Figure 5.)

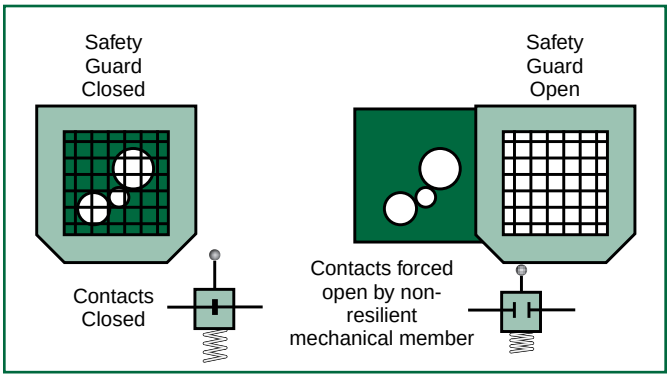


Figure 5

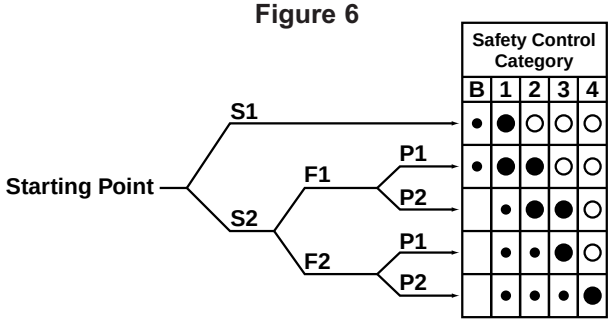
Positive-Opening Contacts: See "Positive-Break Contacts".

Push/Pull Operation: a term applied to emergency rope-pull switches designed to actuate when the rope/trip-wire is pulled and when it is pushed (goes slack). Such rope-pull switches provide a higher level of safety than units which only actuate when the trip-wire/rope is pulled.

Redundancy: the duplication of control circuits and/or components such that if one component/circuit should fail the other (redundant) component/circuit will ensure safe operation.

Risk Assessment: a systematic means of quantifying the relative level of danger different types of machine hazards present to the machine operator and/or maintenance personnel. This assessment is usually done in the early stages of the machine's design to permit such hazards to be designed-out or alternatively determine the scope of the safety system needed to protect personnel from possible injury. One approach suggested in

Figure 6



Selection of the Safety Category:
A brief overview of these safety categories is provided in Figure 7.

● Preferred categories

• Possible categories, which require additional measures

○ Over-dimensioned measures for the relevant risk

Here the safety category is determined by the following parameters:
- S Severity of injury
  S1 Slight injury
  S2 Serious injury
- F Frequency and/or exposure time to the hazard
  F1 Seldom to quite often
  F2 Frequent to continuous
- P Possibility of avoiding the hazard
  P1 Possible under specific conditions
  P2 Scarcely possible

EN954-1 is summarized in Figure 6.
Safeguarding: protecting personnel from hazards using guards, barriers, safety devices and/or safe working procedures.

Safety Controller: an electronic and/or electromechanical device designed expressly for monitoring the integrity of a machine's safety system. Such controllers are designed using positive-guided (force-guided) relays. Depending upon the model, SCHMERSAL's safety controllers are capable of detecting the following types of potential safety system faults:

- Machine guard(s) open
- Guard monitoring switch/sensor failure
- Interconnection wiring "open circuit"
- Interconnection wiring "short circuit"
- Interconnection wiring "short-to-ground"
- Welded contact in controlled output device
- Failure of one of the safety controller's positive-guided relays
- Fault in the safety controller's monitoring circuit
- Insufficient safety controller operating voltage

Upon detection of a system fault, the safety controller will initiate a "machine stop" command and/or prevent the restarting of the machine until the fault has been corrected. The "stop" command may be immediate or time-delayed depending upon the model safety controller

selected.
Safety Enable: (See “Authorized Output.”)

Safety Interlock Switch: a switch designed expressly to safely monitor the position of a machine barrier guard. Such switches typically feature positive-break contacts and are designed to be more tamper-resistant than conventional position/presence-sensing switches.

Safety Output: (See “Authorized Output.”)

Safety Relay: an electromechanical relay designed with positive-guided contacts.

Self-Checking: the performing of periodic self-diagnostics on the safety control circuit to ensure that critical individual components are functioning properly.

Self-Monitoring: see “Self-Checking”.

Single-Channel Safety System: a safety control system characterized by one safety interlock switch whose normally-closed contact is the sole input to a safety controller or a motor contactor. Such systems are unable to detect a short circuit failure in the interconnection wiring and are only recommended for addressing Safety Categories B, 1 and 2 (see “Risk Assessment”).

Solenoid-Latching Safety Interlock Switch: a two-piece safety interlock (actuating key and switch mechanism) whose design prevents the removal of the actuating key until released by an integral latching solenoid. Solenoid latching is typically controlled by a time-delay, motion detector, position sensor or other control components.

Stop Categories:
“0” Requires immediate removal of power from the controlled devices.
“1” Allows for a time delay up to 30 seconds for removal of power. This is commonly used with drive systems where immediate removal of power may result in a longer stop time.

Tamper-Resistant: a term applied to safety interlock switches referring to their relative ability to be defeated or bypassed using simple, readily available means such as a screwdriver, paper clip, piece of tape or wire, etc. Switches and sensors designed expressly for use as machine guard safety interlocks are designed to be more “tamper-resistant” than conventional switches/sensors (e.g. proximity switches, reed switches, conventional limit switches).

Time-delayed Authorized Outputs: a safety controller’s authorized outputs whose activation is delayed (up to 30 seconds) to satisfy Stop Category 1 requirements.

Trailing-edge Reset: (See “Manually-monitored Reset.”)

Two-Hand Control: a machine control system which requires “simultaneous” use of both of the operator’s hands to initiate a machine cycle.

UL (Underwriters Laboratories): an independent testing and standards-making organization. UL tests products for compliance to relevant electrical and safety standards/requirements.

MACHINE SAFETY STANDARDS

European Machinery Directive & CE Marking

The European safety requirements for man and machine are established in the European Machinery Directive (EMD). According to the EMD, machinery must be designed and built to meet the Directive's requirements as defined by existing and emerging European standards. These "European Norms", prepared by representatives of the European Economic Community (EEC) member states and produced by the European standards committees CEN and CENELEC, provide a harmonized baseline for the design and construction of safe machinery.

As of January 1, 1997, machinery sold into or within the EEC must comply with the requirements of the European Machinery Directive. Equipment which complies may be affixed with the CE mark (for "Conformité Europeene"). The CE mark on a machine signifies that it conforms to the essential health and safety requirements defined by the relevant European Norms.

EUROPEAN STANDARDS
These "Norms" form a hierarchical structure which include:

Type A Standards: Fundamental Safety Standards which contain basic concepts, principles of design, and general aspects applicable to all machinery.

Type B Standards: Group Safety Standards, each of which focuses on a specific subject applicable to a range of machinery types. "B1 Standards" cover a specific safety aspect defined in the Fundamental Standards. "B2 Standards" cover the requirements of specific safety related devices such as two-hand controls, interlocking devices, movable guards, etc.

Type C Standards: Specific Machine Safety Standards, each of which define protective measures required for hazardous areas of a specific machine or group of machines.

Type A and Type B Standards are intended to assist in the machinery design process, and eliminate the need to repeat these general requirements in the machine-specific (Type C) Standards.

Many product standards are still in the planning stage and the number of Type C Standards is continuously increasing. Some are still in draft form (designated as "prEN" standards). Others exist as finished ("EN") standards.

Where no machine-specific standard exists, the requirements of the Machinery Directive can be satisfied by observing existing European Standards and relevant national standards/specifications. Draft standards (prEN) published by the European Union are also accepted and used as a basis for evaluating products for compliance to the Directives. It is important to note that such draft standards may change before being finalized and adopted as EN standards.

SELECTED EUROPEAN STANDARDS

Type "A" Standards:

EN292, Safety Machinery – Basic Concepts, General Principles of Design, Parts 1 & 2.

Type "B1" Standards:

EN294 Safety of Machinery – Safety Distances to Prevent Danger Zones from Being Reached by Upper Limbs.

EN349 Safety of Machinery – Minimum Gaps to Avoid Crushing of Parts of the Human Body.

EN954-1 Safety of Machinery – Safety-Related Parts of Control Systems – Part 1. General Principles of Design.

EN999 Safety of Machinery – The Positioning of Protective Equipment in Respect of Approach Speeds of the Human Body.

EN1050 Safety of Machinery – Principles of Risk Assessment.

prEN811 Safety of Machinery – Safety Distances to Prevent Danger Zones from Being Reached by Lower Limbs.

Selected Type "B2" Standards:

EN418 Safety of Machinery – Emergency Stop Devices, Functional Aspects – Principles for Design.

EN547 Safety of Machinery – Two –Hand Control Devices, Functional Aspects – Principles for Design.

EN1088 Safety of Machinery – Interlocking Devices Associated with Guards – Principles for Design & Selection.

prEN953 Safety of Machinery – General Requirements for the Design and Construction of Guards.

prEN1760-1 Safety of Machinery – Pressure Sensitive Safety Devices – Mats
& Floors.

prEN1760-2 Safety of Machinery – Pressure Sensitive Safety Devices – Edges & Bars.

prEN61496 Safety of Machinery – Electrosensitive Protective Equipment.

Type "C" Standards:

prEN415 Packaging Machines

prEN692 Mechanical Presses

prEN693 Hydraulic Presses

prEN746 Thermoprocessing Machines

prEN931 Footwear Manufacturing Machines

prEN1114-1. Rubber & Plastics Machines

prEN1762 Food Processing Machines

Domestic Standards:

Concern for worker safety is not limited to the European community. Domestically machinery builders, machine users, and industrial safety professionals have each recognized the importance of providing safe work-places.

Several standards-making organizations have developed, and continue to develop, more stringent machine safety guidelines and standards. These include:

Occupational Health and Safety Administration (OSHA)

American National Standards Institute (ANSI)

Robotics Industry of America (RIA)

Instrument Society of America (ISA)
National Fire Prevention Association (NFPA)

Underwriters Laboratories, Inc. (UL)

A number of selected domestic standards are listed below.

OSHA 29 CFR 1910.212
General Requirements for (Guarding of) All Machines

OSHA 29 CFR 1910.217
(Guarding of) Mechanical Power Presses

ISA S84.01
Safety Instrumented Systems

ANSI B11.1
Machine Tools - Mechanical Power Presses - Safety Requirements for Construction, Care, and Use of

ANSI B11.2
Hydraulic Power Presses - Safety Requirements for Construction, Care, and Use of

ANSI B11.3
Power Press Brakes - Safety Requirements for Construction, Care, and Use of

ANSI B11.4
Shears - Safety Requirements for Construction, Care, and Use of

ANSI B11.5
Machine Tools - Iron Workers - Safety Requirements for Construction, Care, and Use of

ANSI B11.6
Lathes - Safety Requirements for Construction, Care, and Use of

ANSI B11.7
Cold Headers & Cold Formers - Safety Requirements for Construction, Care, and Use of

ANSI B11.8
Drilling, Milling , and Boring Machines - Safety Requirements for Construction, Care, and Use of

ANSI B11.9
Grinding Machines - Safety Requirements for Construction, Care, and Use of

ANSI B11.10
Metal Sawing Machines - Safety Requirements for Construction, Care, and Use of

ANSI B11.11
Gear Cutting Machines - Safety Requirements for Construction, Care, and Use of

ANSI B11.13
Machine Tools - Single- and Multiple- Spindle Automatic Bar and Chucking Machines -Safety Requirements for Construction, Care, and Use of

ANSI B11.14
Coil Slitting Machines/Systems — Safety Requirements for Construction, Care, and Use of

ANSI B11.15
Pipe, Tube, and Shape Bending Machines - Safety Requirements for Construction, Care, and Use of

ANSI B11.16
Metal Powder Compacting Presses - Safety Requirements for Construction, Care, and Use of

ANSI B11.17
Horizontal Extrusion Presses-Safety Requirements for Construction, Care, and Use of

ANSI B11.18
Machinery and Machine Systems for the Processing of Coiled Strip, Sheet, and Plate - Safety Requirements for

ANSI B11.19
Performance Criteria for the Design, Construction, Care, and Operation of Safeguarding when Referenced by Other B11 Machine Tool Safety Standards

ANSI B11.20
Machine Tools - Manufacturing Systems/Cells - Safety Requirements for Construction, Care, and Use of

ANSI B183
Roll Forming and Roll Bending Machines - Safety Requirements for Construction, Care, and Use of

ANSI/RIA 15.06
Safety Requirements for Industrial Robots and Robot Systems

NFPA 79
Electrical Standard for Industrial Machinery 1994 Edition

Sources for Standards:

EN & IEC Standards are available from:

Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112
Telephone: (800) 854-7179

and

American National Standards Institute (ANSI)
11 West 42nd Street
New York, NY 10036
Telephone: (212) 642-4900

ANSI & NFPA Standards are available from:

American National Standards Institute (ANSI)
11 West 42nd Street
New York, NY 10036
Telephone: (212) 642-4900

OSHA Regulations are available from:

Superintendent of Documents
Government Printing Office
Washington, DC 20402-9371
Telephone: (202) 783-3238

DECLARATIONS OF CONFORMITY

Each SCHMERSAL safety product has been certified to conform to all relevant Standards and Directives. Copies of the Declaration of Conformity for any product in this catalog are available upon request.