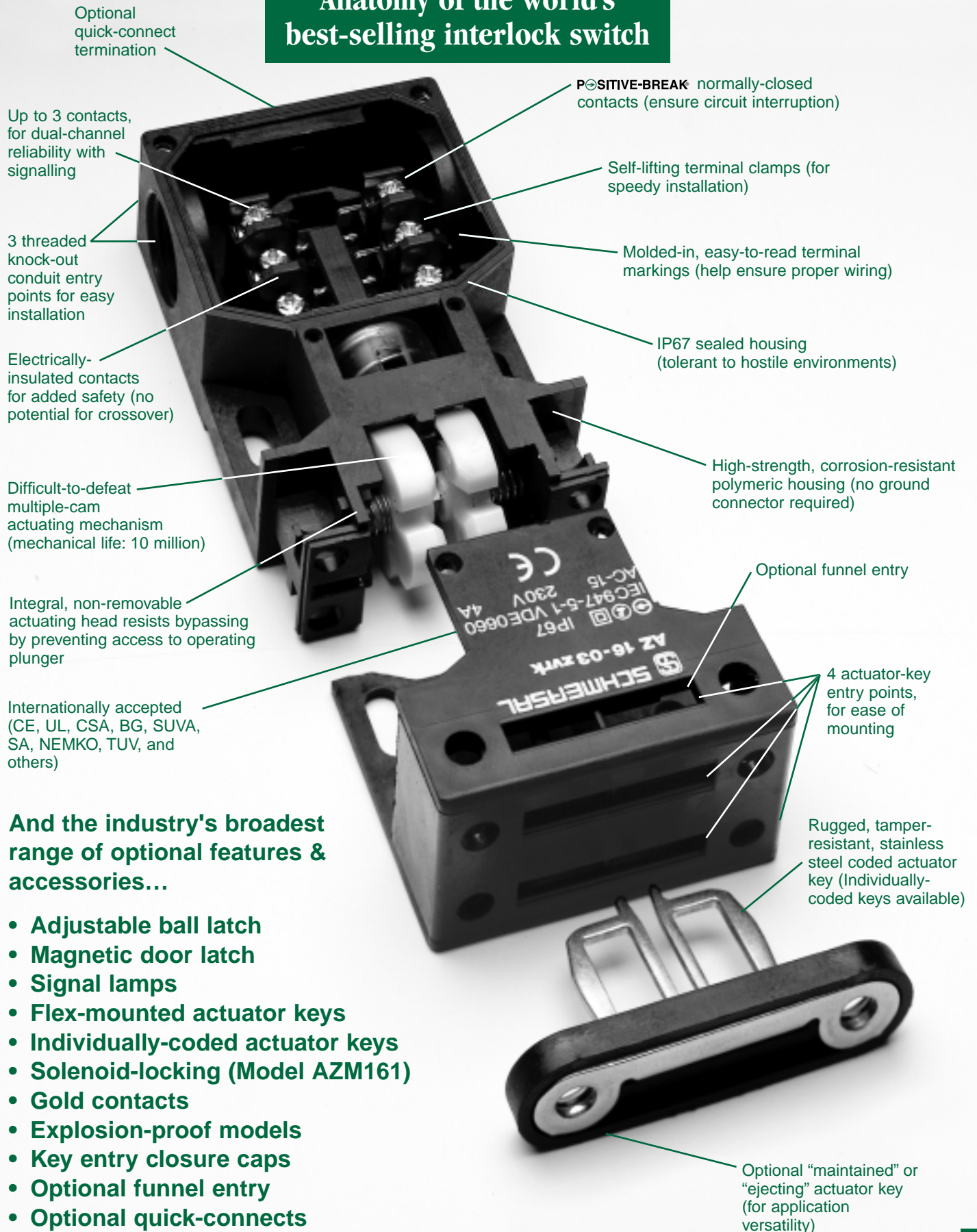


AZ16

Anatomy of the world's best-selling interlock switch



And the industry's broadest range of optional features & accessories...

- Adjustable ball latch
- Magnetic door latch
- Signal lamps
- Flex-mounted actuator keys
- Individually-coded actuator keys
- Solenoid-locking (Model AZM161)
- Gold contacts
- Explosion-proof models
- Key entry closure caps
- Optional funnel entry
- Optional quick-connects

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SCHMERSAL is continuously working to improve our product designs. Therefore we reserve the right to change product specifications/ratings and other information contained in this catalog without notice. Proper installation and use of our products remains the customer's responsibility.

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PICTORIAL PRODUCT INDEX

Keyed Interlock Switches

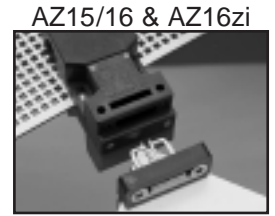
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Keyed Interlock Switches with Solenoid-Latching

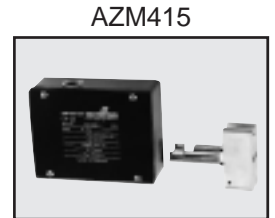
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Application Accessories (Safety Door Handles, Enabling Devices, Safety Foot Switches)

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Emergency Cable-Pull Switches

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Coded-Magnet Sensors & Compatible Safety Controllers

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Hinge-Mounted Interlock Switches

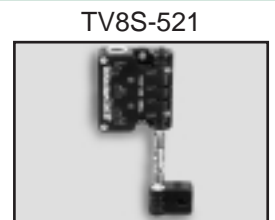
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Safety-Rated, Positive-Break Limit Switches

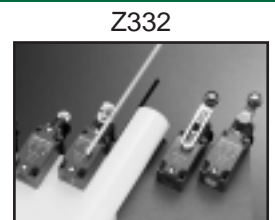
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AZ335



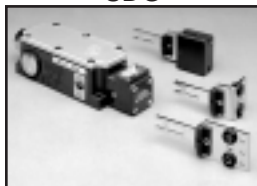
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AZ415



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SDG



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New!

SHGV



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TZG



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TZF/TZM



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TZK



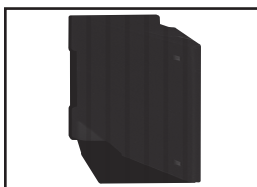
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TKF/TKM



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AZS/FWS



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New!

ZSD



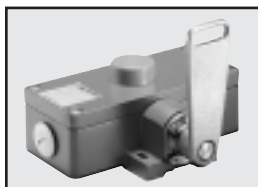
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ZS441



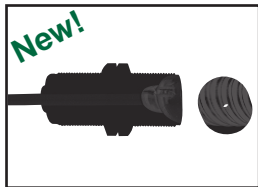
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ZS75S Bidirectional



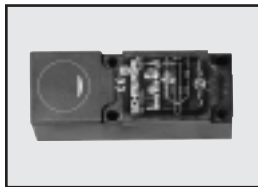
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BNS30 & BNS300



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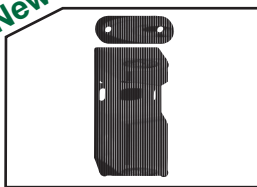
BNS333



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New!

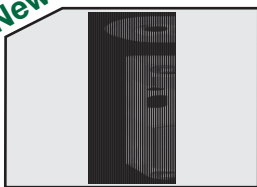
BNS16



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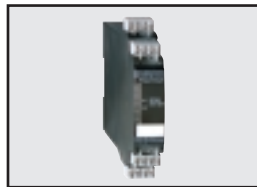
New!

BZ16



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AES



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T.C 235/236



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TESZ



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**Fail-to-Safe
Safety Edges**

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SE Series



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C50



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SCHMERSAL

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 machine guarding 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.

GLOBAL COVERAGE:

Technical support and inventory in more than 22 countries.



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 200 interlock, magnetic and rope-pull switches has earned SCHMERSAL a worldwide 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.

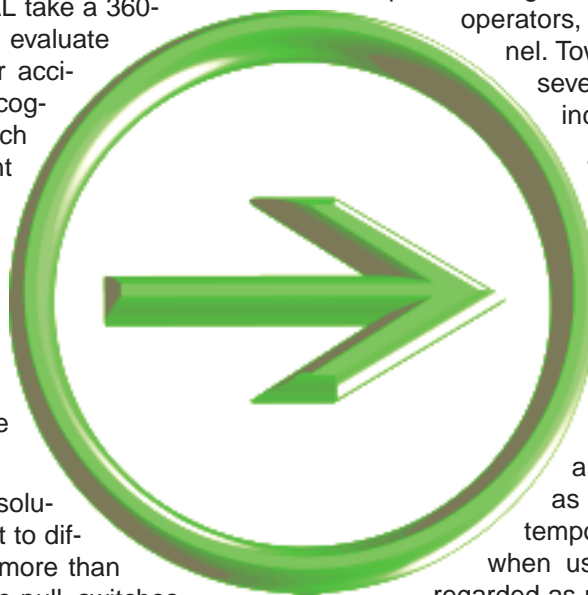
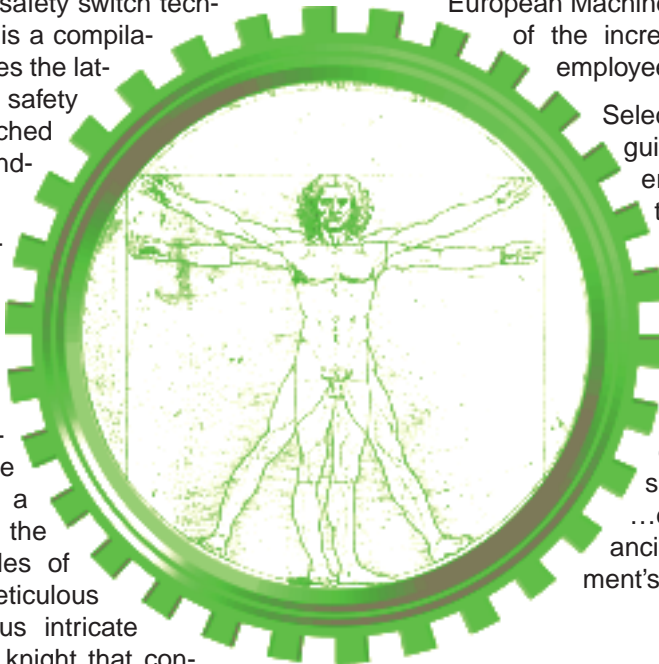
In so doing, they present new challenges to the plant safety specialist and equipment designer ...especially where safety guards ancillary to the production equipment's functional design are required.

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 relays
- 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.



**International symbol for
Positive-Break contacts**

“SAFETY-SPECIFIC” COMPONENTS

New switches, sensors and controls have been designed specifically for safety applications. Each is intended to overcome one or more of the limitations of conventional “non-safety” components ... and to satisfy one or more of the current safety requirements inherent in the latest industry standards and guidelines.

These safety-specific components are the subject of this catalog. They include:

- keyed interlock switches
- keyed interlock switches with solenoid latching
- sealed coded-magnet sensors
- safety foot switches
- push/pull operated emergency cable-pull switches
- E-stop pushbutton stations
- positive-break hinge switches
- fail-to-safe safety edges
- safety-rated limit switches
- safety controllers

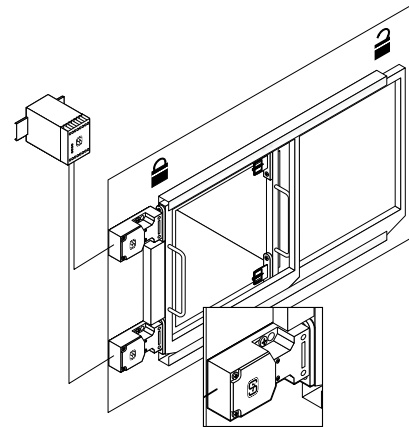
Each of these components is designed to help the safety specialist and equipment designers to better address their responsibility ... to ensure that machinery, built or purchased, does not expose the operators, helpers or maintenance personnel to hazards.

SATISFYING YOUR NEEDS

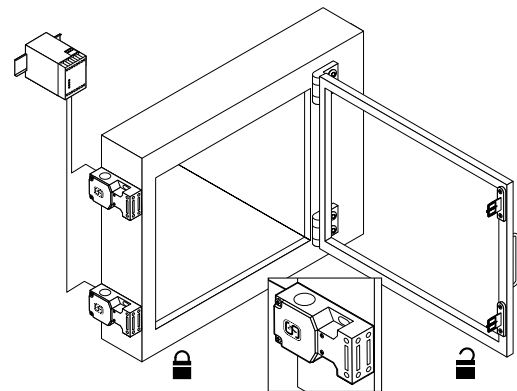
We trust that this Catalog-Handbook, its companion catalogs, and our tutorial Manual and videos, will be useful tools in the selection of suitable components to satisfy your unique application requirements. Your needs are our most important concern.

We welcome your questions and comments, and would appreciate your making us aware of any machine safeguarding requirements which cannot be satisfied with available components.

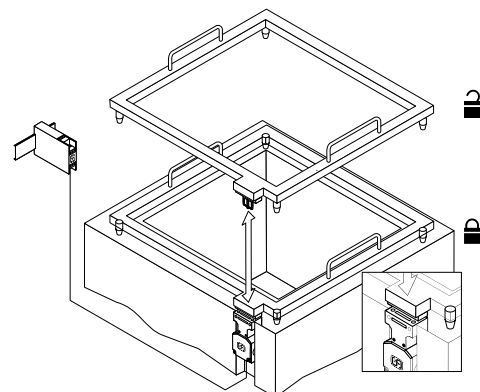
GUIDE TO APPLICATION SYMBOLS USED THROUGHOUT THE CATALOG



Sliding Guard Applications



Hinged Guard Applications



Lift-off Guard Applications



*Safer
by
Design*

KEYED INTERLOCK SWITCHES



SELECTION GUIDE

Switch Series	Housing Material	Envelope Dimensions	Contact Configurations	Catalog Page
ST14	Glass-fiber, reinforced thermoplastic	$\frac{3}{4}'' \times 1\frac{1}{4}'' \times 2''$	1 NO & 1 NC 2 NC	12
AZ17 AZ17zi	Glass-fiber, reinforced thermoplastic	$1\frac{1}{4}'' \times 1\frac{1}{4}'' \times 2\frac{1}{2}''$	1 NO & 1 NC 2 NC	14 18
AZ15/16 AZ16zi	Glass-fiber, reinforced thermoplastic	$1\frac{1}{4}'' \times 2'' \times 3''$	1 NC 1 NO & 1 NC 2 NC 1 NO & 2 NC 3 NC	22 28
TZG	Glass-fiber, reinforced thermoplastic	$1\frac{3}{4}'' \times 2'' \times 3\frac{3}{4}''$	1 NO & 1 NC 2 NC	32
SDG	Die-cast aluminum	$1\frac{3}{4}'' \times 2'' \times 6''$	1 NO & 2 NC 2 NO & 1 NC 3 NC	36
AZ335	Die-cast aluminum	$1\frac{1}{2}'' \times 1\frac{3}{4}'' \times 4\frac{1}{2}''$	1 NO & 1 NC 2 NC 1 NO & 2 NC 3 NC	40
New! SHGV (Key Transfer System)	Die-cast aluminum	$1\frac{3}{4}'' \times 1\frac{3}{4}'' \times 4''$	1 NO & 1 NC	44
AZ415	Die-cast aluminum	$1\frac{3}{4}'' \times 3\frac{1}{2}'' \times 4''$	2 NO & 2 NC	46

SERIES ST14

Sub-Compact, Tamper-Resistant Movable Machine Guard Safety Interlock Switch



Description

The ST14 Series is designed for use with movable machine guards which must be closed for operator safety. Their two-piece, tamper-resistant design, and positive-opening NC contacts, provide a significantly higher level of safety than conventional, spring-driven switches whose contacts can weld or stick shut. Their NEMA 4 (IP67) rating make them ideal for interlocking safety guards in hostile environments. Their compact design allows use in applications where space is severely limited.

Optional right-angle keys, close-radius keys and mounting brackets provide application versatility.

Operation

The ST14 is a two-piece, electromechanical safety interlock switch. It consists of a rugged, sealed switch mechanism and a geometrically-unique actuating key. The actuating key is typically mounted to the movable machine guard or access gate. Upon opening of the guard the NC contact(s) are forced to open by a direct (non-resilient) mechanical linkage with the actuating key. These positive-break contacts assure circuit interruption (and machine stoppage) upon removal of the actuator key. (The NO contact closes upon key removal.)

When the guard is closed, the actuating key forces the NC contact(s) to close, and the NO contact to re-open. Their tamper-resistant design prevents bypassing with simple tools, bent wires or other readily available means.

Typical Applications



The ST14 is intended for use as a safety interlock switch on movable machine guards which, when open, expose the operator/maintenance personnel to machine hazards. Their compact, sealed (NEMA 4) design makes them ideal where space is severely limited and/or where equipment is washed-down or subject to other hostile environments (i.e. business machines, medical equipment, food processing machinery, et al). Typical applications are the interlocking of protective gratings, access doors/guards, hinged covers, access panels and other movable guards.

Features & Benefits

- **Compact design** ... only 3/4" x 1 1/4" x 2". Ideal where space is limited.
- **"Positive-break" NC contacts** ... assure circuit interruption upon actuator key removal.
- **Tamper-resistant design** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **Watertight design** ... meets NEMA 4 (IP67) washdown and immersion requirements.
- **High-strength, stainless-steel actuator key** ... tolerant to mechanical abuse without damage.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Top and side key-entry locations** ... provide installation flexibility.
- **Optional key designs** ... to meet diverse application requirements.
- **Meets rigid safety agency standards** ... IEC, BG, VDE, UL and CSA.
- **Optional "side-entry" cable** ... please consult factory.

AVAILABLE STANDARD MODELS

(Actuator key must be ordered separately)
Please see below.

Part Number	Contacts (with key inserted)	Description
ST14-10/1SK	1 NO & 1 NC	ST14 interlock switch with standard B1 actuator key. (Sealed switch. Contact mechanism embedded in resin.)
ST14-20K	2 NC	ST14 interlock switch with standard B1 actuator key (Sealed switch. Contact mechanism embedded in resin.)

Note: All actuator keys feature integral vibration-tolerant mounting washers.

ACTUATOR KEYS & ACCESSORIES

Part Number	Description
ST14-B1	Standard B1 actuator key
ST14-B3	Close-radius actuator key (for mounting key close to door hinge)
ST14-B5	Right-angle actuator key
ST14-Bracket	Optional switch or key mounting bracket

Note: All actuator keys feature integral vibration-tolerant mounting washers.

ST14 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Glass-fibre reinforced, self-extinguishing thermoplastic
Actuator Key	Stainless steel (defeat-resistant design)
Degree of Protection	IP67 Actuation Head: IP 20
Operating Temperature	-4°F to +175°F
Mechanical Life	> 10 ⁶ operations
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET-15 UL CSA
Minimum Closing Radius	5.9" (with ST14-B1 and ST14-B5 actuator key) 1.97" (with ST14-B3 actuator key)

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Rating	6A (250VAC) 0.25A (220VDC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse 6A (time-delay)
Electrical Connection	Prewired with sealed PVC UL-style 2464 4x20 AWG cable one meter long*

*Other cable lengths available. Please consult factory.

DIMENSIONS

ST 14-B1 (Standard key)
Minimum key entry closing radius 150mm.

Right Angle Key ST 14-B5

ST 14-Bracket Switch or Key Mounting Bracket

ST 14-B3 Close Radius Key

SWITCHING SYMBOLS & CONTACT SCHEMATICS
(Colors identify factory prewiring)

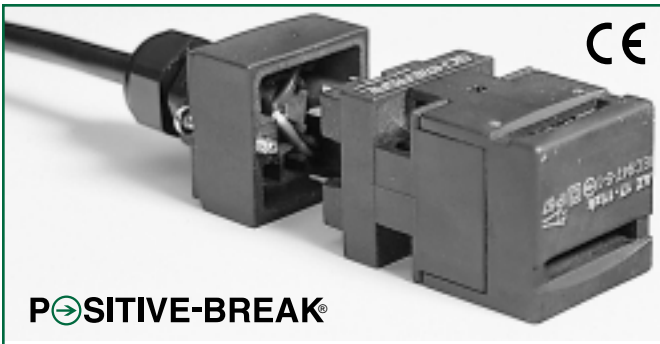
11-12: 11 = red, 12 = orange
23-24: 23 = black, 24 = brown
ST14-10/1S

11-12: 11 = red, 12 = orange
21-22: 21 = black, 22 = brown
ST14-20

For close radius keys for mounting key close to (within 50 mm) door hinge, order ST 14-B3.

SERIES AZ17

Compact Tamper-Resistant Movable Machine Guard Safety Interlock Switch



Description

The compact Series AZ17 is designed for use with movable machine guards/access gates which must be closed for operator safety. Their positive-opening NC contacts provide a significantly higher level of safety than conventional spring-driven switches whose contacts can weld or stick shut. And their tamper-resistant design prevents bypassing with simple tools, bent wires or other readily available means. Their IP67 rating makes them ideal for interlocking safety guards in hostile environments.

Operation

The AZ17 electromechanical safety interlock switch consists of a rugged switch mechanism and a geometrically-unique actuating key. The key is mounted to the movable guard. Upon opening of the guard the NC contact(s) are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. These positive-break NC contacts assure circuit interruption (and machine stoppage) upon removal of the actuator key. (The NO contact closes upon key removal.)

When the guard is closed, the actuating key forces the NC contacts to close and the NO contacts to re-open.

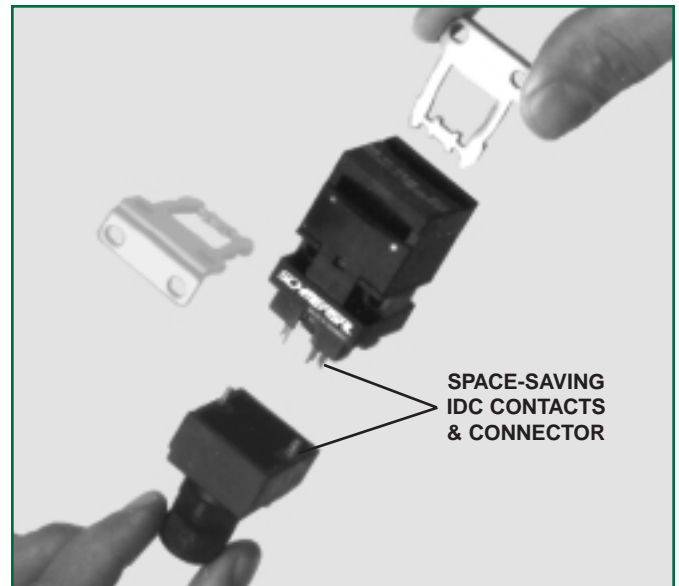
Typical Applications



The AZ17 is intended for use as a safety interlock switch on movable machine guards which, when open, expose the operator/maintenance personnel to machine hazards. Typical applications are the interlocking of protective gratings, access doors/gates, hinged covers, access panels and other movable guards.

Features & Benefits

- **Compact design** ... only 1¼" × 1¼" × 3". Ideal where space is limited.
- **Insulation Displacement Connector (IDC)** ... facilitates fast, easy installation.
- **Watertight design** ... meets IP67 washdown requirements.
- **Eight optional key entry locations** ... depending upon mounting arrangement.
- **Highly tamper-resistant** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **"Positive-break" NC contacts** ... assure interruption of safety circuit upon actuator key removal.
- **High-strength, stainless-steel actuator key** ... tolerant to mechanical abuse without damage.
- **Rugged, corrosion-resistant, high-impact glass-fibre reinforced housing** ... tolerates the most hostile environments.
- **"Padlockable" key for added security during maintenance.**
- **Meets rigid IEC, BG, VDE, UL & CSA standards.**
- **Three styles of actuator key** ... accommodates a wide variety of movable guards.



Note: Available with optional M12x1 quick-connect.

AZ17 AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS (Actuator key must be ordered separately)

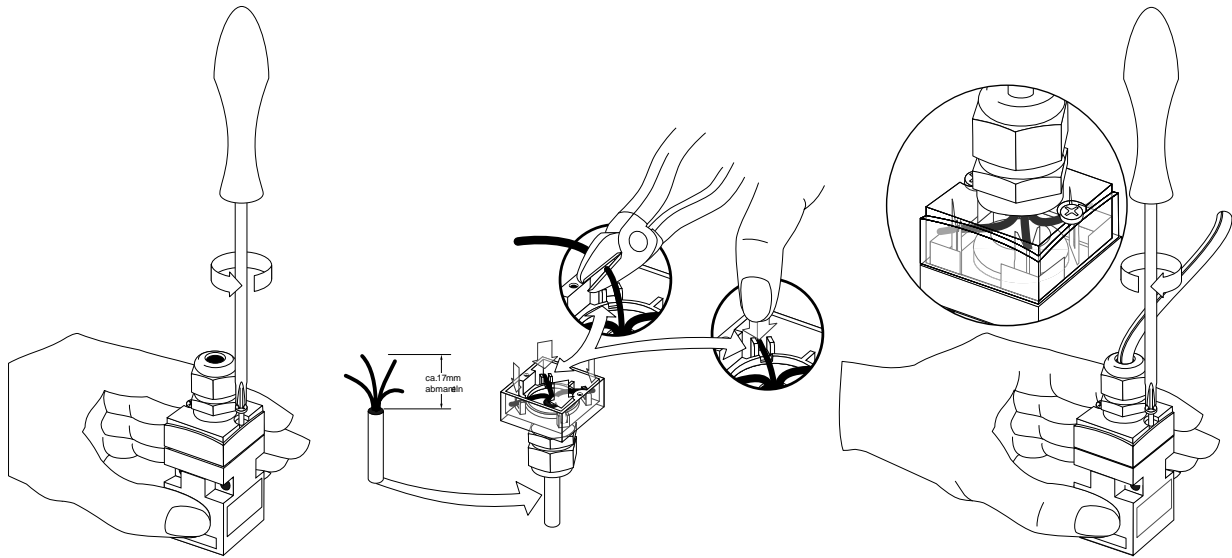
Part Number	Contacts (with actuator key inserted)
AZ17-11zk	1 NO & 1 NC
AZ17-11zrk	1 NO & 1 NC
AZ17-02zk	2 NC
AZ17-02zrk	2 NC
Solenoid-latching models available. (Model AZM170)	
Individually-coded key models available (Model AZ17zi) (For extra security in "high-risk" applications)	

Note: Pre-wired (5 meter length) cable entry models available. Add suffix "2243" for front of unit cable entry or suffix "2243-1" for rear cable entry.

Note: Optional "quick-connect" ... add suffix "ST"
(e.g. AZ17-11zk-ST).

ACTUATOR KEYS & ACCESSORIES

Part Number	Description
AZ17/170-B1	Standard key (7.87" minimum closing radius)
AZ17/170-B5	Right-angle key (7.87" minimum closing radius)
AZ17-B6	Flexible, close-radius key (1.97" minimum closing radius)
AZ17/170-B11	Elongated standard straight key (7.87" minimum closing radius)
AZ17/170-B15	Elongated right-angle key (7.87" minimum closing radius)
AZ17/170-B1-2245	Standard straight key with vibration-resistant mounting (7.87" minimum closing radius)
MS AZ 17	Adjustable mounting kit (Eases installation and facilitates adjustment due to guard misalignment)
Suffix "-ST"	Optional M12x1 quick-connect



SELECTED ACTUATOR KEYS

AZ17/170-B1



AZ17/170-B5



AZ17-B6



AZ17 TECHNICAL DATA

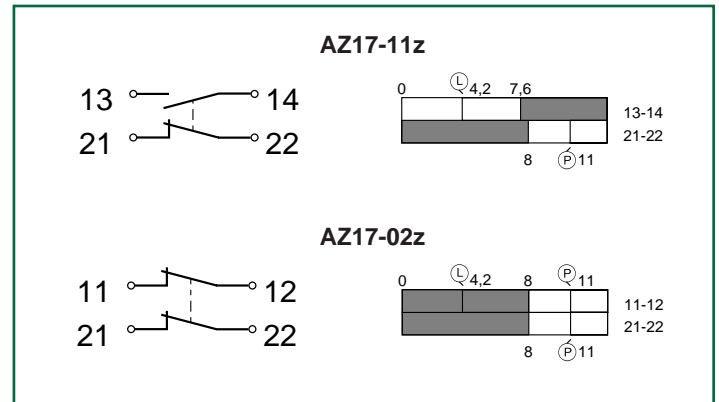
MECHANICAL SPECIFICATIONS

Housing	Glass-fibre reinforced, self-extinguishing thermoplastic
Actuator Key	Stainless steel, 1.4301
Degree of Protection	IP67
Holding Force	zk models: 1.2 pounds zrk models: 7 pounds
Travel for Positive-Break	8 mm (0.315 inches)
Closing Force	Approx. 12N (2.7 pounds)
Operating Temperature	-22°F to +175°F
Mechanical Life	> 10 ⁶ operations
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET, pr EN 1088 UL & CSA
Minimum Closing Radius	1.97" (with AZ17-B6 actuator key) 7.87" (with B1, B5, B11 and B15 actuator key)

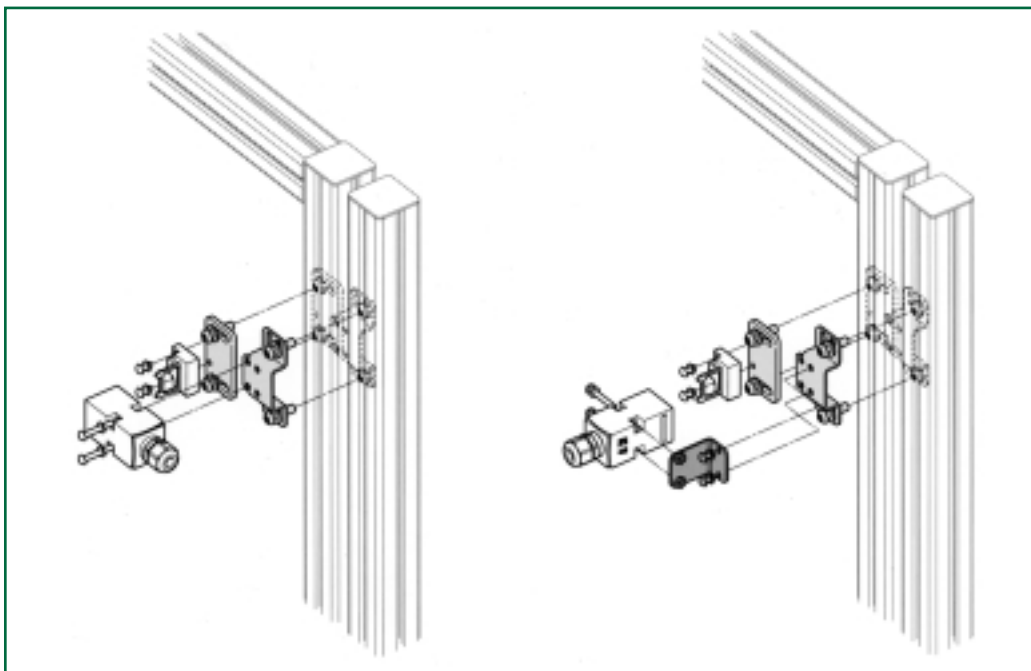
ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Rating	4A/230VAC 2.5A/230VA (with "ST" quick-connect)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	6A (time-delay)
Rated Isolation Voltage	250V
Type Terminals	Insulation displacement contacts & connector for 18AWG flexible stranded wire (0.75 mm ²)

SWITCHING DIAGRAMS & CONTACT SCHEMATICS

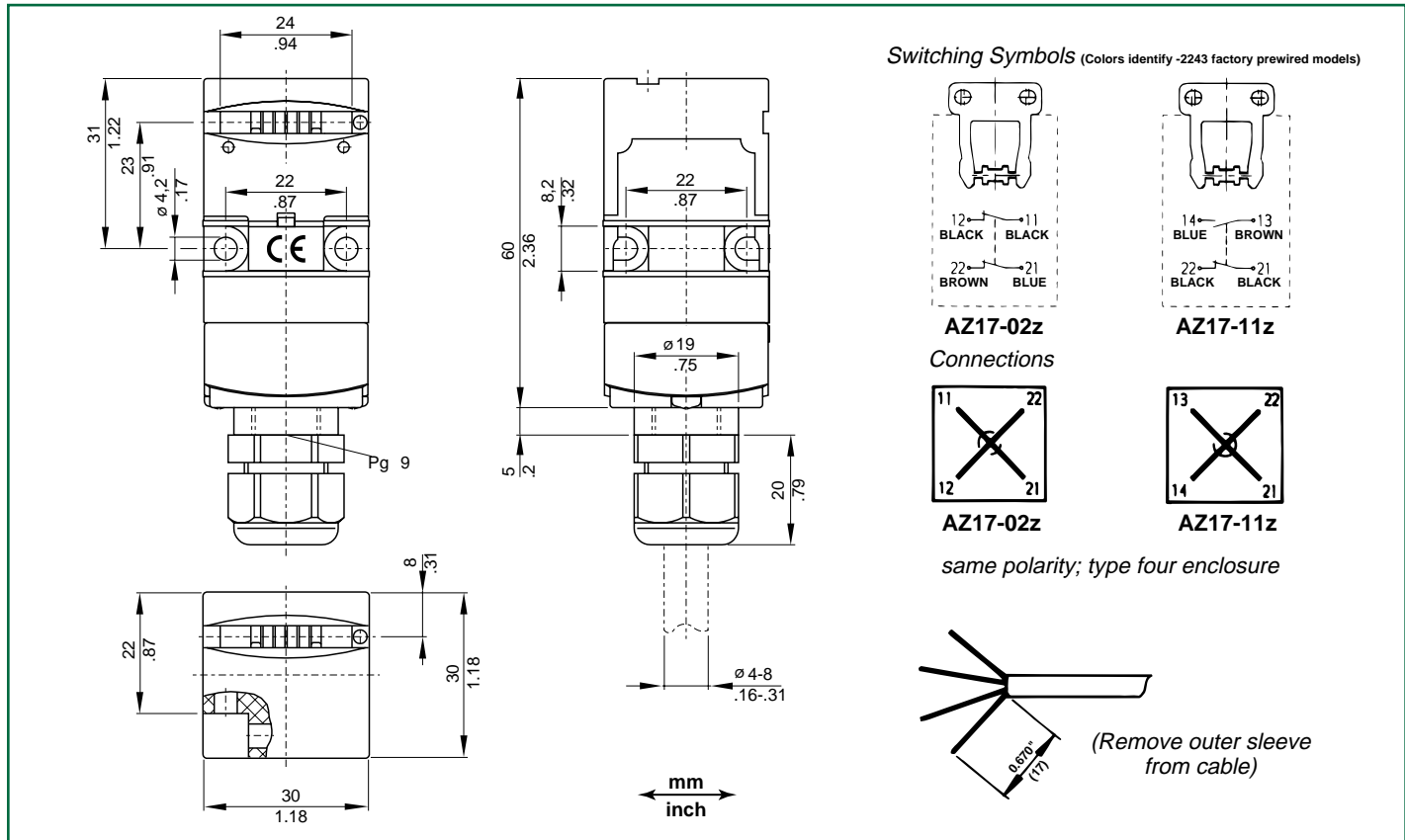


MS AZ 17 ADJUSTABLE MOUNTING KIT

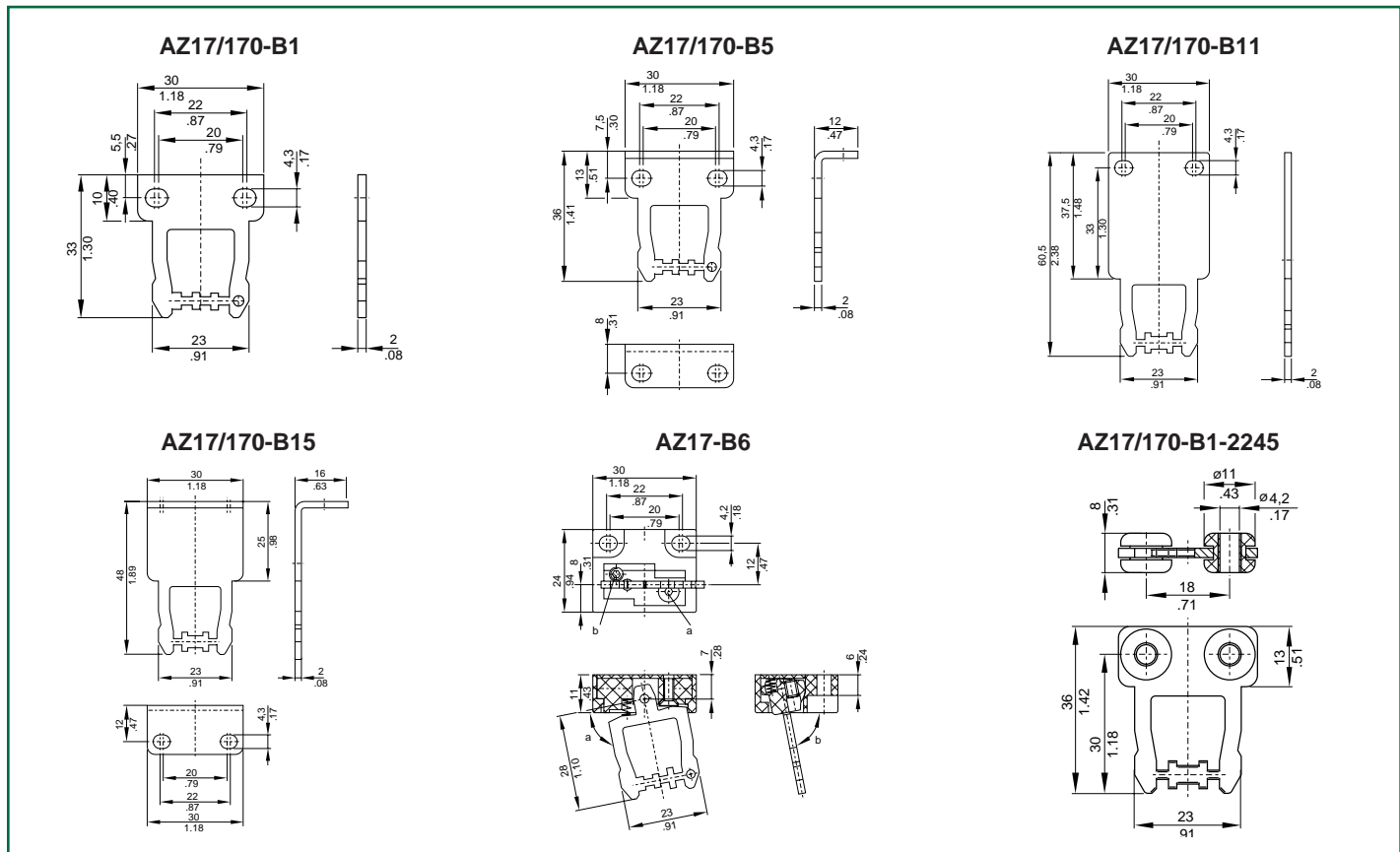


AZ17 TECHNICAL DATA

DIMENSIONS

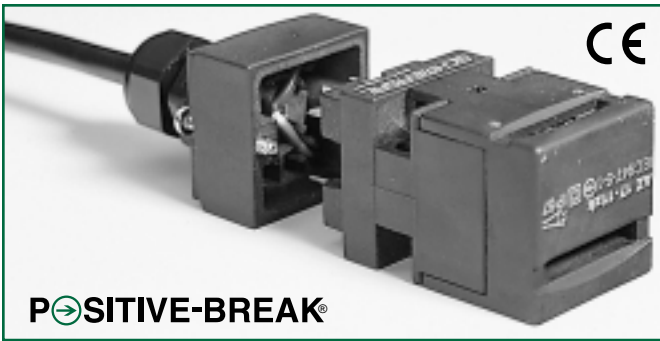


ACTUATOR KEYS



SERIES AZ17zi

Individually-Coded Movable Machine Guard Safety Interlock Switch



POSITIVE-BREAK®



**INDIVIDUALLY-CODED
ACTUATOR KEYS
(15,000 CODES)**

Description

The compact Series AZ17zi are designed for use with movable machine guards which must be closed for operator safety. Their tamper-resistant design, and positive-opening NC contacts, provide a significantly higher level of safety than conventional spring-driven switches whose contacts can weld/stick shut. Their IP67 rating makes them ideal for interlocking safety guards in hostile environments.

Operation

The AZ17zi is a two-piece, electromechanical safety interlock switch. It consists of a rugged switch mechanism and an individually-coded, geometrically-unique actuating key. The key must be directly hard-mounted to the movable guard. Upon opening of the guard, the normally-closed (NC) contact(s) are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. The positive-break NC contacts assure circuit interruption (and machine stoppage) upon removal of the actuator key. (The NO contacts close upon key removal.)

When the guard is closed, the actuating key forces the NC contacts to re-close, and any NO contacts to re-open. The tamper-resistant design prevents bypassing with simple tools, bent wires or other readily available means.

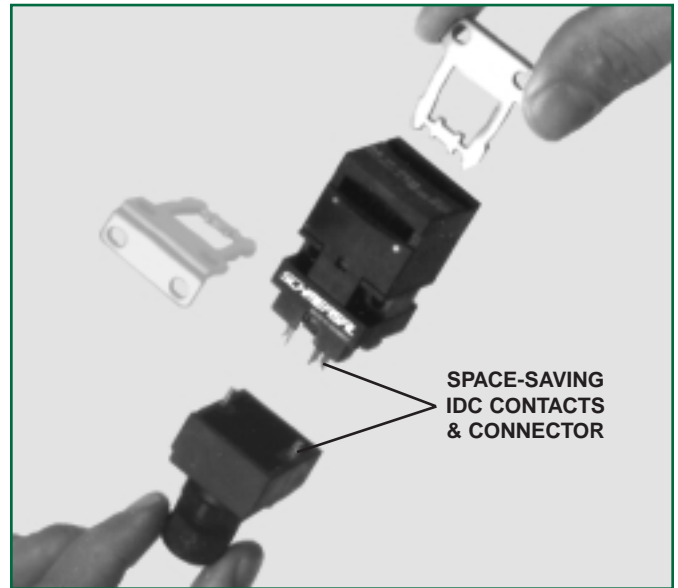
Typical Applications



The AZ17zi is intended for use as a safety interlock on movable machine guards which, when open, expose the operator/maintenance personnel to machine hazards. Typical applications are the interlocking of protective gratings, hinged covers, access panels and other movable guards.

Features & Benefits

- **Highly tamper-resistant actuating mechanism** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **Individually-coded actuator key (15,000 codes)** ... provides extra security in high-risk applications.
- **Compact design** ... only 1 1/4" x 1 1/4" x 3". Ideal where space is limited.
- **Non-removable actuating head** ... heightens tamper-resistance.
- **Four optional key entry locations** ... provide installation flexibility.
- **"Positive-Break" NC contacts** ... assure circuit interruption upon actuator key removal.
- **Watertight design** ... meets IP67 washdown requirements.
- **High-strength, stainless-steel actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Wide selection of accessories** ... to meet diverse application requirements.
- **Padlockable key** ... for added security during equipment maintenance.
- **Meets rigid safety agency standards** ... BG, UL and CSA.



AZ17zi AVAILABLE MODELS AND ACCESSORIES

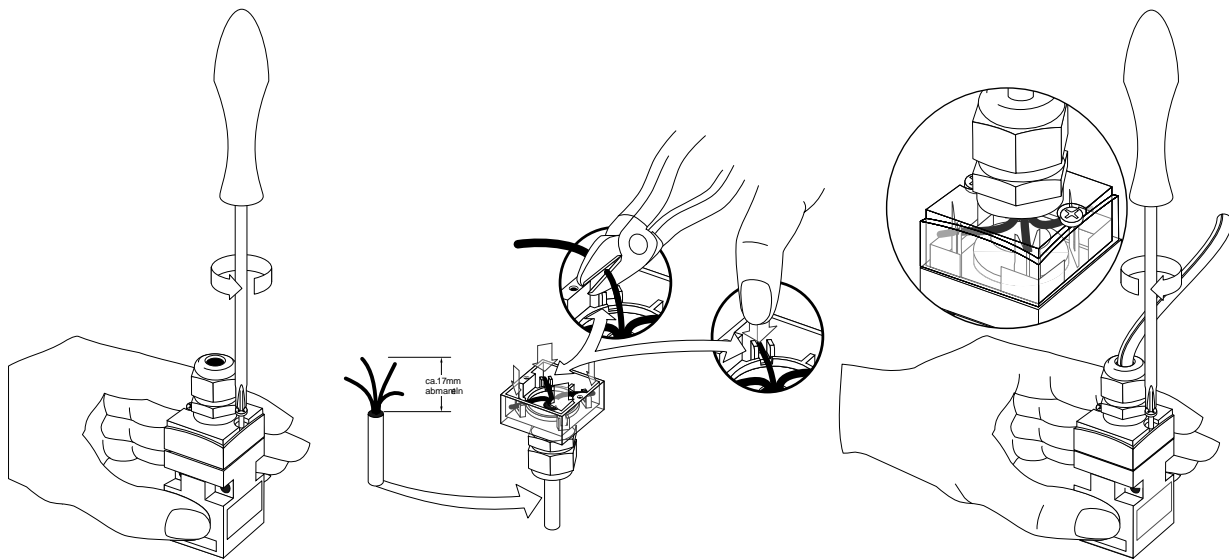
AVAILABLE MODELS (Includes Individually-Coded Actuator Key and 1/2" NPT Plastic Adapter)

Part Number	Description	Contacts (with actuator key inserted)
AZ17-11zi-B1	Standard unit	1 NO & 1 NC
AZ17-11zi-B5		
AZ17-11zi-B6R		
AZ17-11zi-B6L		
AZ17-02zi-B1	Standard unit	2 NC
AZ17-02zi-B5		
AZ17-02zi-B6R		
AZ17-02zi-B6L		

OPTIONAL ACCESSORIES

Part Number	Description
MS AZ 17	Adjustable mounting kit (Eases installation and facilitates adjustment due to guard misalignment)

Note: Standard units feature 1.2 pounds of key retention force. For unit with 7 pounds of key retention force, please add suffix "r" to part number. Example: AZ17-11zir-B1



AZi
15000
CODES

AZ17zi TECHNICAL DATA

MECHANICAL SPECIFICATIONS

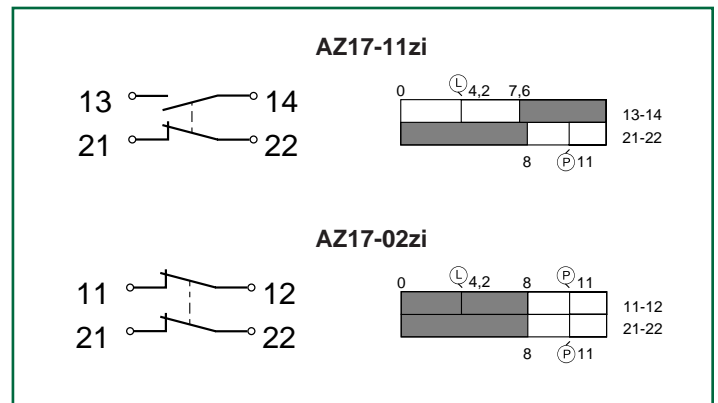
Housing	Glass-fibre reinforced, self-extinguishing thermoplastic
Actuator Key	Stainless steel, 1.4301
Degree of Protection	IP67
Key Retention Force	zi models: 1.2 pounds zir models: 7 pounds
Travel for Positive-Break	8 mm (0.315 inches)
Closing Force	Approx. 12N (2.7 pounds)
Operating Temperature	-22°F to +175°F
Mechanical Life	> 10 ⁶ operations
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET, pr EN 1088 UL & CSA
Minimum Closing Radius	1.97" (with B6L or B6R actuator key) 7.87" (with B1 or B5 actuator key)

ELECTRICAL SPECIFICATIONS

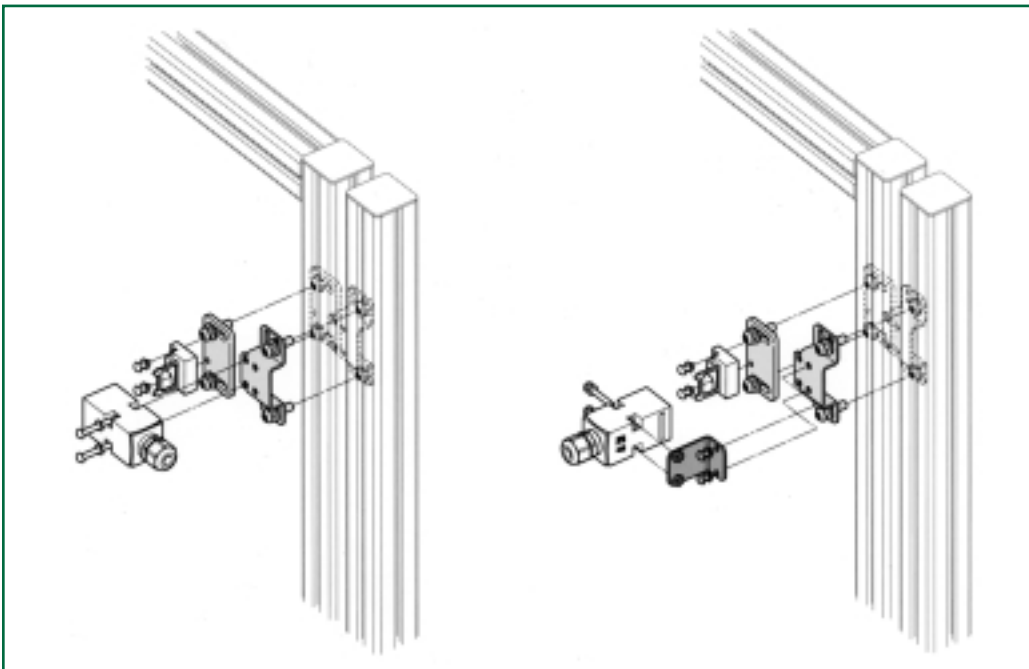
Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Rating	4A/230VAC
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	6A (time-delay)
Rated Isolation Voltage	250V
Type Terminals	Insulation displacement contacts & connector for 18AWG flexible stranded wire (0.75 mm ²)

Note: Pre-wired (5 meter length) cable entry models available. See optional accessories.

SWITCHING DIAGRAMS & CONTACT SCHEMATICS

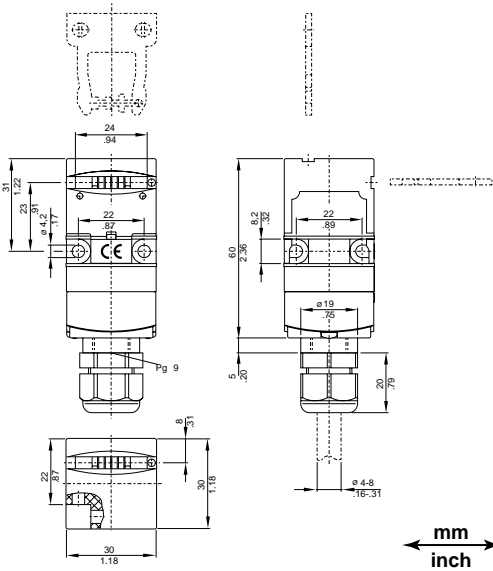


MS AZ 17 ADJUSTABLE MOUNTING KIT

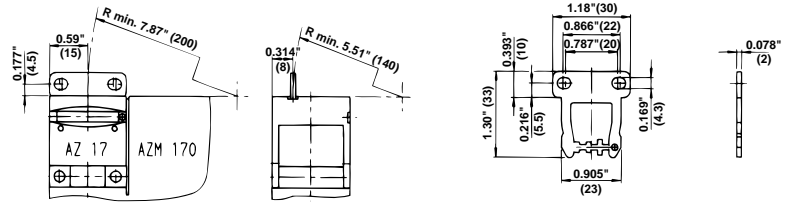


AZ17zi TECHNICAL DATA

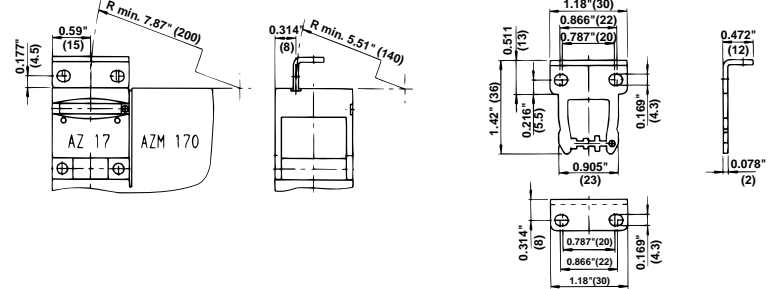
DIMENSIONS



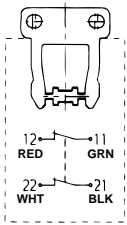
B1 Actuator Key



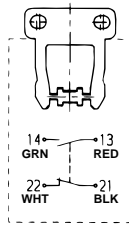
B5 Actuator Key



Switching Symbols (Colors identify -2243 factory prewired models)

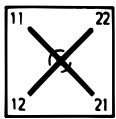


AZ17-02zi

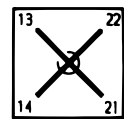


AZ17-11zi

Connections



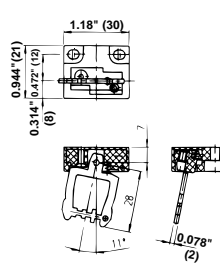
AZ17-02zi



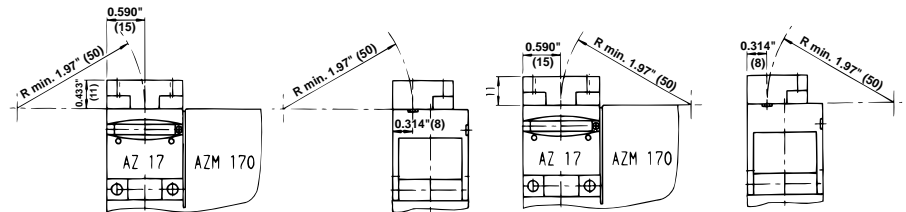
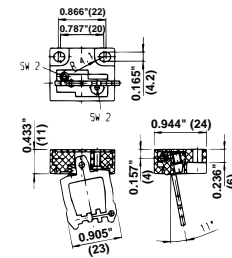
AZ17-11zi

same polarity; type four enclosure

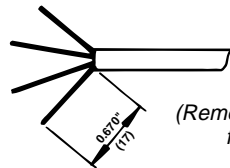
B6L Actuator Key



B6R Actuator Key



(Minimum radius: 50mm)



(Remove outer sleeve from cable)

All dimensions in inches (mm)



Description

The Series AZ15/16 is designed for use with movable machine guards/access gates which must be closed for operator safety. Their positive-opening NC contacts provide a significantly higher level of safety than conventional spring-driven switches whose contacts can weld or stick shut. And their tamper-resistant design prevents bypassing with simple tools, bent wires or other readily available means. Their IP67 rating makes them ideal for interlocking safety guards in hostile environments.

Operation

The AZ15/16 electromechanical safety interlock switch consists of a rugged switch mechanism and a geometrically-unique actuating key. The key is mounted to the movable guard. Upon opening of the guard the NC contact(s) are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. These positive-break NC contacts assure circuit interruption (and machine stoppage) upon removal of the actuator key. (The NO contact closes upon key removal.)

When the guard is closed, the actuating key forces the NC contacts to close and the NO contacts to re-open.

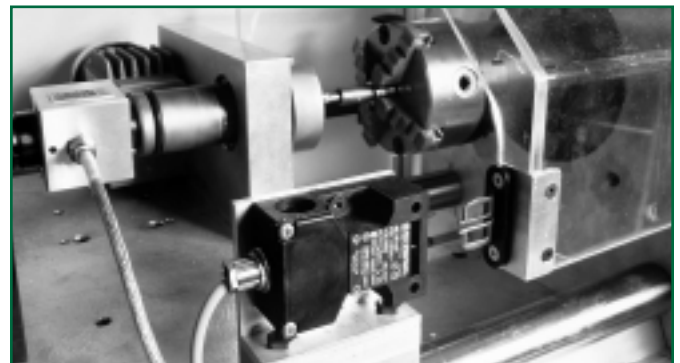
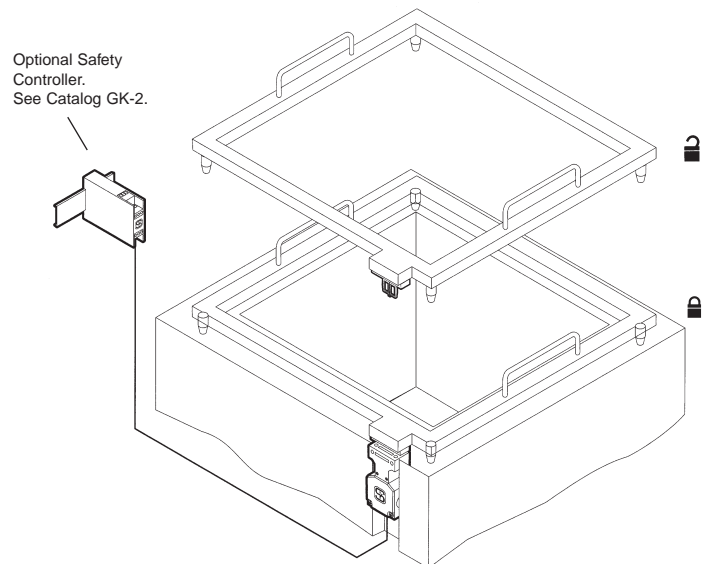
Typical Applications



The AZ15/16 is intended for use as a safety interlock switch on movable machine guards which, when open, expose the operator/maintenance personnel to machine hazards. Typical applications are the interlocking of protective gratings, access doors/gates, hinged covers, access panels and other movable guards.

Features & Benefits

- **Highly tamper-resistant actuating mechanism** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **Non-removable actuating head** ... heightens tamper-resistance.
- **Four optional key entry locations** ... provide installation flexibility.
- **Individually-coded actuator key option (15,000 codes)** ... provides extra security in high-risk applications. See AZ16zi.
- **“Positive-Break” NC contacts** ... assure circuit interruption upon actuator key removal.
- **High key retention force (7 pounds)** ... eliminates inadvertent opening of guard due to shock/vibration.
- **Watertight design** ... meets IP67 washdown requirements.
- **High-strength, stainless-steel actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Wide selection of accessories** ... to meet diverse application requirements.
- **Padlockable key** ... for added security during equipment maintenance.
- **Meets rigid safety agency standards** ... BG, UL and CSA.
- **Explosion-proof model and M12x1 quick-connect (“ST”) available** (Please consult factory).



AZ15/16 AVAILABLE MODELS AND ACCESSORIES

AVAILABLE MODELS (Includes 1/2" NPT Plastic Adapter** Actuator Key Sold Separately)

Part Number	Contacts (with actuator key inserted)
AZ15-zvk (key spring returned)	1 NC
AZ15-zvrk (key maintained upon insertion)*	1 NC
AZ16-zvk (key spring returned)	1 NO & 1 NC
AZ16-zvrk (key maintained upon insertion)*	1 NO & 1 NC
AZ16-02zvkc (key spring returned)	2 NC
AZ16-02zvrkc (key maintained upon insertion)*	2 NC
AZ16-12zvkc (key spring returned)	1 NO & 2 NC
AZ16-12zvrkc (key maintained upon insertion)*	1 NO & 2 NC
AZ16-03zvkc (key spring returned)	3 NC
AZ16-03zvrkc (key maintained upon insertion)*	3 NC

*Feature 7 pound key retention force. For lighter key retention force (1-2 pounds) add suffix "2254".

**To order unit with cordgrip instead of 1/2" NPT adapter, add suffix "CG" to part number...eg. AZ15-zvk-CG.

Short-radius actuator keys available. See below.

ACTUATOR KEYS

Part Number	Description
AZ15/16-B1	Standard Key (5.9" minimum closing radius)
AZ15/16-B2	Small radius actuating key (1.8" minimum closing radius)
AZ15/16-B3	Small radius actuating key (1.3" minimum closing radius)
AZ15/16-B6	Flexible-movement actuating key
AZ15/16-B1-2177	Funnel entry adapter with elongated straight actuating key
AZ15/16-B6-2177	Funnel entry adapter with elongated flexible-movement actuating key
AZ16-B1-KRH	Key Removal Hand-Grip Assembly with Key Retention Chain (for use with AZ15...zvrk and AZ16...zvrk)

ACCESSORIES for AZ15/16 Keyed-Interlock Switches

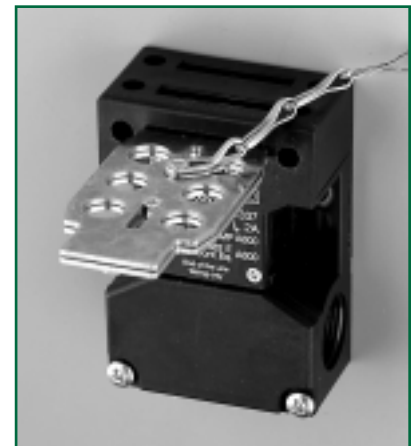
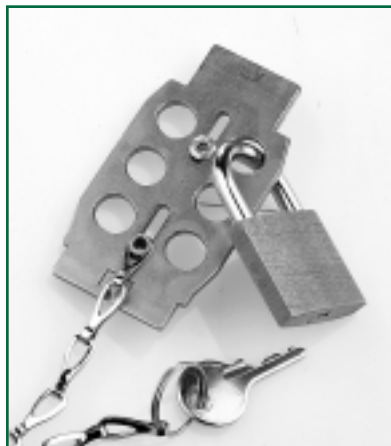
Part Number	Description
AZ15/16-2024	Gasketed key caps
AZ15/16-CAP	Key entry closure caps (for unused entry slots)
M20-CG	Cord grip (cable gland)
M20-1/2"P	Plastic 1/2" NPT adapter
M20-1/2"M	Metal 1/2" NPT adapter
AZ15/16-BI-1747	Door holding magnet kit (7 pound holding force) (for use with AZ16...zvr-2254 models)
AZ15/16-B2-1747	
AZ15/16-B3-1747	
PL-M20-24V	24VAC/DC pilot light kit
PL-M20-120V	120VAC/DC pilot light kit
Add suffix -1637 to basic part number when ordering	Gold contacts (for AZ15/16zvr)
AZ15/16-BI-2053 (for use with AZ16...zvrk)	Ball latch kit (Adjustable holding force up to 22 pounds)
AZ-Align	Actuator key alignment device for sliding doors
#6-3/8"SPH (Package of 6)	#6-3/8" Spanner Pan Head Tamper-resistant sheet metal screws (for actuator key mounting or switch contact cover)
#10-32x1/2" OWOH (Package of 6)	#10-32 One-Way Oval Head Tamper-resistant machine screws
SZ16/335	Actuator Key Lockout Device (Accepts up to 6 padlocks)
AZ15/16-AP	Alignment Pins (Set of 2)
MS AZ 15/16 (See Illustration Page 29)	Adjustable mounting kit (Eases installation and facilitates adjustments due to guard misalignment)
Suffix "-ST"	Optional M12x1 quick-connect (AZ16-02 models only)



AZ15/16-2053 with ball catch
Holding force up to 22 pounds



AZ15/16-1747 with holding magnet
Holding force 7 pounds



Lockout Device SZ16/335
(padlock not included)

AZ15/16 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

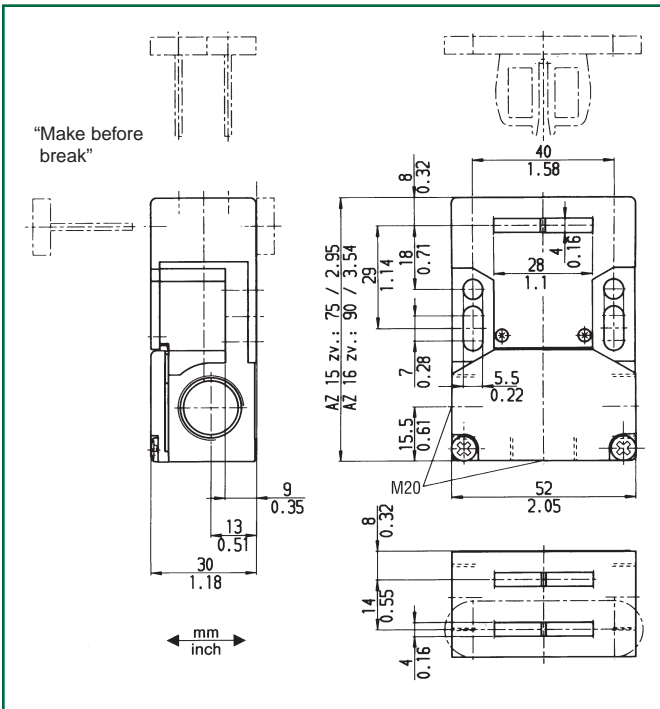
Housing	Glass-fibre reinforced, self-extinguishing thermoplastic
Actuator Key	Stainless steel (defeat-resistant design)
Degree of Protection	IP67
Travel for Positive-Break	8 mm (0.315 inches)
Key Ejection Force	"-zv" models: 3N (0.7 pounds)
Key Retention Force	"-zvr-2254 models: 5N (1.2 pounds) "-zvr" models: 30N (7 pounds)
Closing Force	Approx. 15N (3.4 pounds)
Operating Temperature	-22°F to +175°F
Mechanical Life	> 1 million operations
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET-15 UL & CSA (A600, P300) TUV
Minimum Closing Radius	1.3" (with B3 actuator key) 1.8" (with B2 actuator key) 5.9" (with B1 actuator key)

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Gap	2x2mm (minimum)
Contact Rating	4A/230VAC (A600) 2.5A/230VAC (with M12x1 quick-connect)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse 6A (time-delay)
Rated Isolation Voltage	500VAC
Rated Impulse Withstand Voltage	6kV
Type Terminals*	Screw terminals with self-lifting clamps for up to 13 AWG flexible stranded wire (2.5mm ²)

* Units available with M12x1 quick-connect.
(Please consult factory).

DIMENSIONS



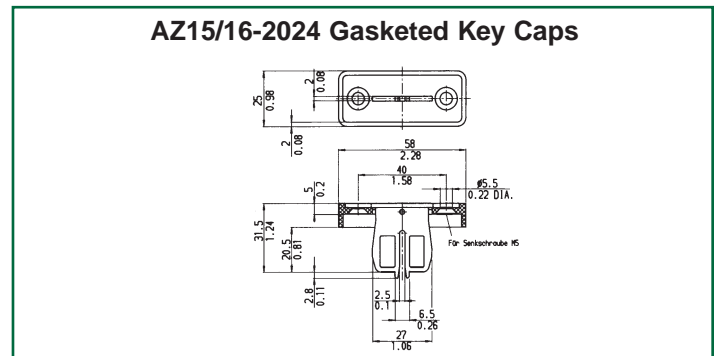
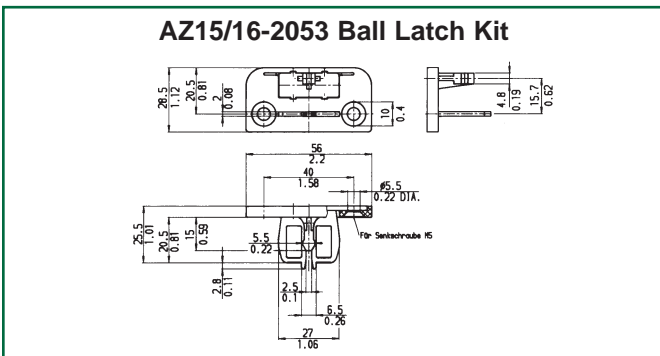
SWITCHING DIAGRAMS & CONTACT SCHEMATICS

AZ16z

AZ16-02z

AZ16-12z

AZ16-03z



AZ15/16 ACTUATOR KEY SPECIFICATIONS

AZ15/16-B1 Actuator Key

Minimum actuating radius with actuator B1/B1-1747

AZ15/16-B1-2177 Actuator Key

Minimum actuating radius with actuator B1/B1-1747

Actuator B1 is standard for AZ15/16; it allows a minimum actuating radius of 150 mm. **Please note that the center of rotation must be in the same plane as the upper edge of the safety switch.**

AZ15/16-B1 Actuator Key with AZ15/16-1747 Holding Magnet Kit

Ordering example: Switch, holding magnet and actuator:
AZ16-zv/B1-1747

AZ15/16-B2 Actuator Key

Minimum actuating radius with actuator B2/B2-1747

Actuator B2 is particularly suitable for **small actuating radii** over the wide edge of the actuator (R=45 to 150mm). The basic setting (angle 15°) provides a minimum radius of 45mm=1.8 in. For larger radii, the angle has to be adjusted correspondingly by turning the set screw counter-clockwise.

AZ15/16-B2 Actuator Key with AZ15/16-1747 Holding Magnet Kit

AZ15/16-B3 Actuator Key

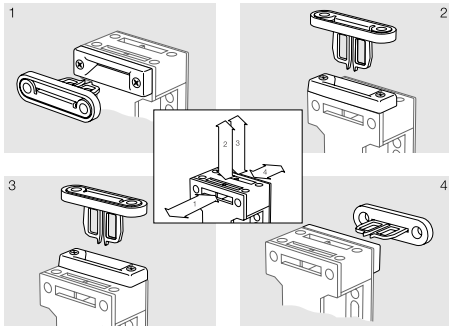
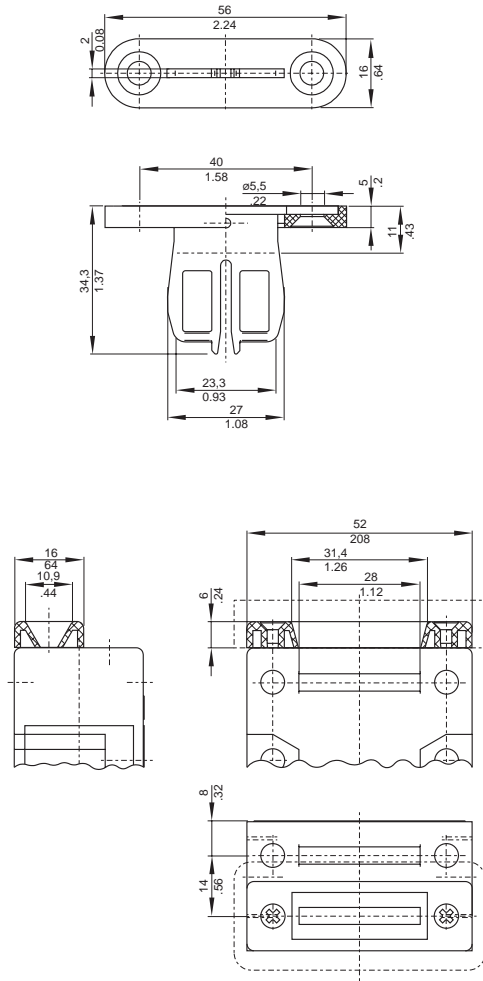
Minimum actuating radius with actuator B3/B3-1747

Actuator B3 is particularly suitable for small actuating radii over the narrow edge of the actuator (R=32 to 150mm). The basic setting (angle 10°) provides a minimum radius of 32mm=1.3in. For larger radii, the angle has to be adjusted correspondingly by turning the set screw clockwise.

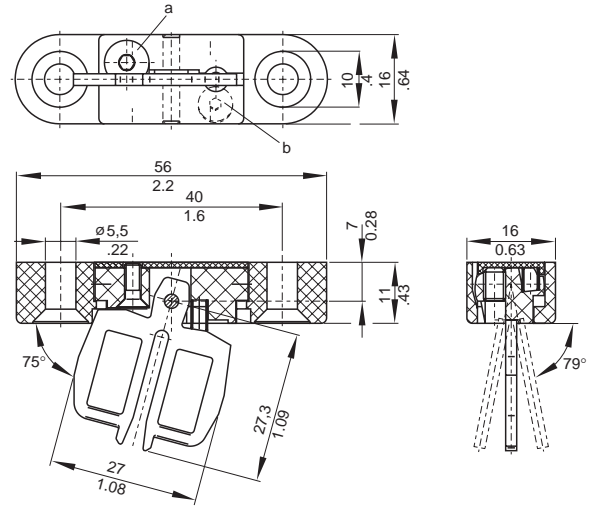
AZ15/16-B3 Actuator Key with AZ15/16-1747 Holding Magnet Kit

AZ15/16 ACTUATOR KEY SPECIFICATIONS

**AZ15/16-B1-2177 Funnel Entry Adapter
(with straight actuating key)**



AZ15/16-B6 Flex Actuator Key

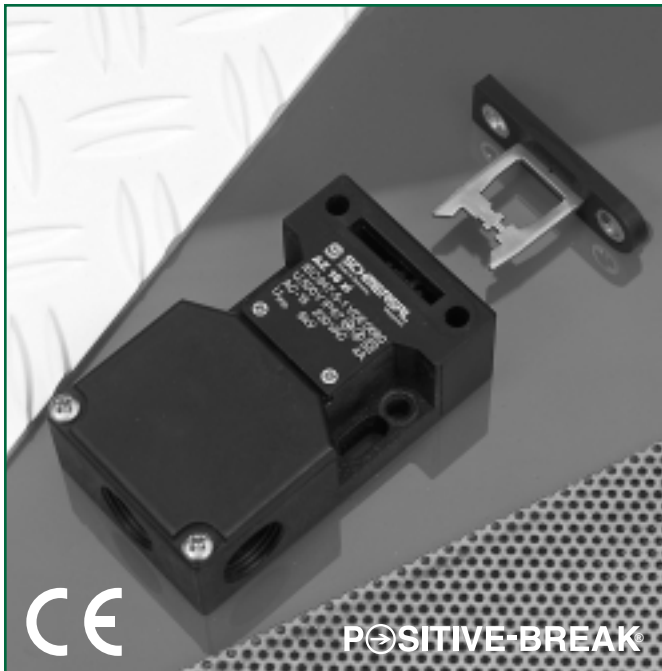




*Safer
by
Design*

SERIES AZ16zi

Individually-Coded Movable Machine Guard Safety Interlock Switch



Features & Benefits

- **Highly tamper-resistant actuating mechanism** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **Individually-coded actuator key (15,000 codes)** ... provides extra security in high-risk applications.
- **Non-removable actuating head** ... heightens tamper-resistance.
- **Four optional key entry locations** ... provide installation flexibility.
- **“Positive-Break” NC contacts** ... assure circuit interruption upon actuator key removal.
- **Watertight design** ... meets IP67 washdown requirements.
- **High-strength, stainless-steel actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Tamper-resistant key mounting screws** ... deter bypassing.
- **Wide selection of accessories** ... to meet diverse application requirements.
- **Padlockable key** ... for added security during equipment maintenance.
- **Meets rigid safety agency standards** ... BG, UL and CSA.

Description

The Series AZ16zi are designed for use with movable machine guards which must be closed for operator safety. Their tamper-resistant design, and positive-opening NC contacts, provide a significantly higher level of safety than conventional spring-driven switches whose contacts can weld/stick shut. Their IP67 rating makes them ideal for interlocking safety guards in hostile environments.

Operation

The AZ16zi is a two-piece, electromechanical safety interlock switch. It consists of a rugged switch mechanism and an individually-coded, geometrically-unique actuating key. The key must be directly hard-mounted to the movable guard. Upon opening of the guard, the normally-closed (NC) contact(s) are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. The positive-break NC contacts assure circuit interruption (and machine stoppage) upon removal of the actuator key. (The NO contacts close upon key removal.)

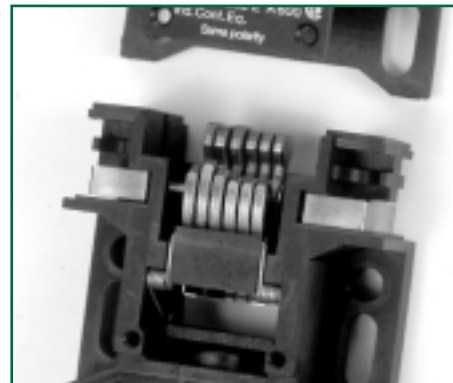
When the guard is closed, the actuating key forces the NC contacts to re-close, and any NO contacts to re-open. The tamper-resistant design prevents bypassing with simple tools, bent wires or other readily available means.

Typical Applications



The AZ16zi is intended for use as a safety interlock on movable machine guards which, when open, expose the operator/maintenance personnel to machine hazards. Typical applications are the interlocking of protective gratings, hinged covers, access panels and other movable guards.

AZi
15000
CODES



Patented geometrically-unique tumbler configuration

AZ16zi AVAILABLE MODELS AND ACCESSORIES

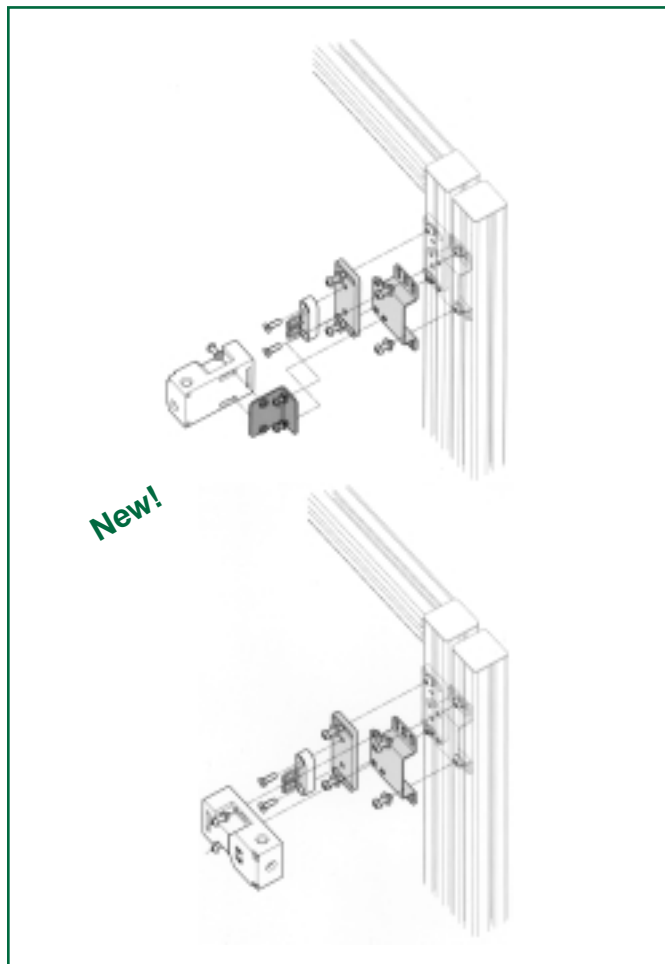
AVAILABLE MODELS (Includes Individually-Coded Actuator Key and 1/2" NPT Plastic Adapter)

Part Number	Description	Contacts (with actuator key inserted)
AZ16-12zi-B1	Standard unit	1 NO & 2 NC
AZ16-03zi-B1		3 NC
AZ16-12zi-B1-1747	Standard unit with built-in key actuator magnet latch	1 NO & 2 NC
AZ16-03zi-B1-1747		3 NC
AZ16-12zi-B1-2024	Standard unit with built-in slot rubber seals on key actuator	1 NO & 2 NC
AZ16-03zi-B1-2024		3 NC
AZ16-12zi-B1-2053	Standard unit with built-in ball-latched key actuator	1 NO & 2 NC
AZ16-03zi-B1-2053		3 NC

AVAILABLE ACCESSORIES

Part Number	Description
M20-CG	Cord grip (cable gland)
M20-1/2"P	Spare Plastic 1/2" NPT adapter (One supplied with each unit)
M20-1/2"M	Metal 1/2" NPT adapter (optional)
AZ15/16-CAP (3 per kit)	Key entry closure caps (for unused entry slots)
#6-3/8 SPH (package of 6)	#6-3/8 Spanner Pan Head Tamper-Resistant Sheet Metal Screws (For use on AZ16zi housing terminal cover)
#10-32 x 1/2" OWOH (package of 6)	#10-32 One-Way Oval Head Tamper-Resistant Machine Screws (For use in mounting actuator key)
AZ-SZ	AZ16zi Lockout Device (accepts up to 6 padlocks)
PL-M20-24V	24VAC/DC LED Pilot Light Kit
PL-M20-120V	110VAC/DC Pilot Light Kit
MS AZ 15/16	Adjustable mounting kit (Eases installation and facilitates adjustments due to guard misalignment)
Suffix "-2177"	Funnel entry adapter (Must be ordered with base switch for factory assembly...see page 30)

MS AZ 15/16 ADJUSTABLE MOUNTING KIT



TYPICAL INDIVIDUALLY-CODED KEYS

EXAMPLE OF INDIVIDUALLY-CODED KEYS 15,000 codes provide extra security



AZ16zi TECHNICAL DATA

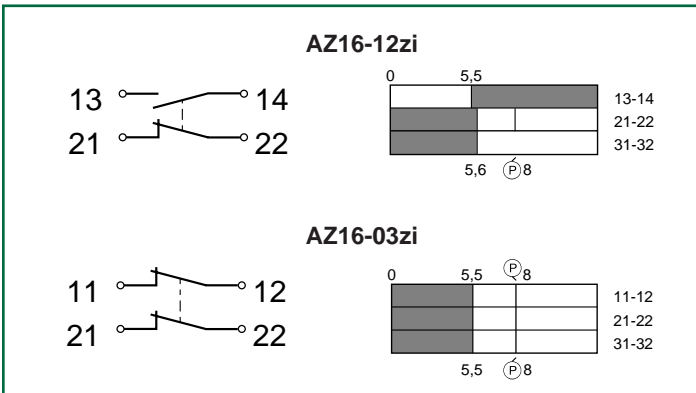
MECHANICAL SPECIFICATIONS

Housing	Glass-fibre reinforced, self-extinguishing plastic
Actuator Key	Stainless steel
Degree of Protection	IP67
Travel for Positive-Break	0.315 inches (8 mm)
Key Ejection Force	3 N (0.7 pounds)
Insertion Force	Approx. 15N (3.3 pounds)
Operating Temperature	-22°F to +175°F
Mechanical Life	1 million operations
Conformity to Standards	UL & CSA, BG A600, P300
Key Withdrawal Speed	2 meters/second (maximum)
Minimum Closing Radius	9.8" (250mm)

ELECTRICAL SPECIFICATIONS

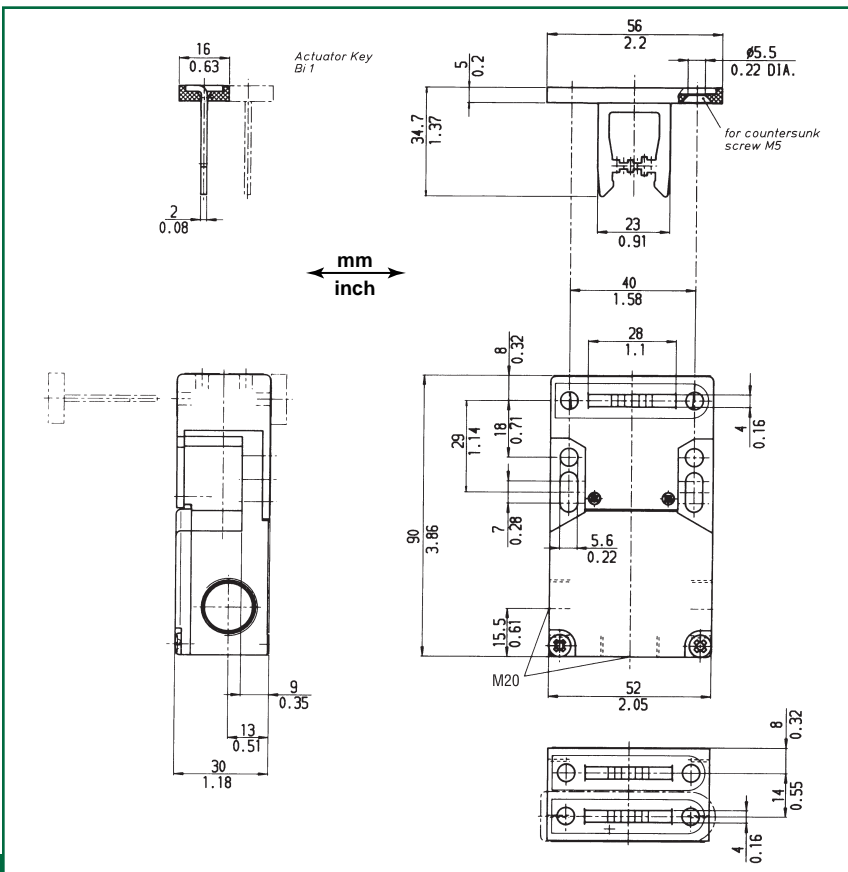
Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Gap	2 × 2 mm
Switching Action	Slow-action, positive-break NC contacts
Contact Rating	A600
Rated Insulation Voltage	500VAC
Thermal Current Rating	10A (300VAC)
Current Rating	6A @ 120VAC 4A @ 230VAC 2.5V/230VAC (with M12x1 quick-connect)
Rated Impulse Withstand Voltage	6kV
Short Circuit Protection	Fuse 6A (slow-blow)
Type Terminals*	Screw terminals with self-lifting clamps for up to 2.5 mm ² (AWG13) wire

SWITCHING DIAGRAMS & CONTACT SCHEMATICS



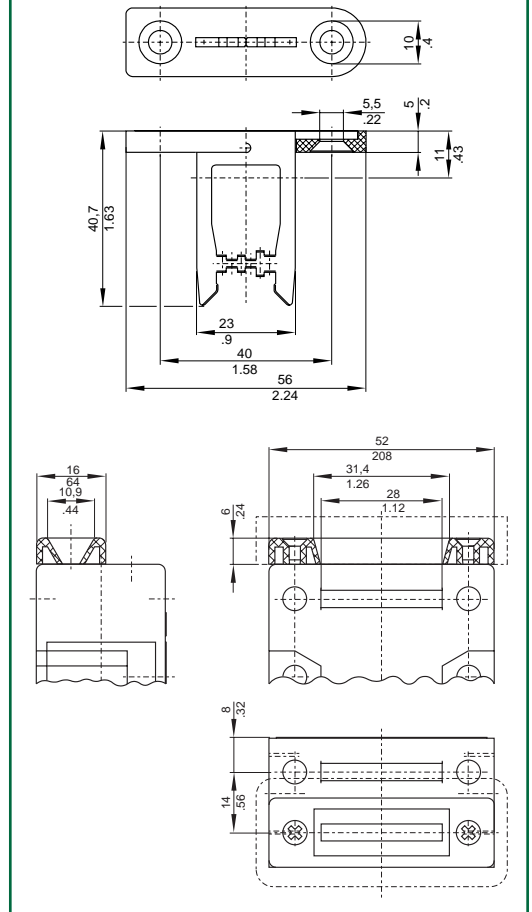
*Optional plug-in M12x1 quick-connect available. Please consult factory.

DIMENSIONS



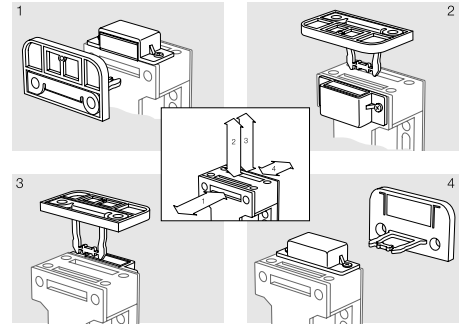
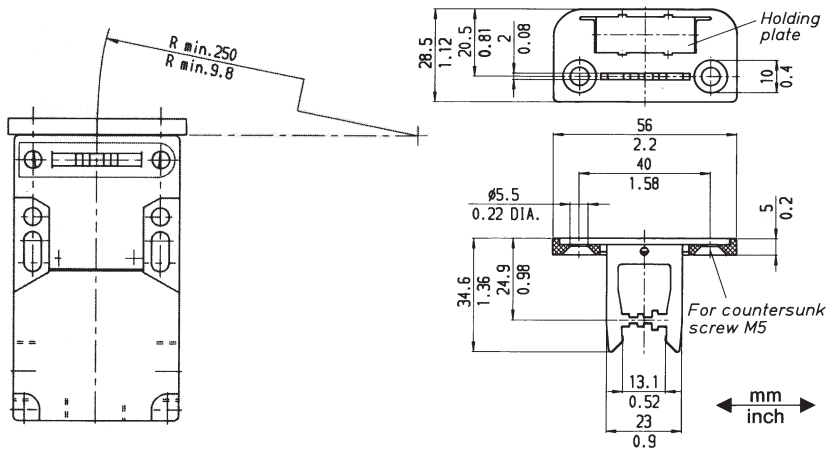
"-2177" Funnel Entry Adapter

(Order as part of base switch...
e.g. AZ16-02z1-B1-2177)

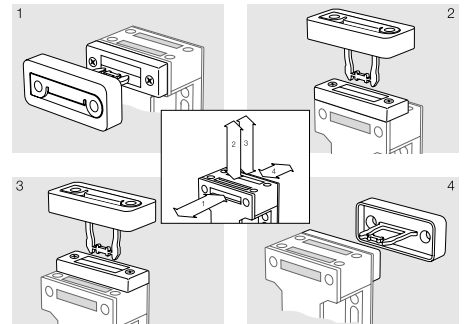
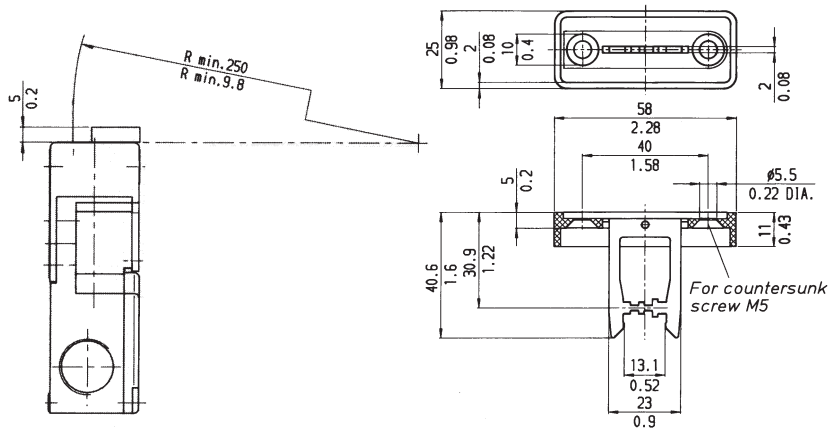


AZ16zi INDIVIDUALLY-CODED ACTUATOR KEY SPECIFICATIONS

-1747 (for holding magnet)

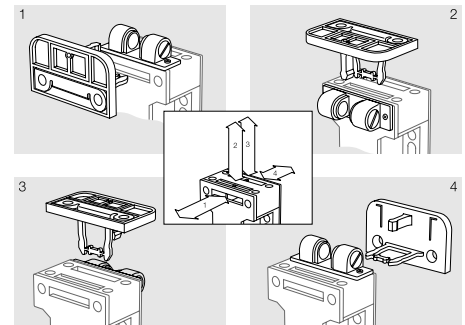
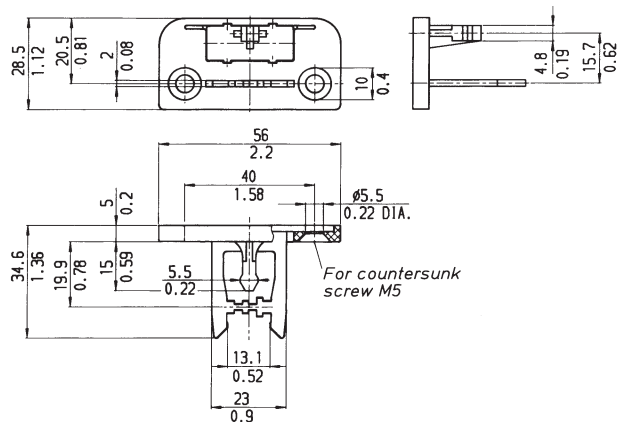


-2024 (for slot rubber seals)

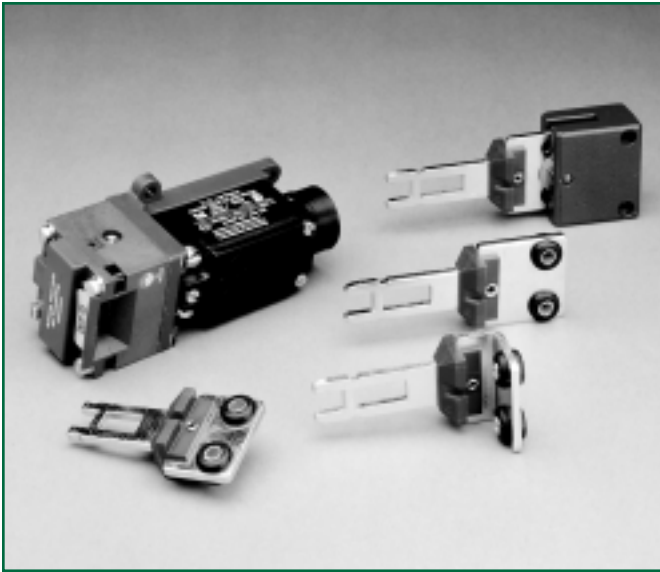


Applications: harsh environments
(coarse dirt, chips, flour...)

-2053 (for ball catch)



For holding light to medium-weight guards closed



Description

The Series TZG is designed for use with movable machine guards/access gates which must be closed for operator safety. Their positive-opening NC contacts provide a significantly higher level of safety than conventional spring-driven switches whose contacts can weld or stick shut. And their tamper-resistant design prevents bypassing with simple tools, bent wires or other readily available means. Their IP67 rating makes them ideal for interlocking safety guards in hostile environments.

Operation

The Series TZG electromechanical safety interlock switch consists of a rugged switch mechanism and a geometrically-unique actuating key. The key is mounted to the movable guard. Upon opening of the guard the NC contact(s) are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. These positive-break NC contacts assure circuit interruption (and machine stoppage) upon removal of the actuator key. (The NO contact closes upon key removal.)

When the guard is closed, the actuating key forces the NC contacts to close and the NO contact to re-open.

Typical Applications



The Series TZG is intended for use as a safety interlock switch on movable machine guards which, when open, expose the operator/maintenance personnel to machine hazards. Typical applications are the interlocking of protective gratings, access doors/gates, hinged covers, access panels and other movable guards.

Features & Benefits

- **Highly tamper-resistant actuating mechanism** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **Four optional key entry locations** ... rotatable actuator head provides installation versatility.
- **“Positive-Break” NC contacts** ... assure circuit interruption upon actuator key removal.
- **High key retention force (5 pounds)** ... eliminates inadvertent opening of guard due to shock/vibration.
- **Watertight design** ... meets IP67 washdown requirements.
- **High-strength, galvanized-steel actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Wide selection of actuating keys** ... to meet diverse application requirements.
- **Padlockable key** ... for added security during equipment maintenance.
- **Meets rigid safety agency standards** ... BG, UL, CSA.
- **Funnel-shaped key entry** ... forgiving of key misalignment.
- **Special types for food industry** ... please consult factory.

TZG AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS (Includes 1/2" NPT Plastic Conduit Adapter. Actuator Keys Sold Separately)

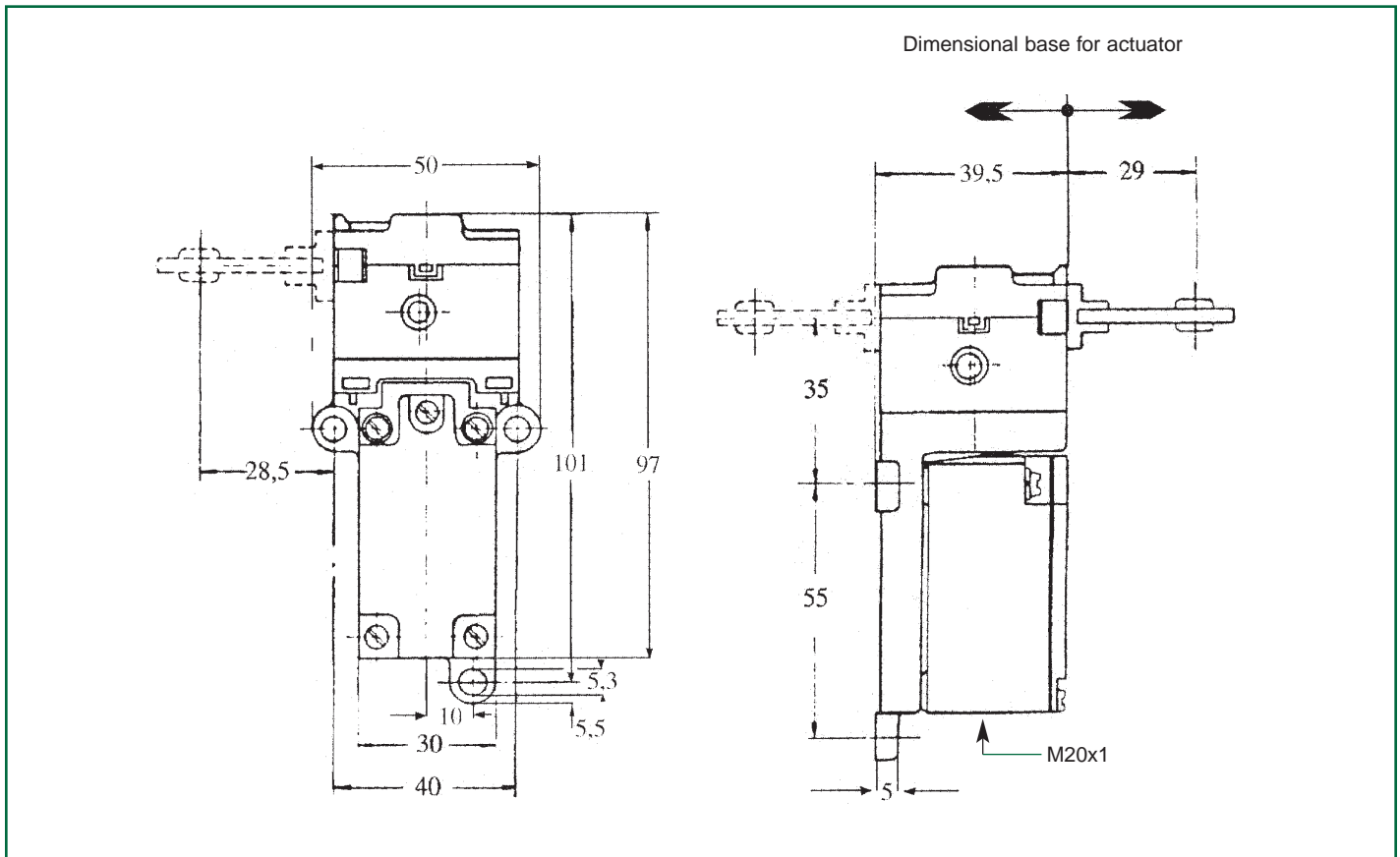
Part Number	Contacts	Description*
TZG01.103	1 NO & 1 NC	Keyed interlock switch with front* key entry and slow action contacts.
TZG01.110	2 NC	

*Field-rotatable for key entry from right, left or rear.

OPTIONAL ACTUATOR KEYS

Part Number	Description
TZ/CO	Standard straight actuator key (13" minimum closing radius)
TZ/CW	Right-angled straight actuator key (11.8" minimum closing radius)
TZ/COR	Radial entry actuator key (11.8" minimum closing radius)
TZ/CK	Short straight actuator key (6.3" minimum closing radius)
TZ/CWR	Right-angled bent actuator key (11.8" minimum closing radius)
TZ/COF/HIS.1	Pivoting straight actuator key (rear-mounted) (13.8" minimum closing radius)
TZ/COF/HIS.2	Pivoting straight actuator key (top-mounted) (13.8" minimum closing radius)
TZ/CORF/HIS.1	Pivoting straight actuator key (rear-mounted) (7.1" minimum closing radius)
TZ/CORF/HIS.2	Pivoting straight actuator key (top-mounted) (5.9" minimum closing radius)

DIMENSIONS



TZG TECHNICAL DATA

MECHANICAL SPECIFICATIONS

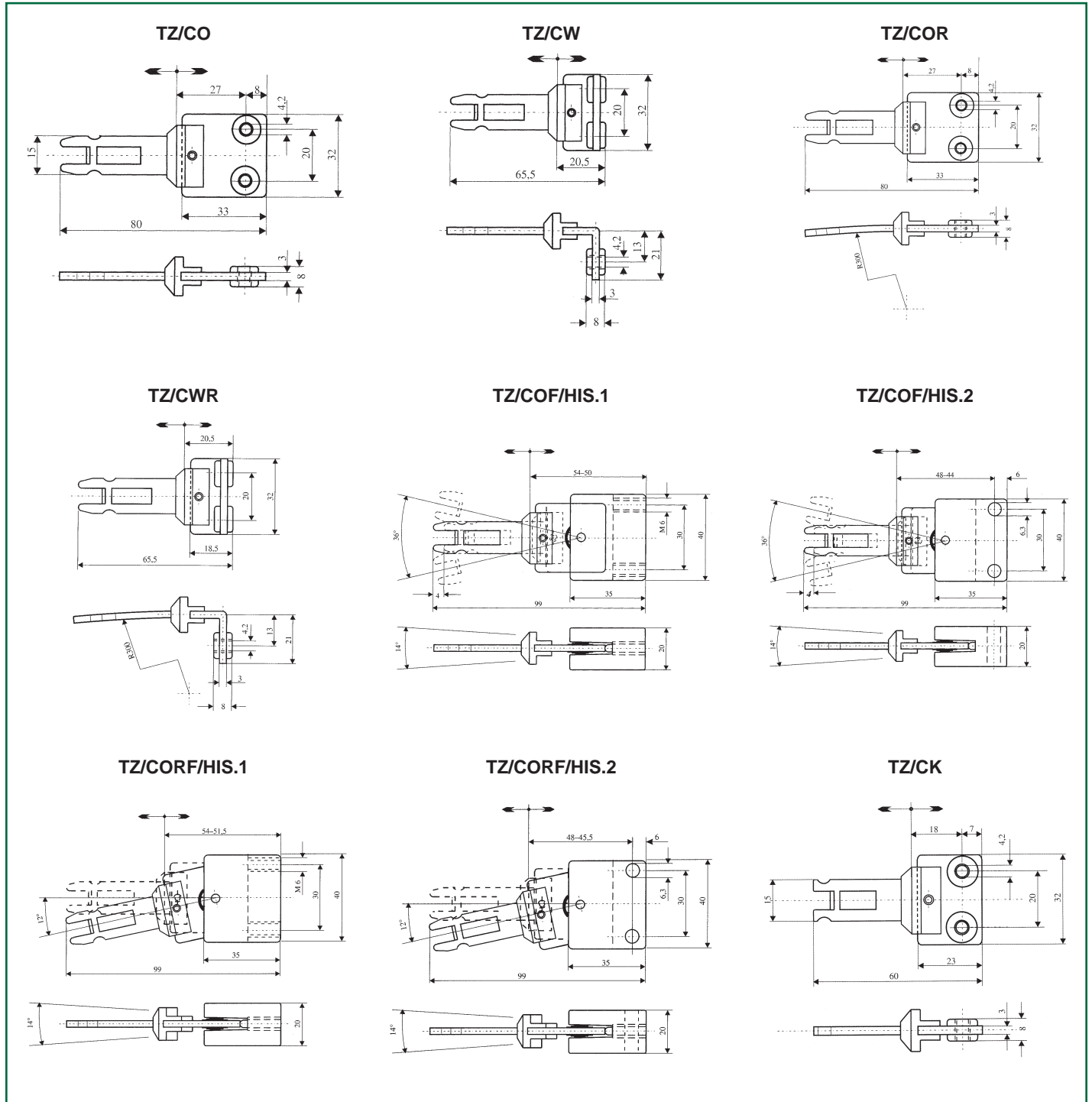
Housing	Glass-fibre reinforced self-extinguishing thermoplastic
Actuator Key	Galvanized steel (defeat-resistant design)
Degree of Protection	IP67
Holding Force	20N (4.8 pounds)
Travel for Positive-Break	12.5mm
Force to Reach Positive-Break	Approx. 20N (4.8 pounds)
Closing Force	Approx. 10 N (2.4 pounds)
Operating Temperature	-13°F to +158°F
Mechanical Life	1 million operations (minimum)
Shock Resistance	>30g / 18ms
Vibration Resistance	>15g / 10...200Hz
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-100 BG-GS-ET-15 UL CSA
Minimum Closing Radius	Dependent upon actuator key used. Please see actuator key selection chart.

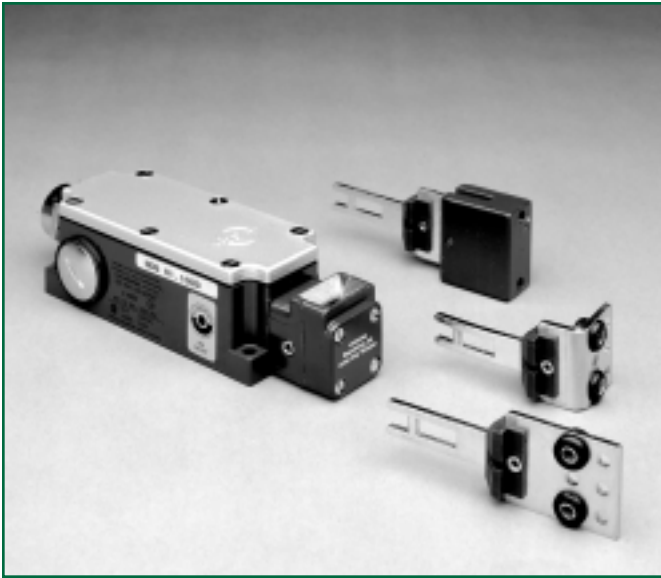
ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Gap	2 × 3.5 mm
Contact Rating	8A (250VAC)
Switching Action	Slow-action, positive-break NC contacts (TZG models) Snap-action, positive-break NC contacts (TZGP models)
Short Circuit Protection	10A (slow-blow) – TZG models 6A (slow-blow) – TZGP models
Rated Insulation Voltage	250VAC
Rated Impulse Withstand Voltage	4kV
Type Terminals	Screw terminals with self-lifting clamps for up to 13 AWG solid wire (2.5mm ²) or 13 AWG stranded (1.5mm ²) wire

TZG ACTUATOR KEY SPECIFICATIONS

ACTUATOR KEYS





Description

The Series SDG is designed for use with movable machine guards/access gates which must be closed for operator safety. Their positive-opening NC contacts provide a significantly higher level of safety than conventional spring-driven switches whose contacts can weld or stick shut. And their tamper-resistant design prevents bypassing with simple tools, bent wires or other readily available means. Their IP67 rating makes them ideal for interlocking safety guards in hostile environments.

Operation

The Series SDG electromechanical safety interlock switch consists of a rugged switch mechanism and a geometrically-unique actuating key. The key is mounted to the movable guard. Upon opening of the guard the NC contact(s) are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. These positive-break NC contacts assure circuit interruption (and machine stoppage) upon removal of the actuator key. (The NO contact closes upon key removal.)

When the guard is closed, the actuating key forces the NC contacts to close and the NO contact to re-open.

Typical Applications



The Series SDG is intended for use as a safety interlock switch on movable machine guards which, when open, expose the operator/maintenance personnel to machine hazards. Typical applications are the interlocking of protective gratings, access doors/gates, hinged covers, access panels and other movable guards.

Features & Benefits

- **Highly tamper-resistant actuating mechanism** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **Four optional key entry locations** ... rotatable actuator head provides installation versatility.
- **“Positive-Break” NC contacts** ... assure circuit interruption upon actuator key removal.
- **Built-in retention force (1.2 pounds)** ... eliminates inadvertent opening of guard due to shock/vibration.
- **Watertight design** ... meets IP67 washdown requirements.
- **High-strength steel actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, corrosion-resistant metal housing** ... tolerates the most hostile environments.
- **Wide selection of actuating keys** ... to meet diverse application requirements.
- **Meets rigid safety agency standards** ... BG, UL, CSA.
- **Funnel-shaped key entry** ... forgiving of key misalignment.
- **Other 2-contact configurations available** ... please consult factory.

SDG AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS (Includes 1/2" NPT Conduit Adapter. Actuator Keys Sold Separately)

Part Number	Contacts	Description*
SDG01.1044	2 NO & 1 NC	Keyed interlock switch with front* key entry and slow action contacts.
SDG01.1103	1 NO & 2 NC	
SDG01.1110	3 NC	

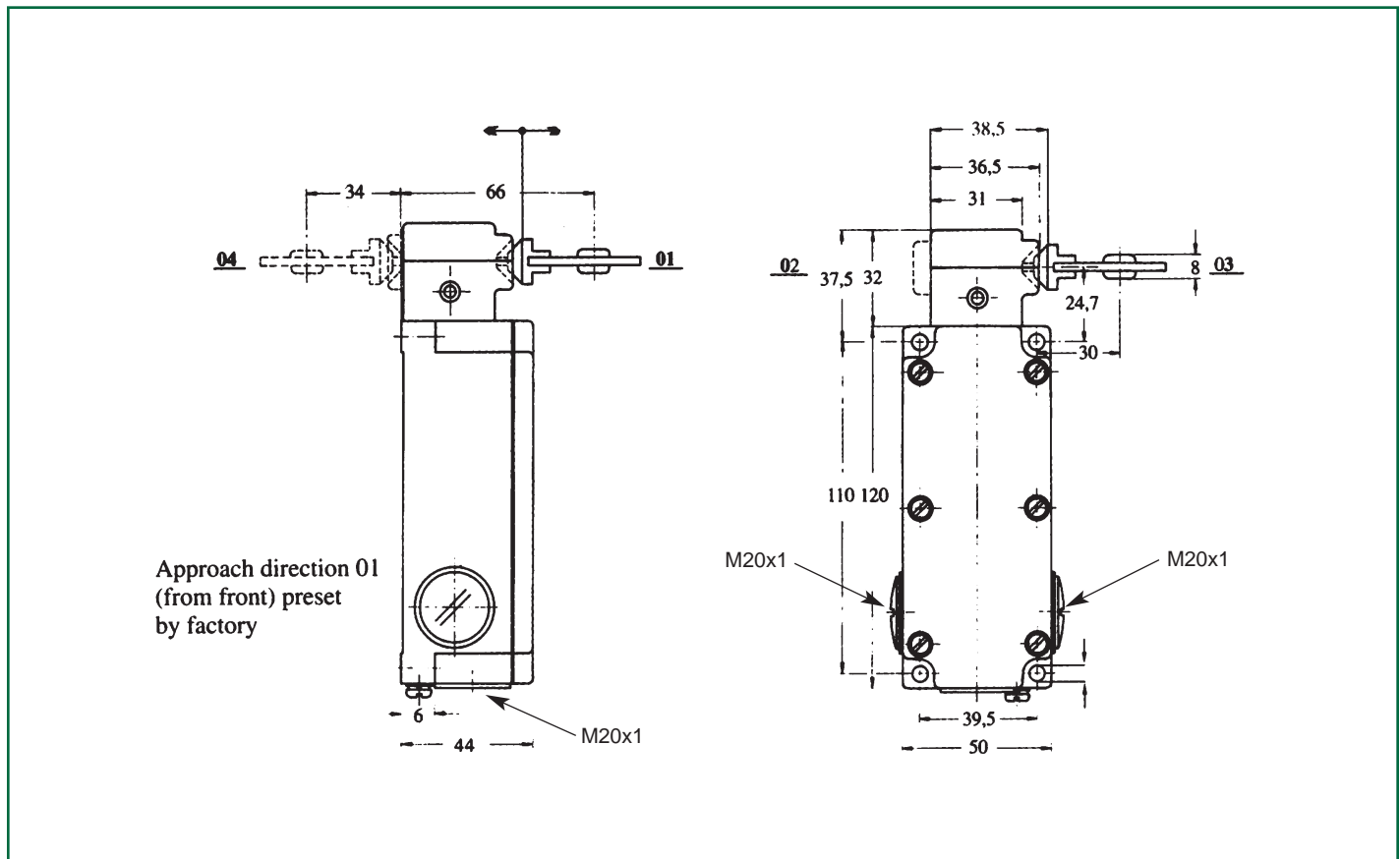
*Field-rotatable for key entry from right, left or rear. Units are supplied with tamper-resistant (one-way) screws to replace the standard screws after rotating the actuator head for desired direction of key entry.

OPTIONAL ACTUATOR KEYS

Part Number	Description
BO	Standard straight actuator key (20" minimum closing radius)
BOW	Right-angled straight actuator key (20" minimum closing radius)
BOR	Radial entry actuator key (10" minimum closing radius)
BOWR	Right-angled bent actuator key (10" minimum closing radius)
BOF/HIS.1	Pivoting straight actuator key (rear-mounted) (13.8" Minimum closing radius)
BOF/HIS.2	Pivoting straight actuator key (top-mounted) (13.8" Minimum closing radius)

1

DIMENSIONS



SDG TECHNICAL DATA

MECHANICAL SPECIFICATIONS

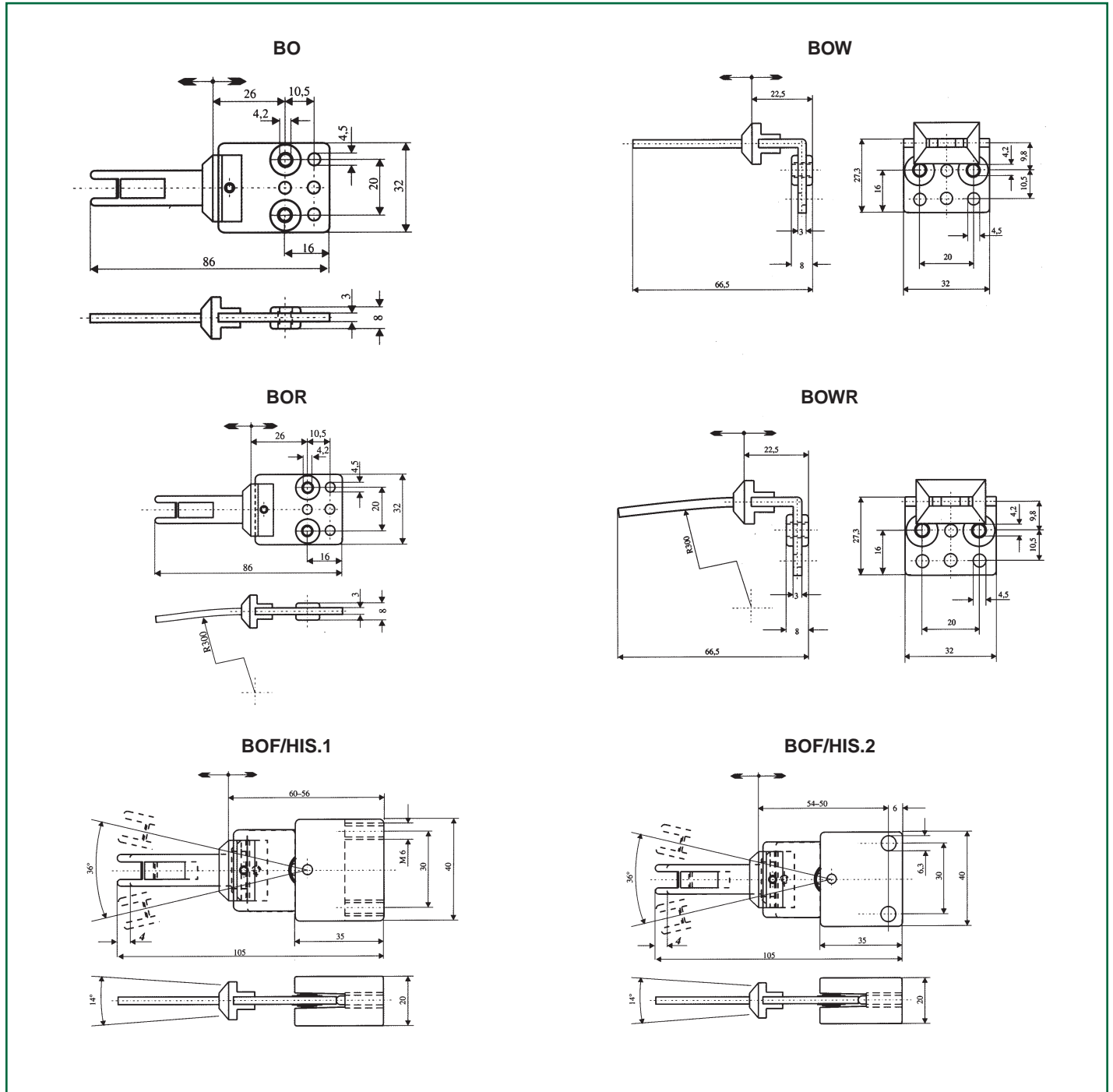
Housing	Cast aluminum with enamel paint
Actuator Key	Steel (chromated) (defeat-resistant design)
Degree of Protection	IP67 (Switch housing) IP00 (Reversing and locking head)
Holding Force	5N (1.2 pounds)
Travel for Positive-Break	12.5mm
Force to Reach Positive-Break	Approx. 5N (1.2 pounds)
Closing Force	Approx. 5N (1.2 pounds)
Operating Temperature	-13°F to +158°F
Mechanical Life	1 million operations (minimum)
Shock Resistance	>30g / 18ms
Vibration Resistance	>15g / 10...200Hz
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-100 BG-GS-ET-15 UL CSA
Minimum Closing Radius	Dependent upon actuator key used. Please see actuator key selection chart.

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Gap	2 × 3.5 mm
Contact Rating	8A (250VAC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	10A (slow-blow)
Rated Insulation Voltage	250VAC
Rated Impulse Withstand Voltage	4kV
Type Terminals	Screw terminals with self-lifting clamps for up to 13 AWG solid wire (2.5mm ²) or 13 AWG stranded (1.5mm ²) wire

SDG ACTUATOR KEY SPECIFICATIONS

ACTUATOR KEYS



SERIES AZ335

Tamper-Resistant Movable Machine Guard Safety Interlock Switch



Description

The AZ335 Series is designed for use with movable machine guards/access gates which must be closed for operator safety. Their positive-opening NC contacts provide a significantly higher level of safety than conventional spring-driven switches whose contacts can weld or stick shut. And the switch's tamper-resistant design prevents bypassing with simple tools, bent wires or other readily available means. Their rugged metal housing and IP67 rating make them ideal for interlocking safety guards in industrial and hostile environments.

Operation

The AZ335 electromechanical safety interlock switch consists of a rugged switch mechanism and a geometrically-unique actuating key. The key is mounted to the movable guard. Upon opening of the guard, the NC contact(s) are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. These positive-break NC contacts assure circuit interruption (and machine stoppage) upon removal of the actuator key. (The NO contacts close upon key removal.)

When the guard is closed, the actuating key forces the NC contact(s) to close, and the NO contacts to re-open.

Typical Applications



The AZ335 is intended for use as a safety interlock switch on movable machine guards which, when open, expose the operator/maintenance personnel to machine hazards. Typical applications are the interlocking of protective gratings, access doors/panels, perimeter access gates, hinged covers and other movable guards on textile machinery, packaging equipment, machine tools, assembly machinery, robot work cells and food/chemical processing equipment.

Features & Benefits

- **Rugged, corrosion-resistant die-cast aluminum housing** ... tolerates the most hostile environments.
- **“Positive-break” NC contacts** ... assure circuit interruption upon actuator key removal.
- **Highly tamper-resistant** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **Watertight design** ... meets IP67 washdown requirements.
- **Eight optional key entry locations** ... depending upon mounting of rotatable mounting head.
- **High-strength, stainless-steel actuator key** ... tolerant to mechanical abuse without damage.
- **Tapered key entry ports** ... tolerant to key misalignment.
- **Meets rigid safety agency standards** ... IEC, BG, VDE, UL and CSA.
- **Lockout accessory** ... prevents key entry and switch actuation.
- **Optional M12x1 quick-connect** ... please consult factory.

AVAILABLE STANDARD MODELS

(Includes 1/2" NPT Adapter. Actuator keys sold separately)

Part Number	Contacts (with key inserted)
AZ335-11ZK	1 NO & 1 NC
AZ335-02ZK	2 NC
AZ335-12ZRK	1 NO & 2 NC
AZ335-03ZRK	3 NC

Note: Available with optional M12x1 quick-connect. Please consult factory.

OPTIONAL ACTUATOR KEYS

Part Number	Description
AZ335/355-B1	Straight actuator key.
AZ335/355-B1-2245	Standard actuator key with rubber grommeted mounting holes.
AZ335/355-B5	Right angle actuator key.
AZ335/355-B6	Adjustable short-radius actuator key.
AZ335/355-B5-Flex	Floating standard actuator key (tolerant to x and y axis misalignment of ±5mm).
AZ335/355-B6-Flex	Floating standard short-radius actuator key (tolerant to x and y axis misalignment of ±5mm).

ACCESSORIES

Part Number	Description
AZ335/355-1990	Key entry port covers (two-part package).
SZ16/335	Lockout device (prevents key entry and switch actuation). Accepts up to six padlocks.
Suffix “-G24” Available on AZ335-11zk only)	Factory installed 24VDC LED indicator kit. (Includes windowed coverplate to display green “Supply Voltage On” LED and yellow “Switch Off” LED)
Suffix “-ST”	Optional M12x1 quick-connect (AZ335-11 and AZ335-02 models only)
AZ335/355-B30-XX	Safety door handle assembly (Please see page 82)

AZ335 TECHNICAL DATA

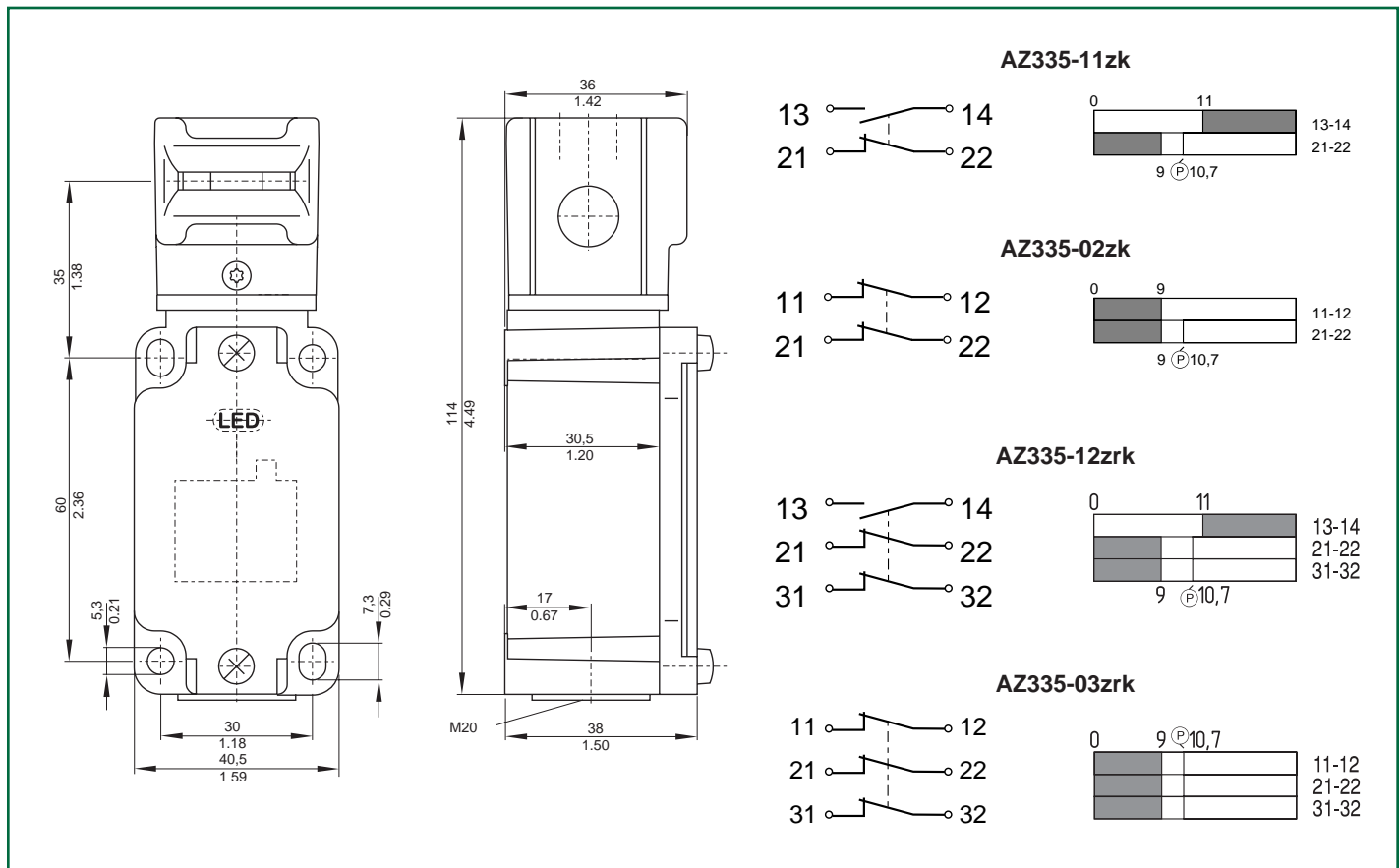
MECHANICAL SPECIFICATIONS

Housing	Diecast aluminum with baked enamel finish
Actuator Key	Stainless steel (defeat-resistant design)
Degree of Protection	IP67
Travel for Positive-Break	10.7 mm (0.4 inches)
Closing Force	Approx. 15 N (3.4 pounds)
Operating Temperature	-22°F to +195°F
Mechanical Life	> 10 ⁷ operations
Key Holding Force	30 N (7 pounds) ("R" models only)
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET-15 UL & CSA
Minimum Closing Radius	B1 & B5 keys: 150mm B6, B5-Flex & B6-Flex keys: 100mm

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Gap	2 × 1.25mm (minimum)
Contact Rating	4A (230VAC) 25A/230VAC (with optional M12x1 quick-connect)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse 6A (time-delay)
Rated Insulation Voltage	500VAC
Rated Impulse Withstand Voltage	6kV
Type Terminals	Screw terminals with self-lifting clamps for up to 13 AWG flexible stranded wire (2.5mm ²)

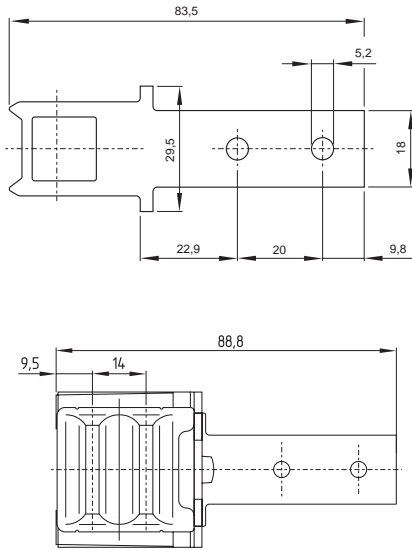
DIMENSIONS & CONTACT SCHEMATICS



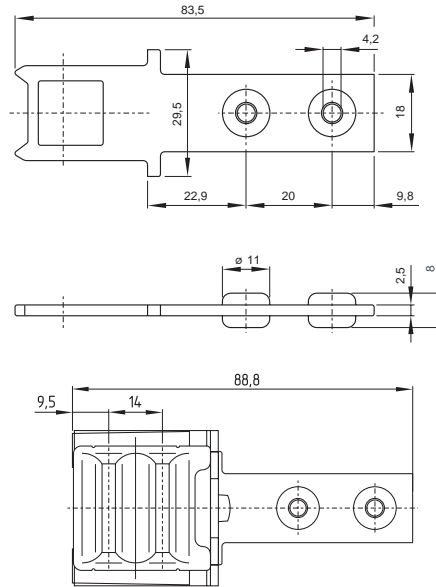
AZ335 INDIVIDUALLY-CODED ACTUATOR KEY SPECIFICATIONS

ACTUATOR KEYS

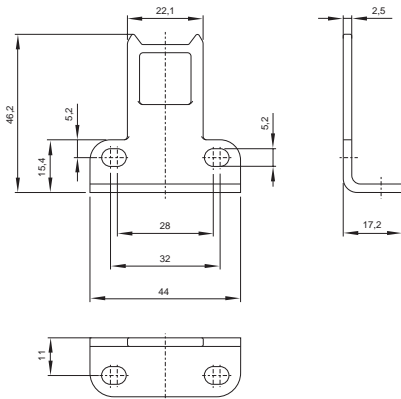
AZ335/355-B1



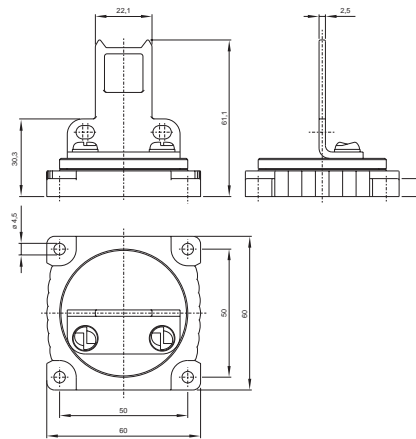
AZ335/355-B1-2245



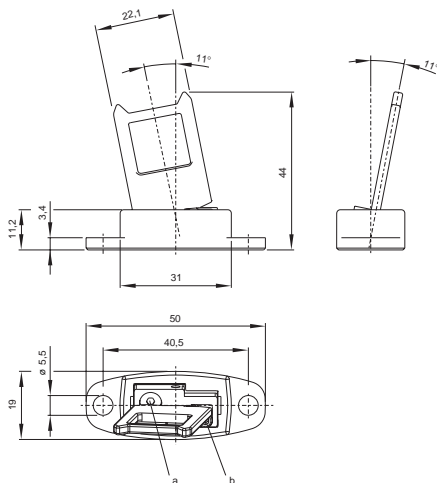
AZ335/355-B5



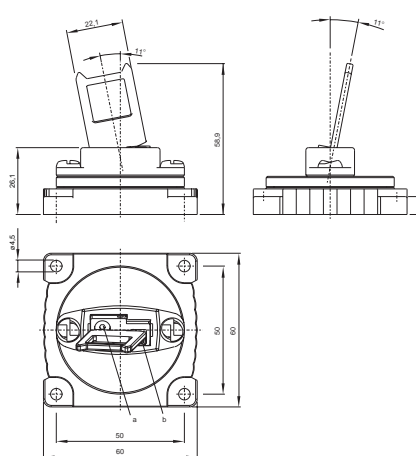
AZ335/355-B5-Flex



AZ335/355-B6



AZ335/355-B6-Flex





*Safer
by
Design*

SERIES SHGV

Cable-less Keyed Mechanical Safety Guard Interlock with Key Transfer System

New!



Description

The SHGV Series consist of a guard-mounted mechanical locking device and a 2-position key operated selector switch for control panel mounting. This unique key transfer system assures the removal of power before allowing the access control guard to be open ... without the need for electrical wiring at the interlocked machine guard location.

Operation

When the machine guard is open the transfer key (for operating the 2-position selector switch) cannot be withdrawn from the guard locking mechanism.

Upon closing of the guard, the mechanical actuator key permits the transfer-key to be turned (locking the guard) and withdrawn. The transfer-key can now be removed and inserted into the 2-position selector switch, allowing it to be operated (e.g. power to be turned on) ... trapping the transfer key in the "on" position.

To unlock (open) the guard, the selector switch must be turned to the off position. The transfer-key can now be withdrawn and inserted into the guard-locking mechanism for release of the mechanical actuator key and opening of the guard.

The two lock barrel version allows the removal of a second transfer key when the mechanical actuator key has been released. This second transfer key prevents the removal of the "power control" transfer key from the keyed interlock. Thus it can be removed from the interlock by the operator to protect against the inadvertent start-up of the equipment.

Typical Applications

Recommended for use where wiring directly to the movable guard is cost prohibitive or subject to damage due corrosive chemicals or other harsh environmental conditions.

Features & Benefits

- **Highly tamper resistant** ... difficult to defeat with simple tools, thereby reducing liability exposure.
- **Four optional key entry positions** ... provides installation versatility.
- **Three optional locking cylinder locations** ... provides installation versatility.
- **Corrosion resistant** ... tolerates hostile environments.
- **Funnel shaped entry** ... forgiving of mechanical actuator key misalignment
- **Low cost guard locking** ... eliminates wiring at the guard.
- **Meets rigid safety agency standards** ...

Selector switch: UL, CSA, IEC, BG, VDE

Mechanical key locking device: IEC, BG, VDE

AVAILABLE MODELS

Part Number	Description
SHGV/L1 (*) ESS21S2/103	Lock Barrel Left
SHGV/R1 (*) ESS21S2/103	Lock Barrel Right
SHGV/B1 (*) ESS21S2/103	Lock Barrel Rear
SHGV/LD1 (*) / (*) ESS21S2/103	Lock Barrel Left & Lock Barrel in Front Cover
SHGV/RD1 (*) / (*) ESS21S2/103	Lock Barrel Right & Lock Barrel in Front Cover

New!
New!

Includes guard device SHGV with standard BO actuator element, keyed selector switch ESS21S2, and contact block EF103 (1NO/1NC)

(*) Individual key identification code stamped on selector switch cylinder.

Note:

This system is recommended for applications in which there is no residual motion or hazard after the removal of power. For applications in which there is residual motion or the presence of a hazard immediately following the removal of power, a solenoid-locking console (Model SVE) is recommended. Please consult factory.

SERIES SHGV TECHNICAL DATA

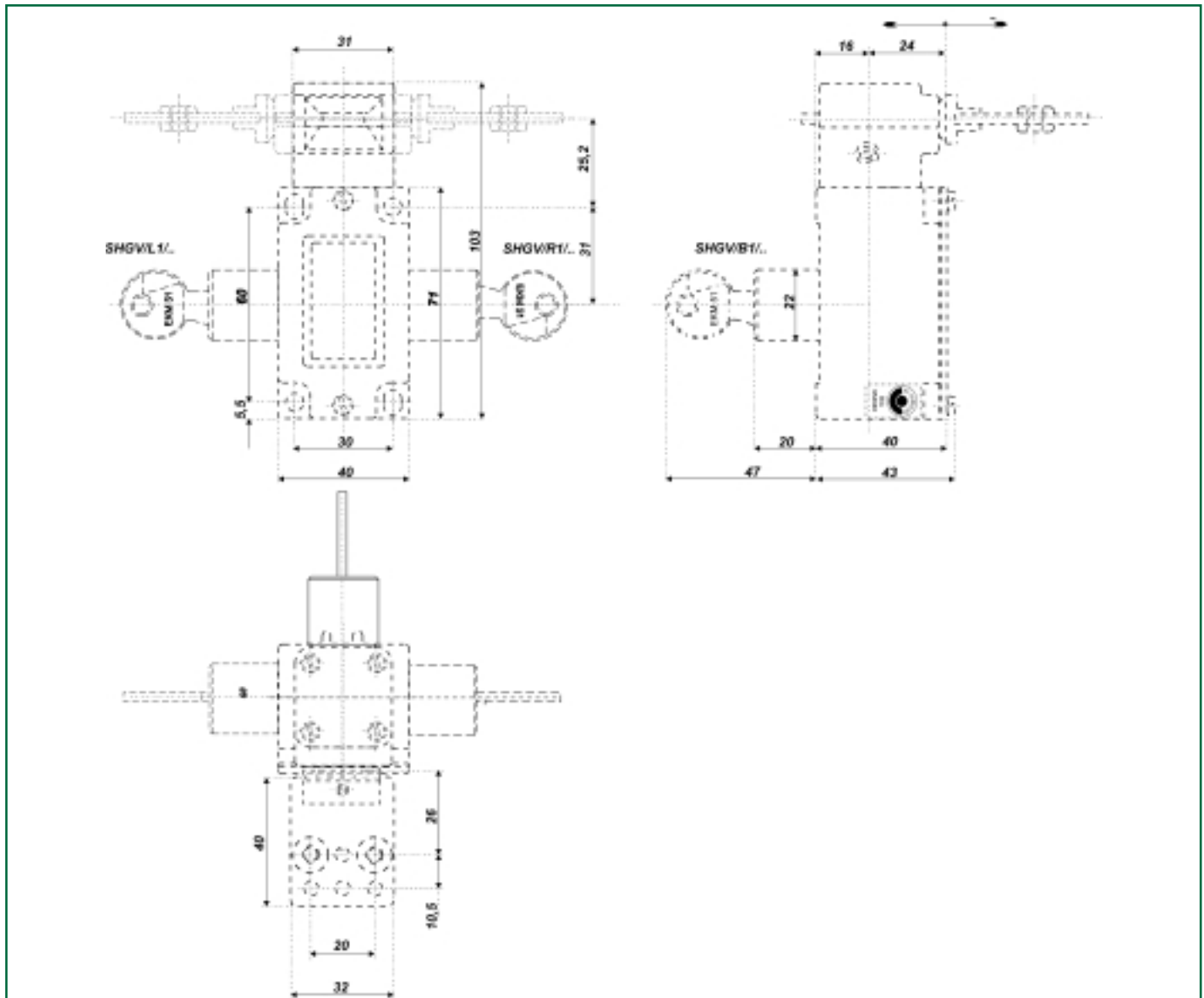
MECHANICAL SPECIFICATIONS

Protection Class	IP 65 (Housing) IEC/EN 60529 IP 00 (Control Head) IEC/EN 60529
Actuating Forces	Insertion of actuating element - 15 N Withdrawal of actuating element - 5 N
Ambient temperature	- 25 °C to + 70 °C
Storage temperature	- 40 °C to + 80 °C
Material	ALsi 12 painted signal red (RAL 3000)
Housing	Steel passivated with
SHG Cover	Perbunan seals(oil and gasoline resistant)
Mechanical life	2 x 10 ⁶ operating cycles
Shock resistance	> 30 x g / 18ms
Vibration resistance	> 15 x g/10 ... 200 Hz
Climatic resistance	40/91 to DIN 50015 FW 24 to DIN 50016

ELECTRICAL SPECIFICATIONS

Conformity to Standard	IEC/EN 60947-5-1
Protection Class	IP 65 to IEC/EN 60529
Contacts	Fine silver
Rated breaking capacity	230Vac/6A - 400VAC/4A
Rated operating current	230Vac/6A - 400VAC/4A
Rated insulation voltage	400VAC / 450VDC
Thermal test current	10 A
Utilization Category	AC-15; DC-13
Max. fuse rating	10 A (slow blow)
Ambient temperature	- 25 °C to + 80 °C
Switching frequency	6000 s/h

DIMENSIONAL DRAWING FOR SHGV GUARD LOCKING DEVICE



SERIES AZ415

Tamper-Resistant Movable Machine Guard Safety Interlock Switch



Description

The AZ415 Series is designed for movable machine guards/access gates which must be closed for operator safety. Their positive-opening NC contacts provide a significantly higher level of safety than conventional spring-driven switches whose contacts can weld or stick shut. And their tamper-resistant design prevents bypassing with simple tools, bent wires or other readily available means.

Operation

The AZ415 electromechanical safety interlock switch consists of a rugged switch mechanism and a geometrically-unique actuating key. The key is mounted to the movable guard. Upon opening of the guard, the NC contacts are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. These NC contacts assure circuit interruption (and machine stoppage) upon removal of the actuator key. (The NO contacts close upon key removal.)

In the closed position, the guard is held shut by an adjustable ball catch integral to the AZ415 housing.

Typical Applications

The AZ415 is intended for use as a safety interlock switch on movable machine guards which, when open, expose the operator/maintenance personnel to machine hazards. Typical applications are the interlocking of protective gratings, access doors/gates, hinged covers, access panels and other movable guards.

Features & Benefits

- **Highly tamper-resistant** ... difficult to defeat.
- **“Positive-break” NC contacts** ... assure circuit interruption upon key removal.
- **Watertight design** ... meets IP67 washdown requirements.
- **High-strength, metal actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, enamel-coated metal housing** ... tolerates the most hostile environments.
- **Adjustable actuator key holding force up to 110 pounds** ... permits use of switch as door latch.
- **Meets rigid safety agency standards** ... UL, CSA, IEC, BG and VDE.

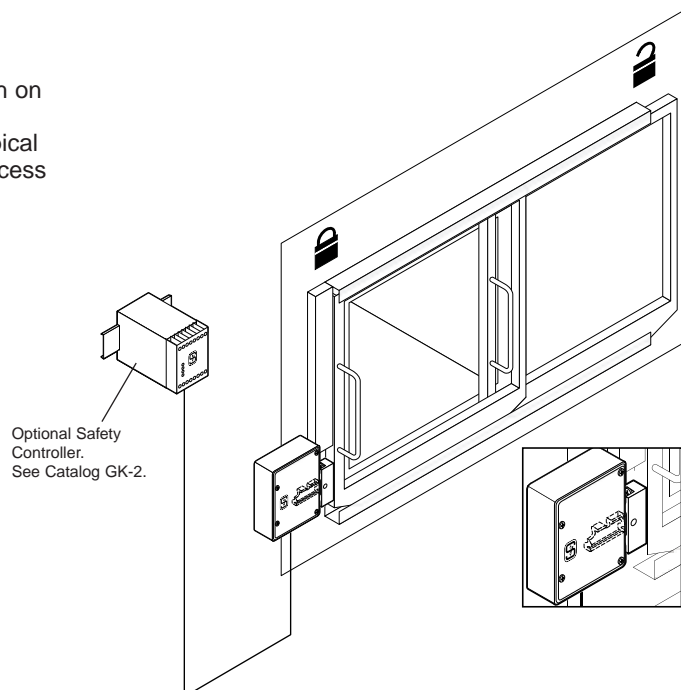
AVAILABLE STANDARD MODELS (Actuator key sold separately ... see below)

Part Number (AZ415 - Switch Block S1* / Switch Block S2)	Contact Configuration with actuator key inserted (Switch Block S1*/Switch Block S2)
AZ415-11/11zpk (formerly p/n AZ415-22zpk)	2 NO / 2 NC
AZ415-11/02zpk	1 NO & 1 NC / 2 NC
AZ415-02/11zpk	2 NC / 1 NO & 1 NC
AZ415-02/02zpk	2 NC / 2 NC

*Only Switch Block S1 has positive-break contacts.

ACTUATING KEYS & ACCESSORIES

Description	Part Number
Linear entry actuator key	AZM415-B1
Small radius x-axis entry actuator key (9.8" minimum closing radius)	AZM415-B2
Small radius y-radius entry actuator key (9.8" minimum closing radius)	AZM415-B3
Slide bolt actuator key	AZ/AZM415-B4/P2



AZ415 TECHNICAL DATA

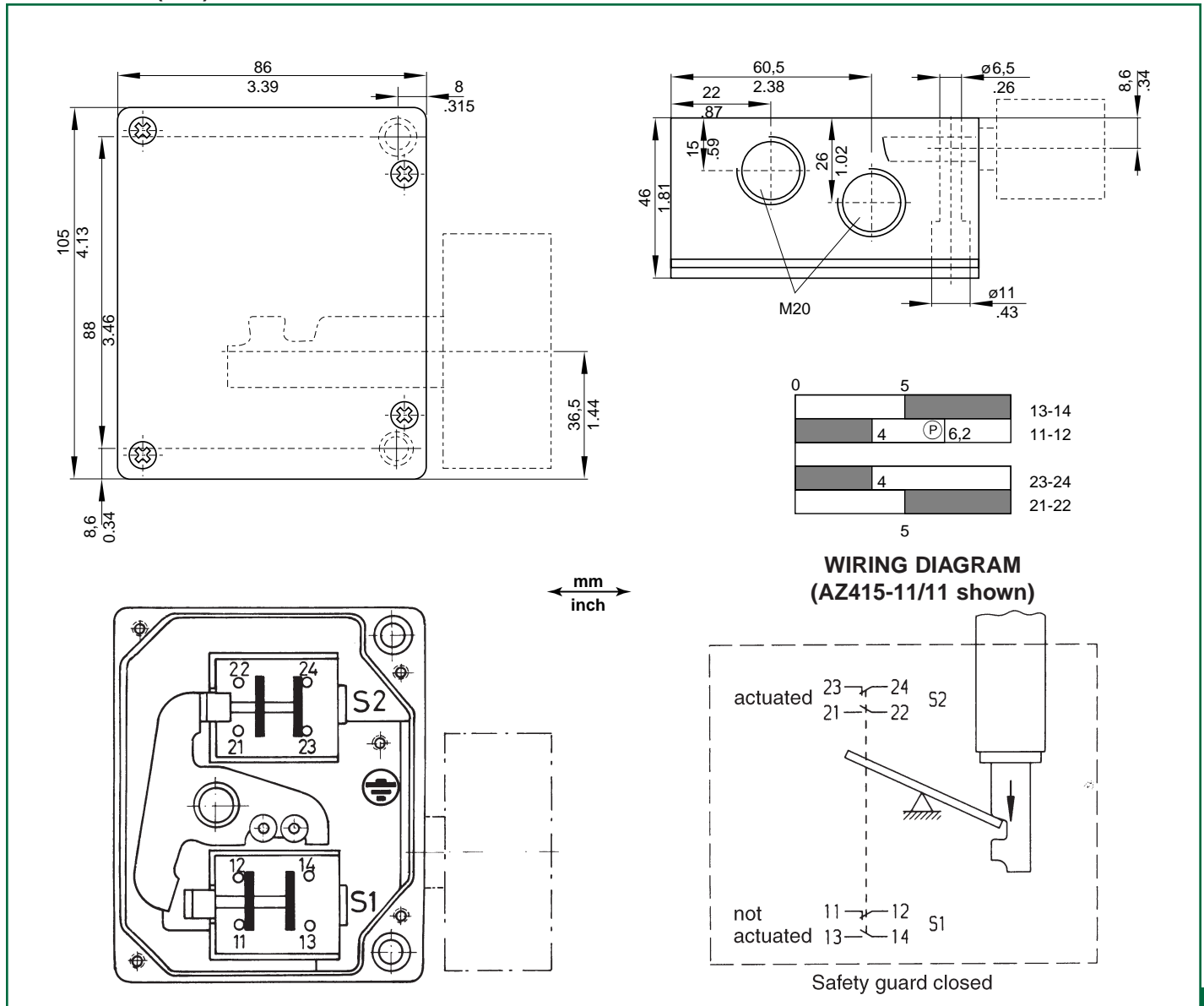
MECHANICAL SPECIFICATIONS

Housing	Die-cast aluminum with blue enamel finish
Actuator Key	Die-cast aluminum
Degree of Protection	IP67
Travel for Positive-Break	0.2 inches (5mm)
Force to Reach Positive-Break	Depending upon ball catch setting (3.5 pounds minimum)
Actuator Key Holding Force	Adjustable, 2.2 to 110 pounds
Operating Temperature	-13°F to +175°F
Mechanical Life	1 million operations
Conformity to Standards	IEC 947-5-1 BG-GS-ET-19 VDE 0660-200
Minimum Closing Radius	9.8" (250 mm) with B2 or B3 actuating key

ELECTRICAL SPECIFICATIONS

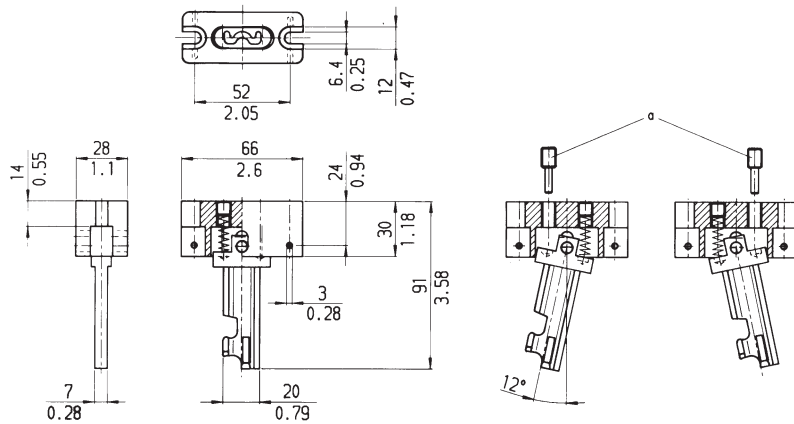
Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Gap	2mm x 2mm
Contact Rating	4A (230VAC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse 6A (slow-blow)
Rated Insulation Voltage	250VAC
Rated Impulse Withstand	4kV
Type Terminals	Screw terminals with self-lifting clamps for up to 1.5mm ² (15AWG) flexible stranded wire

DIMENSIONS (mm)

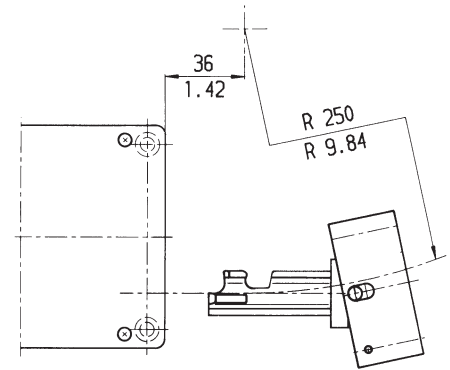


AZ415 TECHNICAL DATA

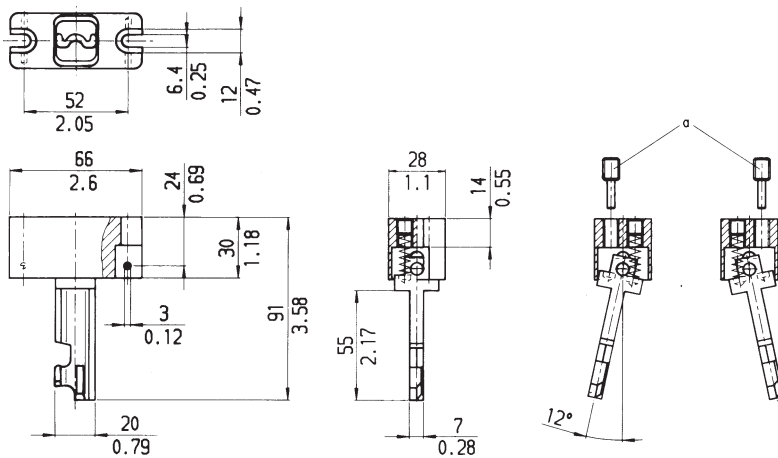
ACTUATOR KEY DIMENSIONS



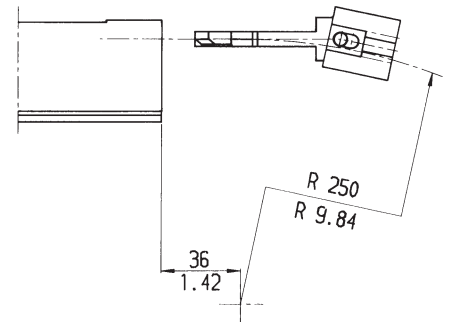
B2 Actuator



B2 Actuating radii
For hinged doors over the wide edge of the actuator



B3 Actuator

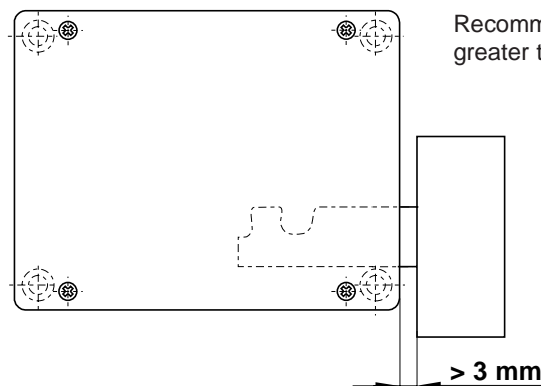


B3 Actuating radii
For hinged doors over the small edge of the actuator

Dowel holes are also provided in the actuator body. With the use of dowel pins the removal of the actuator can be prevented.

By turning the adjusting screw "a," the actuator can be brought into any desired position.

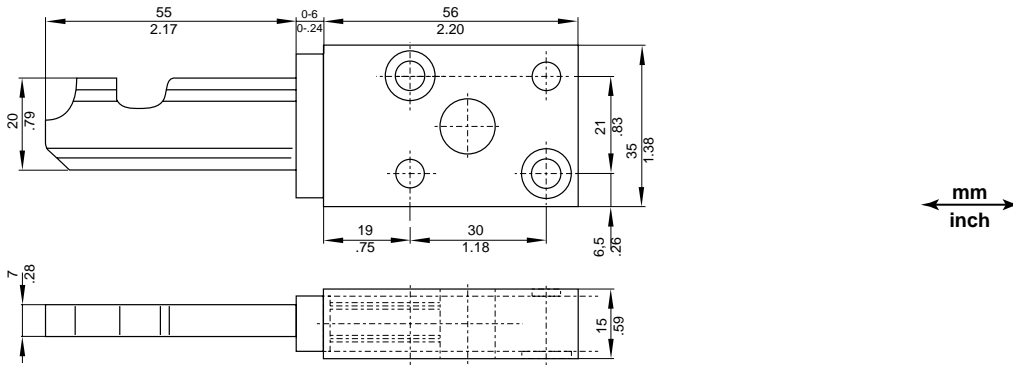
Both actuators can also be used on sliding doors.



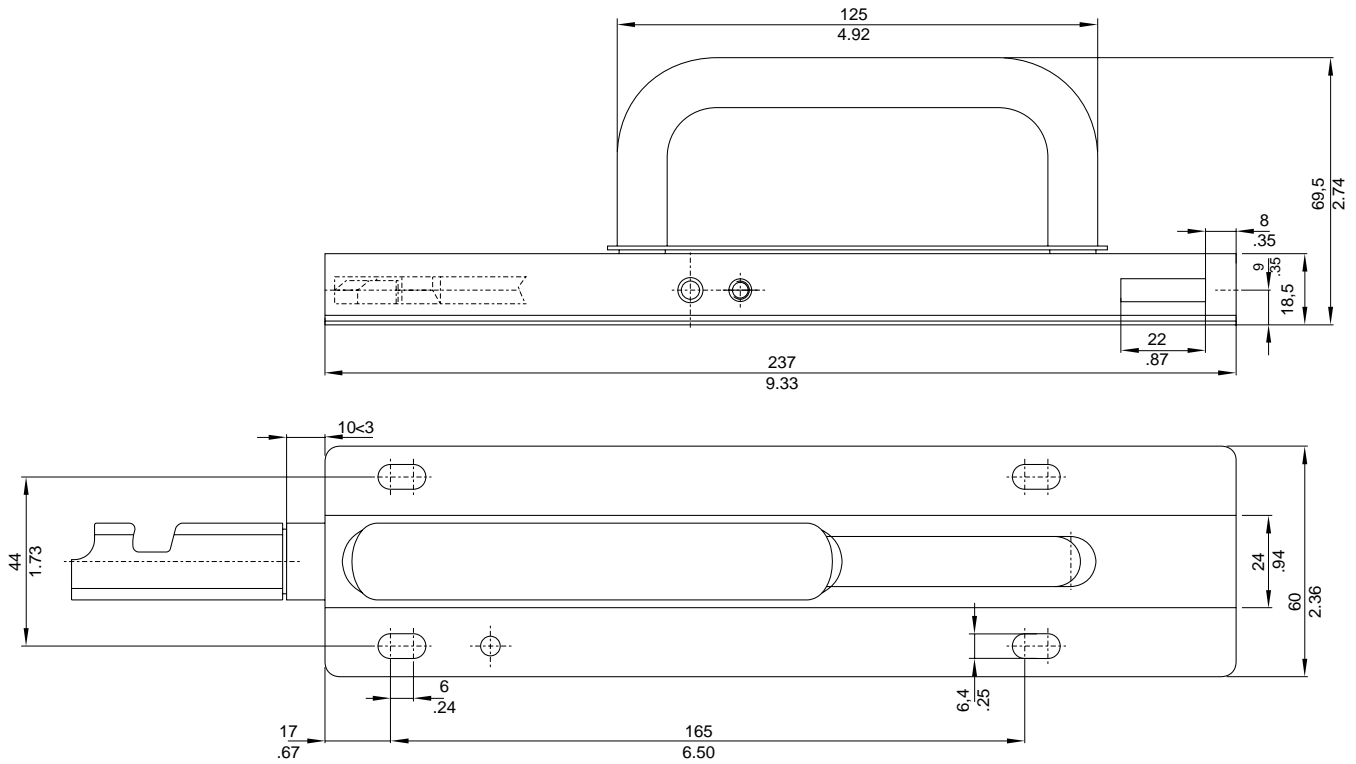
Recommended key clearance greater than 3 mm

AZ415 TECHNICAL DATA

ACTUATOR KEY DIMENSIONS



B1 Actuator



B4pS actuator for hand operated locking

Hand operated locking actuator

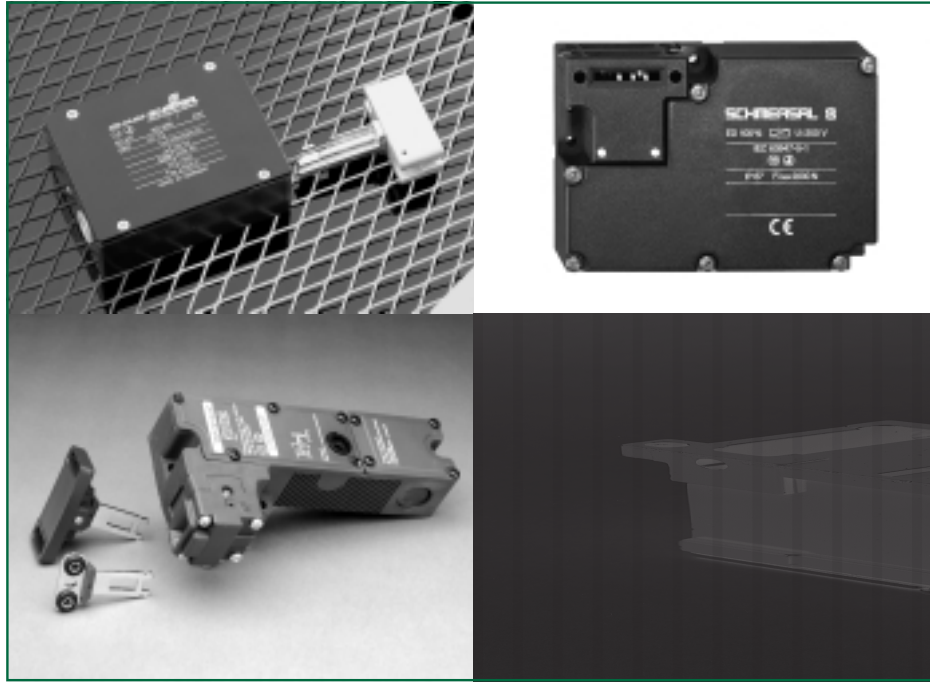
The hand operated lock bolt has the following advantages:

1. No further mechanical expenditures such as handles or levers are necessary.
2. The shearing forces on the actuator is 25,000 N (5,500 lbs.).
3. Simple installation of the unit.
4. Observing the actuating radius is not necessary.
5. An open guard door cannot fall shut and lock, causing the switch to be actuated. The door must be manually closed and locked.
6. To insure personal safety when hazardous conditions are present, three holes are provided for pad-locking which prevents the door from being locked.



*Safer
by
Design*

KEYED INTERLOCK SWITCHES WITH SOLENOID LATCHING



SELECTION GUIDE

Switch Series	Housing Material	Envelope Dimensions	Contact Configurations	Catalog Page
AZM170 AZM170zi	Glass-fiber, reinforced thermoplastic	1¼" × 2½" × 5"	1 NO & 1 NC 2 NC	52 56
AZM161	Glass-fiber, reinforced thermoplastic	1¼" × 3½" × 5½"	2 NO & 4 NC 3 NO & 3 NC	60
TZF/TZM	Glass-fiber, reinforced thermoplastic	1½" × 4" × 5"	2 NO & 1 NC	64
TKF/TKM	Die-cast aluminum	2½" × 3½" × 8"	2 NO & 2 NC	68
TZK	Glass-fiber, reinforced thermoplastic	1¾" × 2" × 7"	1 NO & 2 NC	72
AZM415	Die-cast aluminum	2" × 5" × 5½"	2 NO & 2 NC 3 NO & 3 NC	76
AZM2305 Fail-to-Safe Timer & FWS1205B Fail-to-Safe Standstill Monitor				80

SERIES AZM170

Solenoid-Latching Machine Guard Safety Interlock Switch



Description

The AZM170 Series is designed for machines/work cells where access to a hazardous work area must be controlled until safe conditions exist. Their solenoid-latching feature permits locking a machine guard until dangerous conditions, which may exist immediately after removal of power, have abated. Solenoid-latching may be controlled by a time delay, motion detector, position sensor or other suitable component.

The unit features independent actuator key (guard) position and solenoid-latching pin position contacts. These permit the prevention of machine restart until the guard is closed **and** the solenoid-latching pin is in the locked position.

The AZM170 consists of an electromechanical safety interlock switch joined to a solenoid-latching mechanism. Both the safety switch and solenoid mechanism feature "positive-break" contacts. In addition the actuator key features a built-in latch (unlocked key holding force of 7 pounds), and an auxiliary manual unlocking device ... the latter provided to aid in installation and for use in the event of a power failure (when using the "unlocking by solenoid" model).

Each unit is supplied with a cord grip and a cap to seal the unused key entry port in the solenoid-latching mechanism.

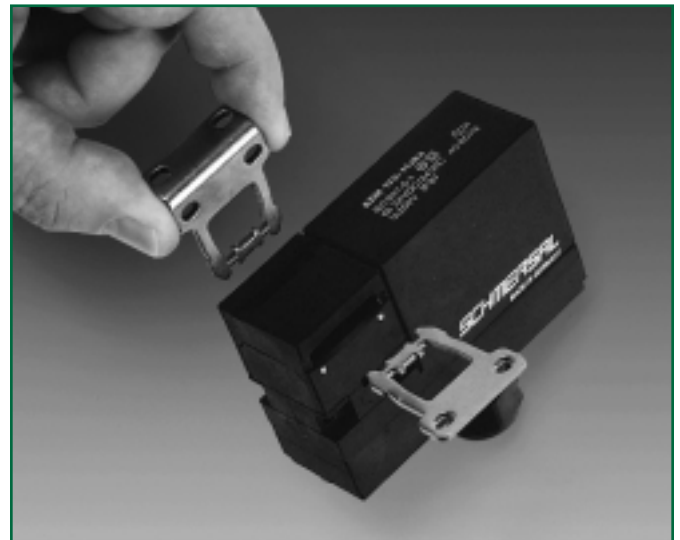
Typical Applications



The AZM170 is intended for use as a safety interlock switch on movable machine guards which must not be opened until dangerous conditions, which may exist after the removal of power, have abated. Such conditions are flywheel overrun, spindle momentum, unstable rest positions, etc. Typical applications are textile machines, stamping presses, articulating robot arms, mixing machines, metal working equipment, printing presses and packaging machinery.

Features & Benefits

- **Compact design** ... only 1¼" × 2¾" × 3⁹⁄₁₆". Ideal where space is limited.
- **Watertight design** ... meets IP67 washdown requirements.
- **Highly tamper-resistant** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **"Positive-break" NC contacts** ... assure interruption of safety circuit upon actuator key removal.
- **Two key entry locations** ... provide mounting flexibility.
- **Rugged, corrosion-resistant, high-impact glass-fibre reinforced housing** ... tolerates the most hostile environments.
- **High-strength stainless steel actuator key** ... tolerant to mechanical abuse without damage.
- **Three styles of actuator key** ... accommodate a wide variety of movable guards.
- **Easy-to-wire screw terminals** ... facilitates fast installation.
- **"Power-on" or "Power-off" latching option** ... for application versatility.
- **Built-in manual unlatching release (via special triangular key)** ... for easier installation.
- **"Padlockable" key** ... for added security during maintenance.
- **Meets rigid IEC, UL, CSA, BG, VDE standards.**
- **Optional integral adjustable time-delay and integral standstill monitor units available.** (Please consult factory)
- **Units available with M12x1 quick-connect.** (Please consult factory).



Two optional key entrances

AZM170 AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS (Order desired actuator key separately)

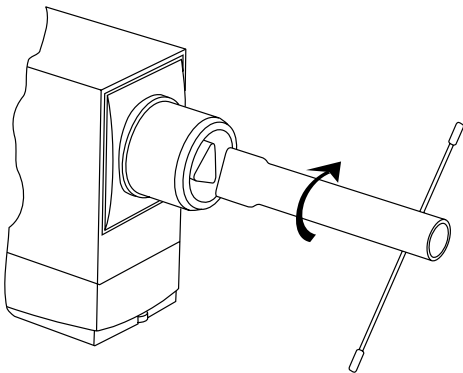
Part Number	Contacts (with actuator key inserted)
Locking via spring. Unlocking via energizing of solenoid.	
AZM170sk-11zrk-2197-*	1 NO & 1 NC
AZM170sk-02zrk-2197-*	2 NC
Locking via energizing of solenoid. Unlocking via spring. (See Note 1 below)	
AZM170sk-11zrka-*	1 NO & 1 NC
AZM170sk-02zrka-*	2 NC
Individually-coded key models available. (Model AZM170zi). (For extra security in "high-risk" applications.)	

*Please specify solenoid operating voltage via addition of one of the following suffix codes:

Voltage	Add Suffix
24VAC/DC	-24VAC/DC
115VAC	-115VAC
230VAC	-230VAC

Example: AZM170sk-11zrk-24VAC/DC designates a switch with a 24VAC/DC solenoid which unlocks upon energizing of solenoid.

Note 1: Use of this model permits the guard to be opened in the event of a power failure. Generally accepted safety standards/practices suggest this model only be used after conducting a thorough risk evaluation in the context of the application.

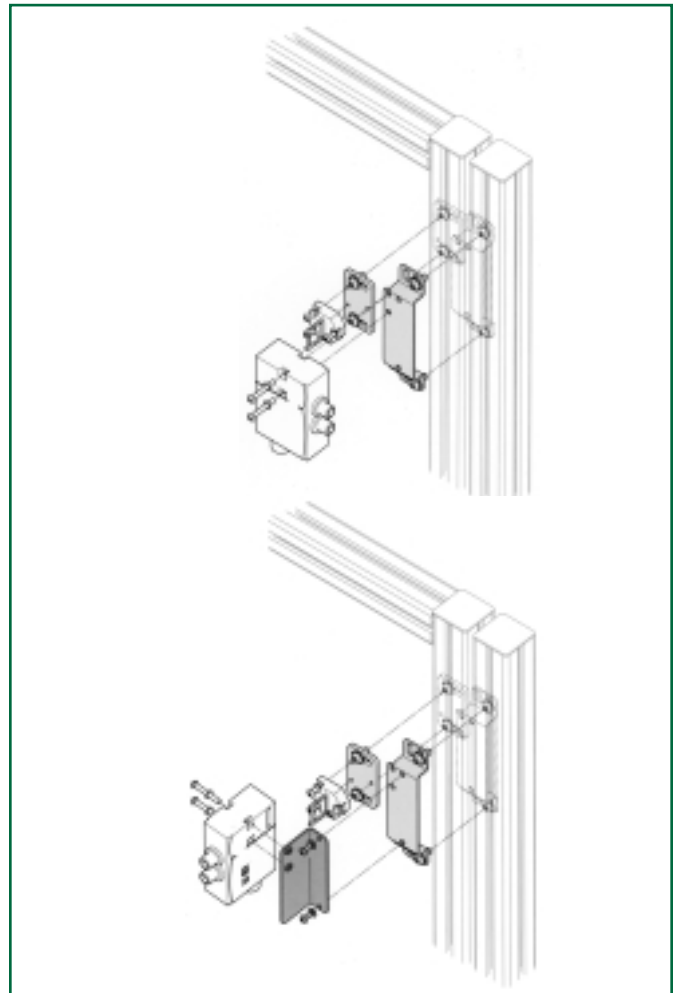


Solenoid-latch bypass/override key
(for locking via spring models only)

ACTUATOR KEYS & ACCESSORIES

Part Number	Description
AZ17/170-B1	Standard key (7.87" minimum closing radius)
AZ17/170-B5	Right-angle key (7.87" minimum closing radius)
AZM170-B6	Flexible, close-radius key (1.97" minimum closing radius)
AZ17/170-B11	Elongated standard straight key (7.87" minimum closing radius)
AZ17/170-B15	Elongated right-angle key (7.87" minimum closing radius)
AZ17/170-B1-2245	Standard straight key with vibration-resistant mounting (7.87" minimum closing radius)
AZM-KEY	Solenoid latch bypass/override key (for locking via spring models only)
MS AZM 170	Adjustable mounting kit (Eases installation and facilitates adjustments due to guard misalignment)
AZS2305	Fail-to-Safe Timer (Please see page 80)
FWS1205B	Fail-to-Safe Standstill Monitor (Page 80)

MS AZM 170 ADJUSTABLE MOUNTING KIT



AZM170 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Glass-fibre reinforced, self-extinguishing thermoplastic
Actuator Key	Stainless steel
Degree of Protection	IP67
Unlocked Key Holding Force	30N (7 pounds)
Travel for Positive-Break	11 mm (0.440 inches)
Closing Force	Approx. 12N (2.7 pounds)
Locking Force	Approx. 1000N (225 pounds)
Operating Temperature	-22°F to +175°F
Solenoid Operating Temperature	-7°F to +140°F
Mechanical Life	> 10 ⁶ operations
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET, EN 1088 UL & CSA
Minimum Closing Radius	1.97" (with B6 actuating key) 7.87" (with B1, B5, B11 and B15 actuating key)

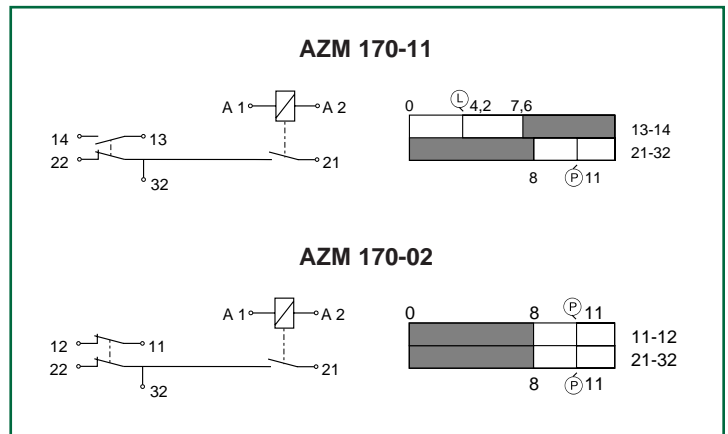
ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Rating	4A/230VAC
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	6A (time-delay)
Rated Isolation Voltage	250V
Type Terminals*	Screw terminals
Solenoid Supply Voltages	24VDC/AC 110VAC 40-60 Hz 230VAC 40-60 Hz Max. 10 Watts

*Optional insulation displacement connection (IDC) or M12x1 quick-connect terminations available. Please consult factory.

**Units with integral adjustable time-delay and units with integral standstill monitor available. Please consult factory.

SWITCHING DIAGRAMS & CONTACT SCHEMATICS

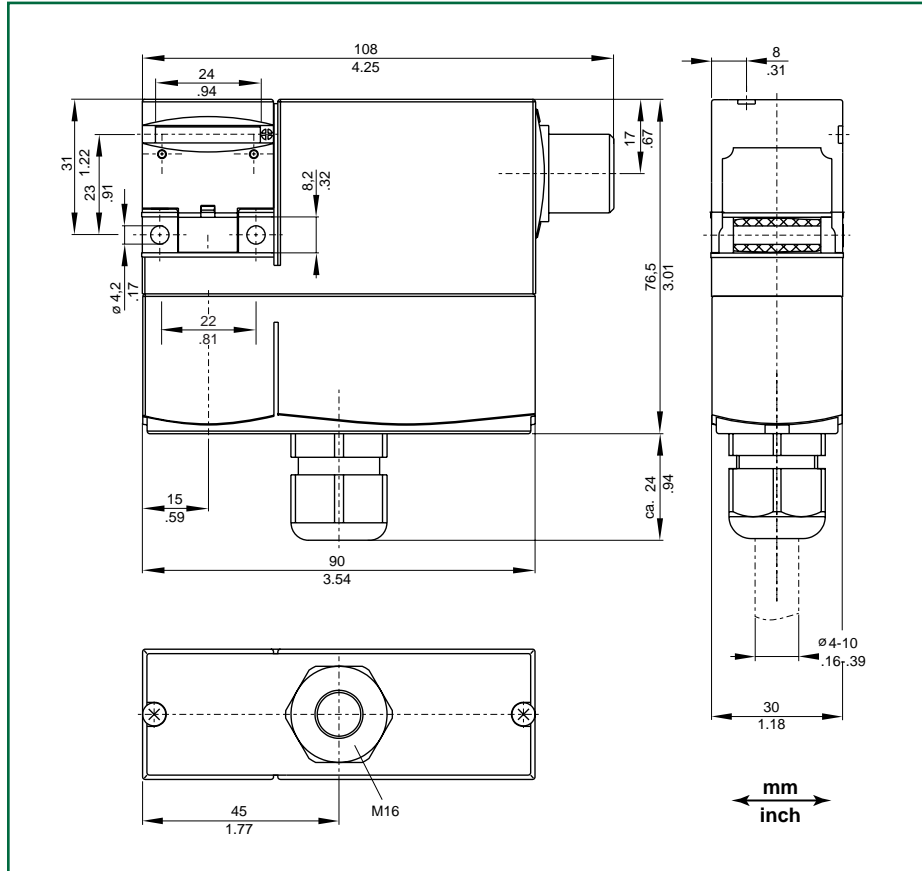


Note:

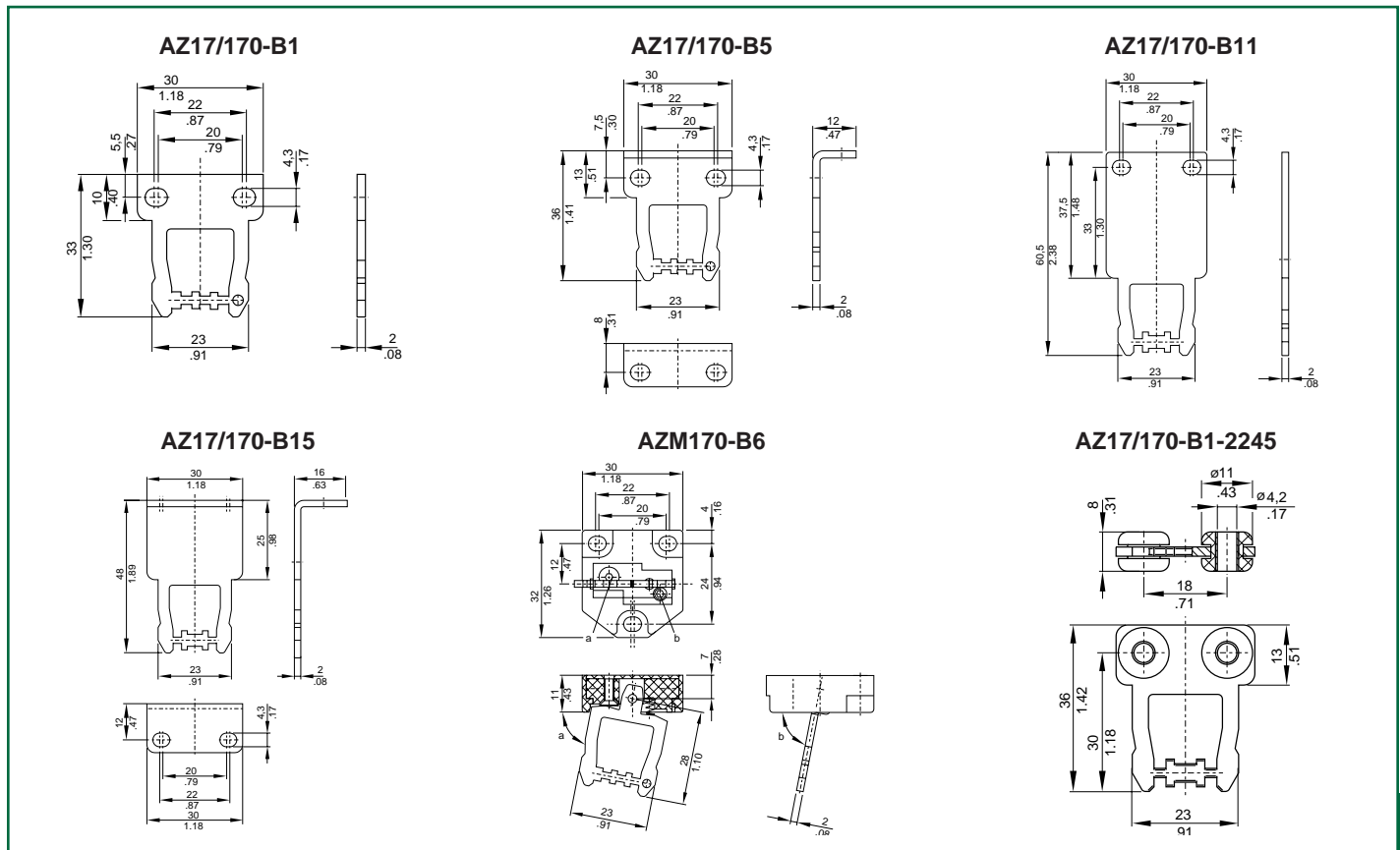
Above diagrams are with actuator key inserted and solenoid de-energized.

AZM170 TECHNICAL DATA

DIMENSIONS



ACTUATOR KEYS



SERIES AZM170zi

Compact, Individually-Coded Solenoid-Latching Machine Guard Safety Interlock Switch



Description

The AZM170zi Series is designed for machines/work cells where access to a hazardous work area must be controlled until safe conditions exist. Their solenoid-latching feature permits locking a machine guard until dangerous conditions, which may exist immediately after removal of power, have abated. Solenoid-latching may be controlled by a time delay, motion detector, position sensor or other suitable component.

The unit features independent actuator key (guard) position and solenoid-latching pin position contacts. These permit the prevention of machine restart until the guard is closed **and** the solenoid-latching pin is in the locked position.

The AZM170zi consists of an electromechanical safety interlock switch joined to a solenoid-latching mechanism. Both the safety switch and solenoid mechanism feature "positive-break" contacts. In addition the actuator key features a built-in latch (unlocked key holding force of 7 pounds), and an auxiliary manual unlocking device ... the latter provided to aid in installation and for use in the event of a power failure (when using the "unlocking by solenoid" model).

Each unit is supplied with a unique actuator key, a cord grip and a cap to seal the unused key entry port in the solenoid-latching mechanism.

Typical Applications



The AZM170zi is intended for use as a safety interlock switch on movable machine guards which must not be opened until dangerous conditions, which may exist after the removal of power, have abated. Such conditions are flywheel overrun, spindle momentum, unstable rest positions, etc. Typical applications are textile machines, stamping presses, articulating robot arms, mixing machines, metal working equipment, printing presses and packaging machinery.

Features & Benefits

- **Compact design** ... only 1 1/4" x 2 3/8" x 3 9/16". Ideal where space is limited.
- **Watertight design** ... meets IP67 washdown requirements.
- **Highly tamper-resistant** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **"Positive-break" NC contacts** ... assure interruption of safety circuit upon actuator key removal.
- **Two key entry locations** ... provide mounting flexibility.
- **Rugged, corrosion-resistant, high-impact glass-fibre reinforced housing** ... tolerates the most hostile environments.
- **High-strength stainless steel actuator key** ... tolerant to mechanical abuse without damage.
- **Individually-coded actuator key option (15,000 codes)** ... provides extra security in "high-risk" applications.
- **Three styles of actuator key** ... accommodate a wide variety of movable guards.
- **"Power-on" or "Power-off" latching option** ... for application versatility.
- **Built-in manual unlatching release (via special triangular key)** ... for easier installation.
- **"Padlockable" key** ... for added security during maintenance.
- **Meets rigid IEC, BG, VDE, UL & CSA standards.**



Two optional key entrances

AZM170zi AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS (Includes specified individually-coded actuator key)

Part Number	Contacts (with actuator key inserted)
Locking via spring. Unlocking via energizing of solenoid.	
AZM170-11zri-B1-*	1 NO & 1 NC
AZM170-02zri-B1-*	2 NC
AZM170-11zri-B5-*	1 NO & 1 NC
AZM170-02zri-B5-*	2 NC
AZM170-11zri-B6L-*	1 NO & 1 NC
AZM170-02zri-B6L-*	2 NC
AZM170-11zri-B6R-*	1 NO & 1 NC
AZM170-02zri-B6R-*	2 NC
Locking via energizing of solenoid. Unlocking via spring. (See Note 1 below)	
AZM170-11zria-B1-*	1 NO & 1 NC
AZM170-02zria-B1-*	2 NC
AZM170-11zria-B5-*	1 NO & 1 NC
AZM170-02zria-B5-*	2 NC
AZM170-11zria-B6L-*	1 NO & 1 NC
AZM170-02zria-B6L-*	2 NC
AZM170-11zria-B6R-*	1 NO & 1 NC
AZM170-02zria-B6R-*	2 NC

*Please specify solenoid operating voltage via addition of one of the following suffix codes:

Voltage	Add Suffix
24VAC/DC	-24VAC/DC
115VAC	-115VAC
230VAC	-230VAC

Example: AZM170-11zri-24VAC/DC designates a switch with a 24VAC/DC solenoid which unlocks upon energizing of solenoid.

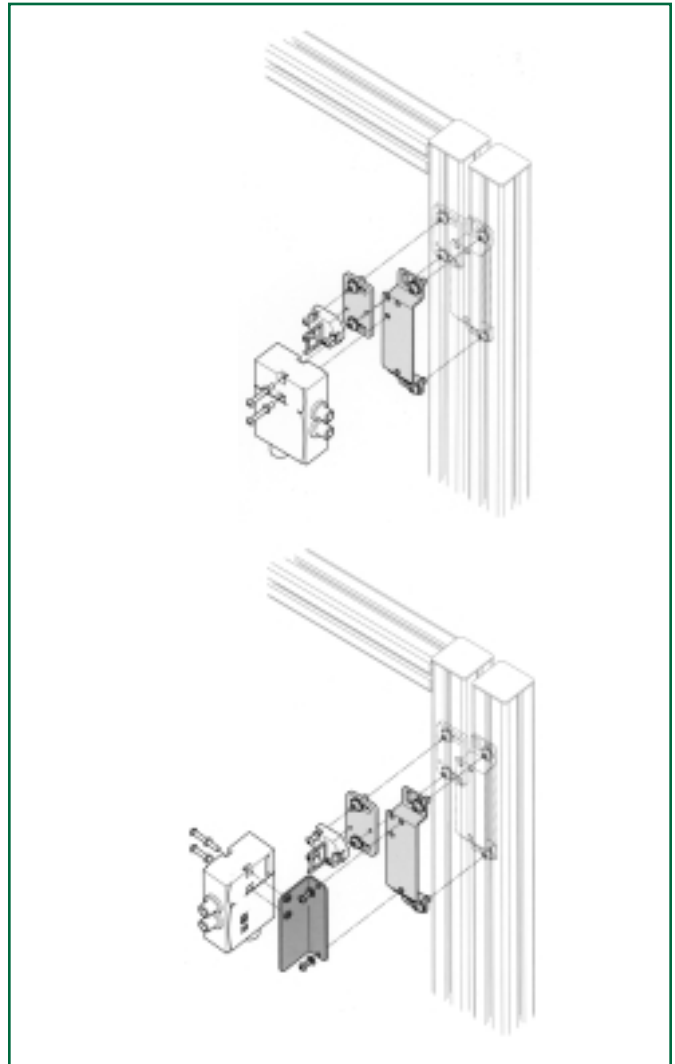
Note 1: Use of this model permits the guard to be opened in the event of a power failure. Generally accepted safety standards/practices suggest this model only be used after conducting a thorough risk evaluation in the context of the application.

ACTUATOR KEY DESCRIPTION & PREWIRING OPTION

Part Number	Description
B1	Standard key (7.87" minimum closing radius)
B5	Right-angle key (7.87" minimum closing radius)
B6L	Flexible, close-radius key for left-hand insertion (1.97" minimum closing radius)
B6R	Flexible, close-radius key for right-hand insertion (1.97" minimum closing radius)
AZM-KEY	Solenoid latch bypass/override key (for locking via spring models only)
MS AZM 170	Adjustable mounting kit (Eases installation and facilitates adjustments due to guard misalignment)
AZS2305	Fail-to-Safe Timer (Please see page 80)
FWS1205B	Fail-to-Safe Standstill Monitor (Page 80)

2

MS AZM 170 ADJUSTABLE MOUNTING KIT



AZM170zi TECHNICAL DATA

MECHANICAL SPECIFICATIONS

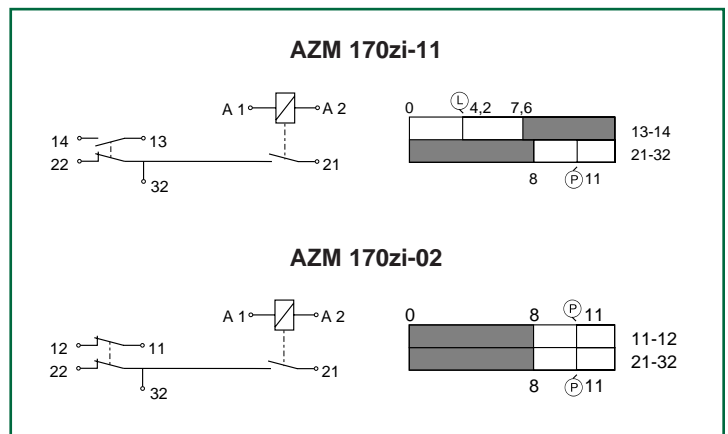
Housing	Glass-fibre reinforced, self-extinguishing thermoplastic
Actuator Key	Stainless steel
Degree of Protection	IP67
Unlocked Key Holding Force	30N (7 pounds)
Travel for Positive-Break	8 mm (0.315 inches)
Closing Force	Approx. 12N (2.7 pounds)
Locking Force	Approx. 1000N (225 pounds)
Operating Temperature	-22°F to +175°F
Solenoid Operating Temperature	-7°F to +140°F
Mechanical Life	> 10 ⁶ operations
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET, pr EN 1088 UL & CSA
Minimum Closing Radius	1.97" (with B6R and B6L actuating key) 7.87" (with B1 and B5 actuating key)

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Rating	4A/230VAC
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	6A (time-delay)
Rated Isolation Voltage	250V
Type Terminals*	Insulation displacement contacts & connector for 18AWG (0.75mm ²) flexible stranded wire
Solenoid Supply Voltages	24VDC/AC 115VAC 40-60 Hz 230VAC 40-60 Hz Max. 10 Watts

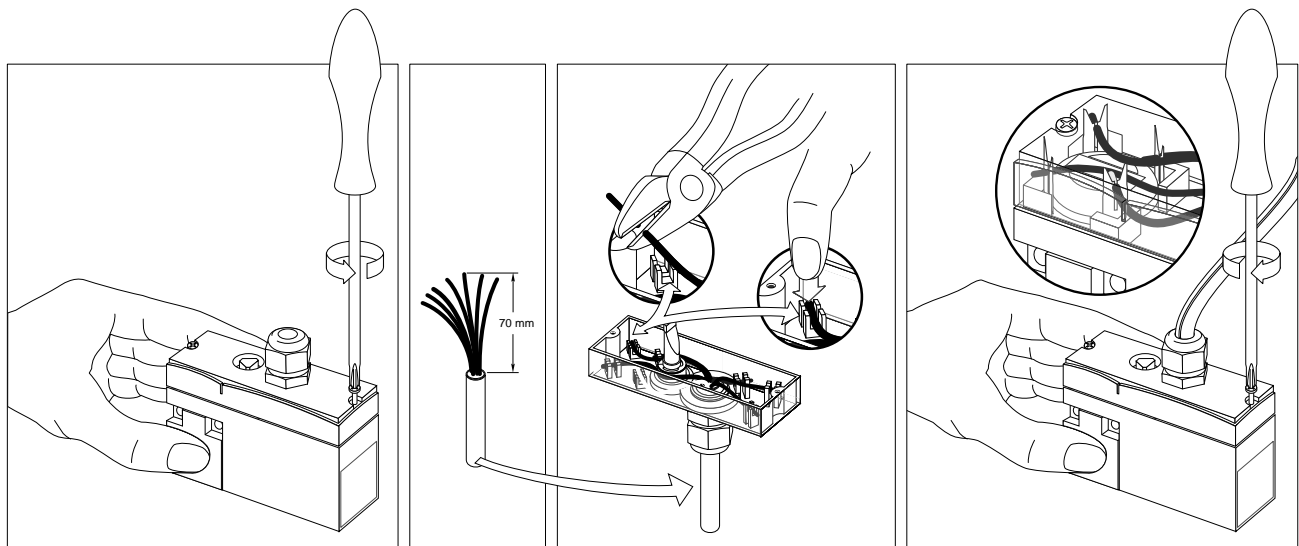
*Optional plug-in M12x1 quick-connect also available. Please consult factory.

SWITCHING DIAGRAMS & CONTACT SCHEMATICS



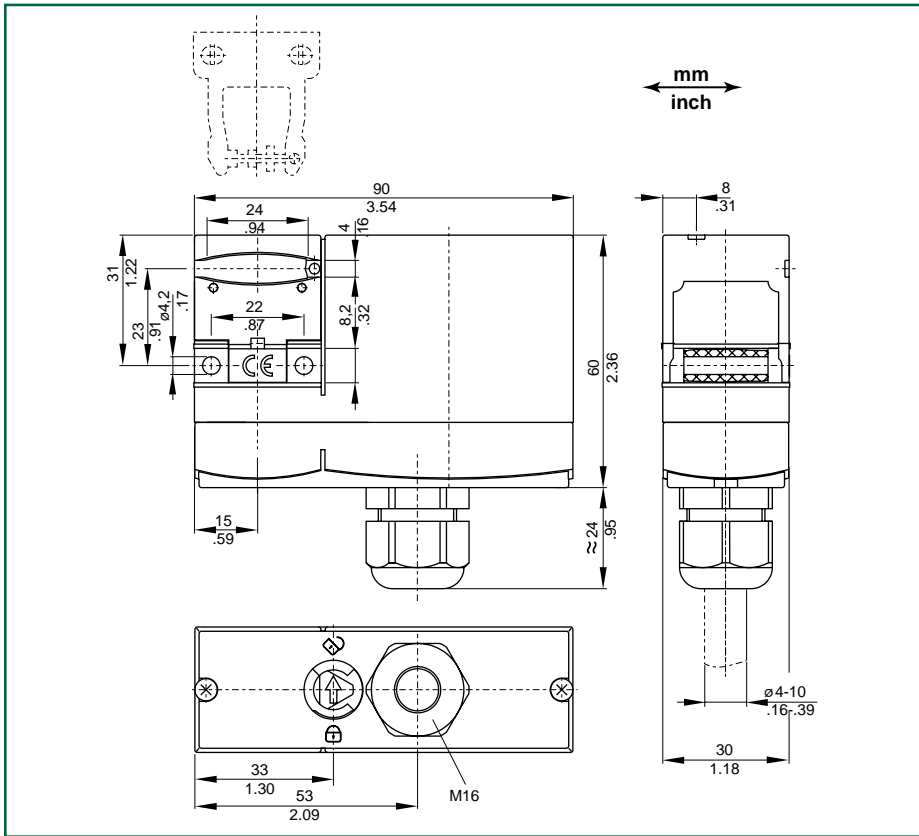
Note: Above diagrams are with actuator key inserted and solenoid de-energized.

Insulation Displacement Connector Terminations

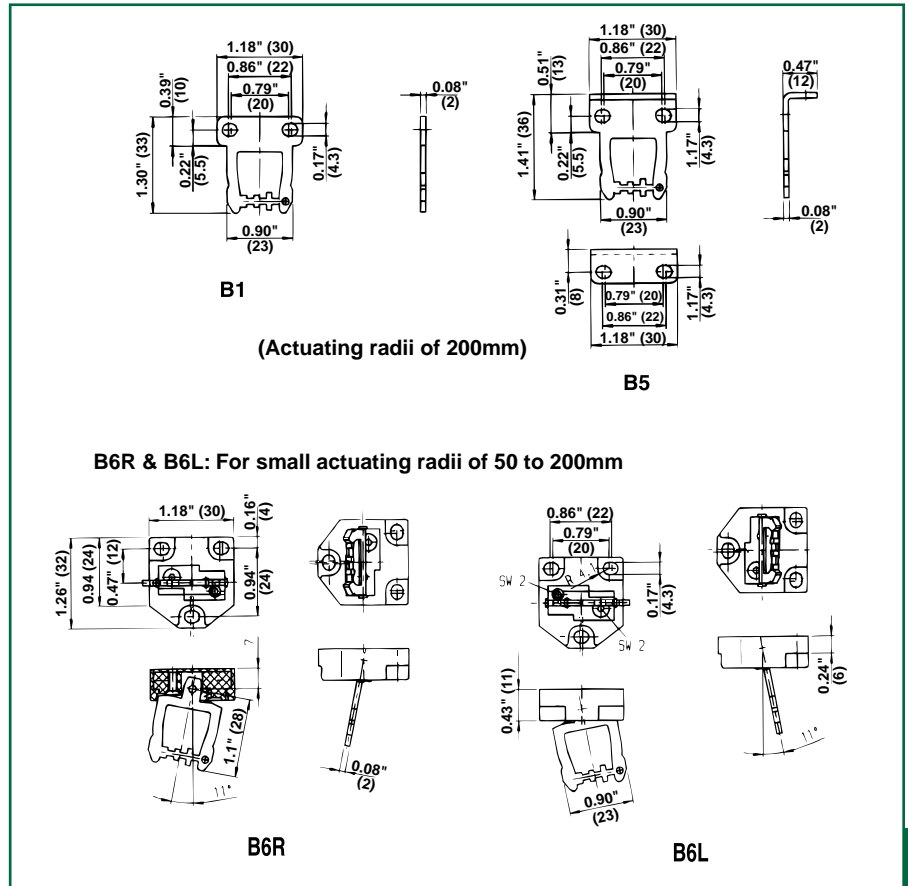


AZM170zi TECHNICAL DATA

DIMENSIONS



ACTUATING KEYS





Description

The AZM161 Series is designed for machines/work cells where access to a hazardous work area must be controlled until safe conditions exist. Their solenoid-latching feature permits locking a machine guard until dangerous conditions, which may exist immediately after removal of power, have abated. Solenoid-latching may be controlled by a time delay, motion detector, position sensor or other suitable component.

The unit features independent actuator key (guard) position and solenoid-latching monitoring contacts. These permit the prevention of machine restart until the guard is closed **and** the solenoid-latching pin is in the locked position.

The AZM161 consists of an electromechanical safety interlock switch with “positive-break” contacts and a locking actuator key. In addition, the solenoid mechanism features a NO and a NC solenoid-latching monitoring contact, and an auxiliary manual unlocking device ... the latter provided to aid in installation and for use in the event of a power failure (when using the “unlocking by solenoid” model).

Operation

The AZM161 electromechanical safety interlock switch assembly consists of a rugged switch-solenoid-latching mechanism and a geometrically-unique locking actuator key. The switch actuating key is typically mounted to a movable machine guard.

When the guard is closed, the actuating key is held in position by the solenoid-latching mechanism. The guard may only be opened by energizing or de-energizing (depending upon model) the solenoid-latching mechanism.

Upon opening of the guard, the switch’s “positive-break” NC contacts are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. The NO contacts close upon key removal.

The solenoid-latching mechanism circuit features a NO and a NC contact which permit monitoring its status. This NC contact is wired in series with the NC contact in the safety switch circuit. Thus the machine is prevented from starting until the actuating key is inserted (guard is closed) *and* the solenoid has locked it in the closed position.

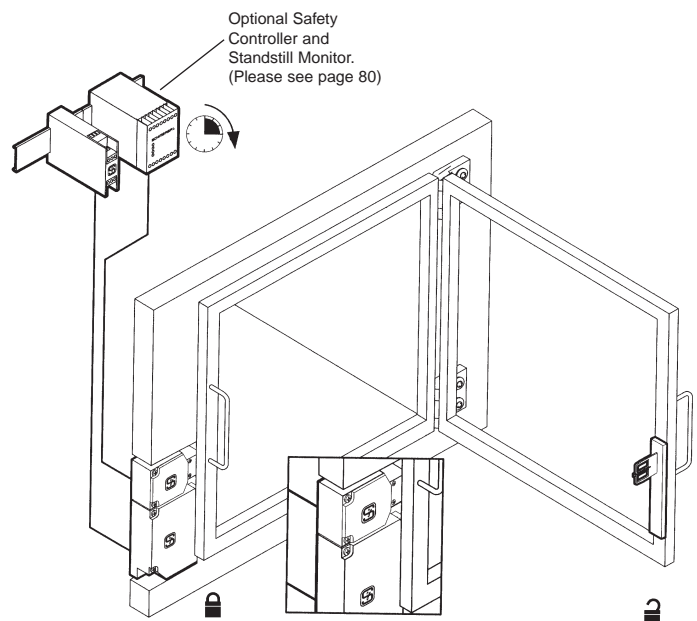
Features & Benefits

- **Solenoid-locking design** ... controls access to hazardous areas until safe conditions exist.
- **Highly tamper-resistant** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **“Positive-break” NC contacts** ... assure circuit interruption upon actuator key removal.
- **Conditional “safe” outputs** ... actuating key must be fully inserted and solenoid must be actuated to lock key before “closed” safety signal is provided.
- **Watertight design** ... meets IP67 environmental requirements.
- **High-strength, stainless-steel actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, corrosion-resistant housing** ... tolerates hostile environments.
- **Four optional key entry locations** ... provide installation flexibility.
- **Independent actuator key position and locking pin position monitoring contacts** ... provide a higher degree of safety.
- **Available in “solenoid-locking” and “solenoid-unlocking” models** ... for application versatility.
- **Meets rigid safety agency standards** ... IEC, BG and VDE (UL and CSA pending).
- **Wide selection of accessories** ... to meet diverse application requirements.

Typical Applications



The AZM161 is intended for use as a safety interlock switch on movable machine guards which must not be opened until dangerous conditions, which may exist after the removal of power, have abated. Such conditions are flywheel overrun, spindle momentum, unstable rest positions, etc. Typical applications are textile machines, stamping presses, articulating robot arms, mixing machines, metal working equipment, printing presses and packaging machinery.



AZM161 AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS (Includes 1/2" NPT Plastic Adapter. Actuator key sold separately)

Part Number	Contacts	Description
AZM161SK-24rk-*	2NO & 4 NC	Actuating key locked by spring and unlocked by energizing solenoid.
AZM161SK-33rk-*	3NO & 3 NC	
AZM161SK-12/12rk-**	2NO & 4 NC	
AZM161SK-24rka-*	2NO & 4 NC	Actuating key locked by energizing solenoid and unlocked by spring. (See Note 1 below)
AZM161SK-33rka-*	3NO & 3 NC	
AZM161SK-12/12rka-**	2NO & 4 NC	

*Please specify solenoid operating voltage via addition of one of the following suffix codes:

Voltage	Add Suffix
24VAC/DC	-24VAC/DC
115VAC	-115VAC
230VAC	-230VAC

**Please specify solenoid operating voltage via addition of one of the following suffix codes:

Voltage	Add Suffix
24VAC/DC	-24VAC/DC
110/230VAC	-110/230VAC

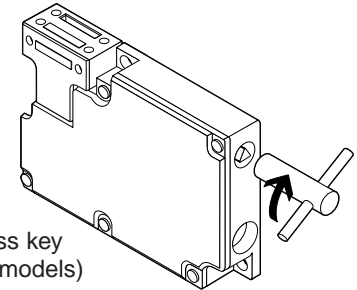
Example: AZM161SK-24rk-24VAC/DC

Note 1: Use of this model permits the guard to be opened in the event of a power failure. Generally accepted safety standards/practices suggest this model only be used after conducting a thorough risk evaluation in the context of the application.

POSITIVE-BREAK is a trademark of SCHMERSAL

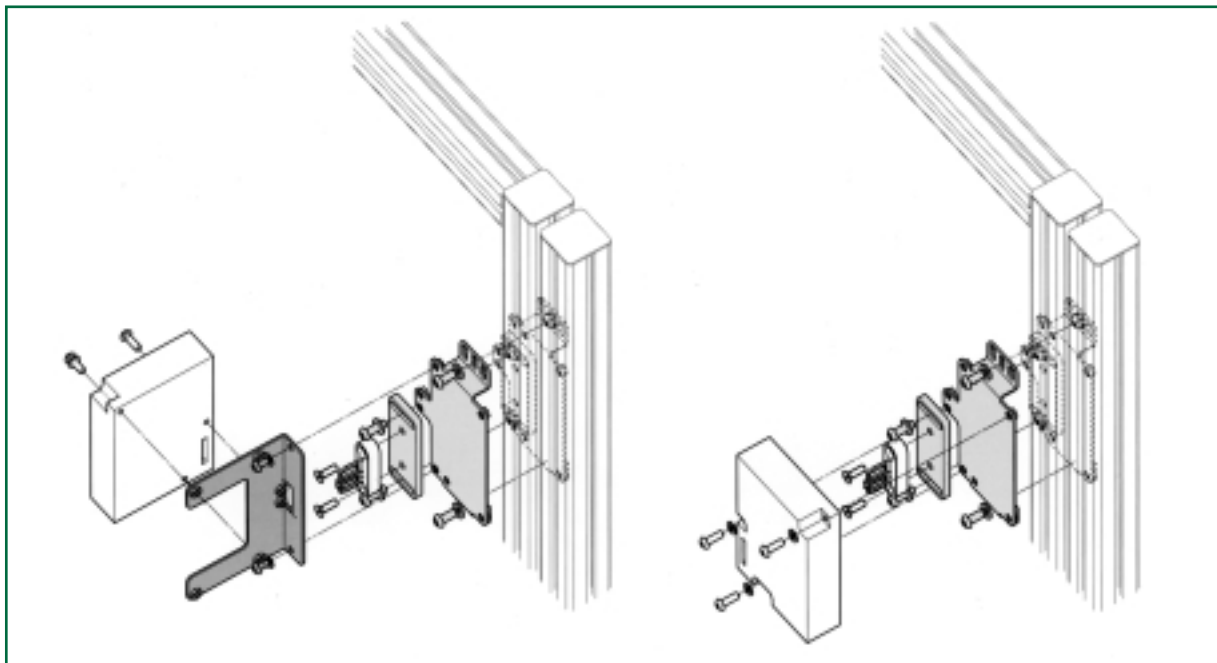
AVAILABLE KEYS & ACCESSORIES for AZM161 Keyed-Interlock Switches

Part Number	Description
AZM161-B1	Standard actuating key
AZM161-B1E	Standard actuating key with heavy-duty mounting bracket
AZM161-B6	Small radius actuating key
AZM161-B6-2177	Funnel entry adapter with elongated flexible-movement actuating key
AZM-Key	Solenoid-latch bypass key
M20-CG	Cord grip (cable gland)
M20-1/2"P	Plastic 1/2" NPT adapter (two supplied with basic unit)
M20-1/2"M	Metal 1/2" NPT adapter
PL-M20-24V	24VAC/DC pilot light kit
PL-M20-120V	120VAC/DC pilot light kit
Add suffix -1637 to basic part number	Gold contacts
MS AZM 161	Adjustable mounting kit (Eases installation and facilitates adjustments due to guard misalignment)
AZS2305	Fail-to-Safe Timer (Please see page 80)
FWS1205B	Fail-to-Safe Standstill Monitor (Page 80)



Solenoid-latch bypass key
(for locking via spring models)

MS AZM 161 ADJUSTABLE MOUNTING KIT



AZM161 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

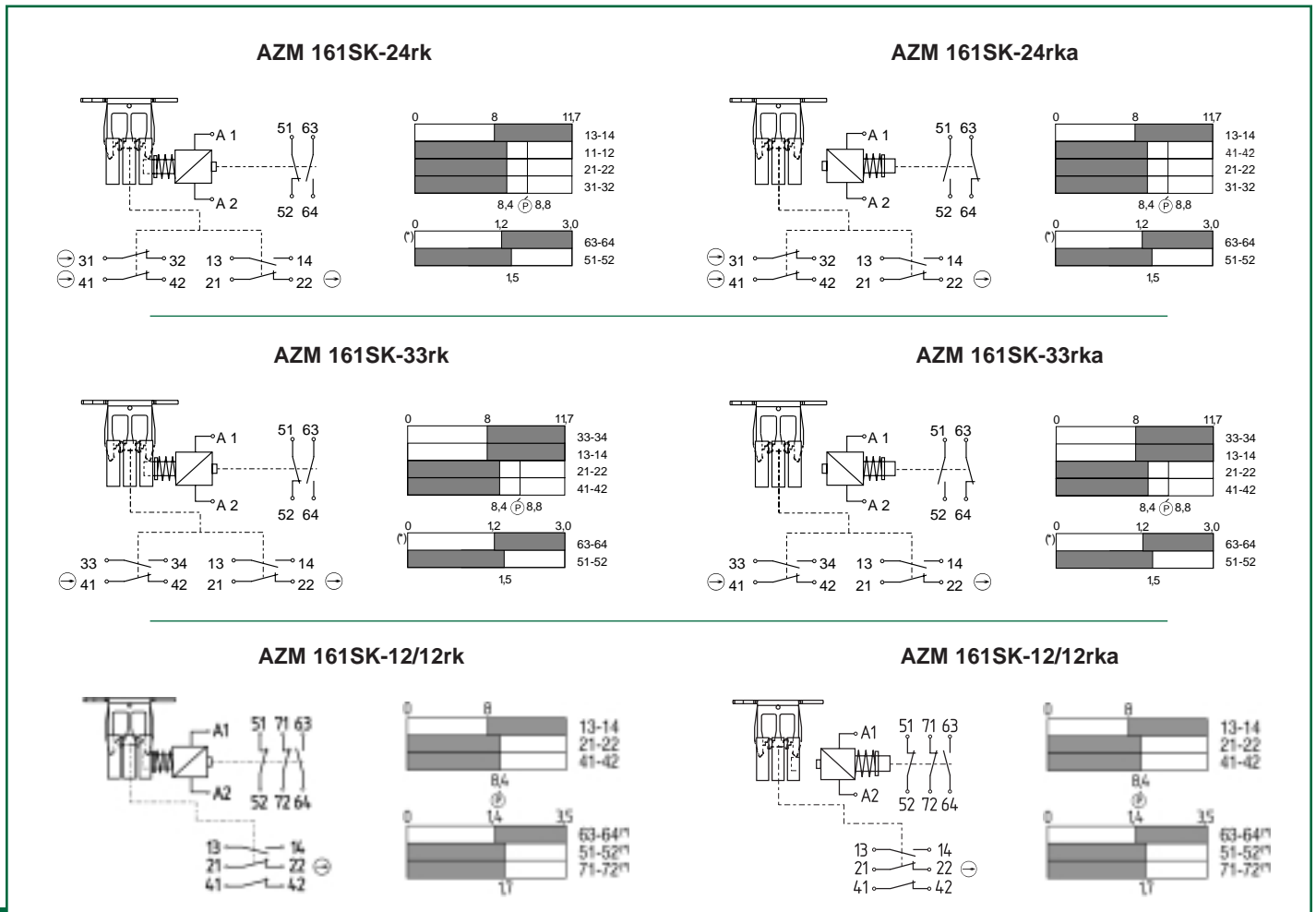
Housing	Glass-fibre reinforced self-extinguishing thermoplastic
Actuator Key	Stainless steel (defeat-resistant design)
Degree of Protection	IP67
Unlocked Holding Force	30N (7 pounds)
Travel for Positive-Break	8mm (0.315 inches)
Force to Reach Positive-Break	10N (Approx. 2.4 pounds)
Closing Force	Approx. 15 N (3.4 pounds)
Operating Temperature	-13°F to +104°F
Mechanical Life	1 million operations
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET-15 UL CSA
Solenoid Locking Force	2,000N (440 pounds)
Key Return Force	0N
Minimum Closing Radius	5.9" (150mm) with B1 and B1E actuating key 3.7" (95mm) with B6 actuating key

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Gap	2 x 2 mm (minimum)
Contact Rating	2A (230VAC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse 6A (time-delay)
Rated Insulation Voltage	250VAC
Rated Impulse Withstand Voltage	6kV
Type Terminals*	Screw terminals with self-lifting clamps for up to 13 AWG flexible stranded wire (2.5mm ²)
Available Solenoid Supply Voltages (Vs)	24VDC, 110VDC, 230VDC 24VAC/50Hz 115VAC/60Hz 230VAC/50Hz
Solenoid Power Consumption	10W (maximum)
Solenoid Duty Cycle	100%
Solenoid Pull-in Voltage	(0.85 to 1.1) Vs
Solenoid Drop-out Voltage	(0.2 to 0.75) Vs

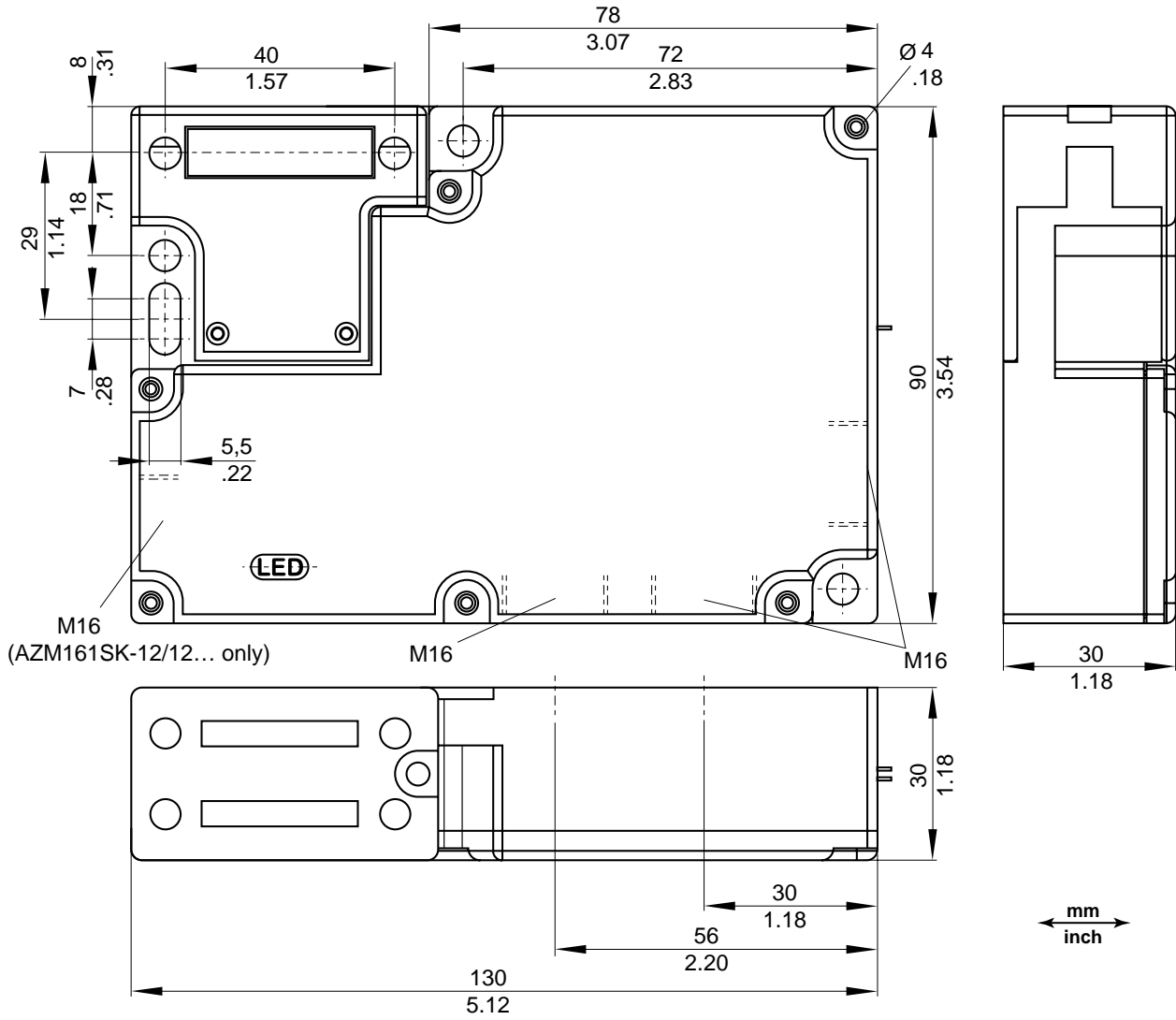
*Optional cage clamp terminations available.
Please consult factory.

SWITCHING DIAGRAMS & CONTACT SCHEMATICS (Solenoid-mechanism not energized)

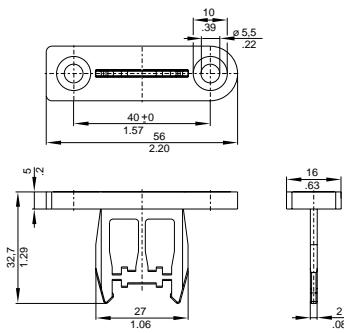


AZM161 TECHNICAL DATA

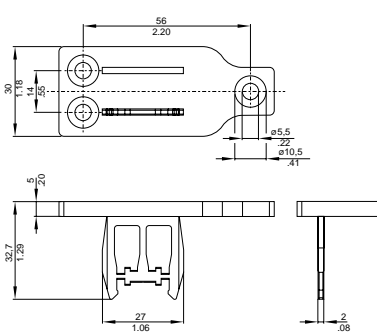
DIMENSIONS (Switch & Actuator Keys)



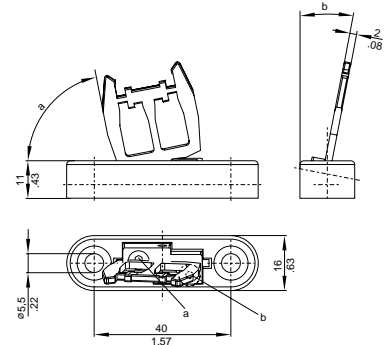
AZM161-B1

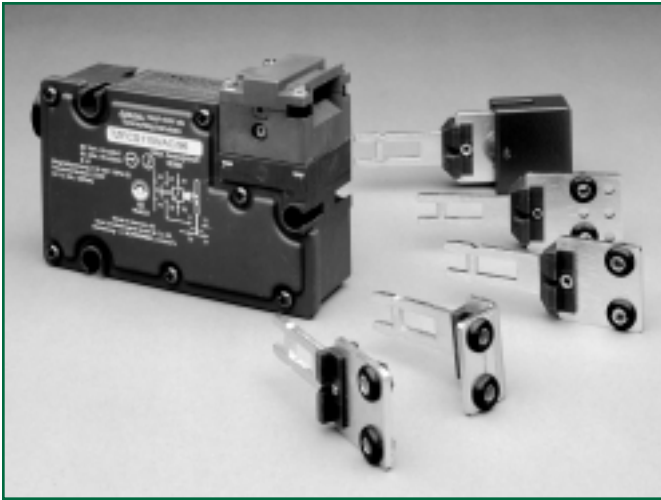


AZM161-B1E



AZM161-B6





Description

The TZF/TZM Series is designed for machines/work cells where access to a hazardous work area must be controlled until safe conditions exist. Their solenoid-latching feature permits locking a machine guard until dangerous conditions, which may exist immediately after removal of power, have abated. Solenoid-latching may be controlled by a time delay, motion detector, position sensor or other suitable component.

The unit features independent actuator key (guard) position and solenoid-latching monitoring contacts. These permit the prevention of machine restart until the guard is closed **and** the solenoid-latching pin is in the locked position.

The TZF/TZM Series consists of an electromechanical safety interlock switch with “positive-break” contacts and a locking actuator key. In addition, the TZFS model features an auxiliary manual unlocking device ... the latter provided to aid in installation and for use in the event of a power failure (when using the “unlocking by solenoid” model).

Operation

The TZF/TZM Series of electromechanical safety interlock switch assembly consists of a rugged switch, a solenoid-operated latching mechanism, and a geometrically-unique actuator key. The switch actuating key is typically mounted to a movable machine guard.

When the guard is closed, the actuating key is held in position by the latching mechanism. The guard may only be opened by energizing or de-energizing (depending upon model) the latching mechanism.

Upon opening of the guard, the switch’s “positive-break” NC contacts are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. The NO contacts close upon key removal.

The solenoid-latching mechanism circuit features a NO and a NC contact which permit monitoring its status. This NC contact is wired in series with the NC contact in the safety switch circuit. Thus the machine is prevented from starting until the actuating key is inserted (guard is closed) *and* the solenoid has locked it in the closed position.

Features & Benefits

- **Solenoid-locking & spring-locking designs** ... controls access to hazardous areas until safe conditions exist.
- **Highly tamper-resistant** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **“Positive-break” NC contacts** ... assure circuit interruption upon actuator key removal.
- **Conditional “safe” outputs** ... actuating key must be fully inserted and solenoid must be actuated to lock key before “closed” safety signal is provided.
- **Watertight design** ... meets IP67 environmental requirements.
- **High-strength, galvanized-steel actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, corrosion-resistant housing** ... tolerates hostile environments.
- **Three optional key entry locations** ... rotatable actuator head provides installation versatility.
- **Independent actuator key position and locking pin position monitoring contacts** ... provide a higher degree of safety.
- **Padlockable key** ... for added security during equipment maintenance.
- **Meets rigid safety agency standards** ... BG, UL, CSA.
- **Wide selection of actuating keys** ... to meet diverse application requirements.
- **Special types for food industry** ... please consult factory.

Typical Applications



The TZF/TZM Series is intended for use as a safety interlock switch on movable machine guards which must not be opened until dangerous conditions, which may exist after the removal of power, have abated. Such conditions are flywheel overrun, spindle momentum, unstable rest positions, etc. Typical applications are textile machines, stamping presses, articulating robot arms, mixing machines, metal working equipment, printing presses and packaging machinery.

SERIES TZF/TZM AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS

(Includes 1/2" NPT Plastic Conduit Adapter and TZ/CO Standard Actuator key)

Part Number	Contacts	Description
TZFCS/96-*	2NC & 1 NO (NC contacts in series)	Actuating key locked by spring and unlocked by energizing solenoid with right-side key entry. (Field-rotatable for entry from front or rear).
TZMC/96-*	2NC & 1 NO (NC contacts in series)	Actuating key locked by energizing solenoid and unlocked by spring with right-side key entry. (Field-rotatable for entry from front or rear). (See Note 1 below)

*Please specify solenoid operating voltage via addition of one of the following suffix codes:

Voltage	Add Suffix
24VDC	No Suffix
115VAC	-115
230VAC	-230

Example: TZMC/96-115

Note 1: Use of this model permits the guard to be opened in the event of a power failure. Generally accepted safety standards/practices suggest this model only be used after conducting a thorough risk evaluation in the context of the application.

OPTIONAL ACTUATOR KEYS & ACCESSORIES

Part Number	Description
TZ/CO	Standard straight actuator key (13" minimum closing radius)
TZ/CW	Right-angled straight actuator key (11.8" minimum closing radius)
TZ/COR	Radial entry actuator key (11.8" minimum closing radius)
TZ/CK	Short straight actuator key (6.3" minimum closing radius)
TZ/CWR	Right-angled bent actuator key (11.8" minimum closing radius)
TZ/COF/HIS.1	Pivoting straight actuator key (rear-mounted) (13.8" minimum closing radius)
TZ/COF/HIS.2	Pivoting straight actuator key (top-mounted) (13.8" minimum closing radius)
TZ/CORF/HIS.1	Pivoting straight actuator key (rear-mounted) (7.1" minimum closing radius)
TZ/CORF/HIS.2	Pivoting straight actuator key (top-mounted) (5.9" minimum closing radius)
TZ-65	Straight safety interlock auxiliary release key (for TZFCS/96 models only)
TZ-75	Right-angled safety interlock auxiliary release key (for TZFCS/96 models only)
AZS2305	Fail-to-Safe Timer (Please see page 80)
FWS1205B	Fail-to-Safe Standstill Monitor (Page 80)

SERIES TZF/TZM TECHNICAL DATA

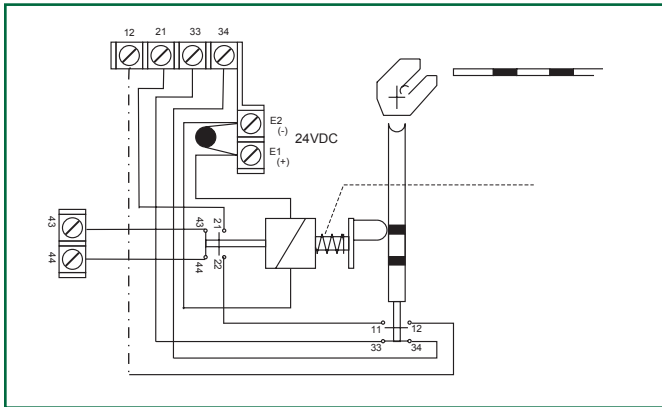
MECHANICAL SPECIFICATIONS

Housing	Glass-fibre reinforced self-extinguishing thermoplastic
Actuator Key	Galvanized steel (defeat-resistant design)
Degree of Protection	IP67
Unlocked Holding Force	20N (4.8 pounds)
Travel for Positive-Break	14.5 mm
Force to Reach Positive-Break	20N (Approx. 4.8 pounds)
Closing Force	Approx. 10 N (2.4 pounds)
Operating Temperature	-13°F to +104°F
Mechanical Life	2 million operations (minimum)
Shock Resistance	30g / 11ms
Vibration Resistance	20g / 10...55Hz
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-100 BG-GS-ET-15 UL CSA
Solenoid Locking Force	1,700N (380 pounds)
Minimum Closing Radius	Dependent upon actuator key used. Please see actuator key selection chart.

ELECTRICAL SPECIFICATIONS

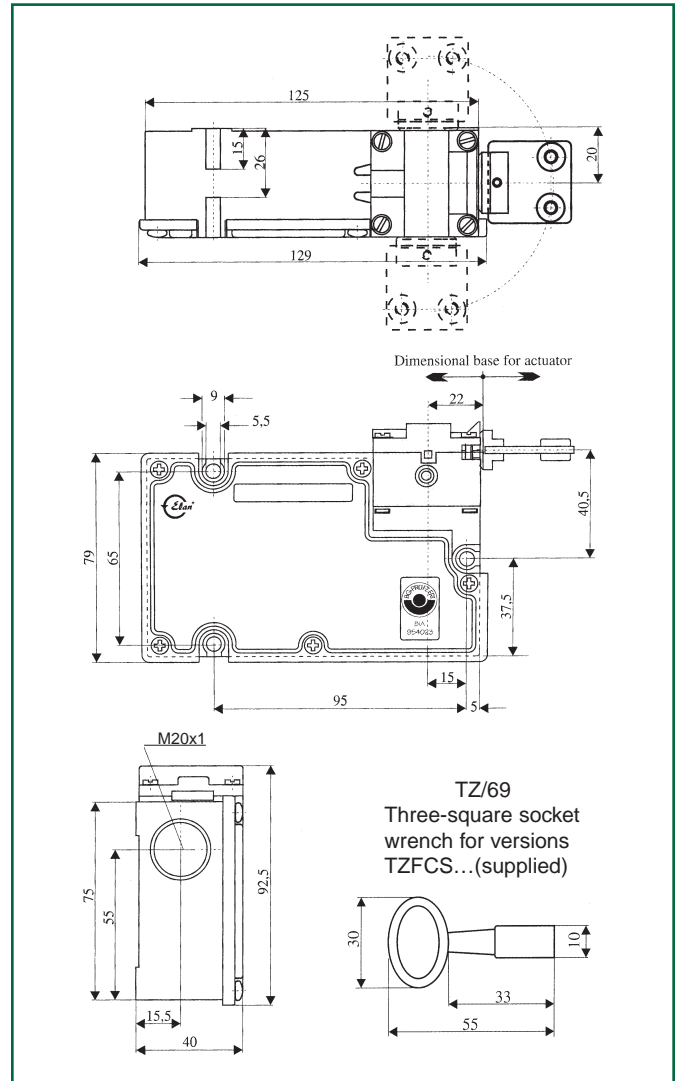
Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Gap	Guard monitoring: 2 × 3.5 mm Solenoid monitoring: 2 × 3 mm
Contact Rating	8A (250VAC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	10A (slow-blow)
Rated Insulation Voltage	250VAC
Rated Impulse Withstand Voltage	4kV
Type Terminals	Screw terminals with self-lifting clamps for up to 13 AWG solid wire (2.5mm ²) or 13 AWG stranded (1.5mm ²) wire
Available Solenoid Voltages	24VDC 115VAC 230VAC
Solenoid Power Consumption	8.8W (maximum)
Solenoid Duty Cycle	100%

WIRING DIAGRAM*



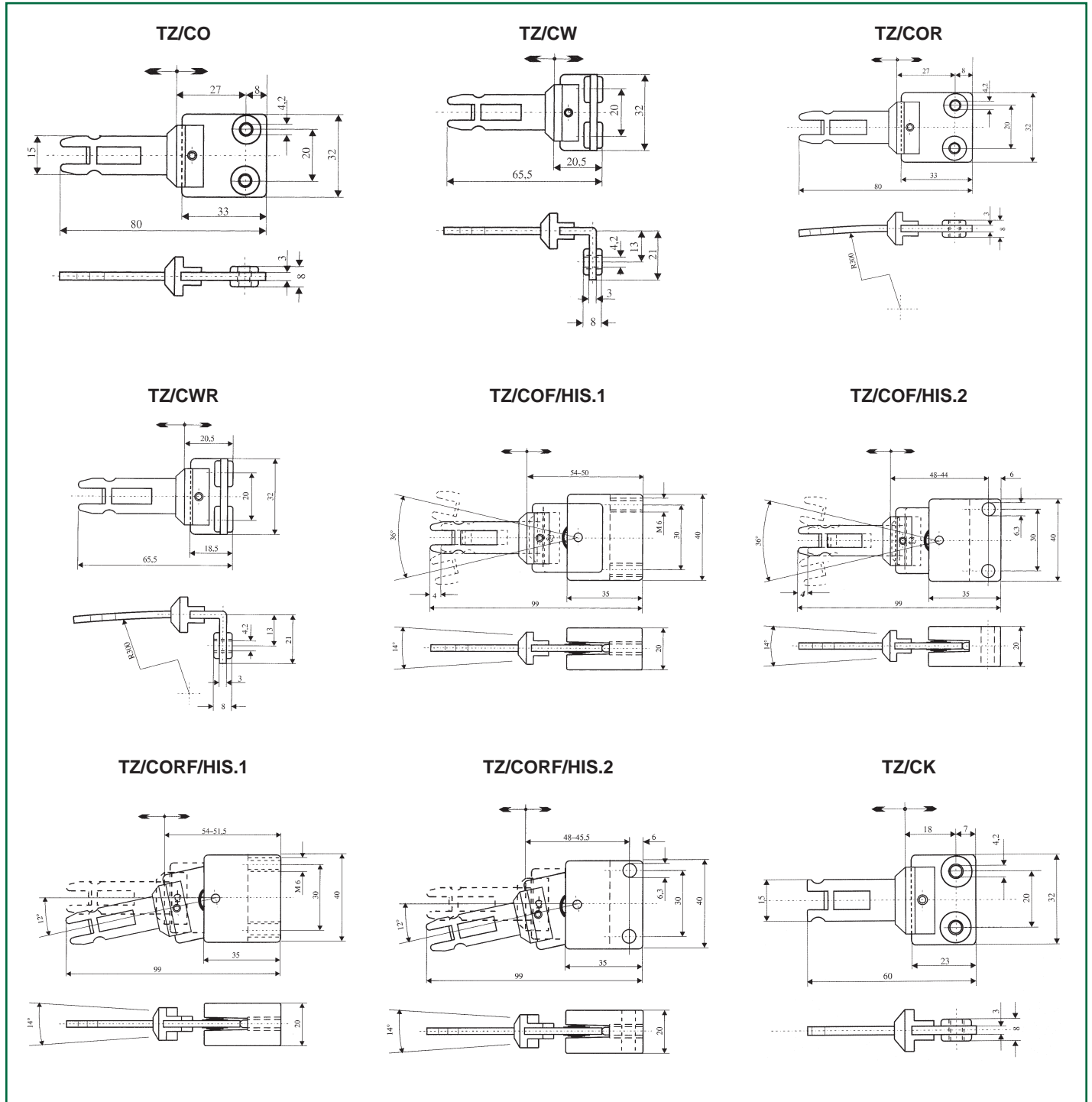
* Actuating key not inserted and solenoid unlocked.

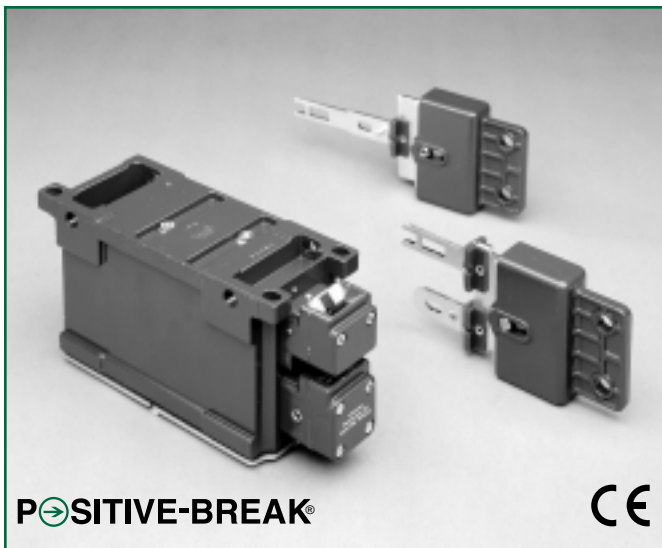
DIMENSIONS



SERIES TZF/TZM ACTUATOR KEY SPECIFICATIONS

ACTUATOR KEYS





Description

The TKF/TKM Series is designed for machines/work cells where access to a hazardous work area must be controlled until safe conditions exist. Their solenoid-latching feature permits locking a machine guard until dangerous conditions, which may exist immediately after removal of power, have abated. Solenoid-latching may be controlled by a time delay, motion detector, position sensor or other suitable component.

The unit features independent actuator key (guard) position and solenoid-latching monitoring contacts. These permit the prevention of machine restart until the guard is closed **and** the solenoid-latching pin is in the locked position.

The TKF/TKM Series consists of an electromechanical safety interlock switch with “positive-break” contacts and a locking actuator key. In addition, the TKFS model features an auxiliary manual unlocking device ... the latter provided to aid in installation and for use in the event of a power failure (when using the “unlocking by solenoid” model).

Operation

The TKF/TKM Series of electromechanical safety interlock switch assembly consists of a rugged switch, a solenoid-operated latching mechanism, and a geometrically-unique actuator key. The switch actuating key is typically mounted to a movable machine guard.

When the guard is closed, the actuating key is held in position by the latching mechanism. The guard may only be opened by energizing or de-energizing (depending upon model) the latching mechanism.

Upon opening of the guard, the switch’s “positive-break” NC contacts are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. The NO contacts close upon key removal.

The solenoid-latching mechanism circuit features a NO and a NC contact which permit monitoring its status. This NC contact is wired in series with the NC contact in the safety switch circuit. Thus the machine is prevented from starting until the actuating key is inserted (guard is closed) *and* the solenoid has locked it in the closed position.

Features & Benefits

- **Solenoid-locking & spring-locking designs** ... controls access to hazardous areas until safe conditions exist.
- **Highly tamper-resistant** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **“Positive-break” NC contacts** ... assure circuit interruption upon actuator key removal.
- **Conditional “safe” outputs** ... actuating key must be fully inserted and solenoid must be actuated to lock key before “closed” safety signal is provided (Series TKM).
- **Watertight design** ... meets IP67 environmental requirements.
- **High-strength, galvanized-steel actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, corrosion-resistant metal housing** ... tolerates hostile environments.
- **Three optional key entry locations** ... rotatable actuator head provides installation versatility.
- **Independent actuator key position and locking pin position monitoring contacts** ... provide a higher degree of safety.
- **Padlockable key** ... for added security during equipment maintenance.
- **Meets rigid safety agency standards** ... BG, UL, CSA.
- **Wide selection of actuating keys** ... to meet diverse application requirements.
- **Special types available for concealed installation** ... please consult factory.

Typical Applications



The TKF/TKM Series is intended for use as a safety interlock switch on movable machine guards which must not be opened until dangerous conditions, which may exist after the removal of power, have abated. Such conditions are flywheel overrun, spindle momentum, unstable rest positions, etc. Typical applications are textile machines, stamping presses, articulating robot arms, mixing machines, metal working equipment, printing presses and packaging machinery.

SERIES TKF/TKM AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS (Includes 1/2" NPT Conduit Adapter. Actuator key sold separately)

Part Number	Solenoid Operating Voltage	Contacts	Description
TKF/90	24VDC	2NC & 2 NO (NC contacts in series)	"Series" actuating key locked by spring and unlocked by energizing solenoid
TKF/*/90	115/230VAC (50/60Hz)		
TKM/90	24VDC	2NC & 2 NO (NC contacts in series)	"Series" actuating key locked by energizing solenoid and unlocked by spring (See Note 1 below)
TKM/*/90	115/230VAC (50/60Hz)		
TKF/R/90	24VDC	2NC & 2 NO (NC contacts in series)	"Parallel" actuating key (for right-hand insertion) locked by spring and unlocked by energizing solenoid
TKF/R*/90	115/230VAC (50/60Hz)		
TKM/R/90	24VDC	2NC & 2 NO (NC contacts in series)	"Parallel" actuating key (for right-hand insertion) locked by energizing solenoid and unlocked by spring (See Note 1 below)
TKM/R*/90	115/230VAC (50/60Hz)		
TKF/L/90	24VDC	2NC & 2 NO (NC contacts in series)	"Parallel" actuating key (for left-hand insertion) locked by spring and unlocked by energizing solenoid
TKF/L*/90	115/230VAC (50/60Hz)		
TKM/L/90	24VDC	2NC & 2 NO (NC contacts in series)	"Parallel" actuating key (for left-hand insertion) locked by energizing solenoid and unlocked by spring (See Note 1 below)
TKM/L*/90	115/230VAC (50/60Hz)		

* Insert 115 for 115VAC model
Insert 230 for 230VAC model

Note 1: Use of this model permits the guard to be opened in the event of a power failure. Generally accepted safety standards/practices suggest this model only be used after conducting a thorough risk evaluation in the context of the application.

ACTUATOR KEYS & ACCESSORIES

Part Number	Description
TK/R/90	Standard "Series" actuator key (For sliding guards only)
TK/RF/90	"Series" actuator key with telescopic section (For sliding guards only)
TK/P/90	"Parallel" actuator key for right- or left-hand insertion (10" minimum closing radius)
TK/PF/90	"Parallel" actuator key (with telescopic section) for right- or left-hand insertion (10" minimum closing radius)
AZS2305	Fail-to-Safe Timer (Please see page 80)
FWS1205B	Fail-to-Safe Standstill Monitor (Page 80)

SERIES TKF/TKM TECHNICAL DATA

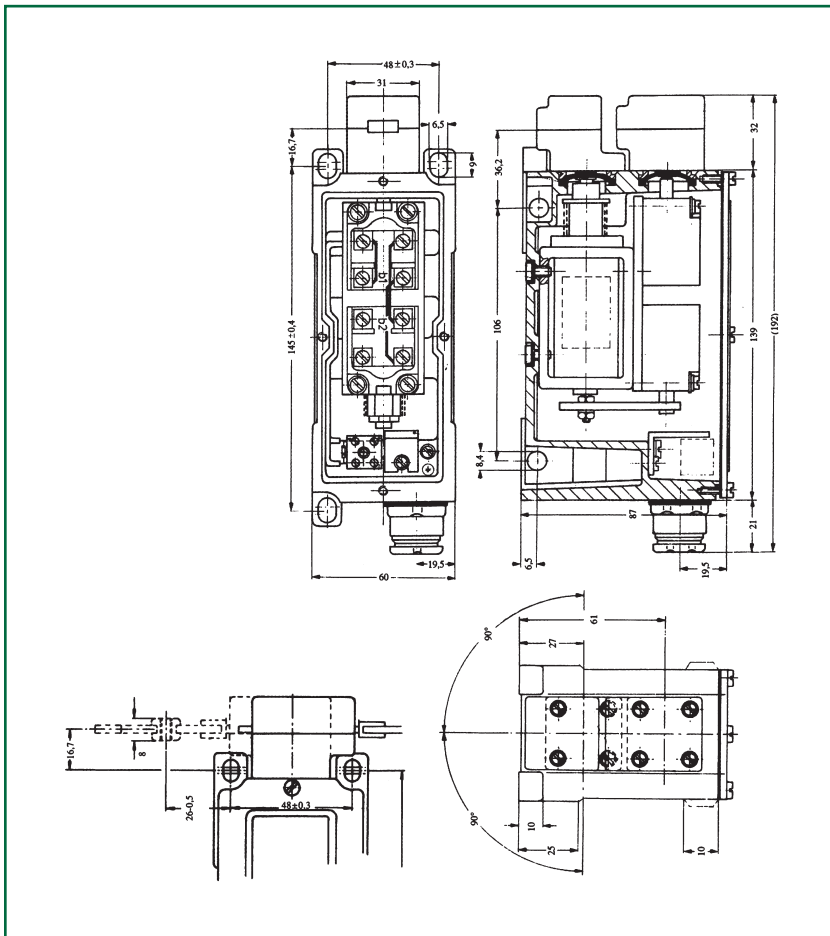
MECHANICAL SPECIFICATIONS

Housing	Cast aluminum, enamel finish
Actuator Key & Locking Bolt	Steel, chromated (defeat-resistant design)
Degree of Protection	IP67
Unlocked Holding Force	5N (1.2 pounds)
Travel for Positive-Break	72 mm ("Series" actuator) 38 mm ("Parallel" actuator)
Force to Reach Positive-Break	5N (Approx. 1.2 pounds)
Closing Force	Approx. 10 N (2.4 pounds)
Operating Temperature	32°F to 120°F
Mechanical Life	1 million operations (minimum)
Shock Resistance	30g / 18ms
Vibration Resistance	20g / 2...100Hz
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-100 BG-GS-ET-15 UL CSA
Solenoid Locking Force	2,000N (450 pounds)
Minimum Closing Radius	250mm ("Parallel" actuator)

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Gap	Guard monitoring: 2 × 3 mm Solenoid monitoring: 2 × 2 mm
Contact Rating	8A (250VAC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	10A (slow-blow)
Rated Insulation Voltage	250VAC
Rated Impulse Withstand Voltage	4kV
Type Terminals	Screw terminals with self-lifting clamps for up to 13 AWG solid wire (2.5mm ²) or 13 AWG stranded (1.5mm ²) wire
Available Solenoid Voltages	24VDC 115VAC/230VAC
Solenoid Power Consumption	12.0W (maximum)
Solenoid Duty Cycle	100%

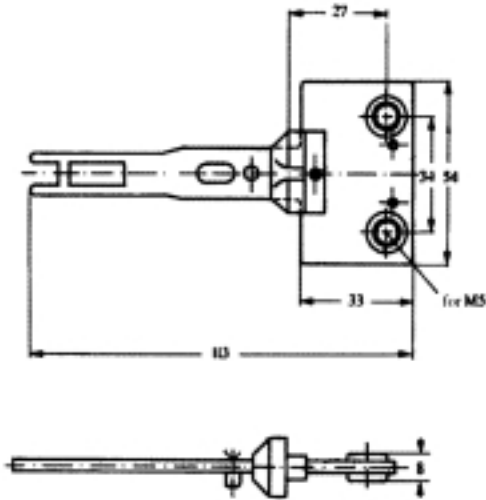
DIMENSIONS



SERIES TKF/TKM ACTUATOR KEY SPECIFICATIONS

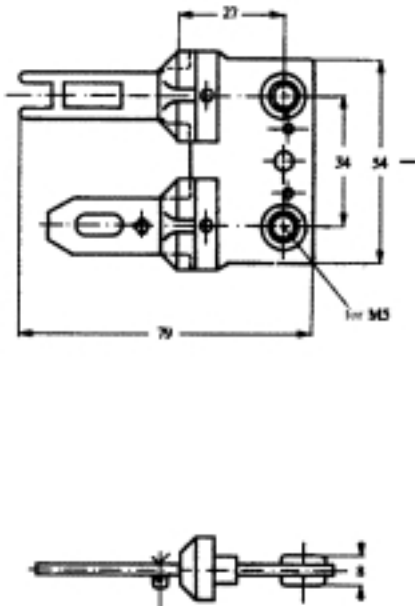
ACTUATOR KEYS

“Series” TK/R/90
(For sliding guards only)

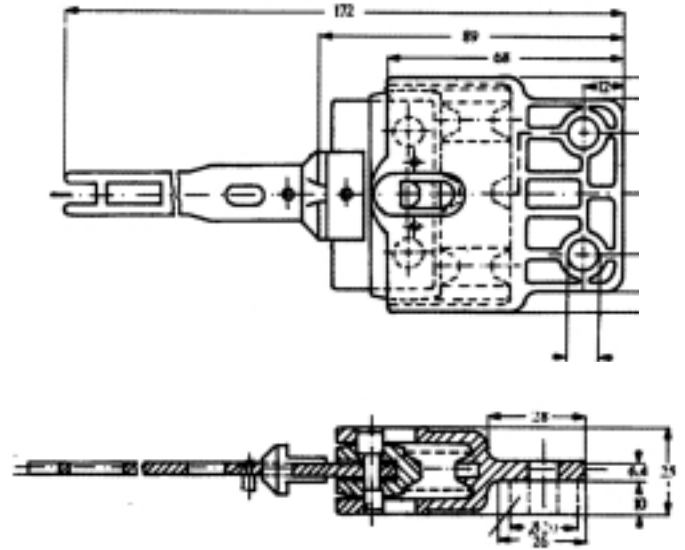


(For sliding guards only)

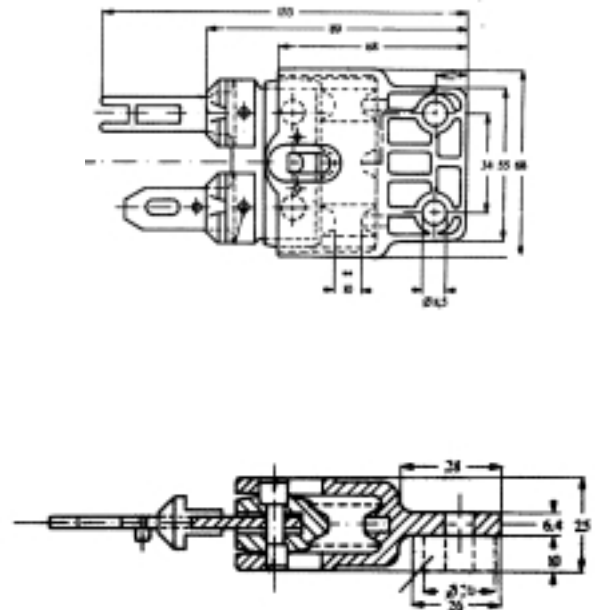
“Parallel” Actuator Key TK/P/90

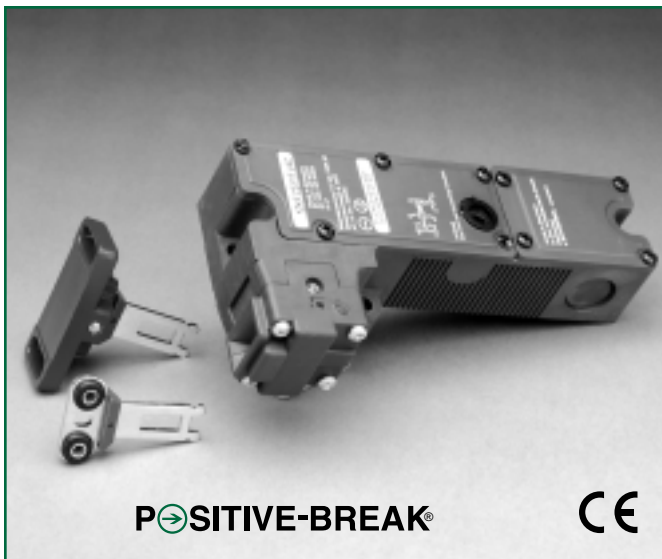


“Series” TK/RF/90 (With telescopic section)
(For sliding guards only)



“Parallel” Actuator Key TK/PF/90 (With telescopic section)





Description

The TZK Series is designed for machines/work cells where access to a hazardous work area must be controlled until safe conditions exist. Their solenoid-latching feature permits locking a machine guard until dangerous conditions, which may exist immediately after removal of power, have abated. Solenoid-latching may be controlled by a time delay, motion detector, position sensor or other suitable component.

The unit's contact arrangement permits the prevention of a machine restart until the guard is closed and in the locked position.

Each unit is supplied with a 1/2" NPT conduit adapter.

Operation

The TZK Series electromechanical safety interlock switch consists of a rugged switch with a solenoid-latching mechanism and a geometrically-unique actuating key. The switch actuating key is typically mounted to a movable machine guard.

When the guard is closed, the actuating key is held in position by the solenoid-latching mechanism. The guard may only be opened by energizing or de-energizing (depending upon model) the solenoid-latching mechanism.

Upon opening of the guard, the switch's "positive-break" NC contacts are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. The NO contacts close upon key removal.

Features & Benefits

- **Solenoid-locking design** ... controls access to hazardous areas until safe conditions exist.
- **Highly tamper-resistant** ... difficult to defeat with simple tools, tape, bent wires, etc. Reduces liability exposure.
- **"Positive-break" NC contacts** ... ensure circuit interruption upon key removal.
- **Watertight design** ... meets IP67 environmental sealing requirements.
- **Positive locking** ... integral mechanical interlock prevents solenoid latching until actuating key is fully inserted.
- **High-strength steel actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Available in "solenoid-locking" and "solenoid-unlocking" models** ... for application versatility.
- **Optional "floating" actuator key** ... tolerates up to 5mm of guard misalignment without damage.
- **Meets rigid safety agency standards** ... IEC, BG (UL and CSA pending)
- **Rotatable actuating head** ... four user-selectable 90° positions for installation flexibility.
- **Funnel entry** ... forgiving of minor guard misalignment.
- **Optional spring-loaded actuator keys** ... tolerates axial misalignment of guard.
- **Built-in key entry dust cover** ... prevents ingress of dirt and dust when key is removed.

Typical Applications



The TZK Series is intended for use as a safety interlock switch on movable machine guards which must not be opened until dangerous conditions, that may exist after the removal of power, have abated. Such conditions are flywheel overrun, spindle momentum, unstable rest positions, etc. Typical applications are textile machines, stamping presses, articulating robot arms, mixing machines, heavy working equipment, printing presses and packaging machinery.

SERIES TZK AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS

(Includes 1/2" NPT Adapter. Order desired actuator key separately)

Part Number*	Contacts (Guard Closed)	Description
TZKF/CS*	1 NO & 2 NC	Actuating key locked by spring and unlocked by energizing solenoid
TZKM/C*	1 NO & 2 NC	Actuating key locked by energizing solenoid and unlocked by de-energizing solenoid (See Note 1 below)

*Please specify solenoid operating voltage via addition of one of the following suffix codes:

Voltage	Add Suffix
24VDC	No Suffix
115VAC	-115VAC
230VAC	-230VAC

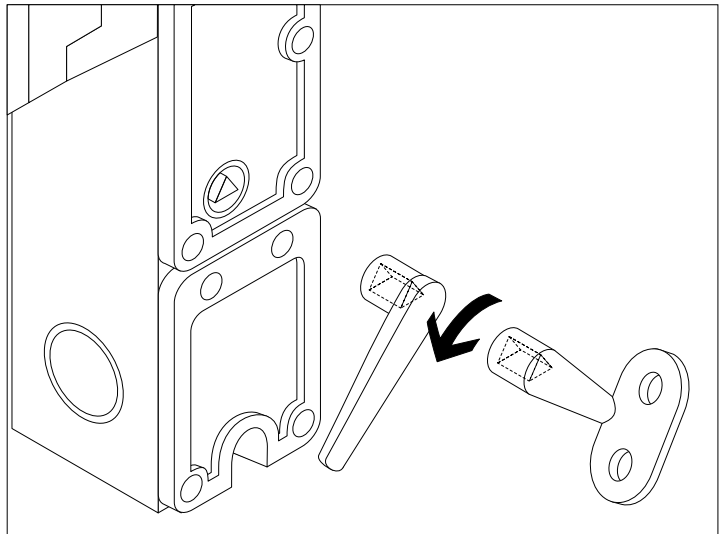
Example: TZKF/CS-115VAC

Note 1: Use of this model permits the guard to be opened in the event of a power failure. Generally accepted safety standards/practices suggest this model only be used after conducting a thorough risk evaluation in the context of the application.

ACTUATOR KEYS & ACCESSORIES

Part Number	Description
TZK/CO	Standard straight actuating key
TZK/CW	Standard right-angle actuating key
TZK/COF	Spring-loaded actuator key tolerates axial movement of +7.5°/-15° or -7.5°/+15° depending upon mounting orientation
TZK/CORF/7.5	Pre-tensioned, spring-loaded actuator key tolerates axial movement of +7.5° or -7.5° depending upon mounting orientation
TZK/CORF/15	Pre-tensioned, spring-loaded actuator key tolerates axial movement of +15° or -15° depending upon mounting orientation
TZK/APL	Mounting adapter plate facilitates easy alignment between actuating key and interlock
TZ-69	Standard straight auxiliary release key
TZ-75	Right-angle auxiliary release key
AZS2305	Fail-to-Safe Timer (Please see page 80)
FWS1205B	Fail-to-Safe Standstill Monitor (Page 80)

2



Auxiliary release keys
(for locking via spring models)

SERIES TZK TECHNICAL DATA

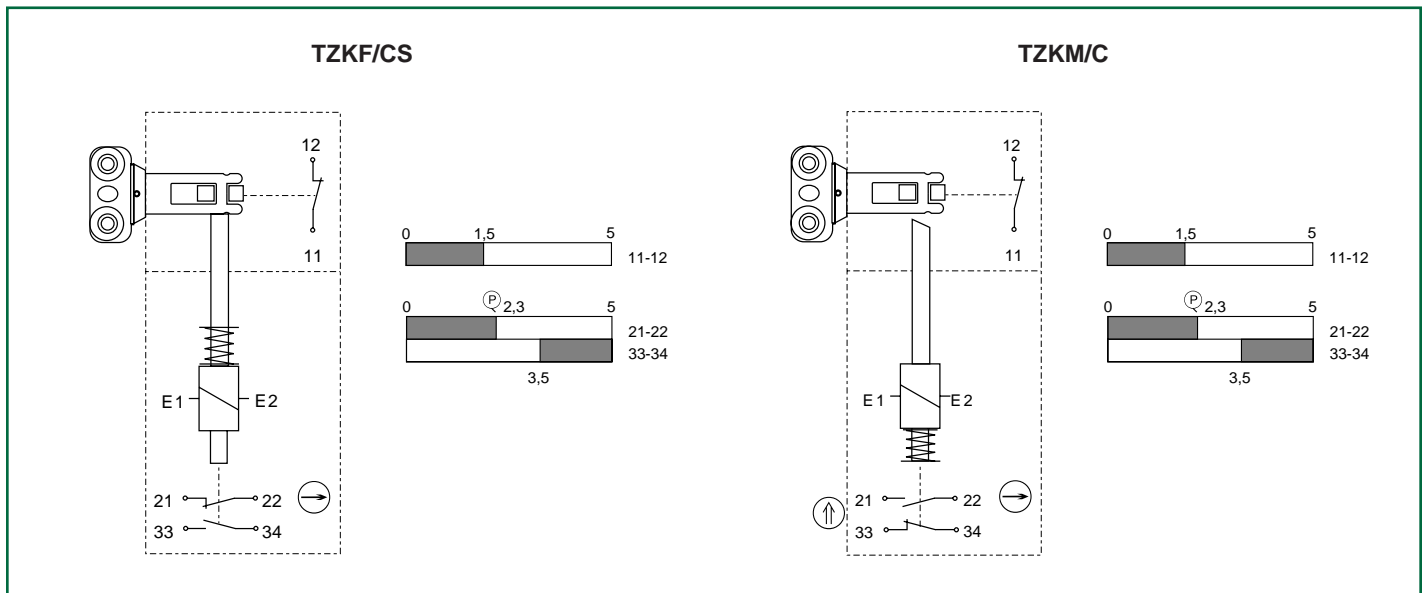
MECHANICAL SPECIFICATIONS

Housing	Glass-fibre reinforced, self-extinguishing thermoplastic
Actuator Key	Galvanized steel
Degree of Protection	IP67
Travel for Positive-Break	2.3mm
Key Insertion Force	10 N (2.2 pounds)
Key Holding Force (without solenoid-latching)	20 N (4.4 pounds)
Solenoid Locking Force	2,000N (440 pounds)
Operating Temperature	+32°F to +122°F (0°C to +50°C)
Mechanical Life	2 x 10 ⁶ Operations (minimum)
Mounting Orientation	Any position
Solenoid Override	Manual release from front surface
Slack Resistance	30g / 11ms
Vibration Resistance	20g / 10-55Hz
Switching Frequency	120 cycles/hour (maximum)
Conformity to Standards	IEC 947 EN 60947 DIN VDE 0660 EN 1088 UL & CSA
Minimum Closing Radius	6.9" (175mm) for CO and CORF actuating key 9.8" (250mm) for CW actuating key 5.9" (150mm) for COF actuating key

ELECTRICAL SPECIFICATIONS

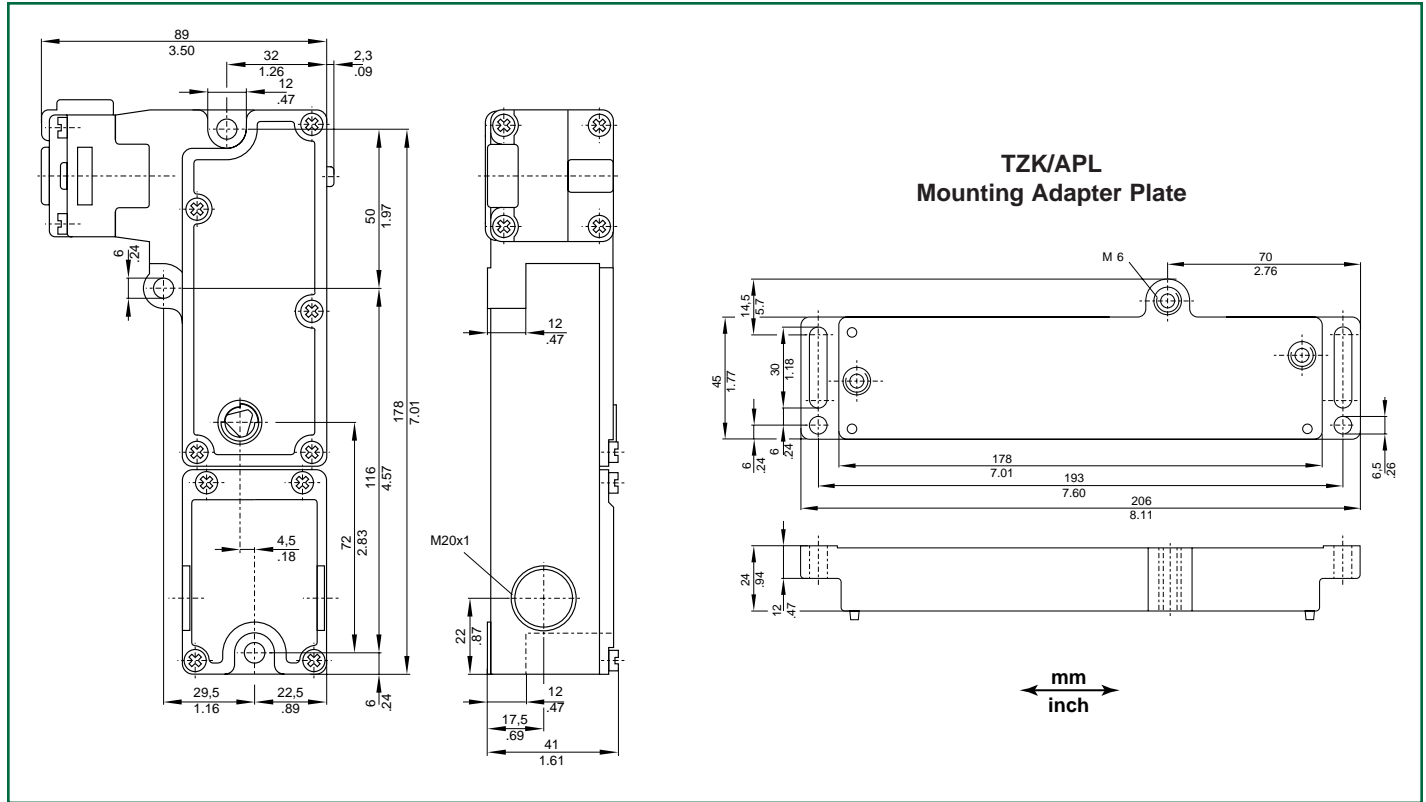
Contacts	Silver-plated, gold
Contact Configuration	Double-pole, double-break, electrically-separated contact bridges
Contact Rating	8A/115VAC, 15A/250VAC (AC 15) 13A/24VDC (DC13)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	10A
Rated Insulation Voltage	250VAC
Rated Impulse Withstand Voltage	2.5 KV
Type Terminals	Screw terminals with self-lifting cable clamps for up to 13AWG flexible stranded wire (1.5mm ²)
Available Solenoid Voltages	24VDC 115VAC/50-60 Hz 230VAC/50-60 Hz
Solenoid Power Consumption	10W (maximum)
Solenoid Duty Cycle	100%

SWITCHING DIAGRAMS & CONTACT SCHEMATICS

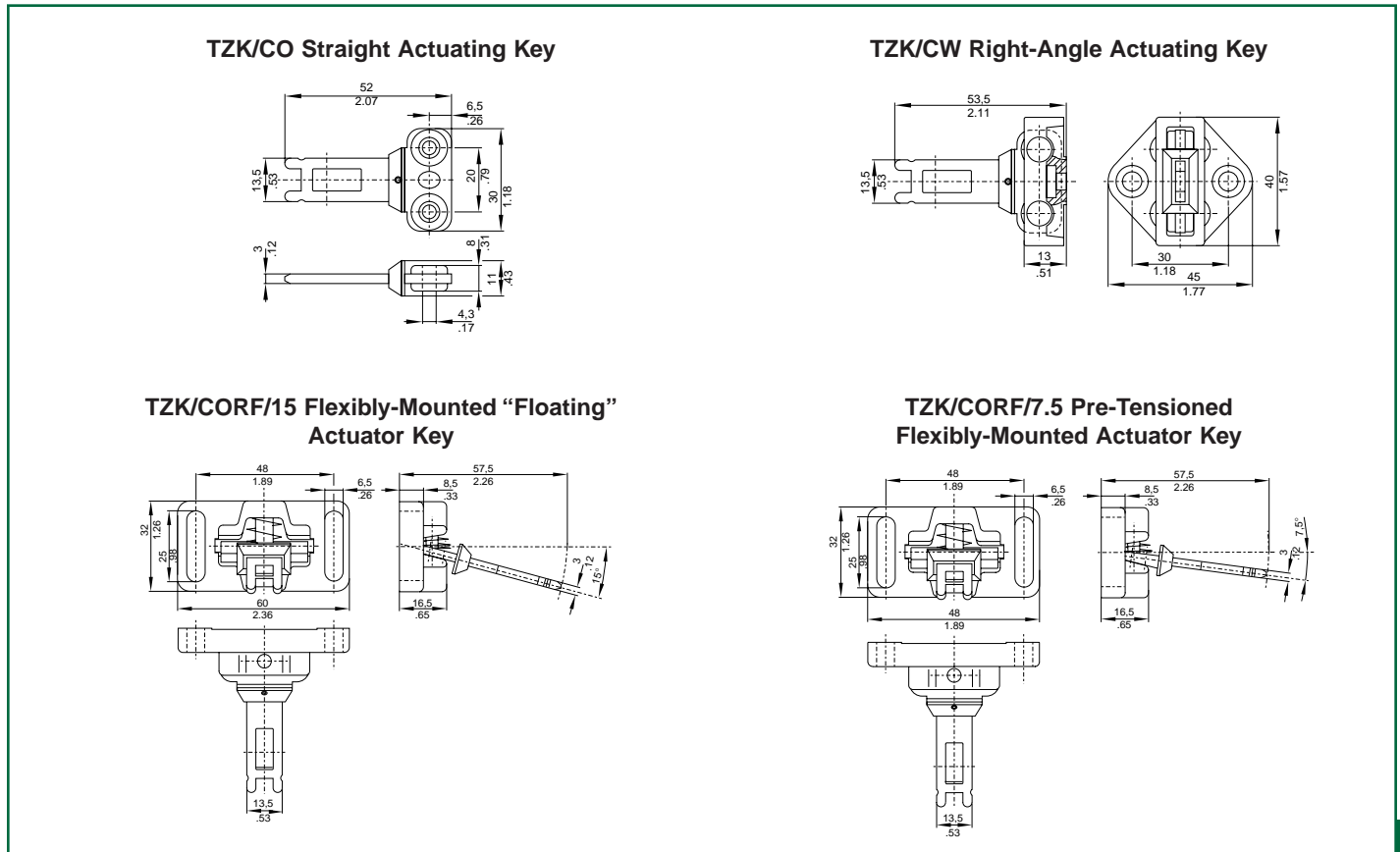


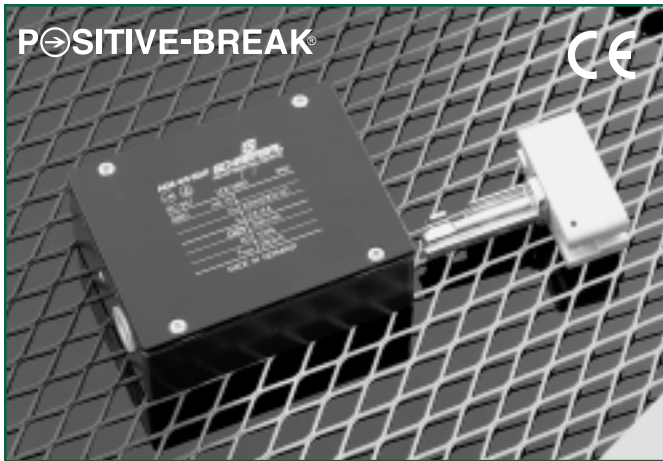
SERIES TZK TECHNICAL DATA

DIMENSIONS (Basic Switch & Optional Mounting Adapter Plate)



ACTUATOR KEY DIMENSIONS





Description

The AZM415 Series is designed for movable machine guards where access to a hazardous work area must be controlled until safe conditions exist. Their solenoid-latching feature permits locking a machine guard until dangerous conditions, which may exist immediately after removal of power, have abated. Solenoid-latching may be controlled by a time-delay, motion detector, position sensor or other suitable component.

Latching may occur upon energizing or de-energizing the solenoid — depending upon model. In addition the AZM415 features “positive-break” NC contacts, and an adjustable-force ball latch which maintains a holding force on the guard when the key is in the unlocked state.

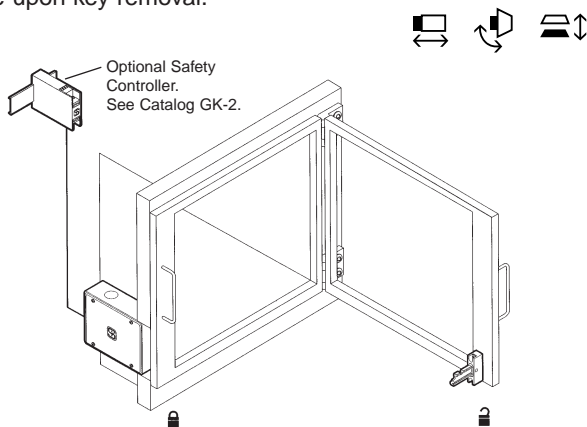
A two-key model is also available for guards which may be open in two directions (Model AZM415-33zpdk).

Operation

The AZM415 two-piece electromechanical safety interlock switch consists of a rugged switch and solenoid-latching mechanism and a geometrically-unique actuating key. The switch actuating key is typically mounted to a movable machine guard.

When the guard is closed, the actuator key is locked in position by a toggle-lever system. The guard may only be opened by energizing or de-energizing (depending upon model) the solenoid-latching mechanism.

Upon opening of the guard the switch’s “positive-break” NC contacts are forced to open through a direct (non-resilient) mechanical linkage with the actuating key. The NO contacts close upon key removal.



Features & Benefits

- **Solenoid-locking design** ... controls access to hazardous areas until safe conditions exist.
- **Highly tamper-resistant** ... difficult to defeat.
- **“Positive-break” NC contacts** ... assure circuit interruption upon actuator key removal.
- **Watertight design** ... meets IP67 washdown requirements.
- **High-strength, metal actuator key** ... tolerates mechanical abuse without damage.
- **Rugged, enamel-coated metal housing** ... tolerates the most hostile environments.
- **Adjustable actuator key holding force up to 110 pounds** ... permits use of switch as door latch.
- **Available in “solenoid-locking” and “solenoid-unlocking” models** ... for application versatility.
- **Meets rigid safety agency standards** ... UL, CSA, IEC, BG and VDE.
- **Industrial-strength locking force** ... up to 560 pounds.
- **Patented toggle-lever locking system** ... facilitates easy unlocking of (even heavily misaligned) guards.
- **Two-key model** ... for double-sided guards (AZM415-33zpdk).
- **Optional B4 Actuator Key** ... prevents unintentional guard closure.

AVAILABLE STANDARD MODELS (Actuator key sold separately ... see chart below)

Part Number	Contacts	Description
AZM415-22zpk-*	2 NO & 2 NC	Actuating key locked by spring and unlocked by energizing solenoid.
AZM415-22zпка-*	2 NO & 2 NC	Actuating key locked by energizing solenoid and unlocked by de-energizing solenoid.
AZM415-33-zpdk- (Dual-entry model. Two actuator keys required.)	3 NO & 3 NC	Actuating keys locked by spring and unlocked by energizing solenoid.
AZM415-33-zpdka- (Dual-entry model. Two actuator keys required.)	3 NO & 3 NC	Actuating keys locked by energizing solenoid and unlocked by de-energizing solenoid.

*Please specify solenoid operating voltage via addition of one of the following suffix codes:

Voltage	Add Suffix
24VAC/DC	-24VAC/DC
120VAC	-120VAC

ACTUATING KEYS & ACCESSORIES

Description	Part Number
Linear entry actuator key (For sliding lift-off guards)	AZM415-B1
Small radius (250mm) x-axis entry actuator key (For hinged guards)	AZM415-B2
Small radius (250mm) y-axis entry actuator key (For hinged guards)	AZM415-B3
Slide bolt actuator key (For sliding guards)	AZ/AZM415-B4pS
Safety door handle assembly (Please see page 82)	AZ/AZM415-B30-XX
Fail-to-Safe Timer	AZS2305 (Page 80)
Fail-to-Safe Standstill Monitor	FWS1205B (Page 80)

AZM415 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Die-cast aluminum with brown enamel finish
Actuator Key	Die-cast aluminum
Degree of Protection	IP67
Travel for Positive-Break	5mm (0.2 inches)
Force to Reach Positive-Break	Depending upon ball catch setting (3.5 pounds minimum)
Solenoid Locking Force	560 pounds
Actuator Key Holding Force	Adjustable, 2.2 to 110 pounds
Operating Temperature	-13°F to +175°F
Mechanical Life	1 million operations
Conformity to Standards	IEC 947-5-1 BG-GS-ET-19 VDE 0660 UL CSA
Minimum Closing Radius	9.8" (250mm)

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically separated contact bridges
Contact Gap	2mm x 2mm
Contact Rating	4A (230VAC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse 6A (slow-blow)
Rated Insulation Voltage	250VAC
Rated Impulse Withstand	4kV
Type Terminals	Screw terminals with self-lifting clamps for up to 13AWG flexible stranded wire (1.5 mm ²)
Available Solenoid Supply Voltages (Vs)	24VAC/DC 115VAC/60Hz 230VAC/50Hz
Solenoid Power Consumption	10W (maximum)
Solenoid Duty Cycle	100%

2

WIRING SCHEMATICS & SWITCHING DIAGRAMS

Solenoid De-energized

Spring to lock
(Closed and locked position)
AZM415-22zpk

Solenoid De-energized

Power to lock
(Closed and unlocked position)
AZM415-22zpk

Solenoid De-energized

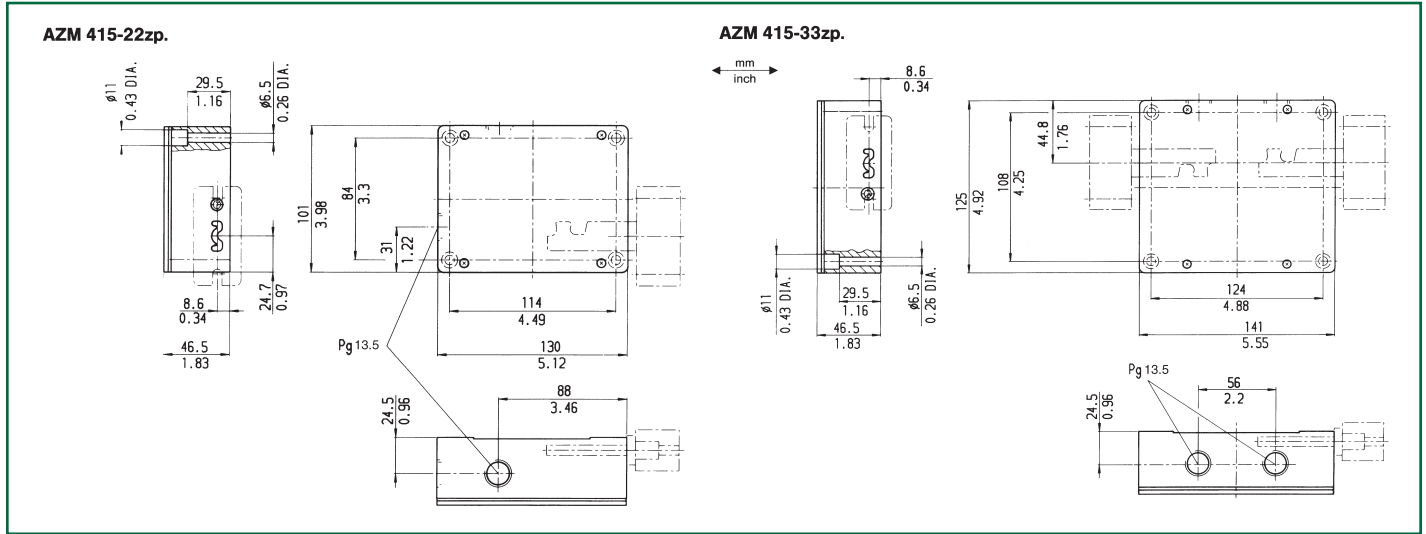
Spring to lock
(Closed and locked position)
AZM415-33zpdk

Solenoid De-energized

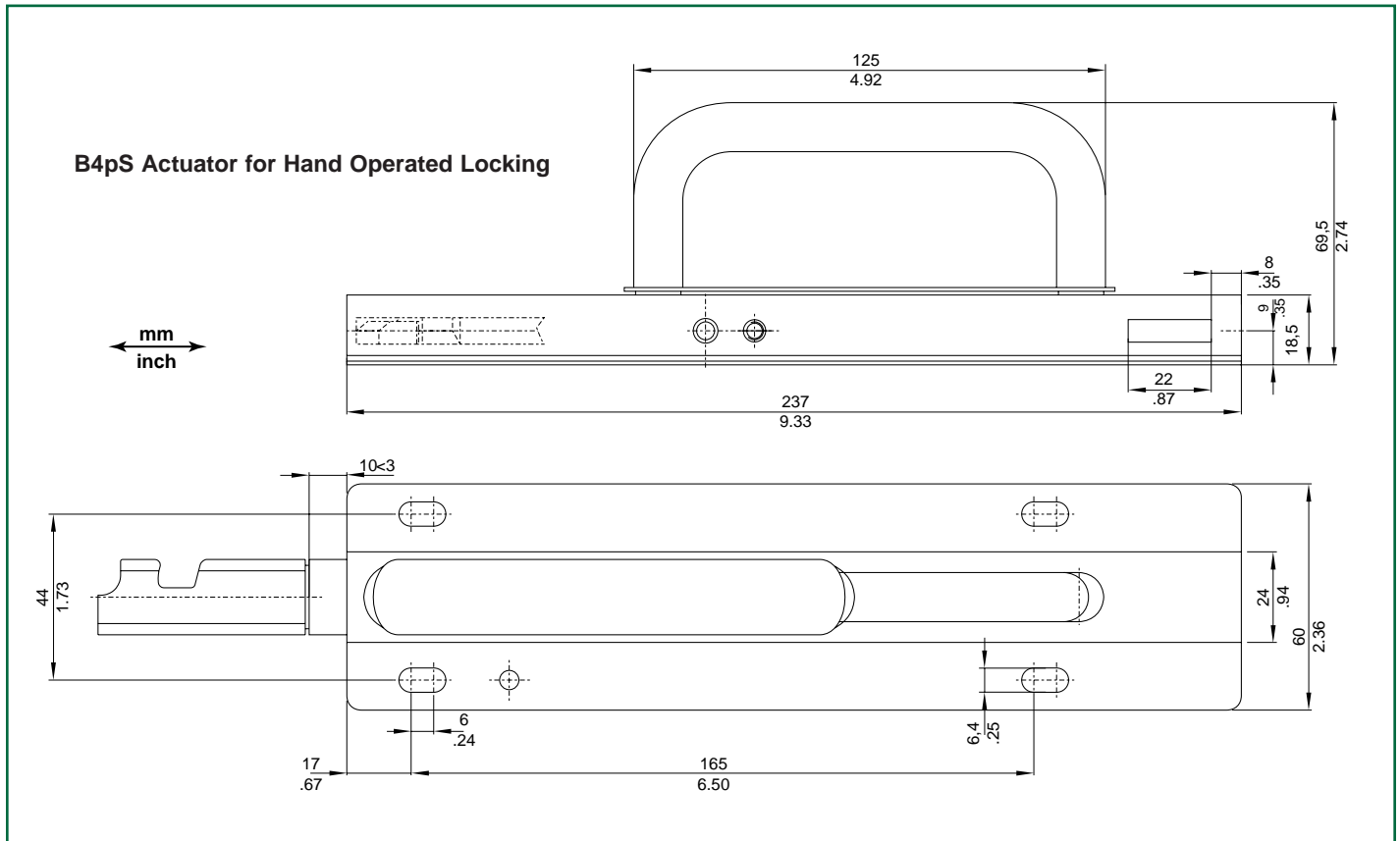
Power to lock
(Closed and unlocked position)
AZM415-33zpdk

AZM415 TECHNICAL DATA

DIMENSIONS



ACTUATOR KEY DIMENSIONS



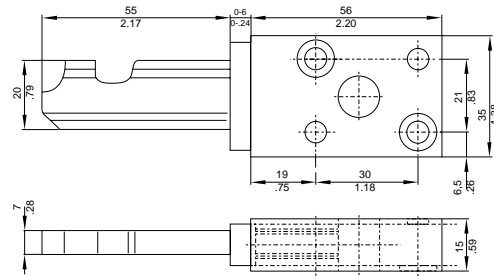
Hand operated locking actuator

The hand operated lock bolt with hold-back spring has the following advantages:

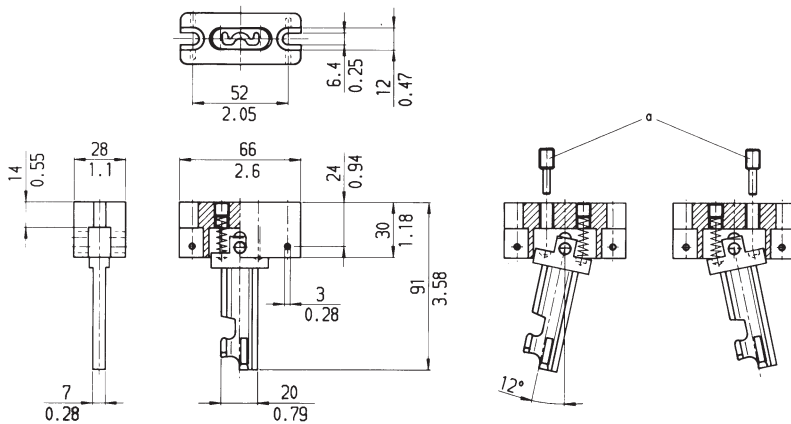
1. No further mechanical expenditures such as handles or levers are necessary.
2. The shearing forces on the actuator is 25,000 N (5,500 lbs.).
3. Simple installation of the unit.
4. Observing the actuating radius is not necessary.
5. An open guard door cannot fall shut and lock, causing the switch to be actuated. The door must be manually closed and locked.
6. The hold back spring also ensures that the actuator is held inside the housing preventing any damage to the actuator.
7. To insure personal safety when hazardous conditions are present, three holes are provided for padlocking which prevents the door from being locked.

AZM415 TECHNICAL DATA

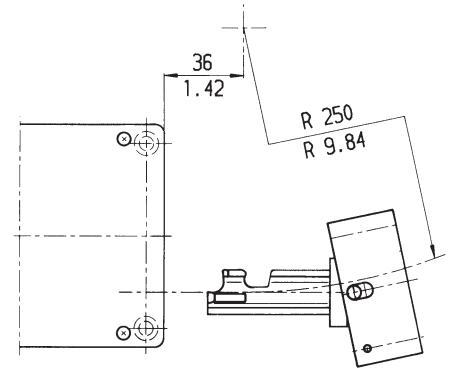
ACTUATOR KEY DIMENSIONS



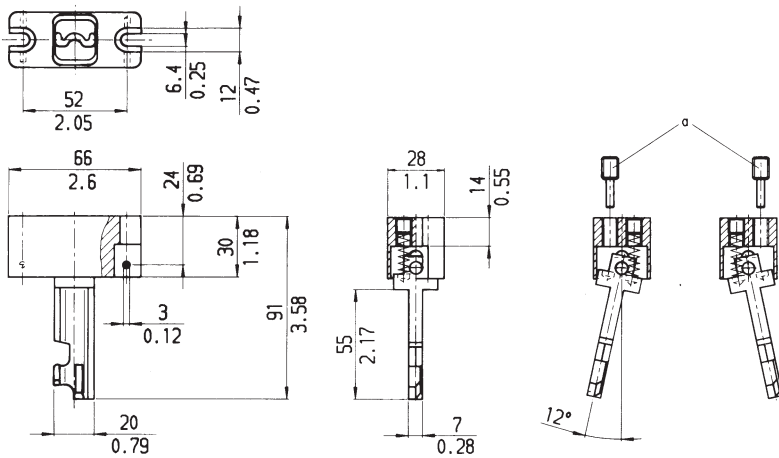
B1 Actuator



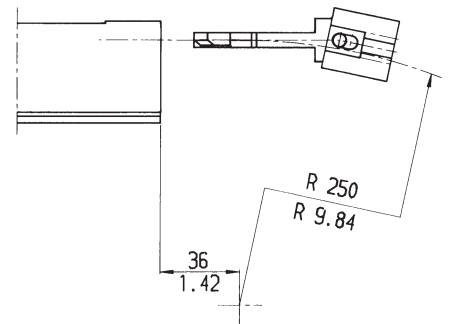
B2 Actuator



B2 Actuating radii
For hinged doors over the wide edge of the actuator



B3 Actuator



B3 Actuating radii
For hinged doors over the small edge of the actuator

Dowel holes are also provided in the actuator body. With the use of dowel pins the removal of the actuator can be prevented.

By turning the adjusting screw "a," the actuator can be brought into any desired position.

Both actuators can also be used on sliding doors.

SOLENOID-LATCHING INTERLOCK SWITCH SAFETY SYSTEM ACCESSORIES

AZS2305
Fail-to-Safe Timer



CHARACTERISTICS

Operating Voltage (Ue)	24VDC ±15% 110VAC 230VAC
Operating Current (Ie)	0.1A
Control Category	3
Monitored Inputs	1 NO & 1 NC (hard contacts)
Enabling Contacts	3
Signaling Outputs	2 Semiconductor
Contact Load Capacity	max. 250VAC max. 3A
Termination	Screw terminals
Cable size	max. 4mm ²
Timing range	Adj. from 100ms to 99 minutes
Timing tolerance	<2%
Agency recognition	UL, CSA, BG
Dimensions	55mm x 75mm x 110mm
Standards	EN954-1, EN1088, IEC60204-1, BG-GS-ET-20

AVAILABLE MODELS

Model Number	Supply Voltage
AZS2305-24VDC	24VDC
AZS2305-110VAC	110VAC
AZS2305-230VAC	230VAC

FWS1205B
Fail-to-Safe Standstill Monitor



CHARACTERISTICS

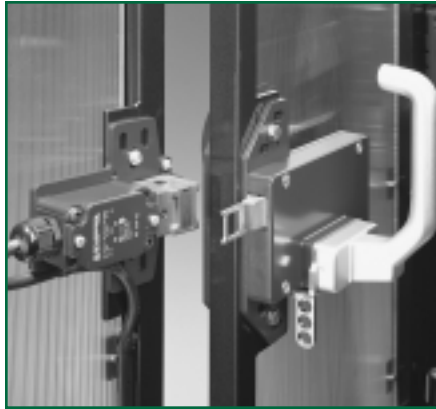
Operating Voltage (Ue)	24VDC ±15%
Operating Current (Ie)	0.2A
Control Category	3
Monitored Inputs	Two PNP proximity switches
Enabling Contacts	1
Signaling Outputs	2 Semiconductor
Contact Load Capacity	max. 250VAC max. 4A
Termination	Screw terminals
Cable size	max. 2.5mm ²
Agency recognition	UL, CSA, BG
Dimensions	22.5mm x 100mm x 121mm
Standards	EN954-1, EN1088, IEC60204-1, BG-GS-ET-20
Minimum pulse duration	125µs

AVAILABLE MODELS*

Model Number	Standstill Frequency (Inputs x1/x2)
FWS1205B-24VDC	2Hz/2Hz

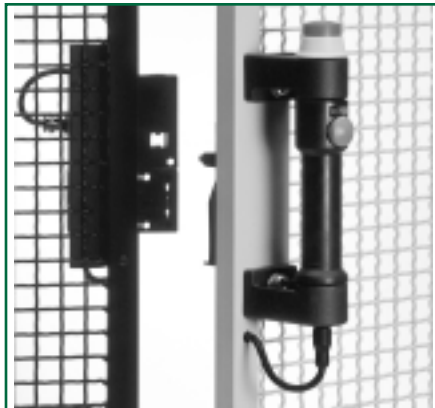
* For other voltages or standstill frequencies, please consult factory.

APPLICATION ACCESSORIES



**B30 Handle
Assembly**

Page 82



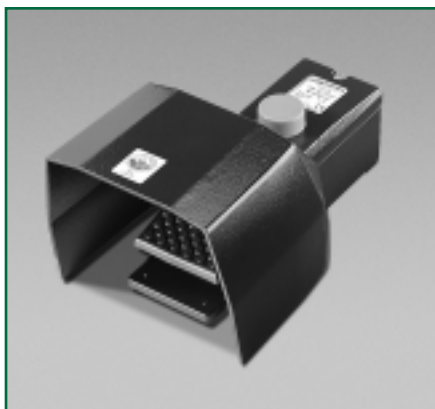
**TG-1
Door Handle**

Page 86



**ZSD
Enabling Device**

Page 88



**GFS Safety
Foot Control**

Page 90

SERIES B30

Safety Guard Door-Handle System (with Emergency Release Option)



Features & Benefits

- **Suited for all types of guards** ... for application versatility.
- **Dual-purpose handle** ... unlocks and opens guard. No additional door handles are needed.
- **Optional inside “emergency” release handle available** ... heightens system safety level.
- **Interlock switch mountable from inside or outside guard** ... for application flexibility.
- **Rugged, durable design** ... actuator designed for 25,000 N (5,600 pounds) of shear force.
- **Mechanical design facilitates easy actuator key withdrawal** ... without “sticking” or “binding.”
- **Meets ANSI/RIA R15.06 safety standards** ... provides for emergency egress.

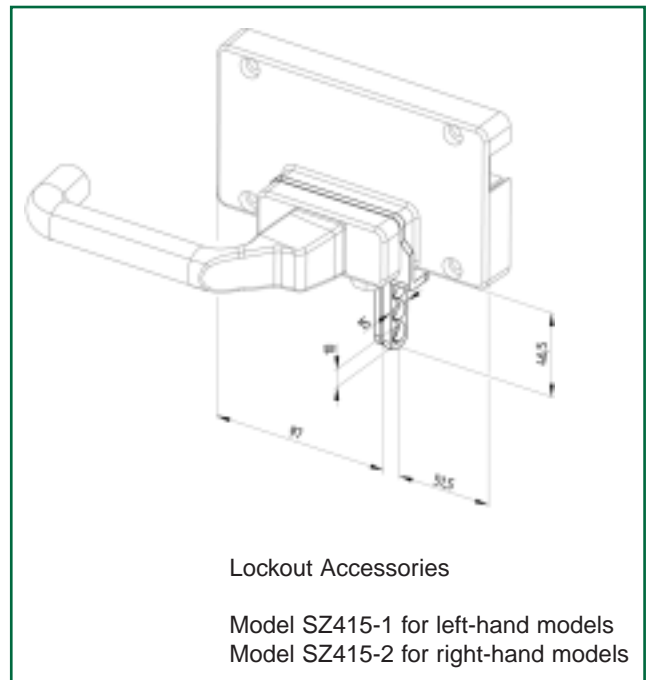
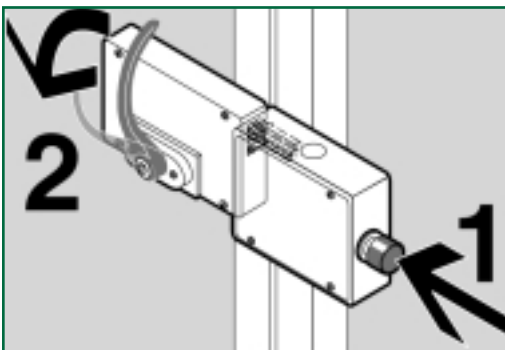
Description

The B30 door handle system consists of one safety interlock switch (with or without solenoid-latching), an actuator key and handle assembly (with or without emergency release handle), mounting plates, and an optional lockout/tagout device. An optional red interior release handle is available which opens the guard from the inside in case of an emergency.

Operation

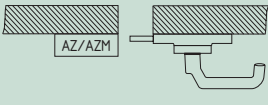
Should someone find themselves in a hazardous area and the guard is accidentally closed, the guard can be opened from the inside by turning the optional emergency handle (2). Locking of the guard from the inside is not possible.

When using the optional emergency handle with the AZM415 solenoid-latching keyed interlock switch, always order the version with emergency unlocking (AZM415-22zpkT). In this case the emergency latching release button (1) provided with this model must be actuated before operating the emergency release handle (2).



B30 ACTUATORS & MOUNTING SETS

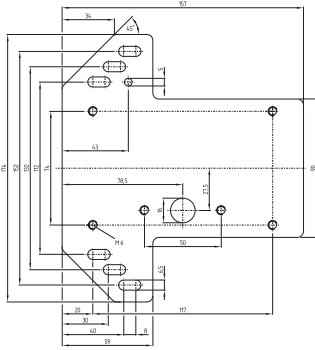
STANDARD AVAILABLE MODELS

B30 Door Handle	Ordering Details		
Mounting Style Desired	Part Numbers to Order with Safety Interlock Switch Series...		
Actuator with emergency handle B30	AZ 335/355	AZ 415	AZM 415
 <p>Hinge R / switch inside (Right-hand)</p>	AZ 335/355 - B30- 01	AZ/AZM 415 - B30 - 01	AZ/AZM 415 - B30 - 01
 <p>Hinge L / switch inside (Left-hand)</p>	AZ 335/355 - B30- 02	AZ/AZM 415 - B30 - 02	AZ/AZM 415 - B30 - 02
 <p>Hinge R / switch outside (Right-hand)</p>	AZ 335/355 - B30- 05	AZ/AZM 415 - B30 - 05	AZ/AZM 415 - B30 - 05*
 <p>Hinge L / switch outside (Left-hand)</p>	AZ 335/355 - B30- 06	AZ/AZM 415 - B30 - 06	AZ/AZM 415 - B30 - 06*
 <p>Mounting set (Includes Mounting Hardware)</p>	MP AZ 335/355 (1 Required) MP AZ/AZM 415 - B30 (2 Required)	MP AZ 415 - 22 (1 Required) MP AZ/AZM 415 - B30 (2 Required)	MP AZM 415 - 22 (1 Required) MP AZ/AZM 415 - B30 (2 Required)
Actuator without emergency handle B30	AZ 335/355	AZ 415	AZM 415
 <p>Hinge R / switch inside (Right-hand)</p>	AZ 335/355 - B30- 03	AZ/AZM 415 - B30 - 03	AZ/AZM 415 - B30 - 03
 <p>Hinge L / switch inside (Left-hand)</p>	AZ 335/355 - B30- 04	AZ/AZM 415 - B30 - 04	AZ/AZM 415 - B30 - 04
 <p>Hinge R / switch outside (Right-hand)</p>	AZ 335/355 - B30- 07	AZ/AZM 415 - B30 - 07	AZ/AZM 415 - B30 - 07
 <p>Hinge L / switch outside (Left-hand)</p>	AZ 335/355 - B30- 08	AZ/AZM 415 - B30 - 08	AZ/AZM 415 - B30 - 08
 <p>Mounting set (Includes Mounting Hardware)</p>	MP AZ 335/355 MP AZ/AZM 415 - B30 (1 Each Required)	MP AZ 415 - 22 MP AZ/AZM 415 - B30 (1 Each Required)	MP AZM 415 - 22 MP AZ/AZM 415 - B30 (1 Each Required)

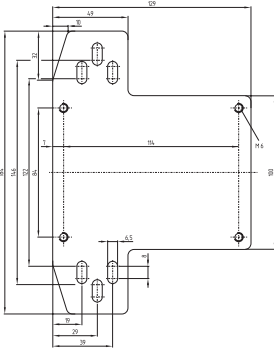
* Only for use if a means of releasing the locked solenoid of the AZM415 is provided on the inside of the guard.

B30 MOUNTING PLATE DIMENSIONS

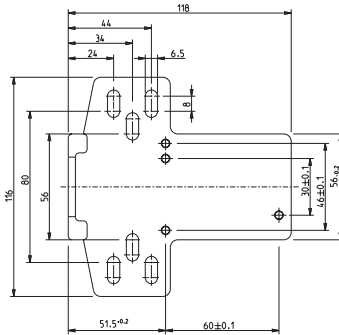
Mounting plate
MP AZ/AZM 415-B30



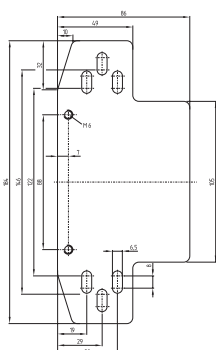
Mounting plate
MP AZM 415-22



Mounting plate
MP AZ 335/355

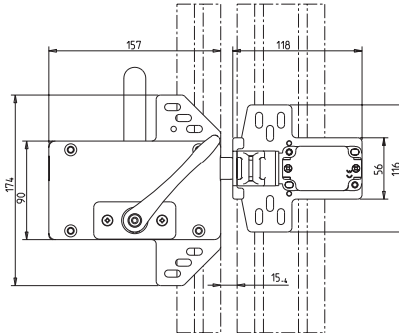


Mounting plate
MP AZ 415-22

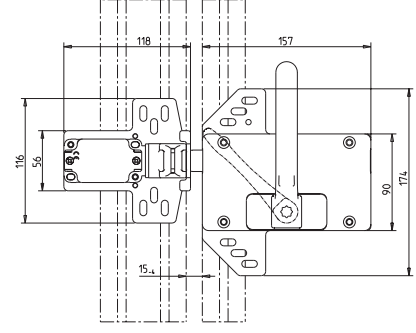


Handle Actuators with Interior Emergency Release

AZ 335/355-B30-01

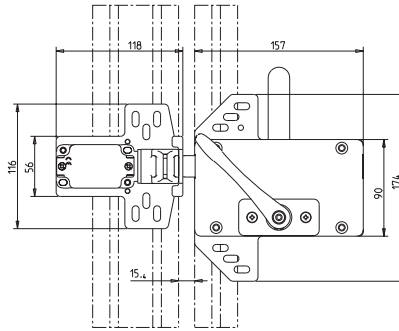


AZ 335/355-B30-05

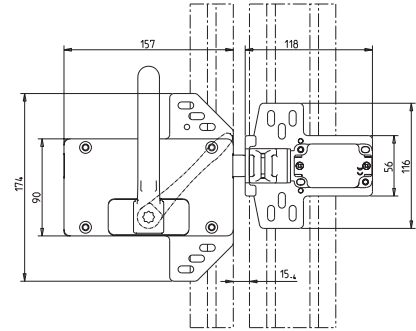


Handle Actuators with Interior Emergency Release

AZ 335/355-B30-02

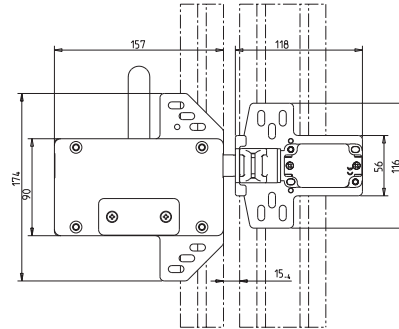


AZ 335/355-B30-06

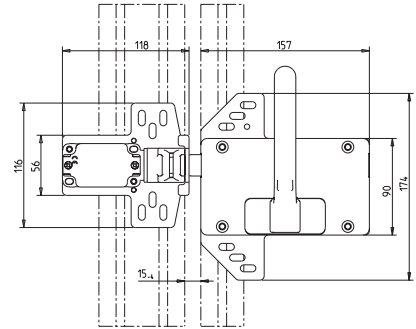


Handle Actuators without Interior Emergency Release

AZ 335/355-B30- 03

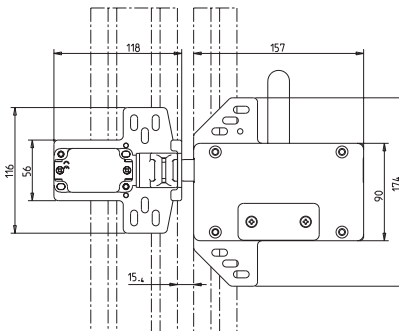


AZ 335/355-B30-07

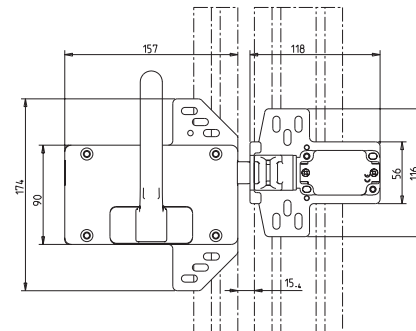


Handle Actuators without Interior Emergency Release

AZ 335/355-B30- 04



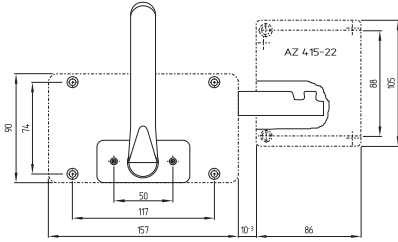
AZ 335/355-B30-08



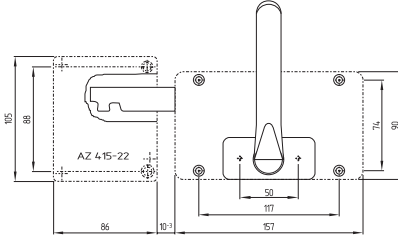
AZ/AZM 415 HANDLE ASSEMBLY DIMENSIONS

With AZ 415 Interlock

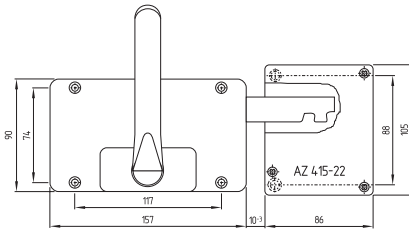
AZ/AZM 415-B30-02/-04



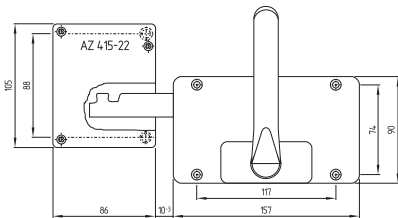
AZ/AZM 415-B30-01/-03



AZ/AZM 415-B30-06/-08

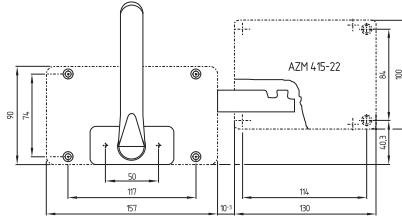


AZ/AZM 415-B30-05/-07

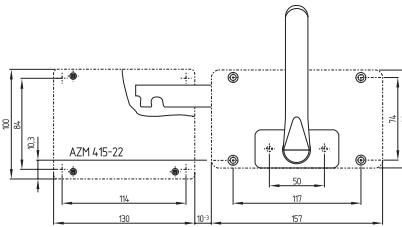


With AZM 415 Interlock

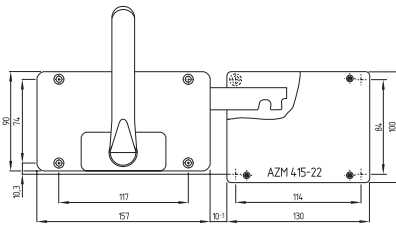
AZ/AZM 415-B30-02/-04



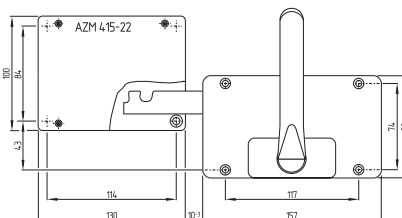
AZ/AZM 415-B30-01/-03



AZ/AZM 415-B30-06/-08

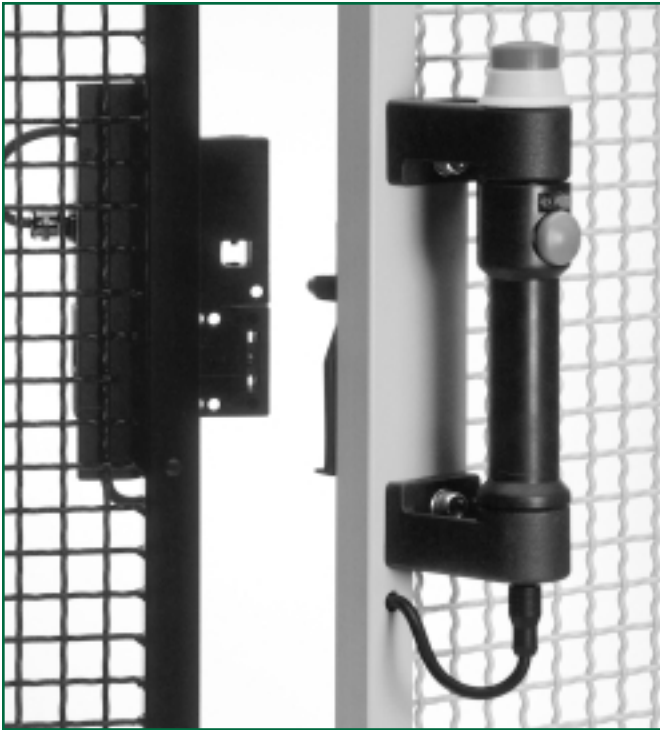


AZ/AZM 415-B30-05/-07



SERIES TG-1

Door Handle For Use With Solenoid Locking Switches



Description

The TG-1 handle has an integrated button for unlocking spring-to-lock solenoid switches. There are two LEDs indicating if the door is locked (green) or unlocked (red).

Operation

Pushing the button will energize the solenoid, allowing the door to be opened using the same hand. Releasing the handle and button will de-energize the solenoid, allowing the door to lock when closed.

Features & Benefits

- **Integrated door release** ... eliminates wiring to a console push-button.
- **LED status indicators** ... door status is known at a glance.
- **Optional integrated push-button**
- **Optional integrated Emergency-Stop** ... eliminates wiring to a remote console.
- **Longer solenoid life** ... solenoid energized only while release button is pushed.
- **Tapered key entry ports** ... tolerant to key misalignment.
- **Meets rigid safety agency standards** ... IEC, BG, VDE, UL and CSA.
- **Lockout accessory** ... prevents key entry and switch actuation.

AVAILABLE STANDARD MODELS

Part Number	Description
TG-WGR	No top button
TG-WGR10	With top-mounted emergency-stop
TG-WGRS	With top-mounted push button

Note: Other variations are available. Please consult factory.

ACCESSORY

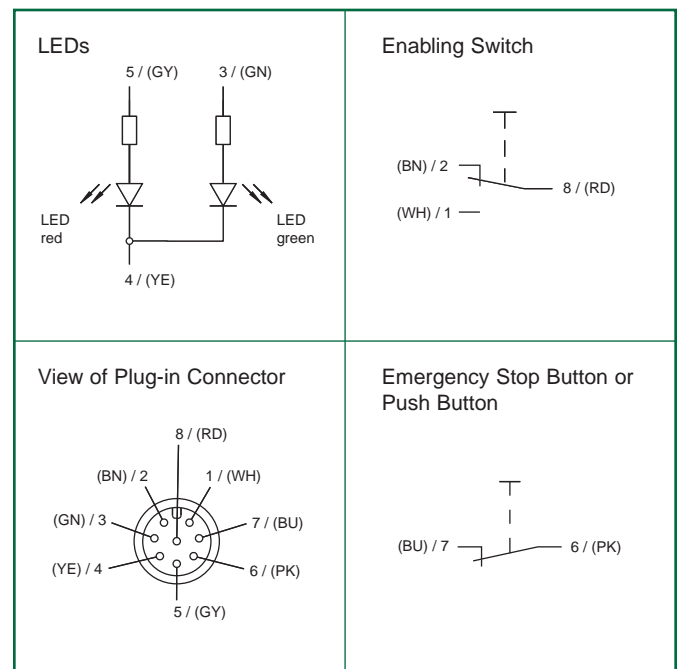
Part Number	Description
M12-8P-5M	Matching cable set.

SERIES TG-1 TECHNICAL DATA

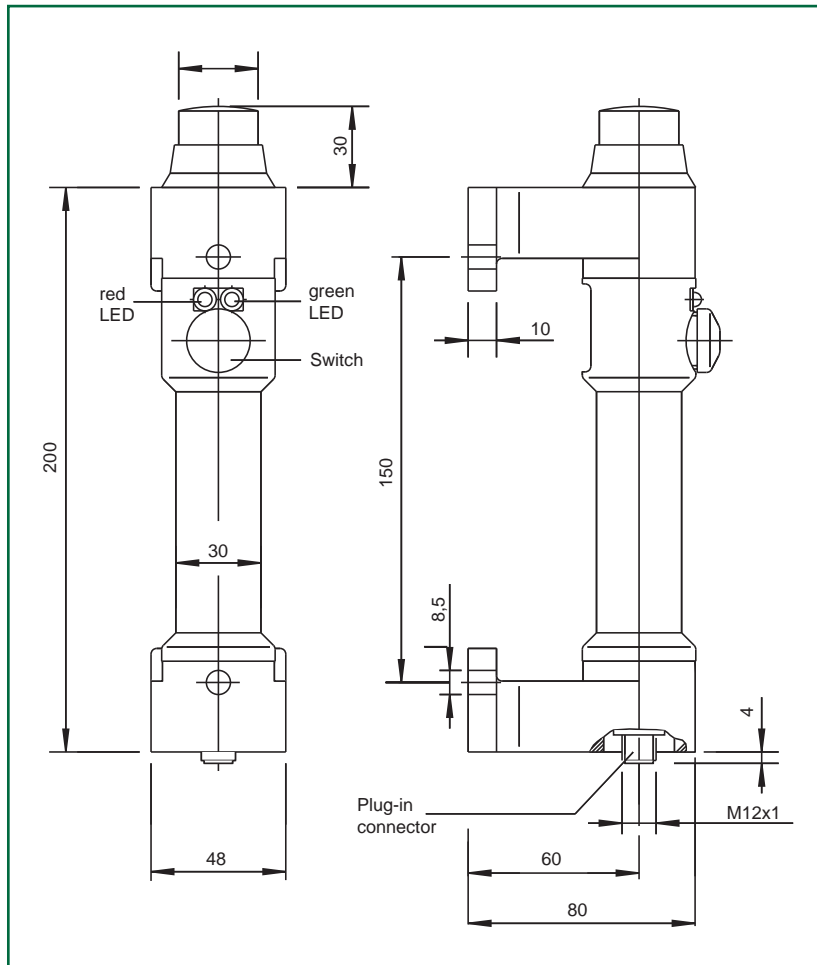
MECHANICAL SPECIFICATIONS

Housing	PA and POM
Degree of Protection	IP65
Termination	Plug-in connector M 12 x 1, 8 pole
Switching Voltage for Enabling Switch and Emergency Stop Button	24VDC; max 30VAC/36VDC
Switching System	Slow action, positive-break NC contacts
Rated Operating Voltage LED	24VDC

WIRING DIAGRAMS



DIMENSIONS





Features & Benefits

- **Redundant contacts** ... allows use in up to safety control category 4 systems.
- **Auxiliary contact** ... for status signalling.
- **Positive-break contacts from position 2 to position 3** ... enhances safety.
- **3-position (OFF-ON-OFF) design** ... provides for machine stop control when operator squeezes or releases actuator from center “on” position.
- **Rugged IP65 rating** ... withstands harsh industrial environments.
- **Optional normally-open top-mounted pushbutton** ... enables machine jog/start control.
- **Meets ANSI/RIA R15.06 safety standards** ... to satisfy enabling device requirements.

Description

The ZSD is a hand-held “dead man” switch with 3 operating positions — OFF-ON-OFF. The machine/robot can be operated in the “on” position. It provides safety based on normal human behavior of either releasing or squeezing the actuator in an emergency situation.

Operation

Machine/robot operation is only allowed when the enabling device is held in the middle (“on”) position. Releasing the switch (position 1) or squeezing the switch (position 3) shuts down the equipment.

Typical Applications

Used in robotic cells and automated manufacturing systems to provide operator safety during set-up, maintenance, or troubleshooting.

SWITCHING DIAGRAM

Operating Characteristics			
Position	1	2	3
Normally open contact 1–2*	█	█	█
Normally open contact 3–4*	█	█	█
Auxiliary contact 5–6	█	█	█
Open: <input type="checkbox"/> , Closed: <input checked="" type="checkbox"/>			
* Positive-break contacts from position 2 to position 3			

AVAILABLE STANDARD MODELS (INCLUDES M20 STRAIN RELIEF)

Part Number	Description
ZSD5	3-Position Enabling Switch (OFF-ON-OFF)
ZSD6	3-Position Enabling Switch (but with top-mounted pushbutton - 1NO contact)
ZSD-H	Metal Holding Bracket

Note: For factory installed cable, add length in meters, e.g. ZSD5-5m.

Use of a SCHMERSAL safety controller with cross short monitoring is required (SCHMERSAL models SRB301ST-24 or SRB301SQ).

ZSD TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Operating Temperature		-25°C to +60°C (no freezing)
Operating Humidity		45% to 85% RH maximum (no condensation)
Storage Temperature		-40°C to +80°C (no freezing)
Operating Frequency		1,200 operations/hour
Mechanical Life		Position 1•2•1: 1,000,000 minimum Position 1•2•3•1: 100,000 minimum
Shock Resistance	Operating Extremes	100m/s ²
	Damage Limits	1000m/s ²
Vibration Resistance	Operating Extremes	5 to 55Hz, amplitude 0.5mm minimum
	Damage Limits	16.7Hz, amplitude 1.5mm minimum
Terminal Pulling Strength		20N minimum
Terminal Screw Torque		0.5 to 0.6Nm
Degree of Protection		IP65
Weight		Approx. 240g (ZSD6) Approx. 210g (ZSD5)
Conforming to Standards		IEC60947-5-1, EN60947-5-1, JIS C8201-5-1, ANSI/RIA R15.6
Approvals		UL, CSA, BG

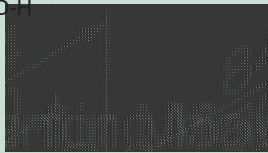
ELECTRICAL SPECIFICATIONS

Contact Resistance	100mΩ maximum
Insulation Resistance	Between live & dead metal parts: 100MΩ maximum (at 500VDC)
	Between positive & negative live parts: 100MΩ minimum (at 500VDC)
Impulse Withstand Voltage	2.5kV
Electrical Life	100,000 cycles (min.) @max. load
Recommended Wire Size	16 - 26 AWG
Recommended Cable	.275 - .512 inch diameter
Conditional Short Circuit Current	50A (250V)
Recommended Short Circuit Protection	250V/10A fast-blow fuse (IEC 60127-1)
Contact Rating	2A @ 30V, 4A @ 125V

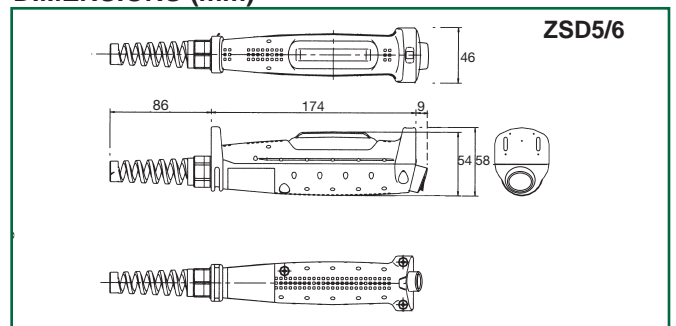
3

ACCESSORIES

Part Number	Description
ZSD-H	Metal holding bracket (for mounting/holding a ZSD enabling device)



DIMENSIONS (mm)



Note: Model with top-mounted pushbutton shown.



Description

Extensive accident prevention research has shown that in the event of pain/distress, the foot is frequently not removed from the foot pedal that is enabling equipment operation. Paradoxically, weight is often shifted forward and pressure on the foot pedal is increased (rather than removed).

Recognizing this, the series GFS safety foot switch features 3-stage operation. It is designed to stop hazardous movements in machinery whether released or fully-depressed in an emergency situation.

Its positive-break, normally-closed contacts provide a significantly higher level of safety than conventional spring-driven contacts which can weld/stick shut. Their glass-fiber reinforced pedal and aluminum protective shield make them ideal for heavy-duty applications in hostile environments.

Operation

The results of accident prevention research has been translated into a specific product according to the research. In the event of pain, the foot is frequently not removed from the switching pedal, but paradoxically pressure is increased, and the weight shifted forward. The solution to this problem is provided by a 3-stage safety foot switch.

Position 1. The pedal is not actuated in the upper position.
→ Machine “ **OFF** ”

Position 2. The operation circuit contact closes after actuating the foot pedal (the pedal is in contact with the tangible pressure-point stop).
→ Machine “ **ON** ”

Position 3. The pressure point is overcome in the event of danger or sensing pain, the circuit contact opens and is automatically latched.
→ Machine “ **Emergency Stop** ”

Operation to position 3 requires manual reset using the integral push button actuator

Optional safety controllers for E-Stop applications are available. Please consult factory.

Features & Benefits

- **Positive-Break Contacts ...** assure circuit interruption upon complete foot pedal actuation.
- **Automatic latching following an emergency stop signal ...** meets EN 418 standard for E-Stop switches.
- **Unique design with protective shield ...** avoids unintentional actuation due to falling debris or dropped items.
- **Release modes ...** only manually by pushing the button on the top of the pedal.
- **Heavy duty aluminum shield ...** tolerates mechanical abuse without damage.
- **Meets rigid safety agency standards ...** UL, CSA, IEC, BG, VDE.

Typical Applications

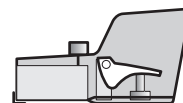
The GFS foot switch is intended for use in machines or areas where operation using the hands is not possible. Typical applications are profile and tube bending machines, bar turning machines, thread cutting, and wire drawing machines.

AVAILABLE MODELS

Part Number	Contacts
GFS 1 S D 1 O VD	1 NO & 1 NC
GFS 2 S D 2 O VD	2 NO & 2 NC

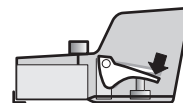
All Enclosures include PG to 1/2" NPT metal conduit adapter

Signal Output



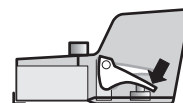
Off

Position 1
(Pedal not actuated)



On

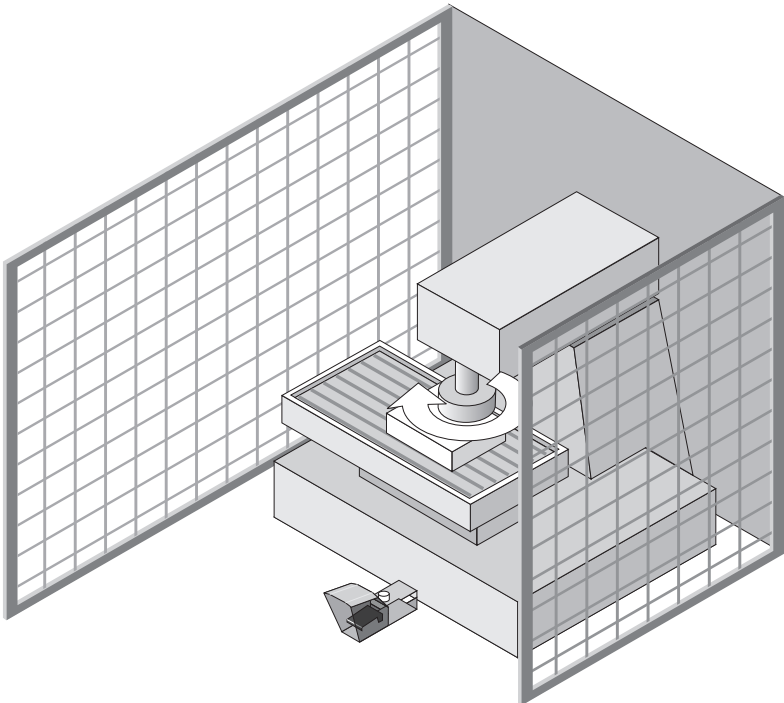
Position 2
(Pedal depressed to pressure point)



Off

Position 3
(Pedal fully depressed)

GFS SERIES TECHNICAL DATA



3

CONTACT DIAGRAMS

GFS 1SD/1OVD			GFS 2SD/2OVD		
1 NO	23	24	2 NO	23	24
1 NC	15	16	2 NC	15	16
Position 1	Position 2	Position 3	Each contact (Same as GFS 1SD/1OVD)		
□	■	■			
			Latched (Release via top-mounted pushbutton)		

GFS SERIES TECHNICAL DATA

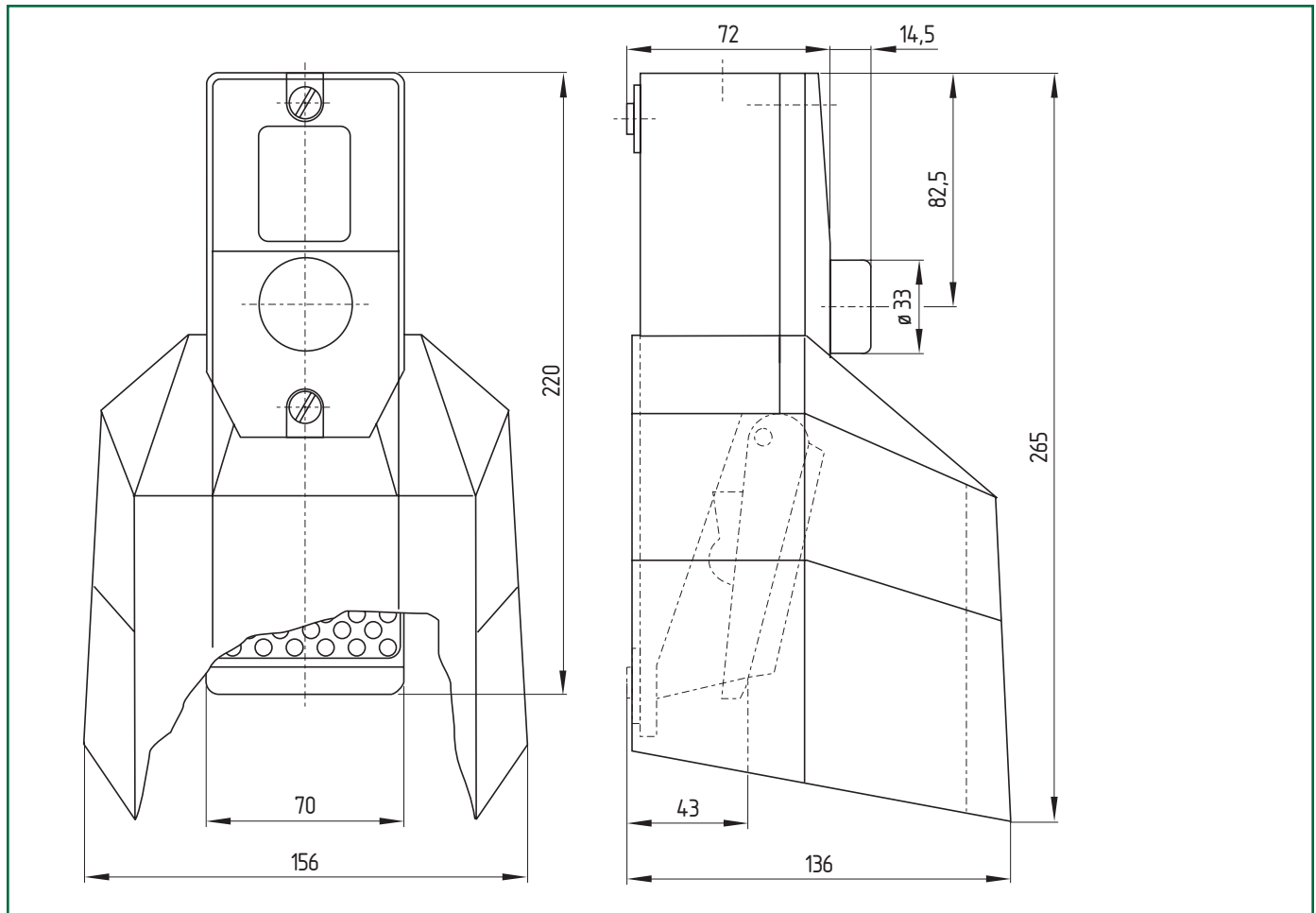
MECHANICAL SPECIFICATIONS

Enclosure	Aluminum (die casting)
Protecting Hood (shield)	Aluminum (die casting)
Pedal	Glass-fiber reinforced thermoplastic (nylon 66)
Degree of Protection	IP 65 to IEC/EN 60529
Ambient temperature	-25 °C to + 80 °C
Mechanical life	> 1 million operations
Conformity to Standards	IEC/EN 60947-5-1, EN 418 BG-GS-ET-15

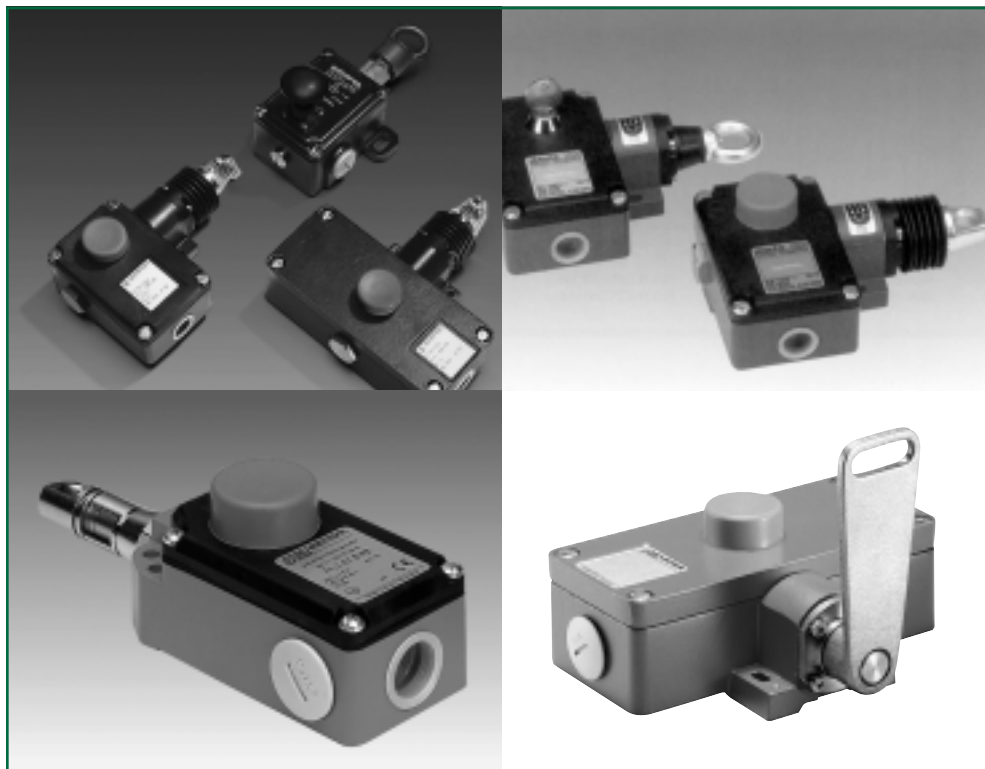
ELECTRICAL SPECIFICATIONS

Contact Rating	16 A / 400VAC
Switching Action	Slow-action NC ➔ Positive break contacts
Rated Insulation Voltage	500 V
Type Terminals	Screw terminals, 2.5 mm ² max. (including conductor ferrules)
Withstand Voltage	6 kV
Thermal test current	10 A
Max. fuse rating	16 A (slow-blow)


GFS SERIES DIMENSIONS (mm)



EMERGENCY CABLE-PULL SWITCHES



SELECTION GUIDE

Switch Series	Housing Material	Maximum Span	Contact Configurations	 Rated	Catalog Page
ZS71	Die-cast aluminum	65 feet	1 NO & 1 NC 2 NC	(Optional)	94
ZS73	Die-cast aluminum	165 feet	1 NO & 1 NC 2 NC	(Optional)	98
ZS75	Die-cast aluminum	165 feet	1 NO & 1 NC 2 NC 2 NO & 2 NC 4 NC	(Optional)	102
ZS441	Die-cast aluminum	80 feet	1 NO & 1 NC 2 NC	No	106
Bidirectional ZS75S	Die-cast aluminum	165 feet (Each Direction)	2 NO & 2 NC 4 NC	(Optional)	110



Features & Benefits

- **Rugged, corrosion-resistant, die-cast aluminum housing ...** tolerates the most hostile environments.
- **“Positive-break” NC contact ...** assures circuit interruption upon pulling of trip wire.
- **Visual position indicator ...** for ease of installation.
- **Push/pull operation ...** actuates if trip-wire is pulled or goes slack.
- **Watertight design ...** meets IP65 requirements.
- **Continuous E-stop protection ...** for supported trip-wire spans up to 65 feet (20m).
- **Meets rigid safety agency standards ...** UL, CSA.
- **Low actuating force ...** operates with only 13.5 lbs of force. Ideal for short-run applications.
- **Explosion protected ...** optional IEC-rated explosion-proof models available.
- **Mounting accessories ...** ease and extend installation.

Description

The ZS71 is designed to provide continuous emergency stop along exposed areas of machinery and conveyors which present hazards to operators/maintenance personnel. Unlike E-stop pushbuttons, emergency-stop cable-pull systems can be actuated at any point along the “trip-wire.”

The unit features a positive-opening NC contact which is forced open when the trip-wire is pulled. This design also assures actuation if the operator falls into, leans on, or is pushed against the trip-wire.

In addition, the switch is designed to operate if the trip wire is cut or goes slack.

Their rugged metal housing, small size and watertight design (IP65) make them ideal for use in hostile environments where space is limited.

Operation

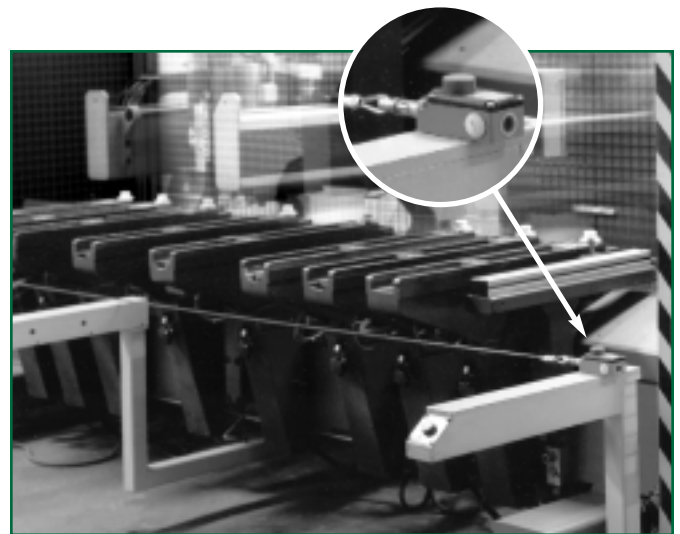
The ZS71 features an axial actuating shaft and a double-pole contact block with either 1 NO & 1 NC or 2 NC contacts (with trip-wire attached). When installed, the trip-wire is pulled out 5 mm, closing the open contact.

When the trip-wire is pulled, the positive-break NC contact is forced open via a direct mechanical linkage with the actuating shaft. If the trip-wire goes slack (e.g. breaks or is cut) the NO contact, closed during pre-tensioning, opens – resulting in equipment stoppage.

Manual (key or pushbutton) reset mechanisms assure the equipment cannot be restarted until the reset is actuated.

Typical Applications

The ZS71 is ideal for replacing multiple, discrete E-stop pushbuttons or achieving a continuous immediately accessible emergency stop ... especially where space is limited. Typical applications include conveyor lines, textile machinery, packaging machinery, turret lathes, and transfer lines.



ZS71 AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS

Part Number	Contact Configuration	Type Reset	Pre-Tensioned Force	Typical Actuating Force (F)	Maximum Cable Length
ZS71-10/1S WVDA-55N*	1 NO & 1 NC	Pushbutton	12.5 lbs (55N)	1.4 lbs (6N)	32.5 ft (10m)
ZS71-10/1S WVDA*	1 NO & 1 NC	Pushbutton	45.5 lbs (200N)	6 lbs (25N)	65 ft (20m)
ZS71-10/1S WVSA-55N*	1 NO & 1 NC	Key	12.5 lbs (55N)	1.4 lbs (6N)	32.5 ft (10m)
ZS71-10/1S WVSA*	1 NO & 1 NC	Key	45.5 lbs (200N)	6 lbs (25N)	65 ft (20m)
ZS71-20 WVDA-55N	2 NC	Pushbutton	12.5 lbs (55N)	1.4 lbs (6N)	32.5 ft (10m)
ZS71-20 WVDA	2 NC	Pushbutton	45.5 lbs (200N)	6 lbs (25N)	65 ft (20m)
ZS71-20 WVSA-55N	2 NC	Key	12.5 lbs (55N)	1.4 lbs (6N)	32.5 ft (10m)
ZS71-20 WVSA	2 NC	Key	45.5 lbs (200N)	6 lbs (25N)	65 ft (20m)

*Available in an IEC-rated explosion-proof design. To order, add suffix "-EX" to part number.

AVAILABLE ACCESSORIES

Part Number	Description
PL-PG13.5-24V	24V Pilot light kit
PL-PG13.5-120V	120V Pilot light kit
STQ441-SC	5mm diameter steel cable, PVC coated
STQ441-EB	M10 eye bolt & hex nut
STQ441-CC	Cable clamp
STQ441-TB	Turnbuckle
STQ441-TH	Thimble
STQ441-PU	Pulley assembly (for cable "cornering")

For recommended installation instructions, please see page 109.

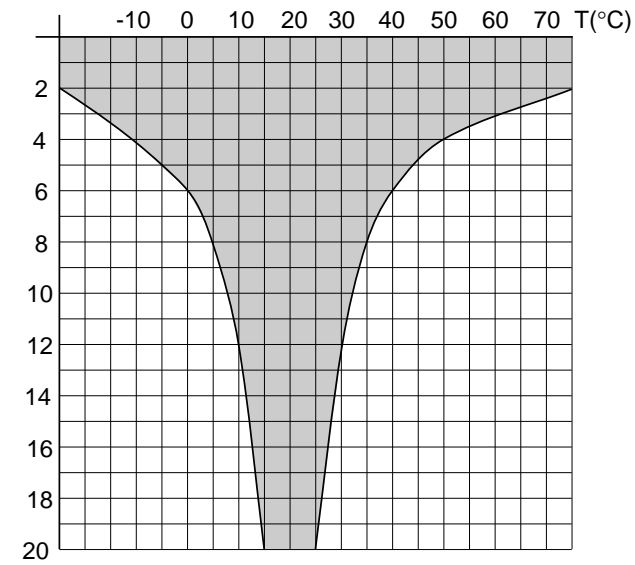
ZS71 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Die-cast aluminum with fiberglass-reinforced thermoplastic cover
Degree of Protection	IP65
Maximum Supported Span	65 feet (20m)
Operating Temperature	-13°F to +158°F (-25°C to +70°C)
Mechanical Life	1 million operations
Conformity to Standards	EN418, UL, CSA
Minimum Cable Tension	6.7 lbs. (30N)
Typical Deflection (S) Required for Operation	4.4" (11cm)

ELECTRICAL SPECIFICATIONS

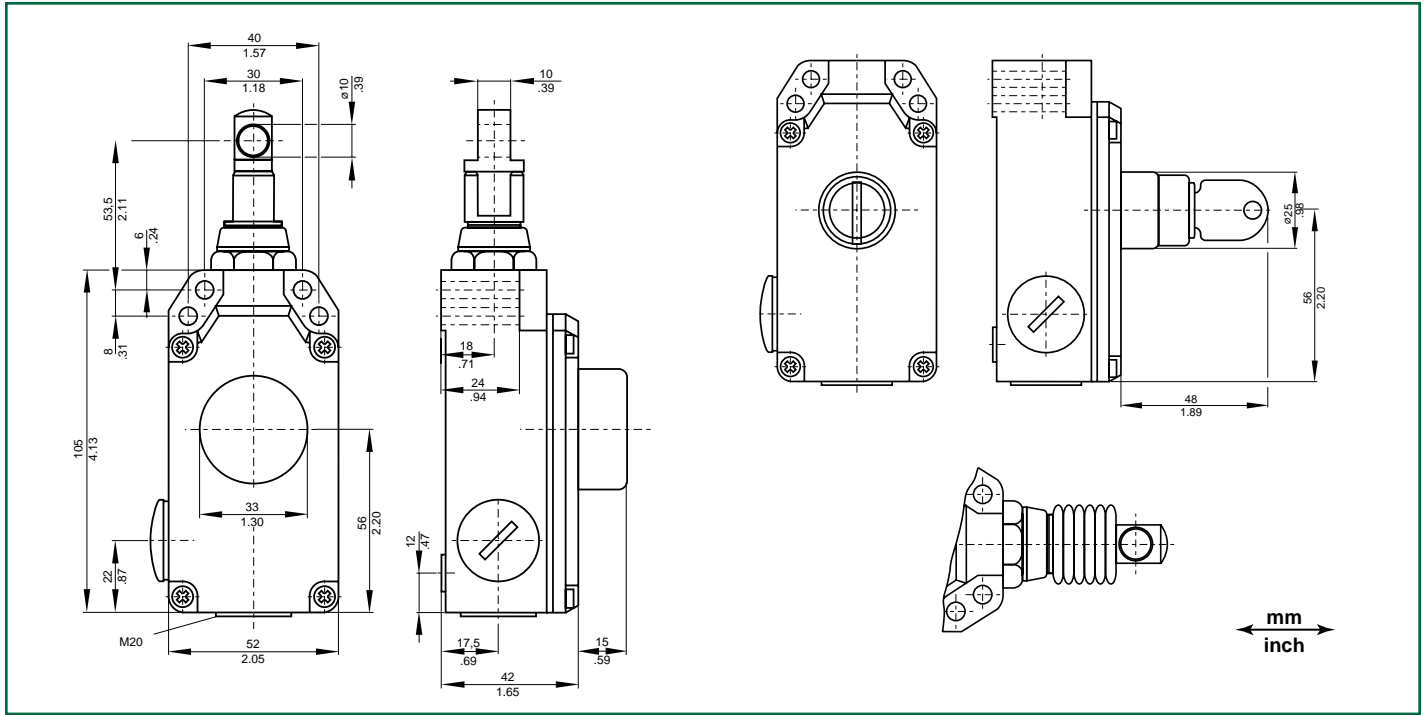
Contacts	Fine silver
Contact Configuration	1 NO & 1 NC or 2 NC double-pole, double-break with electrically-separated contact bridges
Contact Rating	6A/400VAC
Switching Action	Slow-action, positive-break NC contacts (with wire pulling). Snap-action NO contact.
Short Circuit Protection	6A (external)
Type Terminals	Screw terminals with clamping washers



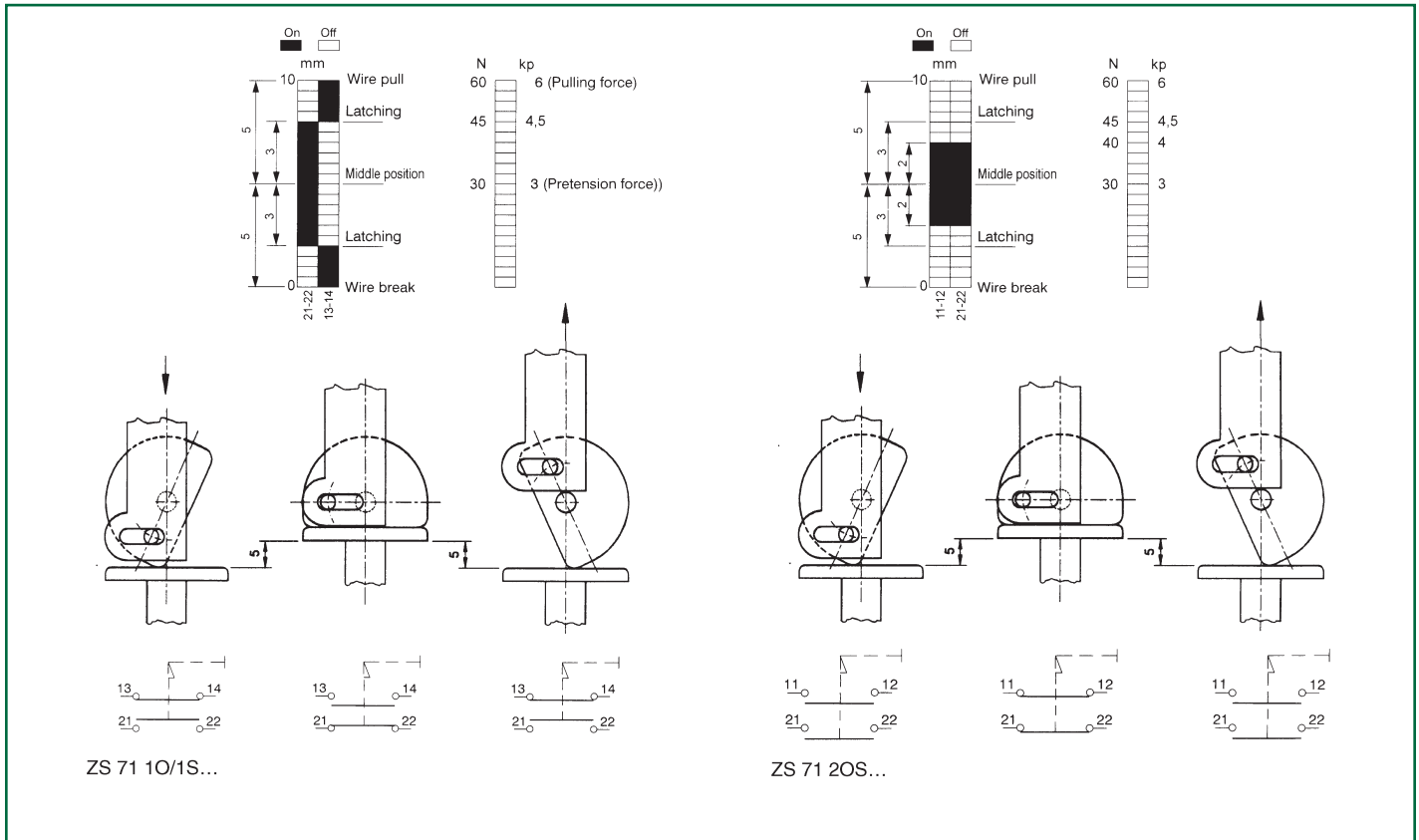
l (m) Cable length vs. temperature range

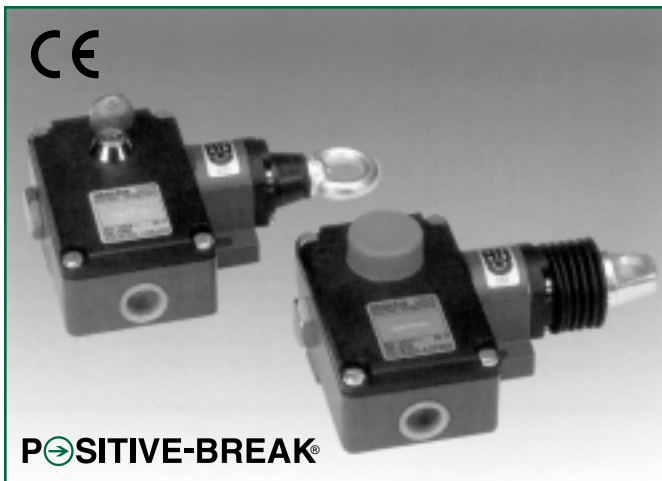
ZS71 TECHNICAL DATA

DIMENSIONS



SWITCHING DIAGRAMS & CONTACT SCHEMATICS





Features & Benefits

- **Rugged, corrosion-resistant, die-cast aluminum housing ...** tolerates the most hostile environments.
- **“Positive-break” NC contacts ...** assure circuit interruption upon pulling of trip wire.
- **Watertight design ...** meets IP65 requirements.
- **Continuous E-stop protection ...** for supported trip-wire spans up to 164 feet (50m).
- **Meets rigid safety agency standards ...** EN 418
- **Available in two operating force models ...** for application compatibility.
- **Mounting accessories ...** ease and extend installation.
- **Satisfies OSHA push/pull operating requirements ...** trips if cable is pulled or goes slack.
- **Explosion protected ...** optional IEC-rated explosion-proof models available.
- **Signal lamp ...** optional lamp signals tripped and latched condition.

Description

The ZS73 is designed to provide a continuous emergency stop along exposed areas of machinery and conveyors which present hazards to operators/maintenance personnel. Unlike E-stop pushbuttons, emergency stop cable-pull systems can be actuated at any point along the “trip-wire.”

The units feature positive-opening NC contacts which are forced open when the trip-wire is pulled. This design also assures machine stoppage if an operator falls into, leans on, or is pulled against the trip wire.

In addition the switch is designed to operate if the trip wire is cut or goes slack. To comply with OSHA and other safety regulations, the ZS73 features a manual mechanical reset which must be actuated before the controlled equipment can be restarted.

Their rugged metal housing and watertight design (IP65) make them ideal for achieving a higher degree of E-stop safety in industrial and hostile environments.

Operation

The ZS73 features an axial actuating shaft and a double-pole contact block with 1 NO and 1 NC contact or 2 NC contacts (with trip-wire attached). When installed, the trip-wire is pre-tensioned until the actuating shaft is pulled out 6 mm, closing the NO contact(s).

When the trip-wire is pulled, the positive-break NC contact(s) are forced open via a direct mechanical linkage with the actuating shaft. If the trip-wire goes slack (e.g. breaks or is cut) the NO contact, closed during pre-tensioning, opens – resulting in equipment stoppage.

Manual pushbutton reset assures the equipment cannot be restarted until the reset is actuated.

Typical Applications

The ZS73 emergency cable-pull switches are ideal for replacing multiple, discrete E-stop pushbuttons or achieving a continuous, immediately accessible emergency stop. Typical applications include conveyor lines, textile machinery, packaging machinery, turret lathes, power plants, gravel processing and transfer lines.

ZS73 AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS

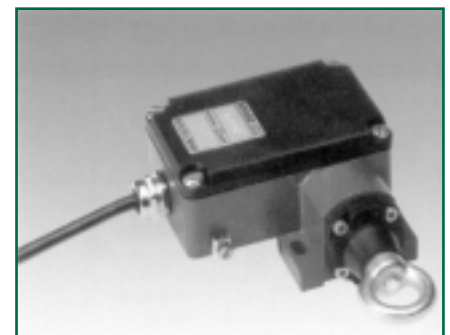
Part Number	Contact Configuration	Type Reset	Pre-Tensioned Force	Typical Actuating Force (F)	Recommended Cable Length (Minimum & Maximum)
ZS73-10/1S WVD-98N*	1 NO & 1 NC	Pushbutton	18-22 lbs (79-98N)	1.1-1.7 lbs (5-8N)	<33 ft (<10m)
ZS73-10/1S WVD-177N*	1 NO & 1 NC	Pushbutton	26-40 lbs (118-177N)	4.2 -5.6 lbs (19-25N)	33-65 ft (10-20m)
ZS73-10/1S WVD-275N*	1 NO & 1 NC	Pushbutton	44-62 lbs (197-275N)	7.4-9.2 lbs (33-41N)	65-100 ft (20-30m)
ZS73-10/1S WVD*	1 NO & 1 NC	Pushbutton	66-88 lbs (295-390N)	8.5-13.5 lbs (38-60N)	100-165 ft (30-50m)
ZS73-10/1S WVS-98N*	1 NO & 1 NC	Key	18-22 lbs (79-98N)	1.1-1.7 lbs (5-8N)	<33 ft (<10m)
ZS73-10/1S WVS-177N*	1 NO & 1 NC	Key	26-40 lbs (118-177N)	4.2 -5.6 lbs (19-25N)	33-65 ft (10-20m)
ZS73-10/1S WVS-275N*	1 NO & 1 NC	Key	44-62 lbs (197-275N)	7.4-9.2 lbs (33-41N)	65-100 ft (20-30m)
ZS73-10/1S WVS*	1 NO & 1 NC	Key	66-88 lbs (295-390N)	8.5-13.5 lbs (38-60N)	100-165 ft (30-50m)
ZS73-20 WVD-98N	2 NC	Pushbutton	18-22 lbs (79-98N)	1.1-1.7 lbs (5-8N)	<33 ft (<10m)
ZS73-20 WVD-177N	2 NC	Pushbutton	26-40 lbs (118-177N)	4.2 -5.6 lbs (19-25N)	33-65 ft (10-20m)
ZS73-20 WVD-275N	2 NC	Pushbutton	44-62 lbs (197-275N)	7.4-9.2 lbs (33-41N)	65-100 ft (20-30m)
ZS73-20 WVD	2 NC	Pushbutton	66-88 lbs (295-390N)	8.5-13.5 lbs (38-60N)	100-165 ft (30-50m)
ZS73-20 WVS-98N	2 NC	Key	18-22 lbs (79-98N)	1.1-1.7 lbs (5-8N)	<33 ft (<10m)
ZS73-20 WVS-177N	2 NC	Key	26-40 lbs (118-177N)	4.2 -5.6 lbs (19-25N)	33-65 ft (10-20m)
ZS73-20 WVS-275N	2 NC	Key	44-62 lbs (197-275N)	7.4-9.2 lbs (33-41N)	65-100 ft (20-30m)
ZS73-20 WVS	2 NC	Key	66-88 lbs (295-390N)	8.5-13.5 lbs (38-60N)	100-165 ft (30-50m)

*Available in an IEC-rated explosion-proof design. To order, add suffix "-EX" to part number.

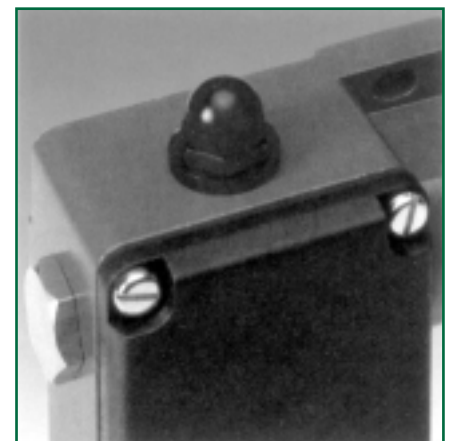
AVAILABLE ACCESSORIES

Part Number	Description
PL-M16-24V	24V Pilot light kit
PL-M16-120V	120V Pilot light kit
STQ441-SC	5mm diameter steel cable, PVC coated
STQ441-EB	M10 eye bolt & hex nut
STQ441-CC	Cable clamp
STQ441-TB	Turnbuckle
STQ441-TH	Thimble
STQ441-PU	Pulley assembly (for cable "cornering")

For recommended installation instructions, please see page 109.



Explosion-proof option



Pilot light option

ZS73 TECHNICAL DATA

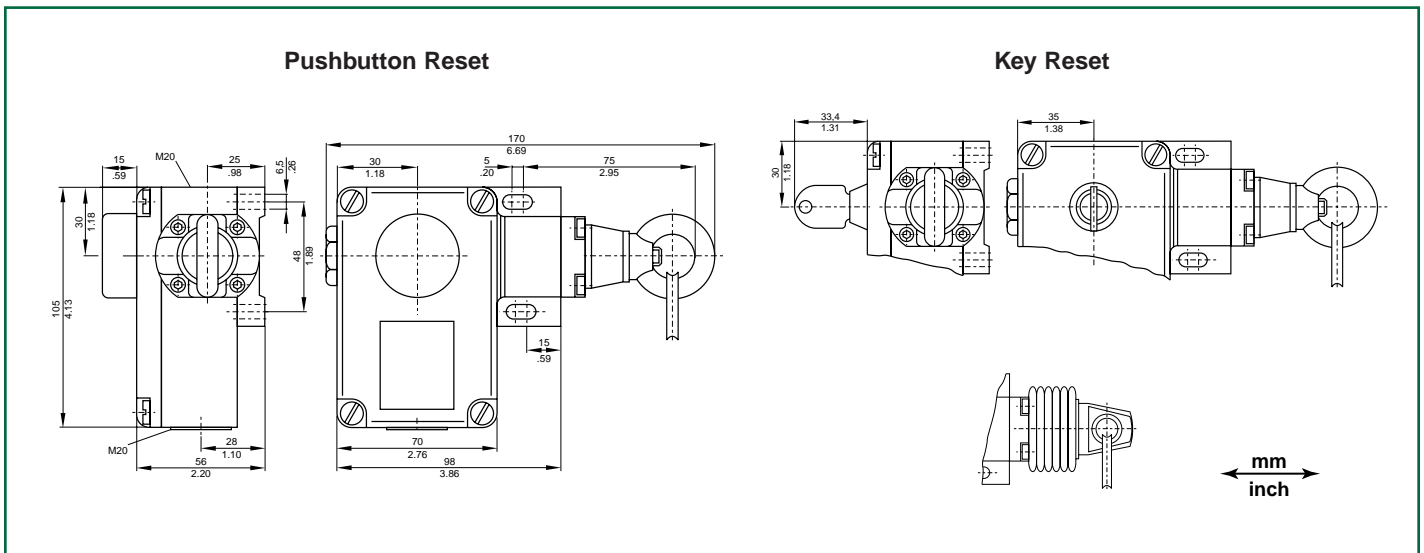
MECHANICAL SPECIFICATIONS

Housing	Die-cast aluminum, color-painted Thermoplastic cover
Degree of Protection	IP65
Maximum Supported Span	164 feet (50m)
Typical Deflection (S) Required for Operation	5.1" (13cm)
Mechanical Life	1 million operations
Operating Temperature	-13°F to +158°F (-25°C to +70°C)
Conformity to Standards	CE UL BG CSA EN 418 IEC 947-5-1 EN 60947-5-1
Explosion Protection	E Ex dll CT6 ("Ex" models only)

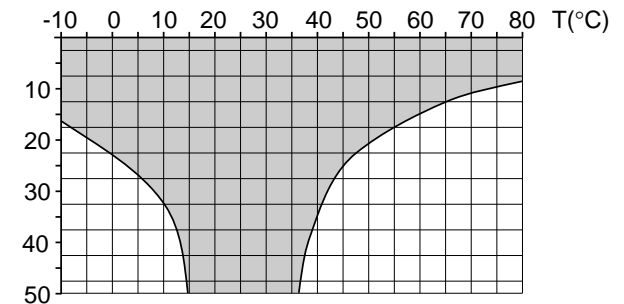
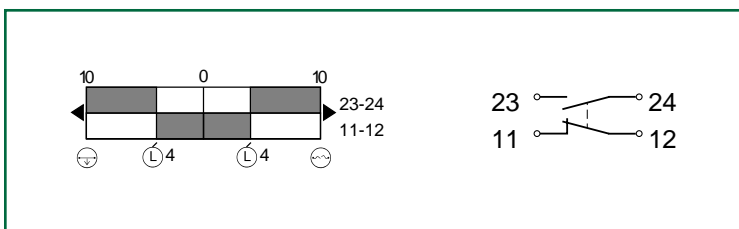
ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Rating	6A/400VAC
Switching Action	Slow-action, positive-break NC contacts (with wire pulling)
Short Circuit Protection	6A (Slow blow)
Rated Insulation Voltage	400VAC
Type Terminals	Screw terminals with clamping washers

DIMENSIONS



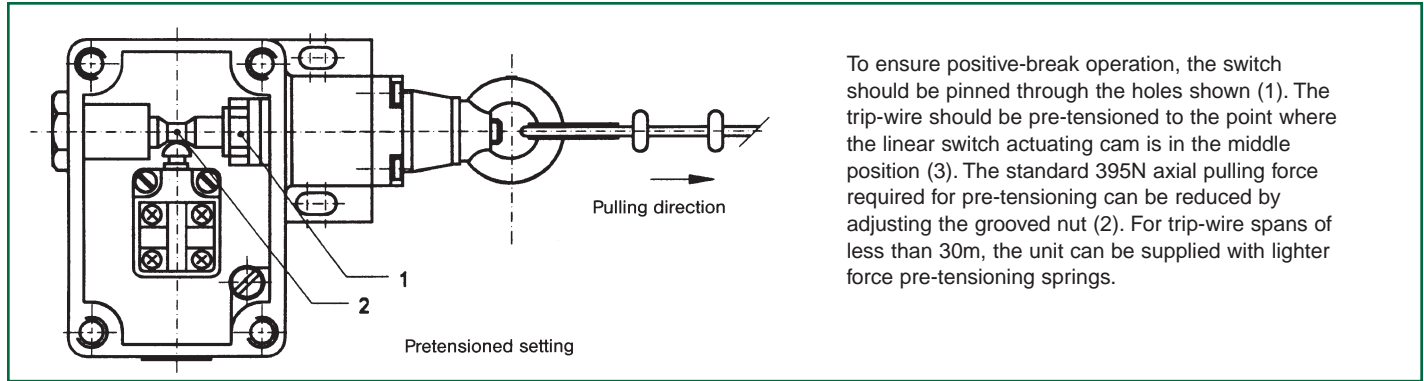
SWITCHING DIAGRAMS & CONTACT SCHEMATICS



I (m) Cable length vs. temperature range

ZS73 INSTALLATION DETAILS

PRE-TENSIONING ADJUSTMENT

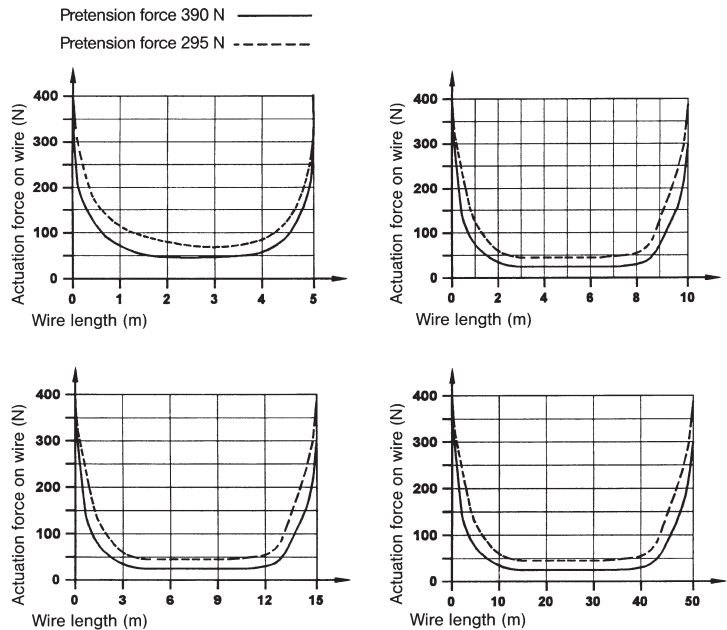


PRE-TENSIONING FORCE VS. ACTUATION FORCE

The actuating force is a function of the:

- trip-wire span
- pre-tensioning spring
- set pre-tensioning force

as shown. Units are available with lighter springs for trip-wire spans of less than 30m. Please see ordering details under AVAILABLE OPTIONS.





Features & Benefits

- **Rugged, corrosion-resistant, die-cast aluminum housing ...** tolerates the most hostile environments.
- **“Positive-break” NC contacts ...** assure circuit interruption upon pulling of trip wire.
- **Watertight design ...** meets IP65 requirements.
- **Continuous E-stop protection ...** for supported trip-wire spans up to 164 feet (50m).
- **Meets rigid safety agency standards ...** EN 418
- **Available in four operating force models ...** for application compatibility.
- **Mounting accessories ...** ease and extend installation.
- **Satisfies OSHA push/pull operating requirements ...** trips if cable is pulled or goes slack.
- **Explosion protected ...** optional IEC-rated explosion-proof models available.
- **Signal lamp ...** optional lamp signals tripped and latched condition.

Description

The ZS75 is designed to provide a continuous emergency stop along exposed areas of machinery and conveyors which present hazards to operators/maintenance personnel. Unlike E-stop pushbuttons, emergency stop cable-pull systems can be actuated at any point along the “trip-wire.”

The units feature positive-opening NC contacts which are forced open when the trip-wire is pulled. This design also assures machine stoppage if an operator falls into, leans on, or is pulled against the trip wire.

In addition the switch is designed to operate if the trip wire is cut or goes slack. To comply with OSHA and other safety regulations, the ZS75 features a manual mechanical reset which must be actuated before the controlled equipment can be restarted.

Their rugged metal housing and watertight design (IP65) make them ideal for achieving a higher degree of E-stop safety in industrial and hostile environments.

Operation

The ZS75 features an axial actuating shaft and up to two double-pole contact blocks. When installed, the trip-wire is pre-tensioned until the actuating shaft is pulled out 6 mm, closing the NO contact(s).

When the trip-wire is pulled, the positive-break NC contact(s) are forced open via a direct mechanical linkage with the actuating shaft. If the trip-wire goes slack (e.g. breaks or is cut) the NO contacts, closed during pre-tensioning, open – resulting in equipment stoppage.

Manual pushbutton reset assures the equipment cannot be restarted until the reset is actuated.

Typical Applications

The ZS75 emergency cable-pull switches are ideal for replacing multiple, discrete E-stop pushbuttons or achieving a continuous, immediately accessible emergency stop. Typical applications include conveyor lines, textile machinery, packaging machinery, turret lathes, power plants, gravel processing and transfer lines.

ZS75 AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS

Part Number	Contact Configuration	Type Reset	Pre-Tensioned Force	Typical Actuating Force (F)	Recommended Cable Length (Minimum & Maximum)
ZS75-20/2S WVD-98N*	2 NO & 2 NC	Pushbutton	18-22 lbs (79-98N)	1.1-1.7 lbs (5-8N)	<33 ft (<10m)
ZS75-20/2S WVD-177N*	2 NO & 2 NC	Pushbutton	26-40 lbs (118-177N)	4.2 -5.6 lbs (19-25N)	33-65 ft (10-20m)
ZS75-20/2S WVD-275N*	2 NO & 2 NC	Pushbutton	44-62 lbs (197-275N)	7.4-9.2 lbs (33-41N)	65-100 ft (20-30m)
ZS75-20/2S WVD*	2 NO & 2 NC	Pushbutton	66-88 lbs (295-390N)	8.5-13.5 lbs (38-60N)	100-165 ft (30-50m)
ZS75-20/2S WVS-98N*	2 NO & 2 NC	Key	18-22 lbs (79-98N)	1.1-1.7 lbs (5-8N)	<33 ft (<10m)
ZS75-20/2S WVS-177N*	2 NO & 2 NC	Key	26-40 lbs (118-177N)	4.2 -5.6 lbs (19-25N)	33-65 ft (10-20m)
ZS75-20/2S WVS-275N*	2 NO & 2 NC	Key	44-62 lbs (197-275N)	7.4-9.2 lbs (33-41N)	65-100 ft (20-30m)
ZS75-20/2S WVS*	2 NO & 2 NC	Key	66-88 lbs (295-390N)	8.5-13.5 lbs (38-60N)	100-165 ft (30-50m)
ZS75-40 WVD-98N	4 NC	Pushbutton	18-22 lbs (79-98N)	1.1-1.7 lbs (5-8N)	<33 ft (<10m)
ZS75-40 WVD-177N	4 NC	Pushbutton	26-40 lbs (118-177N)	4.2 -5.6 lbs (19-25N)	33-65 ft (10-20m)
ZS75-40 WVD-275N	4 NC	Pushbutton	44-62 lbs (197-275N)	7.4-9.2 lbs (33-41N)	65-100 ft (20-30m)
ZS75-40 WVD	4 NC	Pushbutton	66-88 lbs (295-390N)	8.5-13.5 lbs (38-60N)	100-165 ft (30-50m)
ZS75-40 WVS-98N	4 NC	Key	18-22 lbs (79-98N)	1.1-1.7 lbs (5-8N)	<33 ft (<10m)
ZS75-40 WVS-177N	4 NC	Key	26-40 lbs (118-177N)	4.2 -5.6 lbs (19-25N)	33-65 ft (10-20m)
ZS75-40 WVS-275N	4 NC	Key	44-62 lbs (197-275N)	7.4-9.2 lbs (33-41N)	65-100 ft (20-30m)
ZS75-40 WVS	4 NC	Key	66-88 lbs (295-390N)	8.5-13.5 lbs (38-60N)	100-165 ft (30-50m)

*Available in an IEC-rated explosion-proof design. To order, add suffix "-EX" to part number.

AVAILABLE ACCESSORIES

Part Number	Description
PL-M25-24V	24V Pilot light kit
PL-M25-120V	120V Pilot light kit
STQ441-SC	5mm diameter steel cable, PVC coated
STQ441-EB	M10 eye bolt & hex nut
STQ441-CC	Cable clamp
STQ441-TB	Turnbuckle
STQ441-TH	Thimble
STQ441-PU	Pulley assembly (for cable "cornering")

For recommended installation instructions, please see page 109.

ZS75 TECHNICAL DATA

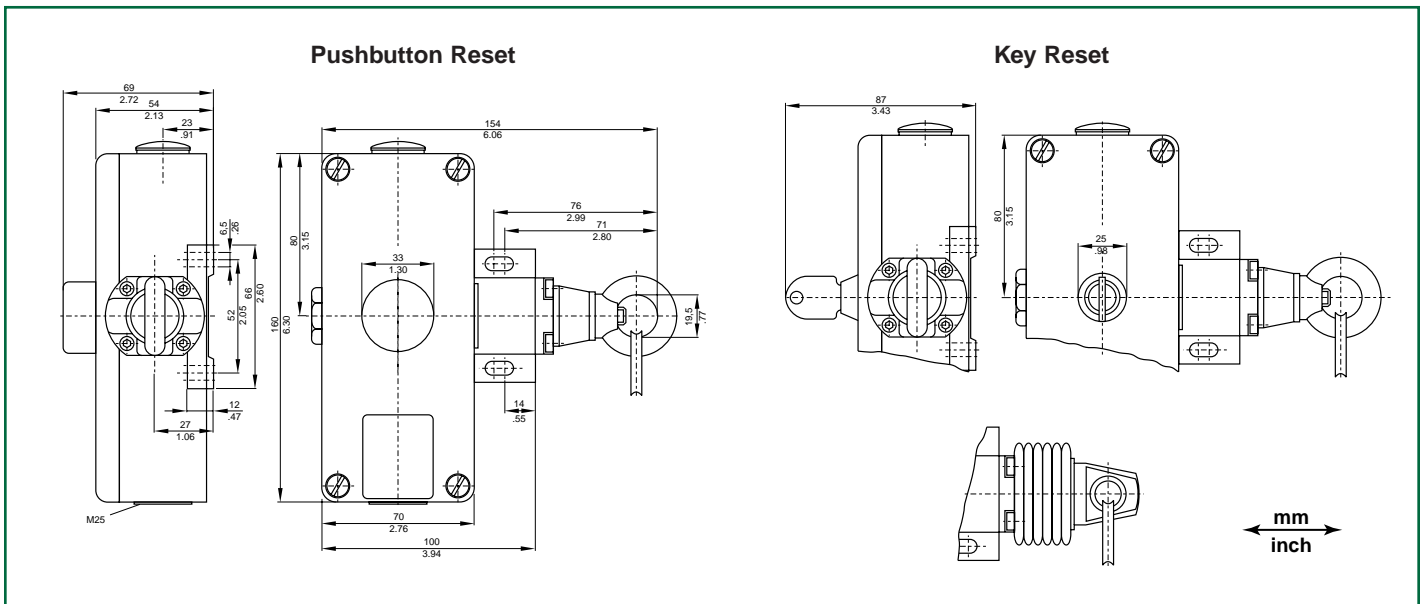
MECHANICAL SPECIFICATIONS

Housing	Die-cast aluminum, color-painted
Degree of Protection	IP65
Maximum Supported Span	164 feet (50m)
Typical Deflection (S) Required for Operation	5.1" (13cm)
Mechanical Life	1 million operations
Operating Temperature	-13°F to +158°F (-25°C to +70°C)
Conformity to Standards	UL CSA BG EN 418 IEC 947-5-1 EN 60947-5-1
Explosion Protection	E Ex dll CT6 ("Ex" models only)

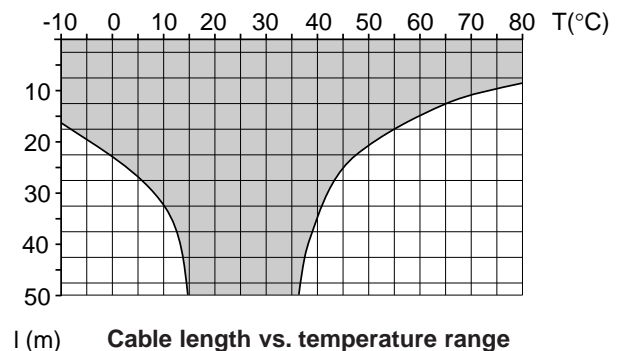
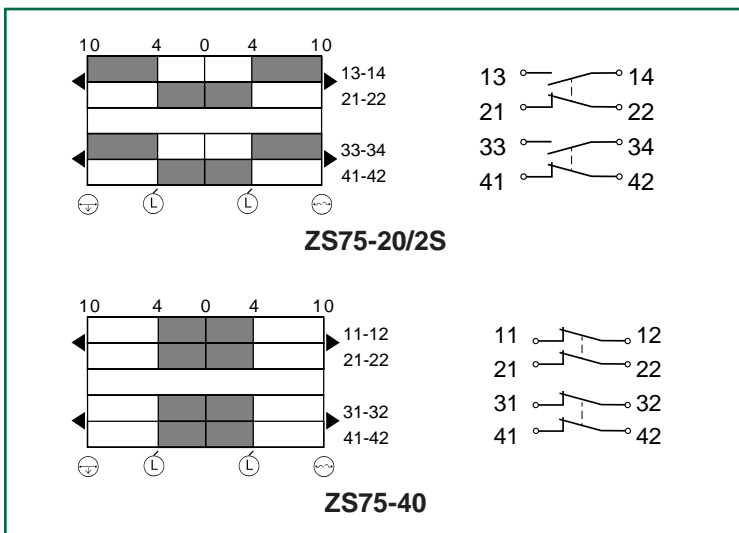
ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Rating	6A/400VAC
Switching Action	Slow-action, positive-break NC contacts (with wire pulling)
Short Circuit Protection	6A (Slow blow)
Rated Insulation Voltage	400VAC
Type Terminals	Screw terminals with clamping washers

DIMENSIONS

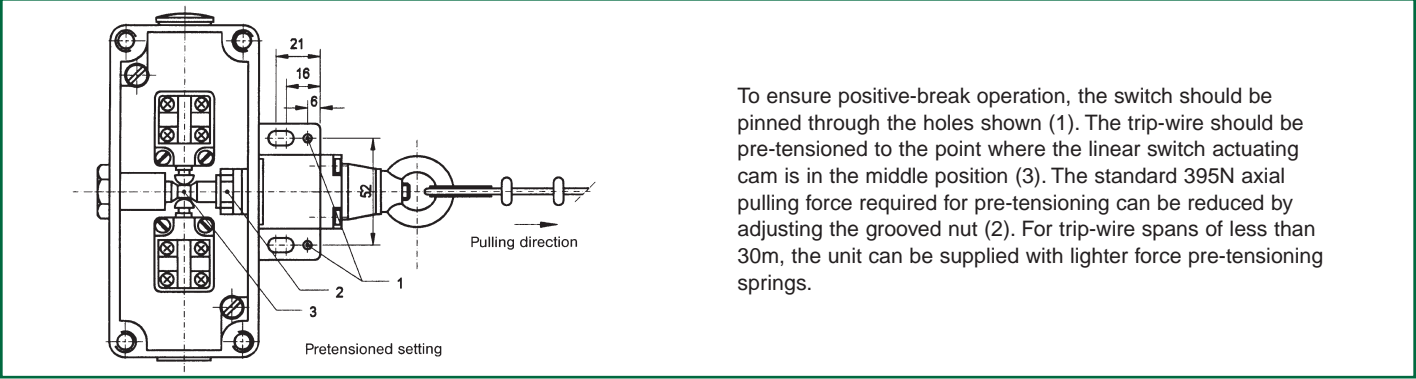


SWITCHING DIAGRAMS & CONTACT SCHEMATICS



ZS75 INSTALLATION DETAILS

PRE-TENSIONING ADJUSTMENT

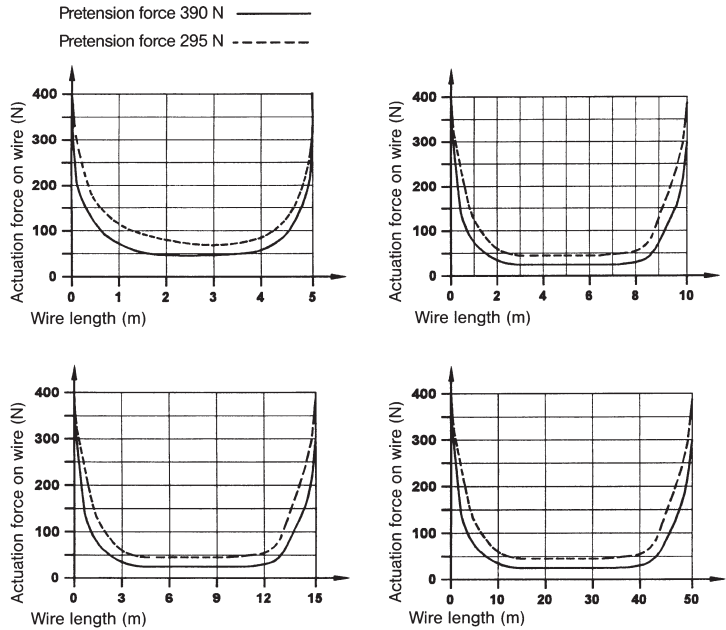


PRE-TENSIONING FORCE VS. ACTUATION FORCE

The actuating force is a function of the:

- trip-wire span
- pre-tensioning spring
- set pre-tensioning force

as shown. Units are available with lighter springs for trip-wire spans of less than 30m. Please see ordering details under AVAILABLE OPTIONS.





Typical Applications

ZS441 emergency cable-pull switches are ideal for replacing multiple, discrete E-stop pushbuttons or achieving a continuous, immediately accessible emergency stop. Typical applications include conveyor lines, textile machinery, packaging machinery, turret lathes, power plants, gravel processing and transfer lines.

Features & Benefits

- **Rugged, corrosion-resistant, die-cast aluminum housing ...** tolerates the most hostile environments.
- **“Positive-break” NC contacts ...** assure circuit interruption upon pulling of trip wire.
- **Watertight design ...** meets IP65 requirements.
- **Continuous E-stop protection ...** for trip-wire spans up to 82 feet (25m).
- **Meets rigid safety agency standards ...** EN 418
- **Available in three reset styles ...** pushbutton, key and non-reset.
- **Available in three operating force models ...** for application compatibility.
- **Mounting accessories ...** ease and extend installation.
- **Built-in vibration tolerance ...** eliminates nuisance tripping.
- **Push/pull operation ...** actuates if trip-wire is pulled or goes slack.

Description

The ZS441 Series is designed to provide a continuous emergency stop along exposed areas of machinery and conveyors which present hazards to operators/maintenance personnel. Unlike E-stop pushbuttons, emergency stop cable-pull systems can be actuated at any point along the “trip-wire.”

The units feature positive-opening NC contacts which are forced open when the trip-wire is pulled. This design also assures machine stoppage if an operator falls into, leans on, or is pulled against the trip wire.

In addition the switch is designed to operate if the trip wire is cut or goes slack. To comply with OSHA and other safety regulations, the ZS441 features a manual mechanical reset which must be actuated before the controlled equipment can be restarted.

Their rugged metal housing and watertight design (IP65) make them ideal for achieving a higher degree of E-stop safety in industrial and hostile environments.

Operation

The ZS441 features an axial actuating shaft and a double-pole contact block with 1 NO/1 NC or 2 NC contacts (with trip-wire attached). When installed, the trip-wire is pre-tensioned until the actuating shaft is pulled out 6 mm, closing the open contact.

When the trip-wire is pulled, the positive-break NC contact is forced open via a direct mechanical linkage with the actuating shaft. If the trip-wire goes slack (e.g. breaks or is cut) the NO contact, closed during pre-tensioning, opens – resulting in equipment stoppage.

Manual (key or pushbutton) reset mechanisms assure the equipment cannot be restarted until the reset is actuated.

AVAILABLE ACCESSORIES

Part Number	Description
PL-M20-24V	24V Pilot light kit
PL-M20-120V	120V Pilot light kit
STQ441-SC	5mm diameter steel cable, PVC coated
STQ441-EB	M10 eye bolt & hex nut
STQ441-CC	Cable clamp
STQ441-TB	Turnbuckle
STQ441-TH	Thimble
STQ441-PU	Pulley assembly (for cable "cornering")

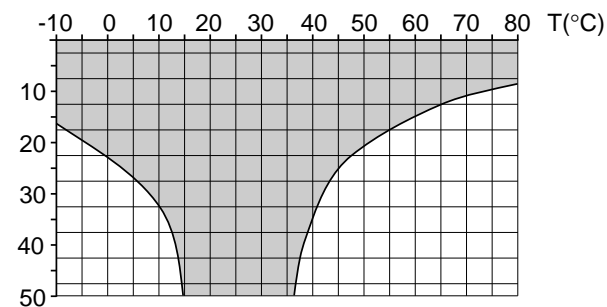
For recommended installation instructions, please see page 109.

ZS441 AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS

Part Number	Contact Configuration	Type Reset	Pre-Tensioned Force	Typical Actuating Force (F)	Recommended Cable Length (Minimum & Maximum)
ZS441-10/1S-60N	1 NO & 1 NC	Non-Reset	13.5 lbs (60N)	1.3 lbs (6N)	0-16.5 ft (0-5m)
ZS441-10/1S-150N	1 NO & 1 NC	Non-Reset	34 lbs (150N)	3.1 lbs (14N)	16.5-50 ft (5-15m)
ZS441-10/1S	1 NO & 1 NC	Non-Reset	50 lbs (220N)	5.2 lbs (23N)	50-80 ft (15-25m)
ZS441-10/1SVD-60N	1 NO & 1 NC	Pushbutton	13.5 lbs (60N)	1.3 lbs (6N)	0-16.5 ft (0-5m)
ZS441-10/1SVD-150N	1 NO & 1 NC	Pushbutton	34 lbs (150N)	3.1 lbs (14N)	16.5-50 ft (5-15m)
ZS441-10/1SVD	1 NO & 1 NC	Pushbutton	50 lbs (220N)	5.2 lbs (23N)	50-80 ft (15-25m)
ZS441-10/1SVS-60N	1 NO & 1 NC	Key	13.5 lbs (60N)	1.3 lbs (6N)	0-16.5 ft (0-5m)
ZS441-10/1SVS-150N	1 NO & 1 NC	Key	34 lbs (150N)	3.1 lbs (14N)	16.5-50 ft (5-15m)
ZS441-10/1SVS	1 NO & 1 NC	Key	50 lbs (220N)	5.2 lbs (23N)	50-80 ft (15-25m)
ZS441-20-60N	2 NC	Non-Reset	13.5 lbs (60N)	1.3 lbs (6N)	0-16.5 ft (0-5m)
ZS441-20-150N	2 NC	Non-Reset	34 lbs (150N)	3.1 lbs (14N)	16.5-50 ft (5-15m)
ZS441-20	2 NC	Non-Reset	50 lbs (220N)	5.2 lbs (23N)	50-80 ft (15-25m)
ZS441-20VD-60N	2 NC	Pushbutton	13.5 lbs (60N)	1.3 lbs (6N)	0-16.5 ft (0-5m)
ZS441-20VD-150N	2 NC	Pushbutton	34 lbs (150N)	3.1 lbs (14N)	16.5-50 ft (5-15m)
ZS441-20VD	2 NC	Pushbutton	50 lbs (220N)	5.2 lbs (23N)	50-80 ft (15-25m)
ZS441-20VS-60N	2 NC	Key	13.5 lbs (60N)	1.3 lbs (6N)	0-16.5 ft (0-5m)
ZS441-20VS-150N	2 NC	Key	34 lbs (150N)	3.1 lbs (14N)	16.5-50 ft (5-15m)
ZS441-20VS	2 NC	Key	50 lbs (220N)	5.2 lbs (23N)	50-80 ft (15-25m)

4



l (m) Cable length vs. temperature range

ZS441 TECHNICAL DATA

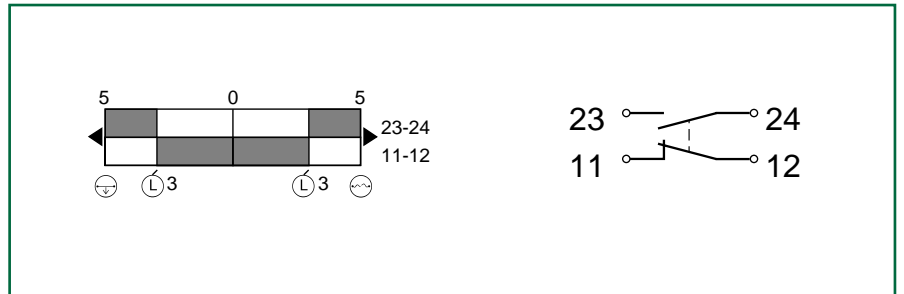
MECHANICAL SPECIFICATIONS

Housing (Standard)	Die-cast aluminum with baked enamel finish
Housing (Optional)	Cast iron
Degree of Protection	IP65
Maximum Supported Span	80 feet (25m)
Typical Deflection (S) Required for Operation	4" (10cm)
Operating Temperature	-22°F to +195°F
Mechanical Life	3 × 10 ⁴ operations
Conformity to Standards	IEC 947-5-1 EN60947-5-1 EN418 DIN VDE 0660-200
	UL CSA

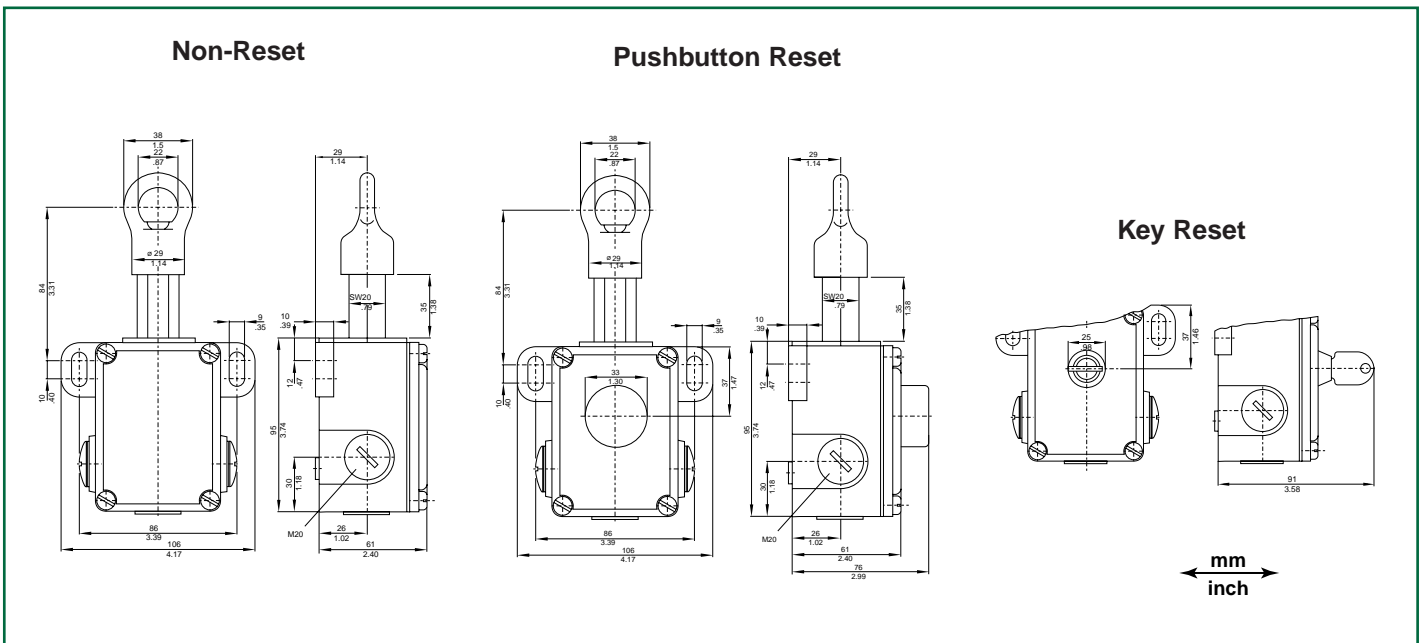
ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Rating	6A (Slow-blow)
Switching Action	Slow-action, positive-break NC contacts (with wire pulling)
Short Circuit Protection	Fuse 25A (time-delay)
Rated Insulation Voltage	400VAC
Type Terminals	Screw terminals with self-lifting clamps for up to 13 AWG flexible stranded wire (2.5 mm ²)

SWITCHING DIAGRAMS & CONTACT SCHEMATICS



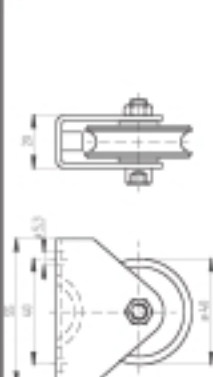




DIMENSIONS



ZS441 TECHNICAL DATA

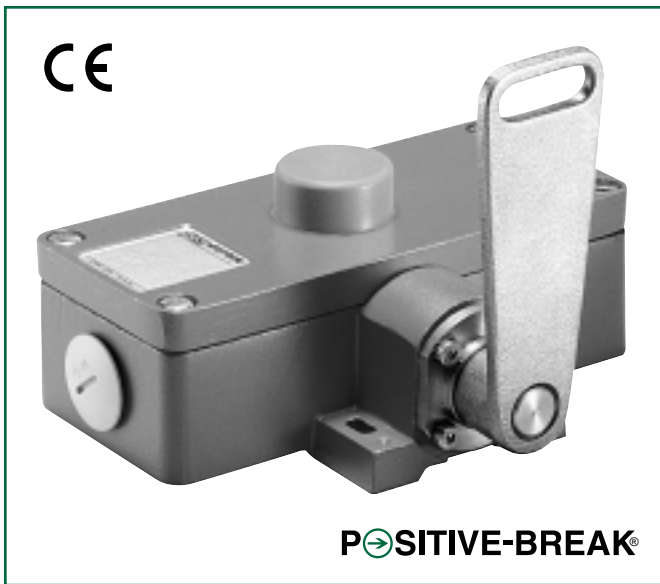
Recommended Emergency Cable-Pull Switch Installation Instructions (For ZS71, ZS73, ZS75 and ZS441 models)

Attention :
 Add 1 extra ft of cable for each loop
 Every switch requires at least 4 loops
 1 switch 2 - Turnbuckle 1 - wall
 Hence every switch requires at least :
 4 STQ 441 TH + 8 STQ 441 CC + 1 STQ 441 TB

	Part # STQ 441 PU-Cable Pulley Usage : To pass cable at an angle (ex. 45 degree , 90 degree)
	Part # STQ 441 TB - Turnbuckle Usage : To adjust middle position for NC contact
	Part # STQ 441 CC - Cable Clamp Usage : To clamp cable in position
	Part # STQ 441 EB - Eye Bolt & Hex Nut Usage : To support cable weight
	Part # STQ 441 TH - Thimble Usage : To protect cable in every loop

ZS75S Bidirectional

Heavy-Duty Bidirectional Emergency Cable-Pull Switch



Description

ZS75S is designed to provide a continuous emergency stop along exposed areas of machinery and conveyors which present hazards to operators/maintenance personnel. Unlike E-stop pushbuttons, emergency stop cable-pull systems can be actuated at any point along the “trip-wire.”

The units feature positive-opening NC contact(s) which are forced open when the trip-wire is pulled. This design also assures machine stoppage if an operator falls into, leans on, or is pulled against the trip-wire.

To comply with OSHA and other safety regulations, the ZS75S features a manual mechanical reset which must be actuated before the controlled equipment can be restarted. In addition the switch is designed to fail-to-safe if the trip wire is cut or goes slack.

Their rugged metal housing and watertight design (IP65) make them ideal for achieving a higher degree of E-stop safety in industrial and hostile environments. An optional signal lamp enables distance viewing of switch status.

Operation

Available with 2 NO & 2 NC or 4 NC contacts, the ZS75S is designed to mount between two trip-wires.

When either trip-wire is pulled, the positive-break NC contact(s) are forced open via a direct mechanical linkage with the actuating lever. If either trip-wire goes slack (e.g. breaks or is cut), the tension spring of the other trip wire pulls the actuating lever — also forcing the NC contacts to open.

When actuated, the switch remains latched until manually reset via a pushbutton or key. (An optional signal lamp is also available.)

Manual reset assures the equipment cannot be restarted until actuated.

Typical Applications

ZS75S emergency rope-pull switches are ideal for replacing multiple, discrete E-stop pushbuttons or achieving a continuous, immediately accessible emergency stop. Typical applications include conveyor lines, textile machinery, packaging machinery, turret lathes, power plants, gravel processing and transfer lines.

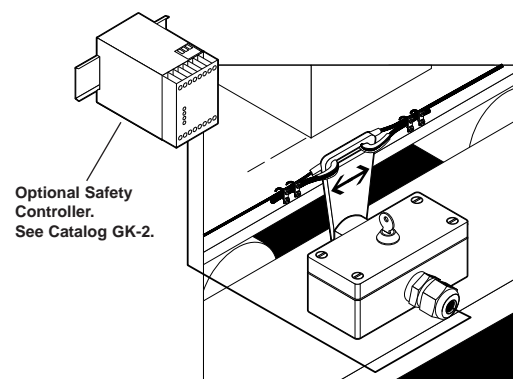
Features & Benefits

- **Rugged, corrosion-resistant, die-cast aluminum housing** ... tolerates the most hostile environments.
- **“Positive-break” NC contacts** ... assure circuit interruption upon pulling of trip wire.
- **Watertight design** ... meets IP65 requirements.
- **Continuous E-stop protection** ... for trip-wire spans up to 164 feet (50m).
- **Meets rigid safety agency standards** ... EN418
- **Available in two operating force models** ... for application compatibility.
- **Mounting accessories** ... ease and extend installation.
- **Satisfies OSHA push-pull operating requirements** ... trips if cable is pulled or goes slack.
- **Signal lamp** ... optional lamp signals tripped and latched condition.

AVAILABLE STANDARD MODELS

Part Number	Contact Configuration	Type Reset
ZS75S-20/2S VD	2 NO & 2 NC	Pushbutton
ZS75S-40 VD	4 NC	
ZS75S-20/2S VS	2 NO & 2 NC	Key
ZS75S-40 VS	4 NC	

Note: Pilot lamp option available for all above models. Add suffix G24V (24VAC) or G120V (120VAC) when ordering.



ZS75S BIDIRECTIONAL TECHNICAL DATA

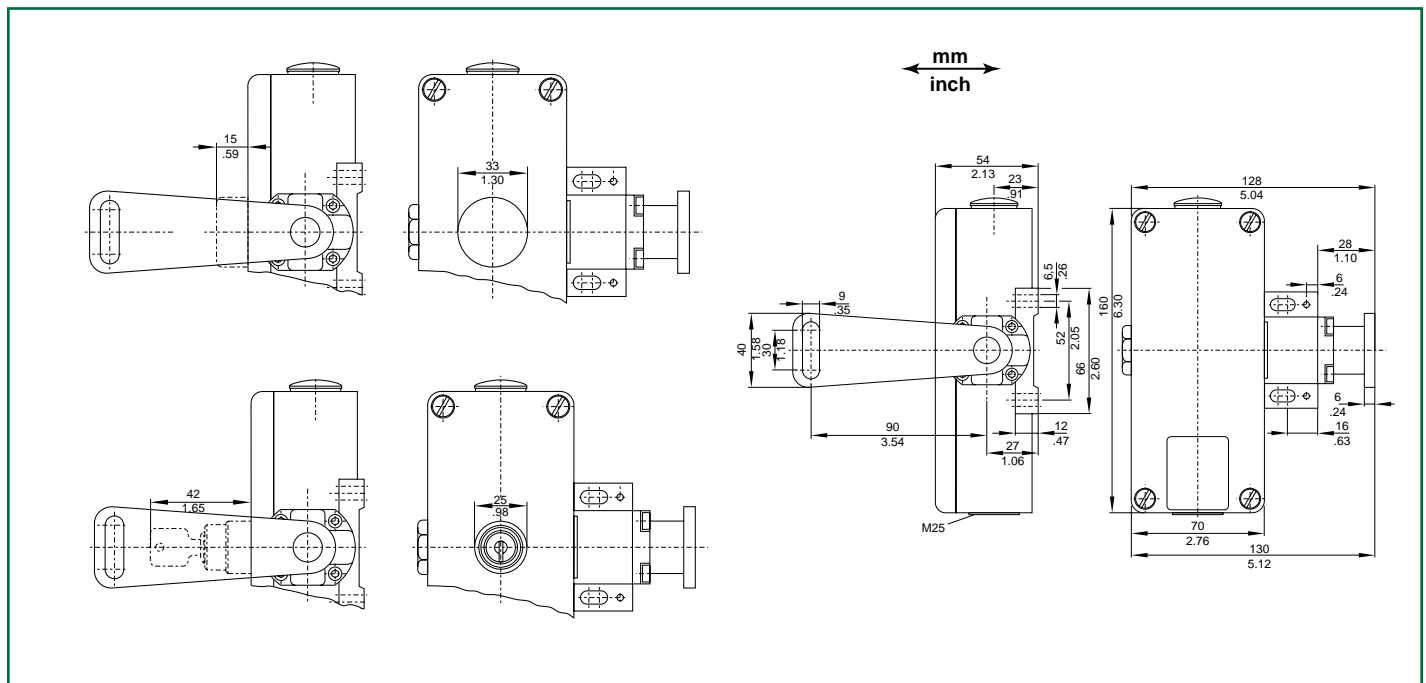
MECHANICAL SPECIFICATIONS

Housing	Die-cast aluminum, color-painted
Degree of Protection	IP65
Actuating Force	Depends upon wire span and model
Maximum Supported Span	165 feet (50m) in each direction
Mechanical Life	1 million operations
Operating Temperature	-13°F to +158°F (-25°C to +70°C)
Conformity to Standards	UL BG EN 418 IEC 947-5-1 EN 60947-5-1

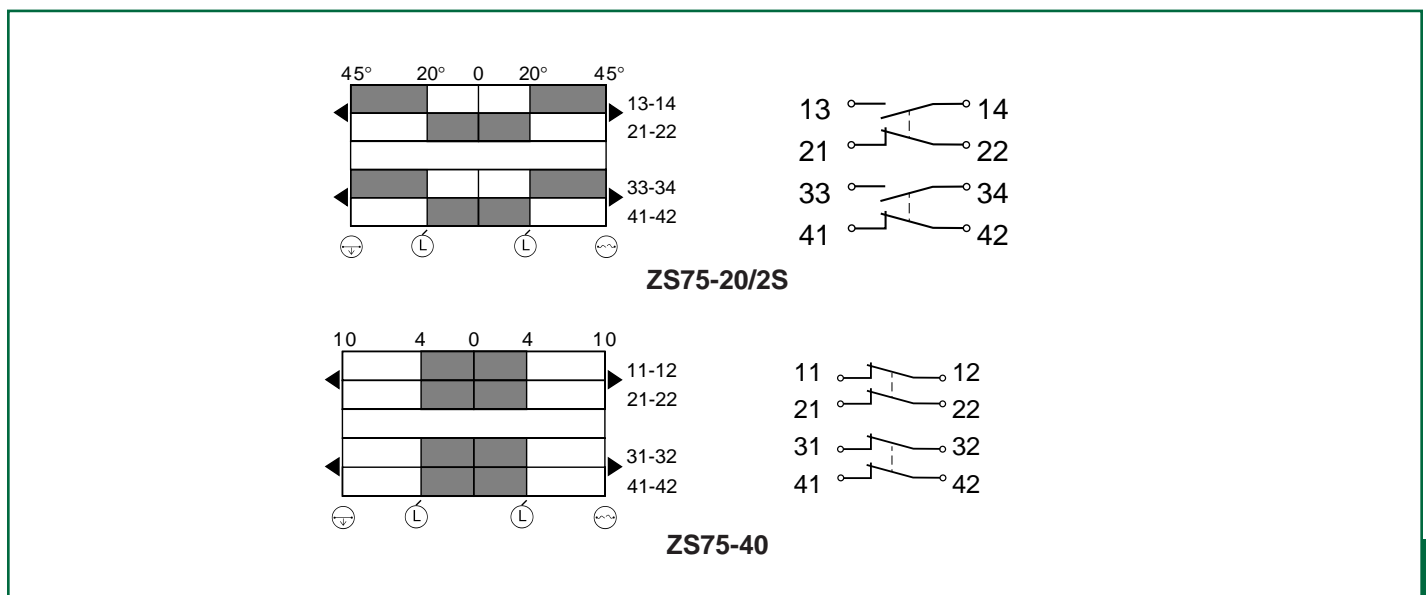
ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Rating	6A/400VAC
Switching Action	Slow-action, positive-break NC contacts (with wire pulling)
Short Circuit Protection	6A (Slow blow)
Rated Insulation Voltage	400VAC
Type Terminals	Screw terminals with clamping washers

DIMENSIONS



SWITCHING DIAGRAMS & CONTACT SCHEMATICS



ZS75S BIDIRECTIONAL TECHNICAL DATA

RECOMMENDED INSTALLATION DETAILS

Mounting Instructions – Cable Pull Switches Series ZS75S Bidirectional

Cable begin

Stainless Steel Spring - STD 441 SS
Turnbuckle - Turn to adjust cable tension

Thimble
Remove the red PVC sleeve in the clamping area prior to fitting the pull wire

Thimble
Cable Clamp

Distance between Eye Bolt
5 in (16 ft)

ZS75S Bidirectional

Cable ends

Wall
Thimble
Cable Clamp

Distance between Eye Bolt
5 in (16 ft)

STQ 441 PU - Cable Pulley

Cable corner

ZS75S Bidirectional

Attention :
Add 1 extra ft of cable for each loop
Every switch requires a least 6 loops
2 - switch 2 - Turnbuckle 2 - spring = total 6
Hence every switch requires at least :
6 STQ 441 TH + 16 STQ 441 CC + 1 STQ 441 TB + 2 STQ 441 SS

	Part # STQ 441 PU - Cable Pulley Usage : To pass cable at an angle (ex. 45 degree , 90 degree)
	Part # STQ 441 TB - Turnbuckle Usage : To adjust middle position for NC contact
	Part # STQ 441 CC - Cable Clamp Usage : To clamp cable in position
	Part # STQ 441 EB - Eye Bolt & Hex Nut Usage : To support cable weight
	Part # STQ 441 TH - Thimble Usage : To protect cable in every loop

CODED-MAGNET SENSORS

These rugged presence-sensing devices feature a sealed (IP67) housing, making them ideal interlocks in hostile environments. Their tamper-resistant design and small size make them attractive alternatives to conventional proximity sensors, magnetic switches, and limit switches. Used with SCHMERSAL's matched safety circuit monitors, they allow achieving the highest levels of machine safety.



SELECTION GUIDE

Sensor Series	Approximate Envelope Dimensions	Operating Voltage	Contact Configuration(s)	Catalog Page No.
BNS250	1.0"×1.4"×0.5"	24 /DC	1 NO & 1 NC 1 NO & 2 NC	114
BNS33	3.5"×1.0"×0.5"	24VAC/DC 120VAC/DC	1 NO & 1 NC 1 NO & 2 NC 1 NO 1 NC 2 NC	116
BNS303	1.25" Ø	100VAC/DC	1 NO & 1 NC 1 NO & 2 NC	120
New!* BNS30* & BNS300	1.25" Ø	24VDC	1 NC	122
BNS333	4.5"×1.7"×1.7"	24VDC	1 NC	124
BNS16	1.25"×2"×3"	100VAC/DC 2 NC	1 NO & 2 NC	126
BZ16	1.25"×2"×3"	24VDC	1 NO & 1 NC	128
Coded-Magnet Sensor Compatible AES Safety Controllers				130



Description

The Series BNS250 coded-magnet sensors are designed for use as a safety interlock switch on movable machine guards/articulating robot arms. Each sensor set consists of a multiple reed switch unit and a coded-magnet actuator. The reed switches, wired in series, will only close in the presence of their matched magnetic field array.

Both switch and magnet assemblies are sealed to IP67 (submersible) standards. Their tamper-resistant design prevents bypassing with a simple magnet or improperly coded magnetic field. In addition, the BNS module features a 1-meter long prewired pigtail.

Operation

The reed switch assembly is typically mounted to a stationary portion of a guard structure, with the coded-magnet assembly mounted to the movable element of the machine guard. When the guard is closed, and the matched magnetic field aligns with the reed switch unit, the switches will close. When the guard is open, or the required magnetic-field array is not properly aligned with the reed switch assembly, the sensor output will remain “off.”

Typical Applications



The sealed, compact BNS250 is ideal for use on movable machine guards in hostile environments. Typical applications include food processing equipment, chemical processing equipment, woodworking machinery, packaging machinery, and articulating robot arm rest position sensing.

Features & Benefits

- **Compact size** ... ideal for limited space applications.
- **Sealed for submersibility** ... assures long-term reliability in the most hostile environments.
- **Tamper-resistant** ... cannot be bypassed with simple magnets.
- **Rugged, corrosion-resistant housing** ... tolerates most industrial environments.
- **Integral LED status indicators** ... facilitate easy installation and provide visual indication of switch status.
- **Shock and vibration tolerant** ... designed to withstand mechanical abuse.
- **Satisfy CE & fail-to-safe requirements** ... when used with Series AES safety controllers.

AVAILABLE STANDARD MODELS (Please order BPS250 magnet separately)

Part Number	Contact Configuration*	Description
BNS250-11z	1 NO & 1 NC	Multiple reed switch (24VDC/100mA) assembly with 1-meter prewired pigtail
BNS250-12z	1 NO & 2 NC	Multiple reed switch (24VDC/100mA) assembly with 1-meter prewired pigtail and built-in LED display
BNS250-11zG	1 NO & 1 NC	Multiple reed switch (24VDC/100mA) assembly with 1 meter pigtail (side entry) and built-in LED display
BNS250-12zG	1 NO & 2 NC	Multiple reed switch (24VDC/100mA) assembly with 1 meter pigtail (side entry) and built-in LED display
BNS250-11zG-2205	1 NO & 1 NC	Multiple reed switch (24VDC/100mA) assembly with 1 meter pigtail (side entry) and built-in LED display
BPS250	N/A	Coded-magnet actuator

*Contact configuration in presence of BPS250 coded-magnet actuator.

***Important Note:** Series BNS Coded-magnet sensors are for use in safety applications only when used with a SCHMERSAL Series AES safety controller. (Please see selection chart on Page 130.)



USE WITH ANY OTHER SAFETY CONTROLLER MAY DAMAGE SENSOR AND/OR VOID WARRANTY.

BNS250 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Fiberglass reinforced thermoplastic
Switching Distance "S"	"On": 4mm (0.16") "Off": 14mm (0.55")
Degree of Protection	IP67
Operating Temperature	-13°F to +158°F
Operating Principle	Magnetic
Shock Resistance	30g/11ms
Vibration Resistance	10 to 55 Hz, amplitude 1mm
Conformity to Standards	CE, UL, CSA VDE 0660 Part 209

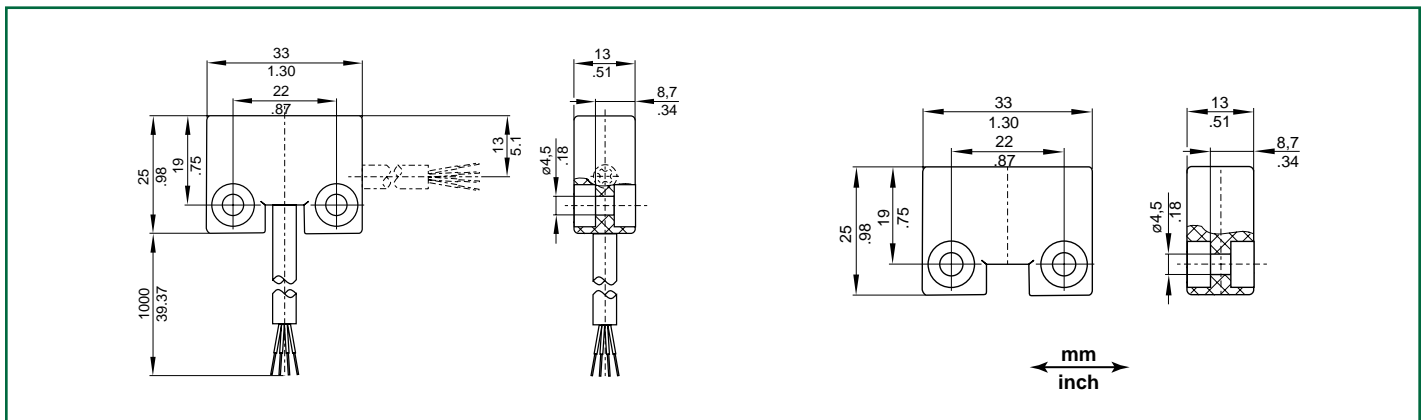
*Without ferromagnetic material in vicinity of switch or magnet. The proximity of ferrous material may affect switching distances.

ELECTRICAL SPECIFICATIONS

Maximum Operating Voltage	24VDC
Maximum Continuous Current Rating	100 mA (BNS250-11z/12z) 10 mA (BNS250-11zG/12zG)
Maximum Switching Capacity (Power Rating)	1W (BNS250-11z/12z) 240mW (BNS250-11zG/12zG)
Type Connection*	1 meter long LiYY4* 0.25mm ² (23AWG) pre-wired pigtail

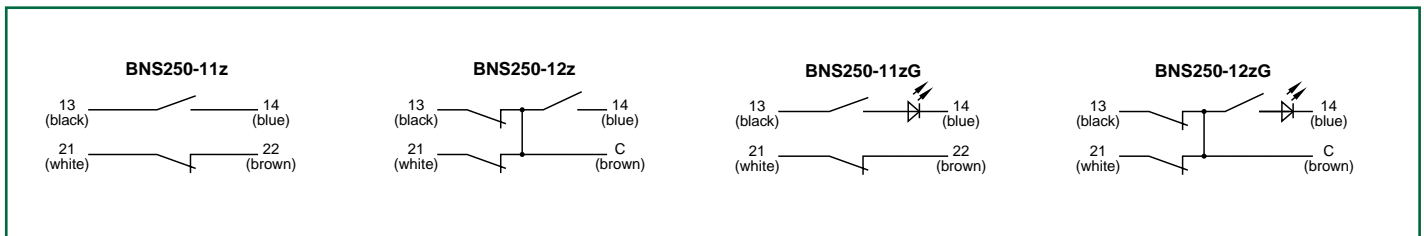
*Longer prewired cables (3M, 5M, or 10M lengths) available on request. Please consult factory.

DIMENSIONS

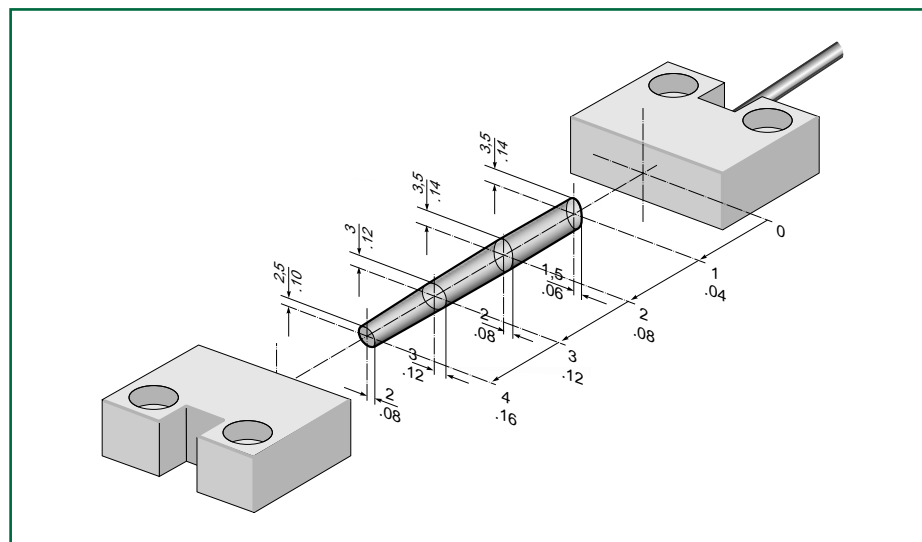


Note: BNS250 reed switch assemblies should be mounted at least 50mm (2") apart.

WIRING DETAILS



MISALIGNMENT ALLOWANCE





Description

The Series BNS33 coded-magnet sensors are designed for use as a safety interlock switch on movable machine guards/articulating robot arms. Each sensor set consists of a multiple reed switch unit and a coded-magnet actuator. The reed switches, wired in series, will only close in the presence of their matched magnetic field array.

Both switch and magnet assemblies are sealed to IP67 (submersible) standards. Their tamper-resistant design prevents bypassing with a simple magnet or improperly coded magnetic field. In addition, the BNS module features an optional built-in LED display of switch status, and a 1-meter long prewired pigtail to assure sealing integrity.

Operation

The reed switch assembly is typically mounted to a stationary portion of a guard structure, with the coded-magnet assembly mounted to the movable element of the machine guard. When the guard is closed, and the matched magnetic field aligns with the reed switch unit, the switches will close. When the guard is open, or the required magnetic-field array is not properly aligned with the reed switch assembly, the sensor output will remain “off.”

Typical Applications

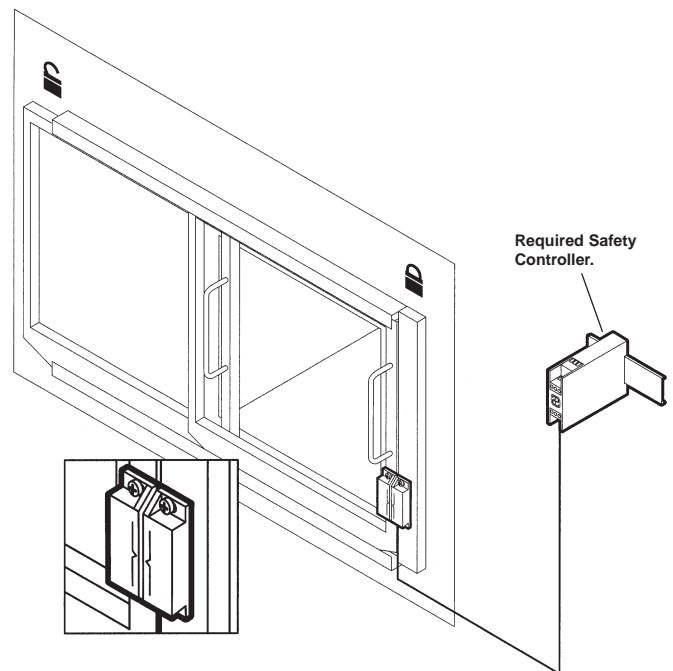


The sealed, compact BNS33 is ideal for use on movable machine guards in hostile environments or where space is limited. Typical applications include food processing equipment, chemical processing equipment, woodworking machinery, packaging machinery, and articulating robot arm rest position sensing.

***Important Note:** Series BNS coded-magnet sensors are for use in safety applications only when used with a SCHMERSAL Series AES safety controller. (Please see selection chart on Page 130.)

Features & Benefits

- **Compact size** ... ideal for limited space applications.
- **Sealed for submersibility** ... assures long-term reliability in the most hostile environments.
- **Tamper-resistant** ... cannot be bypassed with simple magnets.
- **Rugged, corrosion-resistant housing** ... tolerates most industrial environments.
- **Integral LED status indicators** ... facilitate easy installations and provide visual indication of switch status.
- **Shock and vibration tolerant** ... designed to withstand mechanical abuse.
- **Satisfy EN954, Category 1, 3, or 4** ... when used with appropriate Series AES safety controllers.
- **Optional high-strength field coded-magnets** ... extends sensing range to 10mm.
- **Units available with M8 quick-connect.** (Please consult factory).



USE WITH ANY OTHER SAFETY CONTROLLER MAY DAMAGE SENSOR AND/OR VOID WARRANTY.

BNS33 AVAILABLE MODELS AND ACCESSORIES

AVAILABLE STANDARD MODELS

(Please order BPS33 or BPS33-2326 magnet separately)

Part Number	Contact Configuration*	Maximum Contact Rating	Description
BNS33-11z**	1 NO & 1 NC	100VAC/DC (400mA)	Multiple reed switch assembly with 1-meter prewired pigtail
BNS33-12z***	1 NO & 2 NC		
BNS33-11zG**	1 NO & 1 NC	24VDC (10mA)	Multiple reed switch assembly with 1-meter prewired pigtail and built-in LED display
BNS33-12zG***	1 NO & 2 NC		
BNS33-11z-2063	1 NO & 1 NC	120VAC/DC (500mA)	Multiple reed switch assembly with 1-meter prewired pigtail
BNS33-12z-2187**	1 NO & 2 NC	120VAC/DC (250mA)	
BPS33	N/A	N/A	Coded-magnet actuator (5mm sensing distance)
BPS33-2326	N/A	N/A	Coded-magnet actuator (10mm sensing distance)
BNS33-11z-ST**	1NO & 1NC	60VAC/DC (400mA)	Multiple reed switch assembly with M8x1 quick-connect
BNS33-11zG-ST**	1NO & 1NC	24VDC (10mA)	
BNS33-12z-ST***	1NO & 2NC	60VAC/DC (400mA)	
BNS33-12zG-ST***	1NO & 2NC	24VDC (10mA)	

*Contact configuration in presence of BPS33 coded-magnet actuator.

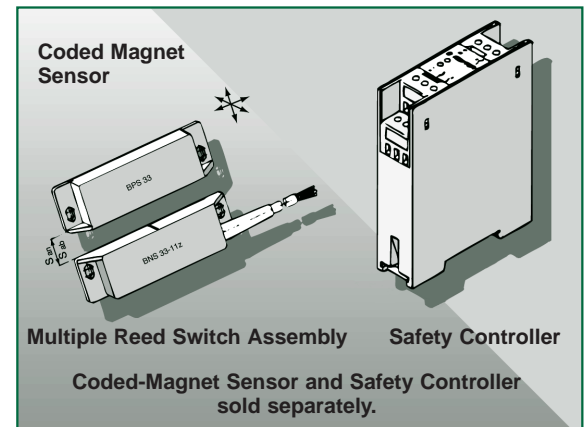
**These models feature isolated contacts.

***These models feature C-form contacts.

Note: Longer prewired cables (3M, 5M, or 10M lengths) available on request.
Please consult factory.

AVAILABLE ACCESSORIES

Part Number	Description
BN31/33	Shim plate for mounting reed switch assembly on ferrous material
M8ST-2M	Straight quick-connect with 2M cable
M8ST-5M	Straight quick-connect with 5M cable
M8ST-10M	Straight quick-connect with 10M cable
M8ST-15M	Straight quick-connect with 15M cable
M8ST-RA-2M	Right-angle quick-connect with 2M cable
M8ST-RA-5M	Right-angle quick-connect with 5M cable
BNS-SS-CVR	Stainless-steel protective cover for BNS33-xxx
BPS-SS-CVR	Stainless-steel protective cover for BPS33-xxx



BNS33 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Fiberglass reinforced thermoplastic
Switching Distance "S" *	"On": 5mm (0.2") "Off": 15mm (0.6")
Degree of Protection	IP67
Operating Temperature	-13°F to +158°F
Operating Principle	Magnetic
Shock Resistance	30g/11ms
Vibration Resistance	10 to 55 Hz, amplitude 1mm
Conformity to Standards	CE, UL, CSA VDE 0470 Part 1 IEC 529/EN60529

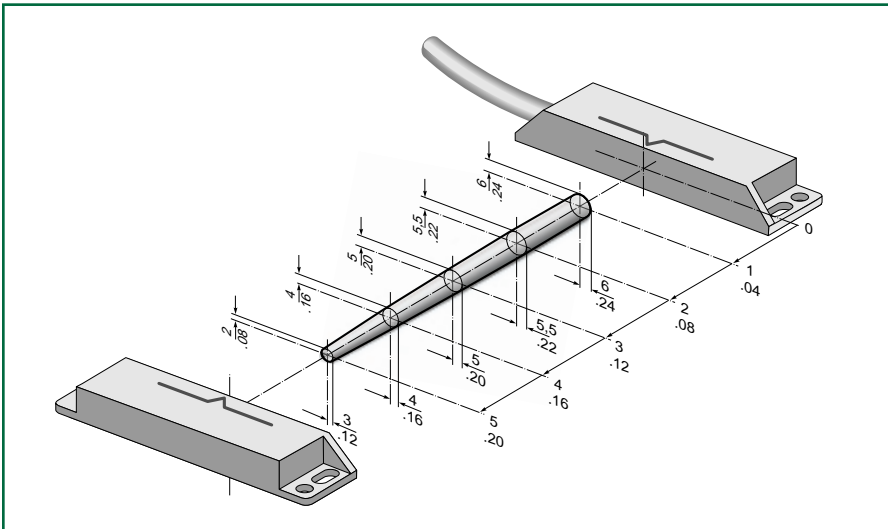
*Without ferromagnetic material in vicinity of switch or magnet. The proximity of ferrous material may affect switching distances.

ELECTRICAL SPECIFICATIONS

Maximum Contact Rating	100VAC/DC (BNS33-11z/12z) 24VDC (BNS33-11zG/12zG) 120VAC/DC (BNS33-11z-2063) 120VAC/DC (BNS33-02z/12z-2187)
Maximum Continuous Current Rating	0.4A (BNS33-11z/12z) 10mA (BNS33-11zG/12zG) 0.5A (BNS33-11z/10z/01z-2063) 250mA (BNS33-02z/12z-2187)
Maximum Switching Capacity (Power Rating)	10VA (BNS33-11z/12z) 240mVA (BNS33-11zG/12zG) 10VA (BNS33-11z/10z/01z-2063) 240mW (BNS33-02z/12z-2187)
Type Connection*	1 meter long LiYY4* 0.25mm ² (23AWG) pre-wired pigtail. M8x1 quick-connect for versions with "ST" suffix

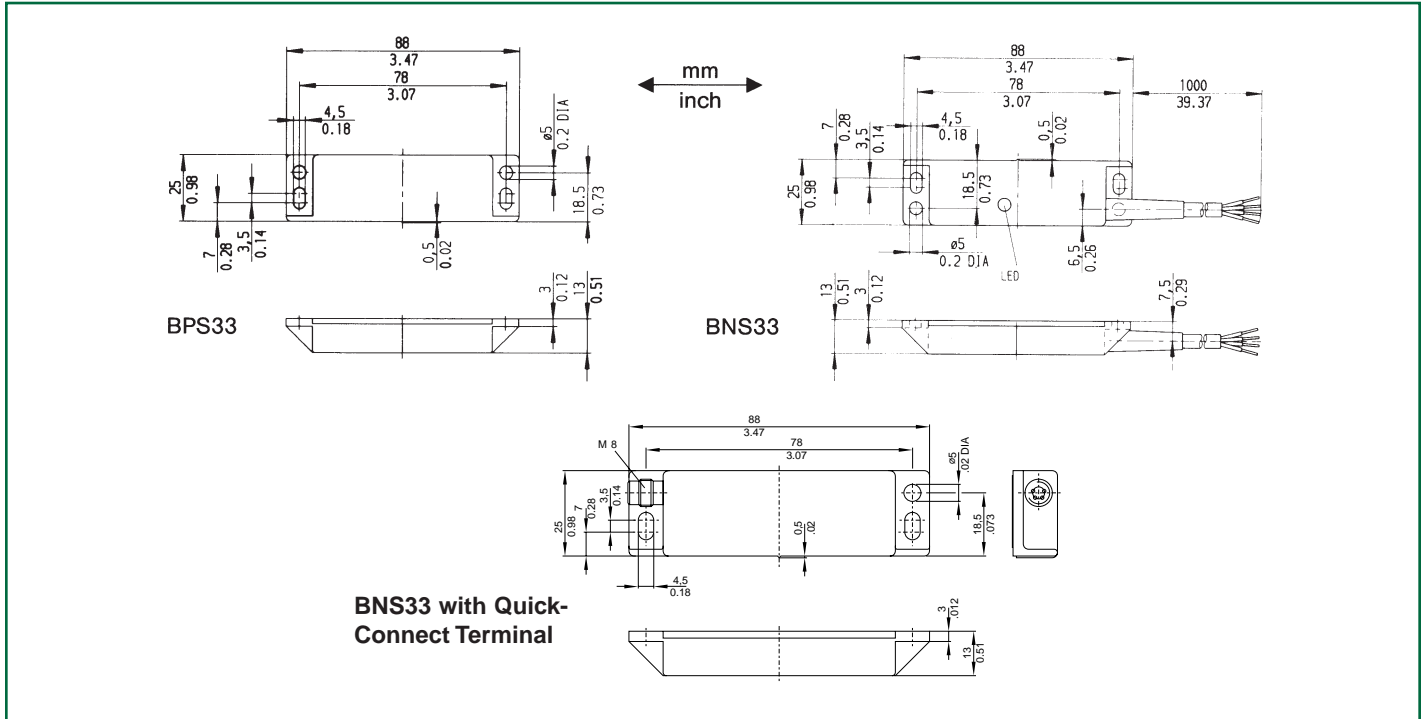
*Longer prewired cables available on request. Please consult factory.

BPS33 MISALIGNMENT ALLOWANCE



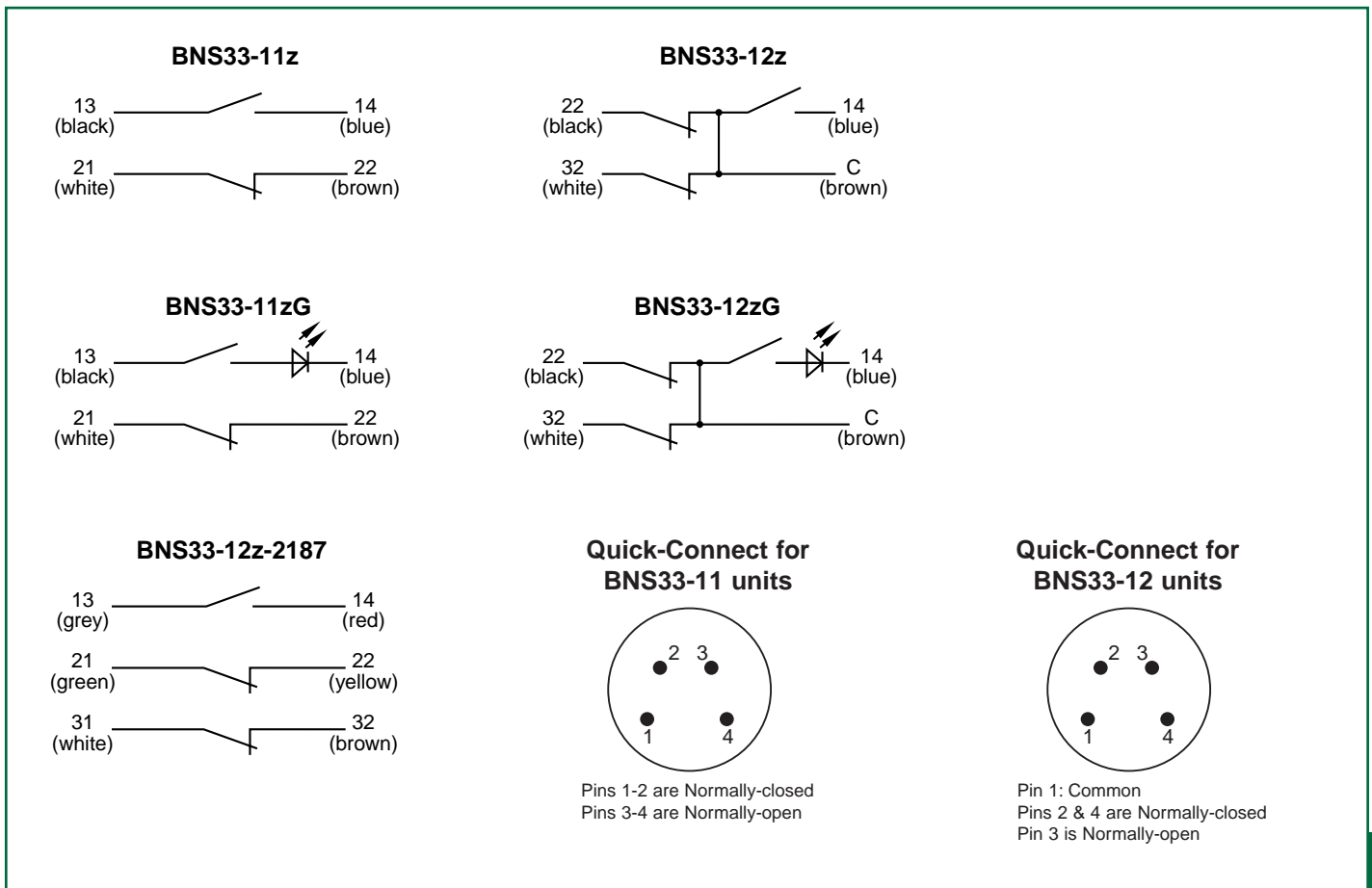
BNS33 TECHNICAL DATA

DIMENSIONS



Note: BNS33 reed switch assemblies should be mounted at least 50mm (2") apart.

WIRING DETAILS





Description

The Series BNS303 coded-magnet sensors are designed for use as a safety interlock switch on movable machine guards/articulating robot arms. Each sensor set consists of a multiple reed switch unit and a coded-magnet actuator. The reed switches, wired in series, will only close in the presence of their matched magnetic field array.

Both switch and magnet assemblies are sealed to IP67 (submersible) standards. Their tamper-resistant design prevents bypassing with a simple magnet or improperly coded magnetic field. In addition, the BNS module features an integral built-in LED display of switch status, and a 1-meter long prewired pigtail.

Operation

The reed switch assembly is typically mounted to a stationary portion of a guard structure, with the coded-magnet assembly mounted to the movable element of the machine guard. When the guard is closed, and the matched magnetic field aligns with the reed switch unit, the switches will close. When the guard is open, or the required magnetic-field array is not properly aligned with the reed switch assembly, the sensor output will remain “off.”

Typical Applications



The sealed, compact BNS303 is ideal for use on movable machine guards in hostile environments. Typical applications include food processing equipment, chemical processing equipment, woodworking machinery, packaging machinery, and articulating robot arm rest position sensing.

***Important Note:** Series BNS coded-magnet sensors are for use in safety applications only when used with a SCHMERSAL Series AES safety controller. (Please see selection chart on Page 130.)

Features & Benefits

- **Compact size** ... ideal for limited space applications.
- **Sealed for submersibility** ... assures long-term reliability in the most hostile environments.
- **Tamper-resistant** ... cannot be bypassed with simple magnets.
- **Rugged, corrosion-resistant housing** ... tolerates most industrial environments.
- **Shock and vibration tolerant** ... designed to withstand mechanical abuse.
- Satisfy EN954, Category 4 ... when used with appropriate safety controller.

AVAILABLE STANDARD MODELS (Please order BPS300 or BPS303 magnet separately)

Part Number	Contact Configuration*	Description
BNS303-11z	1 NO & 1 NC	Multiple reed switch (100VAC/DC/400mA) assembly with 1-meter prewired pigtail
BNS303-12z	1 NO & 2 NC	
BNS303-11zG	1 NO & 1 NC	Multiple reed switch (24VDC/10mA) assembly with 1-meter prewired pigtail and built-in LED display
BNS303-12zG	1 NO & 2 NC	
BPS300	N/A	Coded-magnet actuator (front mount)
BPS303**	N/A	Coded-magnet actuator (rear mount)

*Contact configuration in presence of BPS300 or BPS303 coded-magnet actuator.

**Available with stainless-steel outer jackets. Please consult factory.



BPS300 Actuator



BPS303 Actuator**



USE WITH ANY OTHER SAFETY CONTROLLER MAY DAMAGE SENSOR AND/OR VOID WARRANTY.

BNS303 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Fiberglass reinforced thermoplastic
Switching Distance, "S" *	"On": 5mm (0.2") "Off": 15mm (0.6") "On": 8 mm "Off": 18mm *Suffix 2211 only
Degree of Protection	IP67
Operating Temperature	-13°F to +158°F
Operating Principle	Magnetic
Shock Resistance	30g/11ms
Vibration Resistance	10 to 55 Hz, amplitude 1mm
Conformity to Standards	CE, UL, CSA VDE 0660 Part 209 EN1088

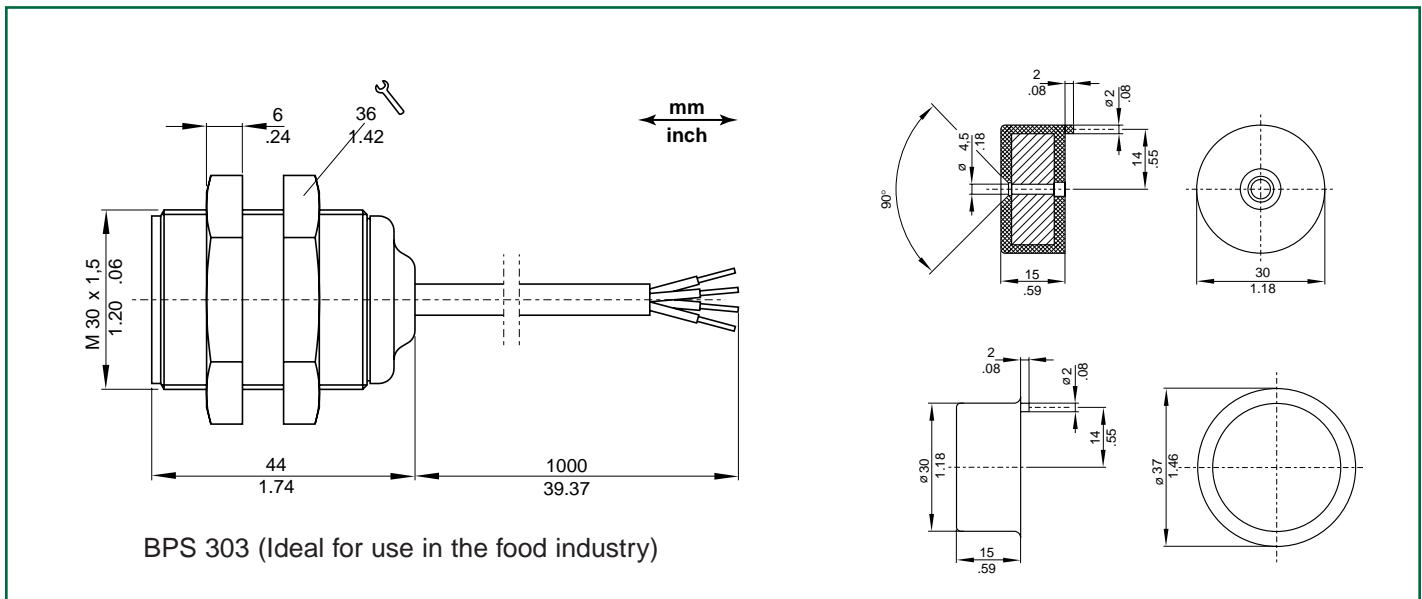
*Without ferromagnetic material in vicinity of switch or magnet. The proximity of ferrous material may affect switching distances.

ELECTRICAL SPECIFICATIONS

Maximum Operating Voltage	24VDC (with LED) 100VAC/DC (without LED)
Maximum Continuous Current Rating	10mA (with LED) 400mA (without LED)
Maximum Switching Capacity (Power Rating)	10VA
Type Connection*	1 meter long LiYY4* 0.25mm ² (23AWG) pre-wired pigtail

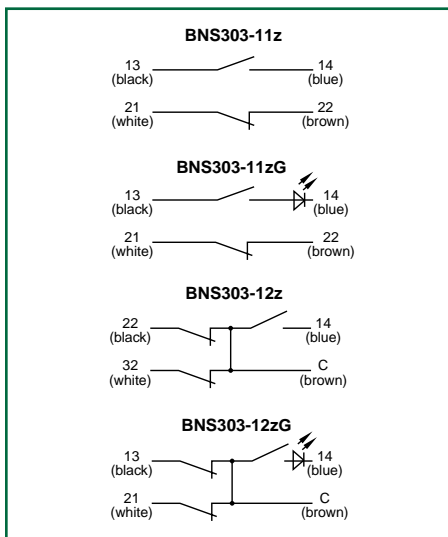
*Longer prewired cables (3M, 5M, or 10M lengths) available on request. Please consult factory.

DIMENSIONS

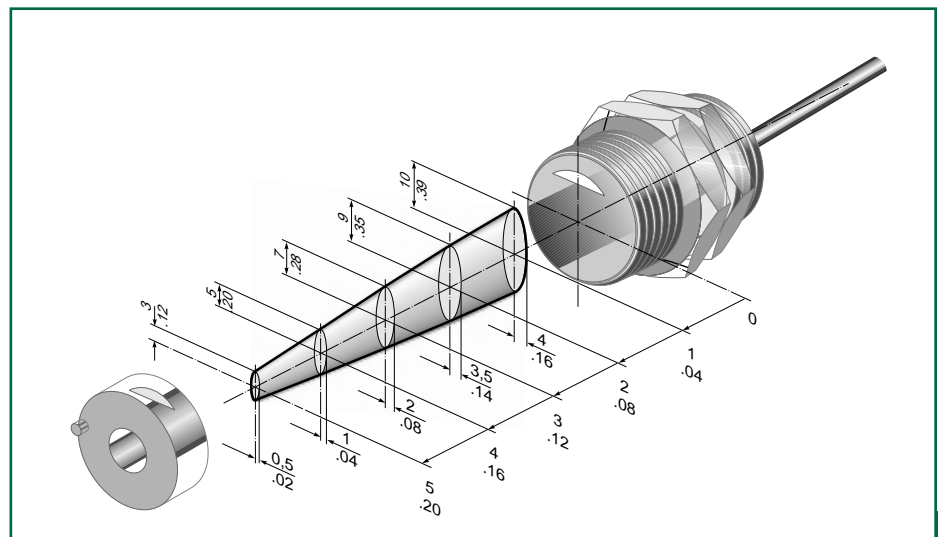


Note: BNS303 reed switch assemblies should be mounted at least 50mm (2") apart.

WIRING DETAILS



MISALIGNMENT ALLOWANCE





Description

The Series BNS30 and BNS300 coded-magnet sensors are designed for use as a safety interlock switch on movable machine guards/articulating robot arms. Each sensor set consists of a multiple reed switch unit and a coded-magnet actuator. The reed switches, wired in series, will only close in the presence of their matched magnetic field array.

In addition, the Series features an integral monitoring and control circuit which detects faults in the reed switch array (satisfying EN954, Category 1 without use of an ancillary safety relay module).

Both switch and magnet assemblies are sealed to IP67 (submersible) standards. Their tamper-resistant design prevents bypassing with a simple magnet or improperly coded magnetic field. In addition, the BNS module features an integral LED display of switch status and a 1-meter long prewired pigtail.

Operation

The reed switch assembly is typically mounted to a stationary portion of a guard structure, with the coded-magnet assembly mounted to the movable element of the machine guard. When the guard is closed, and the matched magnetic field aligns with the reed switch unit, the switches will close. When the guard is open, or the required magnetic-field array is not properly aligned with the reed switch assembly, the sensor output will remain "off."

Typical Applications



The sealed, compact units are ideal for use on movable machine guards in hostile environments. Typical applications include food processing equipment, chemical processing equipment, woodworking machinery, packaging machinery, and articulating robot arm rest position sensing.

Features & Benefits

- **Compact size** ... ideal for limited space applications.
- **Sealed for submersibility** ... assures long-term reliability in the most hostile environments.
- **Tamper-resistant** ... cannot be bypassed with simple magnets.
- **Rugged, corrosion-resistant housing** ... tolerates most industrial environments.
- **Integral LED status indicators** ... facilitate easy installations and provide visual indication of switch status.
- **Shock and vibration tolerant** ... designed to withstand mechanical abuse.
- **Integral reed switch monitoring & control module**... detects faults in reed switch array. Satisfies EN954, Safety Category 1.
- **Available in metal (BNS30) or plastic (BNS300) housings** ... for application versatility.

AVAILABLE STANDARD MODELS (Please order BPS300 or BPS303 magnet separately)

Part Number	Contact Configuration*	Description
BNS30-01ZG** and BNS300-01zG**	1 NC	Multiple reed switch (24VDC/30mA) assembly with 1-meter prewired pigtail and built-in LED display
BPS300	N/A	Coded-magnet actuator (front mount)
BPS303***	N/A	Coded-magnet actuator (rear mount)

*Contact configuration in presence of BPS300 or BPS 303 coded-magnet actuator.

**Important Note: The BNS30 and BNS300 are 4-wire sensors designed to satisfy EN954, Category 1 requirements. They are not designed for use with a separate safety controller.

***Available with stainless-steel outer jacket. Please consult factory



BPS300 Actuator



BPS303 Actuator***

BNS300 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Fiberglass reinforced thermoplastic (BNS300) Brass, nickel-plated (BNS30)
Switching Distance "S"*	"On": 5mm (0.2") "Off": 15mm (0.6")
Degree of Protection	IP67
Operating Temperature	-13°F to +158°F
Operating Principle	Magnetic
Shock Resistance	30g/11ms
Vibration Resistance	10 to 55 Hz, amplitude 1mm
Conformity to Standards	CE, UL, CSA VDE 0660 Part 209 EN954-1 EN1088 BG-GS-ET-14

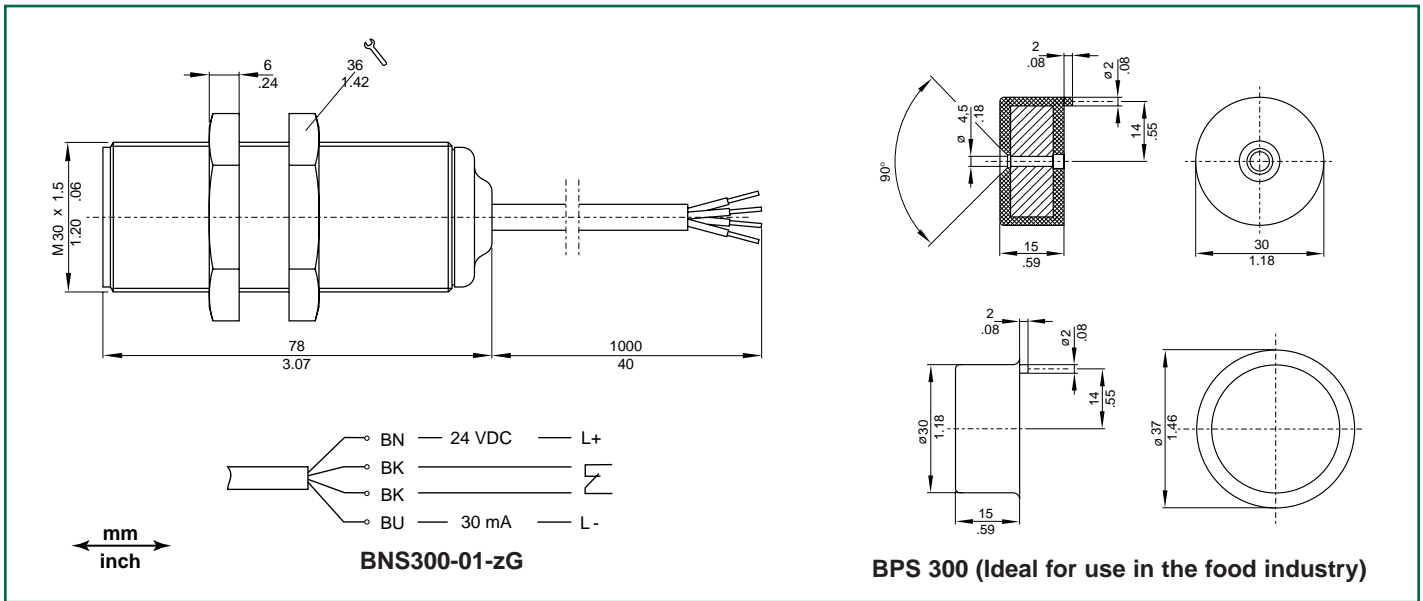
*Without ferromagnetic material in vicinity of switch or magnet. The proximity of ferrous material may affect switching distances.

ELECTRICAL SPECIFICATIONS

Maximum Supply Voltage	24VDC
Maximum Continuous Current Rating	30mA
Maximum Switching Capacity (Power Rating)	Voltage: 250VAC Current: 3A (750VA)
Type Connection*	1 meter long LiYY4* 0.25mm2 (23AWG) pre-wired pigtail

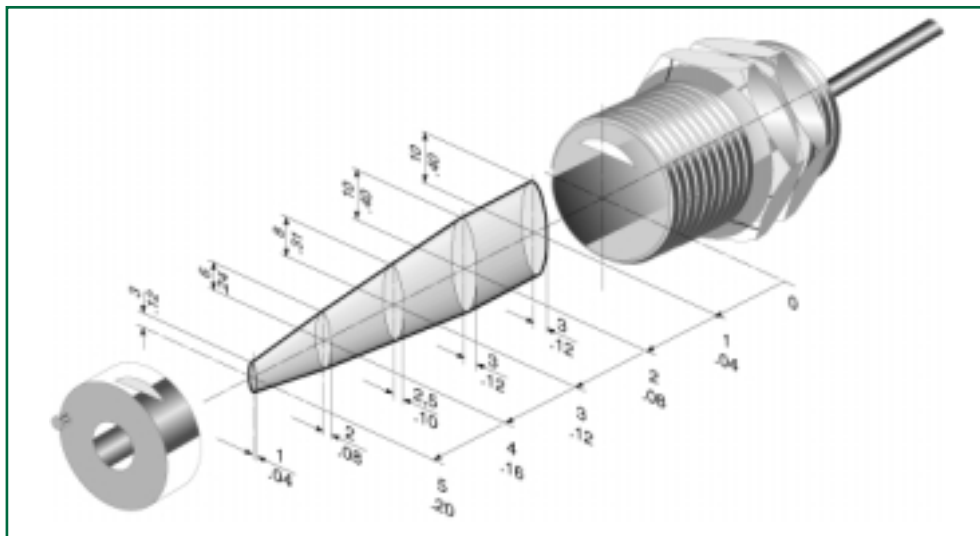
*Longer prewired cables (3M, 5M, or 10M lengths) available on request. Also available with M12x1 quick-connect. Please consult factory.

DIMENSIONS & WIRING DETAILS



Note: BNS300 reed switch assemblies should be mounted at least 50mm (2") apart.

MISALIGNMENT ALLOWANCE



SERIES BNS333

Coded-Magnet Sensors with Integral Safety Control Module



Description

The Series BNS333 coded-magnet sensors are designed for use as a safety interlock switch on movable machine guards/articulating robot arms. Each sensor set consists of a multiple reed switch unit and a coded-magnet actuator. The reed switches, wired in series, will only close in the presence of their matched magnetic field array.

In addition, the BNS333 features an integral monitoring and control circuit which detects faults in the reed switch array (satisfying EN954, Category 1 without use of an ancillary safety circuit monitoring module).

Their tamper-resistant design prevents bypassing with a simple magnet or improperly coded magnetic field. In addition, the BNS module features an optional built-in LED display of switch status.

Operation

The reed switch assembly is typically mounted to a stationary portion of a guard structure, with the coded-magnet assembly mounted to the movable element of the machine guard. When the guard is closed, and the matched magnetic field aligns with the reed switch unit, the switches will close. When the guard is open, or the required magnetic-field array is not properly aligned with the reed switch assembly, the sensor output will remain “off.”

Typical Applications



The sealed, compact BNS333 is ideal for use on movable machine guards in hostile environments. Typical applications include food processing equipment, chemical processing equipment, woodworking machinery, packaging machinery, and articulating robot arm rest position sensing.

Features & Benefits

- **Compact size** ... ideal for limited space applications.
- **Sealed for submersibility** ... assures long-term reliability in the most hostile environments.
- **Tamper-resistant** ... cannot be bypassed with simple magnets.
- **Rugged, corrosion-resistant housing** ... tolerates most industrial environments.
- **Integral LED status indicators** ... facilitate easy installation and provide visual indication of switch status.
- **Shock and vibration tolerant** ... designed to withstand mechanical abuse.
- **Integral reed switch monitoring/control module** ... detects faults in reed switch array. Satisfies EN954, Category 1.

AVAILABLE STANDARD MODELS (Please order BPS300 or BPS303 magnet separately)

Part Number	Contact Configuration*	Description
BNS333-01YU**	1 NC	Multiple reed switch(24VAC/DC/40mA) assembly with integral switch monitoring and control module. Actuation from rear (“U”)
BNS333-01YD**		Same as above but actuation from front (“D”)
BNS333-01YL**		Same as above but actuation from left (“L”)
BNS333-01YR**		Same as above but actuation from right (“R”)
BNS333-01YV**		Same as above but actuation from top (“V”)
BPS300	N/A	Coded-magnet actuator (front mount)
BPS303***	N/A	Coded-magnet actuator (rear mount)

*Contact configuration in presence of BPS300 or BPS 303 coded-magnet actuator.

**The BNS333 is a 4-wire sensor designed to satisfy EN954, Category 1 requirements. It is not designed for use with a separate safety controller.

***Available with stainless steel outer jacket. Please consult factory



BPS300 Actuator



BPS303 Actuator***

BNS333 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

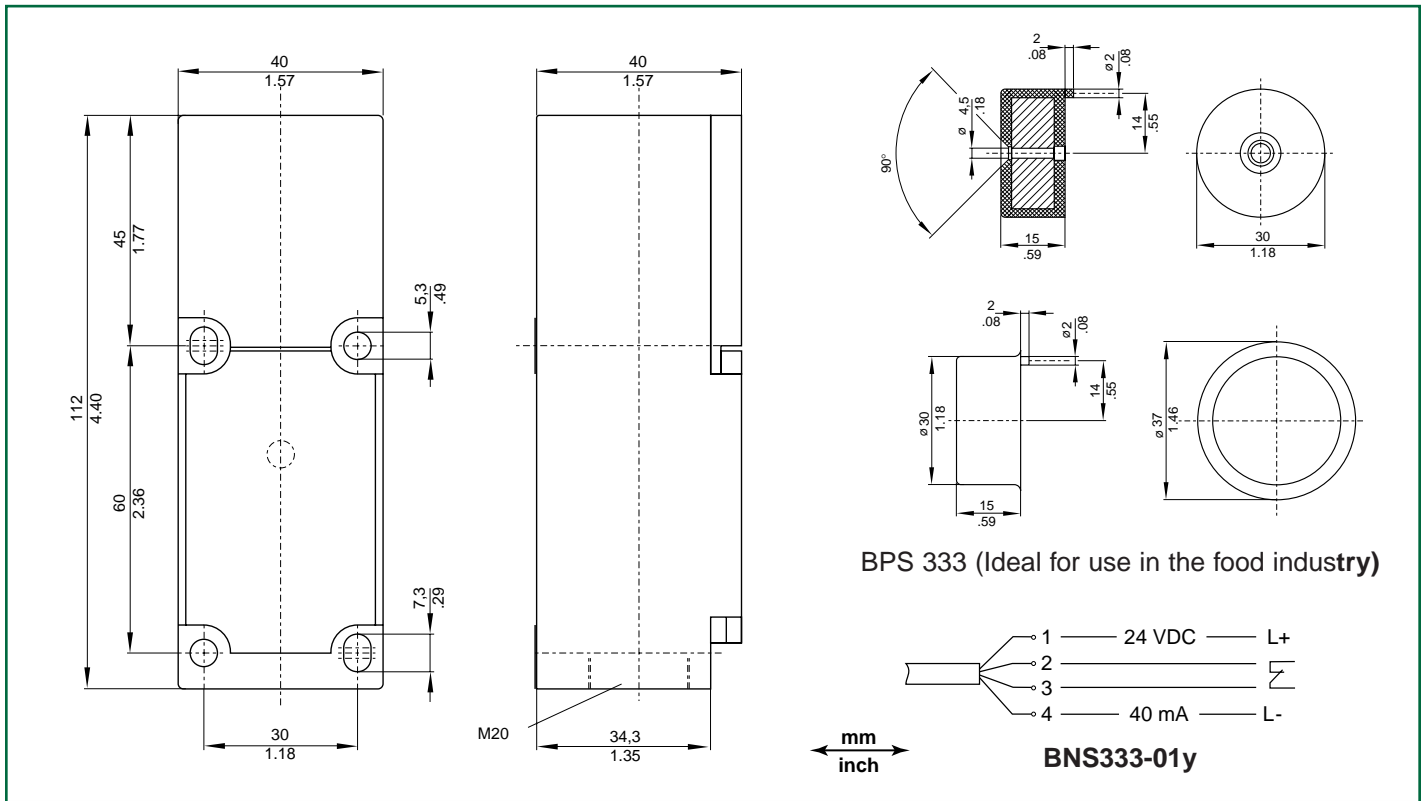
Housing	Fiberglass reinforced thermoplastic
Switching Distance "S"	"On": 4mm (0.16") "Off": 14mm (0.55")
Degree of Protection	IP65
Operating Temperature	-13°F to +158°F
Operating Principle	Magnetic
Shock Resistance	30g/11ms
Vibration Resistance	10 to 55 Hz, amplitude 1mm
Conformity to Standards	CE VDE 0660, Part 209 EN 954-1 EN 1088 BG-GS-ET-1L

*Without ferromagnetic material in vicinity of switch or magnet. The proximity of ferrous material may affect switching distances.

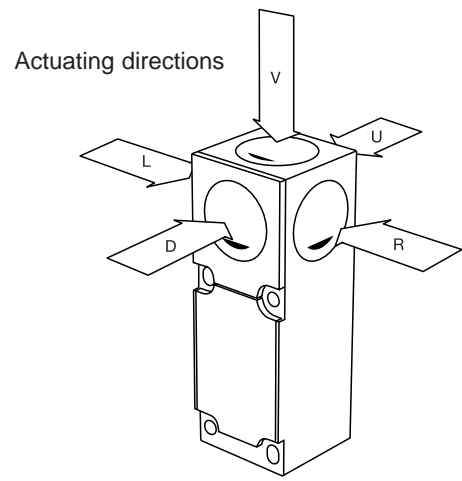
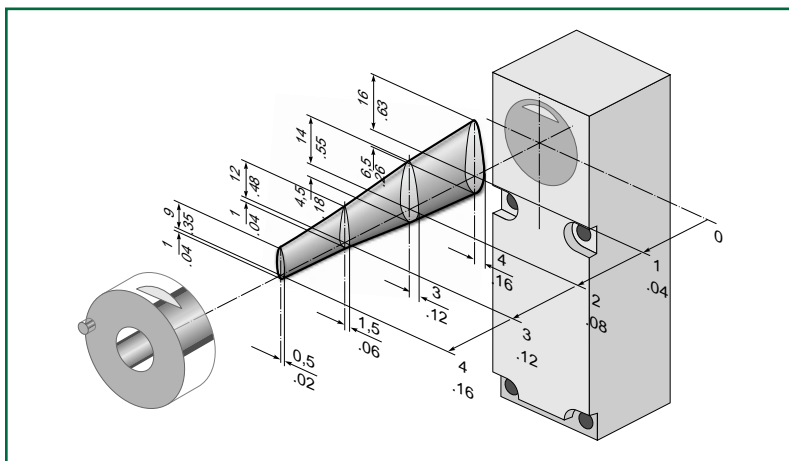
ELECTRICAL SPECIFICATIONS

Maximum Operating Voltage	24VDC
Maximum Continuous Current Rating	40mA
Maximum Switching Capacity (Power Rating)	Voltage: 250VAC Current: 5A (1,250VA)
Type Connection	Screw terminals

DIMENSIONS & WIRING DETAILS



MISALIGNMENT ALLOWANCE





Description

The Series BNS16 coded-magnet sensors are designed for use as a safety interlock on movable machine guards. Each sensor set consists of a multiple reed switch unit and a coded-magnet actuator. The sensor outputs will only change state in the presence of their matched magnetic field array.

Both switch and magnet assembly are sealed to IP67 (submersible) standards. The unit features the same mounting dimensions as our popular Series AZ16 keyed safety interlock switches ... providing an attractive alternative in applications characterized by alignment problems and/or harsh environments.

Operation

The reed switch assembly is typically mounted to a stationary portion of a guard structure, with the coded-magnet assembly mounted to the movable element of the machine guard. When the guard is closed, and the matched magnetic field aligns with the reed switch unit, the switches will close. When the guard is open, or the required magnetic-field array is not properly aligned with the reed switch assembly, the sensor output will remain “off.”

Typical Applications



The sealed, compact BNS16 is ideal for use on movable machine guards in hostile environments or where space is limited. Typical applications include food processing equipment, chemical processing equipment, woodworking machinery, packaging machinery, and articulating robot arm rest position sensing.

Important Note: Series BNS coded-magnet sensors are for use in safety applications only when used with a SCHMERSAL Series AES safety controller. (Please see selection chart on Page 130.) Use with any other safety controller may damage sensor and/or void warranty.

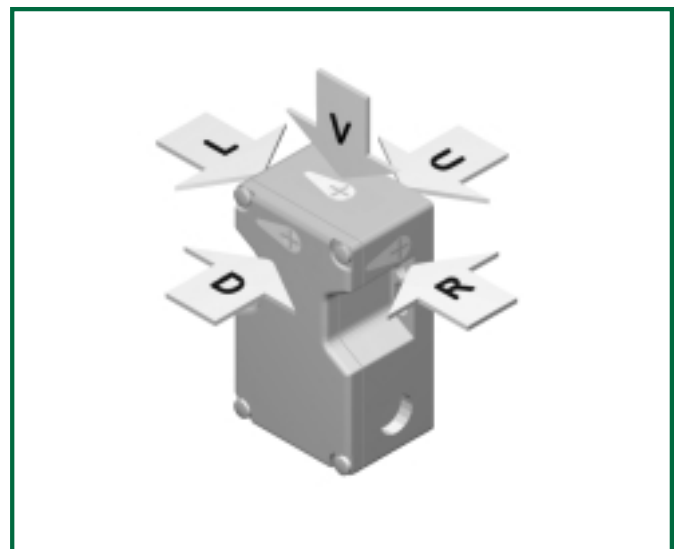
Features & Benefits

- **Sealed for submersibility** ... assures long-term reliability in the most hostile environments.
- **Tamper-resistant** ... cannot be bypassed with simple magnets.
- **Satisfies EN954 Category 4** ... when used with appropriate Series AES safety controller.
- **Shock and vibration tolerant** ... designed to withstand mechanical abuse.
- **Rugged, corrosion-resistant housing** ... tolerates most industrial environments.
- **Long-life** ... no mechanical wear due to non-contact design
- **Same mounting as Series AZ16** ... ideal alternative in wet, dirty environments.

AVAILABLE STANDARD MODELS (BNS16 actuator sold separately)

Part Number	Actuator Plane
BNS16 - 12ZD	Front cover
BNS16 - 12ZU	Back
BNS16 - 12ZV	Top
BNS16 - 12ZR	Right
BNS16 - 12ZL	Left
BPS16	Coded-magnet actuator

Actuating Planes



USE WITH ANY OTHER SAFETY CONTROLLER MAY DAMAGE SENSOR AND/OR VOID WARRANTY.

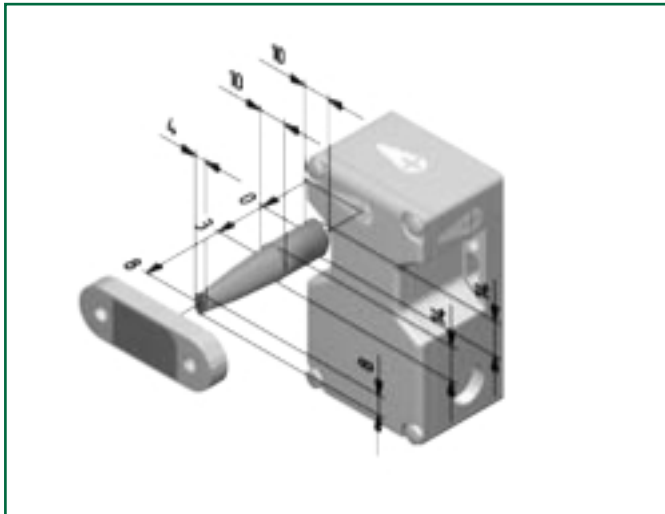
BNS16 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Fiberglass reinforced thermoplastic
Switching Distance "S" *	"On": 8mm (0.315") "Off": 18mm (0.700")
Maximum Switching Frequency	5H (in combination with Series AES safety controller)
Degree of Protection	IP67 per IEC 60529
Operating Temperature	-25°C to +70°C (-13°F to +158°F)
Operating Principle	Magnetic
Shock Resistance	30g/11ms
Vibration Resistance	10 to 55 Hz, amplitude 1mm
Conformity to Standards	EN 60347-5-3/PDF-M CE

*When no ferromagnetic material is present in vicinity of the sensor or actuator.

AXIAL TOLERANCE



WIRING DETAILS

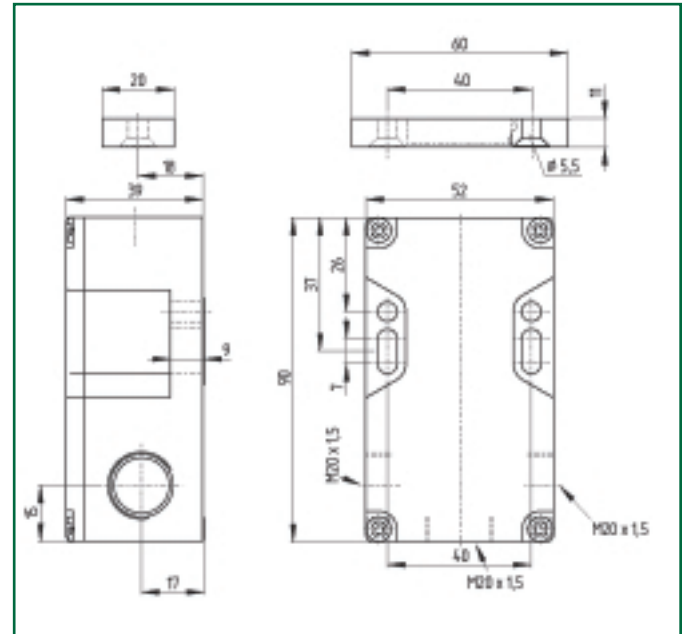
1 NO	S13	—	S14
2 NC	S21	—	S22
	S31	—	S32

ELECTRICAL SPECIFICATIONS

Maximum Contact Rating*	100VAC/DC
Maximum Continuous Current Rating	0.4A
Maximum Switching Capacity (Power Rating)	10VA
Type Connection	3 removable cable entries (M20x1.5) give access to screw terminals with self-lifting clamps for up to 13AWG (2.5mm ²) flexible stranded wire.

*Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

DIMENSIONS



SERIES BZ16

Dual-Channel Non-Contact Safety Interlock Switch (with “tamper-resistant” actuating key)



Description

The BZ16 is a non-contact safety interlock switch with an internal dual-channel design. The assembly consists of the switch and a coded actuating key. The switch can be actuated from the front, top, and rear with each version available with 1 NO/1 NC or 2 NC contacts.

Operation

When 24VDC is applied to the switch an internal oscillator is energized. The operating frequency is sent to a transmitting solenoid in the active area of the switch. When the actuating key is in the proper location it receives the signal, modifies it, and returns it to the switch. This signal is then sent to a monitoring module.

In addition a permanent magnet is located in the actuator. When the actuator is in place, the magnetic field activates a Hall-effect sensor in the active area. This signal is sent to a second monitoring module.

Thus this dual-channel device only operates if both channels are actuated concurrently. Any fault in either channel will be recognized by the next switching cycle such that authorized operation is prevented.

Typical Applications



The BZ16 safety interlock switch is suitable for sliding, hinged, or lift-off safety guards. It is ideal for food processing and other “washdown” applications.

Features & Benefits

- **Tamper-resistant** ... cannot be bypassed with simple magnets.
- **10 mm actuating distance** ... extends application versatility.
- **Rugged, corrosion-resistant housing** ... tolerates most industrial environments.
- **IP 67 rated** ... ideal for wash-down applications.
- **Shock and vibration tolerant** ... designed to withstand mechanical abuse.
- **Non-contact operation** ... tolerant to minor misalignment.
- **Integral “positive-guided” relays** ... heightens reliability.

AVAILABLE STANDARD MODELS

(Includes 1/2" NPT Plastic Adaptor)

Actuating Key sold separately ... see below

Part Number	Contact Configuration*	Description
BZ16-02D	2 NC	Front
BZ16-02V		Top
BZ16-02U		Rear
BZ16-11D	1 NO & 1 NC	Front
BZ16-11V		Top
BZ16-11U		Rear

ACTUATING KEY

(Sold separately)

Part Number	Description
BZ16 - B1	Actuating “Key”



A SAFETY CONTROLLER MAY BE REQUIRED TO MEET SAFETY CONTROL CATEGORIES 3 OR 4.

BZ16 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

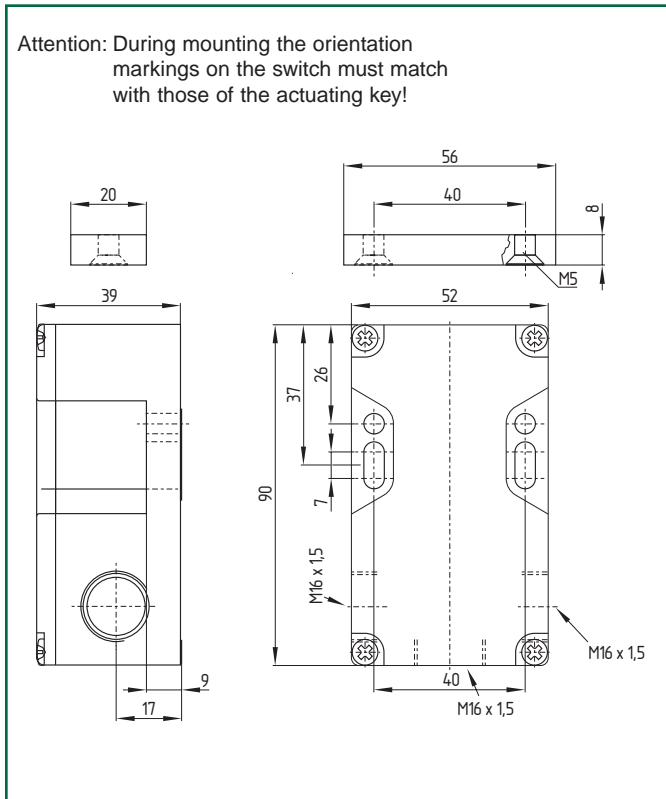
Housing	Fiberglass reinforced thermoplastic Self-extinguishing
Degree of Protection	IP67
Actuator	Non-contact (via coded actuator)
Switching Distance*	"On": Max. 10mm (Note a minimum distance of 2 mm must be maintained when approaching the switch laterally) "Off": Min. 20mm
Maximum Switching Frequency	1Hz
Operating Temperature	0°C to 55°C
Operating Principle	Magnetic & Hall Effect
Conformity to Standards	EN 60947-5-3/PDF-M EN 954-1, EN 1088 CE

*When no ferromagnetic material is present in the vicinity of the sensor or actuator.

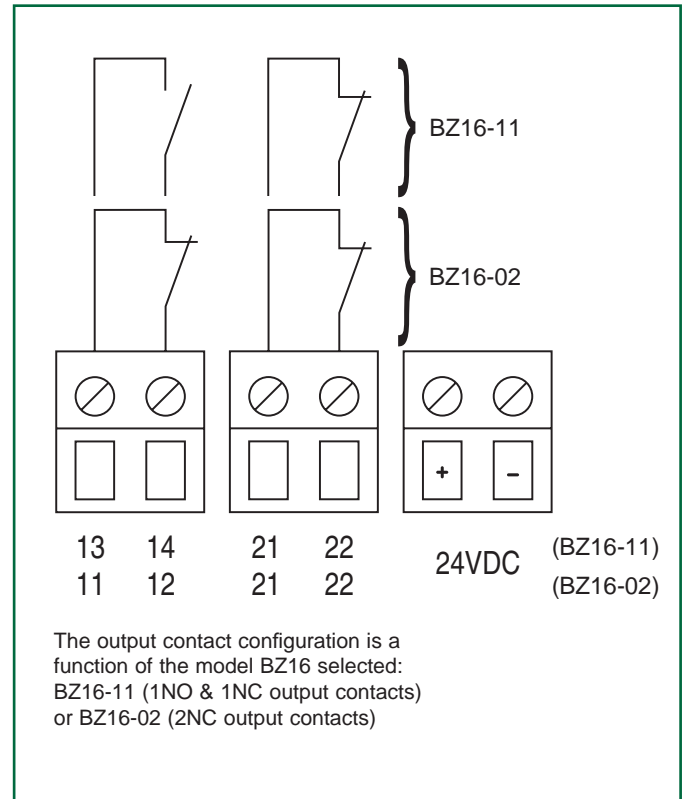
ELECTRICAL SPECIFICATIONS

Operating Voltage	24VDC \pm 15%
Contact Configuration	1 NO & 1 NC (or) 2 NC
Power Consumption	<4W
Maximum Switching Voltage	250VAC
Maximum Switching Capacity	250VAC (max), 1000VA, 4A DC13, 24VDC, 60W, 2.5A
Switching-on time	Approx. 200 ms
Type Connection	Screw terminals with self-lifting clamps (max. 2x2.5mm ² , AWG26-14 solid or stranded wires) (max. 2x1.5mm ² , AWG26-14 with ferrule)

DIMENSIONS



WIRING DIAGRAM



BNS SERIES - COMPATIBLE SAFETY CONTROLLERS

SELECTION CHART



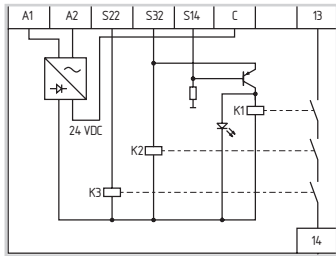
AVAILABLE STANDARD MODELS

Safety Controller Suitable for use with Coded-Magnet Sensor Part Numbers below	Max. Number of Directly-Connected BNS Series Sensors (without "daisy chaining")	Safety Controller Part Number (and available supply voltages)	Number of Safety Outputs (Enabling Paths)	Max. Achievable Safety Control Category per EN 954-1	Type of Reset	Feedback Circuit
BNS250... } BNS33... } BNS303... } 12Z or 12ZG	1	AES1102 (24VAC, 24VDC, 110VAC)	1	1	Automatic	No
	2	AES1112 (24VAC, 24VDC, 110VAC)	1	1	Automatic	No
BNS250... } BNS33... } BNS303... } 11Z or 11ZG	1	AES1135 (24VDC)	1	1/3*	Automatic	No
	2	AES1165 (24VDC)	1	1/3*	Automatic	No
	1	AES1235 (24VDC)	2	3	Automatic	Yes
	2	AES1265 (24VDC)	2	3	Automatic	Yes
BNS16-12Z BNS33-12Z-2187	1	AES2135 (115VAC)	1	1/3*	Automatic	No
	2	AES2165 (115VAC)	1	1/3*	Automatic	No
	1	AES2335 (24VDC, 115VAC)	3	3	Automatic	Yes
BNS250... } BNS33... } BNS303... } 11Z	1	AES1337 (24VAC/DC)	3	4	Automatic or Manual	Yes
	6	AES2285 (24VAC/DC, 48-240VAC)	2	3	Automatic or Manual	Yes
BNS16-12Z BNS33-12Z-2187						

*Category 3 when safety controller is directly connected to load.

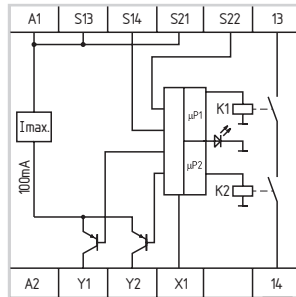
BNS SERIES - COMPATIBLE SAFETY CONTROLLERS

AES1102/1112



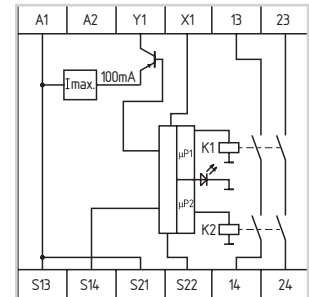
Model 1102

AES1135/1165



Model 1135

AES1235/1265



Model 1235

CHARACTERISTICS

Operating voltage (U _e)	24VDC ± 15 %
	110VAC
	230VAC
	24VAC
	42VAC
Operating current (I _e)	0.1A
Start conditions	automatic
Feedback circuit	no
Stop category	0
Control Category	1
Monitored inputs	2 NC / 1 NO
Enabling contacts	1 enabling path
Contact load capacity	max. 250VAC max. 4 A (cos ρ = 1)
Termination	screw terminals
Cable size	max. 2.5 mm ²
Status indicator	LED
Dimensions	22.5 x 75 x 110 mm
Standards	IEC/EN 60204-1; EN 954-1; EN60947-5-3; BG-GS-ET-14; BG-GS-ET-20
Agency recognition	UL, CSA, CE
For use with	
BNS250	12Z or 12ZG
BNS33	12Z or 12ZG
BNS303	12Z or 12ZG

AVAILABLE MODELS

Model Number	Supply Voltage
AES1102-24DC	24VDC
AES1102-24AC	24VAC
AES1102-115	115VAC
AES1112-24DC	24VDC
AES1112-24AC	24VAC
AES1112-115	115VAC

CHARACTERISTICS

Operating voltage (U _e)	24VDC ± 15 %
Operating current (I _e)	0.2A
Start conditions	automatic
Feedback circuit	no
Stop category	0
Control Category	1
Monitored inputs	1 NC / 1 NO
Enabling contacts	1 enabling path
Contact load capacity	max. 250VAC max. 6 A (cos ρ = 1)
Signalling output	2 transistor outputs Y1 + Y2 = max. 100 mA p-type, short-circuit proof
Termination	screw terminals
Cable size	max. 2.5 mm ²
Status indicator	LED (ISD)
Dimensions	22.5 x 100 x 121 mm
Standards	IEC/EN 60204-1; EN 954-1; EN60947-5-3; BG-GS-ET-14; BG-GS-ET-20
Agency recognition	BG, UL, CSA, CE Pending
For use with	
BNS250	11Z or 11ZG
BNS33	11Z or 11ZG
BNS303	11Z or 11ZG
BNS16-12Z	
BNS33-12Z-2187	

AVAILABLE MODELS

Model Number	Supply Voltage
AES1135	24VDC
AES1165	24VDC

CHARACTERISTICS

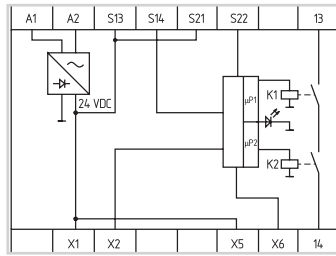
Operating voltage (U _e)	24VDC ± 15 %
Operating current (I _e)	0.2A
Start conditions	automatic or start button
Feedback circuit	yes
Stop category	0
Control Category	3
Monitored inputs	1 NC / 1 NO
Enabling contacts	2 enabling paths
Contact load capacity	max. 250VAC max. 6 A (cos ρ = 1)
Signalling output	1/2 transistor outputs Y1 + Y2 = max. 100 mA p-type, short-circuit proof
Termination	screw terminals
Cable size	max. 2.5 mm ²
Status indicator	LED (ISD)
Dimensions	22.5 x 100 x 121 mm
Standards	IEC/EN 60204-1; EN 954-1; EN60947-5-3; BG-GS-ET-14; BG-GS-ET-20
Agency recognition	BG, UL, CSA, CE Pending
For use with	
BNS250	11Z or 11ZG
BNS33	11Z or 11ZG
BNS303	11Z or 11ZG
BNS16-12Z	
BNS33-12Z-2187	

AVAILABLE MODELS

Model Number	Supply Voltage
AES1235	24VDC
AES1265	24VDC

BNS SERIES - COMPATIBLE SAFETY CONTROLLERS

AES2135/2165



Model 2135

CHARACTERISTICS

Operating voltage (U_e).....24VAC - 15 % / + 10 %
 Operating current (I_e).....0.20A
 Start conditions.....auto start
 Feedback circuit.....no
 Stop category.....0
 Control Category.....1/3
 Monitored inputs1 NC / 1 NO
 Enabling contacts.....1 enabling path
 Contact load capacity.....max. 250VAC
 max. 4 A ($\cos \rho = 1$)
 Terminationscrew terminals
 Cable size.....max. 2.5 mm²
 Status indicator.....LED (ISD)
 Dimensions55 x 75 x 110 mm

For use with

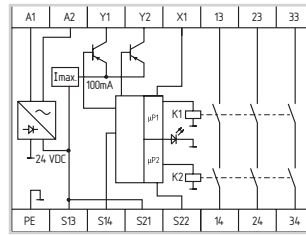
- BNS250.....11Z or 11ZG
- BNS33.....11Z or 11ZG
- BNS303.....11Z or 11ZG
- BNS16 - 12Z
- BNS33 - 12Z - 2187

AVAILABLE MODELS

Model Number	Supply Voltage
AES2135-24VAC	24VAC
AES2135-115VAC	115VAC
AES2165-24VAC	24VAC
AES2165-115VAC	115VAC

*230VAC models also available.
 Please consult factory.

AES2335



CHARACTERISTICS

Operating voltage (U_e).....24VAC - 15 % / + 20 %
 115VAC - 15 % / + 10 %
 Operating current (I_e).....0.20A
 Start conditions.....auto start
 Feedback circuityes
 Stop category.....0
 Control Category.....1/3
 Monitored inputs1 NC / 1 NO
 Enabling contacts3 enabling paths
 Contact load capacity.....max. 250VAC
 max. 3 A ($\cos \rho = 1$)
 Terminationscrew terminals
 Signalling output.....2 transistor outputs
 Y1 + Y2 = max. 100 mA
 p-type, short-circuit proof
 Cable size.....max. 2.5 mm²
 Status indicator.....LED (ISD)
 Dimensions55 x 75 x 110 mm

For use with

- BNS250.....11Z or 11ZG
- BNS33.....11Z or 11ZG
- BNS303.....11Z or 11ZG
- BNS16 - 12Z
- BNS33 - 12Z - 2187

AVAILABLE MODELS

Model Number	Supply Voltage
AES2335-24VDC	24VDC
AES2335-115VAC	115VAC

*230VAC models also available.
 Please consult factory.

BNS SERIES - COMPATIBLE SAFETY CONTROLLERS

AES1337



AES2285



CHARACTERISTICS

Operating Voltage (U_e)24VDC - 15 % / + 20 %
 24VAC - 15 % / + 10 %

Operating Current (I_e)0.08A

Start conditionsstart, reset button,
 (trailing edge), autostart

Feedback circuityes

Stop category0

Control Category4

Monitored inputs1 NC / 1 NO

Enabling contacts3 enabling paths

Contact load capacitymax. 250VAC
 max. 6 A (cos ρ = 1)

Terminationplug-in screw terminals

Signalling output1 NC contact
 100mA, short-circuit proof

Cable sizemax. 2.5 mm²

Status indicator4 LED

Dimensions22.5 x 100 x 121 mm

StandardsIEC/EN 60204-1; EN 954-1;
 EN60947-5-3; BG-GS-ET-14;
 BG-GS-ET-20

Agency recognitionBG, UL, CSA, CE Pending

For use with

BNS25011Z

BNS3311Z

BNS30311Z

BNS16 - 12Z

BNS33 - 12Z - 2187

AVAILABLE MODELS

Model Number	Supply Voltage
AES1337-24	24VAC/DC

CHARACTERISTICS

Operating Voltage (U_e)24VDC - 15 % / + 20 %
 24VAC - 15 % / + 10 %
 48-240VAC

Operating Current (I_e)0.11A

Start conditionsstart, reset button

Feedback circuityes

Stop category0

Control Category3

Monitored inputs6 x 1 NC / 1 NO

Enabling contacts2 enabling paths

Contact load capacitymax. 250VAC
 max. 6 A (cos ρ = 1)

Terminationplug-in screw terminals

Signalling output6 NC contacts
 6 x 20mA, short-circuit proof
 1 NC contact 2 A

Cable sizemax. 2.5 mm²

Status indicator3 LED

Dimensions45 x 100 x 121 mm

StandardsIEC/EN 60204-1; EN 954-1;
 EN60947-5-3; BG-GS-ET-14;
 BG-GS-ET-20

Agency recognitionBG, UL, CSA, CE Pending

For use with

BNS25011Z

BNS3311Z

BNS30311Z

BNS16 - 12Z

BNS33 - 12Z - 2187

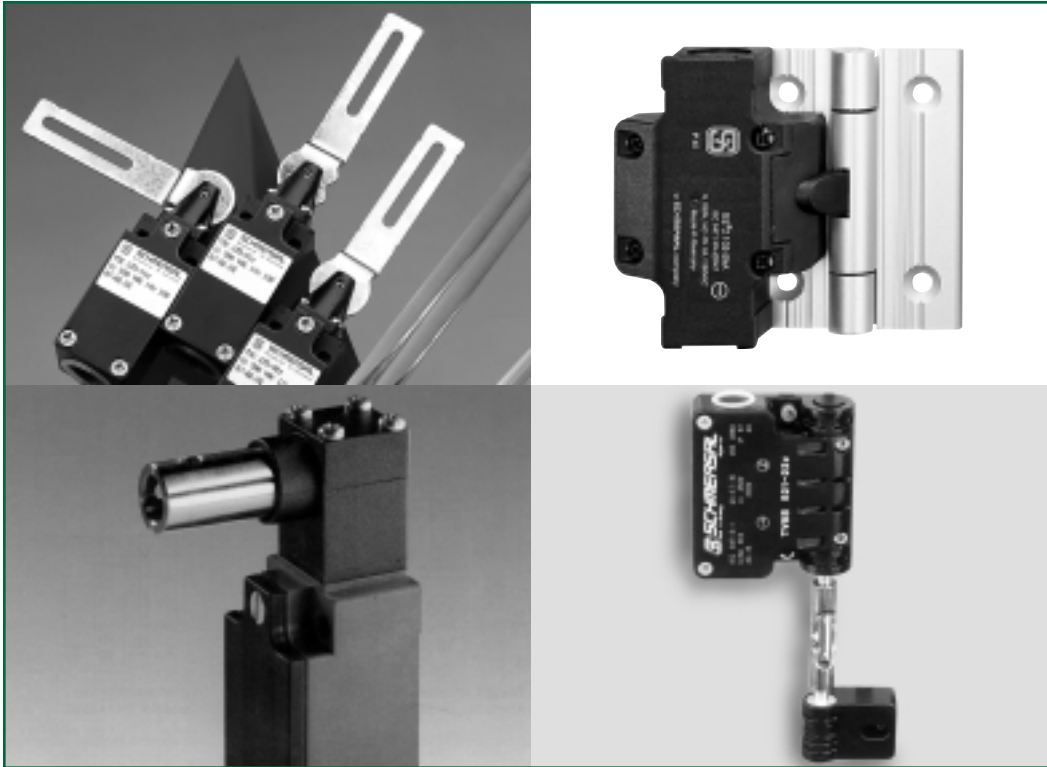
AVAILABLE MODELS

Model Number	Supply Voltage
AES2285-24	24VAC/DC
AES2285-230V	48-240VAC



*Safer
by
Design*

HINGED SAFETY INTERLOCK SWITCHES



SELECTION GUIDE

Switch Series	Housing Material	Angular Displacement for Contact Opening	Contact Configurations	Catalog Page
ES95 SB	Glass-fiber, reinforced thermoplastic	7°	1 NO & 1 NC 2 NC	136
TVS335	Die-cast aluminum, enamel finish	2°	1 NO & 1 NC 2 NC	138
TV8S-521	Die-cast zinc, enamel finish	6°	2 NO & 2 NC	140
T.C 235	Die-cast zinc, enamel finish	4.5°	1 NO & 1 NC 2 NC 1 NC	142
T.C 236	Glass-fiber, reinforced thermoplastic	4.5°	1 NO & 1 NC 2 NC 1 NC	142
TESZ1102 TESZ1110	Glass-fiber, reinforced thermoplastic	4.5°	1 NO & 2 NC 3 NC	148



Typical Applications

The ES95 SB is intended for use as a safety interlock switch on hinged, movable machine guards which, when open, expose operator/maintenance personnel to machine hazards. Their sealed design (IP67) and oil-tolerant seals make them ideal for use in hostile environments.

Features & Benefits

- **Tamper-resistant** ... integral actuator shaft prevents bypassing.
- **“Positive-break” NC contacts** ... ensure circuit interruption upon only 7° of guard displacement.
- **Watertight, oiltight design** ... meets IP67 washdown and immersion requirements.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Meets rigid safety agency standards** ... CSA, IEC and BG.
- **Four 90° actuator head positions** ... provide installation flexibility.

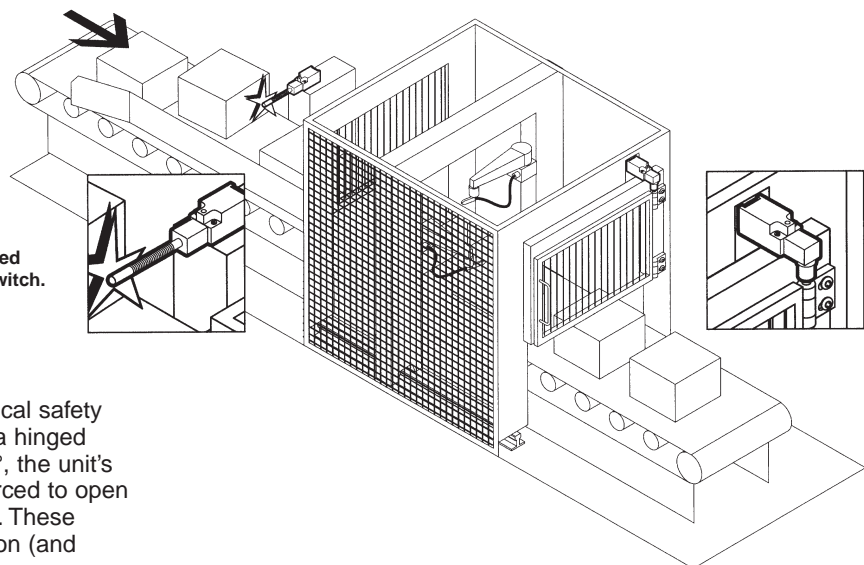
Description

The ES95 SB Series are designed for use with hinged movable machine guards which must be closed for operator safety. Their tamper-resistant design and positive-opening NC contacts provide a significantly higher level of safety than conventional, spring-driven limit switches often used to monitor hinged-guard position. Their IP67 rating make them ideal for interlocking safety guards in hostile environments.

AVAILABLE STANDARD MODELS

Part Number	Contacts (Guard Closed)	Description*
ES95-SB10/1S	1 NO & 1 NC	Hinged safety interlock switch with 10mm diameter shaft bore hole
ES95-SB20	2 NC	

*The actuator head may be rotated into any one of four 90° positions.



Operation

The ES95 SB is a single-piece, electromechanical safety interlock switch which is designed to mount to a hinged machine guard. After opening the guard only 7°, the unit's positive-break, normally-closed contacts are forced to open by a direct (non-resilient) actuating mechanism. These positive-break contacts ensure circuit interruption (and machine stoppage).

ES95 SB TECHNICAL DATA

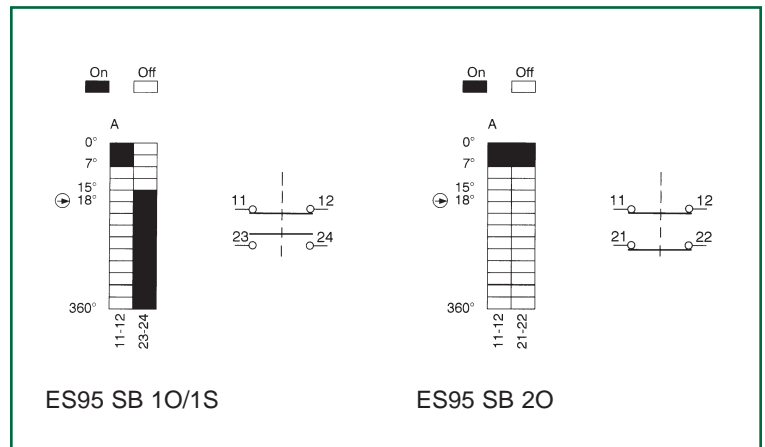
MECHANICAL SPECIFICATIONS

Housing	Glass-fibre reinforced, self-extinguishing thermoplastic
Displacement Angle for Contact Opening	7°
Degree of Protection	IP67
Operating Temperature	-22°F to +195°F
Mechanical Life	10 million operations
Operating Rate	3,600 operations/hour (maximum)
Mounting Arrangement	Mounts on 9mm diameter shaft via mounting screw
Conformity to Standards	BG CSA SUVA

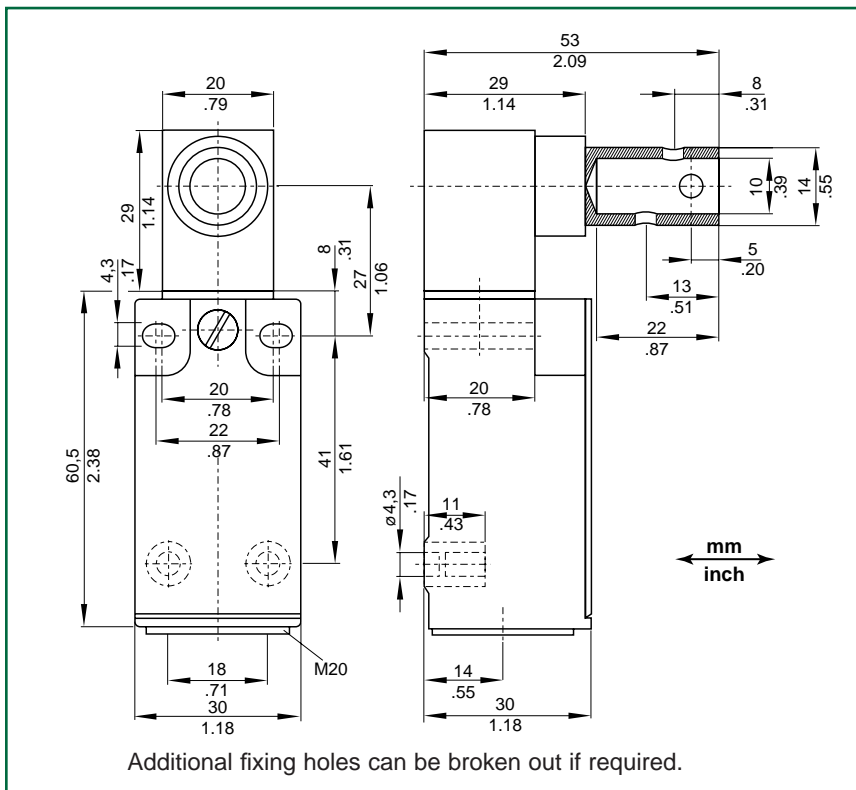
ELECTRICAL SPECIFICATIONS

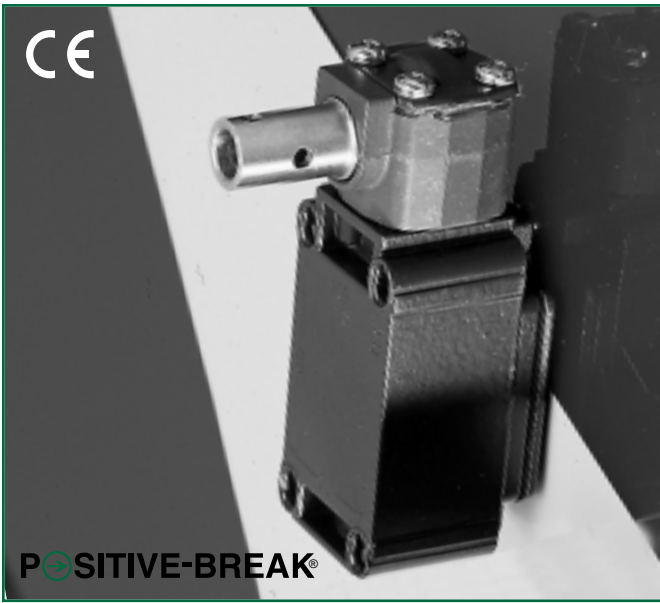
Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Rating	5A/24VAC 6A/400VAC
Switching Action	Slow-action, positive-break NC contacts
Rated Insulation Voltage	500VAC
Rated Impulse Withstand Voltage	6kV
Type Terminals	Screw terminals with self-lifting clamps for up to 13AWG

SWITCHING DIAGRAM



DIMENSIONS





Features & Benefits

- **Tamper-resistant** ... integral actuation shaft prevents bypassing.
- **“Positive-break” NC contacts** ... ensure circuit interruption upon only 3° of guard displacement.
- **Watertight design** ... meets IP67 washdown and immersion requirements.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Meets rigid safety agency standards** ... IEC, BG, UL and CSA.
- **Four 90° actuator head positions** ... provide installation flexibility.
- **Optional LED indicators** ... provide visual display of supply voltage and switch operation.

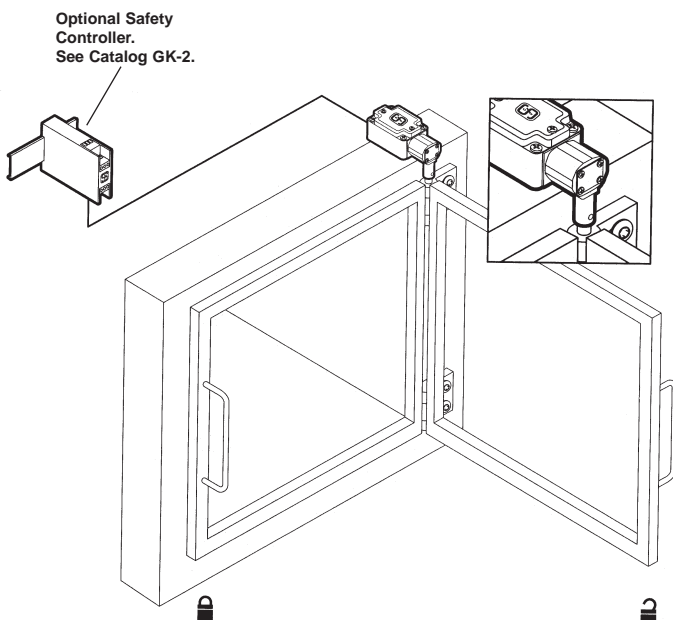
Description

The TVS335 Series are designed for use with hinged movable machine guards which must be closed for operator safety. Their tamper-resistant design and positive-opening NC contacts provide a significantly higher level of safety than conventional, spring-driven limit switches often used to monitor hinged-guard position. Their IP67 rating make them ideal for interlocking safety guards in hostile environments.

Operation



The TVS335 is a single-piece, electromechanical safety interlock switch which is designed to mount to a hinged machine guard. After opening the guard only 3°, the unit's positive-break, normally-closed contacts are forced to open by a direct (non-resilient) actuating mechanism. These positive-break contacts ensure circuit interruption (and machine stoppage).



AVAILABLE STANDARD MODELS

Part Number	Contacts (Guard Closed)	Description*
TV8S-335-11Z	1 NO & 1 NC	Hinged safety interlock switch with 8mm diameter shaft bore hole
TV8S-335-02Z	2 NC	
TV10S-335-11Z	1 NO & 1 NC	Hinged safety interlock switch with 10mm diameter shaft bore hole
TV10S-335-02Z	2 NC	
TV8S-335-11ZG24	1 NO & 1 NC	Hinged safety interlock switch with 8 mm diameter shaft bore and integral LED indicators for supply voltage (green) and switch operation (yellow)
TV8S-335-02ZG24	2 NC	
TV10S-335-11ZG24	1 NO & 1 NC	Hinged safety interlock switch with 10 mm diameter shaft bore and integral LED indicators for supply voltage (green) and switch operation (yellow)
TV10S-335-02ZG24	2 NC	

*The actuator head may be rotated into any one of four 90° positions.

Note: 3-Contact models available. Please consult factory.

TVS335 TECHNICAL DATA

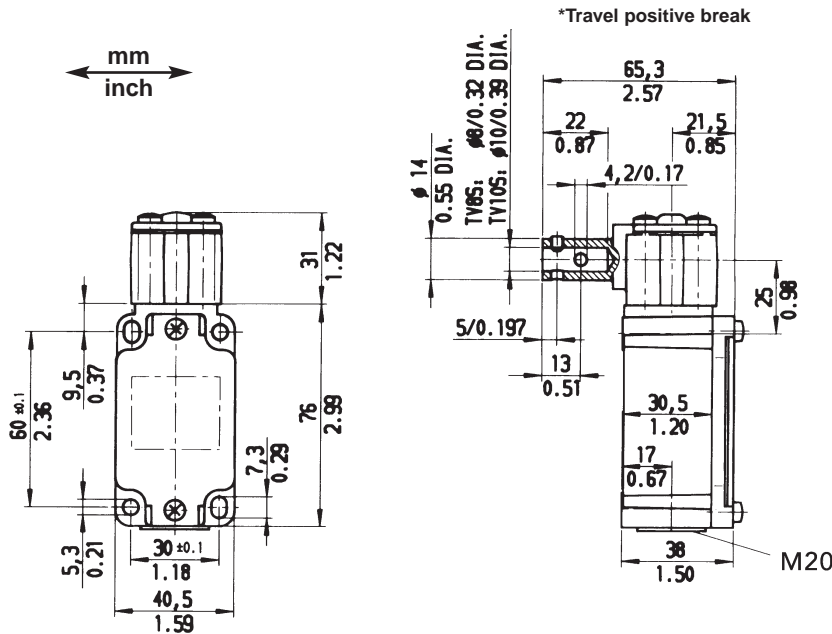
MECHANICAL SPECIFICATIONS

Housing	Diecast aluminum, enamel finish
Displacement Angle for Contact Opening	3°
Degree of Protection	IP67
Operating Temperature	-22°F to +158°F
Mechanical Life	>10 ⁶ operations
Operating Rate	5,000 operations/hour (maximum)
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET15 UL CSA

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Rating	4A (230VAC) 2.5A (400VDC) 1A (500VAC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse 6A (time-delay)
Rated Insulation Voltage	500VAC
Rated Impulse Withstand Voltage	6kV
Electrical Connections	Screw terminals with self-lifting clamps 13AWG (2.5mm ²) maximum wire size

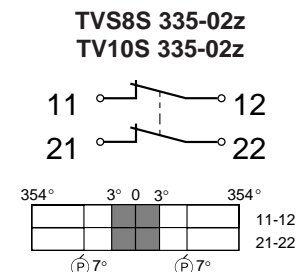
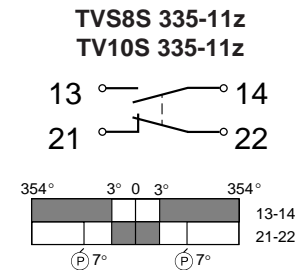
DIMENSIONS



TV8S/TV10S 335

TV8S 335... = bore hole Ø 8 mm
TV10S 335... = bore hole Ø 10 mm

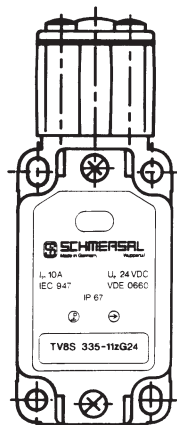
SWITCHING DIAGRAMS & CONTACT SCHEMATICS



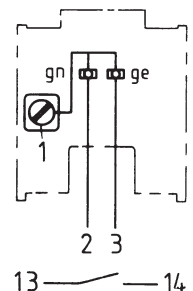
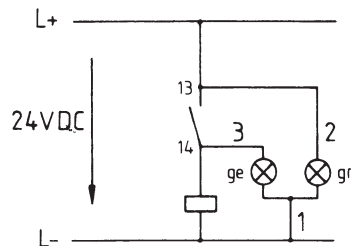
LED Indicators

Green LED (gn) indicator for supply voltage and yellow LED (ge) indicator for switch operation for 24VDC. The LED's must not be wired, however, in the safety circuit!

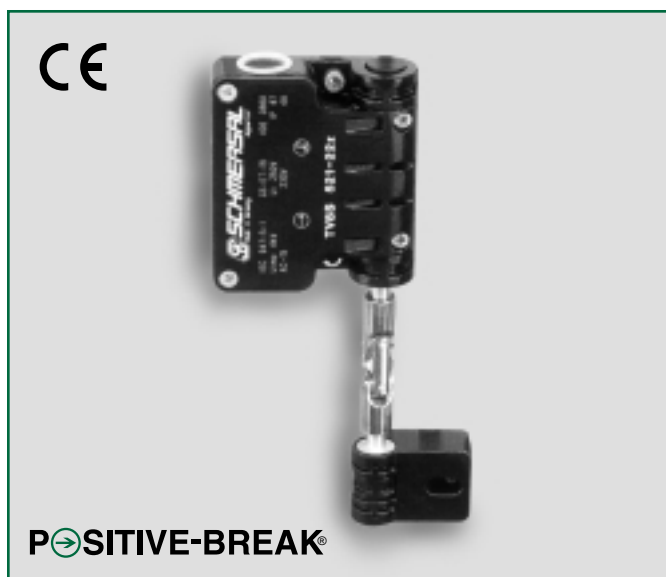
Shown here:
TV8S 335-11zG24



Shown here:
NO contact (model -11zG24) serves for alarm and signaling purposes.



Protected against wrong polarity connection.
Protected against transient voltages.



Description

The TV8S-521 Series are designed for use with hinged movable machine guards which must be closed for operator safety. Their flat design permits opening the door 180°. Their tamper-resistant design and positive-opening NC contacts provide a significantly higher level of safety than conventional, spring-driven limit switches often used to monitor hinged-guard position. Their IP67 rating make them ideal for interlocking safety guards in hostile environments.

Operation

The TV8S-521 is a two-piece, electromechanical safety interlock switch which is designed to mount to a hinged machine guard. After opening the guard only 6°, the unit's normally-closed contacts are forced to open by a direct (non-resilient) actuating mechanism ... achieving positive-break at 14°. These positive-break contacts ensure circuit interruption (and machine stoppage).

Typical Applications



The TV8S-521 Series is intended for use as a safety interlock switch on hinged, movable machine guards which, when open, expose operator/maintenance personnel to machine hazards. Their sealed design (IP67) and oil-tolerant seals make them ideal for use in hostile environments.

Features & Benefits

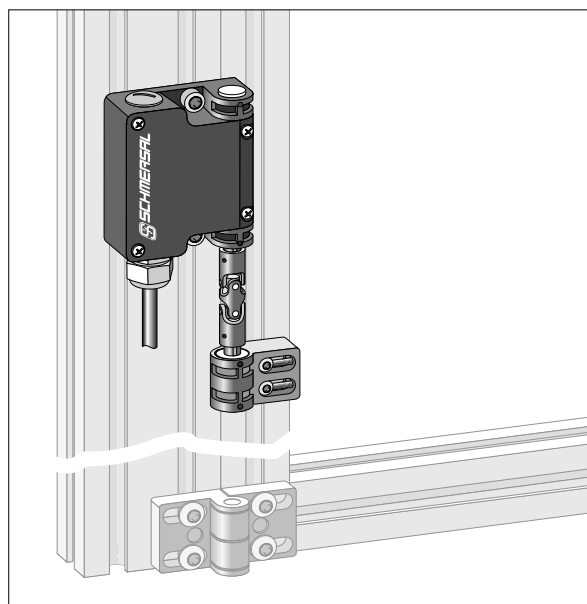
- **Tamper-resistant** ... geometrically-matched mating actuator prevents bypassing.
- **“Positive-break” NC contacts** ... ensure circuit interruption upon only 14° of guard displacement.
- **Watertight design** ... meets IP67 washdown and immersion requirements.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Meets rigid safety agency standards** ... IEC and BG.
- **Flat design** ... permits opening of hinged guard 180°.

AVAILABLE STANDARD MODELS

Part Number	Contacts (Guard Closed)	Description*
TV8S-521-11/11Z	2 NO & 2 NC	Two-piece hinged safety interlock switch with two contact blocks, each having 1 NO & 1 NC contact
TV8S-521-02/20Z	2 NO & 2 NC	Two-piece hinged safety interlock switch with one contact block having 2 NO contacts and one contact block having 2 NC contacts

Note: The TV8S-521 models consist of a base unit, universal shaft assembly and a fixed hinge block. Please consult factory for assistance in ordering.

* Please see switch travel diagrams for operating characteristics.



TV8S-521 TECHNICAL DATA

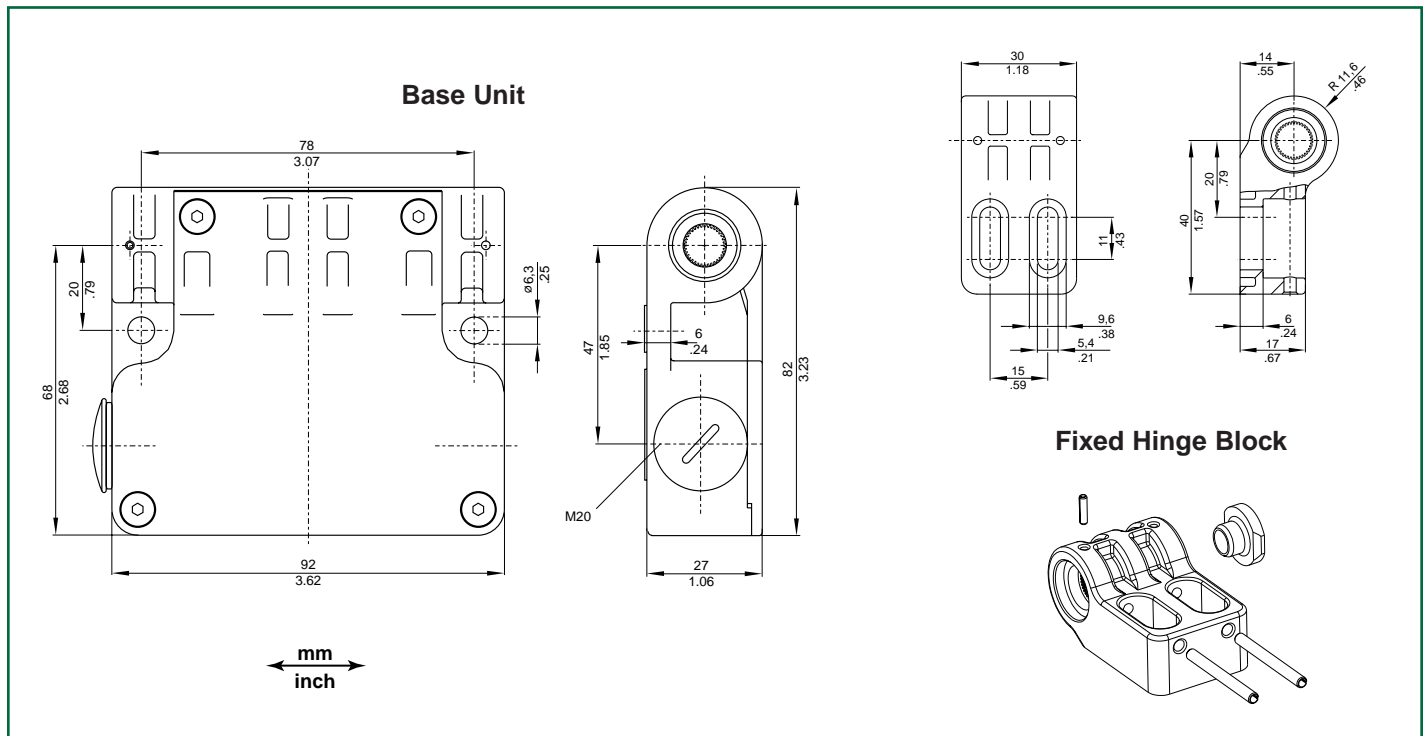
MECHANICAL SPECIFICATIONS

Housing	Diecast zinc, enamel finish
Displacement Angle for Contact Opening	6°
Degree of Protection	IP67
Operating Temperature	-13°F to +158°F
Mechanical Life	>106 operations
Conformity to Standards	EN 1088 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET15 UL & CSA
Displacement angle for positive-break	14°

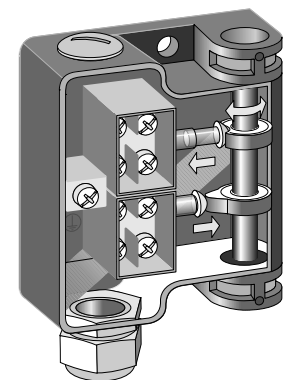
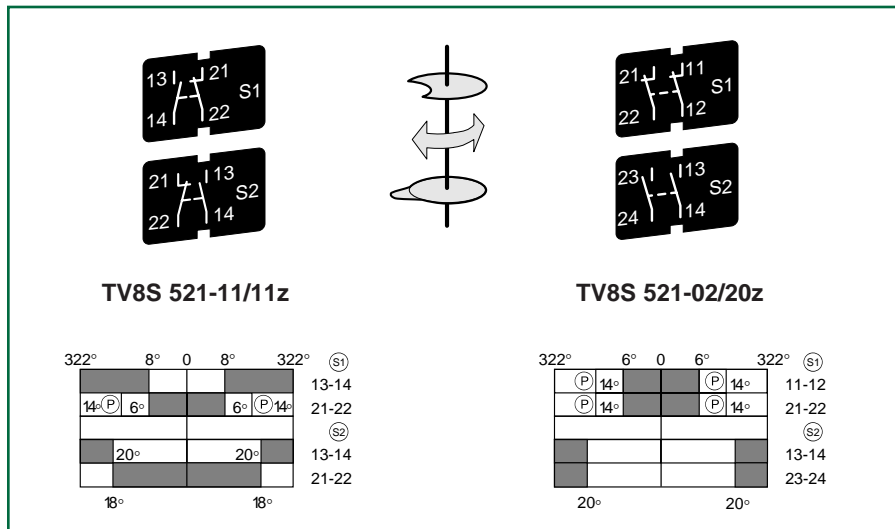
ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Rating	4A (230VAC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse 6A (Slow-blow)
Rated Insulation Voltage	250VAC
Rated Impulse Withstand Voltage	4kV
Electrical Connections	Screw terminals, maximum (13AWG wiring including conductor ferrules)

DIMENSIONS



SWITCHING DIAGRAMS & CONTACT SCHEMATICS



Base Unit



Description

The T.C 235/236 Series are designed for use with hinged movable machine guards which must be closed for operator safety. Their tamper-resistant design and positive-opening NC contacts provide a significantly higher level of safety than conventional, spring-driven limit switches often used to monitor hinged-guard position. Their IP67 rating make them ideal for interlocking safety guards in hostile environments.

Operation

The T.C 235/236 is a single-piece, electromechanical safety interlock switch which is designed to mount to a hinged machine guard. After opening the guard only 4.5°, the unit's positive-break, normally-closed contacts are forced to open by a direct (non-resilient) actuating mechanism. These positive-break contacts ensure circuit interruption (and machine stoppage).

Typical Applications



The T.C 235/236 is intended for use as a safety interlock switch on hinged, movable machine guards which, when open, expose operator/maintenance personnel to machine hazards. Their sealed design (IP67) and oil-tolerant seals make them ideal for use in hostile environments.

Features & Benefits

- **Tamper-resistant** ... integral actuator arm prevents bypassing by operator.
- **“Positive-break” NC contacts** ... ensure circuit interruption upon only 4.5° of guard displacement.
- **Watertight design** ... meets IP67 washdown and immersion requirements.
- **Rugged, corrosion-resistant housing** ... tolerates the most hostile environments.
- **Meets rigid safety agency standards** ... IEC, BG, UL and CSA.
- **Four 90° actuator head positions** ... provide installation flexibility.

AVAILABLE STANDARD MODELS

Part Number	Contacts (Guard Closed)	Description*
T3C235-11Z T3C236-11Z	1 NO & 1 NC	Hinged safety interlock switch with actuating lever to right in rest position
T3C235-02Z T3C236-02Z	2 NC	
T3C235-01Z T3C236-01Z	1 NC	
T4C235-11Z T4C236-11Z	1 NO & 1 NC	Hinged safety interlock switch with actuating lever vertical to switch body in rest position
T4C235-02Z T4C236-02Z	2 NC	
T4C235-01Z T4C236-01Z	1 NC	
T5C235-11Z T5C236-11Z	1 NO & 1 NC	Hinged safety interlock switch with actuating lever to left in rest position
T5C235-02Z T5C236-02Z	2 NC	
T5C235-01Z T5C236-01Z	1 NC	

*The actuator head may be rotated into any one of four 90° positions.

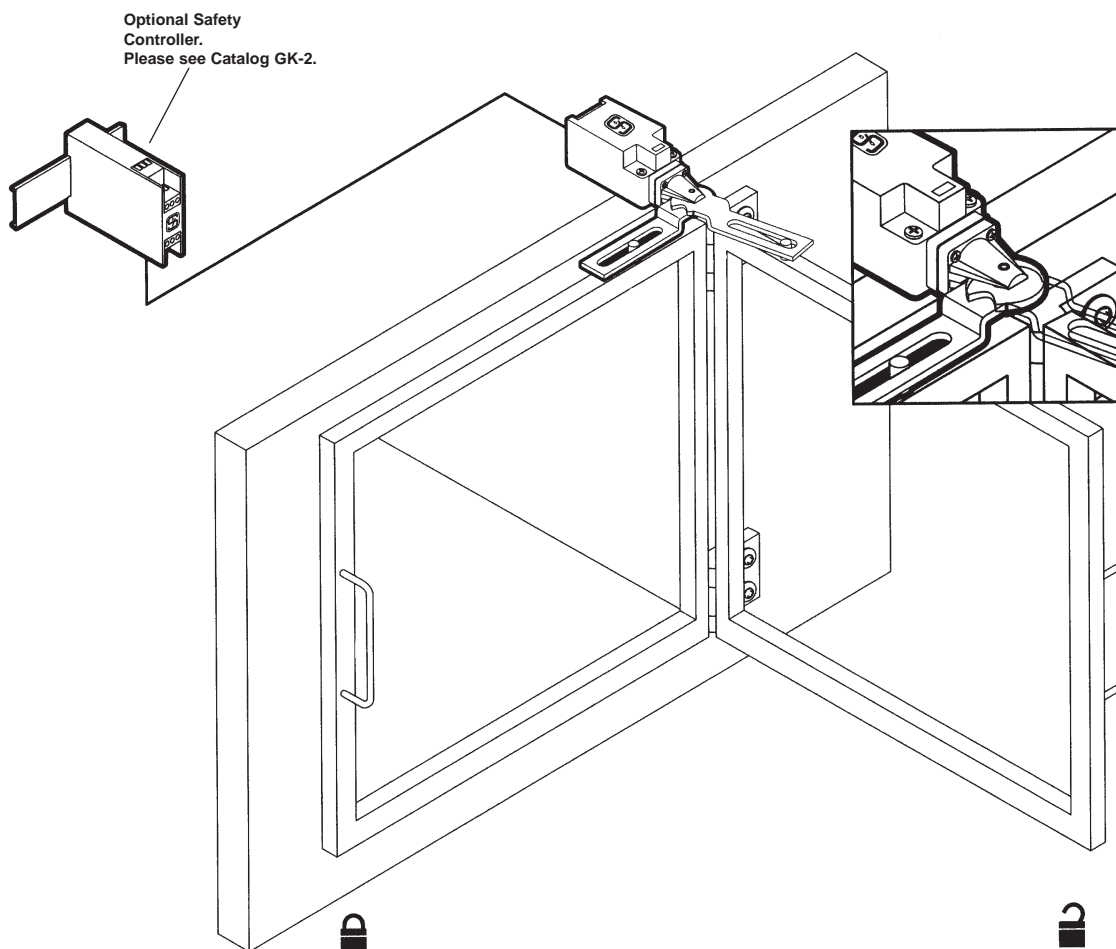
T.C 235/236 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	(Series 235): Diecast zinc, enamel finish (Series 236): Glass-fiber, reinforced, self-extinguishing thermoplastic
Displacement Angle for Contact Opening	4.5°
Degree of Protection	IP67
Operating Temperature	-22°F to +175°F
Mechanical Life	>106 operations
Operating Rate	5,000 operations/hour (maximum)
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660-200 BG-GS-ET15 DIN-EN50047 UL CSA

ELECTRICAL SPECIFICATIONS

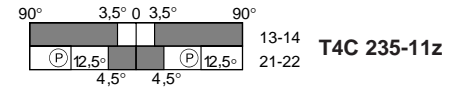
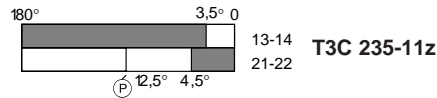
Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Rating	4A (230VAC) 2.5A (400VDC) 1A (500VAC)
Switching Action	Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse 6A (time-delay) as a positive-break switch
Rated Insulation Voltage	500VAC
Rated Impulse Withstand Voltage	6kV
Electrical Connections	Screw terminals with self-lifting clamps for 13AWG (2.5mm ²) maximum wire size



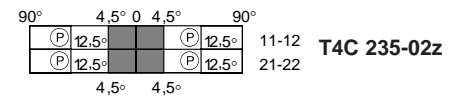
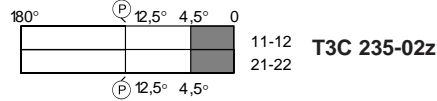
T.C 235 TECHNICAL DATA

Contact function diagrams

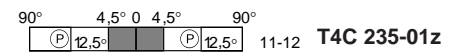
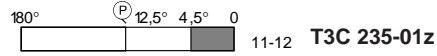
Slow action
1 NO + 1 NC



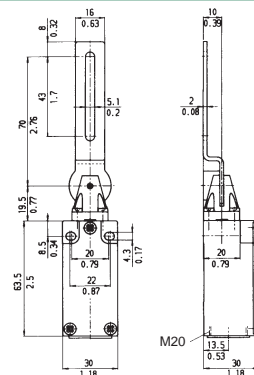
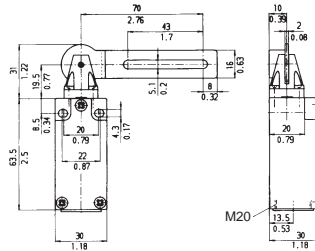
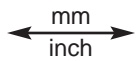
Slow action
2 NC



Slow action
1 NC



Dimensions



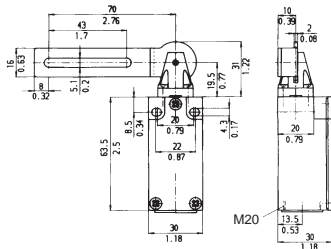
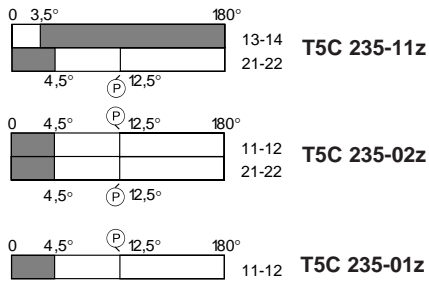
Types of Actuator Levers

Lever 3 C

Lever 4 C

Part No.	Configuration	Action	Model	Model
13-14 21-22		Slow action	T3C 235-11z	T4C 235-11z
11-12 21-22		Slow action	T3C 235-02z	T4C 235-02z
11-12		Slow action	T3C 235-01z	T4C 235-01z

T.C 235 TECHNICAL DATA



Lever 5 C

T5C 235-11z

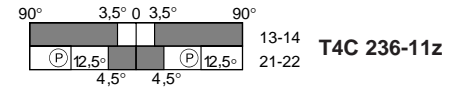
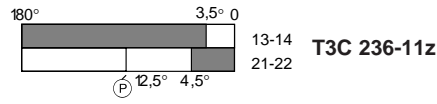
T5C 235-02z

T5C 235-01z

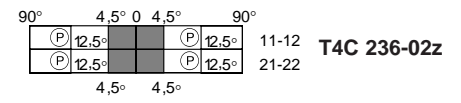
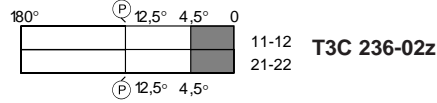
T.C 236 TECHNICAL DATA

Contact function diagrams

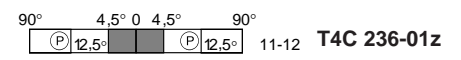
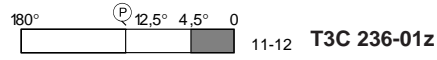
Slow action
1 NO + 1 NC



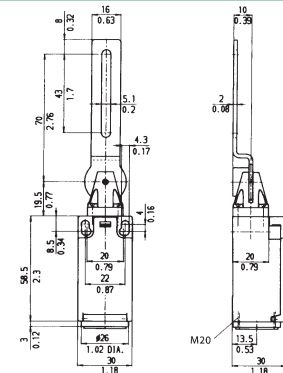
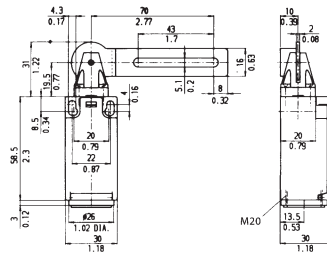
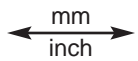
Slow action
2 NC



Slow action
1 NC



Dimensions



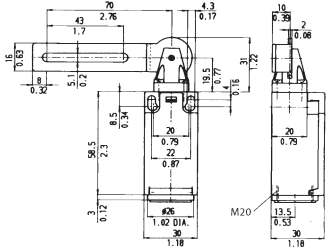
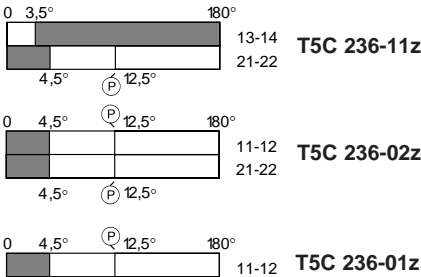
Types of Actuator Levers

Lever 3 C

Lever 4 C

Part No.		Slow action	T3C 236-11z	T4C 236-11z
		Slow action	T3C 236-02z	T4C 236-02z
		Slow action	T3C 236-01z	T4C 236-01z

T.C 236 TECHNICAL DATA



Lever 5 C

T5C 236-11z

T5C 236-02z

T5C 236-01z

Series TESZ

Hinged Safety Interlock Switch



Description

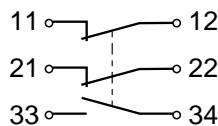
The TESZ Series are designed for use with hinged movable machine guards which must be closed for operator safety. Their tamper-resistant design and positive-opening NC contacts provide a significantly higher level of safety than conventional, spring-driven limit switches often used to monitor hinged-guard position. Their compact, low-profile design and IP65 rating make them ideal for interlocking hinged safety guards in industrial environments. Designed to mount directly on the hinged guard and its stationary frame, it is easy to install on a wide range of guard styles and sizes.

Operation

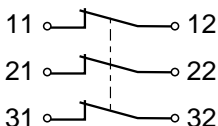


The installed TESZ features an integral electromechanical switch element which is actuated when opening a hinged machine guard. After opening the guard only 4°, the unit's positive-break, normally-closed contact(s) are forced to open by a direct (non-resilient) actuating mechanism. These positive-break contacts ensure circuit interruption and machine stoppage. The normally-open signalling contact closes after 13.5° of guard displacement.

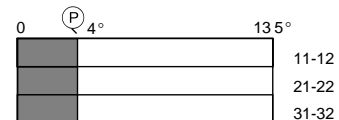
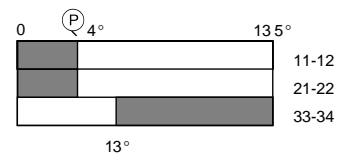
SWITCHING DIAGRAMS & CONTACT SCHEMATICS



TESZ1102



TESZ1110



Features & Benefits

- **Tamper-resistant** ... integral switch element and actuator prevents bypassing.
- **“Positive-break” NC contacts** ... ensure circuit interruption upon only 4° of guard displacement.
- **Splashproof design** ... meets IP65 environmental requirements.
- **Rugged construction** ... tolerates mechanical abuse and hostile environments.
- **Meets rigid safety agency standards** ... IEC, BG. (UL and CSA pending)
- **Easy to install** ... fits most popular extruded hinged guard designs.
- **Compatible with popular extruded profile widths.**
- **Optional integral manual reset** ... please consult factory.

AVAILABLE STANDARD MODELS

Part Number*	Contacts (Guard Closed)	Description
TESZ1102/30 TESZ1110/30	1 NO & 2 NC 3 NC	Hinged safety interlock switch for 30mm width extruded guards
TESZ1102/35 TESZ1110/35	1 NO & 2 NC 3 NC	Hinged safety interlock switch for 35mm width extruded guards
TESZ1102** TESZ1110**	1 NO & 2 NC 3 NC	Hinged safety interlock switch for 40mm width extruded guards
TESZ1102/45 TESZ1110/45	1 NO & 2 NC 3 NC	Hinged safety interlock switch for 45mm width extruded guards

*Includes hinge assembly with switch, switch actuator and an additional hinge assembly (without switch or switch actuator).

**Available with stainless-steel hinges. (Please consult factory)

AVAILABLE ACCESSORIES

Part Number*	Description
TESZ/S/30	Hinge assembly (without switch or switch actuator) for 30mm width extruded guards
TESZ/S/35	Hinge assembly (without switch or switch actuator) for 35mm width extruded guards
TESZ/S	Hinge assembly (without switch or switch actuator) for 40mm width extruded guards
TESZ/S/45	Hinge assembly (without switch or switch actuator) for 45mm width extruded guards

*Includes hinge and hinge pin.

SERIES TESZ TECHNICAL DATA

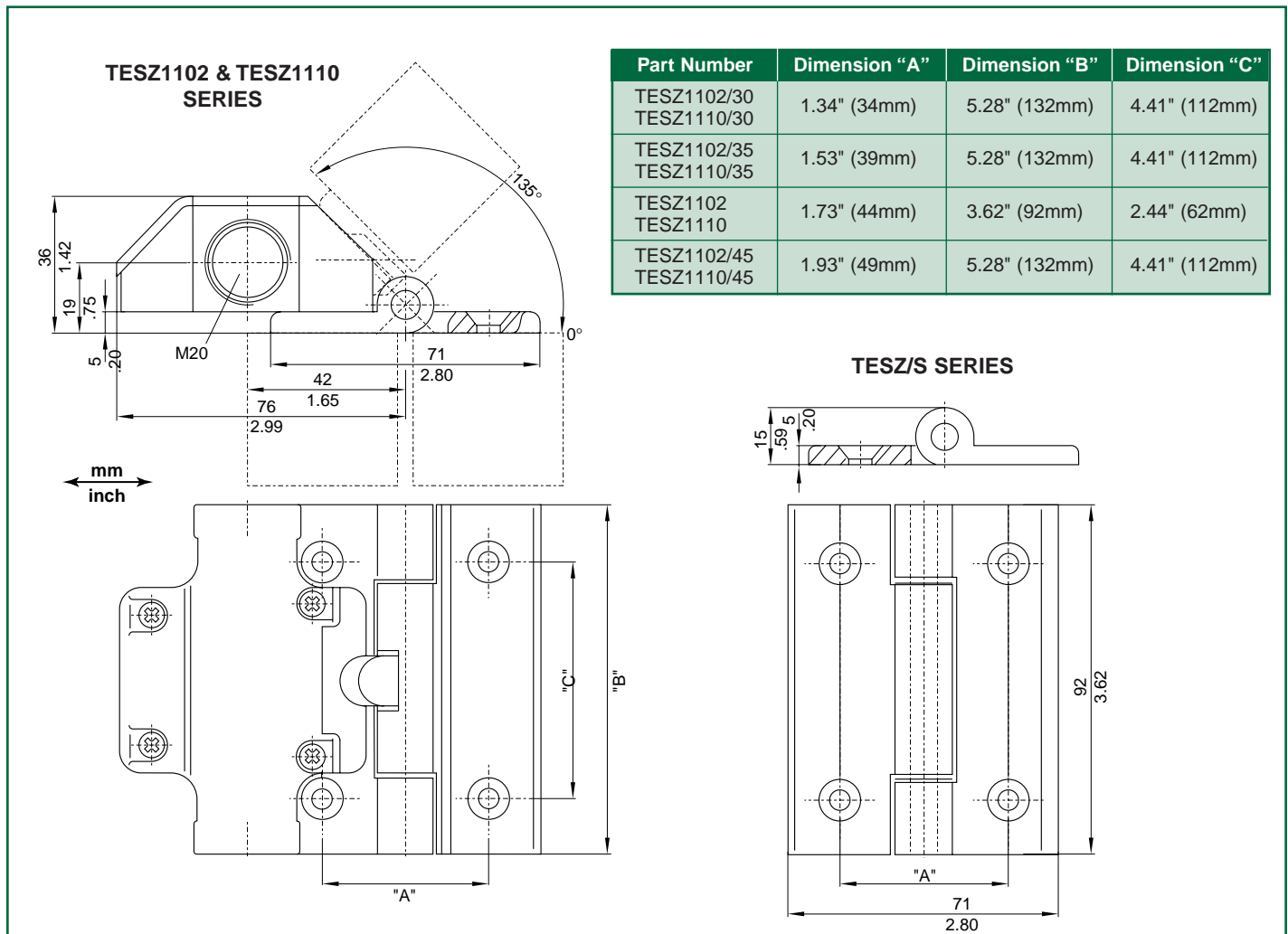
MECHANICAL SPECIFICATIONS

Materials of Construction	Hinge: Aluminum Switch Cover: Thermoplastic
Displacement Angle for NC Contact Opening	4°
Degree of Protection	IP65
Displacement Angle for NO Contact Closing	13.5°
Maximum Opening Angle	135°
Operating Temperature	-13°F to +176°F
Mechanical Life	>10 ⁶ operations
Mechanical Loading Capacity	Maximum torque of 3KN/m at 1m distance from hinge
Operating Rate	1,200 operations/hour (maximum)
Shock Tolerance	30g/18ms
Vibration Tolerance	20g/10... 200Hz
Conformity to Standards	IEC 947-5-1 EN60947-5-1 DIN VDE 0660 EN 1088 UL CSA

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Rating	2A (250VAC), AC-15, DC-13
Switching Action	Slow-acting, positive-break NC contact
Short Circuit Protection	6.0A (Slow blow)
Rated Insulation Voltage	250VAC (maximum)
Rated Impulse Withstand Voltage	2.5kV
Electrical Connections	Screw terminals for 15 AWG maximum stranded wire size

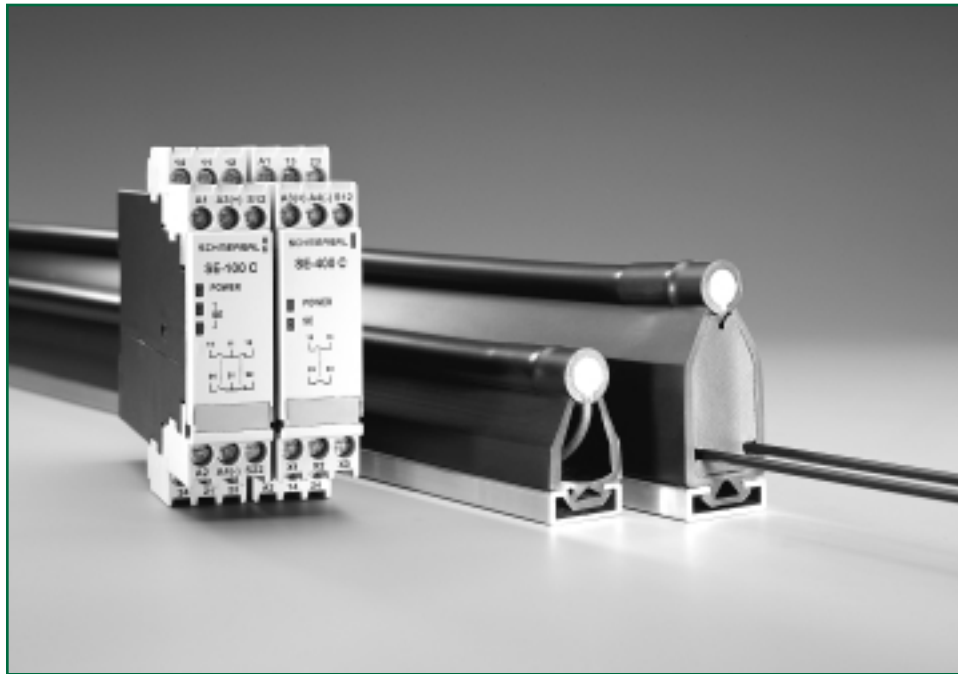
DIMENSIONS





*Safer
by
Design*

FAIL-TO-SAFE SAFETY EDGES



SELECTION GUIDE

SCHMERSAL's Series SE Safety Edges/Bumpers are available as sub-assembly components or as custom assemblies produced to user specifications. The following pages provide details regarding operation, construction and ordering details. Among the user options are safety edge profile, mounting frame profile and length. Please contact us if you have any questions, special needs or require assistance with properly specifying the safety edge which meets your requirements.



Features & Benefits

- **Can be cut & mounted in the field** ... easy to fit and adjust length when placing the edge on the door
- **Safety controller SE 100 handles up to 2 safety edges** ... reduced cost in multiple door applications
- **Rugged corrosion & abrasion resistance rubber profiles** ... tolerant to most industrial environments
- **Watertight design** ... meets IP 68 environmental requirements.
- **Low operating force** ... assures reliable operation
- **Automatic gain control** ... tolerates slight bending
- **Simple field installation** ... low cost & easy to repair
- **Meets rigid safety agency standards** ... BG(pending)

Description

The series SE Safety edge consists of a rugged high tear resistant rubber profile, an aluminum mounting rail, a plug-in optoelectronic transmitter and receiver pair and a compatible safety controller. The design features a high reflective internal rubber surface and a self-adjusting gain optical pair whose performance is uncompromised by slight bending ... and predictable over the specified operating range.

Units can be quickly and easily assembled (without special skills or use of adhesives) for lengths of 400 mm to 10 m.

The self adjusting optical pair assure the same sensitivity and performance independent of chosen length.

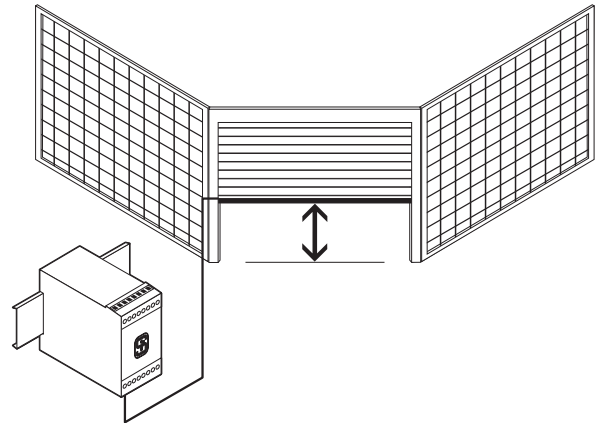
The mechanical design assures encapsulation of the transmitter and receiver ensuring reliable operation unaffected by environmental soiling.

Operation

In operation the transmitted IR beam is detected, by the receiver resulting in enabling of the safety controllers safety output(s). Deformation of the rubber profile interrupts/weakens the signal between the transmitter and receiver. This is sensed by the safety controller disabling the outputs allowing the hazardous movement to be stopped. Depending upon the choice of safety controller the system meets the requirements of EN 954-1 Safety control category 1 or 4.

Typical Applications

Ideal wherever crushing or shearing points are to be safeguarded, such as on guard doors, elevating platforms, rising stages, moving stock shelving, operating process tables, loading ramps, hoists or tipping equipment.



Note: Not recommended for use on overhead doors. Please consult factory for such applications.



SERIES SE ORDERING & ASSEMBLY INFORMATION

AVAILABLE SUBASSEMBLY COMPONENTS

Parts required for a system are:
Aluminum profile, rubber profile,
sensor set and safety controller

Aluminum Profile	Description
SE-AL10-1250	1.25 m
SE-AL10-2500	2.50 m
SE-AL12-1250	1.25 m
SE-AL12-2500	2.50 m
SE-AL20-1250	1.25 m
SE-AL20-2500	2.50 m
SE-AL22-1250	1.25 m
SE-AL22-2500	2.50 m
Rubber Profile	Description
SE- P 40 - 1250 mm	SE-P40 - 1250
SE- P 40 - 2500 mm	SE-P40 - 2500
SE- P 70 - 1250 mm	SE-P70 - 1250
SE- P 70 - 2500 mm	SE-P70 - 2500
Sensor Set	Description
SE- SET	SE - T Transmitter & SE - R Receiver
Safety Controller	Description
SE- 100C (2 Bumpers)	Safety Control Category 1
SE- 400C	Safety Control Category 4
SE- 304C (4 Bumpers)	Safety Control Category 3 (Please contact factory for details)
Accessories	Description
SE- EC 40 (2 required)	End Cap for SE - P 40
SE- EC 70 (2 required)	End Cap for SE - P 70
SE- SC	Rubber profile shears
SE- WA	Wiring aid
SE- J1	Junction Box



Six steps to install the safety edge

1 Cut aluminum rail to desired length and fasten in place



2 Cut the rubber profile to desired length



3 Clip the rubber profile into the aluminum rail



4 Press the transmitter and receiver units into the ends of the rubber profile

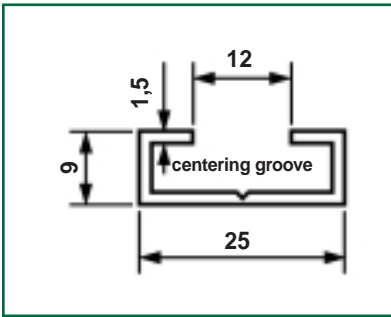


5 Thread emitter or receiver cable through profile to desired cable exit end of rubber profile.

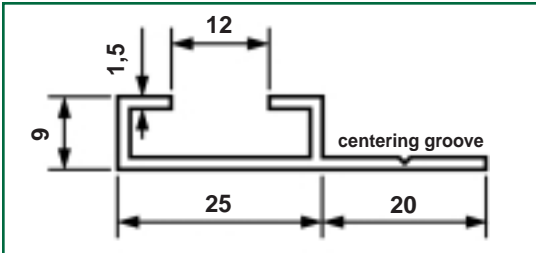
6 Connect to the desired safety controller It is ready !

SERIES SE TECHNICAL DATA

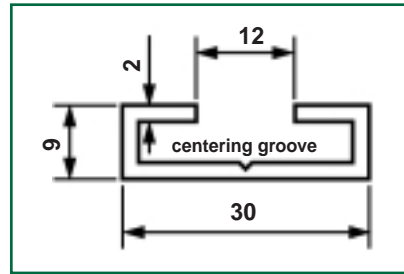
Aluminum Mounting Rail Profiles & Dimensions (mm)



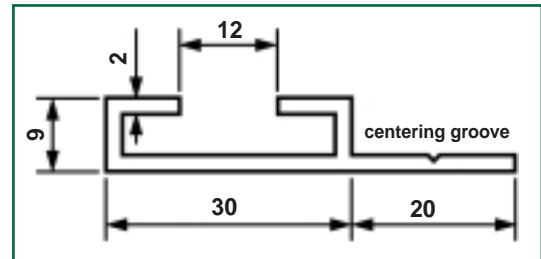
SE AL 10



SE AL 12



SE AL 20

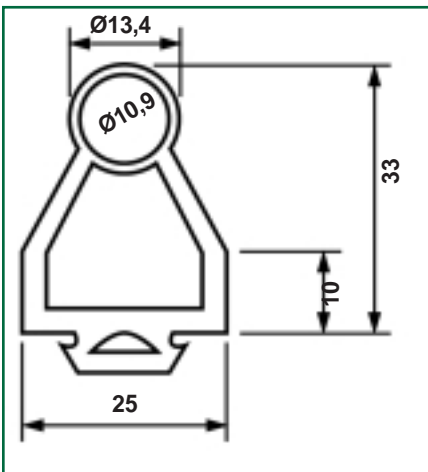


SE AL 22

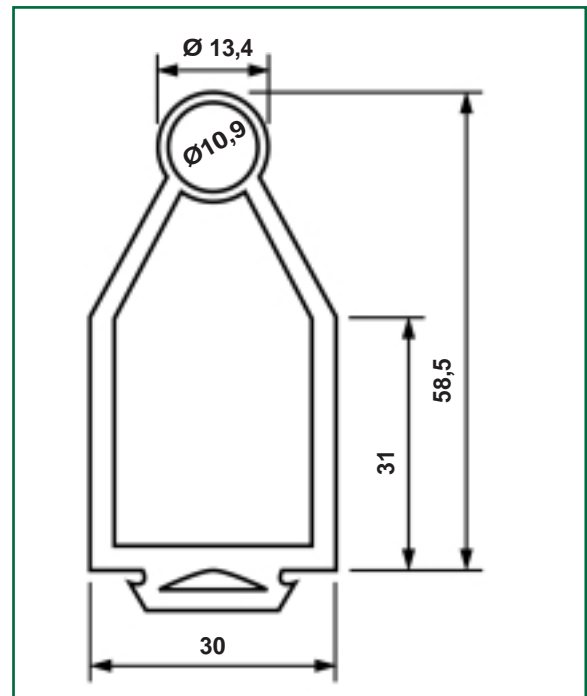
Rubber Mounting Rail Profiles & Dimensions (mm)

Table of Properties

Rubber Profile	SE - P 40 , SE - P 70
Rubber Material	EPDM , shore hardness 60
Temperature Range	- 40 °C to + 170 °C (short term) - 30 °C to + 170 °C (long term)
Resistance	good against ozone , moderate against oils, acids, solvents, fuels

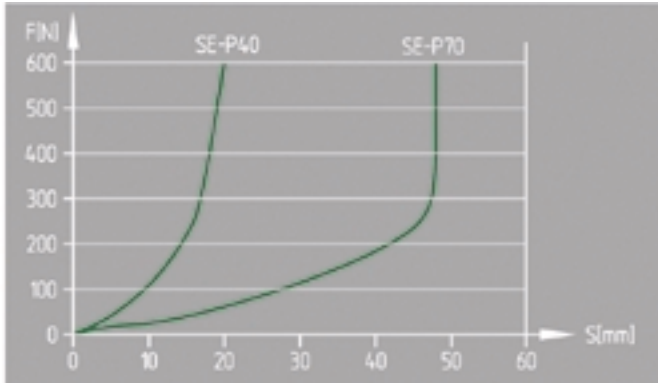


SE P 40

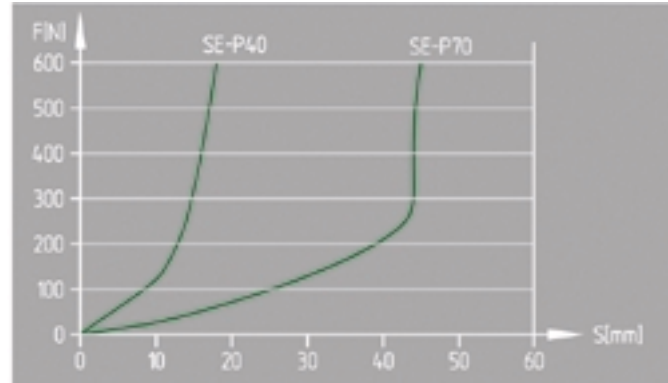


SE P 70

SERIES SE TECHNICAL DATA



Force/Travel diagram for the rubber profiles with SE 100 C controller unit



Force/Travel diagram for the rubber profiles with SE 400 C controller unit

Force/Travel table of rubber profiles with SE-100 C

Force/Travel	Fa [N]	Sa [mm]	Fn [N]	Sn [mm]
Testing Speed	100 mm/s		10 mm/s	
SE-P40	92	9	250	16
			400	18
			600	20
SE-P70	22	8	250	46
			400	47
			600	48

Force/Travel table of rubber profiles with SE-400 C

Force/Travel	Fa [N]	Sa [mm]	Fn [N]	Sn [mm]
Testing Speed	100 mm/s		10 mm/s	
SE-P40	140	11	250	14
			400	16
			600	18
SE-P70	23	9	250	43
			400	44
			600	45

Legend	Fa	Actuating force
	Sa	Actuating travel
	Fn	Overtravel force
	Sn	Overtravel
	Sg	Total deformation travel

$$Sg = Sa + Sn$$

The complete system is suitable for finger recognition in accordance with the above test data.

The measurements are carried out according to EN 1760-2*

Test conditions

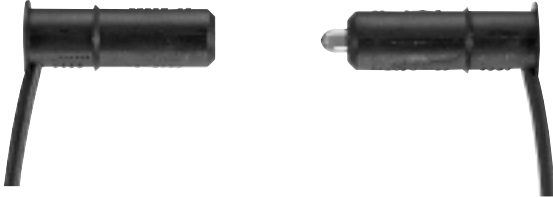
Measurement parameters

Temperature:	T = 20 °C
Mounting position	B (to EN 1760-2*)
Place of measurement	C 3 (to EN 1760-2*)

* preliminary

SERIES SE TECHNICAL DATA

Transmitter and Receiver Pair



Technical Data for SE - T / SE - R

Technical Data	SE - T , SE - R
Material	Polyurethane
Protection class	IP 68
Dimensions	11.5 mm dia., 37 mm long
Connecting cable	3 x 0.14 mm ² stranded wire
Cable length	Transmitter 6.6 m Receiver 3 m
Permissible cable length	Max. 200 m
Operating temperature	-25 °C to +75 °C

Fitting the rubber profile in a light bend

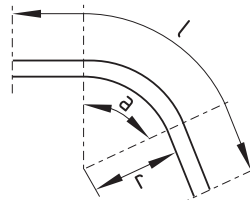
Light bends in the profile reduce the maximum possible length of safety edge.

The infrared signal between the transmitter and receiver overcomes light bends by reflection in the inner wall of the profile and self adjusting gain to increase transmission power.

Large radii offer less resistance in this case than smaller ones.

The reflective properties of the individual batches supplied are not absolutely constant and affect the reproducibility within certain limits.

The reflective characteristics of the SE-P40 and SE-P70 profiles are the same. The SE-P40 profile allows tighter radii to be used than the SE-P70 because of its smaller dimensions. When formed into tight bends, rubber profiles tend to buckle, thus leading to total blockage of the light channel.



Maximum Radius (r)	Bend Angle (a)	Bend Length (l)
0 m	0°	10,0 m
1 m	15°	4,5 m
0,5 m	63°	2,5 m
0,3 m	90°	1,25 m

Note: Maximum edge length is a function of both bend angle and bend radius. The above values are guidelines only.

SERIES SE TECHNICAL DATA

SE Series Safety Controllers



Electrical Specification	SE - 100 C	SE - 400 C
Standards	EN 1760-2, EN60947-5-1, VDE 0660 Part 200	EN1760-2, EN60947-5-1, VDE 0660 Part 200
Safety Control Category	1 to EN 954-1	4 to EN 954-1
Enclosure	PE (black), Crastin (grey)	PE (black), Crastin (grey)
Fixing	DIN rail EN 50 022	DIN rail EN 50 022
Screw terminals	max. 2 x 2.5 mm ² solid wire max. 2 x 1.5 mm ² stranded wire with end thimble	max. 2 x 2.5 mm ² solid wire max. 2 x 1.5 mm ² stranded wire with end thimble
Protection class (terminals)	(IP 20) Enclosure IP 40 IEC/EN 60529/ VDE 0470-1	(IP20) Enclosure IP40 IEC/EN 60529/ VDE 0470-1
Operational voltage	24VDC (+ 20 % / - 10 %)	24VDC (+ 20 % / - 10 %)
Fuse rating (supply)	1A (surge-resistant)	1A (surge-resistant)
Inputs	1 or 2 pairs SE-T/R Transmitter/Receiver	1 pair SE-T/R Transmitter/Receiver
Outputs	Changeover contacts	Normally closed contacts
Safety contacts	11/14	13/14, 23/24
Signalling contacts	21/22/24	Semiconductor X1, Connection to internal ground U _{max} . 36 V, I _{max} . 50 mA
Max. switching capacity	max. 1000 VA	max. 1000 VA
Utilization category	AC-15; DC-13	AC-15; DC-13
Rated operational current/voltage I _e / U _e	2 A/230VAC; 2 A/24VDC	2 A/230VAC; 3 A/24VDC
Switching voltage	250V AC/DC	250V AC/DC
Max. switching current	6A (resistive load)	4A (resistive load)
Contact fuse rating	6A surge-resistant	4A surge-resistant
Mechanical life	2 x 10 ⁷ switching cycles	3 x 10 ⁷ switching cycles
Readiness time	Max. 300ms	Approx. 32ms
Switch-on delay	Max. 300ms	Approx. 32ms
Switch-off delay	Typically 15ms	Typically 15ms
Ambient temperature	+5 °C to +55 °C	+5 °C to +55 °C
Shock resistant	< 5g / 33Hz (VDE 0160)	< 5g / 33Hz (VDE 0160)
Interference	According to EMC Directive	According to EMC Directive
Weight Approx.	0.18kg	Approx. 0.2kg
Clearance and creepage distances	Degree of soiling 2 to VDE 0160 Overvoltage category III / 4kV to VDE 0160	Degree of soiling 2 to VDE 0160 Overvoltage category III / 4kV to VDE 0160
Power consumption	< 4 W	< 4 W

Note: Maximum distance to controller: 200m. Use 20AWG to extend bumper leads to safety controller.

SERIES SE TECHNICAL DATA

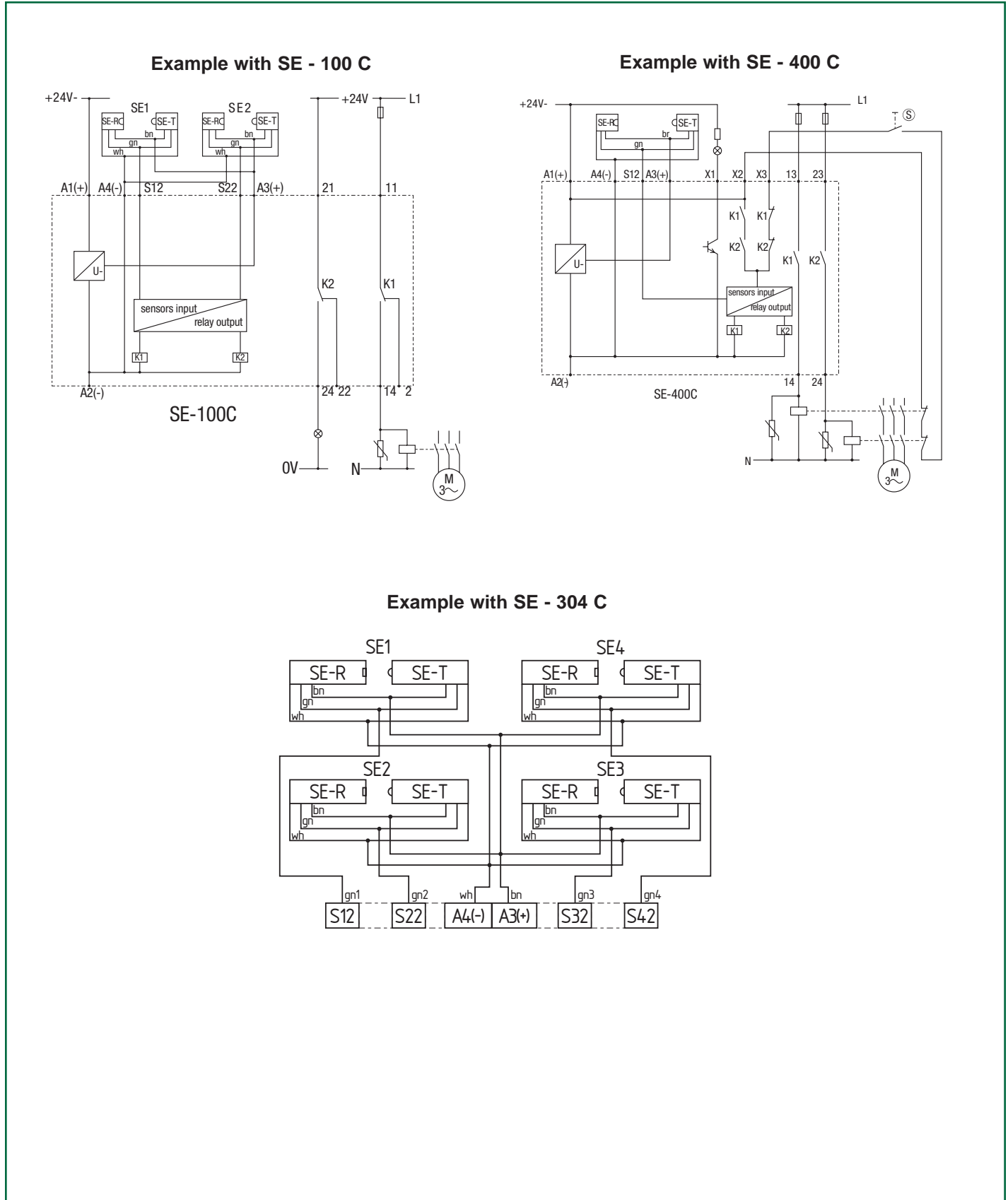
SE Series Safety Controllers



Electrical Specification	SE - 304C
Standards	EN 1760-2
Safety Control Category	3 to EN954-1
Enclosure	Thermoplastic
Mounting	DIN rail EN50 022
Screwterminals	Max. 2x2.5mm ² solid wire Max. 2x1.5mm ² stranded with end thimble
Protection class (terminals)	(IP20) Enclosure IP40 IEC/EN 60529/VDE 0470-1
Operating voltage	24VDC (+20%/-10%) 24VAC (+10%/-10%)
Fuse rating (supply)	1A (Slow-blow)
Inputs	1 to 4 pairs SE-T/R Transmitter/Receiver
Outputs	NO contact
Safety contacts	13/14
Signalling contacts	Semi-conductor XI, I _{max} . 50 mA
Max. switching capacity	Max. 1500VA
Utilization category	AC-15, DC-13
Rated operational current/voltage	2A/230VAC, 2A/24VDC
Switching voltage	250VAC/60VDC
Max. switching current	2A
Mechanical life	>10 ⁷ switching cycles
Switch-off delay	Typically 17ms
Ambient temperature	+5°C to +55°C
Shock resistant	<5g/33Hz (VDE 0160)
Interference	According to EMC Directive
Weight	0.185 kg
Power consumption	<4W

SERIES SE TECHNICAL DATA

Typical Wiring Diagram





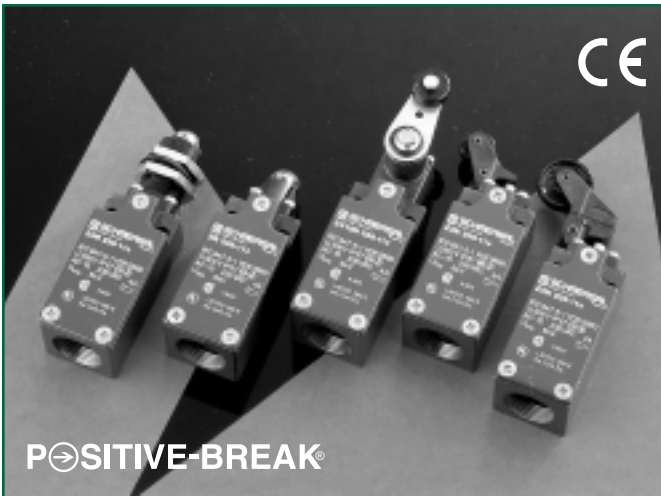
*Safer
by
Design*

SAFETY-RATED, POSITIVE-BREAK LIMIT SWITCHES



SELECTION GUIDE

Switch Series	Housing Material	Housing Dimensions	Degree of Protection	Contact Configurations	Catalog Page
Z/T235	Die-cast zinc	1¼"×1¼"×2½"	IP67	1 NO & 1 NC 2 NO 2NC	162
Z/T236	Glass-fibre reinforced thermoplastic	1¼"×1¼"×2½"	IP67	1 NO & 1 NC 2 NO 2NC	170
Z/T335	Die-cast aluminum	1½"×1¼"×3"	IP67	1 NO & 1 NC 2 NO 2NC	178
Z/T336	Glass-fibre reinforced thermoplastic	1½"×1½"×3"	IP67	1 NO & 1 NC 2 NO 2NC	184
Z332	Die-cast aluminum	1½"×1½"×3"	IP65	1 NO & 1 NC (snap-action only)	190
C50	Glass-fibre reinforced thermoplastic	1"×1⅛"×¾"	IP30	1 NO & 1 NC	194



Description

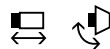
The Z/T235 Series limit switches are designed for use with movable machine guards/access gates which must be closed for operator safety ... and for any other presence/position sensing application normally addressed with conventional limit switches. Their positive-opening NC contacts provide a higher level of safety and reliability than conventional spring-driven switches whose contacts can weld or stick shut.

Each is available with a choice of six standard actuators ... rounded plunger, roller plunger, roller rocking lever, rod rocking lever, adjustable roller rocking lever and one-way roller lever ... mountable in any one of four 90° positions. All rocking levers are positively-locked to the shaft, and are adjustable throughout 360° in 10° increments.

Units are available with a choice of slow-action or snap-action contacts.

Their rugged metal housing and IP67 rating make them ideal alternatives to conventional limit switches.

Typical Applications



The Z/T235 Series may be used in any presence/position sensing application normally addressed with conventional limit switches. Snap-action models with positive-break NC contacts (Z235 Series) are approved for use in safety systems. For safety applications the switch must be mounted such that the actuating element of the machine displaces the switch actuator far enough to exceed the positive-break point. (See contact function diagrams: symbol *).

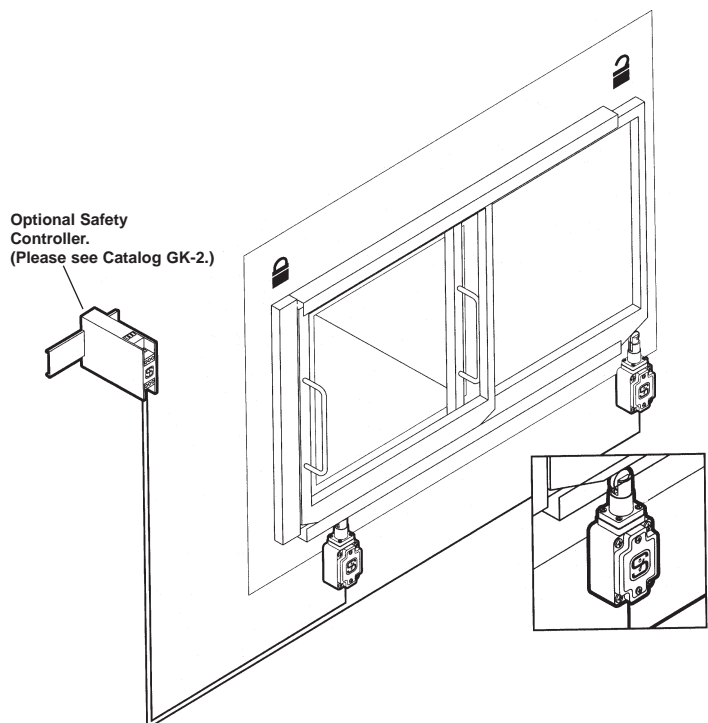
Features & Benefits

- “Positive-Break” NC contacts ... won’t stick or weld shut.
- Watertight design ... meets IP67 washdown requirements.
- Rugged, corrosion-resistant housing ... tolerates hostile environments.
- Six popular actuator styles ... for application versatility.
- Four 90° actuator mounting positions ... provide installation flexibility.
- Slow or snap-action operation ... choose to best satisfy application requirements.
- Safety-system approved (Z235 Series) ... for use in machine guarding applications.
- Meets rigid safety agency standards ... IEC, BG, VDE, UL and CSA.

ORDERING GUIDE

FOR FEATURE:	SPECIFY:
1. Contact operation: Slow Action Snap Action	T Z
2. Operating head	V
3. Roller lever	12 H
4. Body size	235-
5. No. of NO contacts	1
6. No. of NC contacts	1
7. Degree of protection IP 67	z
8. Sealing of operating head (optional)	z*
	Example 1: TV12 H 235-11z
	Example 2: ZV 12 H 235-11z

*Available on rocking lever actuator style only.



Z/T235 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Chromated diecast zinc with brown enamel finish
Operating Temperature	-22°F to +175°F (-30°C to +80°C)
Mechanical Life	20 million operations
Minimum Cam Speed (Referenced to Plunger)	Z235 Series: 0.04m./minute T235 Series: 2.4m./minute
Maximum Operating Rate	5000 operations/hour
Bounce Time	Z235 Series: £ 3 ms T235 Series: Function of cam speed
Changeover Time	Z235 Series: £ 5 ms for minimum cam speed T235 Series: Function of cam speed
Degree of Protection	IP67
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660 Part 200 BG-GS-ET15 DIN EN 50 047 CSA-C22.2 UL508

ELECTRICAL SPECIFICATIONS

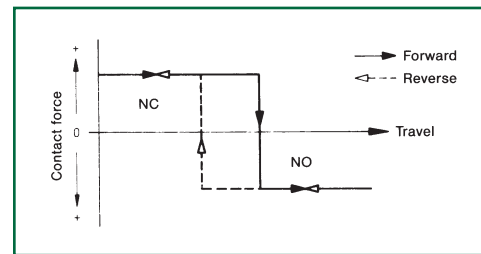
Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Gap	Z235 Series: 2x0.08 inches (2x2mm) T235 Series: 2x0.14 inches (2x3.5mm)
Contact Rating	4A/230VAC 2.5A/400VAC
Switching Action	Snap-action, positive-break NC contacts (Z235) Slow-action, positive-break NC contacts (T235)
Short Circuit Protection	Fuse: 10A (time delay) 2.5A (no time delay) 6A (time delay) as positive-break position switch
Rated Insulation Voltage	500VAC
Rated Impulse Withstand Voltage	6kV
Type Terminals	Screw terminals, maximum 2.5mm (AWG13) wire



Series T235
Slow-action
switch

Series Z235
Snap-action
switch

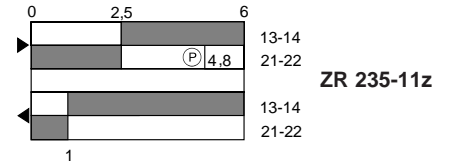
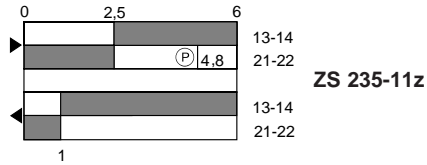
CONTACT SYSTEMS



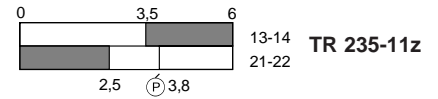
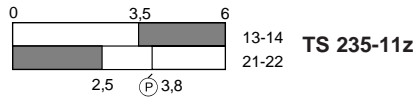
Z/T235 TECHNICAL DATA

Contact function diagrams

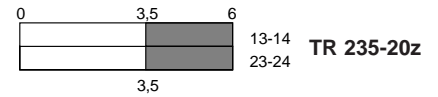
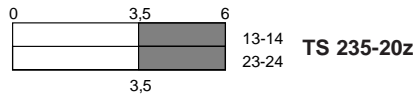
Snap action positive break
1 NO + 1 NC



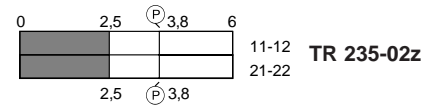
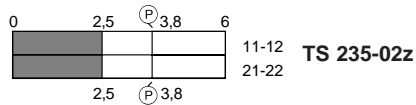
Slow action
1 NO + 1 NC (break before make)



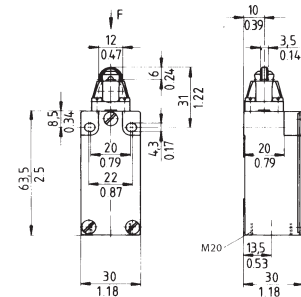
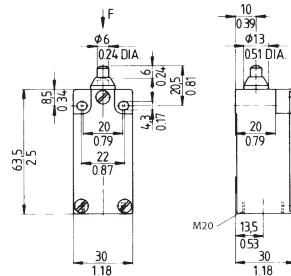
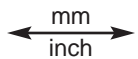
2 NO (simultaneous)



2 NC (simultaneous)



Dimensions



Types of Actuators

Rounded plunger Style S

Roller plunger Style R

Actuating force/torque

9 N (19 N positive break)

9 N (19 N positive break)

Actuating speed Z/T at ∇

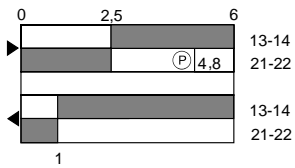
0°: min. 10/60 mm/min, max. 1 m/s

30°: min. 20/120 mm/min, max. 1 m/s

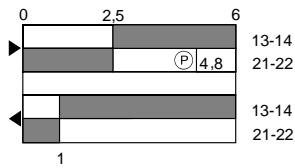
Part No.	Actuator Type	Model	Model
13-14 21-22	Snap Action positive break	ZS 235-11z	ZR 235-11z
13-14 21-22	Slow action	TS 235-11z	TR 235-11z
13-14 23-24	Slow action	TS 235-20z*	TR 235-20z*
11-12 21-22	Slow action	TS 235-02z	TR 235-02z

* Not for use in safety applications

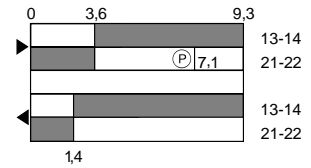
Z/T235 TECHNICAL DATA



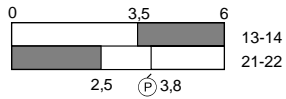
Z4S 235-11z



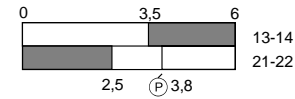
Z4R 235-11z



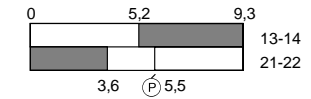
ZK 235-11z



T4S 235-11z



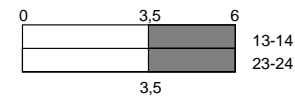
T4R 235-11z



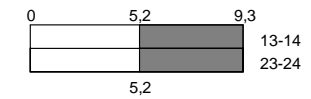
TK 235-11z



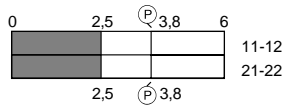
T4S 235-20z



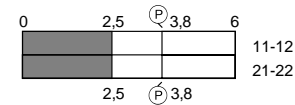
T4R 235-20z



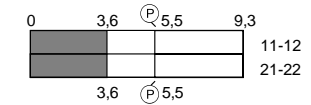
TK 235-20z



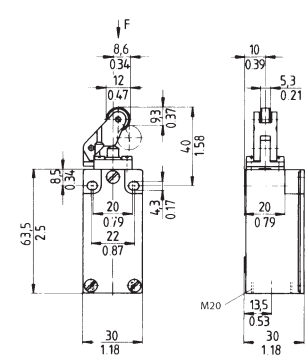
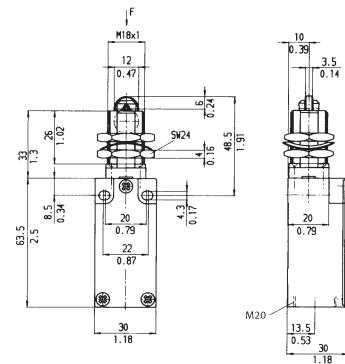
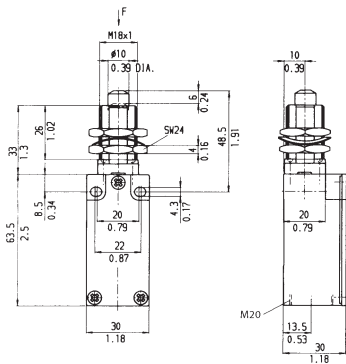
T4S 235-02z



T4R 235-02z



TK 235-02z



Rounded plunger (central mounting) Style 4S

Top roller plunger (central mounting) Style 4R

One-way roller lever Style K

9 N (19 N positive break)

9 N (19 N positive break)

8 N (18 N positive break)

0°: min. 10/60 mm/min, max. 1 m/s

30°: min. 20/120 mm/min, max. 1 m/s

30°: min. 24/240 mm/min, max. 1 m/s

Z4S 235-11z

Z4R 235-11z

ZK 235-11z

T4S 235-11z

T4R 235-11z

TK 235-11z

T4S 235-20z*

T4R 235-20z*

TK 235-20z*

T4S 235-02z

T4R 235-02z

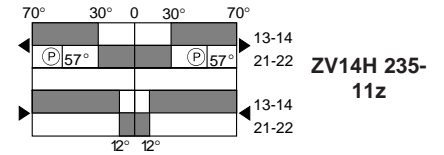
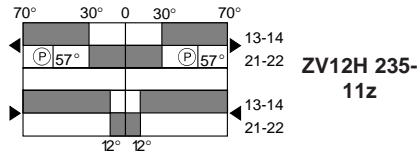
TK 235-02z

* Not for use in safety applications

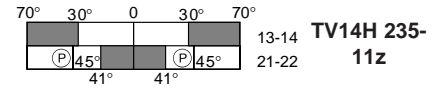
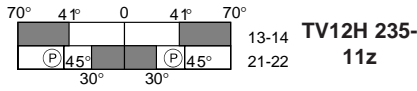
Z/T235 TECHNICAL DATA

Contact function diagrams

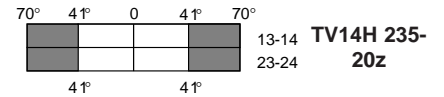
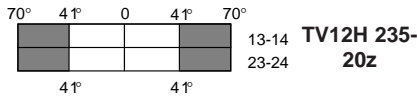
Snap action positive break
1 NO + 1 NC



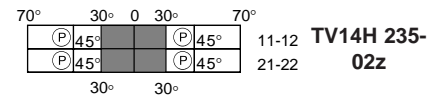
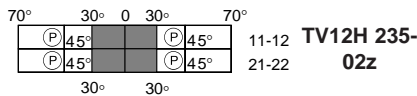
Slow action
1 NO + 1 NC (break before make)



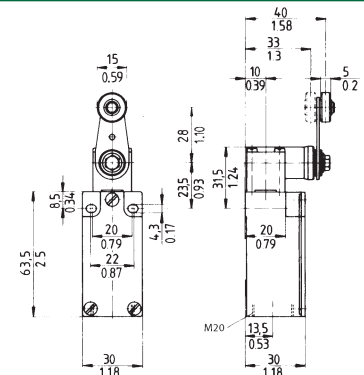
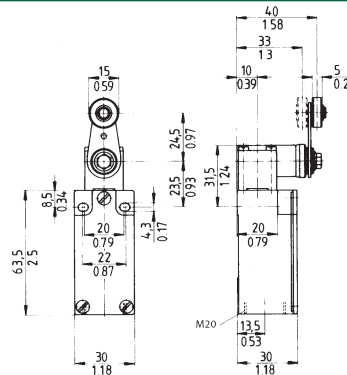
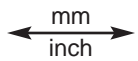
2 NO (simultaneous)



2 NC (simultaneous)



Dimensions



Types of Actuators

Roller rocking lever Style 12H

Roller rocking lever Style 14H

Actuating force/torque

15 Ncm (18.5 Ncm positive break)

15 Ncm (18.5 Ncm positive break)

Actuating speed Z/T at ∇

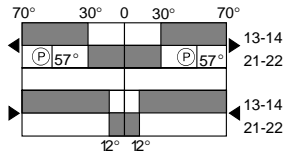
30°: min. 687/4122 mm/min, max. 1 m/s

30°: min. 687/4122 mm/min, max. 1 m/s

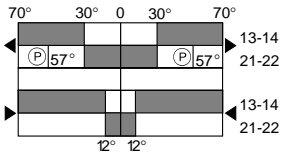
Part No.	Actuator Type	Style 12H	Style 14H
13-14 21-22	Snap Action positive break	ZV12H 235-11z	ZV14H 235-11z
13-14 21-22	Slow action	TV12H 235-11z	TV14H 235-11z
13-14 23-24	Slow action	TV12H 235-20z*	TV14H 235-20z*
11-12 21-22	Slow action	TV12H 235-02z	TV14H 235-02z

* Not for use in safety applications

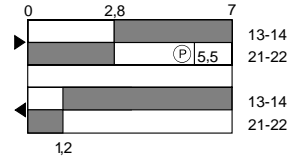
Z/T235 TECHNICAL DATA



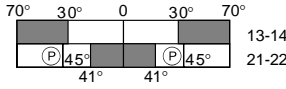
ZV7H 235-11z



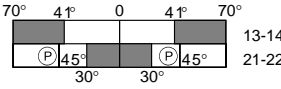
ZV10H 235-11z



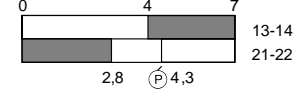
Z3K 235-11z



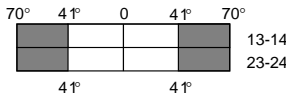
TV7H 235-11z



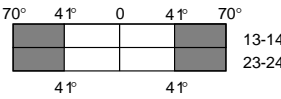
TV10H 235-11z



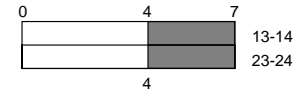
T3K 235-11z



TV7H 235-20z



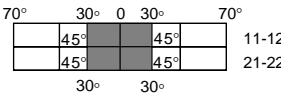
TV10H 235-20z



T3K 235-20z



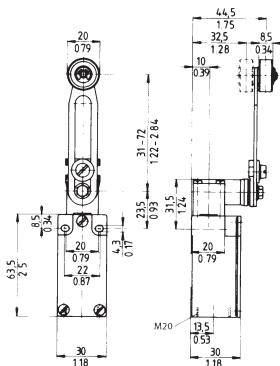
TV7H 235-02z



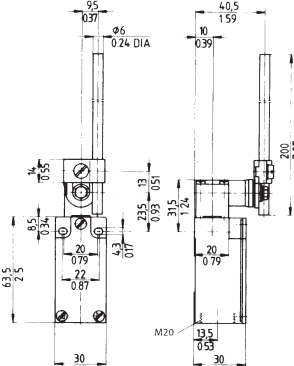
TV10H 235-02z



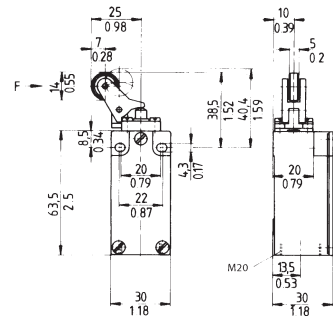
T3K 235-02z



**Adjustable roller rocking lever*
Style 7H**



**Rod rocking lever*
Style 10H**



**One-way roller lever
Style 3K**

15 Ncm (18.5 Ncm positive break)

15 Ncm (18.5 Ncm positive break)

9 N (19 N positive break)

30°: min. 240/1440 mm/min, max. 1 m/s

30°: min. 687/4122 mm/min, max. 1 m/s

30°: min. 27/160 mm/min, max. 1 m/s

ZV7H 235-11z*

ZV10H 235-11z*

Z3K 235-11z

TV7H 235-11z*

TV10H 235-11z*

T3K 235-11z

TV7H 235-20z*

TV10H 235-20z*

T3K 235-20z*

TV7H 235-02z*

TV10H 235-02z*

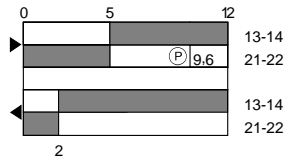
T3K 235-02z

* Not for use in safety applications

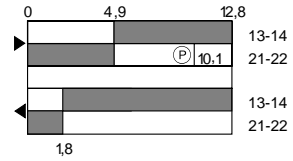
Z/T235 TECHNICAL DATA

Contact function diagrams

Snap action positive break
1 NO + 1 NC

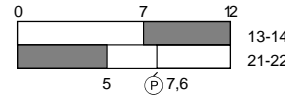


Z4K 235-11z

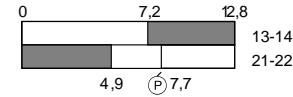


ZK4 235-11z

Slow action
1 NO + 1 NC (break before make)

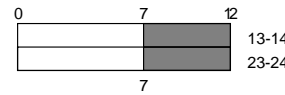


T4K 235-11z

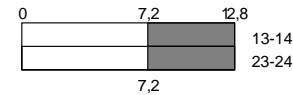


TK4 235-11z

2 NO (simultaneous)

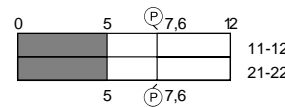


T4K 235-20z



TK4 235-20z

2 NC (simultaneous)



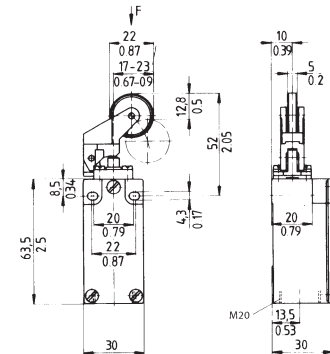
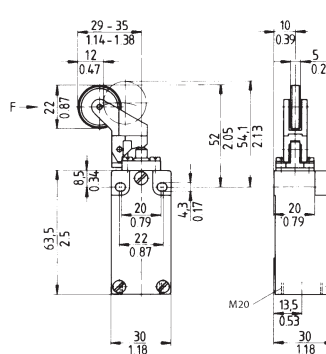
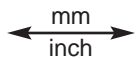
T4K 235-02z



TK4 235-02z



Dimensions



Types of Actuators

One-way roller lever
Style 4K

One-way roller lever
Style K4

Actuating force/torque

6 N (16 N positive break)

6 N (16 N positive break)

Actuating speed Z/T at ∇

30°: min. 44/264 mm/min, max. 1 m/s

30°: min. 56/336 mm/min, max. 1 m/s

Part No.	Contact Function	Actuator Style	Part No.
13-14 21-22	Snap Action positive break	Z4K 235-11z	ZK4 235-11z
13-14 21-22	Slow action	T4K 235-11z	TK4 235-11z
13-14 23-24	Slow action	T4K 235-20z*	TK4 235-20z*
11-12 21-22	Slow action	T4K 235-02z	TK4 235-02z

*Not for use in safety applications.



*Safer
by
Design*



Features & Benefits

- **“Positive-Break” NC contacts** ... won’t stick or weld shut.
- **Watertight design** ... meets IP67 washdown requirements.
- **Rugged, corrosion-resistant housing** ... tolerates hostile environments.
- **Six popular actuator styles** ... for application versatility.
- **Four 90° actuator mounting positions** ... provide installation flexibility.
- **Slow or snap-action operation** ... choose to best satisfy application requirements.
- **Safety-system approved (Z236 Series)** ... for use in machine guarding applications.
- **Meets rigid safety agency standards** ... IEC, BG, VDE, UL and CSA.

Description

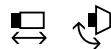
The Z/T236 Series limit switches are designed for use with movable machine guards/access gates which must be closed for operator safety ... and for any other presence/position sensing application normally addressed with conventional limit switches. Their positive-opening NC contacts provide a higher level of safety and/or reliability than conventional spring-driven switches whose contacts can weld or stick shut.

Each is available with a choice of six standard actuators ... rounded plunger, roller plunger, roller rocking lever, rod rocking lever, adjustable roller rocking lever and one-way roller lever ... mountable in any one of four 90° positions. All rocking levers are positively-locked to the shaft, and are adjustable throughout 360° in 10° increments.

Units are available with a choice of slow-action or snap-action contacts.

Their rugged fiberglass-reinforced housing and IP67 rating make them ideal alternatives to conventional limit switches.

Typical Applications



The Z/T236 Series may be used in any presence/position sensing application normally addressed with conventional limit switches. Snap-action models with positive-break NC contacts (Z236 Series) are approved for use in safety systems. For safety applications the switch must be mounted such that the actuating element of the machine displaces the switch actuator far enough to exceed the positive-break point. (See contact function diagrams: symbol *).

ORDERING GUIDE

FOR FEATURE:	SPECIFY:
1. Contact operation: Slow Action Snap Action	T Z
2. Operating head	V
3. Roller lever	7 H
4. Body size	236-
5. No. of NO contacts	1
6. No. of NC contacts	1
7. Degree of protection IP 67	z
8. Sealing of operating head (optional)	z*
Example 1:	TV7 H 236-11z
Example 2:	ZV7 H 236-11z

*Available on rocking lever actuator style only.

Z/T236 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Glass fiber reinforced self-extinguishing thermoplastic
Operating Temperature	-22°F to +175°F (-30°C to +80°C)
Mechanical Life	20 million operations
Minimum Cam Speed (Referenced to Plunger)	Z236 Series: 0.04m./minute T236 Series: 2.4m./minute
Maximum Operating Rate	5000 operations/hour
Bounce Time	Z236 Series: £ 3 ms T236 Series: Function of cam speed
Changeover Time	Z236 Series: £ 5 ms for minimum cam speed T236 Series: Function of cam speed
Degree of Protection	IP67
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660 Part 200 BG-GS-ET15 DIN EN 50 047 CSA-C22.2 UL508

ELECTRICAL SPECIFICATIONS

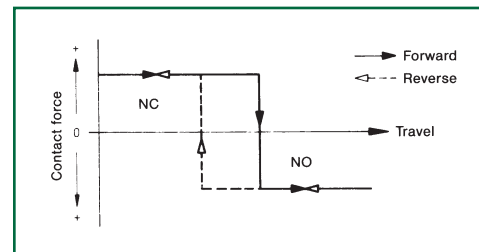
Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Gap	Z236 Series: 2x0.08 inches (2x2mm) T236 Series: 2x0.14 inches (2x3.5mm)
Contact Rating	4A/230VAC 2.5A/400VAC
Switching Action	Snap-action, positive-break NC contacts (Z236) Slow-action, positive-break NC contacts (T236)
Short Circuit Protection	Fuse: 10A (time delay) 2.5A (no time delay) 6A (time delay) as positive-break position switch
Rated Insulation Voltage	500VAC
Rated Impulse Withstand Voltage	6kV
Type Terminals	Screw terminals, maximum 2.5mm (AWG13) wire



Series T236
Slow-action
switch

Series Z236
Snap-action
switch

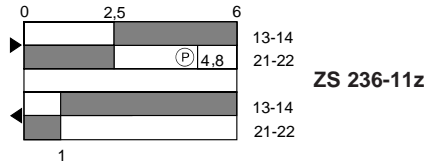
CONTACT SYSTEMS



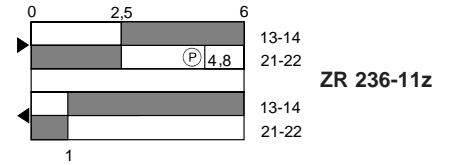
Z/T236 TECHNICAL DATA

Contact function diagrams

Snap action positive break
1 NO + 1 NC

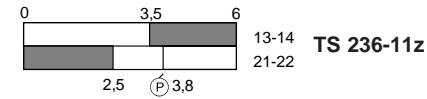


ZS 236-11z

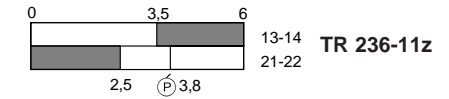


ZR 236-11z

Slow action
1 NO + 1 NC (break before make)

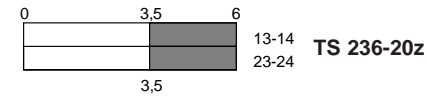


TS 236-11z

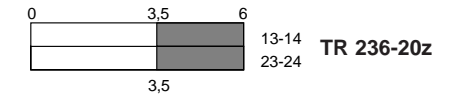


TR 236-11z

2 NO (simultaneous)

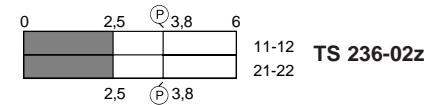


TS 236-20z

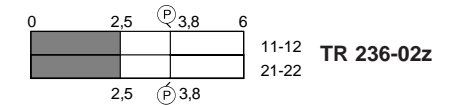


TR 236-20z

2 NC (simultaneous)



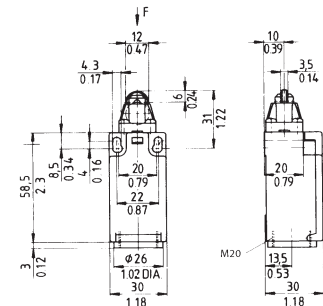
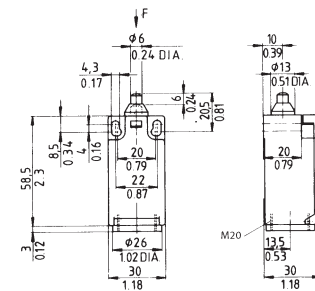
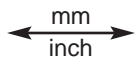
TS 236-02z



TR 236-02z



Dimensions



Types of Actuators

Rounded plunger Style S

Roller plunger Style R

Actuating force/torque

9 N (19 N positive break)

9 N (19 N positive break)

Actuating speed Z/T at \angle

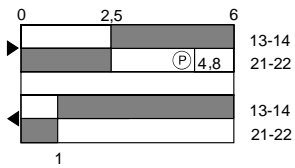
0°: min. 10/60 mm/min, max. 1 m/s

30°: min. 20/120 mm/min, max. 1 m/s

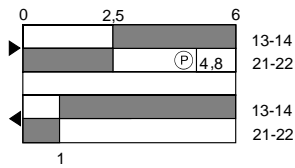
Part No.	Actuator Type	Model	Model
13-14 21-22	Snap Action positive break	ZS 236-11z	ZR 236-11z
13-14 21-22	Slow action	TS 236-11z	TR 236-11z
13-14 23-24	Slow action	TS 236-20z*	TR 236-20z*
11-12 21-22	Slow action	TS 236-02z	TR 236-02z

* Not for use in safety applications

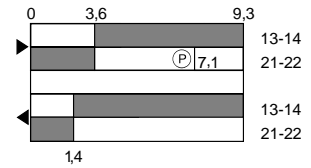
Z/T236 TECHNICAL DATA



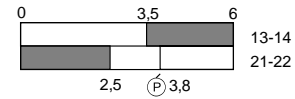
Z4S 236-11z



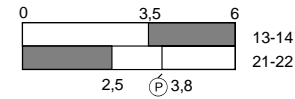
Z4R 236-11z



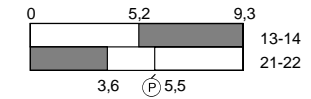
ZK 236-11z



T4S 236-11z



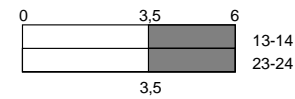
T4R 236-11z



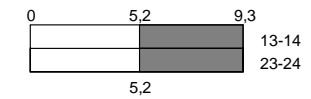
TK 236-11z



T4S 236-20z



T4R 236-20z



TK 236-20z



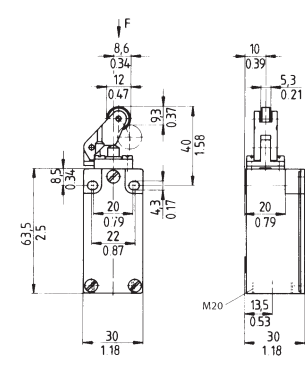
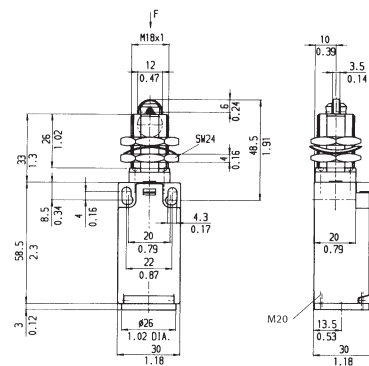
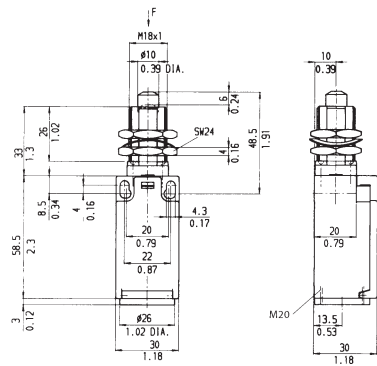
T4S 236-02z



T4R 236-02z



TK 236-02z



Rounded plunger (central mounting) Style 4S

Top roller plunger (central mounting) Style 4R

Top roller lever Style K

9N (19N positive break)

9 N (19N positive break)

8 N (18 N positive break)

0°: min. 10/60 mm/min, max. 1 m/s

30°: min. 20/120 mm/min, max. 1 m/s

30°: min. 24/240 mm/min, max. 1 m/s

Z4S 236-11z

Z4R 236-11z

ZK 236-11z

T4S 236-11z

T4R 236-11z

TK 236-11z

T4S 236-20z*

T4R 236-20z*

TK 236-20z*

T4S 236-02z

T4R 236-02z

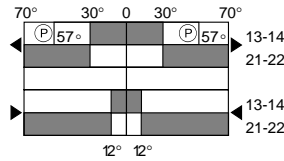
TK 236-02z

* Not for use in safety applications

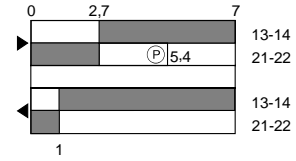
Z/T236 TECHNICAL DATA

Contact function diagrams

Snap action positive break
1 NO + 1 NC

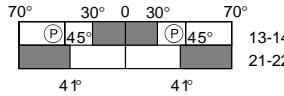


ZV1H 236-11z



Z1R 236-11z

Slow action
1 NO + 1 NC (break before make)

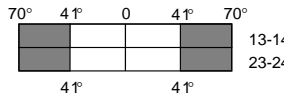


TV1H 236-11z

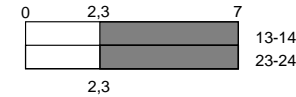


T1R 236-11z

2 NO (simultaneous)

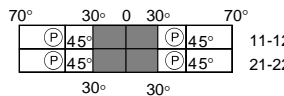


TV1H 236-20z

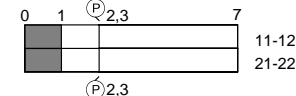


T1R 236-20z

2 NC (simultaneous)



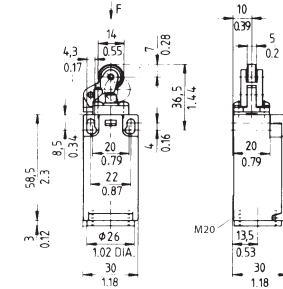
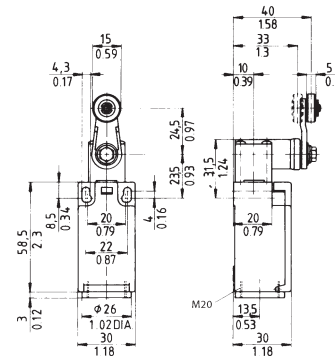
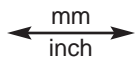
TV1H 236-02z



T1R 236-02z



Dimensions



Types of Actuators

Roller rocking lever Style 1H

Top roller lever Style 1R

Actuating force/torque

15 Ncm (18.5 Ncm positive break)

15 Ncm (18.5 Ncm positive break)

Actuating speed Z/T at ∇

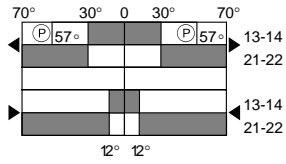
30°: min. 92/492 mm/min, max. 1 m/s

30°: min. 27/160 mm/min, max. 1 m/s

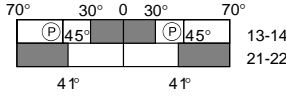
Part No.	Actuator Type	Roller rocking lever Style 1H	Top roller lever Style 1R
13-14 21-22	Snap Action positive break	ZV1H 236-11z	Z1R 236-11z
13-14 21-22	Slow action	TV1H 236-11z	T1R 236-11z
13-14 23-24	Slow action	TV1H 236-20z*	T1R 236-20z*
11-12 21-22	Slow action	TV1H 236-02z	T1R 236-02z

* Not for use in safety applications

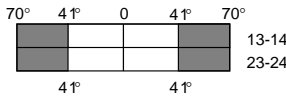
Z/T236 TECHNICAL DATA



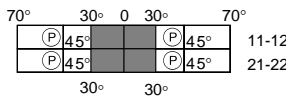
ZV7H 236-11z



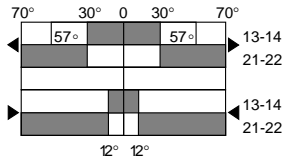
TV7H 236-11z



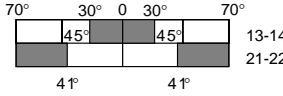
TV7H 236-20z



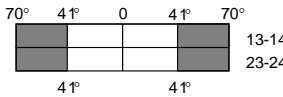
TV7H 236-02z



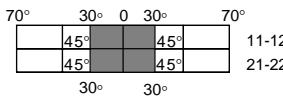
ZV10H 236-11z



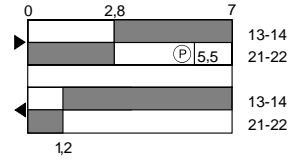
TV10H 236-11z



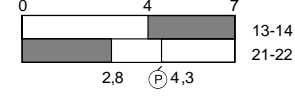
TV10H 236-20z



TV10H 236-02z



Z3K 236-11z



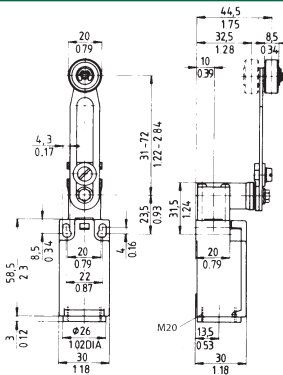
T3K 236-11z



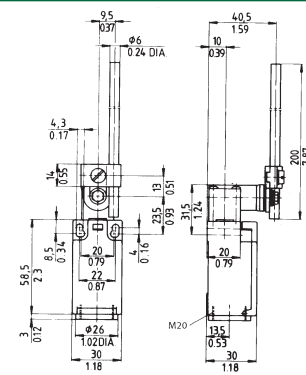
T3K 236-20z



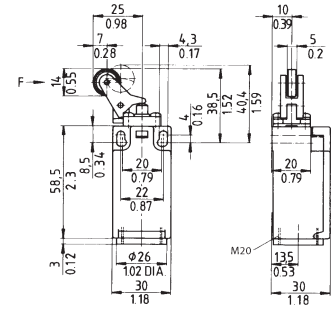
T3K 236-02z



**Adjustable roller rocking lever*
Style 7H**



**Rod rocking lever*
Style 10H**



**One-way roller lever
Style 3K**

15 Ncm (18.5 Ncm positive break)

15 Ncm (18.5 Ncm positive break)

9 N (19 N positive break)

30°: min. 240/1440 mm/min, max. 1 m/s

30°: min. 687/4122 mm/min, max. 1 m/s

30°: min. 27/160 mm/min, max. 1 m/s

ZV7H 236-11z*

ZV10H 236-11z*

Z3K 236-11z

TV7H 236-11z*

TV10H 236-11z*

T3K 236-11z

TV7H 236-20z*

TV10H 236-20z*

T3K 236-20z*

TV7H 236-02z*

TV10H 236-02z*

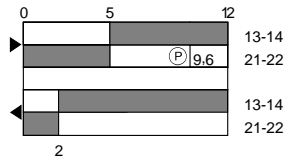
T3K 236-02z

* Not for use in safety applications

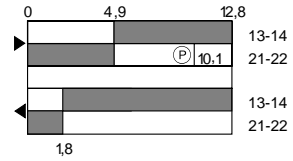
Z/T236 TECHNICAL DATA

Contact function diagrams

Snap action positive break
1 NO + 1 NC

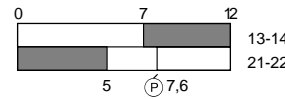


Z4K 236-11z

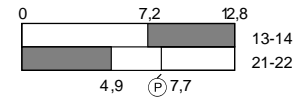


ZK4 236-11z

Slow action
1 NO + 1 NC (break before make)

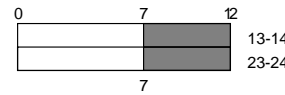


T4K 236-11z

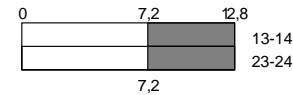


TK4 236-11z

2 NO (simultaneous)

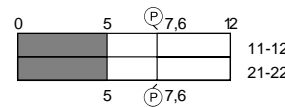


T4K 236-20z



TK4 236-20z

2 NC (simultaneous)



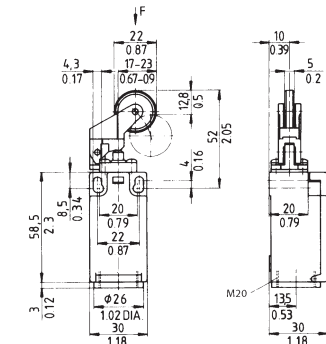
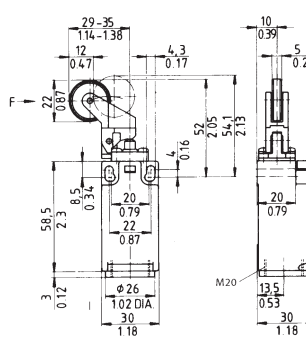
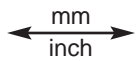
T4K 236-02z



TK4 236-02z



Dimensions



Types of Actuators

One-way roller lever
Style 4K

One-way roller lever
Style K4

Actuating force/torque

6 N (16 N positive break)

6 N (16 N positive break)

Actuating speed Z/T at ∇

30°: min. 44/264 mm/min, max. 1 m/s

30°: min. 56/336 mm/min, max. 1 m/s

Part No.	Actuator Type	Style 4K	Style K4
13-14 21-22	Snap Action positive break	Z4K 236-11z	ZK4 236-11z
13-14 21-22	Slow action	T4K 236-11z	TK4 236-11z
13-14 23-24	Slow action	T4K 236-20z*	TK4 236-20z*
11-12 21-22	Slow action	T4K 236-02z	TK4 236-02z

* Not for use in safety applications



*Safer
by
Design*

SERIES Z/T335

Heavy-Duty Safety-Rated, Positive-Break Limit Switches



Features & Benefits

- **“Positive-Break” NC contacts** ... won’t stick or weld shut.
- **Watertight design** ... meets IP67 washdown requirements.
- **Rugged, corrosion-resistant housing** ... tolerates hostile environments.
- **Six popular actuator styles** ... for application versatility.
- **Four 90° actuator mounting positions** ... provide installation flexibility.
- **Slow or snap-action operation** ... choose to best satisfy application requirements.
- **Safety-system approved (Z335 Series)** ... for use in machine guarding applications.
- **Meets rigid safety agency standards** ... IEC, BG, VDE, UL and CSA.
- **Optional LED indicators** ... provide visual display of supply voltage and switch operation.

Description

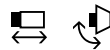
The Z/T335 Series limit switches are designed for use with movable machine guards/access gates which must be closed for operator safety ... and for any other presence/position sensing application normally addressed with conventional limit switches. Their positive-opening NC contacts provide a higher level of safety and/or reliability than conventional spring-driven switches whose contacts can weld or stick shut.

Each is available with a choice of six standard actuators ... rounded plunger, roller plunger, roller rocking lever, rod rocking lever, adjustable roller rocking lever and one-way roller lever ... mountable in any one of four 90° positions. All rocking levers are positively-locked to the shaft, and are adjustable throughout 360° in 10° increments.

Units are available with a choice of slow-action or snap-action contacts.

Their rugged metal housing and IP67 rating make them ideal alternatives to conventional limit switches.

Typical Applications

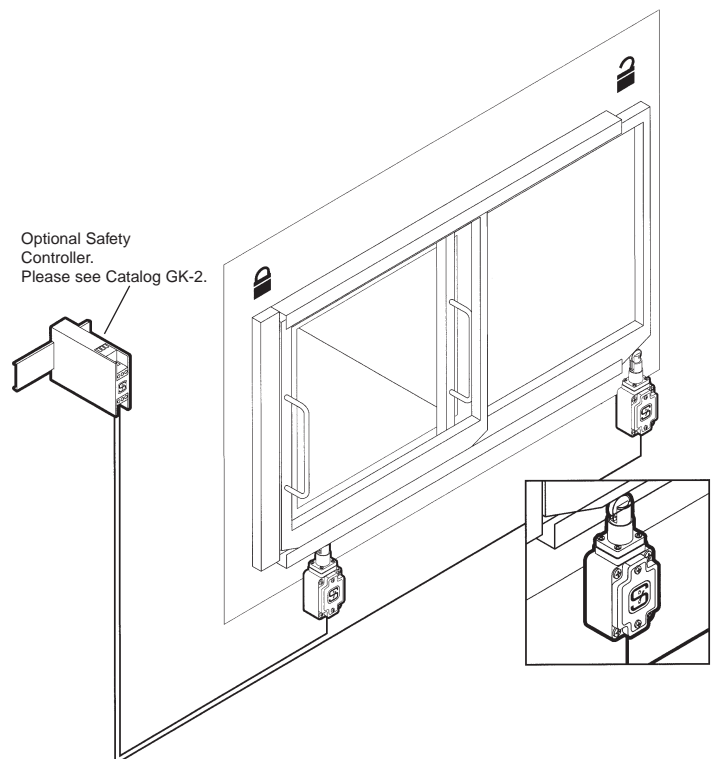


The Z/T335 Series may be used in any presence/position sensing application normally addressed with conventional limit switches. Snap-action models with positive-break NC contacts (Z335 Series) are approved for use in safety systems. For safety applications the switch must be mounted such that the actuating element of the machine displaces the switch actuator far enough to exceed the positive-break point. (See contact function diagrams: symbol *).

ORDERING GUIDE

FOR FEATURE:	SPECIFY:
1. Contact operation: Slow Action Snap Action	T Z
2. Operating head	4V
3. Roller lever	H
4. Body size	335-
5. No. of NO contacts	1
6. No. of NC contacts	1
7. Degree of protection IP 67	z
8. Sealing of operating head (optional)	z
Example 1:	T4VH 335-11z
Example 2:	Z4VH 335-11z

Note: The Z/T335 Series is also available with 1 NO and 2 NC and with 3 NC contacts. Please consult factory.



Z/T335 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Diecast aluminum with enamel finish
Operating Temperature	-22°F to +195°F (-30°C to +90°C)
Mechanical Life	30 million operations
Maximum Operating Rate	5000 operations/hour
Bounce Time	Z335 Series: < 2 ms T335 Series: Function of cam speed
Changeover Time	Z335 Series: < 2 ms for cam speed of 1 mm/minute T335 Series: Function of cam speed
Degree of Protection	IP67
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660 Part 200 BG-GS-ET-15 DIN EN 50041 CSA-C22.2 No. 14 (Suffix -1577) UL508 (Suffix -1594)

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Gap	Z335 Series: 2x0.03 inches T335 Series: 2x0.16 inches
Contact Rating	4A/230VAC 2.5A/400VAC
Switching Action	Z335 Series: Snap-action with positive-break NC contacts T335 Series: Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse: 10A (time delay) 16A (no time delay) 6A (time delay) as positive-break position switch
Rated Insulation Voltage	500VAC
Rated Impulse Withstand Voltage	6kV
Type Terminals	Screw terminals, maximum 2.5mm ² (AWG13) wire

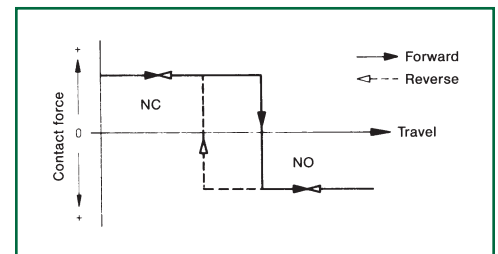


Slow Action Switch
T335 Ⓢ Ⓟ

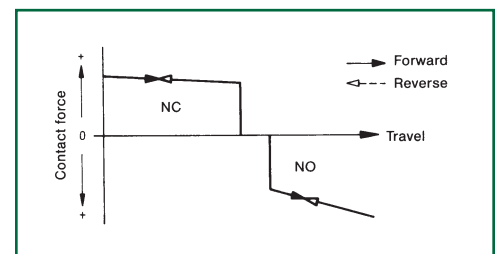


Snap Action Switch
Z335 Ⓢ Ⓟ

SNAP ACTION CONTACT SYSTEMS

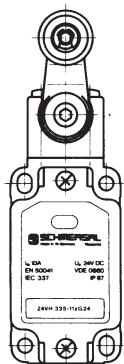


SLOW ACTION CONTACT SYSTEMS



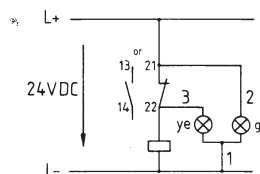
LED INDICATOR MODELS

Green LED (gn) indicator supply voltage and yellow LED (ye) indicator for switch operation of NO or NC contacts for **24VDC**. Available for all models of Series 335.

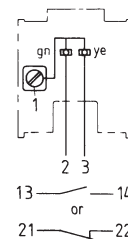


Shown here:
Z4VH 335-11zG24

Wiring diagram:



Shown here:
indication of operation of NC contact (terminals 21-22);
for indication of operation of NO contact use terminals 13-14



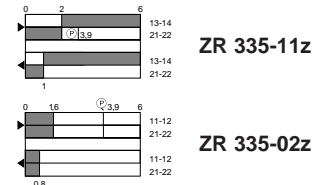
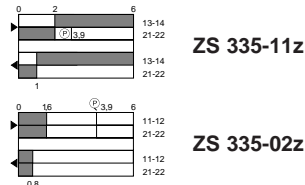
protected against wrong polarity connection
protected against transient voltages 700V
Attention: no inductive loads

Z/T335 TECHNICAL DATA

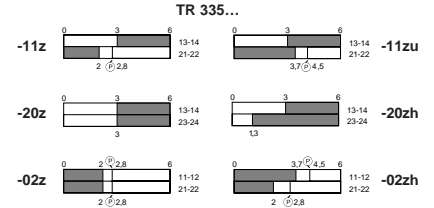
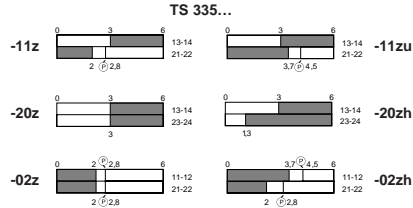
Contact function diagrams

Snap action positive break
1 NO + 1 NC

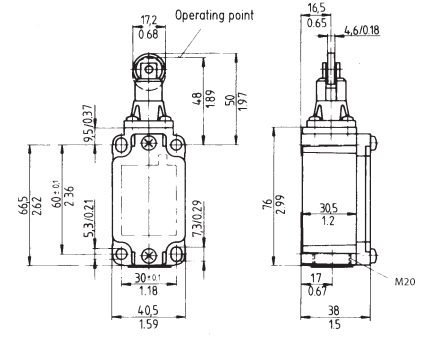
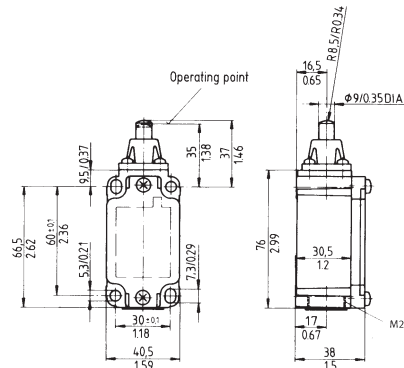
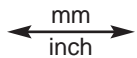
2 NC



Slow action 1 NO + 1 NC
make before break make before break
2 NO simultaneous contacts staggered
 (2-step)
2 NC simultaneous contacts staggered
 (2-step)
1 NC + 1 NC (CW-CCW)



Dimensions



Types of Actuators

Rounded plunger
Style S

Roller plunger
Style R

		Actuating Force		Actuating Force		
		Snap Action positive break	ZS 335-11z	12 N	ZR 335-11z	12 N
		Snap Action positive break	ZS 335-02z	12 N	ZR 335-02z	12 N
Part No.		Slow Action Make before break	TS 335-11z	15 N	TR 335-11z	15 N
		Slow Action 2-step	TS 335-20z* TS 335-20zh*	17 N	TR 335-20z* TR 335-20zh*	17 N
		Slow Action 2-step	TS 335-02z TS 335-02zh	14 N	TR 335-02z TR 335-02zh	14 N

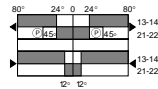
* Not for use in safety applications

Slow Action
1 NC CW + 1 NC CCW

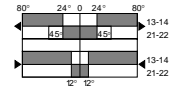
Z/T335 TECHNICAL DATA



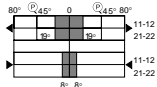
Z4VH 335-11z



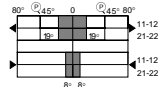
Z4V7H 335-11z



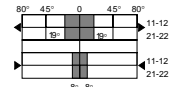
Z4V10H 335-11z



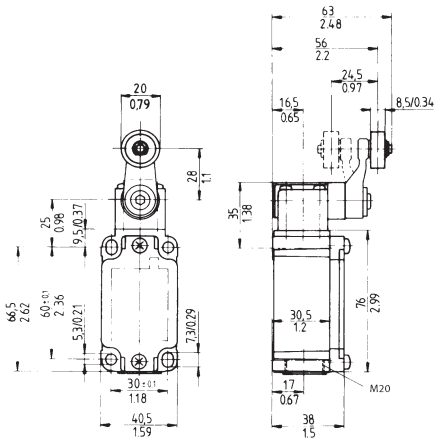
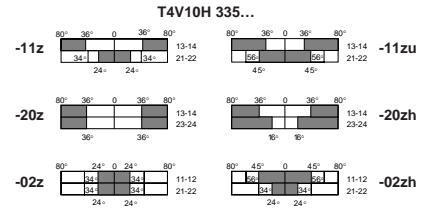
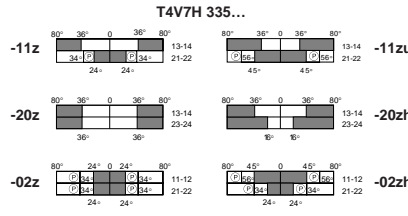
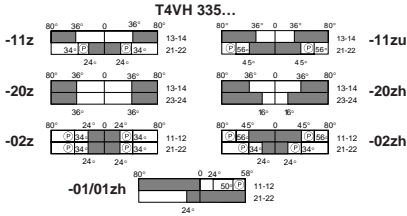
Z4VH 335-02z



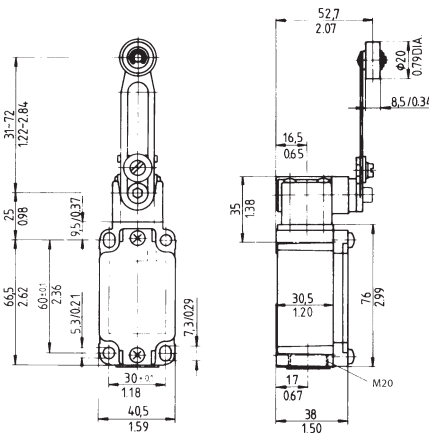
Z4V7H 335-02z



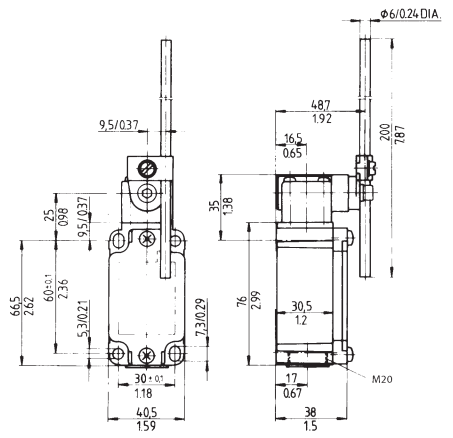
Z4V10H 335-02z



4V operating head with roller rocking lever Style H



4V operating head with adjustable roller rocking lever Style 7H*



4V operating head with rod rocking lever Style 10H*

	Actuating Force		Actuating Force		Actuating Force
Z4VH 335-11z	27 Ncm	Z4V7H 335-11z*	27 Ncm	Z4V10H 335-11z*	27 Ncm
Z4VH 335-02z	27 Ncm	Z4V7H 335-02z*	27 Ncm	Z4V10H 335-02z*	27 Ncm
T4VH 335-11z	27.5 Ncm	T4V7H 335-11z*	27.5 Ncm	T4V10H 335-11z*	27.5 Ncm
T4VH 335-11zu	27.5 Ncm	T4V7H 335-11zu*	27.5 Ncm	T4V10H 335-11zu*	27.5 Ncm
T4VH 335-20z*	28 Ncm	T4V7H 335-20z*	28 Ncm	T4V10H 335-20z*	28 Ncm
T4VH 335-20zh*	28 Ncm	T4V7H 335-20zh*	28 Ncm	T4V10H 335-20zh*	28 Ncm
T4VH 335-02z	27.5 Ncm	T4V7H 335-02z*	27.5 Ncm	T4V10H 335-02z*	27.5 Ncm
T4VH 335-02zh	27.5 Ncm	T4V7H 335-02zh*	27.5 Ncm	T4V10H 335-02zh*	27.5 Ncm

TVH 335-01/01zh 26.5 Ncm
(other levers upon request)

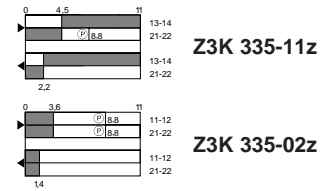
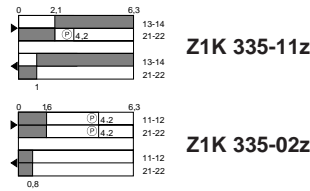
* Not for use in safety applications

Z/T335 TECHNICAL DATA

Contact function diagrams

Snap action positive break
1 NO + 1 NC

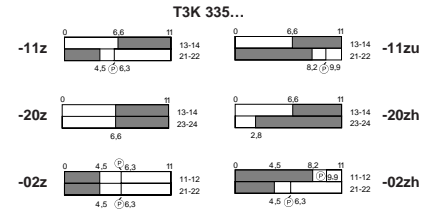
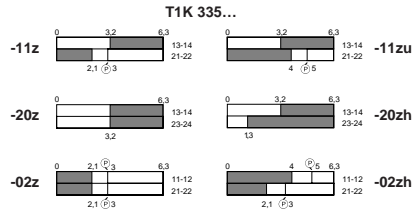
2 NC



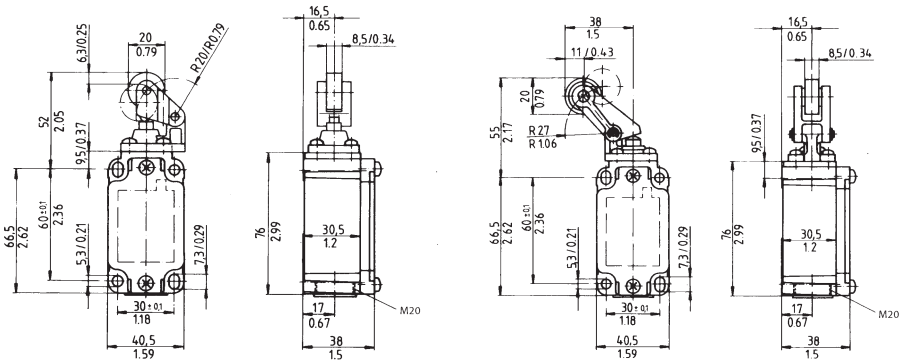
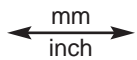
Slow action 1 NO + 1 NC

make before break 2 NO simultaneous contacts staggered (2-step)

2 NC simultaneous contacts staggered (2-step) (CW-CCW)



Dimensions



Types of Actuators

One-way roller lever
Style 1K

One-way roller lever
Style 3K

Part No.	Contact Function	Model	Actuating Force	
			Style 1K	Style 3K
13-14 21-22	Snap Action positive break	Z1K 335-11z	12 N	Z3K 335-11z 5.0 N
11-12 21-22	Snap Action positive break	Z1K 335-02z	12 N	Z3K 335-02z 5.0 N
13-14 21-22	Slow Action Make before break	T1K 335-11z	15 N	T3K 335-11z 6.3 N
13-14 23-24	Slow Action 2-step	T1K 335-20z* T1K 335-20zh*	17 N	T3K 335-20z* T3K 335-20zh* 7.2 N
11-12 21-22	Slow Action 2-step	T1K 335-02z T1K 335-02zh	14 N	T3K 335-02z T3K 335-02zh 6.0 N

* Not for use in safety applications



*Safer
by
Design*



Features & Benefits

- **“Positive-Break” NC contacts** ... won’t stick or weld shut.
- **Watertight design** ... meets IP67 washdown requirements.
- **Rugged, corrosion-resistant housing** ... tolerates hostile environments.
- **Six popular actuator styles** ... for application versatility.
- **Four 90° actuator mounting positions** ... provide installation flexibility.
- **Slow or snap-action operation** ... choose to best satisfy application requirements.
- **Safety-system approved (Z336 Series)** ... for use in machine guarding applications.
- **Meets rigid safety agency standards** ... IEC, BG, VDE, UL and CSA.

Description

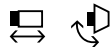
The Z/T336 Series limit switches are designed for use with movable machine guards/access gates which must be closed for operator safety ... and for any other presence/position sensing application normally addressed with conventional limit switches. Their positive-opening NC contacts provide a higher level of safety and/or reliability than conventional spring-driven switches whose contacts can weld or stick shut.

Each is available with a choice of six standard actuators ... rounded plunger, roller plunger, roller rocking lever, rod rocking lever, adjustable roller rocking lever and one-way roller lever ... mountable in any one of four 90° positions. All rocking levers are positively-locked to the shaft, and are adjustable throughout 360° in 10° increments.

Units are available with a choice of slow-action or snap-action contacts.

Their rugged fiberglass-reinforced thermoplastic housing and IP67 rating make them ideal alternatives to conventional limit switches.

Typical Applications



The Z/T336 Series may be used in any presence/position sensing application normally addressed with conventional limit switches. Snap-action models with positive-break NC contacts (Z336 Series) are approved for use in safety systems. For safety applications the switch must be mounted such that the actuating element of the machine displaces the switch actuator far enough to exceed the positive-break point. (See contact function diagrams: symbol *).

ORDERING GUIDE

FOR FEATURE:	SPECIFY:
1. Contact operation: Slow Action Snap Action	T Z
2. Operating head	4V
3. Roller lever	H
4. Body size	336-
5. No. of NO contacts	1
6. No. of NC contacts	1
7. Degree of protection IP 67	z
8. Sealing of operating head (optional)	z*
Example 1:	T4VH 336-11z
Example 2:	Z4VH 336-11z

*Available on rocking lever actuator style only.

Z/T336 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

Housing	Glass fiber reinforced self-extinguishing thermoplastic
Operating Temperature	-22°F to +195°F (-30°C to +90°C)
Mechanical Life	30 million operations
Maximum Operating Rate	5000 operations/hour
Bounce Time	Z336 Series: < 2 ms T336 Series: Function of cam speed
Changeover Time	Z336 Series: < 2 ms for cam speed of 1 mm/minute T336 Series: Function of cam speed
Degree of Protection	IP67
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660 Part 200 BG-GS-ET-15 DIN EN 50041 CSA-C22.2 No. 14 (Suffix -1577) UL508 (Suffix -1594)

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Gap	Z336 Series: 2x0.03 inches T336 Series: 2x0.16 inches
Contact Rating	4A/230VAC 2.5A/400VAC
Switching Action	Z336 Series: Snap-action with positive-break NC contacts T336 Series: Slow-action, positive-break NC contacts
Short Circuit Protection	Fuse: 10A (time delay) 16A (no time delay) 6A (time delay) as positive-break position switch
Rated Insulation Voltage	500VAC
Rated Impulse Withstand Voltage	6kV
Type Terminals	Screw terminals, maximum 2.5mm (AWG13) wire

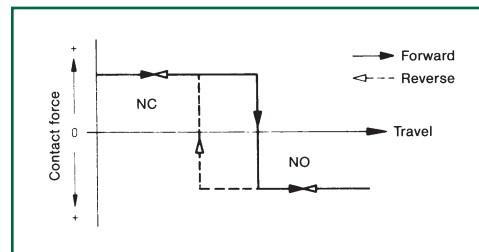


Slow Action Switch
T336 Ⓢ Ⓟ

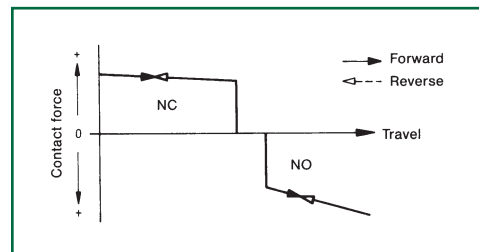


Snap Action Switch
Z336 Ⓢ Ⓟ

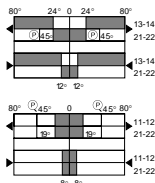
SNAP ACTION CONTACT SYSTEMS



SLOW ACTION CONTACT SYSTEMS

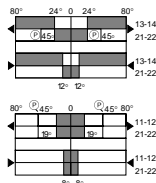


Z/T336 TECHNICAL DATA



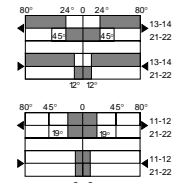
Z4VH 336-11z

Z4VH 336-02z



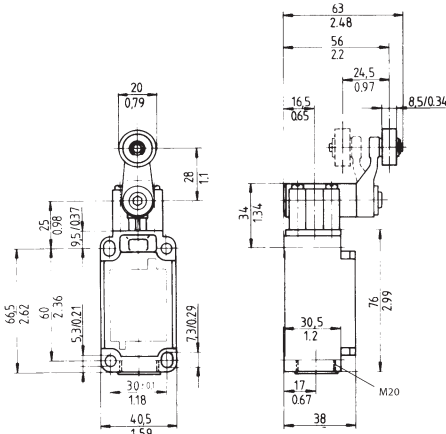
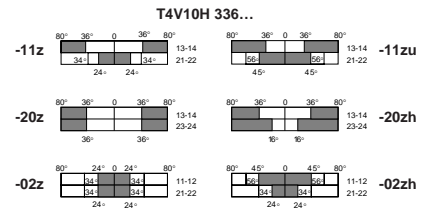
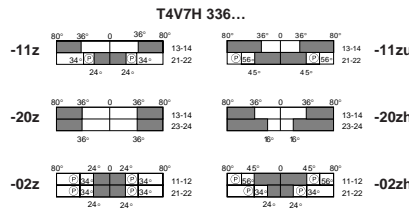
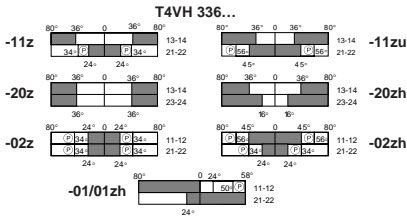
Z4V7H 336-11z

Z4V7H 336-02z

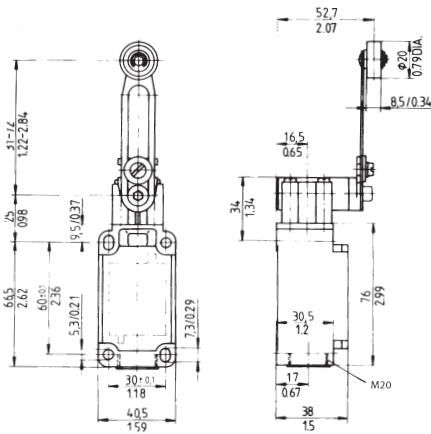


Z4V10H 336-11z

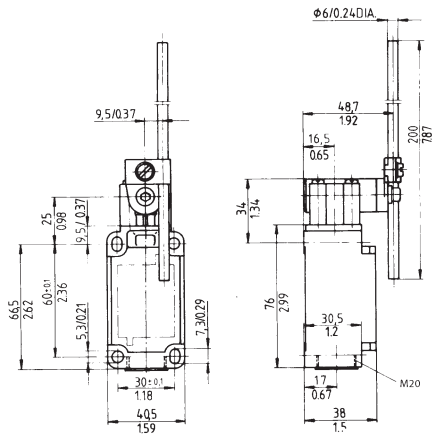
Z4V10H 336-02z



4V operating head with roller rocking lever Style H



4V operating head with adjustable roller rocking lever Style 7H*



4V operating head with rod rocking lever Style 10H*

Actuating Force		Actuating Force		Actuating Force	
Z4VH 336-11z	27 Ncm	Z4V7H 336-11z*	27 Ncm	Z4V10H 336-11z*	27 Ncm
Z4VH 336-02z	27 Ncm	Z4V7H 336-02z*	27 Ncm	Z4V10H 336-02z*	27 Ncm
T4VH 336-11z	27.5 Ncm	T4V7H 336-11z*	27.5 Ncm	T4V10H 336-11z*	27.5 Ncm
T4VH 336-11zu		T4V7H 336-11zu*		T4V10H 336-11zu*	
T4VH 336-20z*	28 Ncm	T4V7H 336-20z*	28 Ncm	T4V10H 336-20z*	28 Ncm
T4VH 336-20zh*		T4V7H 336-20zh*		T4V10H 336-20zh*	
T4VH 336-02z	27.5 Ncm	T4V7H 336-02z*	27.5 Ncm	T4V10H 336-02z*	27.5 Ncm
T4VH 336-02zh		T4V7H 336-02zh*		T4V10H 336-02zh*	

TVH 336-01/01zh 26.5 Ncm
(other levers upon request)

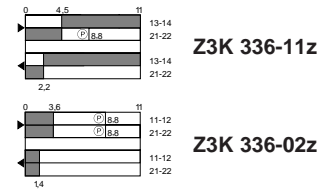
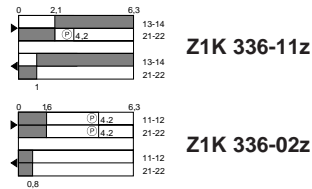
* Not for use in safety applications

Z/T336 TECHNICAL DATA

Contact function diagrams

Snap action positive break
1 NO + 1 NC

2 NC

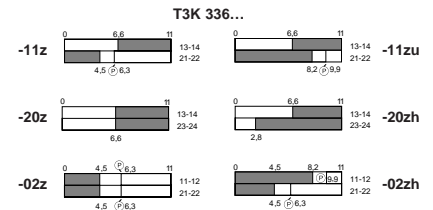
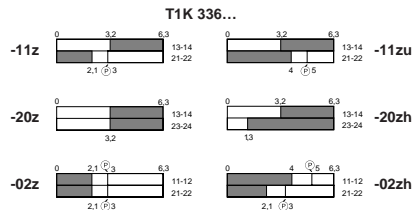


Slow action 1 NO + 1 NC

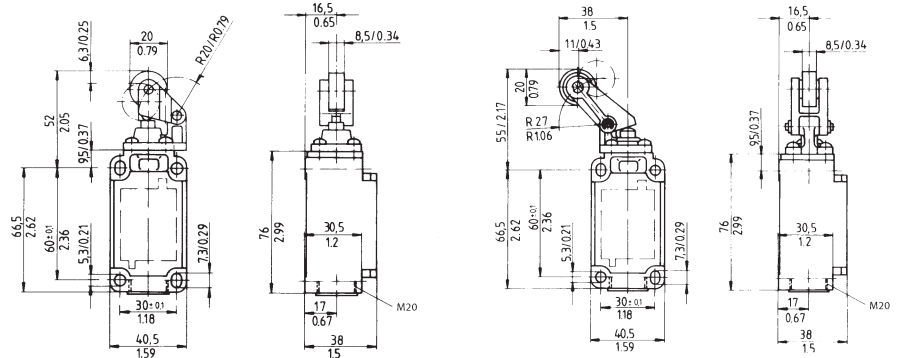
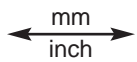
make before break 2 NO simultaneous contacts staggered (2-step)

2 NC simultaneous contacts staggered (2-step)

1 NC + 1 NC (CW-CCW)



Dimensions



Types of Actuators

One-way roller lever
Style 1K

One-way roller lever
Style 3K

Part No.	Contact Function	Model	Actuating Force	
			Style 1K	Style 3K
13-14 21-22	Snap Action positive break	Z1K 336-11z	12 N	Z3K 336-11z 5.0 N
11-12 21-22	Snap Action positive break	Z1K 336-02z	12 N	Z3K 336-02z 5.0 N
13-14 21-22	Slow Action Make before break	T1K 336-11z	15 N	T3K 336-11z
		T1K 336-11zu		T3K 336-11zu 6.3 N
13-14 23-24	Slow Action 2-step	T1K 336-20z*	17 N	T3K 336-20z*
		T1K 336-20zh*		T3K 336-20zh* 7.2 N
11-12 21-22	Slow Action 2-step	T1K 336-02z	14 N	T3K 336-02z
		T1K 336-02zh		T3K 336-02zh 6.0 N

* Not for use in safety applications



*Safer
by
Design*



Features & Benefits

- **“Positive-Break” NC contacts** ... won’t stick or weld shut.
- **Watertight design** ... meets IP65 washdown requirements.
- **Rugged, corrosion-resistant housing** ... tolerates hostile environments.
- **Five popular actuator styles** ... for application versatility.
- **Four 90° actuator mounting positions** ... provide installation flexibility.
- **Safety-system approved** ... for use in machine guarding applications.
- **Meets rigid safety agency standards** ... IEC, BG, VDE, and CSA.

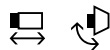
Description

The Z332 Series limit switches are designed for use with movable machine guards/access gates which must be closed for operator safety ... and for any other presence/position sensing application normally addressed with conventional limit switches. Their positive-opening NC contacts provide a higher level of safety and/or reliability than conventional spring-driven switches whose contacts can weld or stick shut.

Each is available with a choice of five standard actuators ... rounded plunger, roller plunger, roller rocking lever, rod rocking lever and adjustable roller rocking lever ... mountable in any one of four 90° positions. All rocking levers are positively-locked to the shaft, and are adjustable throughout 360° in 10° increments.

Their rugged metal housing and IP65 rating make them ideal alternatives to conventional limit switches.

Typical Applications



The Z332 Series may be used in any presence/position sensing application normally addressed with conventional limit switches. Featuring positive-break NC contacts, they are approved for use in safety systems. For safety applications the switch must be mounted such that the actuating element of the machine displaces the switch actuator far enough to exceed the positive-break point. (See contact function diagrams: symbol *).

ORDERING GUIDE

FOR FEATURE:	SPECIFY:
1. Contact operation: Snap Action	Z
2. Operating head	4V
3. Roller lever	H
4. Body size	332-
5. No. of NO contacts	1
6. No. of NC contacts	1
7. Degree of protection IP 65	y
Example:	Z4VH 332-11y

Z332 TECHNICAL DATA

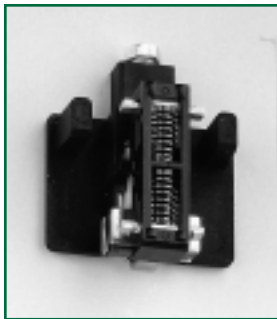
MECHANICAL SPECIFICATIONS

Housing	Diecast aluminum with enamel finish
Operating Temperature	-22°F to +195°F (-30°C to +90°C)
Mechanical Life	1 million operations
Minimum Cam Speed (Referenced to Plunger)	1 mm/minute
Maximum Operating Rate	5000 operations/hour
Bounce Time	2 ms
Changeover Time	1.5 ms for minimum cam speed
Degree of Protection	IP65
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660 Part 200 BG-GS-ET-15 DIN EN 50041 CSA-C22.2 No. 14 (Suffix -1220)

ELECTRICAL SPECIFICATIONS

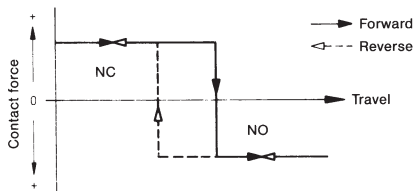
Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated contact bridges
Contact Gap	2 × 0.05 in. immediately after switching 2 × 0.19 in. with full travel of actuator
Contact Rating	2.5A/250VAC
Switching Action	Z332 Series: Snap-action with positive-break NC contacts
Short Circuit Protection	Fuse: 20A (time delay) 25A (no time delay) 6A (time delay) as positive-break position switch
Rated Insulation Voltage	250VAC
Rated Impulse Withstand Voltage	6kV
Type Terminals	Screw terminals, maximum 2.5mm (AWG13) wire

Contact System



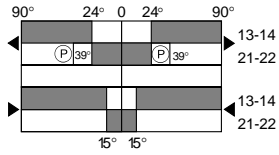
Magnetic storage snap-action system

SNAP ACTION CONTACT SYSTEMS

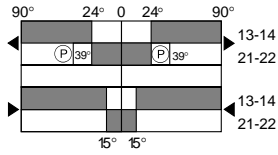


- Snap-action switching, 1 NO 1 NC
- Change-over, double-gap with four terminals
- Two electrically separated moving contacts
- Plated solid silver contacts
- Positive-break NC contact with snap-action switching
- Reliable change-over, even with slow plunger actuation
- Snap-action system separated from contact system
- Full contact force right up to operating point
- Constant operating position, as independent of contact burning
- Short, constant flight time of only 1.5 ms
- Short bounce time
- High short-circuit resistance
- High vibration resistance of 10 g still only 0.01 mm before operating point
- Wide contact gap of 2 × 1.25 mm immediately after switching point

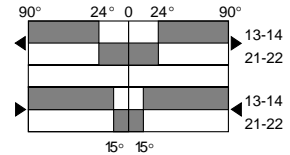
Z332 TECHNICAL DATA



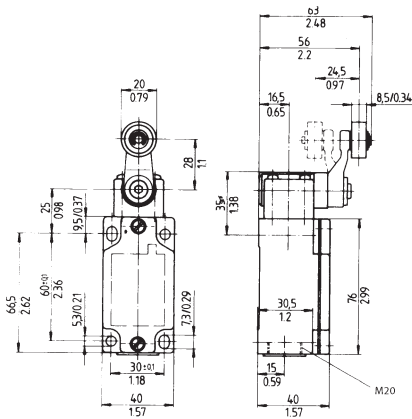
Z4VH 332-11y



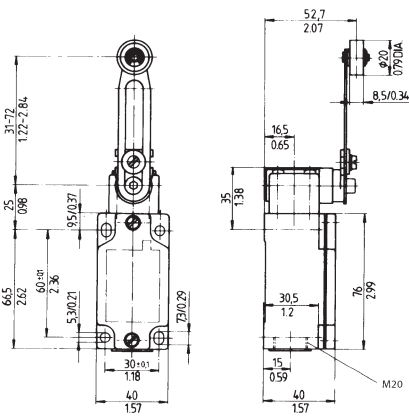
Z4V7H 332-11y



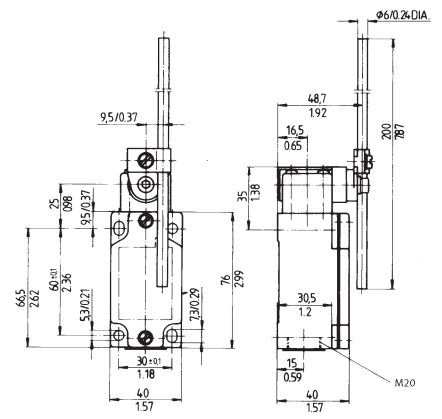
Z4V10H 332-11z



4V operating head with roller rocking lever Style H



4V operating head with adjustable roller lever Style 7H*



4V operating head with rod rocking lever Style 10H*

Actuating Force

Actuating Force

Actuating Force

Z4VH 332-11y

35 Ncm

Z4V7H 332-11y*

35 N

Z4V10H 332-11y*

35 Ncm

* Not for use in safety applications

SERIES C50

Compact, Safety-Rated, Positive-Break Limit Switches



Features & Benefits

- “Positive-Break” NC contact ... won’t stick or weld shut.
- Compact size ... ideal where space is limited.
- Rugged, corrosion-resistant housing ... tolerates hostile environments.
- Meets rigid safety standards ... IEC, VDE.
- Electrically-insulated contacts ... for added safety.

AVAILABLE STANDARD MODELS

Part Number	Contact Configuration	Actuator Type
C50R	1 NO & 1 NC	Roller plunger
C50ST	1 NO & 1 NC	Adjustable plunger

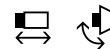
Description

The C50 Series limit switches are designed for use with movable machine guards/access gates which must be closed for operator safety ... and for any other presence/position sensing application normally addressed with conventional limit switches. Their positive-opening NC contact provides a higher level of safety and reliability than conventional spring-driven limit switches whose contacts can weld or stick shut.

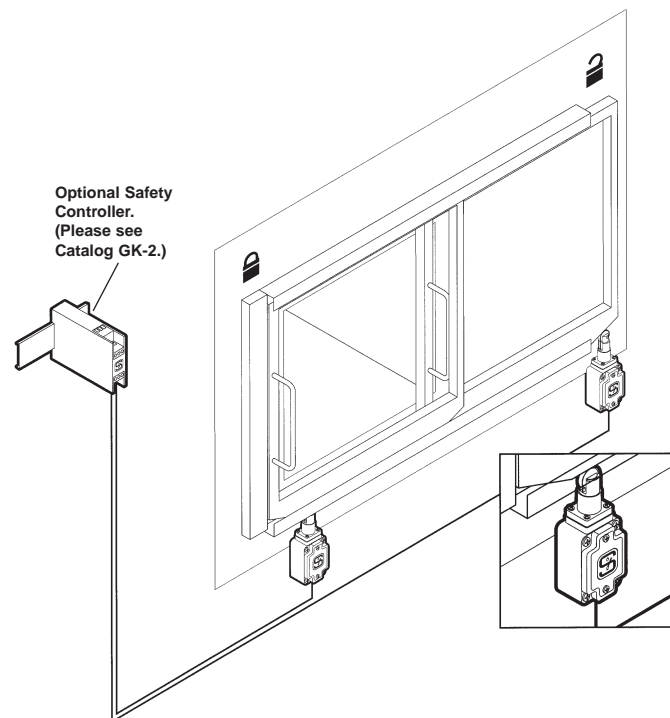
Operation

The C50 Series are designed to mount to a machine structure such that when the guard is open, it directly drives the switch actuator to force open the unit’s positive-break, normally-closed contact. The positive-break NC contact ensures circuit interruption (and machine stoppage). Note that for safety applications, these switches must be mounted in the “positive-mode.”

Typical Applications



The C50 Series may be used in any presence/position sensing application normally addressed with conventional limit switches.



SERIES C50 TECHNICAL DATA

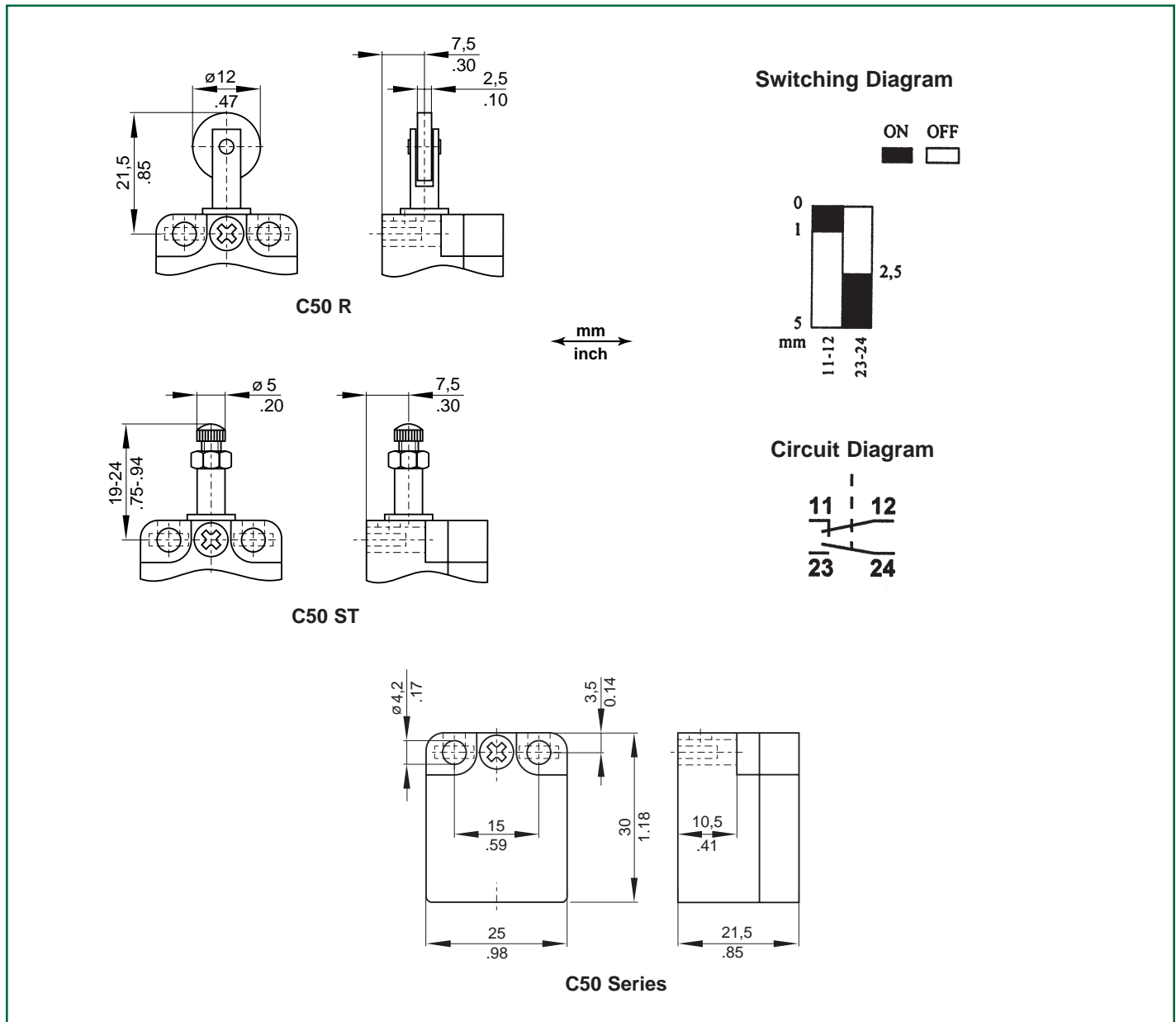
MECHANICAL SPECIFICATIONS

Housing	Glass-fiber reinforced (UL94-V0), self-extinguishing thermoplastic
Operating Temperature	-13°F to +167°F
Degree of Protection	IP30
Maximum Operating Rate	1,800 operations/hour
Mechanical Life	>5 million operations
Repeat Accuracy	+/- 0.02 mm
Conformity to Standards	IEC 947-5-1 EN 60947-5-1 DIN VDE 0660 Part 200 EN 60204-1 UL & CSA

ELECTRICAL SPECIFICATIONS

Contacts	Fine silver
Contact Configuration	Double-pole, double-break with electrically-separated bridges
Contact Rating	4A/400VAC (AC-15)
Switching Action	Slow-action, positive-break NC contacts
Electrical Connections	Screw terminals (M3), maximum 13AWG wire
Short Circuit Protection	4A (Slow-blow)

DIMENSIONS & SWITCHING DIAGRAMS



APPENDICES

Topic	Page
• Selected Machine Safeguarding Terminology	197
• Machine Safety Standards	202
• Selected Conversion Factors	205
• NEMA, UL, CSA & IEC Ingress Protection Ratings	206

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 (Berufsgenossenschaft): 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 Européenne) 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 tapping down the switch actuator when the safety guard is open.

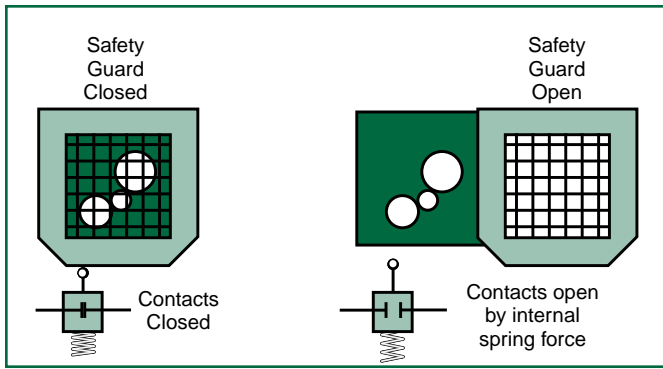


Figure 1
NEGATIVE-MODE INSTALLATION

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).

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

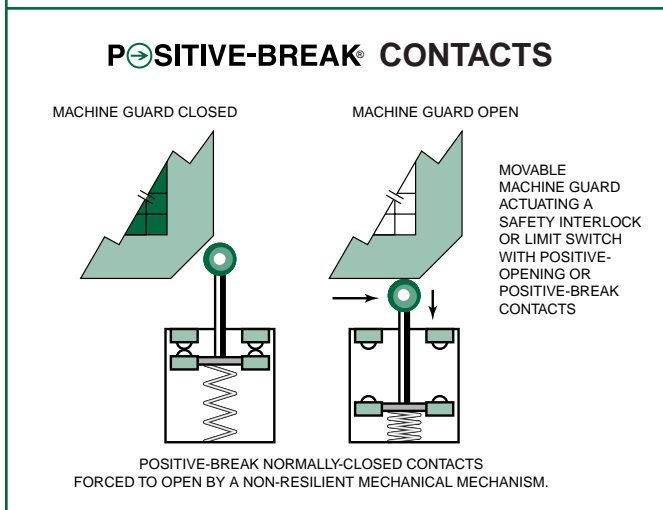
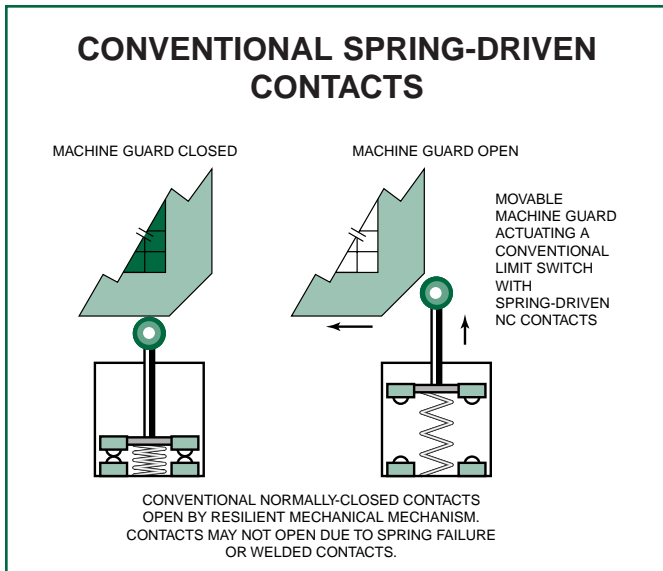


Figure 2
CONVENTIONAL VERSUS POSITIVE-OPENING CONTACTS

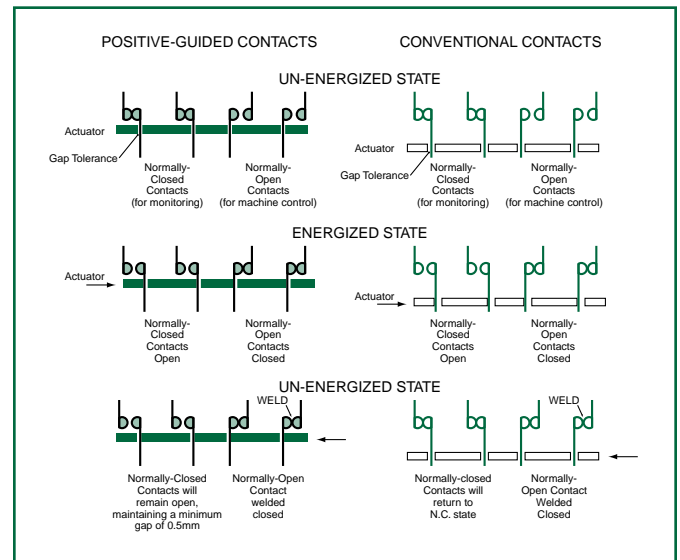


Figure 3

contacts cannot change state. (See 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.)

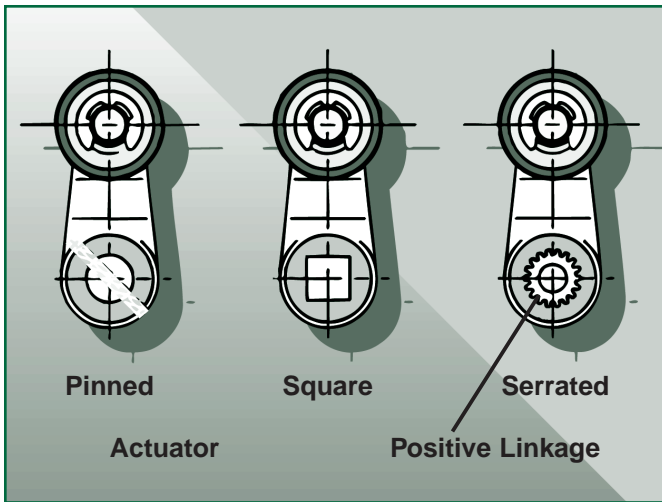


Figure 4

Positive-Mode Mounting: the mounting of a single-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.)

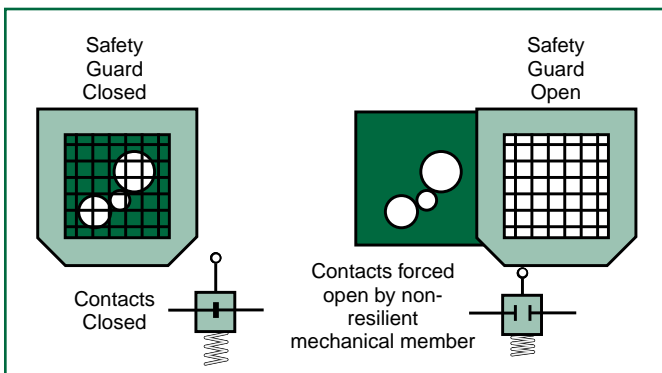


Figure 5

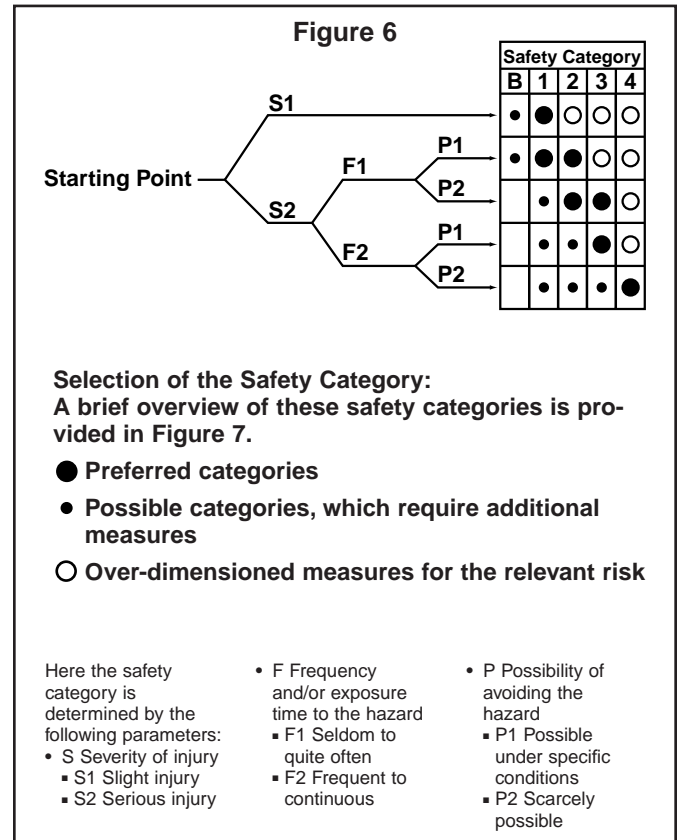
Positive-Opening Contacts: See “Positive-Break Contacts”.

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 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 Européenne"). 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.

SELECTED CONVERSION FACTORS

TO CONVERT				TO CONVERT			
Parameter	From	To	Multiply by	Parameter	From	To	Multiply by
Temperature	°C	°F	$(^{\circ}\text{C} \times 9/5) + 32$	Force	centigrams	grams	0.01
	°F	°C	$(^{\circ}\text{F} - 32) \times 5/9$		dynes	grams	0.00102
	°C	°K	$^{\circ}\text{C} + 273.18$		dynes	newtons	1.0×10^{-5}
Distance	cm	inches	0.3937		dynes	kg	1.02×10^{-6}
	mm	inches	0.03937		dynes	pounds	2.248×10^{-6}
	cm	feet	0.03281		grams	kilograms	1.0×10^{-3}
	inches	mm	25.4		grams	milligrams	1.0×10^3
	feet	cm	30.48		grams	oz (avdp)	3.527×10^{-2}
	meters	feet	3.281		grams	oz (troy)	3.215×10^{-2}
	meters	inches	39.37		grams	pounds	2.205×10^{-3}
Energy	btu	gram calories	2.52×10^2		kilograms	dynes	9.80665×10^5
	btu	hp-hours	3.927×10^{-4}		kilograms	grams	1.0×10^3
	btu	joules	1.055×10^3		kilograms	newtons	9.807
	btu	kW-hours	2.928×10^{-4}		kilograms	pounds	2.2046
	btu	ergs	1.055×10^{10}	kilograms	oz (avdp)	3.5274×10^1	
	ergs	btu	9.486×10^{-11}	newtons	dynes	4.448×10^5	
	ergs	joules	1.0×10^{-7}	newtons	pounds	0.2248	
	ergs	watt-hours	2.773×10^{-11}	pounds	dynes	1.0×10^5	
	foot pounds	btu	1.286×10^{-3}	pounds	grams	4.5359×10^2	
	foot pounds	gm-calories	3.241×10^{-1}	pounds	newtons	4.448	
	foot pounds	hp-hours	5.05×10^{-7}	pounds	kilograms	4.536×10^{-1}	
					pounds	oz (avdp)	1.6×10^1
				pounds	oz (troy)	1.458×10^1	

NEMA, UL, CSA & IEC INGRESS PROTECTION RATINGS

TABLE 1, NEMA, UL and CSA Enclosure Ratings

ENCLOSURE TYPES FOR NON-HAZARDOUS LOCATIONS			
Type Designation	NEMA National Electrical Manufacturers Association (NEMA Standard 250) and Electrical and Electronic Manufacturers Association of Canada (EEMAC)	 Underwriters Laboratories Inc. (UL 50 and UL 508)	 Canadian Standards Association (Standard C22.2 No. 94)
1	Enclosures are intended for outdoor use primarily to provide a degree of protection against contact with the enclosed equipment or location where unusual service conditions do not exist.	Indoor use primarily to provide protection against contact with the enclosed equipment and against a limited amount of falling dirt.	General purpose enclosure. Protects against accidental contact with parts.
2	Enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.	Indoor use to provide a degree of protection against limited amounts of falling water and dirt.	Indoor use to provide a degree of protection against dripping and light splashing of noncorrosive liquids and falling dirt.
3	Enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet; undamaged by the formation of ice on the enclosure.	Outdoor use to provide a degree of protection against windblown dust and windblown rain; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use; provides a degree of protection against rain, snow, and windblown dust; undamaged by the external formation of ice on the enclosure.
3R	Enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain and sleet; undamaged by the formation of ice on the enclosure.	Outdoor use to provide a degree of protection against falling rain; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use; provides a degree of protection against rain and snow; undamaged by the external formation of ice on the enclosure.
4	Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.	Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use; provides a degree of protection against rain, snow, windblown dust, splashing and hose-directed water; undamaged by the external formation of ice on the enclosure.
4X	Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.	Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure; resists corrosion.	Indoor or outdoor use; provides a degree of protection against rain, snow, windblown dust, splashing and hose-directed water; undamaged by the external formation of ice on the enclosure; resists corrosion.
6	Enclosures are intended for use indoors or outdoors where occasional submersion is encountered.	Indoor or outdoor use to provide a degree of protection against entry of water during temporary submersion at a limited depth; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use; provides a degree of protection against the entry of water during temporary submersion at a limited depth; undamaged by the external formation of ice on the enclosure; resists corrosion.
12	Enclosures are intended for use indoors or outdoors where occasional submersion is encountered.	Indoor use to provide a degree of protection against dust, dirt, fiber flyings, dripping water, and external condensation of non-corrosive liquids.	Indoor use; provides a degree of protection against circulating dust, lint, fibers, and flyings; dripping and light splashing of non-corrosive liquids; not provided with knockouts.
13	Enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and non-corrosive coolant.	Indoor use to provide a degree of protection against lint, dust seepage, external condensation and spraying of water, oil, and non-corrosive liquids.	Indoor use; provides a degree of protection against circulating dust, lint, fibers, and flyings; seepage and spraying of non-corrosive liquids, including oils and coolants.

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Underwriters Laboratories Inc. (UL) shall not be responsible to anyone for the use of or reliance upon a UL Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon a UL Standard.

NEMA, UL, CSA and IEC have each established ratings systems intended to identify an enclosure's ability to repel elements from the outside environment. These rating systems address the enclosure's ability to protect against a variety of environmental conditions. These include:

- Incidental contact
- Rain, sleet and snow
- Windblown dust
- Hosedown and splashing liquids
- Falling dirt
- Oil or coolant spraying/splashing
- Corrosive agents
- Occasional temporary submersion
- Occasional prolonged submersion

While these ratings are intended to help you make a more informed product selection, there are some differences between each organization's system.

As shown in Table 1, the NEMA, UL and CSA ratings most commonly used in North America are based on similar application descriptions and expected performance. However, while UL and CSA require testing in the laboratories (and periodic manufacturer site inspections to ensure continued adherence to prescribed standards), NEMA leaves compliance and certification up to the manufacturer.

While the European IEC (IP) ratings summarized in Table 2 are based on similar test methods, their performance has some slight and subtle differences in interpretation. For example, selected IP ratings permit limited

TABLE 2, IEC (IP) Enclosure Ratings

IP	Tests	IP	Tests
0	No protection	0	No protection
1	Protected against solid objects up to 50mm, e.g. accidental touch by hands	1	Protected against vertically falling drops of water, e.g. condensation
2	Protected against solid objects up to 12mm, e.g. fingers	2	Protected against direct sprays of water up to 15° from vertical
3	Protected against solid objects over 2.5mm, e.g. tools and wires	3	Protected against sprays to 60° from vertical
4	Protected against solid objects over 1mm	4	Protected against water sprayed from all directions (limited ingress permitted)
5	Protected against dust (limited ingress, no harmful deposit)	5	Protected against low pressure jets of water from all directions (limited ingress permitted)
6	Totally protected against dust	6	Protected against strong jets of water
		7	Protected against the effects of immersion between 15 cm and 1 m

ingress of water, while UL/CSA ratings do not.

For your reference and convenience we have attempted to provide an approximate cross-reference between North American enclosure ratings (NEMA, UL and CSA) and selected IEC (IP) enclosure ratings (Table 3). Please recognize that these are nearest-equivalents only and should not be considered as direct comparisons.

Example: IP 2 3

Characteristic letters _____
 1st characteristic numeral _____ (Protection against solid objects)
 2nd characteristic numeral _____ (Protection against liquids)

An enclosure with this designation is protected against the penetration of solid objects greater than 12mm and against spraying water.

TABLE 3, NEMA, UL & CSA vs. IEC (IP) Ingress Protection Ratings*

NEMA, UL, CSA Rating	IEC Rating						
	IP23	IP30	IP32	IP64	IP65	IP66	IP67
1	*						
2		*					
3				*			
3R			*				
3S				*			
4						*	
4X						*	
6							*
12					*		
13					*		

*These are nearest equivalents only, and should not be used to make direct conversions from IEC to NEMA classifications.

GENERAL TERMS & CONDITIONS OF SALE

orders & blanket orders

All orders must include proper description, pricing, quantity and shipping requirements. Buyer must contact the Seller's headquarters for terms and conditions associated with blanket orders.

PRICES

Unless otherwise stated, prices are firm for thirty days. Seller reserves the right to revise price if there is a change in quantity, size, finish, or method and time shipment differing from those indicated herein. Prices and terms on this quotation and/or acknowledgement of order are not subject to verbal changes or other agreements unless approved in writing by the Seller's headquarters' staff. Unless otherwise negotiated, prices for orders for future delivery will be invoiced at the prevailing price at the time of shipment.

DELIVERY

All material is sold and priced F.O.B. Elmsford, NY, USA. Unless otherwise specified by the Buyer, all shipments will be made via UPS Ground.

MINIMUM ORDER

Unless otherwise agreed upon, the minimum order billing is \$100 per shipment exclusive of shipping, insurance or other miscellaneous charges. All orders for less than \$100.00 will be charged a \$20.00 handling fee.

PAYMENT TERMS

Payment terms are net 30 days. Seller reserves the right to hold shipments to firms with unpaid past due balances. Seller also reserves the right to charge interest at the rate of 1½% interest per month for accounts in arrears more than 30 days. This interest will never be greater than that allowed by local law.

TITLE

Title to material, priced at Seller's shipping point, shall pass to Buyer upon shipment. Any charges by carrier for switching, demurrage or other services shall be paid by the Buyer.

CHANGES & CANCELLATIONS

Should Buyer desire to cancel, revise or suspend this order for reasons beyond the Buyer's control, Seller shall discuss the matter promptly with the Buyer and do all possible to make a mutually satisfactory agreement. In cases where the material has been manufactured partially or completely for Buyer's requirements, Seller will advise Buyer of charges incurred to Buyer's account.

CLAIMS FOR DEFECTIVE MATERIALS

All material is warranted to be free from defects in quality and workmanship, and to meet the specifications to which ordered. The Seller's obligation under this warranty is limited to repairing or replacing defective material, or crediting the Buyer with the price of the defective material. If Buyer believes the material to be defective, Buyer must notify Seller within 30 days after delivery. Seller has the right to reinspect any goods before determination of a reasonable settlement. Toward this end, Buyer must contact Seller's headquarters requesting a formal Return Material Authorization (RMA). Seller will not accept any material returns without reference to the RMA number of the Buyer's returned goods packing list.

ORDERS FOR NON-STANDARD/SPECIAL ITEMS

Unless otherwise negotiated and confirmed in writing by the Seller, orders for non-standard and special items made to the Buyer's specifications are non-cancelable. Seller reserves the

right to bill Buyer for materials purchased for the production of such items, and for all goods fully or partially manufactured at the time of notice of the Buyer's desire to cancel the order.

SPECIAL TOOLING

Special tooling required and paid for by the Buyer shall become the property of the Buyer. Where such tooling incorporates trade secrets, it shall be held in perpetuity at the manufacturer's premises for the exclusive use of the Buyer.

GENERAL

All agreements are contingent upon strikes, accidents, fires, availability of materials and all other causes beyond the Seller's control. Typographical, accounting and other administrative errors are subject to correction. Buyer assumes the liability for patent and copyright infringement for goods made to Buyer's specifications. When Buyer furnishes material for use in production, ample allowance must be made for reasonable spoilage. Such materials must be of suitable quality to facilitate efficient production. Conditions not specifically stated herein shall be governed by established trade customs. Terms inconsistent with those stated herein that may appear on the Buyer's formal order will not be binding on the Seller.

SUSPENSIONS & CANCELLATIONS

Unless otherwise negotiated and agreed to by the Seller, the Buyer must accept final and/or complete delivery on all orders within 90 days from date of first shipment. Should the Buyer fail to accept the complete order within this or the negotiated period for order, the Seller reserves the right to cancel the order and re-bill the Buyer at the price schedule covering the total quantity of parts shipped through the date of cancellation.

WARRANTY AND LIMITATIONS OF WARRANTY:

SCHMERSAL INC agrees to replace or repair products which have been found defective due to workmanship or material. This warranty is made only for a period within one year of the date of the invoice to the Buyer. This warranty only applies to products which have been subjected only to normal and proper usage, and to which inspection of the product by the SCHMERSAL INC shows it to be thus defective. THE AGREEMENT TO REPLACE OR REPAIR SUCH PRODUCT IS LIMITED TO F.O.B. SHIPPING POINT AND IS IN NO WAY A LIABILITY FOR DAMAGES, DIRECT OR CONSEQUENTIAL, OR FOR DELAYS, INSTALLATION TRANSPORTATION, ADJUSTMENT OR OTHER EXPENSES ARISING IN CONNECTION WITH SUCH PRODUCT. SCHMERSAL INC is not responsible in this warranty for product which is repaired or altered without the express written authorization of an authorized executive of SCHMERSAL INC. Nor is SCHMERSAL INC responsible in this warranty for products subject to misuse, negligence, or accident. SCHMERSAL INC IS IN NO WAY LIABLE OR RESPONSIBLE FOR INJURIES OR DAMAGES TO PERSONS OR PROPERTY ARISING FROM OR OUT OF USE OF THE PRODUCT WITHIN DESCRIBED. Except for the warranty hereinbefore stated, THERE ARE NO EXPRESS WARRANTIES AND NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THOSE EXPRESSLY SET FORTH ABOVE. THIS LIMITED WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER REPRESENTATIONS MADE, BOTH EXPRESS AND IMPLIED, UNLESS SET FORTH IN WRITING AND SIGNED BY AN AUTHORIZED EXECUTIVE OF THE SCHMERSAL INC.