

# SENSORS / SWITCHES



**Sensors  
Industrial Switches  
and Safety  
Technology Products**

# WARNER ELECTRIC

## Sensors, Industrial Switches and Safety Technology Products

Warner Electric has many years of experience in applying sensors in motion control applications. Warner Electric's broad range of innovative and technologically advanced product range offers our customers the exact solution to satisfy their sensing applications.

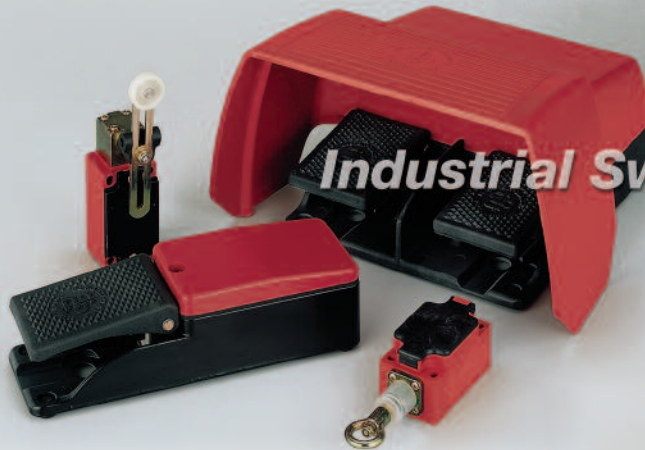
Our full product range is available through more than 800 distributor locations, throughout the United States, Canada and Mexico.

Local Sales Support is provided by a well trained sales force that is backed up by Application Engineering providing immediate technical support.

### *Non-Contact Sensors*



### *Industrial Switches*



#### **Non-Contact Sensors**

- Photoelectric Sensors
- Ultrasonic Sensors
- Inductive Proximity Sensors
- Capacitive Sensors
- Magnetic Sensors

#### **Industrial Switches**

- Limit Switches
- Foot Switches
- Cable Pull Switches

#### **Safety Technology Products**

- Safety Interlocks
- Cable Pull Switches
- Coded Magnetic Monitoring Systems

### *Safety Technology Products*



#### **Approvals and Certification**

Each model is individually identified with its own certification. Documentation is available upon request.

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### Important Safety Warning...

The Non Contact sensors described in this catalog do NOT include the self-checking redundant circuitry necessary to allow them to be used in personnel safety applications. A sensor failure or malfunction can result in either an energized or a de-energized output condition.

Never use these non contact products as sensing devices for personnel protection. Their use as safety devices may create an unsafe condition which could lead to serious bodily injury or death.

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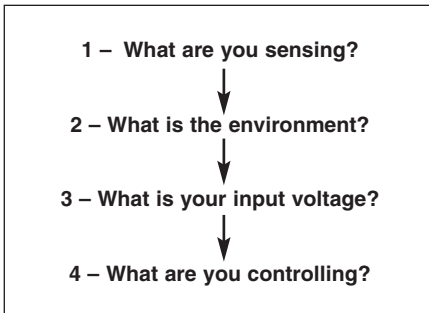
# Choosing the correct sensor for your application

Many situations have developed that have resulted in the loss of valuable production hours, due to not enough time being taken to choose the correct sensor for the application.

These situations can be avoided if each application is systematically approached in the following manner.

## Which sensor?

Four basic questions should be asked:



## 1 – What are you sensing?

It is extremely important to know what the material is you are sensing as the material relates directly to the type of sensor chosen.

At this stage, it is also relevant to consider what distance away from the target would suit your application best.

The final information required is to know the size and shape.

To give a general guideline, the following chart gives an indication of each type of sensor relating to sensing distances.

Range/longest to shortest

Photoelectric – Through-Beam

Photoelectric – Retroreflective

Ultrasonic – Proximity

Photoelectric – Diffuse Reflective

Photoelectric – Background Suppression

Photoelectric – Convergent Beam

Photoelectric – Fiber Optics

Magnetic

Capacitive Proximity

Inductive Proximity

## 2 – What is the environment?

Consider the surrounding and working conditions, steam coolant, metal surfaces, temperature both high and low, all can influence the performance of the sensor.

Ensure not only that the sensor can detect the target cleanly and clearly, but how it will be able to withstand maintenance and wash-down situations.

Sensing variables/least to most affected relating to ambient conditions.

Magnetic

Inductive Proximity

Photoelectric – Through-Beam

Ultrasonic – Proximity

Photoelectric – Convergent Beam

Photoelectric – Retroreflective

Photoelectric – Background Suppression

Photoelectric – Diffuse Reflective

Capacitive Proximity

## 3 – What is your input voltage?

A large factor relating to the exact sensor or sensor system you might eventually choose. A lot of the smaller type sensors need to have power supplies in order that the correct stable D.C. voltage is available.

Eventually this question may not be needed to be taken into account as more and more sensors are becoming available in a multi-voltage AC/DC format, 12-265 AC/DC.

## 4 – What are you controlling?

Always examine the type of output required and its capability to drive the external circuitry.

The most common problem when dealing with D.C. output circuits relates to “sourcing” or “sinking” PNP or NPN.

Always determine the answer to this question prior to any purchase by examining the specification of the control or counter system you are interfacing with, to ensure compatibility.

AC circuits generally come in two types, solid state and electromechanical relays.

Finally remember, any problems or questions, call Sensor Application Support for help.

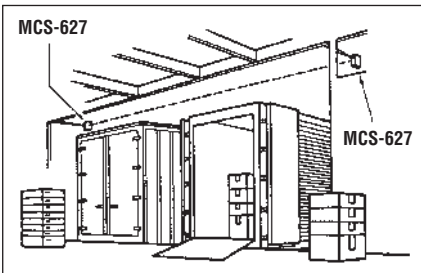
## APPLICATION ASSISTANCE

CALL  
1-800-451-8279

FAX  
1-815-389-6678

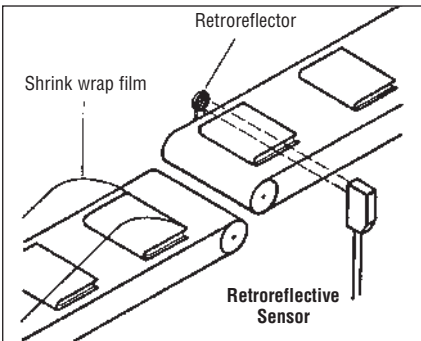
# Photoelectric Applications

- Jam detection and prevention
- Empty line detection
- Counting
- Sorting by size, color or surface
- Automatic routing
- Feed control
- Hopper level control
- Color mark registration
- Edge guiding
- Web break detection
- Positioning
- Cut-off control
- Filling
- Folding and wrapping
- Batch counting
- Missing part detection
- Correct count
- Open flap detection
- Ejected part detection
- Incorrect closure
- Door control
- Sizing



## Truck Height Control

A long range through-beam sensor was positioned at a height just below the overhanging roof and a couple of feet in front, so the breaking of the beam would activate an output wired to an alarm alerting the driver to stop.

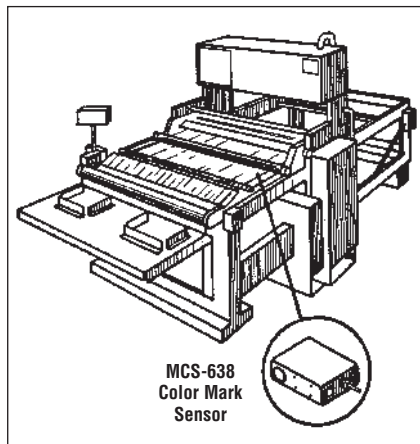


## Conveyor/Material Handling

A retroreflective sensor was chosen to look across the conveyor at the retroreflector. When the book blocks the beam, a signal is given to stop the conveyor.

## Photoelectric Identification Codes

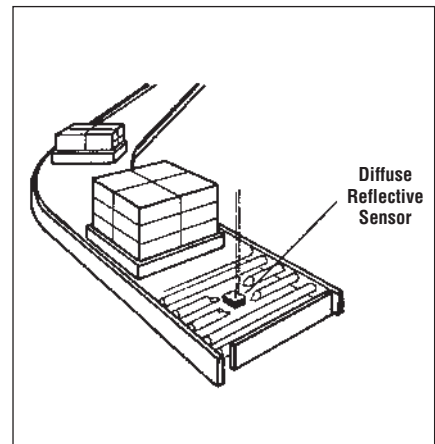
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	+	
Example:	O	M	1	2	R	T	—	D	H	T	P	—	0	2	0	0	—	C	L		
<b>1</b>	O = Photoelectric Sensor										<b>9</b>	Output function									
<b>2</b>	M = Metric metal housing T = Metric thermoplastic housing R = Rectangular design Z = Cylindrical design											A = Complementary LA/DA (light activated/dark activated) D = Dark activated (DA) H = Light activated (LA) O = No output (through-beam transmitter) P = Selectable LA/DA (light activated/dark activated) X = Customer-specified output									
<b>3/4</b>	Specification of housing dimensions e.g. 12 = M12 18 = M18 20 = 20 series 90 = 90 series																				
<b>5/6</b>	ES = Through-beam sensor (Complete set) EE = Through-beam, receiver only SE = Through-beam, transmitter only LC = Fiber optic control (sensor with fiber optics connection) RH = Diffuse reflective sensor with background suppression RS = Retroreflective sensor RT = Diffuse reflective sensor FF = Convergent beam sensor, fixed focus PR = Print registration sensor PS = Polarized retro sensor										<b>10</b>	Output type A = Analog output N = NAMUR O = No output Q = Triac R = Relay S = Others T = Transistor Y = Thyristor									
<b>7</b>	Dash										<b>11</b>	N = NPN transistor output (switched to negative) P = PNP transistor output (switched to positive) G = Push/Pull S = Through-beam light source U = Switch selectable NPN/PNP									
<b>8</b>	Voltage type A = AC D = DC M = Multivoltage, AC/DC, UC P = Programmable voltage (AC or DC)										<b>12</b>	Dash 2 = 2-wire output 3 = 3-wire output 4 = 4-wire output									
											<b>13-16</b>	Sensing distance Sensing distance specifications are always indicated by 4 digits — mm: without decimal point — m: with decimal point e.g. 06.0 = 6 m e.g. 15.0 = 15 m e.g. 0500 = 500 mm									
											<b>17</b>	Dash									
											<b>18</b>	Connection type A = Screw termination B = Plug with screw terminals C = Cable (standard C = 2 m or length in m) S = Plug-in connector									
											<b>19</b>	Options C = Control/diagnostic input D = LED for output indication E = Adjustable sensitivity F = Diagnostic circuit with output and LED for indicator G = LED for output mode, supply voltage and beam control indication H = LED for supply voltage and output mode indication L = LED for output indicator T = Adjustable timer circuit V = LED for operating voltage indication X = Customer-specific options Z = Fixed timer									



## Bag Cutting Machine

Basically, with this being a specialized application, there is only one solution and product selection, and that is the MCS 638 Series Color/Print Registration Sensor.

These units were designed to solve this application with the sensor being capable of sensing small changes in contrast levels or shade differences.



## Object Detection

By placing a diffuse reflective type underneath the conveyor and looking up through the rollers, a safe sensing position has been found for the sensor away from fork lift trucks and other possible damaging actions.

# Photoelectric Sensors

## OR20 Series

### Description

The OR20 Series is a family of self-contained photoelectric sensors, with multi-voltage input and relay output. Standard features include adjustable sensitivity and timing circuits which are easily accessible after removing the “snap cover”. Sensing modes available include: Through-Beam, Retro, Polarized, Diffused Reflective and Background Suppression.

- Rectangular high impact plastic housing
- LED indication of output
- NEMA 4
- Sensitivity control
- Programmable timing Delay or Hold
- Timing range 0.1-10 seconds
- Temperature range -4°F to +158°F
- Multi-voltage 12-265 VAC/DC
- Screw terminals for wiring
- Snap shut hinged back cover
- Relay output - 3A

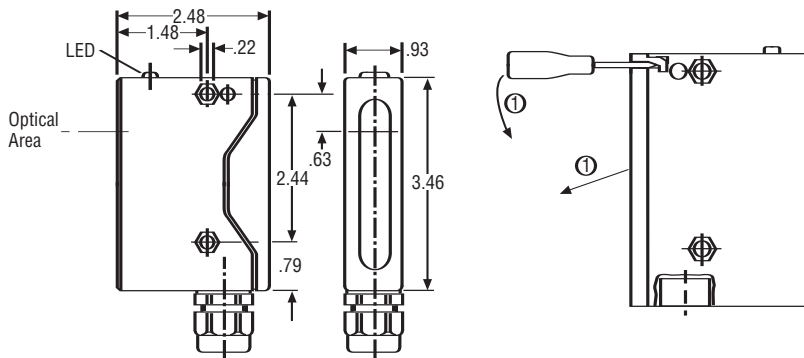


### Sensor Selection

Sensing Principle	Sensing Range	Input Voltage	Switching Function	Output Mode	Maximum Cycle Rate	Output Current	Model	Part Number
Through-Beam	65 ft.	12-265 VAC/DC	SPDT	Relay	>50 Hz	3A	OR20 ES-MAR5-20.0-ALET	655-1686-103*
Retro-Reflective	26 ft.	12-265 VAC/DC	SPDT	Relay	>50 Hz	3A	OR20 RS-MAR5-08.0-ALET	655-4686-001
Polarized Retro	19 ft.	12-265 VAC/DC	SPDT	Relay	>50 Hz	3A	OR20 PS-MAR5-06.0-ALET	655-5686-001
Diffuse Reflective	4.9 ft.	12-265 VAC/DC	SPDT	Relay	>50 Hz	3A	OR20 RT-MAR5-01.5-ALET	655-7686-003
Diffuse Reflective	1.9 ft.	12-265 VAC/DC	SPDT	Relay	>50 Hz	3A	OR20 RT-MAR5-0600-ALET	655-7686-001
BkGnd Suppression	1.2 ft.	12-265 VAC/DC	SPDT	Relay	>50 Hz	3A	OR20 RH-MAR5-0400-ALET	655-8686-002

\* A Through-Beam Sensor can be supplied as separate pieces  
 Projector = Part # 655-1086-001  
 Receiver = Part # 655-1686-003

### Mechanical Data (Dimensions are in inches)



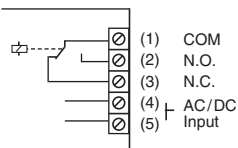
### Notes on operation of OR20 Series Housing types:

- ① Snap-cover housings (to be opened with screwdriver)

### Operation elements:

- ③ Sensitivity potentiometer  
 ④ Timer potentiometer  
 ⑤ Delay-type switch  
 ⑥ Connection terminals

### Wiring Data



### Relay Output

### Accessories

Reflective Disc – 3 1/4" Dia.	Part # 610-8002-001
Mounting Bracket – Fixed	Part # 7430-448-005
Mounting Bracket Adjustable	Part # 7430-448-010

# Photoelectric Sensors

## OR90 Series

### Description

The OR90 Series offers a low cost self-contained family of sensors, housed in a high impact rectangular thermoplastic housing. Termination is made via a 6 ft. long 5 conductor integral cable. Features include, multi-voltage input with relay output, and LED indication of output signal. The series includes 3 sensing modes: Retro, Diffuse and Background Suppression. The OR90 is a simple, low maintenance sensor ideal for material handling applications.

- Totally sealed plastic housing
- LED indication of output
- NEMA 1,3,4,12
- Temperature rating -4°F to +158°F
- 6 ft. cable -5 conductor
- Multi-voltage 12-265 VAC/DC

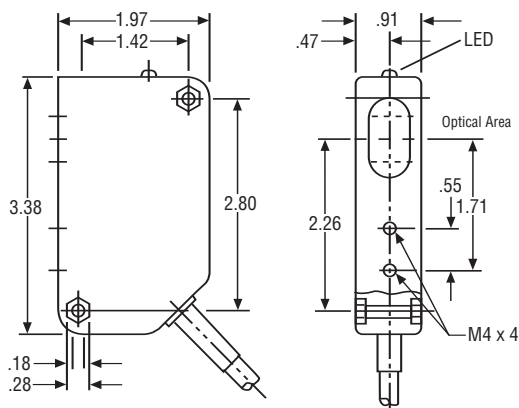


OR90 Series

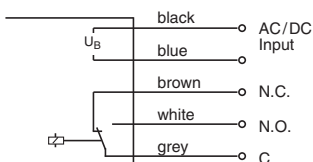
### Sensor Selection

Sensing Principle	Sensing Range	Input Voltage	Switching Function	Output Mode	Maximum Cycle Rate	Output Current	Model	Part Number
Retro-Reflective	26 ft.	12-265 VAC/DC	SPDT	Relay	>80 Hz	3A	OR90 RS-MAR5-08.0-CL	655-4696-001
BkGnd Suppression	3 in.	12-265 VAC/DC	SPDT	Relay	>80 Hz	3A	OR90 RH-MAR5-0080-CL	655-8696-001
Diffuse Reflective	23.6 in.	12-265 VAC/DC	SPDT	Relay	>80 Hz	3A	OR90 RT-MAR5-0600-CL	655-7696-001

(Dimensions are in inches)



### Wiring Data



### Relay Output

### Accessories

Reflective Disc – 3 1/4" Dia.	Part # 610-8002-001
Mounting Bracket	Part # 7430-448-007

# Photoelectric Sensors

## MCS-144/159/165

### Description

This proven range of photoelectric sensors provides the user with a standard self-contained sensor with the possibility of modular expansion with plug-in timer, counter and output modules. A “plug-in” double pole double throw 7 amp relay is supplied with all units. Features include a light activated/dark activated switch, adjustable sensitivity and LED output indication.



MCS-159/165



MCS-144

- Heavy duty plastic housing
- LED indication of sensing
- Sensitivity control
- Optional timing and counting modules
- Replaceable industrial relay
- Selectable LA/DA operation
- Temperature rating 0°F to 125°F
- Screw terminals for wiring
- NEMA 12
- Screw down back cover

### Sensor Selection

Sensing Principle	Sensing Range	Input Voltage	Switching Function	Output Mode	Maximum Cycle Rate	Output Current	Model	Part Number
Retro-Reflective	30 ft.	110 VAC	DPDT	Relay	>25 Hz	7A	MCS-144/814	7120-448-004
Retro-Reflective	15 ft.	110 VAC	DPDT	Relay	>25 Hz	7A	MCS-165/814	7120-448-015
Diffuse Reflective	6 ft.	110 VAC	DPDT	Relay	>25 Hz	7A	MCS-159/814	7100-448-002

### MCS-144, 159 – Plug-in Modules (Order Separately)

#### Timer Modules

Model	Part Number	Timing Range
MCS-836	7400-448-024	0.4 to 15 seconds
MCS-836-1	7400-448-029	1 to 30 seconds

#### Timer Functions (Programmable)

On Delay / Off Delay / Dual Delay / One-Shot  
One-Shot Drop / Delayed One-Shot / Delayed One-Shot Drop

#### Counter Modules

Model	Part Number	Counting Range
MCS-831	7400-448-019	1 to 99
MCS-832	7400-448-020	1 to 9999

#### Output Module (Supplied as Standard)

Model	Part Number	Switching Type
MCS-814	7410-448-008	DPDT 7 Amp

### MCS-165 – Plug-in Modules (Order Separately)

#### Timer Modules

Model	Part Number	Timing Range
MCS-830	7400-448-018	0.4 to 15 seconds
MCS-830-1	7400-448-026	1 to 30 seconds

#### Timer Functions (Programmable)

On Delay / Off Delay / Dual Delay / One-Shot  
One-Shot Drop / Delayed One-Shot / Delayed One-Shot Drop

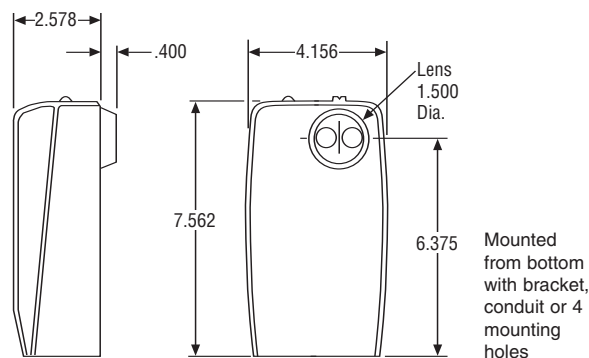
#### Counter Modules

Model	Part Number	Counting Range
MCS-833	7400-448-021	1 to 99
MCS-834	7400-448-022	1 to 9999

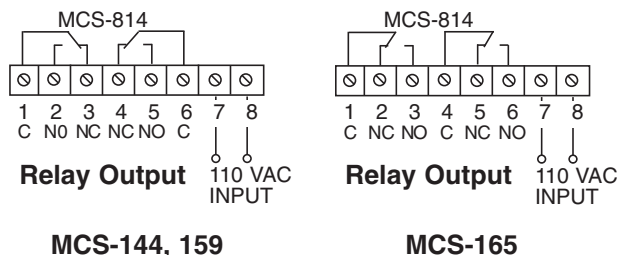
#### Output Module (Supplied as Standard)

Model	Part Number	Switching Type
MCS-814	7410-448-008	DPDT 7 Amp

### Mechanical Data (Dimensions are in inches)



### Wiring Data



### Accessories

Reflective Disc – 3 1/4" Dia.	Part # 610-8002-001
Mounting Bracket	Part # 7430-448-001



# Photoelectric Sensors

## MCS-500 Series

### Description

The MCS-500 Series is a self-contained modular design with many standard features that include programmable multi-function timing circuits, sensitivity adjustment, and LED output indication. Once installed, the base module will accept any of the 3 sensing control heads, which can provide Retro, Polarized and Diffused Reflective modes of sensing. The MCS-850 relay is a plug-in module and is supplied as a standard component when purchased as a complete sensor.

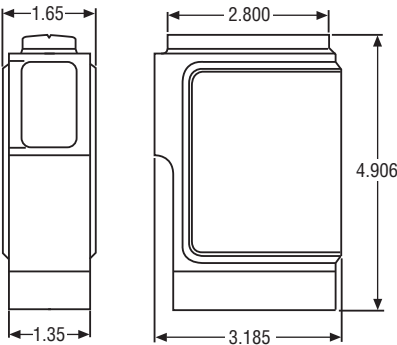
- High impact plastic housing
- Modular design (Control Head/Output Module/Base)
- LED indication of sensing status
- Sensitivity control
- NEMA 12
- Two timing ranges  
Low range 0.5-10 seconds  
High range 3.0-30 seconds
- Programmable timing
- Temperature range 0°F to 125°F
- Screw terminals for wiring



### Sensor Selection

Sensing Principle	Sensing Range	Input Voltage	Switching Function	Output Mode	Maximum Cycle Rate	Output Current	Model	Part Number
Retro-Reflective	15 ft.	110 VAC	SPDT	Relay	>50 Hz	5A	MCS-500-01	7150-448-004
Polarized Retro	12 ft.	110 VAC	SPDT	Relay	>50 Hz	5A	MCS-500P-01	7151-448-001
Diffuse Reflective	6 ft.	110 VAC	SPDT	Relay	>50 Hz	5A	MCS-501-01	7150-448-003

### Mechanical Data (Dimensions are in inches)



### MCS-500 Timing Functions

Switch selectable, multi-function timing is a standard feature on the MCS-500, MCS-500P and MCS-501.

The timing function can be switched from a low timing range of 0.5 to 5.0 seconds to a high timing range of 3.0 to 30 seconds. When no timing is required, the function can be switched off.

On delay, off delay, dual delay, one shot, and delayed one shot functions are quickly achieved by setting the timing switches on the unit. Easy-access timing adjustment controls are accessible from the top of the unit to allow fine tuning during operation.

Timing functions can be employed for light or dark operation.

### Timing Ranges

Low range 0.5 to 5.0 seconds

High range 3.0 to 30 seconds

On-Off switch selectable

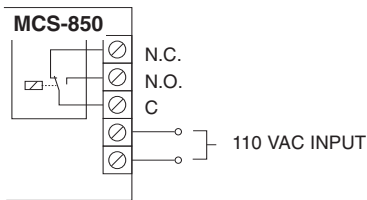
### Ordering Information for Individual modules

Control Module	Part Number
MCS-500-120-CON	7150-101-004
MCS-500P-120-CON	7151-101-001
MCS-501-120-CON	7150-101-003

Base Module	Part Number
MCS-500-120-BAS	7150-101-013

Output Module	Part Number
MCS-850-REL-OUT	7150-101-016
SPDT Relay 5A	

### Wiring Data



### Relay Output

### Accessories

Reflective Disc – 3 1/4" Dia.	Part # 610-8002-001
Mounting Bracket	Part # 7150-101-020
Cable Gland	Part # 7420-448-029

# Photoelectric Sensors

## Compact Series

### Description

The COMPACT Series of photoelectric sensors are rugged industrial DC voltage input photoelectric sensors with a reliable performance for many general purpose applications. Sensing mode capabilities include: Through-Beam (up to 500 ft.), Retro and Diffuse Reflective. Output standard on all units is light activated/dark activated NPN transistor. LA/DA is selectable at the time of installation by wire selection. All Compact Series of sensors are designed to work with the Warner Electric range of sensor controls.

- Heavy duty zinc die cast housing
- LED indication of output
- NEMA 1, 12
- Temperature rating -40°F to +158°F (MCS-629 only)
- Temperature rating -22°F to +158°F
- 10 ft. cable

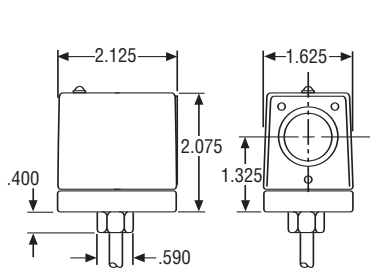


Compact Series

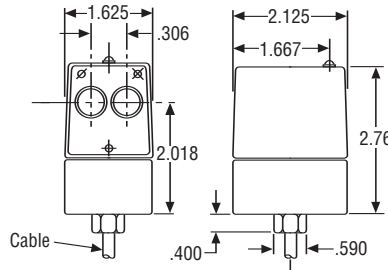
### Sensor Selection

Sensing Principle	Sensing Range	Input Voltage	Switching Function	Output Mode	Maximum Cycle Rate	Output Current	Model	Part Number
Through-Beam	500 ft.	10-30 VDC	LA/DA	NPN	>25 Hz	250 mA	MCS-629	7115-448-005
Through-Beam	50 ft.	12-18 VDC	LA/DA	NPN	>250 Hz	250 mA	MCS-627	7115-448-003
Through-Beam	50 ft.	22-28 VDC	LA/DA	NPN	>250 Hz	250 mA	MCS-637	7115-448-001
Retro-Reflective	15 ft.	12-18 VDC	LA/DA	NPN	>250 Hz	250 mA	MCS-625	7125-448-002
Retro-Reflective	15 ft.	22-28 VDC	LA/DA	NPN	>250 Hz	250 mA	MCS-635	7125-448-003
Diffuse Reflective	0 to 1 ft.	12-18 VDC	LA/DA	NPN	>250 Hz	250 mA	MCS-626	7105-448-002
Diffuse Reflective	0 to 1 ft.	22-28 VDC	LA/DA	NPN	>250 Hz	250 mA	MCS-636	7105-448-005
Diffuse Reflective	.1 to 6 ft.	12-18 VDC	LA/DA	NPN	>250 Hz	250 mA	MCS-626-2	7105-448-007
Diffuse Reflective	.1 to 6 ft.	22-28 VDC	LA/DA	NPN	>250 Hz	250 mA	MCS-636-2	7105-448-011

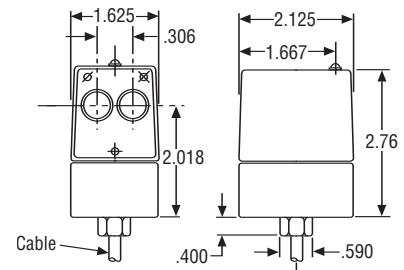
### Mechanical Data (Dimensions are in inches)



MCS-627/629

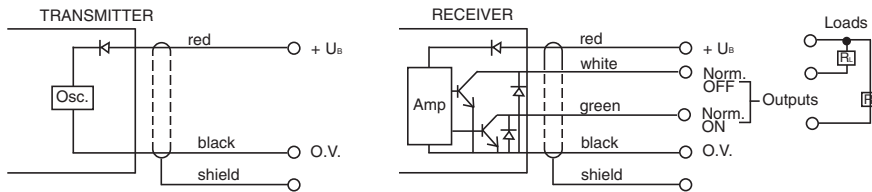


MCS-626/636

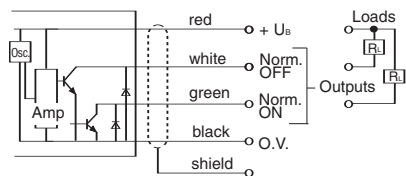


MCS-625/635

### Wiring Data



MCS-627/629



MCS-625/635/626/636/626-2/636-2

### Accessories

- Reflective Disc – 3 1/4" Dia. Part # 610-8002-001
- Mounting Bracket Part # 7430-448-003

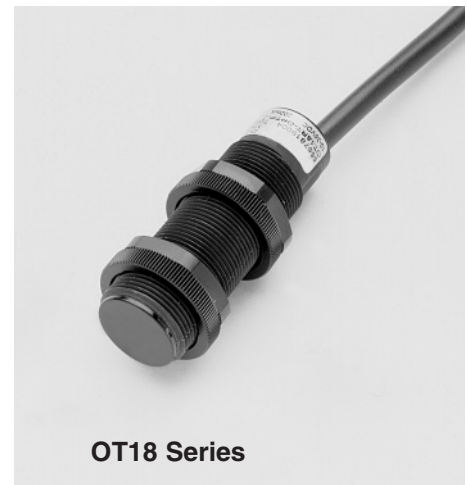
# Photoelectric Sensors

## OT18 Series

### Description

This series of 18mm plastic tubular sensors provides the user with a self-contained DC low voltage sensor with NPN or PNP output. Programmable light activated/dark activated output. Modes of sensing include: Through-Beam, Retroreflective, Polarized Retro-reflective, Diffuse Reflective and Fixed Focus types.

- 18mm diameter cylindrical plastic housing
- Self-contained with 6.5 ft. cable
- IP 67/NEMA 4
- LED indication of output
- Temperature range -20°C to +70°C (-4°F to +158°F)
- 10–36 VDC input voltage
- No-load supply current ≤15 mA (Emitter ≤20 mA)
- Reverse polarity protection
- Short circuit protected
- 200mA switching current
- Voltage drop ≤2 VDC
- Hysteresis ≤15%
- Repeat accuracy ≤10%
- Switching frequency 500 Hz



OT18 Series

### Sensor Selection

Sensing Principle	Sensing Range	Switching Function	Sensitivity	Model Description	Part Number
Through-Beam	26 ft.	NPN	Fixed	OT18ES-DPTN-08.0-CL	655-1219-102
Through-Beam	26 ft.	PNP	Fixed	OT18ES-DPTP-08.0-CL	655-1819-101
Retro-Reflective	2 in. to 9.5 ft.	NPN	Fixed	OT18RS-DPTN-03.0-CL	655-4219-002
Retro-Reflective	2 in. to 9.5 ft.	PNP	Fixed	OT18RS-DPTP-03.0-CL	655-4819-003
Polarized Retro-Reflective	0 in. to 8.2 ft.	NPN	Adjustable	OT18PS-DPTN-02.5-CLE	655-5219-001
Polarized Retro-Reflective	0 in. to 8.2 ft.	PNP	Adjustable	OT18PS-DPTP-02.5-CLE	655-5819-003
Diffuse Reflective	19.6 in.	NPN	Adjustable	OT18RT-DPTN-0500-CLE	655-7219-006
Diffuse Reflective	19.6 in.	PNP	Adjustable	OT18RT-DPTP-0500-CLE	655-7819-006
Diffuse Reflective	11.8 in.	NPN	Adjustable	OT18RT-DPTN-0300-CLE	655-7219-005
Diffuse Reflective	11.8 in.	PNP	Adjustable	OT18RT-DPTP-0300-CLE	655-7819-005
Fixed Focus	1.57 in.	NPN	Fixed	OT18FF-DPTN-0040-CL	655-8219-001
Fixed Focus	1.57 in.	PNP	Fixed	OT18FF-DPTP-0040-CL	655-8819-001

#### Through Beam Sensors:

To order separate transmitters and receivers use the following:

#### Transmitter:

Part Number 655-1019-001  
Model: OT18SE-DOOS-08.0-C

#### Receiver:

Part Number: 655-1219-002  
Model: OT18EE-DPTN-08.0-CL  
Part Number: 655-1819-001  
Model: OT18EE-DPTP-08.0-CL

#### Accessories

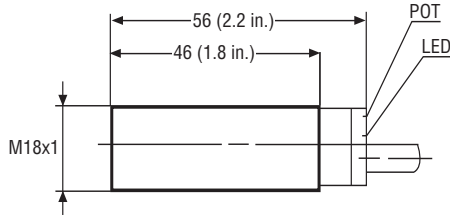
Reflective Disc-3-1/4" Dia.	Part #610-8002-001
Mounting Bracket	Part #7125-101-001

**Note:** The sensors on this page are also available in nickel-plated brass or stainless steel housings, also available in quick disconnect version. Contact Factory.

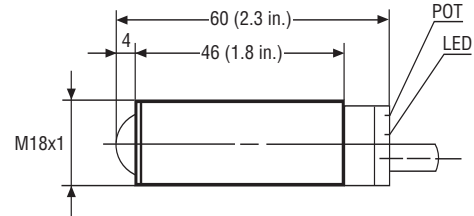
# Photoelectric Sensors

## OT18 Series

### Dimensions and Wiring Details



**Through-Beam, Retro, Diffuse,  
Fixed Focus, Sensors**



**Polarized Retroreflective Sensors**

**Wire Colors:**

Brown = Plus 10 – 36 Volts DC

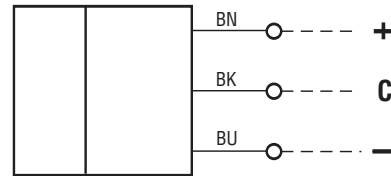
Blue = Zero Volts Common

Black = Output Wire

White = Control Wire

**Note:** The LED output indicator is on when the output is active.

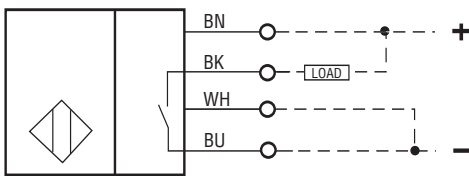
**Wiring Diagram of the Through-Beam Emitter**



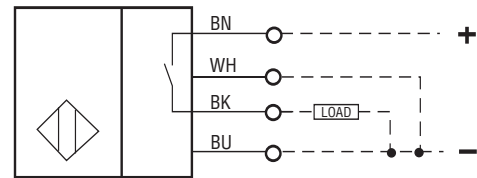
Black = Control Input. The emitter will be turned off when the control wire is connected to minus (common). System Test Function.

**Normally Off**

**NPN – sensors**

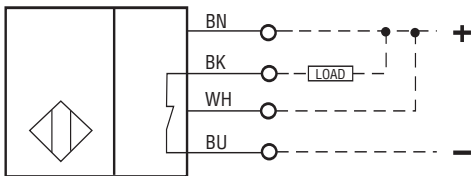


**PNP – sensors**

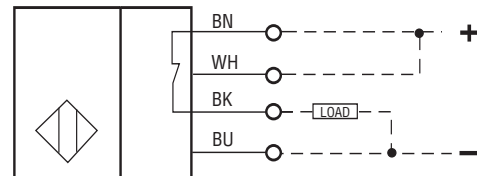


**Normally On**

**NPN – sensors**



**PNP – sensors**



With the Control Wire (White) the output function is programmable. A not connected white wire produces a Normally Open function. Diffuse Reflective and Fixed Focus types are usually operated light active (Normally Off) and other sensors like the Retro, Polarized Retro, and the Through-Beam are usually operated Dark Active (Normally On).

# Photoelectric Sensors

## MCS-638 Series

### Print Registration/Color Mark/Contrast Sensor

- Dual Lens Position
- Automatic selection of best color light source (Green, Red, Blue)
- Static Mode Teach allows one automatic teach step for the target and one automatic teach step for the background.
- Remote Teach Input allows colors to be programmed externally
- Light Operate/Dark Operate modes
- Housing Material Makrolon
- Quick Disconnect (2 Meter Straight Cable included with Sensor)
- Temperature Range -4°F to + 140°F
- LED Indication of Output Status
- Output - Push-Pull (NPN/ PNP)



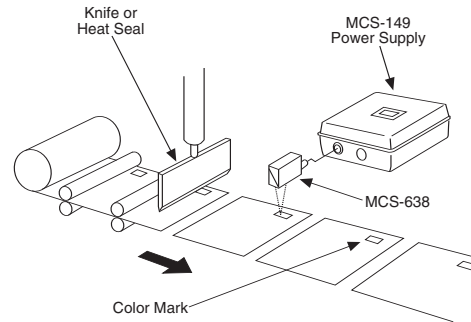
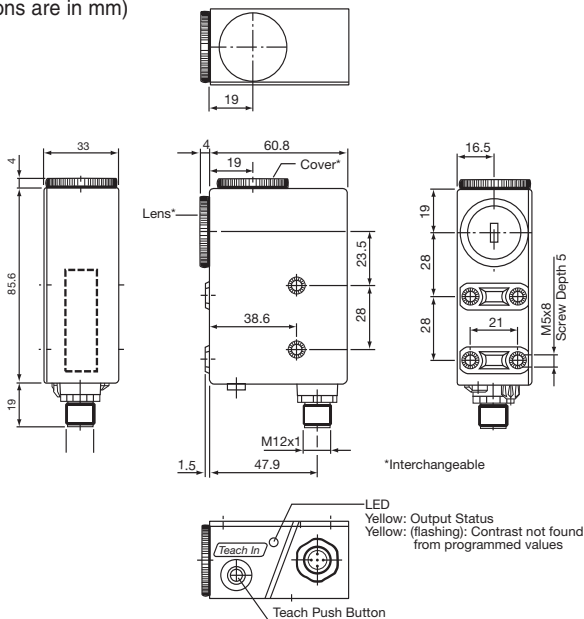
MCS-638 Series

### Sensor Selection

Sensing Range	Input Voltage	Current Consumption	Maximum Cycle Rate	Output Current	Model	Part Number
9.5 mm (3/8 in.)	10 -30 VDC	≤60 mA	16.5 KHz	200 mA	MCS-638-3	7135-448-011
25 mm (1 in.)	10 -30 VDC	≤60 mA	16.5 KHz	200 mA	MCS-638-4	7135-448-012

### Mechanical Data

(Dimensions are in mm)

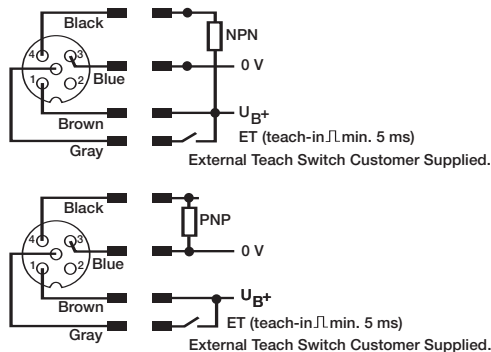


### Programming

1. Connect the supply voltage to the wires noted in the wiring diagram.
2. Aim the light spot at the target mark. For glossy or reflective surfaces, the sensor should be angled at 10° to 15° off the perpendicular axis from the target.
3. Press the Teach push button on the sensor or apply V+ to the Teach Input for a minimum of 50 milliseconds. The LED should flash slowly (at a rate of approximately 1 Hz).
4. Aim the light spot at the background.
5. Press the Teach push button on the sensor or apply V+ to the Teach Input for a minimum of 50 milliseconds. The LED will now turn on when the target mark is present and off when it is absent after a successful teach. If the teach was not successful or the contrast was not sufficient, the LED flashes quickly (at a rate of approximately 4 Hz). Programming the MCS-638 as indicated above sets the switching threshold exactly in the middle of the target and background values. The above procedure is for Light Operate mode. For Dark Operate mode, reverse steps 2 and 4.



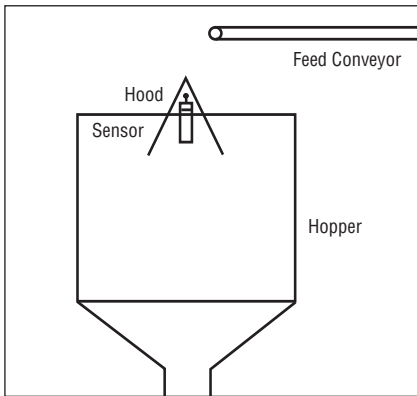
### Wiring Diagram



# Ultrasonic Sensors

## Ultrasonic Applications

- Level Control
- Roll Diameter
- Level Detection
- Liquid Level Control
- Web Break Detection
- Object Detection
- Loop Control
- Thickness and Gauging
- Stacking Height Control



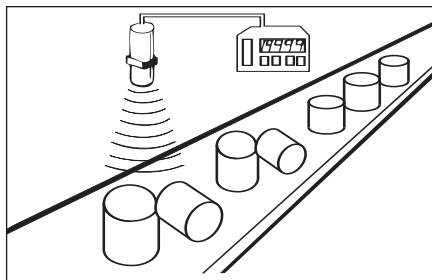
**Level Control of Sand in a Hopper**

## Ultrasonic Sensor Identification Codes

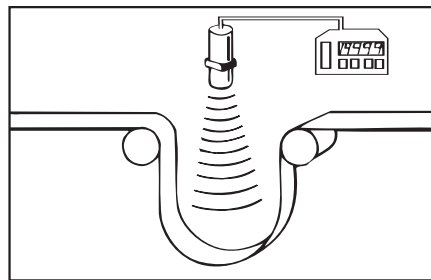
1	2	3 4	5 6	7	8 9 10 11	12	13 14 15 16	17	18	19 20 +
Type of Sensor	Type of Housing	Size of Housing Series/Name	Sensing Discipline	Dash	Electrical Spec	Dash	Sensing Distance	Dash	Type of Termination	Functions & Features
1	U = Ultrasonic				10	Output type			18	Connection type
2	M = Metric threaded barrel metal T = Metric threaded barrel plastic R = Rectangular Housing					A = Analog output R = Relay S = Solid state relay				A = Screw termination S = Quick disconnect C = Cable (standard 2 m or length in m)
3/4	Size of housing e.g. 30 = 30mm Diameter				11	3 = 3-wire output 4 = 4-wire output 5 = 5-wire output 6 = 6-wire output 7 = 7-wire output			19	Options
5/6	UP = Ultrasonic Proximity				12	Dash				S = LED with strength indicator L = LED T = Adjustable detection setting H = Adjustable hysteresis setting I = Current/Voltage inverter circuit M = Microprocessor calibration and gain control circuit C = Current inverter circuit P = PVC housing and PVC sensing face
7	Dash				13-16	Sensing distance - mm: without dot - m: with dot e.g. 06.0 = 6 m e.g. 15.0 = 15 m e.g. 0050 = 50 mm e.g. 10.0 = 10m e.g. 13.0 = 13m				
8	Voltage type A = AC D = DC				17	Dash				
9	Output function C = Current/Voltage output S = 2x NO/NC solid state B = Current output									

## Quick Selection Guide

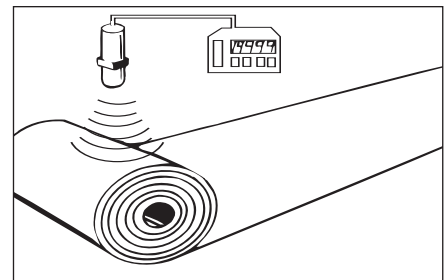
Model/Part #	Input Voltage	Sensing Distance	Output Type	Page #
UT30UP-DCA4-1016-CSI 7600-448-001	20-30 VDC	1016 mm/40 in.	4-20 mA or 0-10 VDC Inverted & Non-inverted Short Circuit Protected	13
UT30UP-DCA4-2032-CSI 7600-448-002	20-30 VDC	2032 mm/80 in.	4-20 mA or 0-10 VDC Inverted & Non-inverted Short Circuit Protected	13
UT30UP-DSS5-1016-CSHT 7600-448-003	20-30 VDC	1015 mm/40 in.	2x Solid State Relays	15
UT30UP-DSS5-2032-CSHT 7600-448-004	20-30 VDC	2032 mm/80 in.	2x Solid State Relays	15



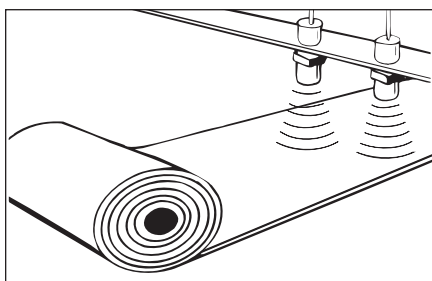
**Quality Control Inspection**



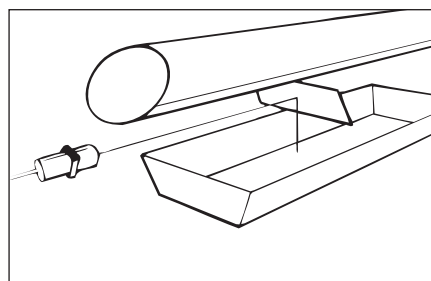
**Loop Control**



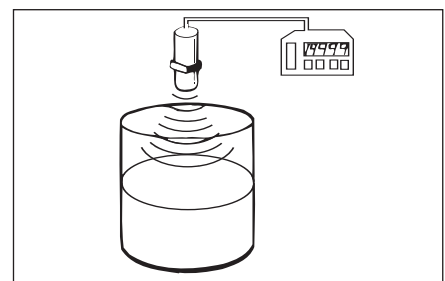
**Roll diameter, Tension Control, Winding and Unwind**



**Web Break Detection**



**45° Deflection; Ink Well Level Detection; Hard to Get At Places**



**Liquid Level Control**

# Ultrasonic Sensors

## with Analog Output

4-20 mA and 0-10 V  
Wire selectable inverted or non-inverted outputs



Threaded plastic barrel  
M 30 x 1.5



Threaded plastic barrel  
M 30 x 1.5

<b>Sensing range</b>	<b>101..1016 mm (4-40")</b>	<b>203..2032 mm (8-80")</b>
<b>Switching functions/output</b>	<b>Analog 4-20 mA and 0-10 V</b>	<b>Analog 4-20 mA and 0-10 V</b>
<b>Ordering Information</b>	<b>Model description Part number</b>	<b>Model description Part number</b>
	<b>UT30UP-DCA4-1016-CSI 7600-448-001</b>	<b>UT30UP-DCA4-2032-CSI 7600-448-002</b>

### Electrical data

Voltage range	min./max.	20-30 VDC reverse polarity protected	20-30 VDC reverse polarity protected
Input current		50 mA	50 mA
Transducer frequency		212 KHz	150 KHz
Short circuit protected		Yes	Yes
LED - (strength indicator)		Yes - green to red; see note (d) on pg. 14	Yes - green to red; see note (d) on pg. 14
Response time		30 mSec	50 mSec
Range control		Zero and span (2 potentiometers)	Zero and span (2 potentiometers)

### Mechanical Data

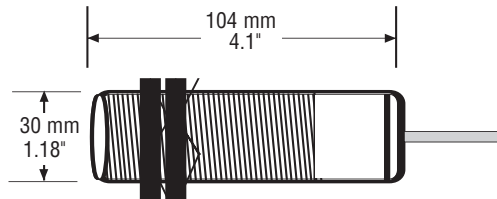
Temperature range	min./max	0°C/+60°C / 32°F/140°F	0°C/+60°C / 32°F/140°F
Degree of protection		IP 65/NEMA 12	IP 65/NEMA 12
Body material		Valox plastic	Valox plastic
Termination	cable 2 m/6 ft. Plug/socket	PVC 4 x 22 gauge Versions available to order	PVC 4 x 22 gauge Versions available to order
Accessories		1) Brackets	1) Brackets
Humidity		0-95% non-condensing	0-95% non-condensing

1) Brackets for M 30 x 1.5

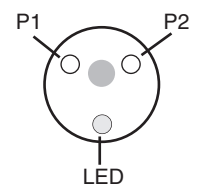
**Ordering Information**  
Plastic - BKS-D34PA  
Part number 596-0223-041

Metal - M 30 ST  
Part number 7430-448-003

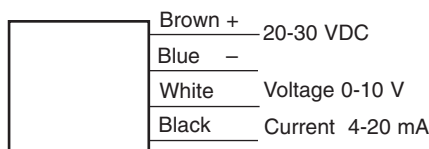
### Dimensions



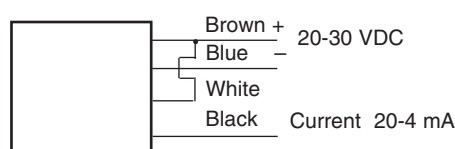
### Adjustment Pots Zero and Span Control



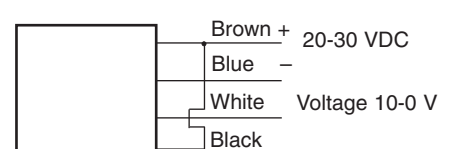
### Wiring Data



**Non Inverted Output**



**Current Output Inverted**

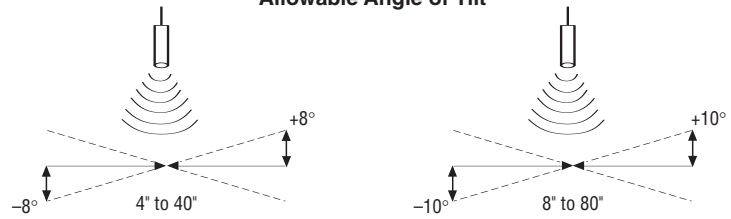


**Voltage Output Inverted**

# Ultrasonic Sensors

## Operation and Set-Up

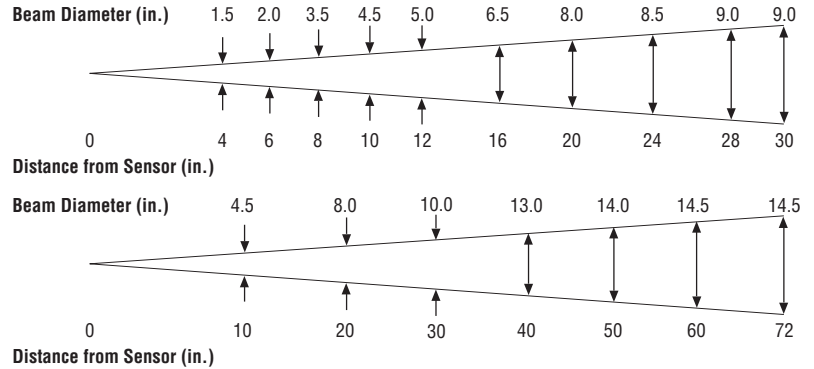
### Allowable Angle of Tilt



### Minimum Analog Ranging

Minimum analog ranging is when you desire to have the full 4-20 mA or 0-10 V output over the minimum 5 inch sensing span. 5 inches of minimum sensing span can be adjusted anywhere in the sensing range. For example 10"-15" or 25"-30". To make this adjustment, you place your target at the minimum sensing range and adjust P1 to 4 mA. Then move your target to the maximum sensing range and adjust P2 to 20 mA. Re-check the readings and make appropriate adjustments, if necessary. See diagram (A).

### Beam Spread vs. Target Distance



### Maximum Analog Ranging

Analog sensing in the maximum range means utilizing the entire 36" span (4"-40") and 72" span (8"-80"). To adjust, set your target at the minimum range, either 4" or 8" and adjust P1 to 4 mA. Move the target to the maximum range and adjust P2 to 20 mA. Re-check readings and make appropriate adjustments, if necessary. See diagram (B).

### Minimum Analog Ranging

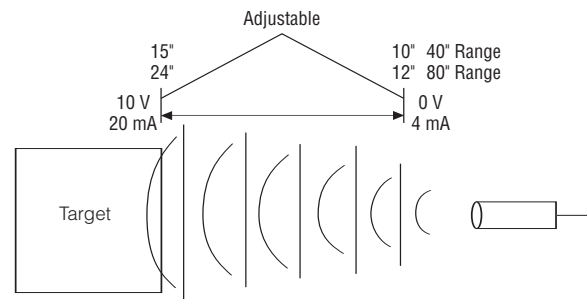


Diagram A

### Inverted Analog Outputs

Inverted outputs means that the 4-20 mA or 0-10 V output signal will decrease proportionally with distance. To adjust, place your target at the minimum sensing distance and adjust P1 to 20 mA. Place your target at the maximum sensing distance and adjust P2 to 4 mA. Re-check readings and make appropriate adjustments, if necessary. See diagram (C).

### Maximum Analog Ranging

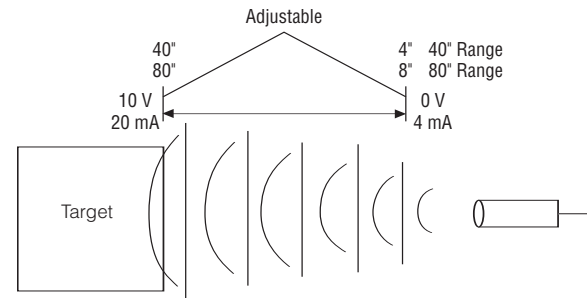


Diagram B

### LED Operation (Note D)

The LED is green when the unit is powered up. It will fade to red as a target is detected with increased intensity as more signal is being reflected from the target. Note: Any color other than green equals a workable signal level.

### Inverted Analog Ranging

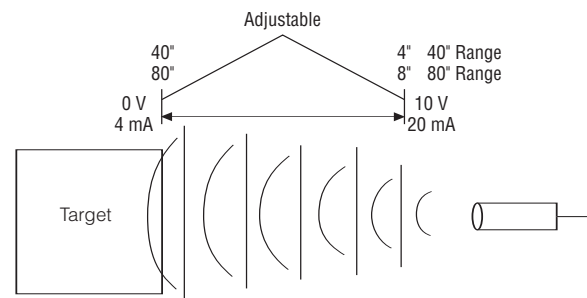
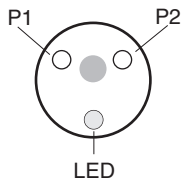


Diagram C

### Adjustment Pots Zero and Span Control





# Ultrasonic Sensors

## with Isolated Solid State Relay Outputs

fitted with Range and Hysteresis Control



Threaded plastic barrel  
M 30 x 1.5



Threaded plastic barrel  
M 30 x 1.5

<b>Sensing range</b>		<b>101..1016 mm (4-40")</b>	<b>203..2032 mm (8-80")</b>
<b>Switching functions/output</b>		<b>2 Solid State Relays</b>	<b>2 Solid State Relays</b>
<b>Ordering Information</b>	Model description Part number	<b>UT30UP-DSS5-1016-CSHT 7600-448-003</b>	<b>UT30UP-DSS5-2032-CSHT 7600-448-004</b>
<b>Electrical data</b>			
Voltage range	min./max.	20-30 VDC reverse polarity protected	20-30 VDC reverse polarity protected
Input current		50 mA	50 mA
Transducer frequency		212 KHz	150 KHz
Short circuit protected		Yes	Yes
LED		Yes - green (not detecting), red (detecting)	Yes - green (not detecting), red (detecting)
Response time		30 mSec	50 mSec
Range control		Range and Hysteresis	Range and Hysteresis
<b>Mechanical data</b>			
Temperature range	min./max.	0°C/+60°C / 32°F/140°F	0°C/+60°C / 32°F/140°F
Degree of protection		IP 65/NEMA 12	IP 65/NEMA 12
Body material		Valox plastic	Valox plastic
Termination	cable 2 m/6 ft. Plug/socket	PVC 4 x 22 gauge Versions available to order	PVC 4 x 22 gauge Versions available to order
Accessories		1) Brackets	1) Brackets
Humidity		0-95% non-condensing	0-95% non-condensing

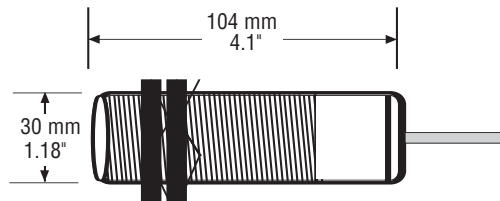
1) Brackets for M 30 x 1.5

### Ordering Information

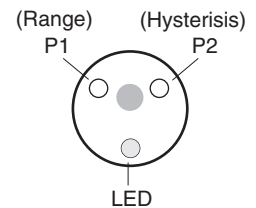
Plastic - BKS-D34PA  
Part number 596-0223-041

Metal - M 30 ST  
Part number 7430-448-003

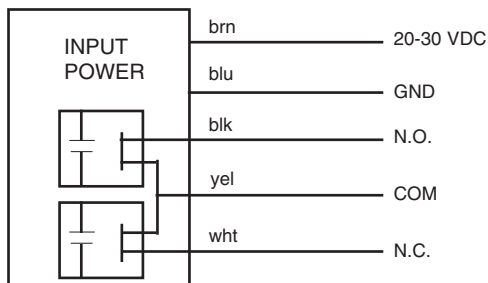
### Dimensions



### Adjustment Pots Detection and Hysteresis Control



### Wiring Data

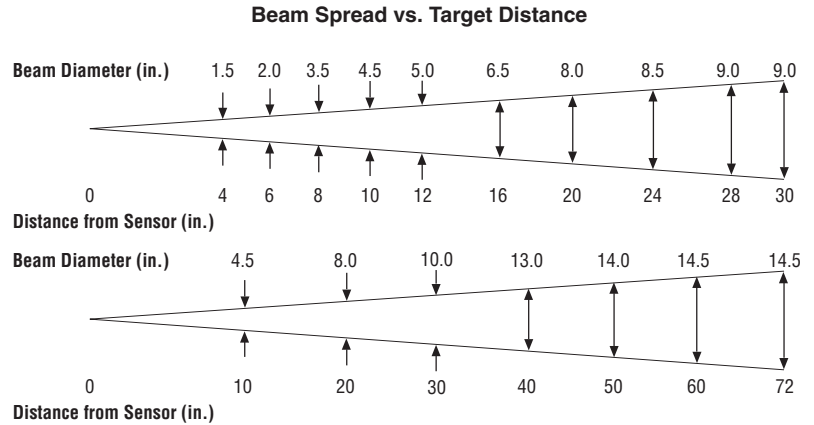
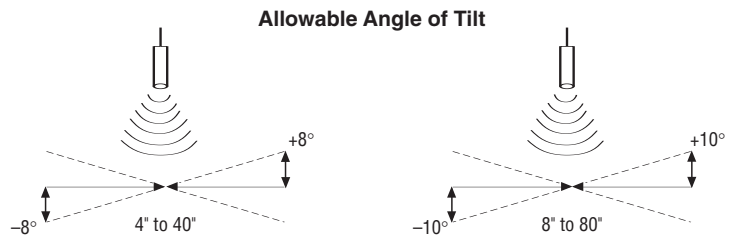


### Output Specification

- 2 x Solid state relays N.O. / N. C.
- 160 VAC or VDC 100 mA continuous
- Short circuit protected
- 1500 volts RMS isolation

# Ultrasonic Sensors

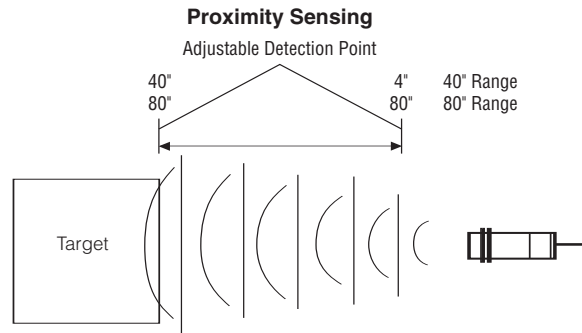
## Operation and Set-Up



## Proximity Sensing

Proximity detection is the detection of an object at a set distance. The sensing range is controlled by the “Range Control” potentiometer. Any object within the desired range is detected while objects beyond the set range are ignored. The sensing distance is dependent upon the sensor chosen, 40" or 80".

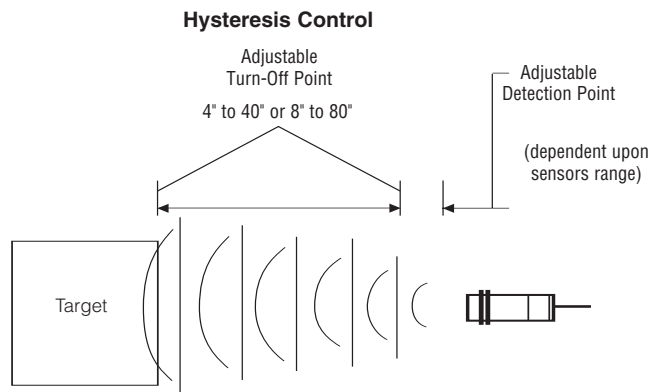
In the proximity mode of operation, the hysteresis potentiometer must be turned to 'off' by turning the pot counterclockwise.



## Hysteresis Control

The sensor is also fitted with a hysteresis control potentiometer. This control allows you to adjust the turn off point while the detection potentiometer sets the “turn on” point.

(Example: Range pot set for 10", hysteresis pot set for 20". With these settings the sensor will detect when the target reaches 10" and stays on as the target moves away to 20".) This hysteresis can be adjusted from .5" to 40" from the detect point with the 40" sensor and 1" to 80" with the 80" sensor.



# Proximity Sensors

## Inductive Sensors

Inductive Proximity Sensors are used when the target or object to be sensed is metal. Inductive types are the most widely used proximity sensors for industrial applications.

### Typical Applications

- Parts Detection
- Parts Counting
- Positioning
- Broken Tool Detection
- Indexing
- Robotics and Conveyors
- Motion and Speed Control
- Punch Press Feed and Ejection Control
- Parts Inspection
- Parts Diverting

## Capacitive Sensors

Capacitive Sensors can sense conducting and non-conducting materials in solid, powder or liquid form. The higher the dielectric constant of the target material, the greater the sensing range.

### Typical Applications

- Liquid Level Control
- Package Inspection (Content and Fill Level)
- Plastic Pellet Detection
- Wire Break Detection

## Inductive and Capacitive Proximity Sensors Identification Codes

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Product Group			—	Type/Size of Housing			Output	Type of Output	—	Sensing Distance			—	Options		
<b>1</b>	K = Non-contact proximity sensor					<b>7</b>	Example		<b>10</b>	Dash						
<b>2</b>	I = Inductive C = Capacitive						03 = 3 mm dia 40 = 40 mm dia format for other shapes: digits 5, 6 and 7		<b>11-13</b>	Sensing distance Example: 1.5 = 1.5 mm 002 = 2.0 mm 040 = 40.0 mm						
<b>3</b>	B = Flush/shielded N = Non-flush/Non-shielded A = Adjustable flush/non-flush via sensitivity control V = Sensor amplifier						S03 = 3.5 mm slot sensor Q05 = 5 x 5 x 25 mm Q08 = 8 x 8 x 40 mm side sensing Q80 = 8 x 8 x 40 mm middle sensing			<b>14</b> Dash						
<b>4</b>	Dash						Q12 = 12 x 12 x 55 mm B40 = Bar sensor E50 = 50 x 25 x 55 mm E28 = 28 x 16 x 11 mm E40 = 40 x 26 x 12 mm N40 = 40 x 40 x 40 mm N04 = 40 x 40 x 72.5 mm N44 = 40 x 40 x 112 mm E68 = 68 x 30 x 15 mm E80 = 80 x 30 x 20 mm			<b>15</b> K = Short circuit protection <b>16</b> L = LED <b>17</b> Cable length in meters Example: 2 = 2 meters 6 = 6 meters						
<b>5</b>	M = Metric threaded metal barrel T = Metric threaded plastic barrel D = Cylindrical metal smooth barrel R = Cylindrical plastic smooth barrel Q = Rectangular metal housing P = PG threaded metal barrel E = Rectangular plastic housing S = Slot type sensor N = DIN standard housing B = Bar sensor							<b>8</b>		S = Socket E = Sensor with extended sensing range V = Short body housing P = Potentiometer PU = Polyurethane cable SD = Plug with terminals according to DIN standard usually comes with plug fitted SM = Mini socket snap fit (quick disconnect) S8 = M8 quick disconnect screw type S12 = M12 quick disconnect screw type SM8 = M8 quick disconnect universal snap and screw N = Stainless steel F = High switching frequency C = High chemical resistance surface T = High temperature						
<b>6</b>	If the housing is cylindrical or barrel, the two digit code refers to the diameter in millimeters.							<b>9</b>		S = Normally open O = Normally closed P = Programmable switch selectable NO/NC A = Analog U = Complementary 4-wire NO/NC						

# Inductive Proximity Sensors

4mm dia. - Smooth Metal Barrel  
 M4, M5, M8, M12, M18, M30 - Threaded Metal Barrel  
 All with potted - in Cable - 6 Feet Long  
 Input Voltage: 10-30 Volts DC - 3 Wire  
 Output Type: NPN (sinking) or PNP (sourcing)  
 - Normally Open



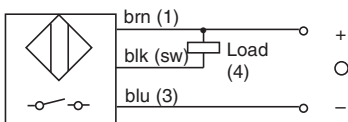
- NEMA 4
- Temperature range -13°F + 158°F
- Short circuit protected
- Reverse polarity protected
- Transient noise protected
- LED function, Output energized

## Sensor Selection

Type and Construction	Sensing Range	Mounting	Switching Function	Switching Freq. Hz	Output Current	Model	Part Number
4mm Dia.	0.8 mm	Flush	NPN/NO	3000	200 mA	KIB-D04NS/0.8 KL2PU	650-2399-004
Smooth Metal Barrel	0.8 mm	Flush	PNP/NO	3000	200 mA	KIB-D04PS/0.8 KL2PU	650-2999-004
M4 x 0.5	0.6 mm	Flush	NPN/NO	3000	100 mA	KIB-M04NS/0.6 KL2	650-2399-018
Threaded Metal Barrel	0.6 mm	Flush	PNP/NO	3000	100 mA	KIB-M04PS/0.6 KL2	650-2999-020
M5 x 0.5	1 mm	Flush	NPN/NO	3000	200 mA	KIB-M05NS/001 KL2	650-2399-003
Threaded Metal Barrel	1 mm	Flush	PNP/NO	3000	200 mA	KIB-M05PS/001 KL2	650-2999-003
	1.5 mm	Flush	NPN/NO	1000	200 mA	KIB-M08NS/1.5 KL2	693-2301-001
M8 x 1	1.5 mm	Flush	PNP/NO	1000	200 mA	KIB-M08PS/1.5 KL2	693-2901-001
Threaded Metal Barrel	2 mm	Non-Flush	NPN/NO	1000	200 mA	KIN-M08NS/002 KL2	650-2316-003
	2 mm	Non-Flush	PNP/NO	1000	200 mA	KIN-M08PS/002 KL2	650-2916-003
	2 mm	Flush	NPN/NO	800	200 mA	KIB-M12NS/002 KL2	693-2303-001
M12 x 1	2 mm	Flush	PNP/NO	800	200 mA	KIB-M12PS/002 KL2	693-2903-001
Threaded Metal Barrel	4 mm	Non-Flush	NPN/NO	400	200 mA	KIN-M12NS/004 KL2	693-2304-001
	4 mm	Non-Flush	PNP/NO	400	200 mA	KIN-M12PS/004 KL2	693-2904-001
M18 x 1	5 mm	Flush	NPN/NO	500	200 mA	KIB-M18NS/005 KL2	693-2305-001
Threaded Metal Barrel	5 mm	Flush	PNP/NO	500	200 mA	KIB-M18PS/005 KL2	693-2905-001
Input Voltage	8 mm	Non-Flush	NPN/NO	200	200 mA	KIN-M18NS/008 KL2	693-2306-001
10-60 VDC	8 mm	Non-Flush	PNP/NO	200	200 mA	KIN-M18PS/008 KL2	693-2906-001
M30 x 1.5	10 mm	Flush	NPN/NO	300	200 mA	KIB-M30NS/010 KL2	650-2307-135
Threaded Metal Barrel	10 mm	Flush	PNP/NO	300	200 mA	KIB-M30PS/010 KL2	650-2907-068
Input Voltage	15 mm	Non-Flush	NPN/NO	100	200 mA	KIN-M30NS/015 KL2	650-2308-001
10-60 VDC	15 mm	Non-Flush	PNP/NO	100	200 mA	KIN-M30PS/015 KL2	650-2908-002

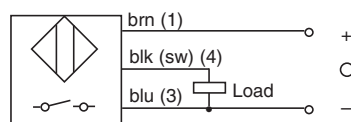
mm x .03937 = inches

## Wiring Diagrams



### NPN – Normally Open

During operation, output NPN transistor is switched to negative.



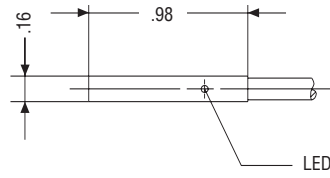
### PNP – Normally Open

During operation, output of PNP transistor is switched to positive.

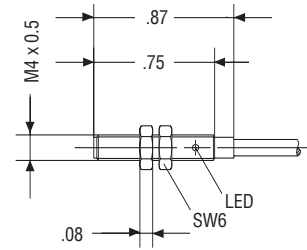
brn = Brown  
 blk = Black  
 blu = Blue  
 sw = Switch

For Brackets see Page 23.

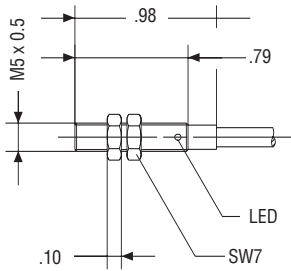
**Mechanical Data** (Dimensions are in inches)



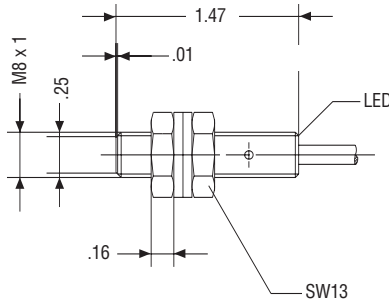
**4 mm Dia.**



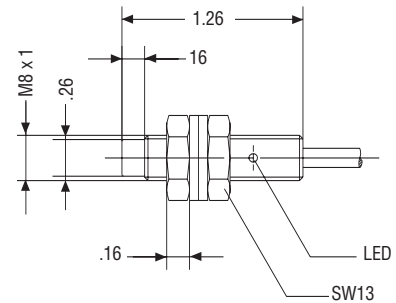
**M4 x 0.5**



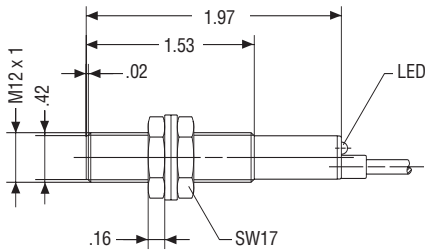
**M5 x 0.5**



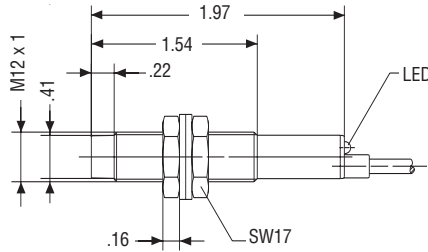
**M8 x 1 Flush**



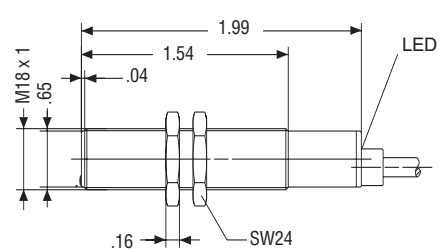
**M8 x 1 Non-Flush**



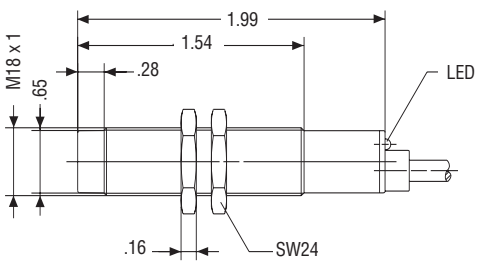
**M12 x 1 Flush**



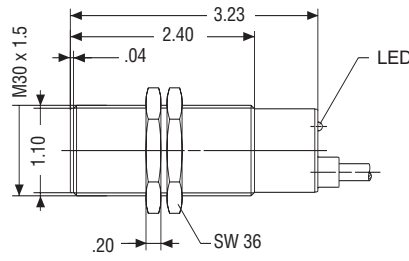
**M12 x 1 Non-Flush**



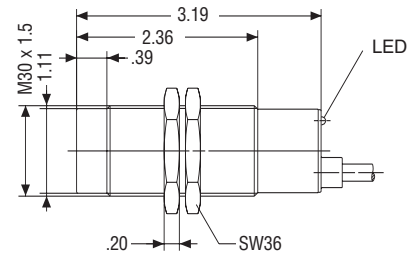
**M18 x 1 Flush**



**M18 x 1 Non-Flush**



**M30 x 1.5 Flush**



**M30 x 1.5 Non-Flush**

# Inductive Proximity Sensors

**M8, M12, M18, M30 - Threaded Metal Barrel**  
**M12 x 1 Quick Disconnect/M8 x 1 Quick Disconnect**  
**Input Voltage: 10-30 Volts DC-3 Wire**  
**Output Types: NPN (sinking) or PNP (sourcing)**  
**- Normally Open**

- NEMA 4
- Temperature range -13°F + 158°F
- Short circuit protected
- Reverse polarity protected
- Transient noise protected
- LED function, Output energized



## Sensor Selection

Type and Construction	Sensing Range	Mounting	Switching Function	Switching Freq. Hz	Output Current	Model	Part Number
M8 x 1*	1.5 mm	Flush	NPN/NO	1000	200 mA	KIB-M08NS/1.5 KLSM8*	693-2342-001
Threaded Metal Barrel	1.5 mm	Flush	PNP/NO	1000	200 mA	KIB-M08PS/1.5 KLSM8*	693-2942-001
Quick Disconnect	2 mm	Non-Flush	NPN/NO	1000	200 mA	KIN-M08NS/002 KLSM8*	650-2342-004
* USE M8 QD	2 mm	Non-Flush	PNP/NO	1000	200 mA	KIN-M08PS/002 KLSM8*	650-2942-006
M12 x 1	2 mm	Flush	NPN/NO	800	200 mA	KIB-M12NS/002 KLS12	693-2343-001
Threaded Metal Barrel	2 mm	Flush	PNP/NO	800	200 mA	KIB-M12PS/002 KLS12	693-2943-001
Quick Disconnect	4 mm	Non-Flush	NPN/NO	400	200 mA	KIN-M12NS/004 KLS12	693-2344-001
	4 mm	Non-Flush	PNP/NO	400	200 mA	KIN-M12PS/004 KLS12	693-2944-001
M18 x 1	5 mm	Flush	NPN/NO	500	200 mA	KIB-M18NS/005 KLS12	693-2305-004
Threaded Metal Barrel	5 mm	Flush	PNP/NO	500	200 mA	KIB-M18PS/005 KLS12	693-2905-004
Quick Disconnect	8 mm	Non-Flush	NPN/NO	200	200 mA	KIN-M18NS/008 KLS12	693-2306-004
10-60 VDC	8 mm	Non-Flush	PNP/NO	200	200 mA	KIN-M18PS/008 KLS12	693-2906-004
M30 x 1							
Threaded Metal Barrel	10 mm	Flush	PNP/NO	300	200 mA	KIB-M30PS/010 KLS12	650-2939-004
Quick Disconnect							
10-60 VDC	15 mm	Non-Flush	PNP/NO	100	200 mA	KIN-M30PS/015 KLS12	650-2935-005

mm x .03937 = inches

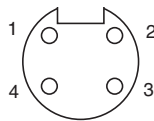
## Quick Disconnect Selection (Available in 2M or 5M Cable Lengths)

### M12 x 1

Quick Disconnects with Lock Nuts

### Terminal Code

- 1 = brown
- 2 = black
- 3 = blue

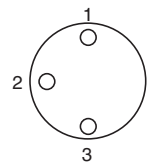


### M8 x 1

Quick Disconnects with Lock Nuts

### Terminal Code

- 1 = brown
- 2 = black
- 3 = blue



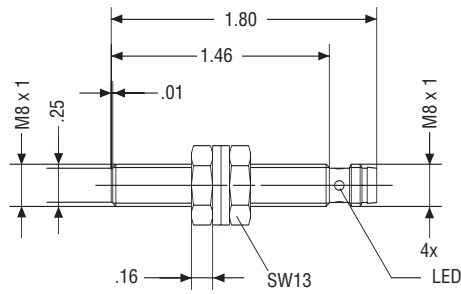
### For M12 and M18 Sensors

### For M8 Sensors

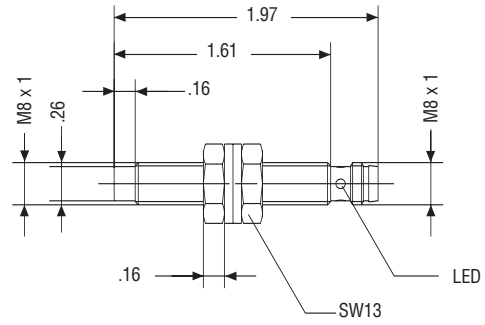
Cable Length	Model	Part #	3-wire	3-wire
2 Meters	WDK-M12US/S00-2	413-9100-280	GDK-M08US/S00-2.5PU	WDK-M08US/S00-2.5PU
			413-9100-261	413-9100-278
5 Meters	WDK-M12US/S00-5	413-9100-281	GDK-M08US/S00-5PU	WDK-M08US/S00-5PU
			413-9100-263	413-9100-279

For Brackets see Page 23.

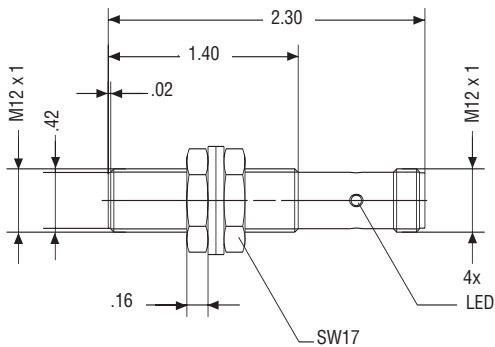
**Mechanical Data** (Dimensions are in inches)



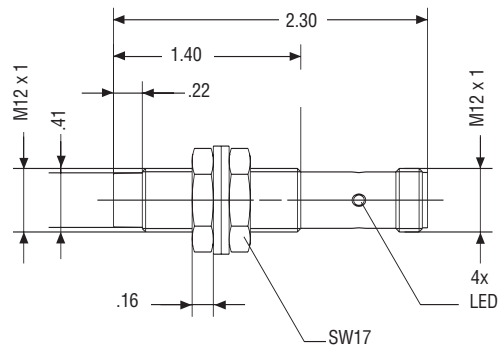
**M8 x 1 Flush**



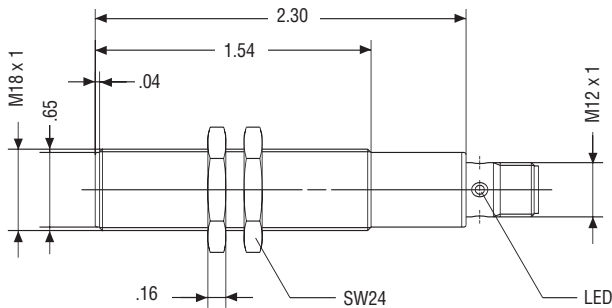
**M8 x 1 Non-Flush**



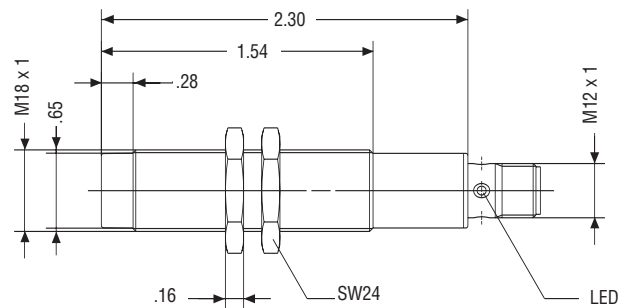
**M12 x 1 Flush**



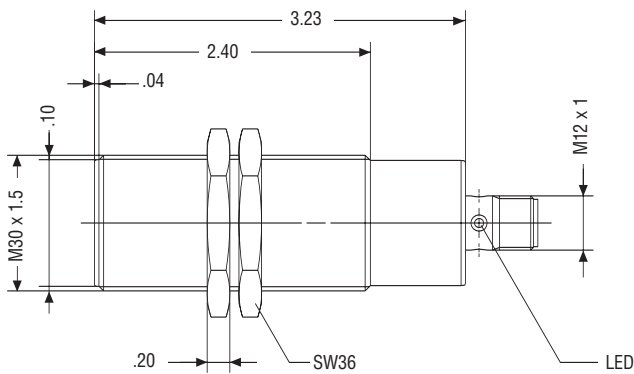
**M12 x 1 Non-Flush**



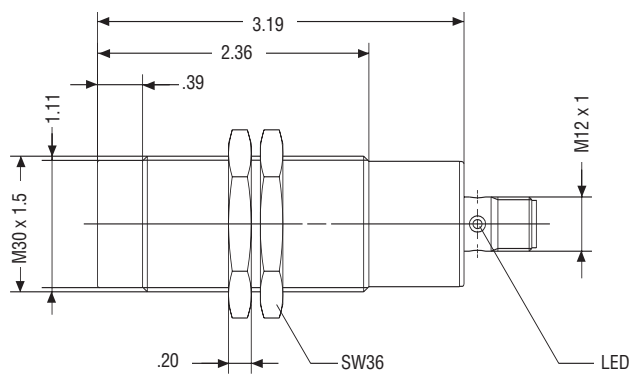
**M18 x 1 Flush**



**M18 x 1 Non-Flush**



**M30 x 1.5 Flush**



**M30 x 1.5 Non-Flush**

# Inductive Proximity Sensors

## 2 Wire AC

**M12, M18, M30 - Threaded Metal Barrel**

**With Potted - in Cable - 6 Feet Long**

**M18 - Threaded Metal Barrel**

**With M12 x 1 Quick Disconnect**

**Input Voltage: 2 Wire AC**

**Output: Normally Open**

- NEMA 4
- Temperature range -13°F + 158°F
- Cable length, 2 meters (standard length)
- LED function, Output energized on cable version only
- Switching frequency 10 hertz



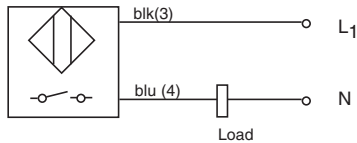
### Sensor Selection

Type and Construction	Sensing Range	Mounting	Switching Function	Input Voltage	Output Current	Model	Part Number
M12 x 1 Integral Cable	2 mm	Flush	NO	90-250 VAC	4/180 mA	KIB-M12AS/002 L2	650-3503-001
Threaded Metal Barrel	4 mm	Non-Flush	NO	90-250 VAC	4/180 mA	KIN-M12AS/004 L2	650-3504-001
M18 x 1 Integral Cable	5 mm	Flush	NO	20-250 VAC	4/400 mA	KIB-M18AS/005 L2	650-3505-004
Threaded Metal Barrel	8 mm	Non-Flush	NO	20-250 VAC	4/400 mA	KIN-M18AS/008 L2	650-3506-002
M30 x 1.5 Integral Cable	10 mm	Flush	NO	20-250 VAC	4/400 mA	KIB-M30AS/010 L2	650-3507-378
Threaded Metal Barrel	15 mm	Non-Flush	NO	20-250 VAC	4/400 mA	KIN-M30AS/015 L2	650-3508-246

mm x .3937 = inches

### Wiring Diagram

For Sensors with Integral Cable



blk = black  
blu = blue

#### AC – 2-wire Normally Open

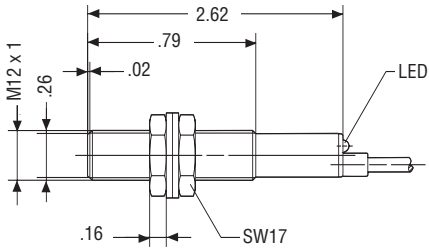
During operation, a thyristor which is positioned above a rectifier bridge applies the load to the operating voltage.

For Brackets see Page 23.

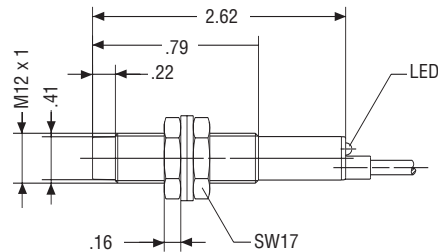


**Mechanical Data** (Dimensions are in inches)

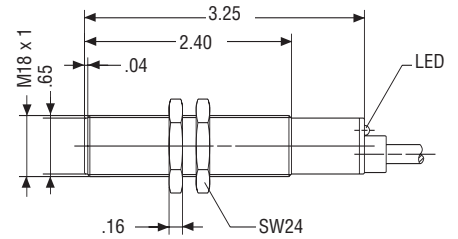
**2 Wire AC**



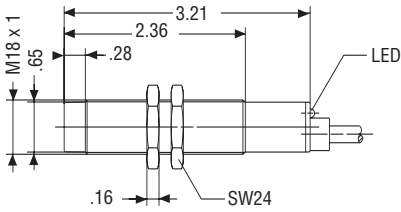
**M12 x 1 Flush**



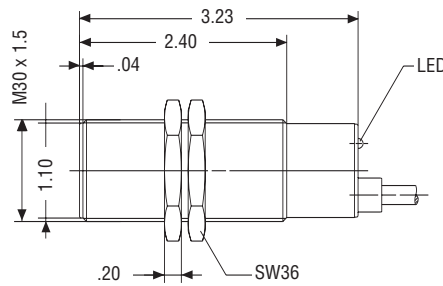
**M12 x 1 Non-Flush**



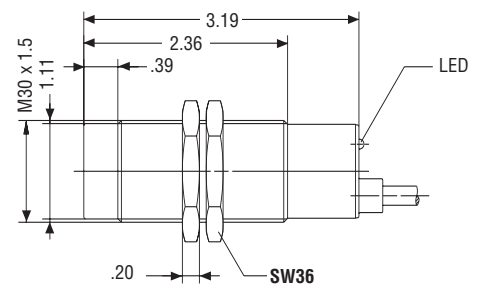
**M18 x 1 Flush**



**M18 x 1 Non-Flush**

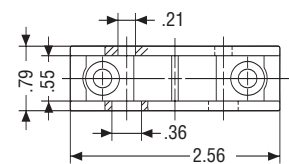
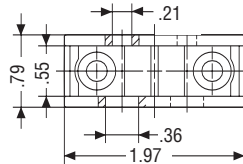
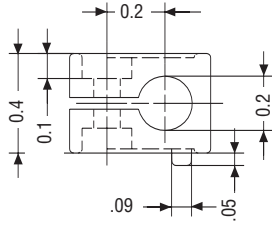
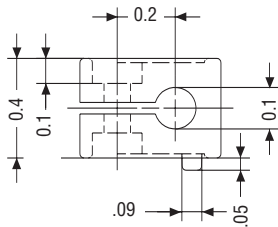
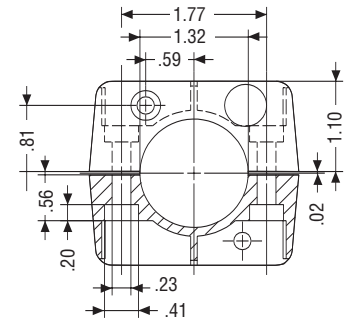
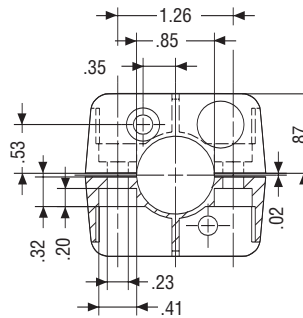
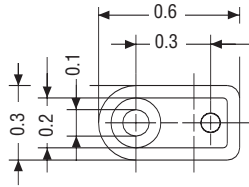
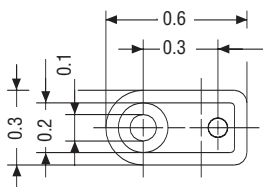


**M30 x 1.5 Flush**



**M30 x 1.5 Non-Flush**

**Brackets**



**Model** BKB-D04PA  
**Part #** 596-0223-069

**Model** BKS-D05PA  
**Part #** 596-0223-070

**Model** BKS-D22PA  
**Part #** 596-0223-040

**Model** BKS-D34PA  
**Part #** 596-0223-041

## Capacitive Sensors

**Barrel Sizes: M12, M18, M30, M32, 34mm Dia**  
**Input Voltage: 3 Wire DC and 2 Wire AC**  
**Integral Cable and Quick Disconnect Versions**  
**All Sensors Fitted With Sensitivity Adjustment**

- NEMA 12
- LED output indication
- Temperature range -13°F + 158°F
- Short circuit protected
- Reverse polarity protected
- Transient noise protected



### Sensor Selection

Type and Construction	Sensing Range	Input Voltage	Switching Function	Switching Freq. Hz	Output Current	Model	Part Number
M12 x 1	4 mm ***	10-36 VDC	NPN/NO	25	200 mA	KCN-T12NS/004 KLP2	650-7319-001
Threaded Plastic Body	4 mm ***	10-36 VDC	PNP/NO	25	200 mA	KCN-T12PS/004 KLP2	650-7919-001
M18 x 1	8 mm ***	10-60 VDC	NPN/NO	100	200 mA	KCA-T18NS/008 KLP2	650-7321-723
Threaded Plastic Body	8 mm ***	10-60 VDC	PNP/NO	100	200 mA	KCA-T18PS/008 KLP2	650-7921-724
Quick Disconnect	8 mm ***	20-250 VAC	NO	15	5/300 mA	KCN-T18AS/008 LP2	650-8521-001
Quick Disconnect	8 mm ***	10-60 VDC	NPN/NO	25	200 mA	KCN-T18NS/008 KLPSM8	650-7321-002
Quick Disconnect	8 mm ***	10-60 VDC	PNP/NO	25	200 mA	KCN-T18PS/008 KLPSM8	650-7921-002
Quick Disconnect	8 mm ***	20-250 VAC	NO	15	5/300 mA	KCN-T18AS/008 LPS12A	650-8521-004
M30 x 1.5	20 mm***	10-60 VDC	NPN/NO	25	400 mA	KCN-T30NS/020 KLP2	650-7323-001
Threaded Plastic Body	20 mm***	10-60 VDC	PNP/NO	25	400 mA	KCN-T30PS/020 KLP2	650-7923-727
Quick Disconnect	20 mm***	20-250 VAC	NO	15	5/300 mA	KCN-T30AS/020 LP2	650-8523-001
M32 x 1.5	30 mm***	10-60 VDC	NPN/PNP*	25	400 mA	KCN-T32DP/030 KLP2	650-7013-001
Threaded Plastic Body			NO/NC				
M32 x 1.5	15 mm**	10-60 VDC	NPN/PNP*	25	400 mA	KCB-M32DP/015 KLP2	650-7013-011
Threaded Metal Body	Flush		NO/NC				
34mm dia.	30 mm***	10-60 VDC	NPN/NO	10	400 mA	KCN-R34NS/030 KLP2	650-7315-001
Smooth Plastic Body	30 mm***	10-60 VDC	PNP/NO	10	400 mA	KCN-R34PS/030 KLP2	650-7915-001
	30 mm***	48-250 VAC	NO	10	10/300 mA	KCN-R34AS/030 LP2	650-8515-001

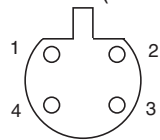
\* See Wiring Diagram PNP/NPN Switch Selectable

\*\* This sensor can be mounted flush.

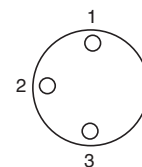
\*\*\* These Capacitive Sensors are Non-Flush Mount, Adjustable by Sensitivity Adjustment

### Quick Disconnect Selection (Available in 2 M or 5 M Cable Lengths)

**M12 x 1**  
**Quick Disconnect**  
**AC Input Voltage**



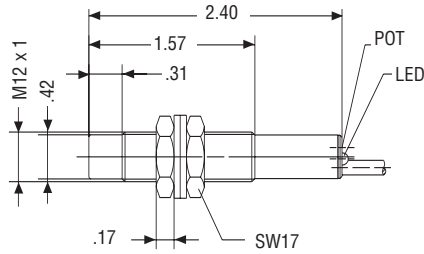
**M8 x 1**  
**Quick Disconnect**  
**DC Input Voltage**



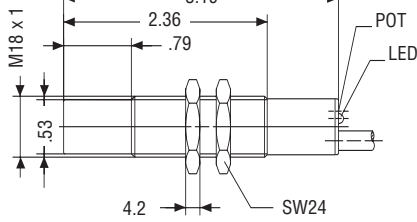
	2-wire	2-wire	3-wire	3-wire
<b>Model</b>	GDK-M12AS/S00-2	WDK-M12AS/S00-2	GDK-M08US/S00-2.5PU	WDK-M08US/S00-2.5PU
<b>Part #</b>	413-9100-248	413-9100-250	413-9100-261	413-9100-278
<b>Model</b>	GDK-M12AS/S00-5		GDK-M08US/S00-5PU	WDK-M08US/S00-5PU
<b>Part #</b>	413-9100-249		413-9100-263	413-9100-279

For Brackets see Page 23.

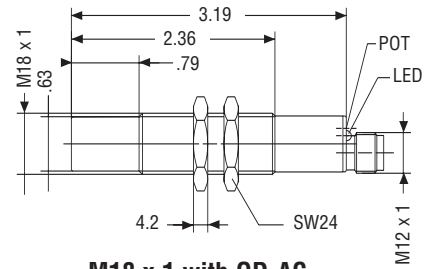
## Mechanical Data (Dimensions are in inches)



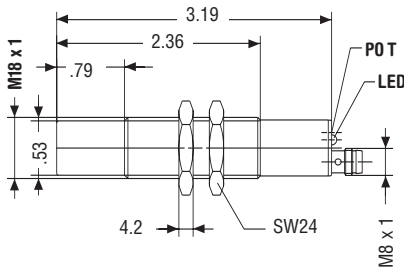
**M12 x 1 with Cable**



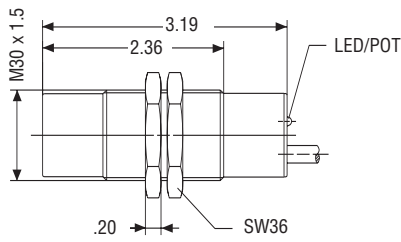
**M18 x 1 with Cable**



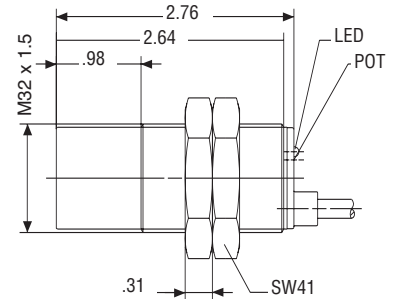
**M18 x 1 with QD-AC**



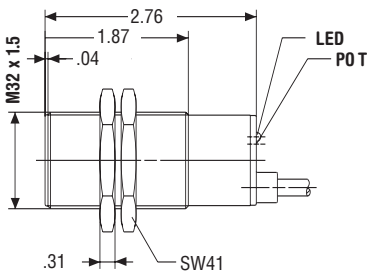
**M18 x 1 with QD-DC**



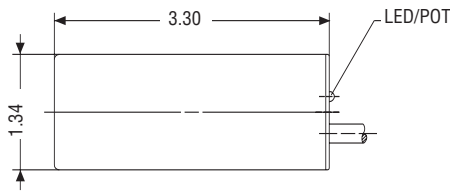
**M30 x 1.5 with Cable**



**M32 x 1.5 Plastic with Cable**

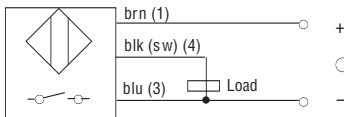


**M32 x 1.5 Metal with Cable**



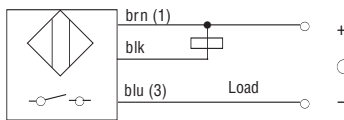
**34 mm Dia. with Cable**

## Wiring Diagram



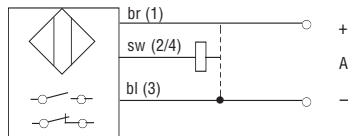
### PNP Normally Open

During operation, output of PNP transistor is switched to positive.



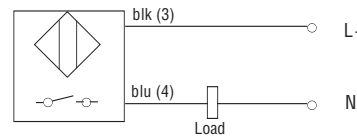
### NPN Normally Open

During operation, output of NPN transistor is switched to negative.



### \*PNP/NPN Switch selectable

Two integrated switches selection between PNP/NPN switching and normally open/ normally closed functions.



### 2 Wire AC Normally Open

During operation, a thyristor which is positioned above a rectifier bridge applies the load to the operating voltage.

brn = Brown  
blk = Black  
blu = Blue  
sw = Switch

# Magnetic Sensors

## Description

A magnetic sensor is a simple, inexpensive sensing device that can be used in very harsh environments because its completely sealed housing makes it unaffected by heavy dust or corrosive atmospheres.

The basic sensor system consists of a sensor and a magnet and can be typically used in food production, printing, and packaging industries. Their rugged construction also makes magnetic sensors suitable for agricultural applications.

The operating component in the magnetic sensor is a reed switch.



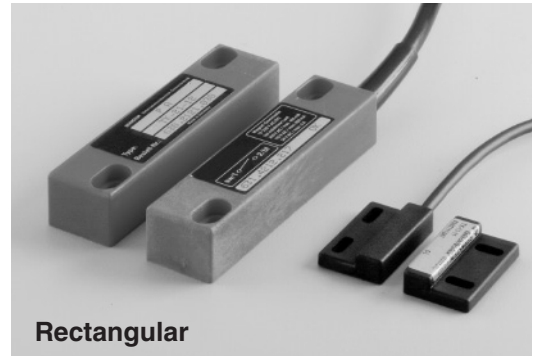
**Cylindrical**

## Operation of a Magnetic Sensor

These sensors are used mainly as proximity switches. The magnet and sensor must be positioned correctly so the strength of the flux magnet and the sensitivity of the sensor operate to the specified sensing distance. Sensor operation does not depend on direction or angle of travel.

## Features

- NEMA 4, 4X
- Temperature range -13°F + 158°F
- Cable length, 3 feet (standard length)
- Extremely stable switching point
- Repeatability better than 0.025 inch
- Life expectancy 10<sup>7</sup> switching operations
- Extremely cost effective
- Operating voltage up to 250 VAC



**Rectangular**

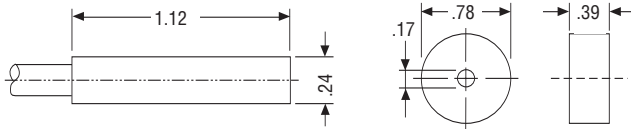
## Sensor Selection

Sensor and Magnet Combination	*Sensing Range	Max Supply Volts	**Switching Function	Max Power/Current	Output Current At 120VAC	Model	Part Number
Smooth Plastic Barrel/MA-30 Magnet T-67 N/S	0.1 inch	250 VAC	NO	10 VA/0.5 A	80 mA	MAK-3012-B T-67 N/S	631-1230-571 630-1167-054
Threaded Metal Barrel/MA-08 Magnet T-62 N/S	0.6 inch	250 VAC	NO	10 VA/0.5 A	80 mA	MAN-0812-B T-62 N/S	631-1208-596 630-1262-039
Threaded Metal Barrel/MA-23 Magnet T-62 N/S	0.3 inch	250 VAC	NO	100 VA/3 A	830 mA	MAM-2312-F T-62 N/S	631-4223-268 630-1262-039
Rectangular Plastic/MA-11 Magnet TK-11-11	0.4 inch	250 VAC	NO	10 VA/0.5 A	80 mA	MAK-1112-B TK-11-11	631-1211-541 630-2111-047
Rectangular Plastic/MA-12 Magnet TK-21-12	0.8 inch	250 VAC	NO	100 VA/0.3 A	830 mA	MAK-1212-F TK-21-12	631-4212-217 630-2121-030
Rectangular Plastic/MA-45 Magnet TK-45	0.4 inch	250 VAC	NO	10 VA/0.5 A	80 mA	MAK-4512-B TK-45	631-1245-539 630-2145-048
Rectangular Plastic/MA-42 Magnet TK-42	1.0 inch	250 VAC	NO	100 VA/3 A	830 mA	MAK-4212-F TK-42	631-4242-533 630-2142-049

\*Sensing range is based on the use of the specified magnet.

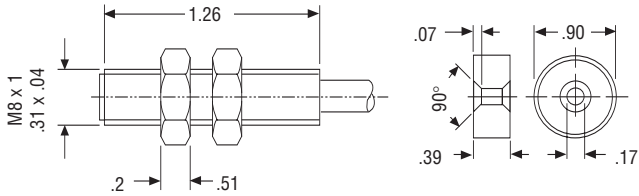
\*\*NO = Normally Open

## Mechanical Data (Dimensions are in inches)



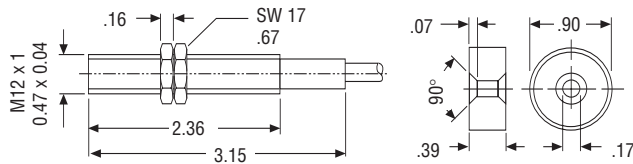
**Sensor MA-30**  
Part # 631-1230-571

**Magnet T-67 N/S**  
Part # 630-1167-054



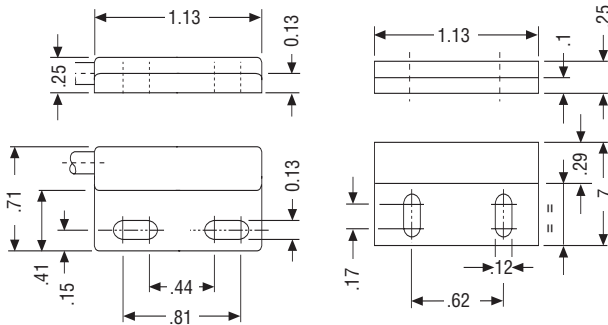
**Sensor MA-08**  
Part # 631-1208-596

**Magnet T-62 N/S**  
Part # 630-1262-039



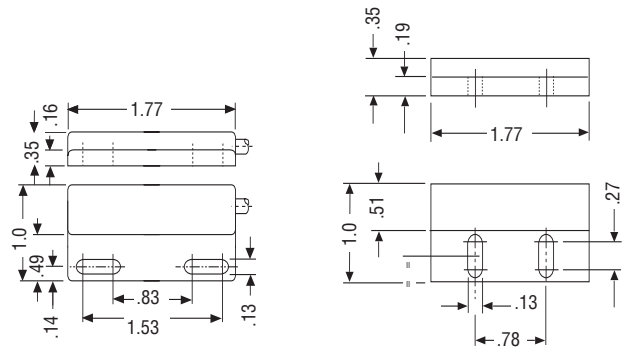
**Sensor MA-23**  
Part # 631-4223-268

**Magnet T-62 N/S**  
Part # 630-1262-039



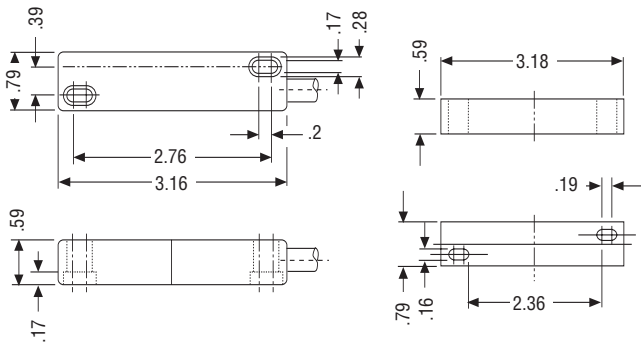
**Sensor MA-11**  
Part # 631-1211-541

**Magnet TK-11-11**  
Part # 630-2111-047



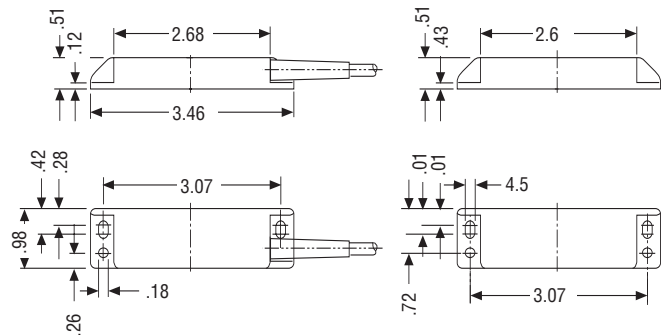
**Sensor MA-45**  
Part # 631-1245-539

**Magnet TK-45**  
Part # 630-2145-048



**Sensor MA-12**  
Part # 631-4212-217

**Magnet TK-21-12**  
Part # 630-2121-030



**Sensor MA-42**  
Part # 631-4242-533

**Magnet TK-42**  
Part # 630-2142-049

## Mounting Instructions for Mounting a Magnetic Sensor on Ferrous Materials

If a magnet and magnetic sensor are mounted on ferrous materials, the specified sensing distance will be reduced. To ensure good operation, the magnet and switch should be a minimum of 0.6 inch from the ferrous material.

Sensor and Magnets are purchased independently.

# Sensor Controls

## Description

The Warner Electric range of sensor controls are designed to aid the use of sensors in fulfilling applications by adding an extra dimension to a sensor's capability.

These controls act as a simple interface to allow the output signal of the sensor to be converted from a solid state transistor to a relay.

All controls offered have 110 VAC input voltage capability and, in the case of the MCS-149/814 'plug-in' modules are available with added timing and counting features. (see note 1 below)

All the MCS-680 Series controls are 'DIN-rail' mount, with the MCS 680-1 being the only control to offer a programmable timing circuit as standard. (see note 2 below)



## Control Selection

Model Part Number	MCS-149/814 6210-448-003	MCS-680 7500-448-008	MCS-680-1 7500-448-009	MCS-680-3 651-2101-045
Function	1 x Input 1 x Output	1 x Input 1 x Output	1 x Input 1 x Output	1 x Input 1 x Output
Operating Voltage	120 VAC	120/240 VAC	120/240 VAC	120 VAC
DC Output	12V at 250 mA	12V at 90 mA	12V at 90 mA	10-20 VDC
Input Signal Accepted	NPN	NPN	NPN	NPN or PNP
Output Relay	MCS-814 7 Amp DPDT	MCS-850 5 Amp SPDT	MCS-850 5 Amp SPDT	1 x 10 A SPDT
Timing Functions	Optional (note 1)	N/A	integral (note 2)	N/A
Operating Temperature	-30°F to 140°F	-4°F to 140°F	-4°F to 140°F	-4°F to 140°F
Mounting	4 Mounting Holes	TS 35 DIN Screw Mount	TS 35 DIN Screw Mount	TS 35 DIN
NEMA Rating	NEMA 12	NEMA 1	NEMA 1	NEMA 1

### MCS-149/814 (Note 1)

Plug-in Modules (Order Separately)

#### Timer Modules

Model	Part Number	Timing Range
MCS-836	7400-448-024	0.4 to 15 seconds
MCS-836-1	7400-448-029	1 to 30 seconds

#### Timing Functions (Programmable)

Delay Pull, Delay Drop, Dual Delay, One-Shot, One-Shot Drop, Delayed One-Shot, Delayed One-Shot Drop

#### Counter Modules

Model	Part Number	Switching Type
MCS-831	7400-448-019	1 to 99
MCS-832	7400-448-020	1 to 9999

#### Output Module (Supplied as Standard)

Model	Part Number	Switching Type
MCS-814	7410-448-008	DPDT 7 Amp

### MCS-680-1 (Note 2)

#### Timer Functions (Integrated)

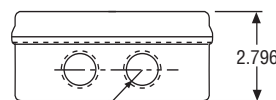
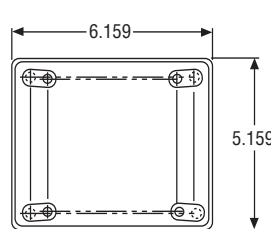
Delay Pull / Delay Drop / One Shot

Timing Range - 0.1 to 10 seconds

#### Output Relay (Supplied as Standard)

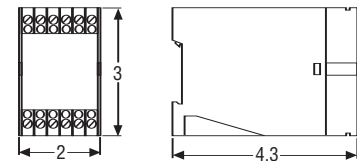
Model	Part Number	Switching Type
MCS-850	7150-101-016	SPDT 5 Amp

## Mechanical Drawing (Dimensions are in inches)

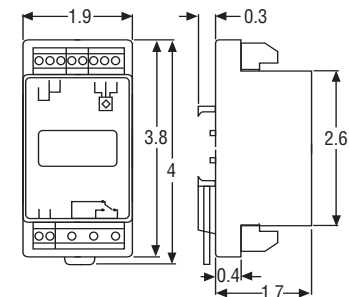


3/4-14 NPSM x .431

**MCS-149/814**



**MCS-680-1/2**



**MCS-680-3**

# Limit Switches

## Thermoplastic International Style



### Body Style Ti2

- Insulating plastic housing and integral cover
- Mounting and dimensions conform to DIN EN 50047
- Actuator head position can be changed in 90° increments
- Contacts galvanically isolated
- One cable entry point
- Conduit adapter or cord grip provided
- Manufactured per IEC 947-5-1 and VDE 0660 T200
- UL, CSA and BG approved
- Can be used as component in safety applications

**Enclosure Body:** PBT, Glass Fiber Reinforced (UL 94-V0)  
**Enclosure Cover:** PA6.6 (Black)  
**Protection Class:** NEMA 4  
**Mechanical Life:** 3 x 10<sup>6</sup>  
**Temperature:** -22°F to + 176°F  
**Switch Rate:** 100 per minute max.

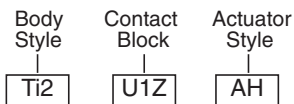
### Contact Block Technical Data

Type	Contacts	Action	Forced Disconnect	Voltage (max.)	Current (max.)
U1Z	1 N.C. 1 N.O.	Slow	Yes	250 VAC	10 A
SU1Z	1 N.C. 1 N.O.	Snap	Yes	250 VAC	10 A

#### Notes:

1. All Contact Blocks Break-Before-Make
2. Normally Closed Contacts (⊖) Forced Disconnect per IEC 947-5-1 Ch.3 (As Indicated)

### Model Identification



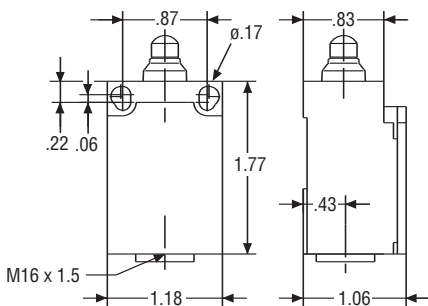
### Switch Selection

Model	Part Number
Ti2-U1 AD	608-8137-027
Ti2-U1Z AH	608-8135-021
Ti2-SU1Z AH	608-8185-022
Ti2-SU1Z FF	608-8190-040
Ti2-U1Z Hw	608-8121-015
Ti2-SU1Z Hw	608-8171-016
Ti2-U1Z w	608-8103-001
Ti2-SU1Z w	608-8153-002
Ti2-U1Z Riw	608-8117-007
Ti2-SU1Z Riw	608-8167-008

SUVA Approved for Safety Applications

### Mechanical Data

(Dimensions are in inches)

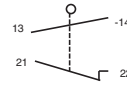


### Contact Block Wiring Details

U1Z - Slow Make-and-Break



SU1Z Snap Action

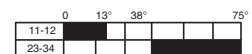
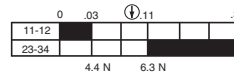


### Types of Contact Block and Action

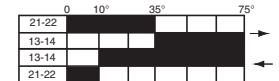
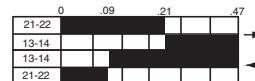
Linear Type Actuator

Rotary Type Lever

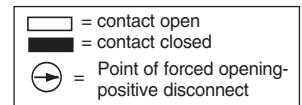
**U1Z** Break-Before-Make the NC contact opens before the NO contact closes



**SU1** Snap action → arrow indicates direction of travel



11-12, 21-22, 23-24 Indicates terminal identification for wiring.  
 Operating force shown in Newtons. Newtons x .2248 = lbs.  
 Graduation Tolerance ± 3.5°  
 Accuracy of switching point ± .009  
 Tolerance of switching pressure ± 10%



### Switching Action Explanation

#### Slow Action

- Used in precision applications for switching on and off at the exact point
- Contact closes at the same speed as actuator/lever

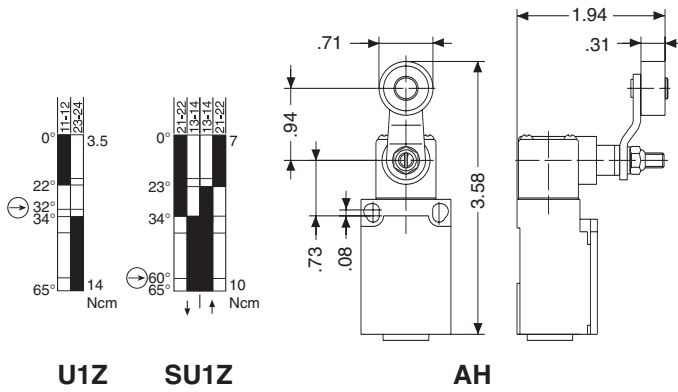
#### Snap Action

- Used when good solid contact is required
- Used with inductive loads to prevent arcing

# Mechanical Drawing Data

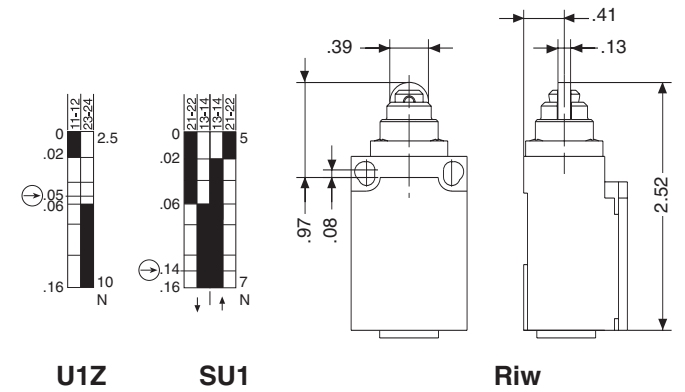
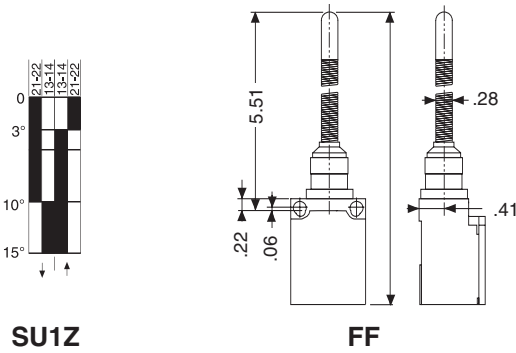
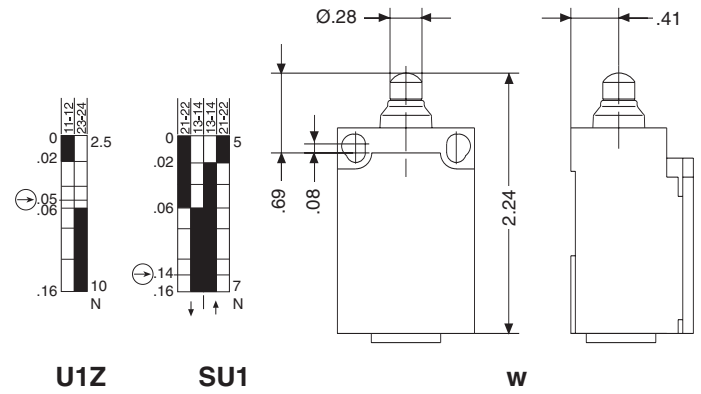
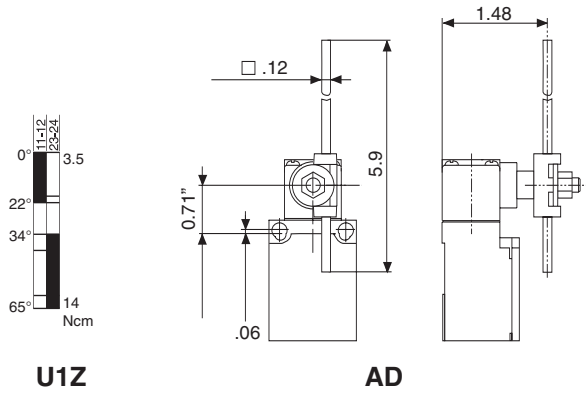
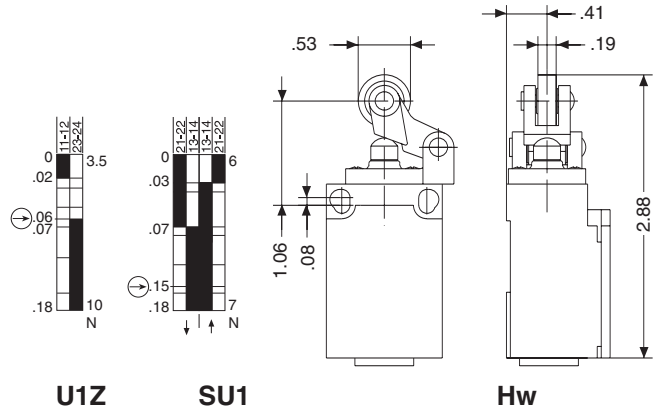
## Contact Block Data

## Mechanical Data (Dimensions are in inches)



## Contact Block Data

## Mechanical Data (Dimensions are in inches)



⊕ = Point of Forced Opening, Positive Disconnect  
 U1Z = Slow Make-and-Break with Positive Disconnect  
 SU1Z = Snap Action with Positive Disconnect



# Mechanical Limit Switches

## Thermoplastic International Style



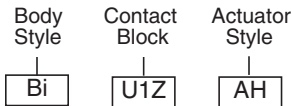
### Body Style Bi

- Insulating plastic housing and integral cover
- Mounting and dimensions conform to DIN EN 50047
- Actuator head position can be changed in 90° increments
- Contacts galvanically isolated
- Two cable entry points
- Conduit adapter or cord grip provided
- Manufactured per IEC 947-5-1 and VDE 0660 T200
- UL, CSA and SEV approved

**Enclosure Body:** PA 6 Thermoplastic (UL 94-V0)  
**Enclosure Cover:** PC Thermoplastic (UL 94-V0)  
**Protection Class:** NEMA 4  
**Mechanical Life:** 10 x 10<sup>6</sup> Cycles  
**Temperature:** -22°F to + 176°F  
**Switch Rate:** 100 per minute max.

Bi Body Style

### Model Identification



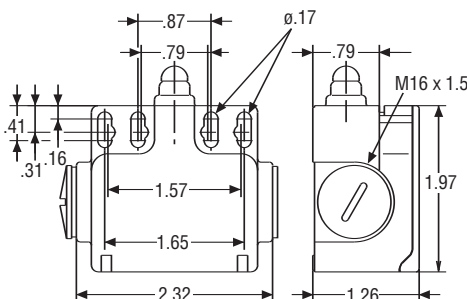
### Switch Selection

Model	Part Number
Bi-U1 AD	608-5137-007
Bi-SU1Z AH*	608-5185-012
Bi-SU1 AV	608-5186-013
Bi-SU1 FF	608-5190-015
Bi-SU1Z Hw*	608-5171-017
Bi-U1Z w*	608-5103-001
Bi-SU1Z w*	608-5153-008
Bi-U1Z Riw*	608-5117-002
Bi-SU1Z Riw*	608-5167-009

\*SUVA approved for safety applications  
 Many more styles of actuators available.  
 Contact local factory for more information.

### Mechanical Data

(Dimensions are in inches)



### Contact Block Technical Data

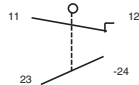
Type	Contacts	Action	Forced Disconnect	Voltage (max.)	Current (max.)
U1Z	1 N.C. 1 N.O.	Slow	Yes	500 VAC	10 A
SU1Z	1 N.C. 1 N.O.	Snap	Yes	500 VAC	10 A
SU1	1 N.C. 1 N.O.	Snap	No	500 VAC	10 A

#### Notes:

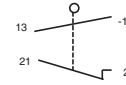
1. All Contact Blocks Break-Before-Make
2. Normally Closed Contacts Forced Disconnect per IEC 947-5-1 Ch.3 (As Indicated)

#### Contact Block Wiring Details

U1Z - Slow Make-and-Break

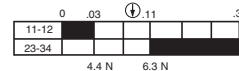


SU1Z Snap Action

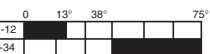


#### Types of Contact Block and Action

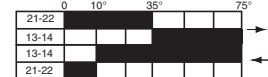
**U1Z** Break-Before-Make the NC contact opens before the NO contact closes



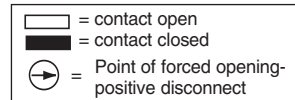
Linear Type Actuator



**SU1Z** Snap action indicates direction of travel



11-12, 21-22, 23-24 Indicates terminal identification for wiring.  
 Operating force shown in Newtons. Newtons x .2248 = lbs.  
 Graduation Tolerance ± 3.5°  
 Accuracy of switching point ± .009  
 Tolerance of switching pressure ± 10%



### Switching Action Explanation

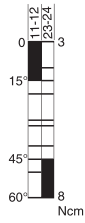
#### Slow Action

- Used in precision applications for switching on and off at the exact point
- Contact closes at the same speed as actuator/lever

#### Snap Action

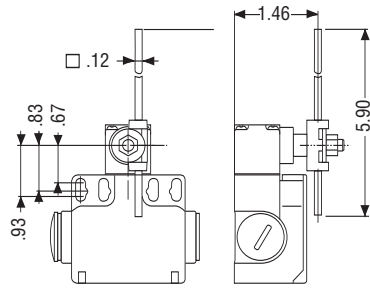
- Used when good solid contact is required
- Used with inductive loads to prevent arcing

### Contact Block Data



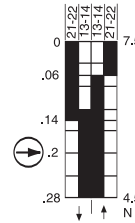
**U1**

### Mechanical Data (Dimensions are in inches)



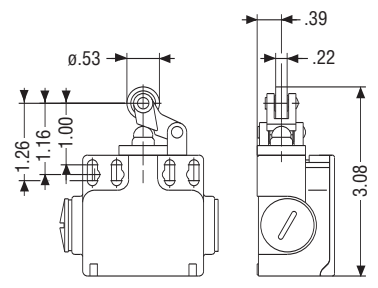
**AD**

### Contact Block Data

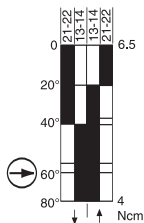


**SU1Z**

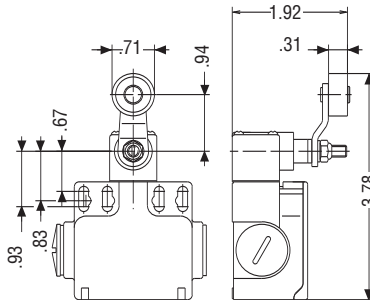
### Mechanical Data (Dimensions are in inches)



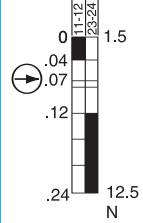
**Hw**



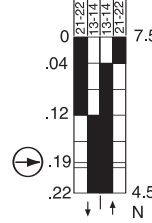
**SU1Z**



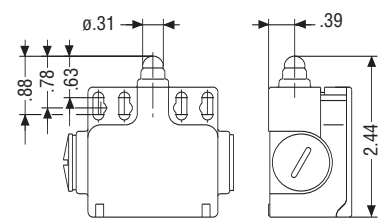
**AH**



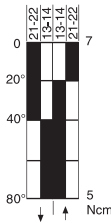
**U1Z**



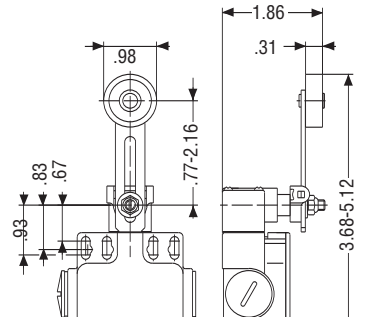
**SU1Z**



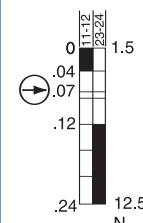
**w**



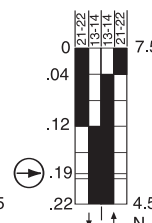
**SU1**



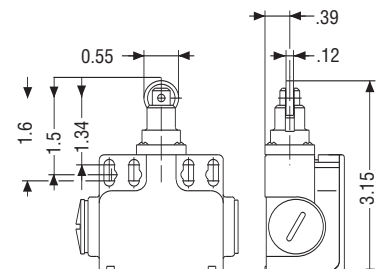
**AV**



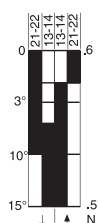
**U1Z**



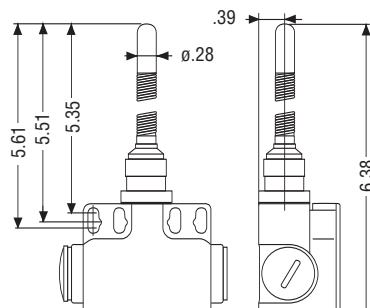
**SU1Z**



**Riw**



**SU1**



**FF**

- ⊙ = Point of Forced Opening, Positive Disconnect
- U1Z = Slow Make-and-Break
- SU1Z = Snap Action with Positive Disconnect
- SU1 = Snap Action

# Mechanical Limit Switches

## Thermoplastic International Style



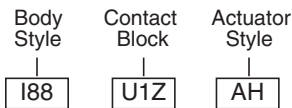
I88 Body Style

### Body Style I88

- Insulating plastic housing and integral cover
- Mounting and dimensions conform to DIN EN 50047
- Actuator head position can be changed in 90° increments
- Contacts galvanically isolated
- One cable entry point
- Conduit adapter or cord grip provided
- Manufactured per IEC 947-5-1 and VDE 0660 T200
- UL, CSA and SEV Approved

**Enclosure Body:** PA 6 Thermoplastic (UL 94-V0)  
**Enclosure Cover:** PC Thermoplastic (UL 94-V0)  
**Protection Class:** NEMA 4  
**Mechanical Life:** 10 x 10<sup>6</sup> Cycles  
**Temperature:** -22°F to + 176°F  
**Switch Rate:** 100 per minute max.

### Model Identification



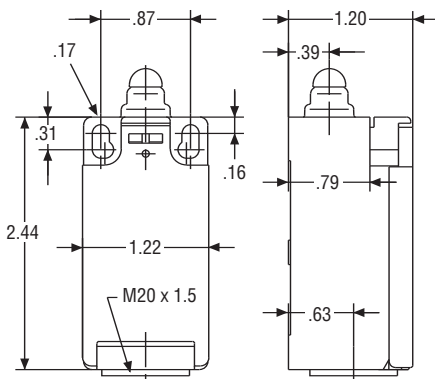
### Switch Selection

Model	Part Number
I88-SU1 AD	608-6187-042
I88-U1Z AH*	608-6135-033
I88-SU1Z AH*	608-6185-034
I88-SU1 AF	608-6139-054
I88-U1 AV	608-6136-037
I88-SU1Z Hw*	608-6171-022
I88-U1Z Hw*	608-6121-021
I88-U1Z w*	608-6103-008
I88-SU1Z w*	608-6153-012
I88-U1Z RiWk*	608-6117-017
I88-SU1Z RiWk*	608-6167-018

\* SUVA Approved for safety applications. Many more styles of actuators available. Contact local factory for more information.

### Mechanical Data

(Dimensions are in inches)



### Contact Block Technical Data

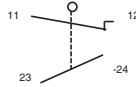
Type	Contacts	Action	Forced Disconnect	Voltage (max.)	Current (max.)
U1Z	1 N.C. 1 N.O.	Slow	Yes	500 VAC	10 A
SU1Z	1 N.C. 1 N.O.	Snap	Yes	500 VAC	10 A
SU1	1 N.C. 1 N.O.	Snap	No	500 VAC	10 A

#### Notes:

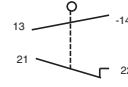
1. All Contact Blocks Break-Before-Make
2. Normally Closed Contacts (⊖) Forced Disconnect per IEC 947-5-1 Ch.3 (as indicated)

### Contact Block Wiring Details

U1Z - Slow Make-and-Break



SU1Z Snap Action

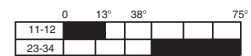
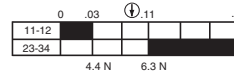


### Types of Contact Block and Action

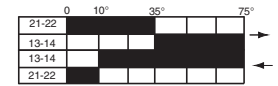
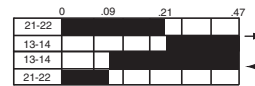
Linear Type Actuator

Rotary Type Lever

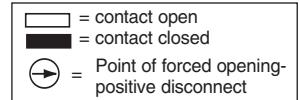
**U1Z** Break-Before-Make the NC contact opens before the NO contact closes



**SU1Z** Snap action → arrow indicates direction of travel



11-12, 21-22, 23-24 Indicates terminal identification for wiring. Operating force shown in Newtons. Newtons x .2248 = lbs. Graduation Tolerance ± 3.5° Accuracy of switching point ± .009 Tolerance of switching pressure ± 10%



### Switching Action Explanation

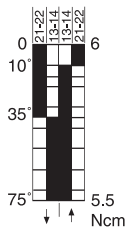
#### Slow Action

- Used in precision applications for switching on and off at the exact point
- Contact closes at the same speed as actuator/lever

#### Snap Action

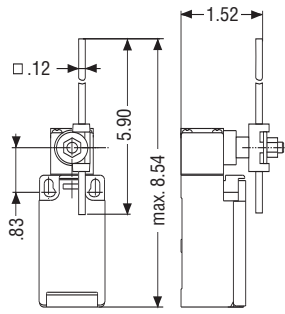
- Used when good solid contact is required
- Used with inductive loads to prevent arcing

**Contact Block Data**



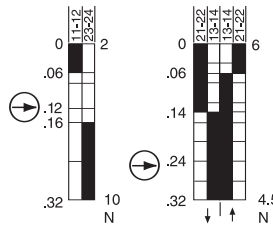
**SU1**

**Mechanical Data**  
(Dimensions are in inches)



**AD**

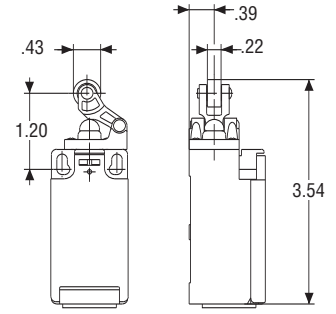
**Contact Block Data**



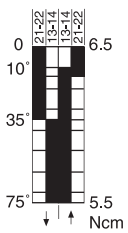
**U1Z**

**SU1Z**

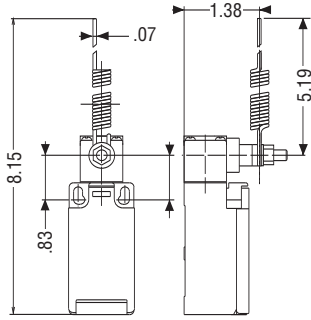
**Mechanical Data**  
(Dimensions are in inches)



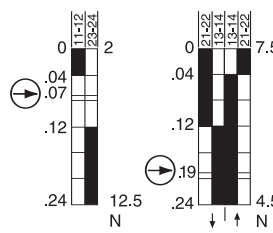
**Hw**



**SU1**

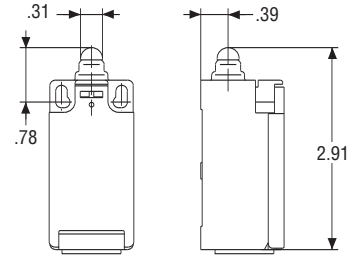


**AF**

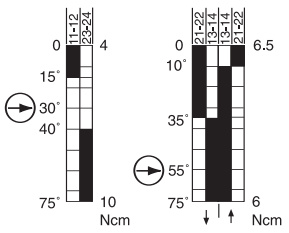


**U1Z**

**SU1Z**

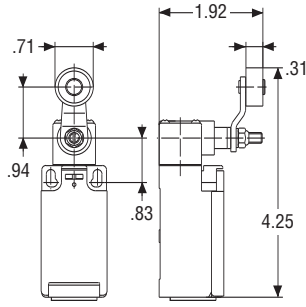


**w**

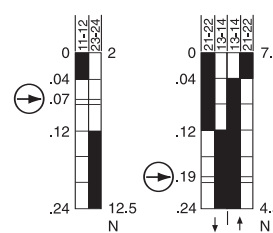


**U1Z**

**SU1Z**

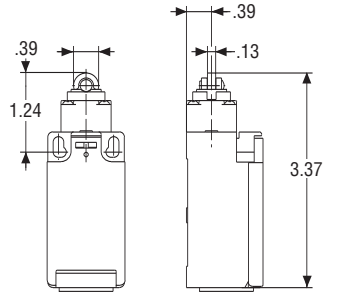


**AH**

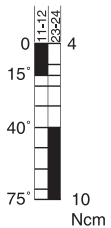


**U1Z**

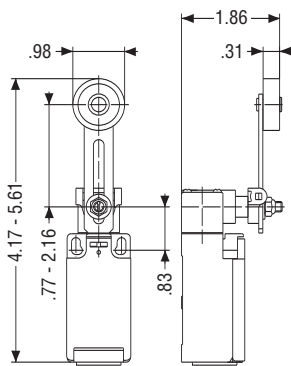
**SU1Z**



**RiWk**



**U1**



**AV**

- ⊕ = Point of Forced Opening, Positive Disconnect
- U1Z = Slow Make-and-Break
- SU1Z = Snap Action with Positive Disconnect
- SU1 = Snap Action

# Mechanical Limit Switches

## Thermoplastic International Style

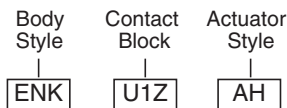


### Body Style ENK

- Insulating plastic housing and integral cover
- Mounting and dimensions conform to DIN EN 50041
- Actuator head position can be changed in 90° increments
- Contacts galvanically isolated
- One cable entry point
- Conduit adapter or cord grip provided
- Manufactured per IEC 947-5-1 and VDE 0660 T200
- UL, CSA and SEV Approved

**Enclosure Body:** PA 6 Thermoplastic (UL 94-V0)  
**Enclosure Cover:** PC Thermoplastic (UL 94-V0)  
**Protection Class:** NEMA 4  
**Mechanical Life:** 10 x 10<sup>6</sup> Cycles (UL 94-V0)  
**Temperature:** -22°F to + 176°F  
**Switch Rate:** 100 per minute max.

### Model Identification



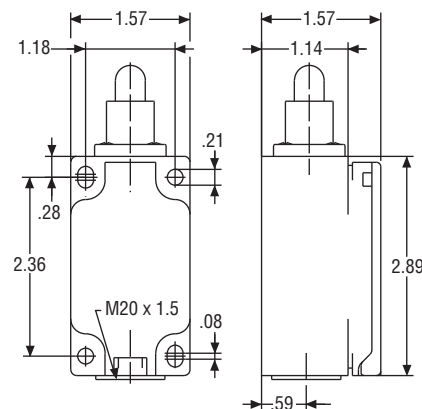
### Switch Selection

Model	Part Number
ENK-U1Z AD	608-1137-011
ENK-SU1Z AD	608-1187-017
ENK-U1Z AHS-V	608-1135-003
ENK-SU1Z AHS-V	608-1185-009
ENK-U1 AV	608-1136-012
ENK-SU1 AV	608-1186-018
ENK-SU1 FF	608-1190-045
ENK-U1Z Riw*	608-1117-002
ENK-SU1Z Riw*	608-1167-008
ENK-U1Z iw*	608-1102-001
ENK-SU1Z iw*	608-1152-007

\* SUVA Approved for safety applications. Many more styles of actuators and contact blocks available. Contact factory for more information.

### Mechanical Data

(Dimensions are in inches)



### Contact Block Technical Data

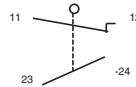
Type	Contacts	Action	Forced Disconnect	Voltage (max.)	Current (max.)
U1Z	1 N.C. 1 N.O.	Slow	Yes	500 VAC	10 A
SU1Z	1 N.C. 1 N.O.	Snap	Yes	500 VAC	10 A
SU1	1 N.C. 1 N.O.	Snap	No	500 VAC	10 A

#### Notes:

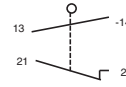
1. All Contact Blocks Break-Before-Make
2. Normally Closed Contacts (⊖) Forced Disconnect per IEC 947-5-1 Ch.3 (As Indicated)

#### Contact Block Wiring Details

U1Z - Slow Make-and-Break



SU1Z Snap Action

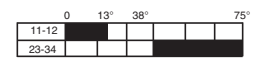
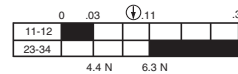


#### Types of Contact Block and Action

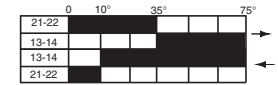
Linear Type Actuator

Rotary Type Lever

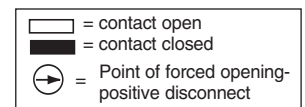
**U1Z** Break-Before-Make the NC contact opens before the NO contact closes



**SU1Z** Snap action → arrow indicates direction of travel



11-12, 21-22, 23-24 Indicates terminal identification for wiring. Operating force shown in Newtons. Newtons x .2248 = lbs. Graduation Tolerance ± 3.5° Accuracy of switching point ± .009 Tolerance of switching pressure ± 10%



### Switching Action Explanation

#### Slow Action

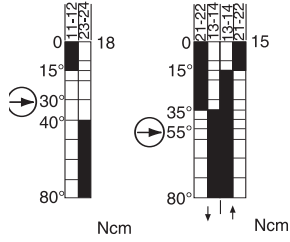
- Used in precision applications for switching on and off at the exact point
- Contact closes at the same speed as actuator/lever

#### Snap Action

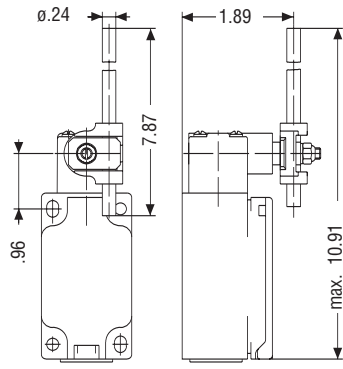
- Used when good solid contact is required
- Used with inductive loads to prevent arcing

**Contact Block Data**

**Mechanical Data**  
(Dimensions are in inches)



**U1Z SU1Z**



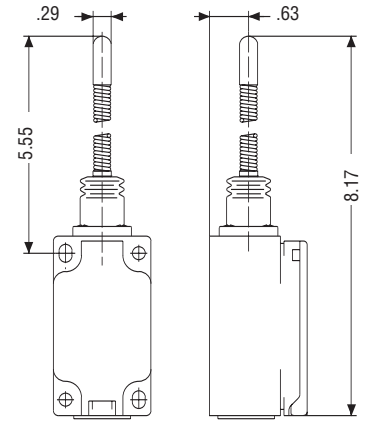
**AD**

**Contact Block Data**

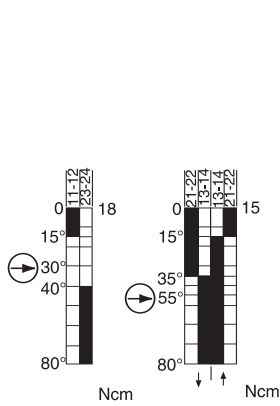
**Mechanical Data**  
(Dimensions are in inches)



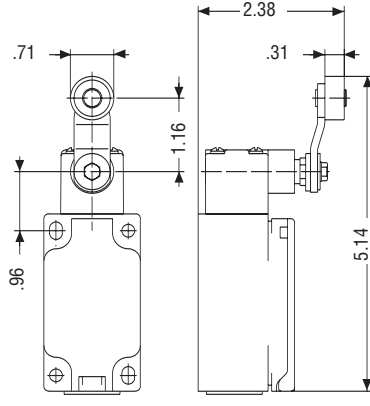
**SU1**



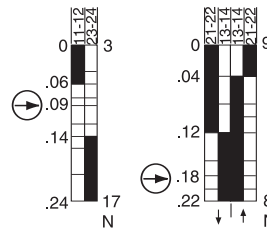
**FF**



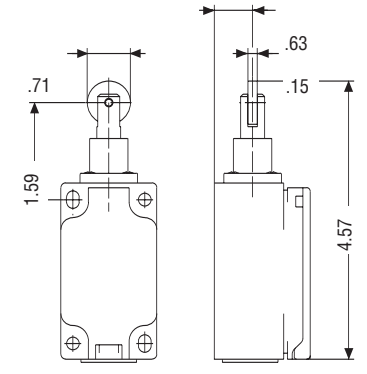
**U1Z SU1Z**



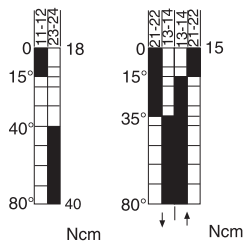
**AHS-V**



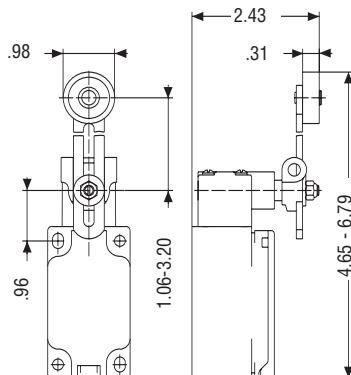
**U1Z SU1Z**



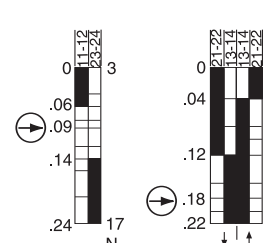
**Riw**



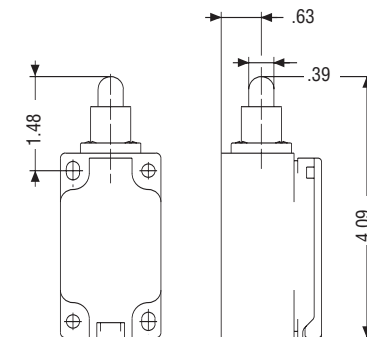
**U1 SU1**



**AV**



**U1Z SU1Z**



**iw**

⊕ = Point of Forced Opening, Positive Disconnect  
 U1Z = Slow Make-and-Break  
 SU1Z = Snap Action with Positive Disconnect  
 SU1 = Snap Action

# Mechanical Limit Switches

## Metal International Style

### Body Style ENM2

- Metal housing with screw down cover
- Mounting and dimensions conform to DIN EN 50041
- Actuator head position can be changed in 90° increments
- Contacts galvanically isolated
- One cable entry point
- Conduit adapter or cord grip provided
- Manufactured per IEC 947-5-1 and VDE 0660 T200
- UL, CSA and SEV approved

### Model Identification



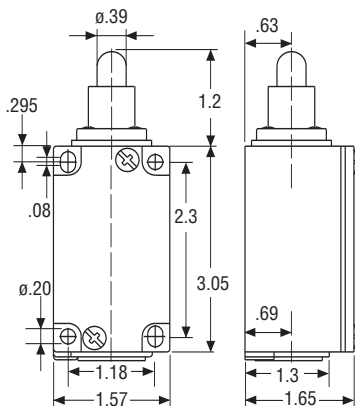
### Model Part Number

ENM2-U1Z AD	608-7137-018
ENM2-SU1Z AD	608-7387-019
ENM2-U1Z AHS-V*	608-7135-013
ENM2-SU1Z AHS-V*	608-7385-014
ENM2-U1 AV	608-7136-016
ENM2-SU1 AV	608-7386-017
ENM2-U1Z Riw*	608-7117-004
ENM2-SU1Z Riw*	608-7367-005
ENM2-U1Z iw*	608-7102-001
ENM2-SU1Z iw*	608-7352-002
ENM2-U1Z DGHw	608-7121-007
ENM2-SU1Z DGHw	608-7371-008
ENM2-U1Z DGKw	608-7127-010
ENM2-SU1Z DGKw	608-7377-011

\* SUVA approved for safety applications. Many more styles of actuators and contact blocks available. Contact factory for more information.

### Mechanical Data

(Dimensions are in inches)



ENM2 Body Style

**Enclosure Body:** Metal  
**Enclosure Cover:** Metal  
**Protection Class:** NEMA 4  
**Mechanical Life:** 10 x 10<sup>6</sup> Cycles  
**Temperature:** -22°F to + 176°F  
**Switch Rate:** 100 per minute max.

### Contact Block Technical Data

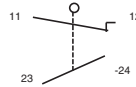
Type	Contacts	Action	Forced Disconnect	Voltage (max.)	Current (max.)
U1Z	1 N.C. 1 N.O.	Slow	Yes	400 VAC	10 A
SU1Z	1 N.C. 1 N.O.	Snap	Yes	400 VAC	10 A
SU1	1 N.C. 1 N.O.	Snap	No	400 VAC	10 A

#### Notes:

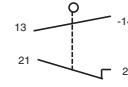
1. All Contact Blocks Break-Before-Make (in metal housing - replaceable)
2. Normally Closed Contacts Forced Disconnect per IEC 947-5-1 Ch.3 (as indicated)

### Contact Block Wiring Details

U1Z - Slow Make-and-Break



SU1Z Snap Action

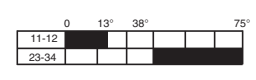
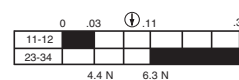


### Types of Contact Block and Action

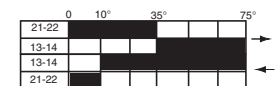
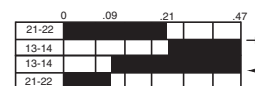
Linear Type Actuator

Rotary Type Lever

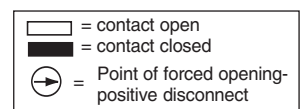
**U1Z** Break-Before-Make the NC contact opens before the NO contact closes



**SU1Z** Snap action indicates direction of travel



11-12, 21-22, 23-24 Indicates terminal identification for wiring. Operating force shown in Newtons. Newtons x .2248 = lbs. Graduation Tolerance ± 3.5° Accuracy of switching point ± .009 Tolerance of switching pressure ± 10%



### Switching Action Explanation

#### Slow Action

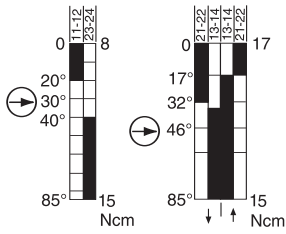
- Used in precision applications for switching on and off at the exact point
- Contact closes at the same speed as actuator/lever

#### Snap Action

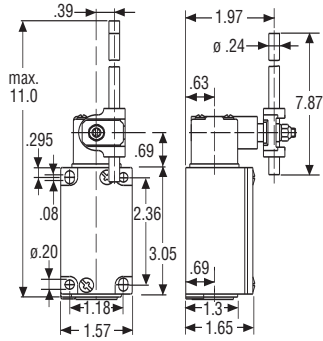
- Used when good solid contact is required
- Used with inductive loads to prevent arcing

**Contact Block Data**

**Mechanical Data**  
(Dimensions are in inches)



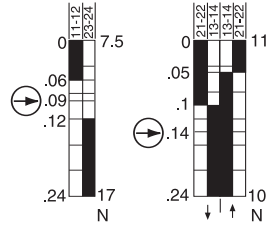
**U1Z SU1Z**



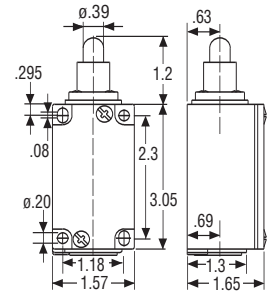
**AD**

**Contact Block Data**

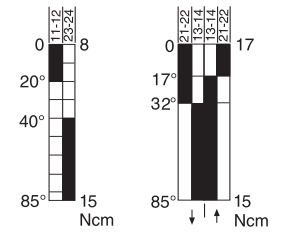
**Mechanical Data**  
(Dimensions are in inches)



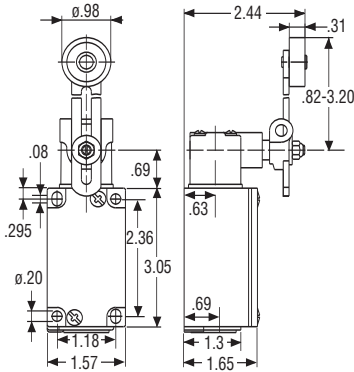
**U1Z SU1Z**



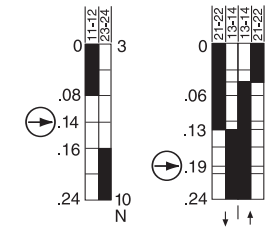
**lw**



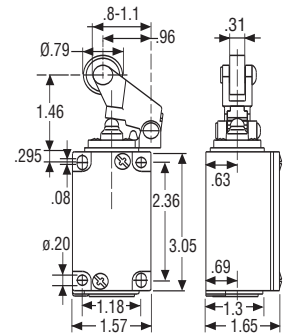
**U1 SU1**



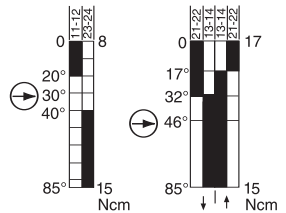
**AV**



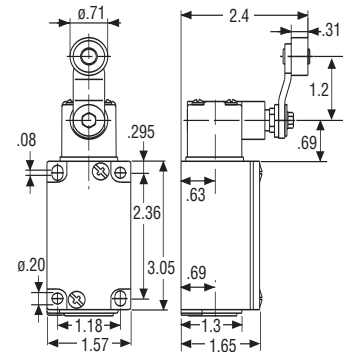
**U1Z SU1Z**



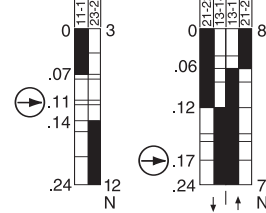
**DGHw**



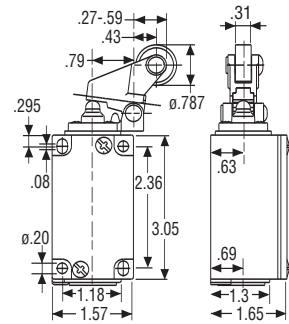
**U1Z SU1Z**



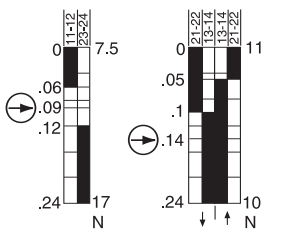
**AHS-V**



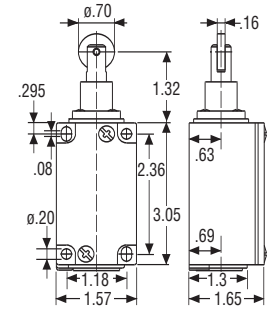
**U1Z SU1Z**



**DGKw**



**U1Z SU1Z**



**Riw**

■ Closed  
□ Open

⊙ = Point of Forced Opening, Positive Disconnect

U1Z = Slow Make-and-Break

SU1Z = Snap Action with Positive Disconnect

SU1 = Snap Action



# Heavy Industrial Foot Switches

## Single / Two / Three Pedal

### with and without Protective Guard

#### Operational Modes Available

**Momentary:** Press pedal to start process. Remove foot and allow pedal to spring back to initial position and process to stop.

**Maintained:** Press pedal once to start process. Press pedal again to stop process.

**Proportional Output:** When the pedal is pressed, the output is proportional to the movement of the 10 K Ohm, 2 Watt potentiometer.

**Anti-Trip:** The Anti-Trip lever is an additional safety feature allowing the pedal to be activated only when the lever has been pushed forward.



#### Specification Overview

##### Mechanical Features:

- Case Material:** Aluminum die cast
- Protective Guard:** Aluminum die cast
- Actuator:** Foot lever
- Ambient Air Temperature:** -22° F to 176° F
- Switch Action:** Dependent upon switch selected
- Contacts:** Dependent upon switch selected
- Mechanical Life:** 10 x 10<sup>6</sup> for on/off version switch operations
- Switching Frequency:** 50 times per minute
- Mounting:** Free standing on rubber bumpers
- Terminals:** 4 screw terminals per contact block (replaceable)
- Cable Entries:** All switches supplied with 1/2" conduit adapter
- Weight:** Approximately - F1 types 1.5 Kg. (3.3 lbs.)

##### Electrical Features:

- Maximum Voltage:** 500V AC
- Enduring Current:** 20 Amps
- Inrush Current:** Per IEC 947-5-1, AC 15, DC 13
- Standards:** According to VDE 0660, 0113 IEC 947-5-1
- Protection Class:** NEMA 4, according to DIN 40 050
- UL/CSA Approved:** 10 Amp, 300 VAC, A300 (same polarity)

Type and Construction	Operating Mode	Contact Block	Model	Part Number	Drawing
Single Pedal	Momentary	1 N.O. - 1 N.C.	F1-SU1Z	606-1300-011	a
Single Pedal with Guard	Momentary	1 N.O. - 1 N.C.	F1-SU1Z UN	606-1800-012	b
Single Pedal with Guard & Anti-Trip	Momentary	1 N.O. - 1 N.C.	F1 SU1Z AT UN	616-1800-482	b
Single Pedal	Maintained	1 N.O. - 1 N.C.	F1-U1Y	606-1100-001	a
Single Pedal with Guard	Maintained	1 N.O. - 1 N.C.	F1-U1Y UN	606-1600-002	b
Single Pedal	Proportional	10K Ohm, 2W**	F1-SU1 Mi RG	616-1300-327	a
Single Pedal with Guard	Proportional	10K Ohm, 2W**	F1-SU1 Mi RG UN	616-1800-328	b
Two Pedal*	Momentary	2 x 1 N.O. - 1 N.C.	F2-SU1Z-SU1Z	606-2330-021	d
Two Pedal with Guard*	Momentary	2 x 1 N.O. - 1 N.C.	F2-SU1Z-SU1Z UN	606-2830-022	e
Three Pedal*	Momentary	3 x 1 N.O. - 1 N.C.	F3-U1Z-U1Z-U1Z	606-3111-025	f
Three Pedal with Guard*	Momentary	3 x 1 N.O. - 1 N.C.	F3-SU1Z-SU1Z-SU1Z UN	606-3833-045	g

\* On multi-pedal switches, each pedal operates independently.

\*\*Contacts rated at 5 amps

See page 40 of catalog for data on the Safety Foot Switch. F1-SU1Z/UV1DUN Part # 616-1000-203

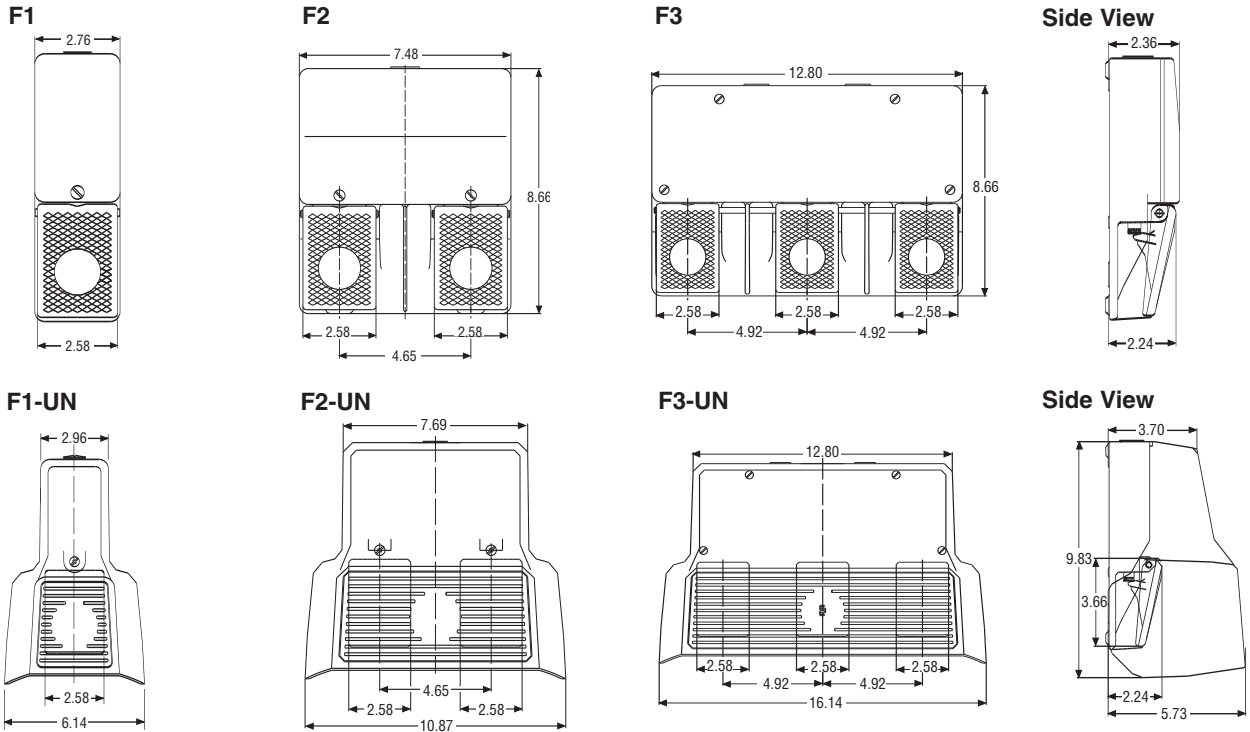
Other special versions available include, Foot Switches for Medical Applications and Foot Switches for use in explosive areas, these foot switches can be designed and manufactured to order.



#### Safety Foot Switches

Safety Foot Switches are “enabling devices” that are generally used on machinery where the operator needs to be able to immediately interrupt any given process in order to avoid bodily harm. Safety Foot Switch on Page 40.

## Mechanical Data (Dimensions are in inches)



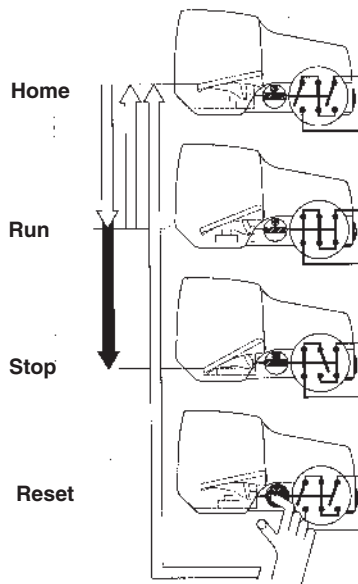
## SAFELOCK Safety Foot Switch

A safety foot switch is based on the operation of a standard type momentary action switch, with an additional safety latching switch mechanism.

The machine will only operate when the foot switch pedal is pushed down. Releasing the pedal or applying overpressure on the pedal will stop the machine. The foot switch locks in the emergency stop position when pushed through the secondary switch. To prevent accidental restarts, it must be manually reset.

- Rugged, heavy duty, metal housing
- Forced disconnect of the N.C. contact
- Contacts galvanically isolated
- Three cable entry points
- Cord grip provided
- UL, CSA, SEV and BG Approved

**Model:** F1-SU1Z/UV1 DUN  
**Part Number:** 616-1000-203  
**Enclosure:** Die Cast Aluminum  
**Contacts:** 1 Normally Closed  
 ⊕ Forced Disconnect per IEC 947-5-1 Ch. 3  
 2 Normally Open  
**Voltage Rating:** 500 VAC (max.)  
**Current Rating:** 10 A (max.)  
**Protection Class:** NEMA 4  
**Mechanical Life:** 10 x 10<sup>6</sup> Cycles  
**Temperature:** -22°F to +176°F  
**Switch Rate:** 50 per minute max.



**Home Position** - Operating Contacts Open

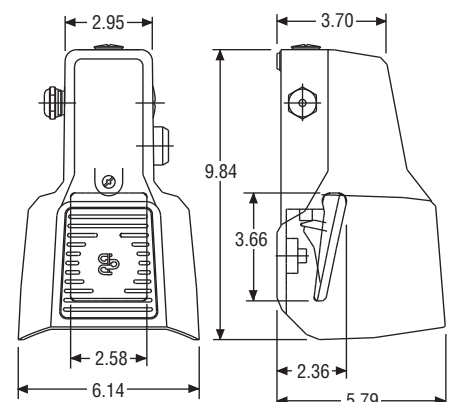
**Run Position** - Operating Contacts Closed

**Emergency Stop** - Safety Contact Open  
(Foot switch locks in emergency position until manually reset)

**Manual Reset** - Operation now back to home position



(Dimensions are in inches)



# SAFELOCK

## Safety Switches

Warner Electric offers a large selection of different styles of safety switches. All of the safety switches carry the “CE” mark and are manufactured to all relevant European and International Safety Standards such as, the Machine Directive 89/392/EEC, IEC 947-5, as well as other sub-standards that pertain to specific types of machinery and/or safety installations.



### Safety Interlock Switches

Safety Interlock Switches are generally used on the guarding (i.e. protective doors/covers) of industrial machinery, such as test and assembly or packaging machinery in order to shield operators from potential injuries that could result due to unauthorized access.



### Solenoid Locking Switches

Solenoid Locking Switches are typically used in applications that require guarding for machines that have coasting rundown cycles after the power supply has been turned off. Application examples include robotic cells, sawmills, as well as stamping presses.



### Hinge Interlock Switches

Actuator arms VKS, VKWRE and VKWLI give the user the opportunity to install them as permanently mounted operational arms on flaps and covers or in the case of the AHDB styled actuator to be directly connected to a hinge point of a rotating shaft. The normally closed safety contacts will open after 10 degrees of movement.



### Safety Hinge Switches

Safety Hinge Switches are load bearing hinges with the safety contact mounted internally. They are designed for mounting onto extruded aluminum profiles, steel or plastic doors, etc. The switch point of the safety contact is programmable to any point within the 180° operation angle of the switch.



### Safety Cable Pull Switches

Safety Cable Pull Switches are used in applications where large exposed areas exist that need to be secured. Application examples include large printing presses and conveyor systems. Safety Cable Pull Switches are required to operate in emergency stop installations and therefore are governed by European Standard EN 418 which governs emergency stop devices.

### Attention

#### Replacement Keys:

Replacement Keys are made available for replacement purposes only and shall not be used for other purposes such as defeating the Safety Function of any Interlock Switch. To do so may create an unsafe situation which could lead to serious injury or death.

For Replacement Keys: Please contact your local Warner Electric Distributor.

# SAFELOCK

## SKT and SKI Safety Interlock Switches with Separate Actuator



The SKT and SKI safety interlock switches slim compact design according to EN50047 are perfect for safety applications that require a particularly slim and compact switching device while still offering the same advantages, relating to safety, as all other products in this range. The principal function of the SKT and SKI safety interlock switches is to switch the machine drive off when a movable protective guard is opened or removed.

### Common Features:

- Limit Switch Design (EN 50047)
- Insulated device (IEC 60947-5-1) on all models with plastic housing
- Positive Opening safety contacts (IEC 60947-5-1)
- Rotating head allows actuator engagement from four sides or four top positions; no tools are required to rotate head

Model	Part Number	Contacts	Voltage (Max.)	Current (Max.)
SKT-U1Z M3	601-6419-059	1 NO/1 NC (U1Z)	250 VAC	10A
SKT-SU1Z M3	601-6409-060	1 NO/1 NC (SU1Z)	250 VAC	10A
SKT-A2Z M3	601-6469-066	2 NC (A2Z)	250 VAC	10A
SKT-SA2Z M3	601-6469-067	2 NC (SA2Z)	250 VAC	10A
SKI-U1Z M3	601-6819-052	1 NO/1 NC (U1Z)	250 VAC	10A
SKI-SU1Z M3	601-6809-057	1 NO/1 NC (SU1Z)	250 VAC	10A
SKI-A2Z M3	601-6869-056	2 NC (A2Z)	250 VAC	10A
SKI-UV15Z M3	601-6869-058	2 NC/1 NO (UV15Z)	400 VAC	6A

### Model Identification

Body Style

SKT = 3.27" tall  
SKI = 3.94" tall

Contact Block

U1Z = 1 NC/1 NO Slow Action  
SU1Z = 1 NC/1 NO Snap Action  
A2Z = 2 NC Slow Action  
SA2Z = 2 NC Snap Action  
UV15Z = 2 NC/1 NO Slow Action Make before Break  
Z = Forced Disconnect per IEC 60947-5-1

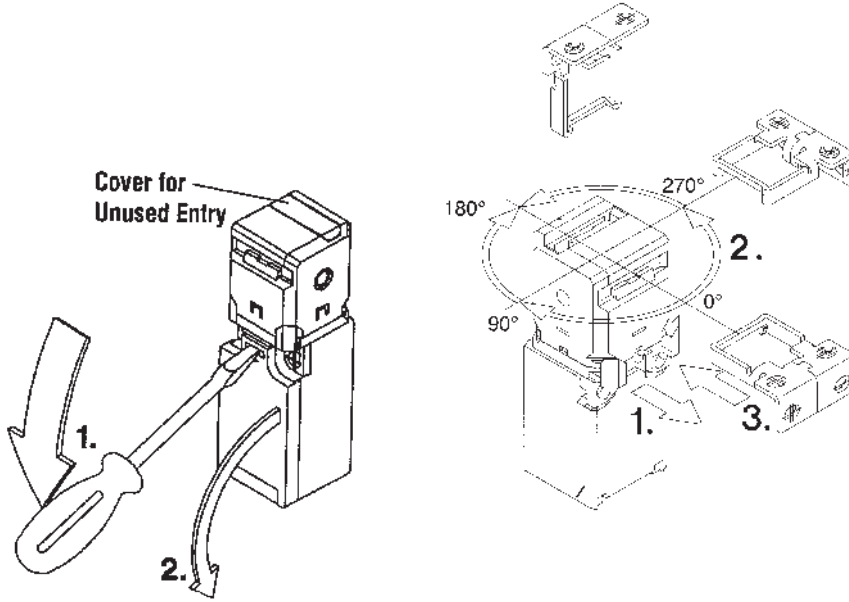
Actuator Style

M3 = Stainless Steel Actuator  
For other styles contact factory

### Other Specifications

Max Switching Speed	30 operations per minute
Max Actuator Speed	1 meter per second
Minimum Actuator Radius	150 mm (6 inches)
Contact Material	Silver-nickel alloy
Actuator Extraction Force	12 Newtons (2.6 lbs.)
Mechanical Life	1 million operations
Operating Temperature	-30° to +80°C (-22° to +176°F)
Construction	Glass fiber-reinforced polyamide thermoplastic housing UL94-VO rating
Environmental Rating	NEMA 4/IP65
Certifications	CE CSA UL BG
Weight	SLT = .26 lb. SLI = .29 lb.

# SKT and SKI Operational Features



## Features

### Easy Access

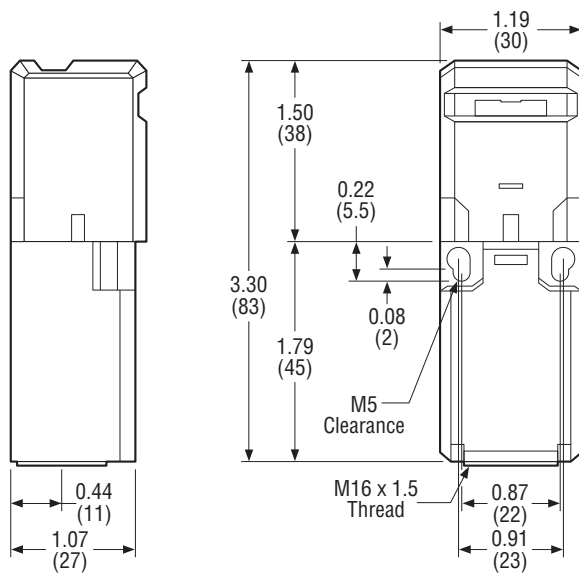
The wiring chamber is accessed via a hinged door. Simply insert a flat-blade screwdriver, as shown, and pry gently down to open.

### Rotating Actuator Head

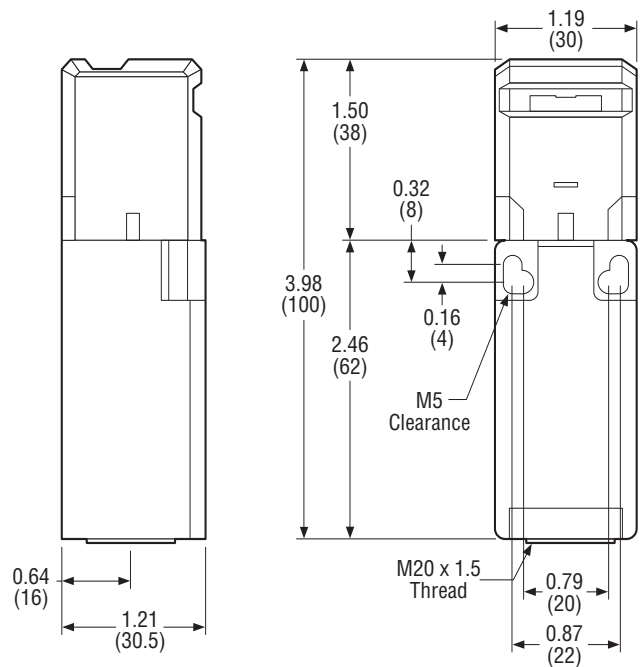
The actuator head may be rotated in 90° increments to create eight possible actuator engagement locations. To rotate the head, pull the holding clamp forward, rotate the head to the desired position, and push the holding clamp back into lock.

## SKT Dimensions

inches (mm)



## SKI Dimensions



# SAFELOCK

## SK and SKC Safety Interlock Position Switches with Separate Actuator

### Description

The SK and SKC safety position switches offer outstanding performance in personal protective functions.

Constructional safety features of these models have been implemented according to DIN EN 60947-5-1 and test principle GS-ET 15.

The principle function of the SK and SKC safety position switches is to switch the machine drive off when a movable protective guard is opened or removed.

The SKC series is ideal for space limited applications since its overall length is just 2.85 inches (75 mm). A standard SK switch is 3.55 inches (90 mm) long.



SKC



SK

### Common Features

<b>Safety Category:</b>	4
<b>Protection Class:</b>	NEMA 4
<b>Mechanical Life:</b>	1 x 10 <sup>6</sup> Cycles
<b>Temperature:</b>	-22°F to +176°F
<b>Switch Rate:</b>	30 per minute max.
<b>Actuator Holding Force:</b>	2.3 lbs. [10 N] other options available
<b>Enclosure:</b>	PA 6 Thermoplastic (UL 94-V0)
<b>Approvals:</b>	UL, CSA, and BG approved

Model	Part Number	Contacts	Voltage (max.)	Current (max.)	Actuator Style	Drawing
SKC-A1Z M	601-6169-039	1 N.C.	500 VAC	10 A	M	A
SK-U1Z M	601-6119-016	1 N.C., 1 N.O.	500 VAC	10 A	M	B
SK-U1Z MRH	601-6119-041	1 N.C., 1 N.O.	500 VAC	10 A	MRH	B
SK-U1Z MRV	601-6119-040	1 N.C., 1 N.O.	500 VAC	10 A	MRV	B
SK-UV15Z M	601-6169-026	2 N.C., 1 N.O.	400 VAC	6 A	M	B
SK-UV15Z MRH	601-6169-064	2 N.C., 1 N.O.	400 VAC	6 A	MRH	B
SK-UV15Z MRV	601-6169-065	2 N.C., 1 N.O.	400 VAC	6 A	MRV	B
SK-UV15Z F	601-6169-063	2 N.C., 1 N.O.	400 VAC	6 A	F	B

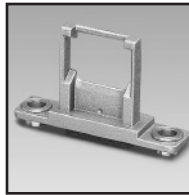
### Model Identification

Body Style    Contact Block    Actuator Style

**SK**    **U1Z**    **M**

A1Z = 1 N.C., Forced Disconnect  
 U1Z = 1 N.C., 1 N.O., Forced Disconnect  
 UV15Z = 2 N.C., 1 N.O., Forced Disconnect Make Before Break

Normally Closed Contacts  $\ominus$  Forced Disconnect per IEN EN 947-5-1 Ch. 3



**Type M Metal Actuator**  
Cast Stainless Steel



**Type F Flexible Actuator**  
Tolerates Misalignment of Guard Door



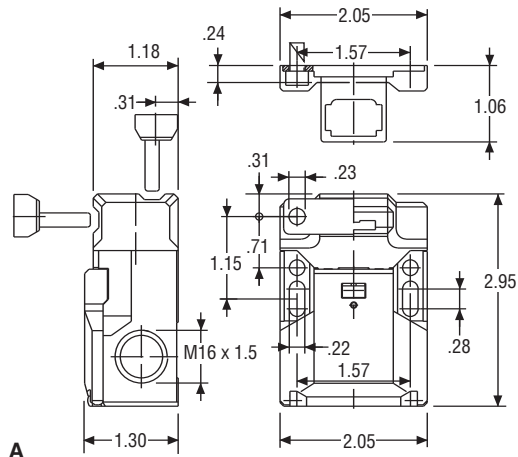
**Type MRH Horizontal Short Radius Actuator**  
Hinge Distance 2" [50 mm] Or More



**Type MRV Vertical Short Radius Actuator**  
Hinge Distance 2" [50 mm] Or More

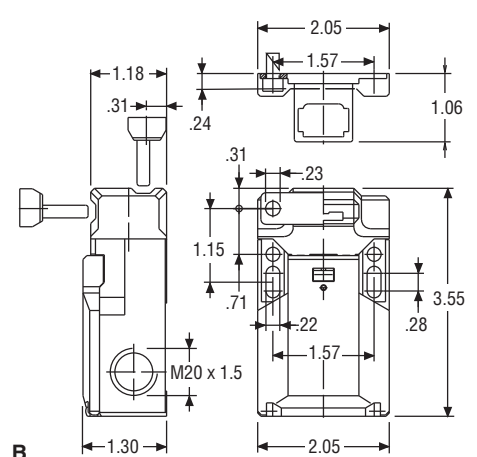
### Model SKC

(Dimensions are in inches)



### Model SK

(Dimensions are in inches)



### Non-Standard Options

- F30: Actuator holding force of 7 lbs. [30 N]
- F100: Actuator holding force of 23 lbs. [100 N]
- FE10: Actuator not retained

Other contact arrangements are also available. Consult the factory for details.

# SK and SKC Operational Features

## Easy Access

The self retained snap on cover is released by a screw driver (Fig. 1) and can be opened to an angle of 135° providing easy access to the wiring terminals (Fig. 2).

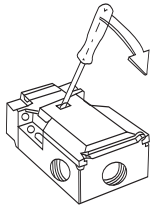


Fig. 1

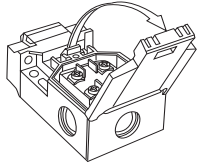
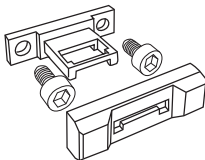


Fig. 2

## Removal Protection

A cover cap with one-way latching to seal the assembly screws prevents unauthorized removal of the actuator.



- Triple coding of the actuator for a high level of safety
- Increased functional safety through two interlocks operating independently
- Actuator mates with switch in one of four positions
- Actuator has smooth surface with no protruding sharp parts
- Forced disconnection of the N.C. contacts
- Three cable entries
- Conduit adapter provided (1/2 NPT) Cord grip available upon request
- Manufactured to DIN EN 60947-5-1, IEC 947-5-1, and test principle GS-ET 15

## Multi Directional Actuation

After opening the switch cover, the head can be removed from the top (Fig. A). After a rotation of 180° (Fig B) the head can be attached again on the enclosure and locked by the switch cover. This results in four directions of approach.

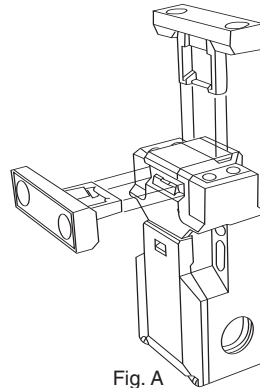


Fig. A

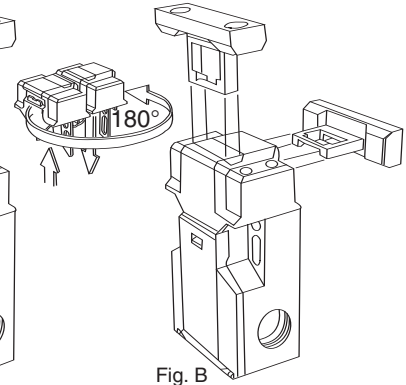


Fig. B

# GC Safety Interlock Position Switch with Separate Actuator

## Description

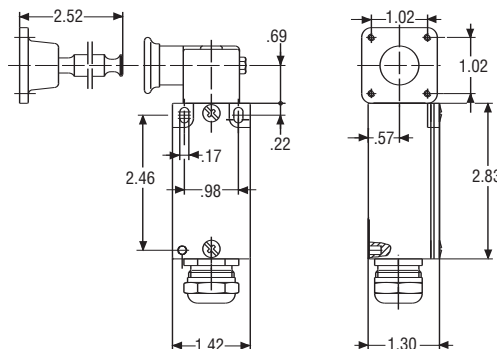
The GC Style Interlock Position Switch is a unique type of switch because of its "Pole" type actuator that fits more like a plug than the other interlock switches. The head offers a flexible spring type adjustment, making it very flexible in operation.

- Rugged, heavy duty metal housing
- Positive forced disconnection of the N.C. contacts
- Contacts galvanically isolated
- Cord grip provided
- UL, CSA, and SUVA Approved



<b>Model:</b>	<b>GC-U1Z VT 90°</b>
<b>Part Number:</b>	<b>612-1100-555</b>
<b>Enclosure:</b>	Die Cast Aluminum
<b>Contacts:</b>	1 Normally Closed ⊕ Forced Disconnect per IEC 947-5-1 Ch. 3 1 Normally Open
<b>Voltage Rating:</b>	500 VAC (max.)
<b>Current Rating:</b>	10 A (max.)
<b>Protection Class:</b>	NEMA 4
<b>Mechanical Life:</b>	25 x 10 <sup>3</sup> Cycles
<b>Temperature:</b>	-22°F to +176°F
<b>Switch Rate:</b>	10 per minute max.

(Dimensions are in inches)



# SAFELOCK

## Integral Safety Hinge Switch

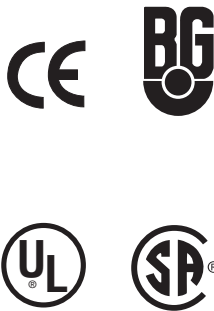
### IP 67 Metal housing

Hinged machinery guards and covers as well as safety fence doors may be found in every type of industry.

The safety hinge switch SHS is the integration of a safety switch and load bearing hinge for industrial applications.

Designed to facilitate mounting onto extruded aluminum profiles, steel or plastic doors, the slim profile of the SHS even when fully closed, allows the hinge to be readily mounted where space is constrained.

Traditional safety switches with separate actuator keys are often subject to mechanical wear, particularly when mounted on the closing edge of guards where accumulated tolerances can cause misalignment. The SHS removes this problem with the safety contact mounted internally, inaccessible to the user and therefore providing excellent tamper protection. One or more switches may be used dependent on the category of safety protection required. Matching hinges without safety contacts are also available, allowing the style to be standardized for general use. In operation, consideration must be given to the required contact operation angle, which is determined by guard size and the maximum allowable guard opening distance before actuation.



#### Safe:

- 2 SHS hinge switches each with a forced disconnect safety contact allow safety category 4 systems to be configured subject to the required risk analysis and safety contact monitoring.

#### Flexible:

- The hinge operation angle is 0-180°.
- The switch point may similarly be selected through 180°.
- AC/DC to 250 V or 60 VDC versions available.

#### Fast:

- Industry standard M12 x 1 connectors with axial and radial (rear) mounting available as well as fixed cable version.

#### Reliable:

- A cast Zinc alloy body allows the SHS a high degree of mounting freedom.
- In its hinge capacity the SHS can bear up to 750 N axially and over 1000 N radially, when the switching point has been set.
- Ingress protection to IP 67

### SHS Configuration Summary

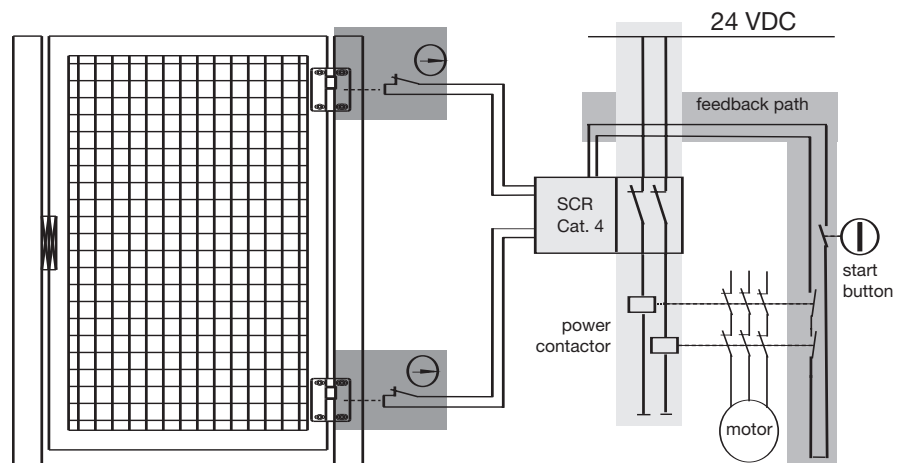
Part No.	Description	Contact Function	Type DC	Type AC/DC	Quick Disconnect		Fixed Cable		BG-Type Approval
					axial (SA)	radial (SR)	axial (KA)	radial (KR)	
601-9261-009	SHS-A1Z-SA	A1Z	—	X	Metal	—	—	—	—
601-9261-010	SHS-A1Z-SR	A1Z	X	—	—	Plastic	—	—	—
601-9261-011	SHS-A1Z-KA5	A1Z	—	X	—	—	X	—	BG
601-9261-014	SHS-A1Z-KR5	A1Z	—	X	—	—	—	X	BG
601-9261-015	SHS-A1Z-SA	A1Z	X	—	Metal	—	—	—	—
601-9261-016	SHS-A1Z-SR	A1Z	—	X	—	Metal	—	—	—
601-9261-017	SHS-A1Z-SA-BG	A1Z	—	X	Metal	—	—	—	BG
601-9261-018	SHS-A1Z-SR-BG	A1Z	—	X	—	Metal	—	—	BG
601-9291-013	SHS-OZ	Hinge without safety contact	—	—	—	—	—	—	—



# True Category 4 (EN 954-1/2)

- true electrical redundancy
- true mechanical redundant safety
- avoids mechanical common mode failure

## Installation example:



## Plug M 12 x 1 with molded cable

### Terminal code, AC/DC configuration

- 1 = green-yellow
- 2 = black
- 3 = blue

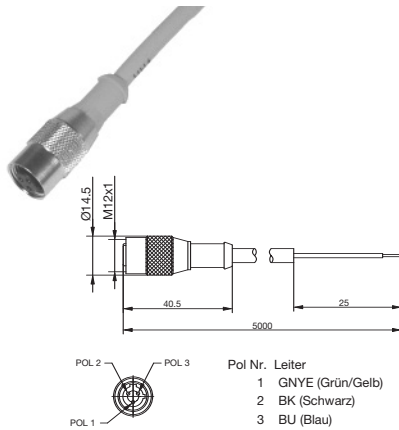
### Terminal code, DC configuration

- 1 = brown
- 2 = -
- 3 = blue
- 4 = black

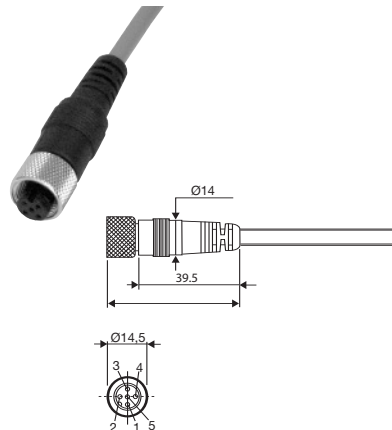
### Terminal code, AC/DC configuration

- 1 = brown
- 2 = black
- 3 = blue
- 4 = green-yellow

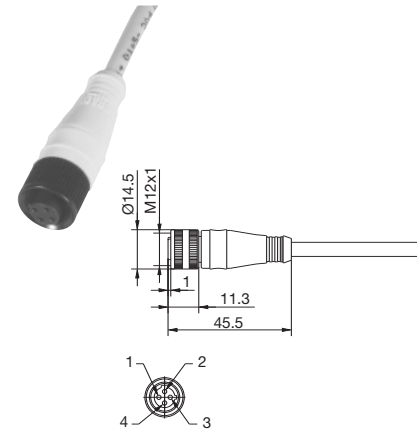
### AC/DC Configuration



### DC Configuration



### AC/DC Configuration

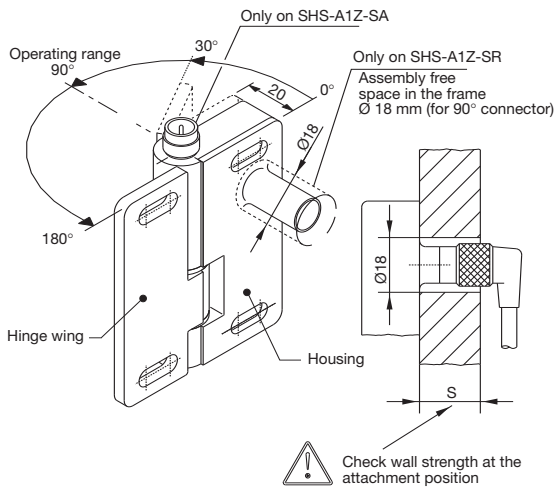


Straight line	Right-angle
on request	on request
AN-KAB.SHS 5M AC 325-1103-234	AN-KAB.SHS 5M 325-1103-236
—	—
Material of cable sleeve:	PVC (UL)/PVC (UL)
Material body/Contact carrier:	PUR (UL)/PUR (UL)
Rated voltage max.:	300 VAC
Current carrying capacity max.:	3 A
Temperature range min./max.:	-25 °C/+70 °C -13 °F/+158 °F
Cable structure mm <sup>2</sup> :	3 x 0.5
Protection class after installation:	IP 67

Straight line	Right-angle
AN-KAB.SHS 2M DC 325-1003-221	AN-KAB.SHS 2M DC 325-1003-224
AN-KAB.SHS 5M DC 325-1003-222	AN-KAB.SHS 5M DC 325-1003-225
AN-KAB.SHS 10M DC 325-1003-223	AN-KAB.SHS 10M DC 325-1003-226
Material of cable sleeve:	PVC/PVC
Material body/Contact carrier:	PUR/PUR
Rated voltage max.:	60 VAC/75 VDC
Current carrying capacity max.:	1.5 A
Temperature range min./max.:	-25 °C/+70 °C -13 °F/+158 °F
Cable structure mm <sup>2</sup> :	3 x 0.34
Protection class after installation:	IP 67

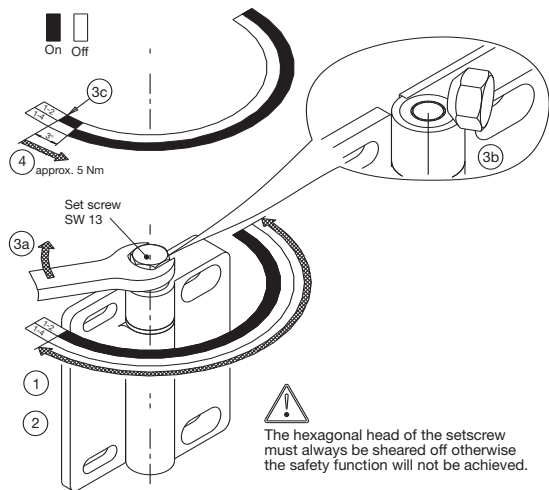
Straight line	Right-angle
—	—
AN-KAB.SHS 5M AC 325-1004-219	AN-KAB.SHS 5M AC 325-1004-220
—	—
Material of cable sleeve:	PVC/PVC
Material body/Contact carrier:	PUR/Nylon 6.6
Rated voltage max.:	300 VAC
Current carrying capacity max.:	4.0 A
Temperature range min./max.:	-5 °C/+70 °C +23 °F/+158 °F
Cable structure mm <sup>2</sup> :	4 x 0.34
Protection class after installation:	IP 68

# Safety Hinge Switch Operation and Set Point Programming

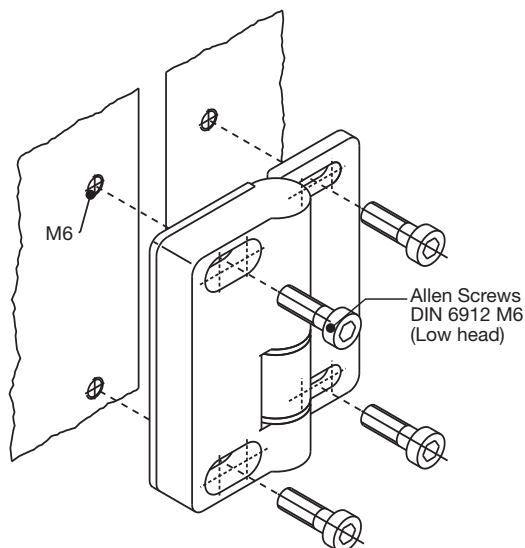


For proper installation the procedure below must be followed.

- SHS without switching point set shall be mounted under no load condition on the guard.
- SHS switching point shall be set in one successive procedure.
- The guard shall be moved only after properly setting the switch point.
- Finally, the set SHS shall be completely fixed on the guard.



- The guard door must turn freely through the total operating range.
- Fix the guard door in the closed position.
  - Tighten the setscrew with a box spanner (SW13/max. 20 mm) until resistance is met.
  - Continue until the setscrew shears. (Md = 25Nm)
  - The set point for the switching angle is now fixed.
- An increased actuation force (torque approx. 5 Nm) is required during the first use of the guard.



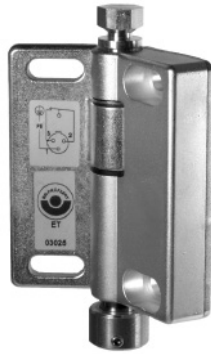
## Operating angle

0° - 30° = Allen Screw DIN 6912 necessary without washer in the hinge wing

30° - 180° = Allen Screw DIN 912 permissible washer DIN 125 in the hinge wing

# SAFELOCK

## SHS Hinge Switches



Designation

**Part number**

Contact diagram

Forced disconnect to

IEC 947-5-1 annex k

Za: non-galv. separated contact

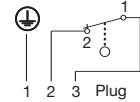
Zb: galv. separated contact

Slow make and break/snap action

Sealed internally (iw)/ externally (w)

SHS-A1Z-SA-BG

**601-9261-017**



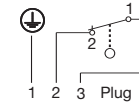
⊖ C

●/-

iw

SHS-A1Z-SR-BG

**601-9261-018**

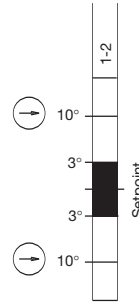
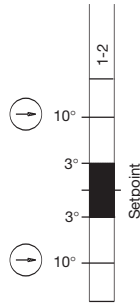


⊖ C

●/-

iw

Switch angle degrees  
Tol. +1, 5°  
-1, 0°

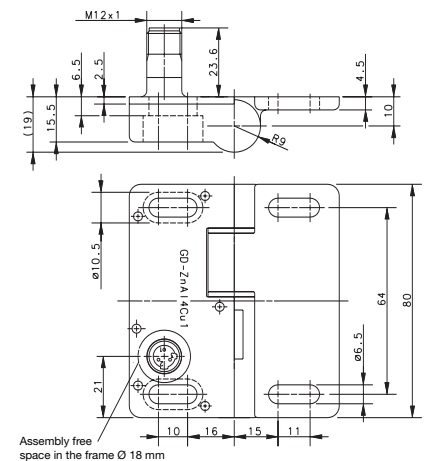
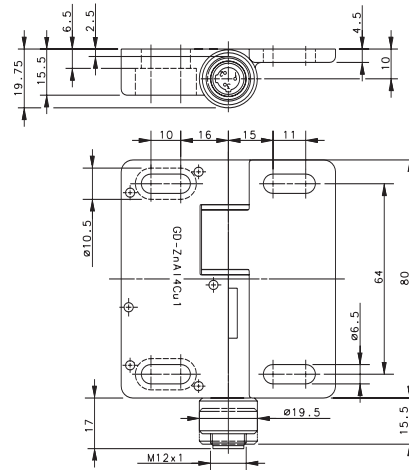
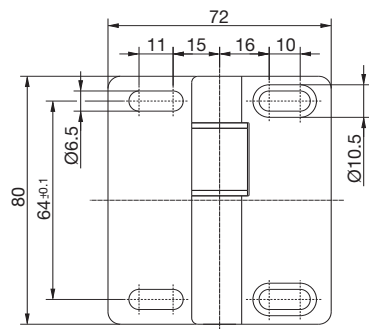


Switching hysteresis: -1.0°

Voltage	max.	250 VAC
Thermal current	max.	3A
Utilization category per IEC 947-5-1 AC 15/DC 13		60 V/0.5 A 230 VAC/1.5 A
Switching frequency	max.	1200/h
Mechanical life - switching operations		1 x 10 <sup>6</sup>
Operating temperature	min./max.	-25 °C/+70 °C -13 °F/+158 °F
Approvals		BG, UL and CSA
Weight		0.4 kg
Delivery: ex-stock/built to order		●/-

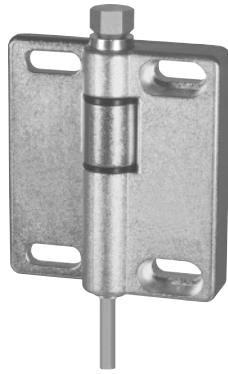
Voltage	max.	250 VAC
Thermal current	max.	3A
Utilization category per IEC 947-5-1 AC 15/DC 13		60 V/0.5 A 230 VAC/1.5 A
Switching frequency	max.	1200/h
Mechanical life - switching operations		1 x 10 <sup>6</sup>
Operating temperature	min./max.	-25 °C/+70 °C -13 °F/+158 °F
Approvals		BG, UL and CSA
Weight		0.4 kg
Delivery: ex-stock/built to order		●/-

(All dimensions in mm)



# SAFELOCK

## SHS Hinge Switches



Designation

Part number

Contact diagram

Forced disconnect to

IEC 947-5-1 annex k

Za: non-galv. separated contact

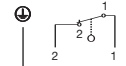
Zb: galv. separated contact

Slow make and break/snap action

Sealed internally (iw)/ externally (w)

SHS-A1Z-KA-5

601-9261-011



GNYE Fixed cable, 5 m

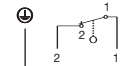
⊖ C

•/-

iw

SHS-A1Z-KR-5

601-9261-014



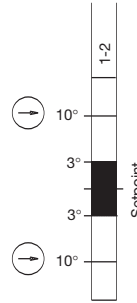
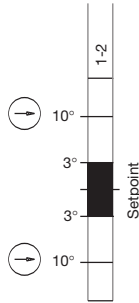
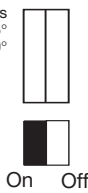
GNYE Fixed cable, 5 m

⊖ C

•/-

iw

Switch angle degrees  
Tol. + 1, 5°  
-1, 0°

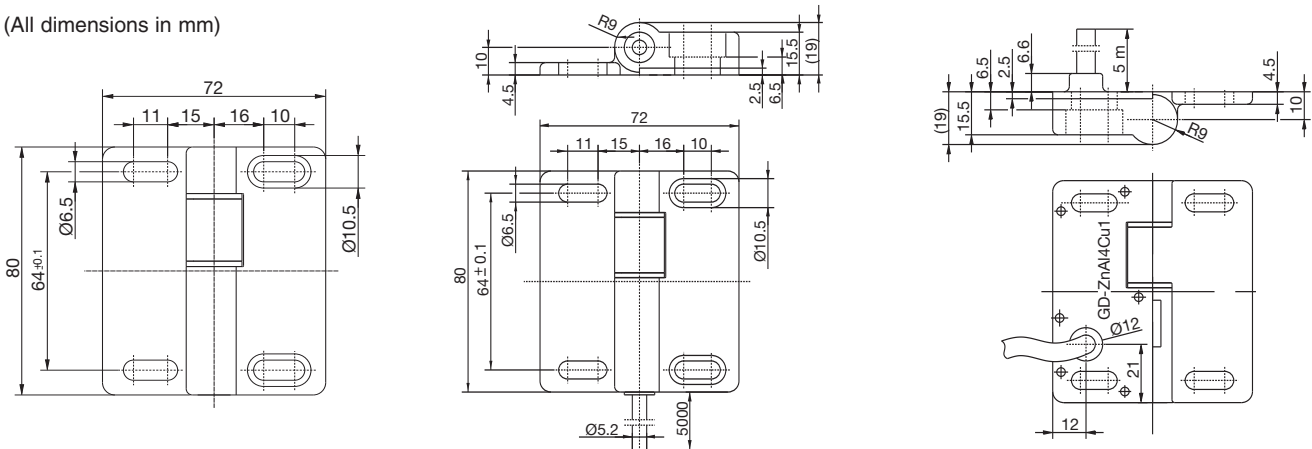


Switching hysteresis: -1.0°

Voltage	max.	250 VAC
Thermal current	max.	3A
Utilization category per IEC 947-5-1 AC 15/DC 13		60 V/0.5 A 230 VAC/1.5 A
Switching frequency	max.	1200/h
Mechanical life - switching operations		1 x 10 <sup>6</sup>
Operating temperature	min./max.	-25 °C / +70 °C -13 °F / +158 °F
Approvals		BG, UL and CSA
Weight		0.4 kg
Delivery: ex-stock/built to order		•/-

Voltage	max.	250 VAC
Thermal current	max.	3A
Utilization category per IEC 947-5-1 AC 15/DC 13		60 V/0.5 A 230 VAC/1.5 A
Switching frequency	max.	1200/h
Mechanical life - switching operations		1 x 10 <sup>6</sup>
Operating temperature	min./max.	-25 °C / +70 °C -13 °F / +158 °F
Approvals		BG, UL and CSA
Weight		0.4 kg
Delivery: ex-stock/built to order		•/-

(All dimensions in mm)

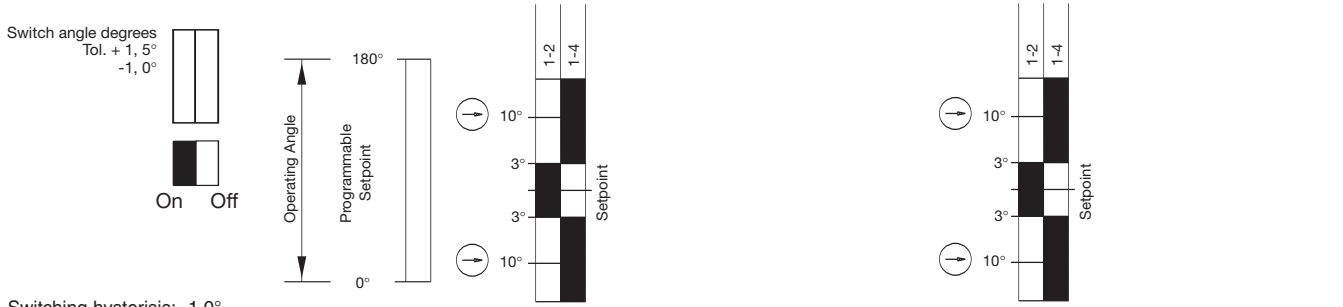


# SAFELOCK

## SHS Hinge Switches

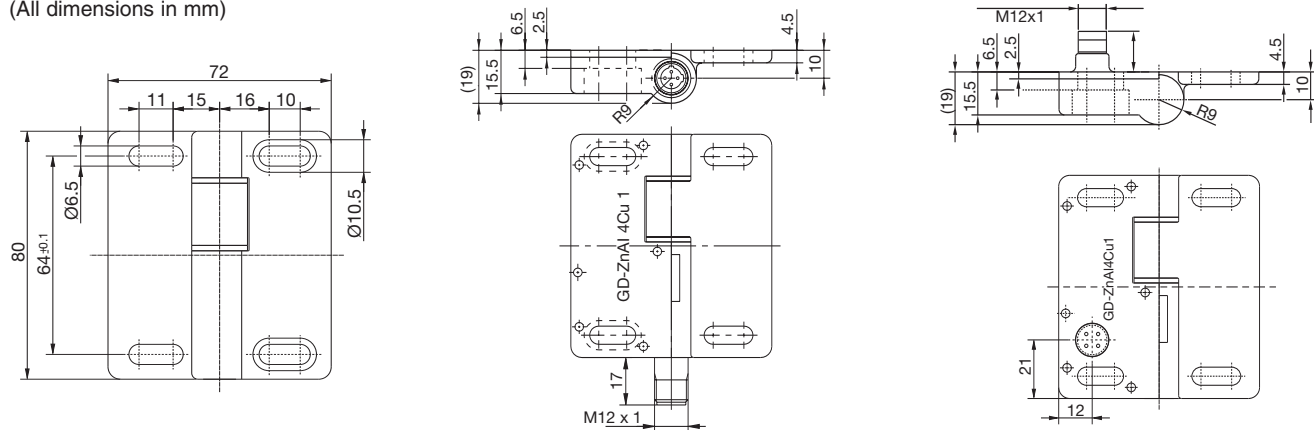


Designation	SHS-A1Z-SA	SHS-A1Z-SR
Part number	601-9261-015	601-9261-010
Contact diagram		
Forced disconnect to IEC 947-5-1 annex k		
Za: non-galv. separated contact		
Zb: galv. separated contact		
Slow make and break/snap action		
Sealed internally (iw)/ externally (w)	iw	iw



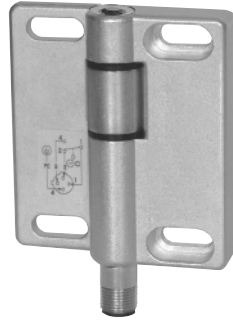
Switching hysteresis: -1.0°		
Voltage	max. 250 VAC	250 VAC
Thermal current	max. 3A	3A
Utilization category per IEC 947-5-1 AC 15/DC 13	60 V/0.5 A	60 V/0.5 A
Switching frequency	max. 1200/h	1200/h
Mechanical life - switching operations	1 x 10 <sup>6</sup>	1 x 10 <sup>6</sup>
Operating temperature	min./max. -25 °C/+70 °C -13 °F/+158 °F	-25 °C/+70 °C -13 °F/+158 °F
Approvals	UL and CSA	UL and CSA
Weight	0.4 kg	0.4 kg
Delivery: ex-stock/built to order	•/-	•/-

(All dimensions in mm)

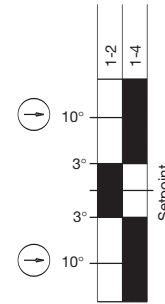
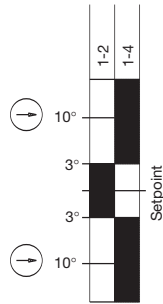
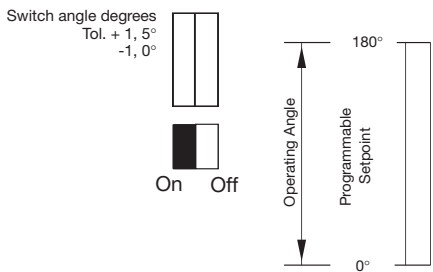


# SAFELOCK

## SHS Hinge Switches

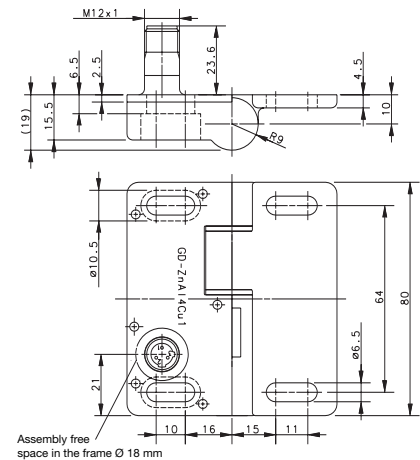
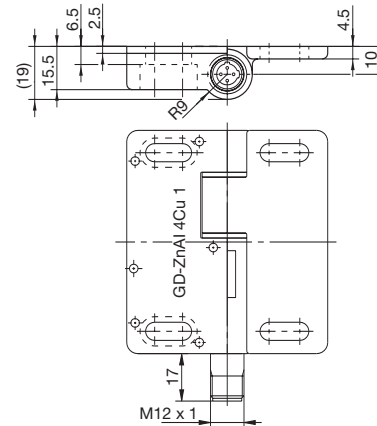
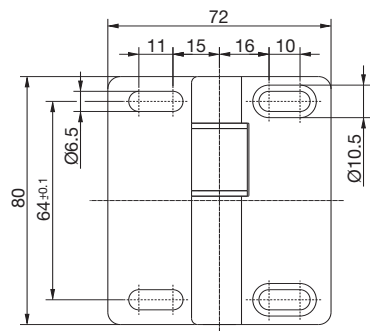


Designation	SHS-A1Z-SA	SHS-A1Z-SR
Part number	601-9261-009	601-9261-016
Contact diagram		
Forced disconnect to IEC 947-5-1 annex k		
Za: non-galv. separated contact		
Zb: galv. separated contact		
Slow make and break/snap action		
Sealed internally (iw)/externally (w)	iw	iw



Switching hysteresis: -1.0°		
Voltage	max. 250 VAC	250 VAC
Thermal current	max. 3A	3A
Utilization category per IEC 947-5-1 AC 15/DC 13	60 V/0.5 A 230 VAC/1.5 A	60 V/0.5 A 230 VAC/1.5 A
Switching frequency	max. 1200/h	1200/h
Mechanical life - switching operations	1 x 10 <sup>6</sup>	1 x 10 <sup>6</sup>
Operating temperature	min./max. -25 °C/+70 °C -13 °F/+158 °F	-25 °C/+70 °C -13 °F/+158 °F
Approvals	UL and CSA	UL and CSA
Weight	0.4 kg	0.4 kg
Delivery: ex-stock/built to order	•/-	•/-

(All dimensions in mm)



# SAFELOCK

## I88 Style Position Safety Hinge Interlock Switches

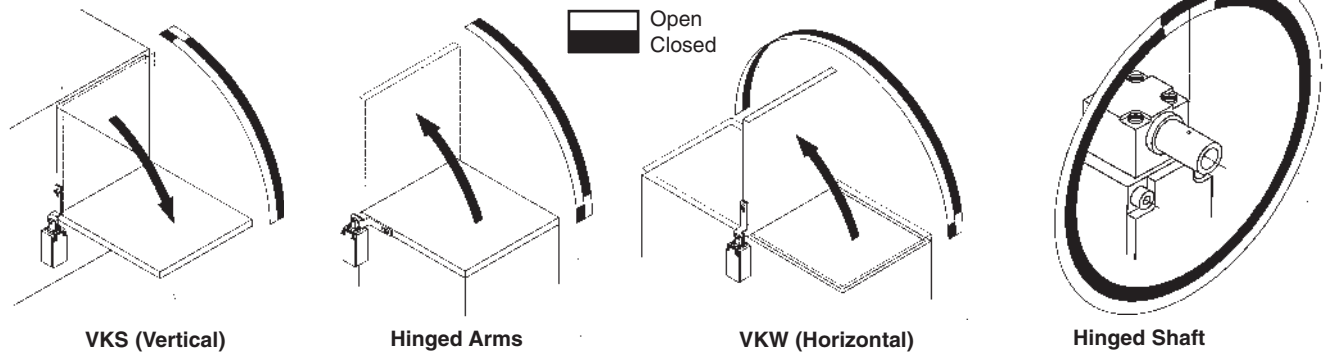


The I88 style Hinge Safety Switch is available with two distinctive types of operational actuators.

Actuator arms VKS, VKW RE and VKW LI give the user the opportunity to install them as permanently mounted operational arms on flaps and covers, as shown in the drawings below.

The AHDB styled actuator is designed to be directly connected to a hinge point of a rotating shaft. The normally closed safety contacts will open after 10 degrees of movement.

- Insulated plastic housing with hinged cover
- Forced disconnection of the N.C. contacts
- Contacts galvanically isolated
- Conduit adapter



**Model:** I88-U1Z VKS  
**Part Number:** 608-6100-093  
**Operation:** Central

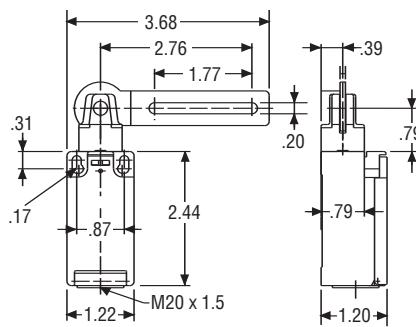
**Model:** I88-U1Z VKW RE  
**Part Number:** 608-6100-094  
**Operation:** Right

**Model:** I88-U1Z VKW LI  
**Part Number:** 608-6100-095  
**Operation:** Left

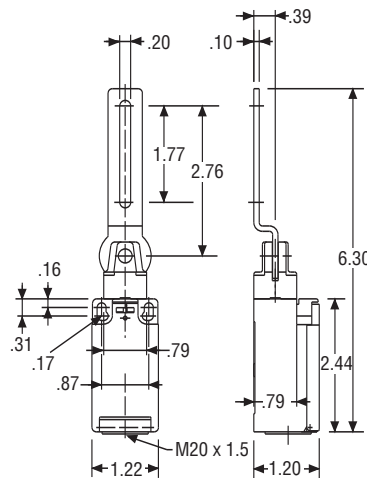
**Enclosure:** Thermoplastic  
 1 Normally Closed  
 ⊕ Forced Disconnect per IEC 947-5-1 Ch. 3  
 1 Normally Open

**Voltage Rating:** 500 VAC (max.)  
**Current Rating:** 10 A (max.)  
**Protection Class:** NEMA 4  
**Mechanical Life:** 1 x 10<sup>6</sup> Cycles  
**Temperature:** -22°F to +176°F  
**Switch Rate:** 50 per minute max.  
**Approvals:** UL, CSA

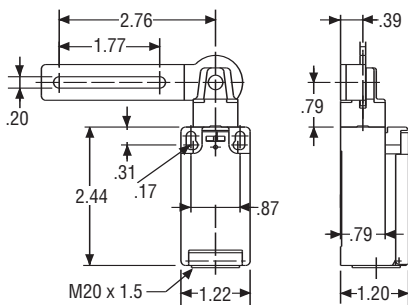
(Dimensions are in inches)



**I88-U1Z VKW RE**

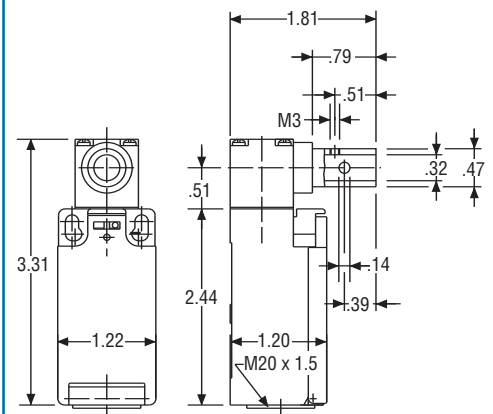


**I88-U1Z VKS**



**I88-U1Z VKW LI**

**Model:** I88-U1Z AHDB  
**Part Number:** 618-6100-267  
**Enclosure:** Thermoplastic  
**Contacts:** 1 Normally Closed  
 ⊕ Forced Disconnect per IEC 947-5-1 Ch. 3  
 1 Normally Open  
**Voltage Rating:** 500 VAC (max.)  
**Current Rating:** 10 A (max.)  
**Protection Class:** NEMA 4  
**Mechanical Life:** 1 x 10<sup>6</sup> Cycles  
**Temperature:** -22°F to +176°F  
**Switch Rate:** 50 per minute max.  
**Approvals:** UL, CSA



**I88-U1Z AHDB**

# SAFELOCK

## Solenoid Locking Interlock Switches with Separate Actuator



### Description

The SLK series of Solenoid Locking Switches are designed to ensure movable protective guards and are kept locked in place on machinery until the operating sequence or machine cycle is completed.

The actuator key is held in position under force, while the interlocking mechanism is activated. The interlocking mechanism is directly connected to the machine's control system.

Safety Interlock Switches perform three functions:

1. Allow the machine/process to operate when the protective guard is in position and locked.
2. Ensure the machine/process cannot operate when the actuator key is not in the locked and closed position.
3. Monitor the switch and the interlocking mechanism during operation.

### System Description

Two types of locking methods are available:

**Spring Lock...**Mechanically locked-power to solenoid unlocks actuator

**Magnetic Lock...**Power to solenoid locks actuator in position.

#### Features

- Compact and slim in design
- Rugged plastic insulated housing
- Triple coding of the actuator for a high level of safety
- Flexible mounting options with rotatable actuator head (4X90°) and horizontal or vertical actuator approach
- Three cable entries
- Wiring chamber protected to IP 67/NEMA 4

#### Electrical Features

##### Switching Devices

<b>Rated isolation voltage max.:</b>	250 V
<b>Thermal Continuous Current max.:</b>	10 A
<b>Category of Use:</b>	AC 15 230 V/4 A
<b>Short Circuit protection:</b>	DIAZED- DIN VDE 0636 Part 1 6 A/inert gl/gG

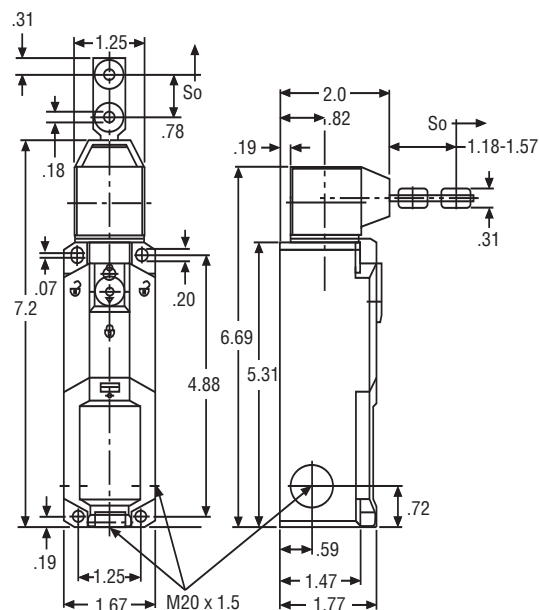
##### Solenoid

<b>Duration of Current:</b>	3.4/100% ED
<b>Temperature Class:</b>	E (120°C)
<b>Inrush Power Consumption:</b>	56 VA (0.2s)
<b>Permanent Power Consumption:</b>	1.1 VA (constant)
<b>Switching Frequency:</b>	600/hr. max.

##### Actuation

- Standard actuator allows 8 different mounting positions
  - 4 Horizontal in 90° increments
  - 4 Vertical in 90° increments

(Dimensions are in inches)



Head Mounted Vertical  
(Standard Actuator)

Head Mounted Horizontal  
(Standard Actuator)

#### Mechanical Characteristics

<b>Enclosure:</b>	PA 6 GV (UL94-V0)
<b>Actuator Key:</b>	Stainless Steel/PA
<b>Ambient Temperature:</b>	-25°C to +70°C
<b>Switching Function:</b>	2 NC; 2 NO contacts
<b>Mechanical Life:</b>	1,000,000 cycles
<b>Actuation Radius:</b>	400mm min.
<b>Approach Speed:</b>	V = 0.5m/s max
<b>Weight:</b>	approx. 0.3 kg
<b>Locking Force:</b>	1000 N (250 lbs.)

Part Number	Designation	Locking Spring Force Magnet Force	Connection Safety Equipment	Assembly Locking	Control Voltage	Add. Functions Auxiliary Release (AR)	LED (L)	Actuator Standard Radial Actuator
601-8119-001	SLK-FVTU24UC-55-AR	Spring Force	1 NC ⊕ 1 NO	1 NC ⊕ 1 NO	24 VAC/DC	AR	—	Standard
601-8119-002	SLK-FVTU24-230MC-55-AR	Spring Force	1 NC ⊕ 1 NO	1 NC ⊕ 1 NO	24-48 VDC + 24-230 VAC	AR	—	Standard
601-8119-003	SLK-MVTU24UC-55	Magnet Force	1 NC ⊕ 1 NO	1 NC ⊕ 1 NO	24 VAC/DC	—	—	Standard
601-8119-004	SLK-MVTU24-230MC-55	Magnet Force	1 NC ⊕ 1 NO	1 NC ⊕ 1 NO	24-48 VDC + 24-230 VAC	—	—	Standard



# SAFELOCK

## Solenoid Locking Interlock Switches with Separate Actuator

### Description

The SLM series of Solenoid Locking Switches is designed to ensure movable protective guards are kept locked in place on machinery until the operating sequence or machine cycle is completed.

The actuator key is held in position under force, while the interlocking mechanism is activated. The interlocking mechanism is directly connected to the machine's control system.

Safety Interlock Switches perform three functions:

1. Allow the machine/process to operate when the protective guard is in position and locked.
2. Ensure the machine/process cannot operate when the actuator key is not in the locked and closed position.
3. Monitor the switch and the interlocking mechanism during operation.

### System Description

Two types of locking methods are available:

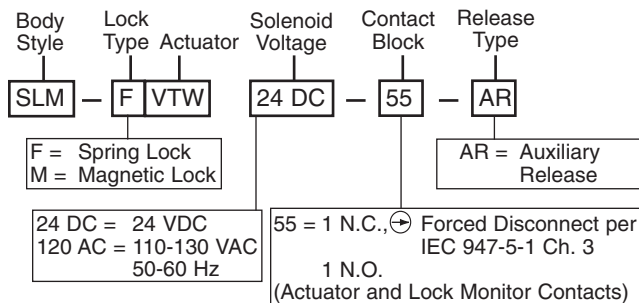
**Spring Lock...**Mechanically locked-power to solenoid unlocks actuator

**Magnetic Lock...**Power to solenoid locks actuator in position

#### Features:

- UL, CSA, and BG approved
- Triple coding of the actuator for a high level of safety
- Rugged, heavy duty, metal housing
- Actuator approach direction can be changed in 90° increments
- Actuator has smooth surface with no protruding sharp parts
- Forced disconnection of the N.C. contacts
- Contacts galvanically isolated
- Two cable entries
- Conduit adapter or cord grip provided
- Manufactured to VDE 0660 part 200, IEC 947-5-1, and test principle GS-ET 19

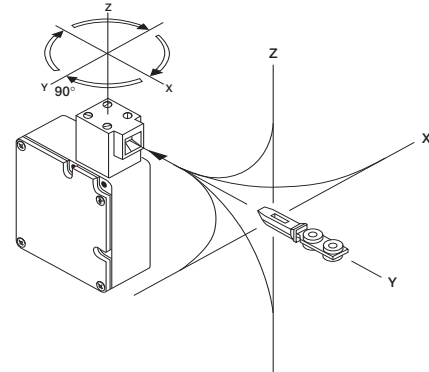
### Model Identification



### Non-Standard Options

- 230 VAC/50 Hz solenoid voltage
- Key operated auxiliary release (Spring Lock Only)
- Mushroom head auxiliary release with key reset (Spring Lock Only)
- LED indicators for switch status
- Extended length actuator

Consult the factory for details.



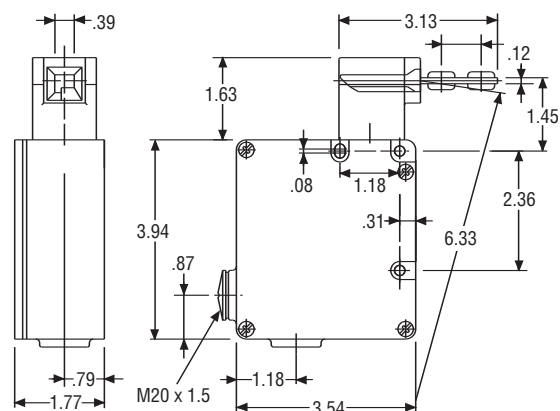
### Common Features

<b>Safety Category:</b>	4
<b>Contact Voltage:</b>	250 V (maximum)
<b>Contact Current:</b>	10 A (maximum)
<b>Protection Class:</b>	NEMA 4
<b>Mechanical Life:</b>	1 x 10 <sup>6</sup> Switching Cycles
<b>Temperature:</b>	-22°F to +140°F
<b>Actuator Locking Force:</b>	225 lbs. [1000 N]
<b>Actuator Holding Force:</b>	4.5 lbs. [20 N]
<b>Operating Radius:</b>	15.7" [400 mm] (minimum)
<b>Enclosure:</b>	Die Cast Aluminum

Model (Spring Lock)	Part Number	Solenoid Voltage
SLM-FVTW 24 DC-55-AR	601-7119-020	24 VDC
SLM-FVTW 120 AC-55-AR	601-7119-032	120 VAC

Model (Magnetic Lock)	Part Number	Solenoid Voltage
SLM-MVTW 24 DC-55	601-7119-023	24 VDC
SLM-MVTW 120 AC-55	601-7119-033	120 VAC

(Dimensions are in inches)



# SAFELOCK

## MUZ-602 and MUZ-202

### Coded Magnetic Monitoring Systems

**BIA Rated for Safety Category 3 EN 954-1**  
**Single Failsafe System With Partial Fault Recognition**

#### Description

The monitoring controls available to Category 3 certification are the MUZ-202, two channel control and the MUZ-602 six channel control. The number of channels indicated refers to the maximum number of Coded Magnetic Sensors that can be used per control.

Both controls can only be used with series MAK-xx36 Coded Magnetic Sensors and corresponding Magnets TK-xx-CD, as shown on page 57.

These systems are intended for use with movable protective guard installations, i.e. flaps, doors, and covers.

Magnetic Coded Monitoring Systems offer an alternative to mechanical interlock switches, especially on machines that operate in areas where cleaning, disinfecting, or contamination play a major role, as the sensor and magnet are fully encapsulated.

#### Features

- BIA rated for Safety Category 3
- Forced disconnection of the safety contacts
- Control unit mounts to 35 mm DIN rail (TS 35)
- BIA Approved

#### System Operation

The correct operation of the system is ensured, as the circuitry monitors each sensor and magnet to ensure they are aligned correctly, by using an evaluation circuit with two timing stages.

Only when all the sensors have met this requirement will the controls output relay give the signal for the machine to operate.

Within this series of controls an additional output contact is available, to be used for informational purposes only and not for any safety function.



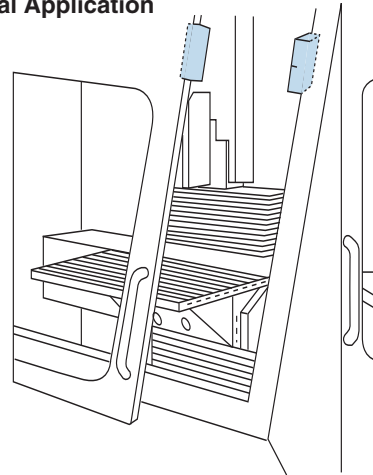
MUZ 202



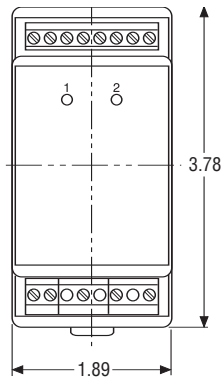
MUZ 602

Model	MUZ-202/D24-UM	MUZ-602/D24-UM
Part Number	639-2702-301	639-2706-302
Enclosure	PA 6.6 Plastic	
Channels	2	6
Safety Contact	1 Normally Closed, Forced Disconnect	
Monitor Contact	1 Normally Open	
Operating Voltage	24 VDC	
Operating Current	100 mA	
Switching Voltage	250 VAC (max.)	
Switching Current	8 A (max.)	
Switching Capacity	1700 VA (MAX.)	
Protection Class	IP 20 (Equivalent to NEMA 1)	
Temperature	+32°F to +131°F [0°C to +55°C]	

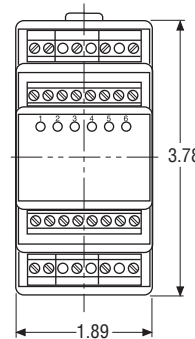
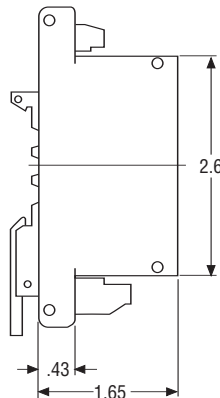
#### Typical Application



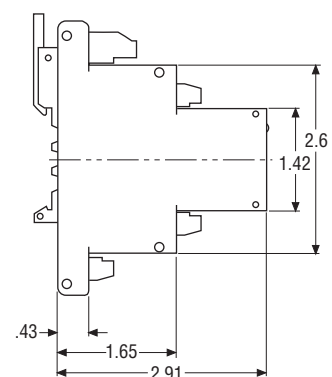
(Dimensions are in inches)



MUZ 202



MUZ 602



# SAFELOCK Coded Magnetic Sensors Coded Magnets

## Model Part Number

MAK-4236-3 <sup>1</sup>	649-0642-301
MAK-4236-STK <sup>2</sup>	649-0642-305
TK-42-CD	640-2042-301

<sup>1</sup>Sensor with 10 ft. (3 m) Cable  
(19 ft. (6 m) and 29 ft. (9 m) Special Order)

<sup>2</sup>Sensor with Connector (Cable Sold Separately)  
Uses either a 413-9100-228 or 413-9100-230 cable

**Enclosure:** PA 6.6 Plastic  
**Voltage Rating:** 30 VDC (max.)  
**Current Rating:** 4 mA (max.)  
**Protection Class:** NEMA 6  
**Operating Range:** 0.12" (3 mm) On (min.)  
 0.55" (14 mm) Off (max.)  
**Temperature:** -4°F to +158°F  
**Controller Type:** MUZ-x02/xxx

## Model Part Number

MAK-5336-3 <sup>1</sup>	649-0653-310
MAK-5336-STK <sup>2</sup>	649-0653-313
TK-43-CD	640-2043-023

<sup>1</sup> Sensor with 10 ft. (3 m) Cable  
(19 ft. (6 m) and 29 ft. (9 m) Special Order)

<sup>2</sup> Sensor with Connector (Cable Sold Separately)  
Uses cable 413-9100-266

**Enclosure:** PA 6.6 Plastic  
**Voltage Rating:** 30 VDC (max.)  
**Current Rating:** 4 mA (max.)  
**Protection Class:** NEMA 6  
**Operating Range:** 0.12" (3 mm) On (min.)  
 0.28" (7 mm) Off (max.)  
**Temperature:** -4°F to +158°F  
**Controller Type:** MUZ-x02/xxx

## Model Part Number

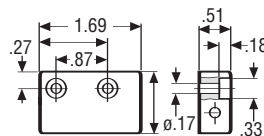
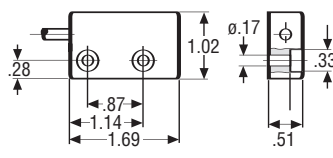
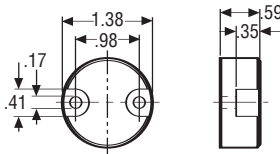
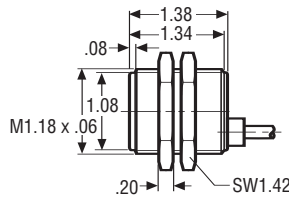
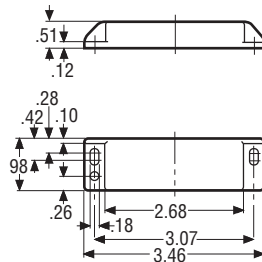
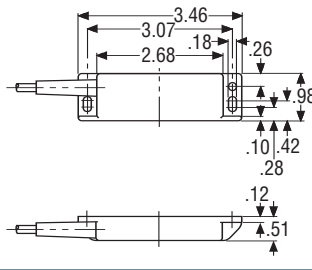
MAK-5236-3 <sup>1</sup>	649-0652-306
MAK-5236-STK <sup>2</sup>	649-0652-309
TK-52-CD-HF	640-2052-305

<sup>1</sup> Sensor with 10 ft. (3 m) Cable  
(19 ft. (6 m) and 29 ft. (9 m) Special Order)

<sup>2</sup> Sensor with Connector (Cable Sold Separately)  
Uses either a 413-9100-228 or 413-9100-230 cable

**Enclosure:** PA 6.6 Plastic  
**Voltage Rating:** 30 VDC (max.)  
**Current Rating:** 4 mA (max.)  
**Protection Class:** NEMA 6  
**Operating Range:** 0.16" (4 mm) On (min.)  
 0.31" (8 mm) Off (max.)  
**Temperature:** -4°F to +158°F  
**Controller Type:** MUZ-x02/xxx

(Dimensions are in inches)



Coded magnetic sensors and coded magnets are designed for use with special purpose safety controllers. They cannot be operated by simple bar magnets.



## Cables for Sensors with Connectors

**Material:** PUR (Cable)  
PA 12 (Connector)  
**Cable Length:** 8 ft. (2.5 m)  
**Protection Class:** NEMA 6

## Model Part Number

GDK-R06US/S00-2.5PU	413-9100-228
WDK-R06US/S00-2.5PU	413-9100-230
WDK-M12UA/S00-2.5PU	413-9100-266



# Cable Pull Safety Switches

## For Cable Lengths of 10, 15, 30 and 75 ft. Single Direction for Standard and Safety Applications

### Description

Cable pull switches give personal ready access to a machine stop switch over a long distance by pulling on the cable. They are especially suited for use along conveyors or on the perimeter of large manufacturing machines.

Safety cable pull switches (type Si) are safety devices according to IEC 947-5-1 and VDC 0660, T200. The action of the N.C. emergency stop contacts is forced due to the contact elements being securely attached to the plunger. This safety switch has make-before-break contacts. The machine will stop when the cable is pulled or when the cable breaks. These functions are made possible by the overlapping contacts of the UV type contact blocks. This operation requires the Cable to be held in position under tension. See the Typical Installation drawing on page 59 for further information.

A latch option keeps the stop contact open after the cable has been pulled and released. The latch is reset by operating a push-button on the switch. Machine restarting is not possible until the latch is reset.

The maximum length of the cable is only limited by its weight. The weight of the cable must not exceed the tension force of the switching system. The maximum length of unsupported cable must not exceed 15 ft.



### Standard Cable Pull Switch

Model	Part Number	*Cable Length	Pull Force	Voltage (max.)	Current (max.)	Enclosure	**Drawing
SI-U1Z	601-3812-075	10 ft.	5.5 lbs.	380 VAC	10 A	Plastic	A
SEK-U1Z	601-1811-133	15 ft.	18 lbs.	500 VAC	10 A	Plastic	B
SEM2-U1Z	601-2811-029	15 ft.	18 lbs.	500 VAC	10 A	Aluminum	C
SD-U1	601-1411-856	30 ft.	27 lbs.	500 VAC	16 A	Aluminum	F
SD-U1/LATCH	601-1411-868	30 ft.	27 lbs.	500 VAC	16 A	Aluminum	E

### Safety Cable Pull Switch

Model	Part Number	*Cable Length	Pull Force	Voltage (max.)	Current (max.)	Enclosure	**Drawing
Sii-UV1Z	601-3832-076	10 ft.	5.5 lbs.	380 VAC	10 A	Plastic	A
SiEK-UV1Z	601-1831-134	15 ft.	18 lbs.	500 VAC	10 A	Plastic	B
SiEM2-UV1Z	601-2831-022	15 ft.	18 lbs.	500 VAC	10 A	Aluminum	C
SiEM2-UV1Z/LATCH	601-2831-023	15 ft.	18 lbs.	500 VAC	10 A	Aluminum	D
SiD-UV1Z	601-1431-857	30 ft.	27 lbs.	380 VAC	16 A	Aluminum	F
SiD-UV1Z/LATCH	601-1431-869	30 ft.	27 lbs.	380 VAC	16 A	Aluminum	E
SiD-UV1Z	601-2431-877	75 ft.	45 lbs.	500 VAC	16 A	Aluminum	G
SiD-UV2Z/LATCH	601-2441-907	75 ft.	45 lbs.	380 VAC	16 A	Aluminum	H

\*Recommended Cable Length

\*\*Drawings shown on page 59

### Accessories

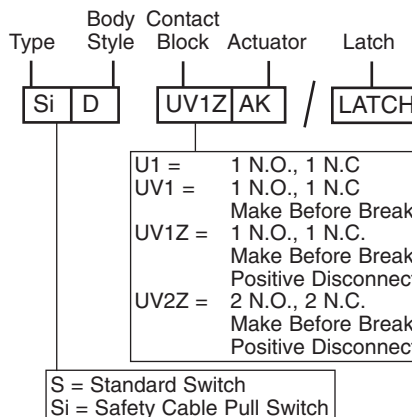
#### Single Direction Cable Kit

Cable Length	Part Number
15 ft.	8010-448-001
30 ft.	8010-448-002
75 ft.	8010-448-003

#### Each One Way Cable Kit Includes:

- Length of cable as listed
- 1 Wrought Iron Tension Screw
- 4 Galvanized Clamps
- 4 Galvanized Thimbles
- (Customer to provide Eye Screws)
- Individual accessories are also available.

### Model Identification



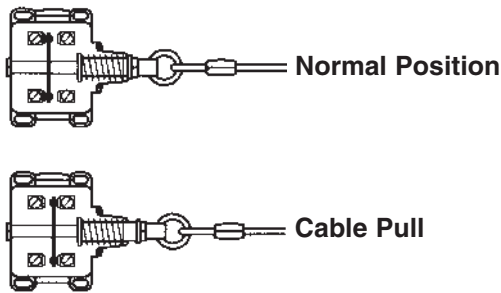
# Cable Pull Switches

For Cable Lengths of 10, 15,  
30 and 75 Feet  
Single Direction  
Mechanical and  
Installation Information

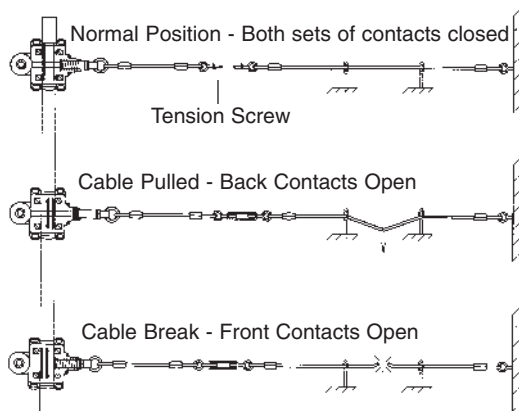
## Common Features

**Degree of Protection:** NEMA 4  
**Temperature:** -22°F to +176°F  
**Enclosure:** Die cast aluminum or glass fiber reinforced thermoplastic  
**Approvals:** UL, CSA

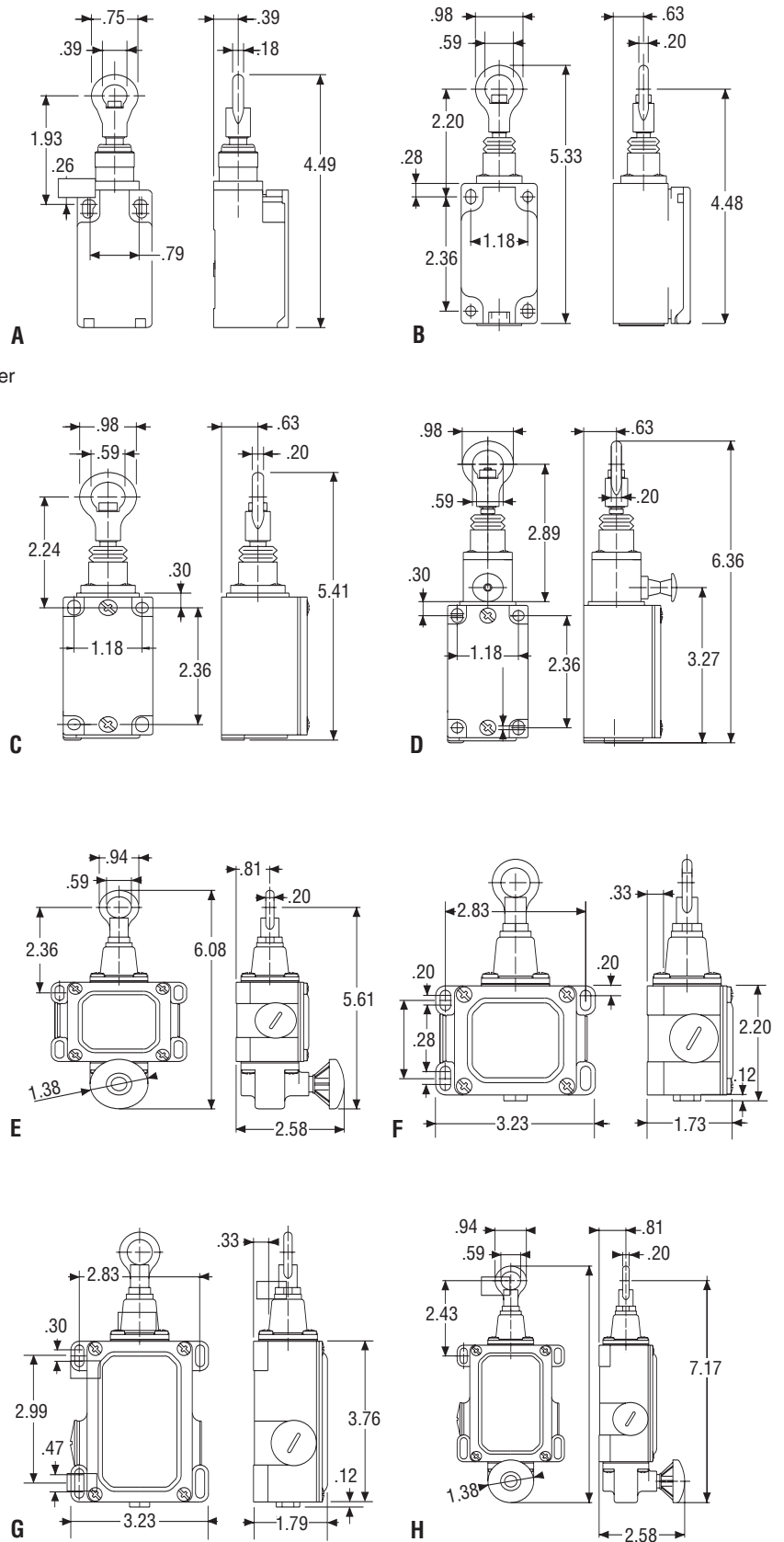
## Standard Switch Installation



## Safety Switch Installation



(Dimensions are in inches)



# Cable Pull Switches

For Cable Lengths Up To 250 Feet  
Two Way Direction  
For Standard and Safety Applications



Si1



Si2

## Description

For cable runs greater than 75 feet, two directional cable pull switches are recommended. Two directional switches can be used in applications of cable runs up to 250 feet (125 feet on each side of the installed switch). This type of cable pull switch operates with the cables under tension. During prestressing of the cable, both sets of contacts are in their original state. Pulling the cable on either side of the switch will cause the actuator on the switch to be displaced. When the displacement reaches a prespecified angle, the switch will lock and the contacts will not be able to switch back to their original state. The lock-out feature ensures that the machine cannot be restarted until the switch is manually reset by the operator. Cocking springs must be used at both ends of the installation, as shown in the Typical Installation drawing. Any cable length over 15 feet should be supported with an eye screw.

## Common Features

- Degree of Protection:** NEMA 4
- Temperature:** -22°F to +176°F
- Enclosure:** Die cast aluminum
- Latch:** Standard with pull ring reset
- Approvals:** UL, CSA, (Si1 = BG)

## Two Way Direction Accessory Cable Kit

Cable Length	Part Number
105 ft. [32 m]	8010-448-004
200 ft. [61 m]	8010-448-005
250 ft. [76 m]	8010-448-006

### Each Two Way Direction Cable Kit Includes:

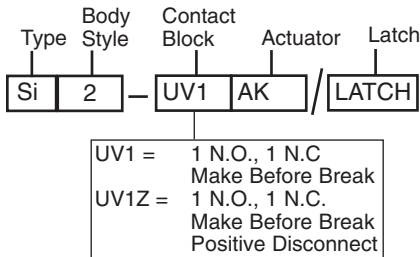
- Length of cable as listed
- 2 Tension Springs
- 4 Galvanized Clamps
- 4 Galvanized Thimbles
- (Customer to provide Eye Screws)
- Individual accessories are also available.

## Two Way Direction Safety Cable Pull Switch

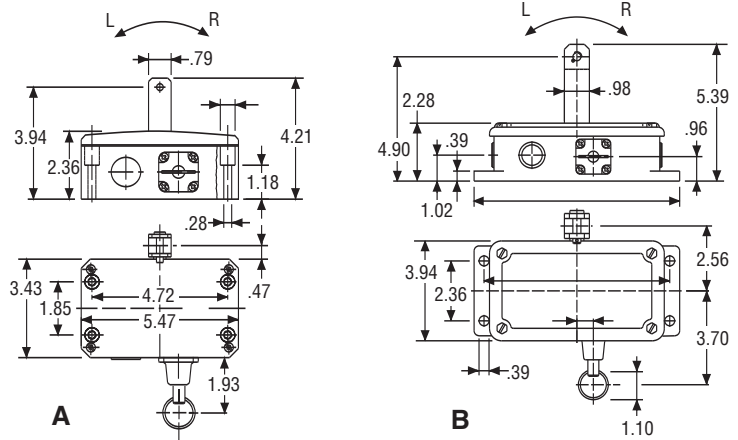
Model	Part Number	Cable Length*	Switching Angle	Voltage (max.)	Current (max.)	Drawing
Si1-UV1ZAK/LATCH	601-4735-001	225 ft.	30 Degrees	500 VAC	10 A	A
Si2-UV1AK/LATCH	601-5735-002	250 ft.	30 Degrees	500 VAC	10 A	B

\* Recommended Cable Length

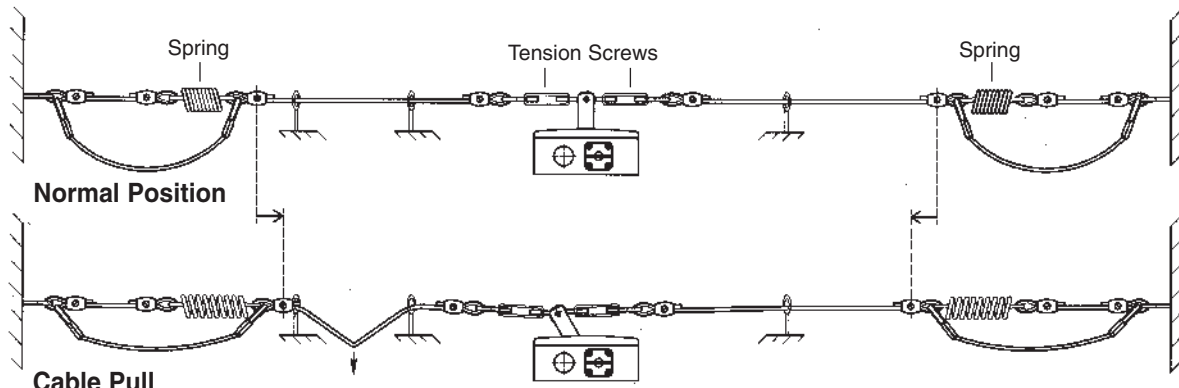
## Model Identification



(Dimensions are in inches)



## Typical Installation Arrangement



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## Glossary of Terms

### Alignment

The correct relation of emitter to receiver as it is important for optimum performance.

### Background Suppression

A general term for diffuse sensors that can be adjusted to ignore the influence of objects/ surfaces behind the target object. Background Suppression Sensors minimize variations in sensing distances because of the difference in reflectivity between highly reflective and dark targets.

### Capacitive

A sensing device that is actuated by conductive and nonconductive materials with a dielectric constant greater than 1.

### Color Mark Sensor

A sensor specifically designed to differentiate between colored marks or between a mark and a background color.

### Converged Beam (Fixed Focus)

The convergent mode is similar to the diffuse sensing mode because an object is sensed when the receiver sees light reflected back to the sensor by the object itself. The emitter and receiver are focused at a fixed point. Because convergent beam sensors make much more efficient use of sensing light energy, they can sense relatively non-reflective materials and objects with small reflective surfaces.

### Dark Activated

Operating mode for photoelectric sensors where the output is turned on (transistor becomes conducting, or relay coil is energized) when light is not received.

### Diffuse Reflective

Sensor configuration with the emitter and receiver located in the same housing. Sensing of target is based on reflection of light from the target itself.

### Hysteresis

The difference between the switch-on and switch-off point for a sensor.

### Inductive Sensing

A sensing technology that identifies the presence of metallic objects by detecting eddy current losses in a magnetic field produced at a sensing face.

### IP

International Protection; an international standard scale for enclosure ratings.

### Kodak 90% Reflective White Card

A standard reference manufactured by Kodak designed to reflect 90% of white light. Used as a standard target for diffuse reflective sensors.

### Light Activated

Operating mode for photoelectric sensors where the output is turned on when light is received.

### Limit Switch

A switch positioned such that it is actuated by a moving part, in order to shut off or reverse the power to the motor driving the part when it reaches the limit set for its travel.

### Magnetic Sensing

A sensing device that is activated when brought into the influence of a magnetic field generated by either a permanent magnet or an electromagnet.

### NEMA

National Electrical Manufacturer's Association; Industrial trade organization that publishes testing standards, including enclosure ratings.

### NPN

Transistor output designed to provide a path to ground for current passing through the load (sinking). When the NPN output is on, current can then pass from Positive, through the load, and through the NPN transistor to ground, completing the circuit.

### Off-Delay

Off delay timers prolong or hold an output signal by a preset time interval after the target leaves the sensing area. The OFF delay can be used as an output pulse extender when target presence is not of sufficient duration for control requirements.

### On-Delay

On-Delay timers delay the generation of an output signal by a preset time interval from the appearance of the target. Target presence shorter in duration than the preset delay interval will not generate an output signal.

### Polarized Retroreflective Sensing

Visible light from the emitter of a retroreflective photoelectric sensor that is filtered so as to be projected in only one plane. The receiver of a polarized unit is filtered to accept only light that is reflected perpendicular to the emitted light. Corner cube reflectors are required to properly rotate the emitted light source.

### PNP

Transistor output that provides a path to "plus" for current passing through the load (sourcing). When the transistor is turned on, current can then pass from Positive, through the PNP transistor, through the load, and to ground, completing the circuit.

### Retroreflective Sensing

Detection method where light from the emitter is aimed at, and reflected back to the receiver, from a retroreflective target.

### Sensing Distance

The maximum distance at which, under specifications, a sensor can detect a target.

### Shielded Sensor

A sensor which senses only to the front of its face and ignores metals to its side.

### Switching Frequency

The maximum number of complete on-off cycles that the control output is capable of in one second, usually expressed in Hz (Hertz, cycles per second).

### Through-Beam Sensing

Sensor where the emitter and receiver are in separate housings and arranged facing each other. The target would be detected passing between the emitter and receiver, interrupting the beam.

### Ultrasonic Sensing

Ultrasonic proximity mode sensors can measure the time delay between the emitted sound and the returned echo, and produce an accurate measurement of sensing distance. Analog Ultrasonic Sensors produce an output that has a highly linear relationship to sensing distance.

### Unshielded Sensor

Refers to inductive-type proximity sensors that do not have an internal metallic ring to reduce interference from surrounding metals and other inductive sensors. Non-shielded sensors cannot be flush mounted in metal and must be spaced further away from other inductive sensors than shielded types of sensors.

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