

Photo Electric Safety Systems

Safety Approach Risk Assessment

SELECTING PRODUCT

When selecting the proper safety system for a potentially dangerous automated machine, the first area that must be examined is the machine's control reliability and suitability for personnel safeguarding. It is also necessary to consider the severity of potential injury that may be caused by a machine being considered for safeguarding. This is termed **Risk Assessment**, and this analysis can be determined using an easy to follow form, see page 66. Risk Assessment will assist in determining potential likelihood of an accident and severity of injury. It will also serve as a guide for selecting the safety product(s) best suited for the particular application being considered for safeguarding. Always refer to the appropriate ANSI, OSHA or Industry Standards before applying safeguards.

A **Risk Assessment Form** is included in this section. Please make copies of it to determine the safe guarding needs for the automated machines in your plant.

It should be noted that many factors go into determining the feasibility for safeguarding an automated machine. For certain machines, danger can be completely eliminated during operation. For others the risk of danger can only be reduced. Additional education and training is necessary as part of a complete safety system. Evaluation of the severity for potential injury must be the highest priority and a point system is utilized on the Risk Assessment Form to determine such potential. Following is a brief summary of the areas to be considered.

Determining "**what is the risk**" falls under three categories:

1. Potential of injury

- a) Fatal
- b) Major- (irreversible) permanent disability, loss of limb, loss of sight, etc.
- c) Serious- (reversible) breakage, burns, etc.
- d) Minor- bruising, cuts, etc.

2. Frequency to exposure

- a) Frequent- several times per day
- b) Occasional- once per day
- c) Seldom- once per week or so

3. Probability of injury

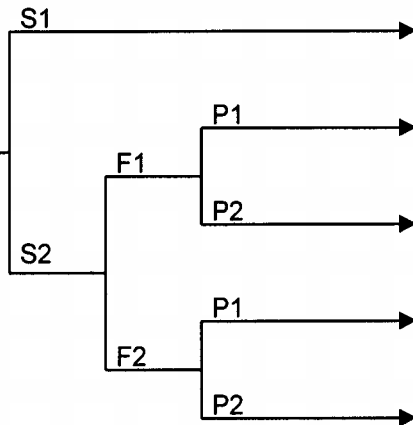
- a) Unlikely
- b) Possible
- c) Probable
- d) Certain

To insure the proper product is being considered for your particular application, perform the **Risk Assessment** and then contact a Tapeswitch Representative for a total safety system evaluation.

Photo Electric Safety Systems

Risk Assessment Form

Starting point for risk elimination for the safety-related part of the control system.



CATEGORY				
B	1	2	3	4
●	●	○	○	○
●	●	●	○	○
	●	●	●	○
	●	●	●	○
	●	●	●	●

- Preferred categories for reference points.
- Possible categories which can require additional measures.
- Measures which can be overdimensioned for the relevant risk.

S = Severity of injury
 S1 Slight injury (normally reversible) i.e. slight cut or bruise.
 S2 Serious injury (normally irreversible) injury including death.

F = Frequency and/or exposure time to the hazard
 F1 Seldom to quite often and/or the exposure time is short.
 F2 Frequent to continuous and/or the exposure time is long.

P = Possibility of avoiding the hazard
 P1 Possible under specific conditions.
 P2 Scarcely possible.

Extract from EN 954-1: risk assessment chart.

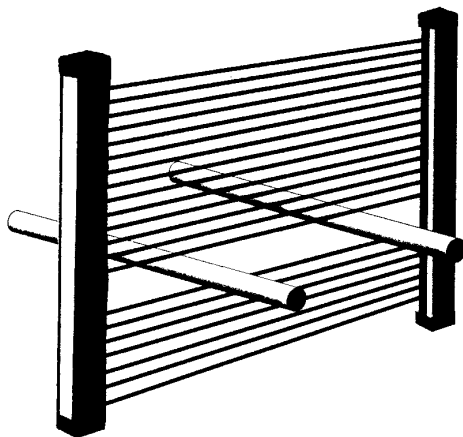
B Series Advanced Safety Systems

The **Guardstar B Series Light Curtain** has been designed as a compact, intelligent unit capable of answering current and future demands within the guarding industry.

Advanced electronics is at the heart of the New B Series with extensive use of powerful surface-mounted micro-processors and Guardstar's Application Specific Integrated Circuits, (ASIC).

These engineered components permit the compact size and sophistication of these units, allowing them to perform many tasks, normally only possible with extensive external equipment and complex wiring.

SYSTEM SPECIFICATIONS	
Detection Capability	14mm (1/2") 30mm (1 3/16") 70mm (2 3/4")
Response Time	<18ms
Curtain Lengths	up to 1800mm (6 ft.)
Enclosure Rating	IP65
Effective Aperture Angle	± 2 degrees
Cross Section	45mm (1 3/4") x 35mm (1 3/8")
Operating Range	6m (14mm) or 13m (30mm & 70mm)
Operating Temperature	0 to 50°C
Weight (per 100mm)	200g (7 oz.)
Wavelength	880 nm
Radiation Intensity	Class 1 LED product (IEC 60825-1)
Safety Outputs	2 x PNP (fail-safe) 500mA @ 24V DC max



FEATURES & BENEFITS

- Redundant Fail-Safe Solid State PNP Outputs.
- Self-contained 2 unit system.
- EN 61496 type 4 design.
- Compact, rugged, simple to install.
- Built-in beam blanking capability.
- Flexible interfacing.
- Robust one-piece aluminum extruded body measures only 35mm (1 3/8") x 45mm (1 3/4").
- Detection Capability, 14mm, 30mm and 70mm.
- CE Certified and Marked. Independently Third Party Approved.



A NEW ADVANCED SAFETY DIMENSION.....

Flexible Interface

An emitter and receiver pair function as a self-contained system which is capable of safety functions without additional equipment. The interface configuration can be used with a variety of readily available safety relay units, and fail-safe PLC's, in addition to a wide range of control units from Tapeswitch.

Construction

The tough one-piece aluminum extruded body measures only 35mm (1 3/8") x 45mm (1 3/4") providing integrated appearance on the machine. It's strong enough for the toughest industrial environments and has excellent resistance to vibration and impacts. The use of ASIC electronics also means a greatly reduced component count for higher reliability and simple servicing.

EN 61496 Type 4 Design

This is the highest level of the most stringent standard in the world, acceptable and suitable for the most dangerous of machines. CE certified and marked. (**Independently third party approved.**)

Product Range

A wide range of sizes and specifications is available, including models for small apertures, large access areas, and point of operation protection for fingers, hands, arms and torsos.

Beam Blanking

Beam blanking allows the light curtain to operate where there is a permanent obstruction in the sensing field, such as workpiece supports. All B Series units have a built-in "teach" function allowing them to learn from a hand-held programming unit without additional equipment or delay. They are easily configured for fixed obstructions and up to two floating beams, allowing the obstruction to move up and down within the sensing field without activating the outputs.

B Series Advanced Safety Systems

B SERIES SENSING UNITS

AVAILABLE CURTAIN LENGTHS							
30mm Detection				14mm Detection		70mm Detection	
Stocked		Available		Available		Available	
Size	P/N	Size	P/N	Size	P/N	Size	P/N
200mm - 8"	0901	1600mm - 64"	0910	200mm - 8"	0912	600mm - 24"	0921
300mm - 12"	0902	1800mm - 72"	0911	300mm - 12"	0913	800mm - 32"	0922
400mm - 16"	0903			400mm - 16"	0914	1000mm - 40"	0923
600mm - 24"	0904			600mm - 24"	0915	1200mm - 48"	0924
800mm - 32"	0905			800mm - 32"	0916	1400mm - 56"	0925
900mm - 36"	0906			900mm - 36"	0917	1600mm - 64"	0926
1000mm - 40"	0907			1000mm - 40"	0918	1800mm - 72"	0927
1200mm - 48"	0908			1200mm - 48"	0919		
1400mm - 56"	0909						

Solid State Surface Mount Construction

The B Series sensing unit is designed using state of the art surface mount technology. All of the sensing unit components are solid state, therefore, there are *no moving parts*. This significantly improves both reliability and response time. The *response time* of less than 15ms is independent of curtain size.

Connectors and Cables

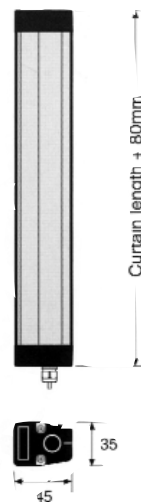
The B Series sensing units are equipped with quick disconnects. The receiver has an 8 pin male and the emitter has a 5 pin female. The molded cable assemblies are keyed to ensure that the cables cannot be inadvertently misconnected. The cables are IP68 rated, UL and CSA recognized. The cables are offered in 15 ft. and 30 ft. lengths and are ordered separately.

Cable Assemblies		Part Number
Emitter Cable 15 ft.	5 Conductor	0972
Emitter Cable 30 ft.	5 Conductor	0973
Receiver Cable 15 ft.	8 Conductor	0974
Receiver Cable 30 ft.	8 Conductor	0975

Mounting Brackets

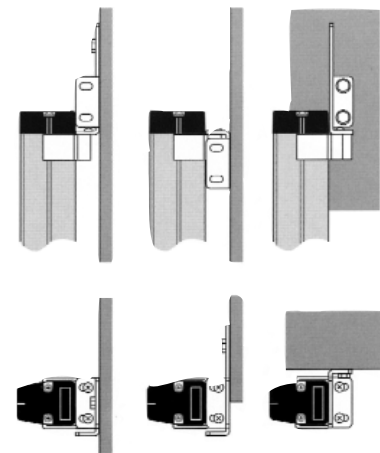
Mounting brackets are supplied with the B Series sensing units. The brackets can be oriented to accommodate most installation requirements. They are designed to fit with most commonly available structural framing systems.

Dimensions



Accessories

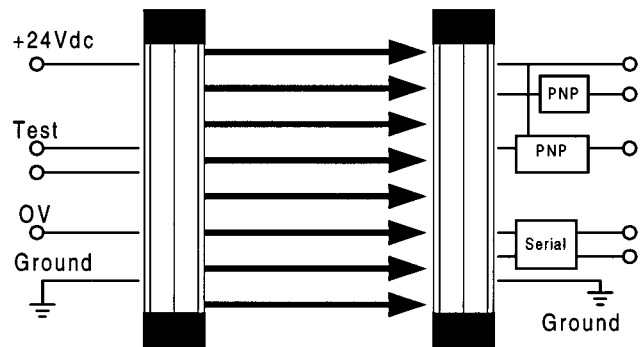
Mounting Brackets



B Series Advanced Safety Systems

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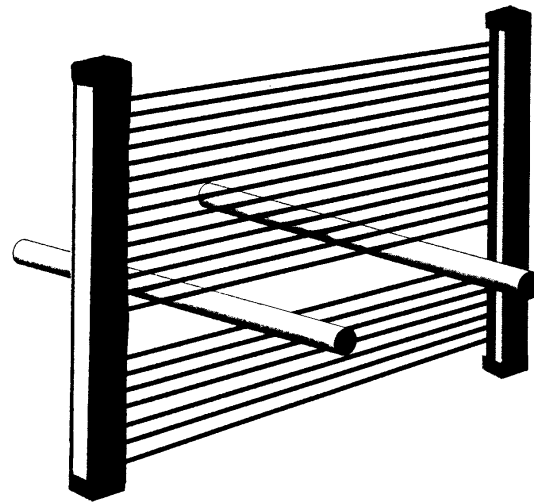
The B Series sensing units are extremely easy to install and interface with only five connections to the emitter (+24V DC, OV DC, ground, test input) and five connections to the receiver (+24V DC, OV DC, ground, safety output, and safety output 2). A "test" input is provided on the emitter which can be used by the machine to check its own circuits (if not used it can be jumpered). On the receiver unit there is a RS485 serial interface used by the hand held programming unit (for blanking). Equipment other than the hand held programming unit is not intended for this serial interface.



Beam Blanking

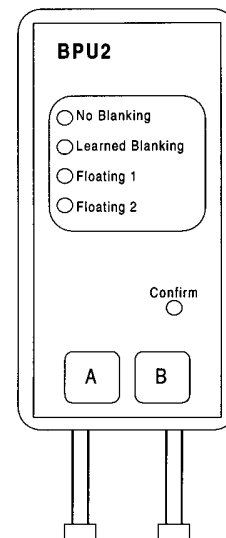
Beam blanking is an important feature of the B Series which allows selected areas of the sensing field to be disabled. This is particularly useful for those applications where fixed objects, such as workpiece supports, protrude through the curtain. All B Series light curtains are capable of being blanked with fixed and floating blanking options available for increased guarding flexibility. When in beam blanked mode, the curtain checks for any change to the programmed condition and will initiate a stop signal to the machine if, for example, an allowable obstruction is removed.

The beam blanking function is initiated via the serial interface by a compact, hand-held programming unit. This single, cost-effective programming unit is designed to provide blanking function only and has the advantage that only one unit is required in order to program any number of light curtains.



Hand Held Programming (Blanking) Unit

The programming unit is used to "teach" the B Series sensing unit when functions such as fixed blanking and floating blanking are required. One programming unit can be used to program any number of light curtains. The hand held unit is quick and easy to use. It simply connects in-line with the receiver unit (during the programming operation) by means of screw on quick disconnect cabling. Once the hand held programming unit is connected to the receiver, the programming sequence is initiated. While the programming unit is connected to the receiver the safety outputs will be in the "off" state, prohibiting the machine from operating. Once the programming is complete, the hand held unit is removed from the system, and outputs will return to the "on" state and the machine is ready to operate in the "new programmed condition".



Model BPU-2
(part number 0954)

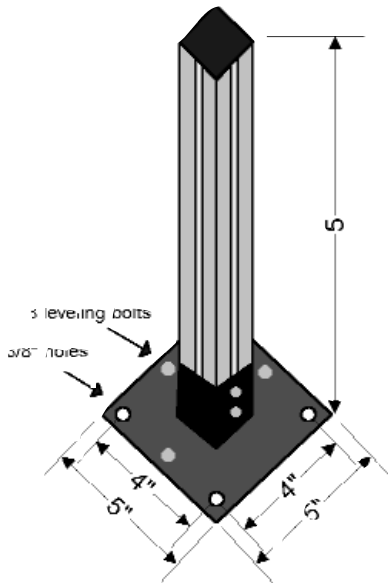
B Series Advanced Safety Systems

ACCESSORIES

Floor Stands

Floor stands are constructed from extruded aluminum. They are 5 ft. tall with a steel base for permanently affixing to the floor. The base has adjustment hardware to assist in fine tuning the optical alignment of the B Series. All of the necessary hardware is provided with the floor stands to allow easy attachment to the mounting brackets provided with the B Series sensing units.

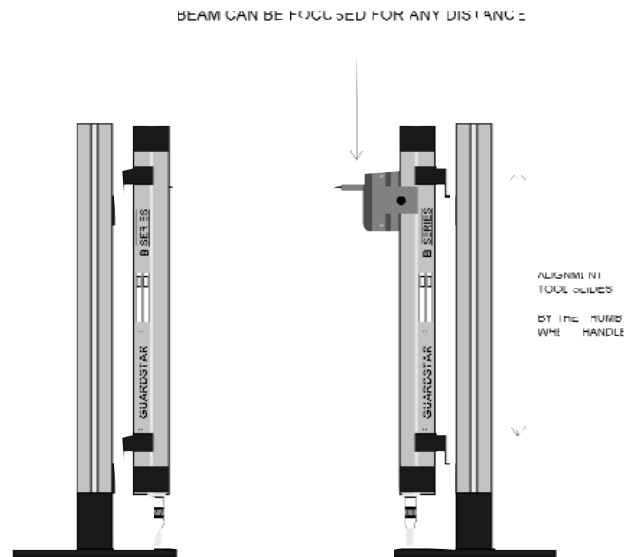
B Series Floor Stand (part number 0957)



Laser Alignment Tool

The laser alignment tool simply snaps onto the emitter or receiver of the B Series. It is intended to provide a visual indication of the alignment of the sensing unit. Particularly useful when the emitter and receiver are separated over long distances and when mirrors are involved in the application.

Laser Alignment Tool (part number 0956)

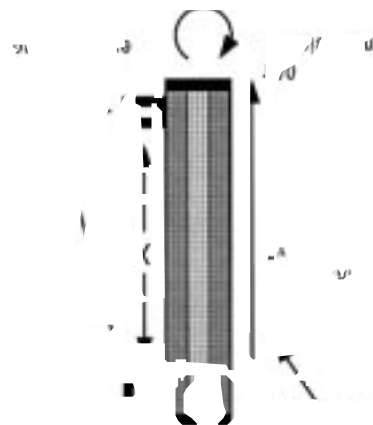


MIRROR ASSEMBLIES

Mirror assemblies are manufactured using high quality silver back mirrors attached to extruded aluminum. They are provided with two pivot brackets for easy alignment. All of the necessary hardware is provided to allow attachment to

the floor stands. The actual length of the mirror is 4" (100mm) larger than the active curtain length (sensing area) to facilitate a wide tolerance for height alignment.

B Series Mirror Assembly View



Curtain Lengths	Mirror Assembly Length	P/N
200mm - 8"	300mm - 12"	0960
300mm - 12"	400mm - 16"	0961
400mm - 16"	500mm - 20"	0962
600mm - 24"	700mm - 28"	0963
800mm - 32"	900mm - 36"	0964
900mm - 36"	1000mm - 40"	0965
1000mm - 40"	1100mm - 44"	0966
1200mm - 48"	1300mm - 52"	0967
1400mm - 56"	1500mm - 60"	0968

For units greater than 56", custom mirrors are available.

B4 Multi-Beam Perimeter Guard

An ideal solution for access and perimeter guarding applications such as automated storage and conveyor systems, the new Guardstar B Series Multi-Beam provides Category 4 level of safety integrity as defined by IEC 61496. The B4 Multi-Beam offers cost-effective guarding. The laser alignment tool can be used in conjunction with the new B Series Multi-Beam system to provide a visual indication of the alignment of the sensing units.

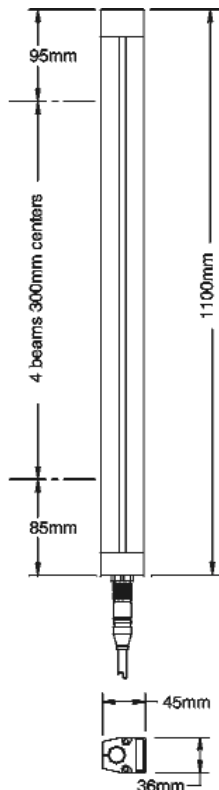
Applications include:

- Palletizers
- Automatic stackers
- Conveyors
- Warehousing systems
- Assembly lines



FEATURES & BENEFITS

- Type 4 IEC 61496
- Small cross section
- Four beams
- Laser alignment option
- Weld immune
- Easy installation
- Fail-safe PNP outputs
- Flexible interfacing
- Quick release connections



B4 Multi-Beam Technical Specifications

Number of beams	4
Beam spacing	300mm (B4)
Cross section	45mm x 36mm
Response time	< 18ms
Operating range	0.5m to 30m
Operating temperature	0 C to + 50 C
Wavelength	880nm
Enclosure rating	IP65
Effective aperture angle	+/- 4 degrees
Power consumption	< 25 VA
Safety outputs	2 x PNP (fail-safe), 500mA at 24V DC
Safety category IEC61496	4 (self monitoring)

B Series Interface Controllers

INTERFACE OPTIONS

The B Series sensing unit constitutes a complete light curtain system. It provides two redundant solid state PNP type outputs. This system has been third party certified as a type 4 device in accordance with EN61496-1. These outputs can be interfaced directly to the machine control circuit, provided this circuitry is compatible to the PNP type outputs (i.e., safety relays, emergency stop relay packages, fail-safe PLC's, etc.). The outputs are actively monitored and are constantly checked by switching them off for 50 microseconds every 5.5 milliseconds. Care should be taken in selecting a proper interface to ensure the interface is compatible to the B Series PNP type outputs. In some applications the B Series output configuration is not suitable for the machine control circuit and thus an intermediate relay package/interface unit should be considered.

BSRSA INTERFACE/CONTROLLER

The BSRSA Controller is a fully self contained unit within a metal enclosure. It is intended to be wall mounted and has four double knockouts capable of accepting standard 1/2" or 3/4" conduit. It is ideal for existing machines and end user and OEM applications. It will accept an input power source of 110/240V AC or 24V DC. It provides the necessary power to the B Series sensing unit emitter and receiver and monitors the output signals from the B Series sensing unit. The BSRSA provides two safety outputs which follow the state of the light curtain, and AUTOMATICALLY resume the "on" state once the obstruction is removed from the light curtain. Upon startup, power up, loss of power/power resumption or fault lockout condition, a front panel key or remote reset switch must be activated.

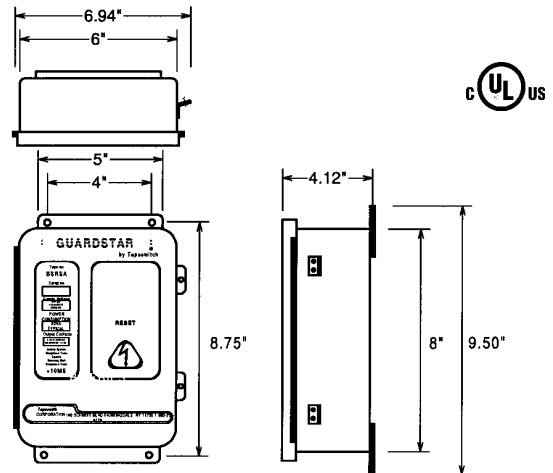
The BSRSA Controller provides a lockout contact which will be closed during normal operation and will open only when one of the above mentioned lockout conditions occurs. Both the high power input (AC) and low power control voltage (24V DC) are internally fused. The safety output contacts

INTERFACE UNITS

Tapeswitch offers a variety of interface/control units to address all applications. All of the interface units provide isolation from the light curtain system to the machine controls.

All of the B Series interface units are self monitored and control reliable. All units perform the switching of machines circuit using positively guided safety relays. All units have a minimum of two safety outputs. Several interface units are available which offer options in configuring the input power source, mounting package and type of electrical interface desired.

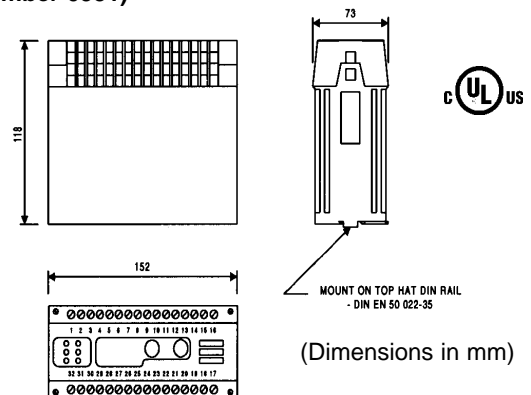
are also fused. Refer to the technical specifications table. (part number 0950)



BSRUA-2 INTERFACE/CONTROLLER

The BSRUA-2 Controller is a compact din rail mount unit capable of interfacing up to two B Series sensing units. It will accept an input power source of 110/240V AC or 24V DC. It provides the necessary power to the B Series sensing unit emitter and receiver. The two safety outputs follow the state of the light curtain and AUTOMATICALLY resume the on state once the obstruction is removed. There is no operator intervention required and no operator power up sequence necessary. The unit contains status and diagnostic indicators. The BSRUA-2 can be used for application where up to two areas of a machine must be protected and the desired machine control is the same regardless of which sensing unit (light curtain) has been obstructed. It can also be used in application where multi-side protection is necessary and conventional use of mirror is impractical.

The BSRUA-2 is ideal for many OEM and end user applications. Refer to the technical specifications table. (part number 0951)

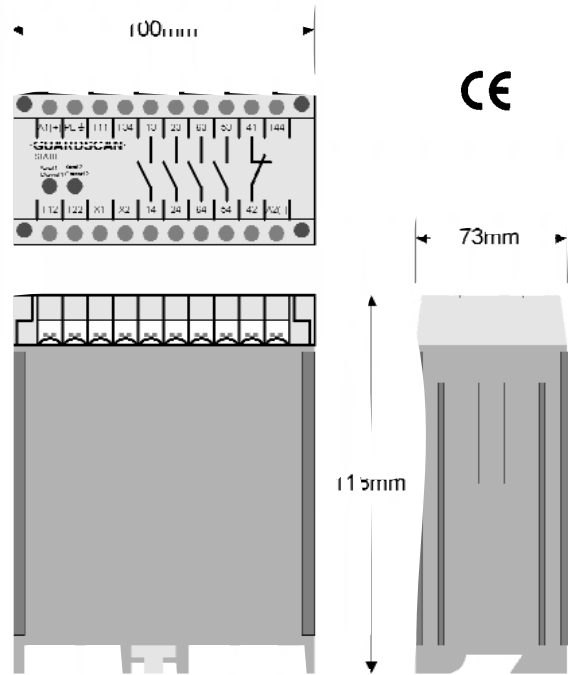


B Series Interface Controllers

SRUB INTERFACE/CONTROLLER

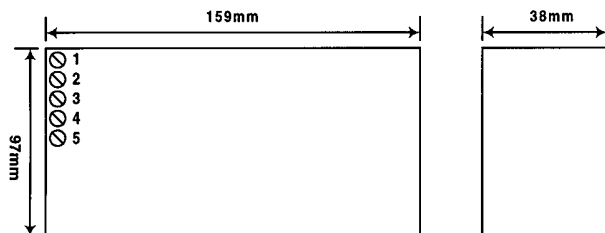
The SRUB Controller is an economical, compact din rail mount unit. It operates from 24V DC. It is field configurable for AUTOMATIC or MANUAL reset. In the automatic mode the two safety outputs follow the status of the light curtain. In this mode no operator intervention or operator power up sequence is necessary. In the manual mode the two safety outputs will go to the "off" state once the light curtain is obstructed. The outputs will remain in the off state until an external (user supplied) reset switch is activated.

The SRUB is perfect for machines with an existing +24V DC control voltage. Small size along with the economical price make it ideal for many OEM applications. Refer to the technical specifications table. **(part number 0952)**



GDC1 (+ 24 VDC POWER SUPPLY)

The GDC1 is a compact switch mode power supply and is specifically intended for use with the Guardstar B Series and SRUB interface unit. It supplies a regulated 24V DC supply to the safety equipment (i.e. safety relay and light curtain) from a wide range of AC input voltages. It is supplied complete with adapter clips to allow it to be din rail mounted. The output voltage is adjustable to account for a variety of loading conditions. **(part number 0953)**



GDC1 Technical Specifications	
Input voltage	85-264 AC
Input frequency	47-63 Hz
Input current	2A/115V 1A/230V
Inrush current	25A/115V 50A/230V
Output voltage	24 DC adj +/- 10%
Output current	2.5A
Ripple	100mV P-P
Line regulation	+/- 0.2%
Load regulation	+/- 0.2%
Overload protection	105% - 150% rated load current automatic recovery
Over voltage protection	115% - 135%
Operating temperature	- 10°C to + 60°C
Dielectric strength	3KV I/P-O/P (1 min)
Weight	550g
Safety standards	UL1012, TÜV EN60950, IEC950, UL1950

B Series Interface Controllers

INTERFACE/CONTROL UNITS TECHNICAL SPECIFICATIONS			
CONTROL UNIT SPECIFICATIONS			
Supply Voltage	BSRSA Wall Mount	SRUB Panel Mount	BSRUA-2 Panel Mount
		110/240 VAC 50/60 HZ or 24 VDC + 10%, - 15%	24 VDC +/- 10%
SAFETY CONTROLS			
Type	BSRSA Wall Mount	SRUB Panel Mount	BSRUA-2 Panel Mount
	Forced Guided Safety Relays	Forced Guided Safety Relays	Forced Guided Safety Relays
Contact Arrangement	2X N.O. 1X N.O. Lockout	2X N.O.	2X N.O.
Contact Rating	4A @ 240 VAC Resistive	6A @ 240 VAC Resistive	4A @ 240 VAC Resistive
Weight	4.0 lbs.	1.50 lbs.	3.2 lbs.
Response Time	10ms	10ms	10ms
Reset Mode	Automatic	Configurable for Manual (Latched) or Automatic	Automatic
ENCLOSURE FEATURES			
Rating	BSRSA Wall Mount	SRUB Panel Mount	BSRUA-2 Panel Mount
	NEMA 1 NEMA 12 Optional	IP20	IP20
Type	Metal Wall Mount	Din Rail EN 50 022-35	Din Rail EN 50 022-35
Connection Type	Captive Terminal Screws With Plug-In Headers	Captive Terminal Screws	Captive Terminal Screws
Features	Auxiliary (non-safety) Output (0.5 amp)	Auxiliary (non-safety) Output N/C (6 amp)	Accepts one or two B Series sensing units
Safety Standard	UL and cUL Listed	CE Marked, third party approved to EN954-1 category 4	UL and cUL Listed

SPARE PARTS LIST FOR M&L SERIES	
CONTROL UNITS	PART NUMBER
SRUL Panel Mount	0855
SRUA-2 Panel Mount	0856
SRUA Panel Mount	0884
SRSA Wall Mount	0885
SRSA Controller Board Only	0885-A

B Series Interface Controllers

C6 MULTIFUNCTION INTERFACE CONTROLLER

The controller acts as an interface between various low voltage sensors and the end user device (machine and/or process control). The C6 Multifunction Interface Controller is designed to incorporate up to six sensor zones. A combination of 1 to 3 B Series Light Curtains and/or 1 to 6 sensing products can be configured. It provides the necessary power to the B Series sensing unit emitter and receiver and monitors the output signals from the B Series sensing unit. In addition to the light curtains, the C6 is specifically engineered for operation with various pressure sensitive, normally open switches (ribbon switches, sensing edges/bumpers and switching mats).

The C6 Controller provides a constant monitoring of the sensing device. In the event of a failure within the sensor or its cable (open or short circuit) the controller automatically detects the failure. In addition to the ability to detect a failure within the sensor or its cabling, the C6 is designed to detect a failure within the controller itself. The C6 Controller is a fully self-contained unit within a metal enclosure. It is intended to be wall mounted and has six knockouts capable of accepting standard 1/2" or 3/4" conduit. It will accept an input power source range of 85 to 264 VAC at an input frequency range of 47 to 63Hz. The unit will also accept a regulated 24 VDC supply.

The C6 Controller provides the option of setting each zone for automatic or manual reset. To manually reset the controller, a key switch is provided on the front panel of the controller.

The controller provides two redundant safety output relay contacts (dry contact or voltage free) in which the output can be configured as normally open or normally closed. When the output relays are configured as normally open, the two closed contacts will open when the sensing device is actuated (i.e., safety mat is stepped on) or should a fault occur within the safety device or in the event that the power is removed.

When the zone(s) is set in Manual Mode the safety outputs will remain open until the sensing device is clear and a reset signal is applied. When the zones are set to AUTO, the safety outputs will reset automatically after the sensing device is clear.

Each of the six zones is equipped with three indicator lights: Manual Mode, Output On and Output Off which aid in providing the status of each zone. The C6 Controller also has non-safety monitor output relays for each zone. They are Form C (normally open, common, normally closed) contact arrangements. The monitor relays are intended for status purposes only. For detailed Technical Specifications consult the table in the Interface Controllers Section of this catalog. **(part number 0480)**

