

Safety monitoring modules

Safety monitoring modules and control systems



Safety controllers are designed to increase the level of safety in machine guarding and/or E-stop control circuits. They feature redundant, dual channel, cross monitoring logic circuits. These continuously check for, and detect, faults in the system's safety circuit components and interconnection wiring.

Safety controllers are capable of detecting many types of potential safety circuit faults (depending on the model): Welded interlock/E-stop switch contacts; Open circuits, short circuits or ground faults; Faults in the modules safety relays; Faults in the modules monitoring circuits; Inadequate supply voltage; Welded or stuck contacts in the controlled output motor contactor or control relay; Capacitive or inductive interference on controller inputs.

Schmersal offers both conventional electro-mechanical relay based (AES) and unique microprocessor based (SRB) models.

For more information on Safety Controllers, please consult our online product catalog at www.usa.schmersal.com, or our GK-2 guide to safety controllers

Selection Guides

5-2



INPUT			OUTPUT			Model Code
Input Contacts	No. of Independent Dual Channel Devices	Operating Voltage	Output Type	Safety Outputs Instant (Delayed)	Auxiliary Output Dry Contact (Semiconductor)	
2NC	1	24VDC	Instant	1 (0)	0 (2)	AES 1135
				2 (0)	0 (0)	AES 1235
		24VAC/DC	Instant	3 (0)	1 (0)	SRB 301 MC
						SRB 301 MA
						SRB 301 ST
				5 (0)	1 (3)	SRB 301 LC(I)
						SRB 301 LC/B
						SRB 504 ST
		Delayed	2 (1)	0 (1)	SRB 211 ST	
			3 (2)	1 (3)	SRB 324 ST	
	0 (3)		1 (0)	SRB 031 MC		
	24-230VAC/DC	Instant	1 (0)	0 (2)	AES 2135	
			3 (0)	0 (2)	AES 2335	
	48-230VAC	Instant	3 (0)	1 (0)	SRB 301 ST-230	
					SRB 301 SQ	
	6	24VAC/DC	Instant	2 (0)	0 (6)	SRB 206 ST
SRB 206 SQ						
48-230VAC		Instant	2 (0)	0 (6)	SRB 206 ST-230	
					SRB 206 SQ-230	
1NO/1NC (Isolated) ¹	1	24VDC	Instant	1 (0)	0 (2)	AES 1135
				2 (0)	0 (0)	AES 1235
		24VAC/DC	Instant	3 (0)	0 (1)	AES 1337
					1 (0)	SRB 301 AN
					0 (1)	SRB 211 AN
	24-230VAC/DC	Instant	1 (0)	0 (2)	AES 2135	
			3 (0)	0 (2)	AES 2335	
	2	24VDC	Instant	1 (0)	0 (0)	AES 1165
				2 (0)	0 (2)	AES 1265
	6	24VDC	Instant	2 (0)	1 (6)	SRB 207 AN-24VDC
AES 2285						
48-230VAC		Instant	2 (0)	1 (6)	SRB 207 AN-230	
1NO/1NC (C-Form) ²	1	24VAC/DC	Instant	1 (0)	0 (0)	AES 1102-24VAC(DC)
		110VAC	Instant	1 (0)	0 (0)	AES 1102.1
	2	24VAC/DC	Instant	1 (0)	0 (0)	AES 1112-24VAC(DC)
		110VAC	Instant	1 (0)	0 (0)	AES 1112.1
1NC	1	24VAC/DC	Instant	4 (0)	1 (0)	SRB 401 LC

¹ **Isolated Contacts:** Galvanically separated contacts

² **C-Form Contacts:** Contacts having a common contact between them

For complete technical information, please visit www.usa.schmersal.net

Model Code	Control Category (Performance Level)	INPUT DEVICE TYPE								Cross Short Monitoring
		E-Stop	Safety Switch ⁴	Reed Switch Compatible	AOPD ⁵	Pulse Echo/RFID	Method of Reset ⁶			
							Automatic	Manual	Monitored Manual	
AES 1135	3 (d)	√	√	√	—	√	√			—
AES 1235	3 (d)	√	√	√	—	√	√	√		—
SRB 301 MC	4 (e)	√	√	√	√	√	√	√		Selectable
SRB 301 MA	4 (e)	√	√	√	√	√			√	Selectable
SRB 301 ST	4 (e)	√	√	√	√	√	√		√	Selectable
SRB 301 LC(I)	4 (e)	√	√	—	—	—	√	√		
SRB 301 LC/B	3 (d)/4 (e) ³	√	√	√	√	√	√	√		—
SRB 504 ST	4 (e)	√	√	√	√	—	√		√	Selectable
SRB 211 ST	4 (e)	√	√	√	√	√	√		√	Selectable
SRB 324 ST	4 (e)	√	√	√	√	√	√		√	Selectable
SRB 031 MC	3 (d)	√	√	√	√	√	√	√		Selectable
AES 2135	3 (d)	√	√	√	—	—	√			—
AES 2335	3 (d)	√	√	√	—	—	√	√		—
SRB 301 ST-230	4 (e)	√	√	—	—	—	√		√	—
SRB 301 SQ	4 (e)	√	√	—	—	—	√		√	√
SRB 206 ST	3 (d)	√	√	—	—	—	√		√	—
SRB 206 SQ	3 (d)	√	√	—	—	—	√		√	√
SRB 206 ST-230	3 (d)	√	√	—	—	—	√		√	—
SRB 206 SQ-230	3 (d)	√	√	—	—	—	√		√	√
AES 1135	3 (d)	√	√	√	—	—	√			√
AES 1235	3 (d)	√	√	√	—	—	√	√		√
AES 1337	4 (e)	√	√	√	—	—	√		√	√
SRB 301 AN	4 (e)	—	√	√	—	—	√		√	√
SRB 211 AN	4 (e)	√	√	√	—	—	√		√	Selectable
AES 2135	3 (d)	√	√	√	—	—	√			√
AES 2335	3 (d)	√	√	√	—	—	√	√		√
AES 1165	3 (d)	√	√	√	—	—	√			—
AES 1265	3 (d)	√	√	√	—	—	√	√		√
SRB 207 AN-24VDC	3 (d)	√	√	√	—	—	√		√	√
AES 2285	3 (d)	√	√	√	—	—	√		√	√
SRB 207 AN-230	3 (d)	√	√	√	—	—	√		√	√
AES 1102-24VAC(DC)	1 (c)	—	√	√	—	—	√			—
AES 1102.1	1 (c)	—	√	√	—	—	√			—
AES 1112-24VAC(DC)	1 (c)	—	√	√	—	—	√			—
AES 1112.1	1 (c)	—	√	√	—	—	√			—
SRB 401 LC	3 (d)	√	√	—	—	—	√	√		—

³ **SRB 301LC/B**: Performance Level e (Control Category 4) when used with a PLe input device which features self-monitoring

⁴ **Safety Switch**: Devices having dry contacts, e.g., keyed interlock switches with and without guardlocking, limit switches, cable pulls, hinge switches, foot switches, etc.

⁵ **AOPD**: Active Optical Protective Device, e.g. safety light curtain

⁶ **Automatic**: Safety outputs enabled as soon as safety inputs are satisfied (no reset signal required)

***Manual**: Safety outputs enabled when safety inputs are satisfied and reset signal supplied (0v to 24v transition)

***Monitored Manual**: Safety outputs enabled when safety inputs are satisfied and reset signal supplied (24v to 0v transition)

Input Expansion Modules

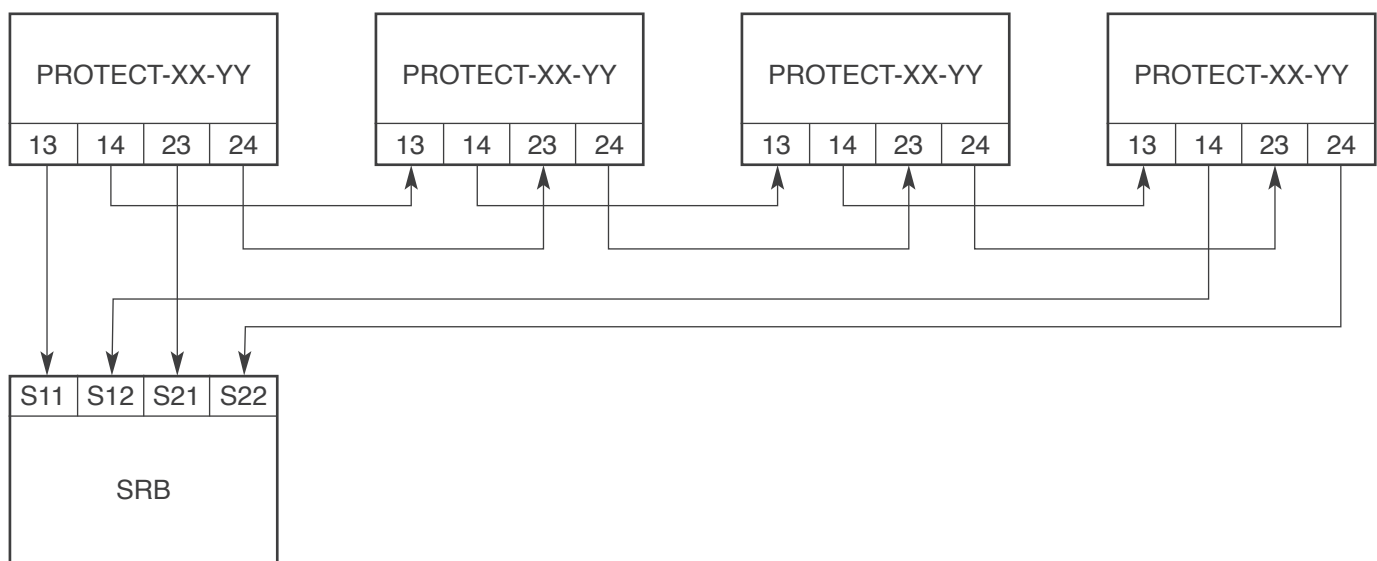
A majority of standard safety controllers used in the industry today will monitor 1 discrete device with 2 channels. Depending on the safety level to be obtained, wiring multiple switches in series to one safety controller can be a solution to scenarios such as an expanding application. This form of “daisy-chaining” however will not allow for individual diagnostics for low level safety device (i.e., limit switches) and can increase installation time and costs. Input expanders allow multiple devices to be wired to one safety controller while still having the ability of individual diagnostics. Multiple PROTECT input expanders can be used to wire a maximum of 80 dual channel devices.

	No. of 2 Channel Devices Monitored	Type of Monitored Input	Output Configuration	Input Configuration	Terminal Connection	Model Code	E-Stop Monitoring	Safety Switch ¹	Coded Magnetic Sensor	AOPD ²	Pulse Echo Compatible	Module Indicator ³ (PNP Out)
Input Expander	4	Dry Contacts	2NC	1NO/1NC	Cage Clamps	PROTECT-IE-11	✓	✓	✓	—	—	—
					Screw Terminals	PROTECT-PE-11	✓	✓	✓	—	—	✓
				Cage Clamps	PROTECT-IE-11-SK	✓	✓	✓	—	—	—	
				Screw Terminals	PROTECT-PE-11-SK	✓	✓	✓	—	—	✓	
			2NC	Cage Clamps	PROTECT-IE-02	✓	✓	✓	—	—	—	
				Screw Terminals	PROTECT-IE-02-SK	✓	✓	✓	—	—	—	
			1NO/1NC	1NO/1NC	Cage Clamps	PROTECT-PE-11-AN	✓	✓	✓	—	—	✓
					Screw Terminals	PROTECT-PE-11-AN-SK	✓	✓	✓	—	—	✓
		Dry/Non-Floating	2NC	2NC	Cage Clamps	PROTECT-PE-02	✓	✓	✓	✓	✓	✓
					Screw Terminals	PROTECT-PE-02-SK	✓	✓	✓	✓	✓	✓

¹ **Devices having dry contacts**, e.g., keyed interlock switches with and without guard locking, limit switches, cable pulls, hinge switches, foot switches, etc.

² **AOPD**: Active Optical Protective Device, e.g. safety light curtain

³ **Module Indication**: +24VDC PNP auxiliary signal indicating that all inputs are satisfied on the expansion unit.



For complete technical information, please visit www.usa.schmersal.net

Output Expansion Modules

Output expanders allow a safety controller to increase the number of safe signals that can be delivered. Each SRB-EM module will provide an additional 4 dry contact safety outputs, 2 dry contact auxiliary contacts and a connection to the main monitoring safety controller to complete an external feedback monitoring loop for the safety function.

	Additional Safety Outputs	Additional Auxiliary Outputs	Terminal Connection	Operating Voltage	Model
Output Expanders	4	2	Screw Terminals	24VAC/DC	SRB 402 EM
				115VAC	SRB 401 EM

Dual Zone Monitoring

The SRB 202C and SRB 400C safety controllers allow for dual zone monitoring without adding the complexity of using a safety PLC. No software or programming tool is required for zone setup. Input 1 is reserved for a global shutdown (the release of all safety outputs) such as an E-Stop actuation. Input 2 is reserved for dropping out only half of the safety outputs of the relay. (More information can be found on Page 9.)

Safety Outputs	Auxiliary Outputs	Input 1 Contacts	Input 2 Contacts	Input 1 Reset	Input 1 Cross Short Monitoring ¹	Model Code	Control Category (Performance Level)	E-Stop Monitoring	Safety Switch ²	Coded Magnetic Sensor	AOPD ³	Pulse Echo Compatible
2	2	2NC	1NO/1NC	Auto or Manual	No	SRB202CA	4 (e)	√	√	√	—	—
					Yes	SRB202CA/Q	4 (e)	√	√	√	—	—
				Trailing Edge	No	SRB202CA/T	4 (e)	√	√	√	—	—
					Yes	SRB202CA/QT	4 (e)	√	√	√	—	—
			2NC	Auto or Manual	No	SRB202CS	4 (e)	√	√	√	—	—
						SRB202CS/T	4 (e)	√	√	√	—	—
4	0	2NC	1NO/1NC	Auto or Manual	No	SRB400CA	4 (e)	√	√	√	—	—
					Yes	SRB400CA/Q	4 (e)	√	√	√	—	—
				Trailing Edge	No	SRB400CA/T	4 (e)	√	√	√	—	—
					Yes	SRB400CA/QT	4 (e)	√	√	√	—	—
			2NC	Auto or Manual	No	SRB400CS	4 (e)	√	√	√	—	—
						SRB400CS/T	4 (e)	√	√	√	—	—

¹ Cross short monitoring and trailing edge not available for Input device 2.

² Devices having dry contacts, e.g., keyed interlock switches with and without guard locking, limit switches, cable pulls, hinge switches, foot switches, etc.

³ AOPD: Active Optical Protective Device, e.g. safety light curtain

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Safe Speed Monitoring

Monitored Speeds	Monitored Method	Operating Voltage	Model Code	Control Category (Performance Level)	Safety Outputs
Standstill	Timer	24VDC	AZS 2305-24VDC	4 (d)	3
		110VAC	AZS 2305-110VAC	4 (d)	3
		230VAC	AZS 2305-230VAC	4 (d)	3
	1 PNP Impulse Sensor	24VDC	FWS 1206	3 (d)	2
		24-230VAC/DC	FWS 2106	3 (d)	1
			FWS 2506	3 (d)	4
	2 PNP Impulse Sensors	24VDC	FWS 1205	3 (d)	2
			DNDS	4 (d)	Selectable
		24-230VAC/DC	FWS 2105	3 (d)	1
			FWS 2505	3 (d)	4
690VAC Back EMF	24VDC	DN3PS2	4 (e)	3	
Safe Speeds	Encoders/Resolver 2 PNP Impulse Sensors	24VDC	DNDS	4 (e)	Selectable

Mats/2-Hand Controls

Operating Voltage	Type of Reset	Model	E-Stop	Safety Switch ¹	Safety Mat ²	Two-Hand Control
24VAC/DC	Monitored Reset	SRB 301HC/R-24	√	√	√	√
	Auto Reset	SRB 301HC/T-24	√	√	√	—
		SRB 201 ZH	—	—	—	√
48-230VAC	Monitored Reset	SRB 301HC/R-230	√	√	√	√
	Auto Reset	SRB 301HC/T-230	√	√	√	—

¹ **Devices having dry contacts**, e.g., keyed interlock switches with and without guard locking, limit switches, cable pulls, hinge switches, foot switches, etc.

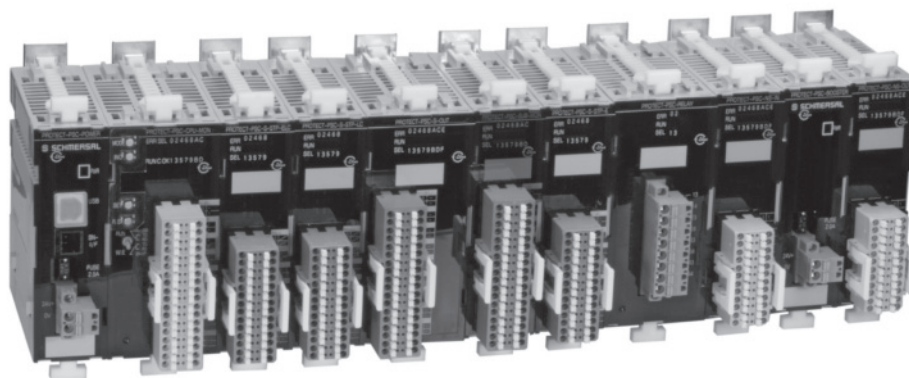
² **Safety mats** operating with an electrical cross-short principle to detect actuation.

Safety Edges Monitors

Operating Voltage	Maximum Number of Edges Monitored	Model	Control Category (Performance Level)	Method of Reset
24VDC	1	SE-400C	4 (e)	Trailing Edge
	2	SE-100C	1 (c)	—
24VAC/DC	4	SE-304C	3 (d)	Trailing Edge

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SYSTEM OVERVIEW OF PROTECT-PSC



The PSC power and PSC-CPU-MON modules with 8 safe inputs and 6 safe outputs form the basic configuration for PROTECT-PSC. (For description, see next page.)

Expand safety with:

- Safe input modules
PSC-S-IN-E and PSC-S-IN-LC
- Safe output modules
PSC-S-IN-OUT and PSC Relay
- Safe input/output modules
PSC-SUB-MON, PSC-STP-E,
PSC-S-STP-LC and PSC-S-STP-ELC

Expand operationally

- (right, gray terminals) with:
- Operational input modules
PSC-NS-IN
 - Operational output modules
PSC-NS-OUT



Module	Number of single channel inputs				Number of single channel outputs				
	Standard signals with dry contacts	Safe Dry	Non-floating	Selectable*	Standard signals with dry contacts		Safe Transistor		Relay
					0.3 A**	0.5 A**	0.3 A**	4 A**	
PSC-CPU-MON	—	4	—	4	—	6	—	—	
PSC-SUB-MON	—	4	—	4	—	6	—	—	
PSC-S-STP-E	—	4	—	2	—	4	—	—	
PSC-S-STP-LC	—	—	4	2	—	4	—	—	
PSC-S-STP-ELC	—	2	2	2	—	4	—	—	
PSC-S-Relay	—	—	—	—	—	—	—	2 x 2	
PSC-S-IN-E	—	16	—	—	—	—	—	—	
PSC-S-IN-LC	—	—	16	—	—	—	—	—	
PSC-S-OUT	—	—	—	—	—	—	16	—	
PSC-NS-IN	16	—	—	—	—	—	—	—	
PSC-NS-OUT	—	—	—	—	16	—	—	—	

* The dry or non-floating information refers to the technical properties of the input signals:

- **Dry-contacts input signals**, e.g. from emergency stop control devices, safety switches, interlocking devices, safety solenoid switches and similar.
- **Non-floating input signals**, e.g. PNP outputs from optoelectronic protective devices such as safety light curtains, laser scanners etc., but also from safety sensors from Schmersal CSS or AZM200 ranges.
- **Selectable**, input signals are monitored without cross short recognition. Outputs from optoelectronic protective devices can be directly connected, or dry contacts can be monitored up to a PL_d.

** Maximum current per output with resistive load.

For complete technical information, please visit www.usa.schmersal.net

Note