Flexible Safety Unit / Safety Guard Switching Unit G9SX/G9SX-GS

CSM_G9SX_G9SX-GS_DS_E_8_3

Logical AND Function Adds Flexibility to Various Safety Circuits



Be sure to read the "Safety Precautions" on page 45.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Unit Variation



Logical AND Function Adds Flexibility to I/O Expansion

- Facilitates partial or complete control system setup.
- Solid-state outputs (excluding Expansion Units).
- Detailed LED indications enable easy diagnosis.
- TÜV SÜD certification for compliance with IEC/EN61508 (SIL3), EN ISO13849-1 (PLe/Safety Category 4).
- Approved by UL and CSA.

Be sure to read the "*Safety Precautions*" on page 45.



For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Application Examples

Segment A

Segment B

Segment C

Segment A

Segmer



Semiconductor Manufacturing Equipment

- All of the equipment stops when the emergency stop switch is pressed.
- The processing section and conveyor section stop when the processing section cover is opened.
- Only the conveyor section stops when the conveyor section cover is opened. (2) Processing section cover (3) Conveyor section cover (3) Conveyor 1) Emergency stop Safety Door Safety Door (2) Processing Switch Switch section cover switch section cover 9 Basic Unit Advanced Unit Advanced Unit G9SX-BC G9SX-AD G9SX-AD Logical AND Logical AND connection connection C Segment B Segment A Seament C (1) Emergency stop switch



Machine Tool

Segment C

Segment C

Segment C

- When the Emergency Stop Switch is pressed, the entire machine will stop.
- If the left door is opened, the left drive section and transport section will stop.
- If the right door is opened, the right drive section and transport section will stop.



(3) Right door

(2) Left door

Model Number Structure

Model Number Legend

G9SX-1 2 3 4 5 6

- 1. Functions
 - AD/ADA: Advanced Unit
 - BC: Basic Unit
 - EX: Expansion Unit
- 2. Output Configuration (Instantaneous Safety Outputs)
 - 0: None
 - 2: 2 outputs
 - 3: 3 outputs
 - 4: 4 outputs
- 3. Output Configuration (OFF-delayed Safety Outputs) 0: None
 - 0: None
 - 2: 2 outputs
 - 4: 4 outputs

Note: Please see "Ordering Information" below for the actual models that can be ordered.

- 4. Output Configuration (Auxiliary Outputs)

 1 output
 2 outputs

 5. Max. OFF-delay Time

 Advanced Unit
 T15: 15 s
 T150: 150 s
 Basic Unit
 No indicator: No OFF delay
 Expansion Unit
 No indicator: No OFF delay
 T: OFF delay

 6. Terminal Block Type

 RT: Screw terminals
 - RC: Spring-cage terminals

Ordering Information

List of Models

Advanced Unit

Safety outputs *3		Auxiliary	Logical AND connection		No. of	Max.	Rated	Terminal block	Model
Instantaneous	OFF-delayed *2	outputs *4	Inputs	Outputs	channels	time *1	voltage	type	Model
								Screw terminals	G9SX-AD322-T15-RT
3 (Semiconductor)	2 (Semiconductor)	2 (Semiconductor)	1 (Semi- conductor)	1		15 s		Spring-cage terminals	G9SX-AD322-T15-RC
				conductor)	tor) 1 or 2	150 s	24 VDC	Screw terminals	G9SX-AD322-T150-RT
				,				Spring-cage terminals	G9SX-AD322-T150-RC
					channels	els 15 s		Screw terminals	G9SX-ADA222-T15-RT
2 (Semiconductor)			2	2				Spring-cage terminals	G9SX-ADA222-T15-RC
			conductor)	conductor)		150 s		Screw terminals	G9SX-ADA222-T150-RT
			,	,				Spring-cage terminals	G9SX-ADA222-T150-RC

*1. The OFF-delay time can be set in 16 steps as follows:

T15: 0/0.2/0.3/0.4/0.5/0.6/0.7/1/1.5/2/3/4/5/7/10/15 s

T150: 0/10/20/30/40/50/60/70/80/90/100/110/120/130/140/150 s

*2. The OFF-delayed output becomes an instantaneous output by setting the OFF-delay time to 0 s.

- *3. P channel MOS-FET output
- *4. PNP transistor output

Basic Unit

Safety outputs *1		Auxiliary outputs No. of input		Bated voltage	Terminal block type	Model	
Instantaneous OFF-delayed		*2	channels	nateu vonage	Terminal block type	Woder	
0		2 (Semiconductor)	1 or 2 channels		Screw terminals	G9SX-BC202-RT	
2				24 VDC	Spring-cage terminals	G9SX-BC202-RC	

*1. P channel MOS-FET output

*2. PNP transistor output

Expansion Unit

Safety outputs		Auxiliary outputs	OFF-delay Bated voltage		Terminal block type	Model	
Instantaneous	OFF-delayed	*1 time		naleu voltage	Terminal block type	Woder	
		1 (Semiconductor)		- 24 VDC	Screw terminals	G9SX-EX401-RT	
4 PST-NO					Spring-cage terminals	G9SX-EX401-RC	
	4 PST-NO		*2		Screw terminals	G9SX-EX041-T-RT	
					Spring-cage terminals	G9SX-EX041-T-RC	

*1. PNP transistor output

*2. The OFF-delay time is synchronized to the OFF-delay time setting in the connected Advanced Unit (G9SX-AD-□/G9SX-ADA-□).

Accessories Terminal Block

Appearance *	Specifications	Applicable units	Model	Remarks
990	Terminal Block with screw terminals (3-pin)	G9SX-AD-□ G9SX-ADA-□	Y9S-03T1B-02A	Two Terminal Blocks (black) with screw terminals, and a set of six code marks to prevent erroneous insertion.
	Terminal Block with screw terminals (4-pin)	G9SX-BC- G9SX-EX-		Two Terminal Blocks (black) with screw terminals, and a set of six code marks to prevent erroneous insertion.
990	Terminal Block with spring- cage terminals (3-pin)	G9SX-AD-□ G9SX-ADA-□	Y9S-03C1B-02A	Two Terminal Blocks (black) with spring-cage terminals, and a set of six code marks to prevent erroneous insertion.
	Terminal Block with spring- cage terminals (4-pin)	G9SX-BC-□ G9SX-EX-□	Y9S-04C1B-02A	Two Terminal Blocks (black) with spring-cage terminals, and a set of six code marks to prevent erroneous insertion.

Note: The G9SX main unit comes with a terminal block as standard equipment. The accessories shown here can be ordered as a replacement. * The illustrations show 3-pin types

Specifications

Ratings

Power input

Item Model	G9SX-AD322-□/ADA222-□	G9SX-BC202-	G9SX-EX-🗆	
Rated supply voltage	ated supply voltage 24 VDC			
Operating voltage range	-15% to 10% of rated supply voltage			
Rated power consumption *	4 W max. 3 W max. 2 W max.		2 W max.	

* Power consumption of loads not included.

Inputs

Item	Model	G9SX-AD322-□/ADA222-□	G9SX-BC202-	
Safety input		- 20.4 VDC to 26.4 VDC, internal impedance: approx. 2.8 k Ω *		
Feedback/reset input				

* Provide a current equal to or higher than that of the minimum applicable load of the connected input control device.

Outputs

Item Model	G9SX-AD322-□/ADA222-□	G9SX-BC202-□
Instantaneous safety output *1 OFF-delayed safety output *1	P channel MOS-FET output Load current: 0.8 A DC max./output *2 *3	P channel MOS-FET output Load current: 0.8 A DC max./output *2 *3
Auxiliary output	PNP transistor output Load current: 100 mA max./output	

*1. While safety outputs are in the ON state, the following signal sequence is output continuously for diagnosis. When using the safety outputs as input signals to control devices (i.e. Programmable Controllers), consider the OFF pulse shown below.

		-	Approx. 100 ms	
UFF	-		- 360 µs max.	

*2. The following derating is required when Units are mounted side-by-side. G9SX-AD322-□/G9SX-ADA222-□/G9SX-BC202-□: 0.4 A max. load current/output

 *3. A load current below 1 A DC/output can be used when the following outputs are used. G9SX-AD322-□/G9SX-ADA222-□: 2 outputs or less G9SX-BC202-□: 1 output

Expansion Unit Ratings

Item Model	G9SX-EX-
Rated load	250 VAC, 3 A/30 VDC, 3 A (resistive load)
Rated carry current	3 A
Maximum switching voltage	250 VAC, 125 VDC

Characteristics

Item	Model	G9SX-AD322-D/ADA222-D	G9SX-BC202-	G9SX-EX-		
Overvoltage	e category (IEC/EN 60664-1)	П		II (Safety relay outputs 13 to 43 and 14 to 44: III)		
Operating t	ime (OFF to ON state) *1	50 ms max. (Safety input: ON) *2 100 ms max. (Logical AND connection input: ON) *3	50 ms max. (Safety input: ON)	30 ms max. *4		
Response t	ime (ON to OFF state) *1	15 ms max.		10 ms max. *4		
Accuracy of	f OFF-delay time *5	Within ± 5% of the set value		Within \pm 5% of the set value		
	Input current	10 mA min.	+			
	ON voltage	11 V min.				
	OFF voltage	5 V min.				
Input	OFF current	1 mA max.				
	Maximum wiring length	100 m max. (External connection impedance	ce: 100 Ω max. and 10 nF max.)			
	Reset input time	100 ms min.				
Outrast	ON-state residual voltage	3.0 V max. (safety output, aux	iliary output)			
OFF-state leakage current		0.1 mA max. (safety output, au	uxiliary output)			
Insulation resistance	Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together	20 MΩ min. (at 100 VDC)				
	Between all terminals connected together and DIN track		20 MΩ min. (at 100 VDC)	100 MΩ min. (at 500 VDC)		
	Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together	500 VAC for 1 min				
Dielectric strength	Between all terminals connected together and DIN track		500 VAC for 1 min	1 000 VAC for 1 min		
-	Between different poles of outputs					
	Between safety relay outputs connected together and other terminals connected together	1		2,200 VAC for 1 min		
Vibration re	sistance	Frequency: 10 to 55 to 10 Hz, 0.375-mm single amplitude (0.75-mm double amplitude)				
Shock	Destruction	300 m/s ²				
resistance	Malfunction	100 m/s ²				
Durability	Electrical		100,000 cycles min. (rated load, switching frequency: 1,800 cycles/hour)			
Durability	Mechanical		5,000,000 cycles min. (switching frequency: 7,200 cycles/hour)			
Ambient op	erating temperature	–10 to 55°C (with no icing or c	ondensation)			
Ambient op	erating humidity	25% to 85%				
Terminal tig	htening torque *6	0.5 N·m				
Weight		Approx. 200 g	Approx. 125 g	Approx. 165 g		

*1. When two or more Units are connected by logical AND, the operating time and response time are the sum total of the operating times and response times, respectively, of all the Units connected by logical AND.

*2. Represents the operating time when the safety input turns ON with all other conditions set.

*3. Represents the operating time when the logical AND input turns ON with all other conditions set.

*4. This does not include the operating time or response time of Advanced Units that are connected.

*5. This does not include the operating time or response time of internal relays in the G9SX-EX-D.

*6. For the G9SX-D-RT (with screw terminals) only.

Logical AND Connection

Item Model	G9SX-AD322-□/ADA222-□	G9SX-BC202-	G9SX-EX-
Number of Units connected per logical AND output	4 Units max.		
Total number of Units connected by logical AND *1	20 Units max.		
Number of Units connected in series by logical AND	5 Units max.		
Max. number of Expansion Units connected *2			5 Units max.
Maximum cable length for logical AND input	100 m max./output		

Note: See Logical AND Connection Combinations below for details.

*1. The number of G9SX-EX401- Expansion Units or G9SX-EX041-T- Expansion Units (OFF-delayed Model) not included.

*2. G9SX-EX401- Expansion Units and G9SX-EX041-T- Expansion Units (OFF-delayed Model) can be mixed.

Logical AND Connection Combinations

 One logical AND connection output from an Advanced Unit G9SX-AD can be logical AND connected to up to four Advanced Units.



 Two logical AND outputs from a Basic Unit G9SX-BC can be logical AND connected to up to eight Advanced Units.



 Two logical AND outputs from an Advanced Unit G9SX-ADA can be logical AND connected to up to eight Advanced Units.



4. Any Advanced Unit with logical AND input can be logical AND connected to Advanced Units on up to five tiers.



5. Two logical AND connection outputs, each from different Advanced/Basic Units, can be logical AND connected to a single G9SX-ADA Unit.



6. The largest possible system configuration contains a total of 20 Advanced and Basic Units. In this configuration, each Advanced Unit can have up to five Expansion Units.

Advanced Unit or Basic Unit	Note 1: Basic Adva Note 2: The G outpu	Unit = G9SX-BC nced Unit = G9S) 9SX-AD322-T- t.	(-AD or G9SX-AI has only one log	DA ical AND Advanced Unit
Advanced Unit Advanced Unit	Advanced Unit Advanced Unit	Advanced Unit Advanced Unit	Advanced Unit Number of U per logical A 4 Units max.	Inits connected ND output:
Advanced Unit	Advanced Unit	Advanced Unit Advanced Unit	Advanced Unit	Advanced Unit
Number of Units in series by logit 5 Units max.	s connected cal AND:		Total numbe connected b	r of Units y logical AND:

Response Time and Operating Time

The following table shows the response time for two or more Units that are logical AND connected.

ltem	Die eis fleus die swere	Max. response time *1	Max. response time *2	Max. operating time *3	Max. operating time *4
Tier	Block flow diagram	Expansion Units)	Units)	Expansion Units)	Units)
First tier	Advanced Unit or Basic Unit	15 ms	25 ms	50 ms	80 ms
Second tier	Advanced Unit	30 ms	40 ms	150 ms	180 ms
Third tier	Advanced Unit	45 ms	55 ms	250 ms	280 ms
Fourth tier	Advanced Unit	60 ms	70 ms	350 ms	380 ms
Fifth tier	Advanced Unit	75 ms	85 ms	450 ms	480 ms

*1. The maximum response time (not including Expansion Units) in this block flow diagram is the time it takes the output from the Unit on the lowest tier to switch from ON to OFF after the input to the Unit on the highest tier switches from ON to OFF.

*2. The maximum response time (including Expansion Units) in this block flow diagram is the time it takes the output from the Expansion Unit connected to the Unit on the lowest tier to switch from ON to OFF after the input to the Unit on the highest tier switches from ON to OFF.
 *3. The maximum operating time (not including Expansion Units) in this block flow diagram is the time it takes the output from the Unit on the lowest

- 3. The maximum operating time (not including Expansion Onits) in this block how diagram is the time it takes the output from the Onit on the lowest tier to switch from OFF to ON after the input to the Unit on the highest tier switches from OFF to ON.
- *4. The maximum operating time (including Expansion Units) in this block flow diagram is the time it takes the output from the Expansion Unit connected to the Unit on the lowest tier to switch from OFF to ON after the input to the Unit on the highest tier switches from OFF to ON.

Connections

Internal Connection G9SX-AD322(Advanced Unit)



- * 3
- *1. Internal power supply circuit is not isolated.
- *2. Logical AND input is isolated.
- *3. Outputs S14 to S54 are internally redundant.

G9SX-BC202 (Basic Unit)



- *1. Internal power supply circuit is not isolated.
- *2. Outputs S14 and S24 are internally redundant.

G9SX-ADA222- (Advanced Unit)



- *1. Internal power supply circuit is not isolated.
- *2. Logical AND inputs are isolated.
- *3. Outputs S14 to S54 are internally redundant.

G9SX-EX401-□/G9SX-EX041-T-□ (Expansion Unit / Expansion Unit OFF-delayed model)



- *1. Internal power supply circuit is not isolated.
- *2. Relay outputs are isolated.

Wiring of Inputs and Outputs

Signal name	Terminal name	Description of operation	Wiring	
Power supply input	A1, A2	The input terminals for power supply. Connect the power source to the A1 and A2 terminals.	Connect the power s terminal. Connect the power s terminal.	supply plus (24 VDC) to the A1 supply minus (GND) to the A2
Safety input 1	T11, T12		Using 1 safety input channel	
Safety input 2	T21 T22	To set the safety outputs in the ON state, the ON state signals must be input to both safety input 1 and safety input 2. Otherwise the safety outputs cannot be in the ON state.	Using 2 safety input channels (cross fault detection OFF)	$ \begin{array}{c} $
	121, 122		Using 2 safety input channels (cross fault detection ON)	
Feedback/reset	T01 T00 T00	To set the safety outputs in the ON state, the ON state signal must be input to T33. Otherwise the safety outputs cannot be in the ON state.	Auto reset	+24 V +23 V (31) - (132) - (133) - (133)
input	131, 132, 133	To set the safety outputs in the ON state, the signal input to T32 must change from the OFF state to the ON state, and then to the OFF state. Otherwise the safety outputs cannot be in the ON state.	Manual reset	Reset
Logical AND connection input	T41, T42, T51, T52	A logical AND connection means that one unit (Unit A) outputs a safety signal "a" to a subsequent unit (Unit B) and Unit B calculates the logical multiplication (AND) (i.e., outputs the AND) of the signal "a" and safety signal "b", which is input to Unit B. Thereby the logic of the safety output of Unit B is "a" AND "b". (An AND of inputs "a" and "b" is output.) To set the safety outputs of the subsequent Unit in the ON state, its logical AND connection preset switch must be set to AND (enable) and the HIGH state signal must be input to T41 of the subsequent unit.	Unit A G9SX-BC202 or G9SX-AD322-T Output (a) Unit B G9SX-AD322-T Output (a) G9SX-AD322-T Output (a) G9SX-AD322-T Output (abb) G9SX-AD322-T C Unit B G9SX-AD322-T C C G9SX-AD322-T C G9SX-AD322-T C C G9SX-AD322-T C C C C C C C C C C C C C C C C C C C	ND connection sig. (1st layer) Next unit (4 unit max.) Ut b G9SX-AD322-T ND connection sig. (2nd layer) Next unit (4 unit max.)
Cross fault detection input	Y1	Selects the mode for the failure detecting (cross fault detecting) function for the safety inputs of G9SX corresponding to the connection of the cross fault detection input.	Y1 connection varies T21 are used or not. 1 and 2.	s depending on whether T11 and Refer to wiring of the safety input
Instantaneous safety output	S14, S24, S34	Turns ON/OFF according to the state of the safety inputs, feedback/reset inputs, and logical AND connection inputs. During OFF-delay state, the Instantaneous safety outputs are not able to turn ON.	Keep these outputs	open when not used.
OFF-delayed safety output	S44, S54	OFF-delayed safety outputs. The OFF-delay time is set by the OFF-delay preset switch. When the delay time is set to zero, these outputs can be used as instantaneous safety outputs.	Keep these outputs	open when not used.
Logical AND connection output	L1, L2	Outputs a signal of the same logic as the instantaneous safety outputs.	Keep these outputs	open when not used.
Auxiliary monitor output	X1	Outputs a signal of the same logic as the instantaneous safety outputs	Keep these outputs	open when not used.
Auxiliary error output	X2	Outputs when the error indicator is lit or blinking.	Keep these outputs	open when not used.

Connecting Safety Sensors and the G9SX

1. When connecting safety sensors to the G9SX, the Y1 terminal must be connected to 24 VDC. The G9SX will detect a connection error, if the Y1 terminal is open.

2. In many cases, safety sensor outputs include an OFF-shot pulse for self diagnosis.

- The following condition of test pulse is applicable as safety inputs for the G9SX. OFF-shot pulse width of the sensor, during the ON-state: $500 \ \mu s \ max$.



Operation

Functions Logical AND Connection

• Example with G9SX-AD322-

The logical AND connection means that the Basic Unit (or Advanced Unit) outputs a safety signal "a" to an Advanced Unit, and the Advanced Unit calculates the logical multiplication (AND) of the safety signal "a" and safety signal "b." The safety output of an Advanced Unit with the logical AND connection shown in the following diagram is "a" AND "b".



This is illustrated using the application in the following diagram as an example. The equipment here has two hazards identified as Robot 1 and Robot 2, and it is equipped with a safety door switch and an emergency stop switch. You may have overall control where both Robot 1 and Robot 2 are stopped every time the emergency stop switch is pressed. You may also have partial control where only Robot 1, which is closest to the door, is stopped when the door is opened. In that case, Robot 2 will continue to operate. The actual situation using a G9SX for this application is shown in this example.

(Note: The logical AND setting on the Advanced Unit must be set to AND (enabled).)



• Example with G9SX-ADA222-

The Advanced Unit G9SX-ADA222- is equipped with two logical AND connection inputs. Therefore, it is capable of receiving two safety signals, each from different Advanced or Basic Units. As shown in the diagram below, the output of Advanced Unit G9SX-ADA222- will be "a" AND "b" AND "c".



Connecting Expansion Units

- The G9SX-EX and G9SX-EX-T Expansion Units can be connected to an Advanced Unit (G9SX-AD322-□/G9SX-ADA222-□) to increase the number of safety outputs. (They cannot be connected to a Basic Unit.)
- A maximum of five Expansion Units can be connected to one Advanced Unit. This may be a combination of G9SX-EX Instantaneous types and G9SX-EX-T OFF-delayed types.
- Remove the terminating connector from the receptacle on the Advanced Unit and insert the Expansion Unit cable connector into the receptacle. Insert the terminating connector into the receptacle on the Expansion Unit at the very end (rightmost).
- When Expansion Units are connected to an Advanced Unit, make sure that power is supplied to every Expansion Unit. (Refer to the following diagram for actual Expansion Unit connection.)



Setting Procedure

1.Cross Fault Detection (Advanced Unit/Basic Unit)

Set the cross fault detection mode for safety inputs by shorting Y1 to 24 V or leaving it open. When cross fault detection is set to ON, short-circuit failures are detected between safety inputs T11-T12 and T21-22. When a cross fault is detected, the following will occur.

- 1. The safety outputs and logical AND outputs lock out.
- 2. The LED error indicator is lit.
- 3. The error output (auxiliary output) turns ON.



2.Reset Mode (Advanced Unit/Basic Unit)

Set the reset mode using feedback/reset input terminals T31, T32, and T33.

Auto reset mode is selected when terminal T32 is shorted to 24 V and manual reset mode is selected when terminal T33 is shorted to 24 V.



3.Setting Logical AND Connection (Advanced Unit)

When connecting two or more Advanced Units (or Basic Units) by logical AND connection, set the logical AND connection preset switch on the Advanced Unit that is on the input side (Advanced Unit G9SX-AD322 in the following diagram) to AND.

The default setting of the logical AND connection preset switch is set to OFF.

(1) Using G9SX-AD322 on the Input Side



- **Note: 1.** A setting error will occur and Advanced Unit G9SX-AD322 will lock out if the logical AND setting switch on the Unit is set to OFF.
 - 2. Set the logical AND setting switch on Advanced Unit A to OFF or an error will occur.
 - 3. A logical AND input cannot be sent to a Basic Unit.

(2) Using G9SX-ADA222 on the Input Side



- Note: 1. When not connecting Advanced Unit B, leave terminals T41 and T42 of the G9SX-ADA222 Advanced Unit open, and set the logical AND setting switch T41/T42 to OFF.
 - When not connecting Advanced Unit C, leave terminals T51 and T52 of the G9SX-ADA222 Advanced Unit open, and set the logical AND setting switch T51/T52 to OFF.

The following table shows the relationship between the logical ON setting switches and the conditions for safety outputs turning ON.

Logical AND preset	connection switch	Conditions for safety outputs turning ON			
T41/T42	T51/T52	Safety input	Logic input 1	Logic input 2	
OFF	OFF	ON	OFF	OFF	
AND	OFF	ON	ON	OFF	
OFF	AND	ON	OFF	ON	
AND	AND	ON	ON	ON	

4.Setting the OFF-delay Time (Advanced Unit)

The OFF-delay preset time on an Advanced Unit is set from the OFFdelay time preset switch (1 each on the front and back of the Unit). Normal operation will only occur if both switches are identically set. An error will occur if the switches are not identically set. The default setting of the OFF-delay time preset switch is set to 0 s.



Refer to the following illustration for details on setting switch positions.

G9SX-AD322-T15/G9SX-ADA222-T15



Example 1: 0-second

Example 1: 0-second



70 80 90

Example 2: 1-second OFF-delay setting

Switch

G9SX-AD322-T150/G9SX-ADA222-T150

OFF-delay setting



0 J 0 150 OFF-DELAY 0-second OFF-delay setting OFF-delay setting OFF-delay setting OFF-delay setting

60

LED Indicators

Marking	Color	Name	G9SX-AD	G9SX-ADA	G9SX-BC	G9SX-EX	G9SX-EX-T	Function	Reference
PWR	Green	Power supply indicator	О	О	О	о	о	Lights up while power is supplied.	
T1	Orange	Safety input 1 indicator	0	0	0			Lights up while a HIGH state signal is input to T12. Blinks when an error relating to safety input 1 occurs.	
T2	Orange	Safety input 2 indicator	0	0	0			Lights up while a HIGH state signal is input to T22. Blinks when an error relating to safety input 2 occurs.	
FB	Orange	Feedback/ reset input indicator	Э	0	Э			 Lights up in the following cases: With automatic reset while a HIGH state signal is input to T33. With manual reset while a HIGH state signal is input to T32. Blinks when an error relating to feedback/reset input occurs. 	
AND	Orange	Logical AND input indicator	о					Lights up while a HIGH state signal is input to T41. Blinks when an error relating to logical AND connection input occurs.	
AND1	Orange	Logical AND input indicator		о				Lights up while a HIGH state signal is input to T41. Blinks when an error relating to logical AND connection input occurs.	*
AND2	Orange	Logical AND input indicator		о				Lights up while a HIGH state signal is input to T51. Blinks when an error relating to logical AND connection input occurs.	
EI	Orange	Safety output indicator	0	о	о	о		Lights up while the Instantaneous safety outputs (S14, S24, S34) are in the ON-state. Blinks when an error relating to the instantaneous safety output occurs.	
ED	Orange	OFF-delayed safety output indicator	О	о			0	Lights up while OFF-delayed safety outputs (S44, S54) are in the ON-state. Blinks when an error relating to OFF-delayed safety output occurs.	
ERR	Red	Error indicator	О	О	0	О	О	Lights up or blinks when an error occurs.	

* Refer to Fault Detection on the next page for details.

Settings Indication (at Power ON)

Settings for the G9SX can be checked by the orange indicators for approx. 3 seconds after the power is turned ON. During this settings indication period, the ERR indicator will light, however the auxiliary error output will remain OFF

Indicator	Item	Setting position	Indicator status	Setting mode	Setting status
т1	Cross fault detection mode	V1 torminal	Lit	Cross fault detection mode: ON	Y1 = open
	cross fault detection mode	r i terminai	Not lit	Cross fault detection mode: OFF	Y1 = 24 VDC
FB	Reset mode	T32 or T33 terminal	Lit	Manual reset mode	T33 = 24 VDC
			Not lit	Auto reset mode	T32 = 24 VDC
AND	Logical AND connection input	Logical AND	Lit	Enable logical AND input	"AND"
(AND1, AND2)	mode	connection preset switch	Not lit	Disable logical AND input	"OFF"

Fault Detection

When the G9SX detects a fault, the ERR indicator and/or other indicators light up or blink to inform the user about the fault.

Check and take necessary measures referring to the following table, and then re-supply power to the G9SX.

(Advanced Unit/Basic Unit)

ERR indicator	Other indicator	Fault	Expected causes of the fault	Check points and measures to take
-) Blinks		Fault due to electro-magnetic disturbance or of internal circuits.	 Excessive electro-magnetic disturbance Failure of the internal circuit 	 Check the disturbance level around the G9SX and the related system. Replace with a new product.
	-ઌૻૣ- T1 blinks	Fault involved with safety input 1	 Failure involving the wiring of safety input 1 Incorrect setting of cross fault detection input Failure of the circuit of safety input 1 	 Check the wiring to T11 and T12. Check the wiring to Y1. Replace with a new product.
	-Č- T2 blinks	Fault involved with safety input 2	 Failure involving the wiring of safety input 2 Incorrect setting of cross fault detection input Failure of circuits of safety input 2 	 Check the wiring to T21 and T22. Check the wiring to Y1. Replace with a new product.
		Faults involved with feedback/reset input	 Failures involving the wiring of feedback/ reset input. Failures of the circuit of feedback/reset input 	 Check the wiring to T31, T32 and T33. Replace with a new product.
• Lights up	-Ď- FB blinks	Fault in Expansion Unit	 Improper feedback signals from Expansion Unit Abnormal supply voltage to Expansion Unit Foilure of the sizevit of apfety relay context 	 Check the connecting cable of Expansion Unit and the connection of the termination socket. Check the supply voltage to Expansion Unit. Note: Make sure that all Expansion units' PWR indicators are lit. Dependent the expansion List with a new and
			outputs	3) Replace the Expansion Unit with a new one.
		Fault involved with instantaneous safety outputs or logical AND connection outputs or auxiliary monitor output	 Failure involving the wiring of instantaneous safety outputs Failure of the circuit of Instantaneous safety outputs 	 Check the wiring to S14, S24, and S34. Replace with a new product.
			 Failure involving the wiring of the logical AND connection output Failure of the circuit of the logical AND connection output 	 3) Check the wiring to L1 and L2. 4) Replace with a new product.
			 Failure involving the wiring of the auxiliary monitor output Impermissible high ambient temperature 	5) Check the wiring to X1.6) Check the ambient temperature and spacing around the G9SX.
	-Ď- ED blinks	Fault involved with OFF- delayed safety outputs	 Failure involving the wiring of OFF-delayed safety relay contact outputs Incorrect set values for OFF-delay time Failure of the circuit of OFF-delayed safety relay contact outputs Impermissible high ambient temperature 	 Check the wiring to S44 and S54. Confirm the set values of the two OFF-delay time preset switches. Replace with a new product. Check the ambient temperature and spacing around the G9SX.
	-Ò- AND blinks (AND1, AND2)	Fault involved with logical AND connection input	 Failure involving the wiring of the logical AND connection input Incorrect setting for the logical AND connection input Failure of the circuit of the logical AND connection input 	 Check the wiring to T41 and T42 (T51 and T52). Note: Make sure that the wiring length for the T41, T42, T51, T52 terminal is less than 100 meters. Note: Make sure that the logical AND connection signal is branched for less than 4 units. Confirm the set value of the logical AND connection preset switch. Replace with a new product.
	-Ŭ- All indicators except PWR blink	Supply voltage outside the rated value	1) Supply voltage outside the rated value	1) Check the supply voltage to the Units.

When indicators other than the ERR indicator blink, check and take necessary actions referring to the following table.

ERR indicator	or Other		Fault	Expected cause of the fault	Check points and measures to take
O Off	T1 T2	-Ŭ- Blink	Mismatch between input 1 and input 2.	The input status between input 1 and input 2 is different, due to contact failure or a short circuit of safety input device(s) or a wiring fault.	Check the wiring from safety input devices to the G9SX. Or check the input sequence of safety input devices. After removing the fault, turn both safety inputs to the OFF state.

(Expansion Unit)

ERR indicator	Other indicators	Fault	Expected cause of the faults	Check points and measures to take
• Lights		Fault involved with safety relay outputs of Expansion Units	1)Welding of relay contacts 2)Failure of the internal circuit	Replace with a new product.

G9SX

(Unit: mm)

Dimensions and Terminal Arrangement



Expansion Unit G9SX-EX401-Expansion Unit (OFF-delayed Model) G9SX-EX041-T-



Application Examples

Highest achievable PL/ safety category	Model	Stop category	Reset
PLe/4 equivalent	Emergency Stop Switch A165E/A22 Flexible Safety Unit G9SX-BC202 Safety Limit Switch D4B-N/D4N/D4F Flexible Safety Unit G9SX-AD322-T15	M1, M2: 0	Emergency Stop: Manual Guard: Manual

Note: The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

Application Overview 1

- 1. When the emergency stop switch S1 is pressed.
- The power supply to the motor M1 and M2 is turned OFF immediately when the emergency stop switch S1 is pressed.
- The power supply to the motor M1 is kept OFF until the emergency stop switch S1 is released and the reset switch S2 is pressed.
- The power supply to the motor M2 is kept OFF until the guard is closed and the reset switch S2 and S5 are pressed while the emergency stop switch S1 is released.
- 2. When the guard is opened (the emergency stop switch S1 is released).
- The power supply to the motor M2 is turned OFF immediately when the S3 and S4 detect that the guard is opened. (The power supply to the motor M1 is kept ON.)

Е

• The power supply to the motor M2 is kept OFF until the guard is closed and the reset switch S5 is pressed.



S1:	Emergency Stop Switch
S2, S5:	Reset Switch
S3:	Safety Limit Switch
S4:	Limit Switch
KM1 to KM6:	Magnetic contactor
M1 to M2:	Motor

Timing chart 1

G9SX-BC202 (Unit 1)	(2) ∎
mergency stop switch S1	,	i i
Reset switch S2		
Unit 1 S14, S24		ļ
Unit 1 Logical AND output L1 —		<u> </u>
KM1, KM2 N.O. contact		
G9SX-AD322-T15 (Unit 2 Unit 2 Logical AND input T41 —) 🕂	
Safety limit switch S3		1
Limit switch S4		
Reset switch S5		
Unit 2 S14, S24		1
KM3, KM4 N.O. contact		

(1) Guard opened: Only the Unit 2 stops.

(2) Emergency stop switch pressed: Both the Unit 1 and 2 stop.

Note: In this example, press reset switch S2, confirm that Unit 1 has started operating, and then press reset switch S5.

Highest achievable PL/ safety category	Model	Stop category	Reset
PLe/4 equivalent	Emergency Stop Switch A165E/A22E Flexible Safety Unit G9SX-BC202 Safety Limit Switch D4B-N/D4N/D4F Safety Light Curtain F3SG Flexible Safety Unit G9SX-AD322-T15 Flexible Safety Unit G9SX-ADA222-T150	M1 to M4: 0	Emergency Stop: Manual Guard 1, 2: Auto Safety Light Curtain: Auto

Note: The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

Application Overview 2

- 1. When the emergency stop switch S1 is pressed.
- The power supply to the motor M1 to M4 is turned OFF immediately when the emergency stop switch S1 is pressed.
- The power supply to the motor M1 is kept OFF until the reset switch S2 is pressed while the emergency stop switch S1 is released.
- The power supply to the motor M2 is kept OFF until the reset switch S2 is pressed while the guard 1 is closed and the emergency stop switch S1 is released.
- The power supply to the motor M3 is kept OFF until the reset switch S2 is pressed while the guard 2 is closed and the emergency stop switch S1 is released.
- The power supply to the motor M4 is kept OFF until the reset switch S2 is pressed while the guard 1 and 2 are closed and the safety light curtain is unblocked and the emergency stop switch S1 is released.
- 2. When the guard 1 is opened (the emergency stop switch S1 is released).
- The power supply to the motor M2 and M4 is turned OFF immediately when the S3 and S4 detect that the guard 1 is opened.
- The power supply to the motor M2 is kept OFF until the guard 1 is closed.
- The power supply to the motor M4 is kept OFF until the guard 1 and 2 are closed and the safety light curtain is unblocked.

3. When the guard 2 is opened (the emergency stop switch S1 is released).

- The power supply to the motor M3 and M4 is turned OFF immediately when the S5 and S6 detect that the guard 2 is opened.
- The power supply to the motor M3 is kept OFF until the guard 2 is closed.
- The power supply to the motor M4 is kept OFF until the guard 1 and 2 are closed and the safety light curtain is unblocked.

4. When the safety light curtain is blocked (the emergency stop switch S1 is released).

- The power supply to the motor M4 is turned OFF immediately when the safety light curtain is blocked.
- The power supply to the motor M4 is kept OFF until the guard 1 and 2 are closed and the safety light curtain is unblocked.



Note: Use safety light curtains with PNP control outputs.

Timing o	chart 2							
G9SX-B0	C202 (Unit 1)					(3	3)	
	Emergency stop switch S1							
	Reset switch S2	ļ						
	Unit 1 S14, S24							
	Unit 1 Logical AND output L1, L2							
	KM1, KM2, N.O. contact							
G9SX-AI	D322-T15 (Unit 2)	(1)					
	Unit 2 Logical AND input T41	 1						
	Safety limit switch S3	 ! 					 	
	Limit switch S4	1	İ				! !	1
	Unit 2 S14, S24		1					
	Unit 2 Logical AND output L1		_					
	KM3, KM4, N.O. contact		1					
G9SX-AI	D322-T15 (Unit 3)							
	onit o Logical And input 141		1					
	Safety limit switch S5	1	1	1			1	1
	Limit switch S6		1 !	1			1	1
	Unit 3 S14, S24		!					
	Unit 3 Logical AND output L1		1	_i				
	KM5, KM6, N.O. contact		<u>i</u>					
G9SX-AI	DA222-T150 (Unit 4)			(2)			
	Unit 4 Logical AND input T41		_					
	Unit 4 Logical AND input T51		1	<u>.</u>	i i			
	Safety Light Curtain		i 1					
	Unit 4 S14, S24				_			
	KM7, KM8, N.O. contact				1			
	Rotation of motor M4		i		i			

(1) Guard 1 opened: Unit 2 and Unit 4 stop.
 (2) Guard 3 opened: Unit 4 stops.
 (3) Emergency stop switch pressed: All units stop.

Safety Guard Switching Unit G9SX-GS

A Safety Measure for Hazardous Operations That Does Not Lower Productivity

- Two functions support two types of application:
 - Auto switching: For applications where operators work together with machines
- Manual switching: For applications with limited operations
- External indicator outputs enable indicating the switching status of two safety input devices.
- Auxiliary outputs enable monitoring of safety inputs, safety outputs, and errors.
- Detailed LED indications enable easy diagnosis.
- Logical AND connection allows complicated applications in combination with other G9SX-series Units.
- Certification for compliance with IEC/EN 61508 (SIL3), IEC/EN 62061 (SIL3) and EN ISO13849-1 (PLe/Safety Category 4).

Be sure to read the "Safety Precautions" on page 45.





For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Application Examples





Model Number Structure

Model Number Legend

1. Functions GS: Safety Guard Switching Unit

- EX: Expansion Unit
- 2. Output Configuration (Instantaneous Safety Outputs)
 - 0: None
 - 2: 2 outputs
 - 4: 4 outputs
- 3. Output Configuration (OFF-delayed Safety Outputs) 0: None
 - 2: 2 outputs
 - 4: 4 outputs

Note: Please see "Ordering Information" below for the actual models that can be ordered.

- 4. Output Configuration (Auxiliary Outputs) 1: 1 output
 - 6: 6 outputs
- 5. Max. OFF-delay Time Safety Guard Switching Unit T15: 15 s Expansion Unit No indicator: No OFF delay T: OFF delay
- 6. Terminal Block Type RT: Screw terminals RC: Spring-cage terminals

Ordering Information

List of Models

Safety Guard Switching Unit

Safety o	utputs *3	Auxiliany	Logical AND connection		Max.	Patod	Terminal		
Instantaneous	eous OFF-delayed outputs *4		Inputs	Outputs	OFF-delay time *1	voltage	block type	Model	
2	2 (semiconductor)	6 semiconductor) (semiconductor)	1 (semiconductor)	1 (semiconductor)	15 s	24 VDC	Screw terminals	G9SX-GS226-T15-RT	
(semiconductor)							Spring-cage terminals	G9SX-GS226-T15-RC	

***1.** The OFF-delay time can be set in 16 steps as follows:

T15: 0, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 1, 1.5, 2, 3, 4, 5, 7, 10, or 15 s

*2. The OFF-delayed output becomes an instantaneous output by setting the OFF-delay time to 0 s.

*3. P channel MOS-FET output

*4. PNP transistor output (except for the external indicator outputs, which are P channel MOS-FET outputs)

Expansion Unit

Safety outputs		Auviliany outputs *1	OFE-dolov time	Pated voltage	Torminal block type	Madal
Instantaneous	OFF-delayed	Auxiliary outputs	OFF-delay lime	naleu voltage	Terminal block type	Model
A DET NO		1 (semiconductor)		24 VDC	Screw terminals	G9SX-EX401-RT
(contact)					Spring-cage terminals	G9SX-EX401-RC
	4 PST-NO (contact)		*2		Screw terminals	G9SX-EX041-T-RT
					Spring-cage terminals	G9SX-EX041-T-RC

*1. PNP transistor output

*2. The OFF-delay time is synchronized to the OFF-delay time setting in the connected Unit (G9SX-GS226-T15-□).

Accessories Terminal Block

Appearance *	Specifications	Applicable units	Model	Remarks
999	Terminal Block with screw terminals (4-pin)	G9SX-GS G9SX-EX-⊡	Y9S-04T1B-02A	Two Terminal Blocks (black) with screw terminals, and a set of six code marks to prevent erroneous insertion.
BDD	Terminal Block with spring- cage terminals (4-pin)	G9SX-GS G9SX-EX-⊡	Y9S-04C1B-02A	Two Terminal Blocks (black) with spring-cage terminals, and a set of six code marks to prevent erroneous insertion.

Note: The G9SX main unit comes with a terminal block as standard equipment. The accessories shown here can be ordered as a replacement. * The illustrations show 3-pin types

Specifications

Ratings

Power Input

Item Me	lodel	G9SX-GS226-T15-	G9SX-EX-	
Rated supply voltage		24 VDC		
Operating voltage range		-15% to 10% of rated supply voltage		
Rated power consumption *		5 W max.	2 W max.	

* Power consumption of loads not included.

Inputs

Item M	lodel	G9SX-GS226-T15-□
Safety inputs		
Mode selector input Feedback/reset input		Operating voltage: 20.4 VDC to 26.4 VDC, Internal impedance:

* Provide a current equal to or higher than that of the minimum applicable load of the connected input control device.

Outputs

Item Model	G9SX-GS226-T15-□
Instantaneous safety outputs *1	P channel MOS-FET outputs
OFF-delayed safety outputs *1	Load current: 0.8 A DC max./output *2
Auxiliary outputs	PNP transistor outputs
(for input, output, and error monitoring)	Load current: 0.8 A DC max./output *2
External indicator outputs	P channel MOS-FET outputs Connectable indicators • Incandescent lamp: 24 VDC, 3 to 7 W • LED lamp: 10 to 300 mA DC/output

*1. While safety outputs are in the ON state, the following signal sequence is output continuously for diagnosis.

When using the safety outputs as input signals to control devices (i.e. Programmable Controllers), consider the OFF pulse shown below.

		-	Approx. 100 ms	
OFF	-		- - 360 μs max.	

*2. The following derating is required when Units are mounted side-by-side. G9SX-GS226-T15-□: 0.4 A max. load current/output

Expansion Unit

Item Mode	I G9SX-EX-
Rated load	250 VAC, 3 A / 30 VDC, 3 A (resistive load)
Rated carry current	3 A
Maximum switching voltage	250 VAC, 125 VDC

Characteristics

Item	Model	G9SX-GS226-T15-□	G9SX-EX-		
Overvoltage category (IEC/EN 60664-1)		П	II (Safety relay outputs 13 to 43 and 14 to 44: III)		
Operating time (OFF to ON state) *1 Response time (ON to OFF state) *1		50 ms max. (Safety input: ON) *2 100 ms max. (Logical AND connection input: ON) *3	30 ms max. *4		
Response ti	me (ON to OFF state) *1	15 ms max.	10 ms max. *4		
Allowable switching time for mode selector input \star5 \star7		450 ms max.			
Response ti *6 *7	me for switching operating modes	50 ms max.			
ON-state res	sidual voltage	3.0 V max. for safety outputs, auxiliary output	its, and external indicator outputs		
OFF-state le	eakage current	0.1 mA max. for safety outputs and auxiliary outputs	outputs, 1 mA max. for external indicator		
Maximum w logical AND	iring length of safety input and input	100 m max. (External connection impedance: 100 Ω max	. and 10 nF max.)		
Reset input time (Reset button pressing time)		100 ms min.			
Accuracy of	OFF-delay time *8	Within \pm 5% of the set value			
Insulation resistance	Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together	20 MΩ min. (at 100 VDC)			
	Between all terminals connected together and DIN track		100 MΩ min. (at 500 VDC)		
	Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together	500 VAC for 1 min			
Dielectric strength	Between all terminals connected together and DIN track		1,200 VAC for 1 min		
	Between different poles of outputs				
	Between safety relay outputs connected together and other terminals connected together		2,200 VAC for 1 min		
Vibration re	sistance	Frequency: 10 to 55 to 10 Hz, 0.375-mm sin	gle amplitude (0.75-mm double amplitude)		
Shock	Destruction	300 m/s ²			
resistance	Malfunction	100 m/s ²			
Durability	Electrical		100,000 cycles min. (rated load, switching frequency: 1,800 cycles/hour)		
	Mechanical		5,000,000 cycles min. (switching frequency: 7,200 cycles/hour)		
Ambient operating temperature		-10 to 55°C (with no icing or condensation)			
Ambient op	erating humidity	25% to 85%			
Terminal tig	htening torque *9	0.5 N·m			
Weight		Approx. 240 g Approx. 165 g			

*1. When two or more Units are connected by logical AND, the operating time and response time are the sum total of the operating times and response times, respectively, of all the Units connected by logical AND.

*2. Represents the operating time when the safety input turns ON with all other conditions set.

*3. Represents the operating time when the logical AND input turns ON with all other conditions set.

*4. This does not include the operating time or response time of Safety Guard Switching Units that are connected.

*5. This is the allowable switching time for the operating mode selector. If switching takes more than 450 ms, the G9SX-GS will detect an error.

*6. This is the time required for the safety input to actually switch to an activated condition after the mode selector input is switched.

(When M2 turns ON after M1 turns OFF)



(When M1 turns OFF after M2 turns ON)



*7. Only when the G9SX-GS is used with manual switching.

*8. This does not include the operating time or response time of internal relays in the G9SX-EX-D.

*9. For the G9SX- \Box -RT (with screw terminals) only.

ItemModelG9SX-GS226-T15-G9SX-EX-Number of Units connected per logical AND output4 Units maxTotal number of Units connected by logical AND *120 Units maxNumber of Units connected in series by logical AND5 Units maxMax. number of Expansion Units connected *25 Units max.Maximum cable length for logical AND input100 m max	Logical AND Connection Note	Please see "Ordering Information" below for	or the actual models that can be ordered.
Number of Units connected per logical AND output4 Units maxTotal number of Units connected by logical AND *120 Units maxNumber of Units connected in series by logical AND5 Units maxMax. number of Expansion Units connected *25 Units max.Maximum cable length for logical AND input100 m max	Item Model	G9SX-GS226-T15-	G9SX-EX-□
Total number of Units connected by logical AND *1 20 Units max. Number of Units connected in series by logical AND 5 Units max. Max. number of Expansion Units connected *2 5 Units max. Maximum cable length for logical AND input 100 m max.	Number of Units connected per logical AND output	4 Units max.	
Number of Units connected in series by logical AND 5 Units max. Max. number of Expansion Units connected *2 5 Units max. Maximum cable length for logical AND input 100 m max.	Total number of Units connected by logical AND *1	20 Units max.	
Max. number of Expansion Units connected *2 5 Units max. Maximum cable length for logical AND input 100 m max.	Number of Units connected in series by logical AND	5 Units max.	
Maximum cable length for logical AND input 100 m max	Max. number of Expansion Units connected *2		5 Units max.
	Maximum cable length for logical AND input	100 m max.	

*1. The number of G9SX-EX401- Expansion Units or G9SX-EX041-T- Expansion Units (OFF-delayed Model) not included.

*2. G9SX-EX401- Expansion Units and G9SX-EX041-T- Expansion Units (OFF-delayed Model) can be mixed.

Connections

Internal Connection G9SX-GS226-T15 (Safety Guard Switching Unit)



*1. Internal power supply circuit is not isolated.

*2. Logical AND input is isolated.

*3. Outputs S14 to S54 and L1 are internally redundant.

G9SX-EX401-□/G9SX-EX041-T-□

(Expansion Unit/Expansion Unit with OFF Delay)



*1. Internal power supply circuit is not isolated.

*2. Relay outputs are isolated.

Wiring of Inputs and Outputs

Signal name	Terminal name	Description of operation	Wiring		
Power supply input	A1, A2	The power supply input terminals for the G9SX-GS . Connect the power source to the A1 and A2 terminals.	Connect the power s terminal. Connect the power terminal.	supply plus (24 VDC) to the A1 supply minus (GND) to the A2	
Safety input A, channel 1	T11, T12	Using Auto Switching:	Using 1 safety input channel		
		For the safety output to go to the ON state, both channels 1 and 2 of safety input A must be in the ON state, channels 1 and 2 of safety input B must be in the	Using 2 safety input channels (cross fault detection OFF)		
Safety input A, channel 2		ON state. Using Manual Switching:	Using 2 safety input channels (cross fault detection ON)		
Safety input B, channel 1	T61, T62	input A is activated, both channels 1 and 2 of safety input A must be in the ON state (for maintenance mode).	Using 1 safety input channel		
Cofety in put D		For the safety output to go to the ON state when safety input B is activated, both channels 1 and 2 of safety input B must be in the ON state (for normal operating mode)	Using 2 safety input channels (cross fault detection OFF)		
channel 2	T71, T72		Using 2 safety input channels (cross fault detection ON)	⊕† ⊕† ┌®®®™@──@¬	
Feedback/reset	T31, T32, T33	For the safety output to go to the ON state, the ON state signal must be input to T33. Otherwise the safety outputs cannot be in the ON state.	Auto reset	Feedback loop +24 v 	
input		For the safety output to go to the ON state, the signal input to T32 must change from the OFF state to the ON state, and then to the OFF state. Otherwise the safety outputs cannot be in the ON state.	Manual reset	Reset C	
Logical AND connection input	T41, T42	A logical AND connection means that one Unit (Unit A) outputs a safety signal "a" to a subsequent Unit (Unit B) and Unit B calculates the logical AND of "a" and safety signal "b." In the example shown at the right, the logical AND connection results in a safety output of "a AND b" for Unit B. Connect L1 of Unit A and T41 of Unit B to the power supply negative terminal (GND) of Unit A and T42 of Unit B. For the safety output to go to the ON state in the subsequent Unit, its logical AND connection preset switch must be set to AND (enabled) and the HIGH state signal must be input to T41 of the subsequent Unit.	Unit A G95X-GS: Output (a) (1) (42) G95X-GS: Unit B (1) (42) G95X-GS: Output (a) (1) (42) G95X-GS: (1) (42) (41) (42) (1) (42	AND connection sig. (1st layer) Next unit (4 units max.) put b (4) (4) (4) (4) (4) (4) (4) (4)	
Mode selector input	M1, M2	When manual switching is selected, the SPST-NO/ SPST-NC input enables the input of either safety input A or safety input B. The relationship of the safety input enable state and the mode selector input is as follows: M1 = ON, M2 = OFF: Safety input B is enabled (normal operating mode) M1 = OFF, M2 = ON: Safety input A is enabled (maintenance mode)	Keep the circuits op switching.	Mode selector	
Cross fault detection inputs	Pross fault Pross fault Pretection inputs Y1, Y2 Selects the mode for the failure detecting (cross fault detecting) function for the safety inputs of G9SX-GS□ corresponding to the connection of the cross fault detection input.		Keep Y1 open when using T11 and T21 (wiring to enable cross fault detection). Keep Y2 open when using T61 and T71 (wiring to enable cross fault detection). Connect Y1 to 24 VDC when not using T11 and T21 (wiring to disable cross fault detection, or when connecting safety sensors). Connect Y2 to 24 VDC when not using T61 and T71 (wiring to disable cross fault detection, or when connecting safety sensors)		
External indicator diagnosis switching inputs	Y3, Y4	Enables or disables error detection for the external indicator outputs of the G9SX-GS□.	Keep Y3 open wher Keep Y4 open wher Connect Y3 to 24 V for UA. Connect Y4 to 24 V for UB.	n detecting errors for UA. n detecting errors for UB. DC when not detecting errors DC when not detecting errors	

Signal name	Terminal name	Description of operation	Wiring
Instantaneous safety outputs	S14, S24	Turns ON/OFF according to the state of the safety inputs, feedback/reset input, and logical AND connection input. During OFF-delay state, the instantaneous safety outputs cannot turn ON.	Keep these outputs open when not used.
OFF-delayed safety outputs	S44, S54	OFF-delayed safety outputs. The OFF-delay time is set by the OFF-delay preset switch. When the delay time is set to zero, these outputs can be used as instantaneous safety outputs.	Keep these outputs open when not used.
Logical AND connection output	L1	Outputs a signal of the same logic as the instantaneous safety outputs.	Keep this output open when not used.
Auxiliary monitor output	X1	Outputs a signal of the same logic as the instantaneous safety outputs	Keep this output open when not used.
Auxiliary error output	X2	Outputs when the error indicator is lit or blinking.	Keep this output open when not used.
Auxiliary monitor outputs	X3, X4	X3 outputs a signal that is synchronized with and has the same logic as the input state of safety input A. X4 outputs a signal that is synchronized with and has the same logic as the input state of safety input B.	Keep these outputs open when not used.
External indicator outputs	UA, UB	Outputs the disabled state of the safety input. UA outputs a signal that is synchronized and has the same logic as the disabled state of safety input A. UB outputs a signal that is synchronized and has the same logic as the disabled state of safety input B.	Keep these outputs open when not used.

Connecting Safety Sensors and G9SX-GS \square

- To input the control output from safety sensors to the G9SX-GS
 the Y1 terminal must be connected to 24 VDC when the control
 output is connected to channel A. Likewise, the Y2 terminal must
 be connected to 24 VDC when the control output is connected to
 channel B. The G9SX-GS
 will detect a connection error if these
 terminals are not connected to 24 VDC.
- 2. In many cases, safety sensor outputs include an OFF-shot pulse for self diagnosis.

The following condition of test pulse is applicable as safety inputs for the G9SX.

 \bullet OFF-shot pulse width of the sensor, during the ON-state: 500 μs max.



Operation

Functions

Auto Switching Function

The following table shows the relationship between the safety inputs and safety outputs of the G9SX-GS \square when auto switching is selected.

Safety input A	ON	ON	OFF	OFF
Safety input B	ON	OFF	ON	OFF
Safety output	ON	ON	ON	OFF

Note: 1. If the logical AND connection input is enabled, it must be ON as a necessary condition for the above table.

Select either auto reset or manual reset for the reset mode, depending on the operation of the application.

Manual Switching Function

As shown in the following table, the relationship between the safety inputs and safety outputs of the G9SX-GS depends on the setting of the connected mode selector when manual switching is selected.

Mode Selector = Normal Operating Mode (M1 = ON, M2 = OFF)

Safety input A	ON	ON	OFF	OFF
Safety input B	ON	OFF	ON	OFF
Safety output	ON	OFF	ON	OFF

Mode Selector = Maintenance Mode (M1 = OFF, M2 = ON)

Safety input A	ON	ON	OFF	OFF
Safety input B	ON	OFF	ON	OFF
Safety output	ON	ON	OFF	OFF

Note: 1. If the logical AND connection input is enabled, it must be ON as a necessary condition for the above table.

 Select either auto reset or manual reset for the reset mode, depending on the operation of the application.

Logical AND Connection

The logical AND connection means that one Unit (Unit A) outputs a safety signal "a" to a subsequent Unit (Unit B) and Unit B calculates the logical AND between safety signal "a" and safety signal "b." In the example shown below, the logical AND connection results in a safety output of "a AND b" for Unit B.



External Indicator Outputs

The operator can be notified of two safety input states (enabled/ disabled) by connecting external indicator outputs UA and UB to indicators. External indicator outputs UA and UB turn ON when safety inputs A and B, respectively, are disabled, and turn OFF when safety inputs A and B, respectively, are enabled.

If error monitor output X2 turns ON, UA and UB will both turn OFF. Auto Switching Selected

External indicator output	Description of operation	Output ON condition
UA	Safety input A is disabled.	Safety input B is ON.
UB	Safety input B is disabled.	Safety input A is ON.

Manual Switching Selected

External indicator output	Description of operation	Output ON condition	
UA	Safety input A is disabled.	Mode selector switch must be set to normal operating mode.	
UB	Safety input B is disabled.	Mode selector switch must be set to maintenance mode.	

Note: Fault of external indicators can be detected. (Refer to page 32.)

Auxiliary Outputs

Auxiliary outputs X1 to X4 can be used to notify the operator of input, output, and error states, as shown in the following table.

Terminal name	Signal name	Output ON condition
X1	Auxiliary monitor output	X1 is ON when the instantaneous safety output is ON.
X2	Auxiliary error output	X2 is ON when the error LED is lit or flashing.
Х3	Input A monitor	X3 is ON when safety input A is ON.
X4	Input B monitor	X4 is ON when safety input B is ON.

Connecting Expansion Units

- The G9SX-EX and G9SX-EX-T Expansion Units can be connected to the G9SX-GS226-T15 to increase the number of safety outputs.
- A maximum of five Expansion Units can be connected to one G9SX-GS226-T15-□. This may be a combination of the G9SX-EX Instantaneous Expansion Unit and the G9SX-EX-T OFF-delayed Expansion Unit.
- When Expansion Units are connected to the G9SX-GS226-T15-D, make sure that power is supplied to every Expansion Unit. (Refer to the following diagram for actual Expansion Unit connections.)



Setting Procedure 1.Switching Function

Auto or manual switching is set by using the Switching Function setting switch on the bottom of the G9SX-GS \square . Set the switch to *Auto* for auto switching and *Manual* for manual switching.



For manual switching, connect the mode selector as shown in the following table.



2.Reset Mode

Set the reset mode using feedback/reset input terminals T31, T32, and T33.

Auto reset mode is selected when terminal T32 is shorted to 24 V and manual reset mode is selected when terminal T33 is shorted to 24 V.



3.Cross Fault Detection

When connecting a Door Switch or other safety input device, you can use Y1 or Y2 to switch the cross fault detection setting. When Y1 is open, short-circuit failures are detected between safety inputs T11-T12 and T21-T22. When Y2 is open, short-circuit failures are detected between safety inputs T61-T62 and T71-T72. When a cross fault is detected, the following will occur.

1. The safety outputs and logical AND output will be locked out.

2. The LED error indicator will light.

3. The error output (auxiliary output) will turn ON.

When a safety sensor, such as a Safety Light Curtain, is connected to safety input A, connect Y1 to 24 V. When a safety sensor is connected to safety input B, connect Y2 to 24 V. If they are not connected to 24 V, the G9SX-GS will detect an error.

Cross fault detection	Equivalent safety category	Safety input A	Safety input B
OFF	Using 1 safety input channel	+24 V S1 (1)-(12)-(22)-(1) (1)-(12)-(22)-(1)	+24 V S1 +24 V +24 V +24 V +24 V +24 V +24 V
OFF	Using 2 safety input channels	$\begin{array}{c} +24 \lor \\ & +24 \lor \\ & \\ \bigcirc \\ \bigcirc \\ & & \bigcirc \\ & & +24 \lor \\ & & +24 \lor \\ & & & +24 \lor \\ & & & +24 \lor \\ & & & & +24 \lor \\ & & & & +24 \lor \\ & & & & & +24 \lor \\ & & & & & & +24 \lor \\ & & & & & & +24 \lor \\ & & & & & & & +24 \lor \\ & & & & & & & +24 \lor \\ & & & & & & & & +24 \lor \\ & & & & & & & & & +24 \lor \\ & & & & & & & & & & +24 \lor \\ & & & & & & & & & & +24 \lor \\ & & & & & & & & & & & +24 \lor \\ & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & & & & & \\ &$	$\begin{array}{c} +24 \lor \\ 51 \\ \bigcirc \\ \hline
ON		S1 → S1 → Open (1) (1) (2) (2) (2) (1)	S1 → S1 → Open (6) - (6) - (7) - (7) - (7) → (

4. Diagnostic Checks of External Indicators

Diagnostic checks of external indicators connected to external indicator outputs UA and UB can be switched with Y3 and Y4, respectively. Enabling the diagnostic check makes it possible to detect indicator burnout or wiring errors.

If there is no indicator connected to external indicator output UA, connect Y3 to 24 V. If there is no indicator connected to external indicator output UB, connect Y4 to 24 V. If they are not connected to 24 V, the G9SX-GS \square will detect an error.



Note: Diagnostic checks cannot be made for LED indicators. Disable the diagnostic check if using LED indicators.

5.Setting Logical AND Connection

When connecting two or more Units using a logical AND connection, set the logical AND connection preset switch on the Unit that is on the input side to AND.

The default setting of the logical AND connection preset switch is set to OFF.



- Note: 1. A setting error will occur and Unit B will lock out if the logical AND setting switch on Unit B is set to OFF.
 - 2. Set the logical AND setting switch on Unit A to OFF, otherwise the Unit A output will not turn ON.

6.Setting the OFF-delay Time

The OFF-delay preset time is set from the OFF-delay time preset switch (1 each on the front and back of the Unit).

Normal operation will only occur if both switches are identically set. An error will occur if the switches are not identically set.

The default setting of the OFF-delay time preset switch is set to 0 s.



Refer to the following illustration for details on setting switch positions. **G9SX-GS226-T15-** \Box



ple 1: 0-second OFF-delay setting



Example 2: 1-second OFF-delay setting

LED Indicators

Marking	Color	Name	G9SX-GS	G9SX-EX	G9SX-EX-T	Function	Reference
PWR	Green	Power supply indicator	О	0	О	Lit while power is supplied.	
T1	Orange	Safety input A, channel 1 indicator	0			Lit while a HIGH state signal is input to T12. Blinks when an error relating to safety input A channel 1 occurs.	
T2	Orange	Safety input A, channel 2 indicator	0			Lit while a HIGH state signal is input to T22. Blinks when an error relating to safety input A channel 2 occurs.	
Т6	Orange	Safety input B, channel 1 indicator	0			Lit while a HIGH state signal is input to T62. Blinks when an error relating to safety input B channel 1 occurs.	
T7	Orange	Safety input B, channel 2 indicator	0			Lit while a HIGH state signal is input to T72. Blinks when an error relating to safety input B channel 2 occurs.	
FB	Orange	Feedback/ reset input indicator	О			 Lit in the following cases: With automatic reset while a HIGH state signal is input to T33. With manual reset while a HIGH state signal is input to T32. Blinks when an error relating to feedback/reset input occurs. 	*
AND	Orange	Logical AND input indicator	0			Lit while a HIGH state signal is input to T41. Blinks when an error relating to logical AND connection input occurs.	
EI	Orange	Safety output indicator	0	0		Lit while the Instantaneous safety outputs (S14, S24) are in the ON-state. Blinks when an error relating to the instantaneous safety output occurs.	
ED	Orange	OFF-delayed safety output indicator	0		0	Lit while OFF-delayed safety outputs (S44, S54) are in the ON-state. Blinks when an error relating to OFF-delayed safety output occurs.	
UA	Orange	Safety input A disabled state indicator	0			Lit while the input of safety input A (T12, T22) is disabled. Blinks when an error relating to the external indicator (UA) occurs.	
UB	Orange	Safety input B disabled state indicator	0			Lit while the input of safety input B (T62, T72) is disabled. Blinks when an error relating to the external indicator (UB) occurs.	
ERR	Red	Error indicator	0	0	0	Lights or blinks when an error occurs.	

* Refer to "Fault Detection" on the next page for details.

Settings Indication (at Power ON)

Settings for the G9SX-GS can be checked by the orange indicators for approx. 3 seconds after the power is turned ON. During this settings indication period, the ERR indicator will light, however the auxiliary error output will remain OFF

Indicator	Item	Setting position	Indicator status	Setting mode	Setting status
т1	Cross fault detection mode for	V1 torminal	Lit	Enabled	Y1 = open
	safety input A	r i terminai	Not lit	Disabled	Y1 = 24 VDC
те	Cross fault detection mode for	VQ terminal	Lit	Enabled	Y2 = open
10	safety input B	rz terminai	Not lit	Disabled	Y2 = 24 VDC
	Popot modo	T33 or T32 terminal	Lit	Manual reset mode	T33 = 24 VDC
гD	neset mode		Not lit	Auto reset mode	T32 = 24 VDC
	Logical AND connection input mode	Logical AND	Lit	Enabled	"AND"
AND		connection preset switch	Not lit	Disabled	"OFF"
	Switching Eurotion	Switching Function	Lit	Manual switching	"Manual"
UA, UB	Switching Function	setting switch	Not lit	Auto switching	"Auto"

Fault Detection

When the G9SX-GS \Box detects a fault, the ERR indicator and/or other indicators light or blink to inform the user about the fault. Check and take necessary measures referring to the following table, and then re-supply power to the G9SX-GS \Box .

Safety Guard Switching Unit

ERR indicator	Other indicator	Fault	Expected causes of the fault	Check points and measures to take
-Ŭ- Blinks		Fault due to electro- magnetic disturbance or of internal circuits.	 1) Excessive electromagnetic disturbance 2) Failure of the internal circuit 	 Check the disturbance level around the G9SX-GS□ and the related system. Replace with a new product.
	-ઌૣ૾- T1 blinks	Fault involved with safety input A, channel 1	 Failure involving the wiring of safety input A channel 1 Incorrect setting of cross fault detection input Failure of the circuit of safety input A channel 1 	 Check the wiring to T11 and T12. Check the wiring to Y1. Replace with a new product.
	-ઌૣૻ- T2 blinks	Fault involved with safety input A, channel 2	 Failure involving the wiring of safety input A channel 2 Incorrect setting of cross fault detection input Failure of the circuit of safety input A channel 2 	 Check the wiring to T21 and T22. Check the wiring to Y1. Replace with a new product.
	-) T6 blinks	Fault involved with safety input B, channel 1	 Failure involving the wiring of safety input B channel 1 Incorrect setting of cross fault detection input Failure of the circuit of safety input B channel 1 	 Check the wiring to T61 and T62. Check the wiring to Y2. Replace with a new product.
● Lights	-∳- T7 blinks	Fault involved with safety input B, channel 2	 Failure involving the wiring of safety input B channel 2 Incorrect setting of cross fault detection input Failure of the circuit of safety input B channel 2 	 Check the wiring to T71 and T72. Check the wiring to Y2. Replace with a new product.
	-∳- FB blinks	Faults involved with feedback/reset input	 Failures involving the wiring of feedback/reset input. Failures of the circuit of feedback/reset input 	 Check the wiring to T31, T32 and T33. Replace with a new product.
		Fault in Expansion Unit	 Improper feedback signals from Expansion Unit Abnormal supply voltage to Expansion Unit Failure of the circuit of safety relay contact outputs 	 Check the connecting cable of Expansion Unit and the connection of the terminating connector Check the supply voltage to Expansion Unit. Note: Make sure that all Expansion units' PWR indicators are lit. Replace the Expansion Unit with a new one.
	∹∳ El blinks	Fault involved with instantaneous safety outputs or logical AND connection outputs	 Failure involving the wiring of instantaneous safety outputs Failure of the circuit of Instantaneous safety outputs Failure involving the wiring of the logical AND connection output Failure of the circuit of the logical AND connection output Impermissible high ambient temperature 	 Check the wiring to S14 and S24. Replace with a new product. Check the wiring to L1. Replace with a new product. Check the ambient temperature and spacing around the G9SX-GS□.
	-∳Ç- ED blinks	Fault involved with OFF- delayed safety outputs	 Failure involving the wiring of OFF- delayed safety relay contact outputs Incorrect set values for OFF-delay time Failure of the circuit of OFF-delayed safety relay contact outputs Impermissible high ambient temperature 	 Check the wiring to S44 and S54. Confirm the set values of the OFF-delay time preset switches on the front and back of the Unit. Replace with a new product. Check the ambient temperature and spacing around the G9SX-GS□.

ERR indicator	Other indicator	Fault	Expected causes of the fault	Check points and measures to take
• Lights	َبْلِ- AND blinks	Fault involved with logical AND connection input	 Failure involving the wiring of the logical AND connection input Incorrect setting for the logical AND connection input Failure of the circuit of the logical AND connection input 	 Check the wiring to T41 and T42. Note: Make sure that the wiring length for the T41, T42 terminal is less than 100 meters. Note: Make sure that the logical AND connection signal is branched for less than 4 units. Confirm the set value of the logical AND connection preset switch. Replace with a new product.
	ېر- UA blinks	Fault involved with the external indicator output (UA)	 Failure involving the wiring of the external indicator output Failure involving the wiring of the external indicator diagnosis switching input Failure of the circuit of the external indicator output Failure of the external indicator 	 Check the wiring to UA. Check the wiring to Y3. Note: When no indicator is connected, or an LED indicator is connected, connect Y3 to 24 V. Replace with a new product. Replace the connected external indicator.
	-∳Ç- UB blinks	Fault involved with the external indicator output (UB)	 Failure involving the wiring of the external indicator output Failure involving the wiring of the external indicator diagnosis switching input Failure of the circuit of the external indicator output Failure of the external indicator 	 Check the wiring to UB. Check the wiring to Y4. Note: When no indicator is connected, or an LED indicator is connected, connect Y4 to 24 V. Replace with a new product. Replace the connected external indicator.
	ېر- UA and UB alternately blink	Fault involved with the Switching Function	 Failure involving the setting of the Switching Function setting switch Failure involving the wiring of the mode selector input Failure involving the circuit of the mode selector input Failure involving the mode selector switching time 	 Check the setting of the Switching Function setting switch. Check the wiring to M1 and M2. Replace with a new product. Check the signal switching time of the mode selector input (M1, M2).
	-Ò- All indicators except PWR blink	Supply voltage outside the rated value	1) Supply voltage outside the rated value	1) Check the supply voltage to the Units.

When indicators other than the ERR indicator blink, check and take necessary actions referring to the following table.

ERR indicator	Ot indic	her ators	Fault Expected cause of the fault		Check points and measures to take
	T1	÷.	Safety input A mismatch	The input status between safety input A channel 1 and safety input A channel 2 is different due to contact failure or a short	Check the wiring from safety input devices to the G9SX-GS. Or check the input sequence of safety input devices. After removing the fault
T2 Blink		circuit of safety input device(s) or a wiring fault.	turn both safety input A channels 1 and 2 to the OFF state.		
Off	Т6	Ņ.	Safaty input B mismatch	The input status between safety input B channel 1 and safety input B channel 2 is different due to contact failure or a short	Check the wiring from safety input devices to the G9SX-GS. Or check the input sequence of safety input devices. After removing the fault
	T7 Blir	Blink	Salety input b mismatch	circuit of safety input device(s) or a wiring fault.	turn both safety input B channels 1 and 2 to the OFF state.

(Expansion Unit)

ERR indicator	Other indicators	Fault	Expected cause of the faults	Check points and measures to take
• Lights		Fault involved with safety relay outputs of Expansion Units	1) Welding of relay contacts 2) Failure of the internal circuit	Replace with a new product.

Dimensions and Terminal Arrangement

Safety Guard Switching Unit



Expansion Unit G9SX-EX401-Expansion Unit (OFF-delayed Model) G9SX-EX041-T-



(Unit: mm)

Application Examples

Highest achievable PL/ safety category	Model	Stop category	Reset
PLe/4 equivalent	Emergency Stop Switch A165E/A22E Flexible Safety Unit G9SX-BC202 Safety Light Curtain F3SJ-B/F3SJ-E/F3SJ-A Flexible Safety Unit G9SX-GS226-T15	M1, M2: 0	Emergency Stop: Manual Safety Light Curtain: Auto

Note: The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

Application Overview 1

- 1. When the emergency stop switch S1 is pressed.
- The power supply to the motor M1 and M2 is turned OFF immediately when the emergency stop switch S1 is pressed.
- The power supply to the motor M1 is kept OFF until the reset switch S2 is pressed while the emergency stop switch S1 is released.
- The power supply to the motor M2 is kept OFF until one of the safety light curtains 1 and 2 is unblocked and the reset switch S2 is pressed while the emergency stop switch S1 is released.
- 2. When the operator and robot block the beams at the same time.
- The power supply to the motor M2 is turned OFF immediately when both beams are blocked. (The power supply to the motor M1 is kept ON.)
- The power supply to the motor M2 is kept OFF until one of the safety light curtains 1 and 2 is unblocked.



Timing Chart 1

G9SX-BC202 (Unit1)					(6) 📕	
Emergency stop switch S1					i	
Reset switch S2						
		1				
Unit 1 514, 524						
KM1, KM2 NO contact						
Unit 1 Logical AND output L1						
G95X-G5226-115 (Unit 2)	-					
Unit 2 Logical AND input 141	(1)		(3) 🖡			
(monitoring the robot: Input A)		(0) -	(4) -	(5) -		
Safety Light Curtain 2 control output	_	(2)	(4)	(5)		_
(monitoring the operator: Input B)						
Unit 2 S14, S24			-			
KM3, KM4 NO contact			1			
Input A monitor output X3						
Input B monitor output X4						
External indicator output LIA						_
External indicator output UB	-					
	į					
Controls not related to safety						
Robot movement enabled						
Robot movement enabled in						
specific area only						
Robot movement disabled			-			

Prior to operation start
 Operator inserts workpiece
 Robot processes workpiece
 Both operator and robot enter the coordinated area: Only Unit 2 stops.
 Unit 2 restarts.
 Emergency stop switch pressed: All units stop.

Highest achievable PL/ safety category	Model	Stop category	Reset
PLe/4 equivalent	Emergency Stop Switch A165E/A22E Flexible Safety Unit G9SX-BC202 Safety Limit Switch D4B-N/D4N/D4F Guard Lock Safety-door Switch D4NS/D4GS-N/D4BS Safety Key Selector Switch A22TK Flexible Safety Unit G9SX-GS226-T15	M1, M2: 0	Manual

Note: The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

Application Overview 2

- 1. Normal operating mode (When the mode M1 of the G9SX-GS is turned ON.)
- Normal operating mode (M1 = ON, M2 = OFF) is selected on the selector switch S7. The enabling switch S3 and S4 for detecting the conveyor cart position are disabled.

1-1. When the emergency stop switch S1 is pressed.

- The power supply to the motor M1 and M2 is turned OFF immediately when the emergency stop switch S1 is pressed.
- The power supply to the motor M1 is kept OFF until the reset switch S2 is pressed while the emergency stop switch S1 is released.
- The power supply to the motor M2 is kept OFF until the reset switch S2 and S8 are pressed while the guard is closed and the emergency stop switch S1 is released.

1-2. When the guard is opened (the emergency stop switch S1 is released).

- The power supply to the motor M2 is turned OFF immediately when the S5 and S6 detect that the guard is opened. (The power supply to the motor M1 is kept ON.)
- The power supply to the motor M2 is kept OFF until the guard is closed and the reset switch S8 is pressed.
- 2. Maintenance mode (When the mode M2 of the G9SX-GS is turned ON.)

Maintenance mode (M1 = OFF, M2 = ON) is selected on the selector switch S7. The S5 to detect the opening and closing of the guard is disabled.

2-1. When the emergency stop switch S1 is pressed.

- The power supply to the motor M1 and M2 is turned OFF immediately when the emergency stop switch S1 is pressed.
- The power supply to the motor M1 is kept OFF until the reset switch S2 is pressed while the emergency stop switch S1 is released.
- The power supply to the motor M2 is kept OFF until the reset switch S2 and S8 are pressed while the conveyor cart is at the safety position and safety limit switch S3 and S4 are turned ON and the emergency stop switch S1 is released.

2-2. When the conveyor cart moves away from its safe position (the emergency stop switch S1 is released).

- The power supply to the motor M2 is turned OFF after the conveyor cart moving away from the safety position and the safety limit switch S3 and S4 being turned OFF. (The power supply to the motor M1 is kept ON.)
- The power supply to the motor M2 is kept OFF until the reset switch S8 is pressed after the conveyor cart returning to the safety position and the safety limit switch S3 and S4 being turned ON.



- S7: Safety Key Selector Switch KM1 to KM4: Magnetic Contactors M1 and M2: Motors

- Note: Diagnostic checks for the external indicators connected to external indicator outputs UA and UB can be switched with Y3 and Y4, respectively.

Timing Chart 2

G9SX-BC202 (Unit 1)				(10)	,
Emergency stop switch S1					
Reset switch S2	—				
Unit 1 S14, S24 —					
Unit 1 Logical AND output L1 —					
KM1, KM2 NO contact					
G9SX-GS226-T15 (Unit 2)					
Unit 2 Logical AND input T41		(4) -			
Limit switch S3		(4)			
Safety limit switch S4	(2)				
Safety Door Switch S5 Safety limit switch S6	(3)	(0)	•		
Reset switch S8	(1)	(5)	(7) 🖡	(9)	
Mode selector input M1	(2)			(8)	
Mode selector input M2					
Unit 2 S14, S24					
Unit 2 Input A monitor output X3					
Unit 2 Input B monitor output X4					
External indicator output UA					
External indicator output UB					
KM3, KM4 NO contact		_			
Controls not related to sofaty					
onveyor section movement enabled					
ith machine in normal operating mode)					
pecific area only					

Start Unit 2 in normal operating mode.
 Use the selector switch to change to maintenance mode when the conveyor cart is at the safety position.
 The operator opens the guard and performs maintenance.
 When Safety Limit Switch S3 and Limit Switch S4 are turned OFF in maintenance mode, Unit 2 stops.

(5) After the guard is closed and the operating mode is switched to normal operating mode, restart Unit 2.
 (6) When the guard is opened during normal operating mode, Unit 2 stops.

(7) Close the guard and restart Unit 2.
(8) When the operating mode is switched to maintenance mode while Safety Limit Switch S3 and Limit Switch S4 are turned OFF, Unit 2 stops.

(9) Switch to normal operating mode, and when the guard is closed, restart Unit 2.
 (10) Emergency stop switch pressed: All units stop.

Note: 1. In this example, press reset switch S2, confirm that Unit 1 has started operating, then press reset switch S8.

2. To use the set value of the mode selector for control, use external indicator output UA for control and external indicator output UB for the operator's indication. In this case, disable the diagnostic check of the external indicator output UA.

Highest achievable PL/ safety category	Model	Stop category	Reset
PLe/4 equivalent	Emergency Stop Switch A165E/A22E Flexible Safety Unit G9SX-BC202 Safety Limit Switch D4B-N/D4N/D4F Guard Lock Safety-door Switch D4NS/D4GS-N/D4BS Safety Key Selector Switch A22TK Flexible Safety Unit G9SX-GS226-T15 Flexible Safety Unit G9SX-AD322-T15	M1, M2, M3: 0	Manual

Note: The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

Application Overview 3

- 1. When the emergency stop switch S1 is pressed.
- The power supply to the motor M1, M2, and M3 is turned OFF immediately when the emergency stop switch S1 is pressed.
- The power supply to the motor M1 is kept OFF until the reset switch S2 is pressed while the emergency stop switch S1 is released.
- The power supply to the motor M2 is kept OFF until the reset switch S2 and S8 are pressed while the guard 1 is closed and the emergency stop switch S1 is released.
- The power supply to the motor M3 is kept OFF until the reset switch S2 and S11 are pressed while the guard 2 is closed and the emergency stop switch S1 is released.

2. When the guard 2 is opened (the emergency stop switch S1 is released).

- The power supply to the motor M3 is turned OFF immediately when the S9 and S10 detect that the guard 2 is opened. (The power supply to the motor M1 and M2 is kept ON.)
- The power supply to the motor M3 is kept OFF until the guard 2 is closed and the reset switch S11 is pressed.

3-1.Normal operating mode (When the mode M1 of the G9SX-GS is turned ON.)

Normal operating mode (M1 = ON, M2 = OFF) is selected on the selector switch S7. The safety limit switch S3 and S4 to detect the conveyor cart position are disabled.

- The power supply to the motor M2 is turned OFF immediately when the S5 and S6 detect that the guard 1 is opened. (The power supply to the motor M1 and M3 is kept ON.)
- The power supply to the motor M2 is kept OFF until the guard 1 is closed and the reset switch S8 is pressed.

3-2.Maintenance mode (When the mode M2 of the G9SX-GS is turned ON.)

Maintenance mode (M1 = OFF, M2 = ON) is selected on the selector switch S7. The S5 and S6 to detect the opening and closing of the guard 1 are disabled.

- The power supply to the motor M2 is turned OFF after the conveyor cart moving away from the safety position and the safety limit switch S3 and S4 being turned OFF. (The power supply to the motor M1 and M3 is kept ON.)
- The power supply to the motor M2 is kept OFF until the reset switch S8 is pressed after the conveyor cart returning to the safety position and the safety limit switch S3 and S4 being turned ON.



Timing Chart 3

G9SX-BC202 (Unit1)							(10)	L	
Emergency stop switch S1									
Reset switch S2 _									
Unit 1 S14, S24 _									
Unit 1 Logical AND output L1									
KM1, KM2, NO contact	_								
G9SX-GS226-T15 (Unit2) Unit 2 Logical AND input T41 − Limit switch S3 ■		(4)	•	1					
Safety limit switch S4		(3) L		(6) L					
Safety Door Switch S5 Safety limit switch S6	(1)	(-)	(5)	(7)		(9)			
Reset switch S8 _		(0) -	(5)	(7)	(0) -	(3)		r	-
Mode selector input M1		(2)			(8).	·			
Mode selector input M2									
Unit 2 S14, S24 _									
Unit 2 Input A monitor output X3									
Input B monitor output X4									
External indicator output UA Unit 2									+
External indicator output UB -									
KIVIS, KIVI4, NO CONTACT									
Controls not related to safety Conveyor section movement enabled									
(with machine in normal operating mode) – Conveyor section movement enabled in specific area only –									
(with machine in maintenance mode) Conveyor section movement disabled _									-
G9SX-AD322-T15 (Unit 3)									
Unit 3 Logical AND input T41 _ Safety Door Switch S9									
Safety limit switch S10									
Reset switch S11									
Unit 3 S14, S24 _									
KM5, KM6, NO contact									<u> </u>

(1) Start Unit 2 in normal operating mode.

(1) Start Unit 2 in normal operating mode.
 (2) Use the selector switch to change to maintenance mode when the conveyor cart is at the safety position.
 (3) The operator opens the guard 1 and performs maintenance.
 (4) When Safety Limit Switch S3 and Limit Switch S4 are turned OFF in maintenance mode, Unit 2 stops.
 (5) After the guard 1 is closed and the operating mode is switched to normal operating mode, restart Unit 2.

(6) When the guard 1 is opened during normal operating mode, Unit 2 stops.(7) Close the guard 1 and restart Unit 2.

(a) When the operating mode is switched to maintenance mode while Safety Limit Switch S3 and Limit Switch S4 are turned OFF, Unit 2 stops.
 (9) Switch to normal operating mode, and when the guard 1 is closed, restart Unit 2.
 (10) Emergency stop switch pressed: All units stop.

Note: 1. In this example, press reset switch S2, confirm that Unit 1 has started operating, then press reset switch S8 and S11.

2. To use the set value of the mode selector for control, use external indicator output UA for control and external indicator output UB for the operator's indication. In this case, disable the diagnostic check of the external indicator output UA.

Safety Precautions

Be sure to read the Common Precautions for Safety Warning at the following URL: http://www.ia.omron.com/.

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Indication and Meaning for Safe Use

	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
Precautions for Safe Use	Supplementary comments on what to do or avoid doing, to use the product safely.
Precautions for Correct Use	Supplementary comments on what to do or avoid doing, to prevent failure to operate, or undesirable effect on product performance.

<Precautions for All G9SX Models>

Serious injury may possibly occur due to breakdown of safety outputs. Do not connect loads beyond the rated value to the safety outputs.	\bigcirc
Serious injury may possibly occur due to loss of required safety functions. Wire the G9SX properly so that the safety outputs do not short-circuit with the Unit power supply or load power supply.	0
Serious injury may possibly occur due to malfunction of safety outputs.	

safety outputs. Add a circuit to protect against back electromotive force

when connecting inductive loads to safety outputs. Serious injury may possibly occur due to loss of safety

functions. Use appropriate devices as given in the following table.

Control Devices	Requirements
Door interlocking switches or Safety limit switches	Use approved devices with Direct Opening Mechanism complying with IEC/EN 60947-5-1 and capable of switching micro loads of 24 VDC, 5 mA.
Safety sensors	Use approved devices complying with the relevant product standards, regulations and rules in the country where it is used. Consult a certification body to assess that the entire system satisfies the required safety category level.
Relays with forcibly guided contacts	Use approved devices with forcibly guided contacts complying with EN 50205 (IEC/EN61810-3) . For feedback purpose use devices with contacts capable of switching micro loads of 24 VDC, 5 mA.
Contactors	Use approved devices complying with IEC/EN 60947-4-1 auxiliary contact linked with power contact (mirror contact). For feedback purpose use devices with contacts capable of switching micro loads of 24 VDC, 5 mA.
Emergency stop switches	Use approved devices with Direct Opening Mechanism complying with IEC/EN 60947-5-1 Do not connect an emergency stop switch to the G9SX-GS□.
Other devices	Evaluate whether devices used are appropriate to satisfy the requirements of safety category level.

<G9SX-GS□>

Serious injury may possibly occur due to loss of safety functions. Construct an appropriate safety system as shown in the following table.



Switching function	Auto switching
Safety	Safety Sensor A
system	Area A
configuration	Safety Sensor B
example	Person
Safety	 Select Safety Sensors that satisfy the following condition:
precautions	Diameter of the smallest detectable object < Diameter of the object to be detected Install the Safety Sensors so that they satisfy the following conditions: (1)Use Safety Sensor A to detect the entry of the machine into area A, and Safety Sensor B to detect the entry of a person into area A. (2)Make sure that the machine can reach area A only by passing through Safety Sensor B. Provide a protective structure to prevent a person from passing completely through Safety Sensor B and stepping into area A. If this is not possible, install a sensor that will detect the presence of a person inside area A and prevent the machine from being restarted while the person is inside area A. Provide a sufficient safety distance (S1) considering the entry speed of a person and a sufficient safety distance (S2) considering the entry speed of the machine. For details, refer to "Safety Distance" on page 46.

Switching function	Manual switching				
Safety system configuration example	Safety Sensor Area A Safety Door Switch Safety Limit Switch Person				
Safety precautions	 Person Select Safety Sensors that satisfy the following condition: Diameter of the smallest detectable object < Diameter of the object to be detected Install the Safety Sensors so that they satisfy the following conditions: Use the Safety Sensor to detect the entry of the machine into area A. Make sure that the machine can reach area A only by passing through the Safety Sensor. Provide a protective structure to prevent a person from stepping into area A when the door is opened. If this is not possible, install a sensor that will detect the presence of a person inside area A and prevent the machine from being restarted while the person is inside area A. Provide a sufficient safety distance (S2) considering the entry speed of the machine. For details, refer to "Safety Distance" on page 46. Position the mode selector in a location where it 				

Safety Distance

The safety distance is the minimum distance that must be provided between the safety input device and a machine's hazardous part to stop the hazardous part before a person or object reaches it. The safety distance varies according to the standards of each country and the specifications of each machine. In addition, the calculation of the safety distance differs if the direction of approach is not perpendicular to the detection zone of the safety input device. Always refer to the relevant standards.

Safety Distance Concepts



1. To determine the approach speed K1, consider all factors, including the operator's physical abilities.

2. To determine the maximum approach speed K2, consult with a notified body or other authoritative institutes.

3. The response time of a machine is the time from when the machine receives a stop signal to the time when the machine's hazardous part stops. Measure the response time on the actual system. Also, periodically check that the machine's response time has not changed.

 For information on the response time of the G9SX system, refer to item 10 of "Precautions for Correct Use" on page 47.

Precautions for Safe Use

<Precautions for All G9SX Models>

- 1. Use G9SX within an enclosure with IP54 protection or higher of IEC60529.
- 2. Incorrect wiring may lead to loss of safety function. Wire conductors correctly and verify the operation of G9SX before commissioning the system in which G9SX is incorporated.
- 3. Do not apply DC voltages exceeding the rated voltages, or any AC voltages to the G9SX power supply input.
- 4. Use DC supply satisfying requirements below to prevent electric shock.
 - DC power supply with double or reinforced insulation, for example, according to IEC/EN60950 or EN50178 or a transformer according to IEC/EN61558.
 - DC supply satisfies the requirement for class 2 circuits or limited voltage/current circuit stated in UL 508.
- Apply properly specified voltages to G9SX inputs. Applying inappropriate voltages cause G9SX to fail to perform its specified function, which leads to the loss of safety functions, damages to G9SX, or burning.
- 6. Auxiliary error outputs and auxiliary monitoring outputs are NOT safety outputs. Do not use auxiliary outputs as any safety output. Such incorrect use causes loss of safety function of G9SX and its relevant system.

Also Logical AND connection outputs can only be used for logical AND connections between G9SXs.

- After installation of G9SX, qualified personnel should confirm the installation, and should conduct test operations and maintenance. The qualified personnel should be qualified and authorized to secure the safety on each phases of design, installation, running, maintenance and disposal of system.
- 8. A person in charge, who is familiar to the machine in which G9SX is to be installed, should conduct and verify the installation.
- Inspect the G9SX daily and every six months. Incorrect system operation may result in serious injury.
- 10. Do not dismantle, repair, or modify G9SX. It may lead to loss of its safety functions, creating a dangerous situation.
- 11. Use only appropriate components or devices complying with relevant safety standards corresponding to the required level of safety categories. Conformity to requirements of safety category is determined as an

Conformity to requirements of safety category is determined as an entire system.

It is recommended to consult a certification body regarding assessment of conformity to the required safety level.

- OMRON shall not be responsible for conformity with any safety standards regarding to customer's entire system.
- **13.** Disconnect G9SX from power supply when wiring, to prevent electric shock or unexpected operation.
- **14.** Be cautious not to have your fingers caught when attaching terminal sockets to the plugs on G9SX.
- 15. Do not use in combustible gases or explosive gases.

<G9SX-GS□>

- Be sure to correctly connect safety input devices to safety input A and safety input B to ensure proper operation of the safety functions.
- 2. When setting the Switching Function, be sure to consider safety control requirements, safety level and safety category of the entire system.
- 3. A qualified personnel who has a thorough understanding of the installed machine must switch the mode selector input. For example, a Switching Unit with Key must be used for the mode selector, and the key must be managed and used in such a way that the machine cannot be operated by unauthorized persons.

<G9SX-EX >

1. The durability of relays depend greatly on the switching condition. Confirm the actual conditions of operation in which the relay will be used in order to make sure of the permissible number of switching operations.

Precautions for Correct Use

<Precautions for All G9SX Models>

- 1. Handle with care
 - Do not drop G9SX to the ground or expose to excessive vibration or mechanical shocks. G9SX may be damaged and may not function properly.
- 2. Conditions of storage
 - G9SX may be damaged and may not function properly. Do not store in such conditions stated below.
 - 1. In direct sunlight
 - 2. At ambient temperatures out of the range of -10 to 55°C.
 - At relative humidity out of the range of 25% to 85% or under such temperature change that causes condensation.
 - 4. In corrosive or combustible gases
 - 5. With vibration or mechanical shocks out of the rated values.
 - 6. Under splashing of water, oil, chemicals
 - 7. In the atmosphere containing dust, saline or metal powder.
- 3. Mounting
 - Mount G9SX to DIN track with attachments (PFP-M, not incorporated to this product), not to drop off the track by vibration or other force especially when the length of DIN track is short compared to the widths of G9SX.
- Following spacing around G9SX should be available to apply rated current to outputs of G9SX and for enough ventilation and wiring:
 - 1. At least 25 mm beside side faces of the G9SX.
 - 2. At least 50 mm above top face of G9SX and below bottom face of G9SX.



- 5. Wiring (1) G9SX
 - Wire the G9SX as described below.

Solid wire	0.2 to 2.5 mm ² (AWG24 to AWG12)			
Stranded wire	0.2 to 2.5 mm ² (AWG24 to AWG12)			
<u> </u>				

- Strip no more than 7 mm of insulation from the end of the wire.
- (2) G9SX-D-RT (with Screw Terminals)
 - Tighten each screw to 0.5 to 0.6 N⋅m or the G9SX-□-RT may malfunction or generate heat.
- (3) Wiring for a Logical AND Connection
 - Use a 2-conductor cabtire cable or shielded cable to wire a logical AND connection between Units.
- 6. Connecting Expansion Units (G9SX-EX--):
 - (Only G9SX-AD□/-ADA□/-NSA□/-GS□) (1)Remove the termination connector from the G9SX, and insert the connector of the Expansion Unit into the G9SX to connect
 - it. (2)Insert the termination connector into the last Expansion Unit as viewed from the G9SX. When the G9SX is used without any Expansion Units, do not remove the termination connector from the G9SX.
 - (3)Do not remove the termination connector while the system is operating.
 - (4)Before applying the power supply voltage, confirm that the connecting sockets and plugs are locked.
 - (5)Make sure that all connected Expansion Units are supplied with power within 10 s after the power to the G9SX is turned ON. Otherwise, the G9SX will detect a power supply error for the Expansion Units.
- Use cables with a length of 100 m maximum to connect the safety inputs, feedback/reset input, logical AND connection input, logical AND connection output, or mode selector inputs.
- 8. Set the time duration of OFF-delay to an appropriate value that does not cause the loss of safety function of system.
- 9. Logical AND connection between Units
 - 1. When using Logical AND connection inputs, set the Logical AND connection preset switch to 'AND' position for the units which the logical AND connection signal are input to.
 - Connect Logical AND connection outputs appropriately to Logical AND connection inputs of the relevant unit. Verify the operation of G9SX before commissioning the system.
 - 3. Give careful consideration to the response time delay during logical AND connection in order to prevent any reduction in the safety of the safety control system.
 - 4. Use two-conductor cabtyre cable or shielded cable for wiring the logical AND connections between Units.
- 10. To determine the safety distance to hazards, take into account the delay of safety outputs caused by the following times:(1) Response time of safety inputs
 - (2) Response time of logical AND connection input (Also consider the precaution in " * " below)
 - (3) Preset OFF-delay time
 - (4) Accuracy of OFF-delay time
- * When connecting multiple Units with logical AND connections, the operating time and response time after logical AND connection inputs will be the sum of the operating times and response times of the Units that are connected in series by logical AND connections.

- 11. Start entire system after more than 5 s have passed since applying supply voltage to all G9SXs in the system.
- 12. Power Supply
 - The G9SX may malfunction due to electromagnetic disturbances. Be sure to connect terminal A2 to ground.
 - (2) When sharing a power supply with a Safety Light Curtain, use a power supply that will not fail for a momentary power interruption of 20 ms or less.
- **13.** Devices connected to G9SX may operate unexpectedly. When replacing G9SX, disconnect it from power supply.
- 14. Adhesion of solvent such as alcohol, thinner, trichloroethane or gasoline on the product should be avoided. Such solvents make the marking on G9SX illegible and cause deterioration of parts.
- **15.** Do NOT mix AC load and DC load to be switched in one G9SX-EX□-□. When switching of both AC load and DC load is necessary, connect more than two G9SX-EX□-□ and use each unit for AC load and DC load exclusively.

 Operate the reset input more than 0.4 seconds immediately after the safety outputs are OFF.
 G9SX does not accept the reset input from when the outputs are

turned ON and until 0.4 seconds passes after the outputs are turned OFF.

<G9SX-GS>

1. Use a mode selector that has an SPST-NO + SPST-NC contact form (e.g., OMRON's A22K-□-11-□□).

Safety Category (EN ISO 13849-1)

In the condition shown in *Application Examples*, G9SX can be used for the corresponding categories up to Safety category 4 per EN ISO13849-1.

This does NOT mean that G9SX can always be used for required category under all the similar conditions and situations.

Conformity to the categories must be assessed as a whole system. When using G9SX for safety categories, be sure to confirm the conformity as a whole system.

Applicable Safety Category 4 (EN ISO13849-1)

- 1. Input signals to both safety inputs (T11-T12, T21-T22, T61-T62, and T71-T72).
- Input signals to the safety inputs (T11-T12, T21-T22, T61-T62, and T71-T72) through switches equipped with a direct opening mechanism.

When using limit switches, at least one of them must have a direct opening mechanism.

- **3.** When connecting a Safety Sensor to the G9SX, use a TYPE 4 Safety Sensor.
- Input the signal through a NC contact of the contactor to Feedback/ Reset input (T31-T32 for manual reset or T31-T33 for auto reset).
- Keep the cross fault detection mode input (Y1 and Y2) open. However, when connecting devices that have a self-diagnosis function, such as Safety Sensors, apply 24 VDC to Y1 or Y2.
- 6. Be sure to connect A2 to ground.
- 7. When using a G9SX-EX□-□ Expansion Unit, connect fuses with a current rating of 3.15 A maximum to the safety relay outputs to prevent the contacts from welding.

Compliance with International Standards

Item		G9SX-AD G9SX-ADA	G9SX-BC	G9SX-GS	G9SX-EX
Approved by TÜV SÜD	EN60204-1	Approved	Approved	Approved	Approved
	EN ISO13849-1 PLe/Safety Category 4	Approved	Approved	Approved	Approved
	EN61508 SIL3	Approved	Approved	Approved	Approved
	EN62061 SIL3	Not approved	Not approved	Approved	Not approved
	IEC/EN60947-5-2	Not approved	Not approved	Not approved	Not approved
	IEC/EN60947-5-3	Not approved	Not approved	Not approved	Not approved
Approved by UL	UL508	Approved	Approved	Approved	Approved
	UL1998	Approved	Approved	Approved	Approved
	CAN/CSA C22.2 No.142	Approved	Approved	Approved	Approved
Approved by KOSHA		Approved	Approved	Approved	Approved

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