

Safety Relay Unit with negative common (NPN) G9SA-P

Units with negative common (NPN) join G9SA Series



- Four kinds of 45-mm wide Units are available:
A 3-pole model, a 5-pole model, and models with 3 poles and 2 OFF-delay poles.
- OFF-delay models have 15-step OFF-delay settings.
- Conforms to EN ISO13849-1 (PLe/Safety Category 4) *.
- Both DIN track mounting and screw mounting are possible.

* Except for some models.

Refer to "Applicable Performance Level (PL)" on page 7, or "Reliability data for safety of control components_SISTEMA library" on OMRON's website.



Be sure to read the "Safety Precautions" on page 6

Model Number Structure

Model Number Legend

Note: Specify the power supply voltage when ordering.

G9SA- □□□□□□ **-** □□□□□ **- P**
1 2 3 4 5 6 7

1. Function

None: Emergency stop

2. Contact Configuration (Safety Output)

- 0: None
- 3: 3PST-NO
- 5: 5PST-NO

3. Contact Configuration (OFF-delay Output)

- 0: None
- 2: DPST-NO
- 3: 3PST-NO

4. Contact Configuration (Auxiliary Output)

- 0: None
- 1: SPST-NC

5. Input Configuration

None: 1-channel or 2-channel input possible

6. OFF-delay Time (Max. setting time)

- None: No OFF-delay
- T075: 7.5 seconds
- T15: 15 seconds
- T30: 30 seconds

7. Common Inputs

- P: Negative common (NPN)
- None: Positive common (PNP)

Ordering Information

Specify the power supply voltage when ordering.

G9SA Master Units

Emergency-stop Units

Main contacts	Auxiliary contact	Number of input channels	Rated voltage	Model
3PST-NO	SPST-NC	1 channel or 2 channels possible	24 VDC	G9SA-301-P G9SA-501-P

Emergency-stop OFF-delay Units

Main contacts	OFF-delay contacts	Auxiliary contact	Number of input channels	OFF-delay time	Rated voltage	Model
3PST-NO	DPST-NO	SPST-NC	1 channel or 2 channels possible	7.5 s	24 VDC	G9SA-321-T075-P
				15 s		G9SA-321-T15-P
				30 s		G9SA-321-T30-P

Note: Set to maximum values in the factory.

* The following 15-step OFF-delay time settings are available:

T075: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, and 7.5 s

T15: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 s

T30: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and 30 s

G9SA-P

Specifications

Ratings

Power Input

Item	Model	G9SA-301-P	G9SA-501-P	G9SA-321-T□-P
Power supply voltage		24 VDC		
Operating voltage range		-15% to +10% of rated power supply voltage		
Power consumption		1.7 W max.	2.6 W max.	3.3 W max.

Inputs

Item	Model	G9SA-301-P/321-T□-P	G9SA-501-P
Input current		40 mA max.	60 mA max.

Contacts

Item	Model	G9SA-301-P/501-P/321-T□-P
	Load	Resistive load
Rated load		250 VAC, 5 A 30 VDC, 5 A
Rated carry current		5 A

Characteristics

Item	Model	G9SA-301-P	G9SA-501-P/321-T□-P	
Contact resistance *1		100 mΩ		
Operating time *2		30 ms max.		
Response time *3		10 ms max.		
Isolation specification	Isolation voltage (Ui)		250 VAC	
	Impulse withstand voltage (Uimp)		4 kV	
	Insulation resistance *4	Between input and output	100 MΩ min. (at 500 VDC)	
		Between different poles of output		
Dielectric strength	Between input and output	2,500 VAC 1min.		
	Between different poles of output			
Vibration resistance		10 to 55 to 10 Hz, 0.375-mm single amplitude (0.75-mm double amplitude)		
Shock resistance	Destruction	300 m/s ²		
	Malfunction	100 m/s ²		
Durability *5	Mechanical	5,000,000 operations min. (at approx. 7,200 operations/hr)		
	Electrical	100,000 operations min. (at approx. 1,800 operations/hr)		
Failure rate (P Level) (reference value)		5 VDC, 1 mA		
Ambient operating temperature		-25 to 55°C (with no icing or condensation)		
Ambient operating humidity		35% to 85%		
Terminal tightening torque		0.6 N·m		
Weight		Approx. 210 g	Approx. 270 g	

*1. The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.

*2. Not including bounce time.

*3. The response time is the time it takes for the main contact to open after the input is turned OFF. Includes bounce time.

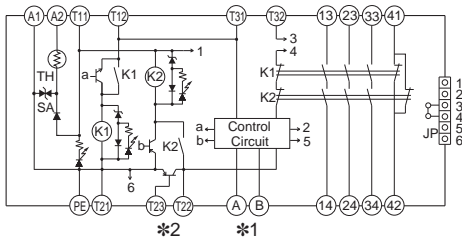
*4. The insulation resistance was measured with 500 VDC at the same places that the dielectric strength was checked.

*5. The durability is for an ambient temperature of 15 to 35°C and an ambient humidity of 25% to 75%.

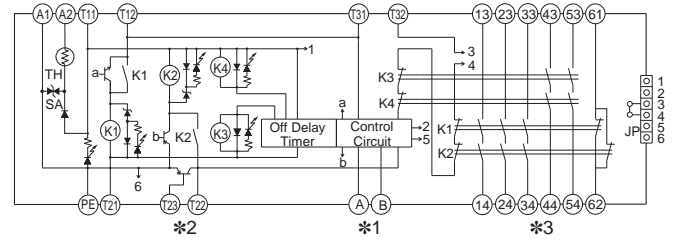
Connections

Internal Connections

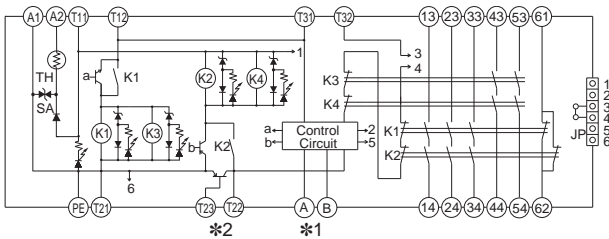
G9SA-301-P (24 VDC)



G9SA-321-T□-P (24 VDC)



G9SA-501-P (24 VDC)



Note: If the power supply is not connected to a protective ground, be sure to connect PE to a protective ground.

- *1. Use terminals A and B to switch reset mode.
A to B open: Manual reset
A to B closed: Auto-reset
- *2. Terminal T23 is used for 2-channel input with a negative common (when connecting a safety sensor with a NPN output).
When using T23, make sure that T21 and T22 are open.
For 1-channel input, make sure that T12 and T23 are shorted.
- *3. Terminals 43-44 and terminals 53-54 are OFF-delayed outputs.

Wiring of Inputs and Outputs

Signal name	Terminal name	Description of operation
Power supply input	A1, A2	The input terminals for power supply. Connect the power source to the A1 and A2 terminals. DC inputs have polarity, so A1 should be connected to the positive side and A2 to the negative side.
Safety input 1	T11, T12	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.
Safety input 2	T21, T22, T23 *1	
Feedback/reset input	T31, T32	To set the safety outputs in the ON state, the ON state signal must be input to T31 - T32. Otherwise the safety outputs cannot be in the ON state.
Instantaneous safety outputs	See below. *2	Turns ON/OFF according to the state of the safety inputs and feedback/reset inputs. During OFF-delay state, the Instantaneous safety outputs are not able to turn ON.
OFF-delayed safety outputs	See below. *2	OFF-delayed safety outputs. The OFF-delay time is set by the OFF-delay preset switch.
Auxiliary output	See below. *2	Synchronized with Instantaneous Safety Output.
Manual/Auto selector input	A, B *3	Switch between Auto Reset and Manual Reset modes.
Ground terminal	PE	The power supply is not grounded, please be sure to connect the PE to a protective earth.

***1. Terminal T23**

Terminal T23 is used for 2-channel input with a negative common (when connecting a safety sensor with a NPN output). When T23 is being used, please open T21 and T22.

***2. Output Contacts**

G9SA-301-P: Safety Output Contacts 13-14, 23-24, 33-34. Auxiliary Contact 41-42.

G9SA-501-P: Safety Output Contacts 13-14, 23-24, 33-34, 43-44, 53-54. Auxiliary Contact 61-62.

G9SA-321-T□-P: Safety Output Contacts 13-14, 23-24, 33-34. Safety OFF-delay Output Contact 43-44, 53-54. Auxiliary Contact 61-62.

***3. Terminals A and B**

A-B Opening: Manual Reset

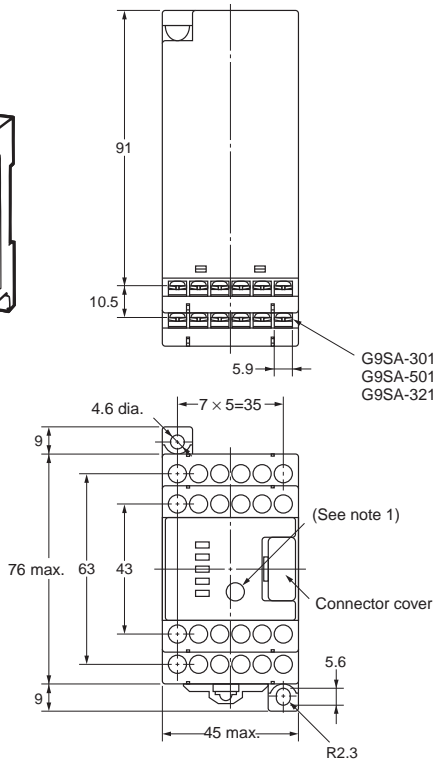
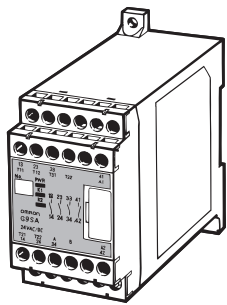
A-B Short Circuit: Auto Reset

G9SA-P

Dimensions and Terminal Arrangement

(Unit: mm)

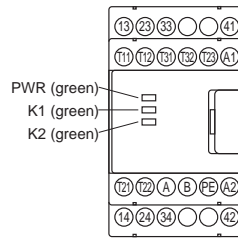
G9SA-301-P
G9SA-501-P
G9SA-321-T□-P



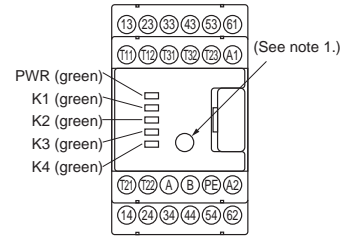
G9SA-301-P: Twenty, M3
G9SA-501-P: Twenty-four, M3
G9SA-321-T□-P: Twenty-four, M3

Terminal Arrangement

G9SA-301-P

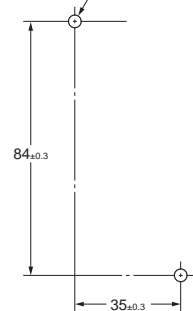


G9SA-501-P
G9SA-321-T□-P



Mounting Holes

Two, 4.2 dia. or M4



Note 1: The OFF-delay time setting switch is found on the G9SA-321-T□-P only.
Note 2: The K1 to K4 indicators light when the NO contacts of internal relays K1 to K4 close.

Application Examples

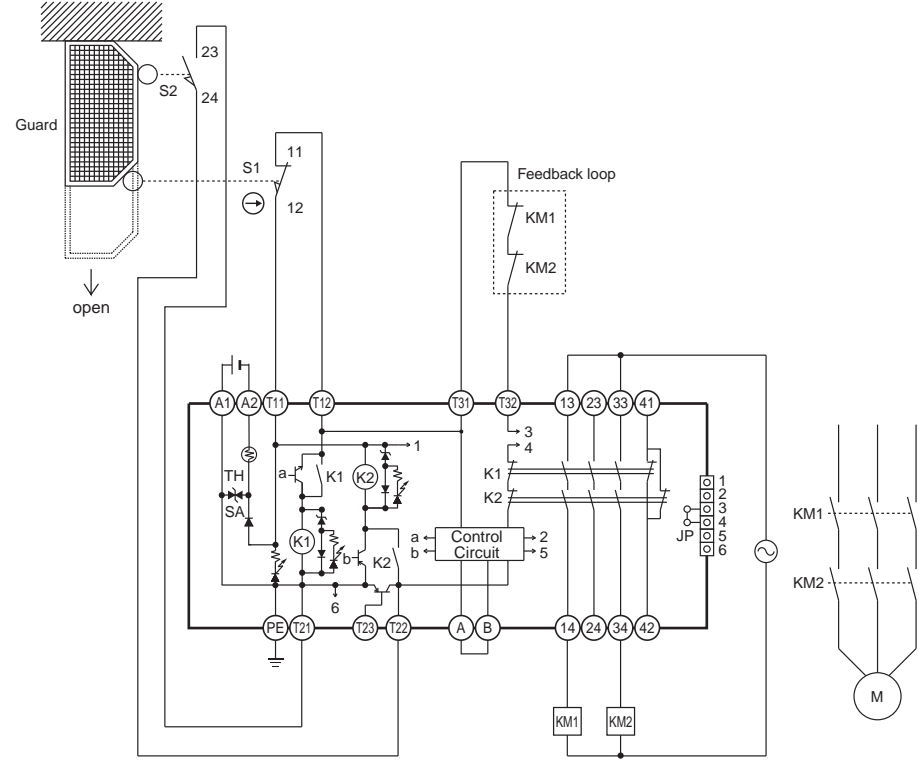
G9SA-301-P (24 VDC) with 2-channel Limit Switch Input/Manual Reset

Highest achievable PL/ safety category	Model	Stop category	Reset
PLe/4 equivalent	Safety Limit Switch D4B-N/D4N/D4F Safety Relay Unit G9SA-301-P (24 VDC)	0	Manual

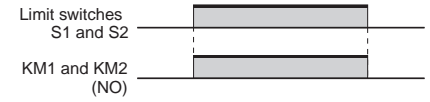
Note: The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

●Application Overview

- The power supply to the motor M is turned OFF when the S1 and S2 detect that the guard is opened.
- The power supply to the motor M is kept OFF until the guard is closed.



Timing Chart



- S1: Safety limit switch
- S2: Limit switch
- KM1 and KM2: Magnetic contactor
- M: Motor


Safety Precautions

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



Precaution for Safe Use

Meanings of Signal Words

The following signal words are used in this manual.

 WARNING	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, malfunction, or undesirable effects on product performance.

Meaning of Alert Symbols

	Indicates prohibited actions
	Indicates mandatory actions

WARNING

Serious injury may possibly occur due to breakdown of safety outputs. Do not connect loads beyond the rated value to the safety outputs.



Serious injury may possibly occur due to loss of required safety functions. Wire G9SA properly so that supply voltages or voltages for loads do NOT touch the safety inputs accidentally or unintentionally.



Precautions for Safe Use

- (1) When ready for wiring, the power source should be disconnected first. Further, at operating this unit, the terminal cover should be closed correctly in order to prevent an electrical shock.
- (2) Do not wire in case of threat of Lightning, otherwise an electric shock may occur.
- (3) Do not apply any excessive voltage or current to the input or output circuit of the G9SA. Doing so may result in damage to the G9SA or cause a fire.
- (4) Do not apply any variable voltage, otherwise G9SA may malfunction.
- (5) Do not connect any overload to the output circuit, otherwise the G9SA in operation will generate excessive heat and the output elements of the G9SA may short-circuit or fire may result.
- (6) The lifetime of G9SA depends on the conditions of switching of its outputs. Be sure to conduct its test operation under actual operating conditions in advance and use it within appropriate switching cycles. Change the G9SA before expected operation. Over operation may cause short-circuit or may malfunction.
- (7) Do not operate the G9SA with flammable or explosive gas. An arc with operation and the heat of relay will cause a fire or an explosion.
- (8) Do not disassemble, repair, or modify the G9SA, otherwise an electric shock may occur or the G9SA may malfunction.
- (9) Use protective device (Fuse of 5 A current rating etc) for short-circuit protection and ground fault protection, otherwise a fire may occur or the G9SA may malfunction.

Precautions for Correct Use

- (1) For malfunctions in case that the power supply picks up gradually
Malfunctions in case that the power supply picks up gradually. In case that the input circuits close before the power supplies, internal logic may malfunction.
- (2) Handling
 1. Do not drop the G9SA or shock or vibrate the G9SA excessively. Doing so may result in damage to the G9SA or cause G9SA to malfunction.
 2. Do not turn the off-delay setting volume switch of G9SA-321-T□-P less than the MIN value or more than the MAX value. Otherwise the G9SA may be failed.
- (3) For adhesion of solvent
Adhesion of solvent, likely Alcohol, Thinner, Trichloroethane, Gasoline, on the product should be prohibited. Such solvent cause erasing the marking and being inferior of the parts.
- (4) Operating and Storage Environment
Do not operate or store the G9SA under the following conditions. Doing so may result in damage to the G9SA or cause the G9SA to malfunction.
 1. The places with direct sunlight.
 2. The places with ambient temperature ranges not within -25 to 55°C.
 3. The places with rapid temperature changes resulting in condensation or relative humidity ranges not within 35 to 85% RH.
 4. The places with atmospheric pressure out of the range 86 to 106 kpa.
 5. The places with corrosive or inflammable gas.
 6. The places with water, oil, or chemical sprayed on the G9SA.
 7. The places with vibration or shock affecting the G9SA.
 8. The places with atmosphere containing dusts, saline or metal powder.
- (5) Mounting multiple units
When mounting multiple units close to each other, the rated current will be 3 A. Do not apply a current higher than 3 A.
- (6) For feedback purpose use devices with contacts capable of switching micro loads of 24 VDC, 5 mA.
- (7) The Safety input OFF signal for T11/T12 (or T23) and T21/T22 terminals must be longer than the response time (10 ms). Otherwise, the G9SA will be locked out or will not be able to be started or restarted. Also, a shorter safety input OFF signal might cause the G9SA to be locked. In this case, all safety inputs must be turned off or the power supply for G9SA must be off before restarting the G9SA.
- (8) Wiring
 1. Use the following to wire the G9SA.
 - Stranded wire (Flexible wire): 0.75 to 1.5 mm²
 - Solid wire: 1.0 to 1.5 mm²
 - Maximum Stripping length: 7 to 8mm
 2. The G9SA may malfunction or generate heat.
 - Tighten each screw to a torque of 0.5 to 0.7 N·m
 3. External inputs connected to T11 and T12 or T21 and T22 of the G9SA must be no-voltage contact inputs.
 4. PE is a ground terminal. When machine is grounded at the negative, the PE terminal should not be grounded.
- (9) This is a class A product. In residential areas it may cause radio interference, in which case the user may be required to take adequate measures to reduce interference.
- (10) Mounting Expansion units
When an Expansion Unit is being used, remove the connector cover from the G9SA Master Units and insert the connector of the Expansion Unit's connector cable. Make sure that the connector is correctly locked before operating.

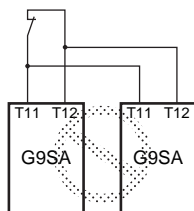
Connector Cover

Do not remove the connector cover of the G9SA-301-P, G9SA-501-P, or G9SA-321-T□-P unless an Expansion Unit is being used.

Connecting Inputs

If using multiple G9SA models, inputs cannot be made using the same switch. This is also true for other input terminals.

Incorrect



Ground Shorts

The G9SA internal circuits have a positive thermistor (TH) built in, which will detect ground short malfunctions (where S1 and S2 are grounded) and 1-channel and 2-channel short malfunctions, and cut off the safety output. If the short breakdown is repaired, the G9SA automatically recovers.

Resetting Inputs

When only channel 1 of the 2-channel input turns OFF, the safety output is interrupted. In order to restart when this happens, it is necessary to turn OFF and ON both input channels. It is not possible to restart by resetting only channel 1.

Applicable Performance Level (PL) (EN ISO13849-1)

G9SA Safety Relay Units can be applied to PLe/Safety Category 4. (The OFF-delay output section of G9SA-321-T□-P is applied to PLd/Safety Category 3.)

The above is provided according to circuit examples presented by OMRON. Therefore, the above may not apply to all operating environments.

The applicable safety category is determined from the whole safety control system. Make sure that the whole safety control system meets ISO 13849-1 requirements.

Resetting Inputs During OFF Delay Time

The G9SA-321-T□-P operates as follows according to the reset mode when the inputs are to be re-entered during the OFF delay time of the G9SA-321-T□-P:

For auto reset, after the OFF delay time has ended, the outputs will turn OFF, and then the outputs will turn ON again.

For manual reset, after the OFF delay time has ended, the outputs will turn OFF, and then the outputs will turn ON again when the reset is input.

Durability of Contact Outputs

Relay with Forcibly Guided Contact durability depends greatly on the switching condition. Confirm the actual conditions of operation in which the Relay will be used in order to make sure the permissible number of switching operations.

When the accumulated number of operation exceeds its permissible range, it can cause failure of reset of safety control circuit. In such case, please replace the Relay immediately. If the Relay is used continuously without replacing, then it can lead to loss of safety function.

Certified Standards

The G9SA-301-P/501-P/321-T□-P conform to the following standards.

- EN standards, certified by TÜV Rheinland:
 - EN60947-5-1
 - EN ISO13849-1
 - EN ISO13849-2
- UL standards: UL508 (Industrial Control Equipment)
- CSA standards: CSA C22.2 No. 14 (Industrial Control Equipment)
- CCC Certification: GB/T 14048.5

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Note: Do not use this document to operate the Unit.

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