Original instructions

OMRON

Sti Type G9SE-201 Type G9SE-401 Type G9SE-221-T Safety Relay Unit **USER'S MANUAL** English Thank you for purchasing G9SE Safety Relay Unit. Please read and understand this manual before using the products. Keep this manual ready to use whenever needed. Only qualified person trained in professional electrical technique should handle G9SE. Please consult your OMRON representative if you have any questions or comments. **OMRON** Corporation 4022078-4 C EU/EC Declaration of Conformity OMRON declares that G9SE series are in conformity with the requirements of the following EU/EC Directives. If you need a complete Declaration of Conformity, please contact your Omron representative: EMC Directive: 2004/108/EC, 2014/30/EU Machinery Directive: 2006/42/EC Standards G9SE series are designed and manufactured in accordance with the following standards: - EN ISO13849-1: 2008 PL e Category 4 - IEC/EN 60947-5-1, - IEC/EN 62061 SIL3 EN81-1 - FN81-2 - CAN/CSA C22.2 No.14 - GB14048.5 - UL508 Precaution for Safe Use Meanings of Signal Words signal words are used in this manual. The following Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may **M**WARNING result in serious injury or death Additionally there may be significant property damage Meaning of Alert Symbols The following alert symbols are used in this manual ()Indicates prohibited actions **(**) Indicates mandatory actions A WARNING Serious injury may possibly occur due to breakdown of safety outputs. \bigcirc Do not connect loads beyond the rated value to the safety outputs. Serious injury may possibly occur due to loss of required safety function Wire G9SE properly so that supply voltages or voltages for loads do NOT touch the safety inputs accidentally or unintentionally. Serious injury may possibly occur due to loss of safety functions 0 Use appropriate devices réferring to the information shown below Controlling Devices Requirements Emergency stop switch Use approved devices with Direct Opening Mechanism complying with EC/EN 60947-5-1 Use approved devices with Direct Opening Mechanism complying with IEC/EN 60947-5-1 and capable of switching micro loads of 24VDC, 5mA. Door interlocking switc Limit switch Safety Sensor Use approved devices complying with the relevant product standards, regulations and rules in the country where it is used. Relay with forcibly guided Jse approved devices with forcibly guided contacts complying with contacts FN 50205 For feedback purpose use devices with contacts capable of switching micro loads of 24VDC, 5mA. Use contactors with forcibly guided mechanism to input the signal to Feedback/Reset input of G9SE through the NC contact of the contactor. Contactor For feedback purpose use devices with contacts capable of switching micro loads of 24VDC, 5mA. Failure to open contacts of a contactor cannot be detected by monitoring ts auxiliary NC contact without forcibly guided mechanism valuate whether devices used are appropriate to satisfy the requirements Other devices of safety category level Precautions for Safe Use U1 Use G95E within an enclosure with IP54 protection or higher of IEC/EN60529.
 When ready for wiring, the power source shall be disconnected first. Further, at operating this unit, do not touch the terminals in order to prevent an electrical shock. (3) Do not apply any excessive voltage or current to the input or output circuit the G9SE. Doing so may result in damage to the G9SE or cause a fire. (4) Incorrect wiring may lead to loss of safety function. Wire conductors correctly and verify the operation of G9SE before commissioning the system in which G9SE is incorporated.
(5) Do not apply DC voltages exceeding the rated voltages, or AC voltages to G9SE.
(6) Use SELV/PELV DC porwer 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 stated in UL 508.
 (7) The lifetime of G9SE 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. Apply protection

circuitry against back electromotive force in case connecting inductive loads to safety outputs. (8) Do not operate the G9SE with flammable or explosive gas. An arc with operation and the heat of relay will cause a fire or an explosion (9) Do not drop G9SE to the ground or dismantle, repair, modify G9SE, otherwise an electric shock may occur or

(b) Do not do by any malfunction. It may lead to loss of its safety functions.
(10) Use protective device (Fuse etc.) for short-circuit protection and ground fault protection, otherwise a fire may occur

or the G9SE may malfunction. (11) 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 G9SE and its relevant system.

(12) After installation of G9SE, qualified personnel shall confirm the installation, and shall conduct test operations and maintenance

The qualified personnel shall be qualified and authorized to secure the safety on each phases of design, installation, running, maintenance and disposal of system

(13) A person in charge, who is familiar to the machine in which G9SE is to be installed, shall conduct and verify

(14) Perform daily and 6-month inspections for the G9SE. Otherwise, the system may fail to work properly, resulting in serious injury. Turn OFF the signal to Safety input and make sure G9SE operates without fault by checking the state of the LED indicator in inspection.
 (15) Conformity to requirements of performance level is determined as an entire system. It is recommended to consult

a certification body regarding assessment of conformity to the required safety level (16) OMRON shall not be responsible for conformity with any safety standards regarding to customer's entire

(17) Dispose of the Units according to local ordinances as they apply. Precautions for Correct Use

(1) Handle with care Do not drop G9SE to the ground or expose to excessive vibration or mechanical shocks. G9SE may be damaged

(2) Adhesion of solvents such as alcohol, thinner, trichloroethane or gasoline on the product should be avoided. Such solvents make the marking on G9SE illegible and cause deterioration of parts.

(3) Conditions of storage Do not store in such conditions stated below

- 1) In direct sunlight
- 2) At ambient temperatures out of the range of -10 to 55 $^\circ\!\!C$
- 3) At relative humidity out of the range of 25% to 85% or under such temperature change that causes condensation
- 4) At atmospheric pressure out of the range 86 to 106 kPa.

5) In corrosive or combustible gases

6) With vibration or mechanical shocks out of the rated values.

7) Under splashing of water, oil, chemicals

8) In the atmosphere containing dust, saline or metal powder and other conductive dusts.

G9SE may be damaged and may not function properly. (4) At least 50 mm above top face of G9SE and below bottom face of G9SE should be available to apply rated current to outputs of G9SE and for enough ventilation.

(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. If the output current is 3 A or more, make sure that there is a minimum distance of 10mm each between all adjacent G9SE units. (6) DIN rail mounting
- Mount G95E to DIN rails with attachments (TYPE PFP-M, not incorporated to this product), not to drop out of rails by vibration etc. especially when the length of DIN railing is short compared to the widths of G95E.

 (7) Wire correctly according to B Wiring.
 (8) Use cables with length less than 100 m to connect to Safety Inputs, Feed-back/Reset inputs, respectively.
 (9) G9SE may malfunction due to electro-magnetic disturbances. Be sure to connect the negative terminal of DC power supply to ground. When using a DC power supply with light curtains, use DC power supply which has no interruption by a power failure of 20 ms.

(10)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.
 (11) Do NOT mix AC load and DC load to be switched in the following terminals.

Screw mounting

Inser

- G9SE-201 : between 13-14 terminal and 23-24 terminal - G9SE-401 : between 13-14 terminal and 23-24 terminal, 33-34 terminal and 43-44 terminal - G9SE-221-TC : between 13-14 terminal and 23-24 terminal, 37-38 terminal and 47-48 terminal (12) Start entire system after more than 2s have passed since applying supply voltage to G9SE.

- Set the time duration of OFF-delay (Type G9SE-221-Tn)
 Set the time duration of OFF-delay to an appropriate value that does not cause the loss of safety function of system. Set both of the two Off-delay Time Preset Switches, one each on the front and back, to the same value. When setting the
- different value, it is detected as a fault. After setting, make sure G9SE operating time is correct.
- (14) To determine safety distance to hazards, take into account the (14) To betermine safety distance to hazards, take into account of delay of Safety outputs caused by the following time:
 1) Response time
 2) Preset off-delay time and accuracy of off-delay time
 (15) Before G95E outputs become in ON-state, non-regular self-

 (15) Before O'S to subjust solution in the wate, non-regular set diagnosis for Safety output circuit may be executed.
 On this occasion, the operating noise of internal relays occurs.
 (16) In the place subjected to strong vibration or shock, mount G9SE to a mounting surface with screws and the screw mounting attachm

Otherwise, G95E may not function properly due to vibration or mechanical shocks out of the rated values caused by sympathetic vibration of G9SE and the mounting parts, and so on

1 Appearance and Explanation of Each Parts



	inuica	lors	
Marking	Color	Name	Function
D14/D		Power supply	Lights up while power is supplied.
PWR	Green	Indicator	Blinks corresponding to the occurring error
IN1 C	Orange	Safety Input	Lights up while high signal is input to T12
		#1 indicator	Blinks when error relating to Safety input #1 occurs.
		Cofoty Immut	Lights up while high signal is input to T22
	Orange	#2 indicator	Blinks when error relating to Safety input #2 occurs.
OUT		Safety Output	Lights up while Safety outputs (13-14, 23-24, 33-34, 43-44) are in ON-state
OUT1	Orange	indicator	Blinks when an error relating to Safety output occurs.
		OFF-delayed	

Safety Output Indicator Blinks when an error relating to Safety off-delayed solid-state output occurs. OUT2 Orange

● Preset Switches (only applies to Type G9SE-221-T□) ed from power supply Change the value of the preset switches only

0.30.40.5



When setting the different value, it is detected as a fault.

(*2)See following illustration for setting position of Off-delay Time Preset Switch. Make sure that the direction of cutting edge of preset switch is correctly pointed to the off-delay time value which must be set

0 30.40 5



[mm]

4 Ratings and Specifications

Ratings

Katings									
Item		G9SE-201	G9SE-401	G9SE-221-T					
_	Rated supply voltage	24 VDC							
Power input	Operating voltage range	-15% to 10% of rated supply voltage							
	Rated power consumption (See Note1)	3 W max.	4 W max.	4 W max.					
Outputs	Safety output OFF-delayed Safety output	Contact output 250 VAC 5 A 30 VDC 5 A (resistive load)							
	Auxiliary output	PNP transistor output Load current : 100 mA DC max.							

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- she	cific	catio	ns a	nd performa	nce					
					G9SE-201	G9SE-401	G9SE-221-T			
Operating time (OFF to ON state) (See Note2)					100 ms Max. (See Note3)					
Response time (ON to OFF state)					15 ms Max.	-				
Accuracy of OFF-delay time					-	-	Within plus or minus 10% of the set value			
	Input current				5 mA Min.					
Inputs	ON voltage				11 VDC Min.					
	OFF voltage				5 VDC Max.					
	OFF current				1 mA Max.					
	Max	imum	cable	length	100 m Max.					
	Reset input time			9	250 ms Min.					
	Con	tact re	sistan	ce (See Note4)	100 mΩ Max.					
	Med	hanica	al dura	ability	5,000,000 opera	tions Min.				
	Electrical durability			lity	50,000 operation	ns Min.				
Contact outputs	Switching specification for				AC15: 240 VAC 2 A					
outputs	Indu	uctive	oad (I	EC/EN60947-5-1)	DC13: 24 VDC 1.5 A					
	Min	imum	applic	able load	24 VDC 4 mA					
	Conditional short-circuit current (IEC/EN60947-5-1)				100 A (See Note5)					
Pollution degree					2					
Over voltage category (IEC/EN60664-1)				C/EN60664-1)	Safety output: Class ${\rm I\!I\!I}$, the others: Class ${\rm I\!I}$					
				Between input and output	6 kV					
Insulatio			N	Between different poles of output	6 kV (between 13-14/23-24 and 33-34/43-44(37-38/47-48)) 4 kV (between 13-14 and 23-24, between 33-34(37-38) and 43-44(47-48))					
specifica			tric	Between input and output	2,200 VDC					
				Between different poles of output	1,500 VAC	00 VAC				
		Insula	tion r	esistance	100 MΩ Min.					
Vibration resistance (See Note6)					Frequency:10 to 55 to 10 Hz Amplitude:0.35 mm half amplitude (0.7 mm double amplitude)					
Mechan	Destruction			ruction	300 m/s ²					
shock re		sistance		unction	100 m/s ²					
1000.00	iding Air Temperature			ature	-10 to 55°C (No freezing or condensation)					
Surroun	Ambient humidity				25% to 85%RH					
	it hui	midity					IP20			
			on							

(1) Power consumption of loads not included

(2) This does not include the bounce time of internal relay in the G9SE

(3) This is in normal operation. When executing non-regular self-diagnosis for Safety output circuit,

G9SE operating time become 500 ms max..

(4) This is initial value using the voltage-drop method with 1A at 5VDC.

(5) Use for each contact output an 8A fuse that conforms to IEC 60127 as a short-circuit protection device This fuse is not included with the G9SE.

(6) Condition: G9SE is mounted to mounting surface with screw and the screw mounting attachment. In the case of DIN rail mounting, mount DIN rail with G9SE to the place without big vibration. (Amplitude guideline: Less than 0.15 mm half amplitude (0.3 mm double amplitude))

Continued on back page

Suitability for Use

Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases. NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR

PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

OMRON

OMRON Corporation (Manufacturer) Shimogyo-ku Kyoto 600-8530 JAPAN

Regional Headquarters OMRON FUROPE BV (Representative and Importer in EU) Wegalaan 67-69, 2132 JD Hoofddorp The Netherlands

OMRON ASIA PACIFIC PTE. LTD. No. 438A Alexandra Road # 05-05/08 (Lobby 2), Alexandra Technopark, Singapore 119967 Tel: (65) 6835-3011/Fax: (65) 6835-2711 OMRON SCIENTIFIC TECHNOLOGIES INC. 6550 Dumbarton Circle Fremont CA 94555 U.S.A Tel: (1) 510-608-3400/Fax: (1) 510-744-1442

OMRON (CHINA) CO., LTD. Room 2211, Bank of China Tower, 200 Yin Cheng Zhong Road, PuDong New Area, Shanghai, 200120, China Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

Contact: www.ia.omron.com Note: Specifications subject to change without notice.

•Wiring of inputs and outputs



(1) Construct the safety system taking into account that in the Auto reset mode Safety outputs turn ON automatically when Safety inputs 1 and 2 turn ON.

(2) When the inputs of G9SE-221-T are restored during off-delay time, G9SE-221-T will operate

- as below. Depending on the reset mode. Auto reset mode: Outputs turn off after off-delay time, then immediately turns on.
- Manual reset mode: Outputs turn off after off-delay time, then turn on when reset input is given. Connecting Safety Sensors and G9SE

In many case, Safety Sensor outputs include the off-shot pulse for its self test.

The following condition of test pulse is applicable as safety inputs for G9SE. - Off-shot pulse width of the sensor, during the ON-state : $640 \ \mu s$



•Terminal arrangement and LED indicators

Type G9SE-201	Type G9SE-401	Type G9SE-221-T PWR IN1 IN2 OUT1 OUT2
(1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (2) (1) (2) (1) (2) (2)	(A) (B) (D) (D) (D) (A) (D) (D) (D) (D) (D) (D) (D) (D) ((1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (2) (3) (3) (3) (3) (4)









6 Performance level and safety category (EN ISO13849-1)

In the conditions shown in '5.Examples of Application', G9SE can be used for the corresponding safety categories up to 4 and performance level(PL) up to e per ISO13849-1. This does NOT mean that G9SE can always be used for the required category under all the similar conditions

- and situations.
- Conformity to the categories must be assessed as a whole system. When using G9SE for the safety categories, make sure the conformity of the whole system. 1) Input the signals to both of the Safety inputs (T12 and T22)
- 2) Input a signal to the Safety inputs (T11-T12 and T21-T22) through switches with Direct Opening Mechanism. When using limit switches, at least one of them must have Direct Opening Mechanism. And wiring must be done in a way that a short circuit between the wires of Safety input can be prevented.
- 3) When connecting a Safety sensor with G9SE, use a TYPE 4 safety sensor.
- 4) Be sure to connect the negative terminal of DC power supply to ground.
- 5) Use two Safety outputs (e.g. 13-14 and 23-24) to construct the system. 6) In order to ensure sufficient failure detection, it is mandatory to use G9SE only together with
- contactors or relays with forcibly guided contacts.
- 7) Input the signal through NC contacts of the contactors to Feedback/Reset input (T31-T32 for manual reset or T31-T33 for auto reset). (Refer to '5.Examples of Application'.)

7 Fault Detection

When G9SE detects a fault, LED indicators blink to show the information of the fault.

When PWR indicator blinks, check and take needed measures referring to the following table. And then apply supply voltage to G9SE.

LED indicator						
PWR	IN1	IN2	OUT OUT1	OUT2	Expected causes of the faults	Checking points and measures to take
	- Ó - Blink	_	_	_	 Failures involving the wiring of Safety input 1 Failures of the parts of the circuits of Safety input 1. 	 Check the wiring to T11 and T12. Replace with a new product.
	_	- Č - Blink	—	_	 Failures involving the wiring of Safety input 2 Failures of the parts of the circuits of Safety input 2. 	 Check the wiring to T21 and T22. Replace with a new product.
	Safety inputs: ON-state			ate	 Failures involving the wiring of Feedback/Reset input. 	1) Check the wiring to T31, T32, and T33
	Light	ŭp	-	-	2) Failures of the parts of the circuits of Feedback/Reset input.	2) Replace with a new product.
ł	Safety inputs: OFF-state			tate		
-Ŭ- Blink	O Light off	O Light off	-	_		
DIITK	_		-O- Blink	-Č- Blink	 Failures of the parts or relays of the circuits of Safety Output. 	1) Replace with a new product.
	_	I	_	-🌪- Blink	1) Mismatch of the two Off-delay Time Preset Switches.	 Check both of the two Off-delay Time Preset Switches.
	The	-) all ind	Ď- icators	Blink	 Supply voltage outside the rated value. 	1) Check the supply voltage to G9SE.
	The a	(Il indica) ators Lig	ght off	 By excessive electro-magnetic disturbance. Failures of the parts of internal circuits 	 Check the disturbance level around G9SE and its related system. Replace with a new product.

When indicators other than PWR indicator blink while PWR indicator lights up, check and take needed measures referring to the following table. After removing the fault, turn both safety inputs to OFF state.

LED IN		Dinaid	alor		Expected causes of	Checking points and	
PWR	IN1	IN2	OUT OUT1	OUT2	the faults	measures to take	
• Light up	- Q -	Blink	: ON-sta	ate —	1) Mismatch between Safety input 1 and Safety input 2. (OFF timing)	 Check the wiring from safety input devices to G9SE. Or check the inputs sequence of safety input devices. 	

8 Wiring

Use the following to wire to G9SE.

Solid wire: AWG24 to AWG16 (0.25 to 1.5 mm²)
 Stranded wire: AWG24 to AWG16 (0.25 to 1.5 mm²)

Strip the cover of wire no longer than 8 to 10 mm

When using stranded wire, insulated ferrule should be used. Use below insulated ferrule.

But do not use ferrule terminals if G9SE is used as UL Listing. Insert the strand or solid wire(CU only) directly into the holes on the terminal block.

- Insulated ferrule: AWG24 to AWG16 (0.25 to 1.5 mm²)

- Crimp height(H): 2.0 mm max. Width(W): 2.7 mm max. Conductor length: 8 to 10 mm When using the twin type ferrule, use equal-sized wires and preferred insulated ferrule. The twin type ferrule should not be above the adjoining release hole.

Recommended insulated ferrule: manufactured by Phoenix contact

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Type		Wire size			
		Cross section(mm ²)	AWG		
Single	AI 0,34-8TQ	0,34	22		
	AI 0,5-10WH	0,5	20		
	AI 0,75-10GY	0,75	18		
	AI 1-10RD	1,0	18		
	AI 1.5-10BK	1,5	16		
Twin	AI TWIN2x0.75-10GY	2 x 0.75	-		

How to insert solid wire and insulated ferrule

The wire should be pushed into the terminal block straight. No need to use the driver After inserting, make sure wire is fastened on to terminal block

Release hole



• How to release wire

Use the following minus drive to release wire from terminal block. And When releasing wire, the power source should be disconnected first.

Push the driver lightly into the taper of release hole.
 Pull out the wire while the driver is pushed into release hole

3. Pull out the drive





(0.4mm) nded driver

Type SZF0-0.4mmx2.5mm

manufactured by Phoenix contact Type XW4Z-00B manufactured by Omron

Precautions for Correct wiring

Ferminal block may be damaged. 1. Not push the driver into the release hole straight

2. Not push the driver into the release hole by force of 30N and over.

3. Not tip or twist the driver pushed into release hole