

# Safety Relay Unit G9SB

CSM\_G9SB\_DS\_E\_6\_6

## Ultra Slim Safety Relay Unit

- Models of width 17.5 mm available with 2 or 3 poles. Models of width 22.5 mm with 3 poles also available.
- Conforms to EN standards. (TÜV approval)
- DIN track mounting possible.



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

Be sure to read the "Safety Precautions" on page 9.

## Model Number Structure

### Model Number Legend

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

G9SB-        

1 2 3 4 5 6

#### 1. Function

None: Emergency stop

#### 2. Contact Configuration (Safety Output)

2: DPST-NO

3: 3PST-NO

#### 3. Contact Configuration (OFF-delay Output)

0: None

#### 4. Contact Configuration (Auxiliary Output)

0: None

1: SPST-NC

#### 5. Input Configuration

None: 1-channel or 2-channel input possible

0: None (direct breaking)

2: 2-channel input

#### 6. Miscellaneous

A: Auto-reset, inverse input

B: Auto-reset, + common input

C: Manual reset, inverse input

D: Manual reset, + common input

## Ordering Information

| Main contacts | Auxiliary contact | Number of input channels | Reset mode   | Input type        | Rated voltage | Model              |
|---------------|-------------------|--------------------------|--------------|-------------------|---------------|--------------------|
| DPST-NO       | None              | 2 channels               | Auto-reset   | Inverse           | 24 VAC/VDC    | <b>G9SB-2002-A</b> |
|               |                   | 1 channel or 2 channels  |              | + common          |               | <b>G9SB-200-B</b>  |
|               |                   | 2 channels               | Manual reset | Inverse           |               | <b>G9SB-2002-C</b> |
|               |                   | 1 channel or 2 channels  |              | + common          |               | <b>G9SB-200-D</b>  |
| 3PST-NO       | SPST-NC           | None (direct breaking)   | Auto-reset   | ---               | 24 VDC        | <b>G9SB-3010 *</b> |
|               |                   | 2 channels               |              | Inverse           | 24 VAC/VDC    | <b>G9SB-3012-A</b> |
|               |                   | 1 channel or 2 channels  | + common     | <b>G9SB-301-B</b> |               |                    |
|               |                   | 2 channels               | Manual reset | Inverse           |               | <b>G9SB-3012-C</b> |
|               |                   | 1 channel or 2 channels  |              | + common          |               | <b>G9SB-301-D</b>  |

**Note:** 1. Relays with inverse inputs are used mainly when inputting signals from two mechanical switches.

2. Relays with positive commons are used mainly when inputting signals from a safety sensor or from one mechanical switch.

\* The G9SB-3010 can be applied to Safety Category 3 of the EN954-1 if double breaking is used.

## Specifications

### Ratings

#### Power Input

| Item                    | Model | G9SB-200□-□                               | G9SB-3010  | G9SB-301□-□       |
|-------------------------|-------|---|------------|-------------------|
| Power supply voltage    |       | 24 VAC/24 VDC                             | 24 VDC     | 24 VAC/24 VDC     |
| Operating voltage range |       | 85% to 110% of rated power supply voltage |            |                   |
| Power consumption       |       | 2.9 VA/1.4 W max.                         | 1.7 W max. | 3.6 VA/1.7 W max. |

#### Inputs

| Item          | Model | G9SB-200□-□ | G9SB-3010    | G9SB-301□-□ |
|---------------|-------|-------------|--------------|-------------|
| Input current |       | 25 mA max.  | 60 mA max. * | 30 mA max.  |

\* Indicates the current between terminals A1 and A2.

#### Contacts

| Item                | Model | G9SB-200□-□                 | G9SB-3010 | G9SB-301□-□ |
|---------------------|-------|-----------------------------|-----------|-------------|
|                     | Load  | Resistive load              |           |             |
| Rated load          |       | 250 VAC, 5 A<br>30 VDC, 5 A |           |             |
| Rated carry current |       | 5 A                         |           |             |

### Characteristics

| Item                                     | Model                             | G9SB-200□-□   | G9SB-3010     | G9SB-301□-□   |
|--|-----------------------------------|---|---------------|---------------|
| Contact resistance *1                    |                                   | 100 mΩ  |               |               |
| Operating time *2                        |                                   | 30 ms max.  |               |               |
| Response time *3                         |                                   | 10 ms max.  |               |               |
| Isolation voltage (Ui)                   |                                   | 250 V/AC  |               |               |
| Impulse withstand voltage (Uimp)         |                                   | 4 kV  |               |               |
| Insulation resistance *4                 | Between inputs and outputs        | 100 MΩ min. (at 500 VDC)  |               |               |
|  | Between different poles of output |   |               |               |
| Dielectric strength                      | Between inputs and outputs        | 2,500 VAC 1 min.  |               |               |
|  | 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 <sup>2</sup>  |               |               |
|  | Malfunction                       | 100 m/s <sup>2</sup>  |               |               |
| 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%  |               |               |
| Pollution degree                         |                                   | 2   |               |               |
| Protection class                         |                                   | IP20  |               |               |
| Terminal tightening torque               |                                   | 0.5 N·m   |               |               |
| Weight                                   |                                   | Approx. 115 g   | Approx. 135 g | Approx. 120 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.

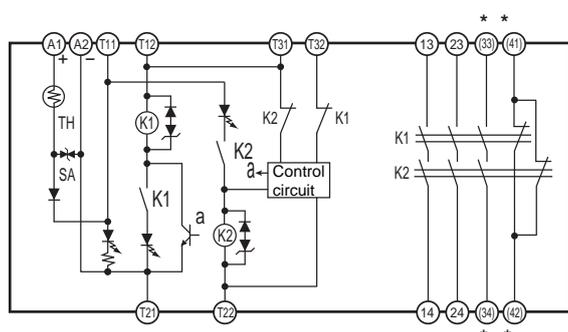
\*5. The durability is for an ambient temperature of 15 to 35°C and an ambient humidity of 25% to 75%.

## Connections

### Internal Connections

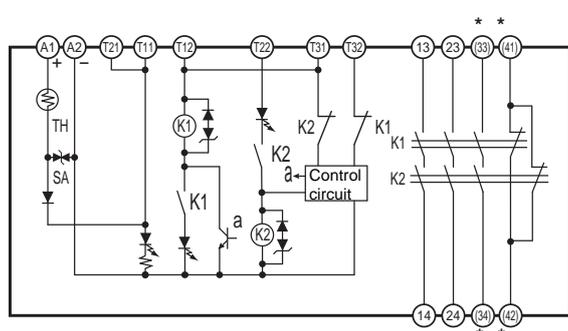
G9SB-2002-A/C (24 VAC/VDC)

G9SB-3012-A/C (24 VAC/VDC)

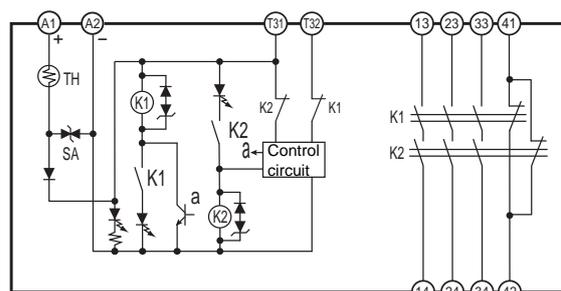


G9SB-200-B/D (24 VAC/VDC)

G9SB-301-B/D (24 VAC/VDC)



G9SB-3010 (24 VDC)



- Note:**
- For 1-channel input with G9SB-□□□-B/D models, short terminals T12 and T22. It is not possible to wire G9SB-□□□2-A/C models for 1-channel input.
  - Always provide a protective ground externally, e.g., on the power supply.

\* Only G9SB-301□-□ models have terminals 33-34 and 41-42.

### 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 *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 *1            | T21, T22      |   |
| 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.   |
| Auxiliary output             | See below. *2 | Synchronized with Instant Safety Output.  |

**Note:** Grounding

Be sure to ground externally, such as at the power supply.

**\*1. Safety Inputs**

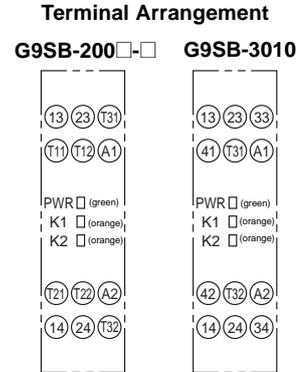
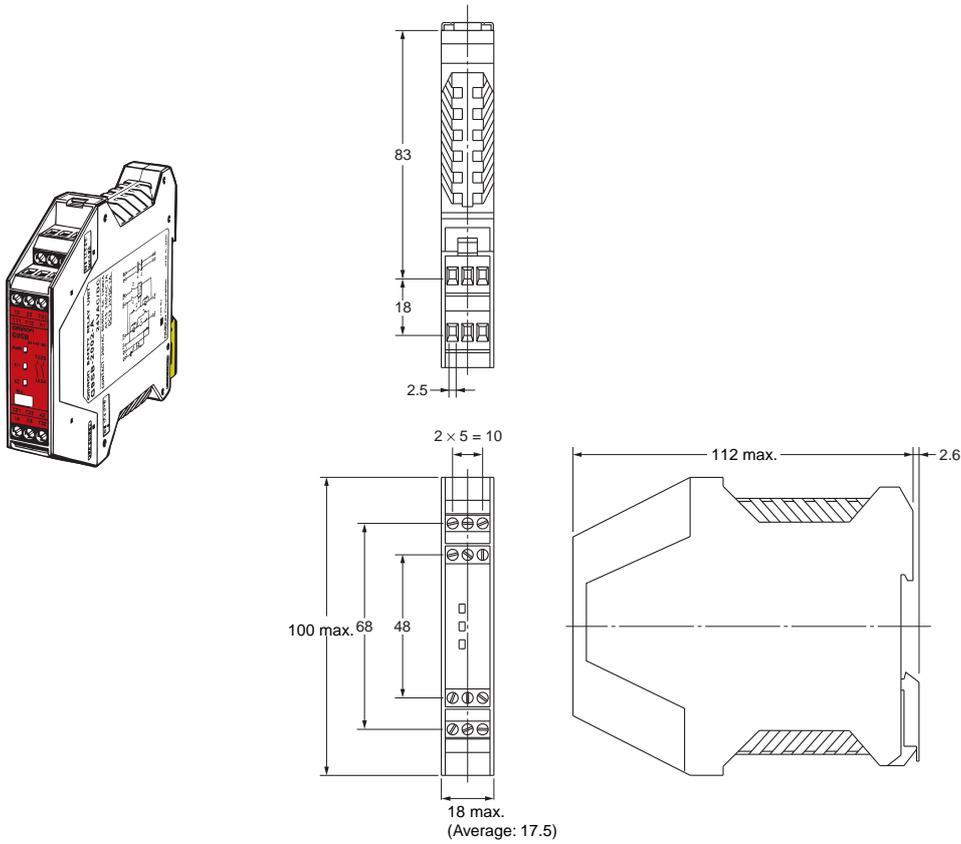
- G9SB-3010 directly cuts off power, and has no Safety Input.
- For 1-channel input with G9SB-□□□-B/D, short circuit T12-T22 and then input.
- With G9SB-□□□2-A/C, 1-channel input wiring is not possible.

**\*2. Output Contacts**

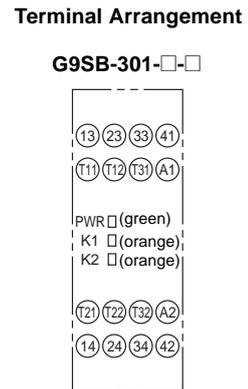
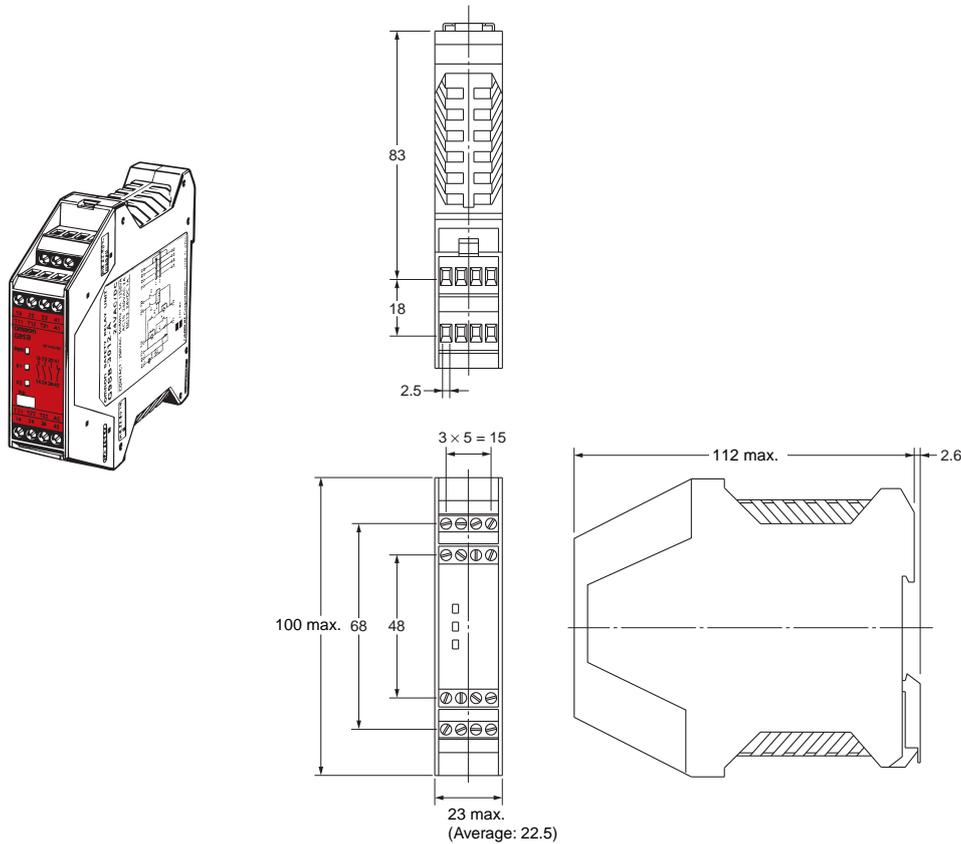
- G9SB-2002-A/C: Safety Output Contacts 13-14, 23-24.  
 G9SB-3012-A/C: Safety Output Contacts 13-14, 23-24, 33-34. Auxiliary Contact 41-42.  
 G9SB-200-B/D: Safety Output Contacts 13-14, 23-24.  
 G9SB-301-B/D: Safety Output Contacts 13-14, 23-24, 33-34. Auxiliary Contact 41-42.  
 G9SB-3010: Safety Output Contacts 13-14, 23-24, 33-34. Auxiliary Contact 41-42.

# Dimensions and Terminal Arrangement

G9SB-200□-□  
G9SB-3010



G9SB-301-□-□



# Application Examples

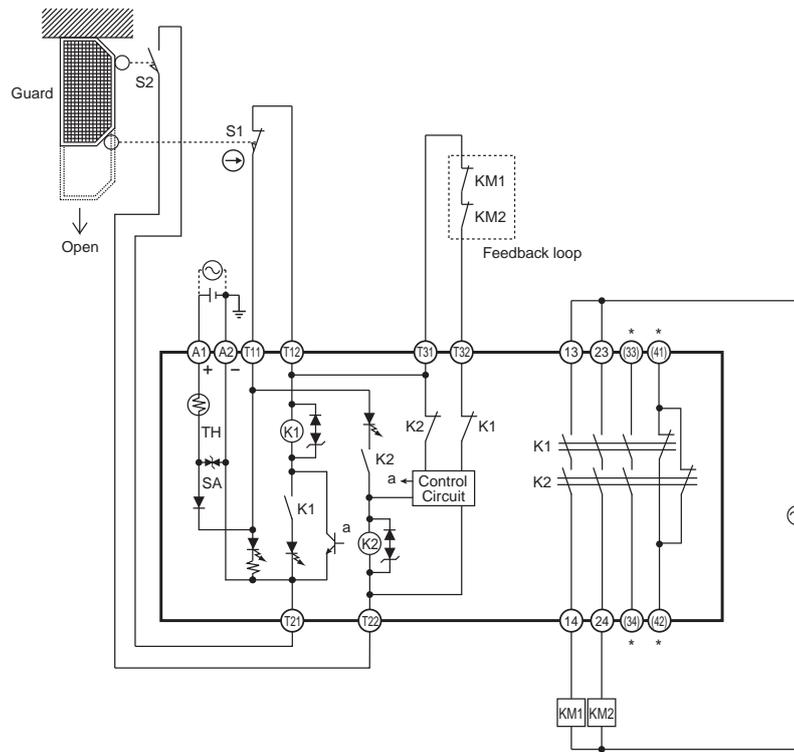
## G9SB-2002-A (24 VAC/VDC) or G9SB-3012-A (24 VAC/VDC) with 2-channel Limit Switch Input/Auto-reset

| Highest achievable PL/ safety category | Model   | Stop category | Reset |
|--|---|---------------|-------|
| PLe/4 equivalent                       | Safety Limit Switch D4B-N/D4N/D4F<br>Safety Relay Unit G9SB-2002-A/3012-A (24VAC/VDC) | 0             | 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

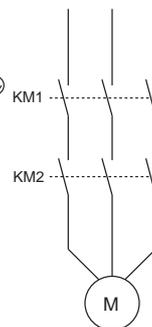
- The power supply to the motor M is turned OFF when the S1 and S2 detect that the guard is opened.
- The power supply to the motor M is kept OFF until the guard is closed.



### Timing Chart



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



**Note:** External connections and timing charts for G9SB-200-B/301-B models are the same as those for G9SB-2002-A/3012-A models.  
\* Only the G9SB-3012-A model has terminals 33-34 and 41-42.

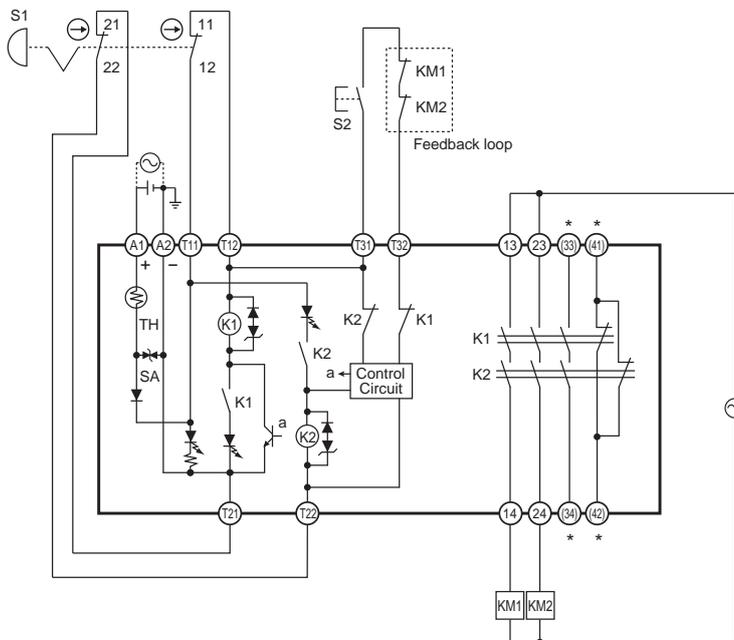
**G9SB-2002-C (24 VAC/VDC) or G9SB-3012-C (24 VAC/VDC) with 2-channel Emergency Stop Switch Input/Manual Reset**

| Highest achievable PL/<br>safety category | Model   | Stop category | Reset  |
|---|---|---------------|--------|
| PLe/4 equivalent                          | Emergency stop switch A165E/A22E<br>Safety Relay Unit G9SB-2002-C/3012-C (24VAC/VC) | 0             | Manual |

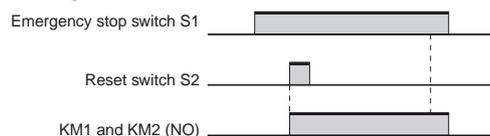
**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

**Application Overview**

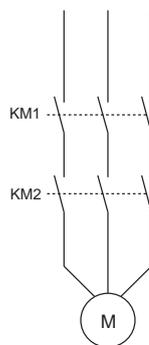
- The power supply to the motor M is turned OFF when the emergency stop switch S1 is pressed.
- The power supply to the motor M is kept OFF until the reset switch S2 is pressed while the emergency stop switch is released.



**Timing Chart**



**Note:** Output turns ON with the rising edge of reset switch S2, but will not operate if there is a short breakdown in S2.



- S1: Emergency stop switch
- S2: Reset switch
- KM1 and KM2: Magnetic contactor
- M: Motor

**Note:** External connections and timing charts for G9SB-200-D/301-D models are the same as those for G9SB-2002-C/3012-C models.

\* Only the G9SB-3012-C model has terminals 33-34 and 41-42.

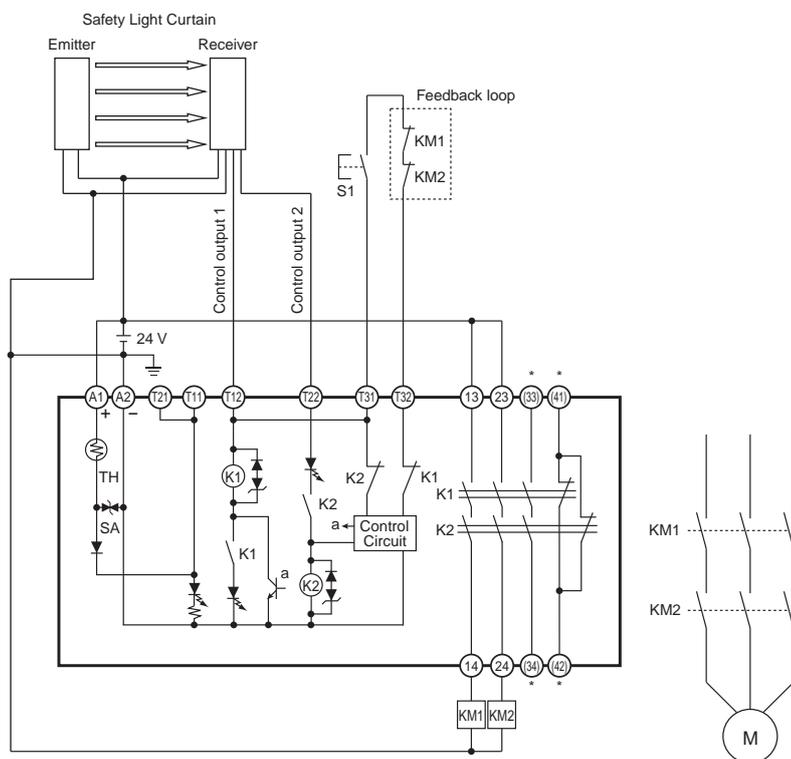
**G9SB-200-D (24 VAC/VDC) or G9SB-301-D (24 VAC/VDC) with 2-channel Safety Sensor/Manual Reset (PNP models only)**

| Highest achievable PL/ safety category | Model  | Stop category | Reset  |
|--|--|---------------|--------|
| PLe/4 equivalent                       | Safety Light Curtain F3SJ-A/-B/-E<br>Safety Relay Unit G9SB-200-D/3012-D (24VAC/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.

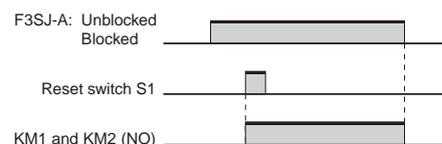
**● Application Overview**

- The power supply to the motor M is turned OFF when the beam is blocked.
- The power supply to the motor M is kept OFF until the beam is unblocked and the reset switch S1 is pressed.



\* Only the G9SB-301-D model has terminals 33-34 and 41-42.

**Timing Chart**



**Note:** Output turns ON with the rising edge of reset switch S1, but will not operate if there is a short breakdown in S1.

S1: Reset switch  
KM1 and KM2: Magnetic contactor  
M: Motor

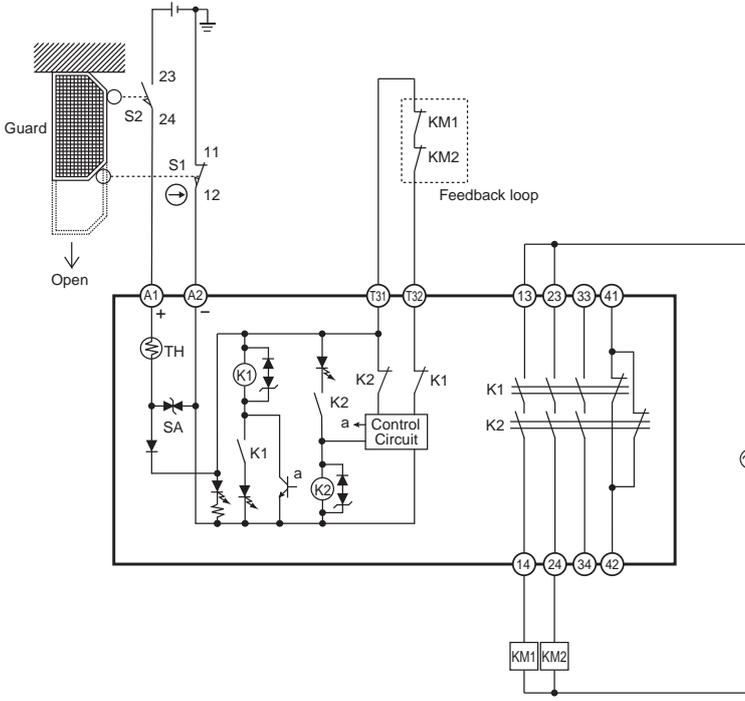
**G9SB-3010 (24 VDC) with 2-channel Limit Switch Input/Auto-reset**

| Highest achievable PL/ safety category | Model  | Stop category | Reset |
|--|--|---------------|-------|
| PLd/3 equivalent                       | Safety Limit Switch D4B-N/D4N/D4F<br>Safety Relay Unit G9SB-3010 (24VDC) | 0             | Auto  |

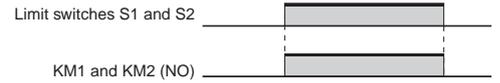
**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

**● Application Overview**

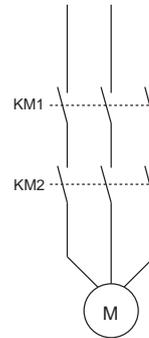
- The power supply to the motor M is turned OFF when the S1 and S2 detect that the guard is opened.
- The power supply to the motor M is kept OFF until the guard is closed.



**Timing Chart**



- S1: Safety limit switch
- S2: Limit switch (NO)
- 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/>.

### Safety Precautions

#### Meanings of Signal Words

|  |   |
|--|---|
|  <b>WARNING</b> | 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. |
| <b>Precautions for Safe Use</b>  | Supplementary comments on what to do or avoid doing, to use the product safely.   |
| <b>Precautions for Correct Use</b>   | 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

|   |   |
|---|---|
|  | <ul style="list-style-type: none"> <li>● Indicates prohibited actions</li> <li>● Indicates a general prohibited action that cannot be specifically identified.</li> </ul> |
|  | <ul style="list-style-type: none"> <li>● Indicates mandatory actions</li> <li>● Indicates a mandatory action that cannot be specifically identified.</li> </ul>           |

### WARNING

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



The safety function may be impaired and cause serious injury. Connect the wiring properly to prevent the safety output from shorting the power supply or the load power supply.



### Precautions for Safe Use

- Use the G9SB Unit within an enclosure with IP54 (IEC/EN60529) or higher rating.
- Be sure to turn OFF the Unit before wiring. Do not touch the terminals while the Unit is powered. Doing so may result in an electrical shock.
- Do not perform wiring work when there is a risk of lightning strikes. Doing so may result in electric shock.
- Do not apply any excessive voltage or current to the input or output circuit the G9SB. Doing so may result in damage to the G9SB or cause a fire.
- Use the specified power supply voltage. Do not use the Unit with a power supply having a large ripple, or a power supply in which an abnormal voltage is generated intermittently.
- Do not use the Unit for loads that exceed the contact rating values, such as the switching capacity (contact voltage, contact current). This will not only result in the loss of the stipulated performance, such as faulty insulation, contact welding, and improper contact, but can also cause damage or burnout.
- Durability varies greatly depending on switching conditions. When using the product, check its operation using real equipment under actual use conditions. Use it with a switching count that provides proper performance. Continuous use of the product with degraded performance will eventually cause a dielectric breakdown between circuits and may cause the product itself to burn out.
- Do not use the Unit in an atmosphere with inflammable or explosive gases. Electric arcs from switches and heat generated from relays may cause a fire or explosion.
- Do not use the product if it has been dropped or if the inside of the product has been disassembled. Such a product will not only fail to produce the proper characteristics, it may also break or burn out.

- Connect an appropriate protective device (Fuse of 5 A current rating etc), if necessary, to protect against load short-circuiting and ground faults. Failure to do so could result in damage to the Unit or a burnout.

### Precautions for Correct Use

#### When using the Unit with a power supply that has a long startup time

When using the Unit with a power supply that has a long startup time, if the power is turned ON while input circuit is still closed, the internal circuit detects a power supply voltage abnormality, and the product does not operate. Apply the power supply voltage to the product after it has reached the rated voltage.

#### Handling

Do not drop the G9SB or shock or vibrate the G9SB excessively. Doing so may result in damage to the G9SB or cause G9SB to malfunction.

#### Installation

The G9SB can be installed in any direction.

#### Adherence of solvents

Take care to avoid the adherence of solvents, such as alcohol, thinner, trichloroethane, gasoline, etc. on the product. Adherence of solvents may cause the marking to be erased, and may degrade the product.

#### Storage and installation location

Do not storage or install the Unit at the following locations as it may damage it or cause it to malfunction.

- In direct sunlight
- Where the ambient temperature is outside the -25 to 55°C range
- Where the relative humidity is outside the 35 to 85% RH range or where drastic temperature changes cause condensation to form
- Where the ambient atmospheric pressure is outside the 86 to 106 kPa range
- Where there is corrosive or inflammable gas
- Where vibrations or shocks exceeding the specified ratings are applied to the product
- Where water, oil, or chemicals may splash
- Locations with high amounts of dust, salinity, or metal powder

#### Mounting multiple Units

- Installing multiple Units close to each other will cause the rated current to be limited to 3 A.  
Use the Unit at 3 A or less.
- Keep a minimum distance of 10 mm between the adjacent G9SB Units if a current of 3 A or more is flowing through the output terminal.

#### Mounting DIN track

Use an end plate (PFP-M, sold separately) on both ends of the G9SB Unit.

#### Wiring

- Use the following to wire the G9SB.
  - Stranded wire (Flexible wire): 0.2 to 2.5 mm<sup>2</sup>
  - Solid wire: 0.2 to 2.5 mm<sup>2</sup>
  - Maximum stripping length: 7 mm Max.
- Tighten the terminal screws to the stipulated torque to prevent them from resulting in malfunctioning of the Unit or heat generation.
  - Terminal screws tightening torque: 0.5 to 0.6 N·m
- Make sure the inputs connected to T11 and T12 (T21 and T22) are no-voltage contact inputs.
- Connect the (-) side of the power supply to the ground. You cannot use the G9SB Unit with a machine in which the (+) side is connected to the ground.

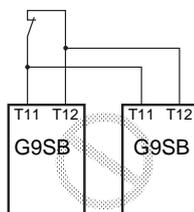
## Feedback contacts

Use a device with feedback contacts capable of switching micro loads of 24 VDC, 5 mA.

## Connecting Inputs

If using multiple G9SB models, inputs cannot be made using the same switch. This is also true for other input terminals.

Incorrect



## Ground Shorts

A positive thermistor (TH) is built into the G9SB internal circuit to detect ground shorts and shorts between channels 1 and 2. When such faults are detected, the safety outputs are interrupted. (Only G9SB-2002-□/3012-□ is able to detect shorts between channels 1 and 2.)

If the short breakdown is repaired, the G9SB automatically recovers.

**Note:** In order to detect earth short breakdowns, connect the minus side of the power supply to ground.

## Applicable Safety Category (EN ISO13849-1)

G9SB-200□-□/301□-□ Safety Relay Units can be applied to PLe/ Safety Category 4.

G9SB-3010 Safety Relay Units can be applied to Safety Category 3 if double breaking is used. 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

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.

## 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.

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.

## Certified Standards

The G9SB-200□-□/3010/301□-□ conforms to the following standards.

- EN standards, certified by TÜV Rheinland:
  - EN60204-1
  - EN60947-1
  - EN60947-5-1
  - EN ISO13849-1
  - EN62061
  - EN61496-1
  - EN 81-20, EN 81-50
- UL standards: UL508 (Industrial Control Equipment)
- CSA standards: CSA C22.2 No. 14 (Industrial Control Equipment)
- CCC Certification: GB/T 14048.5

## Terms and Conditions Agreement

### Read and understand this catalog.

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

### Warranties.

(a) Exclusive Warranty. Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.

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