# Safety Relay Unit

## Ideal for Safety Door and Emergency Stop Switch Circuits

- Three-pole models are only 67.5 mm wide; five-pole models only 90 mm wide are available
- OFF-delay feature models available
- Incorporates LED indicators for monitoring built-in relays
- Finger-protection construction
- DIN-track mounting
- Conforms to EN60204-1 (IEC60204-1), EN954-1, and approved by BIA

Note: Be sure to refer to the *Precautions Section*.

## Ordering Information

### ■ BASIC MODELS

| Number of poles | Main contact form | Number of input channels | Category | Rated voltage | **Part number** |
|---|---|---|---|---|---|
| 3 (See Note) | 3PST-NO | 1 channel or 2 channels possible | 4 | 24 VDC | **G9S-301** |
| | | | | 24 VAC | |
| | | | | 100 VAC | |
| | | | | 120 VAC | |
| | | | | 200 VAC | |
| | | | | 240 VAC | |
| 5 (See Note) | 5PST-NO | | | 24 VDC | **G9S-501** |
| | | | | 24 VAC | |
| | | | | 100 VAC | |
| | | | | 120 VAC | |
| | | | | 200 VAC | |
| | | | | 240 VAC | |

Note: Auxiliary contact is SPST-NC.

### ■ OFF-DELAY MODELS

| Number of poles | Main contact form | OFF-delay form | Number of input channels | Category | OFF-delay time | Rated voltage | **Part number** |
|---|---|---|---|---|---|---|---|
| 3 | 3PST-NO | DPST-NO | 1 channel or 2 channels possible | 3 | 1 s, 1.5 s, 3 s, 4 s, 5 s, **6 s, 10 s, 30 s** | 24 VDC | **G9S-321-T01, -T015, -T03, -T04, -T05, -T06, -T10, -T30** |
| | | | | | | 24 VAC | |
| | | | | | | 100 VAC | |
| | | | | | | 120 VAC | |
| | | | | | | 200 VAC | |
| | | | | | | 240 VAC | |

Note: Each model has an SPST-NC auxiliary contact.
When ordering, specify the voltage.
Example: G9S-301 24 VDC
Rated voltage

## ■ MODEL NUMBER LEGEND

**G9S-□□□-□□□**
1 2 3 4

1. **Contact Configuration (Safety Output)**
   3: 3PST-NO
   5: 5PST-NO
2. **Contact Configuration (OFF-delay Output)**
   0: None
   2: DPST-ND
3. **Contact Configuration (Auxiliary Output)**
   0: None
   1: SPST-NC
4. **OFF-Delay Time**
   None: No OFF-delay
   T01: 1 second
   T015: 1.5 seconds
   T03: 3 seconds
   T04: 4 seconds
   T05: 5 seconds
   T06: 6 seconds
   T10: 10 seconds
   T30: 30 seconds

# Specifications

## ■ RATINGS

### Controller Block

| Model | Rated voltage | Rated current | Rated power consumption |
|---|---|---|---|
| G9S-301 | 24 VDC | 62.5 mA±20% | Approx. 1.5 W |
| | 24 VAC | 125 mA±20% | Approx. 3 VA (60 Hz) |
| | 100 VAC | 30 mA±20% | |
| | 120 VAC | 25.0 mA±20% | |
| | 200 VAC | 15 mA±20% | |
| | 240 VAC | 12.5 mA±20% | |
| G9S-501 | 24 VDC | 127 mA±20% | Approx. 3 W |
| | 24 VAC | 229 mA±20% | Approx. 5.5 VA (60 Hz) |
| | 100 VAC | 55 mA±20% | |
| | 120 VAC | 45.8 mA±20% | |
| | 200 VAC | 27.5 mA±20% | |
| | 240 VAC | 22.9 mA±20% | |
| G9S-321-T□ | 24 VDC | 150 mA±20% | Approx. 3.6 W |
| | 24 VAC | 254 mA±20% | Approx. 6.1 VA (60 Hz) |
| | 100 VAC | 61 mA±20% | |
| | 120 VAC | 50.8 mA±20% | |
| | 200 VAC | 30.5 mA±20% | |
| | 240 VAC | 25.4 mA±20% | |

Note: The above ratings are at an ambient temperature of 23°C.

### Contact

| Item | | G9S-301<br>G9S-501<br>G9S-321-T□ |
|---|---|---|
| Rated load | | 3 A at 240 VAC; (see note)<br>cosϕ = 0.4 |
| | AC15 (IEC-947-5-1/ Table 4) | 3 A at 240 VAC; cosϕ = 0.3;<br>6,050 operations |
| | DC13 (IEC-947-5-1/ Table 4) | 1 A at 24 VDC; L/R=100 ms;<br>6,050 operations |
| Rated carry current | | 5 A |
| Max. switching voltage | | 250 VAC, 24 VDC |
| Max. switching power | | AC: 1,250 VA;<br>DC: 120 W |
| Min. permissible load | | 50 mA at 24 VDC<br>(operating frequency: 60 operations/min.) |

Note: If the load is 5 A at 240 VAC, the service life will be 40,000 operations.

## ■ CHARACTERISTICS

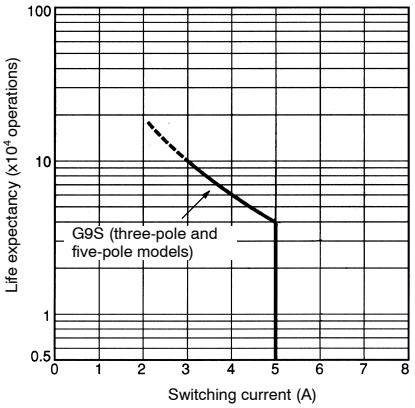
| Item | | G9S-301 | G9S-501 | G9S-321-T□ |
|---|---|---|---|---|
| Input voltage/frequency | | 24 VDC; 24 VAC, 50/60 Hz; 100 VAC, 50/60 Hz; 120 VAC, 50/60 Hz; 200 VAC, 50/60 Hz; 240 VAC, 50/60 Hz | | |
| Supply voltage range | | 85% to 110% of rated input voltage | | |
| Fuse protection | | 0.4 A | | |
| Contact form of safety circuit | | 3PST-NO | 5PST-NO | 3PST-NO |
| Contact form of auxiliary circuit | | SPST-NC | SPST-NC | SPST-NC |
| Contact form of safety OFF-delay circuit | | — | | DPST-NO |
| Contact resistance (see note1) | | 300 mΩ max. | | |
| Operate time | (Rated voltage operation, does not include bounce time) | 300 ms max. | | 300 ms |
| Release time | | 100 ms max. | | 100 ms (except OFF-delay output) |
| Max. switching frequency | Mechanical | 1,800 operations/hr | | |
| | Rated load | 1,800 operations/hr | | |
| Insulation resistance (at 500 VDC) | | 100 MΩ min. between control circuit and the safety and auxiliary circuits, between the safety circuits and auxiliary circuits, and between safety circuits | | |
| Rated insulation voltage P.D. 3 (outside), P.D. 2 (inside) (IEC664-1, DIN VDE 0110/'89) | | 250 V | | |
| Rated impulse withstand voltage Overvoltage category 3 (IEC664-1, DIN VDE 0110/'89) | | 4 kV | | |
| Dielectric strength | | 2,500 VAC (50/60 Hz for 1 min.) between control circuit and the safety and auxiliary circuits, between the safety circuits and auxiliary circuits, and between safety circuits | | |
| Vibration resistance (IEC68-2-6) | Destruction | 10 to 55 Hz, 0.75-mm double amplitude | | |
| | Malfunction | 10 to 55 Hz, 0.5-mm double amplitude | | |
| Shock resistance (IEC68-2-27) | Destruction | 300 $m/s^2$ for 11 ms | | |
| | Malfunction | 50 $m/s^2$ for 11 ms | | |
| Min. permissible load (reference value) | | 24 VDC, 50 mA (24 VDC, 4 mA photocoupler load) | | |
| Ambient temperature | | Operating: −25°C to 55°C (with no icing or condensation)<br>Storage: −25°C to 85°C (with no icing or condensation) | | |
| Ambient humidity | | Operating: 35% to 85%<br>Storage: 35% to 85% | | |
| Degree of protection (IEC529) | Terminals | IP20 | | |
| | Enclosure | IP40 | | |
| Terminal tightening torque | | 0.98 N • m | | |
| Weight (see note 2) | | Approx. 365 g | Approx. 550 g | Approx. 580 g |
| Approved standards | | UL508, CSA22.2 No. 14, EN954-1, EN60204-1 | | |
| EMC | | EMI: EN55011 group 1 class A<br>EMS: EN50082-2 | | |

Note: 1. Measurement conditions: 10 mA at 5 VDC using the fall-of-potential method.
2. These weights are for DC models. AC models are 200 g heavier.

## ■ LIFE EXPECTANCY

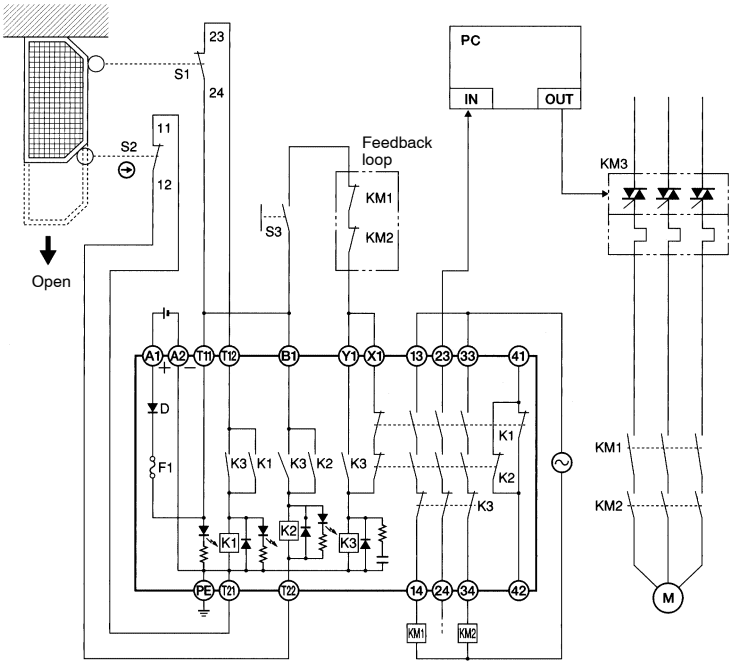
| | |
|---|---|
| Mechanical life | 1,000,000 operations min. with a switching frequency of approx. 1,800 operations/h |
| Electrical life | 100,000 operations min. at the rated load with a switching frequency of approx. 1,800 operations/h |

**Life Expectancy Curve**
**(240 VAC, cosϕ = 0.4)**

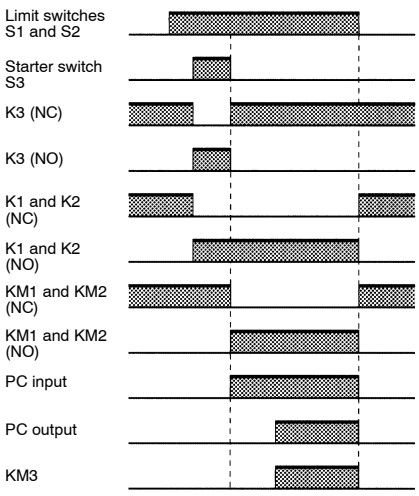



# Application Examples

## ■ G9S-301 (24 VDC) WITH 2-CHANNEL LIMIT SWITCH INPUT

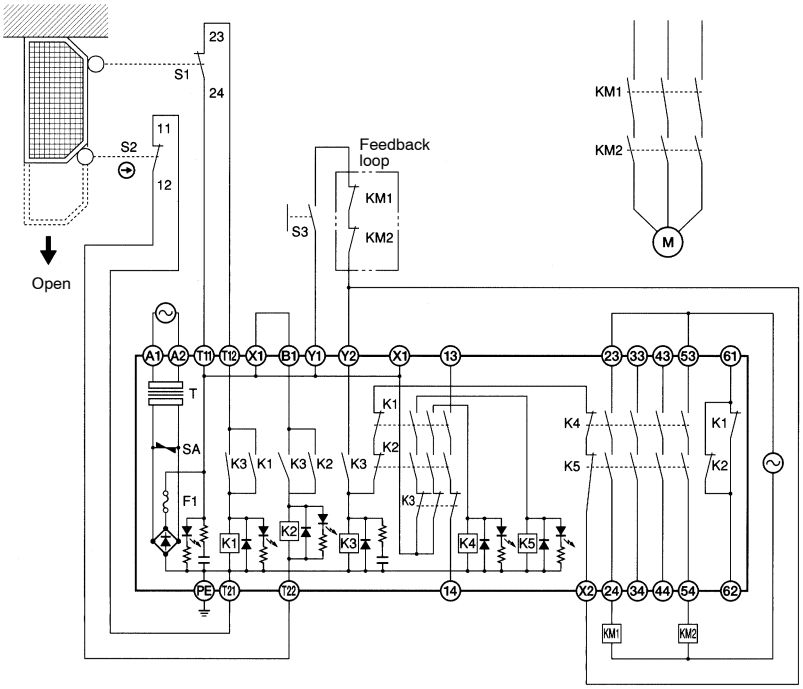



**Timing Chart**

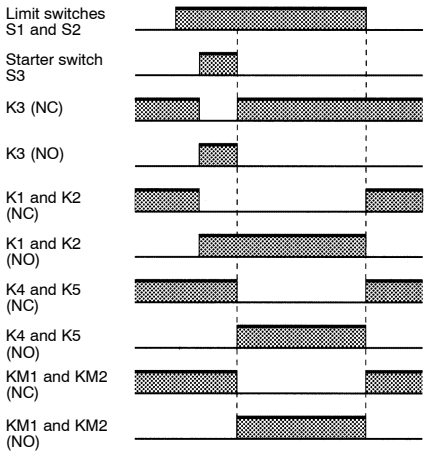



S1: Limit switch
S2: Safety Limit Switch with positive opening mechanism ⊕ (D4D and D4B)
S3: Starter switch
KM1 and KM2: Magnet Contactor
KM3: G3J Solid-state Contactor
M: 3-phase motor

## ■ G9S-501 (AC MODEL) WITH 2-CHANNEL LIMIT SWITCH INPUT

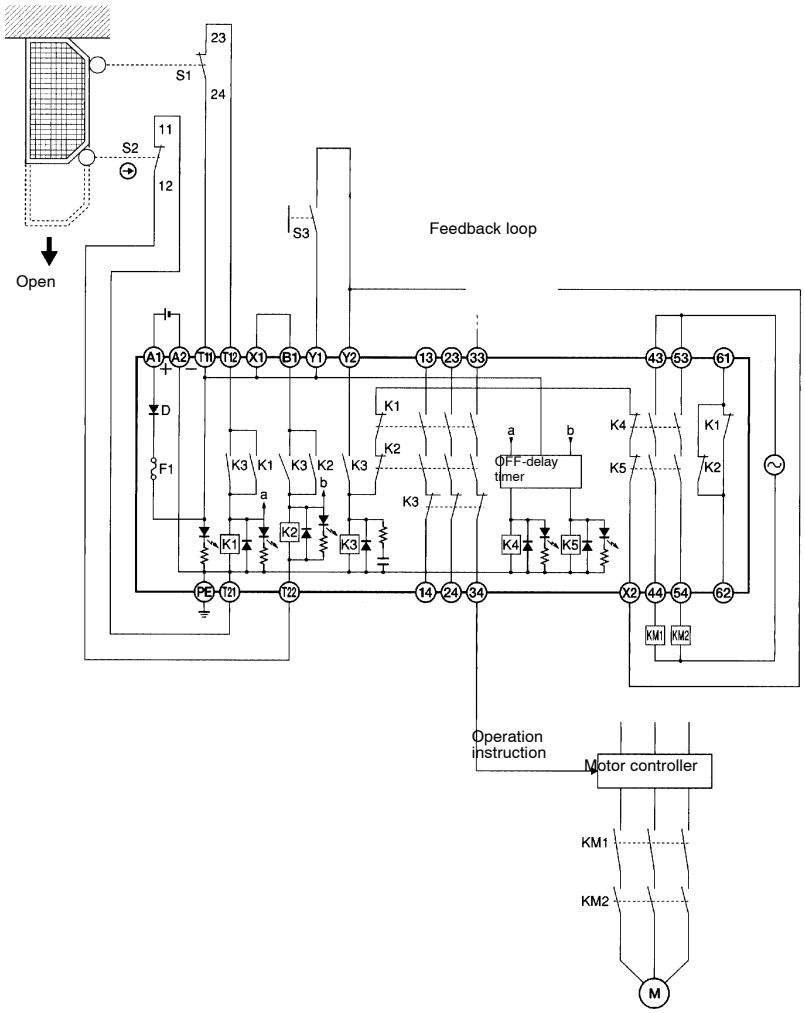



**Timing Chart**

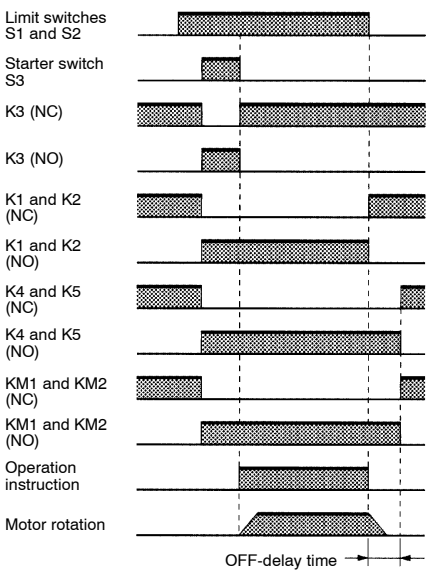



S1: Limit switch
S2: Safety Limit Switch with positive opening mechanism ⊕ (D4D and D4B)
S3: Starter switch
KM1 and KM2: Magnet Contactor
M: 3-phase motor

## ■ G9S-321-T□ (24 VDC) WITH 2-CHANNEL LIMIT SWITCH INPUT

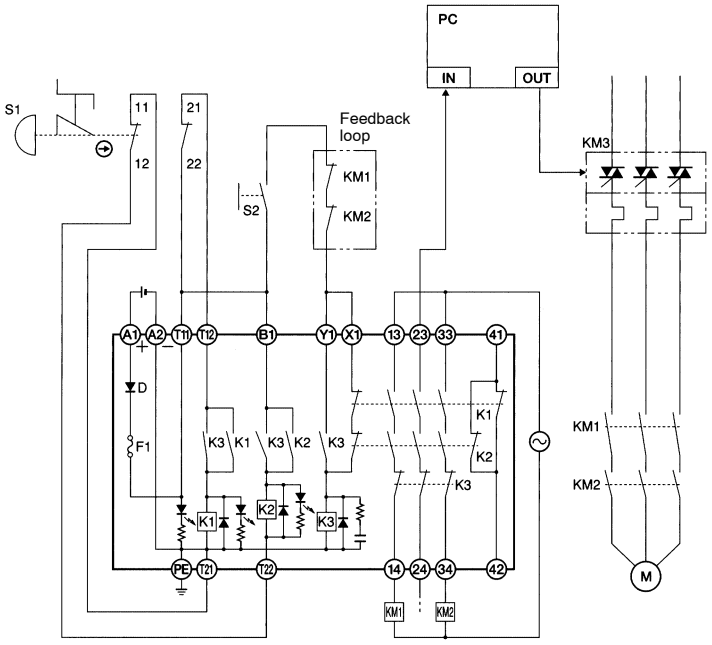



**Timing Chart**

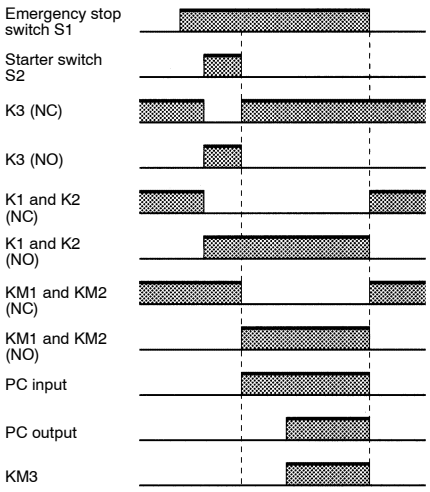



S1: Limit switch
S2: Safety Limit Switch with positive opening mechanism ⊕ (D4D and D4B)
S3: Starter switch
KM1 and KM2: Magnet Contactor
M: 3-phase motor

## ■ G9S-301 (24 VDC) WITH 2-CHANNEL EMERGENCY STOP SWITCH INPUT

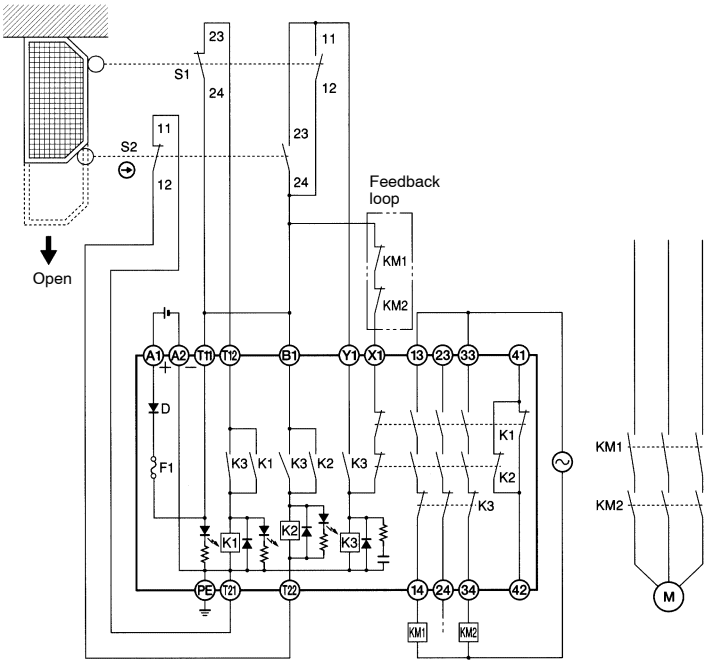



**Timing Chart**

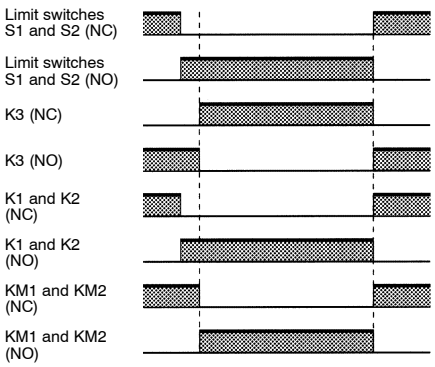



S1: Emergency stop switch
S2: Starter switch
KM1 and KM2: Magnet Contactor
KM3: G3J Solid-state Contactor
M: 3-phase motor

## ■ G9S-301 (24 VDC) WITH 2-CHANNEL AUTO-RESET LIMIT SWITCH INPUT




**Timing Chart**

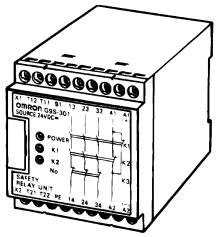


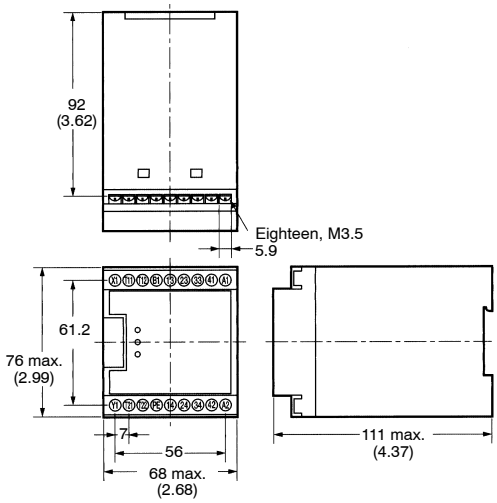

S1: Limit switch
S2: Safety Limit Switch with positive opening mechanism ⊖ (D4D and D4B)
KM1 and KM2: Magnet Contactor
M: 3-phase motor

# Dimensions

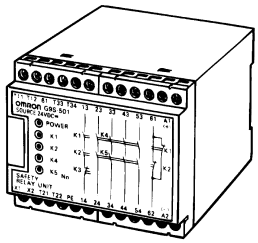
Unit: mm (inch)

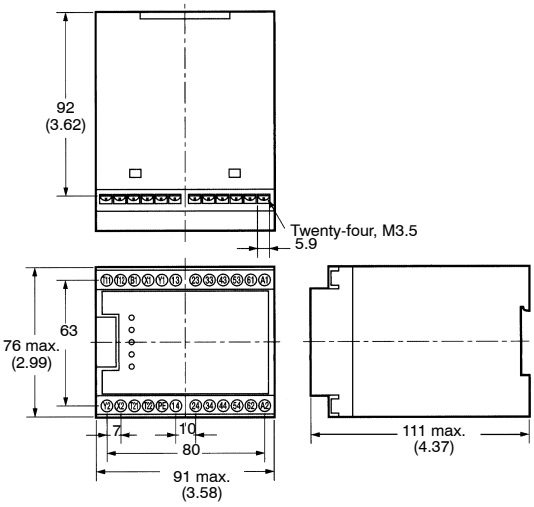
## ■ G9S-301






## ■ G9S-321-T□
## G9S-501

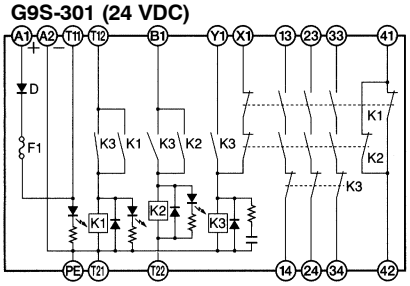




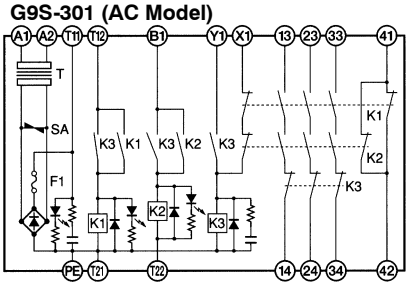
# Installation

## ■ INTERNAL CONNECTIONS

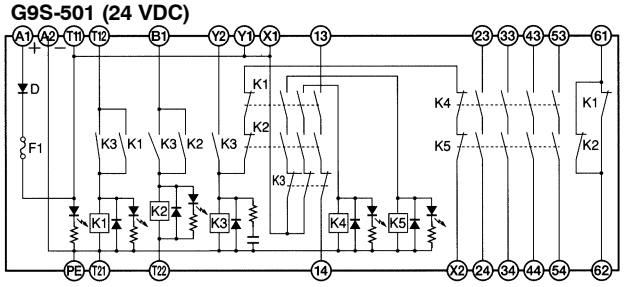
**G9S-301 (24 VDC)**



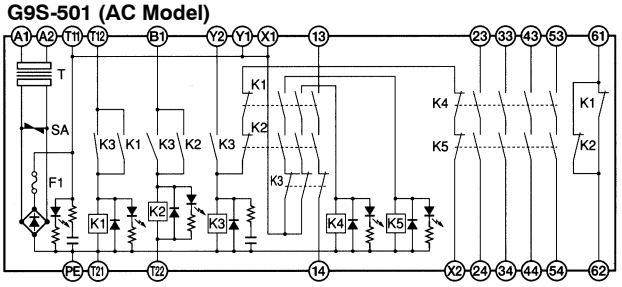

**G9S-301 (AC Model)**



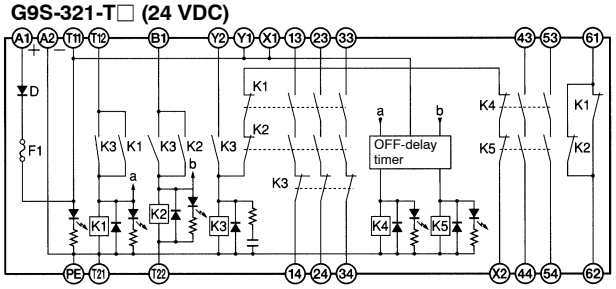

**G9S-501 (24 VDC)**



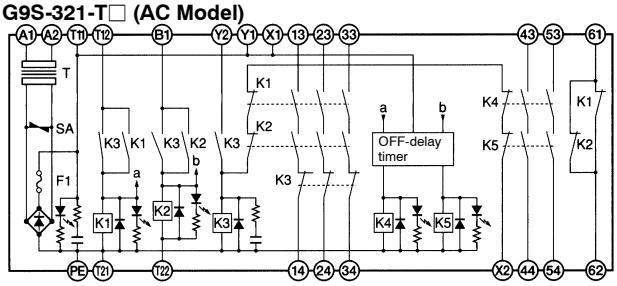

**G9S-501 (AC Model)**




**G9S-321-T□ (24 VDC)**

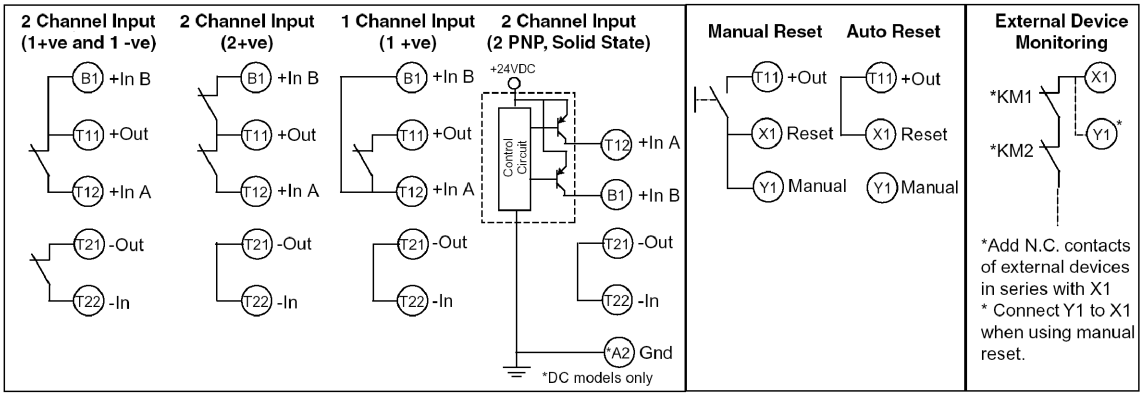



**G9S-321-T□ (AC Model)**

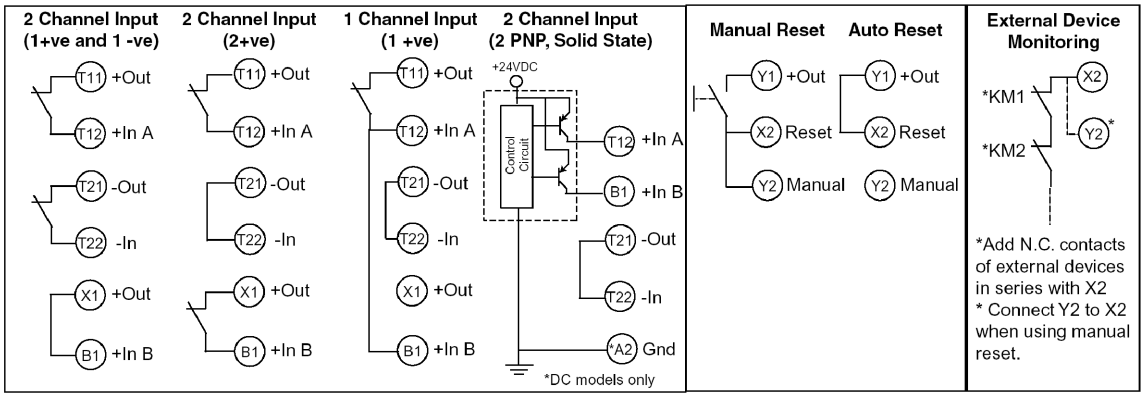


## ■ EXTERNAL CONNECTIONS

### G9S-301 Models




### G9S-321 and G9S-501 Models



# Precautions

## ■ WIRING

Be sure to turn off the G9S before wiring. Do not touch its terminals while the power is turned on because the terminals are charged and may cause an electric shock.

Use the following to wire the G9S.
Strand wire: 0.75 to 1.5 $mm^2$ 16 to 18 AWG
Steel wire: 1.0 to 1.5 $mm^2$ 16 to 18 AWG

Tighten each screw to a torque of 0.78 to 1.18 N•m (8 to 12 kgf•cm), or the G9S may malfunction or generate heat.

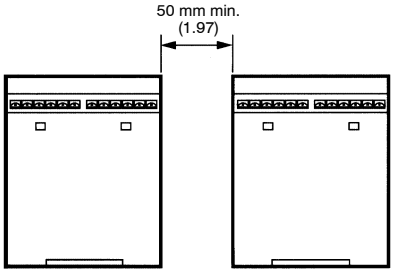
External inputs connected to T11 and T12 or T21 and T22 of the G9S-301 must be no-voltage contact inputs.

PE is a ground terminal.

When a machine is grounded at the positive, the PE terminal should not be grounded.

## ■ MOUNTING MULTIPLE UNITS

If the output current is 3 A or more, make sure that there is a minimum distance of 50 mm (1.97 in) each between all adjacent G9S Units. (24-VDC models do not require this spacing.)



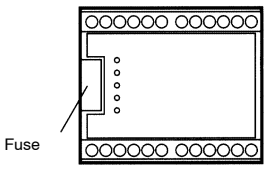

## ■ FUSE REPLACEMENT

### Three- and Five-Pole Models

The power input circuit of the G9S includes a fuse to protect the it from damage that may be caused by short-circuiting. The fuse is mounted to the side panel. Use the following type of fuse as a replacement.
Littel Fuse 218.4 (rated current 0.4 A), IEC127 approval.

Use a flat-blade screwdriver to remove the fuse cover.

Be sure to turn off the G9S before replacing the fuse.




## ■ APPLICABLE SAFETY CATEGORY (EN954-1)

All G9S-series Relays fall under Safety Category 4 of EN954-1 except the G9S-321-T. The G9S-321-T has an OFF-delay output block falling under 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 EN954-1 requirements.

### Safety Category 4 of EN954-1

Apply 2-channel external input to the T11 and T12 terminals and T21 and T22 terminals through switches each incorporating a force-separation mechanism. If limit switches are used, make sure that at least one of them incorporates a force-separation mechanism.

Refer to *Application Examples* and input a signal for the normally-closed contact of the contactor (i.e., input to X1 of the G9S-301, X2 of the G9S-501, or X2 of the G9S-321-T).

Be sure to ground the PE terminal. If the relay is operating with DC, the power supply may be grounded instead.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters into inches, divide by 25.4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