

Safety Relay Unit

G9S

Ideal for Safety Door and Emergency Stop Switch Circuits for Machines in European Countries

- Two-pole slim models that are only 22.5 mm wide, three-pole models that are only 68 mm wide, and five-pole models that are only 91 mm wide are available.
- OFF-delay models are available
- Incorporates LED indicators for monitoring built-in relays.
- Finger-protection construction.
- Both DIN track mounting and screw mounting possible (two-pole models)
- Conforms to EN60204-1 (IEC204-1), EN954-1, and approved by BIA.

Note: Be sure to refer to the *Precautions* on page 12.



Ordering Information

Basic Models

| Number of poles | Main contact form | Number of input channels | Model | Rated voltage |
|-----------------|-------------------|----------------------------------|----------|---------------|
| 2 | DPST-NO | 1 channel | G9S-2001 | 24 VDC |
| | | 2 channels | G9S-2002 | |
| 3 (see note) | 3PST-NO | 1 channel or 2 channels possible | G9S-301 | 24 VDC |
| | | | | 100 VAC |
| | | | | 200 VAC |
| | | | | 240 VAC |
| 5 (see note) | 5PST-NO | | G9S-501 | 24 VDC |
| | | | | 100 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 | Model | OFF-delay time | Rated voltage |
|-----------------|-------------------|----------------|----------------------------------|-------------|----------------|---------------|
| 3 | 3PST-NO | DPST-NO | 1 channel or 2 channels possible | G9S-321-T01 | 1 s | 24 VDC |
| | | | | | | 100 VAC |
| | | | | | | 200 VAC |
| | | | | | | 240 VAC |
| | | | | G9S-321-T10 | 10 s | 24 VDC |
| | | | | | | 100 VAC |
| | | | | | | 200 VAC |
| | | | | | | 240 VAC |
| | | | | G9S-321-T30 | 30 s | 24 VDC |
| | | | | | | 100 VAC |
| | | | | | | 200 VAC |
| | | | | | | 240 VAC |

Note: Each model has an SPST-NC auxiliary contact.

Model Number Legend:

G9S-□□□□-□□□□
 1 2 3 4 5

1. Contact configuration (safety output)

- 2: DPST-ND
- 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. Input configuration

None: 1-channel or 2-channel input possible

- 1: 1-channel input
- 2: 2-channel input

5. OFF-delay time

None: No OFF-delay

- T01: 1 second
- T10: 10 seconds
- T30: 30 seconds

Specifications

■ Ratings

Controller Block

| Model | Rated voltage | Rated current | Rated power consumption |
|----------------------|---------------|---------------|---------------------------|
| G9S-2001 G9S-2002 | 24 VDC | 66 mA±20% | Approx. 1.6 W |
| G9S-301 | 24 VDC | 62.5 mA±20% | Approx. 1.5 W |
| | 100 VAC | 30 mA±20% | Approx. 3 VA (60 Hz) |
| | 200 VAC | 15 mA±20% | |
| | 240 VAC | 12.5 mA±20% | |
| G9S-501 | 24 VDC | 127 mA±20% | Approx. 3 W |
| | 100 VAC | 55 mA±20% | Approx. 5.5 VA (60 Hz) |
| | 200 VAC | 27.5 mA±20% | |
| | 240 VAC | 22.9 mA±20% | |
| G9S-321-T□ | 24 VDC | 150 mA±20% | Approx. 3.6 W |
| | 100 VAC | 61 mA±20% | Approx. 6.1 VA (60 Hz) |
| | 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 G9S-501 G9S-321-T | G9S-2001 G9S-2002 |
|--|--|-------------------------------|
| Rated load | 3 A at 240 VAC; (see note) cosφ = 0.4 | 5 A at 240 VAC; cosφ = 0.4 |
| AC15 (IEC-947-5-1/ Table 4) | 3 A at 240 VAC; cosφ = 0.3; 6,050 operations | |
| DC13 (IEC-947-5-1/ Table 4) | 1 A at 24 VDC; L/R=100 ms; 6,050 operations | |
| Rated carry current | 5 A | |
| Max. switching voltage | 250 VAC, 24 VDC | |
| Max. switching capacity | AC: 1,250 VA; DC: 120 W | |
| Min. permissible load | 50 mA at 24 VDC (operating frequency: 60 operations/min.) | |

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

■ Characteristics

| Item | | G9S-2001 G9S-2002 | G9S-301 | G9S-501 | G9S-321-T□ |
|--|---|--|--|--|---------------------------------------|
| Input voltage/frequency | | 24 VDC±10%, 50/60 Hz | 24 VDC±10%, 50/60 Hz 200 VAC±10%, 50/60 Hz | 100 VAC±10%, 50/60 Hz 240 VAC±10%, 50/60 Hz | |
| Fuse protection | | --- | 0.4 A | | |
| Contact form of safety circuit | | DPST-NO | 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 | | 200 mΩ | 300 mΩ max. (measurement conditions: 5 VDC, 10 mA, voltage drops.) | | |
| Operate time | (Rated voltage operation, does not include bounce time) | 50 ms | 300 ms max. | | 300 ms |
| Release time | | 50 ms | 100 ms max. | | 100 ms; OFF-delay: 1 s, 10 s, 30 s |
| 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 (approx. 30G) for 11 ms | | | |
| | Malfunction | 50 m/s ² (approx. 5G) for 11 ms | | | |
| Minimum applicable load (P standard reference value) | | 24 VDC, 50 mA | | | |
| Ambient temperature | | Operating: -25°C to 55°C Storage: -25°C to 55°C | | | |
| Ambient humidity | | Operating: 38% to 85% RH Storage: 38% to 85% RH | | | |
| Degree of protection (IEC529) | Terminals | IP20 | | | |
| | Enclosure | IP40 | | | |
| Terminal tightening torque | | 10 kgf • cm (0.98 N • m) | | | |
| Weight (see note) | | Approx. 180 g | 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 EMS: EN55082-2 | | | |

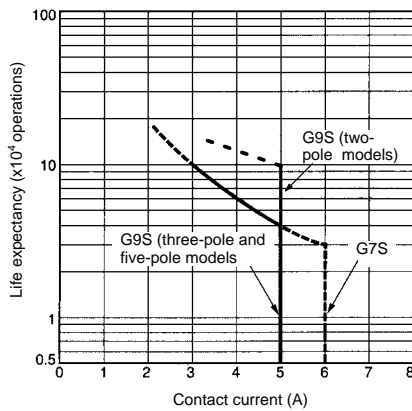
Note: These weights are for DC models. AC models are 200 g heavier.

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 |

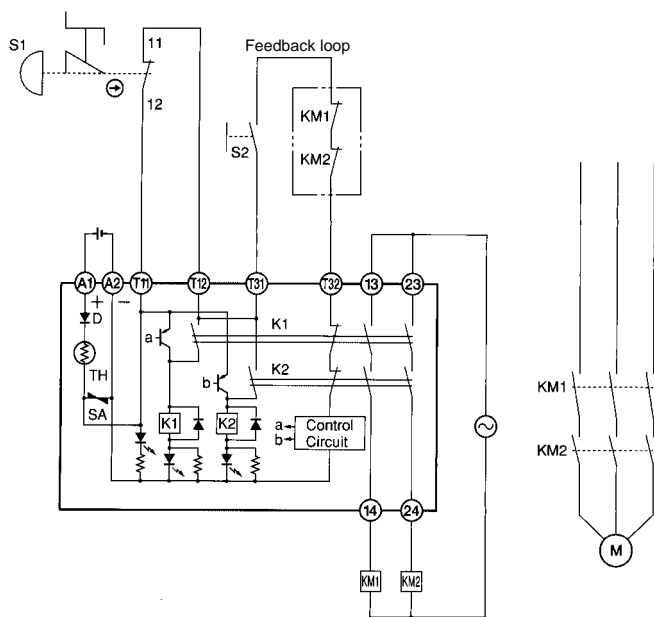
Life Expectancy Curve

(240 VAC, $\cos\phi = 0.4$, $\cos\phi = 1$)

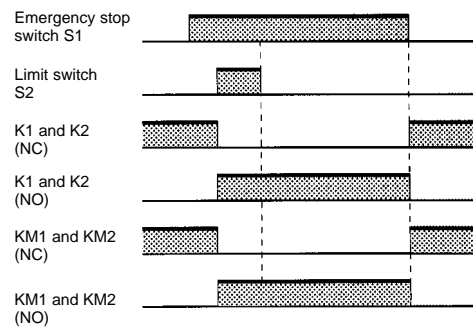


Application Examples

G9S-2001 with Single-channel Manual-reset Emergency Stop Switch Input

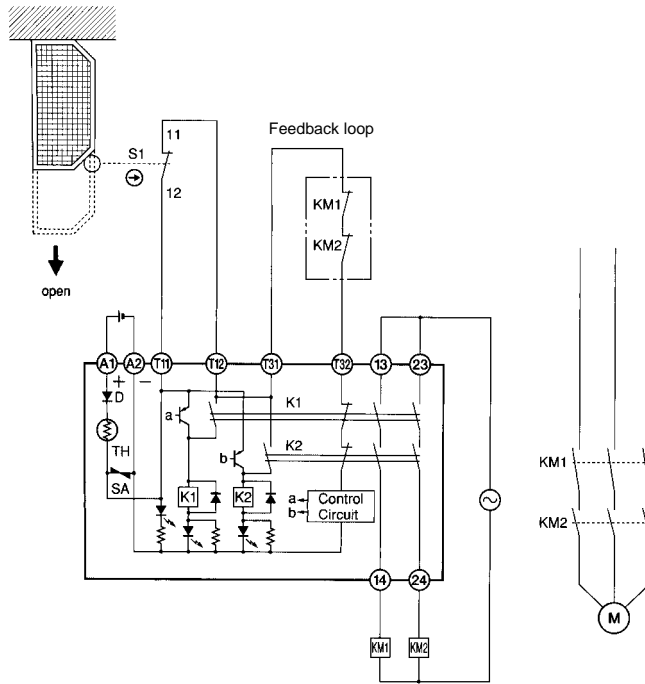


Timing Chart

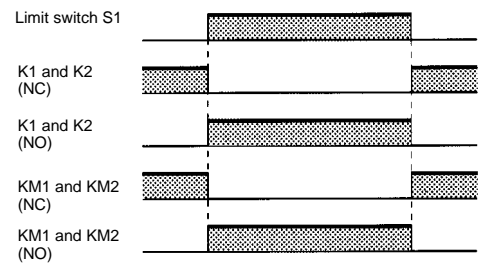


S1: Limit switch
S2: Starter switch
KM1 and KM2: Magnet Contactor
M: 3-phase motor

G9S-2001 with Single-channel Auto-reset Limit Switch Input

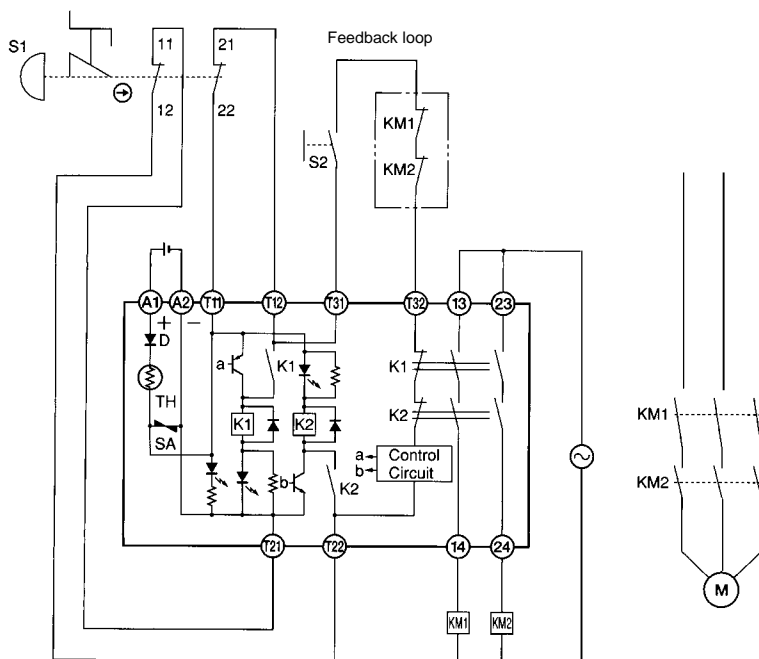


Timing Chart

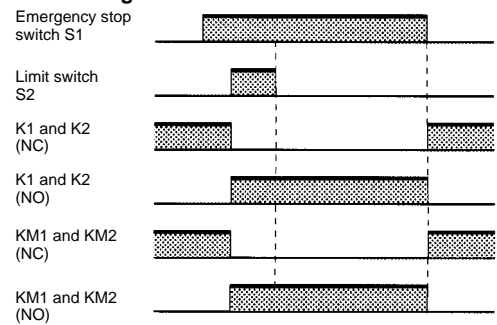


S1: Safety Limit Switch with positive opening mechanism (D4D and D4B)
 KM1 and KM2: Magnet Contactor
 M: 3-phase motor

G9S-2002 with 2-channel Manual-reset Emergency Stop Switch Input

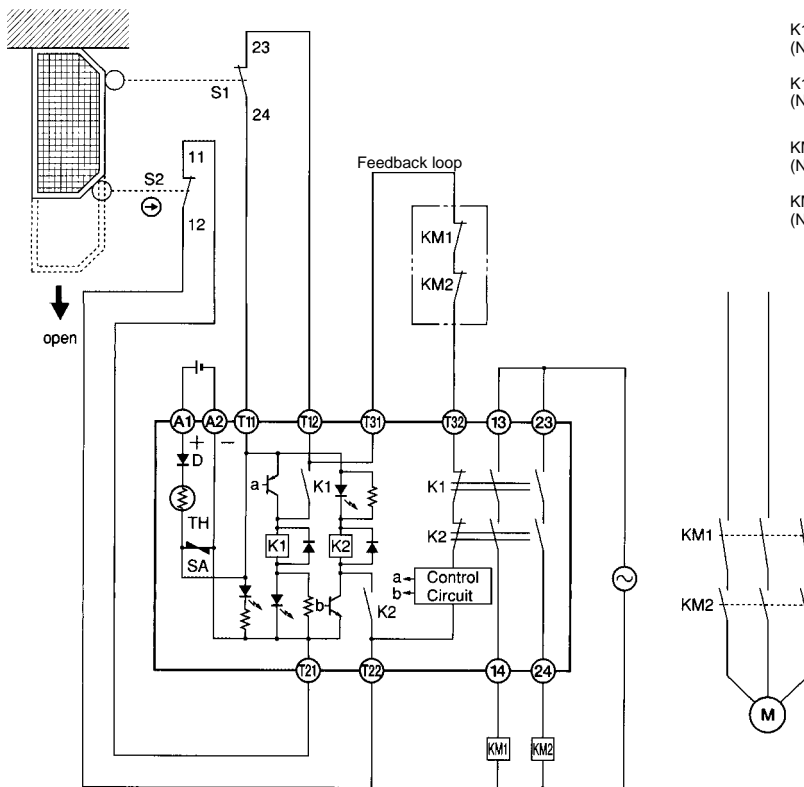


Timing Chart

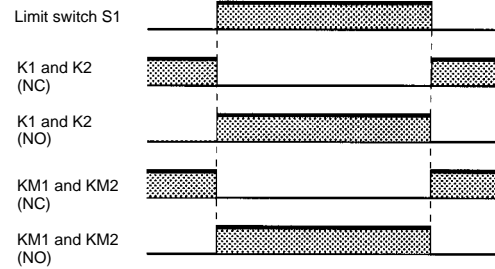


S1: Emergency stop switch with positive opening mechanism
 S2: Starter switch
 KM1 and KM2: Magnet Contactor
 M: 3-phase motor

G9S-2002 with 2-channel Auto-reset Limit Switch Input

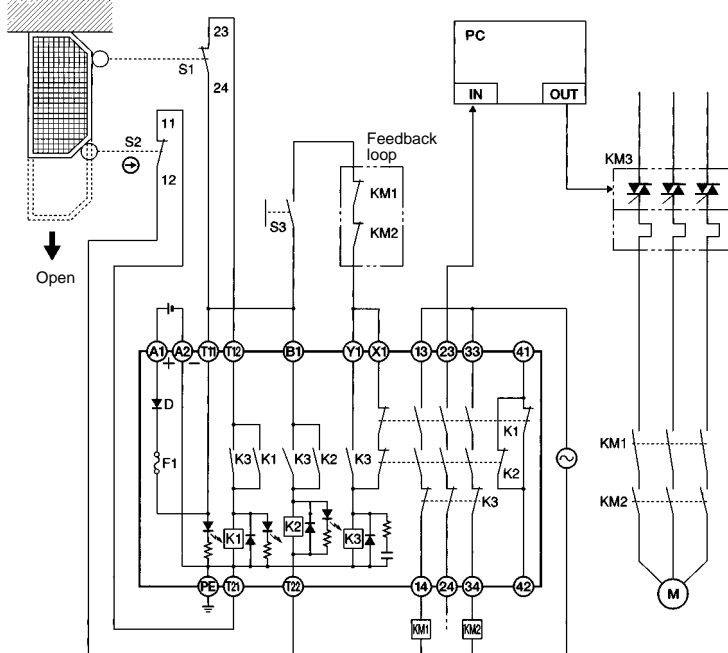


Timing Chart

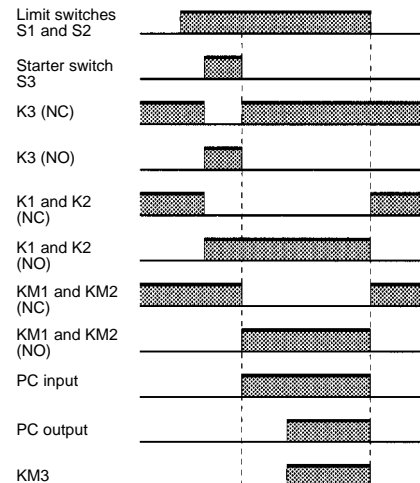


S1: Limit switch
S2: Safety Limit Switch with positive opening mechanism (D4D and D4B)
KM1 and KM2: Magnet Contactor
M: 3-phase motor

G9S-301 (24 VDC) with 2-channel Limit Switch Input

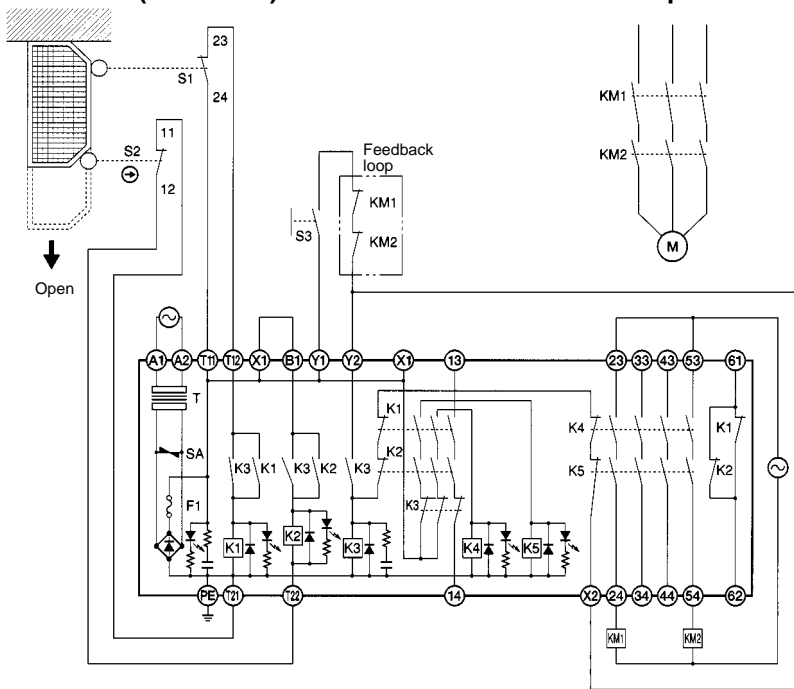


Timing Chart

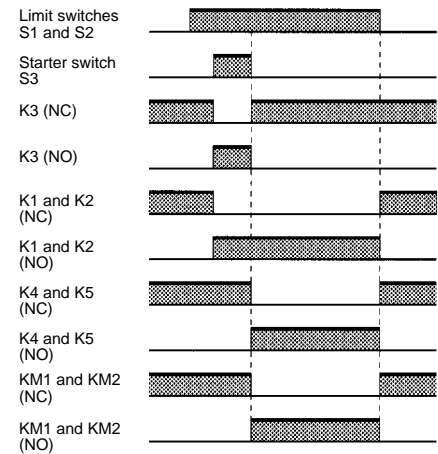


S1: Limit switch
S2: Safety Limit Switch with positive opening mechanism (D4D and D4B)
S3: Starter switch
KM1 and KM2: Magnet Contactor
KM3: G3J Solid-state Contactor
M: 3-phase motor

G9S-501 (AC Model) with 2-channel Limit Switch Input

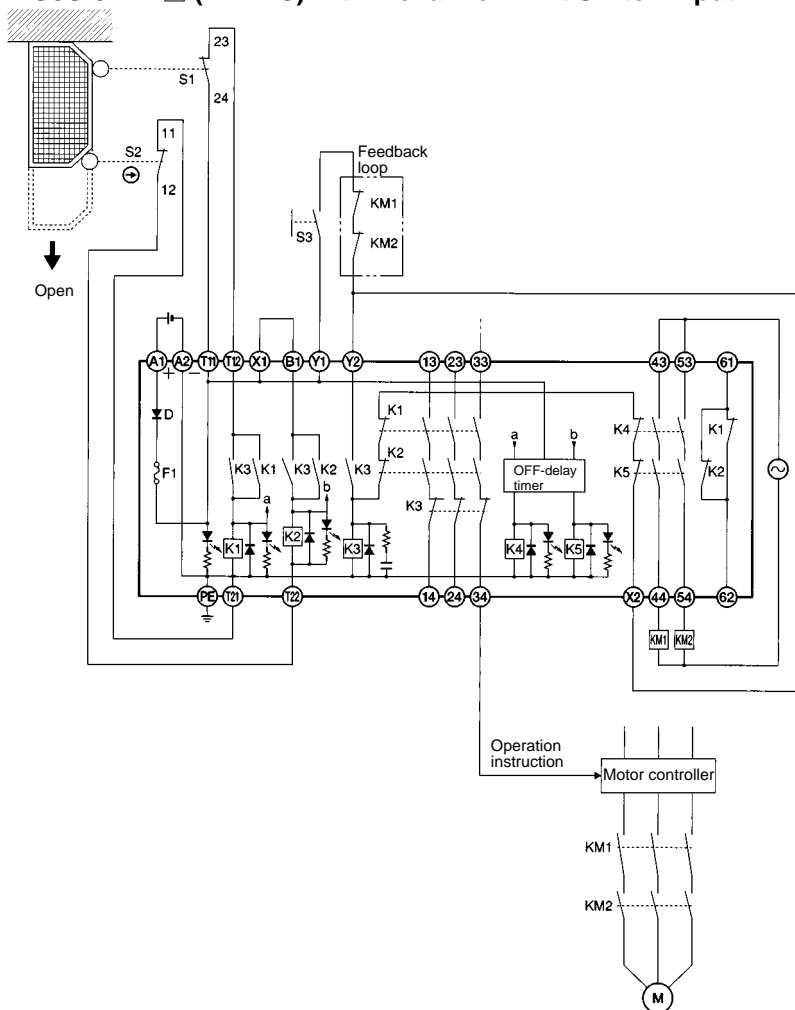


Timing Chart

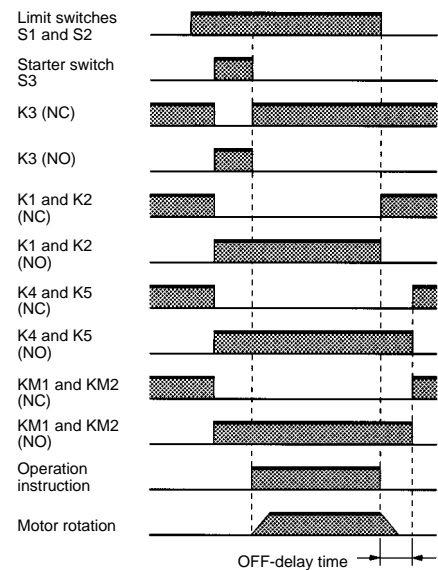


S1: Limit switch
S2: Safety Limit Switch with positive opening mechanism (D4D and D4B)
S3: Starter switch
KM1 and KM2: Magnet Contactor
M: 3-phase motor

G9S-321-T (24 VDC) with 2-channel Limit Switch Input

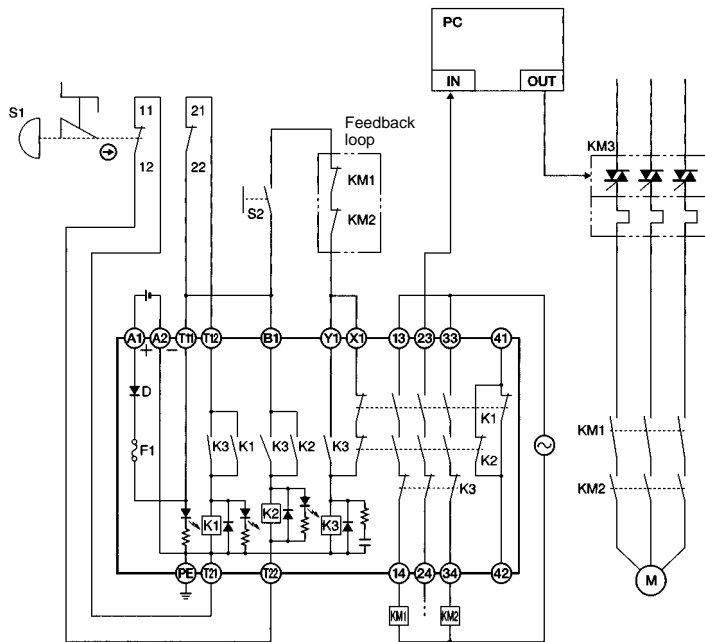


Timing Chart

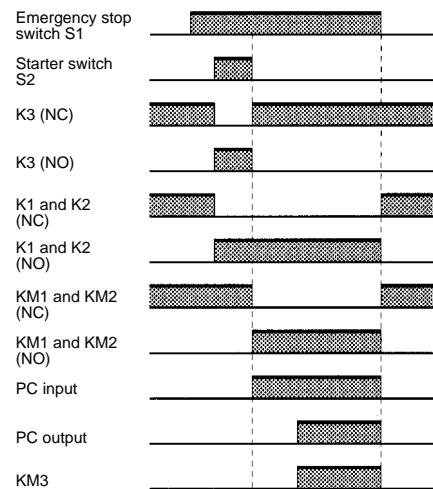


S1: Limit switch
S2: Safety Limit Switch with positive opening mechanism (D4D and D4B)
S3: Starter switch
KM1 and KM2: Magnet Contactor
M: 3-phase motor

G9S-301 (24 VDC) with 2-channel Emergency Stop Switch Input

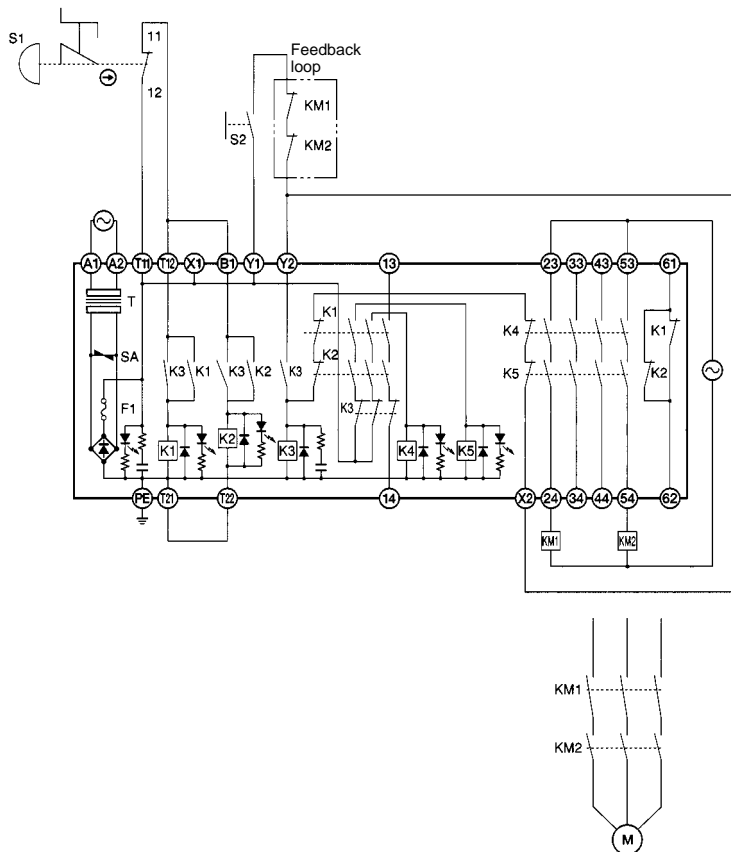


Timing Chart

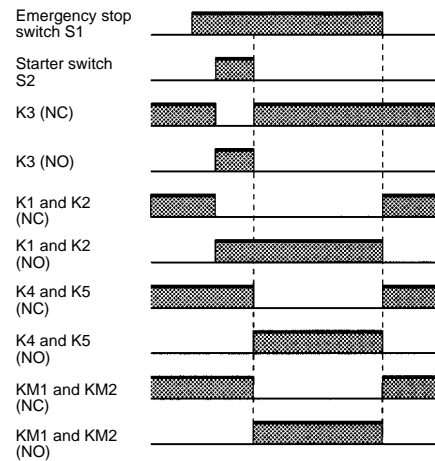


S1: Emergency stop switch
 S2: Starter switch
 KM1 and KM2: Magnet Contactor
 KM3: G3J Solid-state Contactor
 M: 3-phase motor

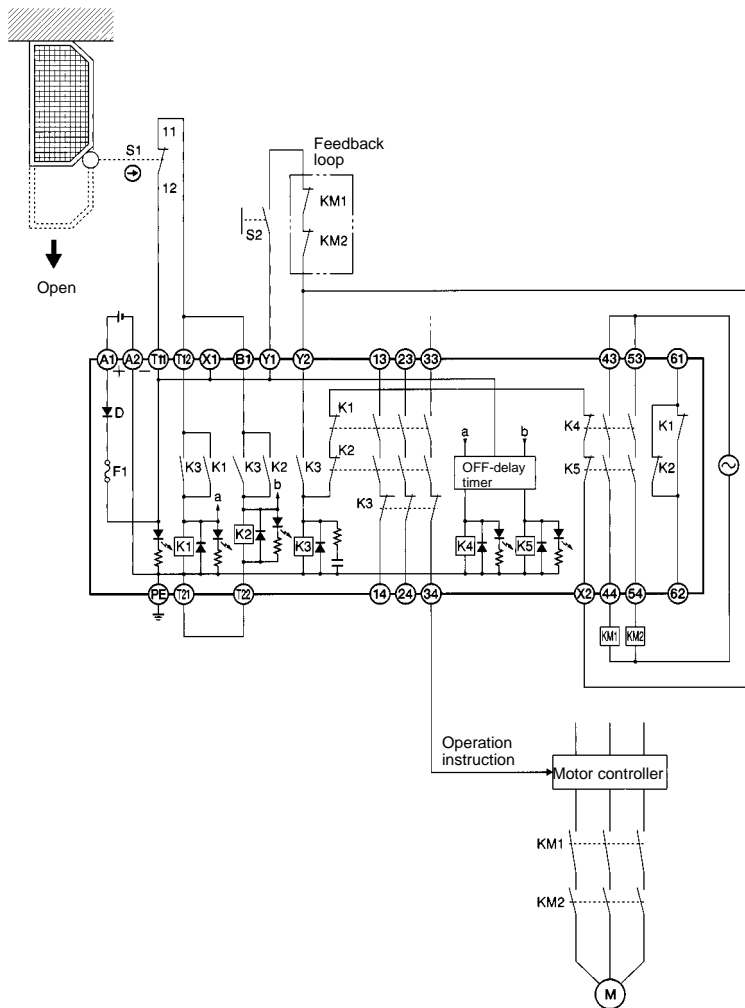
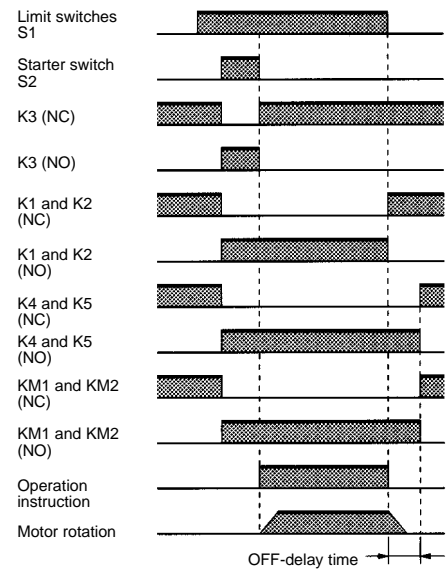
G9S-501 (AC) with Single-channel Emergency Stop Switch Input



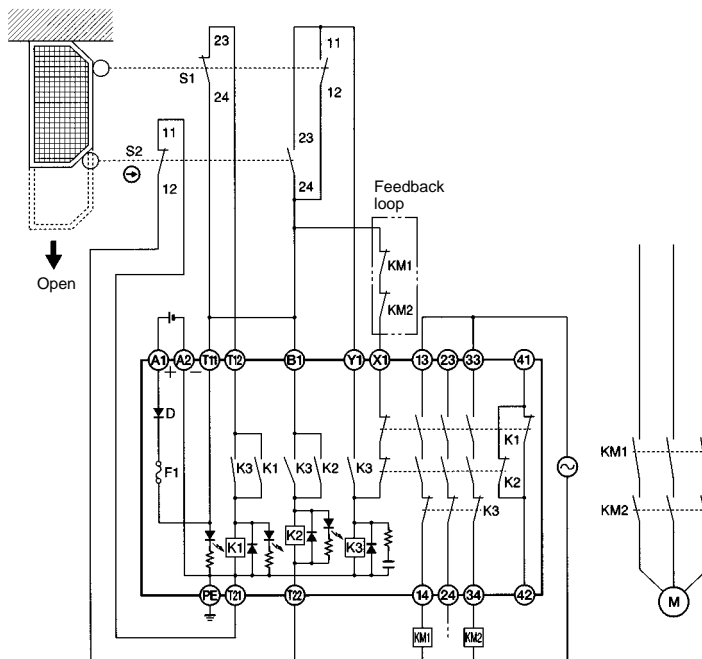
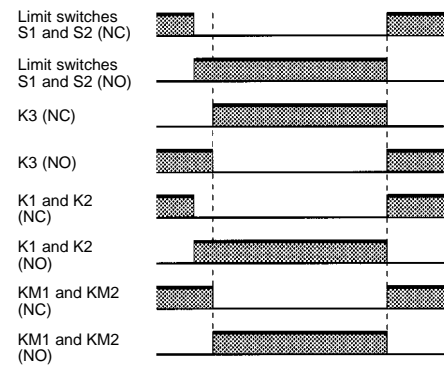
Timing Chart



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

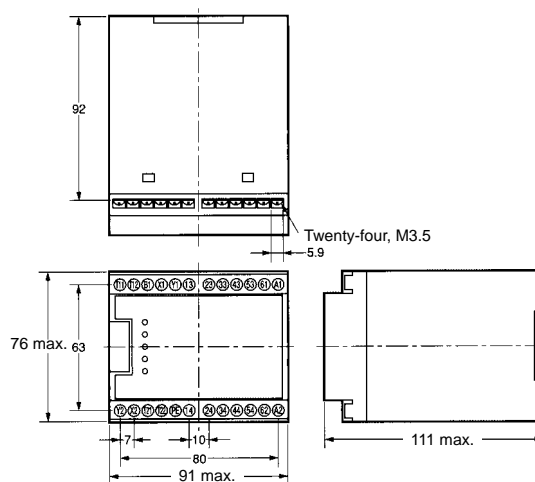
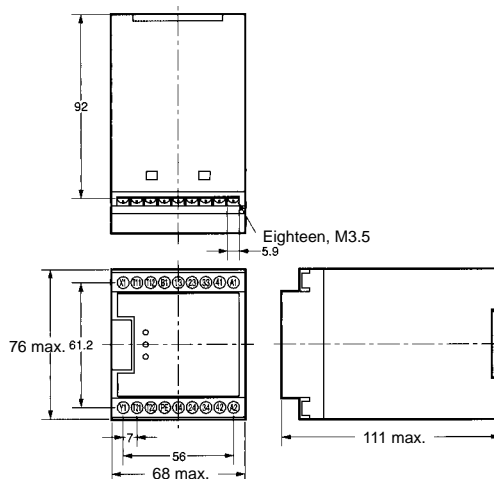
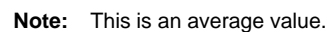
G9S-321-T□ (24 VDC) with Single-channel Limit Switch Input

Timing Chart


- S1: Safety Limit Switch with positive opening mechanism (D4D and D4B)
- S2: Starter switch
- KM1 and KM2: Magnet 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

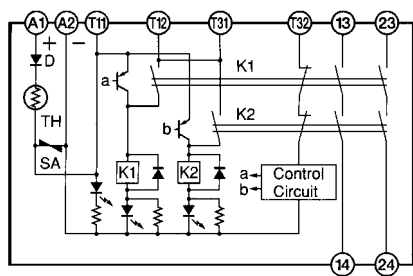
Note: All units are in millimeters unless otherwise indicated.



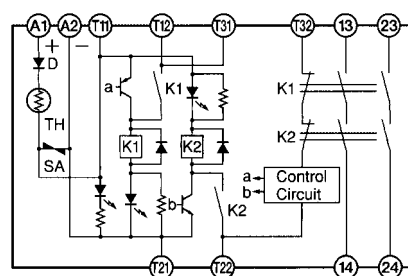
Installation

■ Internal Connections

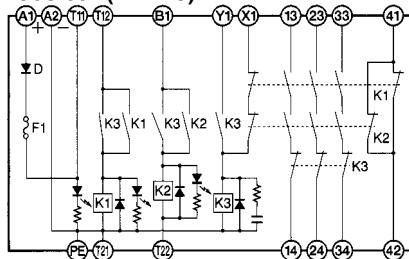
G9S-2001



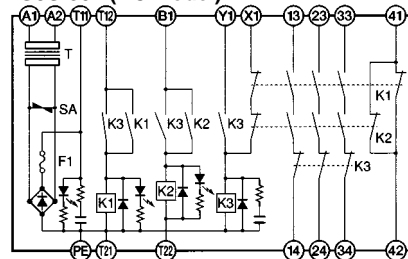
G9S-2002



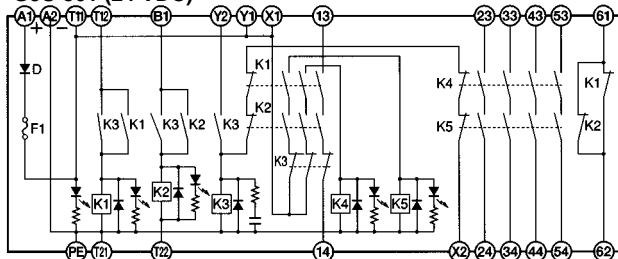
G9S-301 (24 VDC)



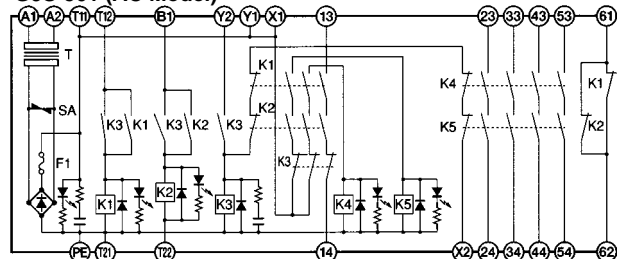
G9S-301 (AC Model)



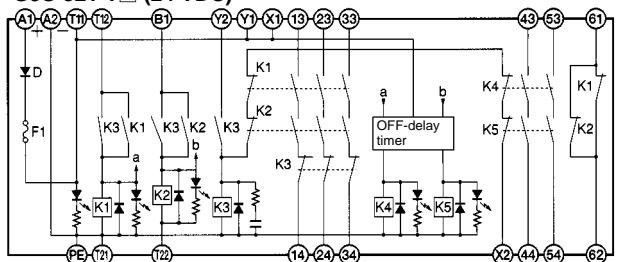
G9S-501 (24 VDC)



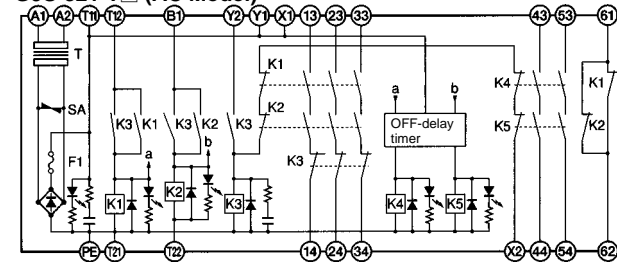
G9S-501 (AC Model)



G9S-321-T□ (24 VDC)



G9S-321-T□ (AC Model)



Precautions

Wiring

Be sure to turn off the G9S before wiring the G9S. Do not touch the terminals of the G9S 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 mm²

Steel wire: 1.0 to 1.5 mm²

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

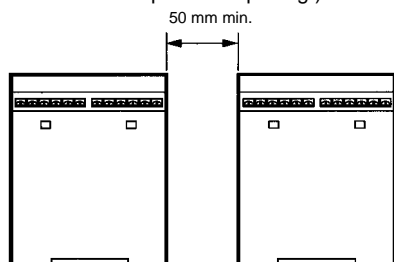
External inputs connected to T11 and T12 or T21 and T22 of the G9S-301 must be no-voltage contact inputs.

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 each between all adjacent G9S Units. (24-VDC models do not require this spacing.)



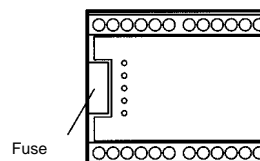
Fuse Replacement (Three- and Five-pole Models)

The power input circuit of the G9S includes a fuse to protect the G9S 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-32I-T and G9S-2001. The G9S-32I-T has an OFF-delay output block falling under Safety Category 3 and G9S-2001 falls under Safety Category 1.

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.

Wire the G9S-2001 or G9S-2002 for auto-reset. If either one of them is connected to a manual-reset switch, EN954-1 requirements will not apply.

Safety Category 4 of EN954-1

Wire the G9S-2001 or G9S-2002 for auto-reset. If either one of them is connected to a manual-reset switch, EN954-1 requirements will not apply.

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, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. J109-E1-3 In the interest of product improvement, specifications are subject to change without notice.

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