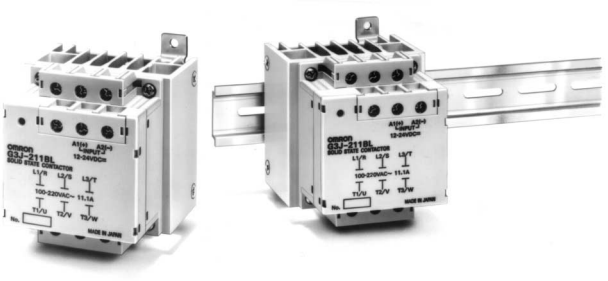
OMRON

Simple SSC

G3J

A Solid-state Contactor for 3-phase Motors that Achieves Harmonized Protection with Thermal Overload Relays and Can Be Used Like a Standard Contactor



- Harmonized protection with thermal overload relays conforming to IEC 947-4-2 (Class 10A/10); can be used like a standard contactor.
- Thermal Overload Relays (J7TY) can be mounted directly.
- Conforms to AC Class 3 (IEC947).
- Meets UL, CSA, IEC, and JEM requirements.
- Mounts with screws or to DIN tracks.
- Compact monoblock construction (80 (W) x 100 (H) x 100 (D)) with a heat sink.
- Snubber circuit and varistor are built-in.
- With an operation indicator.
- Two-element models added to series.

Ordering Information

Number of elements	Insulation method	Rated supply voltage	Applicable motor		Model
3	Phototriac	12 to 24 VDC	2.2 kW (11.1 A)	200 to 220 VAC	G3J-211BL
			0.75 kW (4.8 A)		G3J-205BL
	Photocoupler	100 to 240 VAC	2.2 kW (11.1 A)		G3J-211BL
			0.75 kW (4.8 A)		G3J-205BL
2	Phototriac	12 to 24 VDC	2.2 kW (11.1 A)		G3J-211BL-2
			0.75 kW (4.8 A)		G3J-205BL-2
	Photocoupler	100 to 240 VAC	2.2 kW (11.1 A)		G3J-211BL-2
			0.75 kW (4.8 A)		G3J-205BL-2

Specifications

■ Ratings (Ambient Temperature: 25°C)

Operation Circuit

Item	DC-input models	AC-input models
Rated supply voltage	12 to 24 VDC	100 to 240 VAC (50/60 Hz)
Operating voltage range	9.6 to 28.8 VDC	75 to 264 VAC (50/60 Hz)
Rated input current (impedance)	15 mA max. (at 12 to 24 VDC)	36 kΩ ±20% (100 to 240 VAC)
Must-operate voltage	9.6 VDC max.	75 VAC max.
Release voltage	3.6 VDC min.	20 VAC min.

Main Circuit

Item		G3J-211BL, G3J-211BL-2	G3J-205BL, G3J-205BL-2
Rated load voltage		100 to 240 VAC (50/60 Hz)	
Load voltage range		75 to 264 VAC (50/60 Hz)	
Rated carry current		11.1 A (Ta = 40°C)	4.8 A (Ta = 40°C)
Min. load current		0.5 A	
Peak-value current resistivity		350 A, 60 Hz, 1 cycle	150 A, 60 Hz, 1 cycle
Overload resistance		Refer to *Engineering Data* on page 95.	
Closed current (effective value)	**AC3**	111 A	48 A
	AC4	133.2 A	57.6 A
Breaking current (effective value)	**AC3**	88.8 A	38.4 A
	AC4	111 A	48 A
Applicable load	**3-phase inductive motor (AC3 AC4 AC53-a)**	200 to 220 VAC, 2.2 kW, (11.1 A)	200 to 220 VAC, 0.75 kW, (4.8 A)
		Motors passing the AC3-class, AC4-class, and AC53-a-class switching frequency test (Ta = 40°C) under conditions specified by OMRON. Refer to *Switching Frequency Test Conditions* on page 96.	
	Single-phase motor (AC3) (see note 1)	100 VAC, 0.4 kW (11.1 A) 200 VAC, 0.75 kW (8.8 A)	100 VAC, 0.1 kW, (5.1 A) 200 VAC, 0.4 kW (5.5 A) (see note 2)
	Resistive load (AC1)	100 to 240 VAC, 11.1 A	100 to 240 VAC, 4.8 A

Note: 1. With 2-element models, L2 and T2 are shorted internally.

2. When using 0.75-W models with 3 poles ON simultaneously, use either combination at 4.8 A max.

■ Characteristics

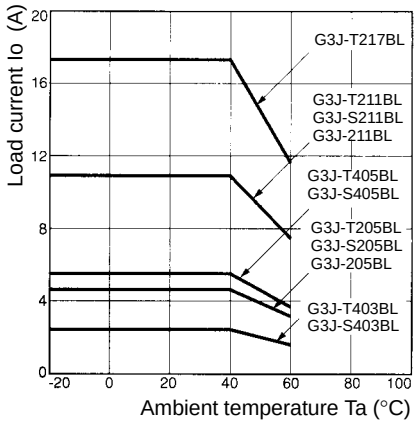
Item	DC-input models	AC-input models
Operating time	1 ms max.	50 ms max.
Release time	5/6 of the load power supply cycle time + 1 ms max.	3/2 of the load power supply cycle time + 1 ms max.
Output ON-voltage drop	1.6 V_{RMS} max.	
Leakage current (see note)	10 mA max. (at 200 VAC)	
Insulation resistance	100 MΩ min. (at 500 VDC)	
Dielectric strength	2,500 VAC, 50/60 Hz for 1 min	
Vibration resistance	Destruction: 10 to 55 Hz, 0.75-mm single amplitude Malfunction: 10 to 55 Hz, 0.75-mm single amplitude	
Shock resistance	Destruction: 294 m/s^2 Malfunction: 147 m/s^2	
Ambient temperature	Operating: –20°C to 60°C (with no icing or condensation) Storage: –30°C to 70°C (with no icing or condensation)	
Ambient humidity	Operating: 45% to 85%	
Weight	Approx. 700 g	
Standards	UL508, CSA22.2 No. 14, IEC947-4-2, JEM1441	

Note: With 2-element models, the S-phase leakage current will be larger by a factor of $\sqrt{3}$.

Engineering Data

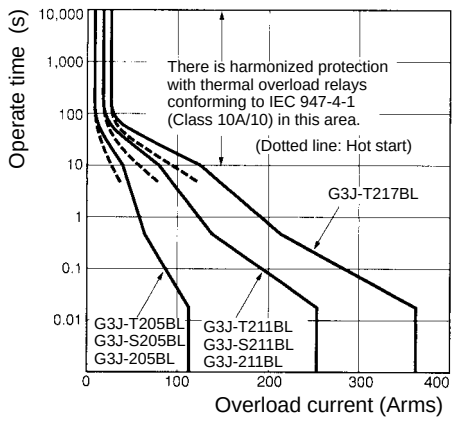
■ G3J

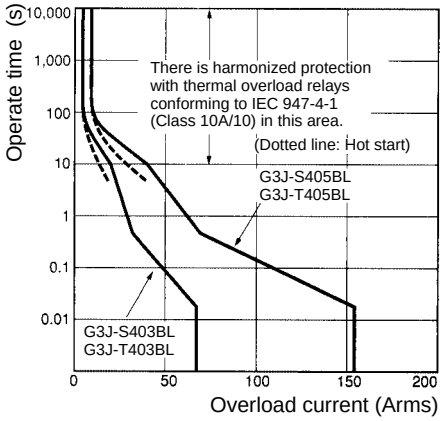
Load Current vs. Ambient Temperature Characteristics (Continuous Current)



Overload Current Resistivity

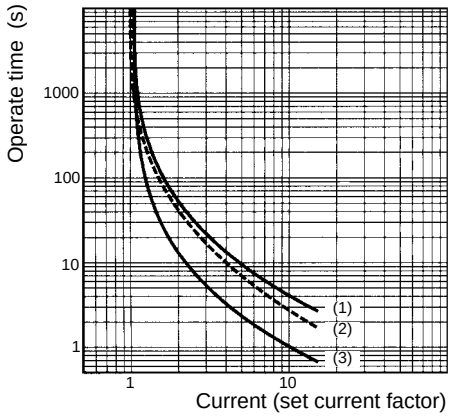
Conditions: 60 Hz, Ta of 25°C, non-repetitive (1/2 for repetitive)





■ Thermal Overload Relay

Overload Characteristics



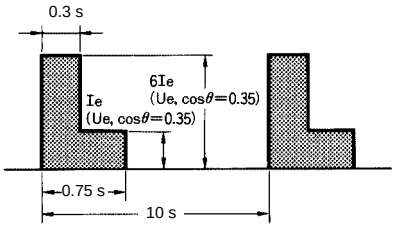
(1): Balanced operation, 3-phase, from cold state

(2): Balanced operation, 2-phase, from cold state

(3): Balanced operation, 3-phase, after a long period of set current flow (hot state).

■ Switching Frequency Test Conditions (AC3/AC4/AC53-a)

AC3 Class (Immediate Start)



Ie: Rated carry current
Ue: Rated load voltage (200/400 V)

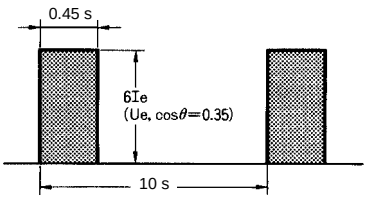
The following Soft-start conditions apply.

Ramp-up time:	1 s
Starting torque:	450% In

The following Soft-start/stop conditions apply:

Ramp-up time:	1 s
Ramp-down time:	1 s
Starting torque:	450% In

AC4 Class (Inching)



Ie: Rated carry current
Ue: Rated load voltage (200/400 V)

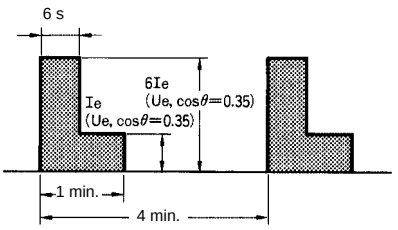
The following Soft-start conditions apply.

Ramp-up time:	1 s
Starting torque:	450% In

The following Soft-start/stop conditions apply:

Ramp-up time:	1 s
Ramp-down time:	1 s
Starting torque:	450% In

AC53-a: 6-6: 25-15



Ie: Rated carry current
Ue: Rated load voltage (200/400 V)

The following Soft-start conditions apply.

Ramp-up time:	1 s
Starting torque:	450% In

The following Soft-start/stop conditions apply:

Ramp-up time:	1 s
Ramp-down time:	1 s
Starting torque:	450% In

Operation

■ Soft Start/Stop

The G3J-T is a solid-state contactor that smoothly starts and stops machines and equipment connected to power supplies without damaging the machines, equipment, or power supplies.

Soft-start Time

The voltage imposed on the motor increases while ignition α is gradually reduced, thus gradually increasing the rotation speed of the motor.

Ramp-up Time

Ramp-up time is a period required for ignition α to become zero degrees with a 100% voltage imposed on the motor.

Starting Torque

Starting torque is determined by the value of ignition α immediately after the input signal is turned ON.

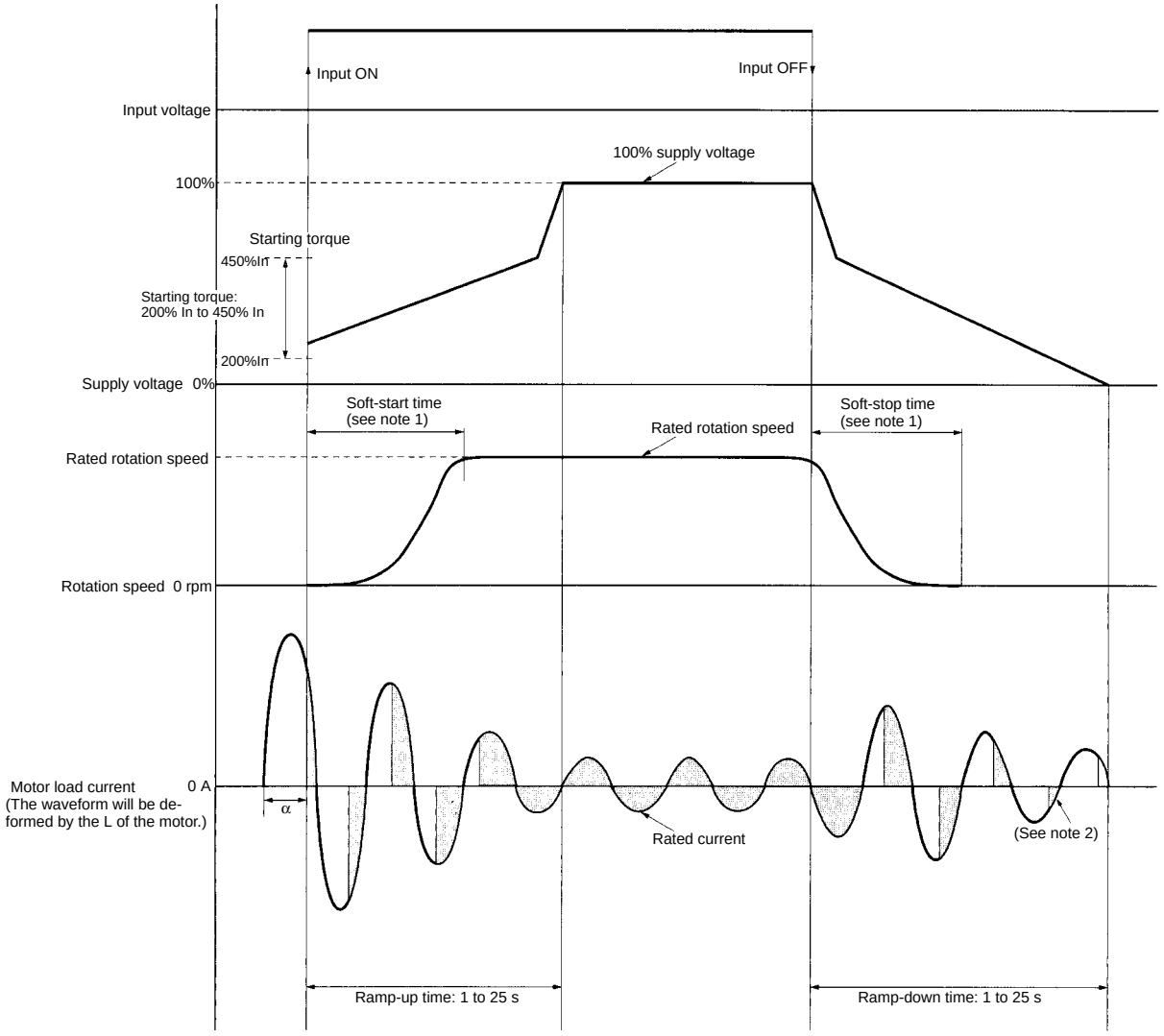
Soft-stop Time

The voltage imposed on the motor decreases while ignition α is gradually increased, thus gradually decreasing the rotation speed of the motor.

Ramp-down Time

Ramp-down time is a period required for ignition α to become 180 degrees with a 0% voltage imposed on the motor.

Soft-start/stop Characteristics



Note: 1. In addition to starting torque, ramp-up time, and ramp-down time, the soft-start time and soft-stop time vary with the load characteristics such as the inertia and friction factor of the load. Therefore, the soft-start time or soft-stop time will not increase beyond a certain point.

2. Due to the soft-stop control characteristics, the load current continues flowing even after the motor stops. Set to the optimum value according to the adjustment steps.

■ Soft-start/stop Setting Method

Adjuster

Starting Torque Setting with the Starting Torque Adjuster

The starting torque of a motor can be set within a range from 200% to 450% In provided that the starting torque is 600% In when the motor is started at full voltage, which allows optimum motor control without any time lag at the time the motor starts.

Set with a Phillips or flat-blade screwdriver.

Ramp-up Time Setting with the Ramp-up Adjuster

The ramp-up time of a motor can be set within a range from 1 to 25 s, with which the soft-start time of the motor is adjusted until the motor rotates at full speed.

Set with a Phillips or flat-blade screwdriver.

Ramp-down Time Setting with the Ramp-down Adjuster

The ramp-down time of a motor can be set within a range from 1 to 25 s, with which the soft-stop time of the motor is adjusted until the motor decelerates to a stop.

Set with a Phillips or flat-blade screwdriver.

Adjustment Steps

1. Start and stop the motor with the factory settings.
   Ramp-up adjuster: 1 s
   Starting torque adjuster: 200% In
   Ramp-down adjuster: 1 s
2. If the motor does not rotate smoothly, increase the starting torque.
3. Gradually increase the ramp-up time to adjust the start time.
4. Gradually increase the ramp-down time to adjust the stop time.
5. The soft-start time or soft-stop time will not increase beyond a certain point (depend on load). Do not set the ramp-up time or ramp-down time beyond this point.

Further Adjustment or Arrangement

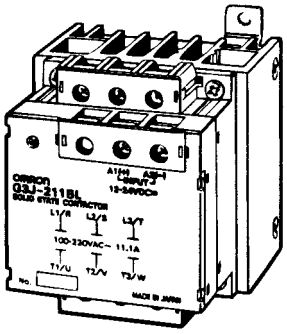
Increase the starting torque if the motor does not start with a long soft-start time.

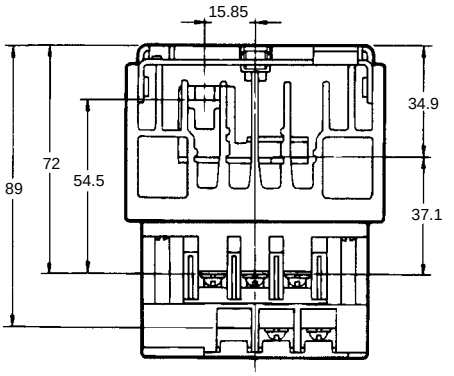
Dimensions

Note: All units are in millimeters unless otherwise indicated.

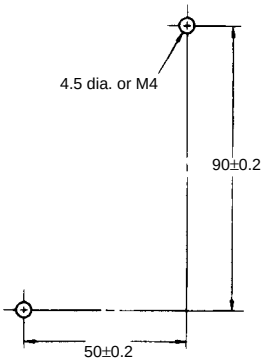
■ SSCs

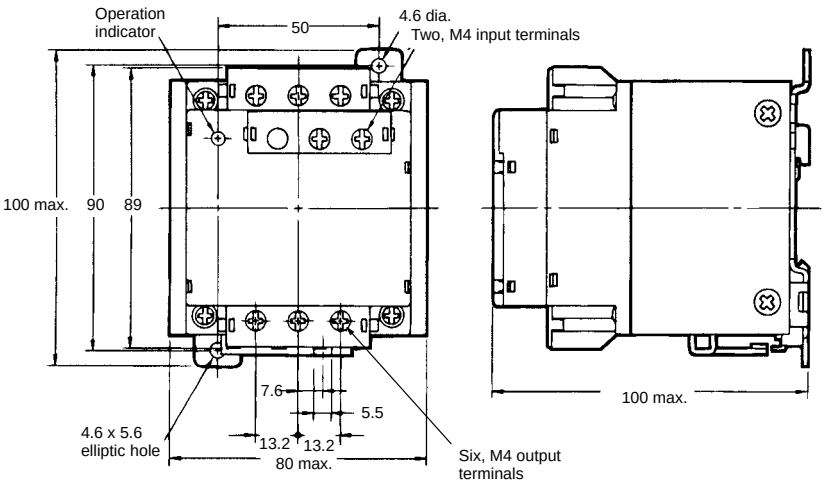
G3J-211BL
G3J-205BL
G3J-211BL-2
G3J-205BL-2



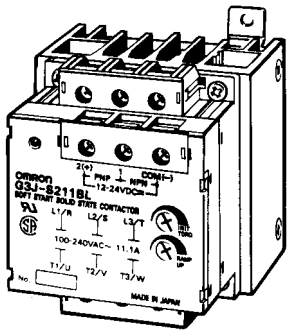


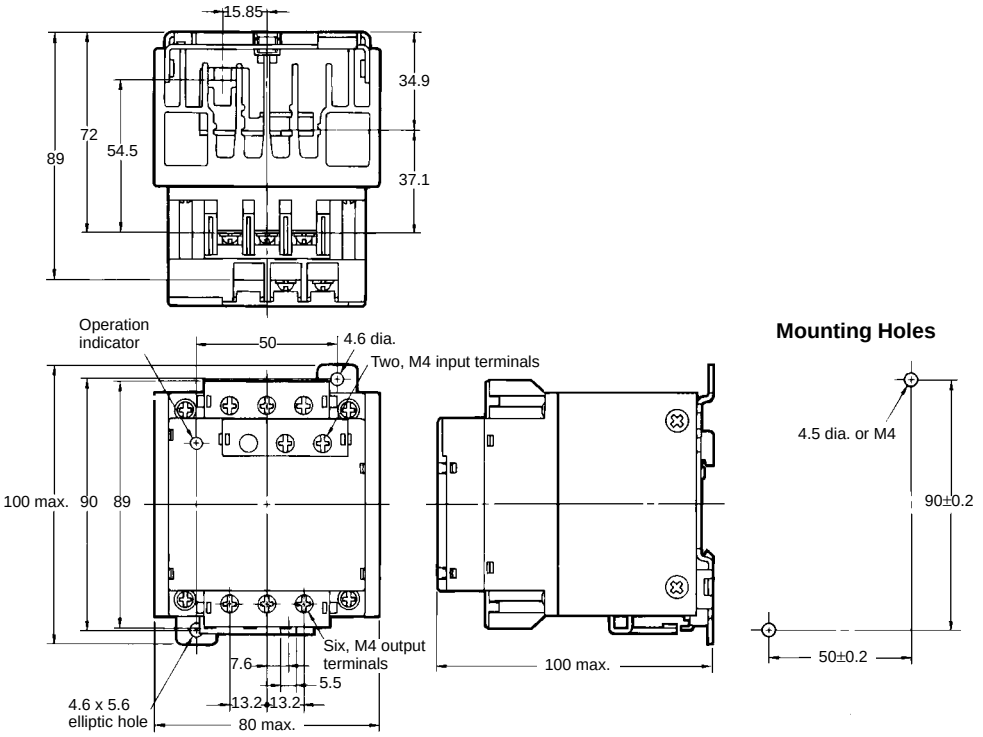
Mounting Holes



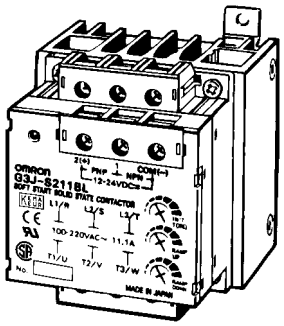


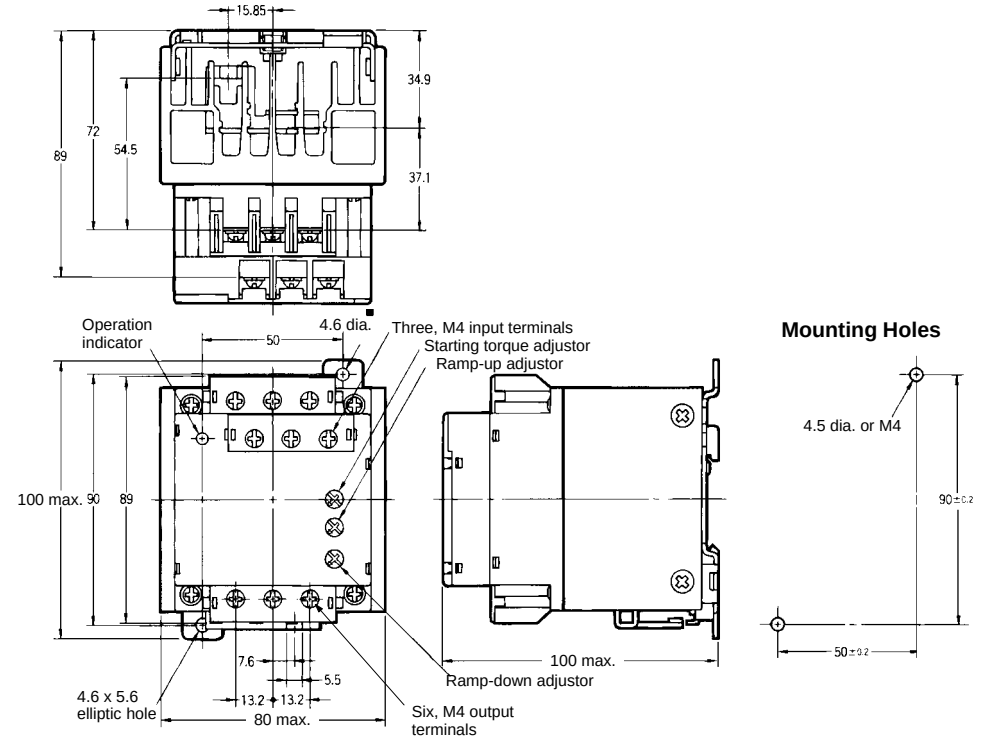
G3J-T211BL
G3J-T205BL
G3J-T405BL
G3J-T403BL



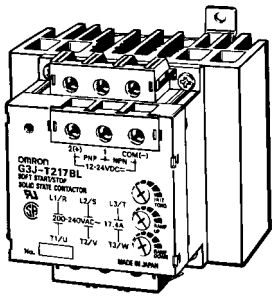


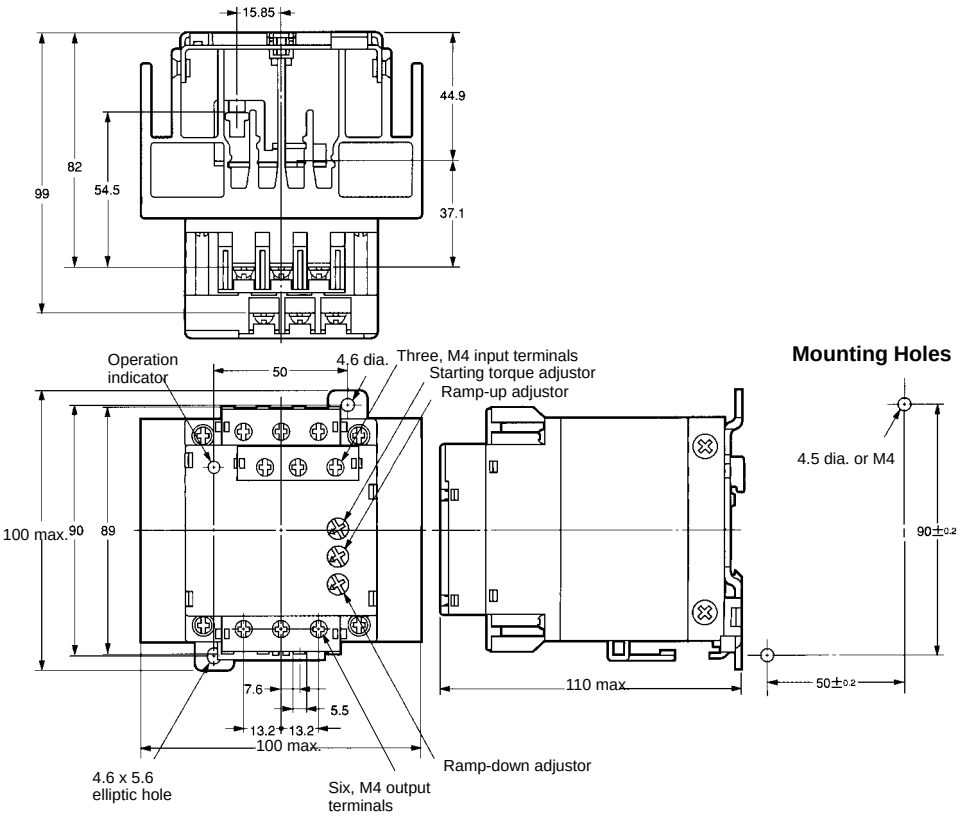
G3J-S211BL
G3J-S205BL
G3J-S405BL
G3J-S403BL



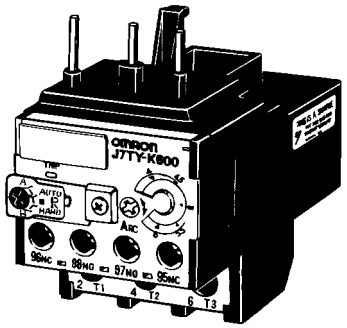


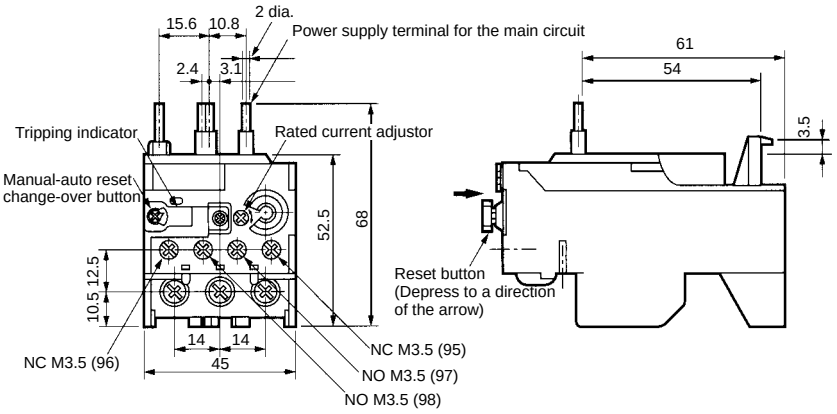
G3J-T217BL

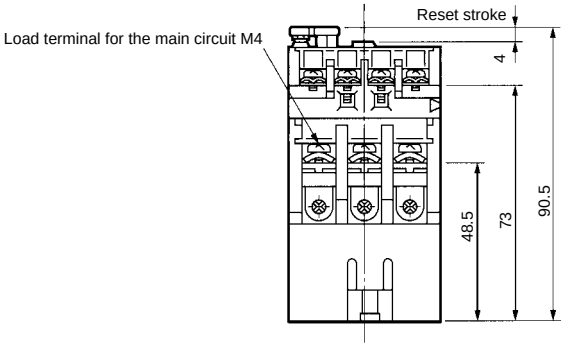




■ J7TY Thermal Overload Relays



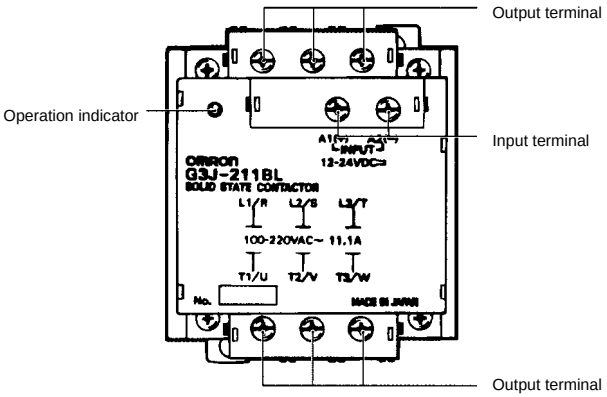




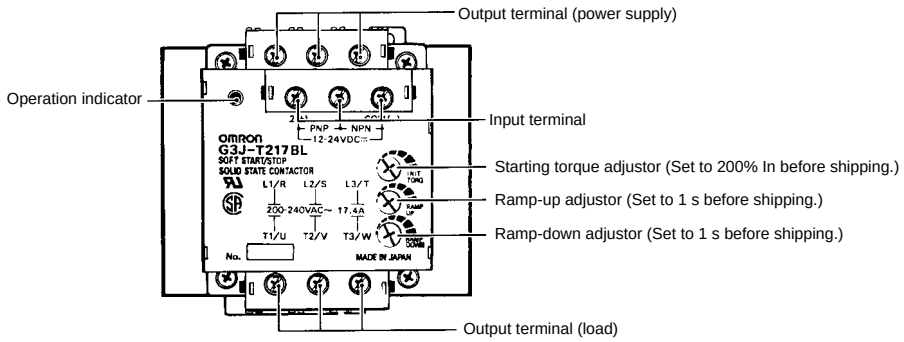
Installation

■ Nomenclature

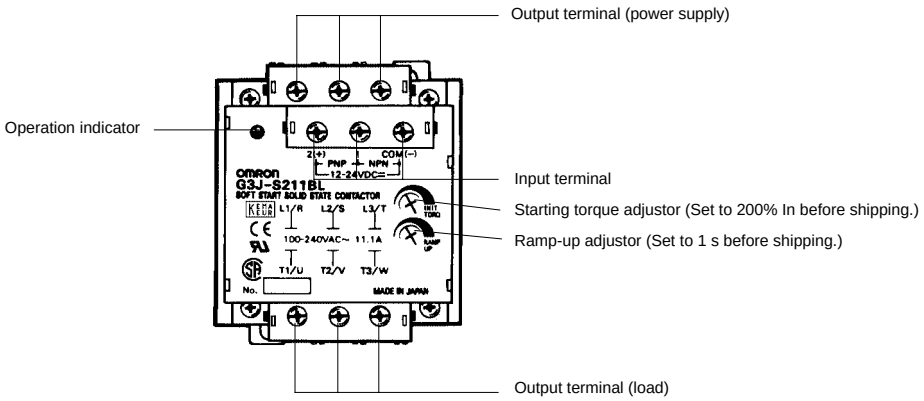
G3J



G3J-T



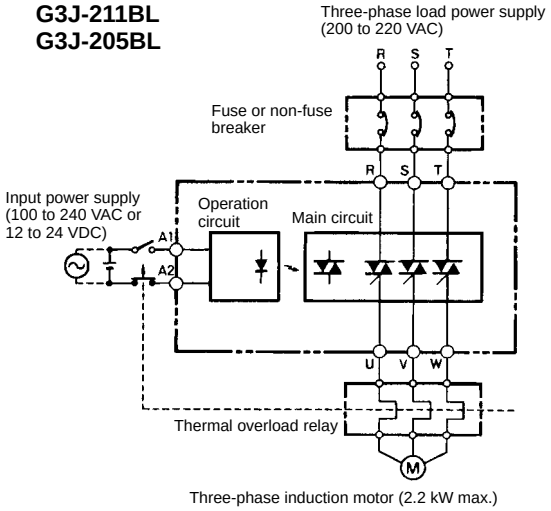
G3J-S



■ Internal Connections

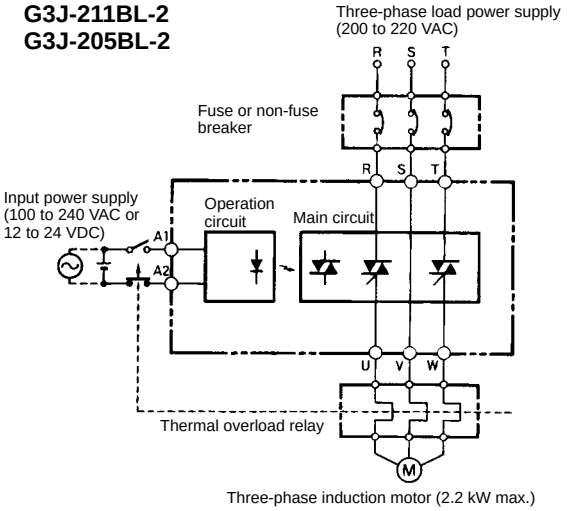
Simple 3-element Models

G3J-211BL
G3J-205BL



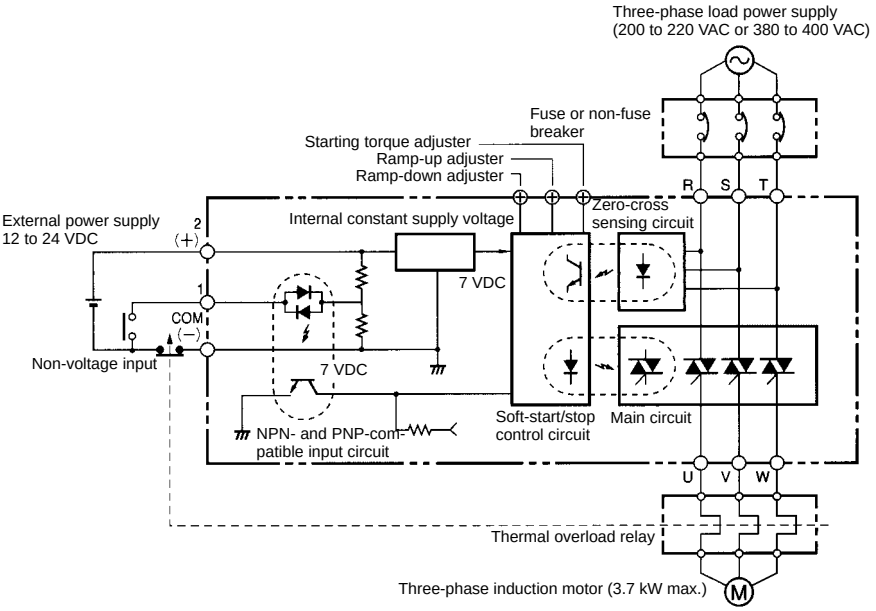
Simple 2-element Models

G3J-211BL-2
G3J-205BL-2



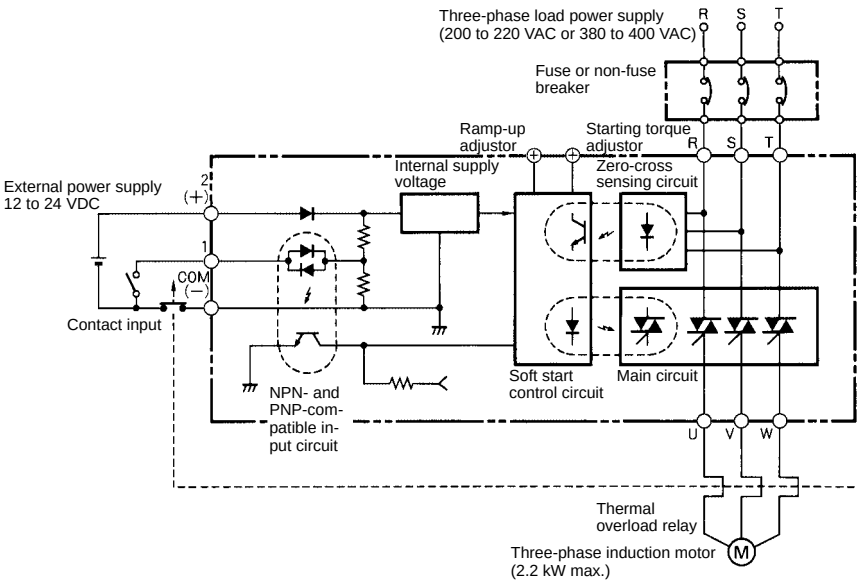
Soft-start/stop Models

G3J-T217BL
G3J-T211BL
G3J-T205BL
G3J-T405BL
G3J-T403BL



Soft-start Models

G3J-S211BL
G3J-S205BL
G3J-S405BL
G3J-S403BL



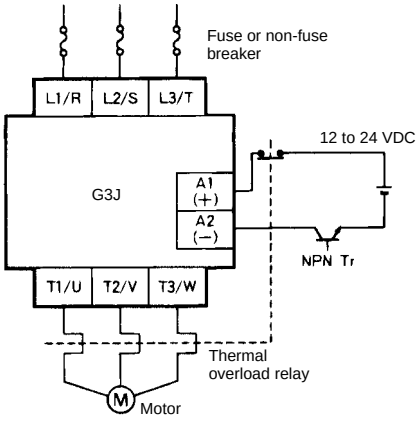
■ Connections Example

Harmonized protection is ensured for motor overcurrents.
Be sure to supply power to the G3J through a fuse or non-fuse breaker to protect the G3J from damage due to short-circuiting.

Simple DC-input Models

G3J-□BL, G3J-□BL-2

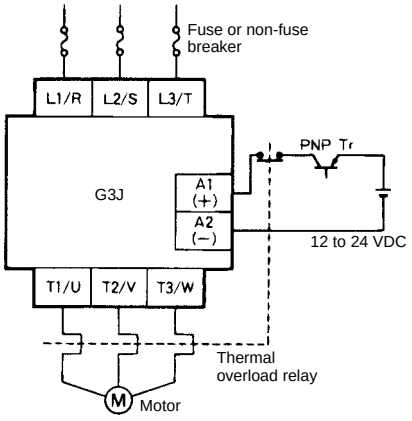
Three-phase, 200 to 220 VAC



Simple DC-input Models

G3J-□BL, G3J□BL-2

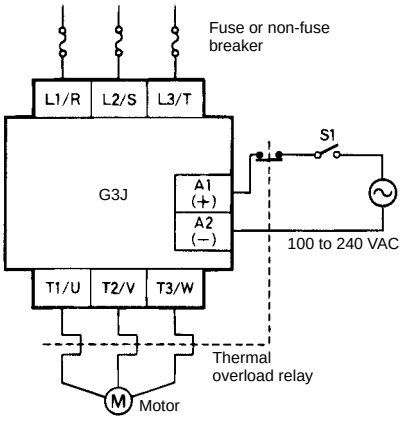
Three-phase, 200 to 220 VAC



Simple AC-input Models

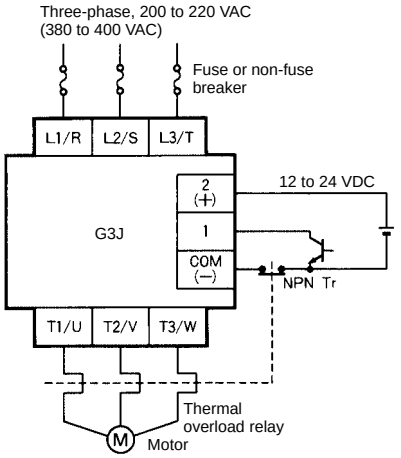
G3J-□BL, G3J-□BL-2

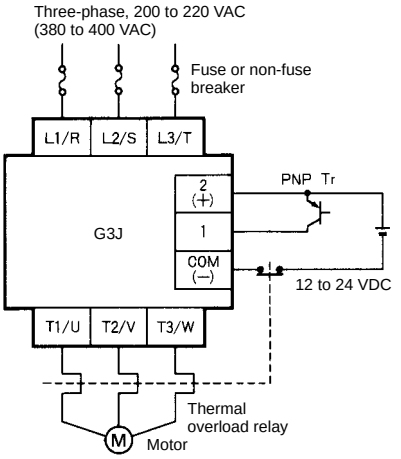
Three-phase, 200 to 220 VAC



Soft-start/Soft-start/stop Models

G3J-S□BL, G3J-T□BL



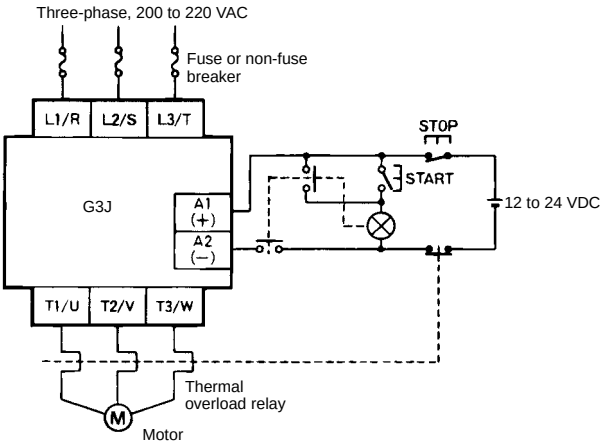


Note: 1. When the minimum applicable load of the thermal relay auxiliary contacts becomes smaller than the input current of the G3J, insert a bleeder resistance.

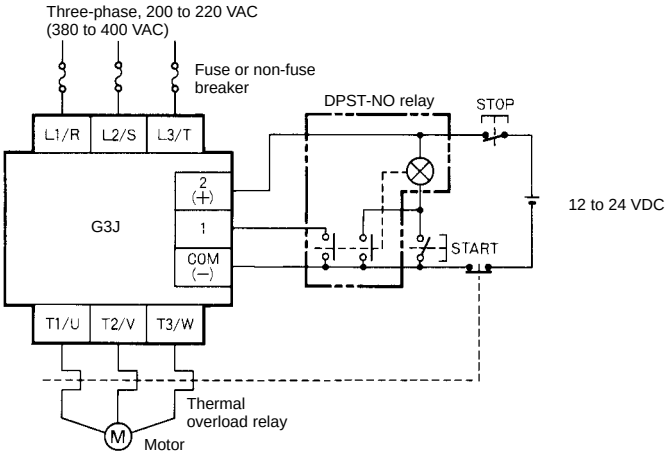
2. Connect the thermal relay b contact to the 2 (+) or COM (–) line. Connecting the thermal relay b contact to the 1 input will cause contact failure.

Self-hold Circuits

G3J-□BL, G3J-□BL-2



G3J-S□BL, G3J-T□BL

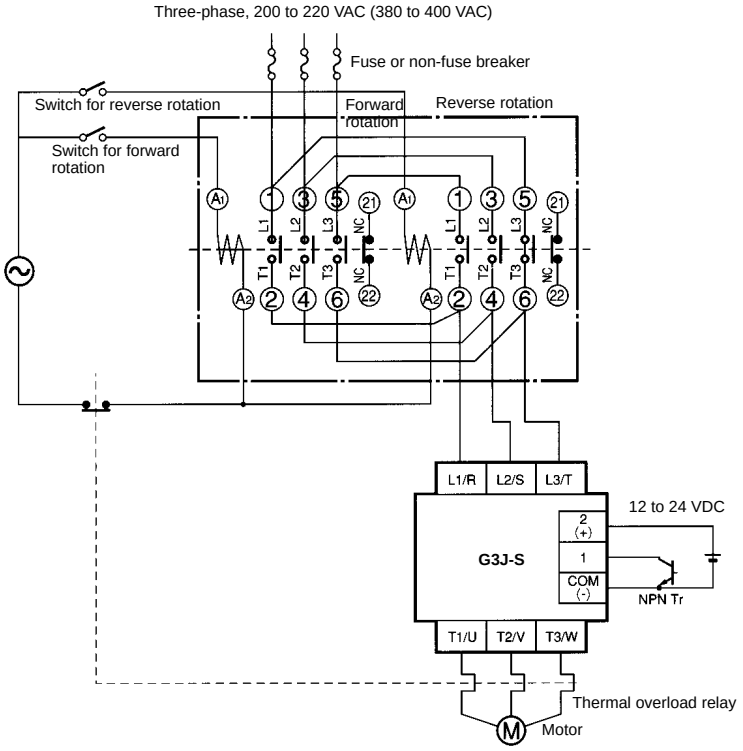


Note: Be sure to use a fuse or non-fuse breaker to protect the G3J.

Forward/Reverse Rotation: Example 1

G3J-S or G3J-T with a Reversible Contactor with Built-in Mechanical Interlock Function

G3J-S□BL, G3J-T□BL

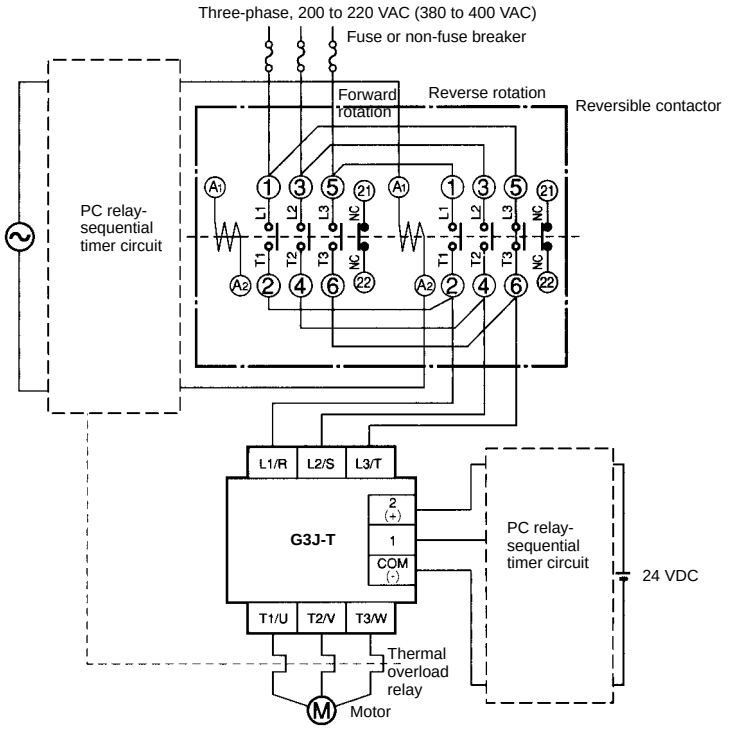


Note: 1. Be sure to use a fuse or non-fuse breaker to protect the G3J.

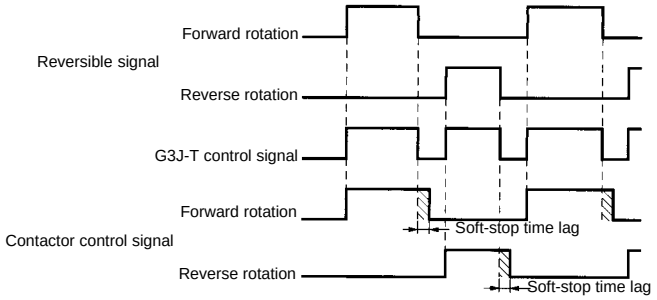
2. Be sure that the interval between forward and reverse operations is at least 100 ms.

3. Be sure to apply the input signal of the G3J-S after the reversible contactor starts operating. If the input signal is applied before the contactor starts operating, the soft-start function may not operate.

G3J-S, G3J-T



For soft-stop control, the G3J-T has enough load current to continue rotating the motor during ramp-down time setting even after the control signal of the G3J-T is turned OFF. Therefore, a time lag is required between the time when the G3J-T stops operating up to the time when the reversible contactor is turned OFF. The ramp-down time of the G3J-T is adjustable up to approximately 25 s max. Therefore, set the time lag to 25 s in the initial sequence during the adjustment stage. Adjust the time lag of the sequential circuit according to the application.



Note: 1. Be sure that the interval between forward and reverse operations is at least 100 ms. If the G3J is turned ON by noise input, short-circuiting between phases will result. In order to prevent this, insert the protective resistor r.

2. Two G3J-S or G3J-T Units cannot be used together in reversible operation.

■ Fuse Selection

The following table shows the I^2t (60 Hz half-wave 1 cyc) values for G3J models.

Model	I^2t
G3J-T217BL	970A^2S
G3J-S211BL **G3J-T211BL**	260A^2S
G3J-S205BL **G3J-T205BL**	121A^2S
G3J-S405BL **G3J-T405BL**	260A^2S
G3J-S403BL **G3J-T403BL**	260A^2S

When selecting a fuse to protect a G3J, use a quick-breaking fuse for semiconductor protection that satisfies the following condition: fuse's I^2t < G3J's I^2t.

Precautions

WARNING

The surface temperature of the G3J in operation is high. Do not touch the G3J while power is supplied to the G3J or immediately after the power is shut off, otherwise a burn injury may occur.

Be sure to shut off power supply to the G3J before wiring the G3J, otherwise an electric shock may occur.

Since voltage charged to the internal capacitor may remain, do not touch terminals before fully discharging the residual voltage. Otherwise an electric shock may occur.

Caution

Do not apply any excessive voltage or current to the input or output circuit of the G3J. Doing so may result in damage to the G3J or cause a fire.

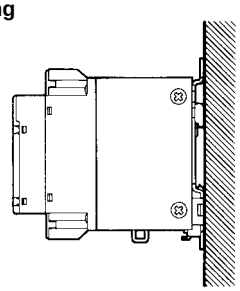
Do not use the G3J with its output terminal screws loosened. Doing so will cause the output terminals to generate excessive heat and a fire may result.

Make sure that the G3J is well ventilated, otherwise the G3J in operation will generate excessive heat and the output elements of the G3J may short-circuit or a fire may result.

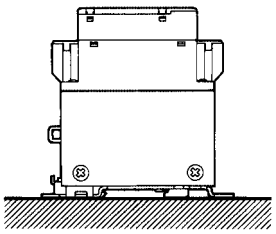
Correct Use

Mounting

Vertical Mounting

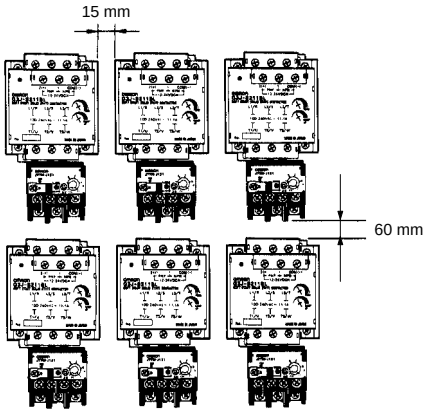


Horizontal Mounting



Note: When the G3J is mounted horizontally, the load current must be 50% of the rated load current if the G3J is used at a temperature exceeding 40°C.

Close Mounting



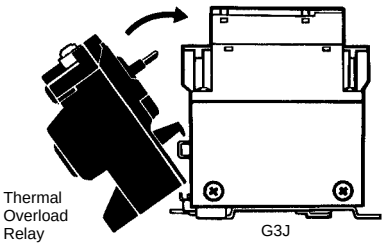
Note: Minimum distances of 15 mm horizontally and 60 mm vertically are required between adjacent G3Js with thermal overload relays mounted.

Harmonized Protection with Thermal Relay

The G3J enables harmonized protection with thermal overload relays conforming to IEC947-4-1 (Class 10A/10).
When using the G3J with the thermal overload relay, set the steady current of the thermal overload relay to a value lower than the current value at 100% motor load (approx. 80% or less of the rated current of G3J).

Directly Mounting Thermal Overload Relays

Thermal Overload Relays can be directly mounted to the G3J. Refer to the following.



1. Loosen the output terminal screws of the G3J and put the hook of the thermal overload relay on the bracket of the G3J.
2. Insert the three leads of the thermal overload relay into the output terminals and tighten the output terminal screws.

Power Supply to Soft-start and Soft-start/stop Models

Perform operation input to the Soft-start type or Soft-start/stop type only after the power supply has sufficiently stabilized to achieve stable soft-start operation.

Wiring

Make sure that each wire connected to the G3J is thick enough for the current flow.

Output terminals T1, T2, and T3 may be charged even if power supply to the G3J is off. An electric shock may occur by touching the terminals.

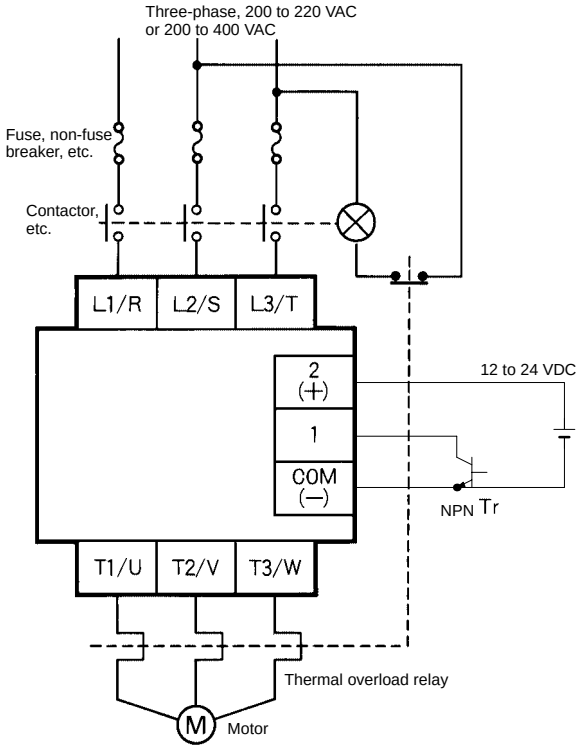
Supply power to the G3J through a breaker.

Be sure to shut off power supply to the G3J before wiring, otherwise an electric shock may occur.

Do not wire any cable connected to the G3J alongside power or high-tension lines in the same conduit. Doing so may cause the G3J to malfunction or break down due to induction noise.

System Protection

The system will be safer by inserting a contactor into the power line of the G3J to shut off power supply to the G3J as shown in the following diagram.



Tightening Screw

Tighten each screw of the G3J securely so that the G3J will not malfunction.

Appropriate tightening torque: 1.2 N • m

Operating Conditions

Make sure that no current exceeding the rated current will flow into the G3J, otherwise the G3J may generate excessive heat.

Make sure that there is no excess ambient temperature rise due to the heat generation of the G3J. If the G3J is mounted inside a panel, install a fan to ventilate the interior of the panel properly.

Operating and Storage Environment

Do not operate or store the G3J under the following conditions. Doing so may result in damage to the G3J or cause the G3J to malfunction.

- Operation or storage in places with direct sunlight.
- Operation in places with ambient temperature ranges not within –20°C to 60°C.
- Operation in places with rapid temperature changes resulting in condensation or relative humidity ranges not within 45% to 85%.
- Storage in places with ambient temperature ranges not within –30°C to 70°C.
- Operation or storage in places with corrosive or inflammable gas.
- Operation or storage in places with excessive dust, salinity, or metal powder.
- Operation or storage in places with vibration or shock affecting the G3J.
- Operation or storage in places with water, oil, or chemical sprayed on the G3J.

Cleaning

Use alcohol to clean the G3J. Do not use paint thinner to clean the G3J. Doing so will damage or discolor the surface of the G3J.

Handling

Do not drop the G3J or shock or vibrate the G3J excessively. Doing so may result in damage to the G3J or cause the G3J to malfunction.

Repairs and Modification

Do not disassemble, repair, or modify the G3J, otherwise an electric shock may occur or the G3J may malfunction.

Power Supply to G3J with Soft-start or Soft-start/stop Function

Use the soft-start or soft-start/stop function of the G3J-S□/T□ after power supply to the G3J-S□/T□ is stabilized so that the G3J-S□/T□will be in stable soft-start or soft-start/stop operation.

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. J103-E1-2A