

Ground Fault Relay K6EL

Economical, Compact, High-performance, DIN 48 × 48-mm Ground Fault Relay for Low Voltages

- Performs continuous monitoring and detection of ground faults in low-voltage circuits due to the deterioration of insulation in electrical devices.
- Higher reliability ensured with improved resistance to high-frequency noise when used for inverter loads.
- Remote monitoring of cubicles is possible with automatic-reset models.
- Ground Fault Relays and through-type ZCTs (zero-phase current transformers) are mutually compatible.
- The through-type ZCTs are equipped with test terminals, allowing operation tests for Ground Fault Relays to be performed with ease.
- Series now includes K6EL-R50, which operates at 50 mA ±10%.



Model Number Structure

■ Model Number Legend

K6EL-□□
1 2 3

1. Ground Fault Relay

2. Operating Time and Reset Method

None: 0.1 s manual reset

A: 0.3/0.8 s (switchable) manual reset

R: 0.5 s automatic reset

3. Sensed Current

30: 30 mA (fixed)

50: 50 mA/150 mA (switchable)

100: 100 mA/200 mA (switchable)

200: 200 mA/500 mA (switchable)

500: 500 mA/1,000 mA (switchable)

Ordering Information

■ List of Models

Manual-reset Ground Fault Relays

| Type | Operating time | Type | Medium-sensitivity models | | | |
|-------------------|------------------------|-------------------------|----------------------------|----------------------------|------------------------------|----------|
| | | High-sensitivity models | 100 mA/200 mA (switchable) | 200 mA/500 mA (switchable) | 500 mA/1,000 mA (switchable) | |
| High-speed models | Less than 0.1 s | 30 mA (fixed) | K6EL-30 | K6EL-100 | K6EL-200 | K6EL-500 |
| Delayed models | 0.3/0.8 s (switchable) | --- | K6EL-A100 | K6EL-A200 | K6EL-A500 | |

Automatic-reset Ground Fault Relays

| Type | Operating time | Type | High-sensitivity models | Medium-sensitivity models |
|----------------|-----------------|----------------------|---------------------------|------------------------------|
| | | Sensed current | 50 mA/150 mA (switchable) | 500 mA/1,000 mA (switchable) |
| Delayed models | Less than 0.5 s | --- | | K6EL-R500 |
| | | K6EL-R50 (See note.) | | --- |

Note: Operating Error
50-mA tap: ±10%
150-mA tap: ±20%

ZCTs (Zero-phase Current Transformers)

| Rated current | Type Sensed current | Indoor through-type models | | Indoor separate-type models | |
|---------------|------------------------|----------------------------|--------------------------|-----------------------------|--------------------------|
| | | Model | Diameter of through-hole | Model | Diameter of through-hole |
| 50 A | | OTG-L21 | 21 mm | --- | --- |
| 100 A | | OTG-L30 | 30 mm | --- | 22 mm |
| 200 A | | OTG-L42 | 42 mm | OTG-CN52 | 52 mm |
| 400 A | | OTG-L68 | 68 mm | OTG-CN77 | 77 mm |
| 600 A | | OTG-L82 | 82 mm | OTG-CN112 | 112 mm |
| 1,000 A | | OTG-L156 | 156 mm | --- | --- |

■ Ground Fault Relay and ZCT Combinations

(OK: Compatible)

| ZCT | Ground Fault Relay | K6EL-30 K6EL-R50 | K6EL-100, -200, -500, -R500 K6EL-A100, -A200, -A500 |
|--------------------|--------------------|---------------------|--|
| OTG-L21 (50 A) | | OK | OK |
| OTG-L30 (100 A) | | OK | OK |
| OTG-L42 (200 A) | | OK | OK |
| OTG-L68 (400 A) | | --- | OK |
| OTG-L82 (600 A) | | --- | OK |
| OTG-L156 (1,000 A) | | --- | OK |
| OTG-CN52 (200 A) | | --- | OK |
| OTG-CN77 (400 A) | | --- | OK |
| OTG-CN112 (600 A) | | --- | OK |

Note: 1. "OK" indicates groupings that can be combined freely.
2. Combinations with the OTG-LA□□ are also possible.

■ Options

Flush Mounting Adapters

| Model |
|---------|
| Y92F-30 |
| Y92F-71 |

Front Cover

| Model |
|-----------------------|
| Y92A-48B (Hard Cover) |
| Y92A-48D (Soft Cover) |

Specifications

■ Ground Fault Relay Ratings

| Item | Type | High-speed models | Delayed models | Delayed high-sensitivity models | |
|--------------------------------|------------------|--|----------------|---------------------------------|--------------|
| Control power supply | | 100/110 VAC or 200/220 VAC, 50/60 Hz (same for all) (See note 1.) | | 100 VAC | |
| Rated current | | Depends on the ZCT | | | |
| Sensed current | | 50% to 100% of the rated sensed current (50 mA ±10%, 150 mA ±20%) (See note 2.) | | | |
| Non-operating current | | 0% to 50% of the rated sensed current | | | |
| Rated short-time current | | 2,500 A | | | |
| Ground fault indication method | | LED (red) | | | |
| Test method | | Relay operation confirmed using a test button. (Independent of ZCT connection.) | | | |
| Reset method | Manual | Either press the reset button or turn the control power supply OFF and ON again. | | | |
| | Automatic | Automatically resets when the ground fault is cleared. | | | |
| Built-in contacts | Contact form | SPDT+SPST-NO | | SPDT | |
| | Carrying current | 5 A | | 3 A | |
| | Rated load | | cosφ = 1 | cosφ = 0.4 (L/R = 7 ms) | cosφ = 1 |
| | | 240 VAC | 5 A | 2 A | 220 VAC, 3 A |
| 110 VDC | | 0.3 A | 0.2 A | | |
| 30 VDC | 5 A | 3 A | | | |
| Power (VA) consumption | | 3 VA max. | | | |
| Weight | | Approx. 110 g | | | |

Note: 1. The K6EL-R50 requires a 100-VAC control power supply.
2. Only the K6EL-R50 can be switched between 50 mA ±10% and 150 mA ±20%.

■ Ground Fault Relay Characteristics

| Item | Type | High-speed models | Delayed models | Delayed high-sensitivity models |
|---------------------------------------|------|--|--|---------------------------------|
| Operating time | | Less than 0.1 s | 0.3 s/0.8 s (switchable) | Less than 0.5 s |
| Inertial non-operating time | | --- | 0.1 s when set to 0.3 s 0.5 s when set to 0.8 s | |
| Control power supply range | | 80% to 110% of the control power supply voltage | | |
| Operating temperature range | | -10 to 55 °C (with no icing) | | |
| Operating humidity range | | 45% to 85% (with no condensation) | | |
| Insulation resistance | | 5 M Ω min. at 500 VDC (between charged parts and the mounting panel) | | |
| Dielectric strength | | 1,500 VAC, 50/60 Hz for 1 min (between charged parts and the mounting panel) | | |
| Lightning impulse dielectric strength | | 1.2/50 μ s, 7,000 V (between control power supply terminals) | | |
| Lightning impulse operation failure | | 1.2/50 μ s, 7,000 V (primary side of ZCT) | | |
| Vibration resistance | | Destruction: 16.7 Hz, 4-mm double amplitude for 1 min | | |
| Shock resistance | | 98 m/s ² | | |

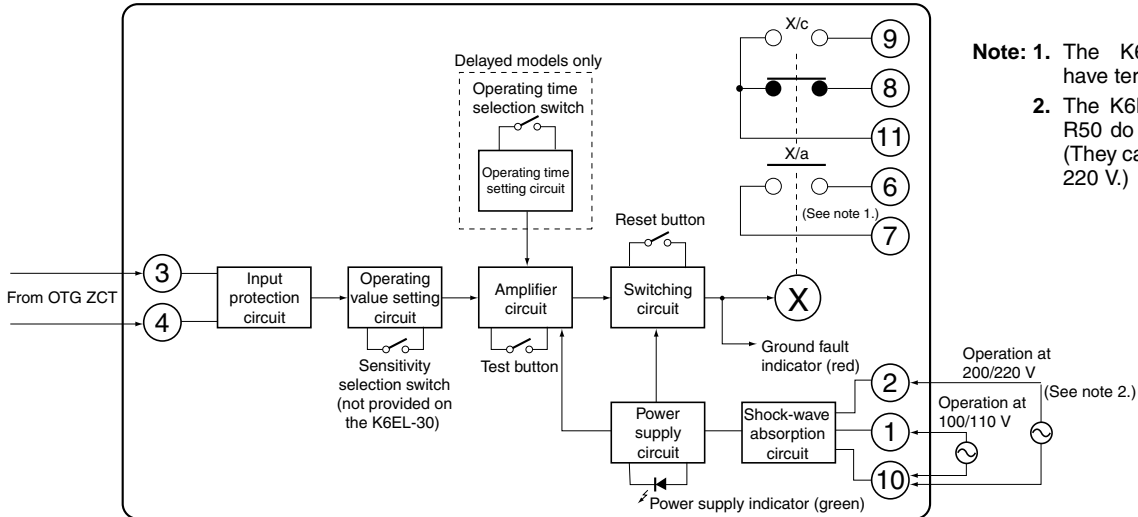
Note: The range for an operating time of 0.3 s is 0.15 to 0.45 s and the range for an operating time of 0.8 s is 0.6 to 1.2 s.

■ ZCT (Zero-phase Current Transformer)

| Item | Structure Model | Indoor through-type models | | | | | Indoor separate-type models | | | |
|-------------------------------|-----------------|---|---------------|---------------|---------------|---------------|-----------------------------|----------------|----------------|----------------|
| | | OTG-L21 | OTG-L30 | OTG-L42 | OTG-L68 | OTG-L82 | OTG-L156 | OTG-CN52 | OTG-CN77 | OTG-CN112 |
| Rated current | | 50 A | 100 A | 200 A | 400 A | 600 A | 1,000 A | 200 A | 400 A | 600 A |
| Diameter of through-hole | | 21 mm | 30 mm | 42 mm | 68 mm | 82 mm | 156 mm | 52 mm | 77 mm | 112 mm |
| Rated voltage | | 600 VAC max., 50/60 Hz, single-phase/three-phase | | | | | | | | |
| Output terminal polarity | | None (The ZCT's output terminals k and l can be connected to either input terminals 3 or 4 of the Relay.) (See note.) | | | | | | | | |
| Insulation resistance | | 100 M Ω min. (between charged metal parts and ground) | | | | | | | | |
| Dielectric strength | | 2,200 VAC, 50/60 Hz for 1 min (between charged metal parts and ground) | | | | | | | | |
| Ambient operating temperature | | -10 to 60 °C (with no icing) | | | | | | | | |
| Weight | | Approx. 90 g | Approx. 130 g | Approx. 230 g | Approx. 480 g | Approx. 700 g | Approx. 6.6 kg | Approx. 1.3 kg | Approx. 2.5 kg | Approx. 3.5 kg |

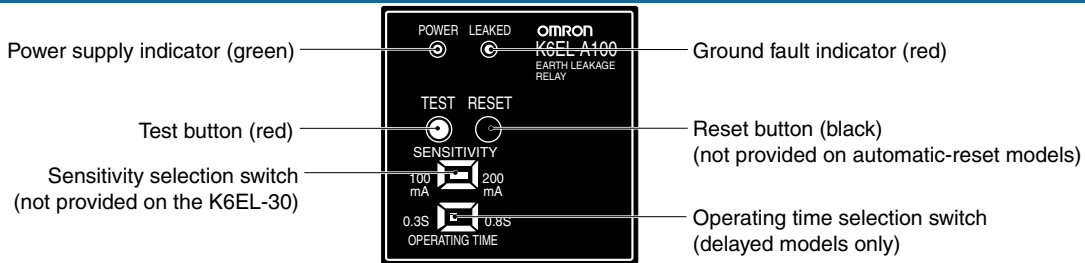
Note: Do not connect ZCT output terminals k and l to ground. Doing so may result in damage to the Relay.

Internal Block Diagram



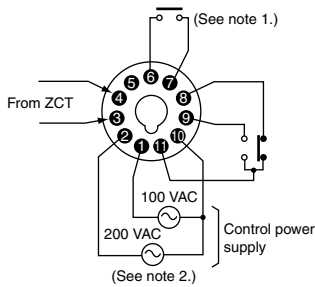
- Note:**
1. The K6EL-R50 does not have terminals 6 and 7.
 2. The K6EL-R500 and K6EL-R50 do not have terminal 2. (They cannot be used at 200/220 V.)

Nomenclature

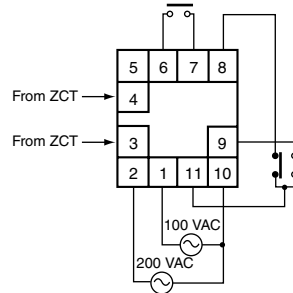


Connections

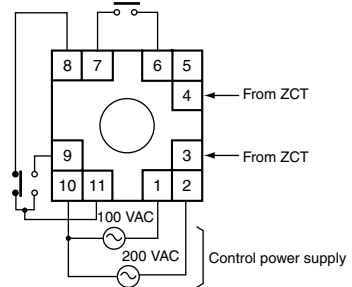
Ground Fault Relay (from Pin Side)



Ground Fault Relay with P3GA-11 (from Terminal Side)



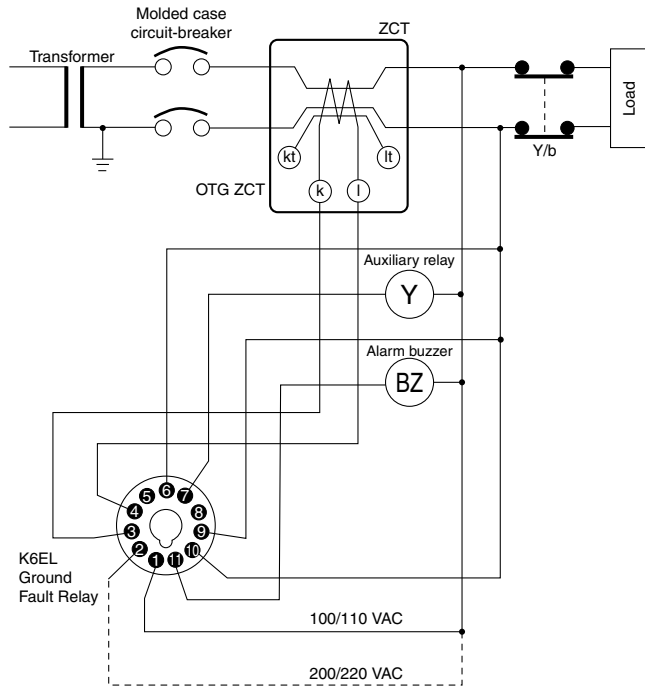
Ground Fault Relay with P2CF-11 (from Terminal Side)



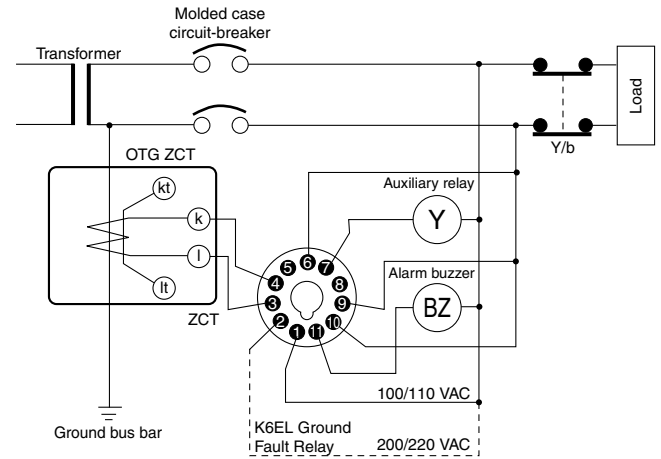
- Note:**
1. The K6EL-R50 does not have terminals 6 and 7.
 2. The K6EL-R500 and K6EL-R50 do not have terminal 2. (They cannot be used at 200/220 V.)

Connection Examples

Installation on the Electrical Path



Installation on a Ground Bus Bar



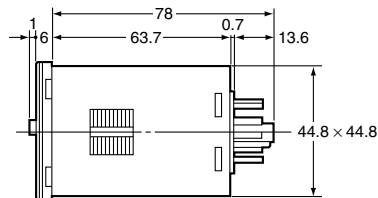
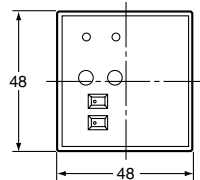
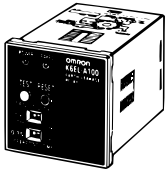
⚠ Do not, under any circumstances, connect the k and l lines to ground.

Note: When not using the kt and It terminals (test terminals), leave them unconnected. The Relay may not be able to attain its performance characteristics if used with the kt and It terminals connected.

Dimensions

Note: All units are in millimeters unless otherwise indicated.

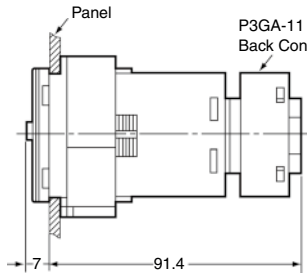
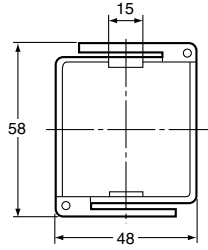
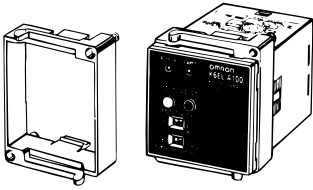
Ground Fault Relay



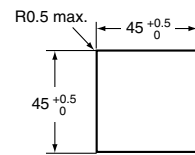
Applicable Connecting Sockets
 P2CF-11 Front Connecting Socket
 P3GA-11 Back Connecting Socket
 PL11 Back Connecting Socket

Dimensions with Adapter Mounted

**Y92F-30 Flush Mounting Adapter
(Sold Separately)**

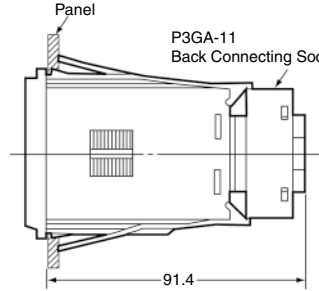
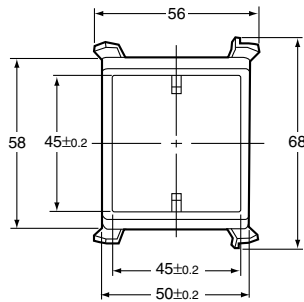
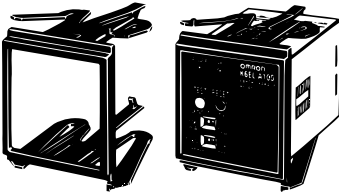


**Mounting Hole
Cutout Dimensions**

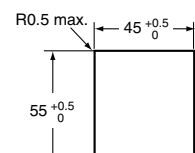


Note: Recommended panel thickness: 1 to 3.2 mm.

**Y92F-71 Flush Mounting Adapter
(Sold Separately)**

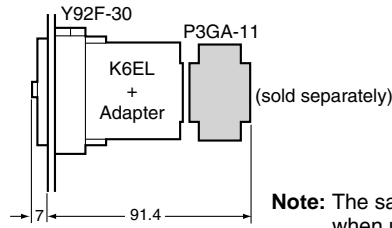
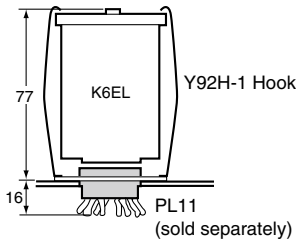
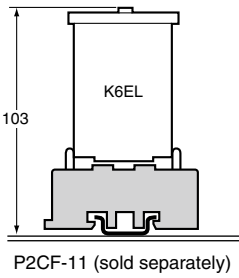


**Mounting Hole
Cutout Dimensions**



Note: Recommended panel thickness: 1 to 3.2 mm.

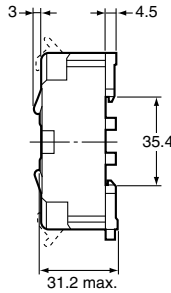
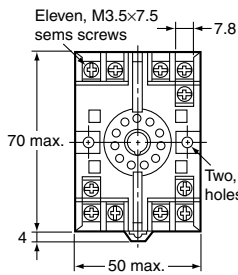
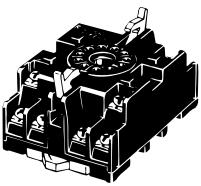
Dimensions for Socket Mounting



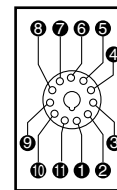
Note: The same dimensions apply when using the Y92F-71 Adapter.

Connecting Sockets

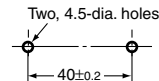
P2CF-11 Front Connecting Socket



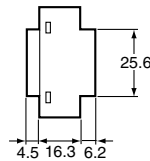
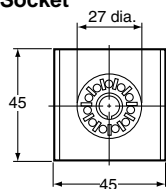
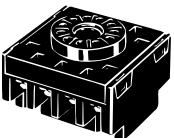
**Terminal Arrangement
(Top View)**



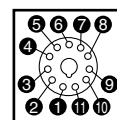
Mounting Holes



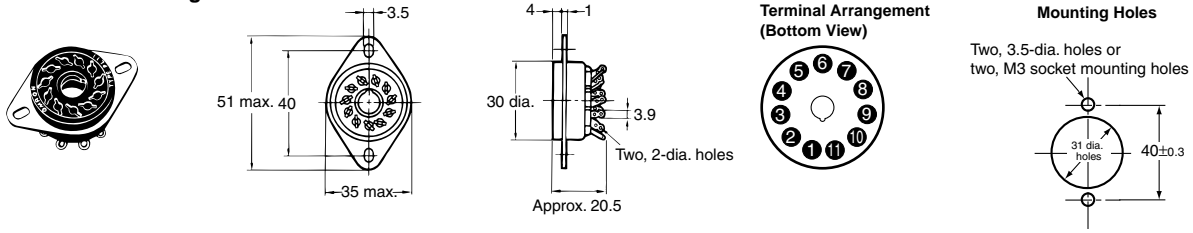
P3GA-11 Back Connecting Socket



**Terminal Arrangement
(Top View)**



PL11 Back Connecting Socket

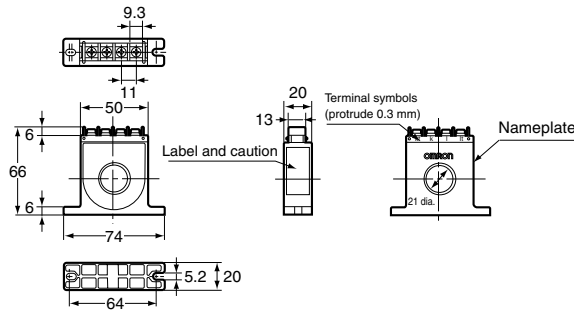


Front Cover

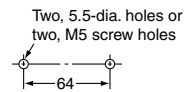
| |
|-----------------------|
| Model |
| Y92A-48B (Hard Cover) |
| Y92A-48D (Soft Cover) |

ZCT

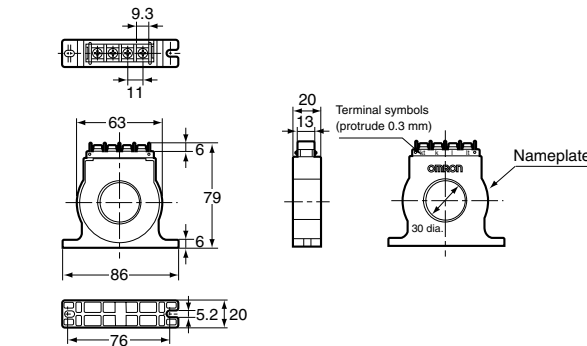
**Indoor Through-type Models
OTG-L21 (50 A)**



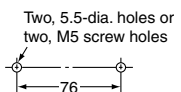
**Mounting Hole
Cutout Dimensions**



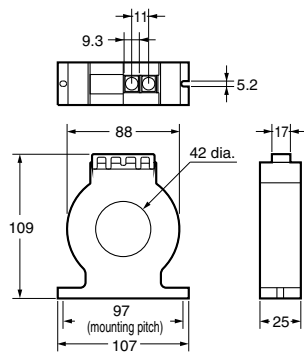
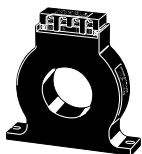
OTG-L30 (100 A)



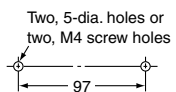
**Mounting Hole
Cutout Dimensions**



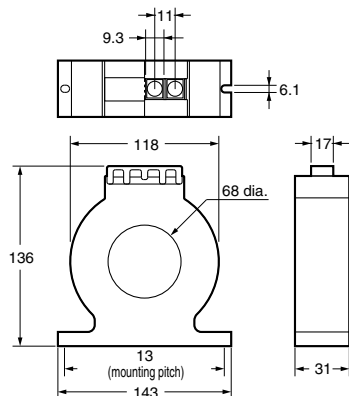
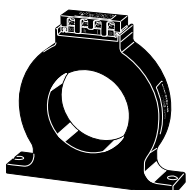
OTG-L42 (200 A)



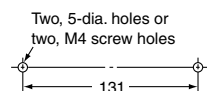
**Mounting Hole
Cutout Dimensions**



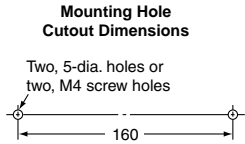
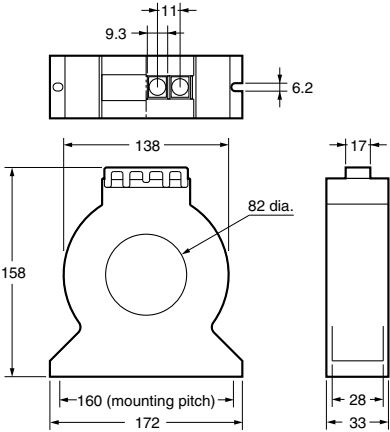
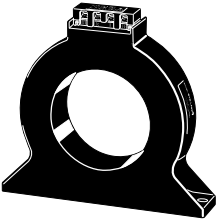
OTG-L68 (400 A)



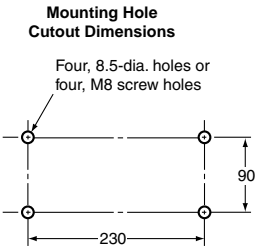
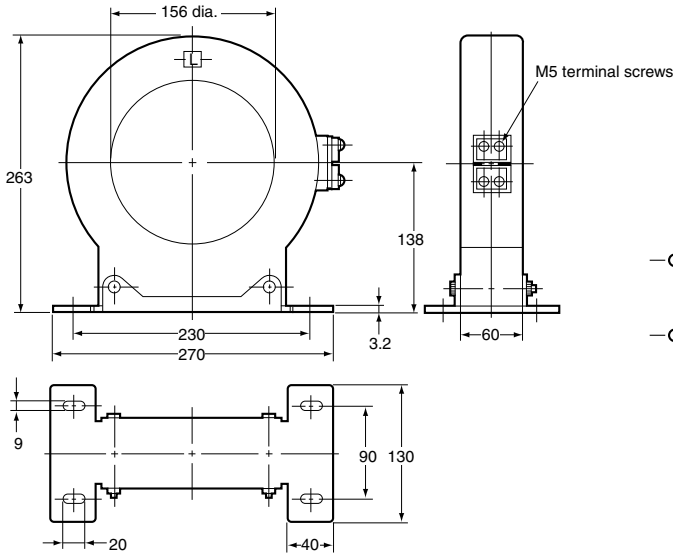
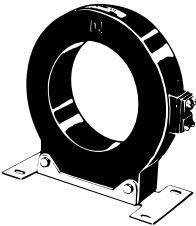
**Mounting Hole
Cutout Dimensions**



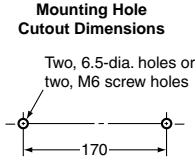
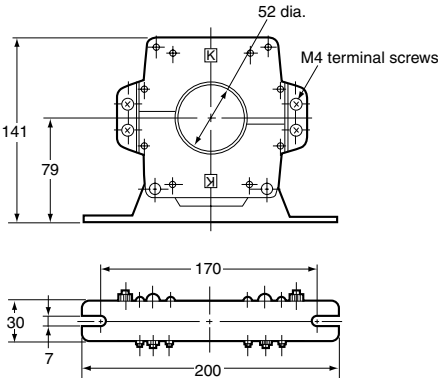
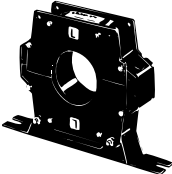
OTG-L82 (600 A)



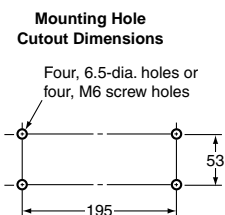
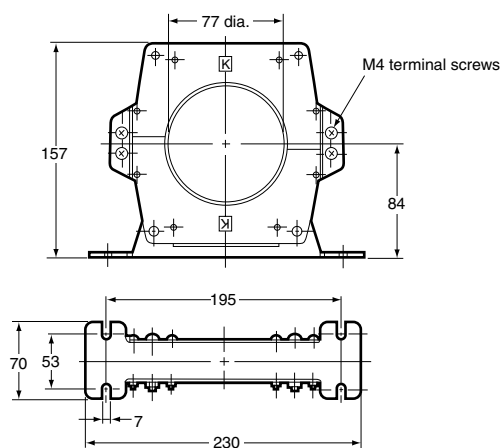
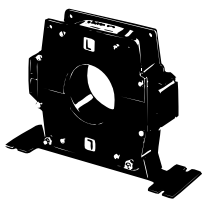
OTG-L156 (1,000 A)



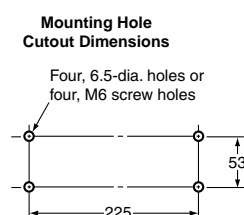
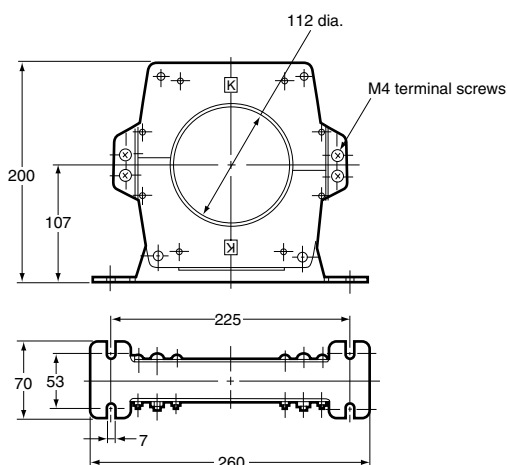
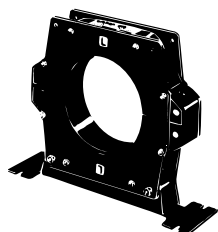
Indoor Separate-type Models
OTG-CN52 (200 A)



OTG-CN77 (400 A)



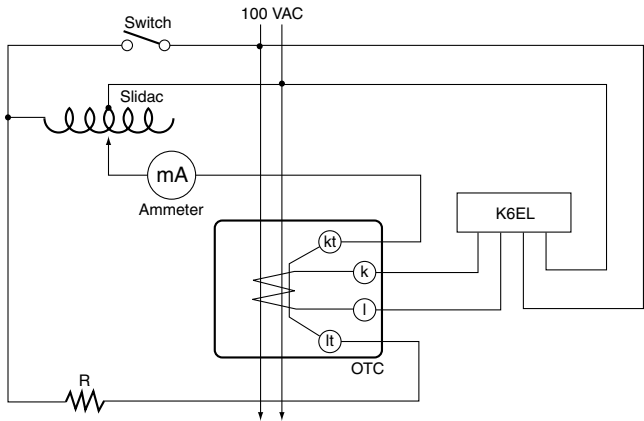
OTG-CN112 (600 A)



■ Maximum Wire Sizes for ZCTs

| Model | Rated current | Wire/cable Through-hole diameter | 600-V vinyl-insulated wire (IV) | | Cable (VVR) | |
|-----------|---------------|----------------------------------|---------------------------------|---------------------|-----------------------|-----------------------|
| | | | 2-wire | 3-wire | 2-wire | 3-wire |
| OTG-L21 | 50 A | 21 dia. | 22 mm ² | 14 mm ² | 8 mm ² | 5.5 mm ² |
| OTG-L30 | 100 A | 30 dia. | 60 mm ² | 38 mm ² | 38 mm ² | 38 mm ² |
| OTG-L42 | 200 A | 42 dia. | 100 mm ² | 100 mm ² | 100 mm ² | 60 mm ² |
| OTG-L68 | 400 A | 68 dia. | 400 mm ² | 325 mm ² | 325 mm ² | 250 mm ² |
| OTG-L82 | 600 A | 82 dia. | 500 mm ² | 500 mm ² | 400 mm ² | 400 mm ² |
| OTG-L156 | 1,000 A | 156 dia. | 500 mm ² | 500 mm ² | 1,000 mm ² | 1,000 mm ² |
| OTG-CN52 | 200 A | 52 dia. | 200 mm ² | 200 mm ² | 150 mm ² | 100 mm ² |
| OTG-CN77 | 400 A | 77 dia. | 500 mm ² | 400 mm ² | 400 mm ² | 325 mm ² |
| OTG-CN112 | 600 A | 112 dia. | 500 mm ² | 500 mm ² | 1,000 mm ² | 1,000 mm ² |

Test Circuit



- 200 mA: 500 Ω, 50 W
- 500 mA: 200 Ω, 100 W
- 1,000 mA: 100 Ω, 200 W

Select the resistance R shown in the test circuit diagram according to the K6EL's rated sensed current. Change the current using the slidac and ascertain the K6EL's operating value each time by reading the ammeter.

For example, R could take the values shown below:
 30 mA: 3.3 kΩ, 6 W
 100 mA: 1 kΩ, 20 W

Safety Precautions

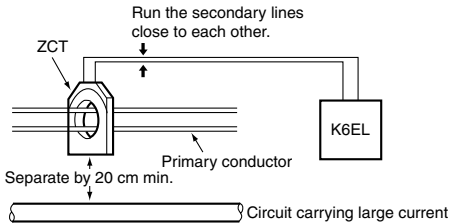
Correct Use

Installation and Wiring

- Do not, under any circumstances, connect the ZCT's output terminals k and l to ground. Doing so may result in damage to the Relay's internal circuits.
- Pass the primary conductor through the ZCT once.
- The Relay detects ground faults in internal wiring of devices due to insulation deterioration and so install the ZCT as close to the power supply side as possible.

ZCT Installation

- Install the ZCT at an outdoor cable inlet or on a ground bus bar at a location allowing easy inspection.
- When installing on the electrical path, use a ZCT with a value greater than the electrical path's rated current.
- If the secondary lines run in parallel to a circuit carrying a large current, either separate the lines as far as possible or use a shield line.



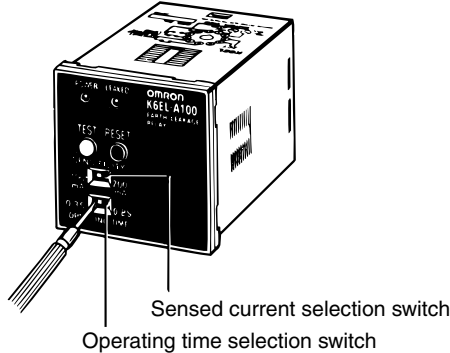
- When installing a separate-type ZCT with current flowing along the primary conductors, short the secondary terminals using clips or some other method.

Switching the Sensed Current

1. With the K6EL-□100, 200, 500, R50, and R500, the sensed current can be switched using a flat-bladed screwdriver.
2. The sensed current for the K6EL-30 is fixed and hence cannot be switched.

Switching the Operating Time

1. With the K6EL-A100, A200, and A500, the operating time can be switched using a flat-bladed screwdriver.
2. The operating time for the K6EL-30, 100, 200, 500, R50, and R500 is fixed and hence cannot be switched.



Testing

- If the ground fault indicator (red) lights when the Relay's test button is pressed, it means that the internal circuits are operating normally.
- To make an overall test, run a simulated ground fault current.

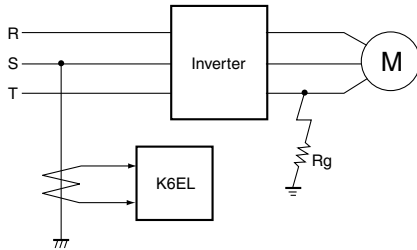
Resetting

- Once manual-reset models operate, they continue to operate until they are reset. Reset them either by pressing the reset button (black) or by turning the control power supply OFF and ON again.
- Automatic-reset models reset automatically when the ground fault is cleared (i.e., the current drops below the sensed current).

Q&A

Q: How does the K6EL operate when used for inverter loads (e.g., inverter motors and inverter air conditioners)?

A: The influence of high-frequency noise generated by the inverter has been reduced by combining a special ground fault relay IC and a capacitor for cutting out high-frequencies. The possibility of malfunctions due to the influence of the inverter is much less than with the existing ESA Ground Fault Relay.



Q: What connection method should be used for ungrounded electrical paths?

A: With ungrounded electrical paths, connect the capacitor or resistor for detection in the way shown in the diagram. The table shows the formulas for calculating the resistance or capacitance as well as the formulas for calculating ground currents for complete ground faults. (Depending on the location, the allowable ground fault current may be restricted. In this case, use values of R and C that do not exceed the restrictions.)

| | Connection method | Formula for resistor or capacitor | Formula for ground current | Formula for safety ground fault |
|------------------------------|-------------------|--|--------------------------------|---------------------------------|
| Single-phase electrical path | | Resistor: $R = \frac{V}{2It}$ (Ω) $P = \frac{5V^2}{R}$ (W) | $I_g = \frac{V}{2R_g + R}$ (A) | $I_g = \frac{V}{R}$ (A) |
| | | Capacitor: $C = \frac{2It}{2\pi fV}$ (F) Dielectric strength > 2 V (V) | | |

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
 To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

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- Поставка образцов и прототипов;
- Техническая поддержка проекта;
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