Littelfuse®
Expertise Applied | Answers Delivered

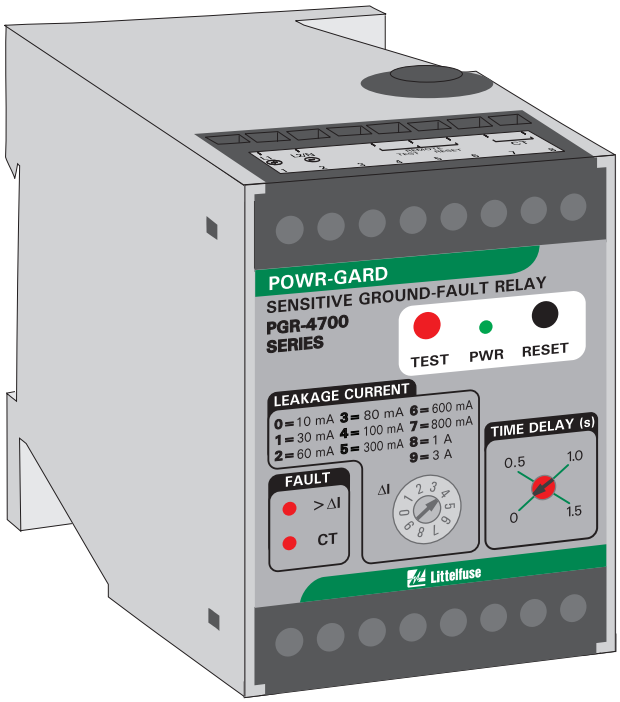
**POWR-GARD®**
**Ground-Fault Protection**
**PGR-4700 SERIES**
**Sensitive Ground-Fault Relay**

# PGR-4700 MANUAL

# SENSITIVE GROUND-FAULT RELAY

**September 8, 2009**

**REVISION 1**






Publication: PGR-4700-M
Document: P95-C700-00000
Printed in Canada.

This page intentionally left blank.

## TABLE OF CONTENTS



## LIST OF FIGURES



## LIST OF TABLES



## DISCLAIMER

Specifications are subject to change without notice. Littelfuse, Inc. is not liable for contingent or consequential damages, or for expenses sustained as a result of incorrect application, incorrect adjustment, or a malfunction.

This page intentionally left blank.

## 1. GENERAL

The PGR-4700 is a ground-fault relay for ac power supply systems that require ground-fault detection as low as 10 mA. It is suited for sensitive ground-fault protection on systems with significant harmonic content. Its output relays can operate in the fail-safe or non-fail-safe mode for undervoltage or shunt-trip applications. The PGR-4700 has two sets of NO/NC (Form C) relay contacts for use in independent control circuits. Additional features include LED trip and power indication, autoreset or latching trips with front-panel and remote reset, test switch, 0- to 1-mA analog output, CT verification with LED indication, a digital trip-level switch, and a trip-time setting.

Ground-fault current is sensed by a PGC-5000-series core-balance current transformer (CT). The trip level of the ground-fault circuit is digital-switch selectable from 10 mA to 3 A. Trip time is adjustable from 0 to 1.5 s.

## 2. OPERATION

### 2.1 Relay Operating Mode

The relay-operating-mode switch is located behind the front panel. See Fig. 1. Disconnect supply voltage before accessing switch. The front panel snaps into the terminal block and can be removed using a screw driver. In the fail-safe mode (switch open), the output relay energizes when the ground-fault circuit is not tripped. Fail-safe mode is the factory setting.

In the non-fail-safe mode (switch closed), the output relay energizes when a ground-fault trip occurs.

### 2.2 Front-Panel Controls

#### 2.2.1 Ground-Fault Trip Level

The ΔI selector switch is used to set the ground-fault trip level from 10 mA to 3 A. For ground-fault detection, the switch setting must be set substantially below the prospective ground-fault current. To avoid sympathetic tripping, the switch setting must be above the charging current of the protected feeder.

#### 2.2.2 Ground-Fault Trip Time

The PGR-4700 has a definite-time trip characteristic. In tripping systems, the TIME DELAY selector is used to set the ground-fault trip time for coordination with upstream and downstream ground-fault devices. Trip time is selectable from 0 to 1.5 s. Coordination requires the same trip level for all ground-fault devices in a system and the trip time to progressively increase upstream. The amount of equipment removed from the system will be a minimum if the first ground-fault device to operate is the one immediately upstream from the fault.

#### 2.2.3 Reset

The front-panel RESET switch is used to reset latching trips. When remote-reset terminals 5 and 6 are connected, a trip remains latched until the RESET switch is pressed or the remote-reset terminals are momentarily opened. Cycling the supply voltage will also reset the PGR-4700.

If the remote-reset terminals are not connected, the PGR-4700 operates in non-latching mode and a trip will reset when the fault is removed.

#### 2.2.4 Test

The TEST switch is used to test the ground-fault CT circuit, the indication, and the output relay. When the TEST switch is pressed, the circuit will trip, the >ΔI LED will light, and the output relay will operate. The analog output will indicate full scale (1 mA) during the test.

### 2.3 Front-Panel Indication

#### 2.3.1 Power

The green LED labeled PWR indicates presence of supply voltage.

#### 2.3.2 >ΔI

The red LED labeled >ΔI indicates a ground-fault trip.

#### 2.3.3 CT

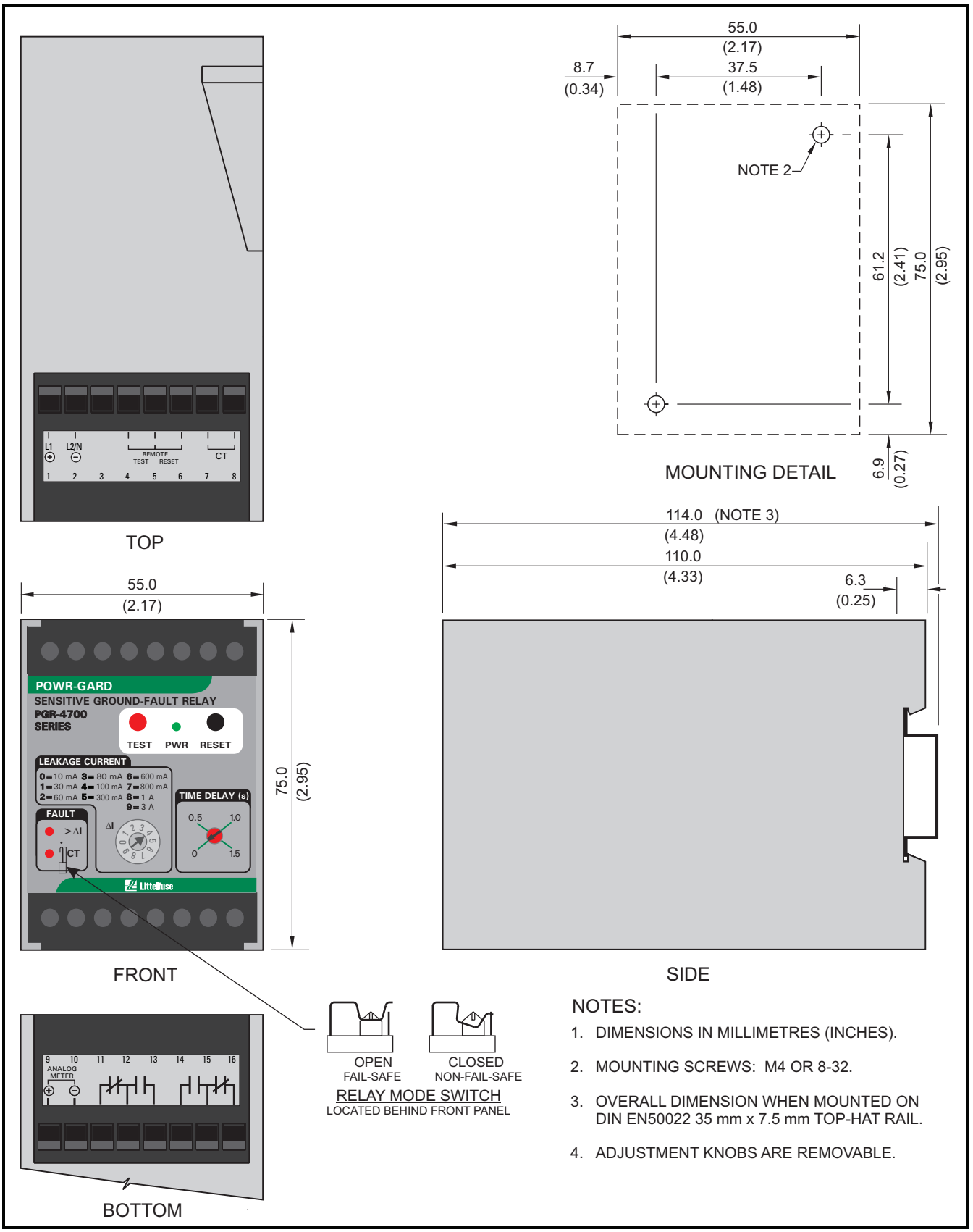
The red LED labeled CT indicates that a PGC-5000-series current transformer is not connected. See Section 2.7.

### 2.4 Analog Output

A non-isolated, 0- to 1-mA output (terminals 9 and 10) indicates ground-fault current sensed by the CT. The full-scale value corresponds to the ground-fault trip setting. For example, if the ground-fault trip setting is 30 mA, then 1 mA output will be indicated when the measured current is 30 mA. The output is linear between zero and full scale. See Figs. 2 and 6 for PGA-0500 meter details.

### 2.5 Remote Test

Connect terminals 4 and 5 to remote test. See Section 2.2.4.




NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MOUNTING SCREWS: M4 OR 8-32.
3. OVERALL DIMENSION WHEN MOUNTED ON DIN EN50022 35 mm x 7.5 mm TOP-HAT RAIL.
4. ADJUSTMENT KNOBS ARE REMOVABLE.

FIGURE 1. PGR-4700 Outline and Mounting Details.

### *2.6 Remote Reset*

Terminals 5 and 6 are used for remote reset. A normally closed contact is required to configure the PGR-4700 for latching operation with remote reset. See Section 2.2.3.

### *2.7 CT Verification*

A trip will occur and the red CT LED will light when a PGC-5000-series CT is not connected to terminals 7 and 8.

## *3. INSTALLATION*

***Note:*** Mounting, terminal block connections and wiring must conform to applicable local electrical codes. Check all applicable codes prior to installation.

This ground-fault monitoring system consists of a PGR-4700-series Sensitive Ground-Fault Relay and a PGC-5000-series CT connected as shown in Fig. 2.

A PGR-4700 can be surface or DIN-rail mounted. See Fig. 1. Panel mounting requires a PGK-0055 or PGK-0060 Panel-Mount Adapter. See Figs. 4 and 5.

Use terminal 1 (L1) as the line terminal on ac systems or the positive terminal on dc systems. Use terminal 2 (L2/N) as the neutral terminal on ac systems or the negative terminal on dc systems. There is no separate ground terminal for a ground wire.

Pass the phase conductors through the CT window and position them in the centre of the opening (for 4-wire and single-phase systems, also pass the neutral conductor through the CT window). Do not pass ground conductors through the CT window. In applications that require shields or drain wires to pass through the CT window, return them through the CT window before connecting them to ground. Connect the PGC-5000-series CT to terminals 7 and 8, and connect the shield to terminal 8. CT connections are not polarity sensitive. Certain applications require twisted- or shielded-twisted pair secondary CT conductors. See Fig. 3 for PGC-5000-series CT dimensional drawings.

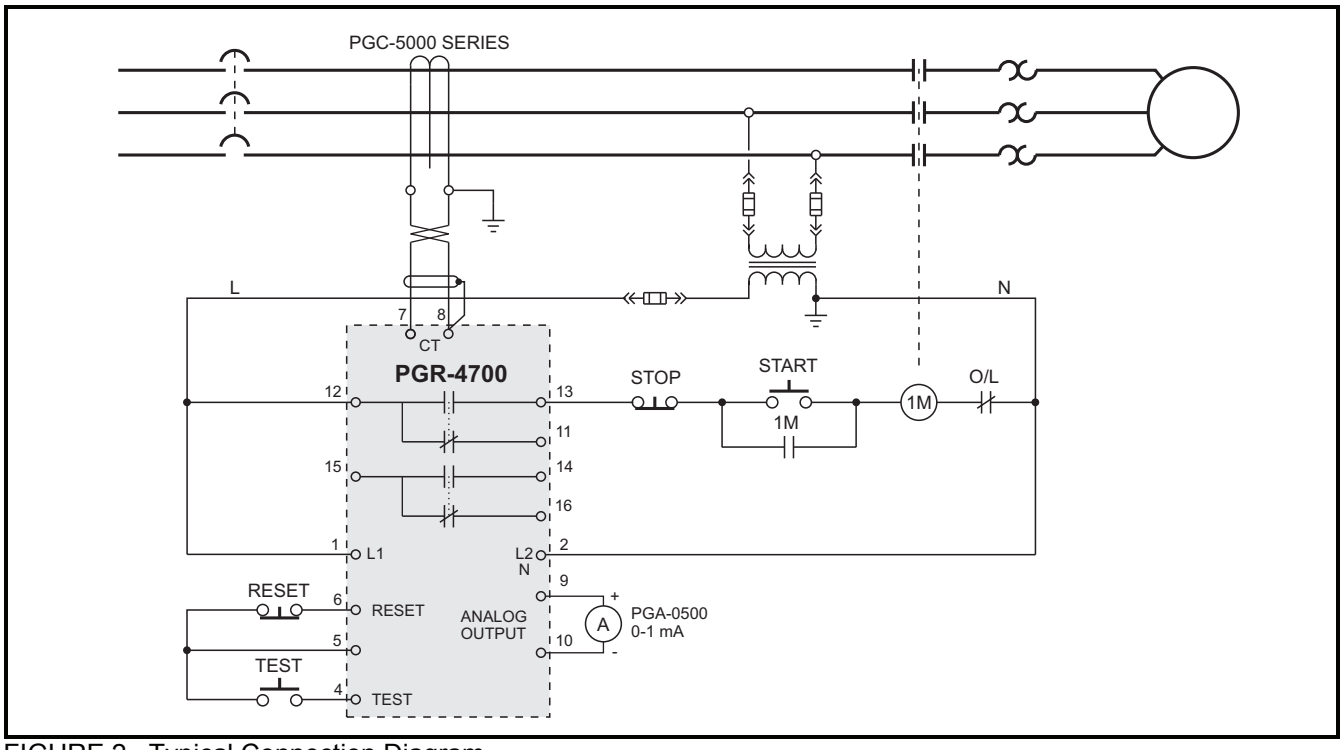
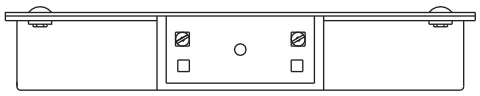
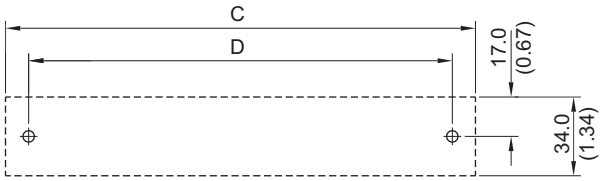



FIGURE 2. Typical Connection Diagram.

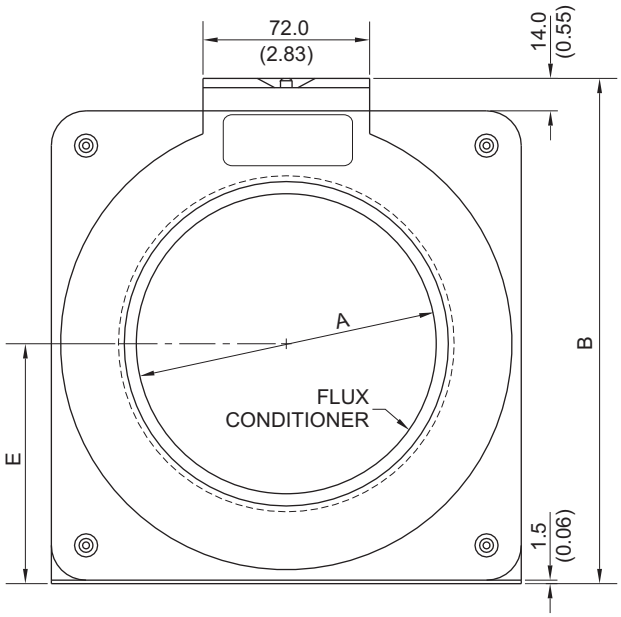
 



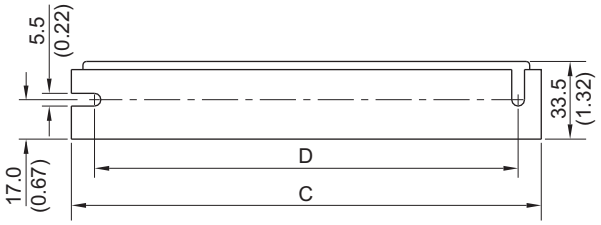
TOP (COVER REMOVED)




MOUNTING DETAIL




FRONT



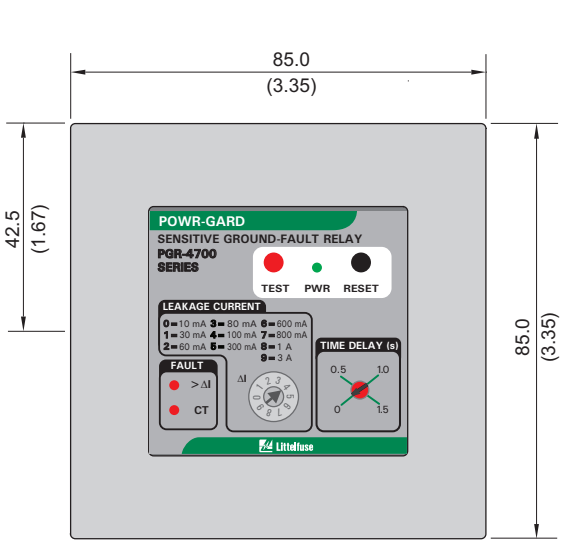

BOTTOM

NOTES:

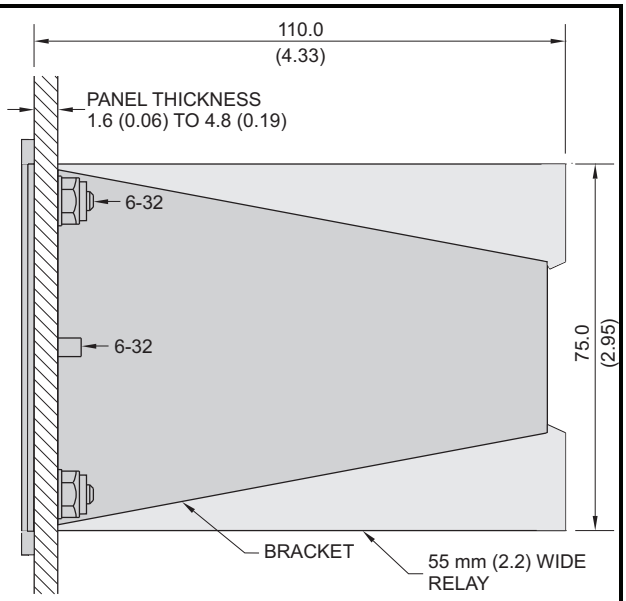
1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MOUNTING SCREWS: M5 OR 10-32.

| PART NUMBER | DIMENSIONS | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| PGC-5025 | 25.0 (0.98) | 99.0 (3.90) | 92.0 (3.62) | 75.0 (2.95) | 42.0 (1.65) |
| PGC-5060 | 60.8 (2.39) | 132.0 (5.20) | 115.0 (4.53) | 98.0 (3.86) | 60.5 (2.38) |
| PGC-5095 | 95.0 (3.74) | 175.0 (6.89) | 158.0 (6.22) | 141.0 (5.55) | 82.0 (3.22) |
| PGC-5130 | 130.0 (5.12) | 218.0 (8.58) | 203.0 (7.99) | 183.0 (7.20) | 103.5 (4.07) |
| PGC-5200 | 200.0 (7.87) | 309.0 (12.17) | 290.0 (11.41) | 270.0 (10.63) | 150.0 (5.90) |

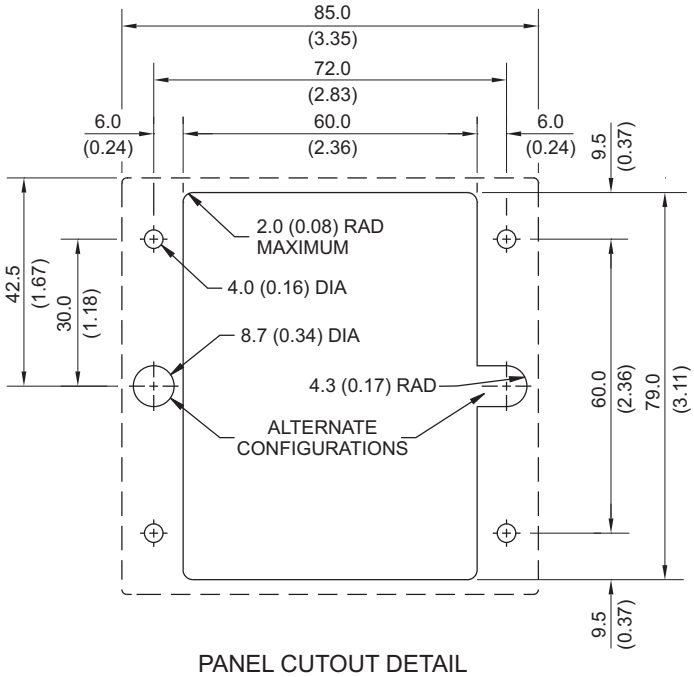
FIGURE 3. PGC-5000-Series Current Transformers.




FRONT VIEW




SIDE VIEW




PANEL CUTOUT DETAIL

INSTALLATION INSTRUCTIONS:

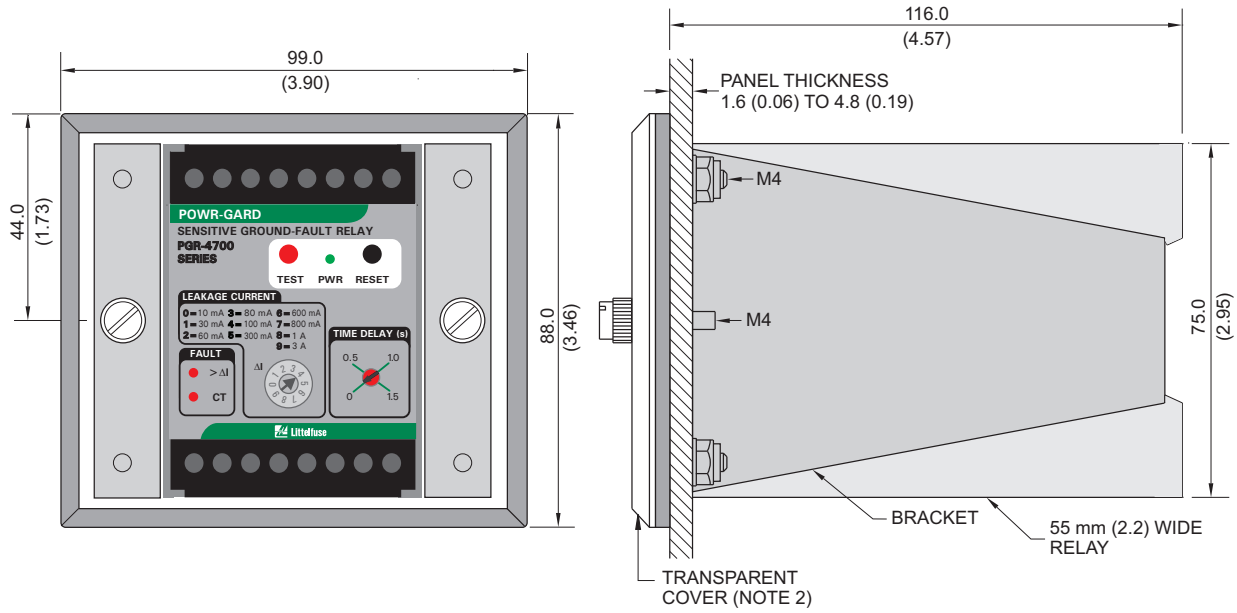
1. REMOVE BEZEL AND LATCH RELAY TO BRACKET.
2. INSERT BRACKET THROUGH FRONT OF PANEL CUTOUT AND SECURE WITH FLAT WASHERS AND LOCKNUTS PROVIDED.
3. CONNECT WIRING TO TERMINALS.
4. INSTALL BEZEL USING 6-32 x 0.31 SCREWS PROVIDED.

NOTE:

1. DIMENSIONS IN MILLIMETRES (INCHES).

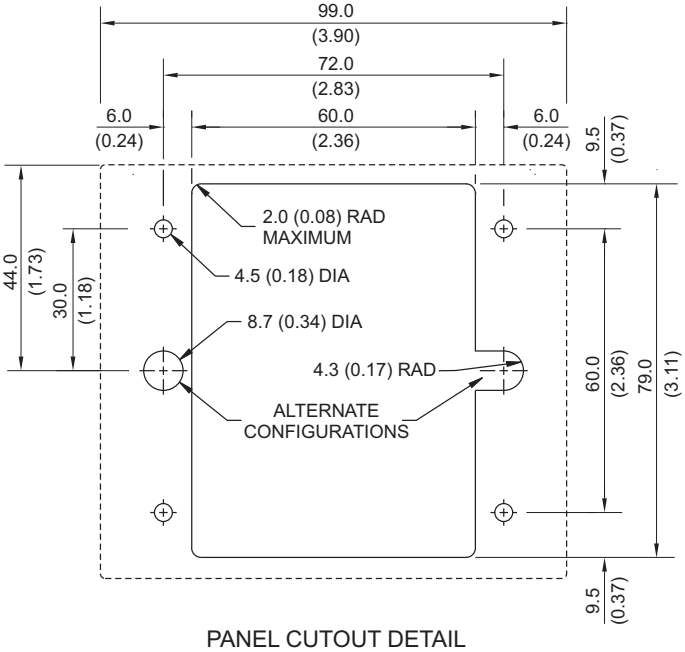
FIGURE 4. PGK-0055 Panel-Mount Adapter.




FRONT VIEW

SIDE VIEW




PANEL CUTOUT DETAIL

INSTALLATION INSTRUCTIONS:

1. WITH COVER REMOVED LATCH RELAY TO BRACKET.
2. INSERT BRACKET THROUGH FRONT OF PANEL CUTOUT AND SECURE WITH FLAT WASHERS AND LOCKNUTS PROVIDED.
3. CONNECT WIRING TO TERMINALS.
4. ATTACH COVER USING THUMB SCREWS PROVIDED.

NOTE:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MEETS NEMA3, IP53.

FIGURE 5. PGK-0060 Panel-Mount Adapter.

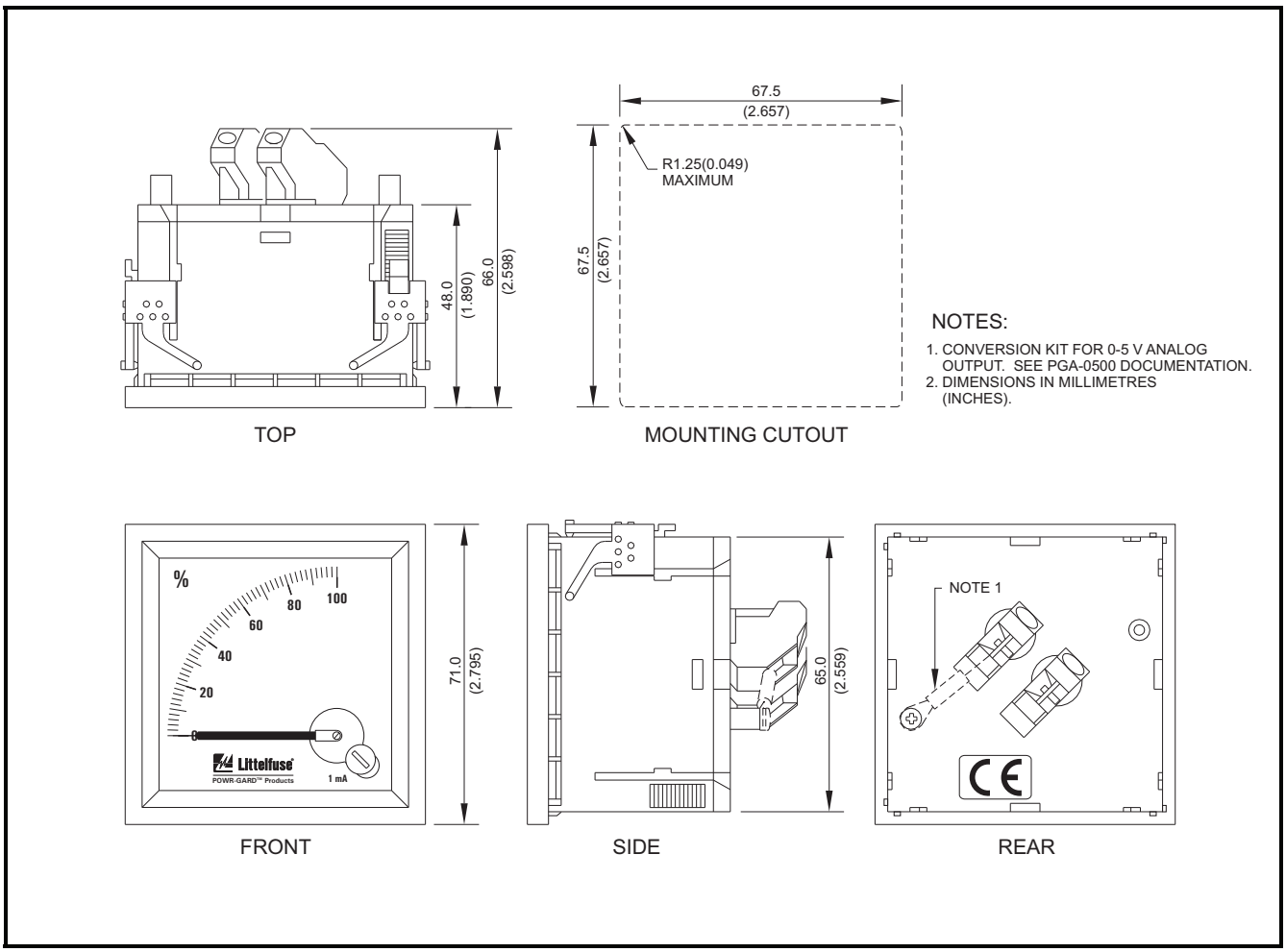



FIGURE 6. PGA-0500 Analog Percent Current Meter.

## 4. TECHNICAL SPECIFICATIONS

Supply:
- 120 Option ..... 4 VA, 120 Vac, (+10, -15%) 50/60 Hz
- 240 Option ..... 4 VA, 240 Vac, (+10, -15%) 50/60 Hz
- 24 Option ..... 3.0 W, 14 to 30 Vdc

Trip-Level Settings (ΔI) ..... 10, 30, 60, 80, 100, 300, 600, 800, 1,000, and 3,000 mA

Trip-Time Settings ..... 0 to 1,500 ms

Accuracies: (1, 2)
- Trip Level: (3)
  - 300 to 3,000 mA ..... +2, -8% (60 Hz) +0, -10% (50 Hz)
  - 60 to 100 mA ..... +4, -4 mA
  - 30 mA ..... +10, -0 mA
  - 10 mA ..... +5, -0 mA
- Trip Time (4) ..... 10% of Setting, 40 ms min

Input:
- 3 dB Frequency Response ..... 20 to 90 Hz
- CT ..... PGC-5000-Series
- CT Detection ..... Open-Circuit Detection
- Thermal Withstand:
  - Continuous ..... 25-A Ground-Fault Current
  - 1-Second ..... 400-A Ground-Fault Current

Analog Output:
- Mode……% of Trip-Level Setting
- Range……..0 to 1 mA dc

Reset ..... Front-Panel Switch and Remote N.C. Contact

Test ..... Front-Panel Switch and Remote N.O. Contact

Output Relay:
- Contact Configuration ..... 2 Form C
- Operating Mode ..... Fail-Safe or Non-Fail-Safe
- CSA/UL Rating ..... 8 A Resistive, 250 Vac, 1/3 HP, 250 Vac 1/6 HP, 120 Vac
- Supplemental Contact Ratings:
  - Carry Continuous ..... 5 A
  - Break:
    - dc (Resistive)..... 5 A, 30 Vdc, 0.3 A, 110 Vdc, 0.12 A, 220 Vdc
    - ac (Resistive)..... 2,000 VA

Operating Mode ..... Latching or Autoreset

Terminals ..... Wire Clamping, 24 to 12 AWG (0.2 to 2.5 $mm^2$) Conductors

Dimensions:
- Height .....75 mm (3.0")
- Width.....55 mm (2.2")
- Depth .....115 mm (4.5")

Shipping Weight .....0.45 kg (1 lb)

Environment:
- Operating Temperature .. -10°C to 60°C
- Storage Temperature..... -40°C to 80°C
- Humidity..... 85% Non-Condensing

Certification..... UL 508 E183688

(1) At 50 or 60 Hz unless otherwise noted.
(2) PGC-5000-series CT included.
(3) Maximum lead resistance of 2 Ω.
(4) At 3 x trip-level setting.

## 5. ORDERING INFORMATION

**PGR-4700-**☐

- 120 120-Vac Supply
- 240 240-Vac Supply
- 24 24-Vdc Supply

PGA-0500 ..... Analog Percent Current Meter
PGC-5025 ..... Current Transformer, 25.0-mm (0.98”) Window
PGC-5060 ..... Current Transformer, 60.8-mm (2.39”) Window
PGC-5095 ..... Current Transformer, 95.0-mm (3.74”) Window
PGC-5130 ..... Current Transformer, 130.0-mm (5.12”) Window
PGC-5200 ..... Current Transformer, 200.0-mm (7.87”) Window
PGK-0055 ..... Panel-Mount Adapter, NEMA 1
PGK-0060 ..... Panel-Mount Adapter, NEMA 3, IP53
PGK-0003 ..... Adapter Plate, GEC/MCGG

Consult factory for custom mounting adapters.

## 6. PERFORMANCE TEST

Some jurisdictions require periodic ground-fault performance tests. A test record form is provided for recording the date and the result of the performance tests. The following ground-fault system tests are to be conducted by qualified personnel.

a) Evaluate the interconnected system in accordance with the overall equipment manufacturer's detailed instructions.

b) Verify proper location of the PGC-5000-series CT. Ensure the cables pass through the CT window. This check can be done visually with knowledge of the circuit. The connection of the current-transformer secondary to the PGR-4700 is not polarity sensitive.

c) Verify that the system is correctly grounded and that alternate ground paths do not exist that bypass the current transformer. High-voltage testers and resistance bridges can be used to determine the existence of alternate ground paths.

d) Verify proper reaction of the circuit-interrupting device in response to a simulated or controlled ground-fault current. To simulate ground-fault current, use CT-primary current injection. Fig. 6 shows a test circuit using the PGT-0400 Ground-Fault-Relay Test Unit. The PGT-0400 has a programmable output of 0.5 to 9.9 A for a duration of 0.1 to 9.9 seconds. Fig. 6 shows the use of resistors that reduce the injected current to 10% of the PGT-0400 setting. Set the test current to 120% of the PGR-4700 setting. Inject the test current through the CT window for at least 2.5 seconds. Verify that the circuit under test has reacted properly. Correct any problems and re-test until the proper reaction is verified.

e) Record the date and the results of the test on the attached test-record form.

***Note:*** Do not inject test current directly into CT-input terminals 7 and 8.

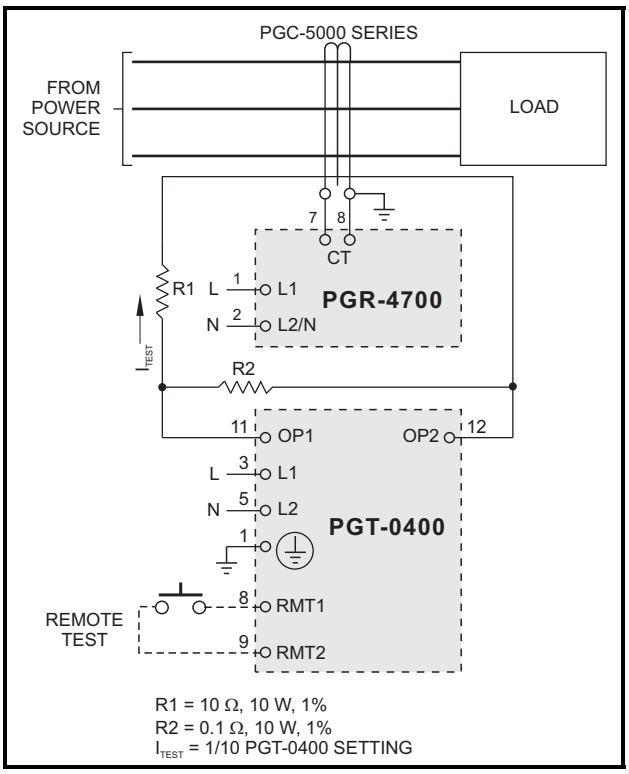



FIGURE 7. Ground-Fault-Test Circuit.

TABLE 1. Ground-Fault-Test Record

| DATE | TEST RESULTS |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Retain this record for the authority having jurisdiction.

This page intentionally left blank.