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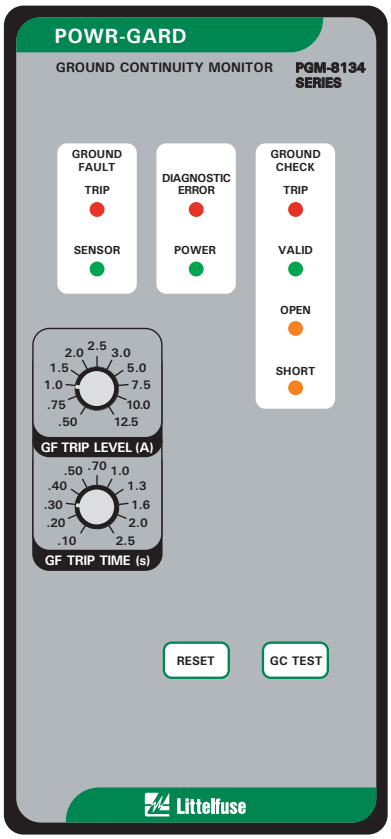
POWR-GARD®
Supplemental Monitoring
PGM-8134 SERIES
Ground Continuity Monitor

PGM-8134 MANUAL

GROUND CONTINUITY MONITOR

August 27, 2009

Revision 4



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1. GENERAL

The PGM-8134 is a microprocessor-based, combination ground-fault and ground-wire monitor for resistance-grounded systems. It has a switching power supply that accepts a wide range of ac and dc voltages, its specifications apply over an industrial temperature range at high humidity, and it meets the IEEE surge-withstand-capability tests (oscillatory and fast transient) for protective relays and relay systems. Isolated, normally open and normally closed contacts are provided for contactor control or for shunt or undervoltage operation in a breaker-trip circuit. All operating conditions are clearly annunciated and two Form C contacts are provided for remote indication. The PGM-8134 is housed in an anodized extruded-aluminum enclosure, and all connections are made with plug-in, wire-clamping terminal blocks. Provision is made for both panel and surface mounting.

The ground-fault circuit detects fundamental-frequency, zero-sequence current with a window-type current sensor and it verifies that the current sensor is connected and not shorted. A definite-time characteristic with 11 trip levels and 11 trip times allows coordination in virtually any resistance-grounded system. Although other current sensors may satisfy the verification circuit, only PGC-4000-series sensors have characteristics that meet system specifications. Current-sensor verification can be disabled for a ground-check-only application.

The ground-check circuit has an open-circuit voltage of 24 Vdc, which is not a hazard to personnel, and it has an output drive current above 100 mA for optimum performance in slip-ring, commutated-load, and high-induced-ac applications. Features include an externally accessible ground-check fuse, a resistance-insertion test, and 3-kV isolation between the ground-check loop and the monitor electronics. Unlike ground-check circuits using other termination devices, and especially those with phase-reversal switches, a ground-check circuit using a termination device with a Zener characteristic is capable of loop measurements that are independent of current in the phase conductors. The PGM-8134 ground-check circuit recognizes the PGA-0TA6 and PGA-0TA7 5.6-volt Zener characteristic as a valid end-of-line completion. This is the only passive characteristic that will satisfy the ground-check circuit's multi-level drive, allow induced currents to circulate in the ground-check loop, survive a phase-to-ground-check fault, and clamp the ground-check voltage during the fault. Although a standard 5.6-volt Zener diode may engage the PGM-8134's ground-check circuit, only PGA-0TA6 and PGA-0TA7 termination assemblies have the compensation required to meet system specifications.

2. OPERATION

2.1 Ground-Fault Circuit

2.1.1 GF Trip Time Setting

The ground-fault circuit has a definite-time characteristic with 11 settings from 0.1 to 2.5 seconds. Time-coordinated ground-fault protection requires the trip time to be longer than the trip time of downstream ground-fault devices.

2.1.2 GF Trip Level Setting

The trip level of the ground-fault circuit is switch selectable with 11 settings from 0.5 to 12.5 A. A minimum tripping ratio of 5 is recommended to achieve at least 80% winding protection, and this requires the trip level to be less than 20% of the grounding resistor let-through current. Suggested trip-level ranges for 5-, 15-, and 25-A neutral-grounding resistors are indicated on the faceplate. A ground-fault trip is latched, requiring a reset. A current-sensor failure will also cause a ground-fault trip. See Section 3.1.

If the PGM-8134 is operated in a ground-check-only application and a PGC-4000-series current sensor is not connected, connect terminals 17 and 18 to disable sensor verification. See Fig. 1.

2.2 Ground-Check Circuit

The ground-check loop consists of the outgoing ground-check conductor, quick-coupler connections, the PGA-0TA6 or PGA-0TA7 termination assembly, the PGA-0TA6 or PGA-0TA7 connection to equipment frame or ground bus, the ground-return path, and the PGM-8134 cable-ground-terminal connection to substation ground.

The PGM-8134 detects a valid ground-check loop when a PGA-0TA6 or a PGA-0TA7 termination assembly is detected in the loop and loop resistance is less than 28 ohms. The loop is not valid if open (or high resistance), or if the ground-check conductor is shorted to ground.

When the ground-check loop is valid, the PGM-8134 ground-check circuit can be tested by pressing the GC TEST switch or by shorting GC TEST terminals 11 and 12. This test invalidates the loop by inserting 47 Ω in the ground-check loop and a trip should occur in less than 250 ms.

The ground-check circuit is usually operated in the non-latching mode; however, it can be operated in the latching mode by connecting terminals 14 and 15.

The ground-check circuit is protected by a 1.5-A time-delay fuse (F1).

If the PGM-8134 is used in a ground-fault-only application, a PGA-0TA6 or PGA-0TA7 must be connected to the ground-check and cable-ground terminals to validate the ground-check circuit. See Fig. 1.

2.3 Reset

All ground-fault trips are latching and ground-check trips can be latching or non-latching. To reset ground-fault trips or latching ground-check trips, press the RESET switch or short the RESET terminals 9 and 10. See Fig. 1.

Cycling the supply voltage will also reset ground-fault trips; however, if the ground-check circuit is configured for latching fail-safe operation, the ground-check circuit will trip when supply voltage is applied.

The single-shot reset circuit responds only to a momentary closure; a jammed or shorted switch will not maintain a reset signal.

2.4 Trip Relay

Isolated, normally open (Trip A, terminals 24 and 25) and normally closed (Trip B, terminals 22 and 23) contacts are provided for use in a contactor- or breaker-control circuit. With no connection between terminals 12 and 13, the PGM-8134 trip relay operates in the fail-safe mode. This mode is used with undervoltage devices where the trip relay energizes and its normally open contact closes if the ground-fault and ground-check circuits are not tripped. This mode is recommended because:

- — Undervoltage devices release if supply voltage fails.
- — Undervoltage ground-check circuits do not allow the power circuit and open cable couplers to be energized until the ground-check loop is verified.

The fail-safe mode of operation of the PGM-8134 trip relay can be used for shunt-trip circuits with a stored-energy trip source. In this case, the normally closed trip contact is used—the contact opens when the PGM-8134 is energized and the ground-fault and ground-check circuits are not tripped. Care must be taken to ensure safe and correct operation during power up and power down.

Connect terminals 12 and 13 for non-fail-safe trip relay operation with shunt-trip devices. In this mode, the normally open trip contact is used—the trip contact is closed when a ground-fault or ground-check trip occurs.

Shunt-trip circuits are not fail-safe and are not recommended because:

- — Shunt-trip devices do not operate if supply voltage fails.
- — Shunt-trip ground-check circuits allow the power circuit and open cable couplers to be energized for a short interval after supply voltage is applied.

Caution: The PGM-8134 is not a lock-out device. Follow lock-out procedures for maintenance.

3. INDICATION

3.1 Ground Fault

A red LED indicates a ground-fault trip and the remote-indication relay GF is energized when the ground-fault circuit is not tripped (fail-safe indication-contact operation). A green LED indicates a current sensor is correctly connected. If the PGC-4000-series current sensor is disconnected or shorted, the green LED will go out and the ground-fault circuit will trip. If the sensor fault is intermittent, the ground-fault circuit will trip and the green LED will flash to indicate that the trip was initiated by a sensor fault.

3.2 Ground Check

A red LED indicates a ground-check trip. A green LED indicates a valid ground-check loop and the remote-indication relay GC is energized when the ground-check loop is valid (fail-safe indication-contact operation). Two yellow LED's indicate the status of an invalid ground-check loop. OPEN indicates the loop resistance exceeds the trip resistance and SHORT indicates the ground-check conductor is shorted to the ground conductor. A flashing yellow LED indicates the corrected cause of a latched ground-check trip.

3.3 Power

The green POWER LED indicates that the internal power supply is on.

3.4 Diagnostic Error

The red DIAGNOSTIC ERROR LED indicates that an internal error caused the PGM-8134 to trip. Return the PGM-8134 to the factory if a reset does not clear the trip.

4. INSTALLATION

4.1 General

This ground-fault ground-check monitoring system consists of a PGM-8134 Monitor, a PGC-4000-series Current Sensor, and a PGA-0TA6 or PGA-0TA7 termination assembly connected as shown in Fig. 1.

4.2 Monitor

Each PGM-8134 is packaged with both panel- and surface-mounting hardware.

Outline and panel-cutout dimensions for the PGM-8134 are shown in Fig. 2. To panel mount the PGM-8134, insert it through the panel cutout and secure it with the four supplied 8-32 locknuts and flat washers.

All connections to the PGM-8134 are made through plug-in, wire-clamping terminal blocks for 24 to 12 AWG (0.2 to 2.5 mm^2) conductors. Each plug-in terminal block can be secured to the monitor by two captive screws for reliable connections in high-vibration applications.

Outline dimensions and mounting details for surface mounting a PGM-8134 are shown in Fig. 3. Fasten the surface-mount adapter to the mounting surface and make connections to the adapter terminal blocks. Follow the instructions on Fig. 3 to mount or remove the PGM-8134.

The option -00 power supply operates from 60 to 265 Vac and 80 to 370 Vdc. Use terminal 2 (L2/N) as the neutral terminal on ac systems or the negative terminal on dc systems.

Note: Terminal 3 (SPG) is internally connected to terminal 4.

4.3 Current Sensors

Outline dimensions and mounting details for the PGC-4000-series current sensors are shown in Fig. 4. Pass only phase conductors through the sensor window as shown in Fig. 1. If a shield, ground, or ground-check conductor enters the sensor window, it must be returned through the window before it is terminated. Connect the current sensor to terminals 16 and 17. Ground terminal 17. Current-sensor primary and secondary connections are not polarity sensitive.

4.4 Termination Assemblies

Outline dimensions and mounting details for the PGA-0TA6 and PGA-0TA7 are shown in Figs. 5 and 6. Install the termination assembly at the load to complete the ground-check loop as shown in Fig. 1. Connect terminal G of the termination assembly to the equipment frame so that the ground-conductor-to-equipment-frame connection will be included in the monitored loop.

4.5 Remote Operation

Remote indication contacts and a reset input are provided for remote indication and remote reset as shown in Fig. 1.

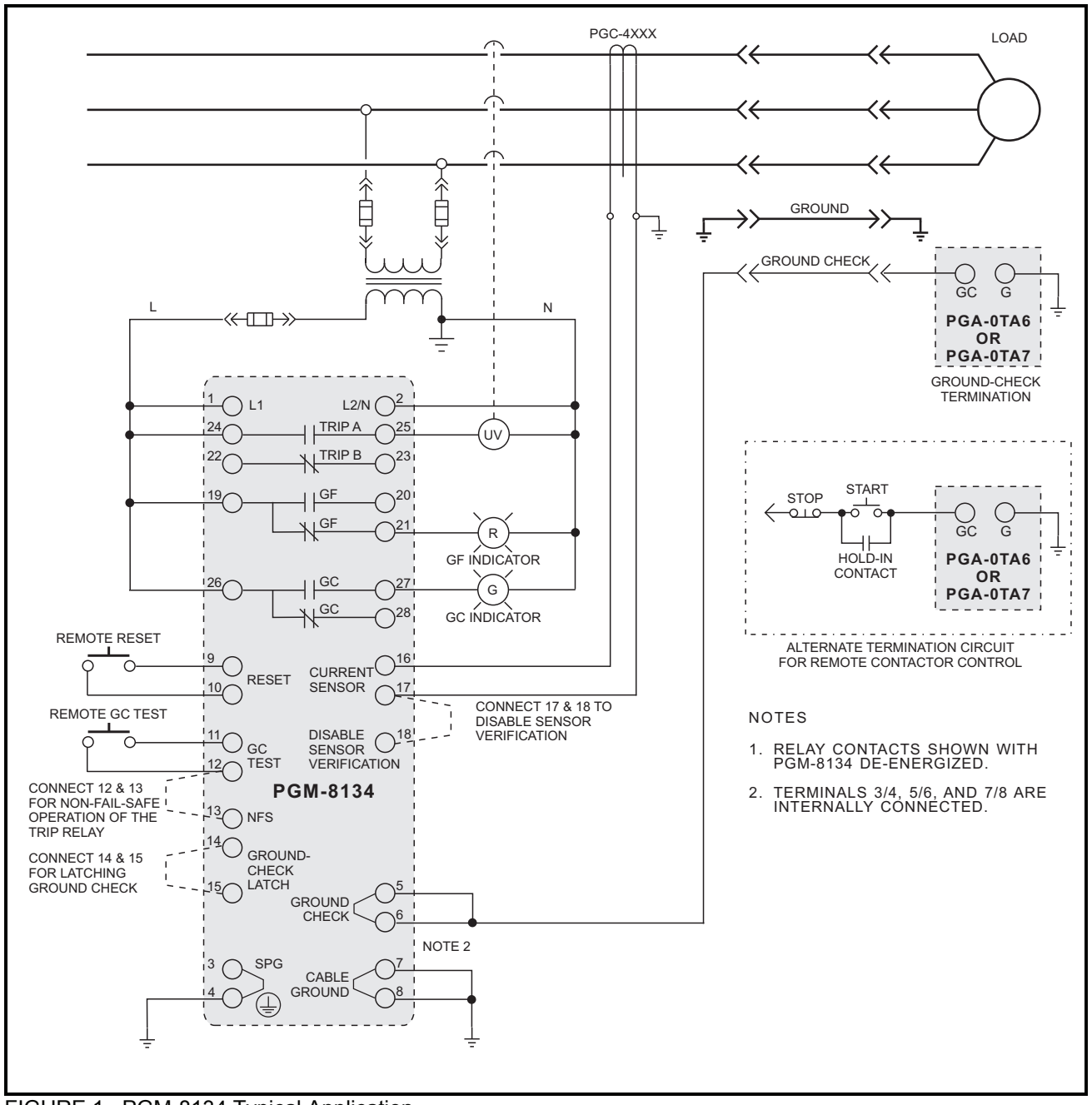


FIGURE 1. PGM-8134 Typical Application.

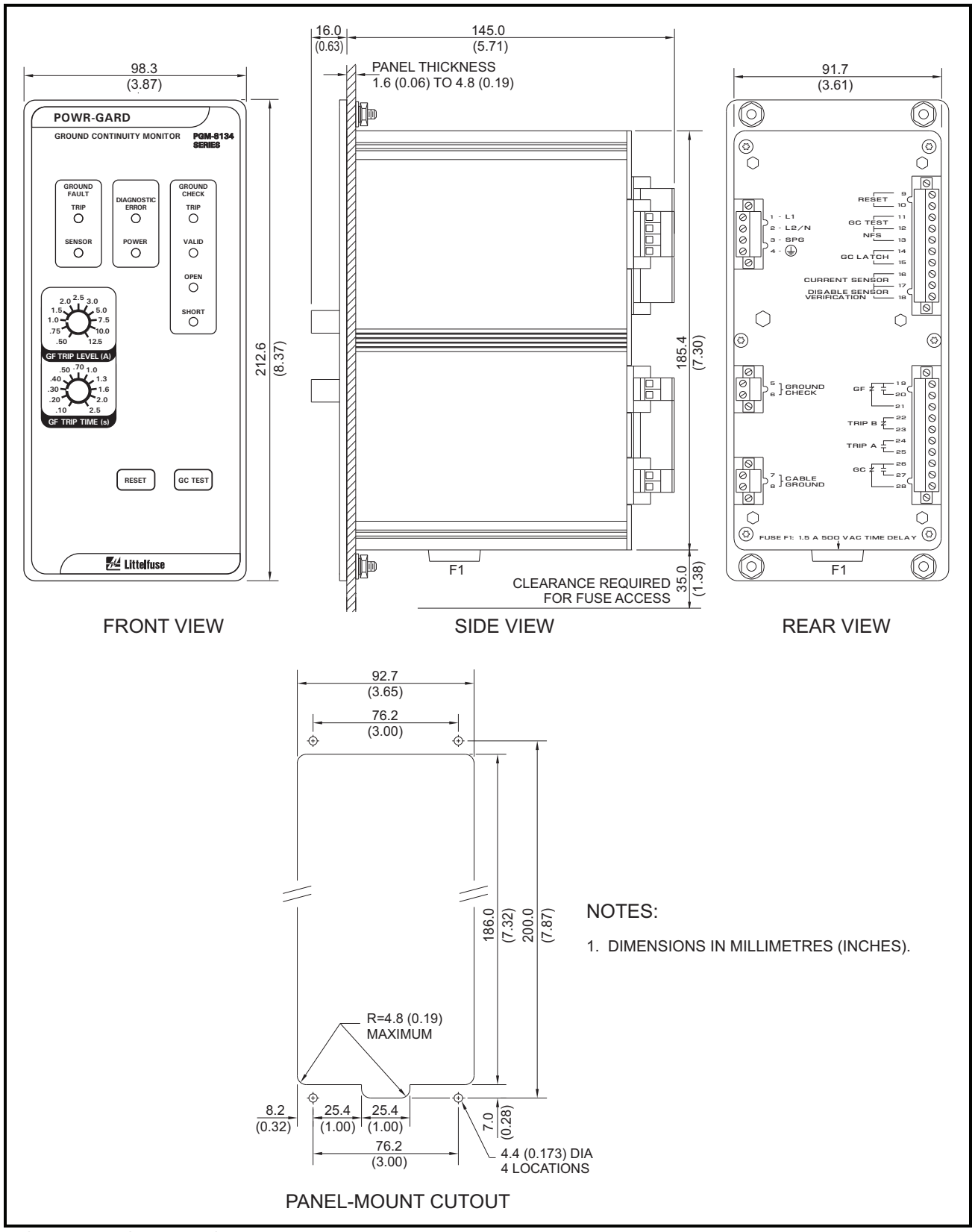
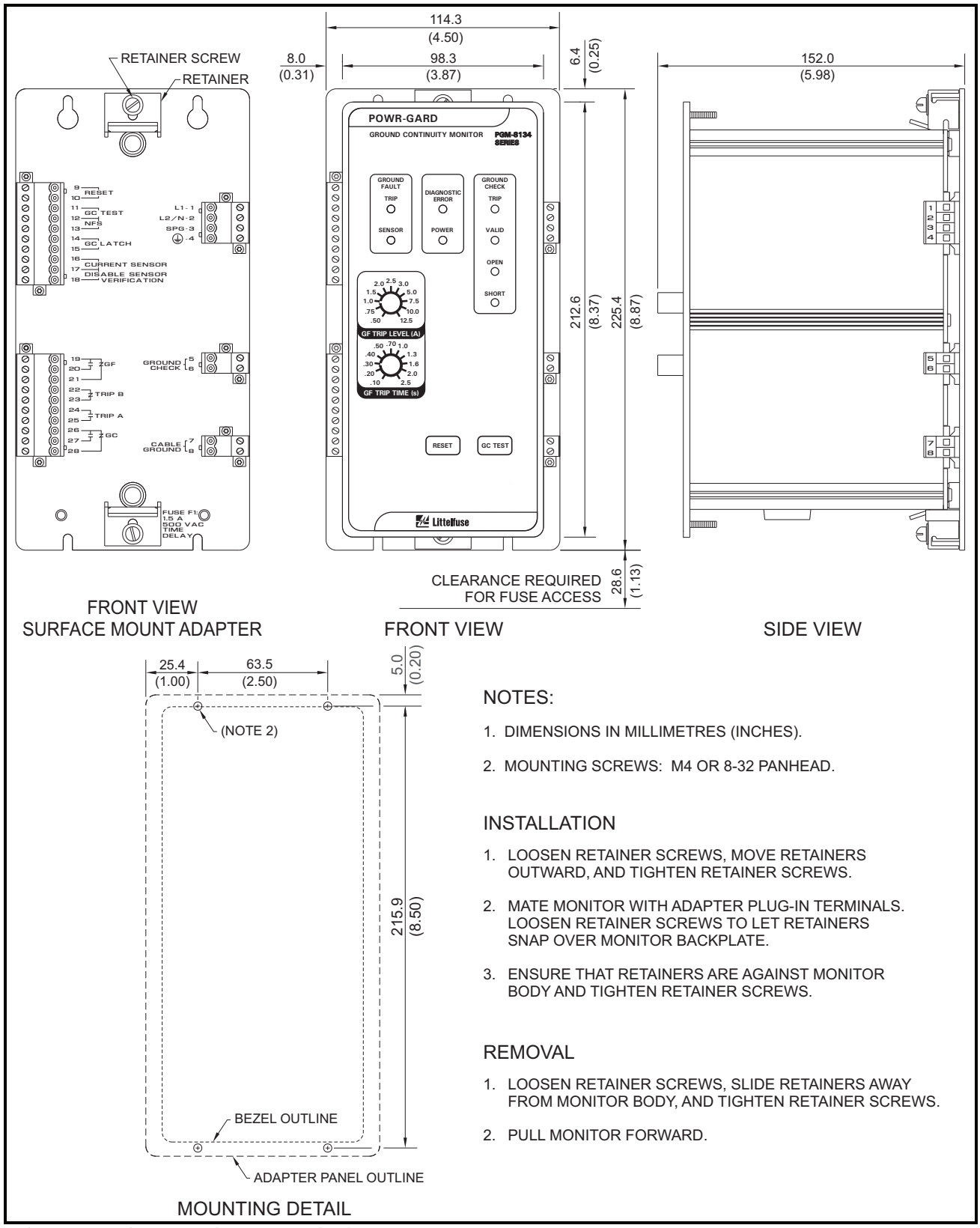


FIGURE 2. PGM-8134 Outline and Panel-Mounting Details.



NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MOUNTING SCREWS: M4 OR 8-32 PANHEAD.

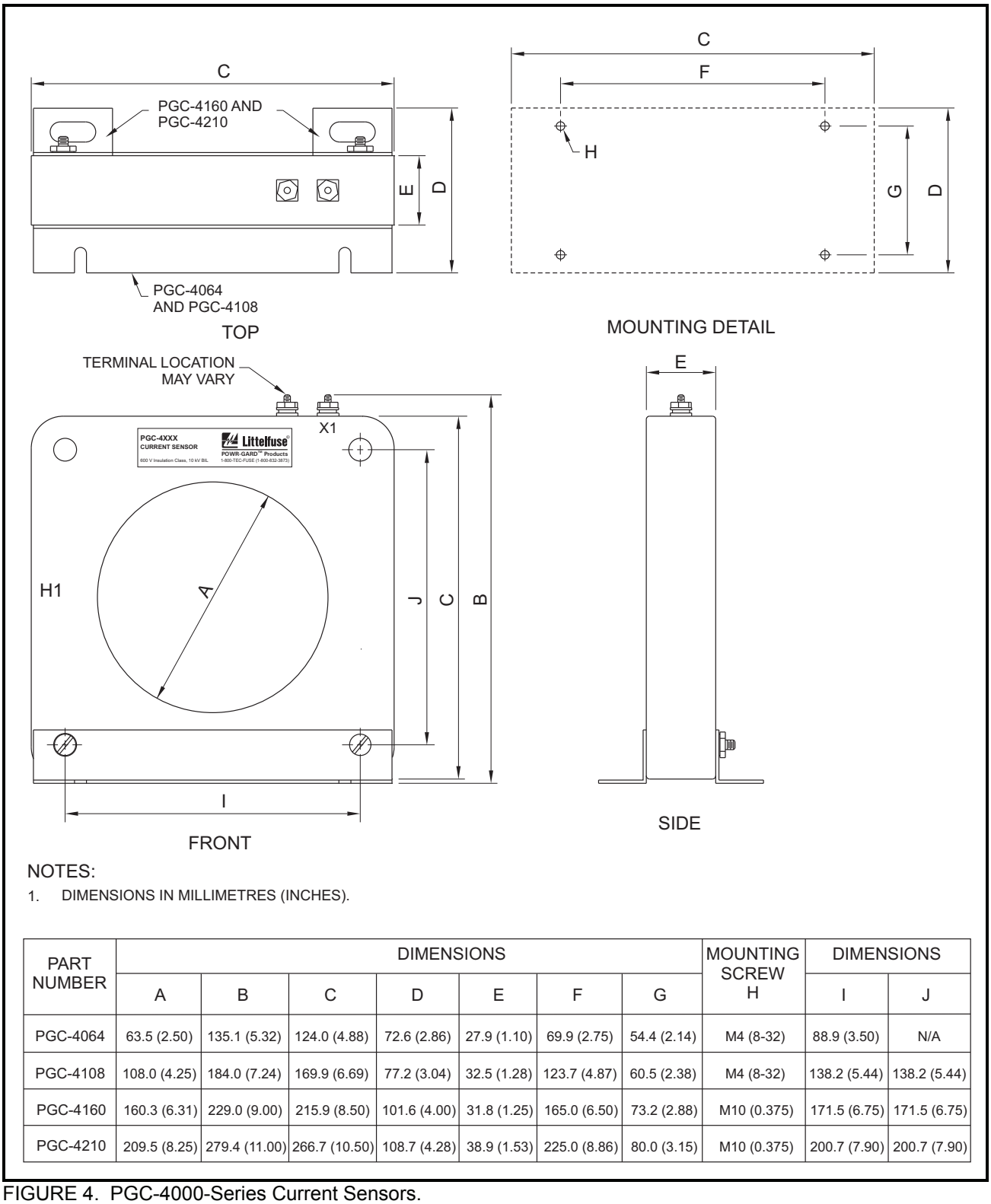
INSTALLATION

1. LOOSEN RETAINER SCREWS, MOVE RETAINERS OUTWARD, AND TIGHTEN RETAINER SCREWS.
2. MATE MONITOR WITH ADAPTER PLUG-IN TERMINALS. LOOSEN RETAINER SCREWS TO LET RETAINERS SNAP OVER MONITOR BACKPLATE.
3. ENSURE THAT RETAINERS ARE AGAINST MONITOR BODY AND TIGHTEN RETAINER SCREWS.

REMOVAL

1. LOOSEN RETAINER SCREWS, SLIDE RETAINERS AWAY FROM MONITOR BODY, AND TIGHTEN RETAINER SCREWS.
2. PULL MONITOR FORWARD.

FIGURE 3. PGM-8134 Outline and Surface-Mounting Details.

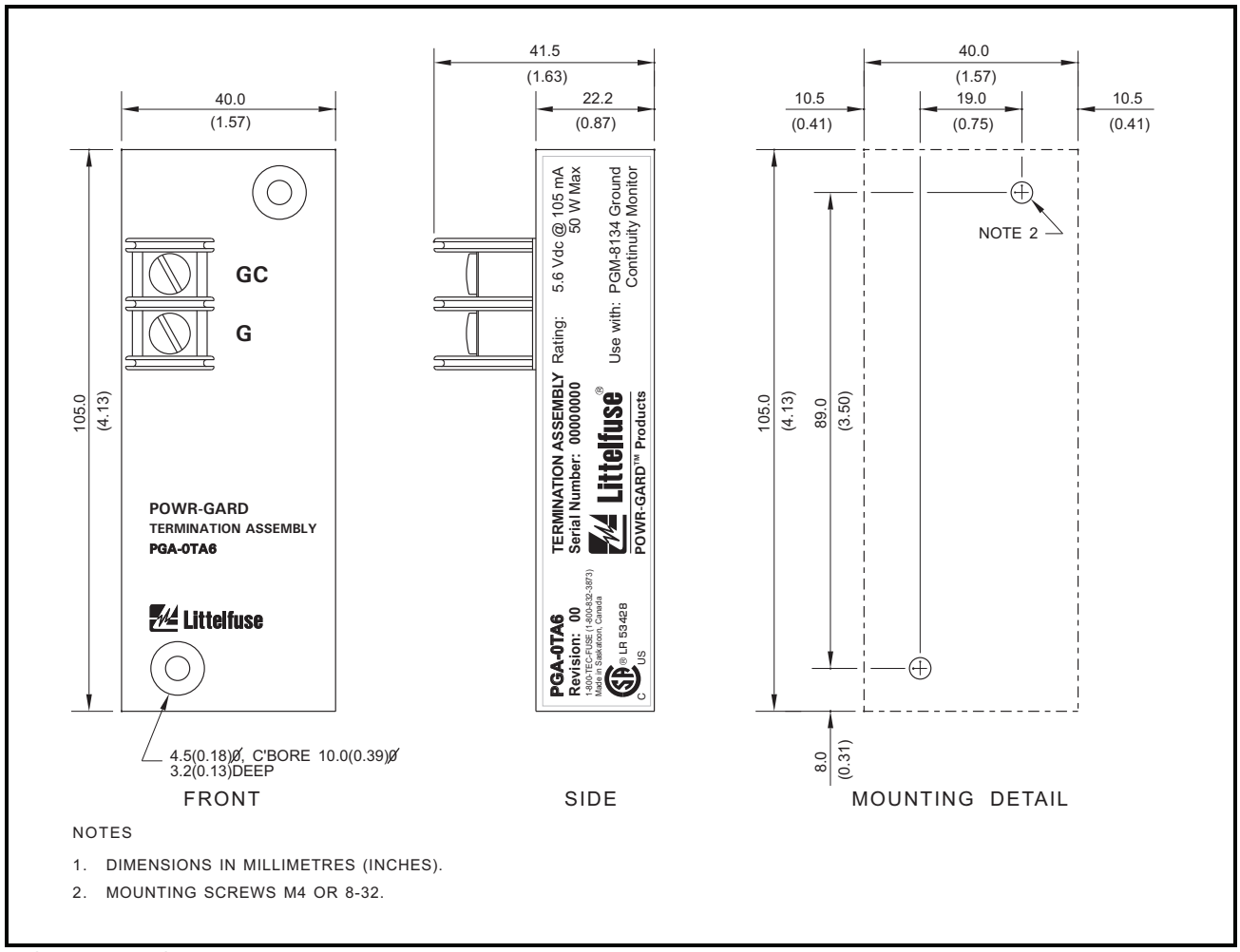


NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).

PART NUMBER	DIMENSIONS							MOUNTING SCREW H	DIMENSIONS	
	A	B	C	D	E	F	G		I	J
PGC-4064	63.5 (2.50)	135.1 (5.32)	124.0 (4.88)	72.6 (2.86)	27.9 (1.10)	69.9 (2.75)	54.4 (2.14)	M4 (8-32)	88.9 (3.50)	N/A
PGC-4108	108.0 (4.25)	184.0 (7.24)	169.9 (6.69)	77.2 (3.04)	32.5 (1.28)	123.7 (4.87)	60.5 (2.38)	M4 (8-32)	138.2 (5.44)	138.2 (5.44)
PGC-4160	160.3 (6.31)	229.0 (9.00)	215.9 (8.50)	101.6 (4.00)	31.8 (1.25)	165.0 (6.50)	73.2 (2.88)	M10 (0.375)	171.5 (6.75)	171.5 (6.75)
PGC-4210	209.5 (8.25)	279.4 (11.00)	266.7 (10.50)	108.7 (4.28)	38.9 (1.53)	225.0 (8.86)	80.0 (3.15)	M10 (0.375)	200.7 (7.90)	200.7 (7.90)

FIGURE 4. PGC-4000-Series Current Sensors.



NOTES

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MOUNTING SCREWS M4 OR 8-32.

FIGURE 5. PGA-0TA6 Termination Assembly.

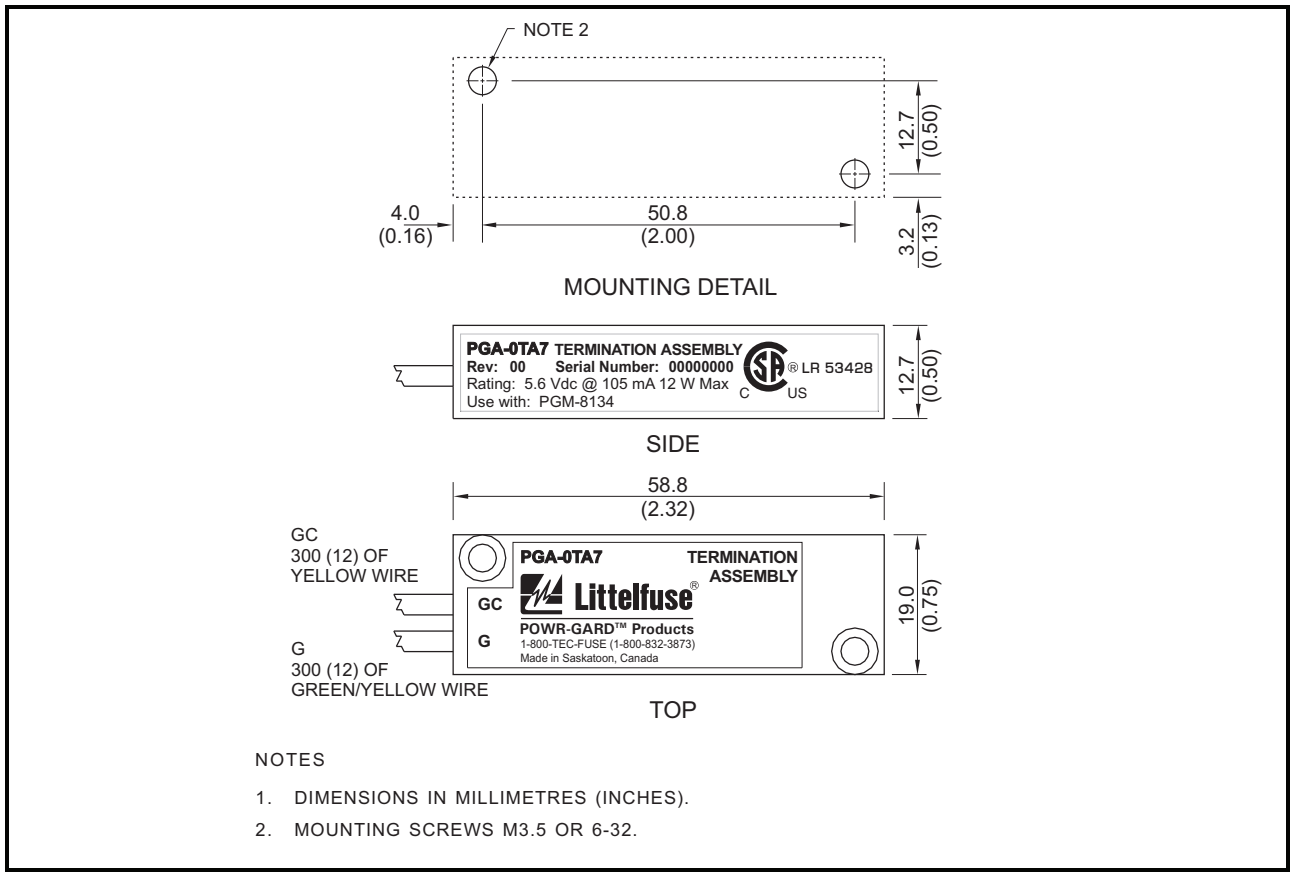


FIGURE 6. PGA-0TA7 Small-Format Termination Assembly.

5. TECHNICAL SPECIFICATIONS

5.1 PGM-8134

Supply:
- Option 00 ..... 25 VA, 120-240 Vac (+10, -45%), 50-400 Hz, 15 W, 110-250 Vdc (+10, -25%)

Ground-Fault Circuit:
- Digital Filter ..... 50 to 60 Hz, Bandpass
- 3 dB Frequency Response 30 to 90 Hz
- Trip-Level Settings ..... 0.5, 0.75, 1.0, 1.5, 2.0, 2.5, 3.0,5.0, 7.5, 10.0, and 12.5 A
- Trip-Time Settings ..... 0.1, 0.2, 0.3, 0.4, 0.5, 0.7, 1.0, 1.3, 1.6, 2.0, and 2.5 s
- Thermal Withstand ..... 150 A Continuous, 1,000 A for 2.5 s (Ground-Fault Current)
- Sensor Load Resistance. 2 Ω maximum
- Trip-Level Accuracy ..... ± 5% or 0.1 A
- Trip-Time Accuracy ..... +50, -15 ms
- Sensor Verification ..... Enabled or Disabled
- Operating Mode ..... Latching

Ground-Check Circuit:
- Open-Circuit Voltage ..... 24 Vdc
- Output Impedance ..... 136 Ω
- Loop Current ..... 105 mA
- Induced ac Withstand ..... 60 Vac Continuous, 120 Vac for 10 s, 250 Vac for 0.25 s
- Pull-in Time ..... ≤ 750 ms
- Trip Resistance ..... 28 Ω ± 10%
- Trip Time @ 50 Ω ..... 220 ± 30 ms
- Isolation ..... 3 kV, 60 Hz, 1 s
- Test ..... Front-Panel Switch and Remote, N.O. Contact
- Fuse Rating (F1) ..... 1.5 A, 500 Vac, Time Delay
- Fuse Part Number ..... FNQ 1½ Buss Fusetron
- Operating Mode ..... Latching or Non-Latching

Trip Relay:
- CSA/UL Contact Rating .. 8 A Resistive 250 Vac, 5 A 30 Vdc, ¼ HP, B300 Pilot Duty
- Supplemental Contact Ratings:
  - Make/Carry (0.2 s) .... 30 A
  - Break dc ..... 75 W Resistive, 35 W Inductive (L/R < 0.04)
  - Break ac ..... 2,000 VA Resistive, 1,500 VA Inductive (PF > 0.4)
  - Subject to maximums of 8 A and 250 V (ac or dc)
- Contact Configuration ..... Isolated N.O. and N.C. Contacts
- Operating Mode ..... Fail-Safe or Non-Fail-Safe

Remote-Indication Relays:
- CSA/UL Contact Rating .. 8 A Resistive 250 Vac, 8 A 30 Vdc
- Supplemental Contact Ratings:
  - Make/Carry (0.2 s) ... 20 A
  - Break dc ..... 50 W Resistive, 25 W Inductive (L/R < 0.04)
  - Break ac ..... 2,000 VA Resistive, 1,500 VA Inductive (PF > 0.4)
  - Subject to maximums of 8 A and 250 V (ac or dc)
- Contact Configuration ..... N.O and N.C. (Form C)
- Operating Mode ..... Fail-Safe

Terminal Block Rating ..... 10 A, 300 Vac, 12 AWG (2.5 mm^2)

PWB Conformal Coating ..... MIL-1-46058 qualified, UL QMJU2 recognized

Mounting Configuration ..... Panel Mount and Surface Mount

Shipping Weight ..... 2.3 kg (5.1 lb)

Environment:
- Operating Temperature .. -40°C to 60°C
- Storage Temperature ..... -55°C to 80°C
- Humidity ..... 85% Non-Condensing

Surge Withstand ..... ANSI/IEEE 37.90.1-1989 (Oscillatory and Fast Transient)

Certification ..... CSA Canada and USA

SP® LR 53428 C US

To:

CSA C22.2 No. 14 Industrial Control Equipment
UL 508 Industrial Control Equipment
UL 1053 Ground Fault Sensing and Relaying Equipment

Australia

5.2 Current Sensors

PGC-4064:
- Current Ratio.....1,000:5 A
- Insulation.....600-V Class
- Window Diameter .....64 mm (2.5”)
- Shipping Weight.....690 g (1.5 lb)

PGC-4108:
- Current Ratio.....1,000:5 A
- Insulation.....600-V Class
- Window Diameter .....108 mm (4.2”)
- Shipping Weight.....1.9 kg (4.3 lb)

PGC-4160:
- Current Ratio.....1,000:5 A
- Insulation.....600-V Class
- Window Diameter .....160 mm (6.3”)
- Shipping Weight.....2.2 kg (4.8 lb)

PGC-4210:
- Current Ratio.....1,000:5 A
- Insulation.....600-V Class
- Window Diameter .....210 mm (8.3”)
- Shipping Weight.....2.2 g (4.8 lb)

5.3 Termination Assemblies

PGA-0TA6:
- Characteristic.....5.6-V Zener, Temperature Compensated
- Power Rating .....50 W
- Screw Terminal.....6-32 x 0.25
- Dimensions .....105 x 40 x 41.5 mm (4.13 x 1.57 x 1.63”)
- Shipping Weight.....300 g (0.7 lb)

PGA-0TA7:
- Characteristic.....5.6-V Zener, Temperature Compensated
- Power Rating .....12 W
- Wire Leads.....18 AWG, 300 mm (11.8”)
- Dimensions .....51 x 19 x 12.7 mm (2.32 x 0.75 x 0.5”)
- Shipping Weight.....45 g (0.1 lb)

Certification .....CSA Canada and USA

LR 53428

6. ORDERING INFORMATION

PGM-8134-00.....Ground-Fault Ground-Check Monitor complete with Surface-Mount Adapter

Ground-Check Termination:
- PGA-0TA6 .....50-W Standard Termination Assembly
- PGA-0TA7 .....12-W Small-Format Termination Assembly with Wire Leads

Current Sensors:
- PGC-4064.....Current Sensor, 64 mm (2.5”) Window
- PGC-4108.....Current Sensor, 108 mm (4.2”) Window
- PGC-4160.....Current Sensor, 160 mm (6.3”) Window
- PGC-4210.....Current Sensor, 210 mm (8.3”) Window

7. TEST PROCEDURES

7.1 Ground-Check Trip Tests

7.1.1 Latching Ground-Check Trip Test

• Connect the monitor, current sensor and termination assembly as shown in Fig 10. Connect terminals 14 and 15 for latching operation. With supply voltage applied, the POWER, SENSOR, and VALID LED's will be on.
• Open the ground-check loop by removing either the GC or G connection between the monitor and the termination assembly. Pressing the faceplate GC TEST button will also perform an open-ground-check test. The monitor will trip. The trip contacts (terminals 22-23 and 24-25) and the ground-check indication contacts (terminals 26-27 and 26-28) will change state. The VALID LED will be off, and both the GROUND CHECK TRIP and the OPEN LED's will be on.
• Reconnect the ground-check loop. The VALID and TRIP LED's will be on and the OPEN LED will be flashing. The TRIP contacts (terminals 22-23 and 24-25) will remain latched and ground-check indication contacts (terminals 26-27 and 26-28) will change state.
• Reset the monitor.
• Short the ground-check loop by connecting G to GC. The monitor will trip. The trip contacts (terminals 22-23 and 24-25) and the ground-check indication contacts (terminals 26-27 and 26-28) will change state. The VALID LED will be off, and both the GROUND CHECK TRIP and the SHORT LED's will be on.
• Remove the short from G to GC. The VALID and TRIP LED's will be on and the SHORT LED will be flashing. The TRIP contacts (terminals 22-23 and 24-25) will remain latched and ground-check indication contacts (terminals 26-27 and 26-28) will change state.
• Reset the monitor.

7.1.2 Non-Latching Ground-Check Trip Test

• Connect the monitor, current sensor and termination device as shown in Fig. 10. With supply voltage applied, the POWER, SENSOR, and VALID LED's will be on.
• Open the ground-check loop by removing either the GC or G connection between the monitor and the termination assembly. Pressing the faceplate GC Test button will also perform an open circuit test. The monitor will trip. The trip contacts (terminals 22-23 and 24-25) and the ground-check indication contacts (terminals 26-27 and 26-28) will change state. The VALID LED will be off, and both the GROUND CHECK TRIP and the OPEN LED's will be on.
• Reconnect the ground-check loop. The monitor will reset.
• Short the ground-check loop by connecting G to GC. The monitor will trip. The trip contacts (terminals 22-23 and 24-25) and the ground-check indication contacts (terminals 26-27 and 26-28) will change state. The VALID LED will be off, and both the GROUND CHECK TRIP and the SHORT LED's will be on.
• Remove the short from G to GC. The monitor will reset.

7.2. Trip Relay Fail-Safe Mode Test

• Connect the monitor, current sensor and termination device as shown in Fig. 10. With supply voltage applied, the POWER, SENSOR, and VALID LED's will be on. The output contacts between terminals 22 and 23 will be open and between 24 and 25 will be closed.
• Remove the supply voltage. The output contacts between terminals 22 and 23 will close and the output contacts between terminals 24 and 25 will open.

7.3 Current-Sensor-Verification Test

• Connect the monitor, current sensor and termination device as shown in Fig. 10. With supply voltage applied, the POWER, SENSOR, and VALID LED's will be on.
• Open the current-sensor circuit by disconnecting one of the sensor leads. The monitor will trip. The trip contacts (terminals 22-23 and 24-25) and the ground-fault indication contacts (terminals 19-20 and 19-21) will change state. The GROUND FAULT TRIP LED will be on and the SENSOR LED will be off.
• Reconnect the current sensor. The GROUND FAULT TRIP LED will stay on and the SENSOR LED will flash. The output contacts will remain latched.
• Reset the monitor.
• Short the current sensor by connecting terminals 16 and 17. The monitor will trip. The trip contacts (terminals 22-23 and 24-25) and the ground-fault indication contacts (terminals 19-20 and 19-21) will change state. The GROUND FAULT TRIP LED will be on and the SENSOR LED will be off.
• Remove the short from terminals 16 and 17. The GROUND FAULT TRIP LED will stay on and the SENSOR LED will flash. The output contacts will remain latched.
• Reset the monitor.

7.4 Termination Assembly Tests

• Apply 15 Vdc across the series combination of a 100-Ω, 5-W current-limiting resistor and the termination assembly, as shown in Fig. 8. In the reverse-biased test, the voltage should be 5.6 V across G and GC. In the forward-biased test, the voltage across G and GC should be between 0.3 and 0.9 V.

7.5 Ground-Fault Performance Test

To meet the requirements of the National Electrical Code (NEC), as applicable, the overall ground-fault protection system requires a performance test when first installed. A written record of the performance test is to be retained by those in charge of the electrical installation in order to make it available to the authority having jurisdiction. A test-record form is provided for recording the date and the final results 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 ground-fault current sensor. Ensure the cables pass through the ground-fault-current-sensor window. This check can be done visually with knowledge of the circuit. The connection of the current-sensor secondary to the PGM-8134 is not polarity sensitive.

c) Verify that the system is correctly grounded and that alternate ground paths do not exist that bypass the current sensor. 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. 7 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. Set the test current to 120% of GF TRIP LEVEL. Inject the test current through the current-sensor 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.

TABLE 1. Ground-Fault-Test Record

DATE	TEST RESULTS

Retain this record for the authority having jurisdiction.

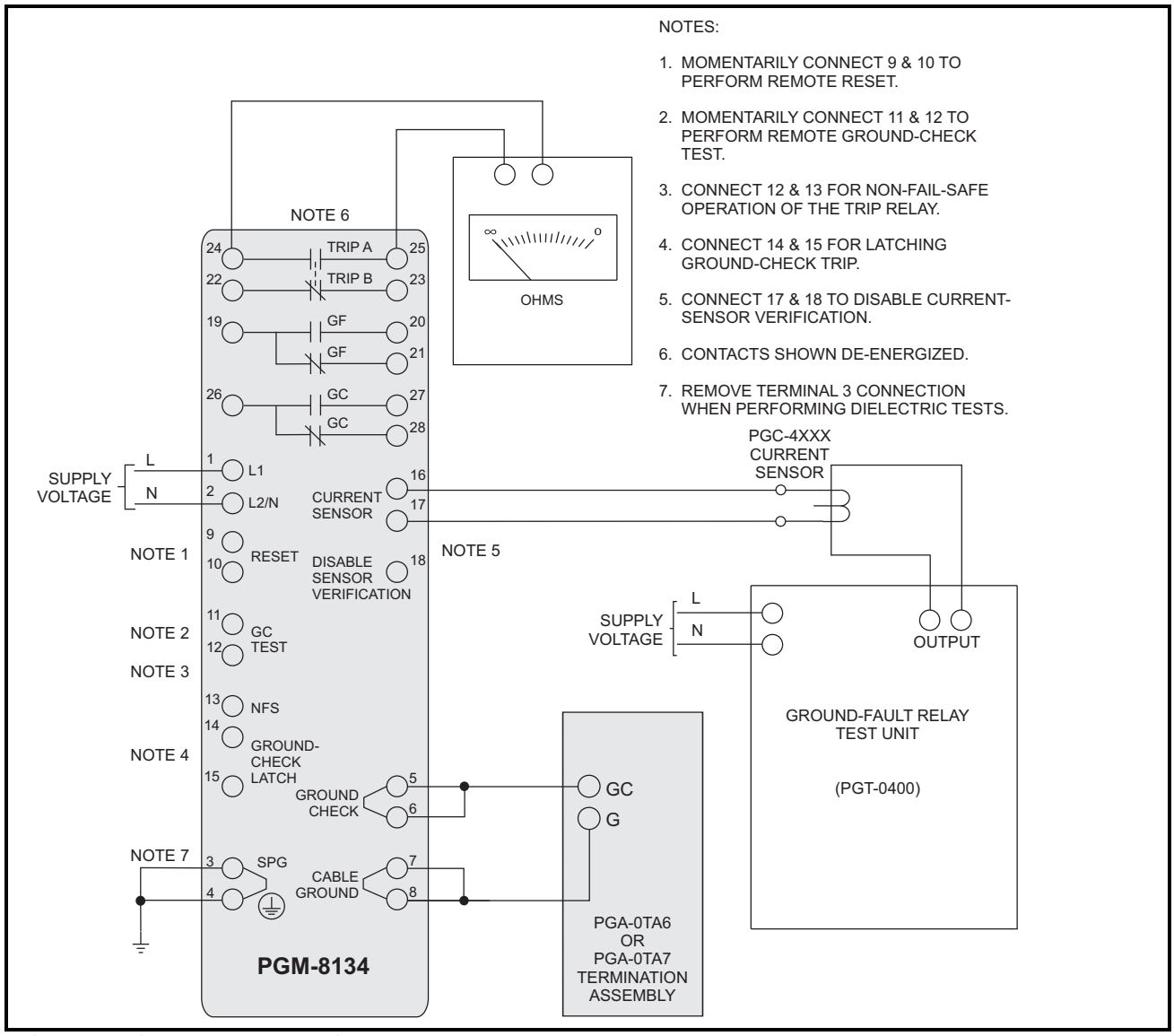


FIGURE 7. Ground-Fault-Test Circuit.

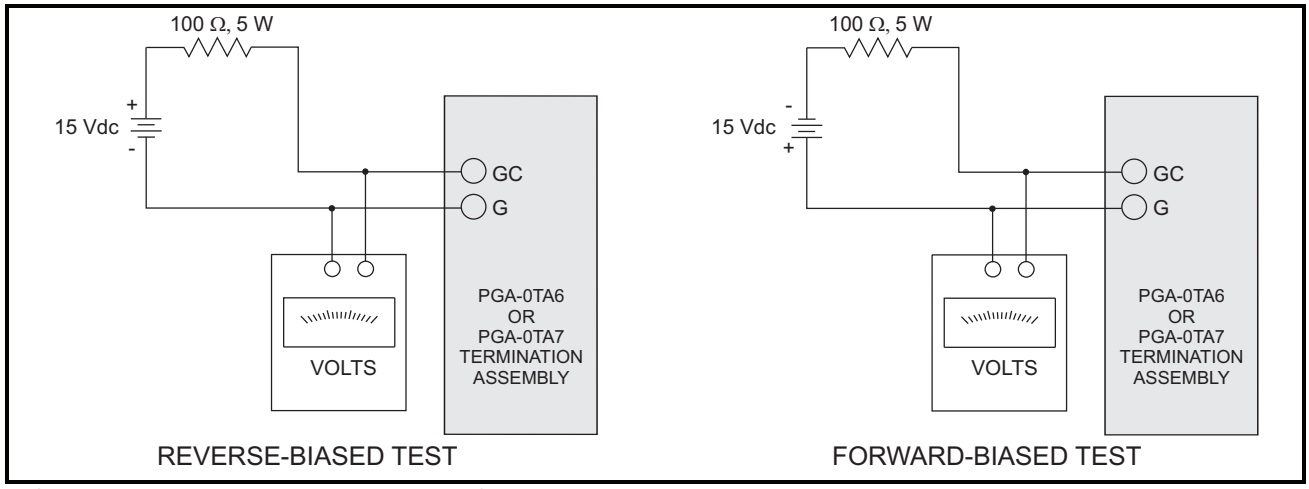


FIGURE 8. Termination-Assembly-Test Circuits.

