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Littelfuse
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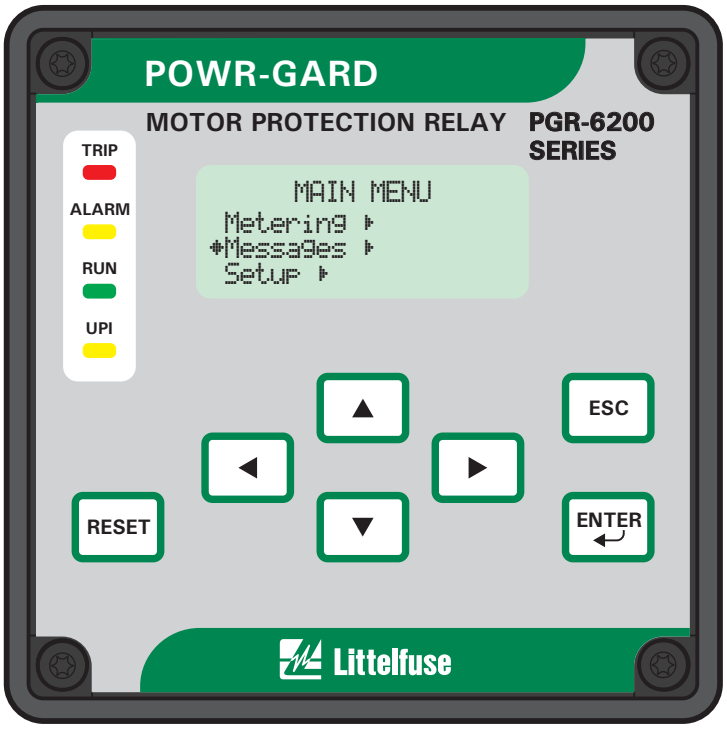
POWR-GARD®
Motor Protection
PGR-6200 SERIES
Motor Protection Relay

PGR-6200 MANUAL

MOTOR PROTECTION RELAY

June 1, 2009

Revision 2



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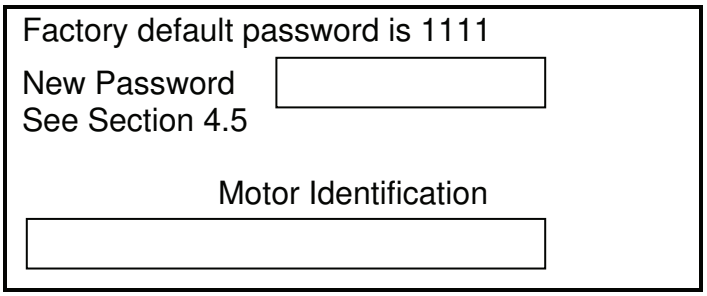
Factory default password is 1111
New Password
See Section 4.5
Motor Identification

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1. INTRODUCTION

1.1 General

The POWR-GARD® PGR-6200 is a motor-protection relay that provides integrated protection, metering, and data-logging functions for fixed- and variable-frequency applications. The PGR-6200 can be programmed using the front-panel operator interface, the TIA-232 port, or an optional communications network.

The PGR-6200 uses a PGA-0CIM current-input module for current-transformer connections as shown in Fig. 1.1. Each PGR-6200 includes a PGA-0CIM.

1.2 PGR-6200 Features

1.2.1 Protection

- Overload (49, 51)
- Overcurrent (50, 51)
- Earth fault (50G/N, 51G/N)
- Unbalance (46)
- Phase loss (46)
- Phase reverse (46)
- Jam
- Undercurrent (37)
- Starts per hour (66)
- Differential (87)
- PTC overtemperature (49)
- RTD temperature (38, 49)

1.2.2 Metering

- Line currents
- Current unbalance
- Positive-sequence current (I_1)
- Negative-sequence current (I_2)
- Zero-sequence current ($3I_0$, calculated)
- Earth-leakage current (CT input)
- Differential currents
- Used thermal capacity
- Thermal trend
- RTD temperatures
- Frequency

1.2.3 Data Logging

- One-hundred records
  - Date and time of event
  - Event type
  - Cause of trip
  - Line currents
  - Current unbalance
  - Earth-leakage current
  - Differential currents
  - Used thermal capacity
  - Thermal capacity used during starts
  - Start time
  - RTD temperatures
- Trip counters
- Running hours

1.2.4 Inputs and Outputs

- Phase-current inputs
- Earth-leakage-current input
- Programmable digital input (24 Vdc)
- 24-Vdc source for digital input
- 4–20-mA analog output, programmable
- Temperature-sensor input, Pt100 RTD or PTC
- I/O module interface
- Three output relays, programmable
- TIA-232 communications
- Network communications

1.2.5 Operator Interface

- 4 x 20 backlit LCD display
- Display-control and programming keys
- LED status indication

1.2.6 PGA-0120 Temperature Input Module (Optional)

- Eight-RTD inputs per module
- Individually selectable RTD types
- Solid-state multiplexing
- Up to three modules per system
- Remote operation up to 1.2 km (4,000')
- Powered by PGR-6200

1.2.7 PGA-0140 Differential Current Module (Optional)

- 3-CT core balance connection
- 6-CT summation connection
- Remote operation up to 1.2 km (4,000')
- Powered by PGR-6200

1.2.8 Communications

The standard communications interface is a TIA-232 port using the Modbus® RTU protocol. In addition to the standard interface, network communications options include TIA-485 with both Modbus® RTU and A-B® DF1 protocols, DeviceNet™, and an IEEE 802.3 port with Modbus® TCP Ethernet protocol.

1.3 Ordering Information

See Fig. 1.2 for PGR-6200, PGA-0CIM, PGA-0120 and PGA-0140 model numbers.

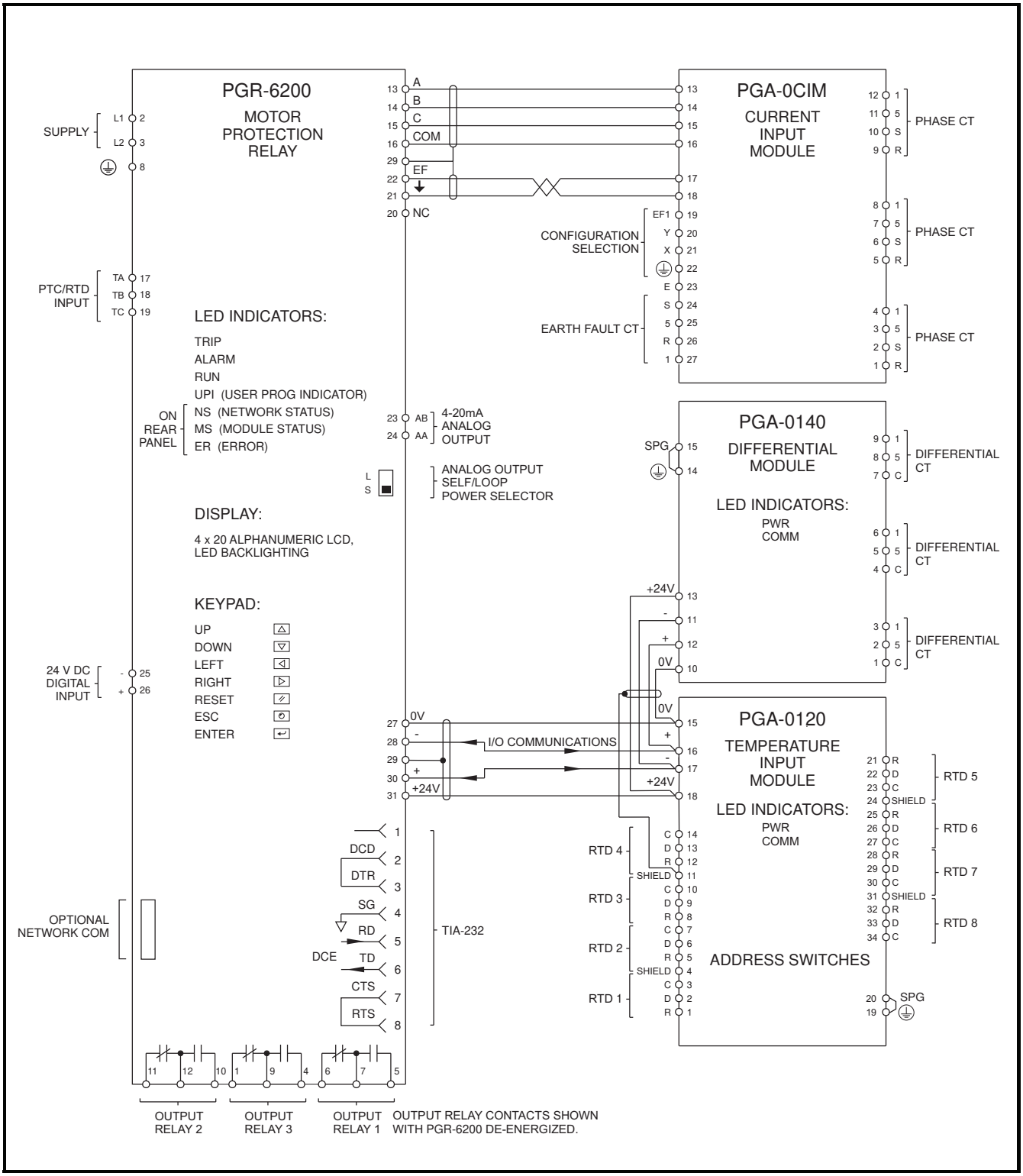
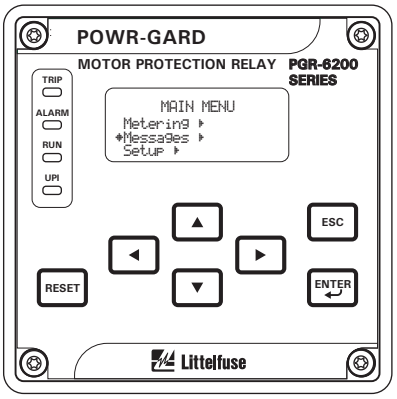


FIGURE 1.1 Motor Protection Relay Block Diagram.

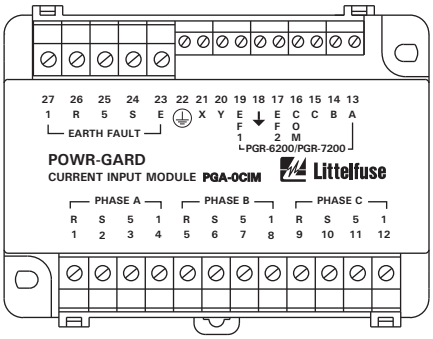


PGR-6200- ☐☐ - ☐☐

Options:
- 00 CIM Input

Network Communications:
- 0 None, TIA-232 only
- 1 TIA-485 c/w A-B® DF1 & Modbus® RTU Protocols
- 2 DeviceNet™
- 4 IEEE 802.3 (Ethernet)

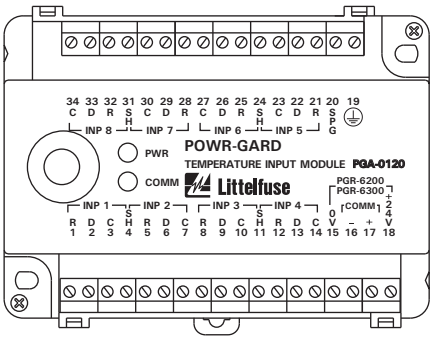
Power Supply:
- 0 Universal ac/dc (65 to 265 Vac and 80 to 275 Vdc)



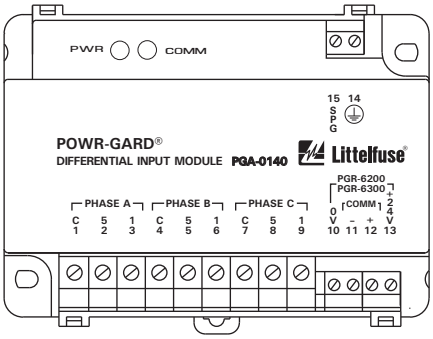
PGA-0CIM

NOTE:

The PGR-6200 consists of the Motor Protection Relay and the PGA-0CIM Current Input Module. To order the relay only, add (-MPU) to the part number listed above.



PGA-0120



PGA-0140

Supplied Interconnect Cable:

P75-P300-20030 . . PGA-0CIM to PGR-6200 Interconnect Cable, 6 m (19') Included with PGA-0CIM

3124A . . . . . I/O Module to PGR-6200 Interconnect Cable, 4 m (13') Included with PGA-0120 and PGA-0140

FIGURE 1.2 PGR-6200 Ordering Information.

Current Transformers:

PGC-3026	Sensitive Earth-Fault CT, 5-A-primary rating, 26-mm (1”) window
PGC-3082	Sensitive Earth-Fault CT, 5-A-primary rating, 82-mm (3.2”) window
PGC-31FC	Flux Conditioner for PGC-3082, 70-mm (2.7”) window
PGC-3140	Sensitive Earth-Fault CT with Flux Conditioner, 5-primary rating, 139-mm (5.5”) window
Other Earth-Fault CT’s	Contact factory
Phase CT’s	Contact factory

Accessories:

PGK-0SMK	Surface-mounting hardware kit
PGA-016A	Watertight faceplate cover
PGA-0420	DB9 to RJ-45 Adaptor with 1.5 m (5’) cable
PGA-0440	USB to TIA-232 serial converter

Software:

PGW-COMM	PC Interface [1]
PGW-FLSH	Firmware Upgrade [1]

[1] Available at www.littelfuse.com/protectionrelays

2. INSTALLATION

2.1 General

A basic system consists of a PGR-6200, a PGR-0CIM, and three 1-A- or 5-A-secondary line-current transformers. Earth-fault protection can be provided from a core-balance CT or from phase CT's. A core-balance CT (1-A, 5-A, or PGC-3000 series) is recommended. In addition to a single PTC/RTD input provided on the PGR-6200, up to three PGA-0120 modules (eight RTD inputs per module) and one PGA-0140 differential module can be connected to a PGR-6200.

The PGR-6200 switch-mode power supply is rated 65 to 265 Vac and 80 to 275 Vdc.

All modules can be mounted in any orientation.

2.2 PGR-6200 Motor Protection Relay

Outline and details for PGR-6200 panel-mounting are shown in Fig. 2.1. The PGR-6200 mounts in a 92 mm (3.62") ¼ DIN square cutout and is secured by a panel-mount clamp. Insert the PGR-6200 through the panel cutout and slip the panel-mount clamp over the PGR-6200 body. Slide the clamp forward until the latch tabs snap into the mating holes. Lock the unit in place by tightening the four clamp screws against the panel.

Caution:
Do not over tighten the clamp screws as this may deform the clamp and release the latch tabs.

Outline and details for PGR-6200 surface-mounting are shown in Fig. 2.2. Ensure that the L/S switch is set before installing surface-mounting brackets. See Section 3.2.1.4 for switch positions. A detailed installation instruction sheet is included with the PGK-0SMK, Surface-Mounting Hardware Kit.

2.3 PGA-0CIM Current Input Module

The PGA-0CIM can be surface or DIN-rail mounted. Outline and mounting details are shown in Fig. 2.3. To minimize CT-lead burden, a PGA-0CIM can be located close to the CT's. The PGA-0CIM terminates phase- and earth-fault-CT secondaries—shorting blocks are not required for PGA-0CIM outputs.

2.4 Sensitive Earth-Fault CT's

Outline and mounting details for the PGC-3026, PGC-3082, and PGC-3140 are shown in Figs. 2.4, 2.5, and 2.6.

2.5 PGA-0120 Temperature Input Module

Outline and mounting details for the PGA-0120 are shown in Fig. 2.7. The PGA-0120 will fit inside most motor RTD-termination junction boxes and it is certified for use in Class I, Zone 2 hazardous locations. The PGA-0120 can be surface or DIN-rail mounted.

2.6 PGA-0140 Differential Current Module

Outline and mounting details for the PGA-0140 are shown in Fig 2.8. The PGA-0140 can be surface or DIN-rail mounted.

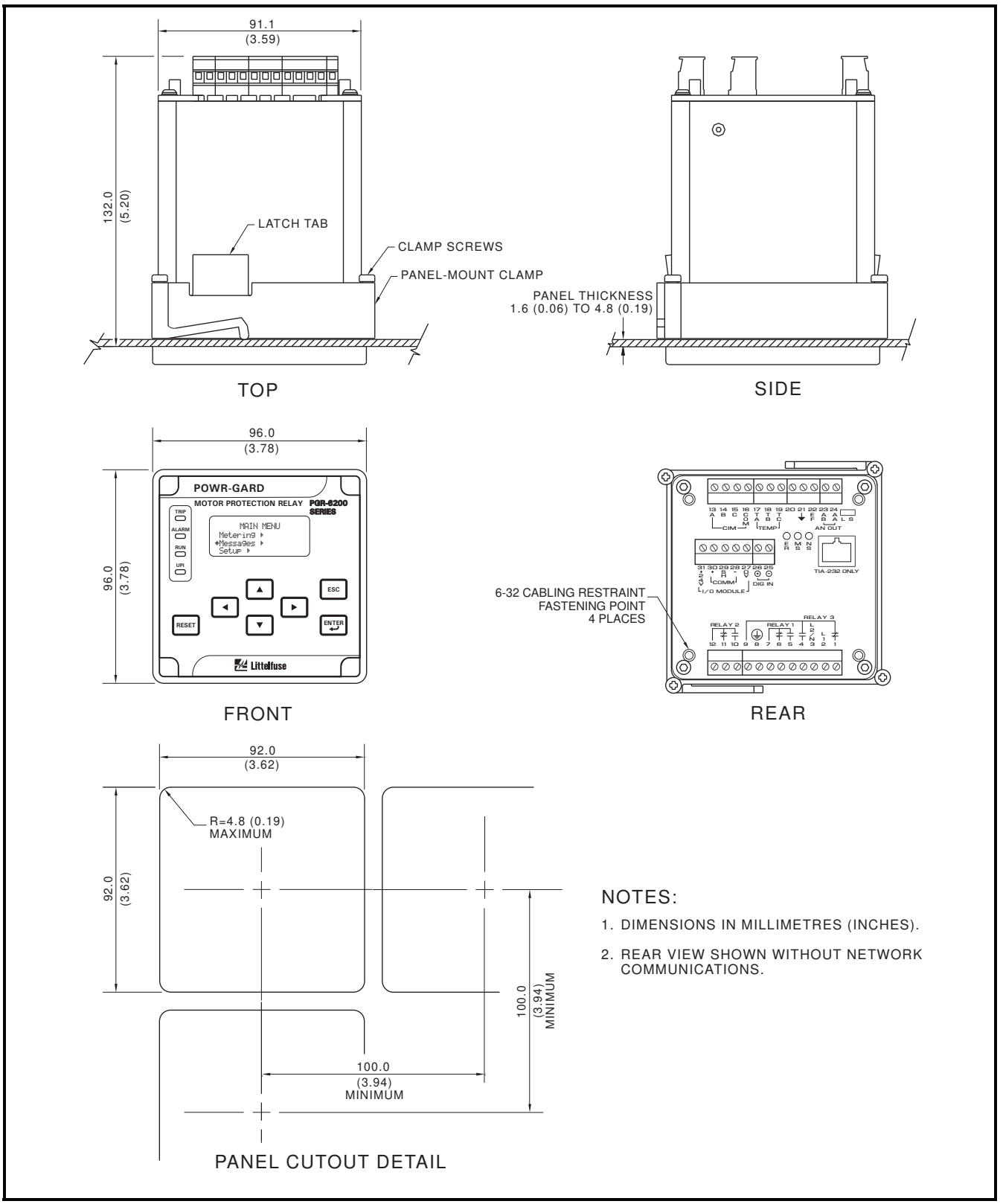
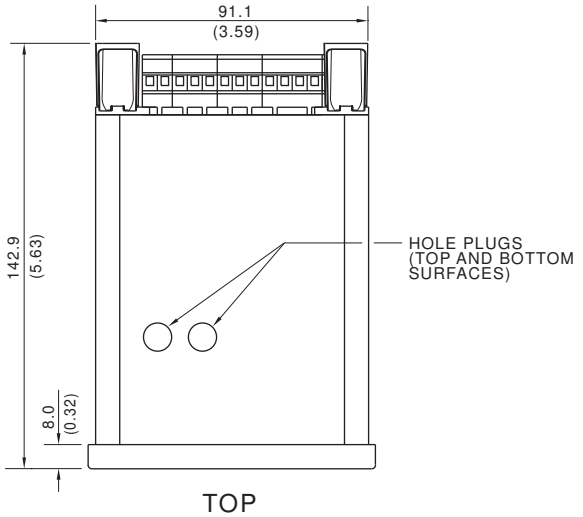


FIGURE 2.1 PGR-6200 Outline and Panel-Mounting Details.



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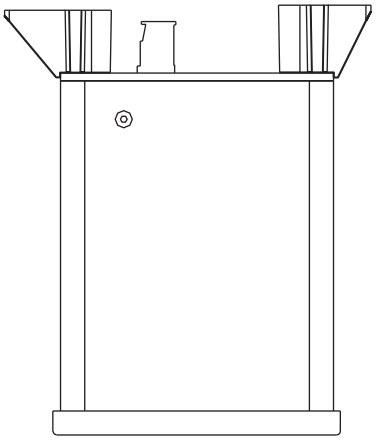

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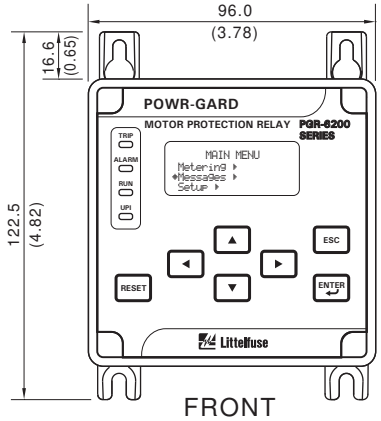

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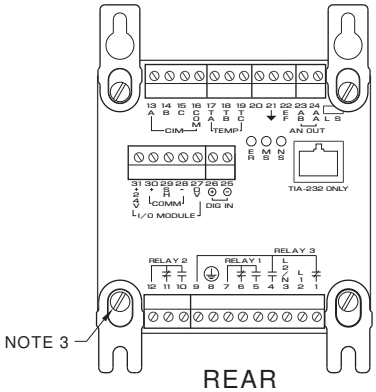

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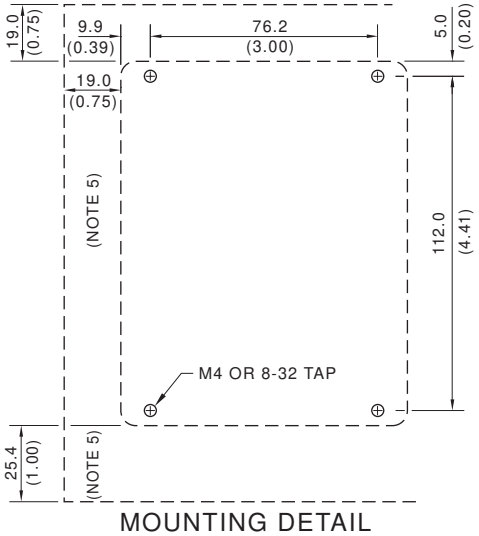
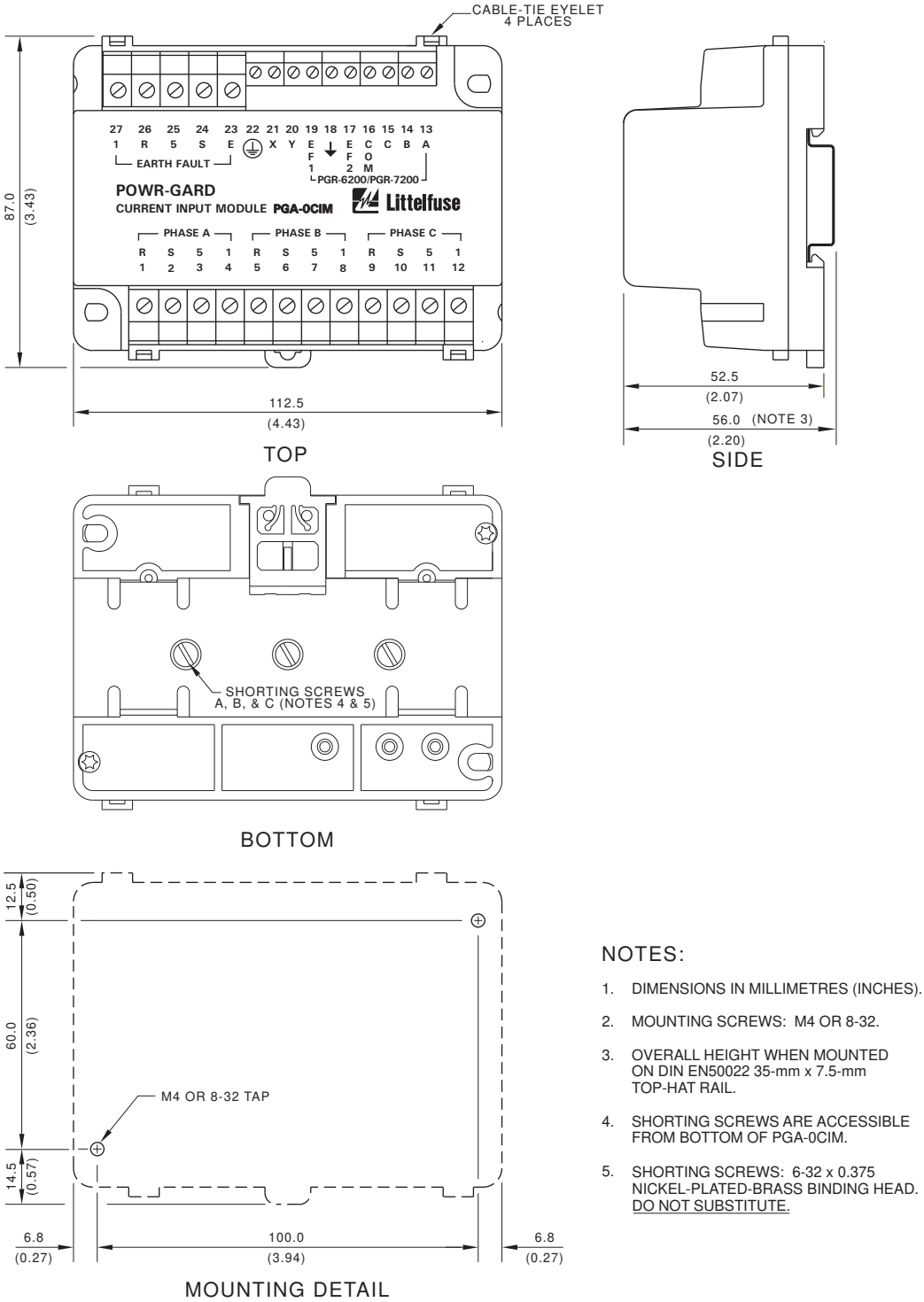


MOUNTING DETAIL

NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. REAR VIEW SHOWN WITHOUT NETWORK COMMUNICATIONS.
3. MOUNT SURFACE MOUNTING BRACKETS WITH 6-32 x 0.375 PAN-HEAD SCREWS AND LOCKWASHERS. (INCLUDED WITH SURFACE-MOUNTING KIT).
4. PGR-6200 MOUNTING SCREWS: M4 OR 8-32 PAN HEAD.
5. MINIMUM CLEARANCE TO ADJACENT OBJECTS.

FIGURE 2.2 PGR-6200 Outline and Surface-Mounting Details.



NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MOUNTING SCREWS: M4 OR 8-32.
3. OVERALL HEIGHT WHEN MOUNTED ON DIN EN50022 35-mm x 7.5-mm TOP-HAT RAIL.
4. SHORTING SCREWS ARE ACCESSIBLE FROM BOTTOM OF PGA-0CIM.
5. SHORTING SCREWS: 6-32 x 0.375 NICKEL-PLATED-BRASS BINDING HEAD. DO NOT SUBSTITUTE.

FIGURE 2.3 PGA-0CIM Outline and Mounting Details.

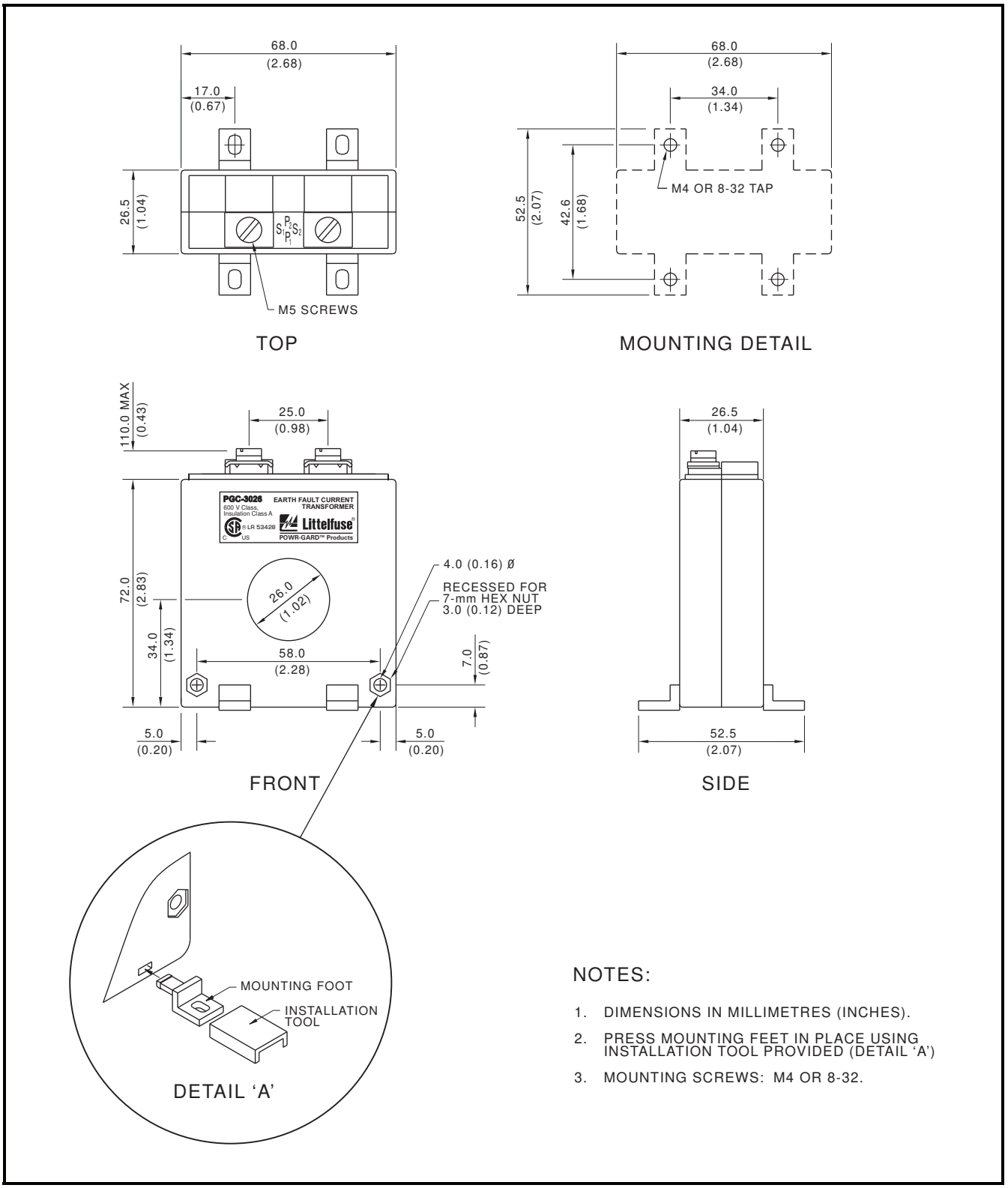
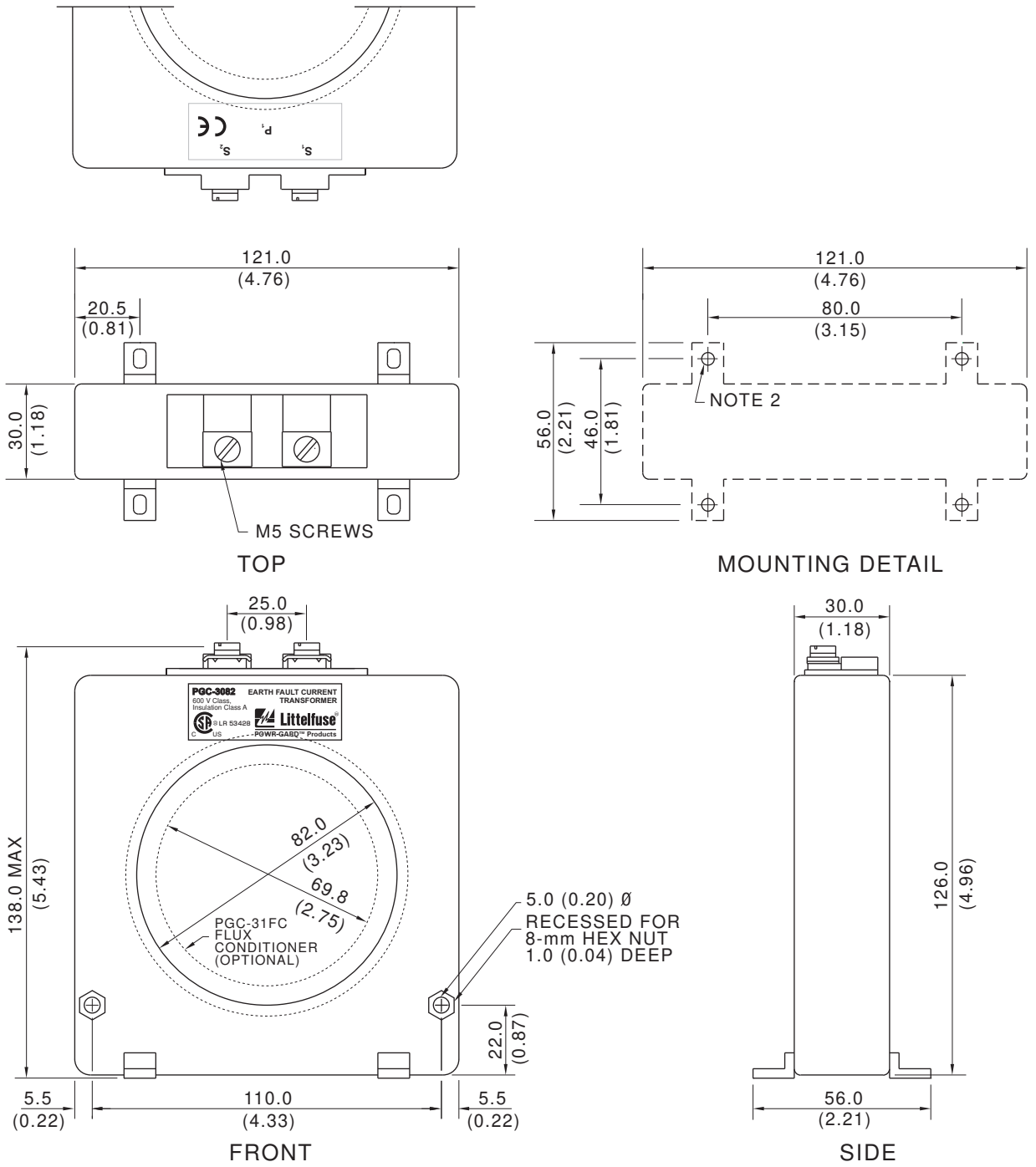


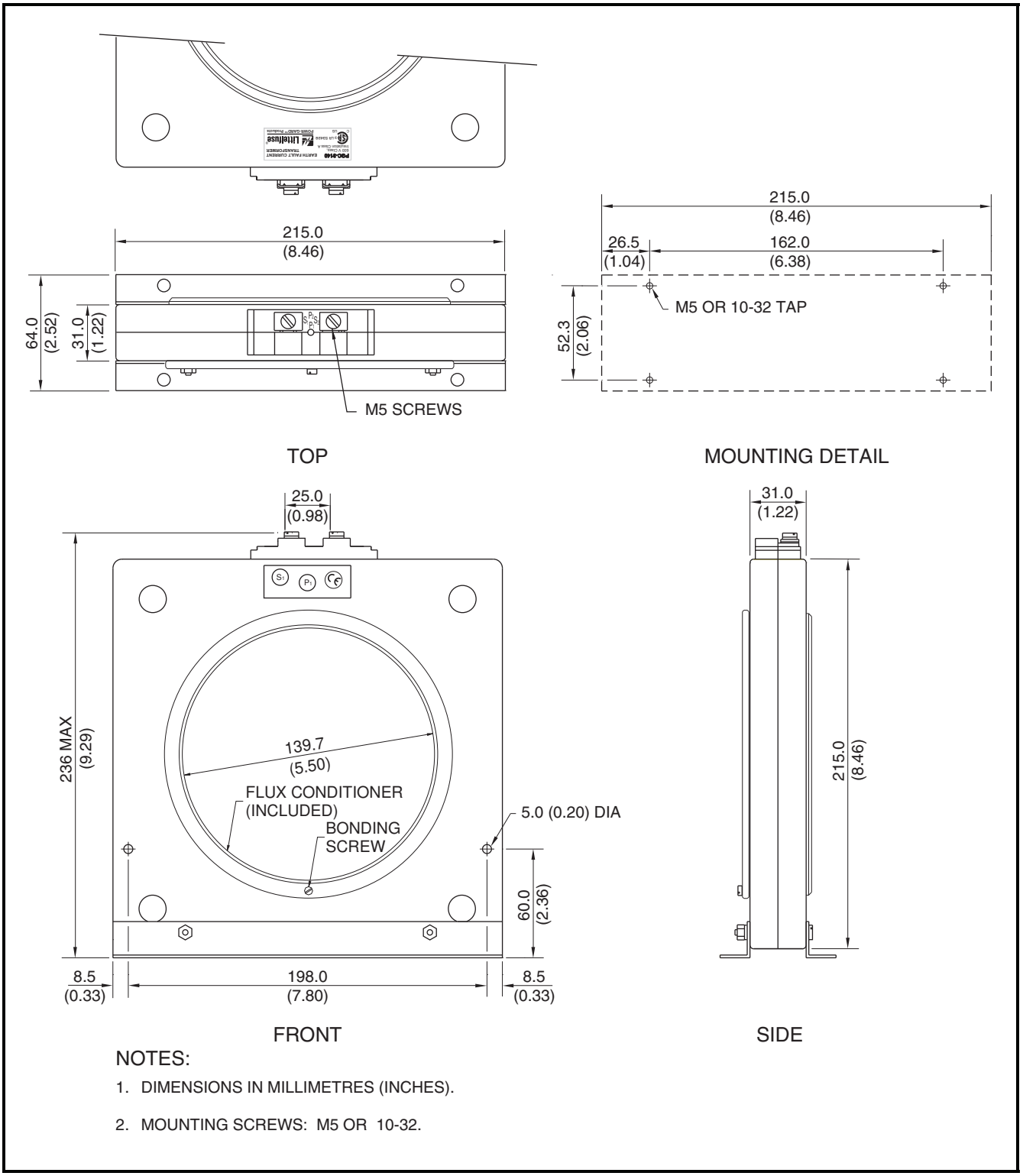
FIGURE 2.4 PGC-3026 Outline and Mounting Details.



NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. MOUNTING SCREWS: M4 OR 8-32.
3. PRESS MOUNTING FEET IN PLACE USING INSTALLATION TOOL PROVIDED.

FIGURE 2.5 PGC-3082 Outline and Mounting Details.



NOTES:

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

FIGURE 2.6 PGC-3140 Outline and Mounting Details.

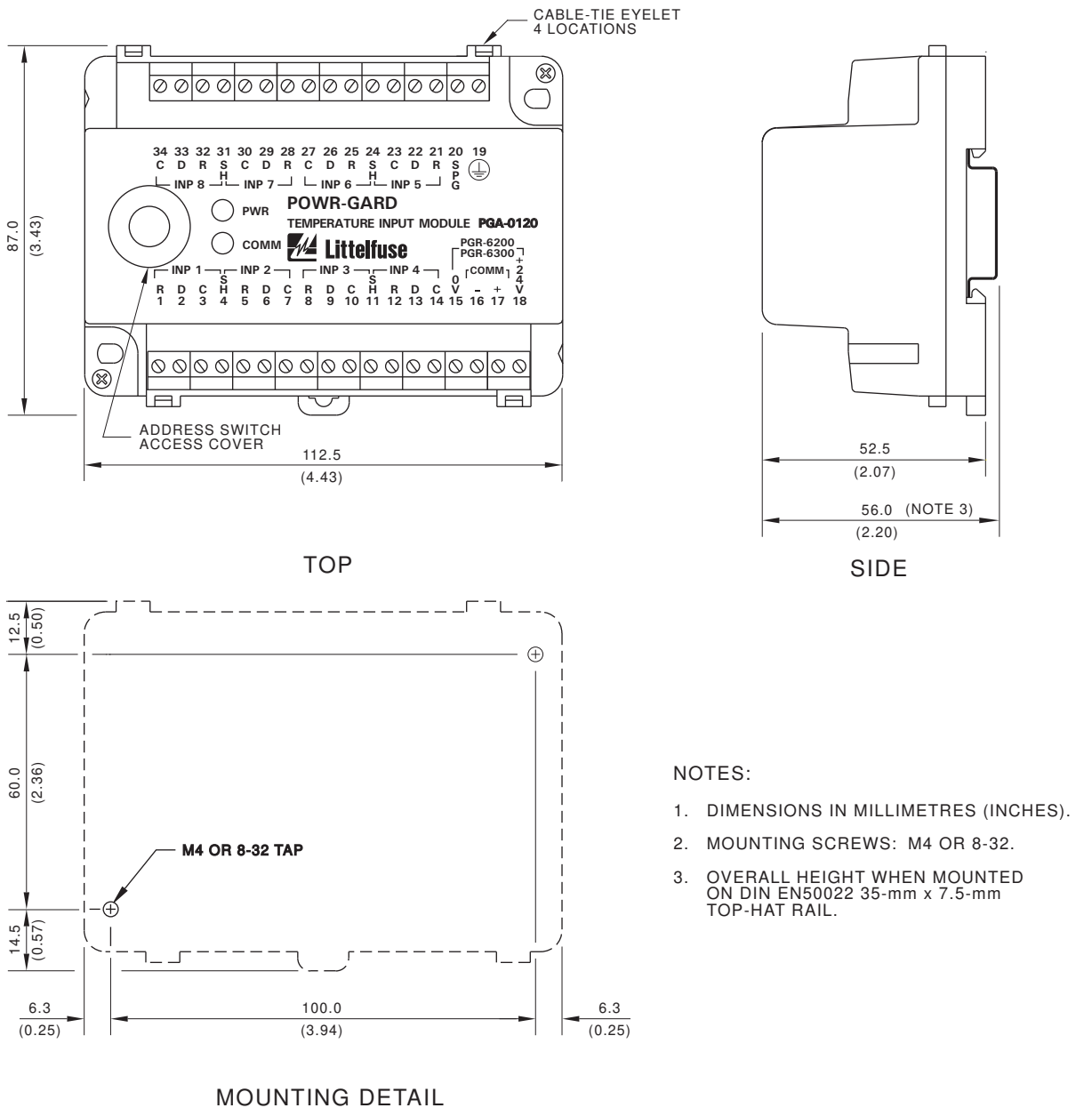
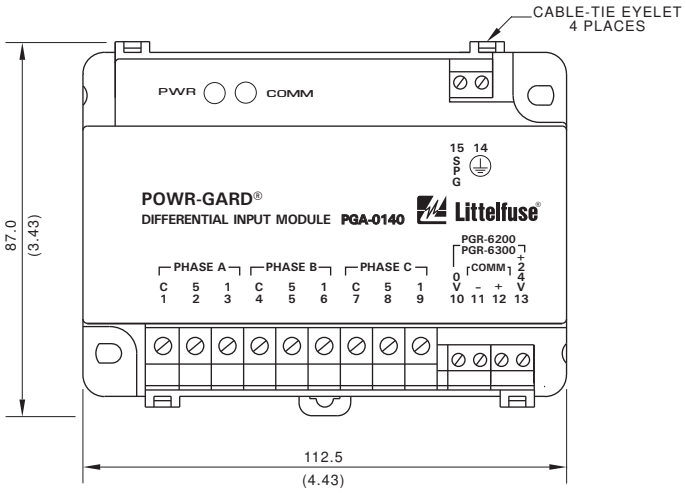


FIGURE 2.7 PGA-0120 Outline and Mounting Details.



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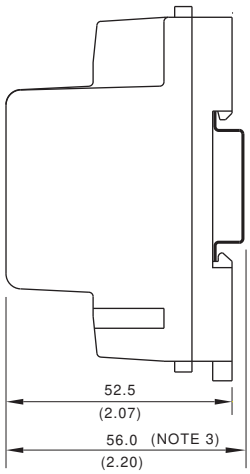

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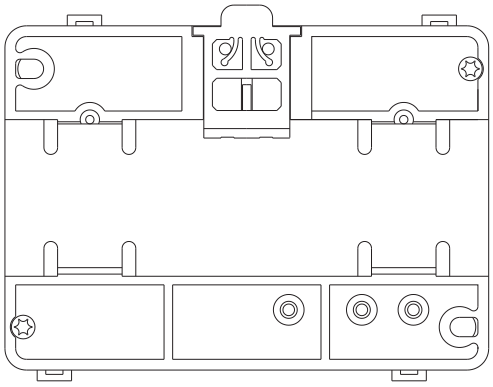
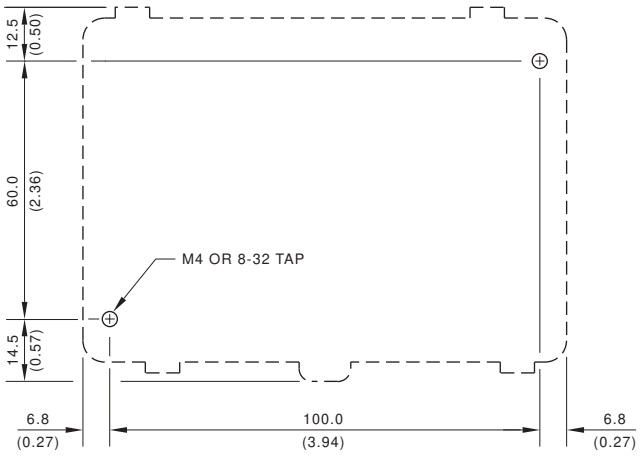


BOTTOM



MOUNTING DETAIL

NOTES:

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

FIGURE 2.8 PGA-0140 Outline and Mounting Details.

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3. SYSTEM WIRING

3.1 General

A typical connection diagram for a PGR-6200 and PGA-0CIM is shown in Fig. 3.1. See Sections 3.2.3 and 3.2.4 for PGA-0120 and PGA-0140 connections.

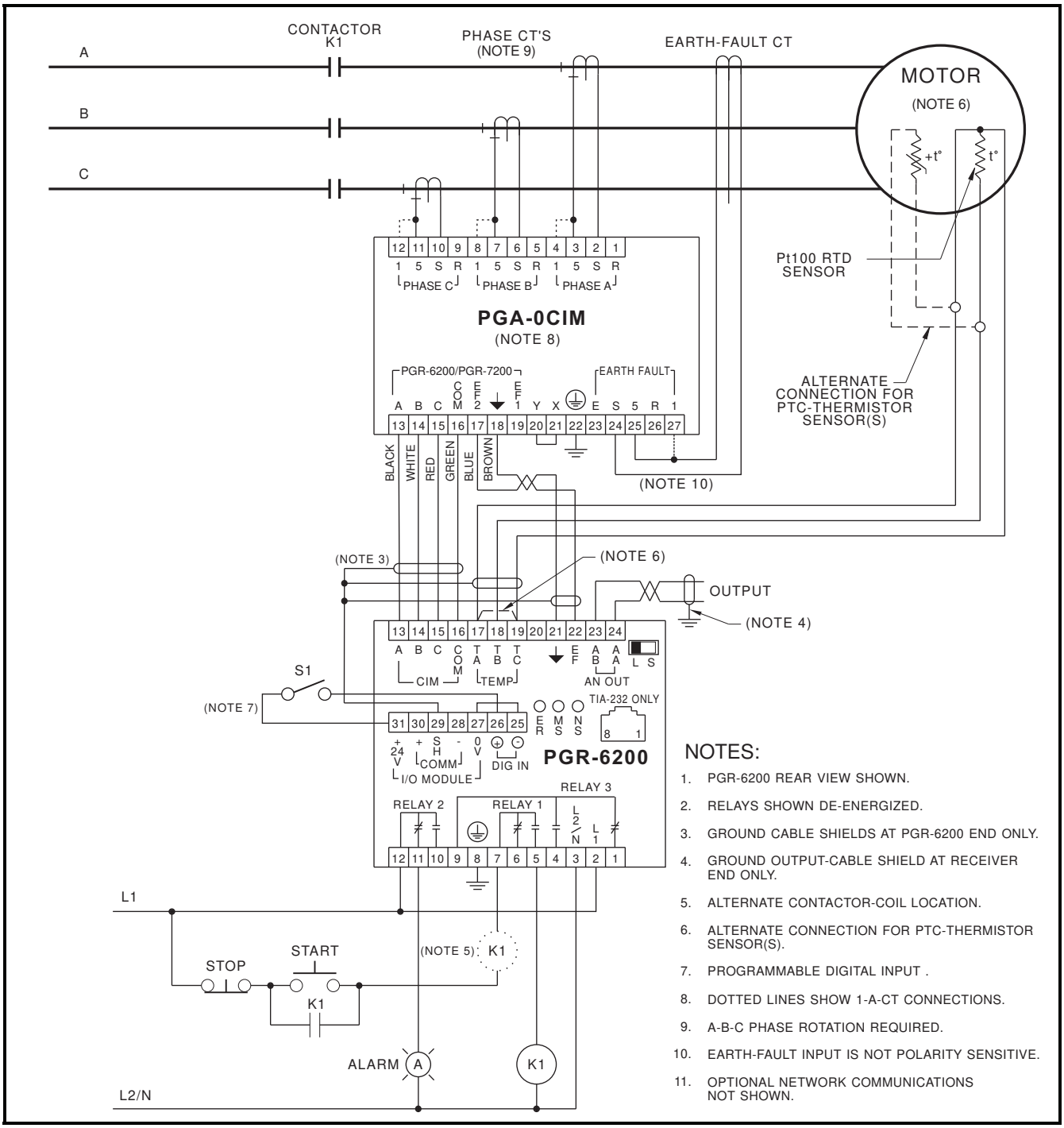


FIGURE 3.1 Typical PGR-6200 Connection Diagram.

3.2 Wiring Connections

3.2.1 PGR-6200 Connections

The PGR-6200 wire-clamping terminal blocks accept 24 to 12 AWG (0.2 to 2.5 mm^2) conductors. These terminal blocks unplug to allow the PGR-6200 to be easily removed.

3.2.1.1 Supply Voltage

Derive supply voltage from the line side of the motor controller or from an independent source. Connect supply voltage to terminals 2 and 3 (L1 and L2/N) as shown in Fig. 3.1. In 120-Vac systems, L2/N is designated as the neutral conductor. For direct-current power supplies, use L1 for the positive terminal and L2/N as the negative terminal. Ground terminal 8 (⏚).

3.2.1.2 CIM Input

Connect the PGR-6200 to the PGA-0CIM as shown in Figs. 3.6 and 3.7 using the cable provided.

3.2.1.3 Digital Input

A 24-Vdc digital input is provided on terminals 25 and 26. This input is polarity sensitive. For a logical 1, terminal 26 must be positive with respect to terminal 25. See Section 4.2.5.

The current-limited 24-Vdc source (terminals 27 & 31) can be used to power the digital input.

3.2.1.4 Analog Output

The analog output is switch selectable as self powered or loop powered.

For the self-powered connection, set the L/S switch to the S position. The self-powered connection is shown in Fig. 3.2 (a). The analog output is referenced to the I/O module supply, terminal 27.

For the loop-powered connection, set the L/S switch to the L position. The loop-powered connection is shown in Fig. 3.2 (b). In loop-powered operation, the analog-output is isolated from all other PGR-6200 terminals.

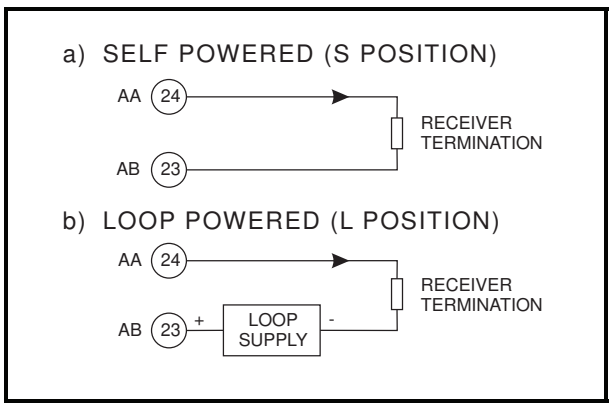


FIGURE 3.2 Analog-Output Connections.

3.2.1.5 PTC or RTD Input (Local)

The temperature-sensor input on the PGR-6200 can be configured for either PTC or Pt100 RTD operation as shown in Fig. 3.3.

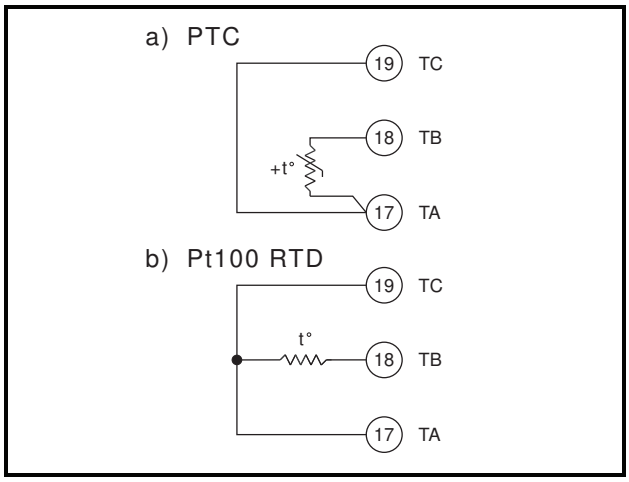


FIGURE 3.3 Local Temperature-Sensor Connections.

3.2.1.6 I/O Module Interface

The I/O module interface supplies power and communications to optional I/O modules such as the PGA-0120 and PGA-0140.

I/O module communication is based on the two-wire multi-drop TIA-485 standard but uses a proprietary protocol. Overall line length must not exceed 1.2 km (4,000'). For line lengths exceeding 10 m (33'), 150-Ω terminations are required at the cable ends. I/O modules are supplied with 4 m (13') of interconnection cable. See Fig. 3.4.

Note: I/O communication is shared with the display. Incorrect wiring can cause the display and keypad to freeze.

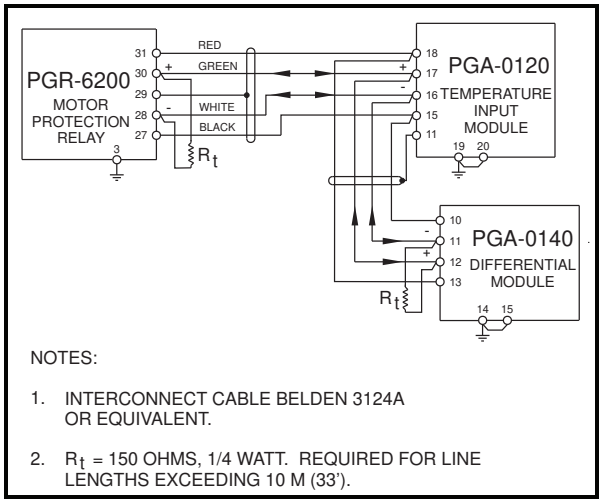


FIGURE 3.4 I/O Module Connection Diagram.

3.2.1.7 RS/EIA/TIA-232 Communications

An RJ-45 TIA-232 connector is provided on the rear panel of the PGR-6200. This port uses Modbus® RTU protocol to communicate with PGW-COMM PC-interface software. For Modbus® RTU protocol, see Appendix D. The slave ID and communication baud rate are set in the *Setup* | *Hardware* | *Local Comms* menu.

Table 3.1 shows the pinout for the optional PGA-0420 adapter for operation with PGW-COMM.

See Fig 3.1 for RJ-45 pinout.

For a USB connection, use an PGA-0440 adapter.

TABLE 3.1 PGA-0420 Adapter Pinout

SYMBOLIC NAME	RJ-45	DB9
RI/DSR	1	9
CD	2	1
DTR	3	4
SG	4	5
RD	5	2
TD	6	3
CTS	7	8
RTS	8	7

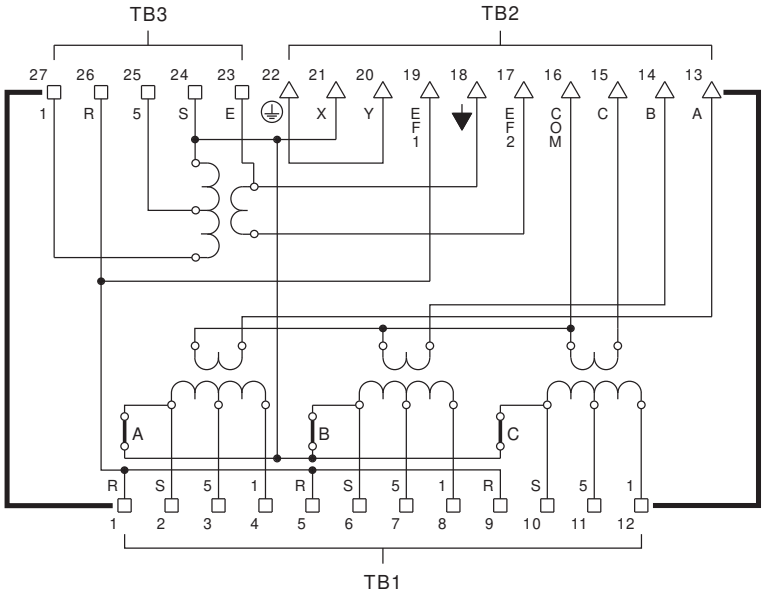
3.2.2 PGA-0CIM Connections

The PGA-0CIM CT-input terminal blocks accept 22 to 10 AWG (0.3 to 4.0 mm^2) conductors. The remaining PGA-0CIM clamping blocks accept 24 to 12 AWG (0.2 to 2.5 mm^2) conductors.

The PGA-0CIM contains four signal-conditioning interface transformers which are interconnected as shown in Fig. 3.5. These transformers isolate the PGR-6200 from the phase and earth-fault CT's. The PGA-0CIM eliminates the need for CT shorting contacts when the PGR-6200 is disconnected. Phase-CT and earth-fault-CT secondaries can be simultaneously grounded through terminal 22 and a jumper to terminal 20. For applications where the CT secondaries must be grounded at another location, the CT secondaries can be isolated by removing shorting screws A, B, and C through holes in the bottom of the PGA-0CIM. See Figs. 2.3 and 3.5.

Note: A-B-C phase sequence and polarity must be observed when connecting phase CT's. See Section 4.2.1.

Connect the PGA-0CIM to the PGR-6200 as shown in Figs. 3.6 and 3.7 using the cable provided.



NOTES:

1. REMOVE SHORTING SCREWS A, B, AND C TO ISOLATE PHASE-CT AND EARTH-FAULT-CT SECONDARIES FOR IN-LINE APPLICATIONS.
2. SHORTING SCREWS A, B, AND C: 6-32 x 0.375 NICKEL-PLATED-BRASS BINDING HEAD. **DO NOT SUBSTITUTE**
3. SHORTING SCREWS A, B, AND C MUST NOT BE REMOVED FOR RESIDUAL OR TWO-CT CONNECTIONS.
4. EACH TERMINAL ON TB1 AND TB3 WILL ACCEPT ONE NO. 10 AWG CONDUCTOR

FIGURE 3.5 PGA-0CIM Schematic.

3.2.2.1 Standard

Standard connections with earth-fault CTs are shown in Fig. 3.6. Dotted lines indicate 1-A-CT connections. Use shielded cable for PGC-3000-series current-transformer connections. Ensure only current-carrying phase conductors pass through the earth-fault-CT window and that ground conductors do not.

3.2.2.2 Residual Earth-Fault

The wired residual earth-fault connection is shown in Fig. 3.7 (a). Dotted lines indicate 1-A-CT connections. Use three identical CT's for this connection.

The PGR-6200 also calculates residual current. See Section 4.2.2.

3.2.2.3 Two-CT

The two-CT connection is shown in Figs. 3.7 (b) and 3.7 (c). Dotted lines indicate 1-A-CT connections. Since this connection derives the current in the unmonitored phase, it should be used only in retrofit applications where it is not possible to install a third CT.

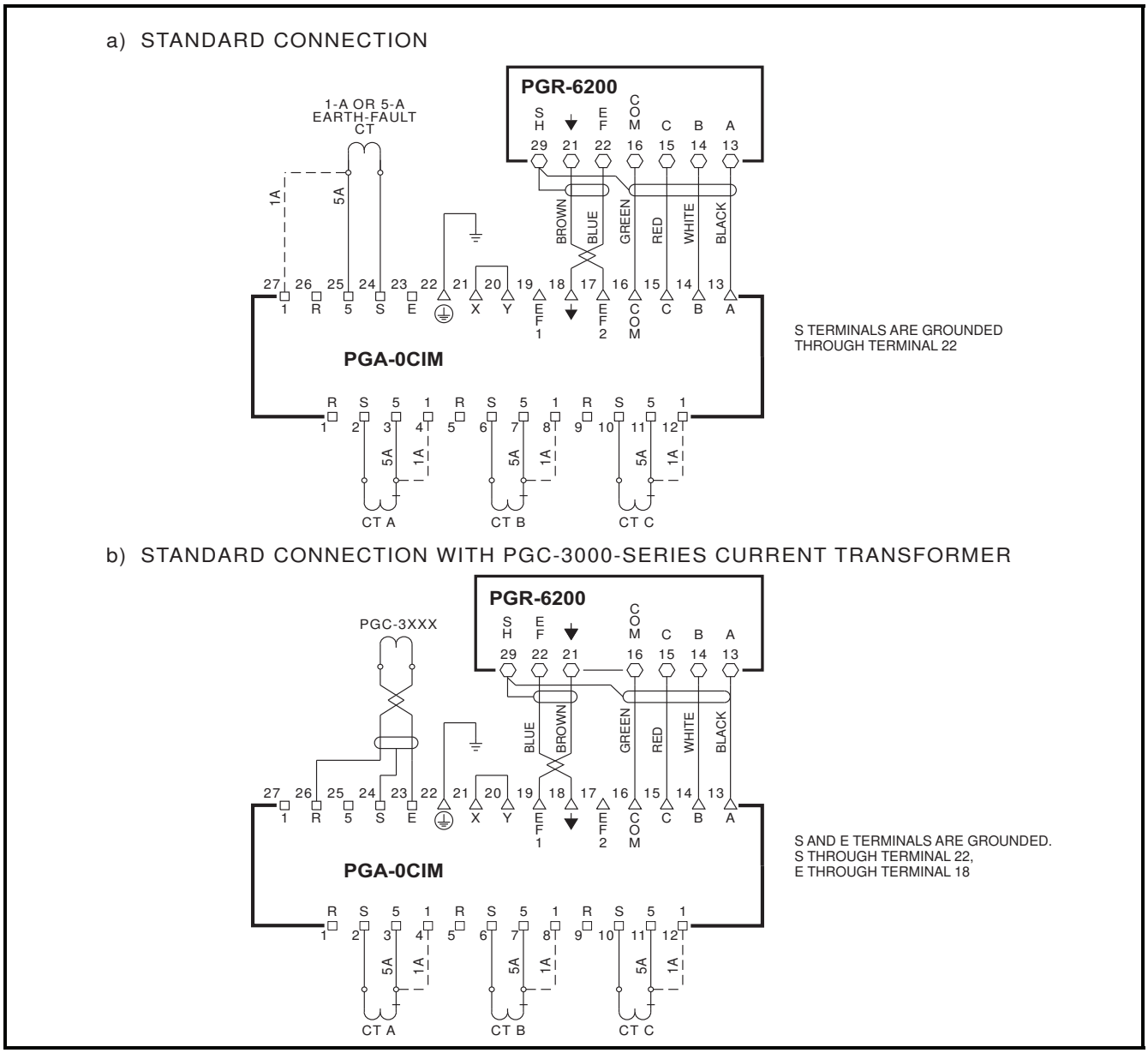
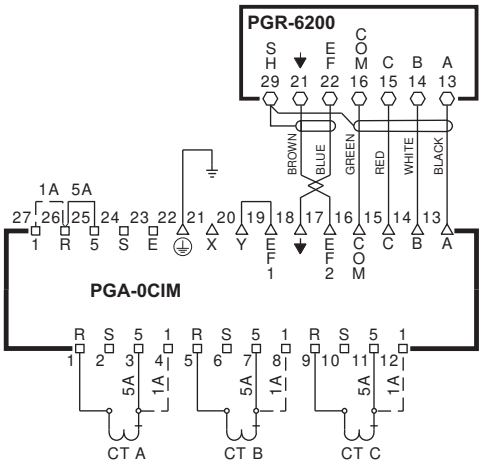


FIGURE 3.6 PGA-0CIM Standard Connections.

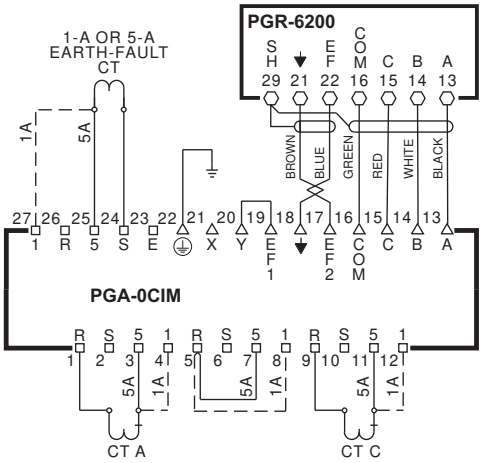
a) RESIDUAL CONNECTION



SHORTING SCREWS A, B, & C MUST NOT BE REMOVED.

R TERMINALS ARE GROUNDED THROUGH TERMINAL 22.

b) TWO-CT CONNECTION

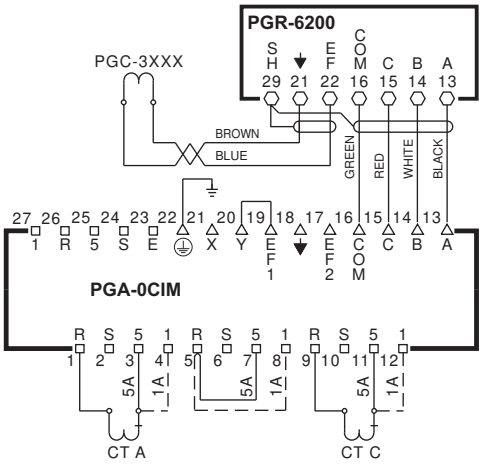


SHORTING SCREWS A, B, & C MUST NOT BE REMOVED.

R TERMINALS ARE GROUNDED THROUGH TERMINAL 22.

EARTH-FAULT CT MUST NOT BE GROUNDED.

c) TWO-CT CONNECTION WITH PGC-3000-SERIES CURRENT TRANSFORMER



SHORTING SCREWS A, B, & C MUST NOT BE REMOVED.

R TERMINALS ARE GROUNDED THROUGH TERMINAL 22.

FIGURE 3.7 Other PGA-0CIM Connections.

3.2.3 PGA-0120 Connections and Address Selection

Connect the PGA-0120 Temperature Input Module to the PGR-6200 using the four-conductor shielded cable (Belden 3124A or equivalent) supplied with the PGA-0120 as shown in Fig. 3.8. The PGR-6200 24-Vdc supply can power up to three PGA-0120 modules.

Connect RTD's to the PGA-0120 as shown in Fig 3.8. When the RTD module is installed in a motor junction box, RTD-lead shielding is not required. PGA-0120 terminal blocks accept 24 to 12 AWG (0.2 to 2.5 mm^2) conductors.

Connect surge-protection (SPG) terminal 20 to terminal 19 (⏚) and ground terminal 19.

The PGA-0120 has two switches to select its network address. See Fig. 3.8. Up to three PGA-0120 modules can be connected to the I/O MODULE bus, and each RTD-module address must be unique. If one module is used, address 1 must be used. If two RTD Modules are used, addresses 1 and 2 must be used. If three RTD Modules are used, addresses 1, 2, and 3 must be used.

Table 3.2 shows the address selection format.

TABLE 3.2 PGA-0120 Address Selection

ADDRESS	SWITCH 1	SWITCH 2
0 (Off line)	Open	Open
1 (First RTD module)	Closed	Open
2 (Second RTD module)	Open	Closed
3 (Third RTD module)	Closed	Closed

3.2.4 PGA-0140 Connections

Connect the PGA-0140 Differential Input Module to the PGR-6200 using four-conductor shielded cable (Belden 3124A or equivalent) as shown in Fig. 3.4.

Connect the surge-protection (SPG) terminal 15 to terminal 14 (⏚), and ground terminal 14.

The PGA-0140 CT-input terminal blocks accept 22 to 10 AWG (0.3 to 4.0 mm^2) conductors. The remaining PGA-0140 clamping blocks accept 24 to 12 AWG (0.2 to 2.5 mm^2) conductors.

3.2.4.1 Core Balance

The core-balance connection uses three differential CT's as shown in Fig. 3.9. To minimize power-cable and CT secondary lead lengths, both the differential CT's and the PGA-0140 can be located near the motor. The primary rating of the differential CT does not have to match the phase-CT primary rating and is usually selected with a lower ratio resulting in more sensitive differential protection. The core-balance method avoids CT-matching issues and is the preferred connection.

3.2.4.2 PGR-6200 Summation

The PGR-6200-summation connection uses three phase CT's and three differential CT's as shown in Fig. 3.10. Both CT-ratio and CT-saturation characteristics must be matched to avoid differential currents under motor starting and running conditions. The PGA-0140 module should be located near the PGA-0CIM to minimize CT-wire length. It is preferred to use three dedicated phase CT's and three core-balance differential CT's as described in Section 3.2.4.1.

For the delta connection, the *FLA Rating* is set equal to the motor's full-load current multiplied by $\sqrt{3}$.

3.2.4.3 DIF Summation

The DIF-summation connection uses six differential CT's as shown in Fig. 3.11. Both CT-ratio and CT-saturation characteristics must be matched to avoid differential currents under motor starting and running conditions. It is preferred to use three core-balance CT's as described in Section 3.2.4.1. This six-CT connection allows the CT's and PGA-0140 to be placed near the motor to minimize power-cable and CT-lead length.

3.2.5 Cable Restraint

All conductors should be restrained within 100 mm (4") of the terminal blocks. Four cabling-restraint points are provided on the PGR-6200 rear panel. Secure cables to the PGA-0CIM, PGA-0120 and PGA-0140 using the cable-tie eyelets and the cable ties provided. See Figs. 2.1, 2.3, 2.7 and 2.8.

3.2.6 Dielectric-Strength Testing

Dielectric-strength testing can be performed only on CT inputs, supply-voltage input, and output relays. Unplug all other I/O and remove the PGA-0CIM ⏚ connection (terminal 22) during dielectric-strength testing.

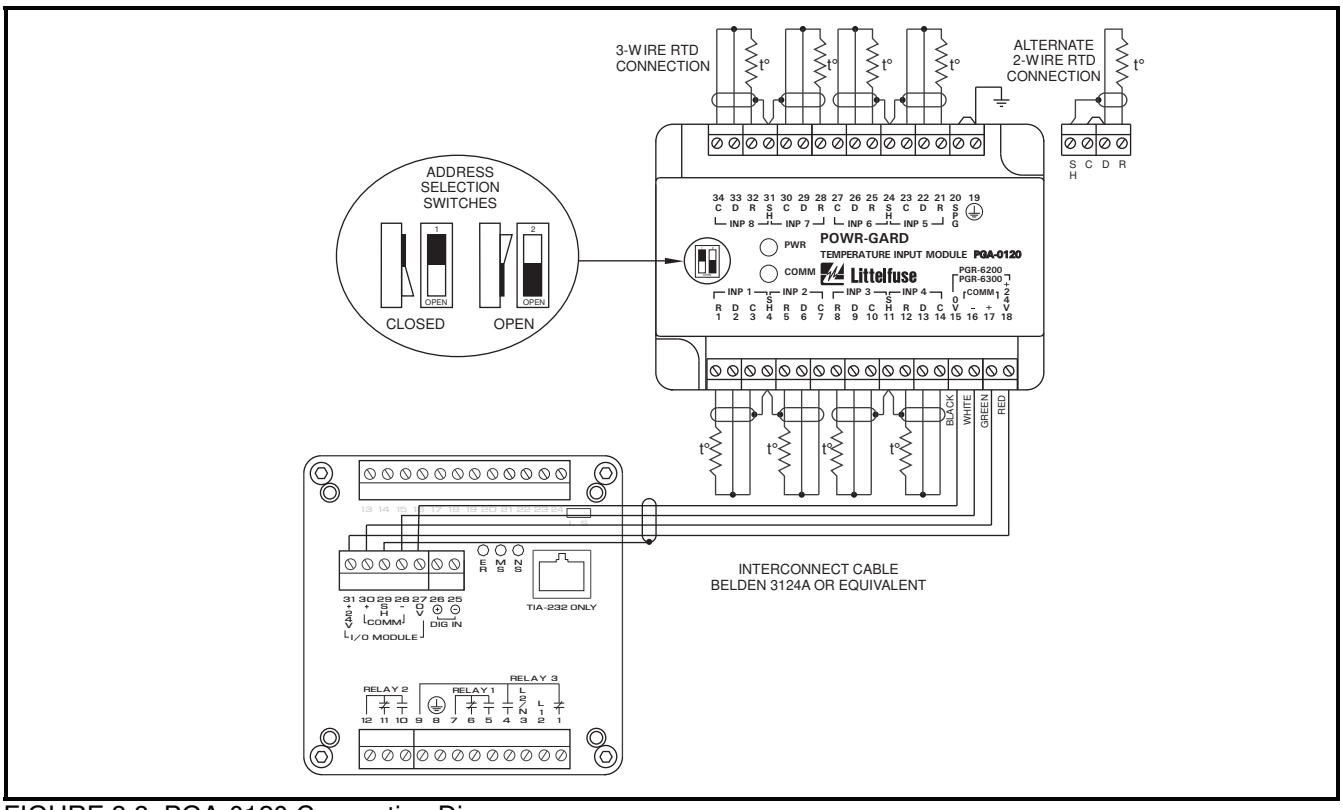


FIGURE 3.8 PGA-0120 Connection Diagram.

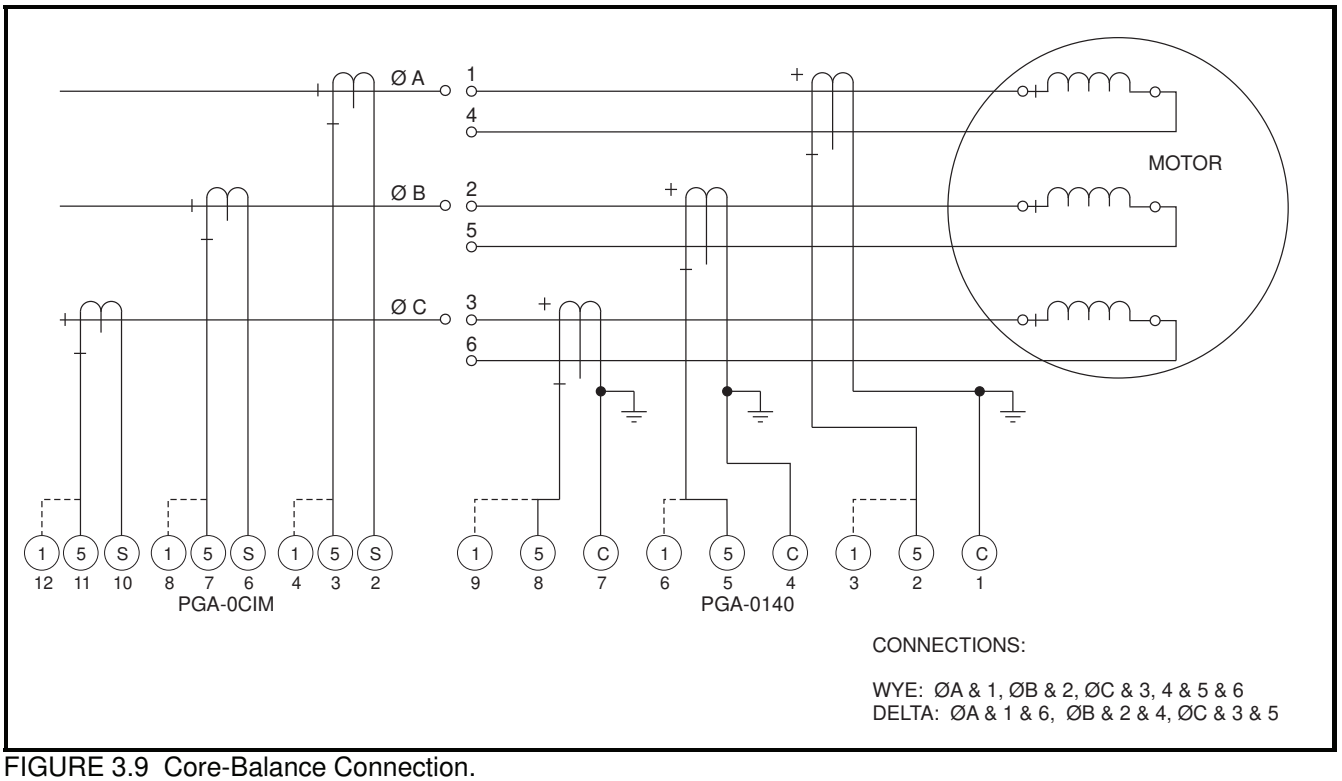


FIGURE 3.9 Core-Balance Connection.