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POWR-GARD®
Motor Protection
PGR-6300 SERIES
Motor Protection System

PGR-6300 MANUAL
MOTOR PROTECTION SYSTEM

JULY 16, 2009

Revision 4

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Publication: PGR-6300-M
Document: P95-M320-00000
Printed in Canada.

Factory default password is 1111

New Password

See Section 4.3.6.

Motor Identification

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1. INTRODUCTION

1.1 General

The POWR-GARD[®] PGR-6300 Motor Protection System is a modular system with integrated protection, control, metering, and data-logging functions. The Control Unit (CTU) is the core module. It can operate as a stand-alone unit or with the Operator Interface (OPI), Temperature Input Modules (PGA-0120), and Differential Current Module (PGA-0140). The CTU can be programmed using the OPI or the communications network. Programmable inputs and outputs provide a flexible hardware platform and custom software can be easily loaded from a PC to the CTU's flash memory. The PGR-6300 block diagram is shown in Fig. 1.1.

1.2 PGR-6300 Features

1.2.1 Protection

Overload (49, 51)
Overcurrent (50, 51)
Earth fault (50G/N, 51G/N)
Unbalance (voltage and current) (46, 47)
Phase loss (voltage and current) (46, 47)
Phase reverse (voltage and current) (46, 47)
Jam
Undercurrent (37)
Failure to accelerate
Underspeed (14)
Overvoltage (59)
Undervoltage (27)
Power factor (55)
Overfrequency (81)
Underfrequency (81)
PTC overtemperature (49)
RTD temperature (38, 49)
Starts per Hour (66)
Differential (87)

1.2.2 Control—Starting Methods ⁽¹⁾

Non-reversing
Reversing
Soft start
Soft start with bypass
Adjustable-speed drive
Two speed
Wye-delta (open or closed transition)
Reactor (open or closed transition)
Resistor (open or closed transition)
Autotransformer
Part winding
Slip ring
Two winding
Double delta

⁽¹⁾ Only three CT's required for all starting methods.

1.2.3 Metering

- Line currents
- Current unbalance
- Positive-sequence current
- Negative-sequence current
- Earth-leakage current
- Differential currents
- Line-to-line voltages
- Line frequency
- Voltage unbalance
- Positive-sequence voltage
- Negative-sequence voltage
- Power
 - Apparent, Reactive, Real, and Power factor
- Energy
 - kWh, kVAh, and kVARh
- Used thermal capacity
- Thermal trend
- Motor speed
- RTD temperatures
- Analog input and output

1.2.4 Data Logging

- Sixty-four records
 - Date and time of event
 - Event type
 - Line currents
 - Current unbalance
 - Earth-leakage current
 - Differential currents
 - Line-to-line voltages
 - Voltage unbalance
 - Thermal capacity
 - Thermal capacity used during starts
 - Start time
 - Analog-input value
 - RTD temperatures
- Trip counters
- Running hours
- Frequency
- Power (P, S, Q, PF)

1.2.5 Inputs and Outputs

- Three ac-current inputs
- Three ac-voltage inputs
- Earth-leakage-current input
- Seven programmable digital (ac/dc) inputs
- 24-Vdc source for digital inputs
- Tachometer (high-speed pulse) input
- 4–20-mA analog input and output
- PTC thermistor temperature input
- Up to twenty-four RTD inputs
- Five programmable output relays
- Network communications
- IRIG-B time-code input



1.2.6 OPI Operator Interface

- 4 x 20 vacuum-fluorescent display
- Starter control keys
- Display-control and programming keys
- LED status indication
- Remote operation up to 1.2 km (4,000')
- Powered by PGR-6300 Control Unit

1.2.7 PGA-0120 Temperature Input Module

- Eight 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-6300 Control Unit

1.2.8 PGA-0140 Differential Current Module

- 3-CT core balance connection
- 6-CT summation connection
- Remote operation up to 1.2 km (4,000')
- Powered by PGR-6300 Control Unit

1.2.9 Communications Interface

The standard network communication interface is an RS-485 port with Modbus® RTU and A-B® DF1 protocol support. In addition to the standard interface, network communication options include DeviceNet™, Profibus®, Modbus® TCP, and Ethernet/IP.

1.3 Ordering Information

See Fig. 1.2 for CTU, OPI, PGA-0120, and PGA-0140 model numbers.

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-A-primary rating, 139-mm (5.5") window
Other Earth-Fault CT's	Contact factory
Phase CT's	Contact factory

Accessories:

PGA-0400	Port-Powered Serial Converter
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

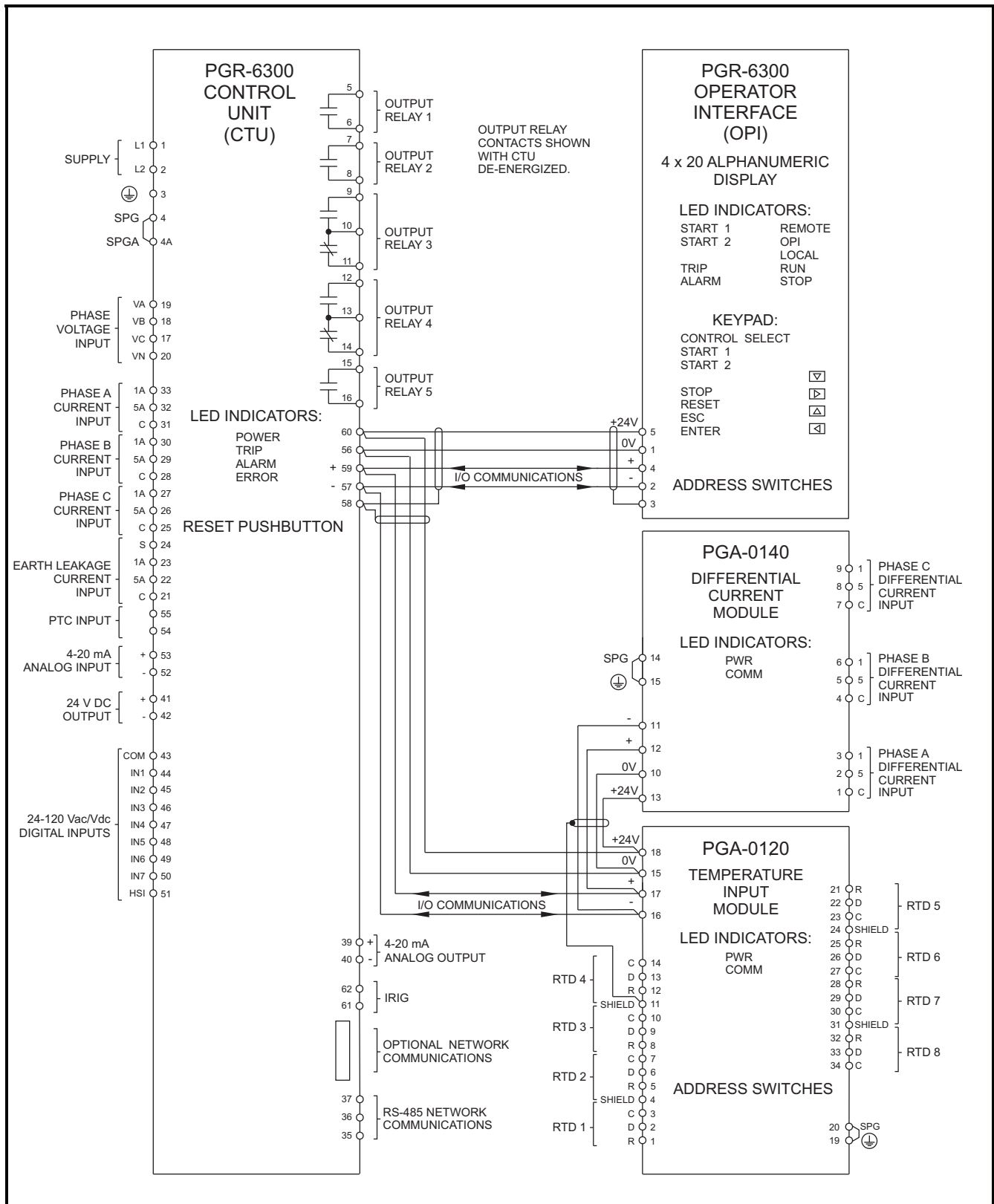


FIGURE 1.1 Motor Protection System Block Diagram.

2. INSTALLATION

2.1 General

A basic PGR-6300 Motor Protection System consists of a Control Unit (CTU) and three customer-supplied current transformers (CT's) for measuring phase current. For core-balance earth-fault detection, a 1-A, 5-A, PGC-3026, PGC-3082, or PGC-3140 CT is required. The residual phase-CT connection can also be used for earth-fault detection. Voltage inputs do not require potential transformers (PT's) for system voltages up to 600 Vac. For RTD-temperature measurement, up to three PGA-120 RTD modules can be connected to the CTU. For differential protection a PGA-0140 module can be connected to the CTU. The OPI provides an operator interface for the PGR-6300.

The PGR-6300 power-factor corrected 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 CTU Control Unit

The Control Unit is configured for surface mounting.

Outline and mounting details for the CTU are shown in Fig. 2.1.

2.3 OPI Operator Interface

Outline and mounting details for the OPI are shown in Fig. 2.2. It is certified for use in Class I, Zone 2 hazardous locations.

The Operator Interface is configured for panel mounting or it can be mounted on the CTU as shown in Fig. 2.3.

2.4 PGA-0120 Temperature Input Module

Outline and mounting details for the PGA-0120 are shown in Fig. 2.4. 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.

2.5 PGA-0140 Differential Current Module

Outline and mounting details for the PGA-0140 are shown in Fig 2.5. The PGA-0140 can be surface or DIN-rail mounted.

2.6 Sensitive Earth-Fault CT'S

Outline and mounting details for the PGC-3026, PGC-3082, and PGC-3140 are shown in Fig. 2.6, 2.7, and 2.8.

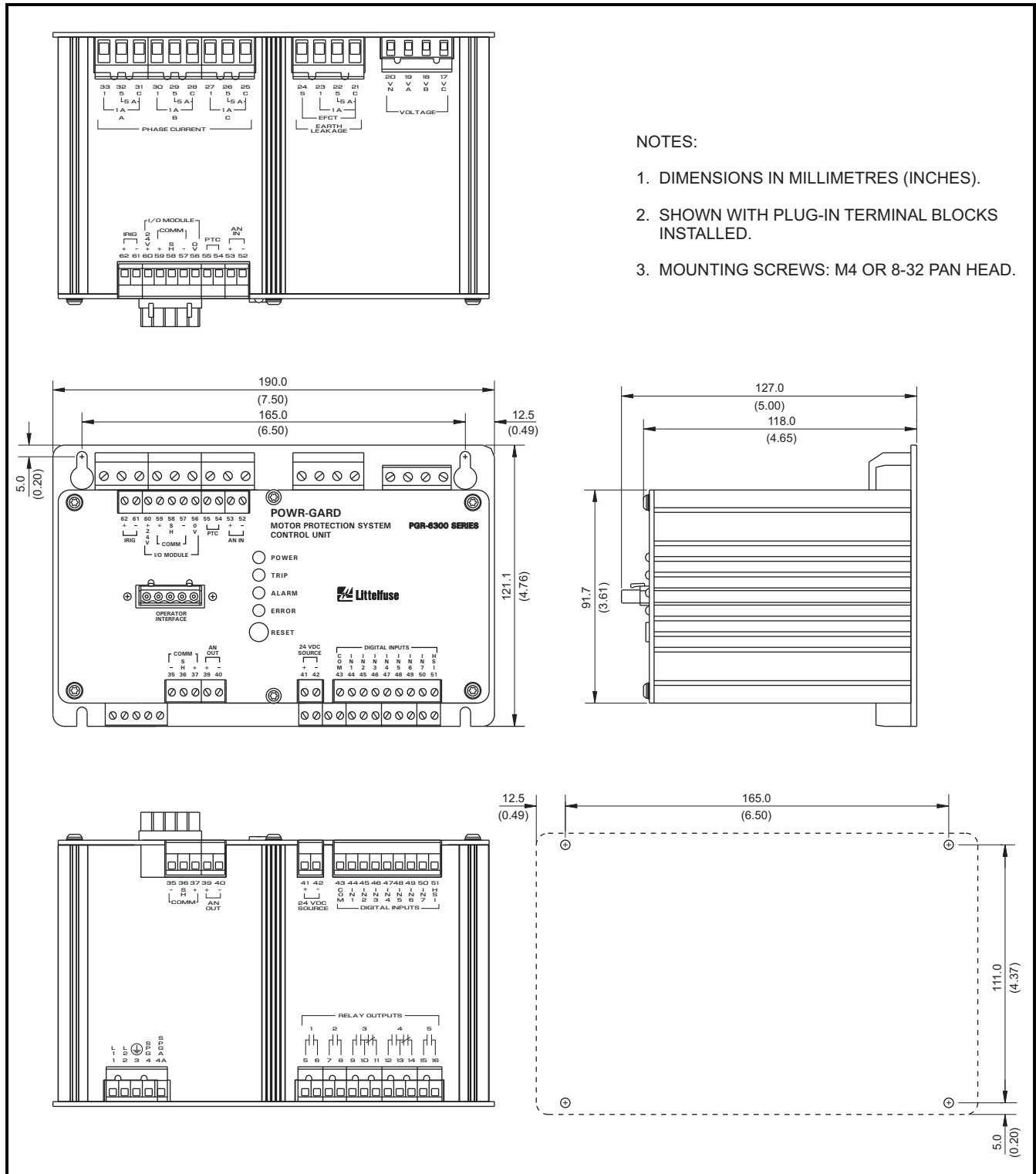


FIGURE 2.1 CTU Outline and Mounting Details.

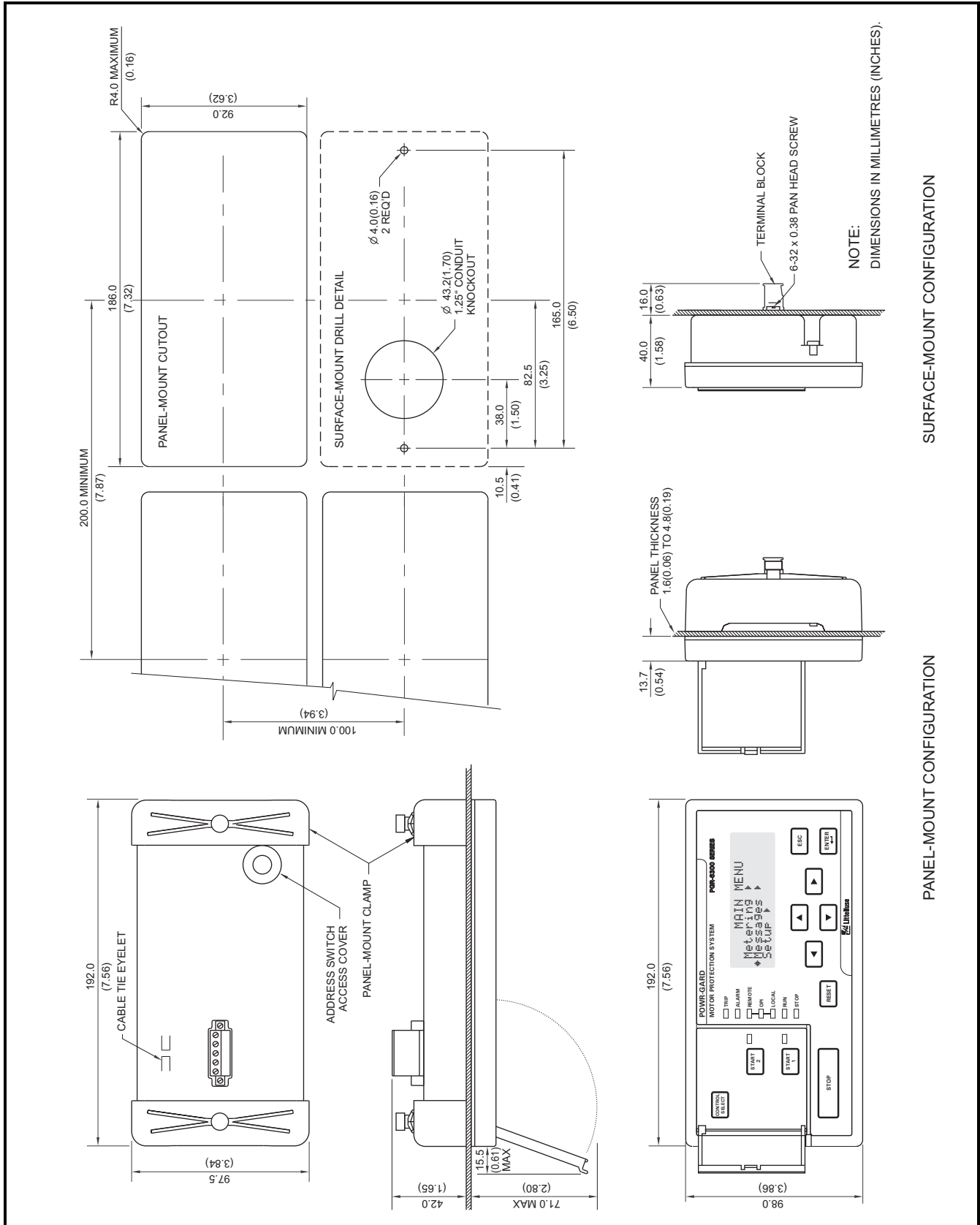


FIGURE 2.2 OPI Outline and Mounting Details.

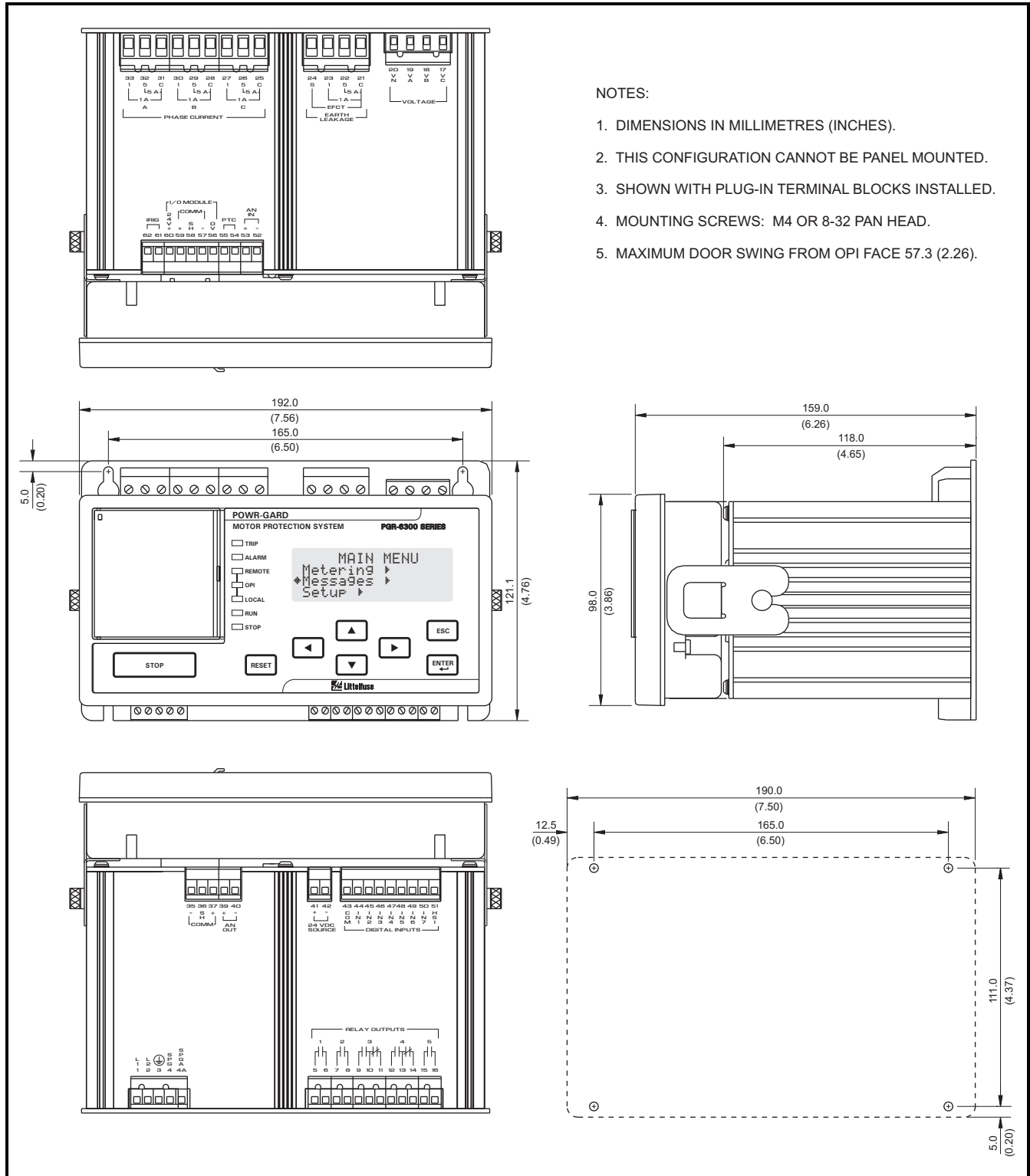


FIGURE 2.3 CTU with OPI Outline and Mounting Details.

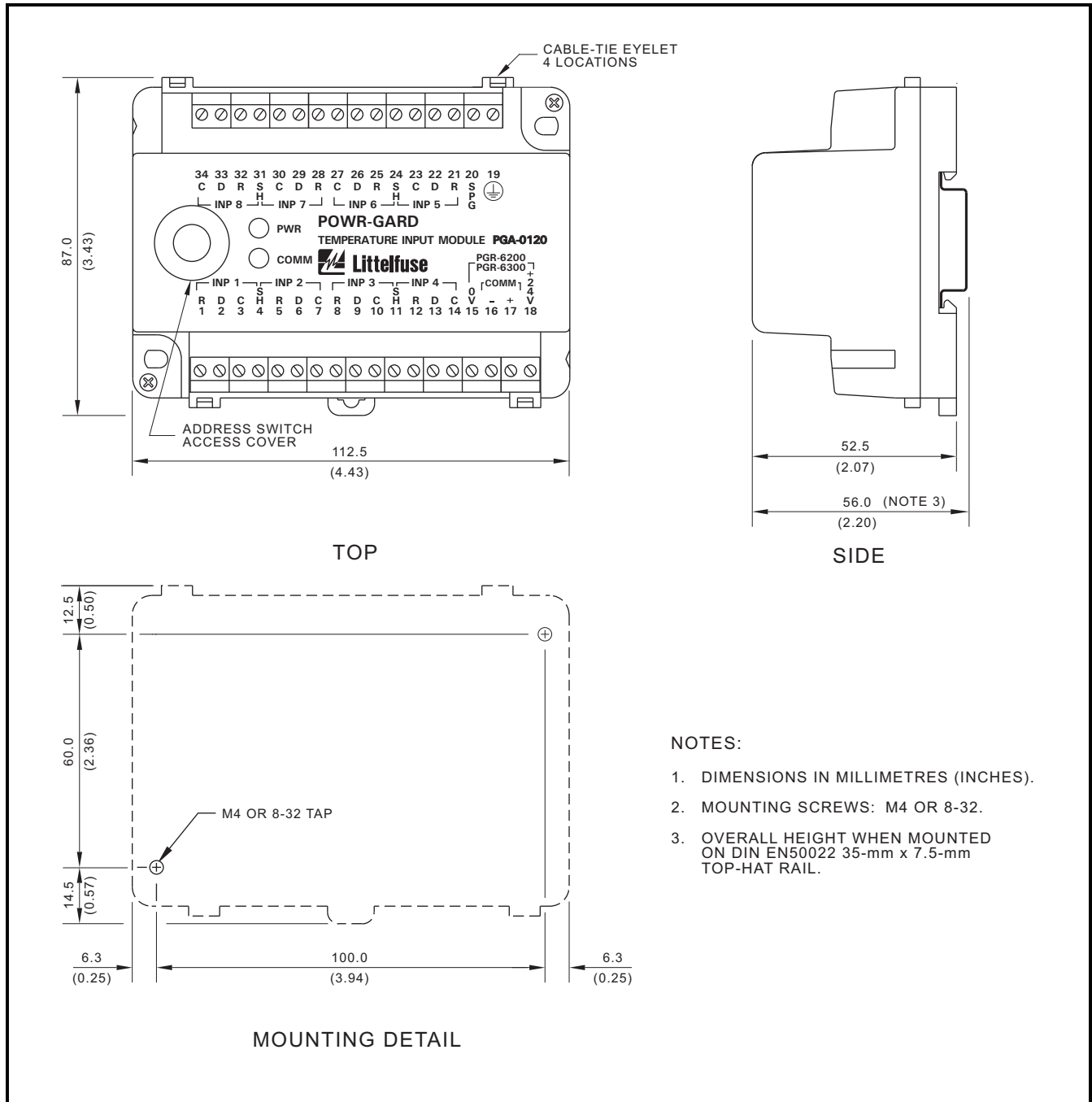


FIGURE 2.4 PGA-0120 Outline and Mounting Details.

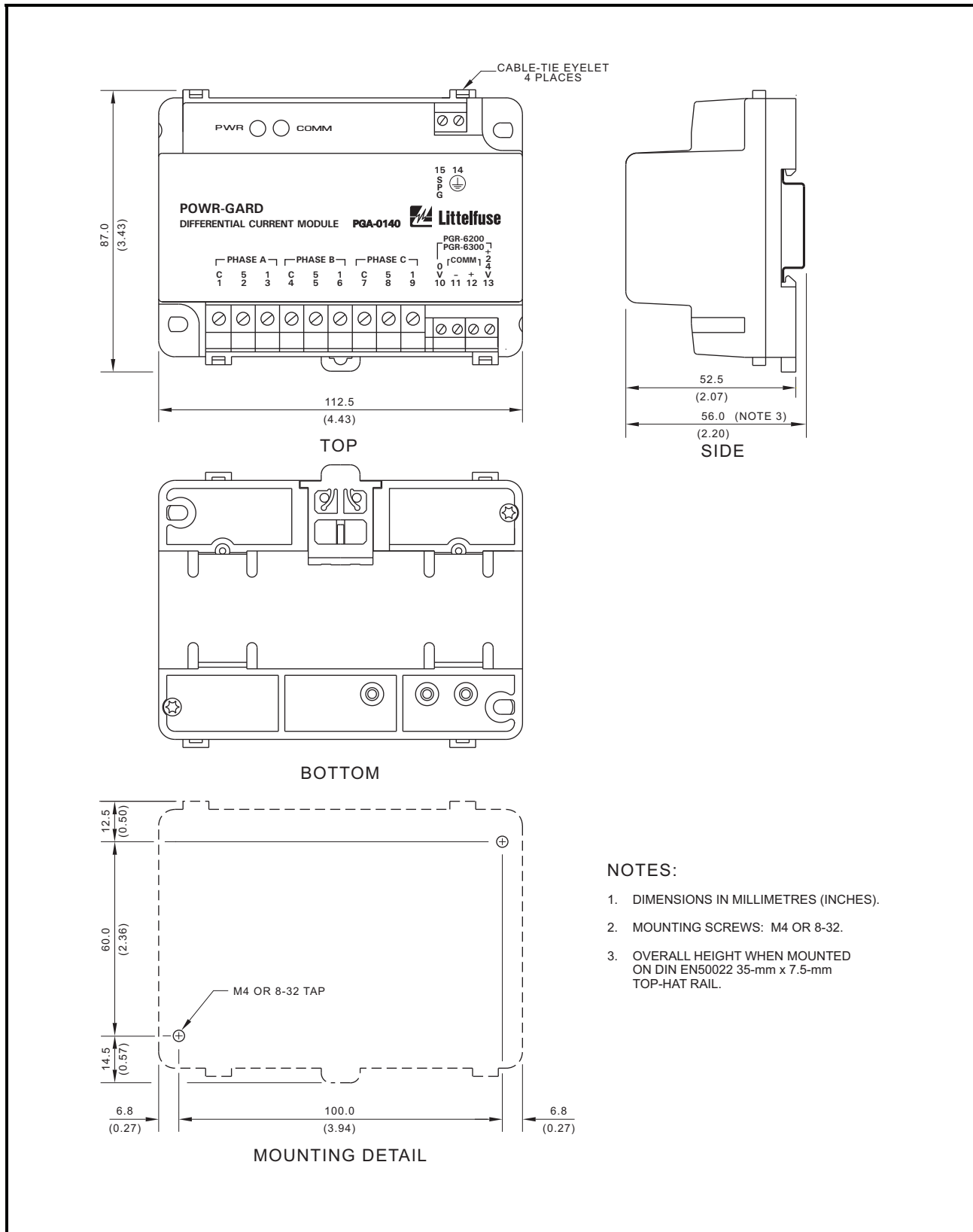


FIGURE 2.5 PGA-0140 Outline and Mounting Details.

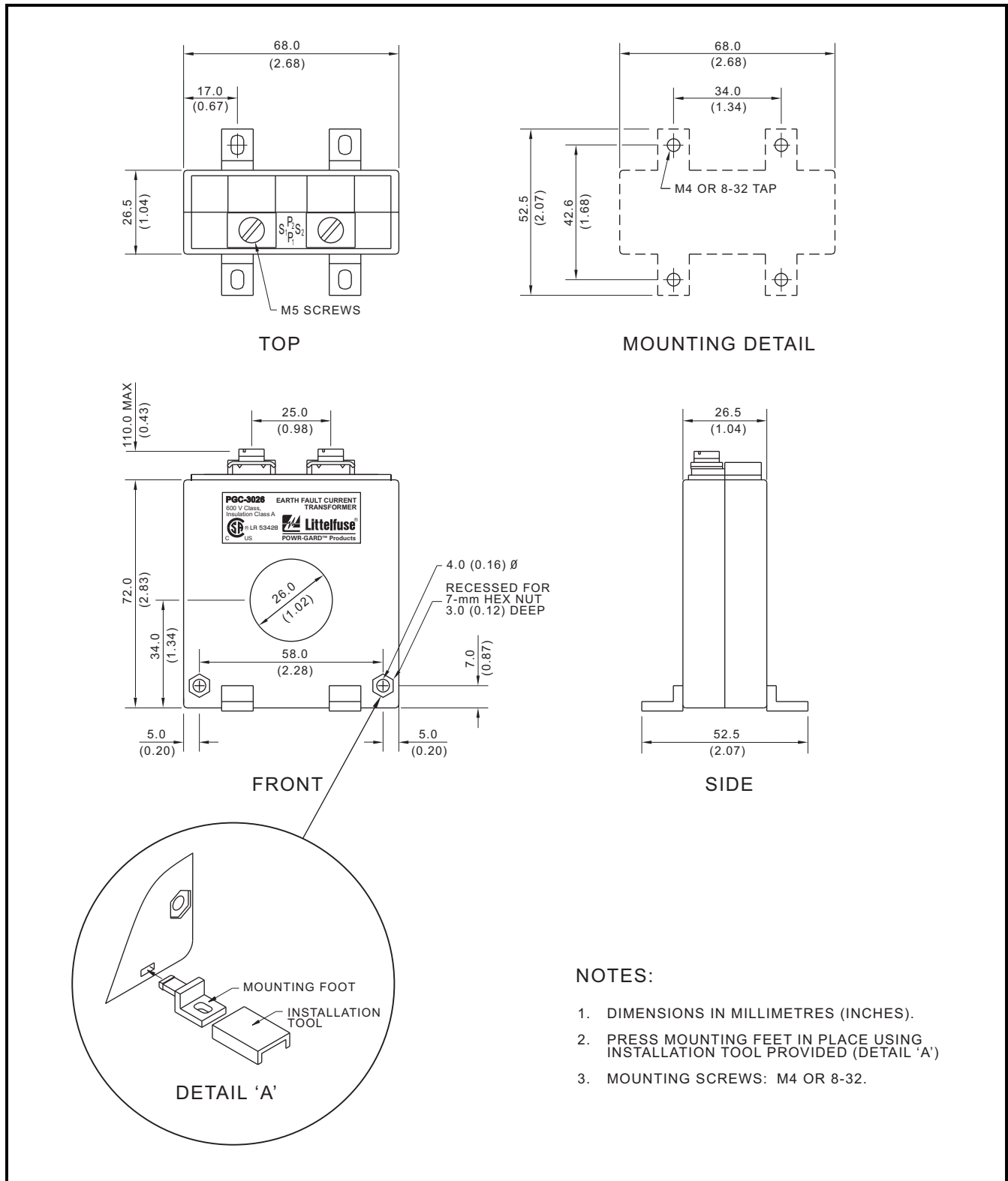


FIGURE 2.6 PGC-3026 Outline and Mounting Details.

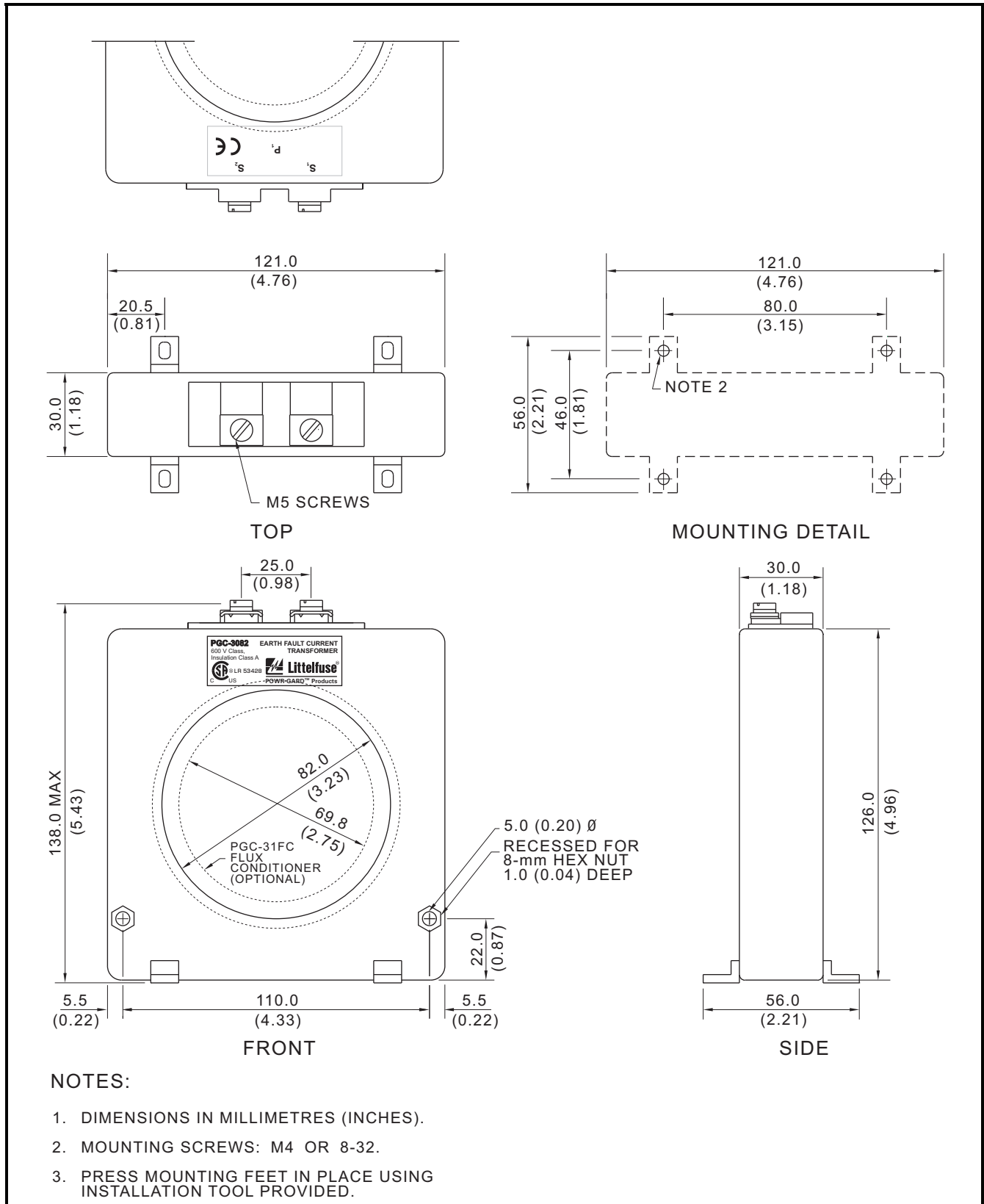


FIGURE 2.7 PGC-3082 Outline and Mounting Details.

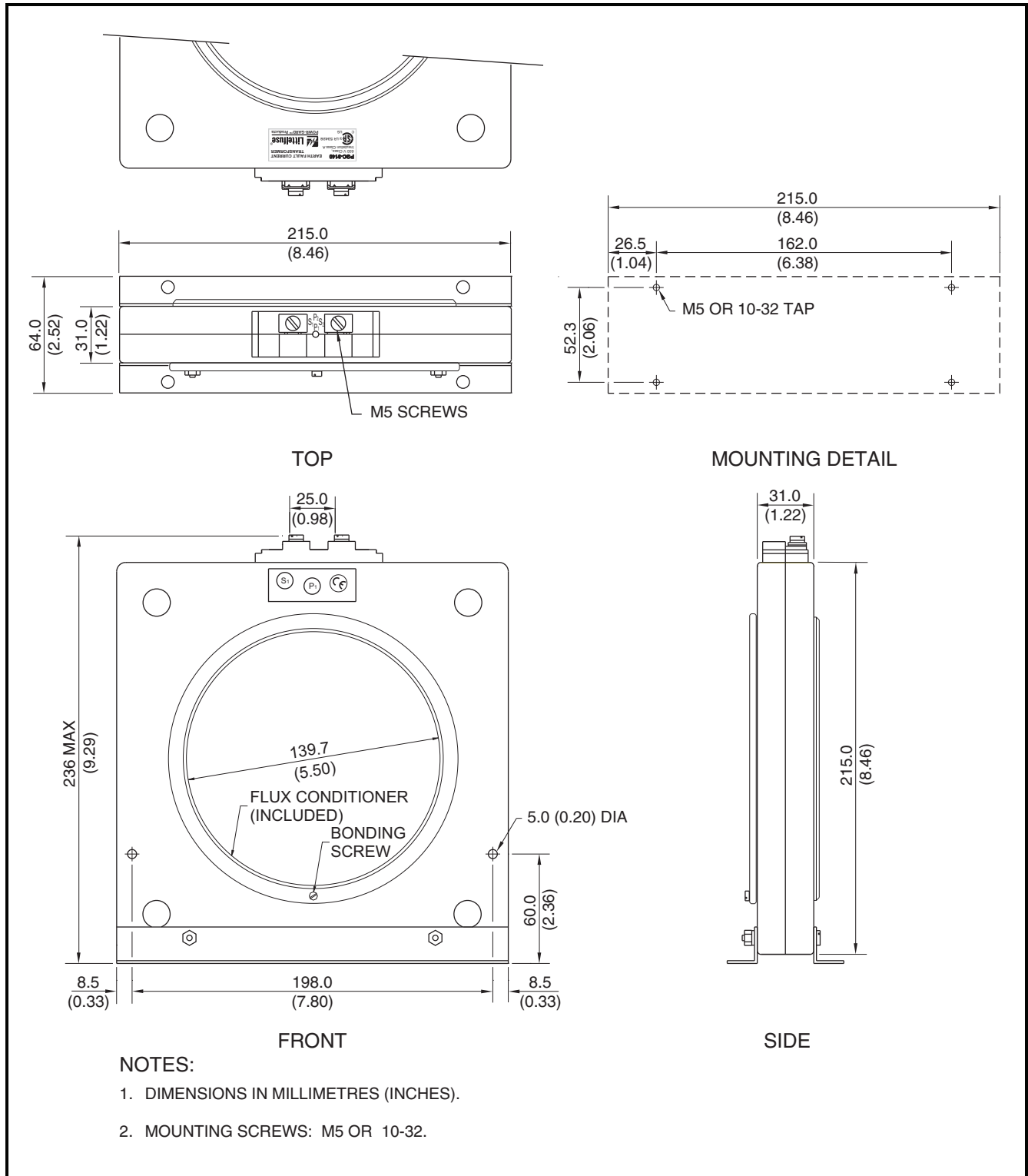


FIGURE 2.8 PGC-3140 Outline and Mounting Details.

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3. SYSTEM WIRING

3.1 General

A typical connection diagram is shown in Fig. 3.2. The CTU provides the 24-Vdc supply for the peripheral modules and it communicates with them using an RS-485 interface. The total length of the I/O communication system must be less than 1.2 km (4,000 ft). I/O communications addressing supports up to three modules of each type; however, the power supply in the CTU will not support more than three I/O modules. An external 24-Vdc power supply is required if more than three modules are used.

The CTU voltage inputs can be directly connected to a system with line-to-line voltages up to 600 Vac. PT's are required for system voltages higher than 600 Vac. Input resistance of the voltage inputs is 3.4 MΩ.

Note: The current and voltage inputs must be phase sequenced A-B-C with correct polarity observed.

START1, START2, and STOP starter-control commands can be issued through the digital inputs, the network interface, or the OPI. Start, stop, and interlock contacts can be wired to any of the programmable digital inputs. The five programmable output relays can be used for starting control, protection, and interlock functions. Relay 5 is a solid-state, low-level output relay not recommended for starter control. See Section 9 for relay ratings.

Note: The default configuration has no assignments for digital inputs and relay outputs.

3.2 Wiring Connections

3.2.1 CTU Connections

The CTU CT-input terminal blocks accept 22 to 10 AWG (0.3 to 4.0 mm²) conductors. The remaining CTU clamping blocks accept 24 to 12 AWG (0.2 to 2.5 mm²) conductors. Terminal blocks unplug to allow the CTU to be easily replaced.

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 1 and 2 (L1 and L2) as shown in Fig. 3.2. In 120-Vac systems, L2 is usually designated as the neutral conductor. For direct-current power supplies, use L1 for the positive terminal and L2 as the negative terminal. Ground terminal 3 (⊕).

Internal surge-protection devices are connected to terminals 4 (SPG) and 4A (SPGA) to allow dielectric-strength testing. Terminals 4 and 4A must be connected except during dielectric-strength testing.

The 24-Vdc I/O module supply (terminals 56 and 60) can support three I/O modules. An external

24-Vdc supply is required if more than three modules are used.

3.2.1.2 Current Inputs

The CTU uses 1-A or 5-A CT's for phase-current measurement. To maintain specified accuracy, phase CT's should be selected with a primary rating between 100 and 300% of motor full-load current (FLA). Current threshold is a function of full-load current and CT-primary rating as defined by the following formula.

$$\text{Percent Threshold} = 1.5 \times \frac{\text{CT Primary Rating}}{\text{FLA}}$$

For synchronous motor applications the CT-primary rating should be selected such that the percent threshold is less than the idle current, typically less than 5%. All CT inputs can withstand a common-mode voltage of 120 Vac so that the CTU can be connected in series with other CT loads. The connection diagram in Fig. 3.2 shows a typical connection where the CTU is the only device connected to the phase CT's. The CTU requires the phase sequence to be A-B-C with correct polarity. A 1-A, 5-A, or sensitive CT is used for core-balance earth-leakage measurement. See Fig. 3.1 for the phase-CT residual connection for earth-fault detection.

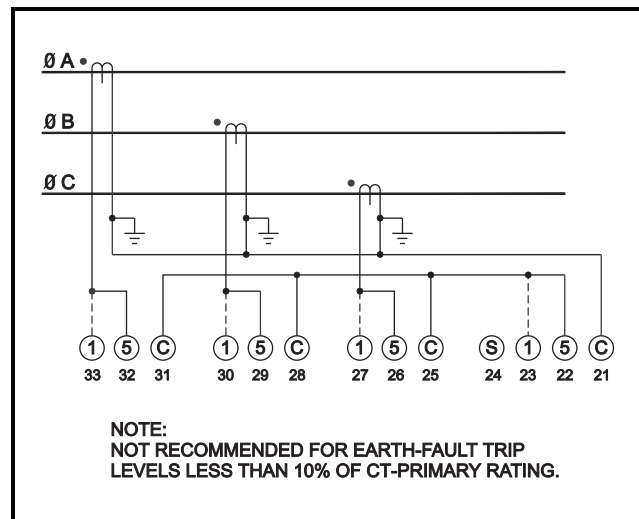


FIGURE 3.1 Residual Phase-CT Connection.

3.2.1.3 VOLTAGE INPUTS

For all input-voltage connections, the CTU requires the phase sequence to be A-B-C with correct polarity.

If voltage inputs are not used, connect VA, VB, and VC to VN.

Note: A voltage input is required for line-frequency metering.

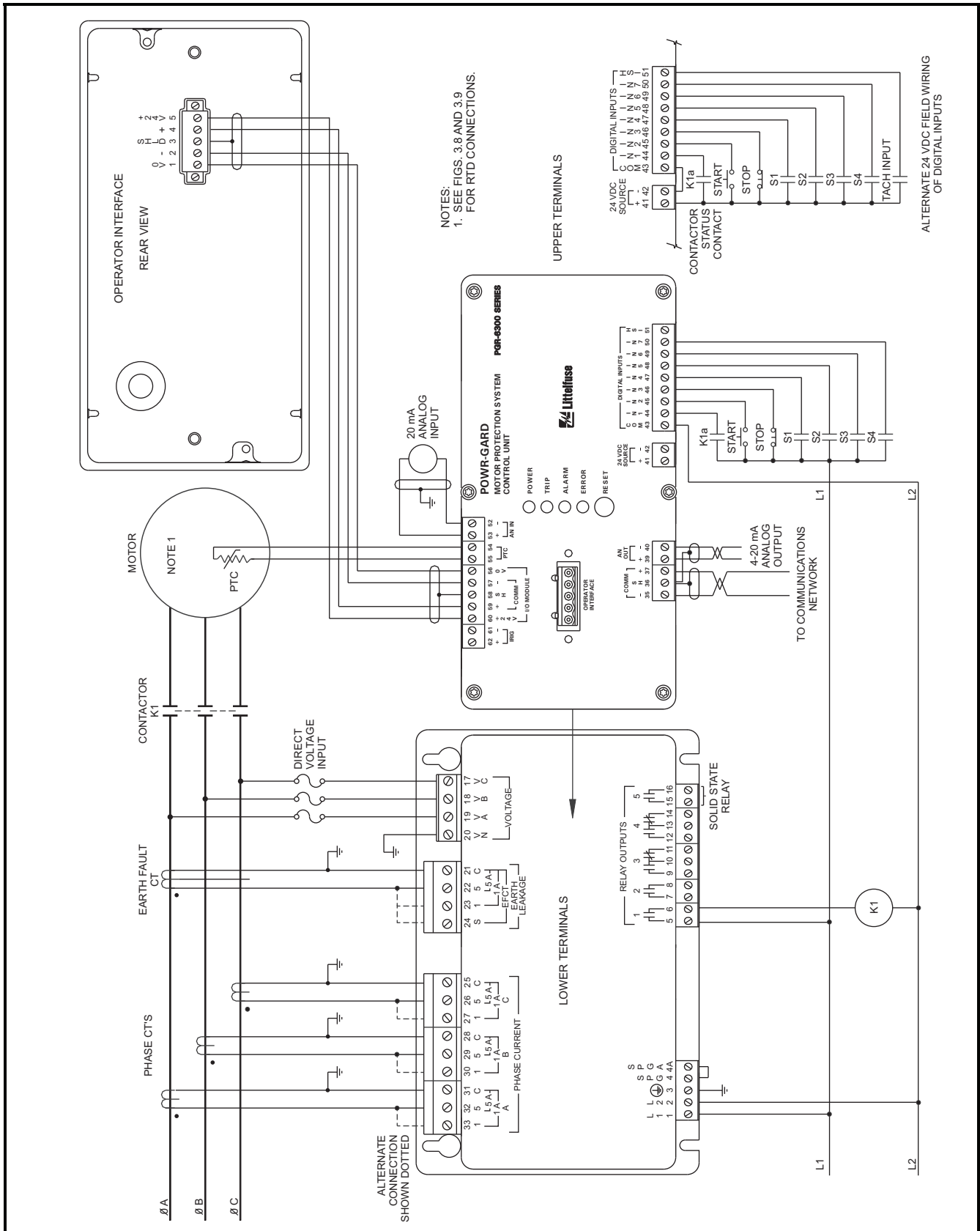


FIGURE 3.2 Typical PGR-6300 Connection Diagram.

3.2.1.3.1 Direct Connection

Potential transformers (PT's) are not required for system voltages up to 600 Vac line-to-line. Connect the voltage inputs as shown in Figs. 3.2 and 3.3.

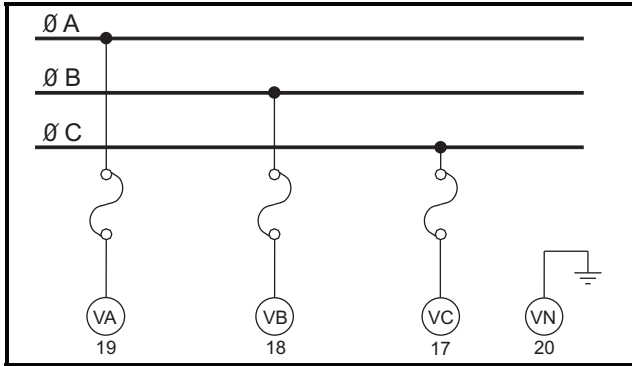


FIGURE 3.3 Direct Connection.

3.2.1.3.2 1-PT Connection

The 1-PT connection is shown in Fig. 3.4. Connect the PT between phase A and phase B. The PT-secondary voltage must be less than 350 Vac.

Note: The 1-PT connection does not allow detection of voltage unbalance.

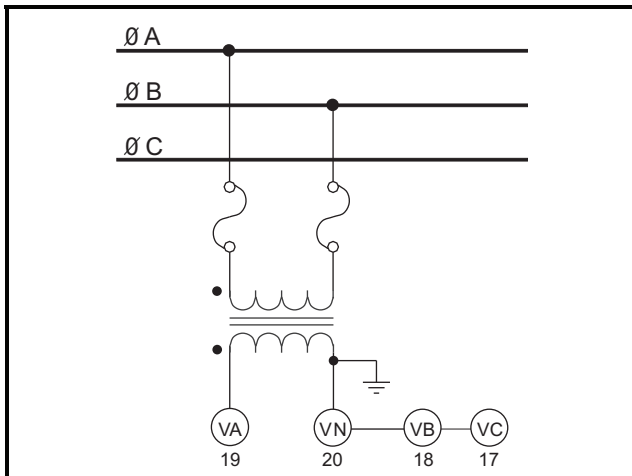


FIGURE 3.4 1-PT Connection.

3.2.1.3.3 2-PT Connection

The 2-PT connection is shown in Fig. 3.5. The PT-secondary voltages must be less than 350 Vac. Connect the PT secondaries in open delta.

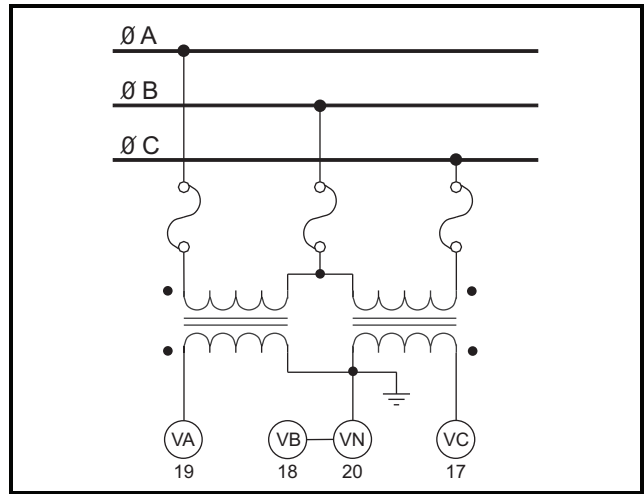


FIGURE 3.5 2-PT Connection.

3.2.1.3.4 3-PT Connection

The 3-PT connection is shown in Fig. 3.6. The PT-secondary voltages must be less than 350 Vac. Since the CTU measures line-to-line voltage, there is no advantage in using a 3-PT connection over a 2-PT connection.

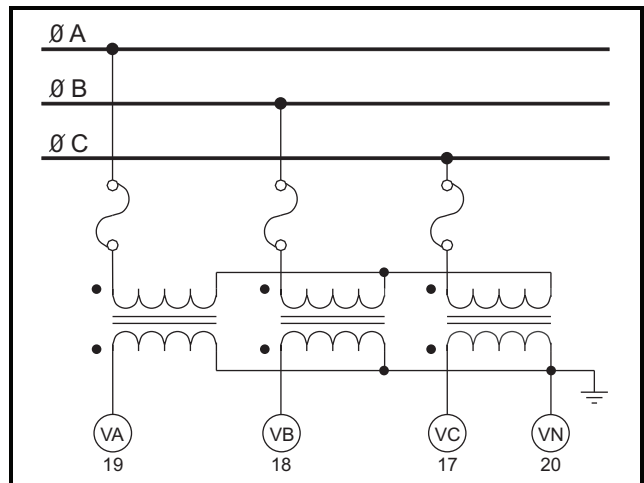


FIGURE 3.6 3-PT Connection.

3.2.1.4 Digital Inputs

Digital inputs 1 to 8 (terminals 44 to 51) are referenced to COM (terminal 43). These inputs are isolated from all other terminals and operate over a 24 to 130 Vac/Vdc range. Inputs 1 to 7 have programmable functions. See Table 4.2. Input 8 is a high-speed input (HSI) for a tachometer sensor.

3.2.1.4.1 DC Operation

Supply voltage for dc-input operation can be obtained from the 24-Vdc source (terminals 41 and 42), or it can be obtained from an external 24- to 130-Vdc supply.

The internal source is current limited at 100 mA and is referenced to the analog output (terminal 40) and the I/O Supply (terminal 56). Connect the “-” terminal of the dc source to COM and connect field inputs between “+” and the digital-input terminals.

3.2.1.4.2 AC Operation

Inputs operate over a 24- to 130-Vac range. Connect the ac neutral to COM and connect field inputs between line and the digital inputs.

3.2.1.4.3 Combined AC and DC Operation

If both ac and dc inputs are used, connect both the ac-supply common and dc-supply “-” to COM.

3.2.1.4.4 Tachometer Input (HSI)

A tachometer sensor can be used to provide motor-speed measurement. Connect a logic-output PNP tachometer as shown in Fig. 3.7.

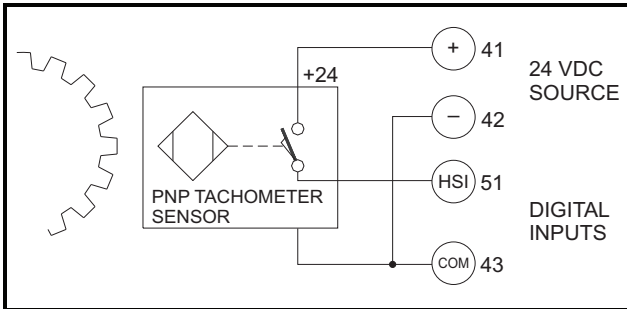


FIGURE 3.7 Digital Tachometer Input (HSI).

3.2.1.5 Analog Input (AN IN)

The analog input (terminal 52 and 53) is a 4–20-mA current input with a 100-Ω input impedance.

Note: The analog input is referenced to an internal supply with 100-kΩ resistors. Maximum common-mode voltage is ± 5 Vdc with respect to CTU terminal 4.

3.2.1.6 Analog Output (AN OUT)

The analog output is a self-powered current-source output. The current source output is the “+” (terminal 39) and the common is “-” (terminal 40).

Note: The analog output (terminal 40) is internally referenced to the 24-Vdc source (terminal 42) and the I/O supply (terminal 56).

3.2.1.7 PTC Input

Terminals 54 and 55 are provided for PTC over-temperature protection. See Section 9 for specifications.

3.2.1.8 IRIG-B Input

Terminals 61 and 62 are used for an IRIG-B time-code signal. When an IRIG-B signal is detected, the real-time clock (RTC) synchronizes with it. The user must set the PGR-6300 date value because the IRIG-B day-of-the-year parameter is not supported.

If the time-code generator does not have a local-time adjustment, the IRIG Offset set points can be used to adjust the hour and minute values so that the PGR-6300 will read local time.

3.2.1.9 I/O Module Communication

The I/O module communications interface (terminals 56 through 60) is used to support optional modules. The connector labeled Operator Interface on the CTU top panel is in parallel with terminals 50 to 56. It is used for direct OPI mounting. See Section 2.3.

I/O module communication is based on the two-wire multi-drop RS-485 standard. Overall line length must not exceed 1.2 km (4,000 ft). For line lengths exceeding 10 m (33 ft), 150-Ω terminations are required at the cable ends. See Fig. 3.9.

3.2.1.10 RS-485 Network Communications

Terminals 35, 36, and 37 are used for the standard RS-485 interface. See Section 4.2.15.

3.2.2 OPI Connections and Address Selection

Connect the OPI to the CTU using shielded cable (Belden® 3124A or equivalent). The 24-Vdc supply for the OPI is provided by the CTU. The cable shield must be connected at both ends so that OPI transient protection is operational. See Fig. 3.9.

The OPI has two switches to select its network address. See Figs. 2.2 and 3.8. Up to three OPI modules can be connected to the I/O MODULE bus, and each active OPI must have a unique address. If one OPI is used, address 1 must be used. If two OPI's are used, addresses 1 and 2 must be used. If three OPI's are used, addresses 1, 2, and 3 must be used.

Table 3.1 and Fig. 3.8 shows the addressing selection format.

TABLE 3.1 OPI Address Selection

ADDRESS	SWITCH 1	SWITCH 2
0 (Factory test)	Open	Open
1 (First OPI)	Closed	Open
2 (Second OPI)	Open	Closed
3 (Third OPI)	Closed	Closed

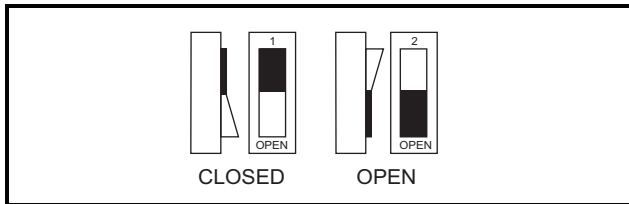


FIGURE 3.8 Address Selection Switch Detail.

3.2.3 PGA-0120 Connections and Address Selection

PGA-0120 terminal blocks accept 24 to 12 AWG (0.2 to 2.5 mm²) conductors.

Connect the PGA-0120 to the CTU using the four-conductor shielded cable (Belden 3124A or equivalent) as shown in Fig. 3.9. The CTU 24-Vdc supply can power up to three PGA-0120 modules.

Connect RTD's to the PGA-0120 as shown in Fig 3.9. When the PGA-0120 module is installed in a motor junction box, RTD-lead shielding is not required.

Connect the surge-protection (SPG) terminal 20 to terminal 19 (⊕), and ground terminal 19.

The PGA-0120 has two switches to select its network address. See Figs. 3.8 and 3.10. Up to three PGA-0120 modules can be connected to the I/O MODULE bus, and each PGA-0120 address must be unique. If one module is used, address 1 must be used. If two modules are used, addresses 1 and 2 must be used. If three modules are used, addresses 1, 2, and 3 must be used.

Table 3.2 shows the addressing selection format.

TABLE 3.2 PGA-0120 Address Selection

ADDRESS	SWITCH 1	SWITCH 2
0 (Off line)	Open	Open
1 (First PGA-0120)	Closed	Open
2 (Second PGA-0120)	Open	Closed
3 (Third PGA-0120)	Closed	Closed

3.2.4 PGA-0140 Connections

The PGA-0140 CT-input terminal blocks accept 22 to 10 AWG (0.3 to 4.0 mm²) conductors. The remaining clamping blocks accept 24 to 12 AWG (0.2 to 2.5 mm²) conductors.

Connect the PGA-0140 to the CTU using four-conductor shielded cable (Belden 3124A or equivalent) as shown in Fig. 3.9.

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

3.2.4.1 Core Balance

The core-balance connection is shown in Fig. 3.11. To minimize power-cable and CT-lead length, 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-6300 Summation

The PGR-6300 summation connection uses three phase CT's and three differential CT's as shown in Fig. 3.12. 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 CTU 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 PGR-6300 *FLA Rating* is set equal to the motor's full-load current multiplied by $\sqrt{3}$. Power, power factor and energy measurements are not correct for the delta connection.

3.2.4.3 DIF Summation

The DIF summation connection uses six differential CT's as shown in Fig. 3.13. 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 Dielectric-Strength Testing

Dielectric-strength testing should be performed only on CT inputs, PT inputs, output relays, and digital inputs. Unplug all other I/O and remove the SPG connection (terminal 4 to terminal 4A) on the CTU during dielectric-strength testing.

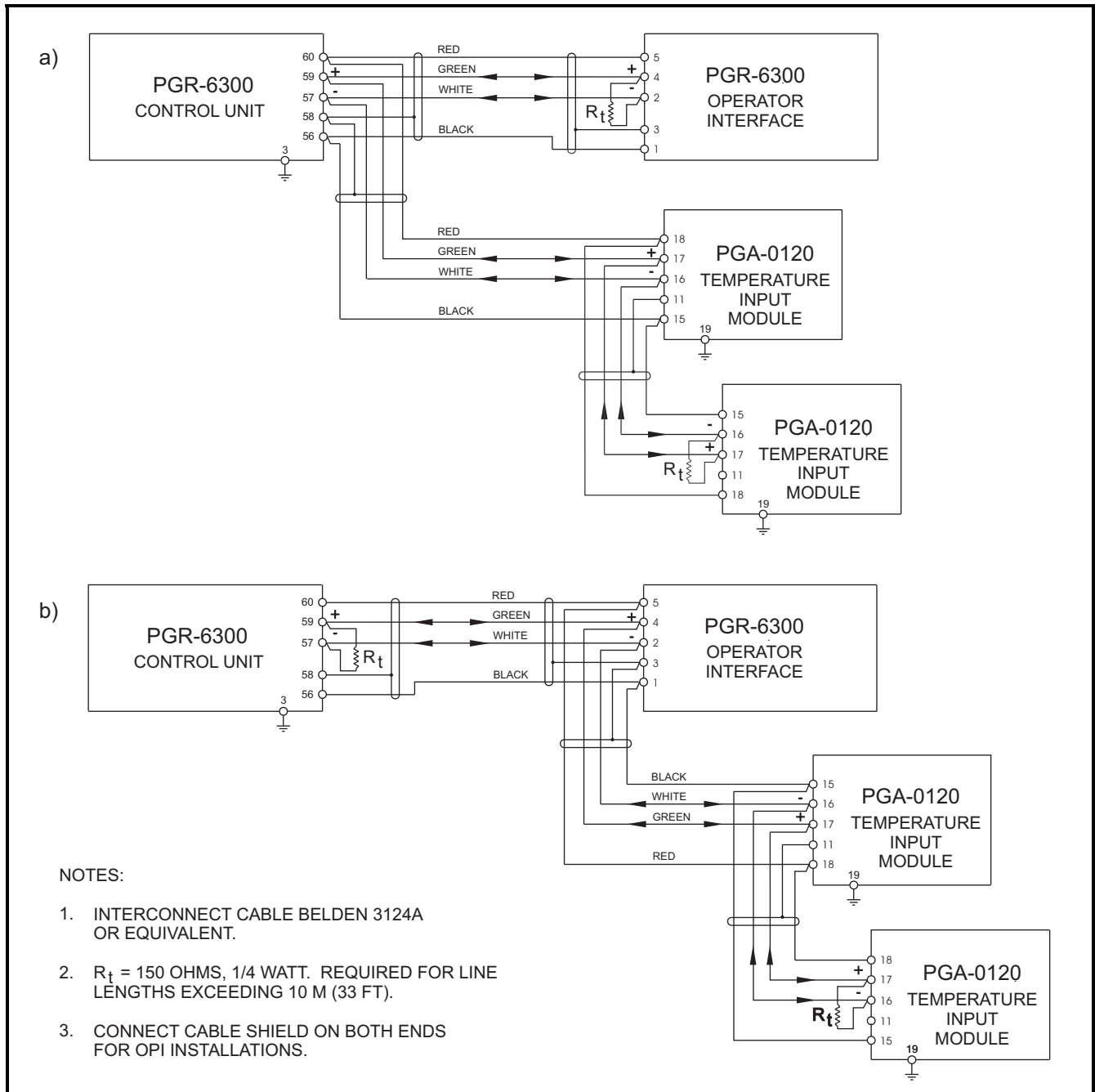


FIGURE 3.9 Two Examples of I/O Module Connections.

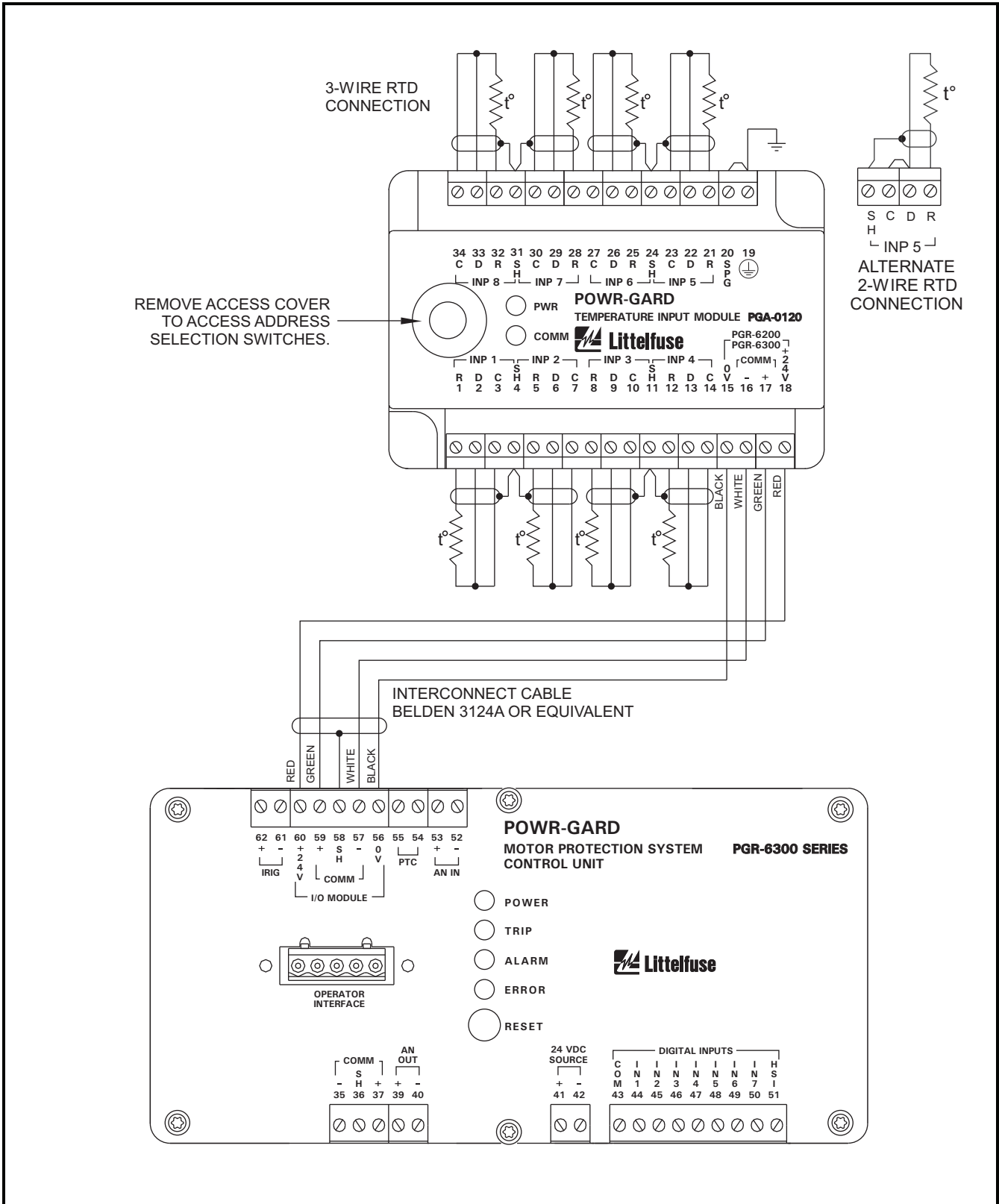


FIGURE 3.10 PGA-0120 Connection Diagram.

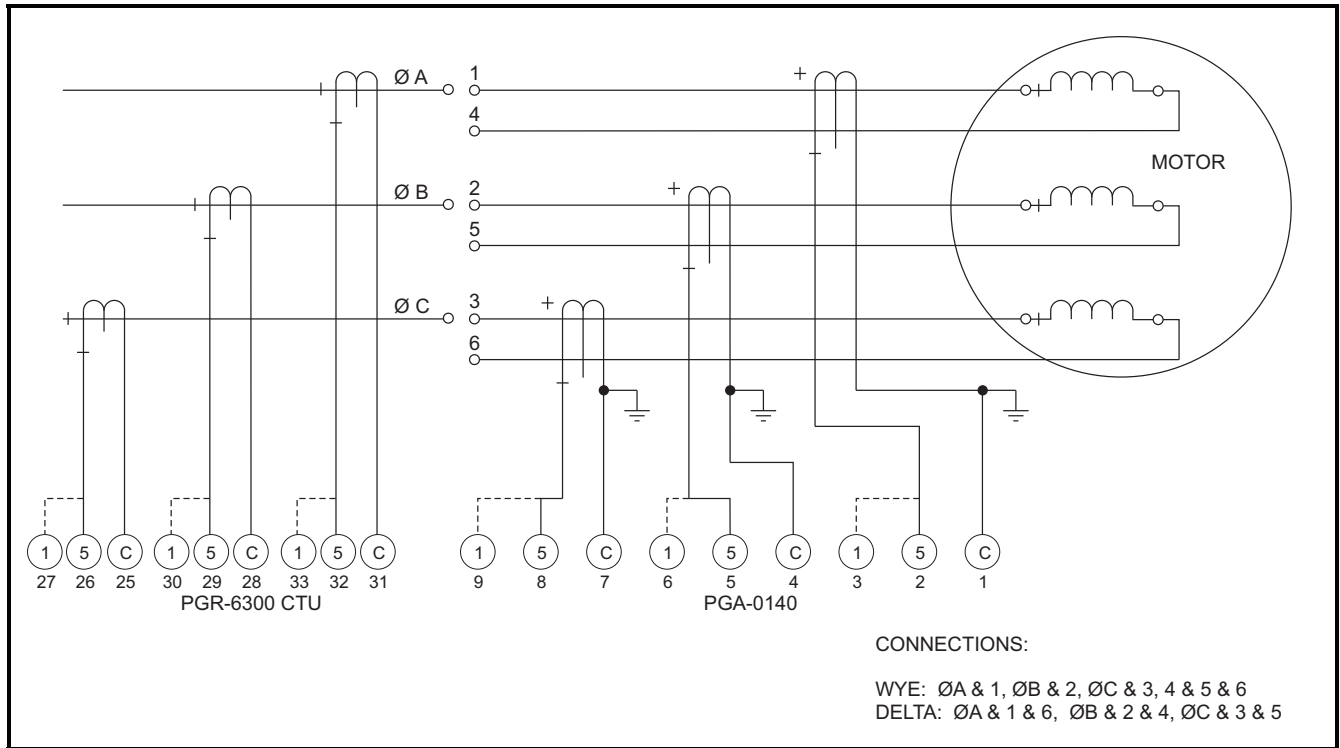


FIGURE 3.11 Core Balance Connection.

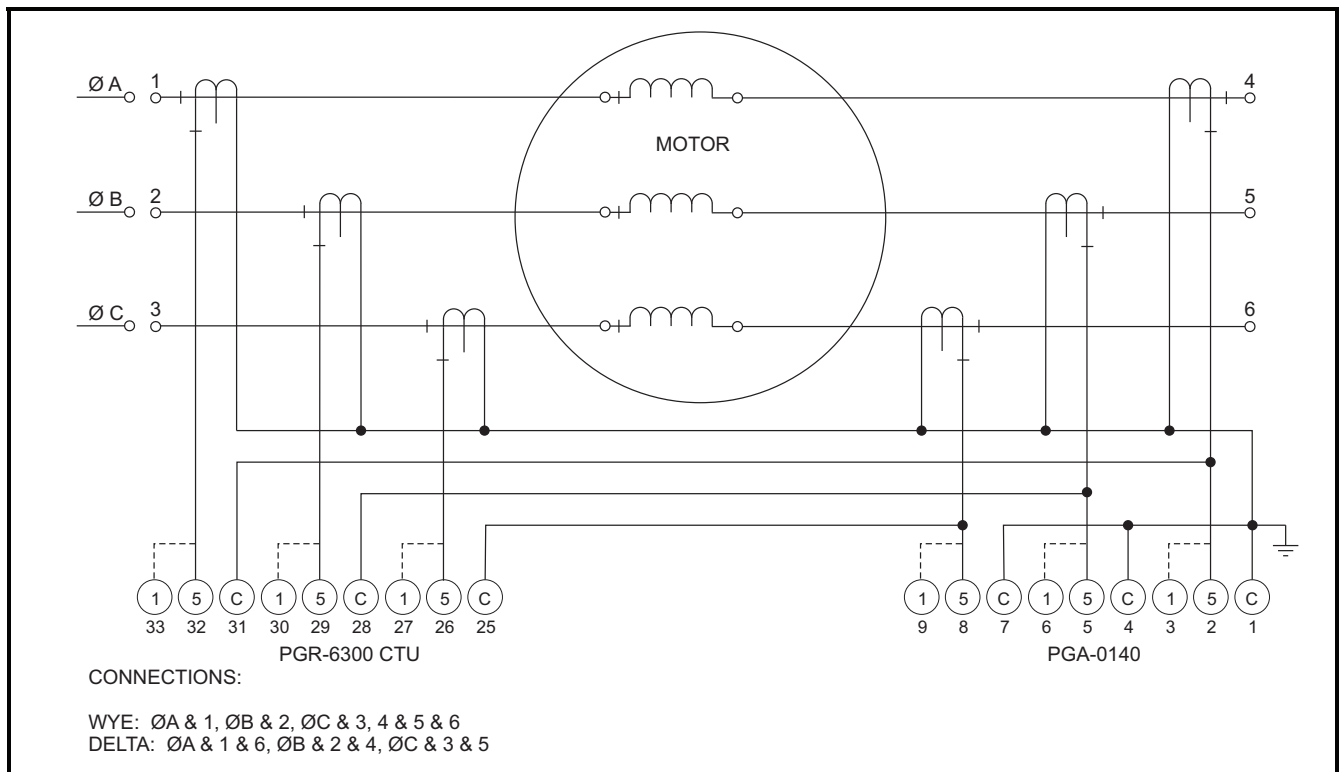


FIGURE 3.12 PGR-6300 Summation Connection.

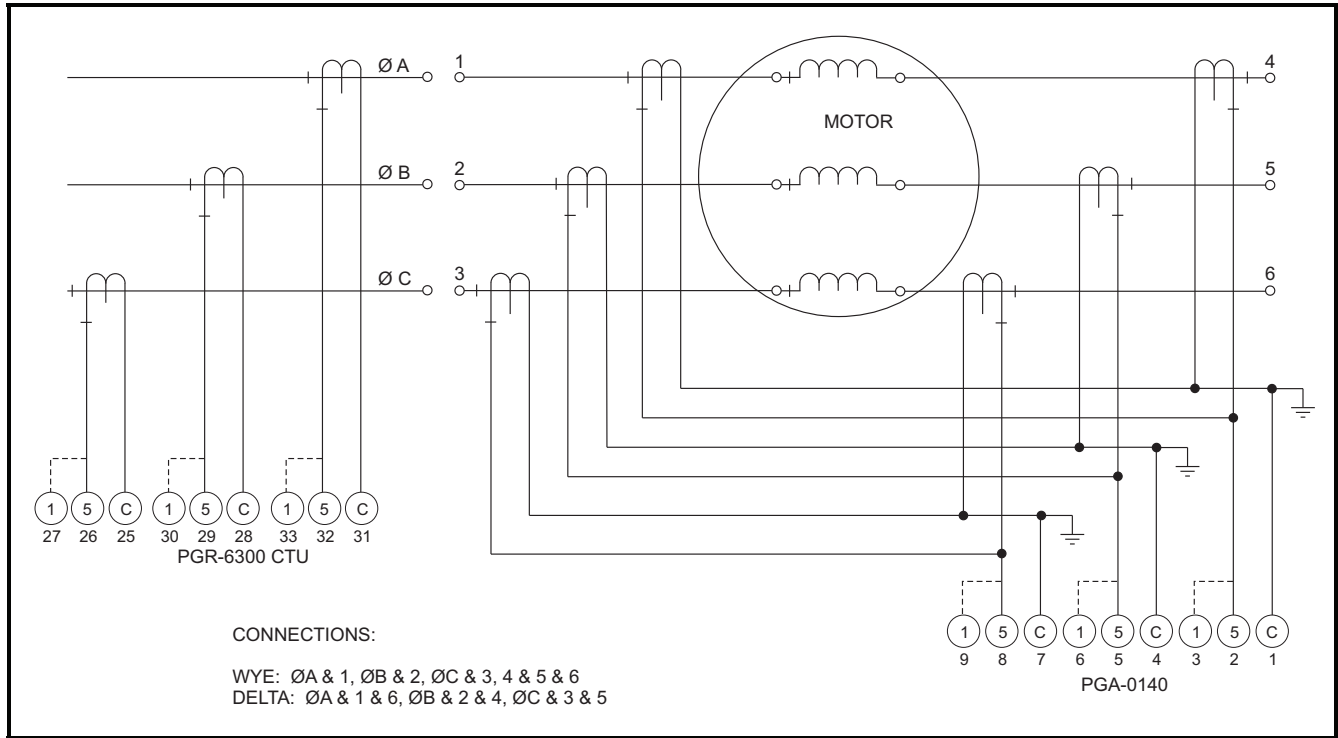


FIGURE 3.13 DIF Summation Connection.

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4. OPERATION AND SETUP

4.1 General

The CTU can operate independently. It can also operate in conjunction with network communications, the OPI, PGA-0120 and the PGA-0140. All settings are stored in the CTU and can be accessed using the OPI or the network communications interface. Use PGW-COMM software and a PGA-0400 to program a PGR-6300 with a personal computer.

In the following sections, menu items and setup parameters are listed in italics and are shown in the format displayed on the OPI. The OPI cannot display subscripts and superscripts.

Menu selection is in the following format:

Menu 1 | Sub Menu 1 | Sub Menu 2 | Sub Menu 3

Example: For the menu item shown in Fig. 4.1, the notation is *Setup | System Ratings | CT Primary*

Metering ▾		
Messages ▾		
▲ Setup ▾	Protection ▾	
	◆ System Ratings ▾	
	Starter ▾	▼ CT Primary →
	•	EF-CT-Primary →
	•	System Voltage →
	•	Input Voltage →
		•
		•
		•

FIGURE 4.1 Menu Example.

Fig. 4.2 shows the symbols that assist in navigating the menu system and how these symbols

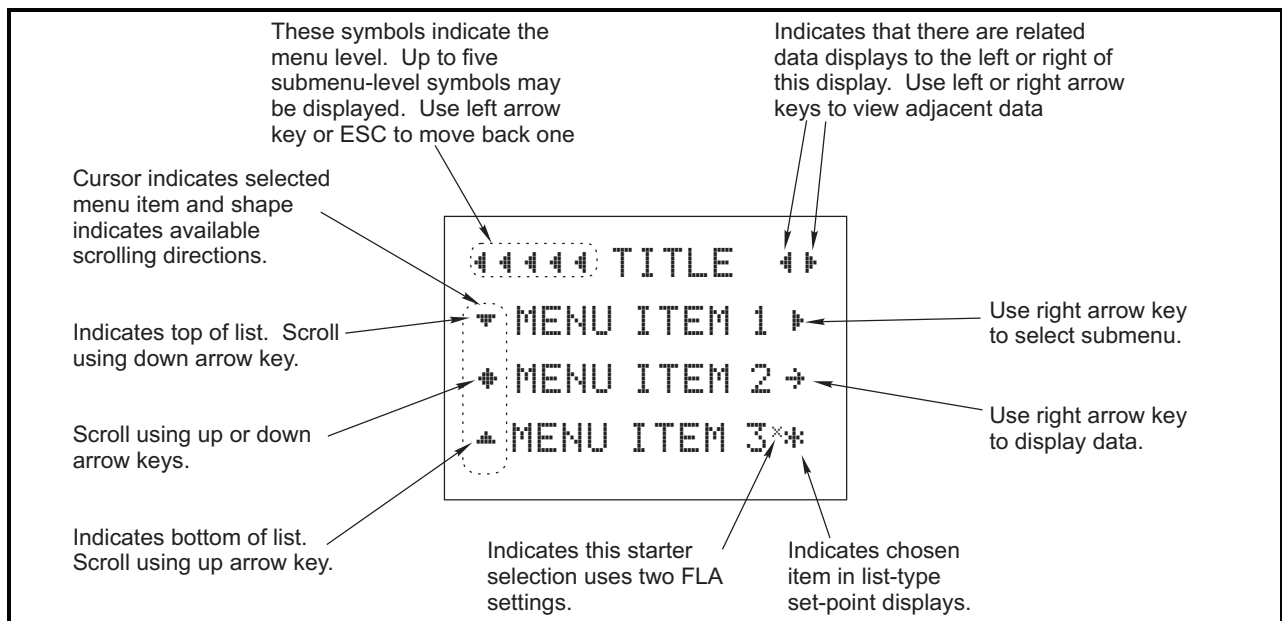


FIGURE 4.2 Menu Symbols.

relate to the arrow keys on the OPI. See the menu map in Appendix A.

4.2 CTU

4.2.1 LED Indication

The four LED's on the CTU indicate POWER (green), TRIP (red), ALARM (yellow), and ERROR (red). The POWER LED is ON when supply voltage is present. The TRIP and ALARM LED's indicate a trip or alarm condition. The ERROR LED is ON during firmware updates or when there is a CTU failure.

4.2.2 Reset Switch

The reset switch is used to simultaneously reset all trips. Trips cannot be held off by a maintained closure.

4.2.3 Phase-CT Inputs

OPI Menu: *Setup | System Ratings | CT Primary*

The setting range for the CT-primary rating is 1 to 5,000 A. To maintain specified accuracy, phase CT's should be selected with a primary rating between 100 and 300% of motor full-load current.

Current unbalance will indicate “-” if the current sequence is B-A-C. If B-A-C sequence is indicated, correct the CT connections so that power measurements will be valid.

Note: B-A-C sequence will cause a trip if current phase-reverse protection is enabled.

Note: Phase-unbalance and phase-loss testing requires three-phase inputs to the PGR-6300.

4.2.4 Earth-Fault-CT Input

OPI Menu: *Setup* | *System Ratings* | *EF-CT Primary*

The setting range for the earth-fault-CT-primary rating is 1 to 5,000 A. The CT-primary rating is 5 A for sensitive CT's—PGC-3026, PGC-3082 and PGC-3140.

4.2.5 Voltage Inputs

OPI Menu: *Setup* | *System Ratings*

Select the voltage-connection type (1 PT line-line, 2 PT line-line, 3 PT line-neutral/direct) to enable voltage-measuring functions. *System Voltage* is the system line-to-line voltage. The system voltage range is 120 V to 25 kV. For the 1-PT and 2-PT connections, *Input Voltage* is the PT-secondary voltage when system voltage is applied. For the 3-PT connection, the *Input Voltage* is the PT-secondary line-to-line voltage. For the direct connection, set *Input Voltage* the same as the *System Voltage* setting. In all cases, line-to-line voltages are displayed.

Voltage unbalance will indicate “-” if the voltage sequence is B-A-C. If B-A-C sequence is indicated, correct the PT connections so that power measurements will be valid.

Note: The 1-PT connection does not allow detection of voltage unbalance.

Note: B-A-C sequence will cause a trip if voltage phase-reverse protection is enabled.

4.2.6 Motor Data

OPI Menu: *Setup* | *System Ratings*

OPI Menu: *Setup* | *Protection* | *Overload*

Motor data must be entered for the *FLA Rating*, *Frequency*, and *Service Factor*. If a tachometer is used, the *Sync Speed* is required. If the starter selected requires two FLA ratings, *FLA Rating 2* must be entered.

The *Frequency* setting determines the sampling rate used by the PGR-6300 for current and voltage measurements. If *Sync to ASD* is selected as the analog-input type, the *Frequency* setting is not used and the analog output from an adjustable-speed drive determines the sampling rate used by current- and voltage-measuring algorithms. See Section 5.27.2.

Locked-rotor current, cold locked-rotor time, and hot locked-rotor time must be entered in the *Protection* | *Overload* menu to provide customized overload protection. See Section 5.2.

4.2.7 Output Relay Assignment

OPI Menu: *Setup* | *Relay Outputs* | *Relay x*

Each of the five output relays can be assigned to one of the functions listed in Table 4.1. More than one relay can be assigned the same function. Note

that Relay 5 is a solid-state relay with a low current rating and should only be used for interlocks or annunciation.

TABLE 4.1 Output-Relay Functions

FUNCTION	ASSIGNMENT OR ACTION
Starter RLYA	Relay is assigned to the Starter Relay A function.
Starter RLYB	Relay is assigned to the Starter Relay B function.
Starter RLYC	Relay is assigned to the Starter Relay C function.
Starter RLYD	Relay is assigned to the Starter Relay D function.
Trip1	Relay operates when a trip occurs in a protective function assigned Trip1, Trip1&2, Trip1&3, or Trip1,2,&3. Fail-safe or non-fail-safe mode selection is active.
Trip1 Pulse ⁽¹⁾	Trip1 energizes the relay for the time duration specified by the <i>RY Pulse Time</i> set point.
Trip2	Relay operates when a trip occurs in a protective function assigned Trip2, Trip1&2, Trip2&3, or Trip1,2,&3. Fail-safe or non-fail-safe mode selection is active.
Trip3	Relay operates when a trip occurs in a protective function assigned Trip3, Trip1&3, Trip2&3, or Trip1,2,&3. Fail-safe or non-fail-safe mode selection is active.
Alarm1	Relay operates when an alarm occurs in a protective function assigned Alarm1, Alarm1&2, Alarm1&3, or Alarm1,2,&3. Fail-safe or non-fail-safe mode selection is active.
Alarm2	Relay operates when an alarm occurs in a protective function assigned Alarm2, Alarm1&2, Alarm2&3, or Alarm1,2,&3. Fail-safe or non-fail-safe mode selection is active.
Alarm3	Relay operates when an alarm occurs in a protective function assigned Alarm3, Alarm1&3, Alarm2&3, or Alarm1,2,&3. Fail-safe or non-fail-safe mode selection is active.
Local	Relay energized when Local starter control is selected.
Interlock	Relay is energized when all digital-input interlocks are completed.
Current	Relay is energized when current is detected.
Run Mode	Relay is energized when motor is running. (Current <125% for <i>Run-Mode Delay</i>)
Sequence Complete	Relay is energized when the starter <i>Start Time</i> has elapsed.
Start Inhibit	Relay is energized when in an I ^{ft} or starts-per-hour inhibit condition.
Watchdog	Relay is energized when the supply voltage is applied and the PGR-6300 is operating properly.
Reduced OC	Relay is energized when in maintenance mode (ROC = On).
None ⁽²⁾	No Assignment (Default).

⁽¹⁾ Assign this function to only one relay. Non-fail-safe operation only.

⁽²⁾ Relay outputs must be assigned. Default is None.

Relay assignments *Starter RLYA*, *Starter RLYB*, *Starter RLYC*, and *Starter RLYD* operate in conjunction with PGR-6300 starting functions to control the motor-starter contactor(s). See Section 6. Contactor status can be monitored using auxiliary contacts and the digital inputs. See Section 4.2.8 and Figs. 6.9 to 6.23.

When a trip occurs, all assigned starter-control relays (*Starter RLYA* to *Starter RLYD*) are de-energized and relays assigned the *Trip1*, *Trip2*, or *Trip3* function operate. The trip signal may originate from a protective function, from a digital input assigned the *Trip1* function, or from a communications network command. See Sections 4.2.8 and 6.

Relays assigned to trip or alarm functions operate in fail-safe or non-fail-safe mode. Set the mode using the *Setup | Relay Outputs | Relay x | Mode* menu.

Except for overload trips, which can be selected to auto-reset, trips must be reset with an OPI, a digital input, or a network command. A trip cannot be reset when the trip condition is present.

When a protective function issues an alarm, relays assigned to the corresponding Alarm1, Alarm2, or Alarm3 function operate. Alarms auto-reset when the alarm condition is corrected.

Relays assigned the *Interlock* function energize when all digital inputs assigned the *Interlock* function are valid (voltage detected at digital input).

4.2.8 Digital Inputs 1 to 7

OPI Menu: *Setup | Digital Inputs | Digital Input x | Input x Function*

OPI Menu: *Setup | Digital Inputs | Digital Input x | In x Start Bypass*

OPI Menu: *Setup | Digital Inputs | Digital Input x | In x Bypass Delay*

OPI Menu: *Setup | Digital Inputs | Digital Input x | In x Trip Delay*

Each digital input can be assigned to one of the functions listed in Table 4.2. More than one digital input can be assigned the same function.

Start inputs are not active when *Protection Only* is selected as the starter type. The STOP function is always active. In *Protection Only* mode, STOP initiates a *Trip1* signal.

Each digital input assigned the *Trip1* function has *Start Bypass*, *Bypass Delay*, and *Trip Delay* set points. When *Start Bypass* is enabled, the *Trip1* function is bypassed during a start for the duration specified by *Bypass Delay*. Since start detection is based on motor current, this feature can be used in the *Protection Only* mode. After the *Bypass Delay*, the *Trip1* function is enabled and a trip occurs if the digital-input voltage is removed for the time specified

by the *Trip Delay*. If *Start Bypass* is disabled, *Bypass Delay* is not used and the *Trip1* function is always enabled. The bypass feature can be used in pump-control applications to allow time for a pressure switch to close.

Reset inputs are “one-shot” resets that require a transition from open to closed. Maintaining a reset switch closure does not inhibit trips.

TABLE 4.2 DIGITAL-INPUT FUNCTIONS

FUNCTION	STATE ⁽¹⁾
Start1	1 = Start1 (Momentary)
Start2	1 = Start2 (Momentary)
Local Select	1 = Per CONTROL SELECT setting 0 = Local Control
Local Start1 ⁽²⁾	1 = Start1 (Momentary)
Local Start2 ⁽²⁾	1 = Start2 (Momentary)
2-Wire Start1	1 = Start1 (Maintained) 0 = Stop
2-Wire Start2	1 = Start2 (Maintained) 0 = Stop
Stop	1 = Start Allowed 0 = Stop
RLYA Status	1 = Contactor Closed 0 = Contactor Open
RLYB Status	1 = Contactor Closed 0 = Contactor Open
RLYC Status	1 = Contactor Closed 0 = Contactor Open
RLYD Status	1 = Contactor Closed 0 = Contactor Open
Interlock	1 = Start Allowed (If all interlocks are valid) 0 = Start Not Allowed
Trip1	1 = No Trip1 0 = Trip1 (Delays selectable)
Reset	1 = Reset Trips
FLA2 Select ⁽³⁾	1 = Select FLA2 0 = Select FLA1
Limit1 Stop	1 = Start1 Allowed 0 = Start1 Stop
Limit2 Stop	1 = Start2 Allowed 0 = Start2 Stop
Reduced OC	1 = Reduced OC set point not operational 0 = Reduced OC set point operational
None	No assignment (Default)

⁽¹⁾ 1 = Input voltage applied, 0 = Input voltage not applied

⁽²⁾ Interlocks bypassed in LOCAL.

⁽³⁾ Applies only to *Protection Only* mode.

LOCAL is selected using the OPI, the digital input, or by network communications. The *Local Select* source is responsible for de-selecting. For example if both the digital input and the network communications select LOCAL, both must also de-select LOCAL.

In applications where PGR-6300 starter functions are not used, *FLA2 Select* can be used to switch between FLA1 and FLA2. This applies only to *Protection Only* mode. The selected FLA is displayed in the *Metering | System State* menu.

Limit1 Stop and *Limit2 Stop* are limit-switch inputs typically used with reversing starters. *Limit1 Stop* is a stop input associated with *Start1* and *Limit2 Stop* is a stop input associated with *Start2*.

The *Reduced OC* selection operates in conjunction with the reduced overcurrent set point which must be enabled. See Section 5.5.

When *Reduced OC* is selected and no digital input voltage is applied, the reduced overcurrent set point is operational. When digital input voltage is applied, the reduced overcurrent set point is not operational.

The following rules apply when multiple inputs are assigned the same function:

- *Start1, Start2, Local Start1, and Local Start2*: Momentary voltage on any input will initiate a start. (PGR-6300 must be in LOCAL for *Local Start1* and *Local Start2* operation.)
- *Stop*: Voltage must be present on all inputs to allow a PGR-6300-controlled start.
- *Interlock*: Voltage must be present on all inputs to allow a PGR-6300-controlled start and to energize an interlock output relay. Digital inputs programmed as *Interlock* are bypassed in LOCAL.
- *RLYA, RLYB, RLYC, and RLYD Status*: Voltage applied to any input programmed for a contactor status results in contactor-closed status.
- *Reset*: Voltage applied to any input will reset trips.
- *2-Wire Start1 and 2-Wire Start2*: Voltage on any input will initiate a start. All inputs must be open for a stop.
- *FLA2 Select*: Voltage on one or more inputs assigned to *FLA2 Select* will select FLA2.

4.2.9 Tachometer Input (HSI)

OPI Menu: *Setup | System Ratings | Sync Speed*

OPI Menu: *Setup | Digital Inputs | Tachometer*

This input is provided for connection to a 24-Vdc proximity sensor for speed measurement. Set the number of pulses per revolution and enable the High-Speed Input in the *Tachometer* menu. Pulse-frequency range is 10 Hz to 10 kHz. These two settings are required for RPM readings.

If Failure to Accelerate protection is used, set the motor's synchronous speed in the *Sync Speed*

menu. To fully utilize a speed-setting range from 10 to 100%, a full-speed frequency of at least 100 Hz is required.

The PGR-6300 averages 16 pulse periods to determine speed.

4.2.10 Analog Output

OPI Menu: *Setup | Analog Output | Output Parameter*

A 25-mA programmable current output is provided on the CTU. Analog-output parameters are shown in Table 4.3.

Factory calibration is 4–20 mA. If calibration is required, use the *Analog Output* menus.

Zero Calibration:

- Select *Zero* in the *Output Parameter* menu.
- Measure the output current and adjust the *Zero Calibrate* setting for the desired output. The calibration number for 4 mA will be in the range of 100 to 110.

Full-Scale Calibration:

- Select *Full Scale* in the *Output Parameter* menu.
- Measure the output current and adjust the *FS Calibrate* setting for the desired output. The calibration number for 20 mA will be in the range of 540 to 550.

Calibration numbers are not changed when factory defaults are loaded.

4.2.11 Analog Input

OPI Menu: *Setup | 4-20 Analog In | Input Function*

The analog input function is selectable as *Metering Only, Protection, Sync to ASD, or Motor Speed*.

4.2.11.1 Metering Only

OPI Menu: *Setup | 4-20 Analog In | Metering Only*

When *Metering Only* is selected, an analog input does not affect PGR-6300 operation, but its value can be observed in the *Metering* menu.

4.2.11.2 Protection

OPI Menu: *Setup | 4-20 Analog In | Protection*

The *Protection* analog input has high- and low-level trip alarm set points. A high-level trip or alarm occurs when the 4-20-mA input exceeds the high-level trip or alarm set point. A low-level trip or alarm occurs when the 4-20-mA input is lower than the low-level trip or alarm set point.

TABLE 4.3 ANALOG-OUTPUT PARAMETERS

PARAMETER	FULL SCALE	COMMENTS
Phase Current	PH-CT-Primary Rating	Maximum of 3 phases
Earth Leakage	EFCT-Primary Rating	
Differential Current	DF-CT-Primary Rating	Maximum of 3 currents
Used I ² t Capacity	100% I ² t	
Stator Temperature ⁽¹⁾	200°C	Maximum of stator RTD's
Bearing Temperature ⁽¹⁾	200°C	Maximum of bearing RTD's
Load Temperature ⁽¹⁾	200°C	Maximum of load RTD's
Ambient Temperature ⁽¹⁾	200°C	Maximum of ambient RTD's
Voltage	System Voltage	Maximum line-to-line voltage
Unbalance (I)	1 per unit or 100%	I ₂ /I ₁
Power Factor	1.0	Absolute value
Real Power	CT Primary × System Voltage × √3	Absolute value
Reactive Power	CT Primary × System Voltage × √3	Absolute value
Apparent Power	CT Primary × System Voltage × √3	Absolute value
Zero	Not applicable	Used for zero calibration
Full Scale	Not applicable	Used for full-scale calibration
Speed	Synchronous Speed	

(1) Output range is 0 to 200°C. The output defaults to the calibrated zero output for an open or shorted RTD sensor.

4.2.11.3 Synchronize to ASD

OPI Menu: *Setup | 4-20 Analog In | Sync to ASD*

When *Sync to ASD* is selected the PGR-6300 uses the 4-20 mA input to set the internal sampling rate for current and voltage inputs.

4.2.11.4 Motor Speed

OPI Menu: *Setup | 4-20 Analog In | Motor Speed*

This selection overrides the selections for the high-speed tachometer input and the failure-to-accelerate protection uses the analog input as the source of speed information.

4.2.12 Starter

OPI Menu: *Setup | Starter*

As a default, *Starter Type* is set to *Protection Only*. When a starter type is selected, output relays must be assigned for contactor control. See Section 4.2.7. Digital inputs must be assigned if contactor-status feedback is required. See Section 4.2.8.

See Section 6 for starter information.

4.2.13 Protection

OPI Menu: *Setup | Protection*

OPI Menu: *Setup | System Ratings | Run Mode Delay*

See Section 5 for protective function details. As a minimum, locked-rotor current and time must be set for overload protection.

Some protective functions are enabled after the *Run-Mode Delay*.

4.2.14 Miscellaneous Configuration

OPI Menu: *Setup | System Config*

<i>System Name</i>	Appears on many of the display screens and can be set by the user. (18-character alphanumeric field)
<i>Password</i>	Used to change the 4-character alphanumeric password.
<i>Clock Setting</i>	Used to set the date, 24-hour clock, and IRIG set points. Daylight savings time is not supported.
<i>Password Timeout</i>	Used to set the password time-out delay. Delay is measured from last key press.
<i>Maintenance</i>	Used to clear event records, trip counters, energy values, and run hours. Used to load defaults. Used to view firmware version and serial numbers. Used to unlock local control if communication is lost. Used for firmware updates.

4.2.15 Network Communications

OPI Menu: *Setup | Hardware | Network Comms*

The standard interface on the PGR-6300 is an RS-485 network. This network supports Modbus[®] RTU and A-B[®] DF1 protocols.

The protocol, network ID (address), error checking, and baud rate are selectable. See Appendices C, D, E, and F.

If equipped with an optional network interface, refer to the appropriate PGR-6300 optional communications interface manual.

4.3 OPI

4.3.1 General

See Fig. 4.2. The Operator Interface (OPI) is used to perform motor-control functions, display meter readings, and program the CTU. Set points are not resident in the OPI. Control voltage for the OPI (24 Vdc) is supplied by the CTU and communications with the CTU is through an RS-485 link. This allows the OPI to be mounted up to 1.2 km (4,000') from the CTU. Up to three OPI's can be used with each CTU.

4.3.2 Configuring the CTU for OPI Operation

OPI Menu: *Setup | Hardware | OPI Display*

Select the number of OPI's in the *Number of OPI's* menu. The CTU supports up to three OPI's. In multiple-OPI systems, all OPI's display the same information and the CTU will process key presses from all OPI's. If an OPI is not used, set number of OPI's to 1 (default).

A loss-of-communication trip can be enabled in the *OPI-Loss Trip* menu. Display intensity can be set in the *Intensity* menu.

To extend the life of the vacuum-florescent display, a screen saver is provided and enabled using the *Screen Saver* menu. The screen saver activation time is defined by the *Setup | System Config | Password Timeout* setting.

4.3.3 Starter Control

OPI Menu: *Setup | Starter | Starter Type*

OPI Menu: *Setup | Hardware | OPI Display | OPI Ctrl Select*

A starter type other than *Protection Only* must be selected for starter functions to become operational.

The OPI has a CONTROL SELECT key and three yellow LED's (labeled REMOTE, OPI, and LOCAL) to select and indicate the start sources that the PGR-6300 will respond to. Each of the start sources can be enabled or disabled in the *OPI Ctrl Select* menu, and the CONTROL SELECT key allows the operator to choose from among the enabled start

sources. The factory default has all sources enabled and REMOTE selected. Regardless of the control setting, all stop sources are always enabled.

4.3.3.1 OPI Control

If only the OPI LED is ON, the PGR-6300 is under OPI control and start keys on the OPI are the only start source the PGR-6300 will respond to. If the OPI has been enabled as a start source for remote control, the OPI LED will also be on when remote control is selected. In this case, the PGR-6300 will also respond to the other sources enabled in remote control.

4.3.3.2 Local Control

OPI Menu: *Setup | Digital Inputs | Digital Input x | Input x Function*

When the LOCAL LED is ON, the PGR-6300 is under local control and digital inputs programmed as *Local Start 1* or *Local Start 2* are the only start sources the PGR-6300 will respond to.

Note: The *I²t Start Inhibit* function and digital inputs programmed as *Interlock* are bypassed in local control.

Local control can also be selected with a network command or by a digital input programmed for *Local Select*—both have priority over the CONTROL SELECT key. If either or both methods force the PGR-6300 into local control and then release local control, the PGR-6300 will return to the previous control setting. Each local control source must release local control to allow the PGR-6300 to return to the previous control setting.

4.3.3.3 Remote Control

OPI Menu: *Setup | Starter | Remote Group*

When the REMOTE LED is ON, PGR-6300 start control is from the start sources enabled in the *Remote Group* menu. Start source selections are *Digital Inputs*, *OPI*, and *Network*. If *Digital Inputs* is enabled, digital inputs programmed for *Start1*, *Start2*, *2-Wire Start1*, and *2-Wire Start2* are enabled. If *OPI* is enabled, the start keys on the OPI are enabled and if *Network* is enabled, start commands from the network are enabled.

Note: The OPI STOP key and digital STOP inputs always cause a stop.

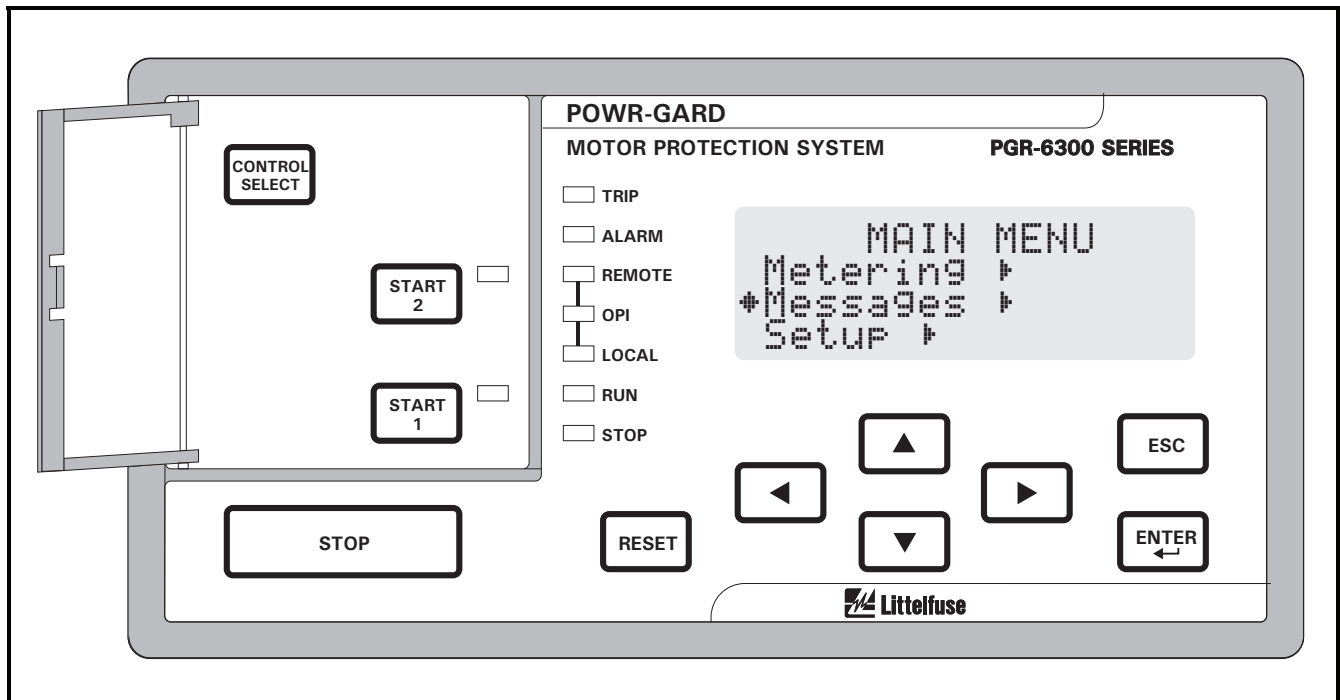


FIGURE 4.3 OPI Interface.

4.3.4 Metering

OPI Menu: *Metering*

OPI Menu: *Setup | Hardware | OPI Display | Meter Summary*

When *Metering* is selected in the main menu, press the right-arrow key to access a list of metering displays. Use the up- and down-arrow keys to scroll through the display list. Pressing the right-arrow key displays the selected metering information. See OPI menu map in Appendix A.

RESET is a “hot key” that is active in all meter displays. Pressing RESET causes a jump to the *Trip and Alarm* display to allow trips to be viewed and reset. Pressing ESC or the left-arrow key causes a return to the *Metering* display.

Many displays include per unit (pu) values where 1.0 pu is equal to 100%. I_a , I_b , I_c , I_1 , and I_2 are in per unit of full-load current. I_g is in per unit of earth-fault-CT-primary rating.

The unbalance display indicates minus (-) if current inputs are not sequenced A-B-C.

The IEEE convention is used for power displays:

- +Watts, +Vars, -PF (Lag) Importing Watts,
Importing Vars
- +Watts, -Vars, +PF (Lead) Importing Watts,
Exporting Vars
- Watts, -Vars, -PF (Lag) Exporting Watts,
Exporting Vars
- Watts, +Vars, +PF (Lead) Exporting Watts,
Importing Vars

Operating range for energy values is $\pm 4E\pm 304$, however the maximum display range is $\pm 2E\pm 34$.

The *Setup | Hardware | OPI Display | Meter Summary* menu is used to configure the type of metering display selected by the *Metering | Summary* menu. In order to view the maximum amount of data, no menu title is displayed.

Display selections for the *Summary* menu are:

IDR Current-based metering (*I*), digital inputs (*D*), and relay outputs (*R*):

Average current, current unbalance, earth leakage, used I^2t , digital input and relay output status.

I: xxxx A Iu: xxxx
I_g:xxxx A I₂t:xx%
Di: 1..7: xxxxxx
Ry: 1..5: xxxxx

This selection is the default for the summary display.



IVP Current-based metering (*I*), voltage (*V*), unbalance, and power (*P*):

Average current, current unbalance, earth leakage, used I^2t , average voltage, voltage unbalance, power and power factor.

I: xxxx A Iu: x.xx
I_g:xxxx A I_{2t}: xx%
V: xx.xx kV Vu: x.xx
P: xx.x kW PF: x.xx

This selection is applicable for a PGR-6300 using voltage inputs.

IVPA Current-based metering (*I*), voltage (*V*), power (*P*), and analog I/O (*A*):

Average current, average voltage, earth leakage, used I^2t , power, power factor, and analog currents.

I: xxxx A V: xx.xx kV
I_g:xxxx A I_{2t}:xx%
P: xx.x kW PF: x.xx
Ai:xxx% Ao: xxx%

This selection is applicable when the PGR-6300 analog output is used in a process control loop. The analog input and output values provide indication of control-system operation.

For each metering display, Table 4.4 shows the information that can be displayed.

4.3.5 Messages

OPI Menu: *Messages*

Selecting this menu item allows trip and alarm messages, status messages, event records, and statistical data to be viewed and resets to be performed.

4.3.5.1 Trip Reset

OPI Menu: *Messages | Trip and Alarm*

Up to fifteen trip and alarm messages can be displayed in a scrollable-list format. Trip messages must be individually selected and reset when the OPI RESET key is used. All trips are simultaneously reset by digital-input reset, with the CTU RESET key or with a communications-network command. Alarms are non-latching and are displayed only for the time that the alarm condition exists.

RESET is a "hot key" to the *Trip and Alarm* display, except during set-point entry. In the *Trip and Alarm* display, pressing ESC or the left-arrow key causes a return to the display shown when RESET was pressed.

4.3.5.2 Status

OPI Menu: *Messages | Status Messages*

This menu is used to display status messages. Status messages are shown in Table 4.5.

4.3.5.3 Data Logging

OPI Menu: *Messages | Event Records*

Trip-record data, start-record data, and Emergency Thermal Resets (ETR) are logged. Trip-record data includes the time of trip, cause of trip, and pre-trip⁽¹⁾ data. ETR records contain a snapshot of the data prior to an ETR.

Trip or ETR records include:

- Time Stamp YY/MM/DD HH:MM:SS,
- V_{ab} , V_{bc} , V_{ca} , I_a , I_b , I_c , and $3I_0$ at time of trip or ETR,
- Unbalance (I_2/I_1 , V_2/V_1) at time of trip or ETR,
- P, Q, S, and PF at time of trip or ETR ⁽¹⁾,
- Used I^2t at time of trip or ETR,
- PTC/RTD temperature data if applicable, and
- Differential module data if applicable.

Start records⁽²⁾ are triggered by motor current and include:

- Time Stamp YY/MM/DD HH:MM:SS,
- maximum values of I_a , I_b , I_c , and $3I_0$ during the start,
- maximum value of I_2/I_1 , V_2/V_1 during the start,
- minimum values of V_{ab} , V_{bc} , V_{ca} during the start,
- maximum differential currents during the start if applicable,
- I^2t used during the start⁽³⁾,
- start duration, and
- PTC/RTD temperature data if applicable.

Record Type Trip/Start/ETR

Number of Records..... 64 (First In First Out)

⁽¹⁾ Recorded values for power quantities (P, Q, S, PF) are averages of measurements over the previous 16 cycles.

⁽²⁾ Values updated at 0.5-s intervals during a start. Record logged when the run mode is entered.

⁽³⁾ Starting I^2t can be used to determine the I^2t Lockout Level. See Section 5.2.



TABLE 4.4 METERING DISPLAY

METERING MENU	INFORMATION DISPLAY ⁽¹⁾
Summary	Displays values as per the <i>Meter Summary</i> menu. IDR, IVP, or IVPA.
Current	I_a, I_b, I_c in A and per unit of I_p .
Unbalance (I)	I_1, I_2 , in per unit of $I_p, I_2/I_1$ in per unit.
Earth Leakage	I_g in A and per unit of I_e .
Thermal Capacity	Used I^2t in percent. Trend I^2t in percent. Displays reset time when tripped on I^2t . Displays time to trip if in overload. Displays time to I^2t Inhibit removal. Displays time to Starts-Per-Hour Inhibit removal. Displays number of available starts.
Voltage	V_{ab}, V_{bc}, V_{ca} in kV and per unit of V_p .
Unbalance (V)	V_1, V_2 , in per unit of $V_p, V_2/V_1$ in per unit.
Differential (A)	DIF_a, DIF_b, DIF_c in A and per unit of I_d .
Power	P in kW, Q in kVA, S in kVAR, PF.
Energy	kWh, kVAh, kVARh.
Frequency	V_{ab} voltage in per unit of V_p and frequency in Hz.
RTD Temperatures	Summary shows maximum and minimum temperatures for stator, bearing, and load RTD's in degrees C. Module and input numbers, name, function, temperature in degrees C for each enabled RTD.
I/O Status	Analog input in mA, digital inputs and relay outputs in binary.
System State	Date and time, motor mode (Stopped, Start, Run). Displays starter state when starter is enabled. Displays active FLA when in protection-only mode. Displays RPM if tachometer input is enabled. Displays Reduced Overcurrent mode (ROC: ON, ROC: Off) Displays ETR mode.
Comm State	Displays DF1 state as online or timed out. Displays Modbus state as online or timed out. Displays Anybus module error and status. Displays DeviceNet errors and status.

⁽¹⁾ All but Summary, RTD, and System State metering displays show System Name.

TABLE 4.5 STATUS MESSAGES

MESSAGES	DESCRIPTION
INx Interlock Open	The interlock assigned to digital input x is open, preventing a start.
INx Stop Open	The stop switch assigned to digital input x is open, preventing a start.
INx Limit1 Open	The Limit1 switch assigned to digital input x is open, preventing a <i>Start1</i> .
INx Limit2 Open	The Limit2 switch assigned to digital input x is open, preventing a <i>Start2</i> .
I^2t Start Inhibit	The Used I^2t has exceeded the I^2t Inhibit level. A start is prevented if I^2t Start Inhibit is enabled.
Sph Start Inhibit	The number of starts per hour has been exceeded. A start is prevented if a starts-per hour trip or alarm is enabled.
t° Disabled by ETR	Indicates that the PGR-6300 is in ETR mode. Does not prevent a start.
Backspin Timer On	When a stop is issued and the backspin timer is enabled, a start is prevented until the backspin timer times out. This message is displayed when the backspin timer is on.

4.3.5.4 Statistical Data

OPI Menu: *Messages | Statistics*

OPI Menu: *Setup | System Config | Maintenance*

The PGR-6300 records the following statistical data:

- Running hours.
- Counters for all trips.

Statistical data can be cleared in the *Maintenance* menu.

4.3.5.5 Emergency Thermal Reset

OPI Menu: *Messages | Emerg I²t Reset*

The *Emerg I²t Reset* menu is used to reset the thermal memory. See Section 5.2.3.

4.3.6 Password Entry and Programming

OPI Menu: *Setup | System Config | Password Timeout*

Note: Factory default password is 1111.

All set points are locked from changes until the four-character password is entered. If set-point access is locked, the user is prompted to enter the password. Once entered, set-point access is allowed and remains enabled until a key has not been pressed for the time defined by the *Password Timeout* set point.

EXAMPLE:

Prior to password entry:

```
LR CURRENT
= 6.75 x FLA
Locked! Press ↵ To
Enter Password.
```

When ENTER is pressed, the *Password Entry* display is shown:

```
PASSWORD ENTRY
Enter Password
And Press ↵
[*****]
```

Use the left- and right-arrow keys to select the position of the flashing cursor. Use the up- and down-arrow keys to select password characters. Press ENTER.

When the correct password is entered, a flashing cursor is displayed, the set-point range and units are shown, and set points can be changed.

```
LR CURRENT
= 6.75 x FLA
(1.00 → 10.00 x FLA)
[00005.25]
```

Use the up- and down-arrow keys to change a set-point update-field character, and use the left- and right-arrow keys to move between characters. Press ENTER to update the set point, or press ESC to exit the display without changing the set point. A set point is set to the minimum or maximum value of its range if an out-of-range value is entered. Press ESC to exit the set-point-update screen.

The sequence for set-point characters depends upon the set-point type. The character sequence for numeric set points is:

```
... 0 1 2 3 4 5 6 7 8 9 . 0 1 2 3 . . . .
```

The character sequence for string set points is:

```
... [0...9] [A...Z] [a...z] SP - . / [0...9] [A...Z] . . . .
```

Characters forming a series are shown in brackets and "SP" represents the space character.

For set points requiring selection from a list, the up and down arrow keys are used to scroll through the items. In the same manner as menu items, selections are displayed using one of the three cursor symbols (½«²) preceding the item. Pressing ENTER selects the item and that item is indicated by the "*" symbol to its right.

EXAMPLE:

```
STARTER TYPE
Full V Non Reverse
* Adj. Speed Drive *
Soft Start
```

4.4 PGA-0120

OPI Menu: *Setup | Hardware | RTD Modules*

OPI Menu: *Setup | Protection | RTD*

Temperature

The PGA-0120 extends PGR-6300 protective functions to include multiple-RTD temperature monitoring. It has eight inputs that can be individually configured for RTD type, trip and alarm settings, name, and function. The RTD types are 10-Ω copper, 100-Ω nickel, 120-Ω nickel, and 100-Ω platinum. Functions are stator, bearing, load, and ambient.

Control voltage for the PGA-0120 (24 Vdc) is supplied by the CTU and communication is through an RS-485 link. This allows the PGA-0120 to be mounted up to 1.2 km (4,000 ft) from the CTU.

To enable RTD protection, the total number of modules must be selected in the *Total Modules*

menu. Up to three PGA-0120 modules can be used. In the *RTD Modules* menu, the action to be taken by the CTU in response to loss of communication is selected.

When the hardware has been configured, temperature set points and sensor-failure action selections in the *RTD Temperature* menu are used for RTD temperature protection. See Section 5.25.

4.5 PGA-0140

OPI Menu: *Setup | Hardware | DIF Module*

OPI Menu: *Setup | Protection | Differential*

The PGA-0140 extends PGR-6300 protective functions to include phase-differential monitoring. It has three differential-CT inputs that can be used in a three-CT core-balance connection, a six-differential-CT connection, or a six-CT connection that includes phase-CT PGR-6300 inputs. The core-balance, three-CT connection is recommended.

Control voltage for the PGA-0140 (24 Vdc) is supplied by the CTU and communication is through an RS-485 link. This allows the PGA-0140 to be mounted up to 1.2 km (4,000 ft) from the CTU, and the link can be shared by other PGR-6300 I/O modules.

Enable the module and loss-of-communications protection in the *Hardware | DIF Module* menu, and choose protection settings in the *Protection | Differential* menu. See Section 5.23.

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5. PROTECTIVE FUNCTIONS

5.1 General

The PGR-6300 measures true RMS, peak, and fundamental-frequency values of current and voltage. Fundamental-frequency values (magnitude and phase angle) are obtained using Discrete-Fourier Transform (DFT) filtering that rejects dc and harmonics. The type of measurement used for a protective function is indicated in each section.

Unless otherwise indicated, protective functions have a programmable definite-time characteristic. Each protective function can be assigned a trip action that defines the output contact(s) used. Except for overload protection which has auto-reset available, PGR-6300 trips are latched. Trips are logged.

Trip-action selections are:

- Disable
- Trip1 ⁽¹⁾
- Trip2 ⁽²⁾
- Trip3 ⁽²⁾
- Trip1 and Trip2
- Trip1 and Trip3
- Trip1 and Trip2 and Trip3
- Trip2 and Trip3

⁽¹⁾ Initiates a starter stop.

⁽²⁾ Does not initiate a starter stop

Most protection functions can be assigned an alarm action. Alarms auto-reset and are not logged.

Alarm-action selections are:

- Disable
- Alarm1
- Alarm2
- Alarm3
- Alarm1 and Alarm2
- Alarm1 and Alarm3
- Alarm1 and Alarm2 and Alarm3
- Alarm2 and Alarm3

To operate output contacts, trip and alarm actions must be assigned to output relays using the *Setup | Relay Outputs* menu. See Section 4.2.7.

Note: When starter functions are used, only set points with a Trip Action that includes Trip1 will cause the starter to stop when a trip occurs.

When enabled, Jam, Power-Factor, and Undercurrent protection are not active during a start

and are active in the Run mode. The Run mode is initiated when motor current is between 5 and 125% FLA for the duration of the setting in the *Setup | System Ratings | Run Mode Delay* menu.

Note: See Appendix B for default set-point values. Per-unit notation (pu) is used. 1 pu = 100%.

5.2 Overload

At a minimum, for customized thermal overload protection, motor data must be entered for Full Load Current, Service Factor, Cold Locked Rotor Current, and Hot Locked Rotor Current.

5.2.1 Thermal Model

OPI Menu: *Setup | Protection | Overload*

OPI Menu: *Setup | System Ratings*

A NEMA- or k-factor-based thermal-model algorithm can be selected.

The NEMA-based algorithm uses the square of the maximum RMS phase current as the thermal-model input:

$$I^2 = I_{max\ rms}^2 \quad I \text{ in per unit}$$

The k-factor-based algorithm uses a thermal-model input based on true positive- and negative-sequence component values:

$$I^2 = I_1^2 + kI_2^2 \quad I \text{ in per unit}$$

Where :

I_1 = positive sequence current

I_2 = negative sequence current

k = factor relating the heat produced by I_2 relative to I_1

A conservative value for k is:

$$k = \frac{230}{I_L^2}$$

Where :

$$I_L = \frac{\text{locked rotor current}}{\text{full load current}}$$

The thermal time constant (τ) used by the thermal model to provide starting and running I^2t protection is:

$$\tau = \frac{T_C}{-\ln\left(1 - \frac{sf^2}{I_L^2}\right)}$$

Where :

T_C = cold locked rotor time in seconds

sf = service factor in per unit

When the motor is stopped, the thermal model uses a time constant that is user selectable as a multiple (*Cooling Factor*) of the thermal time constant.

The cold-curve time-to-trip (t) for current above $FLA \times sf$ is:

$$t = -\ln\left(1 - \frac{sf^2}{I^2}\right) \times \tau$$

The PGR-6300 provides indication of thermal trend and used thermal capacity. Thermal trend is the value that used thermal capacity is tending toward and it is a function of the square of motor current. For currents greater than or equal to $FLA \times sf$, time-to-trip is displayed in *Metering | Thermal Capacity*. The thermal trend value ($Trend I^2t$) is:

$$Trend I^2t = \left(\frac{I^2}{sf^2}\right) \times 100\%$$

For currents less than $FLA \times sf$, the thermal trend value is:

$$Trend I^2t = \left(\frac{I^2}{sf^2}\right) \times \left(\frac{T_C - T_H}{T_C}\right) \times 100\%$$

Where:

T_H = hot locked rotor time in seconds

The curve shown in Fig. 5.1 is a Class-20 thermal-protection curve (20-s trip @ 600% FLA) with a service factor of 1.15. FLA multiplied by service factor is the current at which used thermal capacity begins to tend towards a trip. Time-to-trip approaches infinity when $I = FLA \times sf$. Service factor has little influence on time-to-trip when motor current is greater than 300% FLA.

PGR-6300 thermal-overload protection is dynamic. Time to trip at any overload current depends on the value of $Used I^2t$ — as $Used I^2t$ increases, time to trip decreases. This is illustrated in Fig. 5.1 by the protection curves labeled 25% $Used I^2t$, 50% $Used I^2t$, and 75% $Used I^2t$. Programming software PGW-COMM has a plot function to display and export PGR-6300 protection curves.

An overload alarm occurs when $Used I^2t$ reaches the $I^2t Alarm Level$ set point.

An overload trip occurs when $Used I^2t$ reaches 100%. When an overload trip occurs, reset is not allowed until $Used I^2t$ falls below the $I^2t Inhibit Level$ set point. The time-to-reset in minutes is:

$$t = -\tau \times Cooling Factor \times \ln(I^2t Inhibit Level)$$

Time-to-reset is displayed in the *Metering | Thermal Capacity* menu. The thermal model has three reset modes; *Normal*, *Auto*, and *Multiple Motor Seq.* The thermal overload reset mode is set using the *Setup | Protection | Overload | I^2t Reset Type* menu.

In the *Normal* mode, a thermal-overload trip reset is not allowed until $Used I^2t$ falls below the $I^2t Inhibit Level$ setting. A reset input is required to reset the trip. *Normal* is the default reset mode.

In the *Auto* mode, a thermal-overload trip is automatically reset when $Used I^2t$ falls below the $I^2t Inhibit Level$ setting.

Caution: If the starter circuit is configured for two-wire control, the motor can start without warning when *Auto* mode is selected. A warning label may be required.

In the *Multiple Motor Seq.* mode, $Used I^2t$ decreases exponentially with a fixed two-second time constant when there is no motor current. This mode is used in applications where one overload relay is used to protect several motors operating in sequence with only one motor running at any one time. A two-second stop is required between starts so that $Used I^2t$ decreases sufficiently to allow the next motor to start. It is assumed that each motor is allowed to cool between starts. Motor life may be decreased if this feature is used in single-motor applications. When a thermal trip occurs, the trip is latched but can be reset two seconds after the trip.

When $I^2t Start Inhibit$ is enabled, the $I^2t Inhibit Level$ set point can be used to prevent a start with insufficient I^2t available. When $Used I^2t$ is above the $I^2t Inhibit Level$ set point and motor current is not detected, Alarm1 is issued, starter functions Start1 and Start2 are disabled, and the relay assigned to *Start Inhibit* is energized. The time until a start is permitted is displayed in *Metering | Thermal Capacity*, and $I^2t Inhibit Alarm$ is displayed in the *Trip and Alarm* message window. When $Used I^2t$ falls below the $I^2t Inhibit Level$ set point, the relay assigned to *Start Inhibit* is de-energized, the inhibit alarm is cancelled, and starter functions Start1 and Start2 are enabled. Trips require a manual reset. $I^2t Start Inhibit$ is removed when current is detected. This applies in both Starter and Protection-only modes. The Start-Inhibit relay is shared with the Starts-Per-Hour function. See Section 5.21.

If the motor is equipped with RTD sensors, the thermal model can compensate for high ambient temperature and loss of ventilation. See Section 5.26.

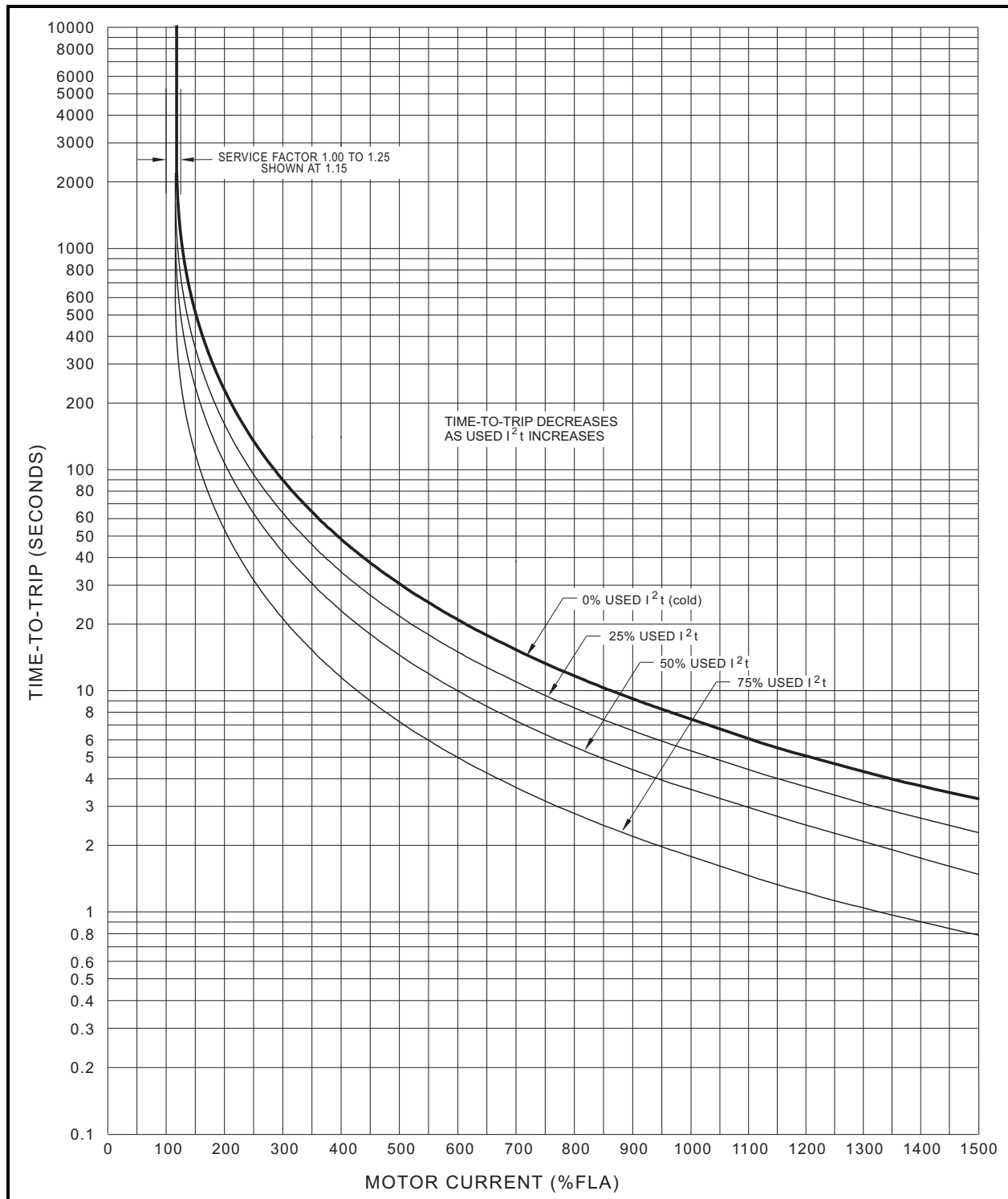


FIGURE 5.1 Class-20 Overload Curve.



I^2t used during each start is recorded in *Messages | Event Records*. This information can be used to determine the *I²t Inhibit Level* set point to ensure sufficient I^2t is available to complete a start, and to minimize thermal-overload-reset time.

FLA Rating.....	1.00 to 5,000.00 A
Service Factor	1.00 to 1.25
Locked-Rotor Current.....	1.50 to 10.00 x FLA
Hot Locked-Rotor Time	0.10 to 100.00 s
Cold Locked-Rotor Time ..	0.10 to 100.00 s
Cooling Factor	0.10 to 10.00
Model Type:.....	NEMA, K-Factor
I^2t Reset Type.....	Normal, Auto, Multiple Motor Sequence
K-Factor.....	1.00 to 10.00
I^2t Alarm.....	0.50 to 1.00 pu
I^2t Inhibit Level.....	0.10 to 0.90 pu
I^2t Start Inhibit.....	Enable/Disable
Protection	Enable/Disable Trip1, 2, 3 Enable/Disable Alarm1, 2, 3
Measurement Method	DFT or RMS

5.2.2 Locked-Rotor Times

In all cases, values for T_H and T_C should be obtained from the motor manufacturer. The following information is provided to assist in selecting values for T_H and T_C only if manufacturer data is not available.

Heater-style overload elements are available as Class 10, Class 20, or Class 30. Class 20 is recommended for general applications, Class 10 is used for motors with short locked-rotor time capability, and Class 30 is used in high-inertia applications to allow additional accelerating time where motors are within Class-30 performance requirements. These overloads can be replicated by setting $T_C = 10, 20, \text{ or } 30 \text{ s}$; $T_H = 0.1 \text{ s}$; and Locked-Rotor Current = $6.00 \times \text{FLA}$.

An induction motor built to the NEMA MG 1 standard is capable of

- two starts in succession (coasting to rest between starts) with the motor initially at ambient temperature (cold start), and
- one start with the motor initially at a temperature not exceeding its rated-load operating temperature (hot start).

Since the connected load has a direct influence on motor heating during a start, NEMA MG 1 defines the load torque and the load inertia (Wk^2) for these starts as a function of the motor's rated power and synchronous speed. To satisfy the cold-start requirement, a start must not use more than 50% thermal capacity. To satisfy the hot-start requirement, used thermal capacity at steady state must be less than 50%.

If the thermal model in the PGR-6300 has the correct value of T_C and if *Used I^2t* increases by 50% during a start, the load is equal to the NEMA-defined load and two starts from cold will be permitted. If *Used I^2t* increases by more than 50% during a start, the load is greater than the NEMA-defined load and two starts from cold should not be permitted — a delay is required between starts. The appropriate delay can be obtained by enabling *I²t Start Inhibit* and setting the *I²t Inhibit Level* equal to 100% minus the I^2t used during a start (a slightly lower level is recommended to allow for supply and load variations). If *Used I^2t* increases by less than 50% during a start, the load is less than the NEMA-defined load and two starts from cold will be permitted.

The magnitude of T_H relative to T_C determines if a hot start will be permitted if *I²t Start Inhibit* is enabled and the *I²t Inhibit Level* is set as described above. If *Used I^2t* increases by 50% or less during a start, a hot start will be permitted if T_H is equal to or greater than 50% of T_C . Increasing T_H above 50% of T_C is not recommended unless specific information is available with respect to T_H .

5.2.3 Emergency Thermal Reset

OPI Menu: *Messages | Emerg I2t Reset | Reset I2t Memory*

Emergency Thermal Reset (ETR) sets *Used I^2t* to 0%, resets starts-per-hour variables, and disables PTC and RTD temperature trips. Program access is required. Disabled-temperature protection is indicated by *t° Disabled by ETR* in the *Status Messages* display. If PTC or RTD temperature protection is not enabled, *t° Disabled by ETR* will not be displayed. Stator RTD or PTC trips are reset when ETR is performed regardless of measured temperatures. Temperature protection must be re-enabled in the *Messages | Emerg I²t Reset | Reenable Temp* menu, or by cycling supply voltage.

Temperature alarms and sensor verification remain enabled during ETR.

Caution: Temperature protection is not automatically re-enabled after an Emergency Thermal Reset.

5.3 Overcurrent

OPI Menu: *Setup | Protection | Overcurrent*

Overcurrent protection is based on the largest fundamental-frequency component (DFT) of the three phase currents. An alarm-level setting is not provided.

When enabled, overcurrent protection is active at all times. It is not bypassed during a start.

Trip Level..... 1.00 to 15.00 x CT-
Primary Rating (I_p)
Trip Delay (TD)..... 0.00 to 10.00 s
(See Tables 5.1 and 5.2)
Protection Enable/Disable Trip1, 2, 3
Measurement Method DFT

TABLE 5.1 Trip Time

FAULT LEVEL (multiples of trip- level setting) ⁽¹⁾	TRIP RELAYS (ms) (± 10 ms)	STARTER RELAYS (ms) (± 15 ms)
2	TD + 35	TD + 45
5	TD + 30	TD + 40
10	TD + 27	TD + 37
18	TD + 26	TD + 36

⁽¹⁾ For overcurrent faults less than 18 x I_p .
For earth faults less than 1 x I_e .

TABLE 5.2 Fault Duration Required for Trip

FAULT LEVEL (multiples of trip- level setting) ⁽¹⁾	FAULT DURATION (ms)	
	TD ≤ 20 ms	TD > 20 ms
2	10	TD - 10
5	5	TD - 15
10	2	TD - 18
18	1	TD - 19

⁽¹⁾ For overcurrent faults less than 18 x I_p .
For earth faults less than 1 x I_e .

The asymmetrical-current multipliers for RMS and DFT measuring methods are shown in Fig. 5.2. Typical X/R values are 6.6 for a low-voltage system, 15 for a medium-voltage system, and can be as high as 25 for a high-voltage system. As shown by the graph, the DFT filters the dc component so that the overcurrent setting can be set closer to the symmetrical fault value.

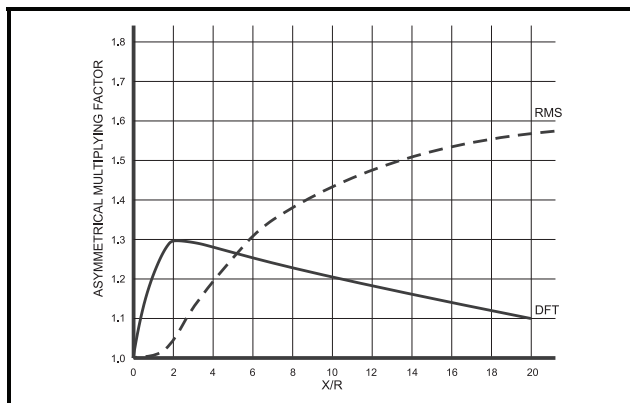


FIGURE 5.2 Asymmetrical-Current Multipliers.

5.4 Auxiliary Overcurrent

OPI Menu: *Setup | Protection | Aux Overcurrent*
Auxiliary overcurrent is the same as overcurrent protection. This function is intended to be used when backup protection for the overcurrent function is required.

Trip Level..... 1.00 to 15.00 x CT-
Primary Rating (I_p)
Trip Delay..... 0.00 to 10.00 s
(See Tables 5.1 and 5.2)
Protection Enable/Disable Trip1, 2, 3
Measurement Method DFT

5.5 Reduced Overcurrent

OPI Menu: *Setup | Protection | Reduced OC*
Reduced overcurrent is used to reduce the overcurrent set point when performing maintenance while a motor is running.

Reduced overcurrent is controlled by a digital input assigned to *Reduced OC*. When the digital input is not applied, this set point is operational and when the digital input is applied, this set point is not operational. When reduced overcurrent is selected, ROC:ON is displayed in the *Metering | System State* menu and a relay assigned to *Reduced OC* will be energized.

The Protection selection must include Trip1, Trip2, or Trip3. If *Disable* is selected, *Reduced OC* mode is disabled.

Trip Level..... 1.00 to 15.00 x CT-
Primary Rating (I_p)
Trip Delay..... Fixed at 0.00 (Instantaneous)
See Tables 5.1 and 5.2
Protection Enable/Disable Trip1, 2, 3

5.6 Jam

OPI Menu: *Setup | Protection | Jam*
A trip or alarm occurs if a jam condition is detected. Jam protection is active when the motor is in the Run mode, allowing protection to be set below motor-starting current.

Trip Level..... 1.00 to 10.00 x FLA
Trip Delay 1.00 to 100.00 s
Alarm Level 1.00 to 10.00 x FLA
Alarm Delay..... 1.00 to 100.00 s
Protection Enable/Disable Trip1, 2, 3
Enable/Disable Alarm1, 2, 3
Measurement Method DFT

5.7 Earth Fault

OPI Menu: *Setup | Protection | Earth Fault*

Earth-fault protection is based on the fundamental-frequency component of zero-sequence current.

Trip Level.....	0.05 to 1.00 x EF-CT-Primary Rating (I_e)
Trip Delay	0.00 to 100.00 s (See Tables 5.1 and 5.2)
Alarm Level.....	0.05 to 1.00 x I_e
Alarm Delay	0.00 to 100.00 s
Protection	Enable/Disable Trip1, 2, 3 Enable/Disable Alarm1, 2, 3
Measurement Method	DFT

5.8 Current Unbalance

OPI Menu: *Setup | Protection | Unbalance (I)*

Positive-sequence current (I_1) and negative-sequence current (I_2) are used to determine current unbalance (I_2/I_1). The unbalance display range is 0.00 to 1.00 where 1.00 is 100% unbalance—a single-phase condition. Negative unbalance will be indicated if current inputs are connected B-A-C. Severe unbalance may be indicated if phase-CT polarity is incorrect.

Trip Level.....	0.05 to 1.00
Trip Delay	1.00 to 100.00 s
Alarm Level.....	0.05 to 1.00
Alarm Delay	1.00 to 100.00 s
Protection	Enable/Disable Trip1, 2, 3 Enable/Disable Alarm1, 2, 3
Measurement Method	DFT

5.9 Phase Loss—Current

OPI Menu: *Setup | Protection | Phase Loss (I)*

Phase loss is a severe form of unbalance. When phase loss occurs, negative-sequence current (I_2) is equal to positive-sequence current (I_1) and current unbalance is 100% or 1.00 pu. The phase-loss algorithm considers I_2/I_1 from 0.90 to 1.00 to be a phase loss. Set the phase-loss trip delay lower than the unbalance trip delay to avoid an unbalance trip in the event of a phase loss.

Trip Delay	1.00 to 100.00 s
Protection	Enable/Disable Trip1, 2, 3
Measurement Method	DFT

5.10 Phase Reverse—Current

OPI Menu: *Setup | Protection | Phase Rev (I)*

If the current phase sequence is B-A-C, the magnitude of negative-sequence current will be larger than the magnitude of positive-sequence current.

Trip and Alarm Delay ⁽¹⁾	1.00 to 100.00 s
Protection	Enable/Disable Trip1, 2, 3 Enable/Disable Alarm1, 2, 3
Measurement Method	DFT

⁽¹⁾ Single set point applies to Trip and Alarm.

5.11 Undercurrent

OPI Menu: *Setup | Protection | Undercurrent*

Undercurrent protection is loss-of-load protection and is active when the motor is in the Run mode. A trip or alarm is initiated if current remains below the set point for the programmed delay.

Trip Level.....	0.10 to 1.00 x FLA
Trip Delay	1.00 to 100.00 s
Alarm Level	0.10 to 1.00 x FLA
Alarm Delay.....	1.00 to 100.00 s
Protection	Enable/Disable Trip1, 2, 3 Enable/Disable Alarm1, 2, 3
Measurement Method	DFT

5.12 Overvoltage

OPI Menu: *Setup | Protection | Overvoltage*

A trip or alarm occurs if the maximum line-to-line voltage exceeds the set point.

Trip Level.....	1.00 to 1.40 x System Voltage Rating (V_p)
Trip Delay	1.00 to 500.00 s
Alarm Level	1.00 to 1.40 x V_p
Alarm Delay.....	1.00 to 500.00 s
Protection	Enable/Disable Trip1, 2, 3 Enable/Disable Alarm1, 2, 3
Measurement Method	DFT

5.13 Voltage Unbalance

OPI Menu: *Setup | Protection | Unbalance (V)*

Positive-sequence voltage (V_1) and negative-sequence voltage (V_2) are used to determine voltage unbalance (V_2/V_1). The unbalance display range is 0.00 to 1.00 where 1.00 is 100% unbalance—a single-phase condition. A negative unbalance will be indicated if voltage inputs are connected B-A-C.

Trip Level.....	0.05 to 1.00
Trip Delay	1.00 to 100.00 s
Alarm Level	0.05 to 1.00
Alarm Delay.....	1.00 to 100.00 s
Protection	Enable/Disable Trip1, 2, 3 Enable/Disable Alarm1, 2, 3
Measurement Method	DFT

Enable the module and communications loss using the *Setup | Hardware | DIF Module* menu. The module uses I/O module communications and both trip and alarm actions are available in the event of communications loss.

Set *DF-CT Primary* equal to the differential-CT-primary rating. For the PGR-6300 summation connection *PH-CT Primary* must be equal to *DF-CT Primary*.

Trip and alarm settings are based on multiples of the *DF-CT Primary* rating (I_d).

- Trip Level..... 0.10 to 15.00 x I_d
- Trip Delay 0.00 to 10.00 s
- Alarm Level..... 0.10 to 15.00 x I_d
- Alarm Delay 0.00 to 10.00 s
- Protection Enable/Disable Trip1,2,3
Enable/Disable Alarm1,2,3
- Measurement Method DFT c/w CT saturation compensation.

5.24 PTC Temperature

OPI Menu: *Setup | Protection | PTC Temperature*

A positive-temperature-coefficient (PTC) thermistor input is provided on the CTU. The total resistance of series-connected PTC thermistors must be less than 1,500 Ω at 20°C. A trip or alarm will occur when series resistance exceeds 2,900 Ω.

During Emergency Thermal Reset, a PTC trip is reset and PTC-temperature protection is disabled. See Section 5.2.3.

- Protection Enable/Disable Trip1, 2, 3
Enable/Disable Alarm1, 2, 3

5.25 RTD Temperature

OPI Menu: *Setup | Protection | RTD Temperature*

Up to three PGA-0120 (RTD Modules) can be connected to the CTU. Select the number of modules in the *Setup | Hardware | RTD Modules* menu. Each PGA-0120 can monitor eight RTD's for a total of twenty-four RTD's. RTD type, function, and trip and alarm set points are programmable for each RTD.

When an RTD type is selected, both *Trip1* and *Alarm1* functions are enabled.

During Emergency Thermal Reset, an RTD trip is reset and RTD-temperature protection is disabled. See Section 5.2.3.

RTD failure detection is provided. The actions for an RTD failure are selectable as *Trip1*, 2, or 3 and as *Alarm1*, 2, or 3. The selections apply to all RTD's.

- Name..... 18 Character, Alphanumeric
- Type Disable, Pt100, Ni100, Ni120, Cu10
- Function..... Stator, Bearing, Load, Ambient
- Trip and Alarm Range 40.00 to 200.00°C
- Display Range -40.00 to 200.00°C

5.26 Hot-Motor Compensation

OPI Menu: *Setup | Protection | RTD Temperature*

If hot-motor compensation (HMC) is enabled, the maximum stator-RTD temperature is used to bias the thermal model by increasing *Used I²t* when the RTD temperature is greater than the thermal-model temperature.

Two set points are used to define the compensation. See Fig. 5.3. *HMC Low* is the stator temperature where compensation begins at 0% *I²t*. *HMC High* is the stator temperature where compensation ends at 100% *I²t*.

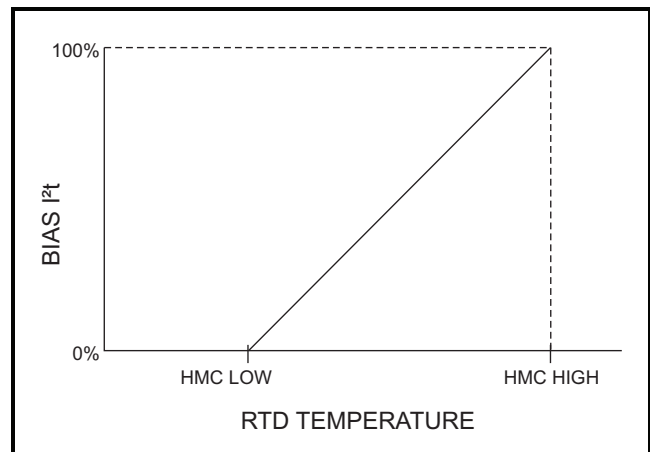


FIGURE 5.3 Used *I²t* Bias Curve.

- HMC Low..... 40.00 to 200.00°C
- HMC High..... 40.00 to 200.00°C
- Protection Enable/Disable

Note: Hot-motor compensation will not be active unless the *HMC High* set point is at least 10°C above the *HMC Low* set point.

5.27 Analog Input

OPI Menu: *Setup | Analog Input | 4-20 Input Type*

The analog input function is selectable as *Metering Only*, *Protection*, *Sync to ASD*, or *Motor Speed*.



5.27.1 Protection

OPI Menu: *Setup | 4-20 Analog In | Protection*

The protection input has high-level and low-level trip and alarm set points. A high-level trip or alarm occurs when the 4–20-mA input exceeds the high-level trip or alarm set point, and a low-level trip or alarm occurs when the 4–20-mA input is lower than the low-level trip or alarm set point.

Trip action is fixed at *Trip1* and alarm action is fixed at *Alarm1*.

- High Level Trip 0.10 to 20.00 mA
- Low Level Trip 0.10 to 20.00 mA
- Trip Delay 0.01 to 100.00 s
- High Level Alarm 0.10 to 20.00 mA
- Low Level Alarm 0.10 to 20.00 mA
- Alarm Delay 0.01 to 100.00 s

5.27.2 Synchronize to ASD

OPI Menu: *Setup | 4-20 Analog In | Sync to ASD*

When *Sync to ASD* is selected, the PGR-6300 uses the 4–20-mA input to set the internal sampling rate for current and voltage inputs so that protection and metering functions use accurate RMS and DFT values from 10.00 to 70.00 Hz.

- 4-mA Frequency (lower)... 0.00 to 70.00 Hz
- 20-mA Frequency (upper) 0.00 to 70.00 Hz
- Frequency Range..... 10.00 to 70.00 Hz

5.27.3 Motor Speed

OPI Menu: *Setup | 4-20 Analog In | Motor Speed*

When the analog input type is selected as *Motor Speed*, the 4–20-mA analog input is used as the speed input. This selection overrides the selections for the high-speed tachometer input and failure-to-accelerate protection uses the analog input as the source of speed information.

- 4-mA Speed..... 0.00 to 100% Sync Speed
- 20-mA Speed 0.00 to 100% Sync Speed

6. STARTER FUNCTIONS

OPI Menu: *Setup | Starter*

6.1 General

All common starter types are supported. From the OPI *Starter Type* menu, select one of seventeen starter types or select *Protection Only*. Starter types requiring two FLA settings are indicated by the “∞” symbol in the OPI display.

When *Protection Only* is selected, all starter functions except STOP are disabled and all OPI control-select LED's will be OFF. Any STOP signal will initiate a *Trip1* when the PGR-6300 is in *Protection Only*.

Caution: When *Protection Only* is selected, STOP will not function if *Trip1* is not assigned to a relay output.

When a starter type is selected, starter control can be performed with the digital inputs, OPI, or network communications. See Section 4.3.3 for details on selecting start sources.

The digital inputs allow concurrent operation of three start-control methods; three-wire start/stop, two-wire start/stop, and three-wire local start/stop. Three-wire control requires two digital inputs, one programmed for *Start1* or *Start2* (N.O. momentary start switch) and one programmed for *Stop* (N.C. momentary stop switch) as shown in Fig. 6.1. Two-wire control uses one input, programmed as *2-Wire Start1* or *2-Wire Start2*, for start/stop control and can be used where a single contact provides start/stop operation. See Fig. 6.2. If a start was activated by a two-wire start input, any other STOP will initiate a latching *Trip1*. In all other cases, STOP does not cause a trip.

Digital inputs programmed for *Limit1 Stop* and *Limit2 Stop* are used to provide stop control for *Start1* and *Start2*. This is typically used in reversing starter applications. The forward-direction limit switch is connected to the *Limit1 Stop* input and the reverse-direction limit switch is connected to the *Limit2 Stop* input.

Note: When starter functions are used, protective functions with the trip action set to *Trip1* will cause the starter to stop when a trip occurs. Reset is required.

Table 6.1 indicates the available start sources.

TABLE 6.1 Start-Source Summary ⁽¹⁾

CONTROL ⁽⁷⁾ SELECTION	START SOURCE	
REMOTE ⁽²⁾	DIGITAL INPUTS ⁽³⁾	Start1 Input (3-wire control) Start2 Input (3-wire control)
		2-W Start1 (2-wire control) ⁽⁴⁾ 2-W Start2 (2-wire control) ⁽⁴⁾
	OPI ⁽³⁾	START1 Key START2 Key
	NETWORK ⁽³⁾	Start1 Command Start2 Command
OPI	OPI START1 Key OPI START2 Key	
LOCAL ⁽⁵⁾⁽⁶⁾	Digital-Input Local Start1 (3-wire) Digital-Input Local Start2 (3-wire)	

- (1) All STOP sources are always enabled.
 (2) Factory default has all sources enabled and REMOTE selected.
 (3) Can be enabled or disabled using the *Setup | Starters | Remote Group* menu.
 (4) STOP causes a latching trip.
 (5) LOCAL can also be selected by a network command or by a digital input programmed for *Local Select*. Each *Local Select* source must de-select local control for the PGR-6300 to return to the previous control setting.
 (6) *I²t Start Inhibit*, *Starts per Hour* alarms and *Interlocks* are bypassed.
 (7) At least one Control Selection must be enabled even when *Protection Only* is selected.

Up to four timers (*Stage 1 to 3 Delay*, and *Start Time*) control the start sequence. These timers control *Starter RLYA*, *Starter RLYB*, *Starter RLYC*, and *Starter RLYD* as shown in the timing diagrams in Section 6.2. These functions can be assigned to any output relay. Digital inputs can be programmed to monitor contactor status. Contactor status corresponding to *Starter RLYA*, *Starter RLYB*, *Starter RLYC*, and *Starter RLYD* outputs are designated as *RLYA Status*, *RLYB Status*, *RLYC Status*, and *RLYD Status*. The PGR-6300 will issue a *Trip1* and indicate *Relay Status Trip* if the status contact does not follow within 500 ms of the command to operate the respective relay output.

The *Start Time* set point is the maximum start time allowed. The starting process will terminate and generate a *Trip1* unless current is between 10 and 125% FLA when the *Start Time* timer times out.

In reduced-voltage-starting applications, the PGR-6300 can use time-based or current-based transfer from the starting to the running connection. The transfer type is selected as *Time Transfer* or *Current Transfer* using the *Transfer Type* menu.

When *Current Transfer* is selected, the start-connection delay (*Stage 1 Delay* or *Stage 2 Delay*, see Table 6.2 and Figs 6.5, 6.6, 6.7, and 6.8)

defines the minimum starting-connection time. The transfer to the run connection occurs when the start-connection delay has expired and current is below the *Transfer Current*. When current is above the *Transfer Current*, the transfer will be delayed up to the maximum time defined by the *Start Time*. If current is below 10% FLA when the start-connection delay expires or if the *Start Time* is exceeded, the PGR-6300 will issue a *Trip1* and indicate *Starter Trip*.

When *Time Transfer* is selected, the start-connection delay set point (*Stage 1 Delay* or *Stage 2 Delay*) is used to determine the transfer time. Transfer to the run connection occurs after the start-connection delay has expired.

In both current- and time-transfer modes, the PGR-6300 will issue a *Trip1* and indicate *Starter Trip* if load current is above 125% FLA or below 10% FLA when the *Start Time* expires. The *Start Time* set point must be long enough to allow the starting sequence to complete and for the motor current to drop below 125% FLA.

When the starting sequence is complete, contactor status is checked every 500 ms and a *Relay Status Trip* will occur if the status changes.

Table 6.2 summarizes starter types and shows which starter set points are active.

The backspin timer is available when a delay is required between starts. The backspin timer is enabled in the *BkSpin En/Disable* menu, and the delay time is set in the *Backspin Delay* menu. The backspin timer is activated by a STOP or when

supply voltage is cycled on the MPS. While the backspin timer is on, the *Backspin Timer On* message is displayed in the *Status Message* menu and starts are not allowed.

The connection diagrams, Figs. 6.9 to 6.23, show typical control circuits with 120-Vac contactor coils and the 24-Vdc source on the CTU used for status contacts. Other supply voltages can be used within the limits of the digital-input and relay-contact ratings. The use of status contacts is optional.

Note: Stop and start control, electrical interlocks, and mechanical interlocks are not shown in connection diagrams.

Note: Connection diagrams show typical output relay assignments that must be set using the *Setup | Relay Outputs | Relay x | Relay x Function* menu.

Note: To cancel a long backspin time, enter new backspin parameters and restart the PGR-6300 using the *Setup | System Config | Maintenance | Restart CTU* menu or cycle supply voltage.

6.2 Starter Timing Sequences

The PGR-6300 uses one of six timing sequences to implement the various starter types. These time-based starter sequences are shown in Figs. 6.3 to 6.8.

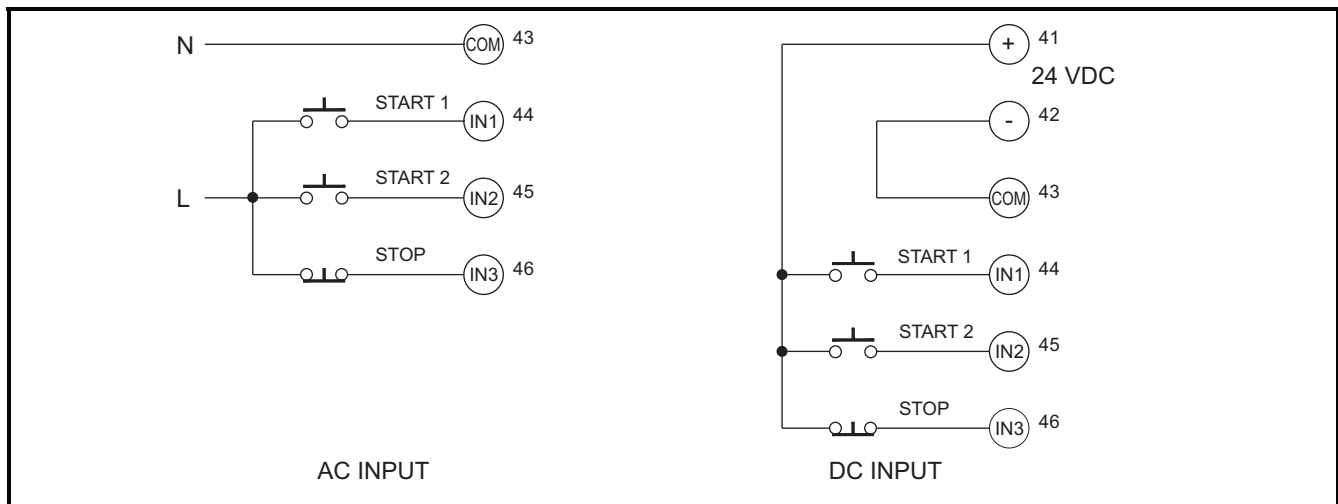


FIGURE 6.1 Typical 3-Wire Control.

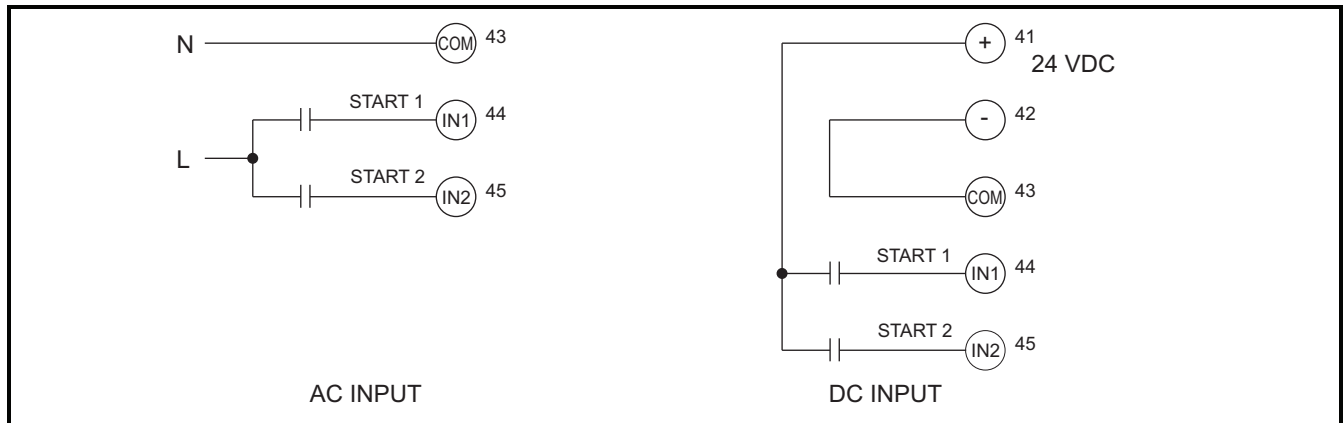


FIGURE 6.2 Typical 2-Wire Control.

TABLE 6.2 Starter Summary

STARTER TYPE	SEQ. NO.	TIMERS USED ⁽¹⁾	START-CONNECTION TIMER NUMBER ⁽¹⁾	ACTIVE FLA SETPOINTS ⁽²⁾		RELAYS AND CONTACTOR STATUS ⁽³⁾			
				FLA	FLA 2	RLYA	RLYB	RLYC	RLYD
Full-Voltage Non-Reversing	1	4		x		x			
Adjustable-Speed Drive	1	4		x		x			
Soft-Start	1	4		x		x			
Full-Voltage Reversing	2	4		x		x	x		
Two-Speed Two-Winding	2	4		x	x	x	x		
Reactor or Resistor Closed-Transition ⁽⁴⁾	3	1,4	1	x		x	x		
Slip-Ring ⁽⁴⁾	3	1,4	1	x		x	x		
Part-Winding ⁽⁴⁾	3	1,4	1	x	x	x	x		
Double-Delta ⁽⁴⁾	3	1,4	1	x	x	x	x		
Soft-Start-with-Bypass ⁽⁴⁾	3	1,4	1	x		x	x		
Reactor or Resistor Open-Transition ⁽⁴⁾	4	1,4	1	x		x	x		
Two-Winding ⁽⁴⁾	4	1,4	1	x	x	x	x		
Wye-Delta Open-Transition ⁽⁴⁾	5	1,2,3,4	2	x	x	x	x	x	
Autotransformer Closed-Transition ⁽⁴⁾	5	1,2,3,4	2	x		x	x	x	
Wye-Delta Closed-Transition ⁽⁴⁾	6	1,2,4	2	x	x	x	x	x	x

⁽¹⁾ TIMERS

- 1: Stage 1 Delay
- 2: Stage 2 Delay
- 3: Stage 3 Delay
- 4: Start Time

⁽²⁾ FLA SETPOINTS

- FLA: Full-Load Current
- FLA2: Full-Load Current 2

⁽³⁾ RELAYS AND CONTACTOR STATUS

- Starter RLYA*, *Starter RLYB*, *Starter RLYC*, and *Starter RLYD* are not automatically assigned. The user must assign these functions to individual relays. Status is assignable to any digital input.

⁽⁴⁾ Current transfer capability when enabled.

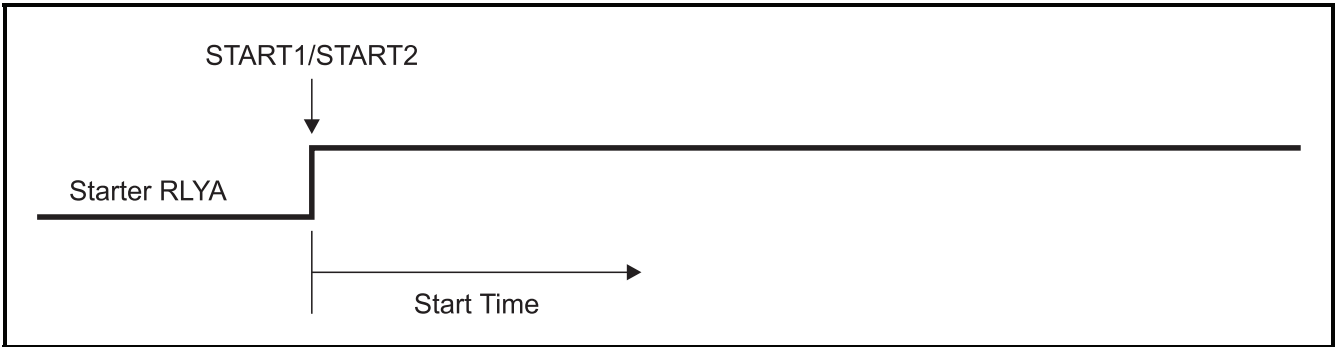


FIGURE 6.3 Starter Sequence 1.

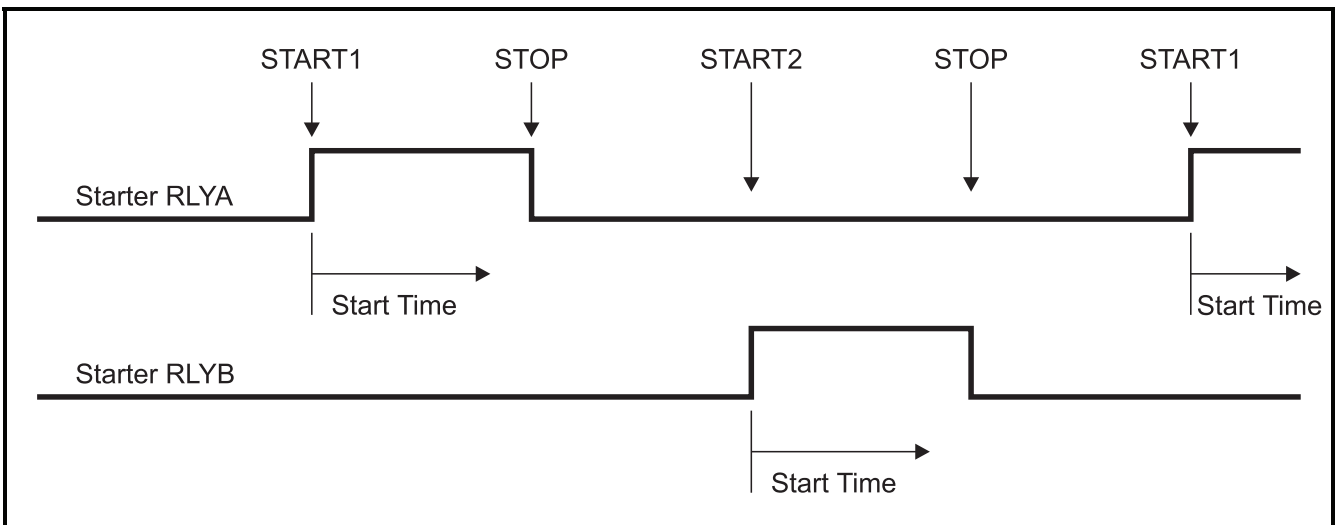


FIGURE 6.4 Starter Sequence 2.

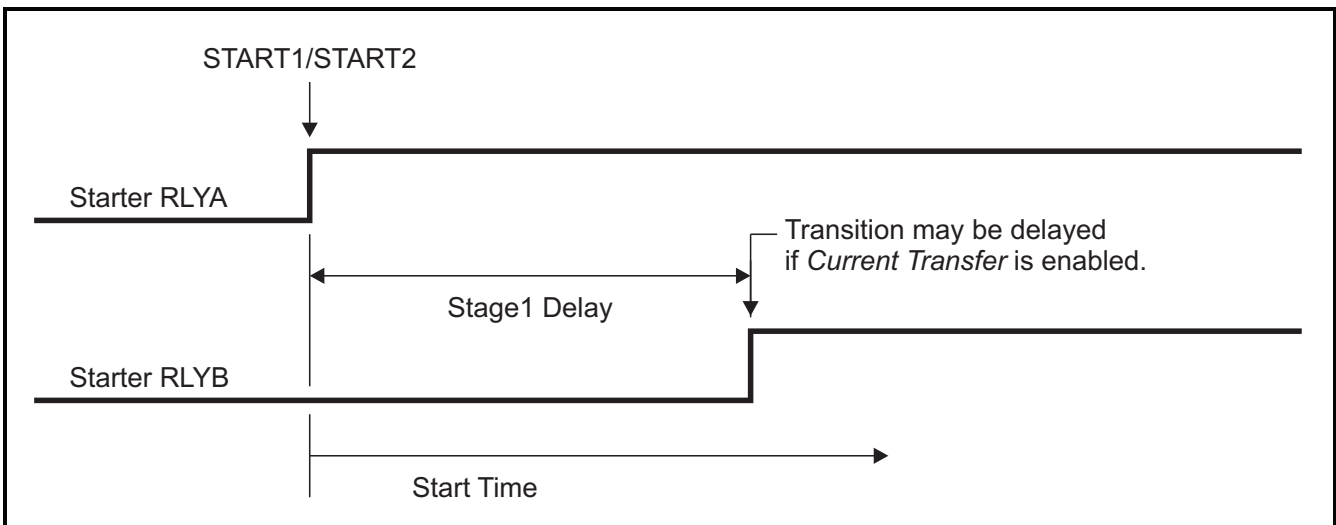


FIGURE 6.5 Starter Sequence 3.

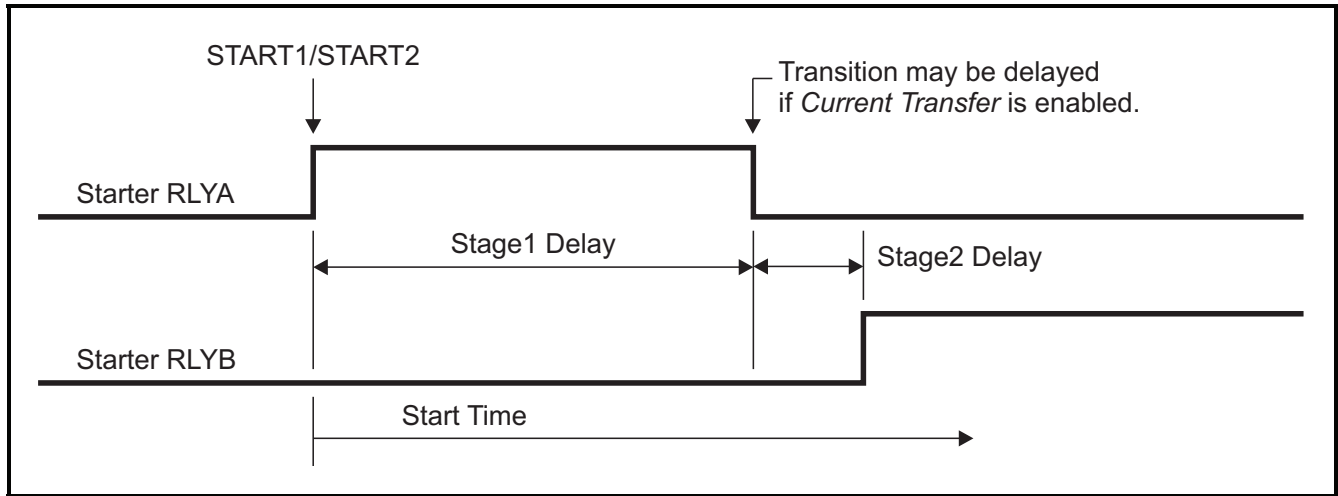


FIGURE 6.6 Starter Sequence 4.

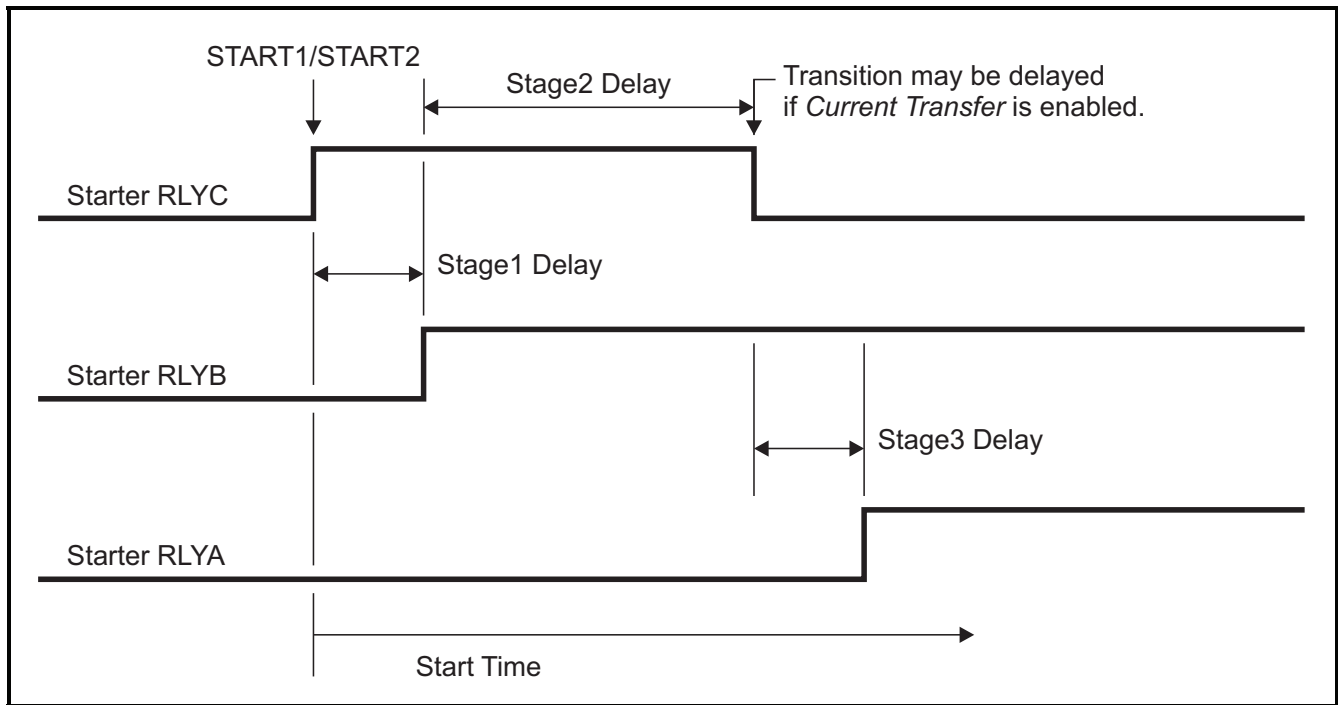


FIGURE 6.7 Starter Sequence 5.

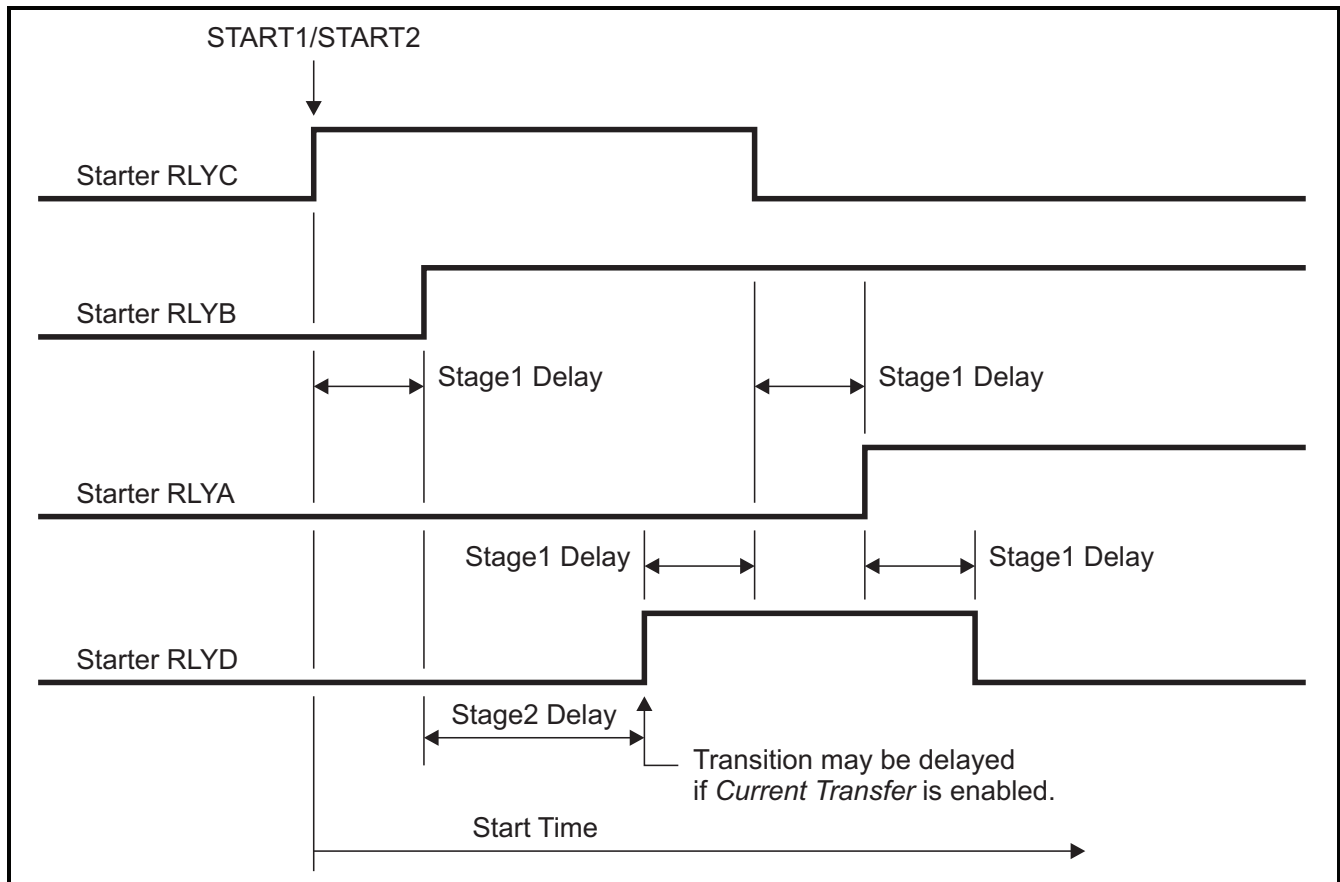


FIGURE 6.8 Starter Sequence 6.

6.3 Full-Voltage Non-Reversing Starter

Sequence: Fig. 6.3
 Connection: Fig. 6.9
 Current Transfer: Not available

START1 or START2 is the start command and Starter RLYA is used as the output to control the contactor.

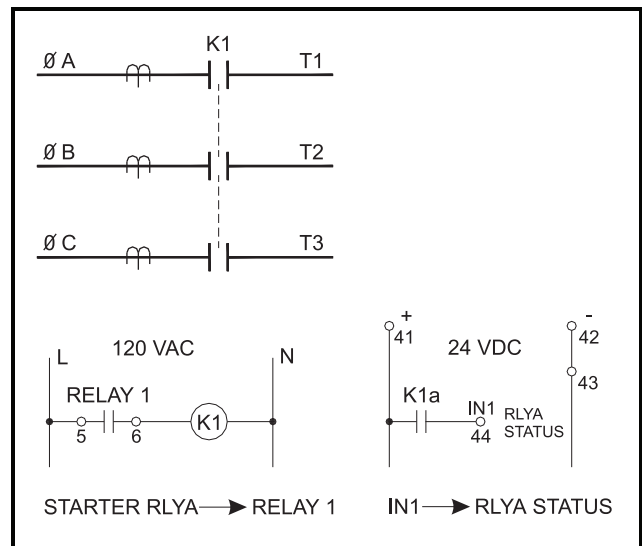


FIGURE 6.9 Full-Voltage Non-Reversing-Starter Connection.

6.4 Adjustable-Speed Drive

Sequence: Fig. 6.3
Connection: Fig. 6.10
Current Transfer: Not available

The CTU provides the start input to an adjustable-speed drive (ASD). START1 or START2 is the start command and Starter RLYA is used as the output to control the ASD.

The CTU has a 4–20 mA input that should be used to synchronize its sampling rate to the ASD output frequency. Then, all protection and metering values are valid for an ASD output frequency from 10 to 70 Hz. In ASD applications, voltage and current inputs must be derived from the load side of the ASD, and undervoltage protection must be disabled.

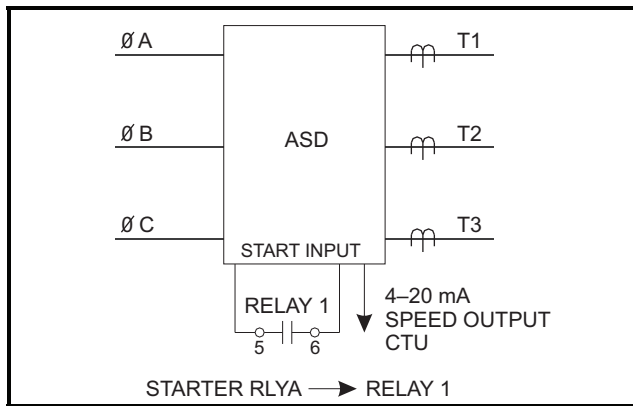


FIGURE 6.10 Adjustable-Speed-Drive Connection.

6.5 Soft-Start Starter

Sequence: Fig. 6.3
Connection: Fig. 6.11
Current Transfer: Not available

The CTU provides the start input to a solid-state starter. START1 or START2 is the start command and Starter RLYA is used as the output to control the starter.

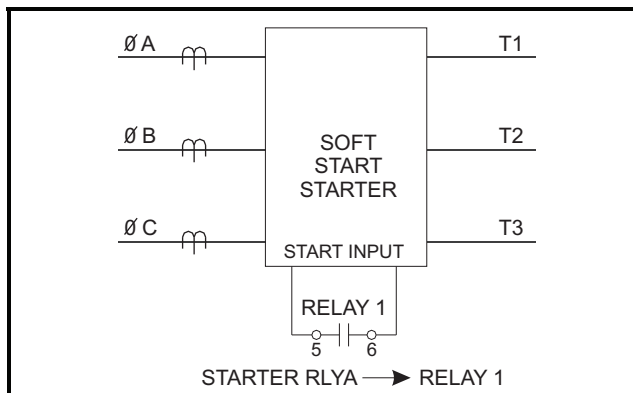


FIGURE 6.11 Soft-Start-Starter Connection.

6.6 Full-Voltage Reversing Starter

Sequence: Fig. 6.4
Connection: Fig. 6.12
Current Transfer: Not available

The full-voltage reversing starter uses START1 to activate Starter RLYA for forward control and START2 to activate Starter RLYB for reverse control. RLYA Status is the status corresponding to Starter RLYA and RLYB Status is the status corresponding to Starter RLYB.

For OPI and 3-wire start/stop control, a direction change requires a STOP command prior to a START1 or START2 command. For 2-wire control a STOP command is not required.

Fig. 6.12 shows the use of forward and reverse limit switches. When Start1 is issued, K1 is energized. If a STOP is issued or LSF opens, K1 is de-energized. Provided LSR is closed, Start2 will energize K2 to allow operation in the reverse direction.

Note: Phase CT's should be located upstream of the contactors.

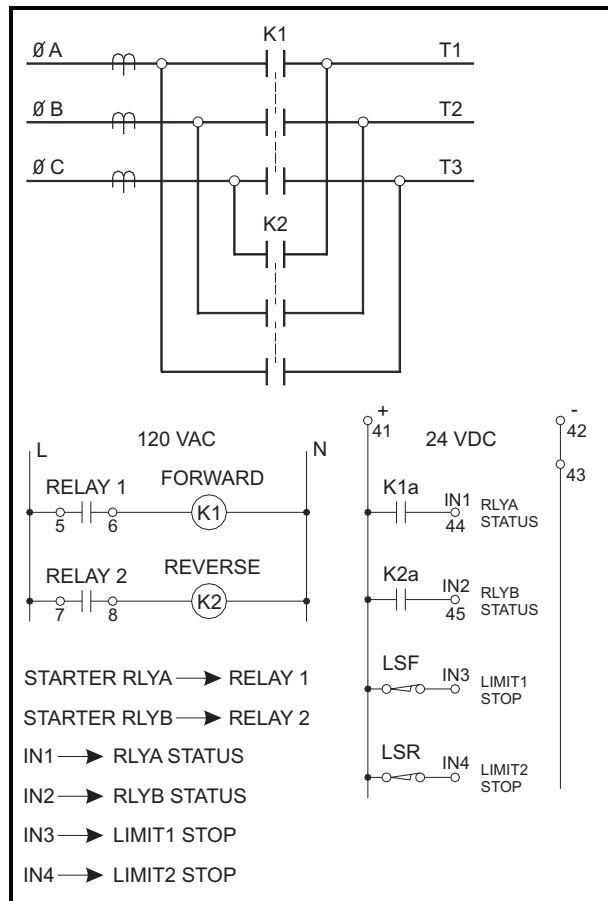


FIGURE 6.12 Full-Voltage-Reversing-Starter Connection.

6.7 Two-Speed Starter

Sequence: Fig. 6.4
 Connection: Fig. 6.13, 6.14, and 6.15
 Current Transfer: Not available

The two-speed starter uses START1 to activate Starter RLYA for high-speed control and START2 to activate Starter RLYB for low-speed control. RLYA Status is the status corresponding to Starter RLYA and RLYB Status is the status corresponding to Starter RLYB. A speed change requires a STOP command prior to a START1 or START2 command. This starter can be used on motors with two separate windings (Fig. 6.13) or on motors with reconnectable windings (Figs. 6.14 and 6.15).

This starter requires two FLA settings. Use FLA Rating for the high-speed connection and FLA Rating 2 for the low-speed connection.

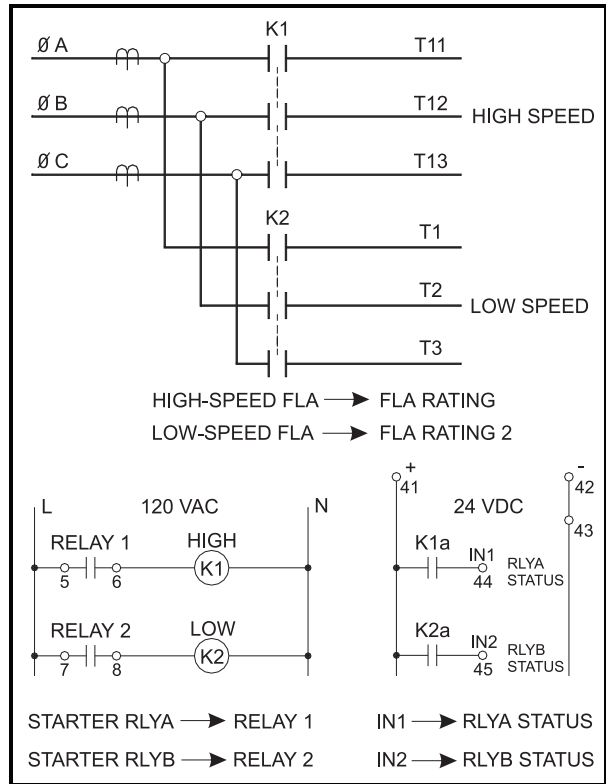


FIGURE 6.13 Two-Speed Two-Winding-Starter Connection.

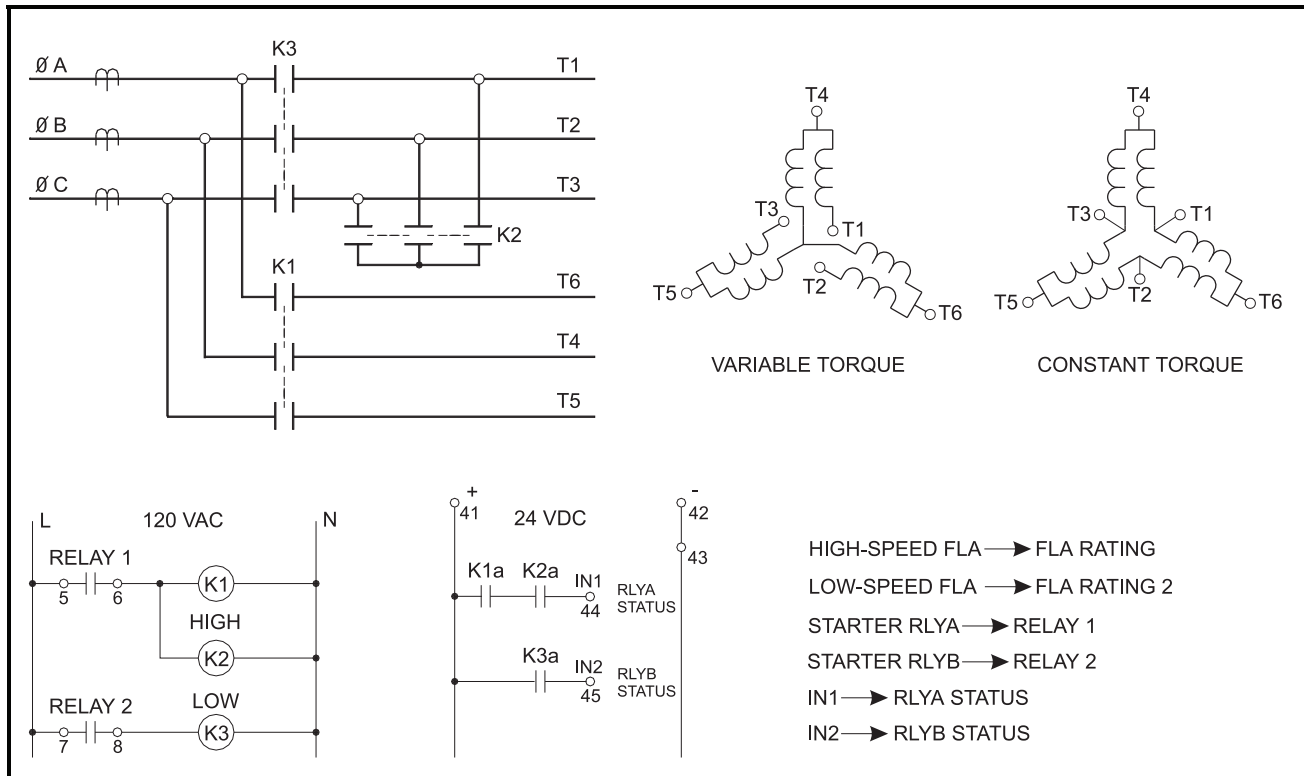


FIGURE 6.14 Two-Speed Constant- and Variable-Torque-Starter Connections.

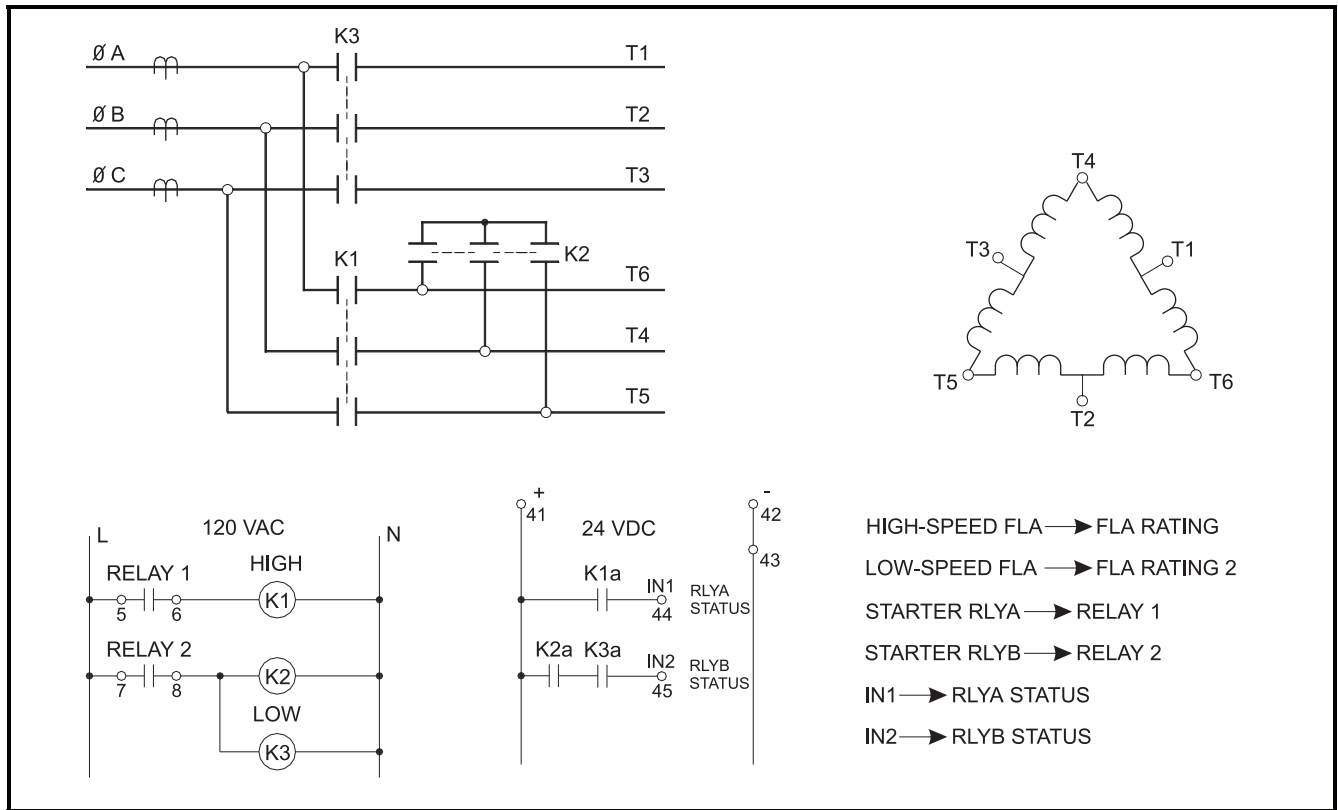


FIGURE 6.15 Two-Speed Constant-Horsepower-Starter Connection.

6.8 Reactor or Resistor Closed-Transition Starter

Sequence: Fig. 6.5
Connection: Fig. 6.16
Current Transfer: Available

This starter uses a reactor or resistor to provide reduced-voltage starting and the reactor or resistor contactor (K1) remains closed during running.

START1 or START2 initiates the starting sequence by activating Starter RLYA. Starter RLYB activates after the Stage1 Delay.

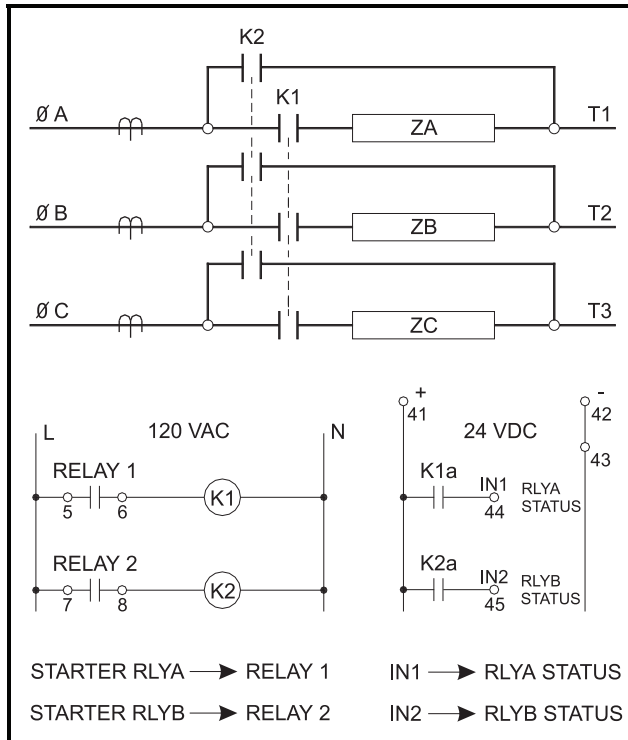


FIGURE 6.16 Reactor or Resistor-Starter Connection.

6.9 Slip-Ring Starter

Sequence: Fig. 6.5
Connection: Fig. 6.17
Current Transfer: Available

The slip-ring starter is a single-stage wound-rotor starter with a single contactor (K2) controlling the rotor resistor bank.

START1 or START2 initiates the starting sequence by activating Starter RLYA. Starter RLYB activates after the Stage1 Delay.

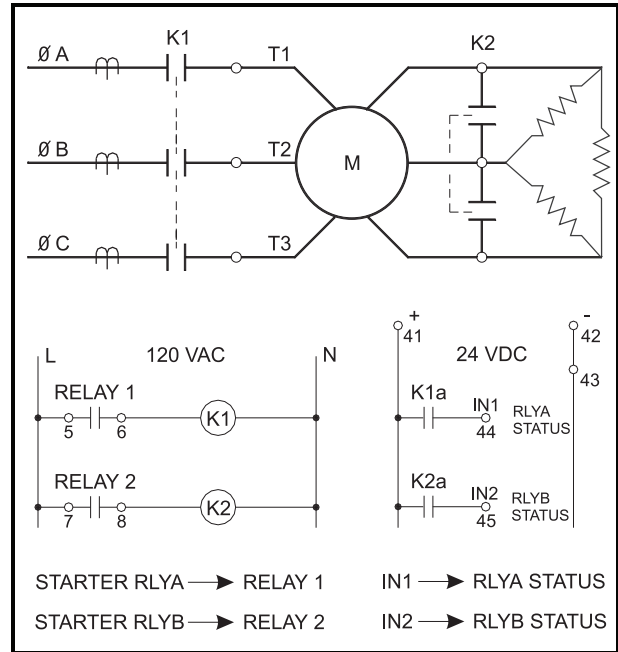


FIGURE 6.17 Slip-Ring-Starter Connection.

6.10 Part-Winding And Double-Delta Starter

Sequence: Fig. 6.5
 Connection: Fig. 6.18
 Current Transfer: Available

The part-winding starter is used on motors with two stator windings and the double-delta starter has a delta winding that is parallel connected during running.

START1 or START2 initiates the starting sequence by activating *Starter RLYA*. *Starter RLYB* activates after the *Stage1 Delay*.

Both starters require two FLA settings. *FLA Rating 2* is the full-load current for the starting connection and *FLA Rating* is the full-load current for the running connection.

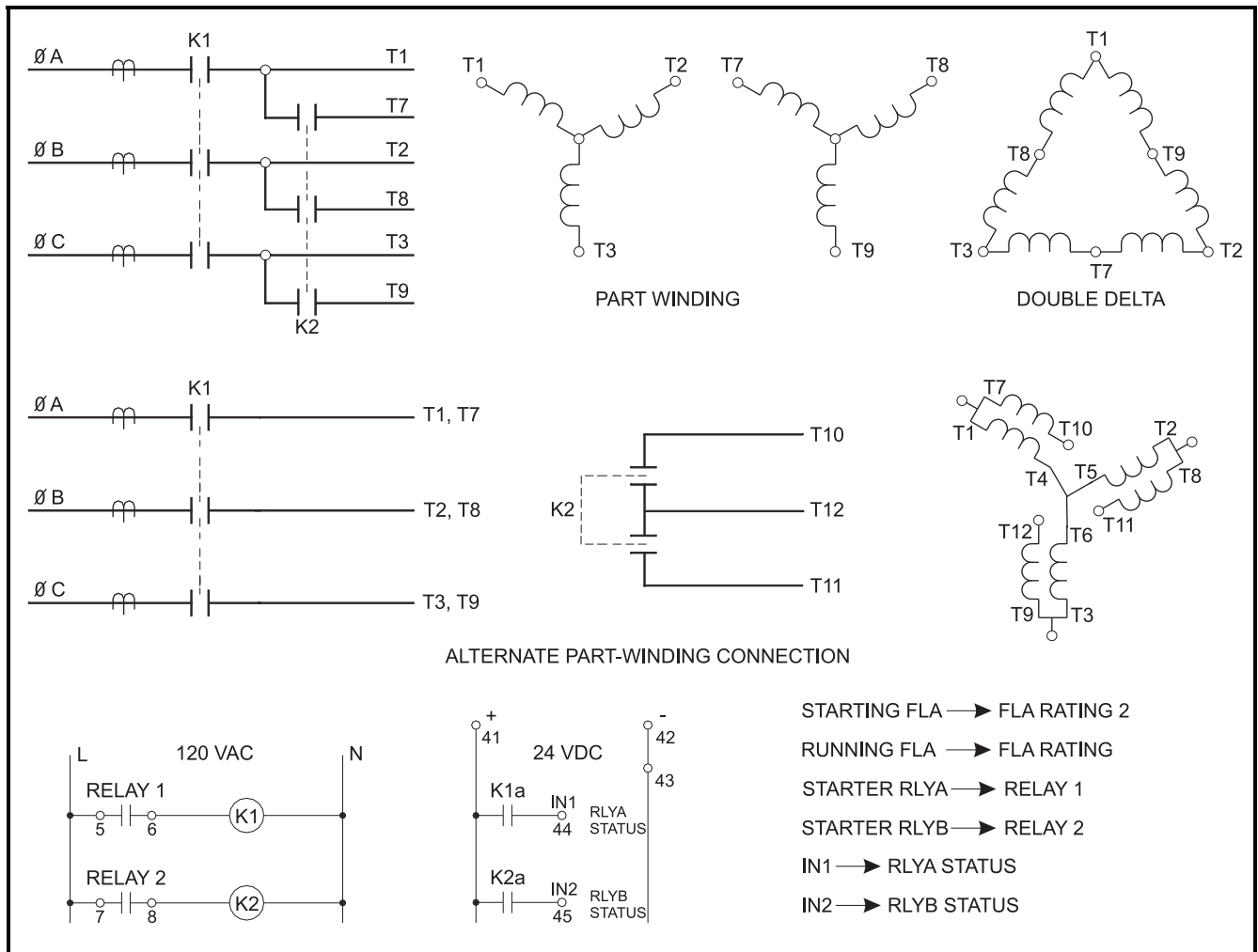


FIGURE 6.18 Part-Winding and Double-Delta-Starter Connections.

6.11 Soft-Start-With-Bypass Starter

Sequence: Fig. 6.5
 Connection: Fig. 6.19
 Current Transfer: Available

START1 or START2 initiates the starting sequence by activating *Starter RLYA*. *Starter RLYB* activates after the *Stage1 Delay* to close the bypass contactor.

Although *RLYA Status* can be selected as a digital input, it is not usually available for this starter.

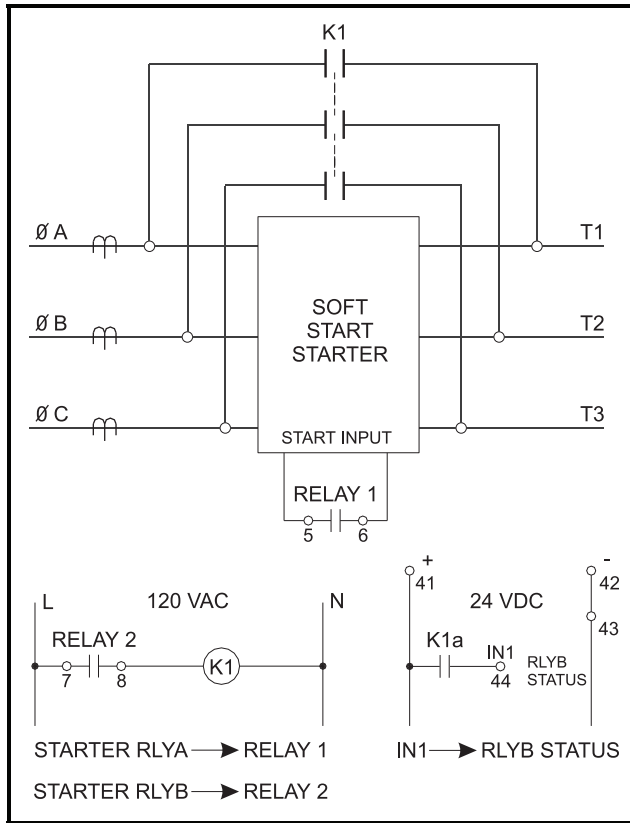


FIGURE 6.19 Soft-Start-With-Bypass-Starter Connection.

6.12 Reactor Or Resistor Open-Transition Starter

Sequence: Fig. 6.6
 Connection: Fig. 6.16
 Current Transfer: Available

START1 or START2 activates *Starter RLYA* for the duration of the *Stage1 Delay*. After *Starter RLYA* de-activates for the *Stage2 Delay*, *Starter RLYB* activates.

6.13 Two-Winding Starter

Sequence: Fig. 6.6
 Connection: Fig. 6.20
 Current Transfer: Available

This starter is an open-transition starter for two-winding motors that run with only one winding energized.

START1 or START2 activates *Starter RLYA* for the time specified by the *Stage1 Delay*. After *Starter RLYA* de-activates for the *Stage2 Delay*, *Starter RLYB* activates.

This starter requires two full-load current set points. *FLA Rating 2* is the full-load current for the starting connection (*Starter RLYA*) and *FLA Rating* is the full-load current for the running connection (*Starter RLYB*).

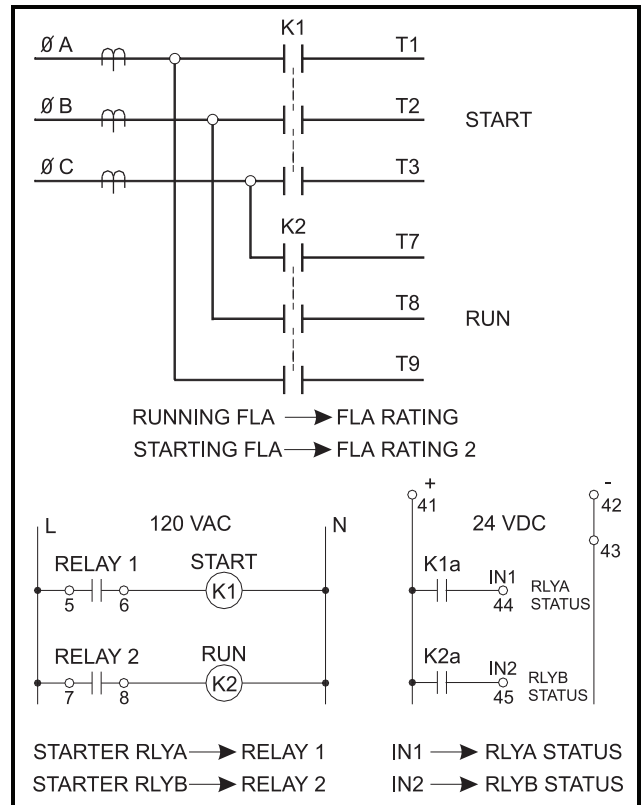


FIGURE 6.20 Two-Winding-Starter Connection.

6.14 Wye-Delta Open-Transition Starter

Sequence: Fig. 6.7
Connection: Fig. 6.21
Current Transfer: Available

START1 or START2 initiates the sequence. Starter RLYC activates to close the neutral contactor (K3). Starter RLYB activates the wye contactor (K2) after the Stage1 Delay. Starter RLYC de-activates to open the neutral contactor after the Stage2 Delay and Starter RLYA activates to close the delta contactor (K1) after the Stage3 Delay. Stage-1 and Stage-3 delays are contactor-transfer times and should be set in the range of 0.1 to 0.5 seconds.

Locate CT's on the line side of the starter.

This starter uses two full-load current settings. Set FLA Rating to the delta full-load current and FLA Rating 2 to the wye full-load current.

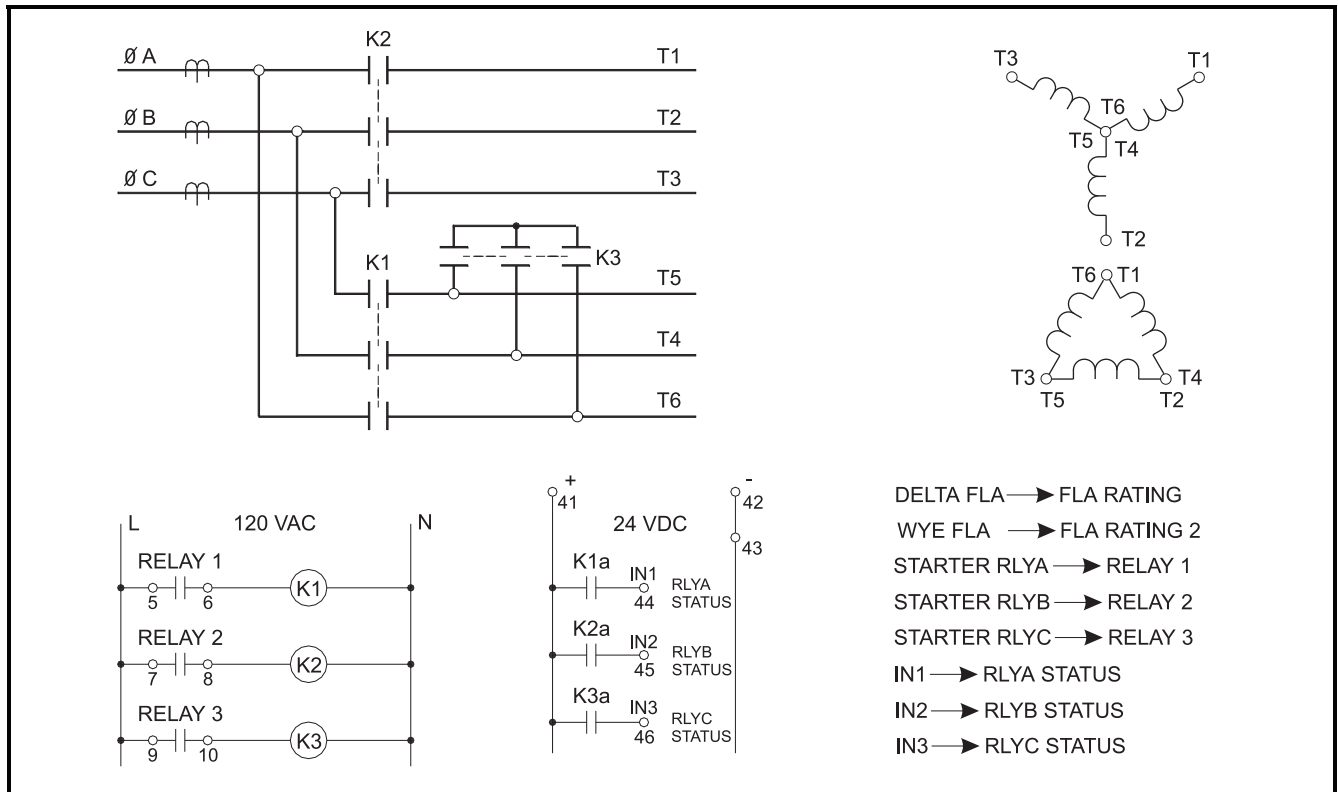


FIGURE 6.21 Wye-Delta Open-Transition-Starter Connection.

6.15 Autotransformer Closed-Transition Starter

Sequence: Fig. 6.7
 Connection: Fig. 6.22
 Current Transfer: Available

START1 or START2 initiates the sequence. Starter RLYC activates to close the neutral contactor (K3) on the autotransformer. Starter RLYB activates to close the main autotransformer contactor (K2) after the Stage1 Delay. Starter RLYC de-activates to open the autotransformer neutral contactor after the Stage2 Delay, and Starter RLYA activates to close the main motor contactor (K1) after the Stage3 Delay. Stage-1 and Stage-3 delays are contactor-transfer times and should be set in the range of 0.1 to 0.5 seconds.

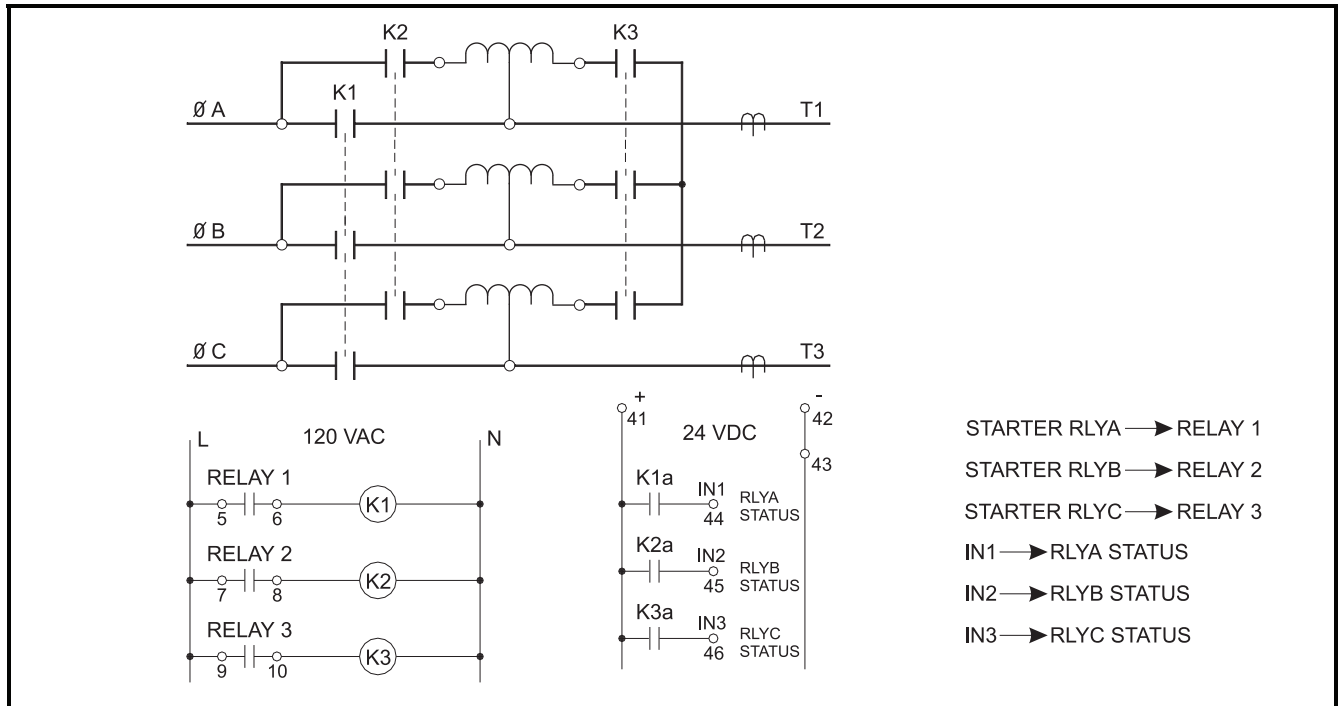


FIGURE 6.22 Autotransformer Closed-Transition-Starter Connection.

6.16 Wye-Delta Closed-Transition Starter

Sequence: Fig. 6.8
 Connection: Fig. 6.23
 Current Transfer: Available

START1 or START2 initiates the start sequence. Starter RLYC activates to close the neutral contactor (K3). Starter RLYB activates to close the wye contactor (K2) after the Stage1 Delay. Starter RLYD activates to close the resistor contactor (K4) after the Stage2 Delay. This is followed by de-activation of Starter RLYC, activation of Starter RLYA to close the main motor contactor (K1), and de-activation of Starter RLYD, all displaced by the Stage1 Delay.

Locate CT's on the line side of the starter. Set FLA Rating to the delta full-load current and FLA Rating 2 to the wye full-load current. Stage-1 delay is a contactor-transfer time and should be set in the range of 0.1 to 0.5 seconds.

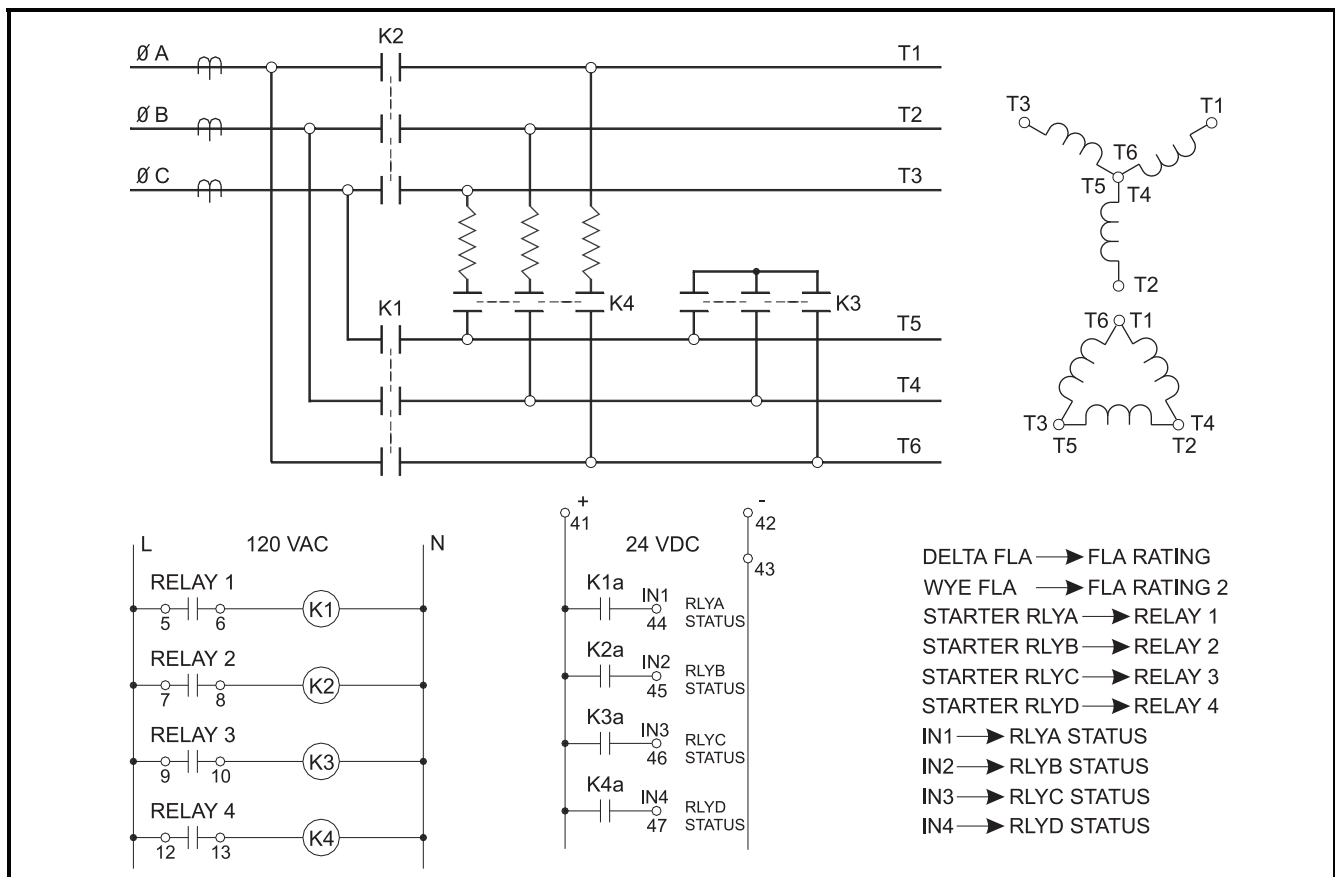


FIGURE 6.23 Wye-Delta Closed-Transition-Starter Connection.

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7. THEORY OF OPERATION

7.1 Signal-Processing Algorithms

The sampling frequency of the PGR-6300 is variable. It can be set for 50-Hz, 60-Hz, or variable-frequency applications. The PGR-6300 obtains sixteen samples per cycle of each current and voltage signal. For an adjustable-speed drive (ASD) application, a speed or frequency output from the ASD can be connected to the 4–20-mA input to synchronize the sampling rate to the ASD output frequency. This maintains accurate measurements of power and sequential components.

The sampling rate is sixteen samples per cycle of the fundamental frequency. A Discrete-Fourier-Transform (DFT) algorithm is used to obtain the magnitude and phase angles of the fundamental-frequency components of the current and voltage waveforms. These values provide true positive- and negative-sequence components. True RMS values of line currents are calculated for use by the thermal-model algorithm. RMS values include up to the 8th harmonic. All calculated values are updated at the sampling frequency to achieve a fast response to fault conditions. RMS values of the fundamental components of current and voltage are displayed.

The PGR-6300 uses the input voltage VA for frequency measurement. The input voltage must be above 30 Vac and a sixteen-cycle interval is used to determine frequency. Frequency protection is inhibited when system voltage is less than 50% of the *System Voltage* setting.

7.2 Power Algorithm

Apparent power (S) is calculated by:

$$S = P + jQ$$

Real power (P) is determined from the in-phase components of I and V, and reactive power (Q) is determined from the quadrature components of I with respect to V. Power factor is the magnitude of the ratio of P to S.

The one-PT connection assumes balanced voltages for power calculations. Power calculations for the other connections are valid for both balanced and unbalanced conditions. In all cases, power calculations use the two-wattmeter method and assume three-wire loads.

The IEEE convention is used for power displays:
+Watts, +Vars, -PF (Lag) Importing Watts,
Importing Vars
+Watts, -Vars, +PF (Lead) Importing Watts,
Exporting Vars
-Watts, -Vars, -PF (Lag) Exporting Watts,
Exporting Vars
-Watts, +Vars, +PF (Lead) Exporting Watts,
Importing Vars

7.3 OPERATOR INTERFACE (OPI)

The OPI is a terminal device used to communicate with the CTU. All set points, operating parameters, and menus are stored in the CTU.

The OPI contains a microprocessor used to communicate with the CTU, read key presses, and perform display functions.

On multiple-OPI systems, all OPI's display the same information. Key presses on any OPI will be processed by the CTU.

7.4 PGA-0120 Temperature Input Module

The PGA-0120 contains a microprocessor, A/D converter, and analog multiplexers used to measure up to eight RTD's. The RTD-measuring circuit is isolated from the I/O Module network. All eight RTD's are scanned every three seconds. RTD linearization, open/short detection, and lead compensation are performed by the PGA-0120. RTD temperature is sent to the CTU where temperature monitoring occurs.

7.5 PGA-0140 Differential Current Module

The PGA-0140 obtains 32 samples per cycle of the differential current. A Discrete-Fourier-Transform (DFT) algorithm is used to obtain the magnitude of the three differential currents. Frequency of operation is set by the CTU and allows differential protection to be used in variable-frequency drive applications. The DFT values are sent to the CTU where differential protection is performed.

7.6 Firmware Diagnostics

Starting with firmware 2.01, diagnostic error handling has been added. In the event of an internal fault, a diagnostic error code is generated and can be viewed with the OPI. The last error code can be viewed by selecting *Setup | System Config | Maintenance | Firmware Version*. The diagnostic code is a two or three digit hexadecimal number.

02 to FF:	Processor Fault
100:	Protection Algorithm Fault
200:	Relay-Control Algorithm Fault
300:	Starter-Control Fault
400:	Menu Display Fault
500:	OPI Key Handler Fault
600:	Real-Time Clock Fault
700:	Communication-Handler Fault
800:	RTD Temperature-Handler Fault
900:	A/D Communication-Interface Fault

The last diagnostic error code is saved in non-volatile memory. The diagnostic code is overwritten by any new codes but can also be manually set to zero. To clear the error code, press RESET while in the *Firmware Version* menu.

When upgrading a PGR-6300 that did not previously support the diagnostic error code, the initial value of the diagnostic code is not valid and should be cleared.

A diagnostic error generates a Trip1 and increments the trip counter, however, a trip record is not generated.

8. COMMUNICATIONS

8.1 Personal-Computer Interface

8.1.1 Firmware Upgrade

The CTU control program is stored in flash memory. Field updates can be made through the I/O module communications connection. The following are required:

- A Windows[®] PC, with the PGW-FLSH program installed,
- a file containing the CTU control program (.s19 file), and
- an RS-232/RS-485 converter that operates at 57,600 bit/s (such as the PGA-0400).

PGW-FLSH is available at

www.littelfuse.com/protectionrelays.

8.1.2 PGW-COMM

PGW-COMM is a Windows-based program used to access PGR-6300 functions with a personal computer (PC) via the RS-485 network interface or Modbus[®] TCP. Use PGW-COMM to program a PGR-6300 either by changing individual set points or by downloading set-point files. Existing PGR-6300 set points can be transferred to the PC. Metered values can be viewed and the PGR-6300 can be controlled with the computer. PGW-COMM extends the event-record storage capability of the PGR-6300 by allowing the user to transfer data to PC memory at a programmable interval. Protection curve plotting capability is included. PGW-COMM is available at www.littelfuse.com/protectionrelays.

8.2 Network Interface

For detailed information see Appendices to this manual and applicable communications manuals.

8.2.1 RS-485 Communications

RS-485 communications support Modbus[®] RTU and Allen-Bradley[®] DF1 half-duplex protocols. All set points and meter values are accessible. Commands are provided to perform trips, resets, and starter control.

Modbus[®] RTU function codes supported:

- Read Holding Registers (Code 3)
- Read Input Registers (Code 4)
- Write Single Register (Code 6)
- Write Multiple Registers (Code 16)
- Command Instruction (Code 5)

DF1 Commands Supported:

- Unprotected Read (CMD = 01)
- Unprotected Write (CMD = 08)
- Typed Read (CMD = 0F, FNC = 68)
- Typed Write (CMD = 0F, FNC = 67)
- Typed Logical Read (CMD = 0F, FNC = A2)
- Typed Logical Write (CMD = 0F, FNC = AA)

8.2.2 DeviceNet Communications

DeviceNet[™] communications support Explicit Messaging and Polled I/O. All set points and meter values are accessible using Explicit Messaging. The Polled I/O connection supports the following ODVA input assemblies:

- Basic Overload (50)
- Extended Overload (51)
- Basic Motor Starter (52)
- Extended Motor Starter 1 (53)
- Extended Motor Starter 2 (53)

In addition to the ODVA assemblies, a user-configurable fixed block of 64 bytes is available.

The Polled I/O connection supports the following ODVA output assemblies:

- Basic Overload (2)
- Basic Motor Starter (3)
- Extended Contactor
- Extended Motor Starter

An Electronic Data Sheet (EDS) file is provided for use with DeviceNet configuration tools such as RSNetWorx and DeltaV.

8.2.3 Ethernet Communications

The PGR-6300 supports Modbus[®] TCP and Ethernet/IP using the Anybus-S module from HMS Fieldbus Systems AB. Data from the PGR-6300 consists of a 64-byte assembly representing user-defined register data. A command structure is provided to write set-point and PGR-6300 commands.

Starting with firmware 2.50, Modbus[®] TCP provides access to all PGR-6300 registers and supports PGW-COMM.

8.2.4 Profibus DP Communications

The PGR-6300 supports Profibus-DP using the Anybus-S module. Data from the PGR-6300 consists of a 64-byte assembly representing user-defined register data. A command structure is provided to write set-point and PGR-6300 commands.

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9. TECHNICAL SPECIFICATIONS

9.1 Control Unit (CTU)

Supply.....25 VA, 65 to 265 Vac,
 40 to 400 Hz, power
 factor corrected.
 25 W, 80 to 275 Vdc.

Power-Up Time800 ms at 120 Vac

Ride-Through Time 100 ms minimum

24-Vdc Source ⁽¹⁾ 100 mA maximum

AC Measurements:

Methods.....True RMS and DFT.
 Positive- and negative-
 sequence components
 of the fundamental.

Sample Rate 16 samples/cycle

Frequency:

Fixed.....50, 60 Hz,
 Variable 10 to 70 Hz,
 sync via 4–20 mA
 signal from ASD

Phase-Current Inputs: ⁽²⁾

Range..... 18 x CT-Primary Rating (I_p)

Accuracy: ⁽³⁾

$I < I_p$ 1% I_p

$I > I_p$ 1% Reading

Burden..... < 0.01 Ω

Unbalance Accuracy0.01 pu

Common-Mode Voltage.. 120 Vac maximum

Thermal Withstand:

Continuous..... 5 x CT Rating

1-Second..... 80 x CT Rating

Earth-Leakage Input:

Range..... 1.5 x Earth-Fault-CT-
 Primary Rating (I_e)

Accuracy ⁽³⁾..... 1% I_e

Burden..... < 0.01 Ω (1- and 5-A
 inputs), 10 Ω for PGC

Common-Mode Voltage.. 120 Vac maximum

Thermal Withstand:

Continuous..... 5 x CT Rating

1-Second..... 80 x CT Rating

Phase-Voltage Inputs: ^(4, 5)

Nominal Input..... 30 to 600 Vac line-to-line

Input Resistance 3.4 M Ω

Range..... 1.4 x PT-Primary Rating (V_p)

Accuracy: ⁽³⁾

$V < V_p$ 1% V_p

$V > V_p$ 1% Reading

Unbalance Accuracy 0.01 pu

Frequency Metering:

Range..... 5 to 100 Hz

Uses VA input,

Sine wave assumed

Accuracy 0.05 Hz

PTC-Thermistor Input: ⁽¹⁾

Cold Resistance..... 1500 Ω maximum at 20°C

Trip Level 2800 $\Omega \pm 100 \Omega$

Sensor Current..... 2 mA maximum

4–20 mA Analog Input:

Input Burden 100 Ω

Common-Mode

Voltage ⁽⁶⁾ ± 5 Vdc

4–20 mA Analog Output: ⁽¹⁾

Load 500 Ω maximum

Range..... 0 to 25 mA

Update Time 500 ms

Tachometer Input: ⁽⁷⁾

Type Active pickup, 24-V logic
 output, sourcing, PNP
 output. TURCK
 Bi1.5-EG08-AP6X-
 V1131 or equivalent

Pulses Per Revolution... 1 to 100

Pulse Frequency 10 Hz to 10 kHz

Accuracy 1%

Delay Timer Accuracies: ⁽⁸⁾

Minimum Delay Set point –10%

Maximum Delay Set point +35 ms

Starter-Control Stop Time:

Digital Input 30 to 80 ms

OPI 70 to 200 ms

Network..... 30 to 80 ms



Relay Contacts (Relays 1 and 2):

Configuration.....N.O. (Form A)
CSA/UL Contact Rating ..8 A resistive 250 Vac,
5 A resistive 30 Vdc

Supplemental Contact Ratings:

Make/Carry 0.2 s.....30 A

Break:

dc75 W resistive,
35 W inductive (L/R = 0.04)

ac2000 VA resistive,
1500 VA inductive
(PF = 0.4)

Subject to maximums of 8 A and 250 V (ac or dc).

Relay Contacts (Relays 3 and 4):

Configuration.....N.O. and N.C. (Form C)
CSA/UL Contact Rating ..8 A resistive 250 Vac,
8 A resistive 30 Vdc

Supplemental Contact Ratings:

Make/Carry 0.2 s.....20 A

Break:

dc50 W resistive,
25 W inductive (L/R = 0.04)

ac2000 VA resistive,
1500 VA inductive
(PF = 0.4)

Subject to maximums of 8 A and 250 V (ac or dc).

Solid-State Output (Relay 5):

Configuration.....N.O. (Form A)
Rating.....100 mA, 250 V (ac or dc)
On Resistance.....30 Ω maximum

Digital Inputs: ⁽¹⁾

Range.....12 to 120 V (ac or dc),
5 mA

Guaranteed On12 Vdc at 3 mA,
20 Vac at 3 mA

Guaranteed Off3 Vdc at 2 mA,
2.5 Vac at 0.3 mA

IRIG-B:

Format.....Amplitude Modulated
IRIG-B122

Amplitude1 to 10 Vpp

Impedance10 kΩ

Ratio.....3:1 to 6:1

I/O Module Interface (OPI, PGA-0120, and PGA-0140):

Module Supply ⁽¹⁾.....24 Vdc, 400 mA maximum
Configuration.....RS-485, 2 wire multi-drop
Bus Length1.2 km (4,000 ft) maximum
CableBelden 3124A or
equivalent

Standard Network Communications:

Configuration.....RS-485, 2 wire multi-drop
Baud Rate1.2, 2.4, 4.8, 9.6, 19.2 kbit/s
ProtocolsModbus RTU and A-B DF1
Isolation.....120 Vac
Bus Length1.2 km (4,000 ft) maximum

Real-Time Clock and Non-Volatile RAM:

Power-Off Retention7 Years at 20°C
Battery Shelf Life.....> 50 Years at 20°C

Shipping Weight2.0 kg (4.4 lb)

PWB Conformal CoatingMIL-1-46058 qualified
UL QMJU2 recognized

Environment:

Operating Temperature. -40 to 60°C
Storage Temperature....-55 to 80°C
Humidity85% Non-Condensing

Surge Withstand.....ANSI/IEEE C37.90.1-1989
(Oscillatory and Fast
Transient)

CertificationCSA, Canada and USA



To:

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

9.2 Operator Interface (OPI)

Supply ⁽¹⁾20 to 30 Vdc, 80 mA

Display Type4 x 20 Alphanumeric
Vacuum Fluorescent


Shipping Weight0.6 kg (1.3 lb)

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

Environment:
 Operating Temperature...-40 to 60°C
 Storage Temperature....-55 to 80°C
 Humidity85% Non-Condensing

Surge Withstand.....ANSI/IEEE C37.90.1-1989
 (Oscillatory and Fast
 Transient)

Certification.....CSA, Canada and USA


 LR 62897
 C US

Hazardous-Location Class I Zone 2 Ex nA II T6
 To:
 CSA C22.2 No. 14 Industrial Control Equipment
 UL 508 Industrial Control Equipment
 UL 1053 Ground Fault Sensing and Relaying
 Equipment

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

Surge Withstand ANSI/IEEE C37.90.1-1989
 (Oscillatory and Fast
 Transient)

Certification CSA, Canada and USA

 LR 62897
 C US

Hazardous-Location Class I Zone 2 Ex nA II T6
 To:
 CSA C22.2 No. 14 Industrial Control Equipment
 UL 508 Industrial Control Equipment
 CSA E60079-15: 02 Electrical Apparatus for
 Explosive Gas Atmospheres
 UL 60079-15 Electrical Apparatus for
 Explosive
 Gas Atmospheres

9.3 Temperature Input Module (PGA-0120)

Supply ⁽¹⁾2 W, 15 to 32 Vdc

Configuration8 inputs, 3 wire RTD

RTD TypesPt100, Ni100, Ni120,
 Cu10

Measurement Range.....-40 to 200°C, with open
 and short detection

Sensor Current.....2 mA

Lead Compensation20 Ω maximum

Accuracy:
 Pt100, Ni100, Ni120 RTD ...1°C
 Cu10 RTD.....3°C

Interconnection Cable:
 TypeBelden® 3124A or
 equivalent
 Maximum Length.....1.2 km (4,000 ft)
 Supplied length.....4 m (13 ft)

Shipping Weight.....0.4 kg (0.9 lb)

PWB Conformal CoatingMIL-1-46058 qualified
 UL QMJU2 recognized

9.4 Differential Current Module (PGA-0140)

Supply 2 W, 15 to 32 Vdc

CT Inputs:
 Thermal Withstand:
 Continuous 5 x CT-Rating
 1-Second 80 x CT-Rating
 Burden 0.01 Ω

Terminal-Block Ratings:
 CT Inputs 25 A, 500 Vac
 10 AWG (4.0 mm²)

Differential-Current Measurement:
 Metering Range 15 x CT-Primary Rating (I_d)
 Protection Range 80 x I_d
 Metering Accuracy:
 I < I_d..... 2% I_d
 I > I_d..... 2% Reading
 Timing Accuracy 5%, minimum trip time
 range is set point +20
 ms to set point +150
 ms, median 81 ms



Interconnection Cable:

TypeBelden® 3124A or
equivalent
Maximum Length..... 1.2 km (4,000 ft)

Shipping Weight0.4 kg (0.9 lb)

PWB Conformal CoatingMIL-1-46058 qualified
UL QMJU2 recognized

Environment:

Operating Temperature...-40 to 60°C
Storage Temperature-55 to 80°C
Humidity85% Non-Condensing

Surge Withstand.....ANSI/IEEE C37.90.1-1989
(Oscillatory and Fast
Transient)

Notes:

(1) The I/O module supply (terminal 56), PTC (terminal 54), AN OUT (terminal 40), and 24-Vdc source (terminal 42) are referenced to the same common.

(2) Current threshold is a function of full-load current and CT-Primary Rating and given by:

$$\text{Percent Threshold} = \frac{1.5 \times \text{CT Primary Rating}}{\text{FLA}}$$

Power readings are not displayed for currents below this threshold. To maintain specified accuracy, phase CT's should be selected with a primary rating between 100% and 300% of motor full-load current.

(3) Transformer accuracy not included.

(4) Voltage unbalance is not displayed for positive-sequence voltage levels below 20% of system voltage setting.

(5) Direct connection for system voltages up to 600 Vac line-to-line.

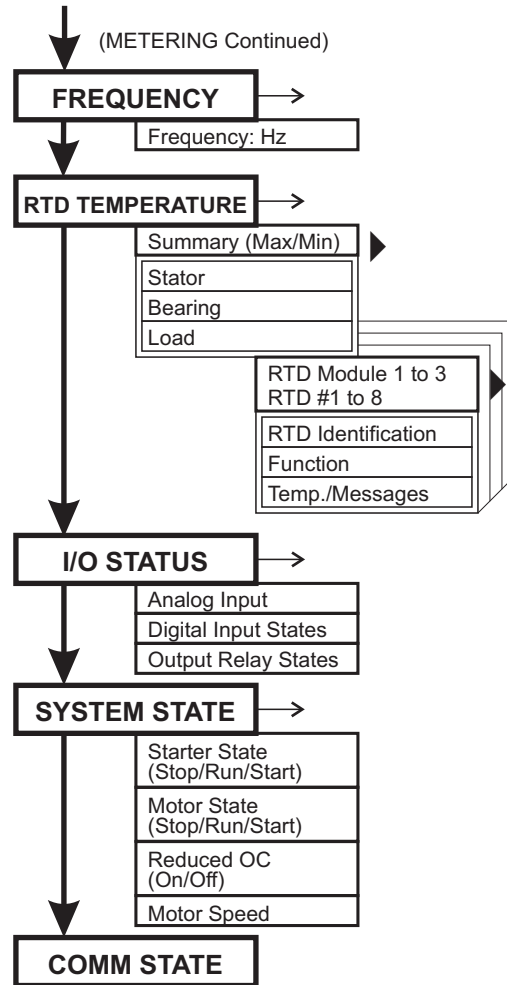
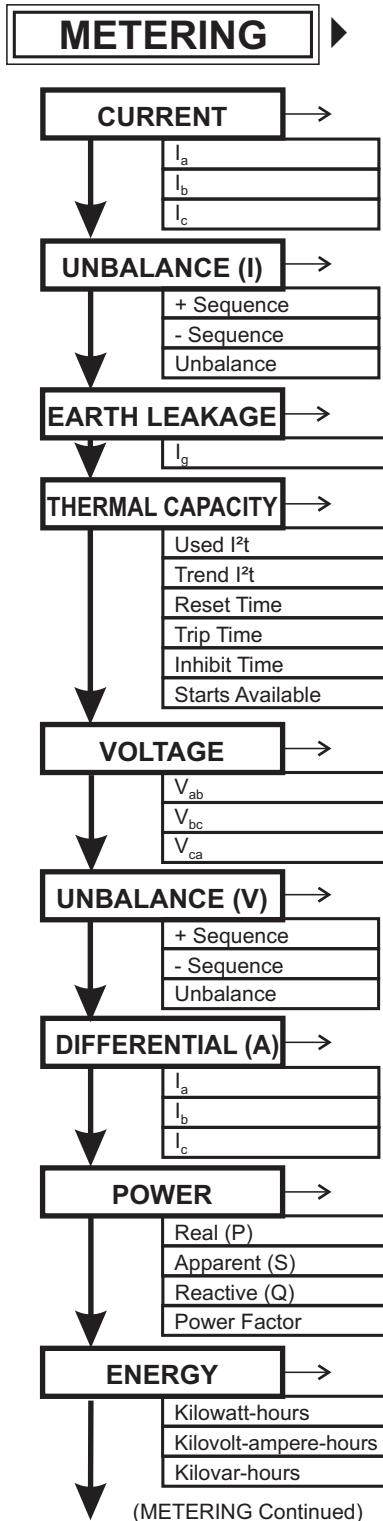
(6) Common-mode voltage relative to CTU terminal 3.

(7) Referenced to COM.

(8) Also see Tables 5.1, 5.2, and PGA-0140 accuracy.

**APPENDIX A
PGR-6300 MENU MAP**

MAIN MENU



Notes:

- List indicates possible trips and alarms.
- Password required.
- List does not match PGR-6300 menu order.
- Password is required and the set point is locked when the motor is running.
- RTD Module = Temperature Input Module PGA-0120.
- DIF Module = Differential Current Module PGA-0140.

Legend:

- [x] Enter numeric
- [s] Enter string
- [E/D] Enable/Disable
- [TA] Trip Action: Disable; Trip1; Trip2; Trip3
- [AA] Alarm Action: Disable; Alarm1; Alarm2; Alarm3
- [EA] Ethernet Address



MESSAGES

TRIP AND ALARM ⁽¹⁾

- Overcurrent Trip
- Aux. Overcurrent Trip
- Reduced Overcurrent Trip
- Overload Trip/Alarm
- Earth-Fault Trip/Alarm
- Differential Trip/Alarm
- I Unbalance Trip/Alarm
- V Unbalance Trip/Alarm
- Jam Trip/Alarm
- Undercurrent Trip/Alarm
- Overvoltage Trip/Alarm
- Undervoltage Trip/Alarm
- Analog High Trip/Alarm
- Analog Low Trip/Alarm
- PTC Trip/Alarm
- Phase Loss Trip (I and V)
- Phase Reverse (I and V)
- Underspeed Trip
- Relay Status Trip
- Digital Input 1 to 7 Trip
- RTD M1 to 3 #1-8 Trip
- RTD M1 to 3 #1-8 Alarm
- RTD M1 to 3 Comm. Trip
- RTD M1 to 3 Comm. Alarm
- RTD Sensor Trip/Alarm
- Start Time Trip
- Display Comm. Trip
- I²t Inhibit Alarm
- NV RAM Error
- A/D Status Error
- Trip Caused by STOP
- Comm Trip/Alarm
- PF Motoring Trip/Alarm
- Starts/Hour Trip/Alarm

STATUS MESSAGES

- INx Stop Open
- INx Interlock Open
- INx Limit1 Open
- INx Limit2 Open
- I²t Start Inhibit
- t° Disabled by ETR
- Backspin Timer On

(MESSAGES Continued)

(MESSAGES Continued)

EVENT RECORDS

- Record Numbers 0 to 63
- Date/Time
- Source: Start/Trip/ETR
- Trip: Trip Source
- Currents: I_a, I_b, I_c, 3I₀
- Voltages: V_{ab}, V_{bc}, V_{ca}
- Differential: I_a, I_b, I_c
- Analog In
- Voltage Unbalance
- Current Unbalance
- Start Time
- Used I²t %
- RTD Temperatures

STATISTICS

Trip Counters

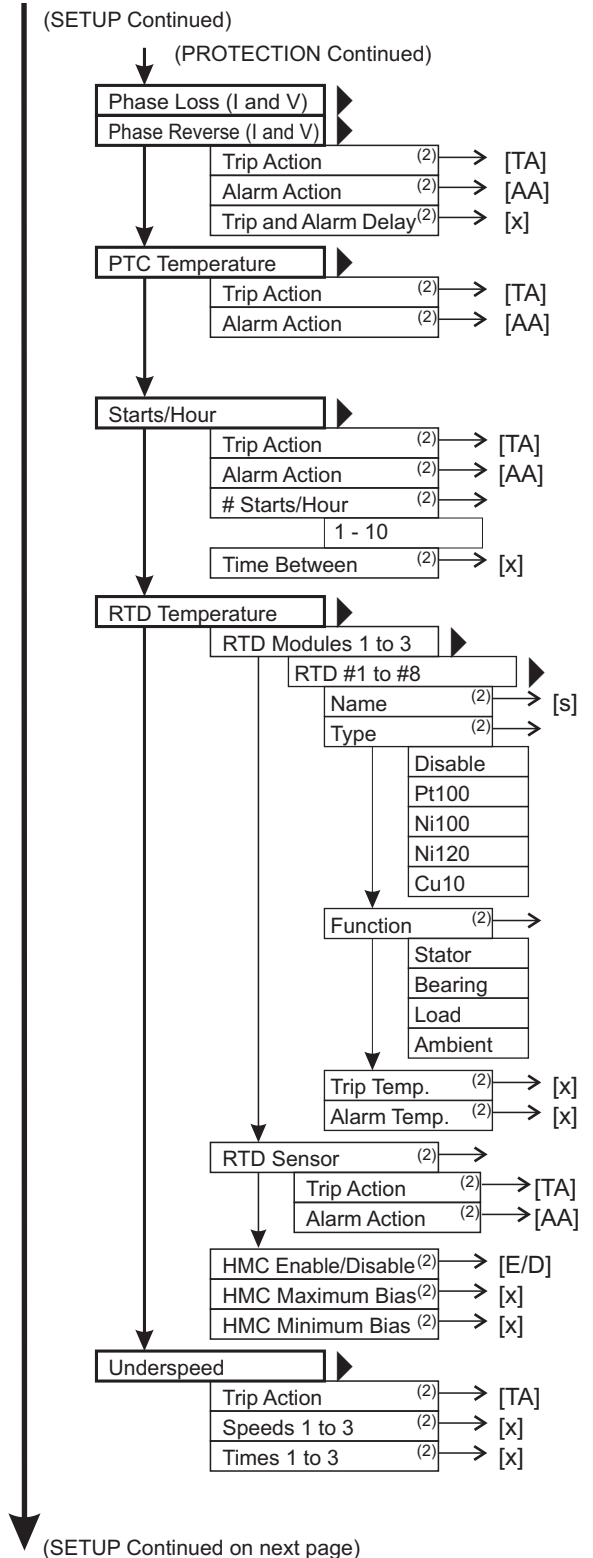
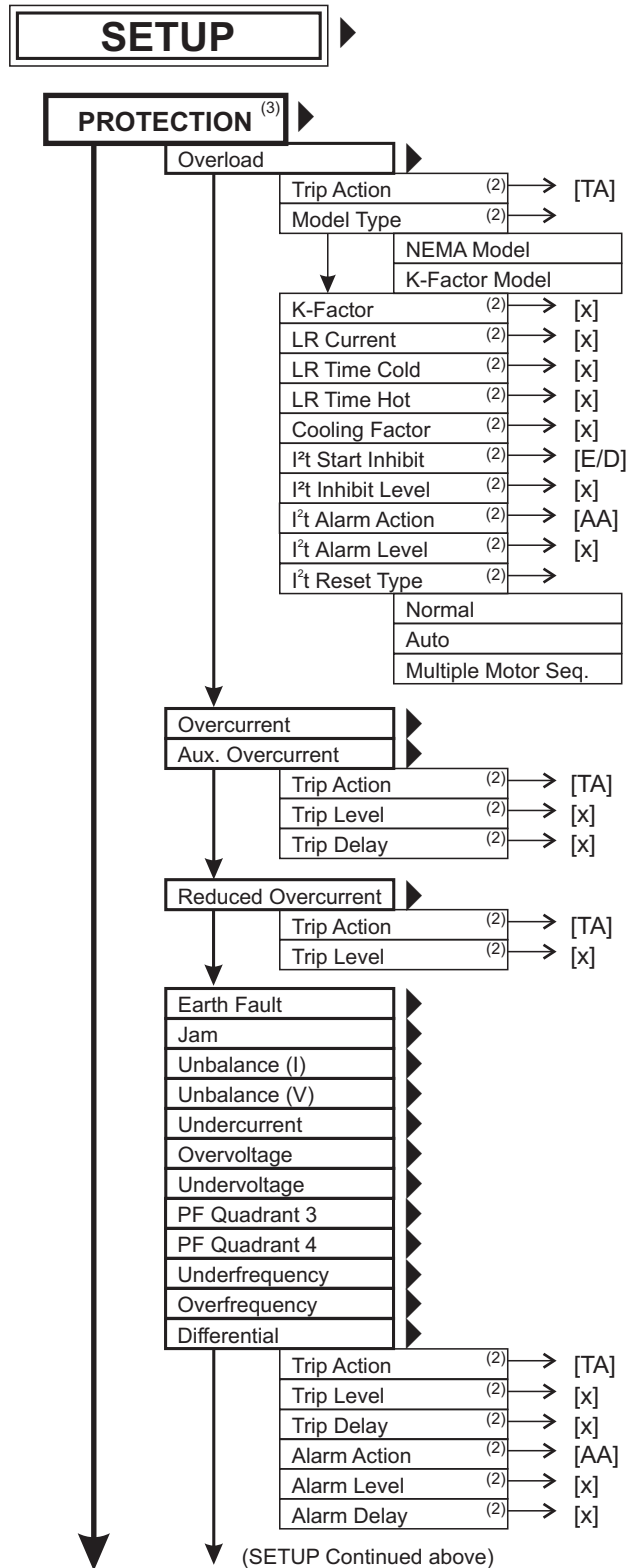
Overcurrent	Digital Inputs 1 to 7
Aux. Overcurrent	RTD M1 #1 to #8
Overload	RTD M2 #1 to #8
Earth Fault	RTD M3 #1 to #8
I Unbalance	NV RAM
V Unbalance	PTC Temperature
Jam	RTD Module Comm
Undercurrent	RTD Sensor
Overvoltage	Starter Sequence
Undervoltage	OPI
Analog High	Stop
Analog Low	Comm
Phase Loss (I and V)	PF Motoring
Phase Reverse (I and V)	Underfrequency
Underspeed	Overfrequency
Contactur Status	Reduced Overcurrent
	Differential
	Diagnostic

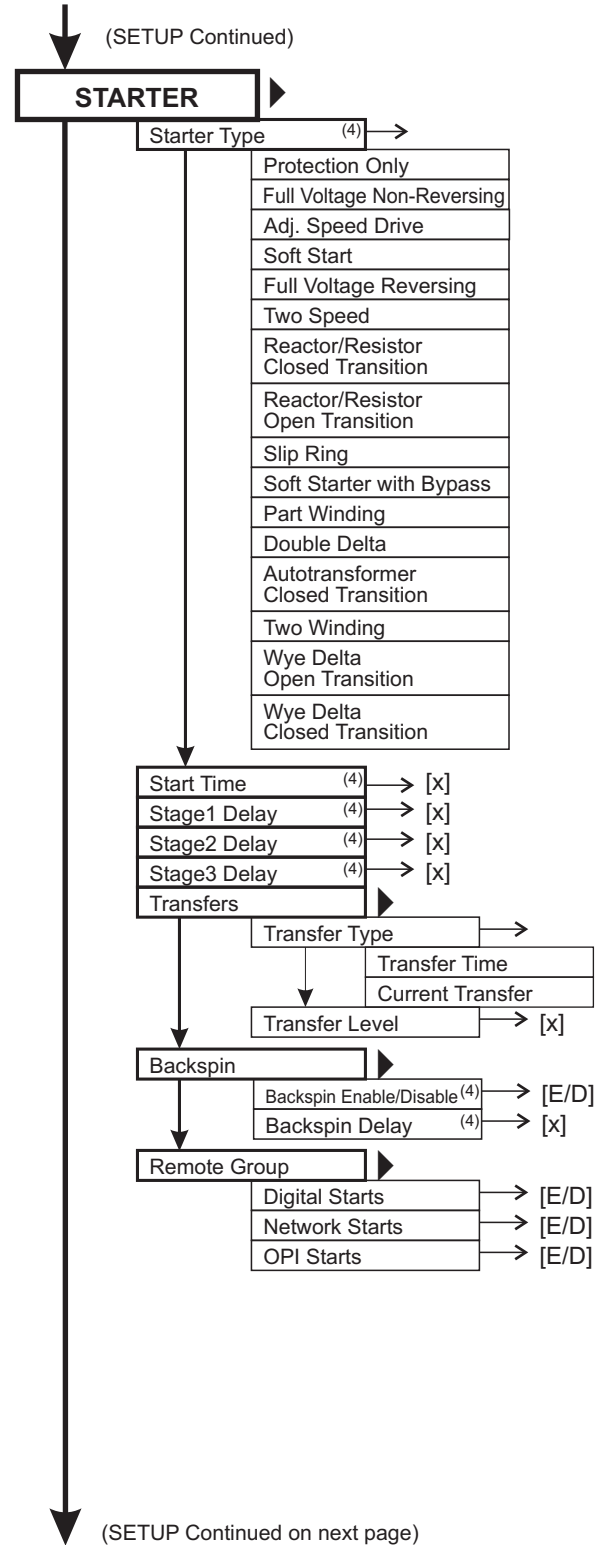
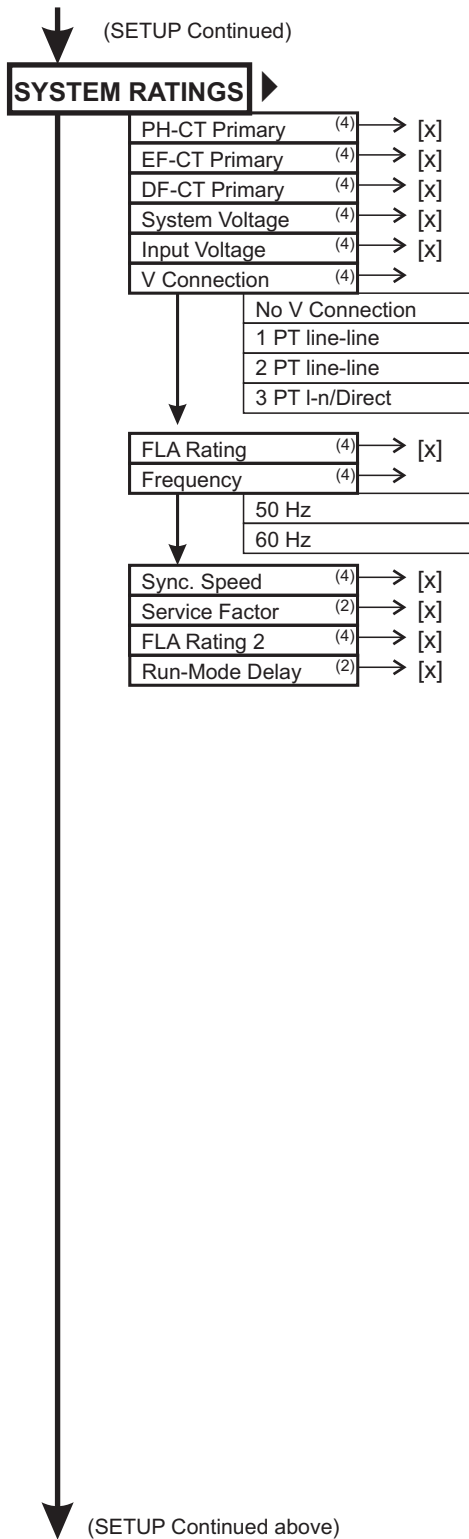
Running Hours

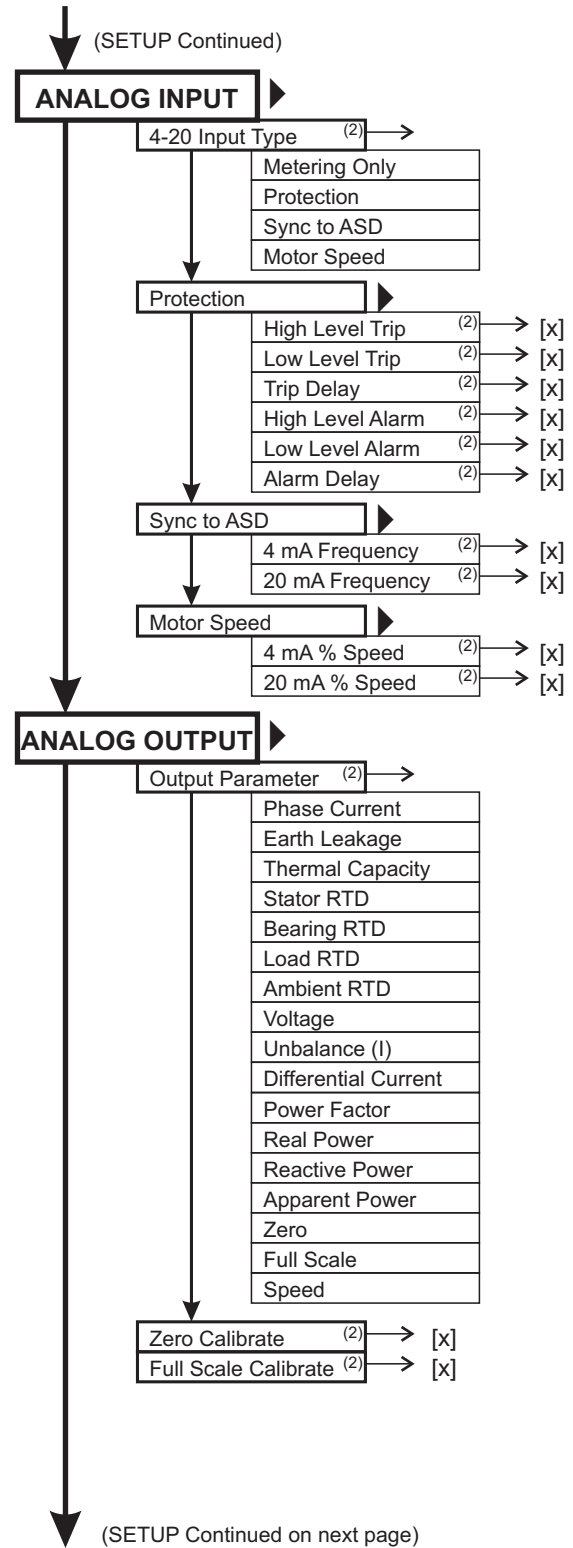
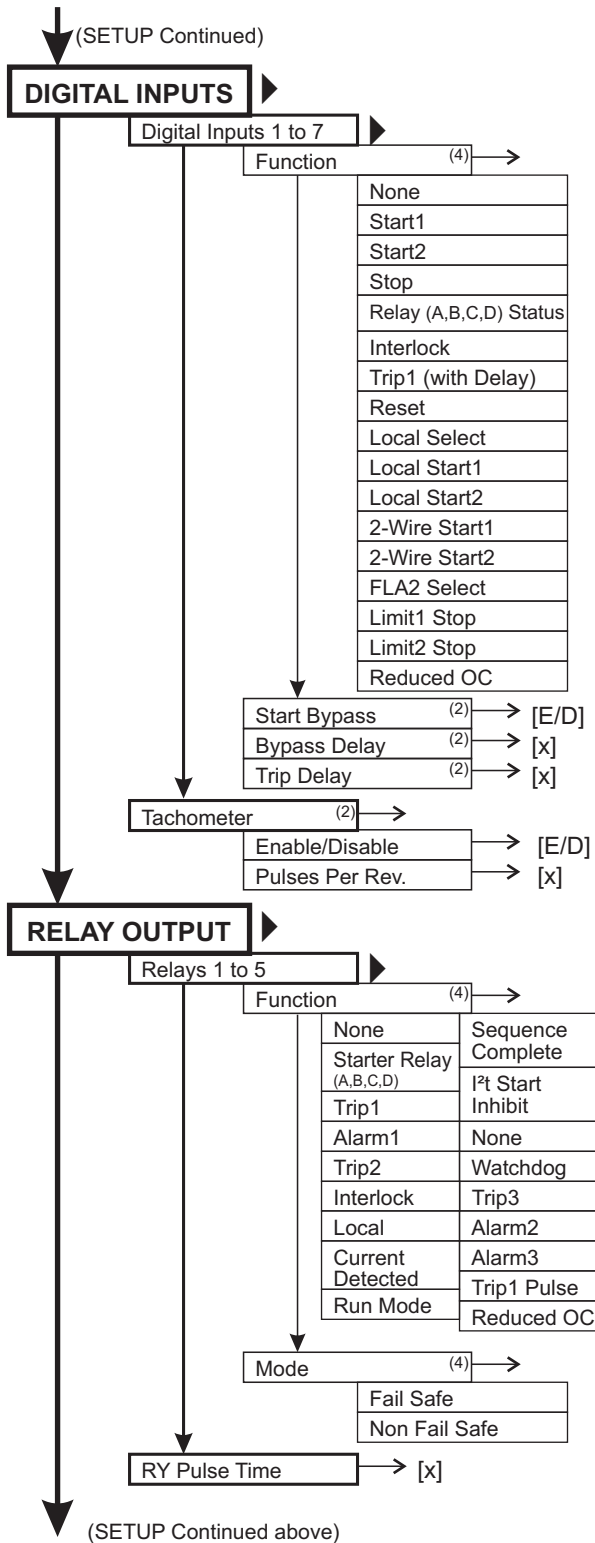
Hours

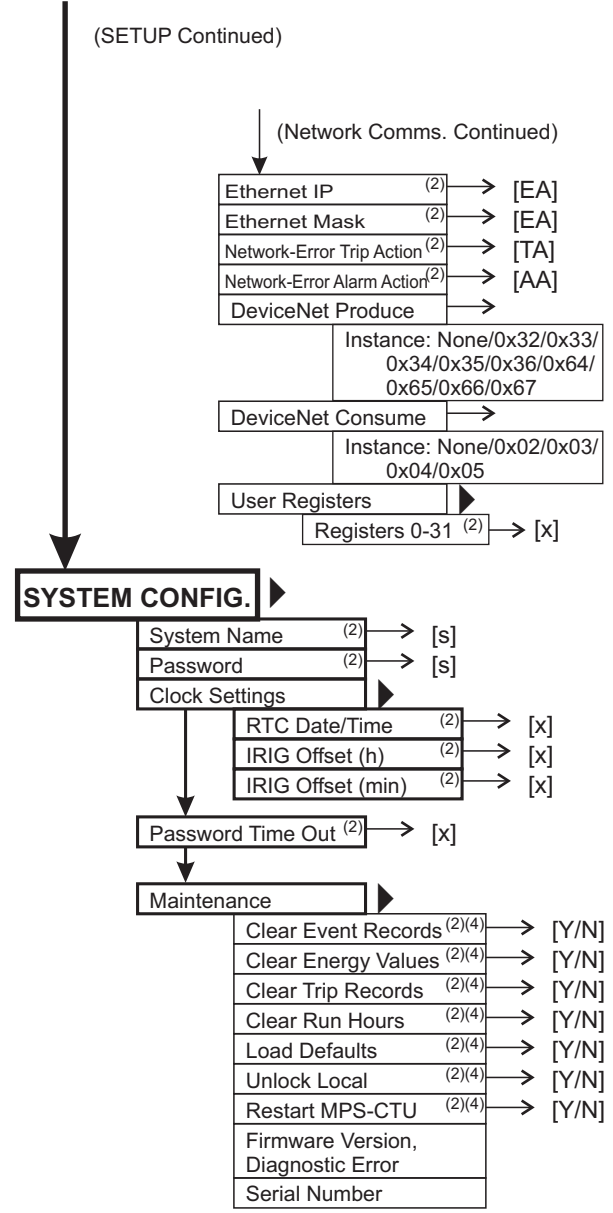
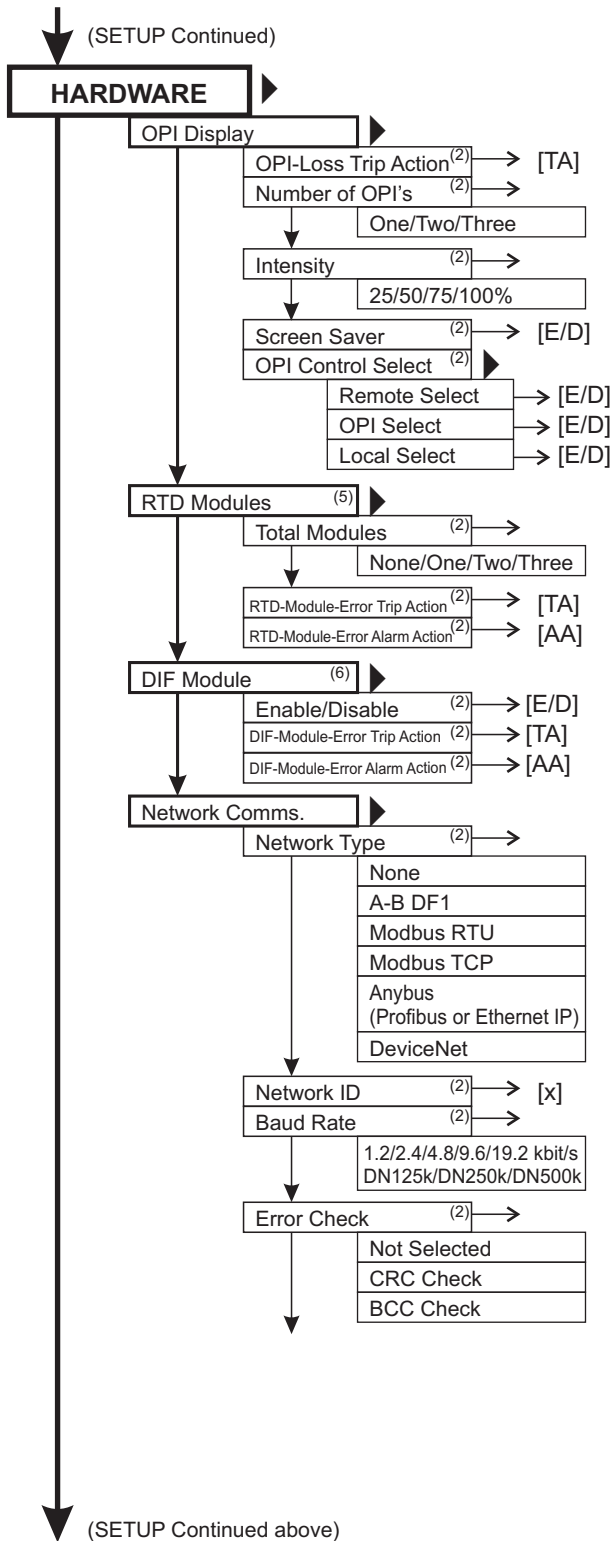
EMERG I²t RESET

- Reset I²t Memory ⁽²⁾
- Re-enable Temp.











**APPENDIX B
PGR-6300 SET-UP RECORD**

Motor: _____ PGR-6300 S/N: _____ Date: _____

Firmware Revision: _____

PART I: SYSTEM AND MOTOR PARAMETERS

PARAMETER AND SETTINGS	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
System Ratings					
PH-CT Primary (I _p)	1	100.00	5,000	A	
EF-CT Primary (I _e)	1	5.00	5,000	A	
DF-CT Primary (I _d)	1	100.00	5,000	A	
System Voltage	0.12	0.60	25	kV	
Input Voltage	0.06	0.12	0.6	kV	
Input Voltage Connection		None			<input type="checkbox"/> None <input type="checkbox"/> 2PT <input type="checkbox"/> 1PT <input type="checkbox"/> 3PT/Direct
Full-Load Current	1	100.00	5,000	A	
Frequency		60		Hz	<input type="checkbox"/> 50 <input type="checkbox"/> 60
Synchronous Speed	10	1,800.00	10k	rpm	
Service Factor	1	1.00	1.25	pu	
FLA Rating 2	1	100.00	5,000	A	
Run-Mode Delay	5	10.00	120	s	
Digital Inputs	See Table 4.2 Input Function Definition				
Input 1: Function		Not used			
Start Bypass		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Bypass Delay	0.5	5.00	100	s	
Trip Delay	0.01	0.10	100	s	
Input 2: Function		Not used			
Start Bypass		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Bypass Delay	0.5	5.00	100	s	
Trip Delay	0.01	0.10	100	s	
Input 3: Function		Not used			
Start Bypass		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Bypass Delay	0.5	5.00	100	s	
Trip Delay	0.01	0.10	100	s	
Input 4: Function		Not used			
Start Bypass		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Bypass Delay	0.5	5.00	100	s	
Trip Delay	0.01	0.10	100	s	
Input 5: Function		Not used			
Start Bypass		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Bypass Delay	0.5	5.00	100	s	
Trip Delay	0.01	0.10	100	s	
Input 6: Function		Not used			
Start Bypass		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Bypass Delay	0.5	5.00	100	s	
Trip Delay	0.01	0.10	100	s	
Input 7: Function		Not used			
Start Bypass		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Bypass Delay	0.5	5.00	100	s	
Trip Delay	0.01	0.10	100	s	

PARAMETER AND SETTINGS	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION	
Tachometer		Disable			<input type="checkbox"/> Enable	<input type="checkbox"/> Disable
Pulses per Revolution	1	60.00	100			
Relay Outputs	See Table 4.1 Output Function Definition					
Relay 1: Function		None				
Mode		Fail Safe			<input type="checkbox"/> Fail Safe	<input type="checkbox"/> Non-Fail Safe
Relay 2: Function		None				
Mode		Fail Safe			<input type="checkbox"/> Fail Safe	<input type="checkbox"/> Non-Fail Safe
Relay 3: Function		None				
Mode		Fail Safe			<input type="checkbox"/> Fail Safe	<input type="checkbox"/> Non-Fail Safe
Relay 4: Function		None				
Mode		Fail Safe			<input type="checkbox"/> Fail Safe	<input type="checkbox"/> Non-Fail Safe
Relay 5: Function		None				
Mode		Fail Safe			<input type="checkbox"/> Fail Safe	<input type="checkbox"/> Non-Fail Safe
RY Pulse Time	0.05	0.25	10	s		
Analog Input						
4–20 Input Type		Metering Only			<input type="checkbox"/> Metering Only <input type="checkbox"/> Protection	<input type="checkbox"/> Sync. to ASD <input type="checkbox"/> Motor Speed
Protection:						
High-Level Trip	0.1	16.00	20	mA		
Low-Level Trip	0.1	7.00	20	mA		
Trip Delay	0.01	5.00	100	s		
High-Level Alarm	0.1	14.00	20	mA		
Low-Level Alarm	0.1	9.00	20	mA		
Alarm Delay	0.01	1.00	100	s		
Sync to ASD Set Points:						
4-mA Frequency	0	10.00	70	Hz		
20-mA Frequency	0	60.00	70	Hz		
Motor Speed Set Points:						
4-mA Percent Speed	0	10.00	100	%		
20-mA Percent Speed	0	100.00	100	%		
Analog Output						
Output Parameter		Phase Current			See Table 4.3 Analog Output Parameter Definition	
Zero Calibrate	Factory Calibrated					
Full-Scale Calibrate	Factory Calibrated					
OPI Display						
OPI-Loss Trip		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip2	<input type="checkbox"/> Trip1 <input type="checkbox"/> Trip3
Number of OPI's		1			<input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3
Intensity		100		%	<input type="checkbox"/> 25 <input type="checkbox"/> 50	<input type="checkbox"/> 75 <input type="checkbox"/> 100
Screen Saver		Enable			<input type="checkbox"/> Enable	<input type="checkbox"/> Disable
OPI Control Select						
Remote Select		Enable			<input type="checkbox"/> Enable	<input type="checkbox"/> Disable
OPI Select		Enable			<input type="checkbox"/> Enable	<input type="checkbox"/> Disable
Local Select		Enable			<input type="checkbox"/> Enable	<input type="checkbox"/> Disable

PARAMETER AND SETTINGS	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION	
RTD Modules (PGA-0120)						
Total Modules		0			<input type="checkbox"/> 0 <input type="checkbox"/> 1	<input type="checkbox"/> 2 <input type="checkbox"/> 3
RTD-Module-Error Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip2	<input type="checkbox"/> Trip1 <input type="checkbox"/> Trip3
RTD-Module-Error Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm2	<input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm3
DIF Module (PGA-0140)						
Enable/Disable		Disable			<input type="checkbox"/> Enable	<input type="checkbox"/> Disable
DIF-Module-Error Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip2	<input type="checkbox"/> Trip1 <input type="checkbox"/> Trip3
DIF-Module-Error Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip2	<input type="checkbox"/> Trip1 <input type="checkbox"/> Trip3
Network Communications						
Network Type		Modbus			<input type="checkbox"/> None <input type="checkbox"/> Allen-Bradley <input type="checkbox"/> Modbus	<input type="checkbox"/> DeviceNet <input type="checkbox"/> Anybus
Network ID	0	254	255			
Baud Rate		SCI 9600			<input type="checkbox"/> SCI 1200 <input type="checkbox"/> SCI 2400 <input type="checkbox"/> SCI 4800 <input type="checkbox"/> SCI 9600 <input type="checkbox"/> SCI 19200	<input type="checkbox"/> DN125 <input type="checkbox"/> DN250 <input type="checkbox"/> DN500
Error Checking		Not Selected			<input type="checkbox"/> Not Selected <input type="checkbox"/> CRC	<input type="checkbox"/> BCC
Ethernet IP		192.168.000.001				
Ethernet Mask		255.255.255.000				
Network-Error Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip2	<input type="checkbox"/> Trip1 <input type="checkbox"/> Trip3
Network-Error Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm2	<input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm3
DeviceNet Producing Assembly		0x36			<input type="checkbox"/> None <input type="checkbox"/> 0x33 <input type="checkbox"/> 0x35 <input type="checkbox"/> 0x64 <input type="checkbox"/> 0x66	<input type="checkbox"/> 0x32 <input type="checkbox"/> 0x34 <input type="checkbox"/> 0x36 <input type="checkbox"/> 0x65 <input type="checkbox"/> 0x67
DeviceNet Consuming Assembly		None			<input type="checkbox"/> None <input type="checkbox"/> 0x03 <input type="checkbox"/> 0x05	<input type="checkbox"/> 0x02 <input type="checkbox"/> 0x04
System Name	POWR-GARD PGR-6300					
Change Password		1111				
Password Timeout	1	10.00	60	min.		
Firmware Revision	See Protection System Config. Maintenance					

PART II: STARTER PARAMETERS

SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
Starter Type (see Table 6.2)	Protection Only				
Start Time	0.1	20.00	500	s	
Stage 1 Delay	0.1	20.00	500	s	
Stage 2 Delay	0.1	20.00	500	s	
Stage 3 Delay	0.1	20.00	500	s	
Backspin Timer		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Backspin Delay	0.1	5.00	3,600	s	
Remote Group					
Digital Inputs		Enable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Network		Enable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
OPI		Enable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
Transfer					
Type		Time			<input type="checkbox"/> Time <input type="checkbox"/> Current
Level	1.0	1.25	3.0	x FLA	

PART III: PROTECTION SET POINTS

FUNCTION & SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
Overload					
Trip Action		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Model Type		NEMA			<input type="checkbox"/> NEMA <input type="checkbox"/> K-Factor
K-Factor	1	6.00	10		
Locked-Rotor Current	1.5	6.00	10	x FLA	
Locked-Rotor Time Cold	0.10	10.00	100	s	
Locked-Rotor Time Hot	0.10	5.00	100	s	
Cooling Factor	0.10	2.00	10		
I ² t Start Inhibit		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
I ² t Inhibit Level (Per unit based on 100% I ² t)	0.10	0.30	.90	pu	
I ² t Alarm Action		Alarm1			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
I ² t Overload Alarm Level	0.50	1.00	1	pu	
Reset Type		Normal			<input type="checkbox"/> Normal <input type="checkbox"/> Auto <input type="checkbox"/> Multiple Motor Sequence
Overcurrent					
Trip Action		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level (I _p is Phase-CT-primary rating)	1	10.00	15	x I _p	
Trip Delay	0	0.05	10	s	
Auxiliary Overcurrent					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level (I _p is Phase-CT-primary rating)	1	10.00	15	x I _p	
Trip Delay	0	0.05	10	s	
Reduced Overcurrent					
Trip Action		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level (I _p is Phase-CT-primary rating)	1	2.00	15	x I _p	

FUNCTION & SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
Earth Fault					
Trip Action		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level (I_e is EF-CT-primary rating)	0.05	0.40	1	$x I_e$	
Trip Delay	0	0.25	100	s	
Alarm Action		Alarm1			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	0.05	0.20	1	$x I_e$	
Alarm Delay	0	1.00	100	s	
Jam					
Trip Action		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level	1	6.00	10	$x FLA$	
Trip Delay	1	5.00	100	s	
Alarm Action		Alarm1			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	1	3.00	10	$x FLA$	
Alarm Delay	1	5.00	100	s	
Unbalance (I)					
Trip Action		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level (Per unit based on I_2/I_1)	0.05	0.25	1	pu	
Trip Delay	1	15.00	100	s	
Alarm Action		Alarm1			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	0.05	0.10	1	pu	
Alarm Delay	1	10.00	100	s	
Phase Loss (I)					
Trip Action		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Phase Loss Delay	1	5.00	100	s	
Phase Reverse (I)					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Alarm Action		Alarm1			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Trip and Alarm Delay	1	2.00	100	s	
Unbalance (V)					
Trip Action		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level (Per unit based on V_2/V_1)	0.05	0.10	1	pu	
Trip Delay	1	15.00	100	s	
Alarm Action		Alarm1			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	0.05	0.05	1	pu	
Alarm Delay	1	10.00	100	s	
Phase Loss (V)					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Phase Loss Delay	1	5.00	100	s	

FUNCTION & SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
Phase Reverse (V)					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Alarm Action		Alarm1			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Phase Reverse Trip and Alarm Delay	1	2.00	100	s	
Undercurrent					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level	0.1	0.50	1	x FLA	
Trip Delay	1	10.00	100	s	
Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	0.1	0.80	1	x FLA	
Alarm Delay	1	20.00	100	s	
Differential (PGA-0140)					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level (I_d is DF-CT-Primary Current)	0.1	1.00	15	x I_d	
Trip Delay	0	0.10	10	s	
Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	0.1	0.50	15	x I_d	
Alarm Delay	0	0.10	10	s	
PF Quadrant 4					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level	0.5	0.80	1		
Trip Delay	0.1	5.00	500	s	
Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	0.5	0.90	1		
Alarm Delay	0.1	5.00	500	s	
PF Quadrant 3					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level	0.5	0.80	1		
Trip Delay	0.1	5.00	500	s	
Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	0.5	0.90	1		
Alarm Delay	0.1	5.00	500	s	
Underfrequency					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level	30	45	80	Hz	
Trip Delay	0.5	5	500	s	
Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	30	48	80	Hz	
Alarm Delay	0.5	1	500	s	

FUNCTION & SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
Overfrequency					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level	30	65	80	Hz	
Trip Delay	0.5	5	500	s	
Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	30	62	80	Hz	
Alarm Delay	0.5	1	500	s	
PTC Temperature					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
RTD-Sensor-Error Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
RTD-Sensor-Error Alarm Action		Alarm1			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Hot-Motor Compensation (HMC)		Disable			<input type="checkbox"/> Enable <input type="checkbox"/> Disable
HMC High	40	150.00	200	°C	
HMC Low	40	40.00	200	°C	
Acceleration Failure—Underspeed					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Speed 1 (Percent Sync Speed)	1	30.00	100	% SS	
Time 1	1	5.00	1,000	s	
Speed 2	1	60.00	100	% SS	
Time 2	1	10.00	1,000	s	
Speed 3	1	90.00	100	% SS	
Time 3	1	15.00	1,000	s	
Overvoltage					
Trip Action		Trip1			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level (V_p is input voltage)	1	1.20	1.4	$x V_p$	
Trip Delay	1	5.00	500	s	
Alarm Action		Alarm1			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	1	1.10	1.4	$x V_p$	
Alarm Delay	1	5.00	500	s	
Undervoltage					
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip1 <input type="checkbox"/> Trip2 <input type="checkbox"/> Trip3
Trip Level	0.5	0.70	1	$x V_p$	
Trip Delay	1	5.00	500	s	
Alarm Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm2 <input type="checkbox"/> Alarm3
Alarm Level	0.5	0.80	1	$x V_p$	
Alarm Delay	1	5.00	500	s	



FUNCTION & SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION	
Starts/Hour						
Trip Action		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Trip2	<input type="checkbox"/> Trip1 <input type="checkbox"/> Trip3
Alarm Action					<input type="checkbox"/> Disable <input type="checkbox"/> Alarm2	<input type="checkbox"/> Alarm1 <input type="checkbox"/> Alarm3
Number of Starts/Hour	1	5	10			
Time Between Starts	0	0.00	500	min		
RTD TEMPERATURE <i>Requires PGA-0120 Module(s)</i>						
RTD M1 #1:						
Name	RTD Module 1 #1					
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Ni100 Ω	<input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Cu10 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Bearing	<input type="checkbox"/> Load <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C		
Alarm	40	110.00	200	°C		
RTD M1 #2:						
Name	RTD Module 1 #2					
Type		Disable				
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Bearing	<input type="checkbox"/> Load <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C		
Alarm	40	110.00	200	°C		
RTD M1 #3:						
Name	RTD Module 1 #3					
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Ni100 Ω	<input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Cu10 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Bearing	<input type="checkbox"/> Load <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C		
Alarm	40	110.00	200	°C		
RTD M1 #4:						
Name	RTD Module 1 #4					
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Ni100 Ω	<input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Cu10 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Bearing	<input type="checkbox"/> Load <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C		
Alarm	40	110.00	200	°C		
RTD M1 #5:						
Name	RTD Module 1 #5					
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Ni100 Ω	<input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Cu10 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Bearing	<input type="checkbox"/> Load <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C		
Alarm	40	110.00	200	°C		

FUNCTION & SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
RTD M1 #6:					
Name	RTD Module 1 #6				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M1 #7:					
Name	RTD Module 1 #7				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M1 #8:					
Name	RTD Module 1 #8				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M2 #1:					
Name	RTD Module 2 #1				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M2 #2:					
Name	RTD Module 2 #2				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M2 #3:					
Name	RTD Module 2 #3				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	

FUNCTION & SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
RTD M2 #4:					
Name	RTD Module 2 #4				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M2 #5:					
Name	RTD Module 2 #5				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M2 #6:					
Name	RTD Module 2 #6				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M2 #7:					
Name	RTD Module 2 #7				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M2 #8:					
Name	RTD Module 2 #8				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M3 #1:					
Name	RTD Module 3 #1				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	



FUNCTION & SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
RTD M3 #2:					
Name	RTD Module 3 #2				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M3 #3:					
Name	RTD Module 3 #3				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M3 #4:					
Name	RTD Module 3 #4				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M3 #5:					
Name	RTD Module 3 #5				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M3 #6:					
Name	RTD Module 3 #6				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	



FUNCTION & SET POINT	MIN	DEFAULT	MAX	UNIT	PROGRAM SELECTION
RTD M3 #7:					
Name	RTD Module 3 #7				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	
RTD M3 #8:					
Name	RTD Module 3 #8				
Type		Disable			<input type="checkbox"/> Disable <input type="checkbox"/> Ni120 Ω <input type="checkbox"/> Pt100 Ω <input type="checkbox"/> Cu10 Ω <input type="checkbox"/> Ni100 Ω
Function		Stator			<input type="checkbox"/> Stator <input type="checkbox"/> Load <input type="checkbox"/> Bearing <input type="checkbox"/> Ambient
Trip	40	130.00	200	°C	
Alarm	40	110.00	200	°C	

APPENDIX C PGR-6300 MODBUS PROTOCOL

C.1 PROTOCOL

The PGR-6300 implements the Modbus® RTU protocol as described in the Gould Modbus Reference Guide, Publication PI-MBUS-300 Rev. B.

The communications system consists of a single master and up to thirty-two PGR-6300 CTU slaves connected using a two-wire RS-485 network. If the master does not have an RS-485 port, an RS-232 to RS-485 converter is required. The converter must have automatic send-data control (SD). SD control does not require hand-shaking lines since it uses the data line to control the transmit/receive line on the RS-485 transceivers.

Only the master can initiate a message transaction. Messages can be addressed to individual slaves or they can be broadcast messages. Broadcast messages are executed on the PGR-6300 slaves but unlike individually addressed messages, the slaves do not generate a reply message.

C.2 MESSAGE SYNCHRONIZATION

Message synchronization is accomplished by detection of an idle communication line. The communication line is considered idle when no communication exists for an equivalent delay of 3.5 characters.

The first byte received after idle-line detection is interpreted as the address byte of the next message. Message bytes must be transmitted in a continuous stream until the complete message has been sent. If a delay of more than 3.5 characters exists within the message, the message is discarded.

Response messages from the PGR-6300 are delayed by at least 3.5 character delays.

C.3 ERROR CHECKING

Modbus RTU uses a 16-bit cyclic redundancy check (CRC). The error check includes all of the message bytes, starting with the first address byte.

When a CRC error is detected, the message is discarded and there will be no response.

If the CRC check is correct but the internal data in the message is not correct, the PGR-6300 will respond with an exception response code.

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C.4 FUNCTION CODES SUPPORTED

The PGR-6300 Modbus Protocol supports the following function codes:

- Read Holding Registers (Function Code 3)
- Read Input Registers (Function Code 4)
- Write Single Register (Function Code 6)
- Write Multiple Registers (Function Code 16)
- Command Instruction (Function Code 5)

Function Codes 3 and 4 perform the same function in the PGR-6300.

Registers in Modbus start at 40001 decimal and the register address generated for this register is 0.

C.4.1 Application Layer

The hexadecimal system is used. Value representations use the “C” convention. For hexadecimal, 0x precedes the value.

C.4.2 Read Input/Holding Registers (Code 04/03)

The first byte of the read message is the slave address. The second byte is the function code. Bytes three and four indicate the starting register. The next two bytes specify the number of 16-bit registers to read. The last two bytes contain the CRC code for the message.

TABLE C.1 Read Registers (Code 04/03)

HEX BYTE	DESCRIPTION
Byte 1	Slave Address
Byte 2	Function Code
Byte 3	MSB Register Address
Byte 4	LSB Register Address
Byte 5	MSB Number of Registers
Byte 6	LSB Number of Registers
Byte 7	LSB CRC
Byte 8	MSB CRC

The two-byte values of starting register and number of registers to read are transmitted with the high-order byte followed by the low-order byte.

The CRC value is sent with the LSB followed by the MSB.

The following message will obtain the value of register 1 (Modbus 40002) from slave 1. Note that Modbus registers are numbered from zero (40001 = zero, 40002 = one, etc.):

0x01 | 0x03 | 0x00 | 0x01 | 0x00 | 0x01 | 0xD5 | 0xCA

The addressed slave responds with its address and Function Code 3, followed by the information field. The information field contains an 8-bit byte count and the 16-bit data from the slave. The byte count specifies the number of bytes of data in the information field. The data in the information field

consists of 16-bit data arranged so that the MSB is followed by the LSB.

The maximum number of 16-bit registers that can be read is 120.

C.4.3 Write To Register

Function Code 6 or 16 is used to make set-point changes.

C.4.3.1 Write Single Register (Code 6)

The function code format for writing a single register is shown in Table C.2.

The message consists of the PGR-6300 address followed by the Function Code 6 and two 16-bit values. The first 16-bit value specifies the register to be modified and the second value is the 16-bit data.

Provided no errors occurred, the slave will re-send the original message to the master. The response message is returned only after the command has been executed by the PGR-6300.

The following message will set register 3 to 300 in slave 5:

0x05 | 0x06 | 0x00 | 0x03 | 0x01 | 0x2C | 0x78 | 0x03

TABLE C.2 Write Single Register (Code 6)

HEX BYTE	DESCRIPTION
Byte 1	Slave Address
Byte 2	Function Code
Byte 3	MSB Register Address
Byte 4	LSB Register Address
Byte 5	MSB of Data
Byte 6	LSB of Data
Byte 7	LSB of CRC
Byte 8	MSB of CRC

C.4.3.2 Write Multiple Registers (Code 16)

The function-code format in Table C.3 can be used for writing single or multiple registers.

TABLE C.3 Write Multiple Registers (Code 16)

BYTE #	DESCRIPTION
Byte 1	Slave Address
Byte 2	Function Code
Byte 3	MSB Register Address
Byte 4	LSB Register Address
Byte 5	MSB of Quantity
Byte 6	LSB of Quantity
Byte 7	Byte Count
.	MSB of Data
.	LSB of Data
.	LSB of CRC
Byte n	MSB of CRC

The PGR-6300 will reply with the slave address, function code, register address, and the quantity followed by the CRC code for a total of 8 bytes.

C.4.4 Command Instruction (Code 5)

Modbus Function Code 5 (Force Single Coil) is used to issue commands to the PGR-6300. The format for the message is listed in Table C.4 and the command code actions and corresponding coil number are listed in Table C.5.

TABLE C.4 Command Format (Code 5)

HEX BYTE	DESCRIPTION
Byte 1	Slave Address
Byte 2	Function Code
Byte 3	MSB of Command Code
Byte 4	LSB of Command Code
Byte 5	Fixed at 0xff
Byte 6	Fixed at 00
Byte 7	LSB of CRC
Byte 8	MSB of CRC

TABLE C.5 Supported Commands

COMMAND CODE	COIL NUMBER	ACTION
0x0000	1	STOP
0x0001	2	START1
0x0002	3	START2
0x0003	4	Reset Trips
0x0004	5	Set Real-Time Clock
0x0005	6	Clear Data-Logging Records
0x0006	7	Clear Trip Counters
0x0007	8	Clear Energy Totals
0x0008	9	Clear Running Hours
0x0009	10	Emergency I ² t and Trip Reset
0x000A	11	Select Local Control
0x000B	12	De-select Local Control
0x000C	13	Re-enable Temperature Protection

Except for a broadcast address, the slave will return the original packet to the master.

C.4.5 Command Instructions Using Write Commands

For PLC's not supporting Function Code 5, PGR-6300 commands can be issued using Write Single Register (Code 6) and Write Multiple Register (Code 16).

Commands are written to PGR-6300 register 6 (Modbus register 40007). Supported commands are listed in the COMMAND CODE column in Table C.5.

When using the Write Multiple Registers function code, the write should be to the single PGR-6300 Register 6. If multiple registers are written starting at PGR-6300 Register 6, the first data element will be interpreted as the command code but no other registers will be written. If the command is successful, the PGR-6300 will return a valid response message.

C.4.6 Exception Responses

The PGR-6300 supports the following exception responses:

- Boundry Error (1)—Applies to writes of 32-bit values. The high-order word must be written first followed by the write to the low-order word. If this sequence is not followed, a Boundry Error is returned and the value will not stored. This does not apply on read requests.
- Address Error (2)—All accesses to communication registers must be within the specified address range or the Address Error code is returned.
- Command Error (3)—This error code is returned if the command code is not supported.
- Illegal Function Code (4)—The function code (Byte 2) is not supported.

The exception message consists of the slave address followed by a retransmission of the original function code. The function code will have the most-significant bit set to indicate an error. The 8-bit byte following the function code is the exception response code. The 16-bit CRC is at the end of the message.

C.5 PGR-6300 DATABASE

Appendix E contains the Modbus Register in the Communications Database Table. The table starts at register 0 (Modbus 40001) and each register is 16-bits wide. Types "long" and "float" are 32-bit values. For both long and float types, the low-order word is transmitted first followed by the high-order word. Word values have the high byte followed by the low byte. Float types as per IEEE 754 Floating-Point Standard. All bytes of long and float types must be written using one message or an error will result. This does not apply for read commands.

C.5.1 Data Records

Only one event record can be read at a time. Record data is for the record indicated by the Record Selector. To select a record, write the record number to Record Selector and then read the values in the record. Record Head points to the next available record. The last event record captured is at Record Head minus one.

Both Record Selector and Record Head values are in the range of 0 to 63. Values outside this range will select record 0.

C.5.2 Custom Data Access

Data access can be customized with the User-Defined Registers and the User-Data Registers.

User-Defined Registers are located in non-volatile memory and contain the register numbers from which data is required. To access the data, read the corresponding User-Data Registers.

The format of the User Data is a function of the corresponding register entered in the User-Defined-Register area.

C.6 NETWORK TIMEOUT

The PGR-6300 can be configured to trip or alarm on a network timeout using the *Setup | Hardware | Network Comms* menu. The *Net Trip Action* and *Net Alarm Action* set points set the actions to be taken when a timeout occurs. To prevent a timeout, a valid message, addressed to the slave, must be received at time intervals less than five seconds.

Caution: Set protocol to *None* before selecting *Network Error* actions; then, select protocol.

C.7 SPECIFICATIONS

Interface	Isolated RS-485, 2 wire, multi-drop, half duplex.
Protocol	Modbus RTU
Baud Rate	1,200 to 19,200 bit/s.
Bit Format.....	8 bits, no parity, one stop bit ⁽¹⁾
Number of CTU's Connected ..	Maximum of 32 units.
Bus length	1,200 m (4,000 ft) total ⁽²⁾

⁽¹⁾ Terminal “-” is negative with respect to terminal “+” for a binary 1 (MARK or OFF) state.

Terminal “-” is positive with respect to terminal “+” for a binary 0 (SPACE or ON) state.

⁽²⁾ For line lengths exceeding 10 m (30 ft), 150-Ω terminations are required at the cable ends.

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APPENDIX D PGR-6300 A-B DF1 PROTOCOL

D.1 PROTOCOL

The PGR-6300 A-B® Protocol is based on the half-duplex master/slave Allen-Bradley (A-B) Data Highway Protocol (DF1) as described in Allen-Bradley Bulletin 1770-6.5.16 October 1996. This publication is available from the A-B web site at www.ab.com.

The communications system consists of a single master and up to thirty-two slaves connected to a two-wire RS-485 multi-drop network. PGR-6300 Control Units are slave devices on this network.

If the master does not have an RS-485 port, an RS-232 to RS-485 converter is required. The RS-485 converter should have automatic send-data control (SD). SD control does not require handshaking lines since it uses the data line to control the RS-485 transmitter.

The PGR-6300 supports the DF1 commands shown in Table D.1. Each PLC has limitations when using a particular command. Determine the best command to use for a particular application.

TABLE D.1 DF1 Commands

COMMAND	CMD	FNC
Unprotected Read	01	-
Unprotected Write	08	-
Typed Read	0F	68
Typed Write	0F	67
Typed Logical Read	0F	A2
Typed Logical Write	0F	AA

The PLC-5 and SLC 500 support reading and writing to integer files (Type N) and float files (Type F). Since PGR-6300 meter values are float types, these will typically be stored in a PLC Type-F file. It is also possible to read float types from the PGR-6300 as two integers; however, further processing is required to obtain the float value.

The PLC requires two communication ports—a PLC programming port and a PGR-6300 communications port. Typically, a DH+ port will be used for PLC programming and the RS-232 port is used for PGR-6300 communications via an RS-232 to RS-485 converter.

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D.2 PLC-5 / SLC 500 CHANNEL-0 SETUP

The RS-232 Channel-0 port is set up for a DF1 half-duplex master. Set the Channel-0 baud rate and CRC to match the PGR-6300 settings. The parity bit is not supported on the PGR-6300. Where applicable, set *Reply Message Wait* to 100 ms.

Additional recommended PLC settings:

DF1 Retries = 3
RTS Send Delay = 1 (20 ms)
RTS Off Delay = 0
Ack timeout = 5 (100 ms)
Reply msg wait = 3 (60 ms)

For the polling mode, select MESSAGE BASED (DO NOT ALLOW SLAVE TO INITIATE MESSAGES) or STANDARD (MULTIPLE MESSAGE-TRANSFER PER NODE SCAN). The PGR-6300 can buffer up to 3 messages. The selection MESSAGE BASED (DO NOT ALLOW SLAVE TO INITIATE MESSAGES) is recommended.

D.3 TYPED-READ

The Typed-Read message is used to read data from the PGR-6300. The Typed-Read message requires a Control Block where the message configuration is stored. In the SLC, this is normally N7:0 but could be any other file that supports the control-block data. Use the following MSG settings:

Read/Write: Read
Target Device: PLC5
Local/Remote: Local
Control Block: N7:0

Note: For the PLC-5, the message block must be of type MG so that the channel number can be set in the message setup screen.

The Setup screen is used to specify file information. In the *This Controller* section, *Data Table Address* is the destination in the PLC where data is to be stored. This can be a float (Fx:x) file or an integer (Nx:x) file. *Element Size* must be set to the number of elements to transfer. This is a decimal value and this value is limited in some controllers. In the SLC 500, the maximum value for integers is 100 and for floats it is 50.

In *Target Device*, set *Data Table Address* to the A-B File address listed in Appendix E. The A-B File in Appendix E is coded as FILE:ELEMENT. To read or write the element as floats, the PLC-5 address would be <F><FILE>:<ELEMENT> (Example F9:222). To read or write the element as integers, add 20 to the file number and precede with N, <N><FILE+20>:<ELEMENT> (Example N29:222). *Local Address* is the PGR-6300 address.

Example settings for reading 25 registers as float type (25 meter readings):

Data Table Address:..... F8:0
 Element Size:..... 25
 Target Device Data
 Table Address:..... F6:0
 Local Address:..... 9 (Must match PGR-6300 setting)

Note: To read float values, both data table addresses must be specified as float (F) type.

Example settings for reading a block of 100 registers (16-bit integer):

This could be a mix of float and integer values since floats can be transferred as two integers in the PGR-6300.

Data Table Address:..... N9:0
 Element Size:..... 100
 Target Device Data
 Table Address:..... N23:264 (Start of Digital Inputs)
 Local Address:..... 9 (Must match PGR-6300 setting)

If a PGR-6300 float has been read into the PLC as two integers and stored in an N-type file, the float can be recovered by using two copy commands. Assume that the two integers from the PGR-6300 read command are stored in N9:0 and N9:1. The first copy command is used to swap the two words so they are in the correct order; copy N9:0 to N9:11, and copy N9:1 to N9:10. The second copy command will copy the two integers to the F-type file; copy N9:10 to F8:0 with a size of 1. The two integers are now combined correctly as a single 4-byte float located in F8:0.

D.4 TYPED-WRITE

The Typed-Write message is used to write data to the PGR-6300.

Read/Write: Write
 Target Device: PLC5
 Local/Remote: Local
 Control Block: N7:0

The Setup screen is used to specify file information. In the *This Controller* section, *Data Table Address* is the source file in the SLC. This can be a float (Fx:x) file or an integer (Nx:x) file. *Element Size* must be set to the number of elements to transfer. For the PGR-6300, the maximum element size is 100 for integers and 50 for floats.

In *Target Device*, set *Data Table Address* to the A-B File address listed in Appendix E. Both integer and float values sent from the SLC are in the correct byte order and interpreted correctly by the PGR-6300. The PGR-6300 will do a range check on all messages to ensure valid data.

Local Address is the PGR-6300 address.

Example settings for writing a single float to set the FLA Rating:

Data-Table Address:..... F8:0 (Location of FLA value)
 Element Size: 1
 Target-Device Data-
 Table Address: F3:225
 Local Address:..... 9 (Must match PGR-6300 setting)

Reset commands to the PGR-6300 are issued by writing an integer command code to PGR-6300 Register 6 (N23:6)

A command message should only be issued when the command is required.

Valid commands are shown Table D.2.

TABLE D.2 PGR-6300 Commands

COMMAND CODE	ACTION
0x0000	STOP
0x0001	START1
0x0002	START2
0x0003	Reset Trips
0x0004	Set Real-Time Clock
0x0005	Clear Data-Logging Records
0x0006	Clear Trip Counters
0x0007	Clear Energy Totals
0x0008	Clear Running Hours
0x0009	Emergency I ² t and Trip Reset
0x000A	Select Local Control
0x000B	De-select Local Control
0x000C	Re-enable Temperature Protection

Example settings for writing a PGR-6300 reset command:

Data-Table Address:..... N9:0 (Reset code = 3)
Element Size:..... 1
Target-Device Data-
Table Address:..... N23:6 (PGR-6300
Command Register
location)
Local Address: 9 (Must match PGR-6300
setting)

D.5 UNPROTECTED READ/WRITE

For PLC-2 and PLC-3 processors not supporting Typed Read/Write messages, Unprotected Read/Write commands can be used. For these messages, the data address is the Octal value of the PGR-6300 Register in Appendix E. The size is the number of registers. The maximum number of registers that can be transferred in a single message is 100.

Unprotected Read/Write commands are used by the PGW-COMM communication program.

D.6 TYPED LOGICAL READ/WRITE

The Typed Logical Read (CMD = 0F, FNC = A2) and Typed Logical Write (CMD = 0F, FNC = AA) messages are supported by the full line of SLC 500 processors and Prosoft MVixx-DFCM communication interfaces.

Both float (F) and integer (N) types are supported. Unlike the typed commands in Section D.3 and D.4 a file offset is not required for integer values. Use the A-B file address as listed in the PGR-6300 manual Appendix E and precede the address with F for float values and N for integer values.

The maximum number of integers and floats that can be read is 100 and 50 respectively.

Reset commands to the PGR-6300 are issued by writing one of the COMMAND CODES listed in Table D.2 to Register 6 (N3:6).

D.7 DATA RECORDS

Only one event record can be read at a time. Data is for the record indicated by the Record Selector. To select a record, write the record number to Record Selector and then read the values in the record. Record-Head points to the next available record. The last event record captured is at Record Head minus one.

Both Record-Selector and Record-Head values are in the range of 0 to 63. Values outside this range will select record 0.

D.8 CUSTOM DATA ACCESS

Data access can be customized with the User-Defined Registers and the User Data Register.

Enter the required data-register numbers in the User-Defined Registers. The format of user data is a function of the corresponding register.

To access the data, read the corresponding User-Data Register.

D.9 NETWORK TIMEOUT

The PGR-6300 can be configured to trip or alarm on a network timeout using the *Setup | Hardware | Network Comms* menu. The *Net Trip Action* and *Net Alarm Action* set points set the actions to be taken when a timeout occurs. To prevent a timeout, a valid message, addressed to the slave, must be received at time intervals less than five seconds.

Caution: Set protocol to *None* before selecting *Network Error* actions; then, select protocol.

D.10 SPECIFICATIONS

Interface..... Isolated RS-485, 2 wire,
multi-drop, half duplex.
Protocol..... Modbus RTU
Baud Rate..... 1,200 to 19,200 bit/s.
Bit Format..... 8 bits, no parity, one
stop bit ⁽¹⁾
Number of CTU's Connected.. Maximum of 32 units.
Bus length..... 1,200 m (4,000 ft) total ⁽²⁾

⁽¹⁾ Terminal “-” is negative with respect to terminal “+” for a binary 1 (MARK or OFF) state.

Terminal “-” is positive with respect to terminal “+” for a binary 0 (SPACE or ON) state.

⁽²⁾ For line lengths exceeding 10 m (30 ft), 150-Ω terminations are required at the cable ends.

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**APPENDIX E
 COMMUNICATIONS DATABASE TABLE**

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
Model Information						
0	40001	3:000	Model Code	Read Only		T3
1			Software Version	Read Only		T3
2			Serial Number	Read Only		T2 (low)
3						T2 (high)
4						
5			Diagnostic Code	Read Only		T3
6	N/A		DF1 Command Register	Write Only		T37
Overload						
8	40009	3:8	Trip Action	R/W	0 – 7	T42
9			Model Type	R/W	0 – 1	T33
10			I ² t Start Inhibit	R/W	0 – 1	T6
11			K-Factor	R/W	0 – 10	T1 (low)
12						T1 (high)
13			Locked-Rotor Current	R/W	1.5 – 10 x FLA	T1 (low)
14						T1 (high)
15			Locked-Rotor Time Cold	R/W	0.2 – 100 s	T1 (low)
16						T1 (high)
17			Locked-Rotor Time Hot	R/W	0.2 – 100 s	T1 (low)
18						T1 (high)
19			Cooling Factor	R/W	0.1 – 10	T1 (low)
20						T1 (high)
21			I ² t Inhibit Level	R/W	0.1 – 0.9	T1 (low)
22						T1 (high)
23			I ² t Alarm level	R/W	0.5 – 1.0	T1 (low)
24						T1 (high)
25			I ² t Alarm Action	R/W	0 – 7	T43
26			I ² t Reset Type	R/W	0 – 2	T38
Overcurrent						
32	40033	3:32	Trip Action	R/W	0 – 7	T42
33			Trip Level	R/W	1 – 15 x I _p	T1 (low)
34						T1 (high)
35			Trip Delay	R/W	0 – 10 s	T1 (low)
36						T1 (high)
Aux Overcurrent						
40	40041	3:40	Trip Action	R/W	0 – 7	T42
41			Trip Level	R/W	1 – 15 x I _p	T1 (low)
42						T1 (high)
43			Trip Delay	R/W	0 – 10 s	T1 (low)
44						T1 (high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
Reduced Overcurrent						
45	40046	3:45	Trip Action	R/W	0 – 7	T42
46			Trip Level	R/W	1 – 15 x I _p	T1 (low)
47						T1 (high)
Earth Fault						
48	40049	3:48	Trip Action	R/W	0 – 7	T42
49			Spare			
50			Trip Level	R/W	0.05 – 1.0 x I _e	T1(low)
51						T1(high)
52			Trip Delay	R/W	0 – 100 s	T1(low)
53						T1(high)
54			Alarm Level	R/W	0.05 – 1.0 x I _e	T1(low)
55						T1(high)
56			Alarm Delay	R/W	0 – 100 s	T1(low)
57						T1(high)
58			Alarm Action	R/W	0 – 7	T43
Jam						
64	40065	3:64	Trip Action	R/W	0 – 7	T42
65			Trip Level	R/W	1 – 10 x FLA	T1(low)
66						T1(high)
67			Trip Delay	R/W	1 – 100 s	T1(low)
68						T1(high)
69			Alarm Level	R/W	1 – 10 x FLA	T1(low)
70						T1(high)
71			Alarm Delay	R/W	1 – 100 s	T1(low)
72						T1(high)
73			Alarm Action	R/W	0 – 7	T43
Current Unbalance						
80	40081	3:80	Trip Action	R/W	0 – 7	T42
81			Trip Level	R/W	0.05 – 1.0 pu	T1(low)
82						T1(high)
83			Trip Delay	R/W	1.0 – 100 s	T1(low)
84						T1(high)
85			Alarm Level	R/W	0.05 – 1.0 pu	T1(low)
86						T1(high)
87			Alarm Delay	R/W	1.0 – 100 s	T1(low)
88						T1(high)
89			Alarm Action	R/W	0 – 7	T43
Phase Reverse (I)						
95	40096	3:95	Alarm Action	R/W	0 – 7	T43
96			Trip Action	R/W	0 – 7	T42
97			Trip and Alarm Delay	R/W	1 – 100 s	T1(low)
98						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
Phase Loss (I)						
99	40100	3:99	Trip Action	R/W	0 – 7	T42
100			Trip Delay	R/W	1 – 100 s	T1(low)
101						T1(high)
Voltage Unbalance						
104	40105	3:104	Trip Action	R/W	0 – 7	T42
105			Trip Level	R/W	0.05 – 1.0 pu	T1(low)
106						T1(high)
107			Trip Delay	R/W	1.0 – 100	T1(low)
108						T1(high)
109			Alarm Level	R/W	0.05 – 1.0 pu	T1(low)
110						T1(high)
111			Alarm Delay	R/W	1.0 – 100	T1(low)
112						T1(high)
113			Alarm Action	R/W	0 – 7	T43
Phase Reverse (V)						
119	40120	3:119	Alarm Action	R/W	0 – 7	T43
120			Trip Action	R/W	0 – 7	T42
121			Trip and Alarm Delay	R/W	1 – 100 s	T1(low)
122						T1(high)
Phase Loss (V)						
123	40124	3:123	Trip Action	R/W	0 – 7	T42
124			Trip Delay	R/W	1 – 100 s	T1(low)
125						T1(high)
Undercurrent						
128	40129	3:128	Trip Action	R/W	0 – 7	T42
129			Trip Level	R/W	0.1 – 1.0 x FLA	T1(low)
130						T1(high)
131			Trip Delay	R/W	1 – 100 s	T1(low)
132						T1(high)
133			Alarm Level	R/W	0.1 – 1.0 x FLA	T1(low)
134						T1(high)
135			Alarm Delay	R/W	1 – 100 s	T1(low)
136						T1(high)
137			Alarm Action	R/W	0 – 7	T43
PTC Temperature						
144	40145	3:144	Trip Action	R/W	0 – 7	T42
145			Alarm Action	R/W	0 – 7	T43
Acceleration Failure—Underspeed						
152	40153	3:152	Trip Action	R/W	0 – 7	T42
153			Speed 1	R/W	1 – 100% FS	T1(low)
154						T1(high)
155			Time 1	R/W	1 – 1,000 s	T1(low)
156						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
157			Speed 2	R/W	1 – 100%-FS	T1(low)
158						T1(high)
159			Time 2	R/W	1 – 1,000 s	T1(low)
160						T1(high)
161			Speed 3	R/W	1 – 100% FS	T1(low)
162						T1(high)
163			Time 3	R/W	1 – 1,000 s	T1(low)
164						T1(high)
Power Factor — Quadrant 4						
166	40167	3:166	Trip Action	R/W	0 – 7	T42
167			Trip Level	R/W	0.5 – 1.0	T1(low)
168						T1(high)
169			Trip Delay	R/W	0.2 – 500 s	T1(low)
170						T1(high)
171			Alarm Level	R/W	0.5 – 1.0	T1(low)
172						T1(high)
173			Alarm Delay	R/W	0.2 – 500 s	T1(low)
174						T1(high)
175			Alarm Action	R/W	0 - 7	T43
Overvoltage						
176	40177	3:176	Trip Action	R/W	0 – 7	T42
177			Trip Level	R/W	1 – 1.4 x Vp	T1(low)
178						T1(high)
179			Trip Delay	R/W	1 – 500 s	T1(low)
180						T1(high)
181			Alarm Level	R/W	1 – 1.4 x Vp	T1(low)
182						T1(high)
183			Alarm Delay	R/W	1 – 500 s	T1(low)
184						T1(high)
185			Alarm Action	R/W	0 – 7	T43
Undervoltage						
192	40193	3:192	Trip Action	R/W	0 – 7	T42
193			Trip Level	R/W	0.5 – 1.0 x Vp	T1(low)
194						T1(high)
195			Trip Delay	R/W	1 – 500 s	T1(low)
196						T1(high)
197			Alarm Level	R/W	0.5 – 1.0 x Vp	T1(low)
198						T1(high)
199			Alarm Delay	R/W	1 – 500 s	T1(low)
200						T1(high)
201			Alarm Action	R/W	0 – 7	T43
System Ratings						
208	40209	3:208	Reserved			
209			V-Connection Type	R/W	0 – 3	T9

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
210			Phase-CT Primary	R/W	1 – 5,000 A	T1(low)
211						T1(high)
212			EF-CT Primary	R/W	1 – 5,000 A	T1(low)
213						T1(high)
214			Input-Voltage Rating	R/W	60 V – 600V	T1(low)
215						T1(high)
216			Run-Mode Delay	R/W	5 – 120 s	T1(low)
217						T1(high)
218			Differential-CT Primary Rating	R/W	1 – 5,000 A	T1 (low)
219						T1 (high)
223	40224	3:223	Screen Saver	R/W	0 – 1	T6
224	40225	3:224	Frequency	R/W	0 – 1	T10
225			Full-Load Rating #1	R/W	1 – 5,000 A	T1(low)
226						T1(high)
227			System-Voltage Rating	R/W	120 V – 25 kV	T1(low)
228						T1(high)
229			Synchronous Speed	R/W	10 – 10,000 RPM	T1(low)
230						T1(high)
231			Spare			
232			Spare			
233			Service Factor	R/W	1 – 1.25	T1(low)
234						T1(high)
235			Full-Load Rating #2	R/W	1 – 5,000 A	T1(low)
236						T1(high)
OPI						
237	40238	3:237	OPI-Loss Trip Action		0 – 7	T42
238			Number of OPI's		0 – 2	T40
239			Control Enable—REMOTE		0 – 1	T6
240			Control Enable—OPI		0 – 1	T6
241			Control Enable—LOCAL		0 – 1	T6
Starter						
242	40243	3:242	Remote Start Sources—Digital Inputs		0 – 1	T6
243			Remote Start Sources—Network		0 – 1	T6
244			Remote Start Sources—OPI		0 – 1	T6
248			Starter Type	R/W	0 – 15	T11
249			Start Time	R/W	0.1 – 500	T1(low)
250						T1(high)
251			Start 1 Delay	R/W	0.1 – 500	T1(low)
252						T1(high)
253			Start 2 Delay	R/W	0.1 – 500	T1(low)
254						T1(high)
255			Start 3 Delay	R/W	0.1 – 500	T1(low)
256						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
257			Backspin-Timer Enable		0 – 1	T6
258			Backspin-Time Delay		0.1 – 3,600 s	T1(low)
259						T1(high)
Current Transfers						
260	40261	3:260	Transfer Type	R/W	0 – 1	T41
261			Transfer Level	R/W	1.0 – 3.0 x FLA	T1 (low)
262						T1 (high)
Digital Inputs						
264	40265	3:264	Input 1 Function	R/W	0 – 19	T12
265			Input 1 Bypass Enable	R/W	0 – 1	T6
266			Input 1 Bypass Delay	R/W	0.5 – 100 s	T1(low)
267						T1(high)
268			Input 1 Trip Delay	R/W	0.01 – 100 s	T1(low)
269						T1(high)
274			Input 2 Function	R/W	0 – 19	T12
275			Input 2 Bypass Enable	R/W	0 – 1	T6
276			Input 2 Bypass Delay	R/W	0.5 – 100 s	T1(low)
277						T1(high)
278			Input 2 Trip Delay	R/W	0.01 – 100 s	T1(low)
279						T1(high)
284			Input 3 Function	R/W	0 – 19	T12
285			Input 3 Bypass Enable	R/W	0 – 1	T6
286			Input 3 Bypass Delay	R/W	0.5 – 100 s	T1(low)
287						T1(high)
288			Input 3 Trip Delay	R/W	0.01 – 100 s	T1(low)
289						T1(high)
294			Input 4 Function	R/W	0 – 19	T12
295			Input 4 Bypass Enable	R/W	0 – 1	T6
296			Input 4 Bypass Delay	R/W	0.5 – 100 s	T1(low)
297						T1(high)
298			Input 4 Trip Delay	R/W	0.01 – 100 s	T1(low)
299						T1(high)
304			Input 5 Function	R/W	0 – 19	T12
305			Input 5 Bypass Enable	R/W	0 – 1	T6
306			Input 5 Bypass Delay	R/W	0.5 – 100 s	T1(low)
307						T1(high)
308			Input 5 Trip Delay	R/W	0.01 – 100 s	T1(low)
309						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
314			Input 6 Function	R/W	0 – 19	T12
315			Input 6 Bypass Enable	R/W	0 – 1	T6
316			Input 6 Bypass Delay	R/W	0.5 – 100 s	T1(low)
317						T1(high)
318			Input 6 Trip Delay	R/W	0.01 – 100 s	T1(low)
319						T1(high)
324			Input 7 Function	R/W	0 – 19	T12
325			Input 7 Bypass Enable	R/W	0 – 1	T6
326			Input 7 Bypass Delay	R/W	0.5 – 100 s	T1(low)
327						T1(high)
328			Input 7 Delay	R/W	0.01 – 100 s	T1(low)
329						T1(high)
330			Digital Tachometer Enable	R/W	0 – 1	T6
331			Pulses Per Revolution	R/W	1 – 100	T1(low)
332						T1(high)
Relay Output Function						
334	40335	3:334	Relay 1 Output Function	R/W	0 – 20	T13
335			Relay 1 Mode	R/W	0 – 1	T14
336			Relay 2 Output Function	R/W	0 – 20	T13
337			Relay 2 Mode	R/W	0 – 1	T14
338			Relay 3 Output Function	R/W	0 – 20	T13
339			Relay 3 Mode	R/W	0 – 1	T14
340			Relay 4 Output Function	R/W	0 – 20	T13
341			Relay 4 Mode	R/W	0 – 1	T14
342			Relay 5 Output Function	R/W	0 – 20	T13
343			Relay 5 Mode	R/W	0 – 1	T14
344			Relay Pulse Time	R/W	0.05 – 10 s	T1(low)
345						T1(high)
Analog Input						
350	40351	3:350	Analog-Input Function	R/W	0 – 3	T34
351			High-Level Trip	R/W	0.1 – 20.0 mA	T1(low)
352						T1(high)
353			Low-Level Trip	R/W	0.1 – 20.0 mA	T1(low)
354						T1(high)
355			Trip Delay	R/W	.01 – 100 s	T1(low)
356						T1(high)
357			High-Level Alarm	R/W	0.1 – 20.0 mA	T1(low)
358						T1(high)
359			Low-Level Alarm	R/W	0.1 – 20.0 mA	T1(low)
360						T1(high)
361			Alarm Delay	R/W	.01 – 100 s	T1(low)
362						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
363			ASD 4-mA Frequency	R/W	0 – 70 Hz	T1(low)
364						T1(high)
365			ASD 20-mA Frequency	R/W	0 – 70 Hz	T1(low)
366						T1(high)
367			Motor 4-mA Speed	R/W	0 – 100%	T1(low)
368						T1(high)
369			Motor 20-mA Speed	R/W	0 – 100%	T1(low)
370						T1(high)
Analog Output						
373	40374	3:373	Output Parameter	R/W	0 – 16	T15
			(See Register 856-859 for Analog Output Calibration)			
Network and I/O Module Communications						
374	40375	3:374	DeviceNet Producing Instance	R/W	0 – 9	T82
375			DeviceNet Consuming Instance	R/W	0 – 4	T83
379	40380	3:379	RTD-Sensor-Error Alarm Action	R/W	0 – 7	T43
380			RTD-Module-Error Alarm Action	R/W	0 – 7	T43
381			Network Alarm Action	R/W	0 – 7	T43
382			Network Type	R/W	0 – 5	T16
383			Network Baud Rate	R/W	0 – 7	T17
384			Error Check	R/W	0 – 2	T18
385			Network ID	R/W	0 – 255	T1(low)
386						T1(high)
387			Network Trip Action	R/W	0 – 7	T42
RTD Module (PGA-0120)						
388	40389	3:388	RTD-Sensor-Error Trip Action	R/W	0 – 7	T42
389			RTD-Module-Error Trip Action	R/W	0 – 7	T42
390	40391	4:0	Number of RTD Modules	R/W	0 – 3	T19
RTD Type (PGA-0120)						
391	40392	4:1	Module 1 #1 Type	R/W	0 – 4	T20
392			Module 1 #2 Type	R/W	0 – 4	T20
393			Module 1 #3 Type	R/W	0 – 4	T20
394			Module 1 #4 Type	R/W	0 – 4	T20
395			Module 1 #5 Type	R/W	0 – 4	T20
396			Module 1 #6 Type	R/W	0 – 4	T20
397			Module 1 #7 Type	R/W	0 – 4	T20
398			Module 1 #8 Type	R/W	0 – 4	T20
399			Module 2 #1 Type	R/W	0 – 4	T20
400			Module 2 #2 Type	R/W	0 – 4	T20
401			Module 2 #3 Type	R/W	0 – 4	T20
402			Module 2 #4 Type	R/W	0 – 4	T20
403			Module 2 #5 Type	R/W	0 – 4	T20
404			Module 2 #6 Type	R/W	0 – 4	T20
405			Module 2 #7 Type	R/W	0 – 4	T20
406			Module 2 #8 Type	R/W	0 – 4	T20

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
407			Module 3 #1 Type	R/W	0 – 4	T20
408			Module 3 #2 Type	R/W	0 – 4	T20
409			Module 3 #3 Type	R/W	0 – 4	T20
410			Module 3 #4 Type	R/W	0 – 4	T20
411			Module 3 #5 Type	R/W	0 – 4	T20
412			Module 3 #6 Type	R/W	0 – 4	T20
413			Module 3 #7 Type	R/W	0 – 4	T20
414			Module 3 #8 Type	R/W	0 – 4	T20
RTD Function (PGA-0120)						
415	40416	4:25	Module 1 #1 Function	R/W	0 – 3	T21
416			Module 1 #2 Function	R/W	0 – 3	T21
417			Module 1 #3 Function	R/W	0 – 3	T21
418			Module 1 #4 Function	R/W	0 – 3	T21
419			Module 1 #5 Function	R/W	0 – 3	T21
420			Module 1 #6 Function	R/W	0 – 3	T21
421			Module 1 #7 Function	R/W	0 – 3	T21
422			Module 1 #8 Function	R/W	0 – 3	T21
423			Module 2 #1 Function	R/W	0 – 3	T21
424			Module 2 #2 Function	R/W	0 – 3	T21
425			Module 2 #3 Function	R/W	0 – 3	T21
426			Module 2 #4 Function	R/W	0 – 3	T21
427			Module 2 #5 Function	R/W	0 – 3	T21
428			Module 2 #6 Function	R/W	0 – 3	T21
429			Module 2 #7 Function	R/W	0 – 3	T21
430			Module 2 #8 Function	R/W	0 – 3	T21
431			Module 3 #1 Function	R/W	0 – 3	T21
432			Module 3 #2 Function	R/W	0 – 3	T21
433			Module 3 #3 Function	R/W	0 – 3	T21
434			Module 3 #4 Function	R/W	0 – 3	T21
435			Module 3 #5 Function	R/W	0 – 3	T21
436			Module 3 #6 Function	R/W	0 – 3	T21
437			Module 3 #7 Function	R/W	0 – 3	T21
438			Module 3 #8 Function	R/W	0 – 3	T21
RTD Trip1/Alarm1 Setpoints (PGA-0120)						
446	40447	4:56	Module 1 #1 Trip Level	R/W	40 – 200°C	T1(low)
447						T1(high)
448			Module 1 #1 Alarm Level	R/W	40 – 200°C	T1(low)
449						T1(high)
450			Module 1 #2 Trip Level	R/W	40 – 200°C	T1(low)
451						T1(high)
452			Module 1 #2 Alarm Level	R/W	40 – 200°C	T1(low)
453						T1(high)
454			Module 1 #3 Trip Level	R/W	40 – 200°C	T1(low)
455						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
456			Module 1 #3 Alarm Level	R/W	40 – 200°C	T1(low)
457						T1(high)
458			Module 1 #4 Trip Level	R/W	40 – 200°C	T1(low)
459						T1(high)
460			Module 1 #4 Alarm Level	R/W	40 – 200°C	T1(low)
461						T1(high)
462			Module 1 #5 Trip Level	R/W	40 – 200°C	T1(low)
463						T1(high)
464			Module 1 #5 Alarm Level	R/W	40 – 200°C	T1(low)
465						T1(high)
466			Module 1 #6 Trip Level	R/W	40 – 200°C	T1(low)
467						T1(high)
468			Module 1 #6 Alarm Level	R/W	40 – 200°C	T1(low)
469						T1(high)
470			Module 1 #7 Trip Level	R/W	40 – 200°C	T1(low)
471						T1(high)
472			Module 1 #7 Alarm Level	R/W	40 – 200°C	T1(low)
473						T1(high)
474			Module 1 #8 Trip Level	R/W	40 – 200°C	T1(low)
475						T1(high)
476			Module 1 #8 Alarm Level	R/W	40 – 200°C	T1(low)
477						T1(high)
478			Module 2 #1 Trip Level	R/W	40 – 200°C	T1(low)
479						T1(high)
480			Module 2 #1 Alarm Level	R/W	40 – 200°C	T1(low)
481						T1(high)
482			Module 2 #2 Trip Level	R/W	40 – 200°C	T1(low)
483						T1(high)
484			Module 2 #2 Alarm Level	R/W	40 – 200°C	T1(low)
485						T1(high)
486			Module 2 #3 Trip Level	R/W	40 – 200°C	T1(low)
487						T1(high)
488			Module 2 #3 Alarm Level	R/W	40 – 200°C	T1(low)
489						T1(high)
490			Module 2 #4 Trip Level	R/W	40 – 200°C	T1(low)
491						T1(high)
492			Module 2 #4 Alarm Level	R/W	40 – 200°C	T1(low)
493						T1(high)
494			Module 2 #5 Trip Level	R/W	40 – 200°C	T1(low)
495						T1(high)
496			Module 2 #5 Alarm Level	R/W	40 – 200°C	T1(low)
497						T1(high)
498			Module 2 #6 Trip Level	R/W	40 – 200°C	T1(low)
499						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
500			Module 2 #6 Alarm Level	R/W	40 – 200°C	T1(low)
501						T1(high)
502			Module 2 #7 Trip Level	R/W	40 – 200°C	T1(low)
503						T1(high)
504			Module 2 #7 Alarm Level	R/W	40 – 200°C	T1(low)
505						T1(high)
506			Module 2 #8 Trip Level	R/W	40 – 200°C	T1(low)
507						T1(high)
508			Module 2 #8 Alarm Level	R/W	40 – 200°C	T1(low)
509						T1(high)
510			Module 3 #1 Trip Level	R/W	40 – 200°C	T1(low)
511						T1(high)
512			Module 3 #1 Alarm Level	R/W	40 – 200°C	T1(low)
513						T1(high)
514			Module 3 #2 Trip Level	R/W	40 – 200°C	T1(low)
515						T1(high)
516			Module 3 #2 Alarm Level	R/W	40 – 200°C	T1(low)
517						T1(high)
518			Module 3 #3 Trip Level	R/W	40 – 200°C	T1(low)
519						T1(high)
520			Module 3 #3 Alarm Level	R/W	40 – 200°C	T1(low)
521						T1(high)
522			Module 3 #4 Trip Level	R/W	40 – 200°C	T1(low)
523						T1(high)
524			Module 3 #4 Alarm Level	R/W	40 – 200°C	T1(low)
525						T1(high)
526			Module 3 #5 Trip Level	R/W	40 – 200°C	T1(low)
527						T1(high)
528			Module 3 #5 Alarm Level	R/W	40 – 200°C	T1(low)
529						T1(high)
530			Module 3 #6 Trip Level	R/W	40 – 200°C	T1(low)
531						T1(high)
532			Module 3 #6 Alarm Level	R/W	40 – 200°C	T1(low)
533						T1(high)
534			Module 3 #7 Trip Level	R/W	40 – 200°C	T1(low)
535						T1(high)
536			Module 3 #7 Alarm Level	R/W	40 – 200°C	T1(low)
537						T1(high)
538			Module 3 #8 Trip Level	R/W	40 – 200°C	T1(low)
539						T1(high)
540			Module 3 #8 Alarm Level	R/W	40 – 200°C	T1(low)
541						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
Hot Motor Compensation						
550	40551	4:160	HMC Enable	R/W		T6
551			HMC Maximum Bias	R/W	40 – 200°C	T1(low)
552						T1(high)
553			HMC Minimum Bias	R/W	40 – 200°C	T1(low)
554						T1(high)
Language						
558			English Only	R/W	0 – 2	T39
IRIG Offset						
568	40569	4:178	IRIG Offset (hours)	R/W	0 – 23	T1(low)
569						T1(high)
570			IRIG Offset (minutes)	R/W	0 – 30	T1(low)
571						T1(high)
Clock Reading						
574	40575	5:0	RTC Date	Read Only		T23(low)
575						T23(high)
576			RTC Time	Read Only		T24(low)
577						T24(high)
Strings						
580	40581	5:6	Clock String (setting only)	R/W		T31
590			Password (first four characters)	R/W		T22
600			System Name	R/W		T22
610			RTD Module 1 #1 Name	R/W		T22
620			RTD Module 1 #2 Name	R/W		T22
630			RTD Module 1 #3 Name	R/W		T22
640			RTD Module 1 #4 Name	R/W		T22
650			RTD Module 1 #5 Name	R/W		T22
660			RTD Module 1 #6 Name	R/W		T22
670			RTD Module 1 #7 Name	R/W		T22
680			RTD Module 1 #8 Name	R/W		T22
690			RTD Module 2 #1 Name	R/W		T22
700			RTD Module 2 #2 Name	R/W		T22
710			RTD Module 2 #3 Name	R/W		T22
720			RTD Module 2 #4 Name	R/W		T22
730			RTD Module 2 #5 Name	R/W		T22
740			RTD Module 2 #6 Name	R/W		T22
750			RTD Module 2 #7 Name	R/W		T22
760			RTD Module 2 #8 Name	R/W		T22
770			RTD Module 3 #1 Name	R/W		T22
780			RTD Module 3 #2 Name	R/W		T22
790			RTD Module 3 #3 Name	R/W		T22
800			RTD Module 3 #4 Name	R/W		T22
810			RTD Module 3 #5 Name	R/W		T22
820			RTD Module 3 #6 Name	R/W		T22
830			RTD Module 3 #7 Name	R/W		T22
840			RTD Module 3 #8 Name	R/W		T22

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
Analog Output Calibration						
856	40857	5:282	Analog-Output Calibration (zero)	R/W	0 – 1,000	T1(low)
857						T1(high)
858			Analog-Output Calibration (FS)	R/W	0 – 1,000	T1(low)
859						T1(high)
Meter Values						
860	40861	6:0	I _a (A)	Read Only		T1(low)
861						T1(high)
862			I _b (A)	Read Only		T1(low)
863						T1(high)
864			I _c (A)	Read Only		T1(low)
865						T1(high)
866			I _g (A)	Read Only		T1(low)
867						T1(high)
868			V _{ab} (kV)	Read Only		T1(low)
869						T1(high)
870			V _{bc} (kV)	Read Only		T1(low)
871						T1(high)
872			V _{ca} (kV)	Read Only		T1(low)
873						T1(high)
874			Apparent Power (S) in kVA	Read Only		T1(low)
875						T1(high)
876			Reactive Power (Q) in kVAR	Read Only		T1(low)
877						T1(high)
878			Real Power (P) in kW	Read Only		T1(low)
879						T1(high)
880			Power Factor (-1 to +1)	Read Only		T1(low)
881						T1(high)
882			Used Thermal Capacity (%)	Read Only		T1(low)
883						T1(high)
884			Analog Input (mA)	Read Only		T1(low)
885						T1(high)
886			Trend I ² t (%)	Read Only		T1(low)
887						T1(high)
888			Positive-Sequence Current (pu)	Read Only		T1(low)
889						T1(high)
890			Negative-Sequence Current (pu)	Read Only		T1(low)
891						T1(high)
892			Unbalance (I) (pu)	Read Only		T1(low)
893						T1(high)
894			Positive-Sequence V (pu)	Read Only		T1(low)
895						T1(high)
896			Negative-Sequence V (pu)	Read Only		T1(low)
897						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
898			Unbalance Voltage (pu)	Read Only		T1(low)
899						T1(high)
900			Motor Speed from tach. (RPM)	Read Only		T1(low)
901						T1(high)
902			Module 1 #1 Temperature I	Read Only		T1(low)
903						T1(high)
904			Module 1 #2 Temperature	Read Only		T1(low)
905						T1(high)
906			Module 1 #3 Temperature	Read Only		T1(low)
907						T1(high)
908			Module 1 #4 Temperature	Read Only		T1(low)
909						T1(high)
910			Module 1 #5 Temperature	Read Only		T1(low)
911						T1(high)
912			Module 1 #6 Temperature	Read Only		T1(low)
913						T1(high)
914			Module 1 #7 Temperature	Read Only		T1(low)
915						T1(high)
916			Module 1 #8 Temperature	Read Only		T1(low)
917						T1(high)
918			Module 2 #1 Temperature	Read Only		T1(low)
919						T1(high)
920			Module 2 #2 Temperature	Read Only		T1(low)
921						T1(high)
922			Module 2 #3 Temperature	Read Only		T1(low)
923						T1(high)
924			Module 2 #4 Temperature	Read Only		T1(low)
925						T1(high)
926			Module 2 #5 Temperature	Read Only		T1(low)
927						T1(high)
928			Module 2 #6 Temperature	Read Only		T1(low)
929						T1(high)
930			Module 2 #7 Temperature	Read Only		T1(low)
931						T1(high)
932			Module 2 #8 Temperature	Read Only		T1(low)
933						T1(high)
934			Module 3 #1 Temperature	Read Only		T1(low)
935						T1(high)
936			Module 3 #2 Temperature	Read Only		T1(low)
937						T1(high)
938			Module 3 #3 Temperature	Read Only		T1(low)
939						T1(high)
940			Module 3 #4 Temperature	Read Only		T1(low)
941						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
942			Module 3 #5 Temperature	Read Only		T1(low)
943						T1(high)
944			Module 3 #6 Temperature	Read Only		T1(low)
945						T1(high)
946			Module 3 #7 Temperature	Read Only		T1(low)
947						T1(high)
948			Module 3 #8 Temperature	Read Only		T1(low)
949						T1(high)
950			Max Stator Temperature	Read Only		T1(low)
951						T1(high)
952			Max Bearing Temperature	Read Only		T1(low)
953						T1(high)
954			Max Load Temperature	Read Only		T1(low)
955						T1(high)
956			Max Ambient Temperature	Read Only		T1(low)
957						T1(high)
958			Min Stator Temperature	Read Only		T1(low)
959						T1(high)
960			Min Bearing Temperature	Read Only		T1(low)
961						T1(high)
962			Min Load Temperature	Read Only		T1(low)
963						T1(high)
964			Min Ambient Temperature	Read Only		T1(low)
965						T1(high)
966			Frequency (Hz)	Read Only		T1(low)
967						T1(high)
Event Records						
973	40974	7:0	Number of New Records	Read Only	0 – 65,535	T3
974			Record Head (Next Record)	Read Only	0 – 63	T3
975			Record Selector	R/W	0 – 63	T3
976			Record Date	Read Only		T23(low)
977						T23(high)
978			Record Time	Read Only		T24(low)
979						T24(high)
980			Record Type	Read Only		T26
981			Message Code	Read Only		T27
982			I _a ⁽¹⁾	Read Only		T1(low)
983						T1(high)
984			I _b ⁽¹⁾	Read Only		T1(low)
985						T1(high)
986			I _c ⁽¹⁾	Read Only		T1(low)
987						T1(high)
988			I _g ⁽¹⁾	Read Only		T1(low)
989						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
990			$V_{ab}^{(2)}$	Read Only		T1(low)
991						T1(high)
992			$V_{bc}^{(2)}$	Read Only		T1(low)
993						T1(high)
994			$V_{ca}^{(2)}$	Read Only		T1(low)
995						T1(high)
996			Analog Input	Read Only		T1(low)
997						T1(high)
998			Current Unbalance ⁽¹⁾	Read Only		T1(low)
999						T1(high)
1000			Voltage Unbalance ⁽¹⁾	Read Only		T1(low)
1001						T1(high)
1002			Start Time	Read Only		T3
1003			Used $I^2t^{(3)}$	Read Only		T1(low)
1004						T1(high)
1005			Module 1 #1 Temperature	Read Only		T1(low)
1006						T1(high)
1007			Module 1 #2 Temperature	Read Only		T1(low)
1008						T1(high)
1009			Module 1 #3 Temperature	Read Only		T1(low)
1010						T1(high)
1011			Module 1 #4 Temperature	Read Only		T1(low)
1012						T1(high)
1013			Module 1 #5 Temperature	Read Only		T1(low)
1014						T1(high)
1015			Module 1 #6 Temperature	Read Only		T1(low)
1016						T1(high)
1017			Module 1 #7 Temperature	Read Only		T1(low)
1018						T1(high)
1019			Module 1 #8 Temperature	Read Only		T1(low)
1020						T1(high)
1021			Module 2 #1 Temperature	Read Only		T1(low)
1022						T1(high)
1023			Module 2 #2 Temperature	Read Only		T1(low)
1024						T1(high)
1025			Module 2 #3 Temperature	Read Only		T1(low)
1026						T1(high)
1027			Module 2 #4 Temperature	Read Only		T1(low)
1028						T1(high)
1029			Module 2 #5 Temperature	Read Only		T1(low)
1030						T1(high)
1031			Module 2 #6 Temperature	Read Only		T1(low)
1032						T1(high)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
1033			Module 2 #7 Temperature	Read Only		T1(low)
1034						T1(high)
1035			Module 2 #8 Temperature	Read Only		T1(low)
1036						T1(high)
1037			Differential Current Phase A (A) ⁽⁶⁾	Read Only		T1(low)
1038						T1(high)
1039			Differential Current Phase B (A) ⁽⁶⁾	Read Only		T1(low)
1040						T1(high)
1041			Differential Current Phase C (A) ⁽⁶⁾	Read Only		T1(low)
1042						T1(high)
1043			Reserved	Read Only		T1(low)
1044						T1(high)
1045			Reserved	Read Only		T1(low)
1046						T1(high)
1047			Reserved	Read Only		T1(low)
1048						T1(high)
1049			Reserved	Read Only		T1(low)
1050						T1(high)
1051			Reserved	Read Only		T1(low)
1052						T1(high)
1053			Frequency	Read Only		T1(low)
1054						T1(high)
1055			Power—S (kVA)	Read Only		T1(low)
1056						T1(high)
1057			Power—P (kW)	Read Only		T1(low)
1058						T1(high)
1059			Power—Q (kVAR)	Read Only		T1(low)
1060						T1(high)
1061			Power Factor	Read Only		T1(low)
1062						T1(high)
Status						
1096	41097	8:0	Trip and Alarm Summary	Read Only		T30
1097			Motor Status	Read Only		T28
1098			Starter Status	Read Only		T29
1099			Digital Inputs	Read Only		T35
1100			Relay Outputs	Read Only		T36
Message Stack						
1104	41105	8:8	Message 0	Read Only		T27
1105			Message 1	Read Only		T27
1106			Message 2	Read Only		T27
1107			Message 3	Read Only		T27
1108			Message 4	Read Only		T27

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
Trip Counters						
1130	41131	8:39	Overcurrent	Read Only		T3
1131			AUX Overcurrent	Read Only		T3
1132			Overload	Read Only		T3
1133			Earth Fault	Read Only		T3
1134			Current Unbalance	Read Only		T3
1135			Voltage Unbalance	Read Only		T3
1136			Jam	Read Only		T3
1137			Undercurrent	Read Only		T3
1138			Overvoltage	Read Only		T3
1139			Undervoltage	Read Only		T3
1140			Analog Input High	Read Only		T3
1141			Analog Input Low	Read Only		T3
1142			PTC	Read Only		T3
1143			Phase-Loss Current	Read Only		T3
1144			Phase-Reverse Current	Read Only		T3
1145			Phase-Loss Voltage	Read Only		T3
1146			Phase-Reverse Voltage	Read Only		T3
1147			Underspeed	Read Only		T3
1148			Contact Status	Read Only		T3
1149			Digital 1 Trip	Read Only		T3
1150			Digital 2 Trip	Read Only		T3
1151			Digital 3 Trip	Read Only		T3
1152			Digital 4 Trip	Read Only		T3
1153			Digital 5 Trip	Read Only		T3
1154			Digital 6 Trip	Read Only		T3
1155			Digital 7 Trip	Read Only		T3
1156			RTD Module 1 #1	Read Only		T3
1157			RTD Module 1 #2	Read Only		T3
1158			RTD Module 1 #3	Read Only		T3
1159			RTD Module 1 #4	Read Only		T3
1160			RTD Module 1 #5	Read Only		T3
1161			RTD Module 1 #6	Read Only		T3
1162			RTD Module 1 #7	Read Only		T3
1163			RTD Module 1 #8	Read Only		T3
1164			RTD Module 2 #1	Read Only		T3
1165			RTD Module 2 #2	Read Only		T3
1166			RTD Module 2 #3	Read Only		T3
1167			RTD Module 2 #4	Read Only		T3
1168			RTD Module 2 #5	Read Only		T3
1169			RTD Module 2 #6	Read Only		T3
1170			RTD Module 2 #7	Read Only		T3
1171			RTD Module 2 #8	Read Only		T3

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
1172			RTD Module 3 #1	Read Only		T3
1173			RTD Module 3 #2	Read Only		T3
1174			RTD Module 3 #3	Read Only		T3
1175			RTD Module 3 #4	Read Only		T3
1176			RTD Module 3 #5	Read Only		T3
1177			RTD Module 3 #6	Read Only		T3
1178			RTD Module 3 #7	Read Only		T3
1179			RTD Module 3 #8	Read Only		T3
1180			RTD Module 1 Comm	Read Only		T3
1181			RTD Module 2 Comm	Read Only		T3
1182			RTD Module 3 Comm	Read Only		T3
1183			RTD Sensor	Read Only		T3
1184			Starter Time	Read Only		T3
1185			Display Comm	Read Only		T3
1186			Stop (In Protection Only)	Read Only		T3
1187			Lagging Power Factor—Q4	Read Only		T3
1188			Underfrequency	Read Only		T3
1189			Overfrequency	Read Only		T3
1190			A/D	Read Only		T3
1191			Network	Read Only		T3
1192			Leading Power Factor—Q3	Read Only		T3
1193			Starts Per Hour	Read Only		T3
1194			Differential Module Trip	Read Only		T3
1195			Differential Current Trip	Read Only		T3
1196			Reduced Overcurrent Trip	Read Only		T3
Running Time						
1210	41211	9:0	Running Seconds	Read Only		T2(low)
1211						T2(high)
Energy						
1212	41213	9:2	kW Seconds	Read Only		T4(word 1)
1213						T4(word 2)
1214						T4(word 3)
1215						T4(word 4)
1216			kVA Seconds	Read Only		T4(word 1)
1217						T4(word 2)
1218						T4(word 3)
1219						T4(word 4)
1220			kVAR Seconds	Read Only		T4(word 1)
1221						T4(word 2)
1222						T4(word 3)
1223						T4(word 4)

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
Differential Module Meter Values (PGA-0140)						
1224	41225	9:14	Differential Current Phase A (A)	Read Only		T1 (low)
1225						T1 (high)
1226			Differential Current Phase B (A)	Read Only		T1 (low)
1227						T1 (high)
1228			Differential Current Phase C (A)	Read Only		T1 (low)
1229						T1 (high)
Underfrequency						
1230	41231	9:20	Trip Action	R/W	0 – 7	T42
1231			Trip Level	R/W	30 – 80 Hz	T1 (low)
1232						T1 (high)
1233			Trip Delay	R/W	0.5 – 500 s	T1 (low)
1234						T1 (high)
1235			Alarm Level	R/W	30 – 80 Hz	T1 (low)
1236						T1 (high)
1237			Alarm Delay	R/W	0.5 – 500 s	T1 (low)
1238						T1 (high)
Overfrequency						
1239	41240	9:29	Trip Action	R/W	0 – 7	T42
1240			Trip Level	R/W	30 – 80 Hz	T1 (low)
1241						T1 (high)
1242			Trip Delay	R/W	0.5 – 500 s	T1 (low)
1243						T1 (high)
1244			Alarm Level	R/W	30 – 80 Hz	T1 (low)
1245						T1 (high)
1246			Alarm Delay	R/W	0.5 – 500 s	T1 (low)
1247						T1 (high)
Underfrequency Alarm Action						
1248	41249	9:38	Alarm Action	R/W	0 – 7	T43
Overfrequency Alarm Action						
1249	41250	9:39	Alarm Action	R/W	0 – 7	T43
Power Factor Quadrant 3						
1250	41251	9:40	Trip Action	R/W	0 – 7	T42
1251			Trip Level	R/W	0.5 – 1.0	T1 (low)
1252						T1 (high)
1253			Trip Delay	R/W	0.2 – 500 s	T1 (low)
1254						T1 (high)
1255			Alarm Level	R/W	0.5 – 1.0	T1 (low)
1256						T1 (high)
1257			Alarm Delay	R/W	0.2 – 500 s	T1 (low)
1258						T1 (high)
1259			Alarm Action	R/W	0 – 7	T43

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
Starts Per Hour/Time Between Starts						
1270	41271	9:60	Trip Action	R/W	0 – 7	T42
1271			Alarm Action	R/W	0 – 7	T43
1272			Starts per Hour Setting	R/W	0 – 9	T25
1273			Time Between Starts	R/W	0 – 500 m	T1 (high)
1274						T1 (low)
Differential Module (PGA-0140)						
1277	41278	9:67	Module Enable	R/W	0 – 1	T6
1278			Module-Error Trip Action	R/W	0 – 7	T42
1279			Module-Error Alarm Action	R/W	0 – 7	T43
Differential Protection (PGA-0140)						
1280	41281	9:70	Trip Action	R/W	0 – 7	T42
1281			Trip Level	R/W	0.1 – 15 x I _d	T1 (low)
1282						T1 (high)
1283			Trip Delay	R/W	0 – 10 s	T1 (low)
1284						T1 (high)
1285			Alarm Level	R/W	0.1 – 15 x I _d	T1 (low)
1286						T1 (high)
1287			Alarm Delay	R/W	0 – 10 s	T1 (low)
1288						T1 (high)
1289			Alarm Action	R/W	0 – 7	T43
Ethernet						
1300	41301	9:90	IP Address	R/W		T22
1310			Address Mask	R/W		T22
User Defined Registers						
1400	41401	9:190	User Register 0	R/W		T3
1401			User Register 1	R/W		T3
1402			User Register 2	R/W		T3
1403			User Register 3	R/W		T3
1404			User Register 4	R/W		T3
1405			User Register 5	R/W		T3
1406			User Register 6	R/W		T3
1407			User Register 7	R/W		T3
1408			User Register 8	R/W		T3
1409			User Register 9	R/W		T3
1410			User Register 10	R/W		T3
1411			User Register 11	R/W		T3
1412			User Register 12	R/W		T3
1413			User Register 13	R/W		T3
1414			User Register 14	R/W		T3
1415			User Register 15	R/W		T3
1416			User Register 16	R/W		T3
1417			User Register 17	R/W		T3
1418			User Register 18	R/W		T3

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
1419			User Register 19	R/W		T3
1420			User Register 20	R/W		T3
1421			User Register 21	R/W		T3
1422			User Register 22	R/W		T3
1423			User Register 23	R/W		T3
1424			User Register 24	R/W		T3
1425			User Register 25	R/W		T3
1426			User Register 26	R/W		T3
1427			User Register 27	R/W		T3
1428			User Register 28	R/W		T3
1429			User Register 29	R/W		T3
1430			User Register 30	R/W		T3
1431			User Register 31	R/W		T3
User Data						
1432	41433	9:222	User Register 0 Data	Read Only	<i>Range and Type defined by user register value.</i>	
1433			User Register 1 Data	Read Only		
1434			User Register 2 Data	Read Only		
1435			User Register 3 Data	Read Only		
1436			User Register 4 Data	Read Only		
1437			User Register 5 Data	Read Only		
1438			User Register 6 Data	Read Only		
1439			User Register 7 Data	Read Only		
1440			User Register 8 Data	Read Only		
1441			User Register 9 Data	Read Only		
1442			User Register 10 Data	Read Only		
1443			User Register 11 Data	Read Only		
1444			User Register 12 Data	Read Only		
1445			User Register 13 Data	Read Only		
1446			User Register 14 Data	Read Only		
1447			User Register 15 Data	Read Only		
1448			User Register 16 Data	Read Only		
1449			User Register 17 Data	Read Only		
1450			User Register 18 Data	Read Only		
1451			User Register 19 Data	Read Only		
1452			User Register 20 Data	Read Only		
1453			User Register 21 Data	Read Only		
1454			User Register 22 Data	Read Only		
1455			User Register 23 Data	Read Only		
1456			User Register 24 Data	Read Only		
1457			User Register 25 Data	Read Only		
1458			User Register 26 Data	Read Only		
1459			User Register 27 Data	Read Only		
1460			User Register 28 Data	Read Only		
1461			User Register 29 Data	Read Only		

PGR-6300 REGISTER (DECIMAL)	MODBUS REGISTER (DECIMAL)	A-B FILE (DECIMAL) (NOTE 4)	DESCRIPTION	ACCESS	RANGE	TYPE
1462			User Register 30 Data	Read Only		
1463	41464	9:253	User Register 31 Data	Read Only		

Notes:

- 1 If the record type is START, these are the maximum values during the start.
- 2 If the record type is START, these are the minimum values during the start.
- 3 If the record type is START, this is the I²t used during the start.
- 4 The A-B File is coded as FILE:ELEMENT. To read or write the element as floats, the PLC-5 or SLC 500 address would be <F><FILE>:<ELEMENT> (Example F9:222). To read or write the element as integers using PLC-5 Typed Read and Typed Write commands, add 20 to the file number and precede with N, <N><FILE+20>:<ELEMENT> (Example N29:222). File offset not required for SLC 500 Protected Typed Logical read and write commands.
- 5 Undefined registers in this table read zero. Registers greater than 1463 return error.

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APPENDIX F REGISTER FORMATS

TYPE	C TYPE	DESCRIPTION
T1	float	IEEE 32-Bit Floating-Point Number
		Bit 31: Sign
		Bits 30..23: Exponent
		Bits 22..0: Mantissa
		Float (high): Bits 31..16
		Float (low): Bits 15..0
T2	long	32-Bit Integer
		(high) Bits 31..16
		(low) Bits 15..0
T3	short	16-Bit Integer
T4	double	IEEE 64-Bit Floating-Point Number
		Bit 63: Sign
		Bits 62..52: Exponent
		Bits 51..0: Mantissa
		Word 1 (least significant word) ... Word 4 (most significant word)
T5		Reserved
T6	short	Enable/Disable
		0: Enabled
		1: Disabled
T9	short	Voltage-Connection Type
		0: No Voltage Input
		1: 1PT
		2: 2PT
		3: 3PT and Direct Connection
T10	short	Frequency
		0: 50 Hz
		1: 60 Hz
T11	short	Starter Type
		0: Protection Only
		1: Full Voltage Non-Reversing
		2: Adjustable-Speed Drive
		3: Soft Start
		4: Full Voltage Reversing
		5: Two Speed
		6: Reactor/Resistor Closed Transition
		7: Reactor/Resistor Open Transition
		8: Slip Ring
		9: Soft Start with Bypass
		10: Part Winding
		11: Double Delta
		12: Autotransformer
		13: Two Winding
14: Wye Delta, Open Transition		
15: Wye Delta, Closed Transition		

TYPE	C TYPE	DESCRIPTION
T12	short	Digital Input Function
		0: Input Not Used
		1: Start 1 (N.O. Contact)
		2: Start 2 (N.O. Contact)
		3: Stop (N.C. Contact)
		4: Starter RLYA Status
		5: Starter RLYB Status
		6: Starter RLYC Status
		7: Starter RLYD Status
		8: Interlock (N.C.)
		9: Trip1 (N.C.)
		10: Reset (N.O.)
		11: Local Select
		12: Local Start1
		13: Local Start2
		14: 2-Wire Start1
		15: 2-Wire Start2
		16: FLA2 Select
		17: Limit1 Stop
		18: Limit2 Stop
19: Reduced OC		
T13	short	Relay Output Function
		0: None
		1: Starter RLYA
		2: Starter RLYB
		3: Starter RLYC
		4: Starter RLYD
		5: Trip1
		6: Alarm1
		7: Trip 2
		8: Interlock
		9: Local
		10: Current Detected
		11: Run Mode
		12: Starter Sequence Complete
		13: Thermal Lockout/Start Inhibit
		14: None
		15: Watchdog
		16: Trip3
		17: Alarm2
		18: Alarm3
19: Trip1 Pulse		
20: Reduced OC		
T14	short	Relay Trip/Alarm Mode
		0: Fail Safe
		1: Non Fail Safe

TYPE	C TYPE	DESCRIPTION
T15	short	Analog Output Function
		0: Phase Current
		1: Earth Leakage
		2: Thermal Capacity
		3: Stator RTD
		4: Bearing RTD
		5: Load RTD
		6: Ambient RTD
		7: Voltage
		8: Unbalance (I)
		9: Power Factor
		10: Real Power
		11: Reactive Power
		12: Apparent Power
		13: Zero
		14: Full Scale
		15: Speed
16: Differential Current		
T16	short	Network Communication Type
		0: None (Disabled)
		1: A-B DF1
		2: Modbus RTU
		3: AnyBus
		4: DeviceNet
T17	short	Network Baud Rate
		0: 1.2 kbit/s
		1: 2.4 kbit/s
		2: 4.8 kbit/s
		3: 9.6 kbit/s
		4: 19.2 kbit/s
		5: DeviceNet 125 kbit/s
		6: DeviceNet 250 kbit/s
7: DeviceNet 500 kbit/s		
T18	short	Error Checking (AB DF1 only)
		0: Not Selected
		1: CRC Check
T19	short	Number of RTD Modules (PGA-0120)
		0: No RTD Module
		1: 1 RTD Module
		2: 2 RTD Modules
		3: 3 RTD Modules

TYPE	C TYPE	DESCRIPTION
T20	short	RTD Type (PGA-0120)
		0: Disable
		1: Platinum 100
		2: Nickel 100
		3: Nickel 120
T21	short	4: Copper 10
		RTD Function (PGA-0120)
		0: Stator
		1: Bearing
		2: Load
T22	char	3: Ambient
		20 ASCII characters
		Register +0: char[0] and char[1]. Char [0] at MSByte
		Register +1: char[2] and char[3]. Char [2] at MSByte
		Register +2: char[4] and char[5]. Char [4] at MSByte
		Register +3: char[6] and char[7]. Char [6] at MSByte
		Register +4: char[8] and char[9]. Char [8] at MSByte
		Register +5: char[10] and char[11]. Char [10] at MSByte
		Register +6: char[12] and char[13]. Char [12] at MSByte
		Register +7: char[14] and char[15]. Char [14] at MSByte
		Register +8: char[16] and char[17]. Char [16] at MSByte
		Register +9: char[18] and char[19]. Char [18] at MSByte
		A character value of 0 (NULL) will terminate the string and the following characters will be ignored.
		Ethernet address strings are of the form: "ddd.ddd.ddd.ddd".
The MAC address is a hex string of the form: "hhhhhhhhhhhh"		
T23	long	Date
		Bits 31..16: Year in binary
		Bits 15..8: 1-12 Months in binary
		Bits 7..0: 1-31 days in binary
T24	long	Time
		Bits 31..24: 0-23 hours in binary
		Bits 23..16: 0-60 minutes in binary
		Bits 15..8: 0-60 seconds in binary
		Bits 7..0: 0-99 hundredths of seconds in binary
T25	Short	Starts Per Hour
		0: 1 Start per hour
		1: 2 Starts per hour
		2: 3 Starts per hour
		3: 4 Starts per hour
		4: 5 Starts per hour
		5: 6 Starts per hour
		6: 7 Starts per hour
		7: 8 Starts per hour
		8: 9 Starts per hour
9: 10 Starts per hour		

TYPE	C TYPE	DESCRIPTION
T26	short	Trigger Source
		0: Empty Record
		1: Trip Record
		2: Start Record
T27	short	3: ETR Record
		Message Code
		0: Main Overcurrent Trip
		1: Auxiliary Overcurrent Trip
		2: Overload Trip
		3: Overload Alarm
		4: Earth-Fault Trip
		5: Earth-Fault Alarm
		6: Current-Unbalance Trip
		7: Current-Unbalance Alarm
		8: Voltage-Unbalance Trip
		9: Voltage-Unbalance Alarm
		10: Jam Trip
		11: Jam Alarm
		12: Undercurrent Trip
		13: Undercurrent Alarm
		14: Overvoltage Trip
15: Overvoltage Alarm		
16: Undervoltage Trip		
17: Undervoltage Alarm		
18: Analog-Input-High Trip		
19: Analog-Input-High Alarm		
20: Analog-Input-Low Trip		
21: Analog-Input-Low Alarm		
22: PTC Temperature Trip		
23: PTC Temperature Alarm		
24: Phase-Loss (Current) Trip		
25: Phase-Reverse (Current) Trip		
26: Phase-Loss (Voltage) Trip		
27: Phase-Reverse (Voltage) Trip		
28: Underspeed Trip		
29: Relay-Status Trip		
30: Digital 1 Trip		
31: Digital 2 Trip		
32: Digital 3 Trip		
33: Digital 4 Trip		
34: Digital 5 Trip		
35: Digital 6 Trip		
36: Digital 7 Trip		
37: RTD Module 1 INP 1 Trip	(PGA-0120)	
38: RTD Module 1 INP 1 Alarm		
39: RTD Module 1 INP 2 Trip		
40: RTD Module 1 INP 2 Alarm		

TYPE	C TYPE	DESCRIPTION
		41: RTD Module 1 INP 3 Trip (PGA-0120)
		42: RTD Module 1 INP 3 Alarm
		43: RTD Module 1 INP 4 Trip
		44: RTD Module 1 INP 4 Alarm
		45: RTD Module 1 INP 5 Trip
		46: RTD Module 1 INP 5 Alarm
		47: RTD Module 1 INP 6 Trip
		48: RTD Module 1 INP 6 Alarm
		49: RTD Module 1 INP 7 Trip
		50: RTD Module 1 INP 7 Alarm
		51: RTD Module 1 INP 8 Trip
		52: RTD Module 1 INP 8 Alarm
		53: RTD Module 2 INP 1 Trip
		54: RTD Module 2 INP 1 Alarm
		55: RTD Module 2 INP 2 Trip
		56: RTD Module 2 INP 2 Alarm
		57: RTD Module 2 INP 3 Trip
		58: RTD Module 2 INP 3 Alarm
		59: RTD Module 2 INP 4 Trip
		60: RTD Module 2 INP 4 Alarm
		61: RTD Module 2 INP 5 Trip
		62: RTD Module 2 INP 5 Alarm
		63: RTD Module 2 INP 6 Trip
		64: RTD Module 2 INP 6 Alarm
		65: RTD Module 2 INP 7 Trip
		66: RTD Module 2 INP 7 Alarm
		67: RTD Module 2 INP 8 Trip
		68: RTD Module 2 INP 8 Alarm
		69: RTD Module 3 INP 1 Trip
		70: RTD Module 3 INP 1 Alarm
		71: RTD Module 3 INP 2 Trip
		72: RTD Module 3 INP 2 Alarm
		73: RTD Module 3 INP 3 Trip
		74: RTD Module 3 INP 3 Alarm
		75: RTD Module 3 INP 4 Trip
		76: RTD Module 3 INP 4 Alarm
		77: RTD Module 3 INP 5 Trip
		78: RTD Module 3 INP 5 Alarm
		79: RTD Module 3 INP 6 Trip
		80: RTD Module 3 INP 6 Alarm
		81: RTD Module 3 INP 7 Trip
		82: RTD Module 3 INP 7 Alarm
		83: RTD Module 3 INP 8 Trip
		84: RTD Module 3 INP 8 Alarm
		85: RTD Module 1 Comm Trip
		86: RTD Module 1 Comm Alarm
		87: RTD Module 2 Comm Trip
		88: RTD Module 2 Comm Alarm

TYPE	C TYPE	DESCRIPTION
		89: RTD Module 3 Comm Trip (PGA-0120)
		90: RTD Module 3 Comm Alarm
		91: RTD Sensor-Failure Trip
		92: RTD Sensor-Failure Alarm
		93: Thermal Lockout
		94: All Defaults Loaded
		95: Non-Volatile Memory (NV) Enumeration Error
		96: NV Numeric Error
		97: NV String Error
		98: NV Event-Record Error
		99: NV Used Thermal Capacity Error
		100: Starter Trip
		101: Display Communications Trip
		102: Diagnostic Error
		103: Trip Caused By STOP
		104: Network-Communications Trip
		105: Network-Communications Alarm
		106: PF Quadrant 4 Trip
		107: PF Quadrant 4 Alarm
		108: Underfrequency Trip
		109: Underfrequency Alarm
		110: Overfrequency Trip
		111: Overfrequency Alarm
		112: PF Quadrant 3 Trip
		113: PF Quadrant 3 Alarm
		114: Phase-Reverse Alarm (Current)
		115: Phase-Reverse Alarm (Voltage)
		116: Starts per Hour Trip
		117: Starts per Hour Alarm
		118 to 127: Reserved
		128: Differential Communication Trip (PGA-0140)
		129: Differential Communication Alarm
		130: Differential Trip
		131: Differential Alarm
		132: Reduced Overcurrent Trip
		252: ETR Request ⁽²⁾
		253: Normal Start ⁽²⁾
		254: Incomplete Start ⁽²⁾
		255: No Trip or Alarm
T28	short	Motor Status
		Bit0: 1 = Motor current > Current threshold
		Bit1: 1 = Motor in run mode
		Bit2: 1 = Motor at full speed (based on tach information)
		Bit3: 1 = Motor current > 125% FLA
		Bit4: 1 = Temperature set point bypassed
		Bit5: 1 = Reduced Overcurrent Operational

TYPE	C TYPE	DESCRIPTION
T29	short	Starter Sequencer Status
		1: Start1
		2: Run1
		3: Start2
		4: Run2
		5: Stop
T30	short	Trip and Alarm Summary
		Bit0: 1 = Trip1 or Trip3
		Bit1: 1 = Alarm1, Alarm2, or Alarm3
		Bit2: 1 = Trip2
		Bit3: 1 = Interlocks Not Valid
		Bit4: 1 = I ² t > I ² t Inhibit Level
T31	char	RTC ASCII Character Setting String:
		Format: YY/MM/DD HH:mm:SS
		YY: 2-digit Year (Year 2000 – 2099)
		MM: Month 1-12
		DD: Day 1-31
		HH: Hour 0-23
		mm: Minute 0-59
		SS: Seconds 0-59
		RTC is updated when "Set RTC" command is issued
T32	short	Record_Head points to the next free record.
		Subtract 1 to obtain last record.
		Range is 0 to 63.
T33	short	Thermal Model Type
		0: NEMA 1: K-Factor
T34	short	4–20 mA Analog Input Type
		0: Metering Only
		1: Generic 4–20 mA
		2: ASD Sync 3: Motor Speed
T35	short	Digital Input Status
		Bit0: 1 = Digital Input 1 Valid
		Bit1: 1 = Digital Input 2 Valid
		Bit2: 1 = Digital Input 3 Valid
		Bit3: 1 = Digital Input 4 Valid
		Bit4: 1 = Digital Input 5 Valid
		Bit5: 1 = Digital Input 6 Valid Bit6: 1 = Digital Input 7 Valid
T36	short	Relay Output Status
		Bit0: 1 = Relay 1 Energized
		Bit1: 1 = Relay 2 Energized
		Bit2: 1 = Relay 3 Energized
		Bit3: 1 = Relay 4 Energized Bit4: 1 = Relay 5 Energized

TYPE	C TYPE	DESCRIPTION
T37	short	PGR-6300 Command
		0: Stop
		1: Start 1
		2: Start 2
		3: Reset Trips
		4: Set Real-Time Clock
		5: Clear Data-Logging Records
		6: Clear Trip Counters
		7: Not Used
		8: Clear Running Hours
		9: Emergency Thermal Reset
		10: Select Local Control
		11: De-select Local Control
12: Re-enable Temperature Protection		
T38	short	Overload Reset Type
		0: Normal
		1: Auto Reset
T39	short	Language
		0: English
		1: Spanish (Not supported at this time)
T40	short	Number of OPI's
		0: 1 OPI
		1: 2 OPI's
T41	short	Starter Transfer Type
		0: Time Transfer
		1: Current Transfer
T42	short	Trip Action
		0: Disabled
		1: Trip1
		2: Trip2
		3: Trip3
		4: Trip1 & Trip2
		5: Trip1 & Trip3
		6: Trip1 & Trip2 & Trip3
7: Trip2 & Trip3		

TYPE	C TYPE	DESCRIPTION
T43	short	Alarm Action
		0: Disabled
		1: Alarm1
		2: Alarm2
		3: Alarm3
		4: Alarm1 & Alarm2
		5: Alarm1 & Alarm3
		6: Alarm1 & Alarm2 & Alarm3
T82	Short	DeviceNet Producing Instance
		0: None
		1: 0x32 Basic Overload
		2: 0x33 Extended Overload
		3: 0x34 Basic Motor Starter
		4: 0x35 Extended Motor Starter 1
		5: 0x36 Extended Motor Starter 2
		6: 0x64 Status/Meters/RTDs
		7: 0x65 Status/Meters
		8: 0x66 Status
9: User Registers		
T83	Short	DeviceNet Consuming Instance
		0: None
		1: 0x02 Basic Overload
		2: 0x03 Basic Motor Starter
		3: 0x04 Extended Contactor
4: 0x05 Extended Motor Starter		

Note-:

- (1) All values are actual numbers unless indicated by "Bitx".
- (2) Not a trip code. Used by event records to indicate a start record type.