

**Distributed Power System
SD3000/SF3000
Parallel Gate Amplifier System**

Instruction Manual S-3045-2

Throughout this manual, the following notes are used to alert you to safety considerations:



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.



ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: The user must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation may result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

ATTENTION: Inserting or removing a module or its connecting cables may result in unexpected machine motion. Turn off power to the rack before inserting or removing a module or its connecting cables.

ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes.

ATTENTION: The modules in the Parallel Gate Amplifier rack contain static-sensitive components. Do not touch the modules' circuit boards or the connectors on the backs of the modules. When not in the rack, modules should be stored in anti-static bags.

The information in this user's manual is subject to change without notice.

Reliance™ and AutoMax™ are trademarks of Rockwell Automation.

©1997 Rockwell International Corporation

CONTENTS

- Chapter 1 Introduction**
 - 1.1 Standard Features 1-2
 - 1.2 Related Hardware and Software 1-2
 - 1.3 Related Publications 1-4

- Chapter 2 About the PGA Rack**
 - 2.1 PGA Rack Mechanical Description 2-1
 - 2.2 PGA Rack Electrical Description 2-1

- Chapter 3 About the PGA Power Supply Module**
 - 3.1 PGA Power Supply Module Mechanical Description 3-1
 - 3.2 PGA Power Supply Module Electrical Description 3-2

- Chapter 4 About the PGA Module**
 - 4.1 PGA Module Mechanical Description 4-1
 - 4.2 PGA Module Electrical Description 4-1

- Chapter 5 Installation Guidelines**
 - 5.1 Wiring the PGA Rack 5-1
 - 5.2 Installing the PGA Rack 5-2
 - 5.3 Grounding Considerations 5-5
 - 5.4 Module Installation/Replacement Guidelines 5-6
 - 5.5 Installing the PGA Power Supply Module 5-6
 - 5.5.1 Connecting AC Input Power 5-7
 - 5.5.2 Installing an Optional External Supply Greater Than +28 VDC 5-7
 - 5.5.3 Connecting the PMI DC Power Technology Module to the PGA Power Supply Module 5-7
 - 5.6 Connecting the PGA Module to the Gate Coupling Circuits 5-8

Appendix A	Rack Specifications	A-1
Appendix B	Power Supply Module Specifications	B-1
Appendix C	PGA Module Specifications	C-1
Appendix D	PGA Maximum System Power Requirements	D-1
Appendix E	External PGA Power Supply Interface	E-1
Appendix F	Replacement Parts	F-1

List of Figures

Figure 1.1 – Four-Slot PGA Rack and Modules (Part No. 805401-7T)	1-5
Figure 1.2 – Eight-Slot PGA Rack and Modules (Part No. 805401-9CC).....	1-6
Figure 1.3 – PGA Parallel Motoring and Regenerating System Example	1-7
Figure 3.1 – Power Supply Module Component Layout	3-3
Figure 3.2 – Power Supply Module Functional Block Diagram.....	3-4
Figure 4.1 – PGA Gate Driver Circuitry	4-3
Figure 4.2 – PGA Module Functional Block Diagram	4-4
Figure 5.1 – Four-Slot PGA Rack Mounting Dimensions	5-3
Figure 5.2 – Eight-Solt PGA Rack Mounting Dimensions.....	5-4
Figure 5.3 – Location of Power Supply Ground Terminal and Four-Slot Rack Grounding Lug.....	5-5
Figure 5.4 – Location of Power Supply Ground Terminal and Eight-Slot Rack Grounding Lug.....	5-5
Figure 5.5 – Gate Driver Plug for Cable Assemblies 612436 and 612567	5-9
Figure 5.6 – PGA System Hardware Connections	5-10

List of Tables

Table 1.1 – Parallel Gate Amplifier System Configurations	1-3
Table 1.2 – DPS Documentation.....	1-4
Table 5.1 – Input Power Connections	5-7
Table 5.2 – Connection Sequence for Cable Assemblies 612436 and 612567	5-9

CHAPTER 1

Introduction

The Parallel Gate Amplifier (PGA) system is used to amplify and distribute the gate pulse signals produced by the AutoMax™ Distributed Power System's DC Power Technology module. It can be used with multiple Reliance Power Modules or with certain other vendor Power Modules. Please contact Reliance regarding the suitability of other vendor Power Modules for use with the PGA system.

The system is comprised of three major components: the PGA Rack/Backplane, the Power Supply module, and the PGA modules.

The Power Supply and PGA modules reside in a modular rack of either four slots or eight slots. The four-slot rack holds the Power Supply and one or two PGA modules (figure 1.1). The eight-slot rack holds the Power Supply and one to six PGA modules (figure 1.2). Two channels (A and B) are provided for gate signals on the rack's backplane. Channel A is used for forward gate signals and channel B for reverse gate signals.

To connect to the two channels, two types of PGA modules are used. The Output-A PGA module is used to access the signals from channel A. The Output-B PGA module is used to access the signals from channel B. The two types of modules are not interchangeable, but may be combined in the rack as needed to meet the requirements of the application.

The amplified PGA output signals drive the gate coupling circuits in the DC Power Modules. Each PGA module can simultaneously drive four six-thyristor power bridges in one direction, either forward or reverse. With the maximum of six PGA modules used in the system, a total of 24 power bridges (6 x 4) can be driven.

The PGA's standard DC bus voltage is +28 VDC, but the PGA module is capable of handling DC bus voltages up to +100 VDC, if required by the application. Voltages greater than the standard +28 VDC must be provided by an externally mounted power supply, as described in chapter 3.

The available PGA configurations are listed in table 1.1. A two card PGA parallel motoring and regenerating system example is shown in figure 1.3.

1.1 Standard Features

The PGA system has the following features:

- Connects to DPS DC Power Technology module
- Capable of driving up to 24 six-thyristor power bridges in parallel (144 gate coupling circuits)
- Overcurrent protection provided by PCB fuses
- Overtemperature detection by NC faceplate contacts on Power Supply module
- Optical isolation of gate signals from biasing networks and firing circuits
- Physical isolation of gate signals from Power Supply and other circuitry
- Externally mounted 100 VDC power supply option
- UR/CUR Recognized

1.2 Related Hardware and Software

The following related DPS components are available separately:

- AutoMax Universal Drive Controller
- Power Module Interface rack and modules
- Fiber-Optic Cables
- AutoMax Programming Executive software

Table 1.1 – Parallel Gate Amplifier System Configurations

Reliance Part No.	Description
805401-7R	4-Slot PGA Rack, w/Fan, Power Supply, Output-A
805401-7S	4-Slot PGA Rack, w/Fan, Power Supply, Output-A/A
805401-7T	4-Slot PGA Rack, w/Fan, Power Supply, Output-A/B
805401-9AX	8-Slot PGA Rack, w/Fan, Power Supply, Output-A
805401-9BX	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A
805401-9CX	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A
805401-9DX	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A/A
805401-9EX	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A/A/A
805401-9FX	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A/A/A/A
805401-9AA	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/B
805401-9BA	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/B
805401-9CA	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A/B
805401-9DA	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A/A/B
805401-9EA	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A/A/A/B
805401-9AB	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/B/B
805401-9BB	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/B/B
805401-9CB	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A/B/B
805401-9DB	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A/A/B/B
805401-9AC	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/B/B/B
805401-9BC	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/B/B/B
805401-9CC	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/A/B/B/B
805401-9AD	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/B/B/B
805401-9BD	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/A/B/B/B/B
805401-9AE	8-Slot PGA Rack, w/Fan, Power Supply, Output-A/B/B/B/B/B

1.3 Related Publications

This manual provides a description of each component of the Parallel Gate Amplifier system as well as installation guidelines. Note that this instruction manual does not describe specific applications of the standard hardware.

Additional information about using the Parallel Gate Amplifier as part of an AutoMax Distributed Power System is found in the instruction manuals, prints, and other documents shipped with each drive system. Always consult the prints shipped with the drive system for specific mounting and connecting information about your drive.

The other instruction manuals located in binder S-3000, Distributed Power System DC Drive, are listed in table 1.2. It is assumed that the user is familiar with these other manuals in S-3000 before using the PGA system.

Table 1.2 – DPS Documentation

Document	Document Part Number
	SD/SF3000 Binder S-3000
DPS Overview	S-3005
UDC Module	S-3007
Fiber-Optic Cabling	S-3009
Configuration and Programming	S-3006 (for SD3000) S-3036 (for SF3000)
Power Module Interface Rack and Modules	S-3008
Diagnostics, Troubleshooting, and Startup Guidelines	S-3011
Information Guide	S-3012

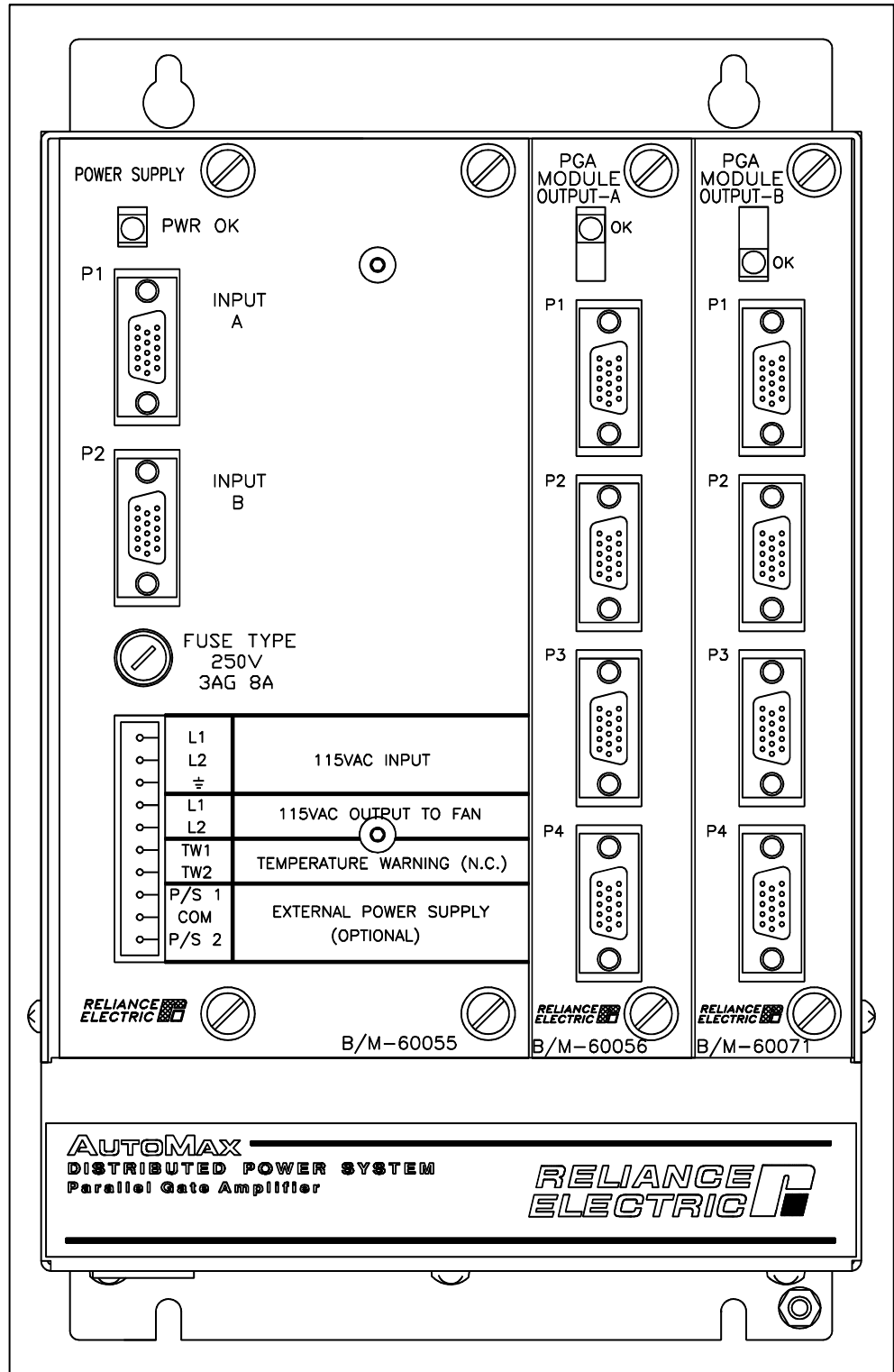


Figure 1.1 – Four-Slot PGA Rack and Modules (Part No. 805401-7T)

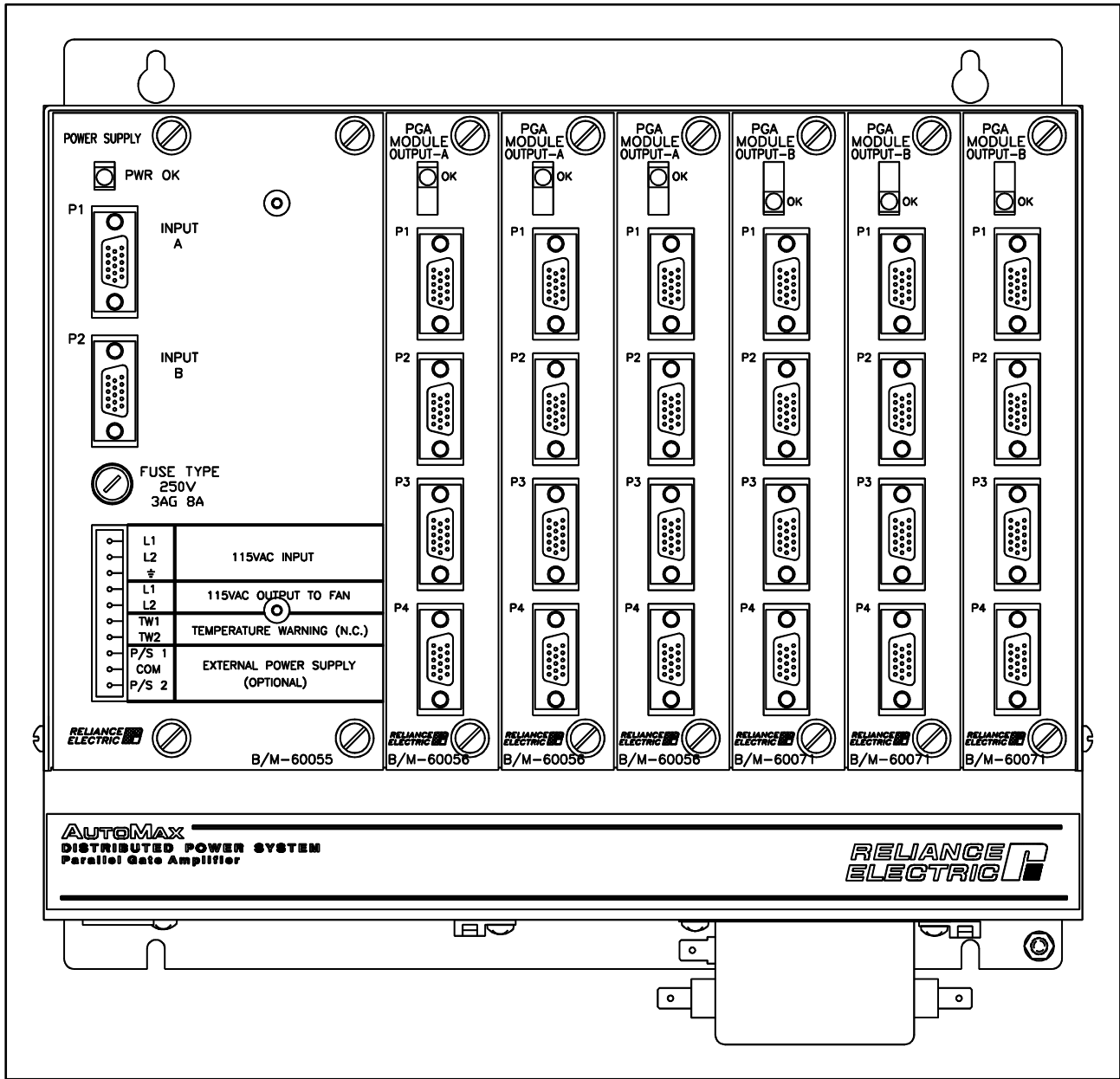


Figure 1.2 – Eight-Slot PGA Rack and Modules (Part No. 805401-9CC)

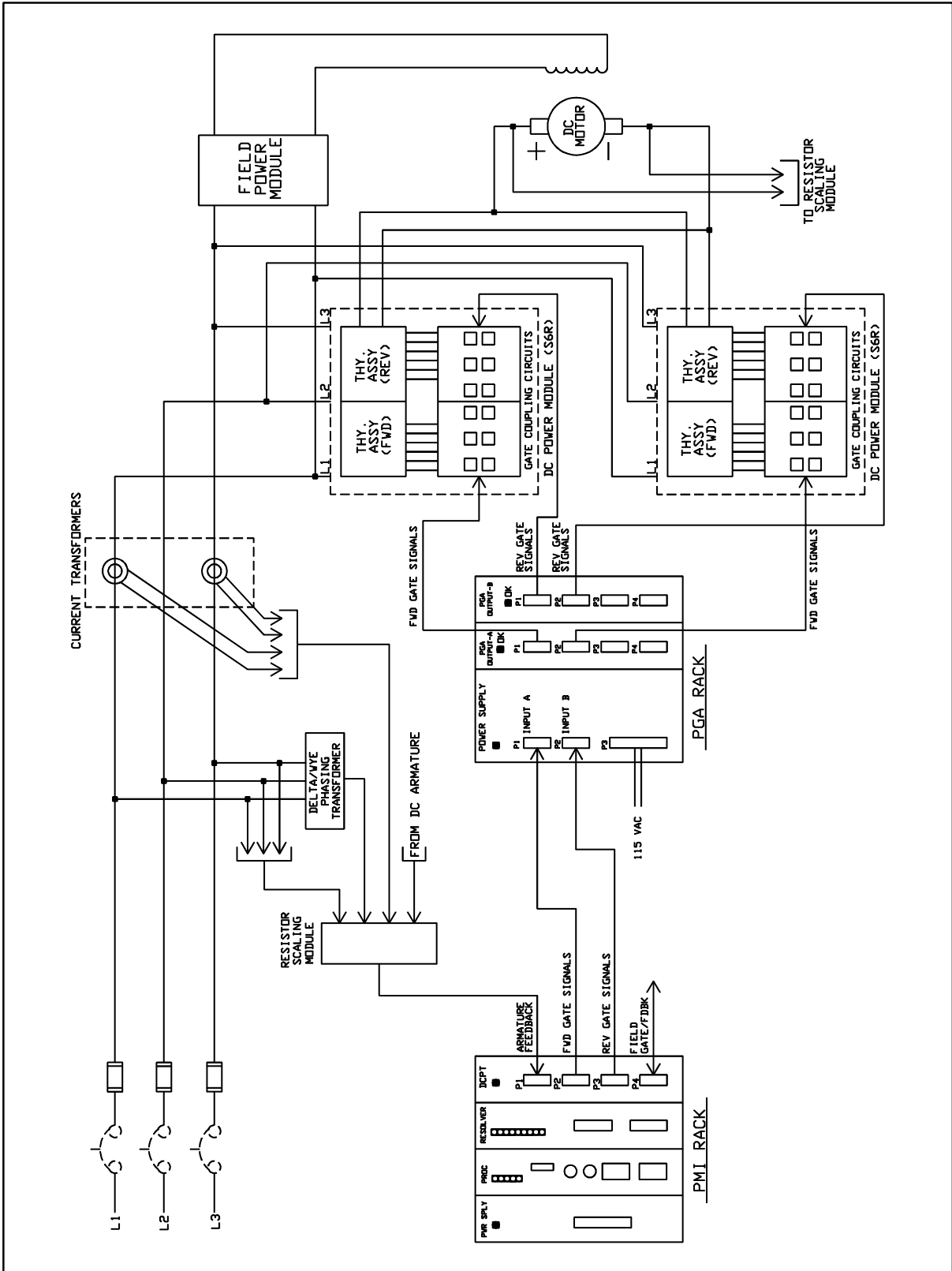


Figure 1.3 – PGA Parallel Motoring and Regenerating System Example

About the PGA Rack

The PGA rack provides the mechanical means for mounting the Power Supply module and the PGA modules. The following sections provide mechanical and electrical descriptions of the rack.

2.1 PGA Rack Mechanical Description

The PGA rack consists of a sheet metal card-cage type enclosure and a backplane. The backplane contains a proprietary parallel bus with DIN-style connectors in each slot for the modules. The leftmost slot is provided for the Power Supply module. The remaining slots are provided for the PGA modules.

The four-slot version of the rack (see figure 5.1) has three identical 48-pin backplane connectors: one for the Power Supply module and two for PGA modules. The eight-slot version (see figure 5.2) has seven identical 48-pin backplane connectors: one for the Power Supply module and six for PGA modules. The Power Supply connector in each rack is vertically offset so that the Power Supply and PGA modules cannot accidentally be interchanged.

The PGA rack must be installed within 18.3 m (60 ft) of the drive's DC Power Module to ensure the integrity of the Power Module interface signals. The rack is designed to be panel-mounted. Mounting holes are provided on the flanges that extend above and below the rack. A grounding lug is provided on the bottom mounting flange. The rack's fan assembly is mounted on the bottom of the rack. Rack installation is described in chapter 5. Rack specifications are given in Appendix A.

2.2 PGA Rack Electrical Description

The four-slot and eight-slot versions of the rack backplane differ only in the number of PGA modules they support. The backplane provides power and ground, and two identical channels ("A" and "B") for gate signals. Six gate signals run on channel A and six on channel B. Each of the gate signals has an associated common signal. The connection between the DC Power Technology module and the PGA Power Supply module determines whether the channel carries the forward or reverse gate signals (see section 3.2).

The gate signals run to the top portion of each 48 pin connector. Four power and ground signals, +5V, DCBUS, +5VCOM, and DCCOM, run to the bottom. The power signals reside on the inside layers of the backplane's four-layer printed circuit board. The inner power plane shares both the +5V and DCBUS signals. The inner ground plane shares the two commons, +5VCOM and DCCOM. A noise filter connects DCCOM to earth ground.

About the PGA Power Supply Module

Through its faceplate connectors, the PGA Power Supply module (B/M O-60055) provides the interface with the DC Power Technology module in the PMI rack. The Power Supply module provides the gate signals and the DC voltages necessary for the proper operation of the PGA modules through the backplane of the PGA rack.

The following sections provide mechanical and electrical descriptions of the Power Supply module. Component layout is shown in figure 3.1. A functional block diagram is shown in figure 3.2.

3.1 PGA Power Supply Module Mechanical Description



ATTENTION: This equipment must be connected to a power source for which it was designed. Verify that the available power is 115 volts AC (10 KVA maximum input source).

The PGA Power Supply module plugs into the leftmost slot of the PGA rack. The module consists of an internal regulated power supply, a printed circuit board containing a DC-to-DC converter, and a faceplate. The faceplate has two thumbscrews at the top and two at the bottom to secure the module in the rack. The back of the module connects to the rack backplane. Power Supply module specifications are given in Appendix B.

The faceplate of the module contains a green LED indicator, two fifteen-pin male D-Shell connectors, an 8A fuse, and a ten-point power connector. The LED, labeled "PWR OK," indicates that the module's +28 VDC and +5 VDC output voltages are present. If either supply fails, the LED will turn off. The two D-shell connectors, labeled "Input A" and "Input B," are used to connect the forward and reverse gate signals from the DC Power Technology module to backplane channels A and B.

The ten-point power connector provides the 115 VAC input to the Power Supply module, 115 VAC output to the rack fan, connection to an optional external power supply, and access to a pair of normally closed contacts ("TW1" and "TW2") for over-temperature warning. Terminal "L1" is the connection for the AC hot input line. Terminal "L2" is the connection for the AC neutral input line. These terminals are internally hardwired to the L1 and L2 terminals labeled "115VAC OUTPUT TO FAN." The Power Supply module's ground terminal must be connected to earth ground, in addition to the PGA rack's grounding lug.



ATTENTION: Ungrounded equipment presents a shock hazard. The ground terminal on the PGA power supply module and the grounding lug on the PGA rack are not connected together. Connect both points to an external earth ground.

3.2 PGA Power Supply Module Electrical Description

The PGA Power Supply module includes an internal +28 VDC regulated power supply and a 28 volt to 5 volt DC-to-DC converter. The internal regulated supply requires a 115 VAC input. Its output provides the DC bus power for the six FET gate firing circuits on each PGA module. The internal regulated supply also powers the DC-to-DC converter, which in turn generates the +5 VDC output necessary for the six biasing networks on each PGA module.

The Power Supply module also has provisions for interfacing with an optional, externally-mounted regulated power supply if the application requires a DC bus voltage greater than +28 VDC. The Power Supply module will work with a regulated external supply of up to +100 VDC. The regulated external supply's current must be limited to 10 amps. See section 5.5.2 and Appendices B and E for further information.

If a regulated external power supply is used, two circuit board jumpers, TB1 and TB2, have to be configured. The regulated external supply is hardwired to the Power Supply module via the faceplate connector, using terminals P/S 2 and COM. Jumper configuration and installation of the regulated external supply is described in section 5.5.2.

The Power Supply module also has a provision for connecting to an optional, externally-mounted +28 VDC power supply via terminals P/S 1 and COM. This option is normally not used. The Power Supply module must be configured for this option at the factory.

Both the regulated external power supply and the internal +28 VDC supply are referenced to the same negative point, DCCOM, accessible through the module's faceplate ("COM"). The +5 VDC output of the DC-to-DC converter has its own negative reference point, +5VCOM. The power and ground signals are transmitted to the PGA modules through the rack backplane.

In addition to powering the PGA modules, the Power Supply module also receives the gate pulses from the DC Power Technology module in the PMI rack, via cables connected to the two 15-pin D-shell connectors ("Input A" and "Input B") on its faceplate. The gate signals are transmitted to the PGA modules through the rack backplane.

The Power Supply module is fused by an external 8A line fuse on its faceplate and an internal 1A fuse at the input to the DC-to-DC converter. The internal fuse is not user-serviceable. A blown internal fuse indicates that the Power Supply module has failed and must be replaced.

The temperature of the internal power supply is monitored by a thermostat. If the temperature exceeds the rated operating level (see Appendix B), a set of normally closed contacts is opened. The contacts are accessible to the user through faceplate connectors TW1 and TW2.

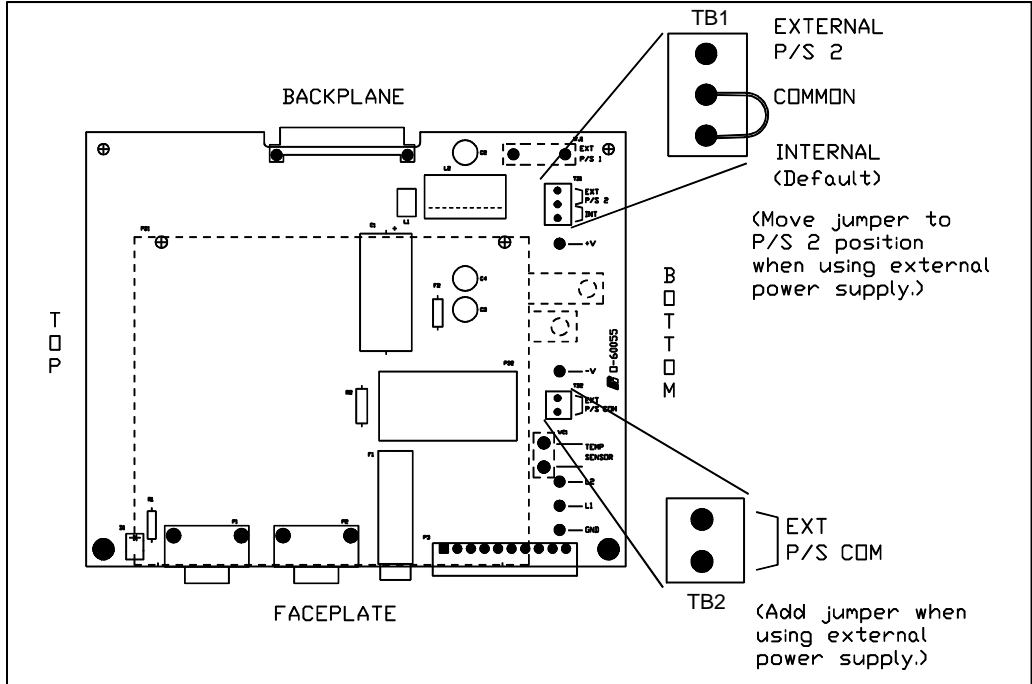


Figure 3.1 – Power Supply Module Component Layout

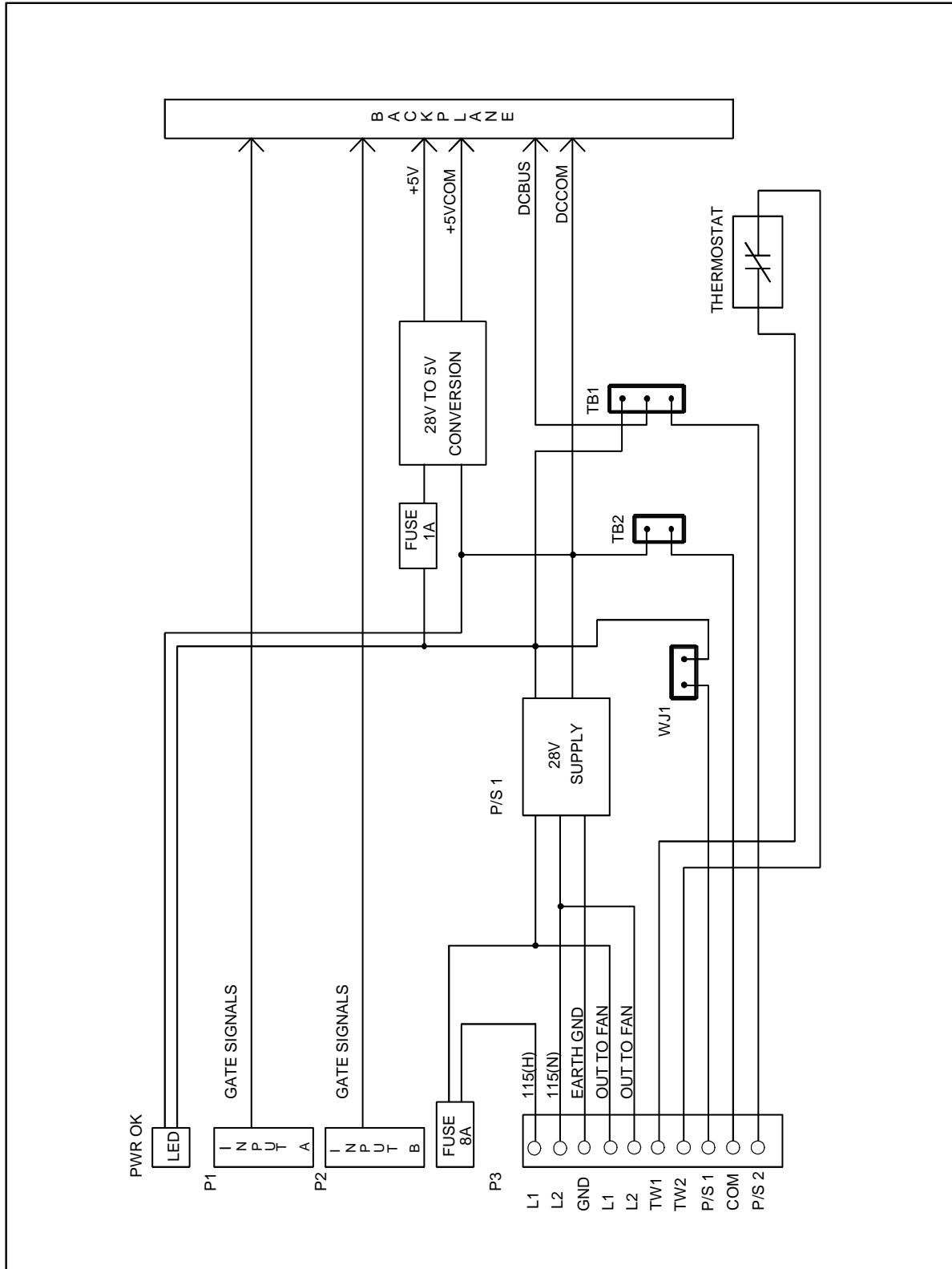


Figure 3.2 – Power Supply Module Functional Block Diagram

About the PGA Module

The PGA module isolates and amplifies the gate signal pulses received from one of the two rack backplane channels, A or B. The type of PGA module used depends upon the channel it will access. An Output-A PGA module (B/M O-60056) receives its signals from channel A. An Output-B PGA module (B/M O-60071) receives its signals from channel B. The user must ensure that the correct type of PGA module is used for the channel desired.

Except for the interface to the rack backplane channels, the two PGA modules are mechanically and electrically identical, as described in the following sections.

4.1 PGA Module Mechanical Description

The PGA module is a printed circuit board assembly that plugs into slot 3 or 4 (four-slot PGA rack) or slot 3 to 8 (eight-slot PGA rack). One or two modules can be used in a four-slot rack. Up to six modules can be used in an eight-slot rack. The two types of modules can be combined in any desired configuration.

Each module consists of a printed circuit board and a faceplate. The top of the faceplate is labeled "OUTPUT-A" or "OUTPUT-B," to indicate which set of backplane signals the module will accept. Thumbscrews at the top and bottom of the faceplate secure the module in the rack. The back of the module plugs into the rack backplane.

The faceplate contains a green "OK" LED indicator and four fifteen-pin female D-shell connectors. The LED lights to indicate that the +5 VDC supply is present and the module is functioning normally. The four fifteen-pin D-shell connectors are used to output the amplified forward or reverse gate signals from the PGA module to the gate coupling circuits in the Power Modules.

4.2 PGA Module Electrical Description

The PGA module will input the gate signals from its designated channel (A or B) on the rack backplane. The channel carries the forward or the reverse gate pulses, depending upon the connection between the DC Power Technology module and the PGA Power Supply module, as described in chapter 3.

Other than channel selection, both types of PGA module operate identically. The incoming gate pulses from the six inputs on each channel are optically isolated from their respective biasing networks and FET gate firing circuits, and physically isolated from the remaining circuitry on the Power Supply module, backplane, and PGA module.

Each of the PGA module's six FET outputs has a fan-out of four, providing each module with the capability of driving up to four power bridges. A maximum of six PGA modules can be used in the system. If all six PGA modules are used, a total of 24 power bridges (6 x 4) can be driven. Figure 4.1 shows one of the four gate signal outputs.

The standard DC bus voltage is +28 VDC, but the PGA module is capable of handling DC bus voltages up to +100 VDC, if required by the application. Voltages greater than the standard +28 VDC must be provided by an externally mounted power supply, connected to the Power Supply module's P/S 2 and COM faceplate terminals. See chapter 3.

The PGA module has one internal fuse. The fuse is not user-serviceable. A blown fuse indicates that the PGA module has failed and must be replaced.

A functional block diagram of the PGA module is provided in figure 4.2. Specifications are listed in Appendix C.

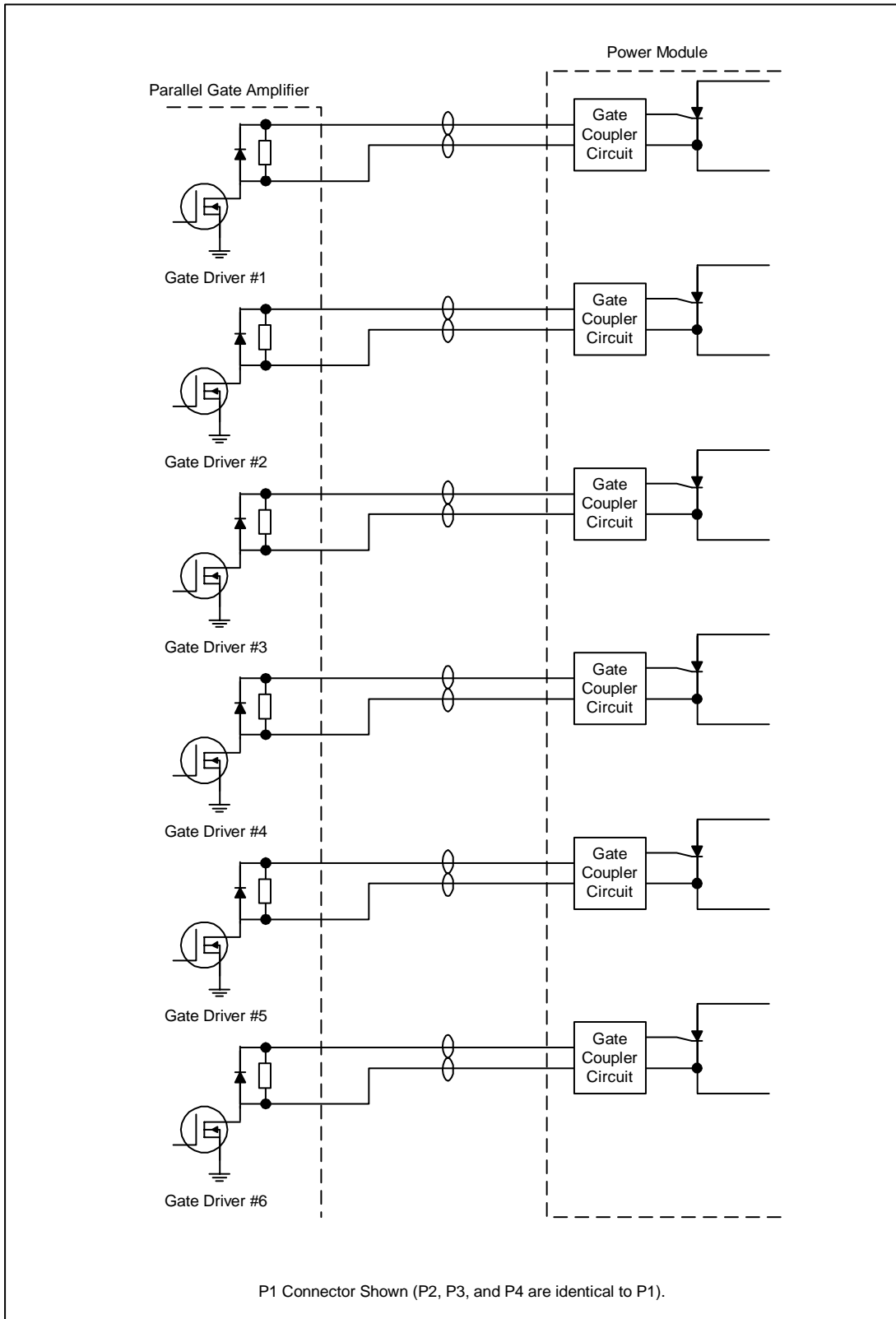


Figure 4.1 – PGA Gate Driver Circuitry

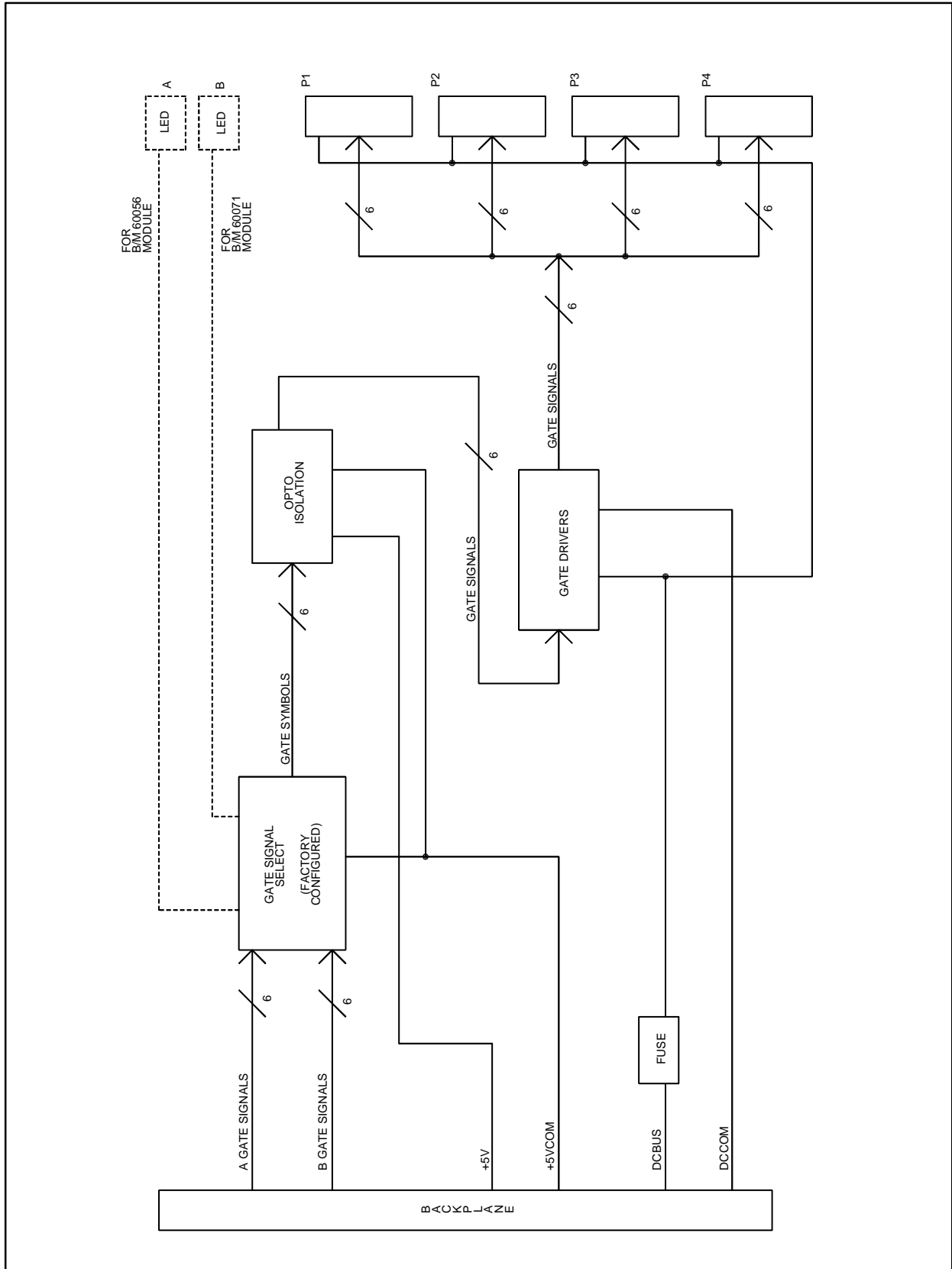


Figure 4.2 – PGA Module Functional Block Diagram

Installation Guidelines



ATTENTION: Only qualified personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding.

ATTENTION: The modules in the Parallel Gate Amplifier rack contain static-sensitive components. Do not touch the module's circuit board or the connectors on the back of the module. When not in the rack, the module should be stored in an anti-static bag.

This section provides guidelines for installing and replacing the PGA rack, the modules, and the cable assemblies. This section provides general guidelines only. Always refer to the wiring diagrams supplied with your system for specific installation information.

5.1 Wiring the PGA Rack



ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes.

The user must ensure that the installation of wiring conforms to all applicable codes. To reduce the possibility of noise interfering with the control system, exercise care when installing wiring from the system to external devices. For detailed recommendations, refer to IEEE Standard 518.

5.2 Installing the PGA Rack

The rack is designed to be panel-mounted using M6 or 1/4"-20 screws. The holes in the top flange have a keyhole shape and the lower holes are U-shaped to facilitate mounting. Refer to figure 5.1 (four-slot rack) or figure 5.2 (eight-slot rack) for mounting dimensions.

Use the following guidelines when installing the PGA rack:

- Ensure that there is enough space for the rack, wiring, terminal strips, and other devices that must be mounted near the rack.
- Allow a large enough clearance around the rack to provide access for inspection, maintenance, and module replacement.
- Allow 50 mm (2 in) of clearance above and below the rack for ventilation.
- Do not mount heat-generating equipment underneath the rack.
- Mount the rack in a vertical position only.
- The cabling distance between the PGA rack and the Power Module must not exceed 18.3 m (60 ft).
- Rack surrounding air temperature must be between 0°C (32°F) and 60°C (140°F).
- Relative humidity must be between 5 and 95% (non-condensing).
- Surrounding air must be clean and dry (e.g., free of flammable or combustible vapors, chemical fumes, oil vapor, steam, excessive moisture, and dirt).

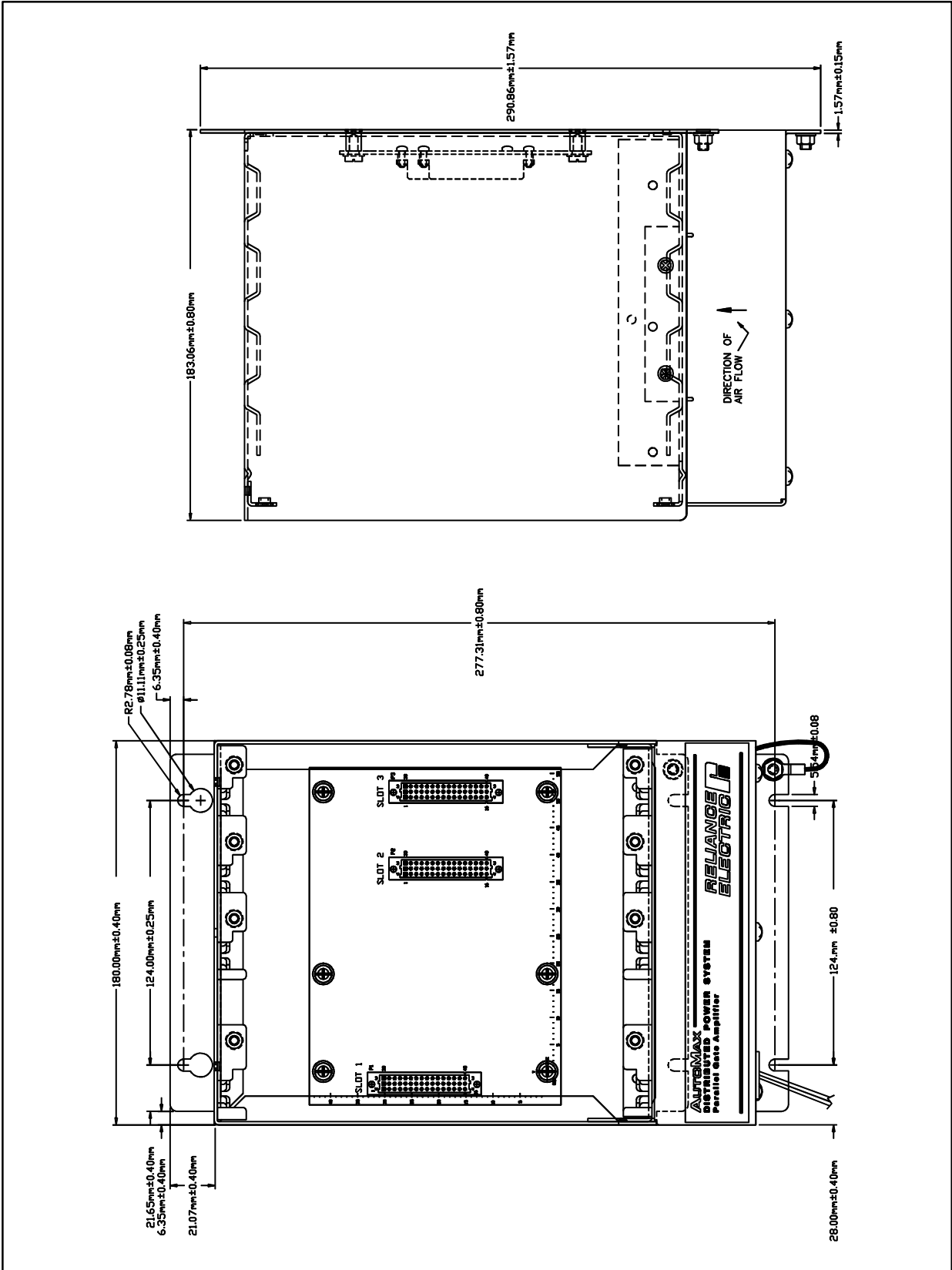


Figure 5.1 – Four-Slot PGA Rack Mounting Dimensions

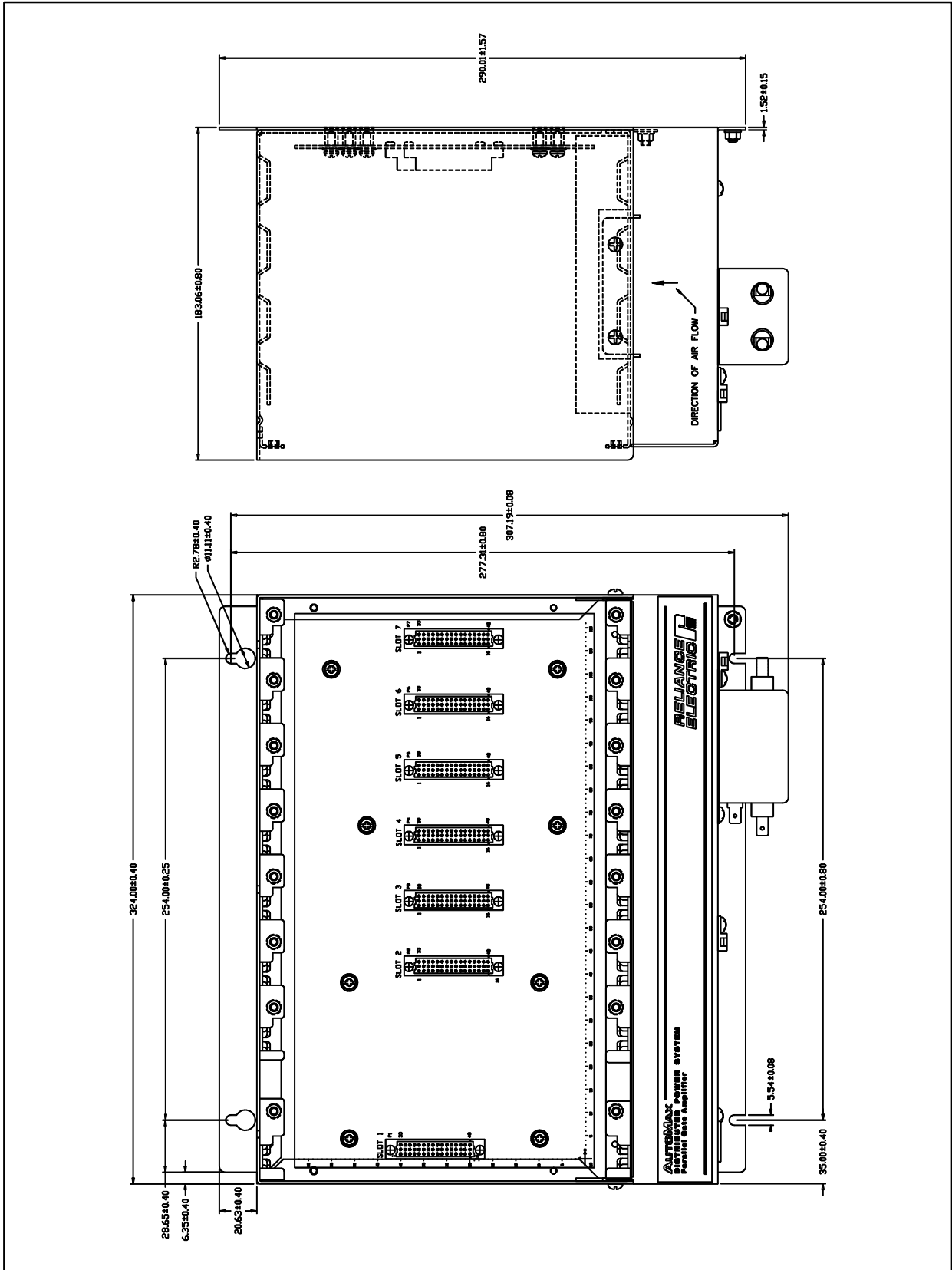


Figure 5.2 – Eight-Slot PGA Rack Mounting Dimensions

5.3 Grounding Considerations



ATTENTION: Ungrounded equipment presents a shock hazard. The ground terminal on the power supply module and the grounding lug on the rack are not connected together. Connect both points to an external earth ground.

The ground terminal on the Power Supply module and the grounding lug on the rack are not connected. Both points must be connected externally to earth ground and checked with an ohmmeter before power is applied. Use a star washer (toothed lock washer) to ensure effective grounding. Refer to figure 5.3 (four-slot rack) or figure 5.4 (eight-slot rack) for the location of the Power Supply module ground terminal and the rack grounding lug.

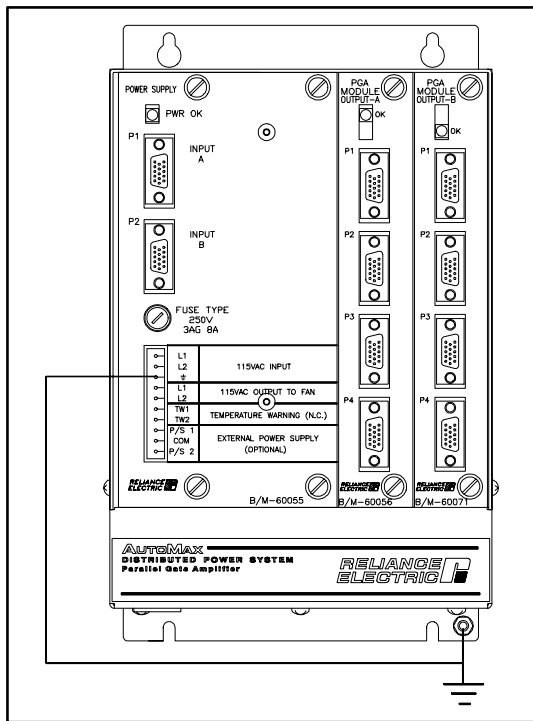


Figure 5.3 – Location of Power Supply Ground Terminal and Four-Slot Rack Grounding Lug

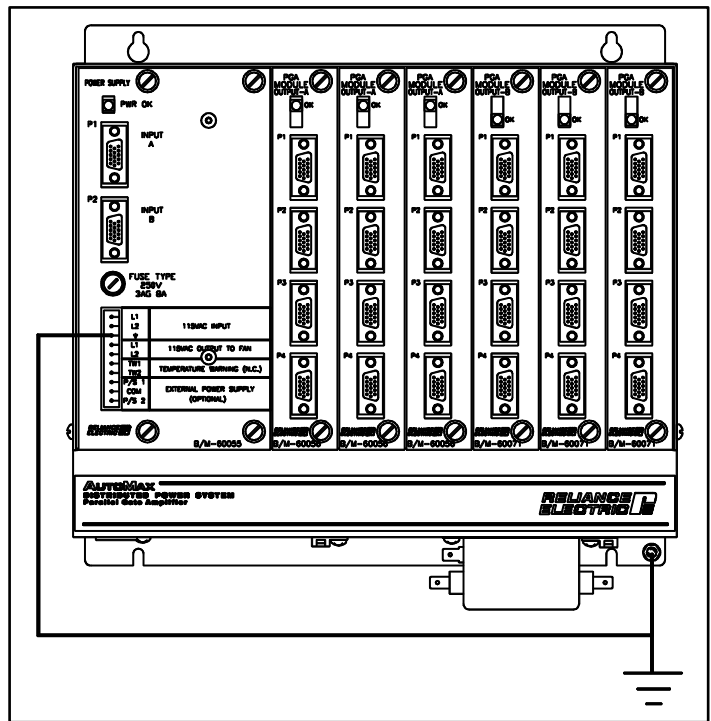


Figure 5.4 – Location of Power Supply Ground Terminal and Eight-Slot Rack Grounding Lug

5.4 Module Installation/Replacement Guidelines



ATTENTION: Inserting or removing a module or its connecting cables may result in unexpected machine motion. Turn off power to the PGA rack before inserting or removing a module or its connecting cables.

ATTENTION: The modules in the Parallel Gate Amplifier rack contain static-sensitive components. Do not touch the module's circuit board or the connector on the back of the module. When not in the rack, the module should be stored in an anti-static bag.

The Power Supply module must be placed in the leftmost slot in the rack. The remaining slots are used for the PGA modules.

Observe the following guidelines when installing or removing a module:

- Ensure that power to the rack as well as power to the wiring leading to the rack is off.
- Use the metal guides provided in the rack to facilitate sliding the module into and out of the rack.
- Use care when inserting a module into the rack to avoid bending the connector pins.
- Ensure that the module is well seated in the rack. Use the thumbscrews provided at the top and bottom of the module faceplate to secure the module to the rack.
- The individual modules are not enclosed; therefore, a module's circuit board is exposed when it is out of the PGA rack. Wear a ground strap and handle the module by the edges only. When not in use, the module should be stored in an anti-static bag.

5.5 Installing the PGA Power Supply Module

The following sections describe the input power and fan connections for the PGA Power Supply module and the cabling between the PGA Power Supply module and the PMI DC Power Technology module.




ATTENTION: The PGA power supply module operates using AC input voltage capable of producing severe shock. Make certain that the external AC supply circuit is turned off before inserting or removing the module or connecting any wires or cables.

5.5.1 Connecting AC Input Power

The 115 VAC Input terminals on the Power Supply module must be wired to the AC power source using twisted-pair wire. Refer to table 5.1 when connecting AC input power to the Power Supply module.

Table 5.1 – Input Power Connections

Wire Color	Wire Label	115VAC Input
Red	AC Line High	L1
White	AC Line Neutral	L2
Green	Earth Ground	

NOTE: *The PGA rack is shipped with the fan internally connected to the L1 and L2 terminals labeled "115 VAC OUTPUT TO FAN."*

5.5.2 Installing an Optional External Supply Greater Than +28 VDC

In the rare case that the +28 VDC supply does not supply sufficient power to fire the gate coupling circuits in the Power Module, an external supply of up to +100 VDC may be used. The power supply's output current must be limited to 10A. To add the external supply to the system, jumpers TB1 and TB2 on the Power Supply module's printed circuit board must be configured as described below. Refer to figure 3.1.

- TB1: Disconnect the jumper from the INTERNAL terminal (the default setting). Connect the jumper from COMMON to the EXTERNAL P/S 2 terminal.
- TB2: Insert a jumper between the two terminals of TB2 (EXT and P/S COM).

The regulated external power supply should be mounted at an appropriate location as described by the manufacturer. It should be connected to terminals P/S 2 and COM on the Power Supply module's faceplate through an appropriate filter network, as shown in Appendix E.

- Connect the regulated external power supply's positive output to terminal P/S 2.
- Connect the regulated external power supply's common to the COM terminal.

5.5.3 Connecting the PMI DC Power Technology Module to the PGA Power Supply Module

For a regenerative drive, both the forward and reverse gate signals from the PMI DC Power Technology module are connected to the PGA Power Supply module's faceplate connectors. For a non-regenerative drive, only the forward gate signals are used. The part numbers of the forward and reverse gate cables are stamped onto the cables and should be compared to the wiring diagrams shipped with your system.

Each cable has a 14-pin male connector on one end that mates with one of the DC Power Technology module's faceplate connectors. The connectors contain key pins to ensure that the forward and reverse cables are not connected to the wrong signals. Near the connector, each cable is normally labeled "C4-Pn," where n is the DC Power Technology module's connector number. For example, the forward gate signal cable labeled C4-P2 mates with the P2 connector.

The other end of each cable has a fifteen-pin female D-shell connector that mates with the faceplate connectors on the PGA Power Supply module. The forward gate signal cable should be connected to Input A and the reverse gate signal cable to Input B.

Appendix F provides a list of the Power Supply module cables used with the PGA system. Note that the Power Supply cable length must not exceed 3.7 m (12 ft).

Refer to the wiring diagrams supplied with your system for the connection instructions specific to your installation.

5.6 Connecting the PGA Module to the Gate Coupling Circuits

The cables that are required for connecting the PGA modules to the gate coupling circuits are specific to your drive system. Each cable is supplied with a 15-pin male D-shell connector on one end that mates with the PGA module's faceplate connector. The cable connectors are color-coded black for Output-A type PGA modules and gray for Output-B type. The other end of the cable is supplied with either a Cannon™ round connector plug (cable #612436 or #612567) or an Elco™ square connector plug (cable #612434 or #612566) to mate with the connector on the DC Power Module.

If needed, a cable (#612435) with individual connectors for the six gate coupling circuits on the Power Module can be supplied as well. This cable mates with the connector plug on the end of cable #612436 (Output-A) or #612567 (Output-B). Table 5.2 describes the gate signals that are transmitted via these cables. The connector plug is shown in figure 5.5.

Appendix F provides a list of the PGA cables that can be supplied with the system. Note that the total cable length from the PGA module to the gate coupling circuit must not exceed 18.3 m (60 ft).

Table 5.2 – Connection Sequence for Cable Assemblies 612436 and 612567

	Signal	From D-Shell Connector Pin	Wire Color	To Gate Driver Plug Pin
Thyristor 1:	Gate 1	5	BRN	1
	DC Bus	15	WHT/BRN	2
Thyristor 2:	Gate 2	4	RED	3
	DC Bus	14	WHT/RED	4
Thyristor 3:	Gate 3	3	ORG	5
	DC Bus	13	WHT/ORG	6
Thyristor 4:	Gate 4	2	YEL	9
	DC Bus	12	WHT/YEL	10
Thyristor 5:	Gate 5	7	GRN	11
	DC Bus	11	WHT/GRN	12
Thyristor 6:	Gate 6	1	BLU	13
	DC Bus	6	WHT/BLU	14

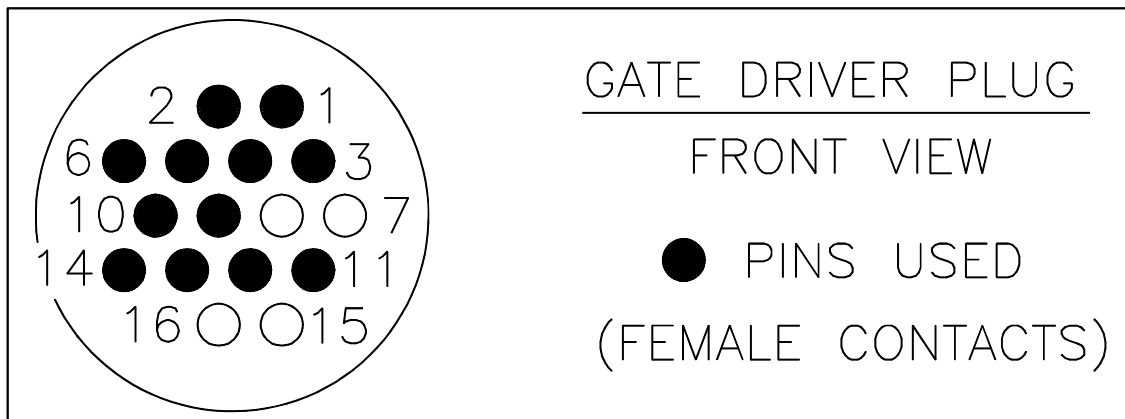


Figure 5.5 – Gate Driver Plug for Cable Assemblies 612436 and 612567

Figure 5.6, on the following page, shows a typical example of PGA module cabling. Refer to the wiring diagrams shipped with your system for the connection instructions specific to your installation. The cable part numbers are stamped onto the cables and should be compared to those listed in the wiring diagrams.

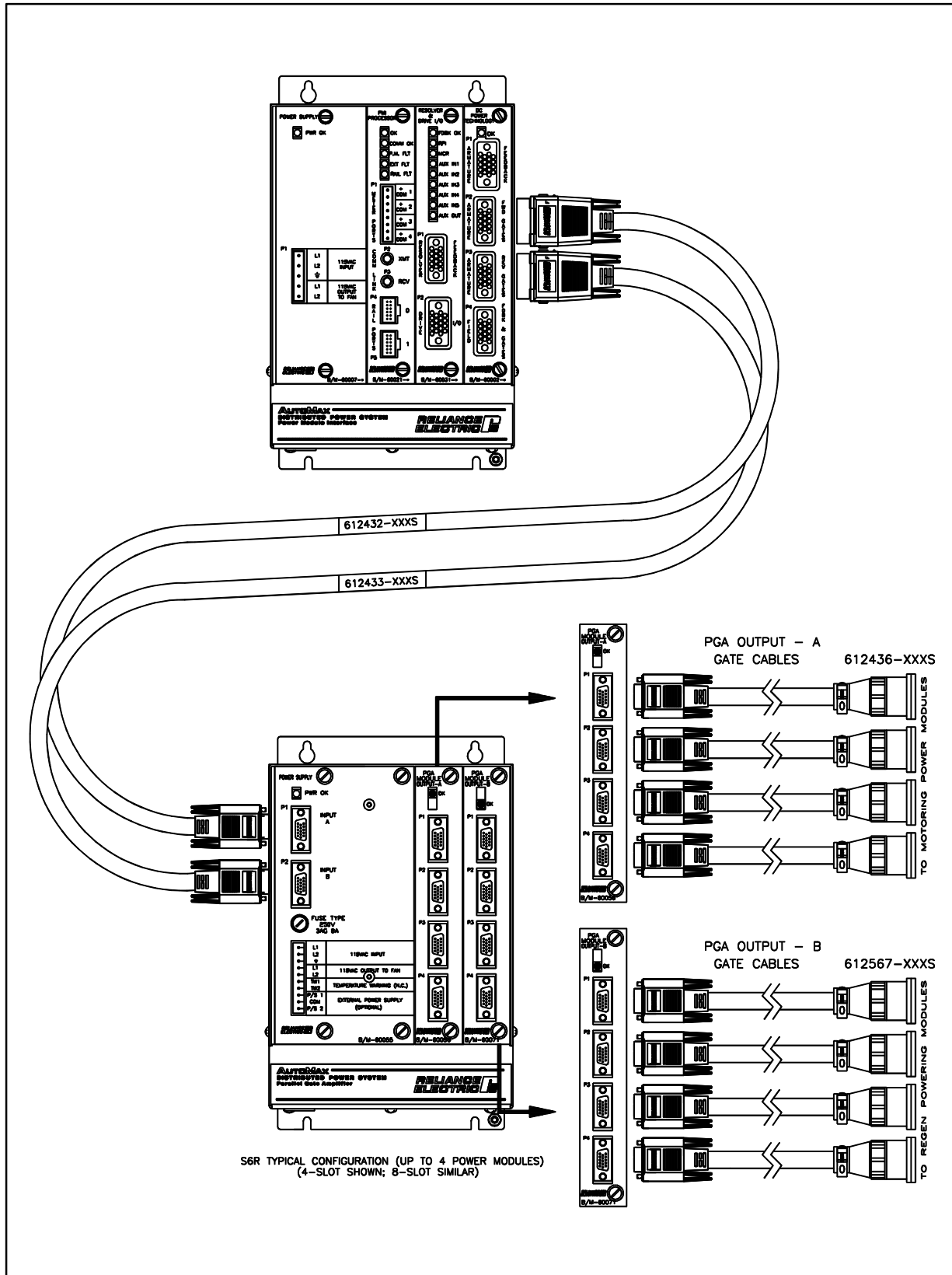


Figure 5.6 – PGA System Hardware Connections

Rack Specifications

Ambient Conditions

- Operating temperature: 0 to 40°C (32 to 104°F) ambient allowing for a maximum 20°C (36°F) temperature rise inside enclosure
- Storage temperature: - 30 to 85°C (-22 to +185°F)
- Humidity: 5 to 95% non-condensing

Rack Dimensions

Four-Slot Rack with Fan

- Height: 290 mm (11.5 in)
- Width: 180 mm (7.09 in)
- Depth: 184 mm (7.25 in)

Eight-Slot Rack with Fan

- Height: 290 mm (11.5 in)
- Width: 324 mm (12.75 in)
- Depth: 184 mm (7.25 in)

Bus Specifications

- Type: Proprietary

Fan Assembly

805400-17R (four-slot Rack)

805400-18R (eight-slot Rack)

- Input voltage: 115 VAC +/-10% (103 - 126 VAC)
- Frequency: 50/60 Hz (47- 63 Hz)
- Power Dissipation: 14/11 W

APPENDIX B

Power Supply Module Specifications

Ambient Conditions

- Operating temperature: 0 to 40°C (32 to 104°F) ambient allowing for a maximum 20°C (36°F) temperature rise inside enclosure
- Storage temperature: - 30 to 85°C (-22 to +185°F)
- Humidity: 5 to 95%, non-condensing

Maximum Module Power Dissipation

- 30 W

Dimensions

- Height: 205 mm (8.063 in)
- Width: 103.0 mm (4.055 in)
- Depth: 178.8 mm (7.039 in)

Maximum Source KVA

- 10

Short Circuit Limitation

- 10,000 VA

Power Requirements

- Input voltage: 115VAC +/-10% (103 - 126 VAC)
- Current: 2.0A maximum
- Frequency: 47- 63 Hz
- Input protection: Fuse (8 A, fast-acting)

Temperature Sensor TW1, TW2 Contact Ratings

- 115VAC, 2A, 47-63 Hz

DC Outputs

5 Volt supply:

- Output voltage: 5V (+/- 1%): 0 - 2 A @ 60°C
- Line regulation: 0.2% (18V - 36V)
- Load regulation: 1% (0 to full load)
- Noise ripple: 75 mV
- Efficiency: 78%
- Overcurrent protection: Can sustain short circuit indefinitely
- Overvoltage protection: Overvoltage clamping @ 6.2 - 6.5V
- Protection: Fuse (not user-serviceable)

28 Volt supply:

- Output voltage: 28V (+/- 5%): 0 - 5A @ 40°C, 0 - 4.4A @ 50°C, 0 - 3.7A @ 60°C
- Line regulation: 0.1% (103V - 126V)
- Load regulation: 0.1% (0 to full load)
- Noise ripple: 150 mV
- Efficiency: 80% (minimum)
- Overcurrent protection: Constant current (above 50% Vout)
Current feedback (below 50% Vout)
- Holdover time: 16.7 mS (max load, low line)

Optional External P/S 2 Power Supply Ratings

- Input voltage: 100 VDC max
- Input current: 2.3A (rms)
- External fuse: 10A, 250V

PGA Module Specifications

Ambient Conditions

- Operating temperature: 0 to 40°C (32 to 104°F) ambient allowing for a maximum 20°C (36°F) temperature rise inside enclosure
- Storage temperature: - 30 to 85°C (-22 to +185°F)
- Humidity: 5 to 95%, non-condensing

Dimensions

- Height: 205 mm (8.063 in)
- Width: 35 mm (1.375 in)
- Depth: 174 mm (6.813 in)

Maximum Module Power Dissipation

- 3 W

Maximum Module Power Requirements

- +28V @ 5A

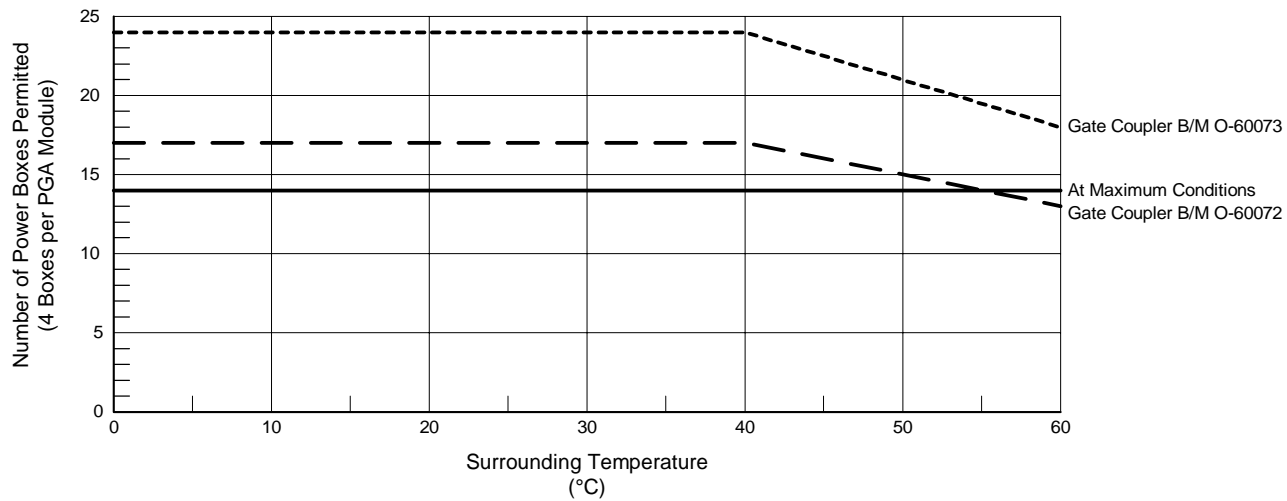
Coupler Circuits Using 28V Supply

- B/M O-60072 (High Output Gate Driver)
Open circuit voltage (Voc): 12V nominal
Short circuit current (Isc): 1000 mA nominal
Isolation voltage: 1200V
- B/M O-60073 ⁽¹⁾
Open circuit voltage (Voc): 12V nominal
Short circuit current (Isc): 700 mA nominal
Isolation voltage: 1200V
⁽¹⁾ Replaces B/M O-51378-19

Coupler Circuits Using External P/S 2 Supply (Maximum Conditions)

- Open circuit voltage (Voc): 100V max
- Short circuit current (Isc): 1300 mA max

PGA Output Loading vs. Temperature



APPENDIX D

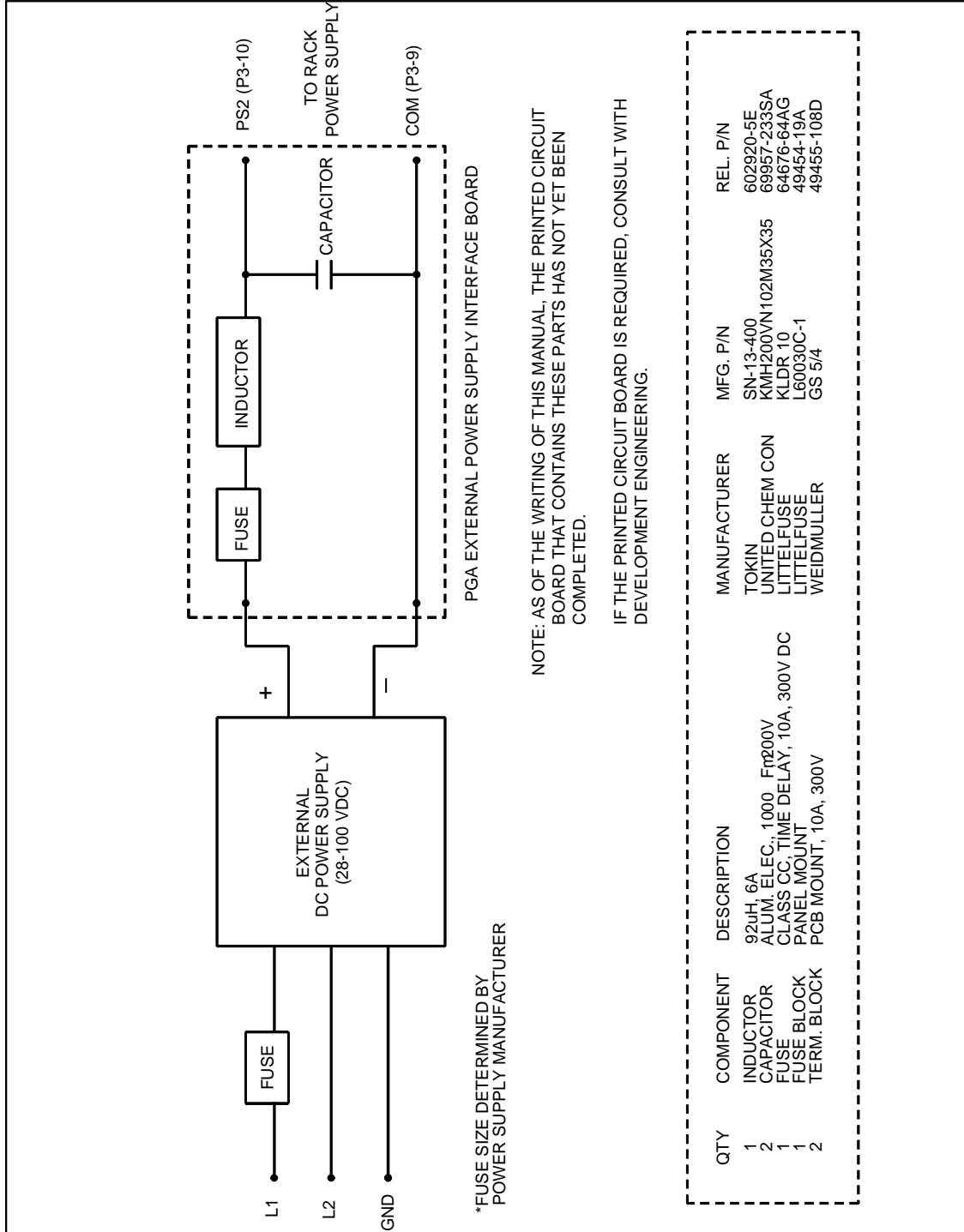
PGA Maximum System Power Requirements

	1 PGA MODULE	2 PGA MODULES	3 PGA MODULES	4 PGA MODULES	5 PGA MODULES	6 PGA MODULES
POWER SUPPLY & FAN	30 VA	30 VA	30 VA	30 VA	30 VA	30 VA
PGA MODULES	48 VA	96 VA	144 VA	192 VA	240 VA	288 VA
MAXIMUM SYSTEM POWER REQUIRED	78 VA	126 VA	174 VA	222 VA	270 VA	318 VA

NOTE: *These values apply when using Reliance B/M O-60073 gate coupling circuits. Values may vary if using other gate coupling circuits.*

APPENDIX E

External PGA Power Supply Interface



NOTE: AS OF THE WRITING OF THIS MANUAL, THE PRINTED CIRCUIT BOARD THAT CONTAINS THESE PARTS HAS NOT YET BEEN COMPLETED.

IF THE PRINTED CIRCUIT BOARD IS REQUIRED, CONSULT WITH DEVELOPMENT ENGINEERING.

APPENDIX F

Replacement Parts

PGA Rack/Backplane

Part or Assy #	Description	Rack Enclosure	Fan Assembly	Backplane
805401-6S	4-Slot PGA Rack Assembly with Fan	805400-R	805400-17R	O-60060
805401-8S	8-Slot PGA Rack Assembly with Fan	805400-14R	805400-18R	O-60057

Modules

Part or Assy #	Description
O-60055	PGA Power Supply Module
O-60056	Output-A PGA Module
O-60071	Output-B PGA Module
707311-94R	Blank Faceplate Assembly

Connector Cables (cable length xxx is specified in inches)

Base P/N	Description/Connections
612432-xxxS ⁽¹⁾	Forward DC Gate Signals; DC Tech. Module P2 to PGA Power Supply Module P1
612433-xxxS ⁽¹⁾	Reverse DC Gate Signals; DC Tech. Module P3 to PGA Power Supply Module P2
612434-xxxS ⁽²⁾	PGA Module Output-A to DC Power Module (Elco square receptacle)
612435- ⁽³⁾	Cable Assemblies 612436 / 612567 to Gate Coupling Circuits
612436-xxxS ⁽²⁾	PGA Module Output-A to DC Power Module (Cannon round receptacle)
612566-xxxS ⁽²⁾	PGA Module Output-B to DC Power Module (Elco square receptacle)
612567-xxxS ⁽²⁾	PGA Module Output-A to DC Power Module (Cannon round receptacle)

⁽¹⁾ Maximum length not to exceed 3.7 m (144 in).

⁽²⁾ Maximum length not to exceed 18.3 m (720 in).

⁽³⁾ Wire lengths for each gate coupling circuit are specified in bill of material. Maximum length not to exceed 3 m (120 in).

Cable assemblies are available in the following standard lengths:

Cable Assy.	Length (inches)	Part Number
612432-	13	612432-013S
612433-	13	612433-013S
612434-	60	612434-060S
	96	612434-096S
612436-	60	612436-060S
	96	612436-096S
	120	612436-120S
612566-	60	612566-060S
	96	612566-096S
612567-	60	612567-060S
	96	612567-096S
	120	612567-120S

Note that cable assembly 61235 does not have a defined standard length as its individual lengths of twisted pairs may all vary.

C

Cables

- cable assemblies, 5-9, F-2
- connector cables, F-1
- PGA module cables, 5-8, 5-9, F-1
- Power Supply module cables, 5-8, 5-9, F-1

D

- DPS documentation, 1-4

E

- External power supply
 - installing, 5-7
 - interface, E-1

F

- Fuse
 - PGA module, 4-2
 - Power Supply module, 3-2

G

- Gate coupling circuits, 1-1, 5-8
- Grounding. See Installation

I

- Input power connections. See Installation
- Installation, 5-1 to 5-10
 - AC input power, 5-7
 - connecting to DC Power Technology module, 5-7
 - connecting to gate coupling circuits, 5-8
 - external power supply, 5-7
 - grounding, 5-5
 - guidelines, 5-1
 - module installation/replacement, 5-6
 - mounting dimensions, 5-3, 5-4
 - PGA module, 5-6
 - Power Supply module, 5-6

- rack, 5-1
- wiring, 5-1

O

- Output-A PGA Module, 1-1, 4-1
- Output-B PGA Module, 1-1, 4-1

P

- parallel motoring and regenerating example, 1-7
- PGA modules
 - electrical description, 4-1
 - functional block diagram, 4-4
 - gate driver circuitry, 4-3
 - mechanical description, 4-1
- PGA system, 1-7
 - configurations, 1-3
 - hardware connections, 5-10
 - overview, 1-1
- Power supply
 - external, 3-1, 5-7, E-1
 - requirements, D-1
- Power Supply module
 - component layout, 3-3
 - electrical description, 3-2
 - functional block diagram, 3-4
 - ground terminal, 5-5
 - mechanical description, 3-1

R

- Rack
 - eight-slot PGA rack and modules, 1-6
 - eight-slot PGA rack mounting dimensions, 5-4
 - electrical description, 2-1
 - four-slot PGA rack and modules, 1-5
 - four-slot PGA rack mounting dimensions, 5-3
 - grounding lug, 5-5
 - mechanical description, 2-1
- Related hardware and software, 1-2
- Related publications, 1-4
- Replacement parts, F-1

S

Standard features, 1-2

System power requirements, D-1

T

Technical specifications

PGA module, C-1

PGA rack, A-1

Power Supply module, B-1

W

Wiring. See Installation

Rockwell Automation / 24703 Euclid Avenue / Cleveland, Ohio 44117 / (216) 266-7000

