Allen-Bradley

Regenerative DC Bus Supply Unit (RGU)

User Manual

Bulletin 2364F
Firmware 3.02

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

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

Attention statements help you to:

- Identify a hazard.
- Avoid the hazard.
- Recognize the consequences.

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

Table of Contents

Changes Since Last Update

The information below summarizes the changes to this publication since the last update.

Description of New or Updated Information	See Page(s)
Corrected original error in figure 6.3 (removed M1 contactor)	6- 4

Introduction

This *Regenerative DC Bus Supply Unit–User Manual* provides you with necessary information and instruction to install and operate your regenerative, common DC bus supply unit (RGU™).

This preface supplies introductory information about this manual, with the following topics:

- who should use this manual
- safety precautions
- contents of this manual
- related documentation
- conventions used in this manual
- receiving your drive system
- Rockwell Automation support

Who Should Use This Manual

This manual is designed for qualified personnel who will be installing or operating an RGU drive.

If you need to gain a foundational understanding of your RGU, please contact your local Rockwell Automation Drive Systems representative for information and instruction before using this product.

Changes To This Manual

The following changes have been implemented in this manual:

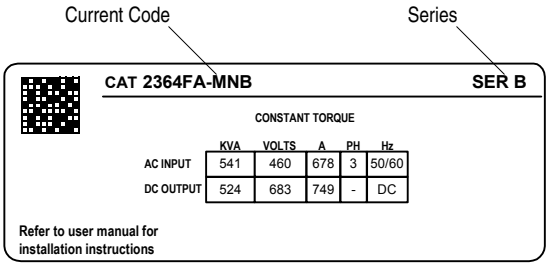
- Updates for Firmware version 3.02.
- Document update (July 1999) regarding Precharge Fuses has been incorporated.

Overview of Product Updates

Table 1: Overview of Product Updates

Item	Update
Firmware	Updates have been added for Single Phase Detection.

Firmware Compatibility



Data nameplate located on power structure

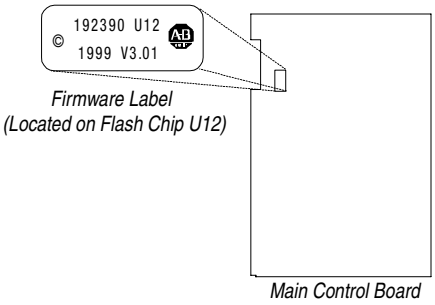


Table 2 shows the firmware versions that may be installed in a particular unit. Note that Series B, M and N-code units can only operate with firmware version 3.01 or 3.02, and Series A, M and N-code RGUs cannot operate with firmware version 3.01 or 3.02.

Table 2: Firmware Compatibility

Version	Series A					Series B	
	J	K	L	M	N	M	N
1.02	Y	Y	Y	Y	Y	N	N
2.01	Y	Y	Y	Y	Y	N	N
2.02	Y	Y	Y	Y	Y	N	N
2.03	Y	Y	Y	Y	Y	N	N
3.01	Y	Y	Y	N	N	Y	Y
3.02	Y	Y	Y	N	N	Y	Y

Safety Precautions

The following general precautions apply to Bulletin 2364F RGUs and to drive system lineups:

ATTENTION: Only those familiar with the drive system, the products used in the system, and the associated machinery should plan or implement the installation, startup, and future maintenance of the system. Failure to comply can result in personal injury and/or equipment damage.

ATTENTION: Only connect Rockwell Automation common DC bus AC drives to the RGU's common DC bus output.

ATTENTION: Do not connect any drives to the RGU common DC bus which have input voltage specifications greater than the maximum input voltages listed below.

Nominal Input Voltage of RGU (V AC)	Maximum DC Input of Drive (V DC)
380	632
460	746
575	933

ATTENTION: Verify that all sources of AC and DC power are deenergized and locked out or tagged out in accordance with requirements of ANSI/NFPA 70E, Part II.

ATTENTION: The system may contain stored energy devices. To avoid the hazard of electrical shock, verify that all voltage on capacitors has been discharged before attempting to service, repair, or remove a drive system or its components. You should only attempt the procedures in this manual if you are qualified to do so and are familiar with solid-state control equipment and the safety procedures in publication NFPA 70E.

ATTENTION: An incorrectly applied or installed drive system can result in component damage and/or a reduction in product life. Wiring or application errors – such as undersizing the motor, incorrect or inadequate AC supply, and excessive ambient temperatures – can result in the malfunction of the drive equipment.

ATTENTION: This drive system contains ESD (electrostatic discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, or repairing this assembly. Component damage can result if ESD control procedures are not followed. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD protection handbook.

Contents of this Manual

Chapter	Title	Contents
	Preface	Discusses the manual layout and provides reference information
1	Overview	Presents how the RGU works, and includes features, and standard options
2	Your Current Code J RGU	Shows the layout, schematics, and components for the J-code RGU
3	Your Current Code K RGU	Shows the layout, schematics, and components for the K-code RGU
4	Your Current Code L RGU	Shows the layout, schematics, and components for the L-code RGU
5	Your Current Code M RGU	Shows the layout, schematics, and components for the M-code RGU
6	Your Current Code N RGU	Shows the layout, schematics, and components for the N-code RGU
7	Installing Your RGU	Includes installation procedures, wiring guidelines, and system testing
8	Setting Up Your RGU	Instructs how to set up the RGU for operation
9	Adjusting Voltage and Current Regulation Parameters	Details on voltage and current regulation
10	Interpreting and Setting Status, Command, and Fault Words	Describes how the status, command, and fault parameters operate
11	Configuring Analog Input and Output Parameters	Describes how analog input and output can be programmed
12	Setting Up Trending	Describes how to program sampling routines
Appendix A	Specifications	Lists electrical specifications, unit dimensions and shipping weights, and operating specifications
Appendix B	RGU Catalog Numbers	Describes catalog numbers for the RGU
Appendix C	RGU Details	Presents circuit breaker settings, meter-mounting hole dimensions, and enclosure architecture
Appendix D	Programming Parameters	Lists and describes the RGU's parameters
	Glossary	Listing of terms used in this manual
	Index	Index of key topics in this manual

Related Documentation

The following documents contain additional information concerning related Rockwell Automation products and related standards. If you would like to obtain a copy of any Rockwell Automation publications, please contact your local Rockwell Automation office or distributor.

For	Read This Document	Document Number
Information on the GPT (graphic programming terminal)	Bulletin 1201 Graphic Programming Terminal User Manual	1201-5.0
Information on the GM1 board for connecting to Remote I/O	Bulletin 1203 Remote I/O Communications Module Getting Started Manual	1203-5.1
Information on the GM5 board for connecting to DeviceNet™	Bulletin 1203 Remote I/O Communications Module Getting Started Manual	1203-5.3
Information on the GM2 board for connecting to RS232/422/483 using DF1 protocol and DH485	Bulletin 1203 Serial Communications Module User Manual	1203-5.5
Information on the 1336 Force™ drives	1336T User Manual — AC Drive	1336 FORCE-5.12
Information on the 1336 Plus drives	1336S User Manual — .05-600HP	1336 PLUS-5.0
PLC-5™ information	PLC-5 Controllers Brochure	1785-1.2
Information about RGU spare parts	2364 Spare Parts Listing	2364-6.0
Information for troubleshooting an RGU	Regenerative DC Bus Supply Unit (RGU)— Troubleshooting Guide	2364F-5.05
Information about parallel configurations	Parallel Configuration—User Manual	2364P-5.01
Additional Information on joining and splicing together MCCs	Instructions — Joining and Splicing Vertical	2100-5.1
Details on receiving, handling, and storing MCCs	Instructions — Receiving, Handling, and Storing Motor Control Centers	2100-5.5
Procedures for tasks to be done at the customer's site before system start up	Bulletin 2300 Installation Manual	2300-5.1
A description of Drive Tools™ software	Drive Tools Software Brochure	9303-1.0
Information on SA3000 drives	SA3000 Binder	S-3001
Information on SA3100 drives	SA3100 Binder	S-3053
Information on FD86N enclosures	FD86N Drive Systems Enclosure Hardware Installation Manual	S-3062
An article on wire sizes and types for grounding electrical equipment	National Electrical Code	ANSI / NFPA 70 Published by the National Fire Protection Association of Boston, MA
An article on safety procedures	Standard for Electrical Safety Requirements for Employee Workplaces	ANSI / NFPA 70E
A complete listing of current documentation, including ordering instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages	Allen-Bradley Publication Index	SD499
A glossary of industrial automation terms and abbreviations	Industrial Automation Glossary	AG-7.1

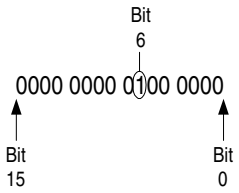
Common Techniques Used in this Manual

The following conventions are used throughout this manual:

- RGU unit configurations are referred to by their catalog string current code. For example, a J-code RGU would refer to a 2364F unit design that has an 85A DC output (380/460V AC input) or 88A DC output (575V AC input). See Appendix A for additional catalog string and rating information.
- References to other manuals and other sections within this manual will appear in italics. For example, "See the section titled *Common Techniques in this Manual*."
- Attention statements, like the one shown below, indicate circumstances that may result in personal injury, death, property damage, or economic loss.

ATTENTION: Attention statements, such as this one, identify circumstances that may result in personal injury, property damage, economic loss, or death.

- Some parameters are displayed in bits (from 0 to 15 as shown below).



Receiving Your Drive System

The customer is responsible for thoroughly inspecting the equipment before accepting the shipment from the freight company. Check the items that you receive against your purchase order. If any items are obviously damaged, do not accept the delivery until the freight agent has noted the damage on the freight bill. Should you discover any concealed damage during unpacking, you are responsible for notifying the freight agent. In such a case, leave the shipping container intact and request that the freight agent make a visual inspection of the equipment.

Rockwell Automation Support

Rockwell Automation offers support services worldwide, with Sales/ Support Offices, authorized distributors, and authorized Systems Integrators located throughout the United States, plus Rockwell Automation representatives in every major country in the world.

Local Product Support

Contact your local Rockwell Automation representative for:

- sales and order support
- product technical training
- warranty support
- support service agreements

Technical Product Assistance

If you need to contact us for technical assistance, please be sure to review the product and troubleshooting information in this manual first.

For the quickest possible response, please have the catalog numbers of your products ready when you call.

Overview

This chapter introduces Rockwell Automation's Bulletin 2364F synchronous line, regenerative DC bus supply unit (RGU).

What is the 2364F?

The RGU is designed to be the regenerative front-end of a common DC bus drive system. RGUs are available with 380V, 460V, and 575V 3-phase input voltages. Read this section for a general description of RGU functionality and packaging.

What does the RGU do?

Your RGU facilitates bi-directional power flow between the 3-phase AC input and the common DC bus:

- The RGU converts the incoming 3-phase, AC line voltage into a regulated DC bus voltage by controlling the power flow to and from the AC line.
- The RGU converts an incoming 3-phase, AC line voltage into a 115V AC RGU control voltage via a basic capacity control transformer (with optional increased transformer capacities available if you desire to also supply control power to a 115V AC control bus).

How will the RGU fit into a 2362 drive system?

The RGU is packaged in CENTERLINE™ Bulletin 2100 motor control centers (MCC) to be compatible with 2362 common DC bus, AC drive system lineups. As an added convenience, you can connect other common bus MCCs to both the right and left sides of standalone RGUs.

How will the RGU fit into a drive system packaged in FD86N enclosures?

FD86N enclosure options permit direct connection to Bulletin 2100 CENTERLINE MCCs that:

- are 20" deep
- have 1.5"-high base channels
- have the DC power bus and control bus (if selected) mounted at a depth of 16.92" from the front of the MCC

How Does An RGU Work?

Primary Electrical Components of Your RGU

The primary electrical components of your RGU are:

- a 3-phase motor circuit protector, 3-phase circuit breaker, or a 3-phase motor-operated circuit breaker (depending upon RGU rating)
- AC line, current-limiting fuses
- AC line reactors
- a power structure
- a main control board
- an isolation board
- a control power transformer
- control transformer fusing (primary and secondary)

These items are shown in the conceptual schematic given in Figure 1.1, then are described in greater detail.

RGU Conceptual Schematic

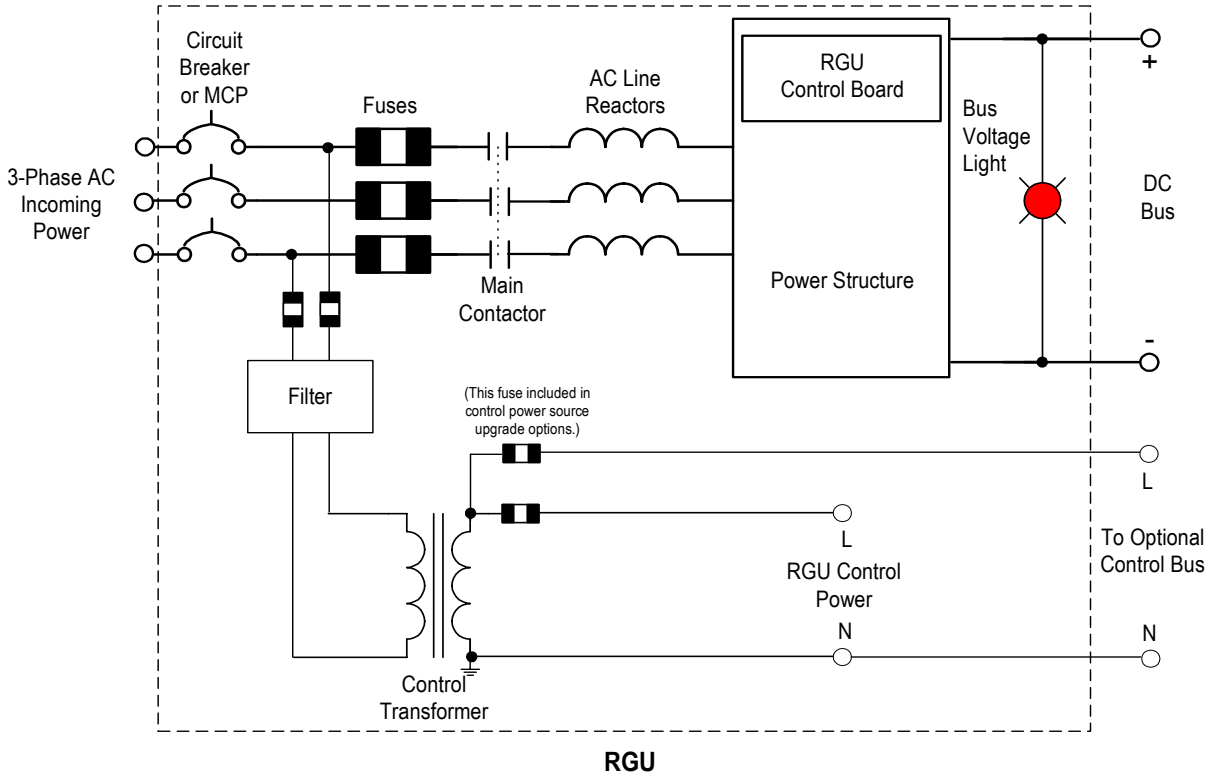
The conceptual schematic shown in Figure 1.1 presents the basic building blocks of your RGU.

The 3-phase, incoming AC power is applied to the inputs at the left of the diagram. This input power is passed through the circuit breaker (or motor circuit protector), line fuses, the main contactor, and AC line reactors. These items ensure that the power structure receives safe, clean power, protected from excessive currents or voltages.

The 3-phase power is then applied to the power structure (which is controlled by the RGU control board). The power is converted to DC through the power structure, and sent out the DC bus.

Two of the phases are tapped off the incoming power, and are passed through line fuses and through a filter, and then transformed through the control transformer. The secondary of this transformer supplies control power to the RGU (including the bridge fan motor). As an option, this power may be supplied to the control bus (fuses and an appropriate control transformer are required).

Figure 1.1
Conceptual Schematic of the RGU



Descriptions of the Primary Electrical Components

Motor Circuit Protector

The motor circuit protector is the disconnect device between the RGU and the 3-phase AC source, used to turn power to the system on and off. It also provides magnetic overload protection. Motor circuit protectors are standard features in J, K, and L-code RGUs.

3-Phase Circuit Breaker

The 3-phase circuit breaker is the disconnect device between the RGU and the 3-phase AC source, used to turn power to the system on and off. It also provides overcurrent trip and magnetic overload protection. 3-phase circuit breakers are standard features in M and N-code RGUs.

AC Line, Current-Limiting Fuses

AC line, current-limiting fuses are placed between the circuit breaker (or motor circuit protector) and the RGU power structure. This fusing protects the bridge from excessive currents and provides a current-limiting action that permits a circuit breaker or motor circuit protector (with a withstand rating less than 65,000A AC fault current available) to effectively provide an AIC rating of 65,000A AC.

AC Line Reactors

AC line reactors reduce peak currents and harmonics in the AC line and peak currents of the bridge circuit; they facilitate current flow from the RGU to the 3-phase AC line during regeneration; and they act as a known AC line impedance to the RGU which functions as a power source while motoring or regenerating.

RGU Power Structure

The RGU power structure is the 3-phase power bridge which converts the 3-phase AC power to DC and DC power to 3-phase PWM AC.

If the RGU is precharged (main contactor closed) but not enabled (RGU not modulating), the RGU functions as a simple six diode 3-phase rectifier. The six diodes are the freewheeling diodes inside the IGBTs, which are capable of supplying 100% motoring current to the DC bus.

Main Control Board

The main control board regulates the power structure operation, controls other RGU operations according to user settings, and communicates with external devices via SCANport, analog I/O, discrete I/O, and R2R (which communicates with other RGUs).

Isolation Board

The isolation board scales input signals (AC line voltage, AC line current, and DC bus voltage) and output signals to and from the main control board and protects the main control board from overcurrent and overvoltage conditions.

Gate Driver Board (and Power Supply)

The gate driver board receives power directly from the high voltage DC bus. A DC to DC converter on the gate driver board steps full DC bus voltage down to 24V DC, an additional DC to DC converter steps the 24V DC down to ±15V DC and +5V DC, used to power the RGU control card.

The gate driver board is connected directly to each IGBT gate lead through a wire harness. The RGU controls the signals to the gate drive board which in turn drives the IGBT gates on and off.

Control Power Transformer

The control power transformer steps down two phases of the 3-phase AC line voltage to provide a single-phase, 115V AC control signal.

Control Transformer Fusing (Primary and Secondary)

Protects the transformer and control circuitry from excessive currents.

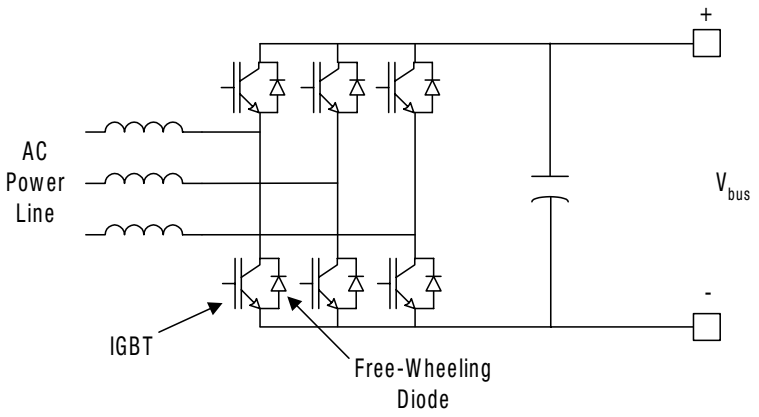
Description of RGU Modes of Operation

Your RGU can operate in following three modes:

Operation	Description
Motoring	The RGU regulates the current and voltage. The RGU controls the IGBT switching. Current flows from the AC line to the DC bus.
Regenerating	The RGU regulates the current and voltage. The RGU controls the IGBT switching. Current flows from the DC bus to the AC line.
Diode Bridge	The RGU does not regulate the current or voltage. The power structure operates as a diode bridge. Current flows from the AC line to the DC bus.

This section shows how these three operations work, using the RGU bridge, shown in Figure 1.2.

Figure 1.2
Typical RGU Bridge



Motoring Operation

While motoring, the RGU functions like a boost converter, controlling the DC bus voltage at a level slightly higher than the peak of the AC line voltage.

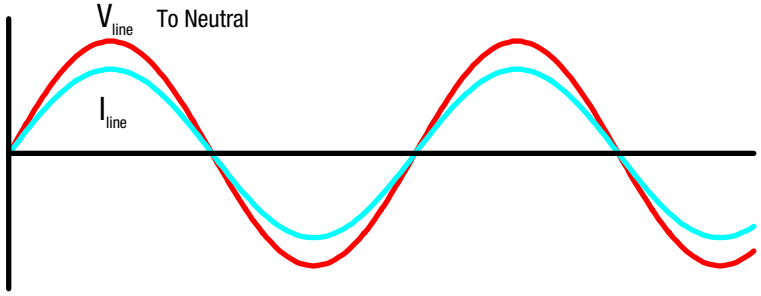
For motoring, the RGU switches the IGBTs (shown in Figure 1.2) on and off in a determined sequence to produce a series of pulses. These pulses are varied in width to produce a 3-phase AC voltage with a nearly-sinusoidal 3-phase AC current. By controlling the magnitude and phase angle of the generated 3-phase voltage, the RGU can control the power flow from the AC line to the DC bus (and the phase angle of the AC line current with respect to line to neutral voltage).

During motoring, the RGU:

- monitors the phase angle of the line voltage
- uses its own phase-lock loop algorithm to track the AC line frequency
- generates a 3-phase voltage with a controlled magnitude and phase angle

Figure 1.3 shows the AC line voltage to neutral and AC line current waveforms of a motoring RGU.

Figure 1.3
3-Phase AC Line Voltage and AC Line Current of a Motoring RGU



Note: *Actual current and line voltage will have some ripple.*

Regenerating Operation

As a secondary function, the RGU can convert DC power back into AC line power in a process known as “regeneration”.

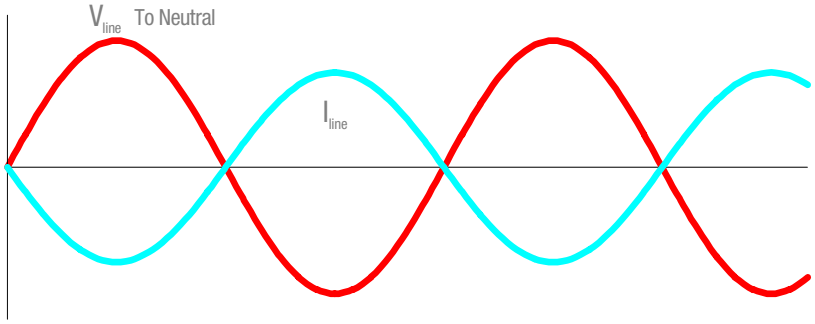
To regenerate, the RGU switches the IGBTs (shown in Figure 1.2) on and off in a determined sequence to produce a series of pulses. These pulses are varied in width to produce a 3-phase AC voltage with a nearly-sinusoidal 3-phase AC current. By controlling the magnitude and phase angle of the generated 3-phase voltage, the RGU can control the power flow from the DC bus to the AC line.

During regeneration, the RGU:

- monitors the phase angle of the line voltage
- uses its own phase-lock loop algorithm to track the AC line frequency
- generates a 3-phase voltage with a controlled magnitude and phase angle

Figure 1.4 shows the AC line voltage to neutral and AC line current waveforms of a regenerating RGU.

Figure 1.4
3-Phase AC Line Voltage and AC Line Current of a Regenerating RGU at Unity Power Factor

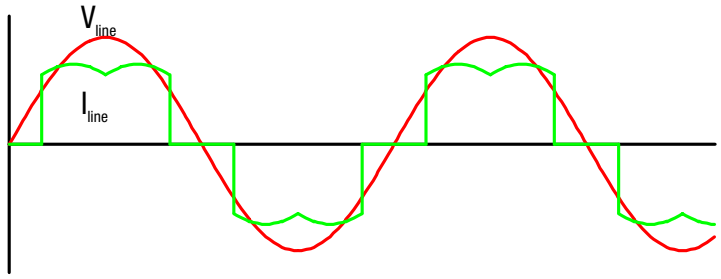


Diode Bridge Operation (RGU Not Enabled)

When the RGU is not enabled, the IGBTs are not modulating. In this mode, current flows only through the free-wheeling diodes. These diodes permit current flow in one direction, from anode to cathode. When an AC voltage is applied to a diode, the output of that diode is a pulsating DC voltage. This mode is identical to a 3-phase diode bridge with line reactors.

Operating as a 3-phase diode bridge, the RGU provides an average DC bus voltage that is approximately 1.35 times the rms line-to-line voltage. At full load, this average DC bus voltage will decrease to about 1.24 times the rms line-to-line voltage, due to the line reactors. Refer to Figure 1.5 for an illustration of the 3-phase AC input voltage and current waveforms when the RGU is not enabled.

Figure 1.5
3-Phase AC Line Voltage To Neutral and AC Line Current of a Diode Bridge (RGU Not Enabled)



What Happens When 3-Phase Power is Applied to the RGU and the Door-Mounted Start Switch is Turned On?

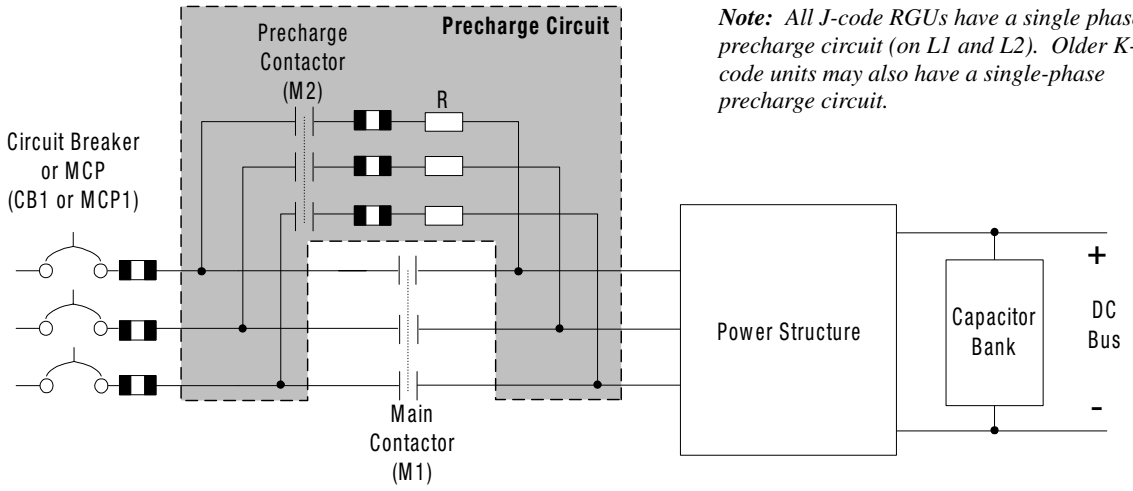
When the RGU's disconnect is closed and the start switch is turned on, the RGU will begin its precharge routine. This routine charges the DC bus capacitor bank in a controlled fashion.

Precharge Operation for J, K, L, and M-Code RGUs

Two contactors (M1 and M2) are used to perform the precharge operation in the J, K, L, and M-code RGUs.

When the disconnect (MCP1 or CB1) is closed and the start switch is turned on, the main contactor (M1) remains open, the precharge contactor (M2) closes, and current begins to flow through the precharge circuit (bypassing the main 3-phase circuit). This precharge circuit (which has a resistive load) charges up the capacitor bank. As the bank approaches capacity, the main contactor (M1) closes, the precharge contactor (M2) opens, and normal operation begins.

Figure 1.6
Precharge Circuit (J, K, L, and M-Code RGUs)



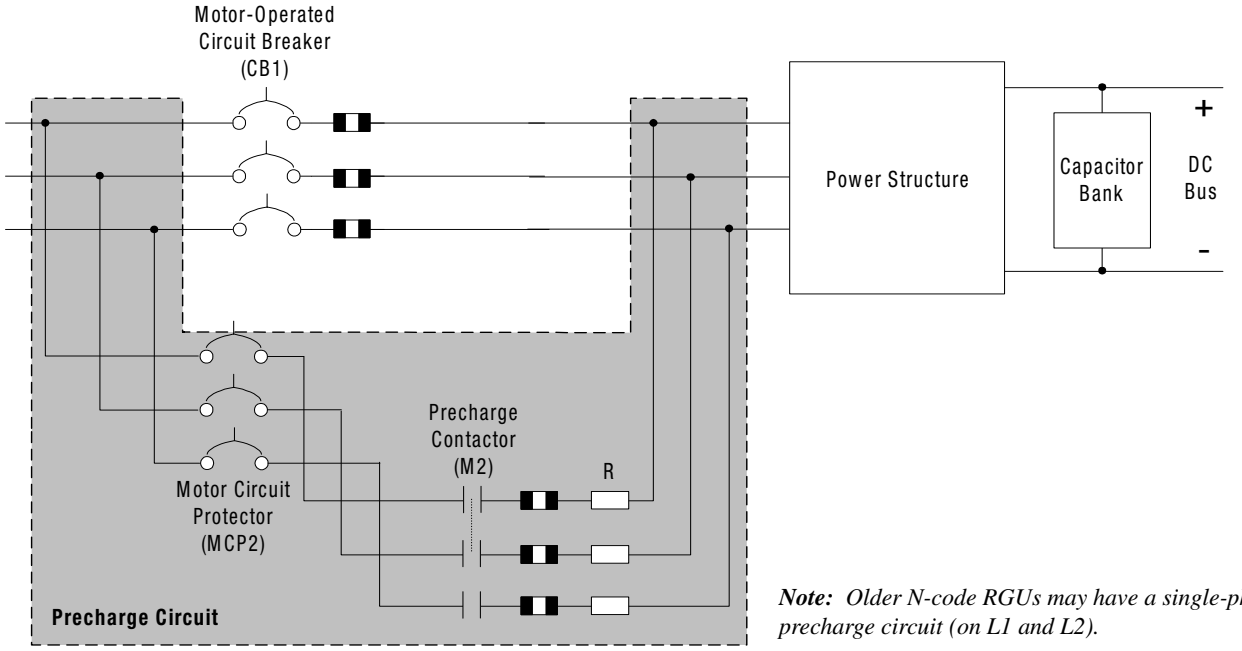
Note: *All J-code RGUs have a single phase precharge circuit (on L1 and L2). Older K-N code units may also have a single-phase precharge circuit.*

Precharge Operation for N-Code RGUs

The precharge circuit for the N-code RGU uses the main disconnect (motor-operated circuit breaker, CB1) in place of a main contactor.

When MCP2 is closed and the start switch is turned on, the main disconnect (CB1) remains open, the precharge contactor (M2) closes, and current begins to flow through the precharge circuit (bypassing the main 3-phase circuit). This precharge circuit (which has a resistive load) charges up the capacitor bank. As the bank approaches capacity, the main disconnect (CB1) closes, the precharge contactor (M2) opens, and normal operation begins.

Figure 1.7
Precharge Circuit (N-Code RGU)



Note: *Older N-code RGUs may have a single-phc precharge circuit (on L1 and L2).*

How Does the RGU Control Power Factor in Motoring and Regenerating Modes of Operation?

To understand how the RGU operates in motoring and regeneration modes, please refer to the example system shown in Figure 1.8, and the single-phase equivalent diagram of the RGU shown in Figure 1.9.

Figure 1.8
RGU Connected to AC Drives

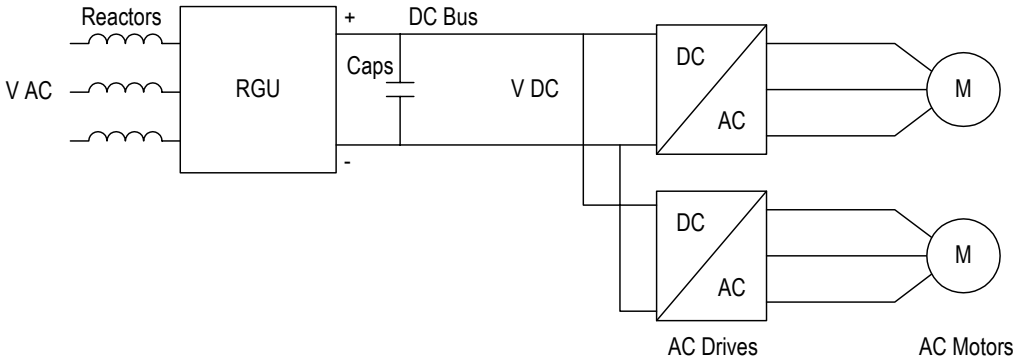
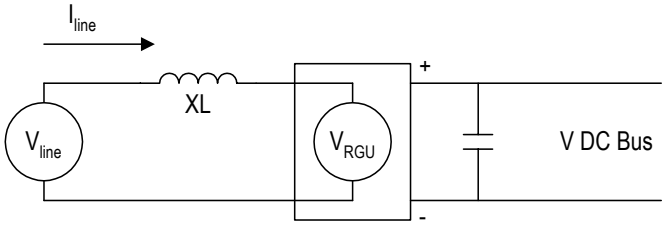


Figure 1.9
Single-Phase Equivalent Circuit of RGU



To understand what happens to the power factor during RGU operation, we will examine the following:

- How does the RGU allow power to flow during motoring while controlling the power factor?
- How does the RGU allow power to flow from the DC bus to the AC line (regenerating mode of operation) and control the power factor?

In the upcoming pages, you will find that the magnitude and phase angle of currents I_d (reactive) and I_q (active) will:

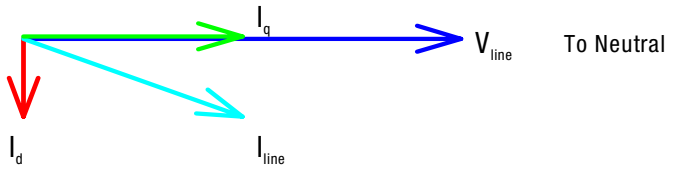
- control V_{RGU} and V DC Bus
- determine whether the RGU is motoring or regenerating
- determine whether the power factor is leading, lagging, or unity

How does the RGU allow power to flow during motoring while controlling the power factor?

Let's examine the voltage vector diagram in Figure 1.11. Symbols in the figures are defined as follows:

- V_{line} is the AC line voltage at a 0° degree phase angle
- V_{RGU} is the AC terminal voltage of the RGU
- XL is the line impedance
- I_q is the active current in the AC line (which is shown in phase with V_{line} in Figure 1.10)
- I_d is the reactive current in the AC line (which is shown lagging I_q by 90° in Figure 1.10)
- I_{line} is the vector sum of I_q (active current) and I_d (reactive current). These currents are controlled by the RGU. (Shown in Figure 1.10)

Figure 1.10
Motoring Current Vector Diagram, Lagging pf



Note: *Iq determines the direction of the current flow. Id determines the leading or lagging in the power factor.*

When current flows in the motoring direction, the voltages across the line reactor (XL * I_q and XL * I_d) are rotated 90° as shown as shown in Figure 1.11.

Figure 1.11
Voltage Vector Diagram

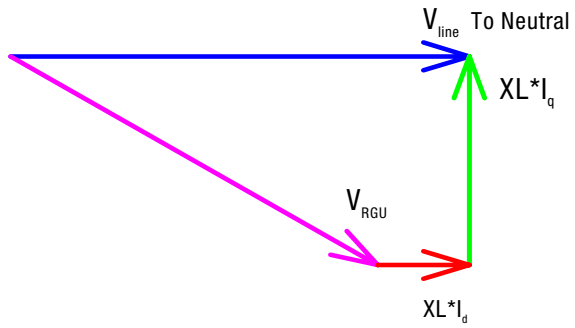
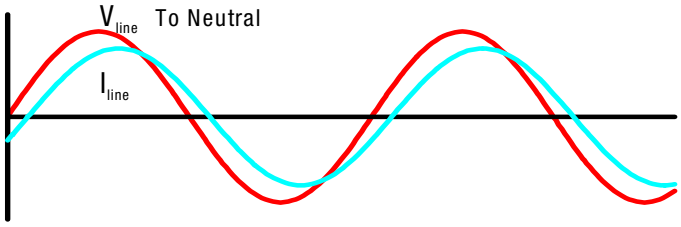


Figure 1.12 shows what the I_{line} and V_{line} waveforms look like for a lagging pf.

Figure 1.12
Waveforms (Lagging pf, Iq > 0, Id < 0)

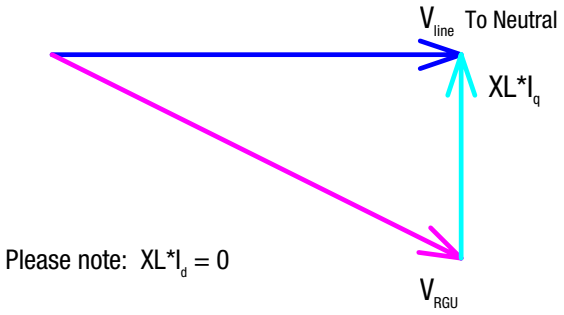


V_{RGU} is controlled by the RGU to be at the proper magnitude and phase angle with respect to V_{line} so that the commanded I_q and I_d exist. In Figure 1.10, Figure 1.11, and Figure 1.12, I_d is commanded to be slightly positive to provide a lagging power factor, and I_q is commanded to be at some non-zero motoring current level.

If I_d were commanded to be equal to 0, V_{RGU} would be increased in magnitude and shifted closer toward V_{line} (to neutral) as shown in Figure 1.14, then we would have the condition where the same amount of real current would be flowing, but now I_d would be equal to zero. I_{line} would be equal to I_q and in phase with V_{line}. The power factor is now unity.

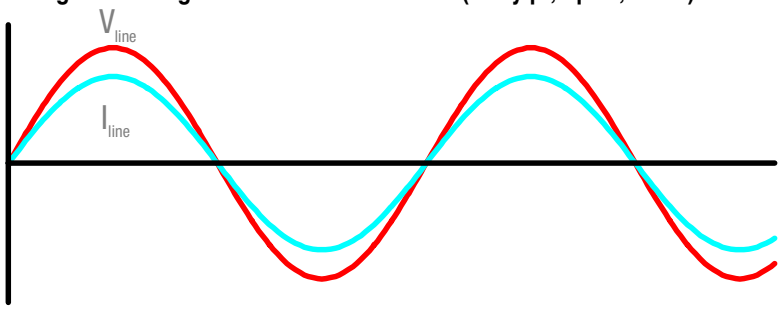
Figure 1.13
Motoring Current Vector Diagram (Unity pf)

Figure 1.14
Voltage Vector Diagram



Notice that in Figure 1.13 and Figure 1.15, V_{line} and I_{line} are in phase with each other and that the RGU is supplying power to the DC bus.

Figure 1.15
Motoring Line Voltage and Current Waveforms (Unity pf, Iq > 0, Id = 0)



Now, if I_d were commanded to be at some negative level, V_{RGU} would be increased and shifted closer still to V_{line} as shown in Figure 1.17, then we would have the same real current, but I_d is now opposite to the I_d in Figure 1.10, and the power factor would be leading.

Figure 1.16
Motoring Current Vector Diagram, Leading pf

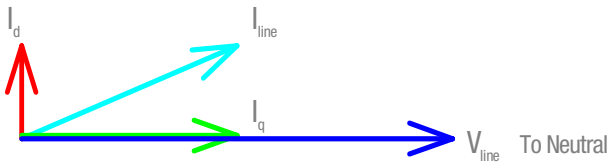


Figure 1.17
Voltage Vector Diagram

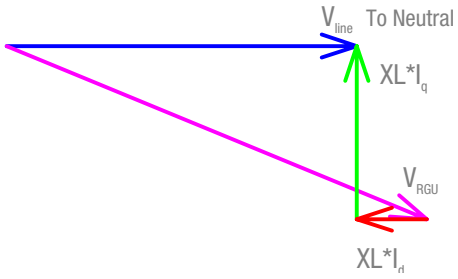
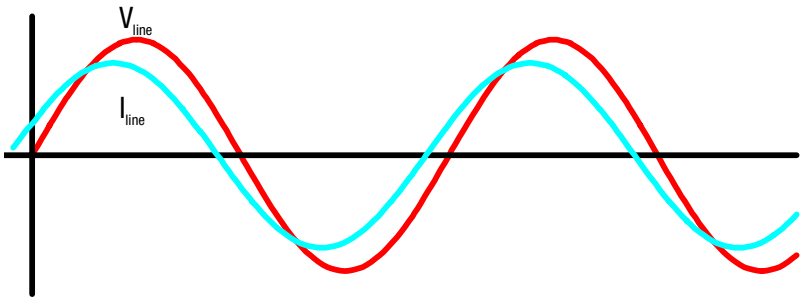


Figure 1.18
Line Voltage and Current Waveforms (Leading pf, Iq > 0, Id > 0)



How does the RGU allow power to flow from the DC bus to the AC line (regenerating mode of operation) and control the power factor?

Commanding I_q to be negative causes a phase shift in V_{RGU} in order to lead V_{line} which regenerates power to the AC line. If I_d is commanded to be 0, the RGU will operate at unity power factor as shown in Figure 1.19, Figure 1.20, and Figure 1.21.

Figure 1.19
Regenerating Current Vector Diagram (Unity pf)

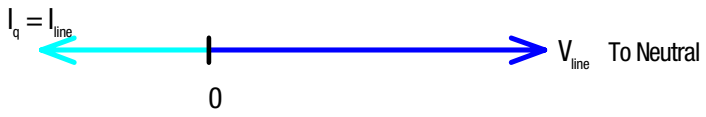
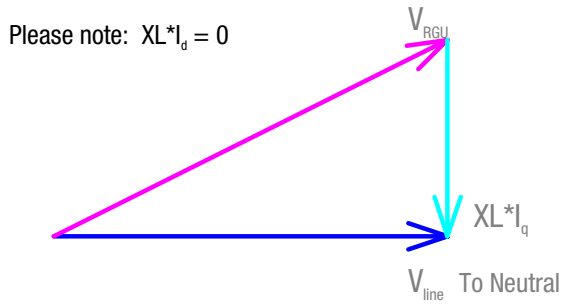


Figure 1.20
Voltage Vector Diagram



Notice that in Figure 1.21, V_{line} is 180 degrees out of phase with I_{line}, and that the RGU is supplying power to the AC line.

Figure 1.21
Line Voltage and Current Waveforms (Unity pf, Iq < 0, Id = 0)

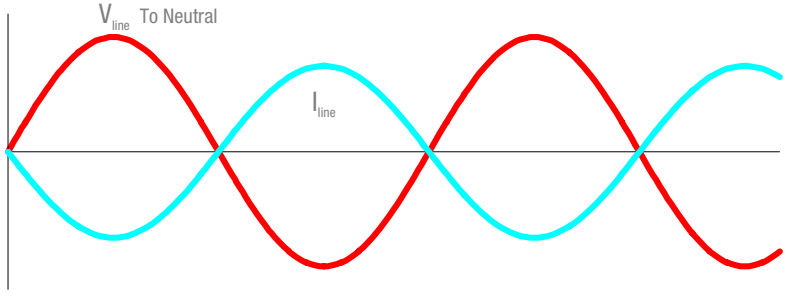


Figure 1.22, Figure 1.23, and Figure 1.24 show the condition where the RGU is regenerating power to the AC line and the power factor is lagging since I_d is commanding some positive value.

Figure 1.22
Regenerating Current Vector Diagram, Lagging pf

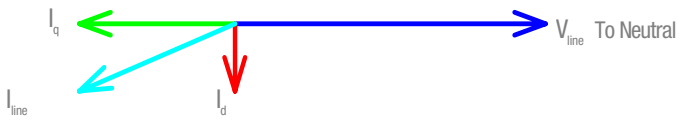


Figure 1.23
Voltage Vector Diagram

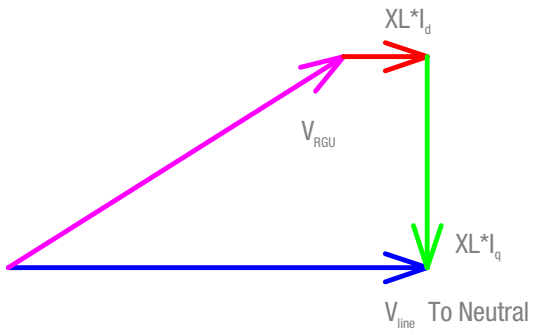


Figure 1.24
Line Current and Voltage Waveforms (Lagging pf, Iq < 0, Id < 0)

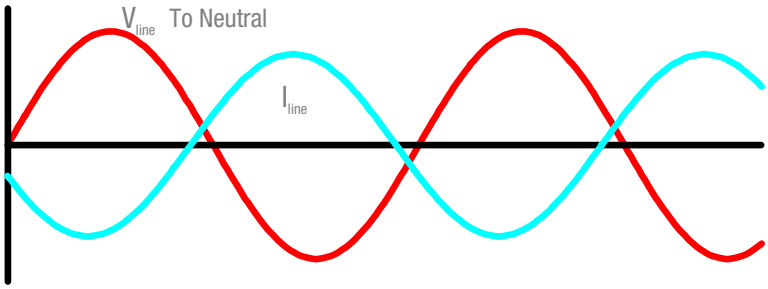


Figure 1.25, Figure 1.26, and Figure 1.27 show the RGU regenerating with a leading power factor since I_d is commanding some negative value.

Figure 1.25
Regenerating Current Vector Diagram (Leading pf)

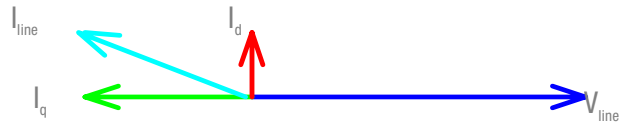


Figure 1.26
Voltage Vector Diagram

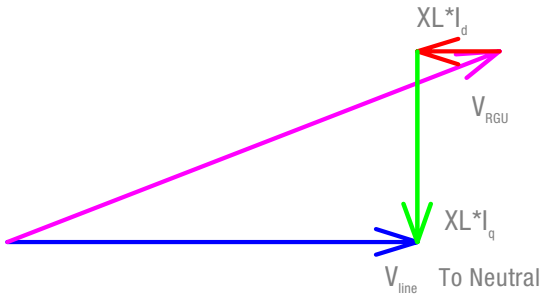
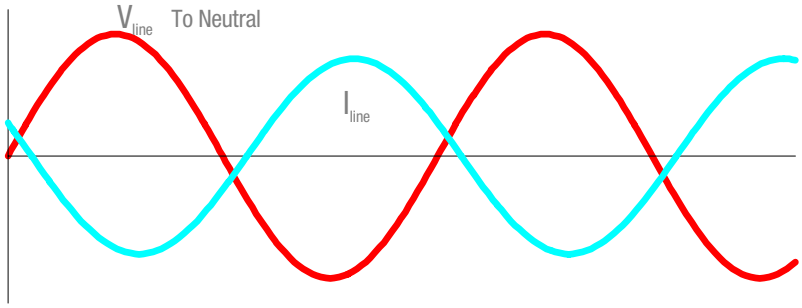


Figure 1.27
Line Current and Voltage Waveforms (Leading pf, Iq < 0, Id > 0)



How Does the RGU Control the DC Bus Voltage?

The voltage source converter block, shown in Figure 1.28, regulates the DC bus voltage to a set value. This arrangement provides near unity power factor, allows regeneration, and yields a low line current distortion.

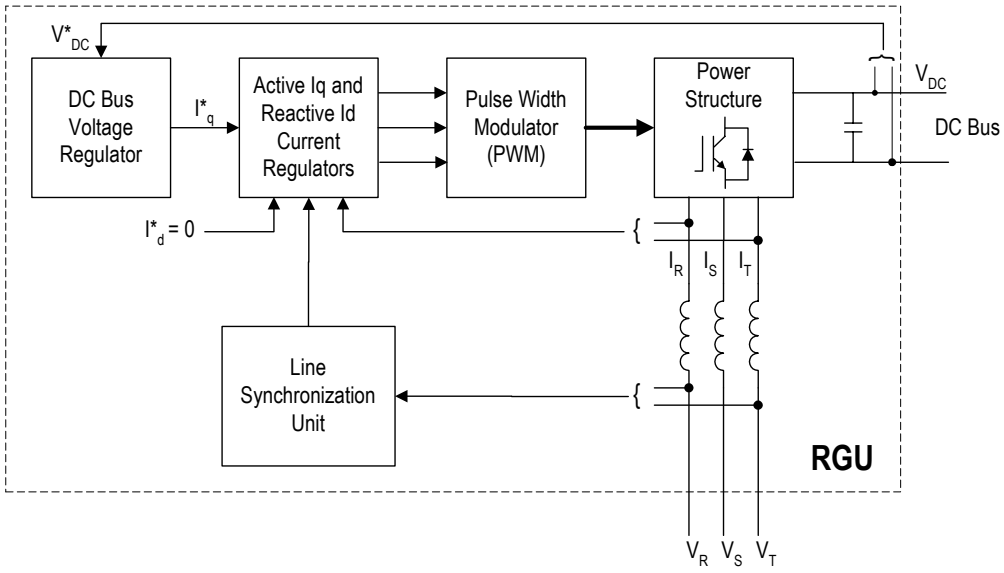
To maintain constant DC bus voltage, regardless of line voltage fluctuation, the DC bus voltage regulator changes Iq (the active current reference), causing an increase, decrease, or reversal in the power flow from the line to the DC bus.

Iq regulates the amplitude of line current components in phase with the line to neutral voltage (see Figures 1.13 and 1.15 for unity power factor). Id (the reactive current reference) regulates reactive component having a 90º angle with respect to the phase voltage (see Figures 1.10 and 1.12 for lagging power factor, and Figures 1.16 and 1.18 for leading power factor). The polarity of Id will determine lagging or leading power factor. The magnitude of Id will determine how much leading or lagging current will flow.

The pulse-width modulator (PWM), which is between the current regulators and power structure, provides the gating pulses to the power structure IGBTs.

The line synchronization unit provides information about utility voltage phase angles to maintain proper phase angles between the line currents and line voltages.

Figure 1.28
Voltage Source Converter Block



Special Applications

RGUs with specific hardware modifications and additions can be placed in parallel with NRUs and/or RGUs in predetermined 2364P parallel configurations. Refer to publication 2364P-5.01 for additional information.

RGU Standard Features

RGU standard features include:

Electrical System Features

- A 3-phase circuit breaker / motor circuit protector rated for 65kAIC:
    - •J, K, and L-code units have motor circuit protectors
    - •M-code units have circuit breakers
    - •N-code units have circuit breakers for control power with motor-operated circuit breakers carrying rated bridge current
- AC line, current-limiting fuses rated at 600V AC with short circuit protection rated at 65kAIC
- AC line reactors in a quantity of 1 per phase
- A "basic capacity" control power transformer that supplies ONLY the RGU with single-phase, 115V AC control power
- Primary and secondary control transformer fusing (excluding the control bus fuse that is supplied with the "6P" control power source upgrade option)
- A "DC-Bus-Energized" pilot light that turns on when the bus voltage is above 50V DC
- A DC bus suppressor module
- Utilization of #16AWG or #14AWG MTW (PVC insulated) rated, stranded copper control wiring

Packaging Features

- The Bulletin 2100 CENTERLINE motor control center (MCC) packaging makes the RGU compatible with other Bulletin 2100 and 2300 products
- Unit depth of 20" (J, K, L-code RGUs), overall unit depth of 25” (M and N-code RGUs)
- Ability to connect to other common DC bus MCC sections on both the right and left sides
- Top-entry AC line input
- Removable top-plate for cutting conduit holes
- Easy accessibility for routine maintenance

- 6"-high, full-section-depth, horizontal wireway at top of MCC enclosure

  Note: *The front-half of the top horizontal wireway is typically reserved for the routing of control/communication wires.*

- Motor circuit protectors and circuit breakers are padlockable.
- Units have removable power structures
- Tin-plated copper horizontal busbars and PE/TE busbars
- Standard DC power bus bracing at 65kAIC
- Horizontal PE and TE copper bus that is bottom-front mounted
- ASA49 gray, baked-enamel finish
- Vented unit door(s) with door fan(s) where appropriate
- Units come standard with cloth wire labels

Communication Features

- Ability to communicate with SCANport devices via ports 1, 2, and 6, expandable to ports 1, 3, 4, 5, and 6
- Port 6 for mounting one of the following optional communication interface boards directly on the control board stack:
  - 14G1 – Remote I/O
  - 14G2 – RS232/422/483 (using DF1 protocol) and DH485
  - 14G5 – DeviceNet

RGU Standard Options

RGUs are available with the following options:

Electrical System Options

- Analog DC bus voltage metering
- A "Unit-Not-Faulted" pilot light
- Analog AC input current metering (phase L1 only)
- Standard capacity control transformer to provide control bus power
- Line RC suppressor module
- A door-mounted, ground-fault detection meter for RGUs powered by 3-phase, grounded-wye secondary supplies

Packaging Options

- A door-mounted, ground-fault detection meter-relay
- A door-mounted, fault-clear pushbutton
- A single-phase 115V AC, 15A duplex receptacle

  Note: *Customer supplies single-phase, 115V AC power and wiring to the duplex receptacle.*

- An audio phone jack
- Tin-plated control bus mounted in rear of cabinet above the power bus

  Note: *Control bus is included as part of the control power source upgrade option.*

- Gasketed unit door areas and door-fan filters
- Brady Datab wire labels offering the added protection of a clear plastic cover on top of the labels

  Note: *Units come standard with cloth wire labels*

- Door mounted HIM (programmer only) or a door-mounted SCANport connector

Communication Options

- 14G1 board for connecting to Remote I/O
- 14G2 board for connecting to RS232/422/483 (using DF1 protocol) and DH485
- 14G5 board for connecting to Device Net

Year 2000 Ready

The RGU is Year 2000 Ready. When the RGU is interfaced with hardware, firmware, and software that will properly exchange unambiguous data and that will not impede the performance of the RGU, the RGU will function consistently without interruption for all valid dates, and will recognize the year 2000 as a leap year. See the Allen-Bradley website, *www.ab.com*, for further details.

Input Voltage (V AC)	DC Bus Current (A DC)	Rated DC Bus kW
380	85	49
460	85	59
575	88	74

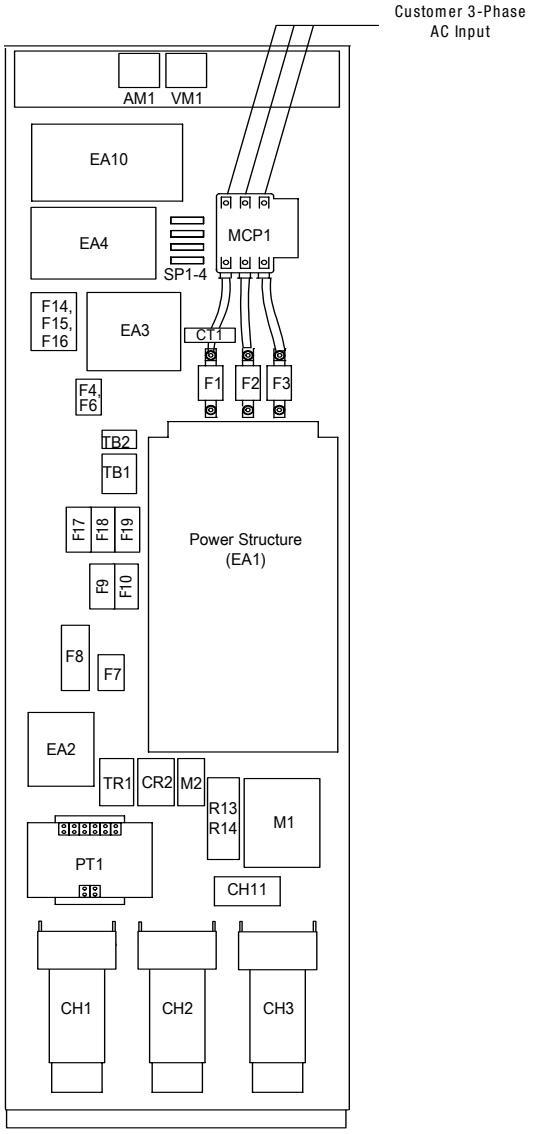
Your Current Code J RGU (Series A)

This chapter provides the following information for the current code J RGU:

- a typical cabinet layout diagram (Figure 2.1)
- a typical electrical schematic (Figure 2.2)
- a typical RGU power structure schematic (Figure 2.3)
- a symbol-to-component reference table for interpreting the electrical schematic (Table 2.1)

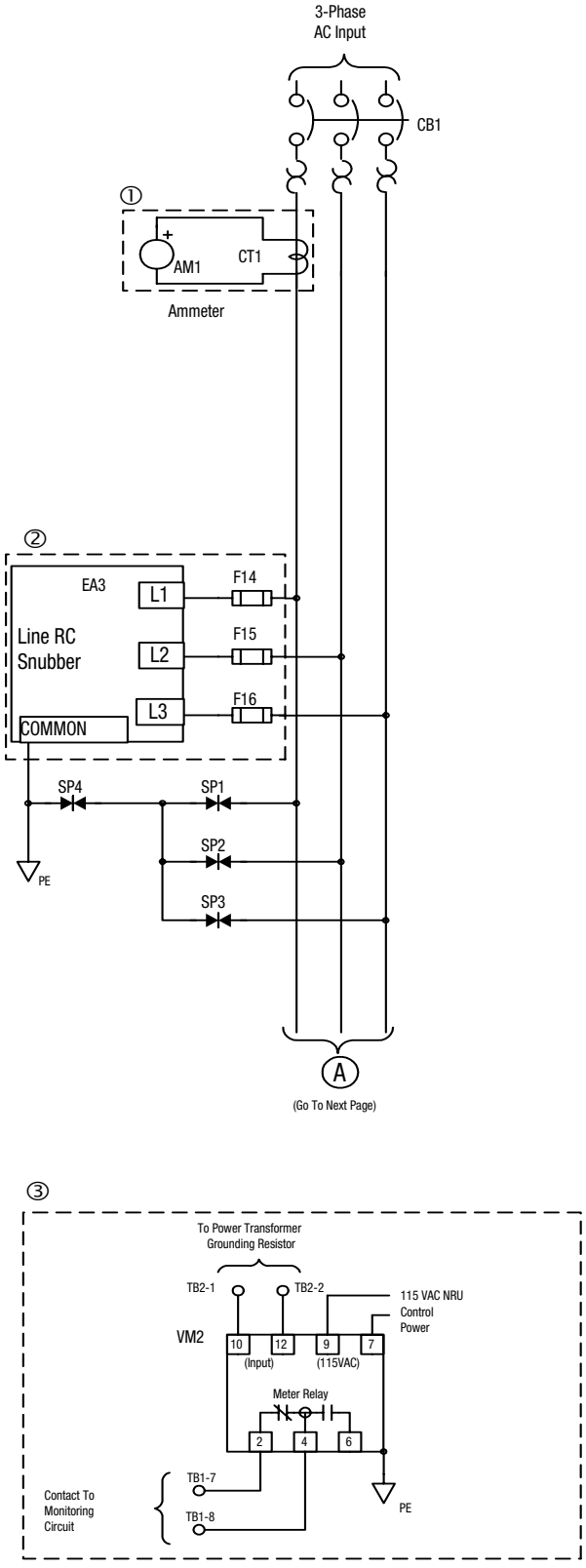
Unit Layout

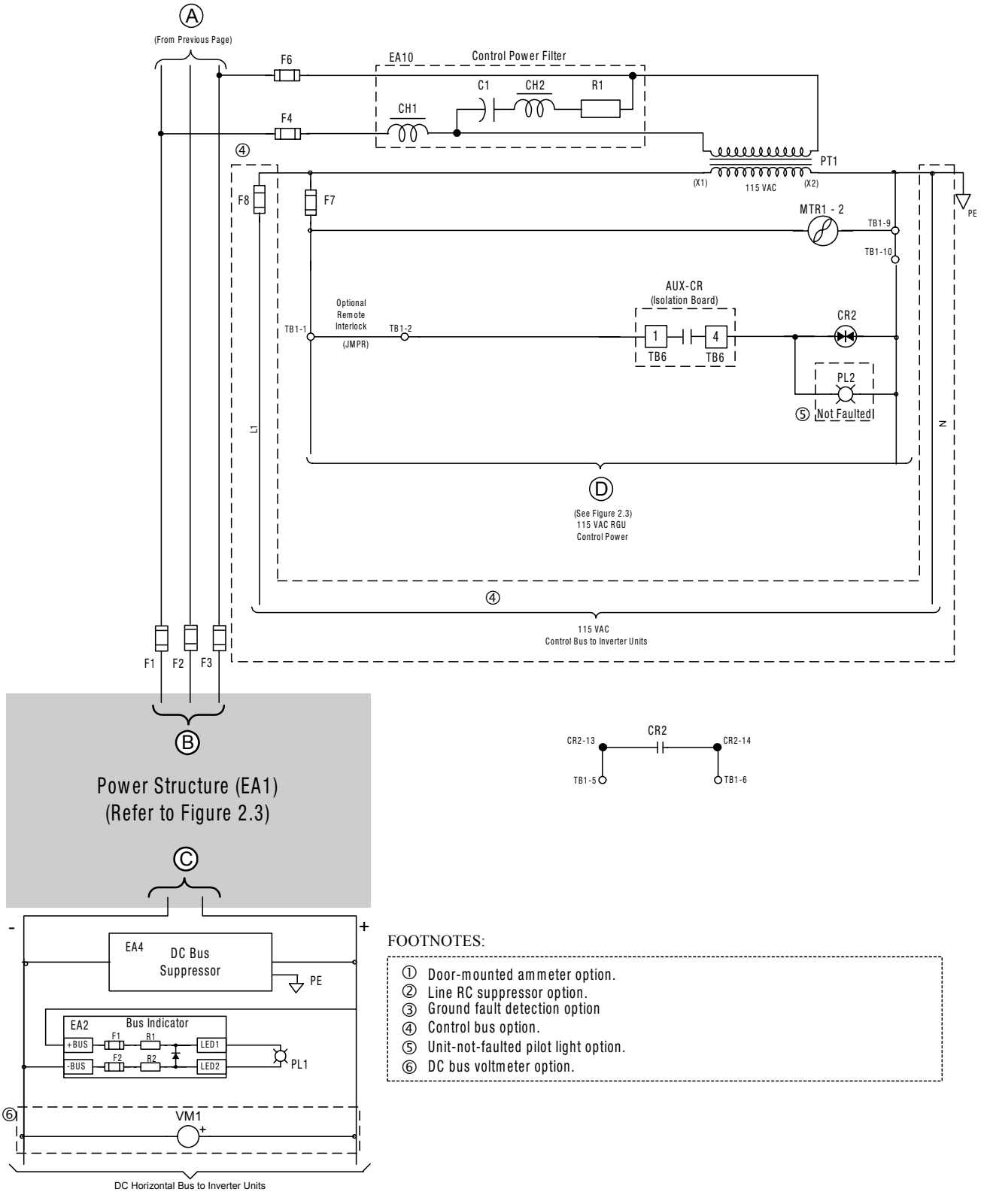
Figure 2.1
Typical Current Code J RGU Layout



Electrical Schematic

Figure 2.2
Typical Current Code J RGU Schematic

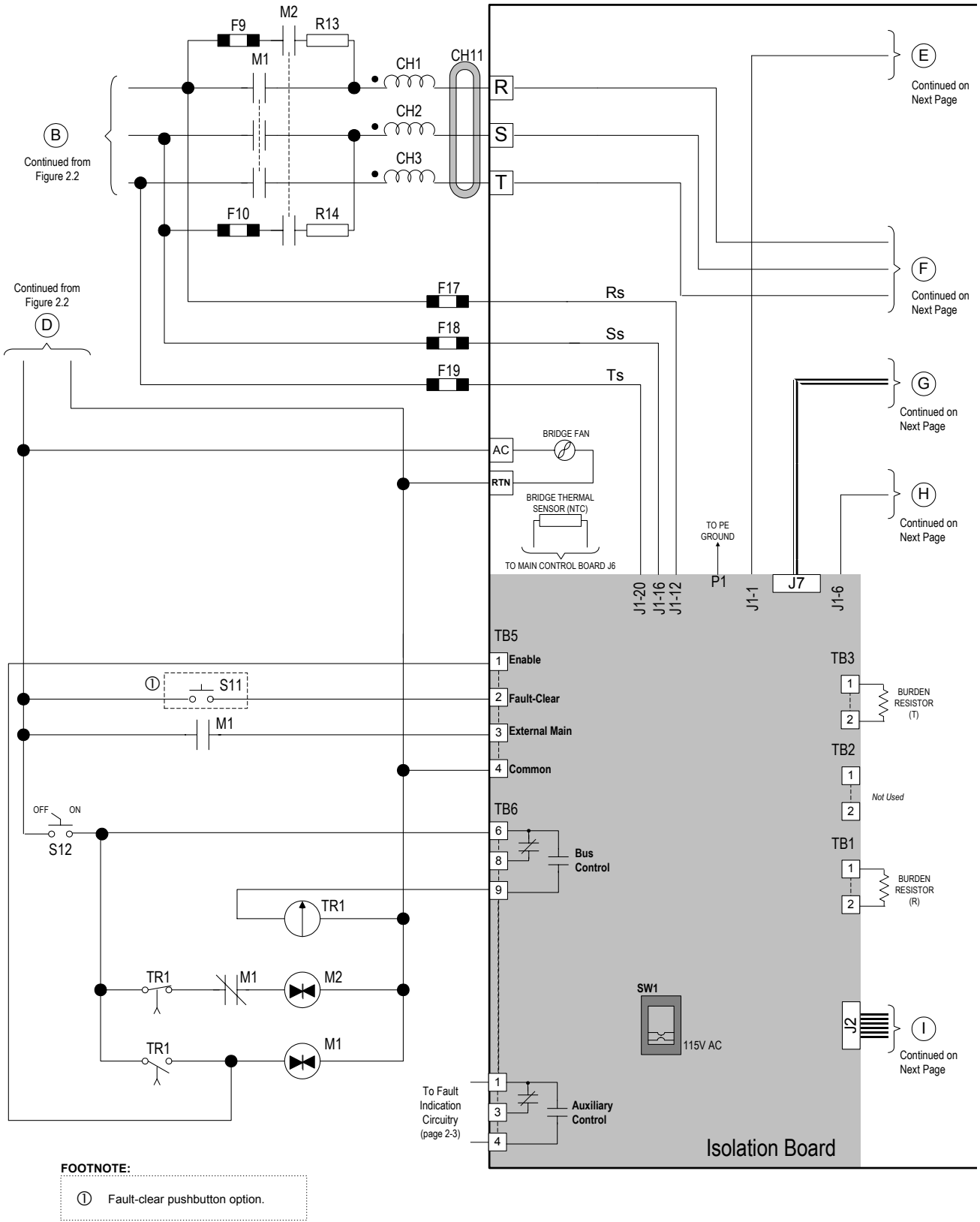




FOOTNOTES:

① Door-mounted ammeter option.
② Line RC suppressor option.
③ Ground fault detection option
④ Control bus option.
⑤ Unit-not-faulted pilot light option.
⑥ DC bus voltmeter option.

Figure 2.3
Typical RGU Power Structure Schematic



FOOTNOTE:

① Fault-clear pushbutton option.

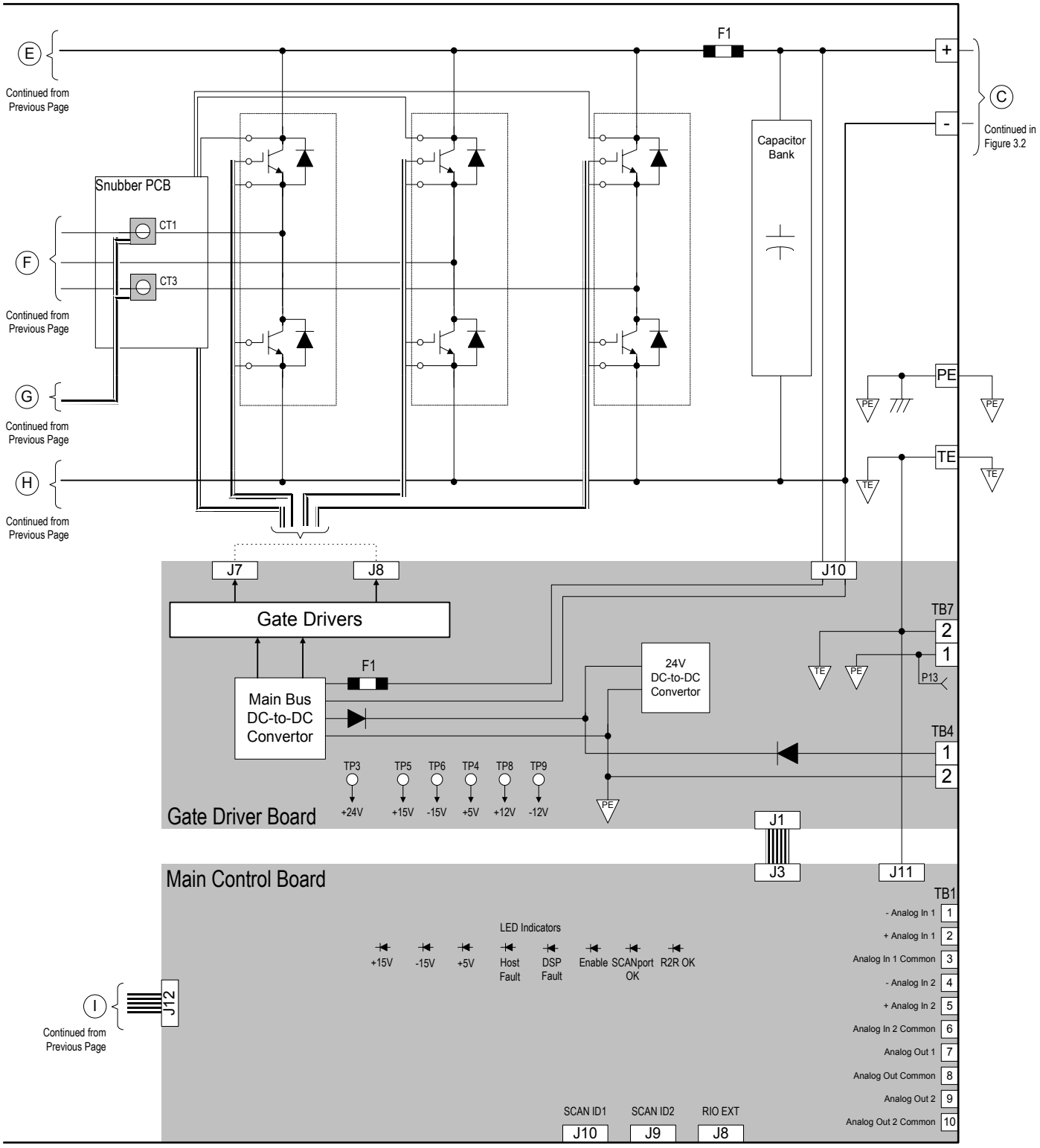

E
Continued from Previous Page
F1
+
-
C
Continued in Figure 3.2
Capacitor Bank
Snubber PCB
CT1
CT3
F
Continued from Previous Page
G
Continued from Previous Page
H
Continued from Previous Page
PE
TE
J7
J8
J10
Gate Drivers
TB7
2
1
P13
F1
Main Bus DC-to-DC Convertor
24V DC-to-DC Convertor
TB4
1
2
TP3
TP5
TP6
TP4
TP8
TP9
+24V
+15V
-15V
+5V
+12V
-12V
Gate Driver Board
J1
J3
J11
Main Control Board
TB1
LED Indicators
+15V
-15V
+5V
Host Fault
DSP Fault
Enable
SCANport OK
R2R OK
- Analog In 1 1
+ Analog In 1 2
Analog In 1 Common 3
- Analog In 2 4
+ Analog In 2 5
Analog In 2 Common 6
Analog Out 1 7
Analog Out Common 8
Analog Out 2 9
Analog Out 2 Common 10
I
J12
Continued from Previous Page
SCAN ID1
SCAN ID2
RIO EXT
J10
J9
J8

Table 2.1 Current Code J RGU Symbol to Component Cross Reference

			AC 3-Phase Input Voltage		
Symbol	**Description**	**Option ①**	**380V AC**	**460V AC**	**575V AC**
AM1	Ammeter monitoring L1	✓	400A AC		
MCP1	Motor Circuit Protector		150AHMCP		
CH1- 3	Input line reactors		1193uH	1193uH	1853uH
CR2	Fault relay		2 NO/ 2 NC		
CT1	Current transducer	✓	100:5		
CT1, 3 (EA1)	Current transducers (on EA1)		1000:1, 0-150A range		
EA1	Power structure				
EA2	Bus indicator PCB				
EA3	Line RC suppressor PCB	✓			
EA4	DC bus suppressor assembly				
EA10	Control power filter		For 4kHz carrier frequency		
F1 (EA1)	DC bus fuse (on EA1)		125A	125A	120A
F1 (gate drv)	Power supply fuse (on gate driver PCB)		1A, KTK-R		
F1 - 2 (EA2)	Bus indicator PCB fuses (on EA2)		1A, 1000V, KVR, 1-3/32" diameter, 3" length, 500AIC		
F1 - 3	Incoming 3-phase, line fuses		125A, A70P		
F4, F6	Primary fuse for a 2 kVA control transformer		10A, KLDR	9A, KLDR	8A, KLDR
	Primary fuse for a 5 kVA control transformer	✓	25A, KLDR	20A, KLDR	17.5A, KLDR
F7	RGU control power fuse		3.5A, KLDR		
F8	Control bus fuse for a 5 kVA control transformer	✓	35A, FRN		
F9, F10	Precharge fuses		10A, KLDR	10A, KLDR	15A, KLDR
F14 - 16	RC suppressor fuses	✓	25A, KTK		
F17 - 19	AC line sensor fuses		1A, KLDR		
M1	Main contactor		110A		
M2	Precharge contactor		12A		
MTR1, 2	Door-mounted fan		7", 340CFM		
PL1	DC-Bus-Energized pilot light		24V AC/DC, red, 800MR		
PL2	Unit-Not-Faulted pilot light	✓	115V AC, amber, 800MR		
PT1	Control power transformer		A 2kVA control transformer is standard, and a 5kVA control transformer is available as an option. This transformer has multiple taps to accomodate 380, 460, and 575 V AC primary voltages.		
R13, R14	Precharge Resistors		6 ohm, 345 W		
S11	Fault clear pushbutton	✓	1 NO, 800MR		
S12	Start switch		1 NO/ 1 NC, 800MR		
SP1 - 3	Line-to-line MOVs		460 J, 320V AC	460 J, 320V AC	550 J, 385V AC
SP4	Neutral-to-ground MOV		760 J, 680V AC	760 J, 680V AC	760 J, 680V AC
TB1	Terminal Block		600V AC/DC, 22-14AWG, 10 terminals		
TB2	Terminal Block		600V AC/DC, 22-14AWG, 2 terminals		
TR1	Timer Relay		2 NO/ 2 NC (instantaneous), 1NO / 1 NC (on delay)		
VM1	DC bus voltmeter	✓	1000V DC		
VM2	Ground fault detection	✓	0-440V AC (meter), NO/NC contacts (relay)		

① These components are provided with RGU standard options. Not all RGUs will have these components.

Input Voltage (V AC)	DC Bus Current (A DC)	Rated DC Bus kW
380	200	116
460	201	141
575	201	170

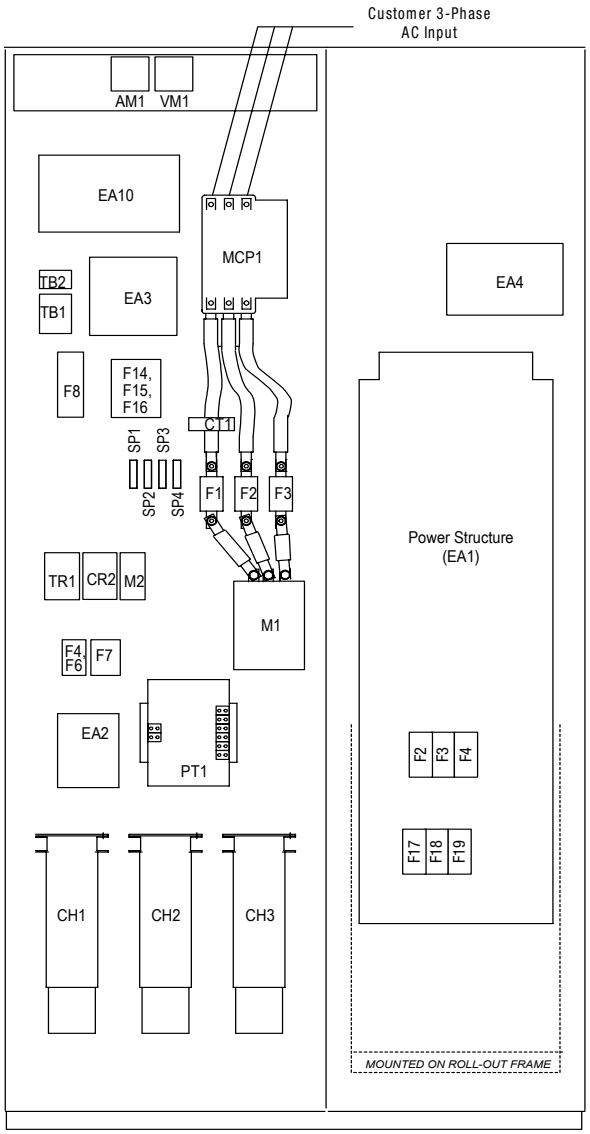
Your Current Code K RGU (Series A)

This chapter provides the following information for the current code K RGU:

- a typical cabinet layout diagram (3)
- a typical electrical schematic (Figure 3.2)
- a typical RGU power structure schematic (Figure 3.3)
- a symbol-to-component reference table for interpreting the electrical schematic (Table 3.1)

Unit Layout

Figure 3.1
Typical Current Code K RGU Layout



Electrical Schematic

Figure 3.2
Typical Current Code K RGU Schematic

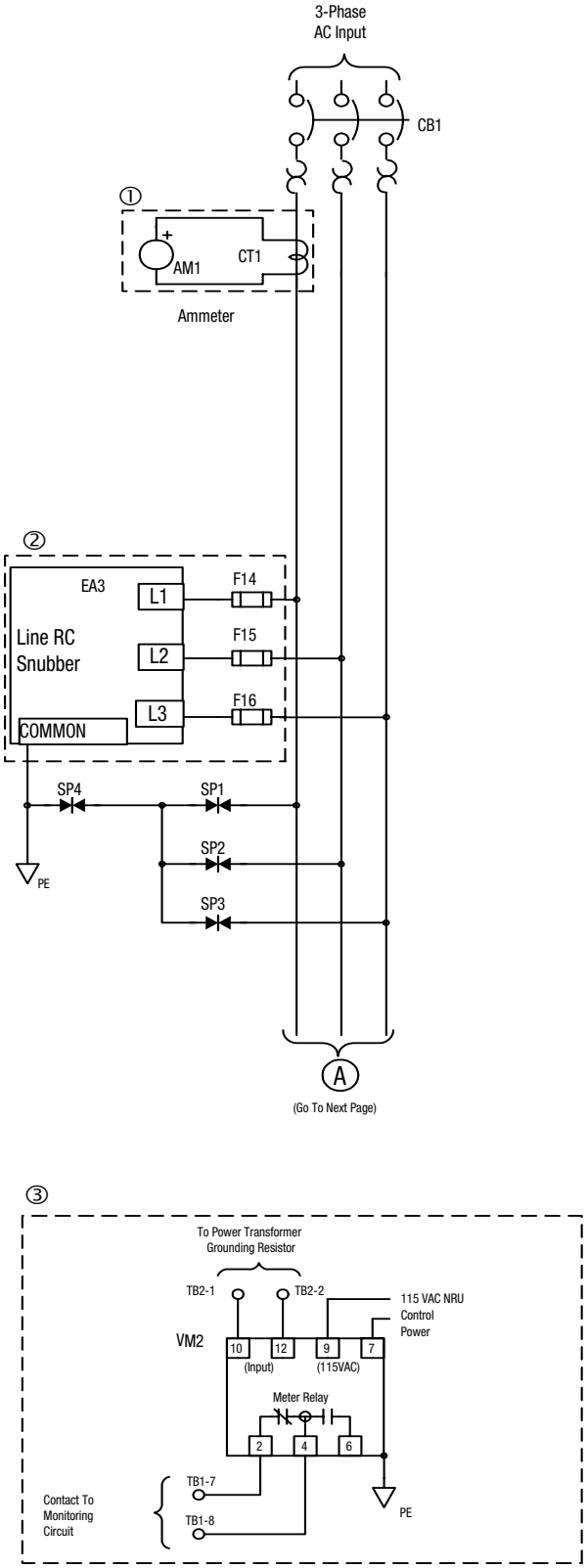
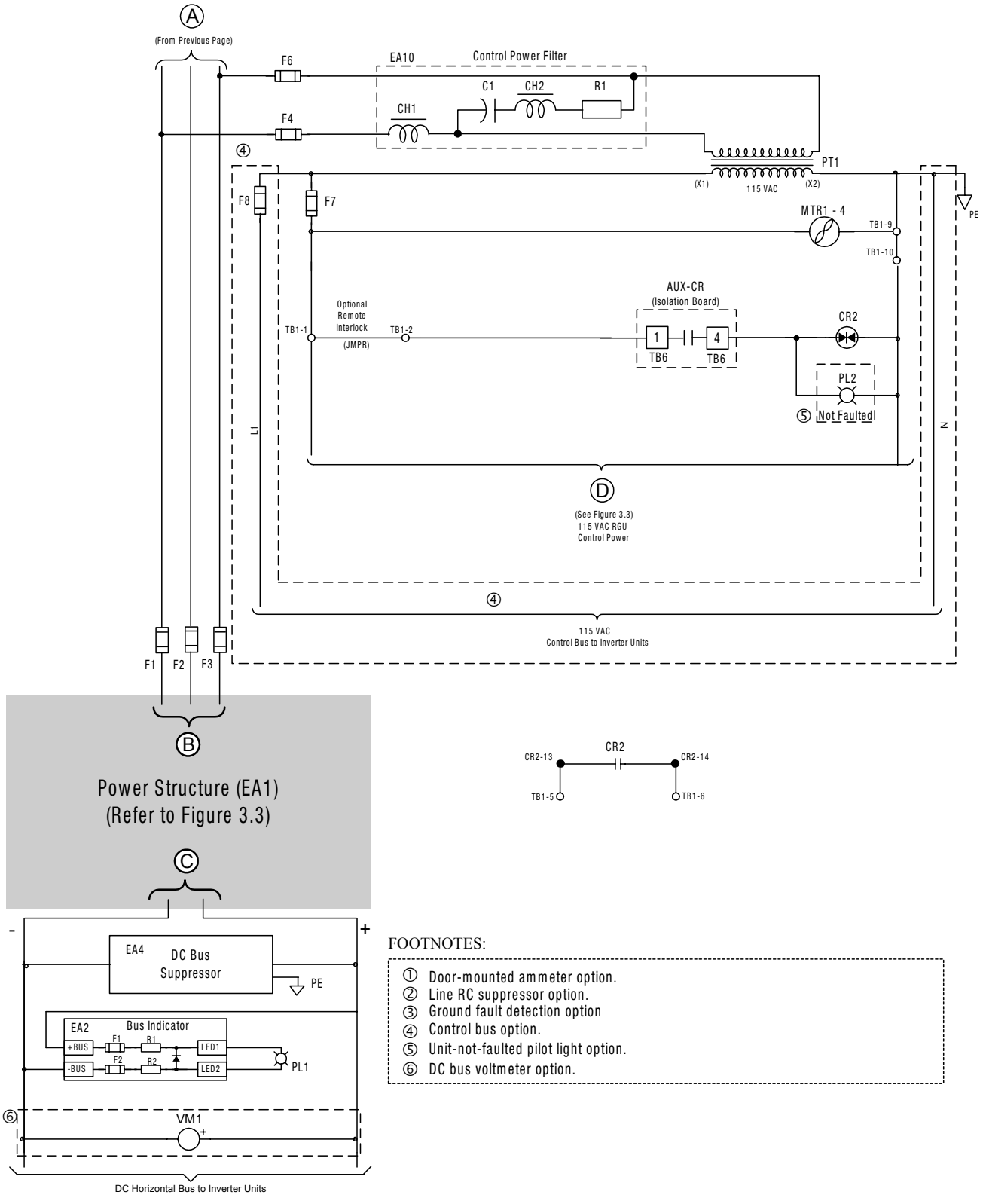
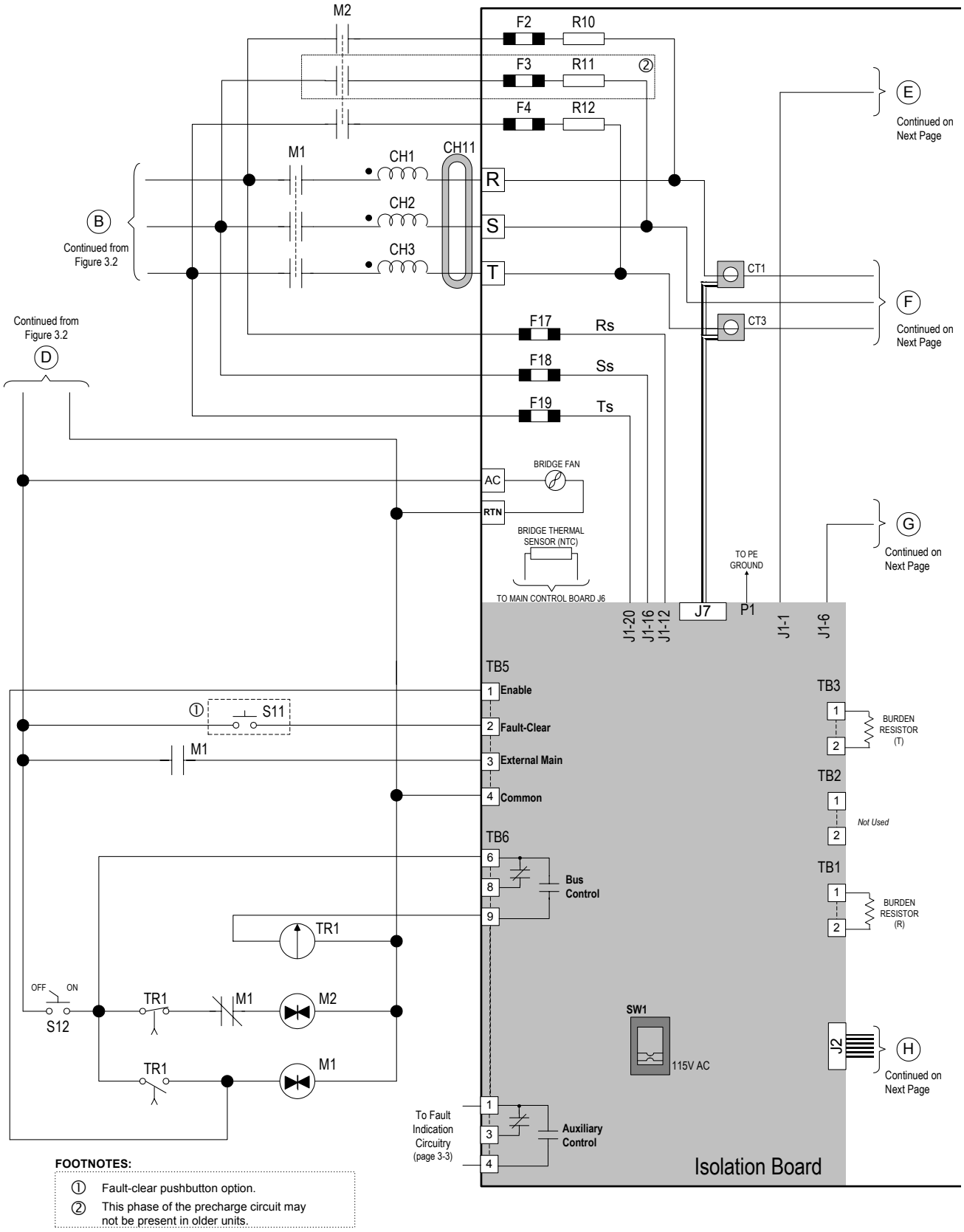


Figure 3.3
Typical RGU Power Structure Schematic



FOOTNOTES:

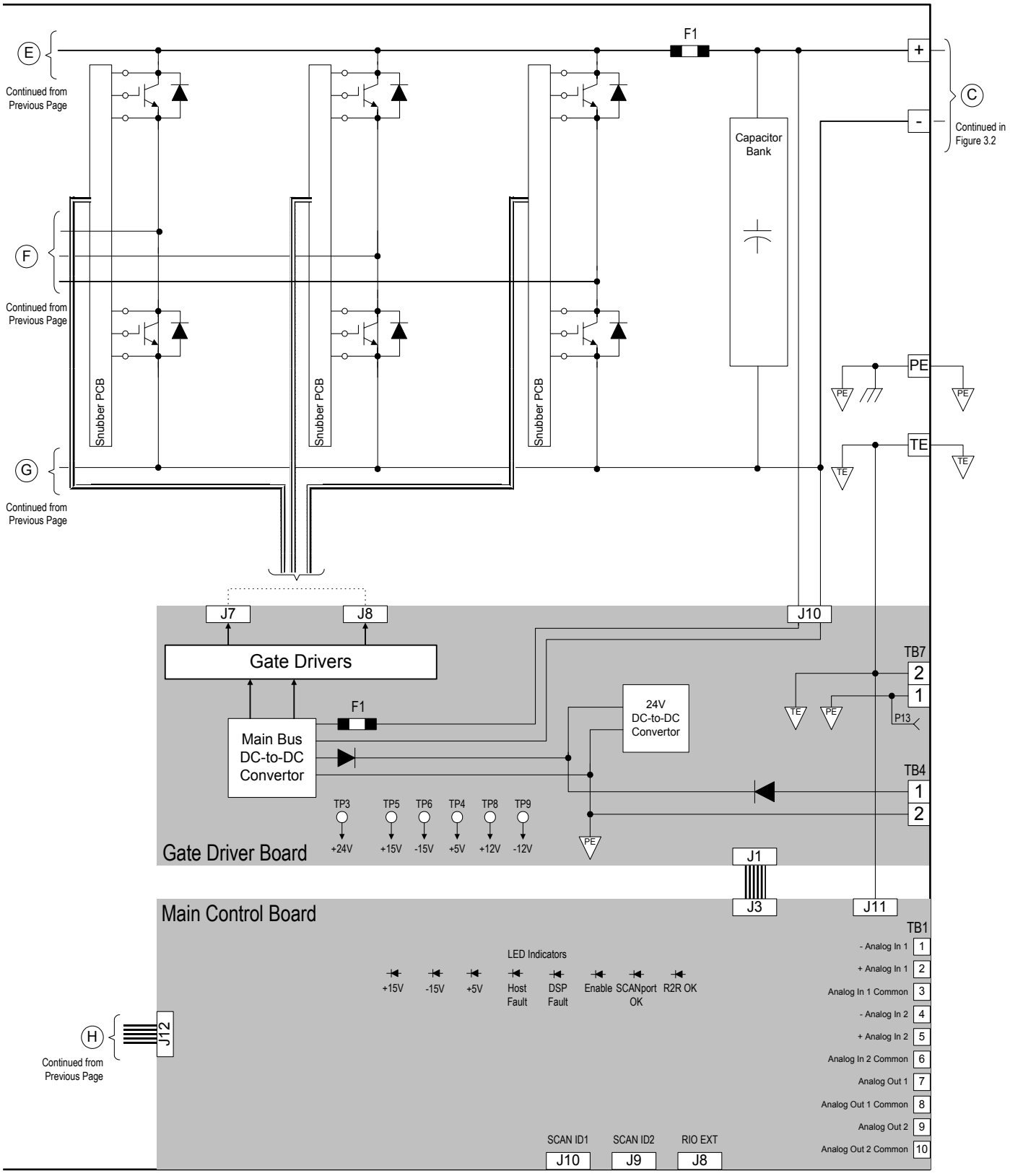
① Door-mounted ammeter option.
② Line RC suppressor option.
③ Ground fault detection option
④ Control bus option.
⑤ Unit-not-faulted pilot light option.
⑥ DC bus voltmeter option.



FOOTNOTES:

① Fault-clear pushbutton option.

② This phase of the precharge circuit may not be present in older units.


E
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F
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G
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H
Continued from Previous Page
F1
+
-
C
Continued in Figure 3.2
Capacitor Bank
Snubber PCB
Snubber PCB
Snubber PCB
PE
TE
J7
J8
J10
Gate Drivers
F1
Main Bus DC-to-DC Convertor
24V DC-to-DC Convertor
TB7
2
1
P13
TB4
1
2
TP3
TP5
TP6
TP4
TP8
TP9
+24V
+15V
-15V
+5V
+12V
-12V
Gate Driver Board
J1
J3
J11
Main Control Board
LED Indicators
+15V
-15V
+5V
Host Fault
DSP Fault
Enable
SCANport OK
R2R OK
TB1
- Analog In 1 1
+ Analog In 1 2
Analog In 1 Common 3
- Analog In 2 4
+ Analog In 2 5
Analog In 2 Common 6
Analog Out 1 7
Analog Out 1 Common 8
Analog Out 2 9
Analog Out 2 Common 10
J12
SCAN ID1
SCAN ID2
RIO EXT
J10
J9
J8

Table 3.1 Current Code K RGU Symbol to Component Cross Reference

			AC 3-Phase Input Voltage		
Symbol	**Description**	**Option ①**	**380V AC**	**460V AC**	**575V AC**
AM1	Ammeter monitoring L1	✓	200A AC		
CH1- 3	Input line reactors		510uH	510uH	832uH
CR2	Fault relay		2 NO/ 2 NC		
CT1	Current transducer	✓	200:5		
CT1, 3 (EA1)	Current transducers (on EA1)		2000:1, 0-750A range		
EA1	Power structure				
EA2	Bus indicator PCB				
EA3	Line RC suppressor PCB	✓			
EA4	DC bus suppressor assembly				
EA10	Control power filter		For 4kHz carrier frequency		
F1 (EA1)	DC bus fuse (on EA1)		350A, 700V		
F1 (gate drv)	Power supply fuse (on gate driver PCB)		1A, KTK-R		
F1 - 2 (EA2)	Bus indicator PCB fuses (on EA2)		1A, 1000V, KVR, 1-3/32" diameter, 3" length, 500AIC		
F1 - 3	Incoming 3-phase, line fuses		250A, 170M		
F2 - 4 (EA1)	Precharge fuses (on EA1)		15A, CCMR	15A, CCMR	15A, CCMR
F4, F6	Primary fuse for a 2 kVA control transformer		10A, KLDR	9A, KLDR	8A, KLDR
	Primary fuse for a 5 kVA control transformer	✓	25A, KLDR	20A, KLDR	17.5A, KLDR
F7	RGU control power fuse		5A, KLDR		
F8	Control bus fuse for a 5 kVA control transformer	✓	35A, FRN		
F14 - 16	RC suppressor fuses	✓	25A, KTK		
F17 - 19 (EA1)	AC line sensor fuses (on EA1)		1A, KLDR		
M1	Main contactor		180A		
M2	Precharge contactor		12A		
MCP1	Motor Circuit Protector		250A HMCP		
MTR1 - 4	Door-mounted fan		7", 340CFM		
PL1	DC-Bus-Energized pilot light		24V AC/DC, red, 800MR		
PL2	Unit-Not-Faulted pilot light	✓	115V AC, amber, 800MR		
PT1	Control power transformer		A 2kVA control transformer is standard, and a 5kVA control transformer is available as an option. This transformer has multiple taps to accommodate 380, 460, and 575V AC primary voltages		
R10 - 12	Precharge Resistors		6 ohm, 345 W		
S12	Start switch		1 NO/ 1 NC, 800MR		
SP1 - 3	Line-to-line MOVs		460 J, 320V AC	460 J, 320V AC	550 J, 385V AC
SP4	Neutral-to-ground MOV		760 J, 680V AC	760 J, 680V AC	760 J, 680V AC
TB1	Terminal Block		600V AC/DC, 22-14AWG, 10 terminals		
TB2	Terminal Block		600V AC/DC, 22-14AWG, 2 terminals		
TR1	Timer Relay		2 NO/ 2 NC (instantaneous), 1NO / 1 NC (on delay)		
VM1	DC bus voltmeter	✓	1000V DC		
VM2	Ground fault detection	✓	0-440V AC (meter), NO/NC contacts (relay)		

① These components are provided with RGU standard options. Not all RGUs will have these components.

Input Voltage (V AC)	DC Bus Current (A DC)	Rated DC Bus kW
380	363	211
460	364	255
575	326	276

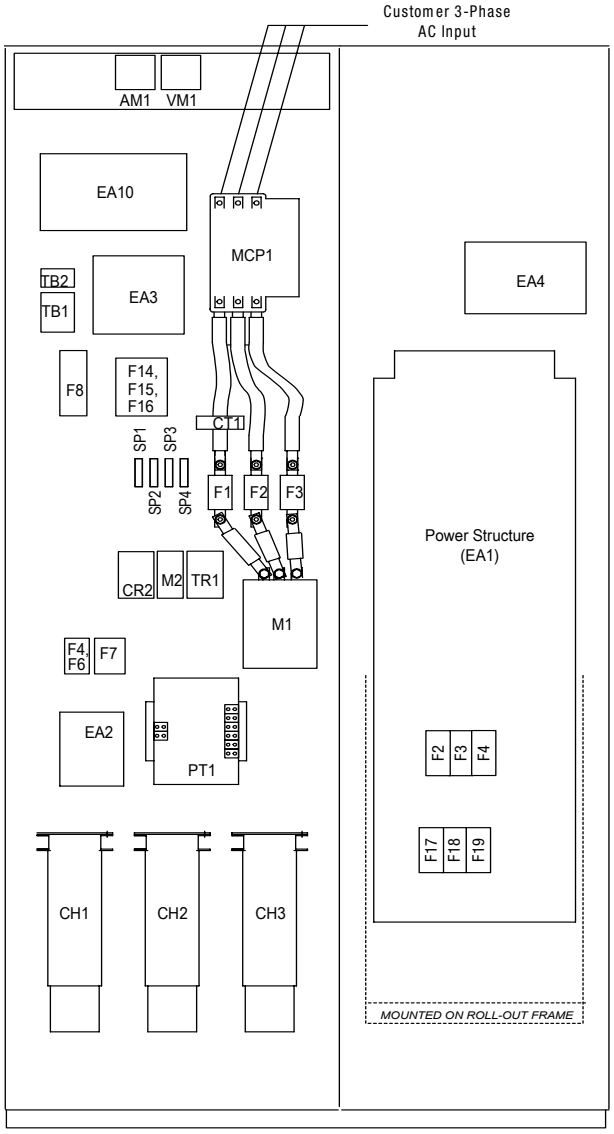
Your Current Code L RGU (Series A)

This chapter provides the following information for the current code L RGU:

- a typical cabinet layout diagram (Figure 4.1)
- a typical electrical schematic (Figure 4.2)
- a typical RGU power structure schematic (Figure 4.3)
- a symbol-to-component reference table for interpreting the electrical schematic (Table 4.1)

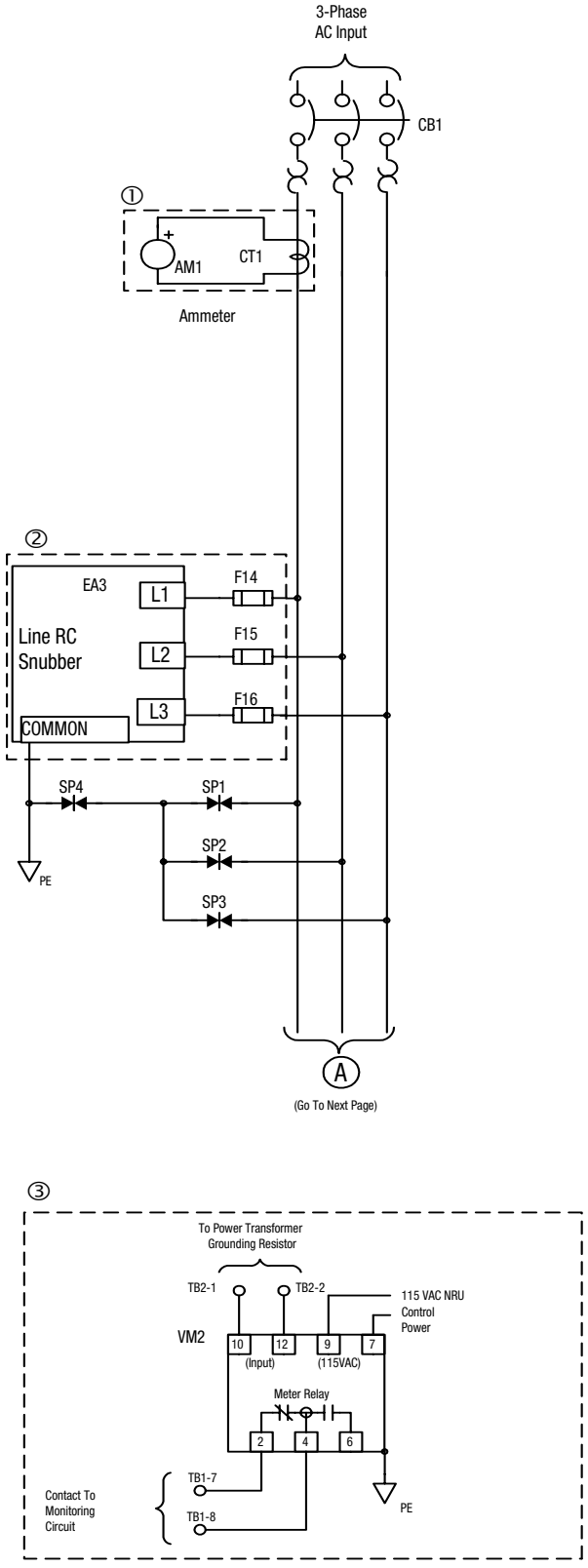
Unit Layout

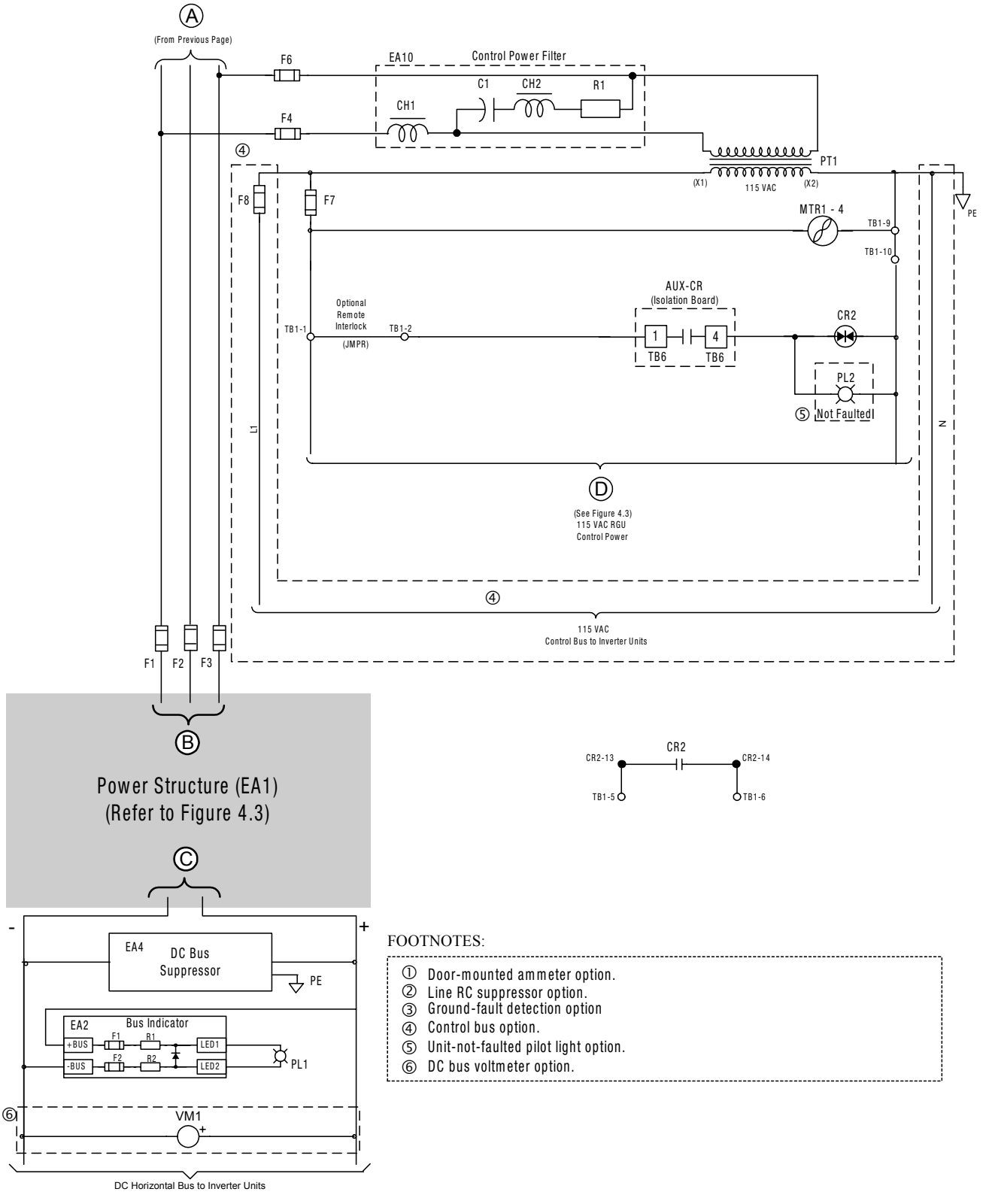
Figure 4.1
Typical Current Code L RGU Layout



Electrical Schematic

Figure 4.2
Typical Current Code L RGU Schematic

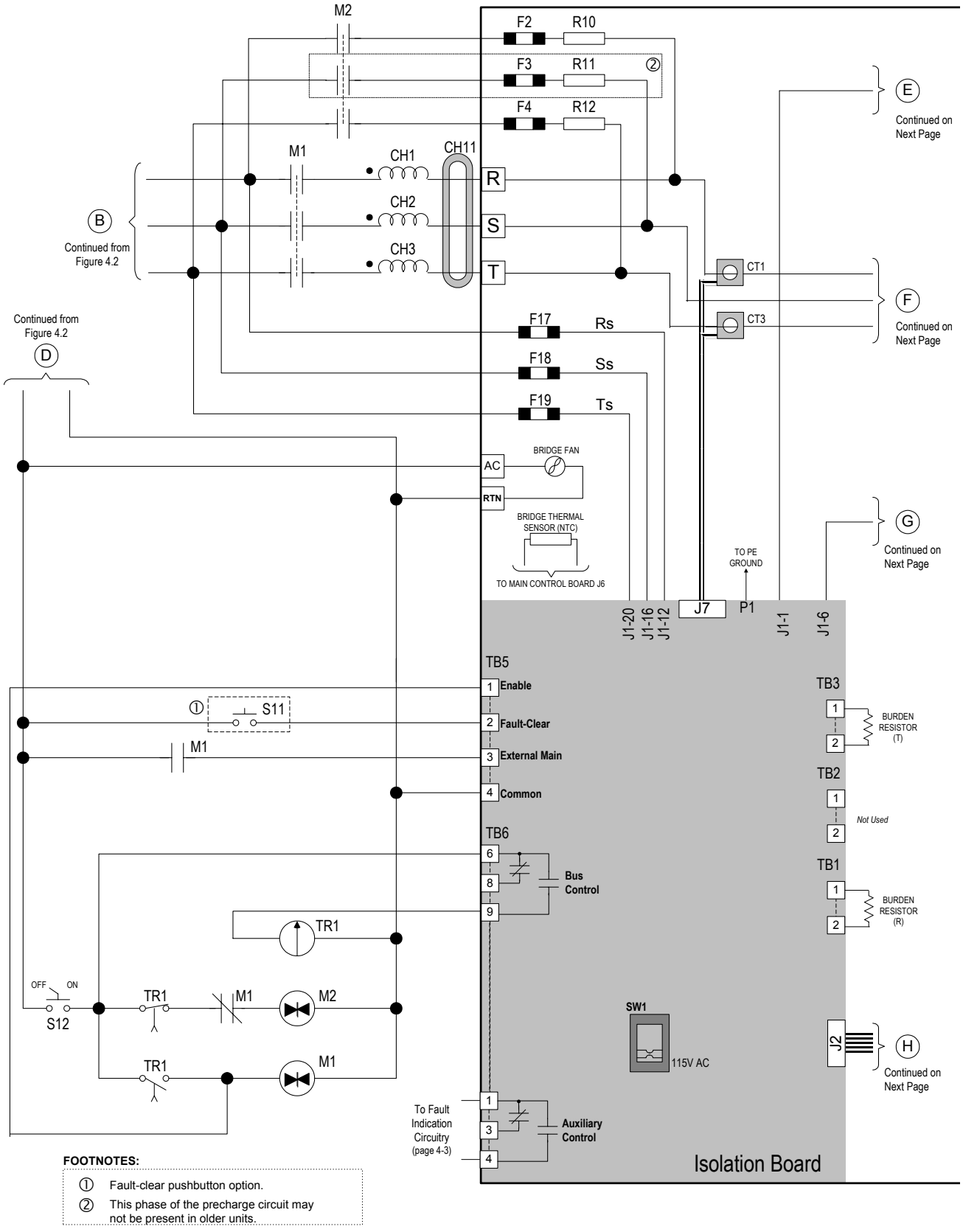




FOOTNOTES:

① Door-mounted ammeter option.
② Line RC suppressor option.
③ Ground-fault detection option
④ Control bus option.
⑤ Unit-not-faulted pilot light option.
⑥ DC bus voltmeter option.

Figure 4.3
Typical RGU Power Structure Schematic



FOOTNOTES:

① Fault-clear pushbutton option.
② This phase of the precharge circuit may not be present in older units.

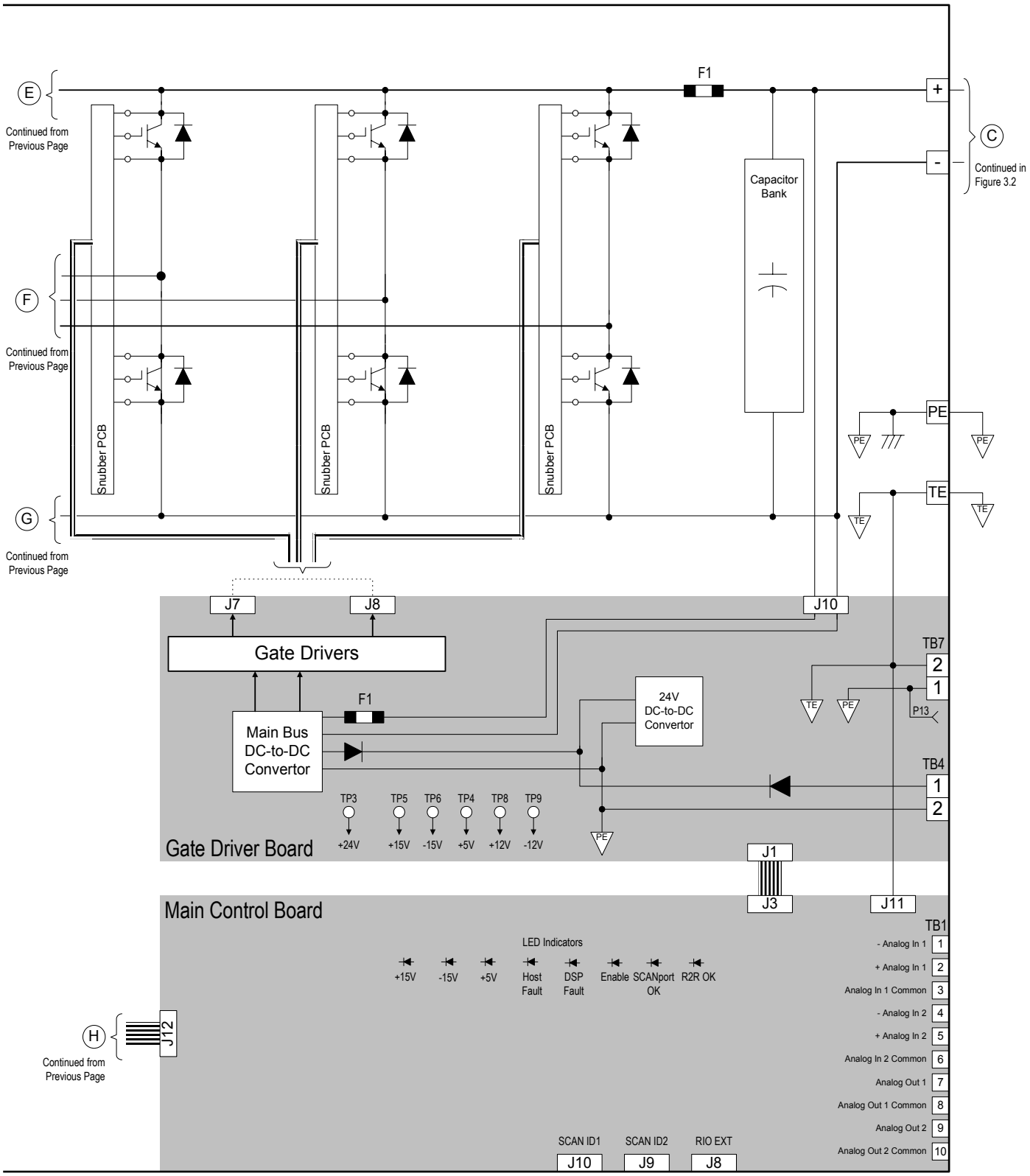

E
Continued from Previous Page
F1
+
-
C
Continued in Figure 3.2
Capacitor Bank
F
Continued from Previous Page
Snubber PCB
Snubber PCB
Snubber PCB
G
Continued from Previous Page
PE
TE
J7
J8
J10
Gate Drivers
TB7
2
1
F1
24V DC-to-DC Convertor
Main Bus DC-to-DC Convertor
P13
TB4
1
2
TP3
TP5
TP6
TP4
TP8
TP9
+24V
+15V
-15V
+5V
+12V
-12V
Gate Driver Board
J1
J3
J11
Main Control Board
TB1
LED Indicators
+15V
-15V
+5V
Host Fault
DSP Fault
Enable
SCANport OK
R2R OK
- Analog In 1 1
+ Analog In 1 2
Analog In 1 Common 3
- Analog In 2 4
+ Analog In 2 5
Analog In 2 Common 6
Analog Out 1 7
Analog Out 1 Common 8
Analog Out 2 9
Analog Out 2 Common 10
H
J12
Continued from Previous Page
SCAN ID1
SCAN ID2
RIO EXT
J10
J9
J8

Table 4.1 Current Code L RGU Symbol to Component Cross Reference

			AC 3-Phase Input Voltage		
Symbol	**Description**	**Option ①**	**380V AC**	**460V AC**	**575V AC**
AM1	Ammeter monitoring L1	✓	400A AC		
CH1- 3	Input line reactors		317uH	317uH	404uH
CR2	Fault relay		2 NO/ 2 NC		
CT1	Current transducer	✓	400:5		
CT1, 3 (EA1)	Current transducers (on EA1)		4000:1, 0-1500A range		
EA1	Power structure				
EA2	Bus indicator PCB				
EA3	Line RC suppressor PCB	✓			
EA4	DC bus suppressor assembly				
EA10	Control power filter		For 2kHz carrier frequency		
F1 (EA1)	DC bus fuse (on EA1)		600A, 700V		
F1 (gate drv)	Power supply fuse (on gate driver PCB)		1A, KTK-R		
F1 - 2 (EA2)	Bus indicator PCB fuses (on EA2)		1A, 1000V, KVR, 1-3/32" diameter, 3" length, 500AIC		
F1 - 3	Incoming 3-phase, line fuses		500A, 170M		
F2 - 4 (EA1)	Precharge fuses (on EA1)		15A, CCMR	15A, CCMR	15A, CCMR
F4, F6	Primary fuse for a 5 kVA control transformer		25A, KLDR	20A, KLDR	17.5A, KLDR
F7	RGU control power fuse		9A, KLDR		
F8	Control bus fuse for a 5 kVA control transformer	✓	30A, KLDR		
F14 - 16	RC suppressor fuses	✓	25A, KTK		
F17 - 19 (EA1)	AC line sensor fuses (on EA1)		1A, KLDR		
M1	Main contactor		250A		
M2	Precharge contactor		12A		
MCP1	Motor Circuit Protector		400A, HMCP		
MTR1 - 4	Door-mounted fan		7", 340CFM		
PL1	DC-Bus-Energized pilot light		24V AC/DC, red, 800MR		
PL2	Unit-Not-Faulted pilot light	✓	115V AC, amber, 800MR		
PT1	Control power transformer		A 5kVA control transformer is standard. This transformer has multiple taps to accommodate 380, 460, and 575V AC primary voltages.		
R10 - 12	Precharge Resistors		6 ohm, 345 W		
S11	Fault clear pushbutton	✓	1 NO, 800MR		
S12	Start switch		1 NO/ 1 NC, 800MR		
SP1 - 3	Line-to-line MOVs		460 J, 320V AC	460 J, 320V AC	550 J, 385V AC
SP4	Neutral-to-ground MOV		760 J, 680V AC	760 J, 680V AC	760 J, 680V AC
TB1	Terminal Block		600V AC/DC, 22-14AWG, 10 terminals		
TB2	Terminal Block		600V AC/DC, 22-14AWG, 2 terminals		
TR1	Timer Relay		2 NO/ 2 NC (instantaneous), 1NO / 1 NC (on delay)		
VM1	DC bus voltmeter	✓	1000V DC		
VM2	Ground fault detection	✓	0-440V AC (meter), NO/NC contacts (relay)		

① These components are provided with RGU standard options. Not all RGUs will have these components.

Input Voltage (V AC)	DC Bus Current (A DC)	Rated DC Bus kW
380	746	433
460	749	524
575	686	582

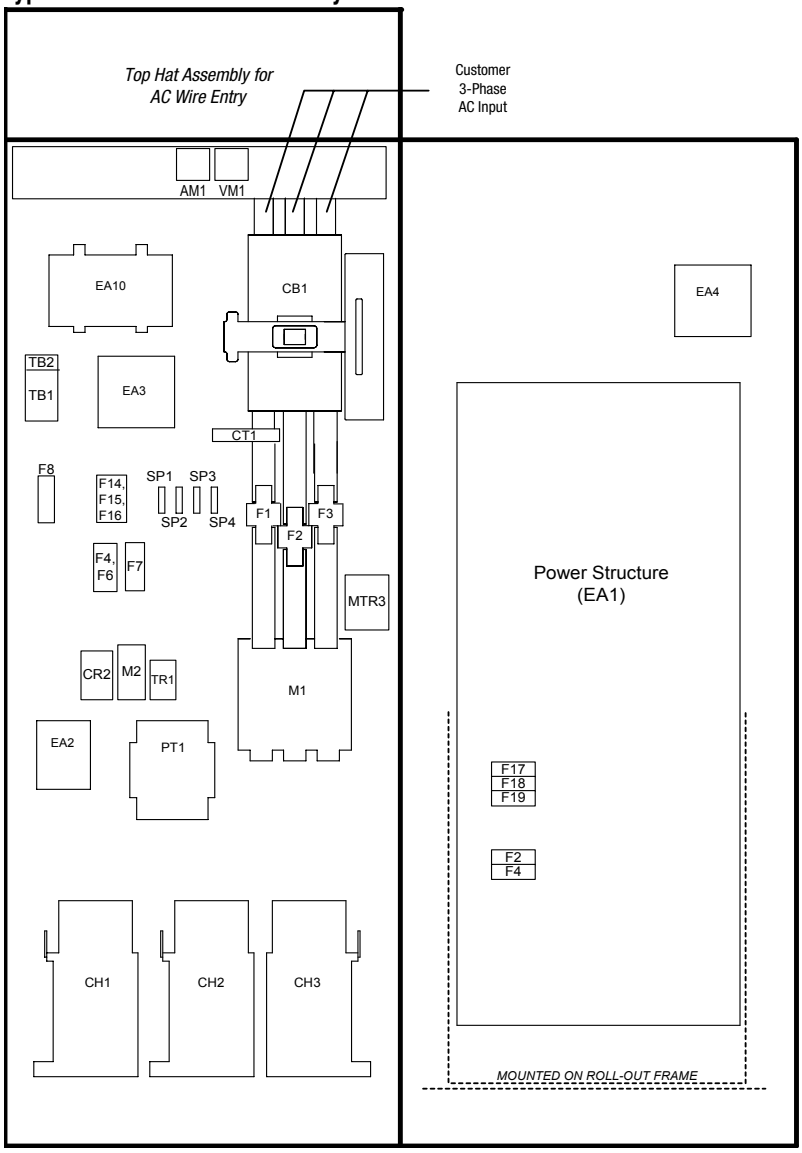
Your Current Code M RGU (Series B)

This chapter provides the following information for the current code M RGU:

- a typical cabinet layout diagram (5)
- a typical electrical schematic (Figure 5.2)
- a typical RGU power structure schematic (Figure 5.3)
- a symbol-to-component reference table for interpreting the electrical schematic (Table 5.1)

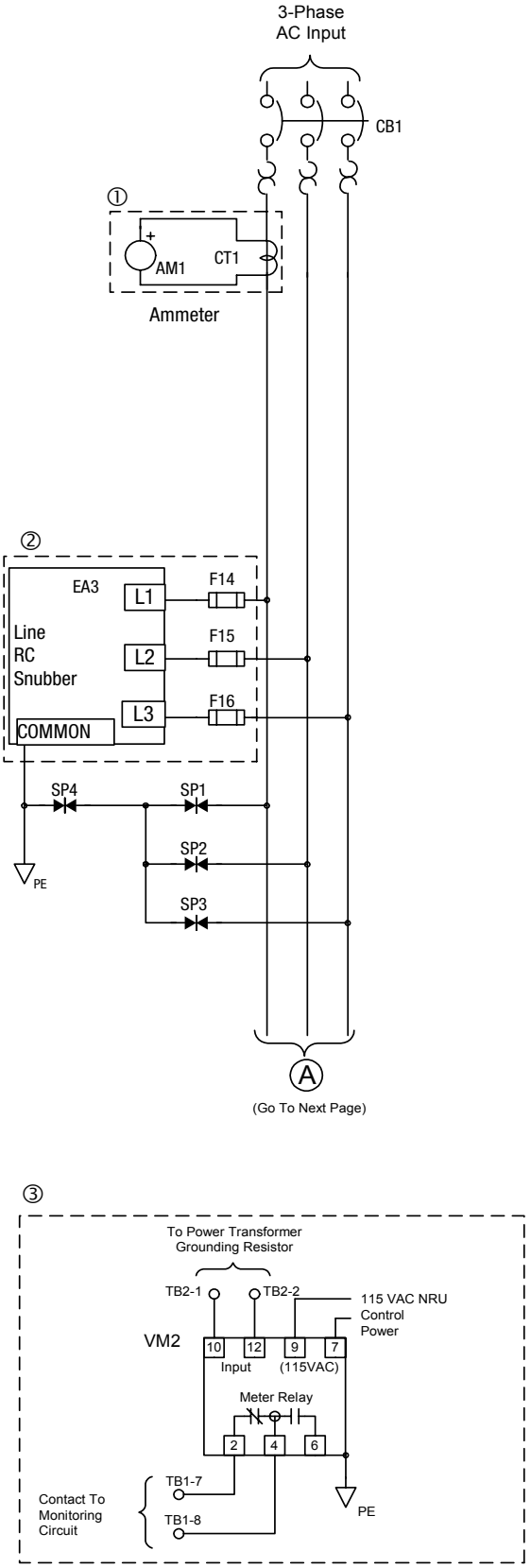
Unit Layout

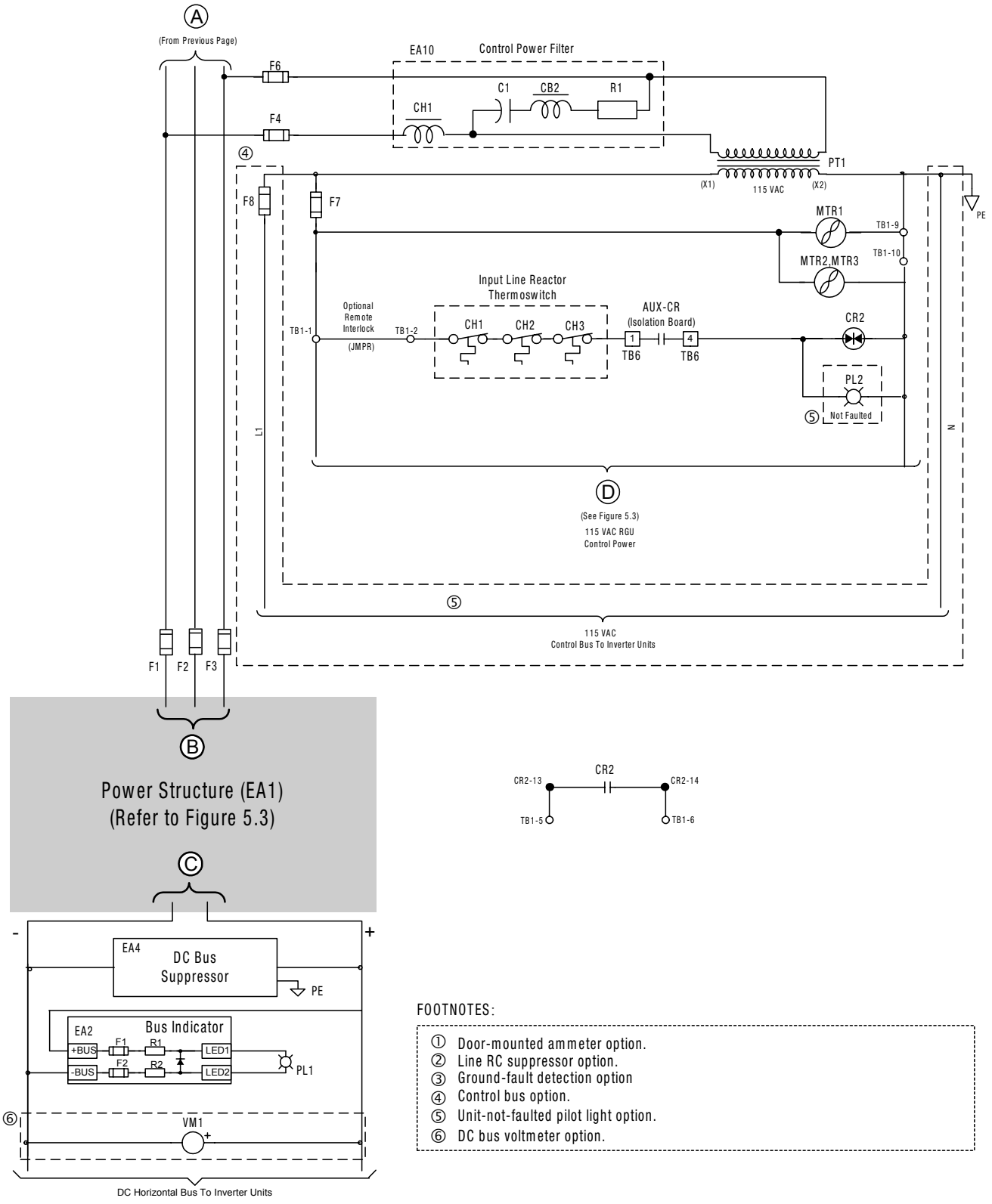
Figure 5.1
Typical Current Code M RGU Layout



Electrical Schematic

Figure 5.2
Typical Current Code M RGU Schematic

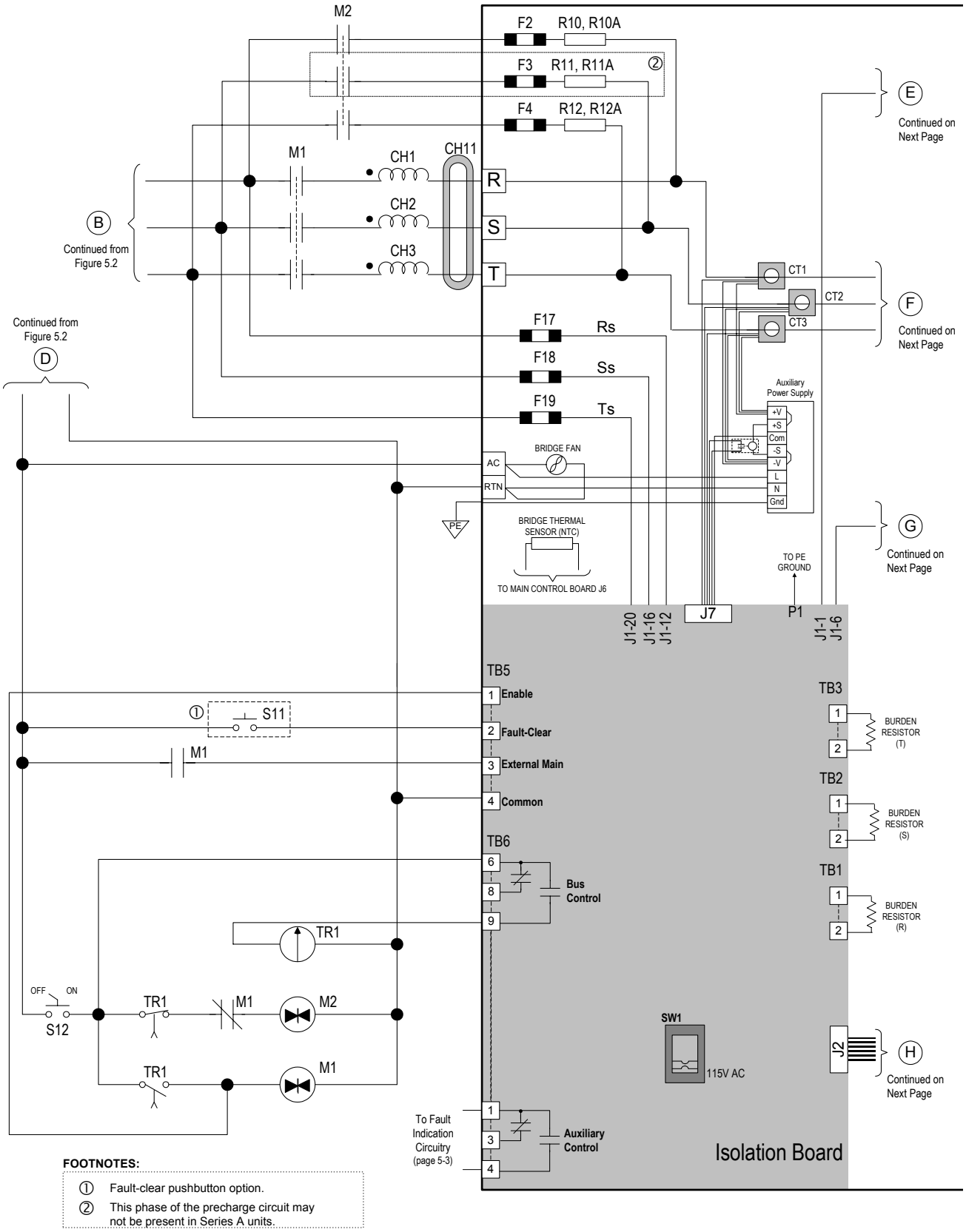




FOOTNOTES:

① Door-mounted ammeter option.
② Line RC suppressor option.
③ Ground-fault detection option
④ Control bus option.
⑤ Unit-not-faulted pilot light option.
⑥ DC bus voltmeter option.

Figure 5.3
Typical RGU Power Structure Schematic



FOOTNOTES:

① Fault-clear pushbutton option.
② This phase of the precharge circuit may not be present in Series A units.

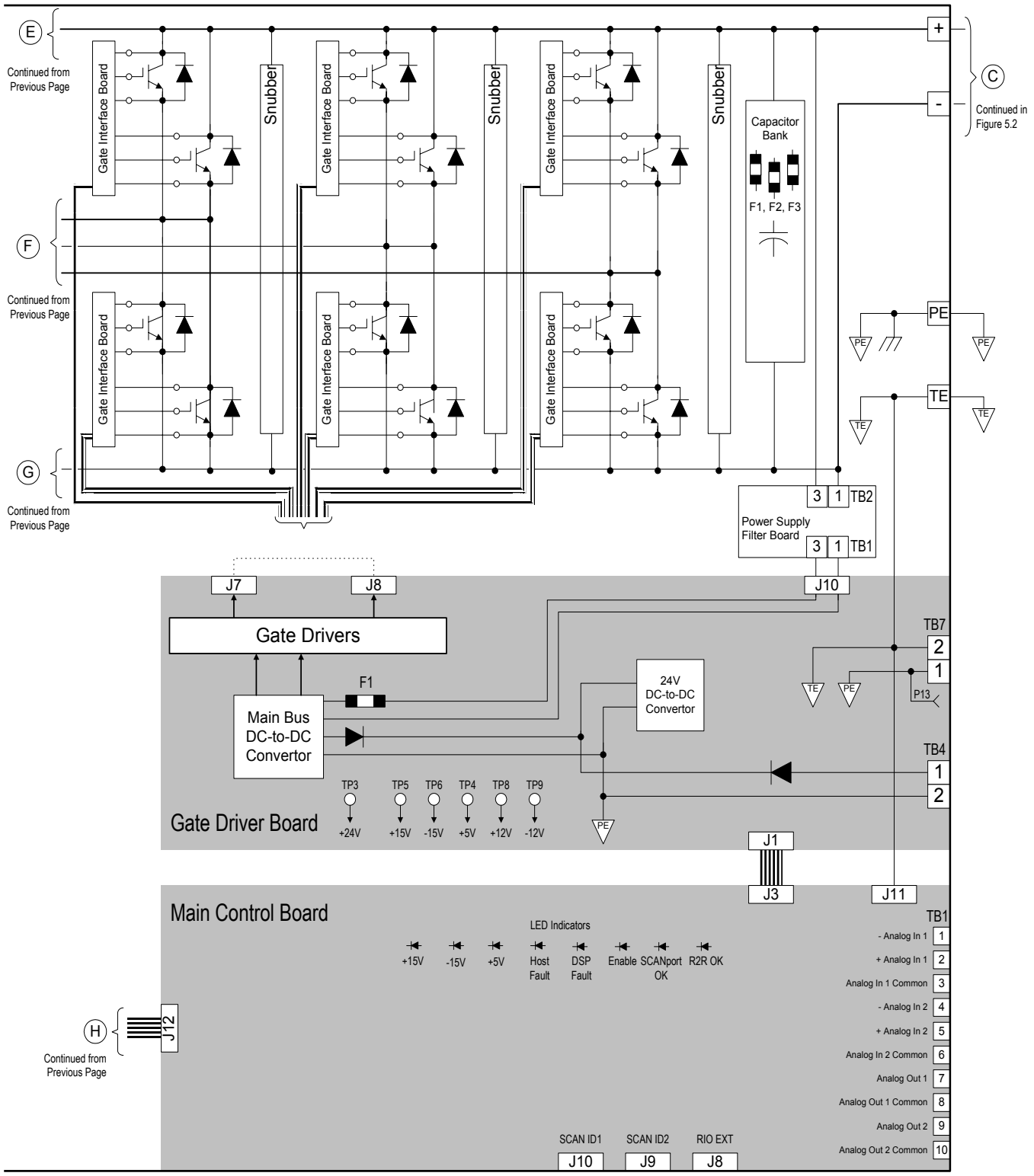

E
Continued from Previous Page
F
Continued from Previous Page
G
Continued from Previous Page
H
Continued from Previous Page
Gate Interface Board
Snubber
Capacitor Bank
F1, F2, F3
+
-
C
Continued in Figure 5.2
PE
TE
3 1 TB2
Power Supply Filter Board
3 1 TB1
J7
J8
J10
Gate Drivers
F1
Main Bus DC-to-DC Convertor
24V DC-to-DC Convertor
TB7
2
1
P13
TB4
1
2
TP3 TP5 TP6 TP4 TP8 TP9
+24V +15V -15V +5V +12V -12V
Gate Driver Board
J1
J3
J11
Main Control Board
LED Indicators
+15V -15V +5V Host Fault DSP Fault Enable SCANport OK R2R OK
TB1
- Analog In 1 1
+ Analog In 1 2
Analog In 1 Common 3
- Analog In 2 4
+ Analog In 2 5
Analog In 2 Common 6
Analog Out 1 7
Analog Out 1 Common 8
Analog Out 2 9
Analog Out 2 Common 10
SCAN ID1 SCAN ID2 RIO EXT
J10 J9 J8
J12

Table 5.1 Current Code M RGU Symbol to Component Cross Reference

			AC 3-Phase Input Voltage		
Symbol	**Description**	**Option ①**	**380V AC**	**460V AC**	**575V AC**
AM1	Ammeter monitoring L1	✓	800A AC		
CB1	Circuit breaker		800A, HND		
CH1- 3	Input line reactors		137uH	137uH	191uH
CR2	Fault relay		2 NO/ 2 NC		
CT1	Current transducer	✓	800:5		
CT1, 3 (EA1)	Current transducers (on EA1)		3000:1, 0-1000A range		
EA1	RGU Power structure				
EA2	Bus indicator PCB				
EA3	Line RC suppressor PCB	✓			
EA4	DC bus suppressor assembly				
EA10	Control power filter		For 2kHz carrier frequency ②		
F1 (gate drv)	Power supply fuse, gate driver PCB		1A, KTK-R		
F1 - 2 (EA2)	Bus indicator PCB fuses (on EA2)		1A, 1000V, KVR, 1-3/32" diameter, 3" length, 500AIC		
F1 - 3	Incoming 3-phase, line fuses		1000A, 170M		
F2 - 4 (EA1)	Precharge fuses (on EA1)		25A, KLDR	25A, KLDR	30A, KLDR
F4, F6	Primary fuse for a 5 kVA control transformer		25A, KLDR ②	20A, KLDR ②	17.5A, KLDR
F7	RGU control power fuse		12A, KLDR		
F8	Control bus fuse for a 5 kVA control transformer	✓	25A, KLDR		
F14 - 16	RC suppressor fuses	✓	25A, KTK		
F17 - 19 (EA1)	AC line sensor fuses (on EA1)		1A, KLDR		
M1	Main contactor		600A		
M2	Precharge contactor		24A		
MTR1 - 2	Door-mounted fan		12", 1200CFM		
PL1	DC-Bus-Energized pilot light		24V AC/DC, red, 800MR		
PL2	Unit-Not-Faulted pilot light	✓	115V AC, amber, 800MR		
PT1	Control power transformer		A 5kVA control transformer is standard. This transformer has multiple taps to accommodate 380, 460, and 575V AC primary voltages.		
R10 - 12, R10 - 12A	Precharge Resistors		6 ohm, 345 W		
S11	Fault reset pushbutton	✓	1 NO, 800MR		
S12	Start switch		1 NO/ 1 NC, 800MR		
SP1 - 3	Line-to-line MOVs		460 J, 320V AC	460 J, 320V AC	550 J, 385V AC
SP4	Neutral-to-ground MOV		760 J, 680V AC	760 J, 680V AC	760 J, 680V AC
TB1	Terminal Block		600V AC/DC, 22-14AWG, 10 terminals		
TB2	Terminal Block		600V AC/DC, 22-14AWG, 2 terminals		
TR1	Timer Relay		2 NO/ 2 NC (instantaneous), 1NO / 1 NC (on delay)		
VM1	DC bus voltmeter	✓	1000V DC		
VM2	Ground fault detection	✓	0-440V AC (meter), NO/NC contacts (relay)		

① These components are provided with RGU standard options. Not all RGUs will have these components.

② If your M-code RGU is equipped with a 4kHz carrier frequency control power filter (EA10), then F4 and F6 will be 17.5 KLDR (380V AC, 5kVA transformer) or will be 15A KLDR (460V AC, 5k VA transformer). All other fuses remain the same.

Input Voltage (V AC)	DC Bus Current (A DC)	Rated DC Bus kW
380	997	578
460	1000	700
575	914	775

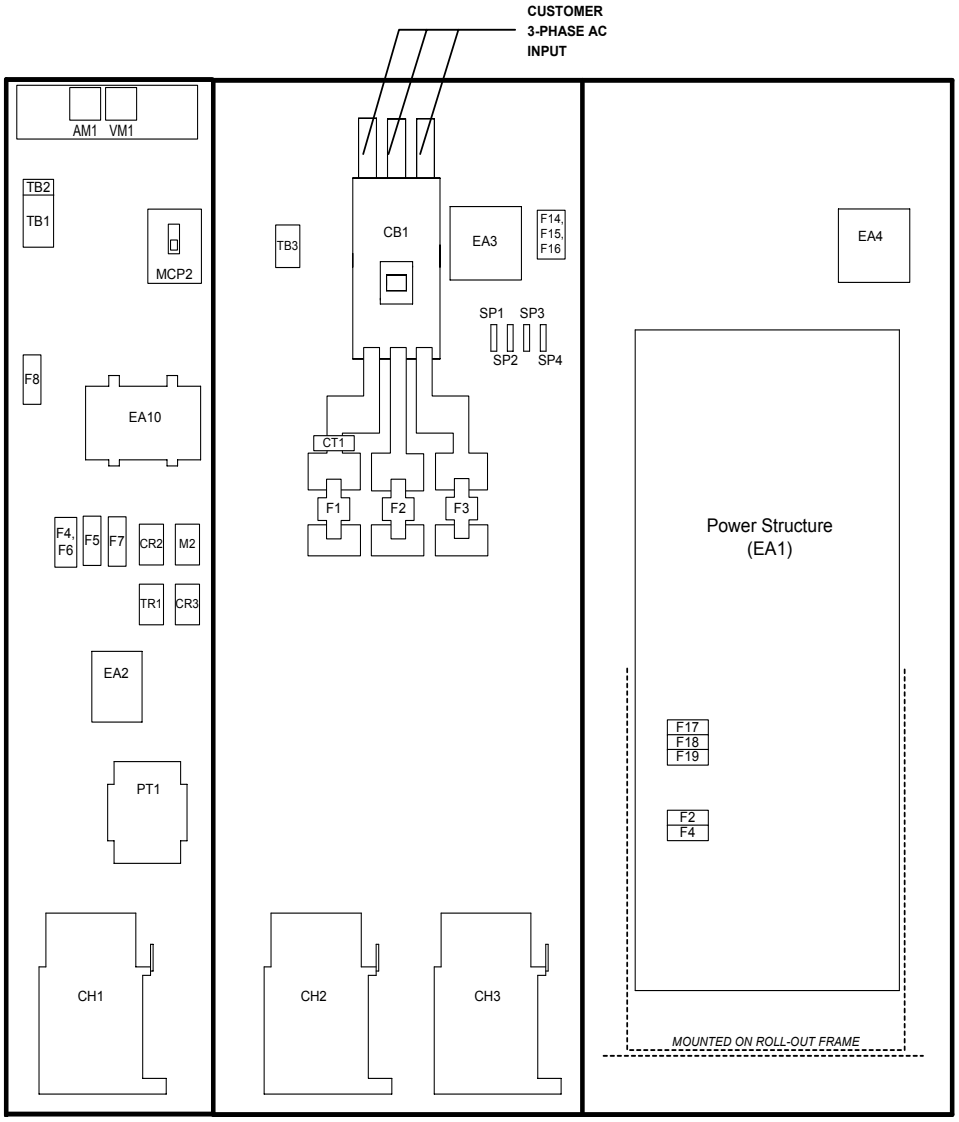
Your Current Code N RGU (Series B)

This chapter provides the following information for the current code N RGU:

- a typical cabinet layout diagram (Figure 6.1)
- a typical electrical schematic (Figure 6.2)
- a typical RGU power structure schematic (Figure 6.3)
- a symbol-to-component reference table for interpreting the electrical schematic (Table 6.1)

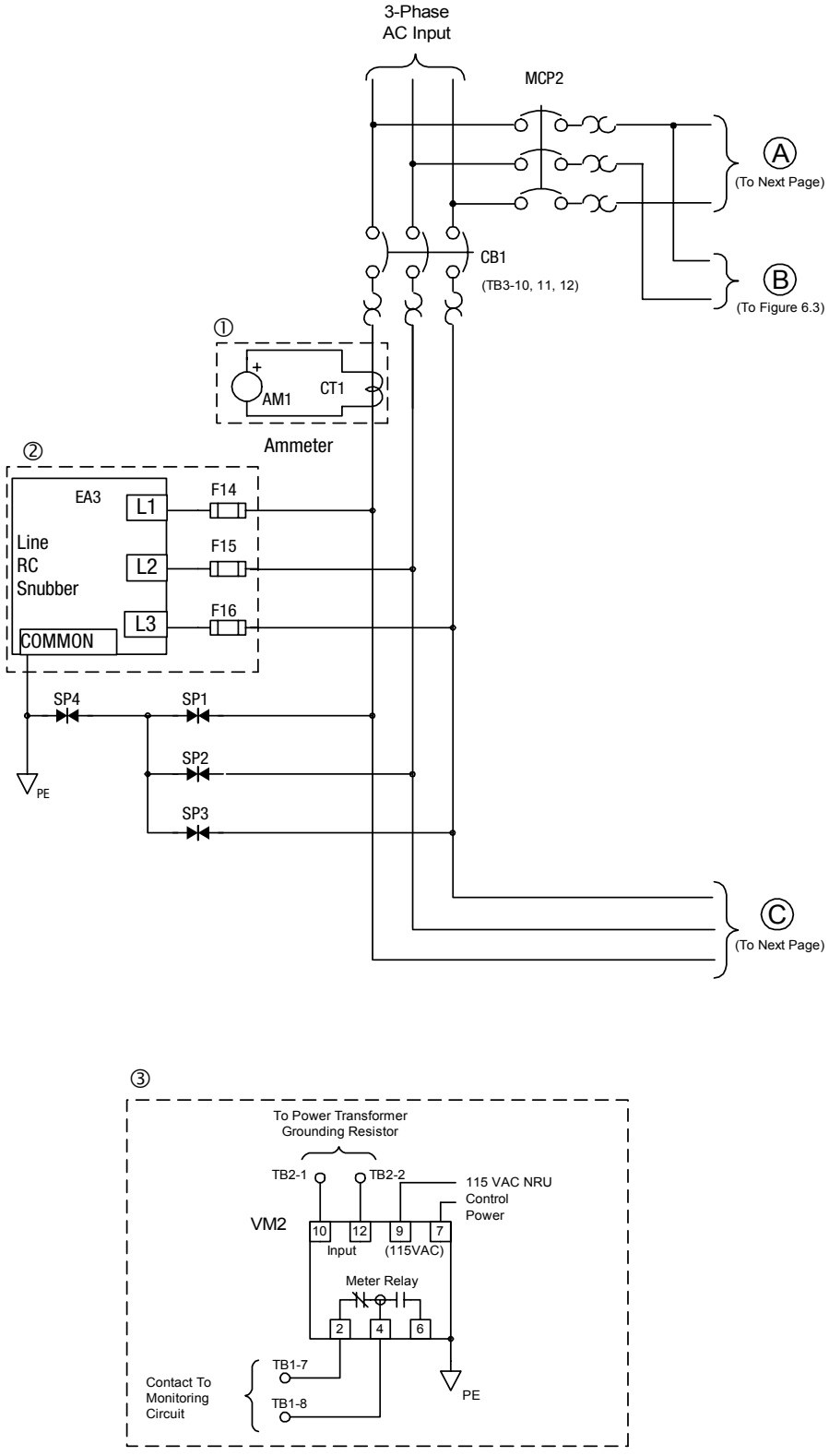
Unit Layout

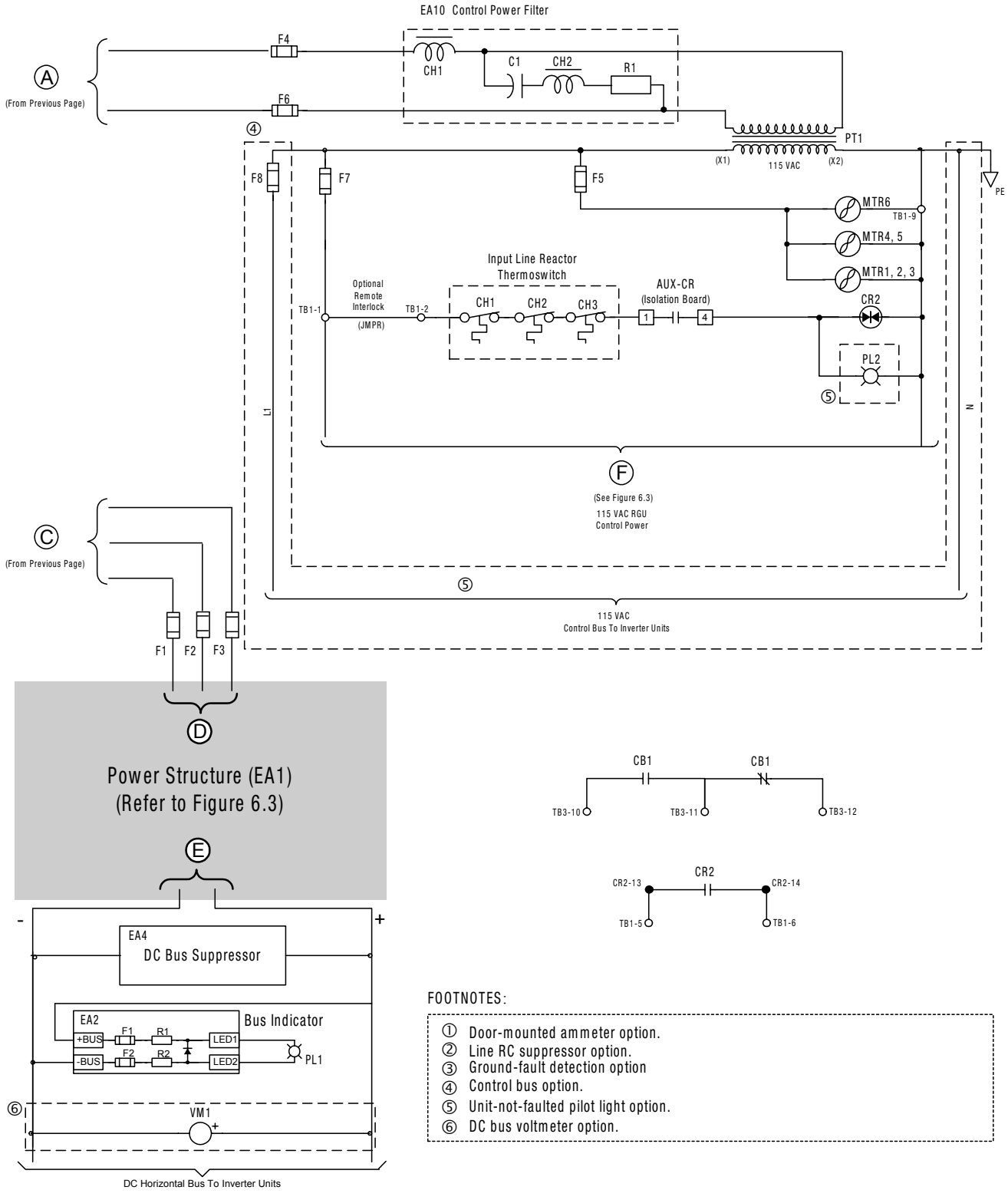
Figure 6.1
Typical Current Code N RGU Layout



Electrical Schematic

Figure 6.2
Typical Current Code N RGU Schematic

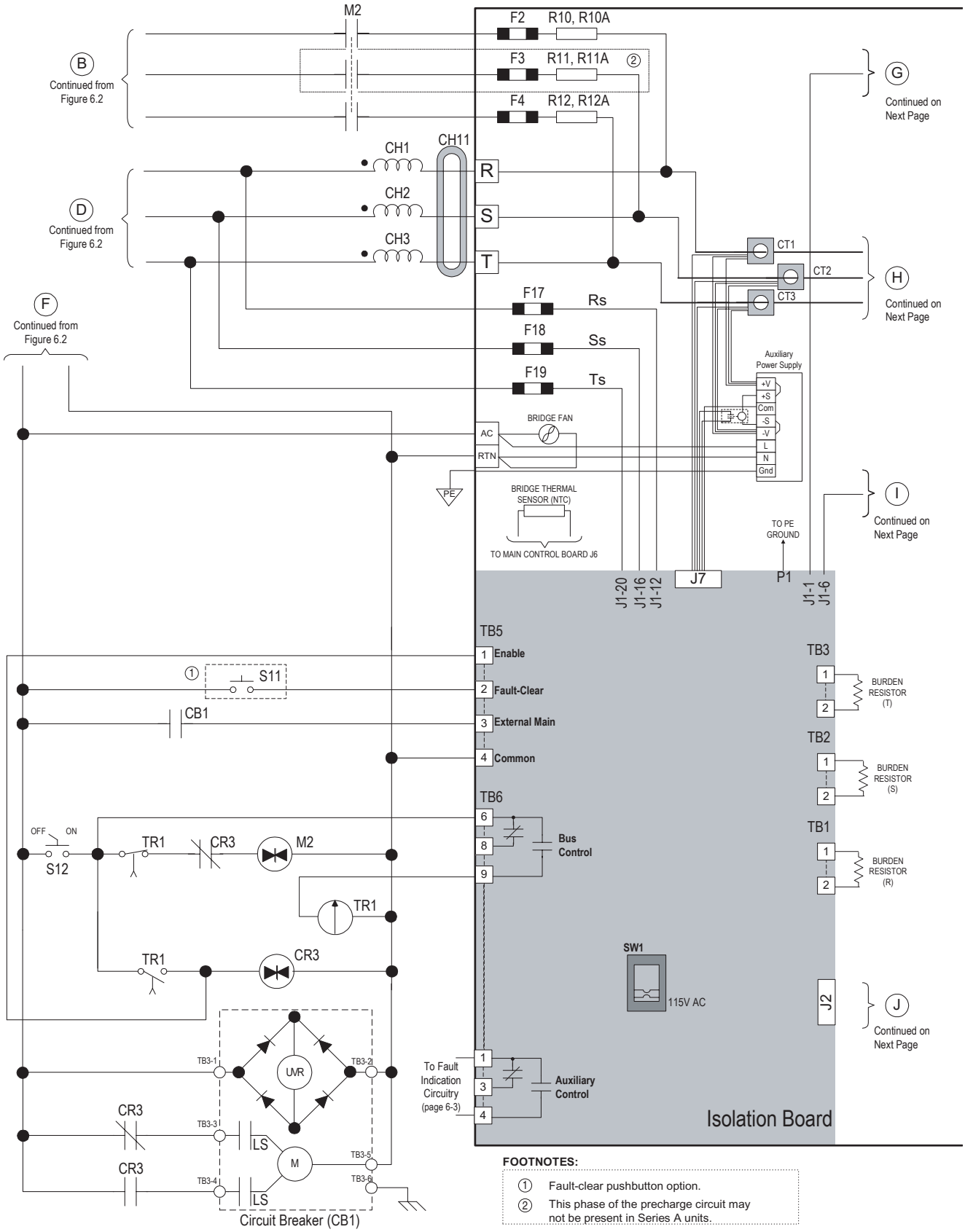




FOOTNOTES:

① Door-mounted ammeter option.
② Line RC suppressor option.
③ Ground-fault detection option
④ Control bus option.
⑤ Unit-not-faulted pilot light option.
⑥ DC bus voltmeter option.

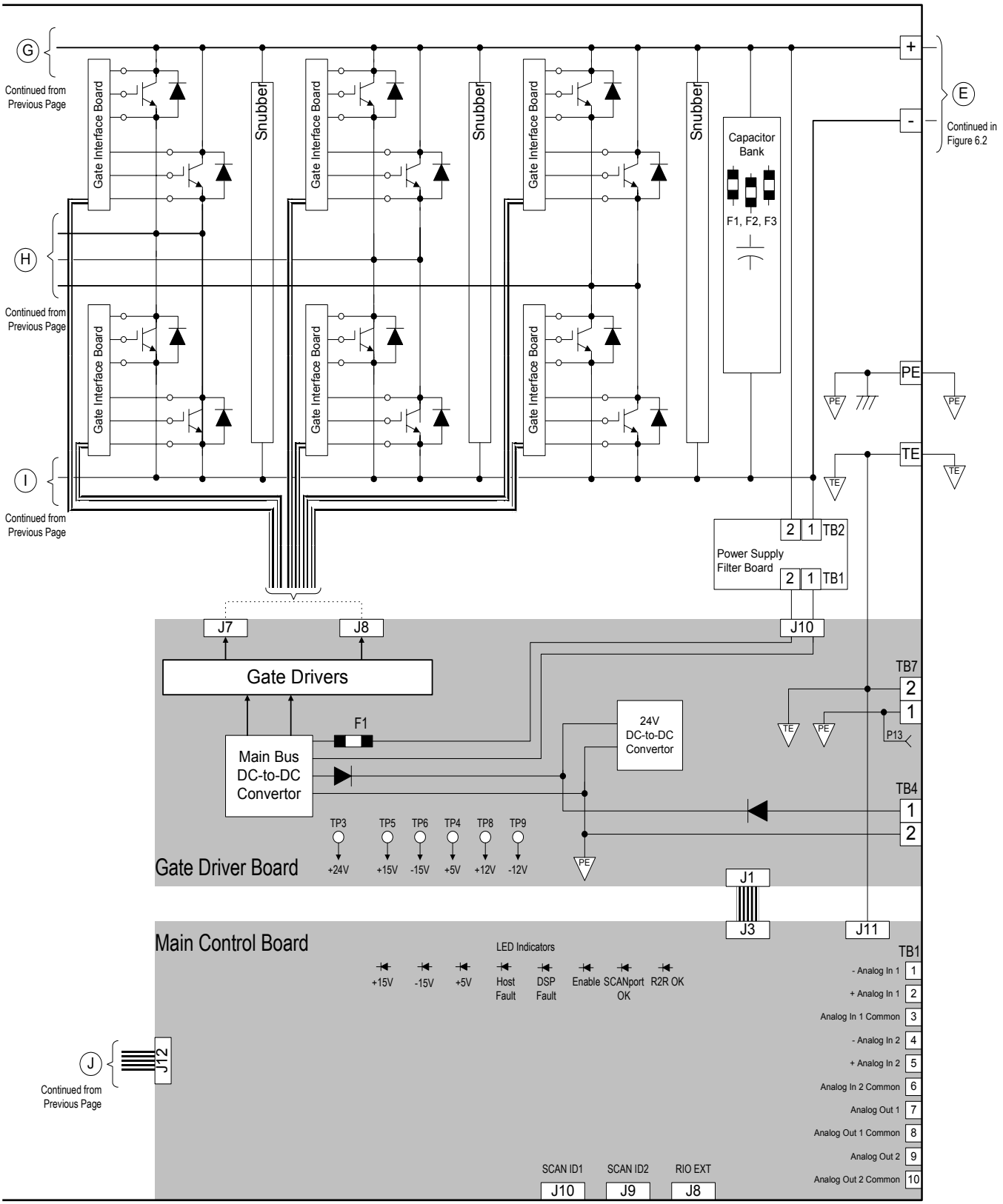
Figure 6.3
Typical RGU Power Structure Schematic



FOOTNOTES:

① Fault-clear pushbutton option.

② This phase of the precharge circuit may not be present in Series A units.


G
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H
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I
Continued from Previous Page
Gate Interface Board
Snubber
+
-
E
Continued in Figure 6.2
Capacitor Bank
F1, F2, F3
PE
TE
2 1 TB2
Power Supply Filter Board
2 1 TB1
J7
J8
J10
Gate Drivers
F1
Main Bus DC-to-DC Convertor
24V DC-to-DC Convertor
TB7
P13
TB4
TP3 TP5 TP6 TP4 TP8 TP9
+24V +15V -15V +5V +12V -12V
Gate Driver Board
J1
J3
J11
Main Control Board
LED Indicators
+15V -15V +5V Host Fault DSP Fault Enable SCANport OK R2R OK
TB1
- Analog In 1 1
+ Analog In 1 2
Analog In 1 Common 3
- Analog In 2 4
+ Analog In 2 5
Analog In 2 Common 6
Analog Out 1 7
Analog Out 1 Common 8
Analog Out 2 9
Analog Out 2 Common 10
SCAN ID1 J10
SCAN ID2 J9
RIO EXT J8
J
J12
Continued from Previous Page

Table 6.1 Current Code N RGU Symbol to Component Cross Reference

			AC 3-Phase Input Voltage		
Symbol	**Description**	**Option ①**	**380V AC**	**460V AC**	**575V AC**
AM1	Ammeter monitoring L1	✓	1000A AC		
CB1	Circuit breaker		1200A, HND		
CH1- 3	Input line reactors		102uH	102uH	144uH
CR2	Fault relay		2 NO/ 2 NC		
CR3	Pilot relay		2 NO/ 2 NC		
CT1	Current transducer	✓	800:5		
CT1, 3 (EA1)	Current transducers (on EA1)		3000:1, 0-1000A range		
EA1	Power structure				
EA2	Bus indicator PCB				
EA3	Line RC suppressor PCB	✓			
EA4	DC bus suppressor assembly				
EA10	Control power filter		For 2kHz carrier frequency		
F1 (gate drv)	Power supply fuse, gate driver PCB		1A, KTK-R		
F1 - 2 (EA2)	Bus indicator PCB fuses (on EA2)		1A, 1000V, KVR, 1-3/32" diameter, 3" length, 500AIC		
F1 - 3 (EA1)	DC bus fuses (on EA1)		350A, 700V		
F1 - 3	Incoming 3-phase, line fuses		1250A, 170M		
F2 - 4 (EA1)	Precharge fuses (on EA1)		25A, KLDR	25A, KLDR	30A, KLDR
F4, F6	Primary fuse for a 5 kVA control transformer		25A, KLDR	20A, KLDR	17.5A, KLDR
	Primary fuse for a 10 kVA control transformer	✓	35A, FRS	30A, KLDR	25A, KLDR
F5	Fan power fuse		10A, KLDR		
F7	RGU control power fuse		15A, KLDR		
F8	Control bus fuse for a 5 kVA control transformer	✓	50A, FRN		
F14 - 16	RC suppressor fuses	✓	25A, KTK		
F17 - 19 (EA1)	AC line sensor fuses (on EA1)		1A, KLDR		
M2	Precharge contactor		24A		
MCP2	Motor circuit protector		30A, HMCP		
MTR1 - 3	Door-mounted fan		11", 1100 CFM		
MTR4 - 6	Door-mounted fan		7", 340 CFM		
PL1	DC-Bus-Energized pilot light		24V AC/DC, red, 800MR		
PL2	Unit-Not-Faulted pilot light	✓	115V AC, amber, 800MR		
PT1	Control power transformer		A 5kVA control transformer is standard, and a 5kVA control transormer is available as an option. This transformer has multiple taps to accomodate for 380, 460, and 575V AC primary voltages.		
R10 - 12, R10 - 12A	Precharge Resistors		6 ohm, 345W		
S11	Fault reset pushbutton	✓	1 NO, 800MR		
S12	Start switch		1 NO/ 1 NC, 800MR		
SP1 - 3	Line-to-line MOVs		460 J, 320V AC	460 J, 320V AC	550 J, 385V AC
SP4	Neutral-to-ground MOV		760 J, 680V AC	760 J, 680V AC	760 J, 680V AC
TB1	Terminal Block		600V AC/DC, 22-14AWG, 10 terminals		
TB2	Terminal Block		600V AC/DC, 22-14AWG, 2 terminals		
TR1	Timer Relay		2 NO/ 2 NC (instantaneous), 1NO / 1 NC (on delay)		
VM1	DC bus voltmeter	✓	1000V DC		
VM2	Ground fault detection	✓	0-440V AC (meter), NO/NC contacts (relay)		

① These components are provided with RGU standard options. Not all RGUs will have these components.

Installing Your RGU

This chapter provides the following information for the RGU:

- the mechanical installation procedures for connecting the RGU to AC input power
- setting up the ground-fault detection option (if supplied)
- RGU installation verifications:
    - •absence of short circuits
    - •correct control voltage selection SW1 on isolation board
    - •correct AC input power connections
- individual power up verifications
- instructions for mechanically connecting your RGU to the lineup
- system test procedures

Before You Begin

Before you begin, be sure to have the items in the following list and all items required by referenced procedures:

Documentation

- drive system schematics and AC inverter (drive manuals)
- this manual
- Rockwell Automation publication 2100-5.5.
- Rockwell Automation publication 2300-5.1, if using a Bulletin 2300 system
- Rockwell Automation publication S-3062, if using FD86N cabinets

Equipment

- the drive system lineup
- wire or bus (sized per local electrical codes) to connect AC line power to your RGU

Tools

- a means to punch holes into sheet metal for the routing of conduit
- a means to connect AC line power to the drive system
- a device for continuity testing

Installation Procedure

ATTENTION: To avoid the hazard of electrical shock, verify that all voltages on the system bus network have been discharged before attempting to service the system.

ATTENTION: Be sure to obey all local electrical codes when installing your drive system. This installation procedure provides guidelines that can be used in the case that codes do not exist.

1. Verify that the RGU has no mechanical damage. If you notice any damage, refer to the section *Drive System Receiving* in the *Preface* of this manual.

2.

If your drive system is packaged in:	Position and secure the RGU enclosure to the remainder of the drive lineup according to the installation practices of publications:
Bulletin 2300 or Bulletin 2100 enclosures	2100-5.5 *Receiving, Handling, and Storing Motor Control Centers–Instructions* 2300-5.1 *Bulletin 2300 Family of Drive Systems Hardware–Installation Manual*
FD86N enclosures	2100-5.5 *Receiving, Handling, and Storing Motor Control Centers–Instructions* S-3062 *FD86N Enclosure Hardware–Installation Manual*

Note: *Do not splice the RGU's common DC bus to the lineup at this time.*

3. Verify that the disconnect is open at this time.

4. Remove the lifting angle (if present) that is secured to the top of the RGU.

5. If a top hat assembly is required (M-code RGUs), refer to publication 2300-5.1 for installation instructions.

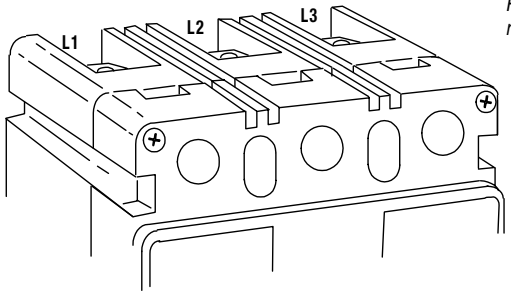
6. Cut holes for cable entry using instructions in publication 2300-5.1.

7. Connect the AC input cables to the RGU input according to local codes. The following table lists the wire sizes that the circuit breaker, motor circuit protector, or input busbar may accommodate.

If your RGU current code is:	Connect the RGU input terminals to the AC input power using:
J	One connector per phase. The input terminals accommodate 1/0 AWG wiring.
K	One connector per phase. The input terminals accommodate a range of 4/0 to 350kcmil AWG.
L	Two connectors per phase. The input terminals accommodate 3/0 AWG wiring.
M	Three connectors per phase. The input busbars accommodate 300kcmil to 500kcmil AWG lugs.
N	Four connectors per phase. The input busbars accommodate 350kcmil AWG lugs.

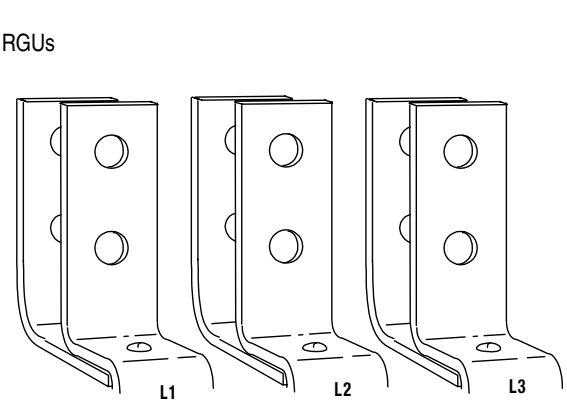
Figure 7.1
Input Connections

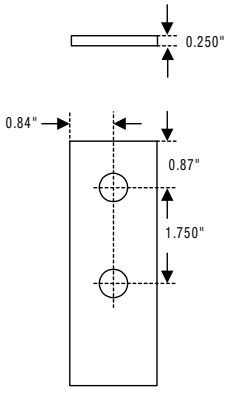
J, K, or L-code RGUs



Refer to local wiring codes. (Current ratings are listed in Appendix B).

M or N-code RGUs

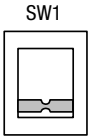




8.

If your RGU current code is:	Torque the RGU input terminals to:
J	Values listed on the MCP
K	Values listed on the MCP
L	Values listed on the MCP
M	45 lb-ft
N	45 lb-ft

9. Set the trip setting of the disconnect according to manufacturer's instructions or per the recommended settings provided in *Appendix C* of this manual. Refer to your drive system schematics for the system's rated current levels.



115V AC Control Voltages

10. Verify that the circuit feeding into the isolation board (at TB5 and TB6) is powered by 115V AC control circuitry. On the isolation board, set SW1 to '115V AC Control Voltages'.

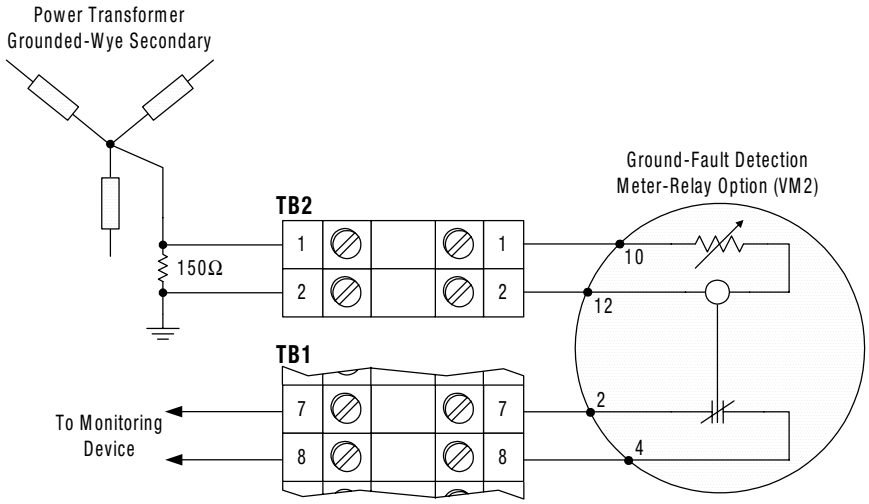
Ground-Fault Detection

If the ground-fault detection option has been selected, a meter relay will be mounted to the door. When wired, the meter will indicate the ground voltage, and the relay will energize when the ground voltage exceeds the defined trip voltage.

To set up the ground-fault detection relay, connect terminals TB2-1 and TB2-2 across the power transformer grounding resistor, in accordance with system schematics and according to transformer manufacturer specifications (see Figure 7.2). TB1-7 and TB1-8 (normally-closed contacts) can be connected to an appropriate monitoring device.

> ***Note:*** *The power transformer must have a resistive grounded-wye secondary with a resistance of 150 ohms.*

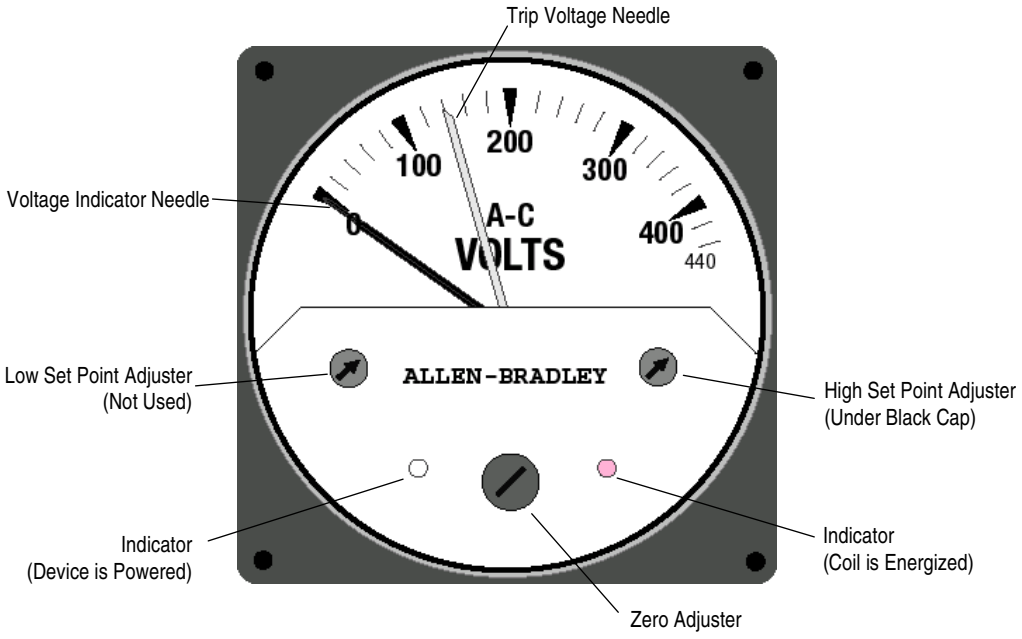
Figure 7.2
Ground-Fault Detection (Wiring)



Note: *See the meter relay label for other wiring configurations (i.e. normally-open contacts).*

To calibrate the meter, turn the zero adjuster until the voltage indicator needle (black) is aligned with the zero mark.

Figure 7.3
Ground-Fault Detection (Meter)



Further setup instructions for the ground-fault detection option will be given in the power up section of this chapter.

Terminal Descriptions

Figure 7.4
Main Control Board

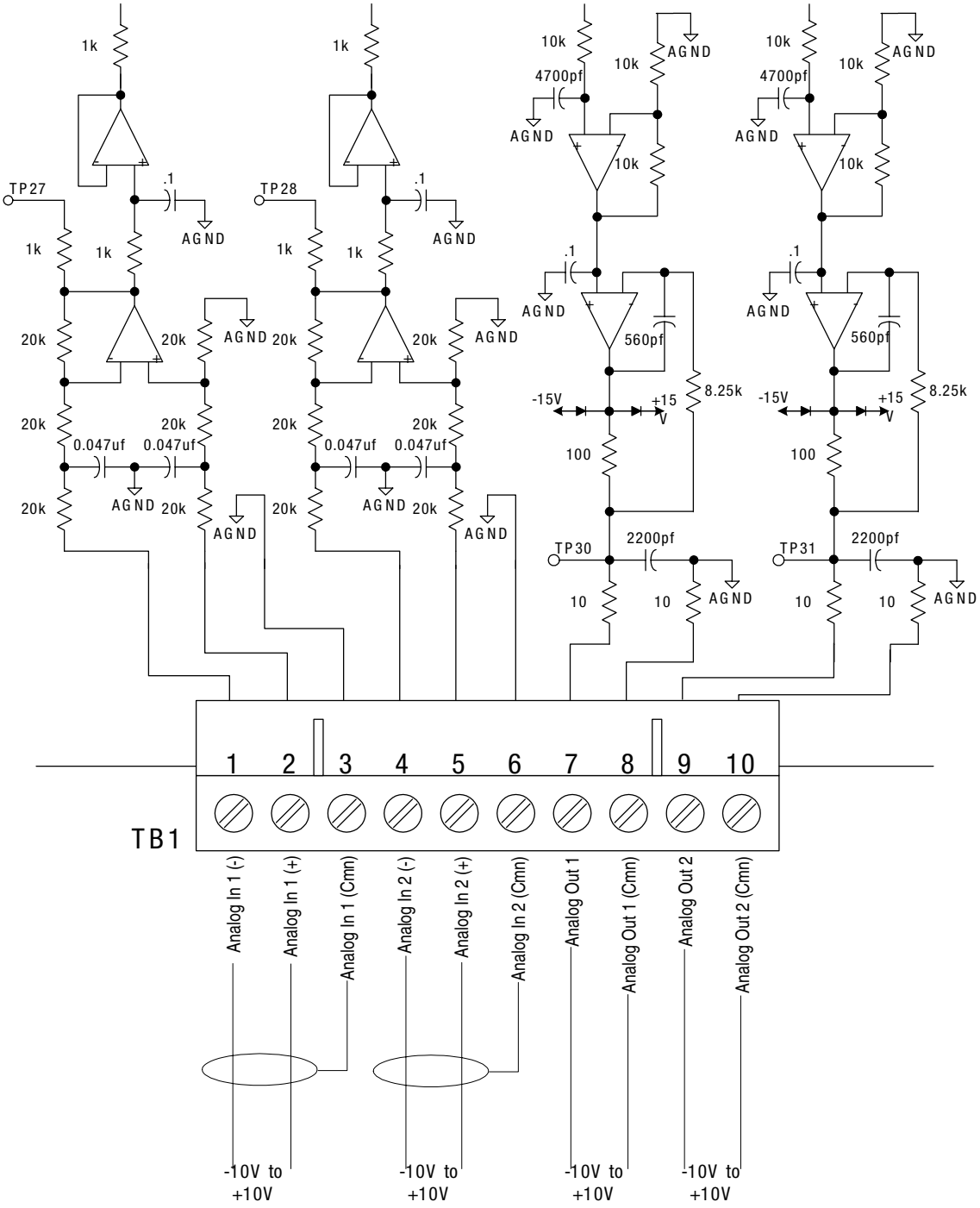
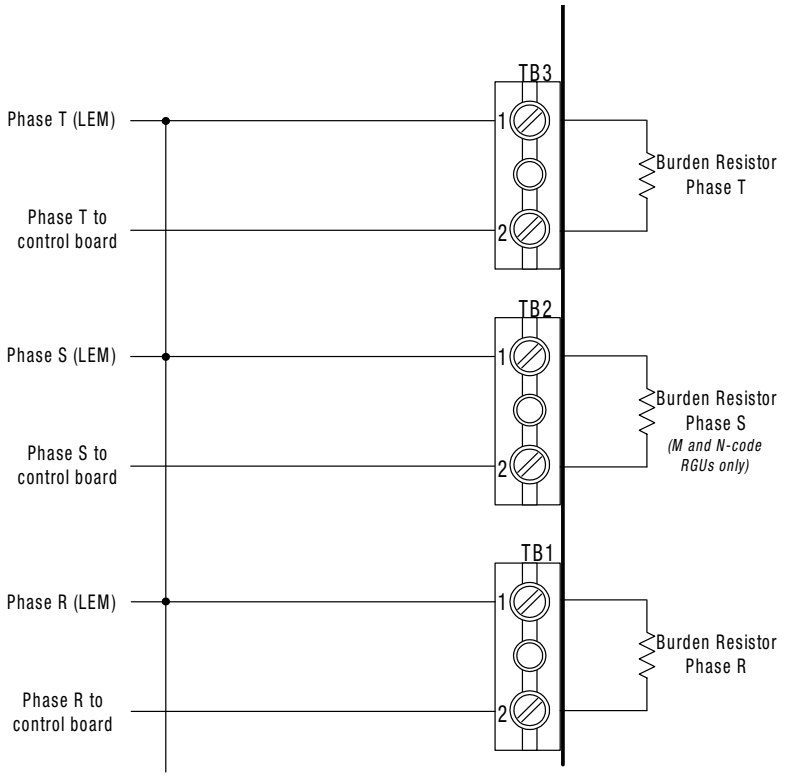


Figure 7.5
Isolation Board (TB1 and TB3)



Terminal Block	Terminal Number	Recommended Wiring/Comments
TB1 (Main Control Board)	1, 2, 3, 4, 5, 6	14AWG. 80k differential input resistance. 40k common-mode input resistance.
	7, 8, 9, 10	14AWG. Minimum 1k load resistance.
TB1, TB2, TB3 (Isolation Board)	1 and 2	Resistor sizes are listed in the electrical specifications table (in Appendix A).
TB5 (Isolation Board)	1, 3, 4, 6, 8, 9	14AWG. 10mA load at 120V.
TB6 (Isolation Board)	1, 2, 3, 4	14AWG. Maximum 1A at 120V.

Figure 7.6
Isolation Board (TB5, TB6)

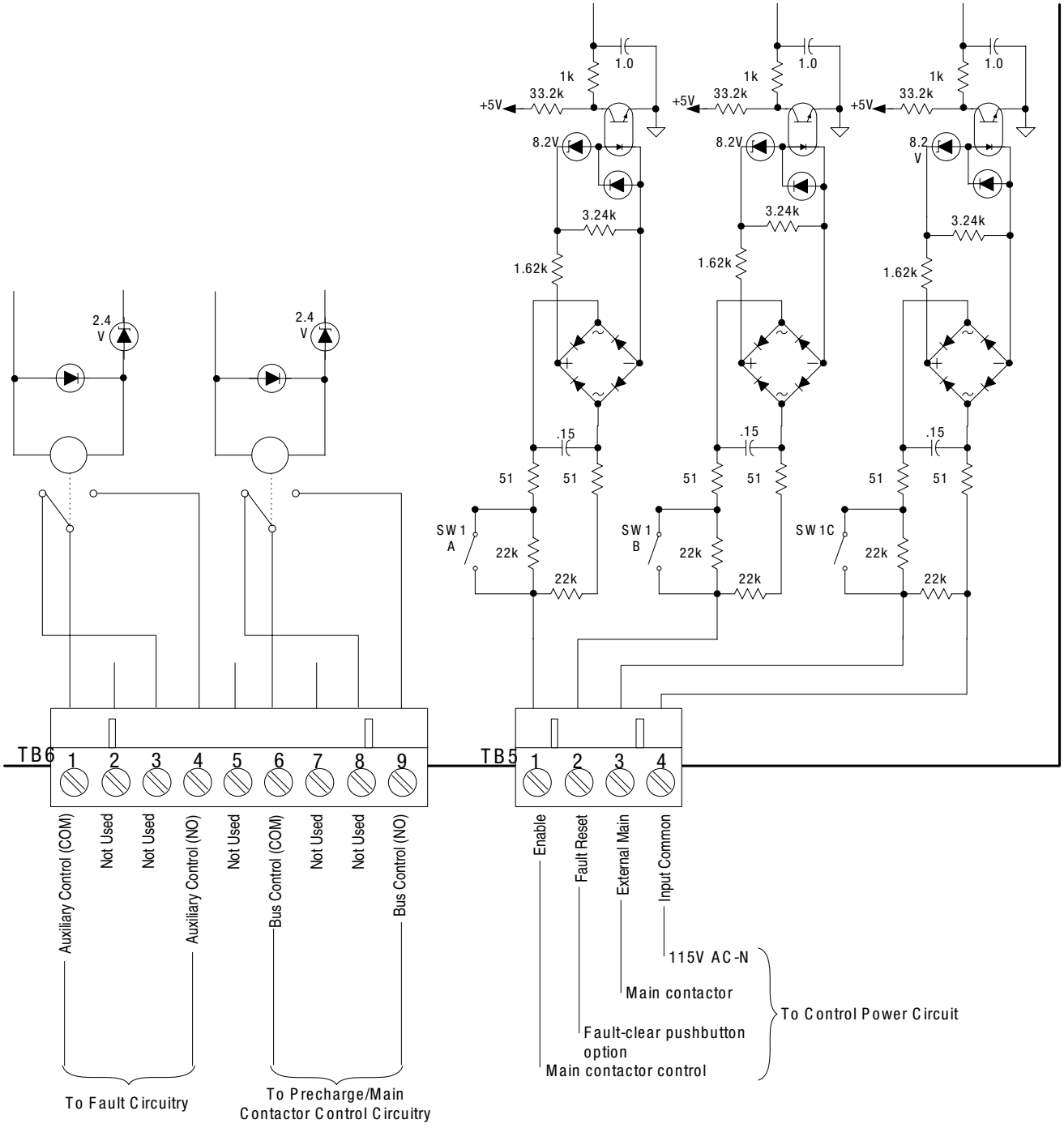
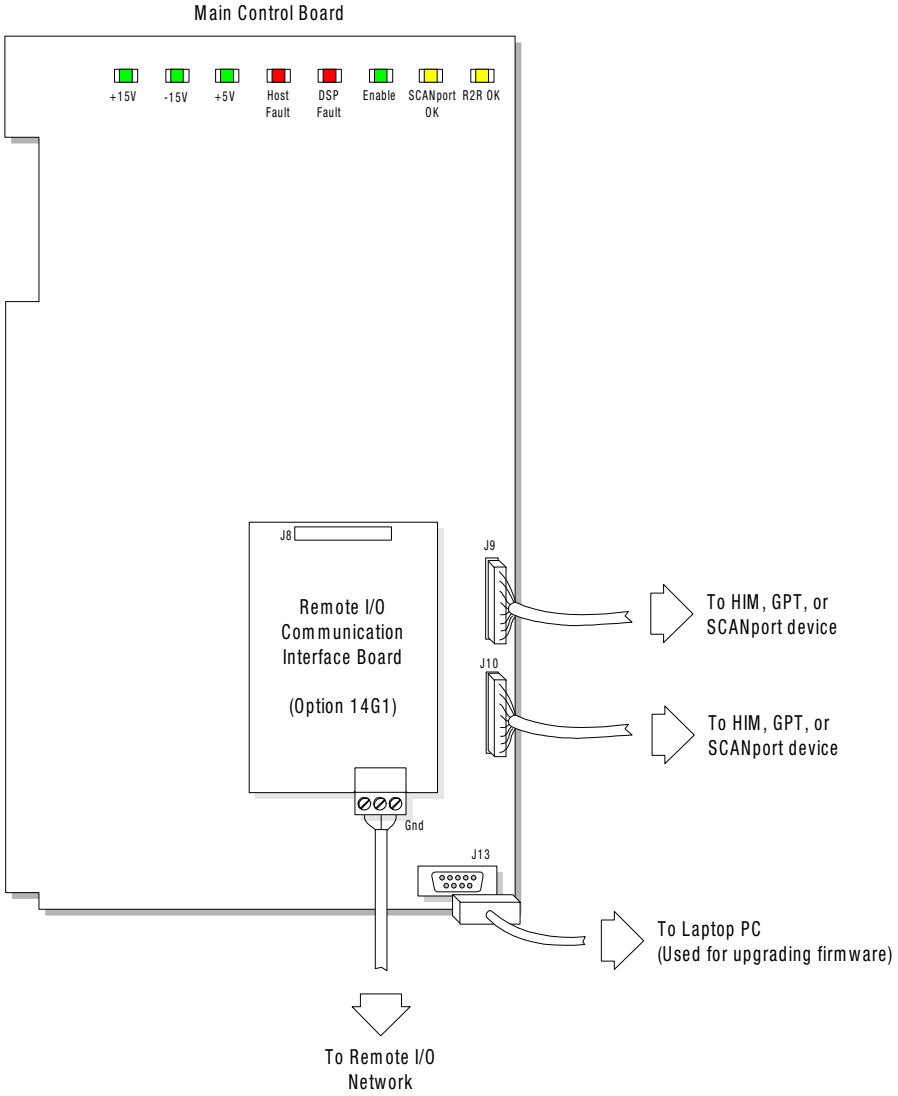


Figure 7.7
Typical Communication Connections (Main Control Board)



Port	Description
J8	SCANport 6 Available for mounting a Remote I/O, DeviceNet, or RS232/422/483-DH485 communication interface board
J9	SCANport 2 Available for hooking up a HIM, GPT, or SCANport device
J10	SCANport 1 Available for hooking up a HIM, GPT, or SCANport device

RGU Installation Verifications

ATTENTION: The verifications described in this section must be done before turning power on to the system. Failure to do so may result in personal injury and/or equipment damage.

ATTENTION: Do not turn on the power if the RGU fails any of the verifications described in this section. Doing so may result in personal injury and/or equipment damage.

ATTENTION: You must correct all problems before proceeding to the next step. Failure to do so may result in personal injury and/or equipment damage.

1. Using an ohmmeter or other continuity testing device, verify that shorts do not exist between:

Source 1	Source 2	Check Below if No Short
L1	L2	❒
L1	L3	❒
L2	L3	❒
L1	PE	❒
L2	PE	❒
L3	PE	❒
R (EA1)	PE	❒
S (EA1)	PE	❒
T (EA1)	PE	❒
DC+ Bus	DC- Bus	❒
DC+ Bus	PE	❒
DC- Bus	PE	❒
DC+ Bus	TE	❒
DC- Bus	TE	❒
PE	TE	❒

2. Verify the AC input connections.

3. If a door-mounted HIM module or SCANport connection has not been selected, connect a HIM or GPT to the RGU's control board at this time.

Individual Unit Power-Up Verifications

ATTENTION: Do not proceed if the RGU fails any of the checks described in this section. Failure to do so may result in personal injury and/or equipment damage.

ATTENTION: Perform these verifications for each RGU in your drive system before connecting the RGU(s) to the drive lineup.

ATTENTION: The RGU supplies power to the DC bus whenever the disconnect is closed.

ATTENTION: This unit contains stored energy devices. To avoid the hazard of electrical shock, verify that all voltage on capacitors has been discharged before attempting to service, repair, or remove a drive system or its components.

ATTENTION: The procedures in this manual should be performed by qualified personnel who are familiar with solid-state control equipment and with the safety procedures in publication NFPA 70E.

1. Verify that the RGU start switch is in the off position.
2. Verify that the incoming phase-to-phase line voltages are within these tolerances (on the line side of the breaker/motor circuit protector):

Nominal AC Input Voltage (V AC)	Minimum AC Input Voltage (V AC)	Maximum AC Input Voltage (V AC)
380	342	418
460	414	506
575	518	632

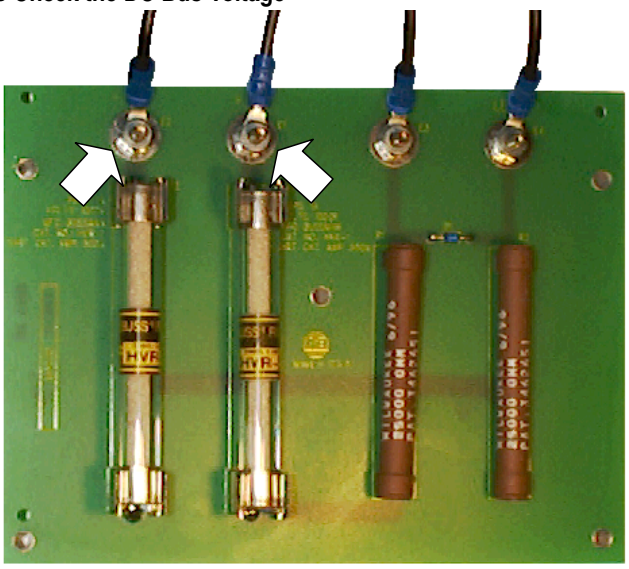
3. Push the disconnect lever to on. Turn the start switch to on. The DC bus and control circuitry will power up.

4. The common DC bus voltage will vary based upon the 3-phase AC input voltage. Verify that the common DC bus voltage is within these tolerances (RGU not modulating):

Nominal AC Input Voltage (V AC)	Nominal DC Bus Voltage (V DC)	Minimum DC Bus Voltage (V DC)	Maximum DC Bus Voltage (V DC)
380	564	483	591
460	683	585	715
575	848	732	894

Note: *The DC bus voltage should be checked at the DC bus energized board (EA2) as shown in Figure 7.8. Please refer to the appropriate layout drawings earlier in this manual for board location.*

Figure 7.8
Where to Check the DC Bus Voltage



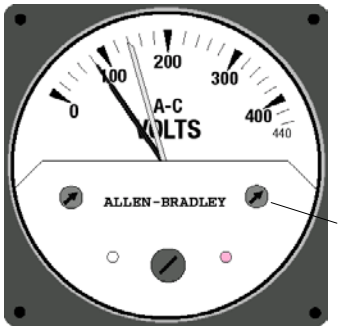
5. Verify that the voltage across X1 to X2 on the secondary side of control transformer PT1, if supplied, is within this tolerance:

Nominal AC Control Voltage (V AC)	Minimum AC Control Voltage (V AC)	Maximum AC Control Voltage (V AC)
115	104	126

6. Verify that all fans are operational.

7. Verify that the *DC Bus Energized* pilot light is illuminated.

8. Verify that the *Not Faulted* pilot light, if supplied, is illuminated. If it is not illuminated, verify that the contacts of the fault circuit are closed.



9. If the optional ground-fault detection meter relay (VM2) is supplied, verify that the meter is operating. Set the orange trip voltage needle 50V higher than the maximum reading of the black voltage indicator needle (200V maximum).

Note: *The black voltage indicator needle should typically read a low value (between 80 and 100V) when the inverters on the DC bus are modulating. This voltage is produced by capacitively-coupled currents to ground in the motor's cables and windings.*

10. Push the disconnect lever to off. Turn the start switch to off. Wait until all stored energy has dissipated.

Connecting the RGU to the Drive Lineup

Splicing Busbars

Splice the RGU DC thru buses in the drive lineup, using the following publications as applicable:

Publication	Enclosures
2300-5.1 *Bulletin 2300 Family of Drive Systems Hardware–Installation Manual*	Bulletin 2300 or Bulletin 2100 enclosures
S-3062 *FD86N Enclosure Hardware–Installation Manual*	FD86N enclosures

Testing the System

Testing the System (Standalone RGU with Inverters)

For a stand alone RGU connected to inverters, first verify that the door-mounted start switch is off and that all disconnects in the system are open.

1. Push the RGU disconnect lever to on.

2. Turn the door-mounted start switch on. The RGU will begin the precharge operation, charging its internal capacitor bank and the capacitors in the inverters.

3. When the precharge sequence is finished (about 30 seconds), the DC bus should be a little under the nominal voltage. At this point, close the circuit breakers for the inverters and check their operation.

4. Push the RGU disconnect lever to off. It may take a minute for the DC bus voltage to go to zero.

5. Open all system circuit breakers.

Test Failures

If the RGU programming parameters are not set up properly, the RGU may not operate as expected. If you are experiencing difficulty or abnormal operation, check the parameters given in chapter 8 and test the system again.

Setting Up Your RGU

This chapter will guide you through the setup procedures necessary for RGU operation. For parallel applications (2364P units), refer to publication 2364P-5.01, *Parallel Configuration–User Manual*.

Introduction to the Human Interface Module (HIM)

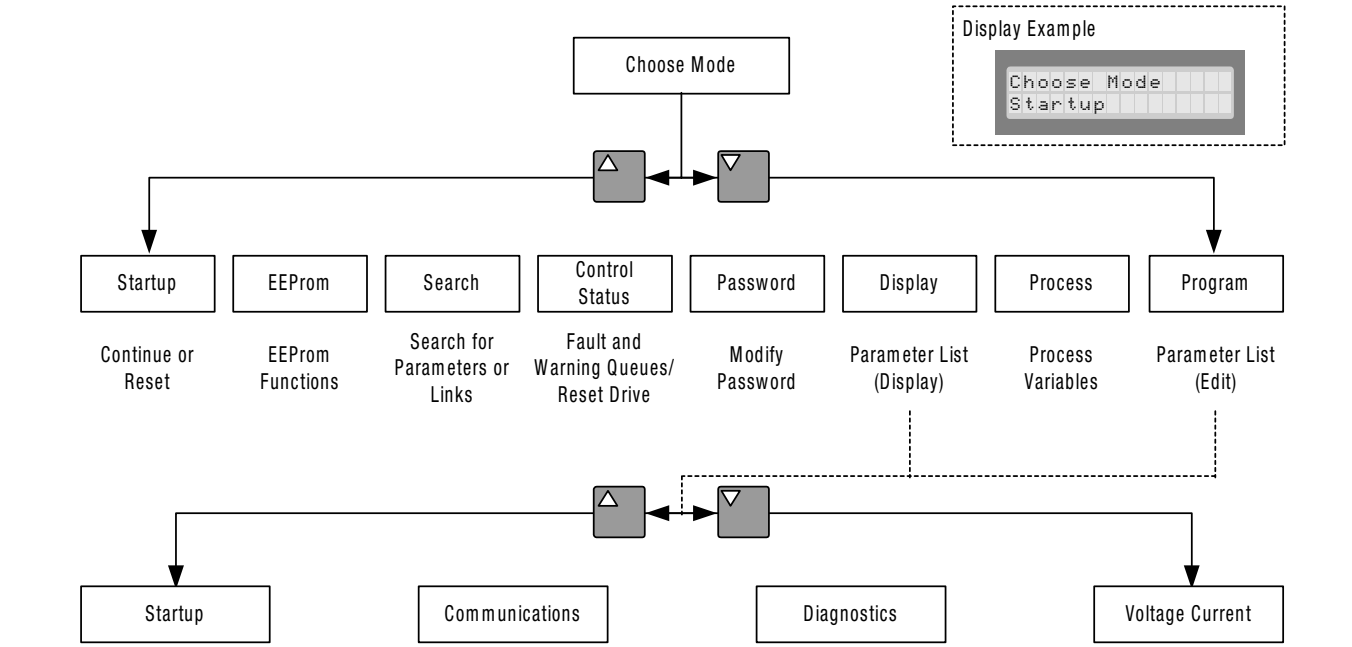
The Human Interface Module (HIM), shown in Figure 8.1, can be used to program and set up the RGU. The table below shows the function of the keys.

Figure 8.1
Human Interface Module (HIM)

ESC	**Escape** Pressing the escape key causes the programming system to go back one level in the menu tree.
SEL	**Select** Pressing the select key alternates between the top and bottom lines in the display.
△	**Increment** Pressing the increment key will increment a displayed value. This key is also used for scrolling through a lists on the display.
▽	**Decrement** Pressing the decrement key will decrement a displayed value. This key is also used for scrolling through lists on the display.
↵	**Enter** Pressing this key causes a parameter entry to be saved to memory. This key is also used to select items on the display.

The parameters and functions are organized into a *menu tree*. This menu tree is broken into seven modes, including Startup, EEProm, Search, Control Status, Password, Display, and Process (see Figure 8.2).

Figure 8.2
HIM Menu Tree



Monitor
- RGU State
- Line Voltage
- Line Voltage Cal
- Abs Junct Temp
- Heatsink Temp
- Iq Fbk Offset
- Iq Feedback
- DC Bus Current
- Iac Total
- Scaled Bus Fbk
- Bus Volt Cal
- +Bus Volt to Gnd
- - Bus Volt to Gnd

Limits
- Rem/Loc Selector
- Line Low Setting
- Line Hi Setting
- Bus Low Setting
- Bus High Setting
- Bus V Tolerance
- Aux Iq Limit
- Iq Pos Limit
- Iq Neg Limit
- Id Pos Limit
- Id Neg Limit

Autotune
- Volt Mode Sel
- Min Bus Ref
- Max Bus Ref
- Bus Rate Ref
- Ref Change Rate
- Bus Reference
- Bus Ref Auto
- Auto RTef Tracking
- DSP Bandwidth
- DSP Damping
- Int Charge Rate
- Sys Charge Rate
- Bus Voltage BW
- Bus Volt Damping
- Bus Volt Cmd

Module Data
- Nom Line Voltage
- Rated AC Current
- Line Inductance
- Utility AC Freq
- Ext Capacitance
- Int Capacitance

Module Cal
- Line Voltage
- Line Voltage Cal
- Iq Fbk Offset
- Iq Feedback
- Scaled Bus Fbk
- Bus Voltage Cal

Linear List
- [Full Parameter List]

SCANport I/O
- Rem Data In:P1
- Rem Data In:P2
- Rem Data In:P3
- Rem Data In:P4
- Rem Data In:P5
- Rem Data In:P6
- Rem Data Out:P1
- Rem Data Out:P2
- Rem Data Out:P3
- Rem Data Out:P4
- Rem Data Out:P5
- Rem Data Out:P6
- Rem Data In:A1
- Rem Data In:A2
- Rem Data In:B1
- Rem Data In:B2
- Rem Data In:C1
- Rem Data In:C2
- Rem Data In:D1
- Rem Data In:D2
- Rem Data Out:A1
- Rem Data Out:A2
- Rem Data Out:B1
- Rem Data Out:B2
- Rem Data Out:C1
- Rem Data Out:C2
- Rem Data Out:D1
- Rem Data Out:D2

SCANport Info
- Port Enable Mask
- Enable Mask
- Clear Fault Mask
- Reset Unit Mask
- Disable Owner
- Enable Owner
- Clr Fault Owner
- Type 1 Status
- Type 2 Status

Fault Sel/Stat
- Fault Status 1
- Flt Report Mask 1
- Fault/Warn Mask1
- Fault Status 2
- Flt Report Mask 2
- Fault/Warn Mask2
- Fault Status 3
- Flt Report Mask 3
- Fault/Warn Mask3
- Fault Status 4
- Flt Report Mask 4
- Fault/Warn Mask4

Relays
- Aux Relay Ind
- Aux Relay Mask
- Aux Relay Select
- Aux Relay Hyst

RGU to RGU
- R2R Xmit Addr
- R2R Xmit, Ind1
- R2R Xmit, Ind2
- R2R Rcv Addr 1
- R2R Rcv, Ind1
- R2R Rcv, Ind2

Analog
- ADC0 Input
- ADC1 Input
- DAC1 Output
- DAC2 Output
- DAC1 Indirect
- DAC1 Offset
- DAC1 Gain
- DAC1 Cutoff Freq
- DAC2 Indirect
- DAC2 Offset
- DAC2 Gain
- DAC2 Cutoff Freq

Linear List
- [Full Parameter List]

Fault Sel/Stat
- Line Low Setting
- Line Hi Setting
- Bus Low Setting
- Bus High Setting
- Bus V Tolerance
- Fault Status 1
- Flt Report Mask 1
- Fault/Warn Mask1
- Fault Status 2
- Flt Report Mask 2
- Fault/Warn Mask2
- Fault Status 3
- Flt Report Mask 3
- Fault/Warn Mask3
- Fault Status 4
- Flt Report Mask 4
- Fault/Warn Mask4

Info
- Software Version
- Password
- Language Sel
- RGU Catalog #
- RGU Control Mode
- Unit Selection
- Nom Line Voltage
- Rated AC Current
- Nom DC Bus Voltage

Host
- Host Command
- Host Status 1
- Host Status 2
- Master Status
- Host Mode
- 14 Bit A/D Chan2
- 14 Bit A/D Chan3
- 14 Bit A/D Chan4
- 14 Bit A/D Chan5
- 14 Bit A/D Chan6
- 14 Bit A/D Chan7
- 14 Bit A/D Chan8
- 14 Bit A/D Chan9
- Bus Volt In Sel

DSP
- DSP DC Bus
- DSP Ave DC Bus
- DSP Status
- CrossCouple Gain
- Iq Ref Scaled
- Id Ref Scaled
- Ide Current Lim
- Current Loop Ki
- Current Loop Kp
- Net Id Cmd, DSP
- Iqe Fbk DSP

Monitor
- RGU State
- Line Voltage
- Line Voltage Cal
- Abs Junct Temp
- Heatsink Temp
- Iq Fbk Offset
- Iq Feedback
- DC Bus Current
- Iac Total
- Scaled Bus Fbk
- Bus Volt Cal
- +Bus Volt to Gnd
- -Bus Volt to Gnd

Factory Use Only
- Real Power
- Reactive Power
- Apparent Power
- Power Factor
- kW Hours
- kVA Hours
- kVAR Hours
- MW Hours
- MVA Hours
- MVAR Hours
- Meter Reset Hour
- Meter Reset Min
- Meter Reset Mon
- Meter Reset Day
- Meter Reset Year

Simulate
- Simulator Rate
- Simulator Load
- Sim Charge Rate
- Sim Bus Fbk

Current Ref
- it Foldback Cur Lim
- Linear PI Out
- Aux Iq Command
- Iq Mode Select
- Iq Pos Limit
- Iq Neg Limit
- Id Reference
- Iq Command
- Filtered Iq Ref
- Iq Reference
- Net Iq Pos Limit
- Net Iq Neg Limit
- Id Reference
- Net Iq Pos Limit
- Net Iq Neg Limit
- Iq Fbk Offset
- Aux Id Command
- Id Command
- Id Mode Select
- Id Pos Limit
- Id Neg Limit
- Id Feedback

Current Autotune
- DSP Bandwidth
- DSP Damping
- Iq Change Rate

Voltage Ref
- Line Low Setting
- Line Hi Setting
- PI Error Limit
- PI Err Lim Step
- PI Err Gain Lim
- Iq Kp Gain
- Iq Ki Gain
- Iq Integ Output
- PI Ref Out
- Aux Volt Cmd
- Volt Mode Sel
- Min Bus Ref
- Max Bus Ref
- Bus RateRef
- Ref Change Rate
- Bus Reference
- Bus Ref Auto
- Auto Ref Tracking
- Bus Volt Cmd

Basic Startup Procedure

The basic startup procedure must be performed when starting a new unit to verify the condition of the unit and to configure essential parameters for operating the unit.

The following items will be needed when starting up the RGU:

- a multimeter (for reading voltage and resistance)
- a HIM, GPT, or other programming device

ATTENTION: The basic startup must be performed when starting a new unit, replacing the main control board, or upgrading firmware. Improper parameter settings may result in poor performance or equipment damage.

ATTENTION: Do not enable the RGU until the basic startup procedure has been completed.

Starting the RGU

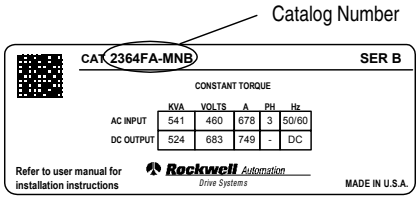
1. Verify that the start switch is turned to off and that the disconnect lever is pushed to off.
2. Verify that the disconnect levers for all inverters are pushed to off.
3. Visually inspect all wiring in the RGU (board connections, DC bus terminals, customer connections, etc.).
4. Push the RGU disconnect lever to on and turn the door-mounted start switch to on. The RGU will power up and perform its precharge routine.

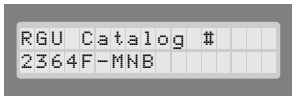
Programming the RGU

Using a HIM, GPT, or other programming device, enter the linear parameter list. The startup procedure below will guide you through several parameters that need to be configured before operating the RGU.

Important: The HIM screens shown are only examples. Program your RGU according to the instructions provided.

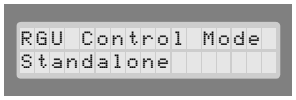
Frame Catalog Number [P4]
Enter the frame catalog number of the unit (this should correspond to the catalog number shown on the data name plate of the RGU, located below the main control board.



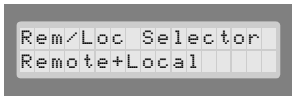


ATTENTION: Changing P4 will reinitialize all parameters in the RGU and will configure several key parameters to the catalog number selected.

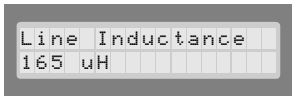
RGU Control Mode [P5]
Set this parameter to the appropriate setting:
Master Mode (0) Use this setting if this is a master unit in a lineup of multiple RGUs.
Slave Mode (1)Use this setting if this is a slave unit in a lineup of multiple RGUs.
Standalone (2)Use this setting if there are no other RGUs in the lineup (default).



Remote/Local Selector [P8]
Set this parameter to the desired setting (Local Only is default):
Local Only (0)Use this setting for automatic enabling at startup (HIM/GPT not used for enable).
Remote+Local (1)Use this setting for manually enabling the RGU by a HIM or GPT.



AC Line Reactor Inductance [P12]
Determine the total line inductance *(the RGU line reactor inductance plus the transformer leakage inductance)*.



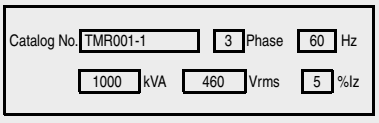
For line reactor values, refer to the P12 listing in Appendix D. For transformer leakage inductance, use the following formulas.

$$\text{Leakage Inductance of Transformer} = \frac{2.65 \times Iz \times Vrms \times Vrms}{kVA} \quad \textit{(at 60Hz)}$$

$$\text{Leakage Inductance of Transformer} = \frac{3.18 \times Iz \times Vrms \times Vrms}{kVA} \quad \textit{(at 50Hz)}$$

Iz *Leakage Reactance of Transformer*
Vrms *Voltage rating (rms) of transformer*
kVA *Transformer size*

Example
An RGU (catalog number 2364FA-MNB) is supplied with a transformer which has the example nameplate shown.



In Appendix A, we find that the catalog number (2364FA-MNB) indicates the unit is a 460V AC M-code RGU. The line reactors for this unit are rated at 137 uH as indicated in the component chart in Chapter 5.

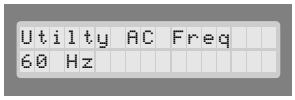
To determine the transformer leakage inductance, we can use the 60Hz formula with the information from the data nameplate.

$$\text{Leakage Inductance of Transformer} = \frac{2.65 \times 0.05 \times 460 \times 460}{1000} = \mathbf{28uH}$$

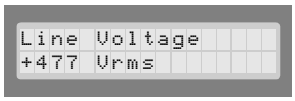
Add the line reactor inductance to the transformer leakage inductance to determine the value for P12.

P12 = 137uH + 28uH = **165uH** (Example only)

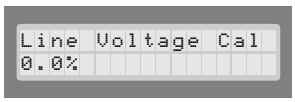
Utility AC Line Frequency [P13]
Set the Utility AC Line Frequency (P13) to the frequency of the AC line.



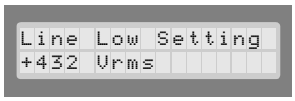
Measured AC Line Voltage [P14]
Using a meter, measure the AC line voltage. Compare the Measured AC Line Voltage (P14) with the meter reading. Determine the adjustment that needs to be made in the RGU (by percent).



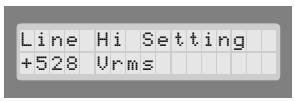
AC Line Voltage Calibration [P15]
Set this parameter to adjust the value in P14. If this calibration parameter is changed, check the Measured AC Line Voltage (P14) again.



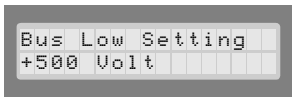
AC Line Low Setting [P26]
Verify that the AC Line Low Setting (P26) is at an acceptable voltage. Typically, the default setting should be sufficient.



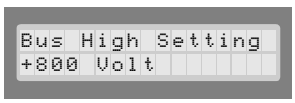
AC Line High Setting [P27]
Verify that the AC Line High Setting (P27) is at an acceptable voltage. Typically, the default setting should be sufficient.



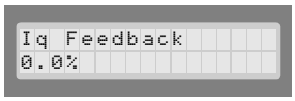
DC Bus Low Setting [P28]
Verify that the DC Bus Low Setting (P28) is at an acceptable voltage. Typically, the default setting should be sufficient.



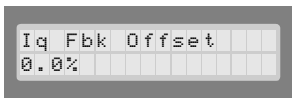
DC Bus High Setting [P29]
Verify that the DC High Setting (P29) is at an acceptable voltage. Typically, the default setting should be sufficient.



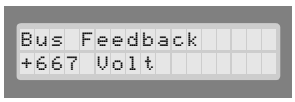
Iq Feedback [P100]
Since all of the inverters are disconnected at this time, this value should be 0.0%. Determine the offset that will be required.



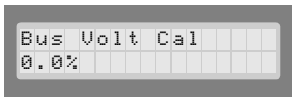
Iq Feedback Offset [P99]
Set this parameter to adjust the value of P100 to equal 0.0%. If this offset parameter is changed, check the Iq Feedback (P100) again.



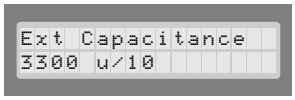
Bus Feedback [P141]
Using a meter, measure the DC bus voltage. Compare the Bus Feedback (P141) with the meter reading. Determine the adjustment that needs to be made in the RGU (by percent).



Bus Voltage Feedback Calibration [P144]
Set this parameter to adjust the value in P141. If this calibration parameter is changed, check the Bus Feedback (P141) again.



External Capacitance [P203]
Determine the maximum amount of capacitance that is expected to be on the DC bus at any one time (a table of inverter capacitances can be seen in Appendix B of this manual).

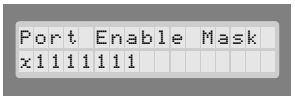
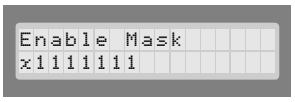
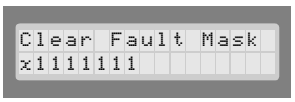
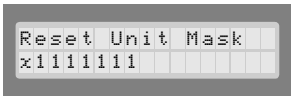


Important: If additional inverters are added in the future, this parameter must be updated.

Example
An RGU (catalog number 2364FA-MNB) is connected to a 1336 FORCE (100HP), 1336 PLUS (150HP), and SA3100 (150HP).

In Appendix A, we find that the catalog number (2364FA-MNB) indicates the unit is a 460V AC M-code RGU. Using the capacitor bank tables in Appendix B (for 460V AC lineups), we have the following values:

1336 FORCE (100HP)	900uf/10
1336 PLUS (150HP)	1200 uf/10
SA3100 (150HP)	1200 uf/10
Total Ext. Capacitance	**3300 uf/10** *(Example only)*

SCANport Port Enable Mask [P224] Verify that the appropriate SCANport ports are active. Note the following bits: SCANport 1 (bit 1) Activates J10 on the main control board (used for HIM, GPT, etc. connection). SCANport 2 (bit 2) Activates J9 on the main control board (used for HIM, GPT, etc. connection). SCANport 6 (bit 6) Activates J8 on the main control board (used for optional SCANport interface board).	
SCANport Enable Mask [P225] This setting determines if the start key on a connected SCANport device can be used to enable the RGU. Verify that the appropriate bits are set to 1. ***Note:*** *P5 (Remote/Local Selector) and P224 (SCANport Port Enable Mask) must be set accordingly if a programming terminal/SCANport device will be used to enable the RGU.*	
SCANport Clear Fault Mask [P226] This setting determines which SCANport ports (i.e. J8, J9, or J10) can be used to clear faults in the RGU. Verify that the desired bits are set to 1. P224 (SCANport Port Enable Mask) must be set accordingly.	
SCANport Reset Mask [P227] This setting determines which SCANport ports (i.e. J8, J9, or J10) can be used to reset the RGU. Verify that the desired bits are set to 1. P224 (SCANport Port Enable Mask) must be set accordingly.	

Enabling the RGU

After the basic startup procedure has been completed, the RGU can be enabled. The RGU can be enabled by three different methods.

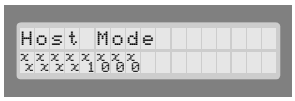
1. Send an enable command to the Host Command Word by setting the *Enable Cmd* bit (P32 bit 1 = 1).
2. If the Remote/Local Selector has been set to *Local Only* (P8=0), reset the RGU. The unit will automatically enable after the reset.
3. If the Remote/Local Selector has been set to *Remote+Local* (P8=1), press the green start key on a HIM, GPT, or DrivePanel (DriveTools). Note that P224 and P225 must be configured appropriately for this.

Advanced Startup Procedure

The advanced startup procedure may be performed after the basic startup has been completed to configure the RGU for optimum performance. A HIM, GPT, or other programming device will be required to complete the advanced startup below.

Host Mode [P35]
The bits in the host mode parameter select current limiting functions in the current regulator.
Regen OnlyLimits the motoring current to 10% (regenerative current limit remains at 150%).
Err LimiterLimits the gain, step, and value allowed in the bus voltage error.
LinearizerAdjusts the current command so the bus voltage corresponds with the line voltage.

Note: The Err Limiter bit should be set to zero if the RGU is connected to any 1336 FORCE or SA3100 drives. Doing so will prevent overvoltage trip problems in the drives.



Id Current Command [P102]
The Id current command determines the amount of reactive current that the RGU should allow. Typically, this value should be set to 0.0% (default).

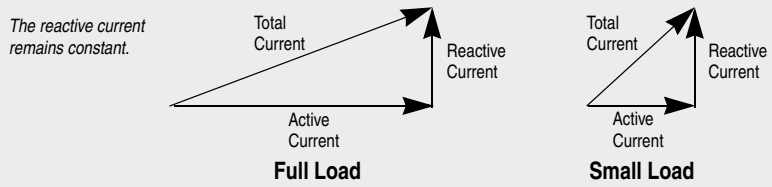
For applications requiring reactive current, P102 can be adjusted from 60% lagging to -40% leading power factor. If a non-zero value is given as the Id current command, the RGU will run at that percentage of reactive current from the rated AC line current, even if the RGU is unloaded.

Note that reactive current in the RGU takes away from the active, work-producing current (Iq), and reduces efficiency of the RGU.

Example
If an RGU is set with a -40% leading reactive current (Id), the available active current (Iq) could be determined in the formula ($\%Id^2 + \%Iq^2 = \%I_{total}^2$).

$\%Iq = \sqrt{(100\%)^2 - (40\%)^2}$ = **92%** (Example Only) [$\%I_{total}$=100%]

At full load, the total current would be 100%, but the active (work-producing) current would only be 92%. Since P102 only determines the amount of reactive current that the RGU will produce (not regarding the load), the RGU would operate at a power factor of 0 (at no load) and increase to a power factor of -0.92 (at full load).

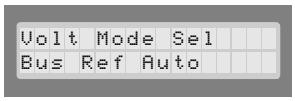


Voltage Mode Select [P123]
This parameter determines the voltage command that should be supplied to the regulator. The default, 'Bus Ref Auto', selects the value from the Bus Reference Automatic (P129), which is calculated by:

P129 = (Measured AC Line Voltage) x $\sqrt{2}$ x 1.05 *i.e.* P129 = 460 x $\sqrt{2}$ x 1.05 = 683V DC

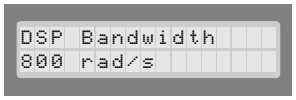
To maintain the bus at a constant voltage, independent of the AC line voltage, the 'Aux Volt Cmd' or 'Bus Volt Cmd' may be selected. However, note that the RGU will not operate at 1.0 power factor if the the specified voltage is less than the peak of the AC line (AC line voltage x $\sqrt{2}$).

For example, if an RGU is supplied with 460V AC input, but the DC voltage command is set to 640V DC, the RGU would be forced to operate with a some lagging current, which would reduce the efficiency of the RGU. In this case, a voltage command greater than 651V DC (460 x $\sqrt{2}$) would be a better choice.



Current Loop Bandwidth [P198]
The current loop bandwidth determines the dynamic behavior of the current loop. The current loop becomes more responsive and is able to track faster as the bandwidth is increased. However, note that system limitations and excessive noise may adversely affect the performance of the RGU if the bandwidth is set too high.

Typically, acceptable bandwidth settings are in the range of 800-1000 rad/s (for J or K-code RGUs) or in the range of 600-900rad/s (for L, M, or N-code RGUs). A current bandwidth of 800 rad/s is recommended.

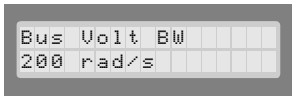


Current Loop Damping [P199]
The current loop damping determines the dynamic behavior of the current loop. This damping influences the amount of overshoot the current loop will exhibit during a transient. Typically, this value should be set to 100%.

Voltage Loop Bandwidth [P205]
The voltage loop bandwidth determines the dynamic behavior of the voltage loop. The voltage loop becomes more responsive and is able to track faster as the bandwidth is increased. However, note that system limitations and excessive noise may adversely affect the performance of the RGU if the bandwidth is set too high.

If the RGU is supplying a single inverter, a voltage loop bandwidth of 200 rad/s is recommended (300 rad/s maximum). If the RGU is supplying multiple inverters, the voltage loop bandwidth should be calculated using the following formula:

$$P205 = \frac{200 \times P204}{P203 + P204}$$

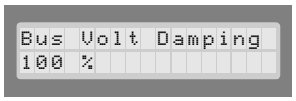


Example
An RGU (catalog number 2364FA-MNB) is connected to a 1336 FORCE (100HP), 1336 PLUS (150HP), and SA3100 (150HP).

The catalog number (2364FA-MNB) indicates the unit is a 460V AC M-code RGU. The internal capacitance for this unit is 2400 uf/10 (as shown in Appendix D, P204). The total external capacitance for the inverters is 3300 uf/10 (which will become the value for P203). Using the formula, we can determine the appropriate value for the voltage loop bandwidth (P205):.

$$P205 = \frac{200 \times 3300}{2400 + 3300} = \textbf{115 rad/s}$$ *(Example Only)*

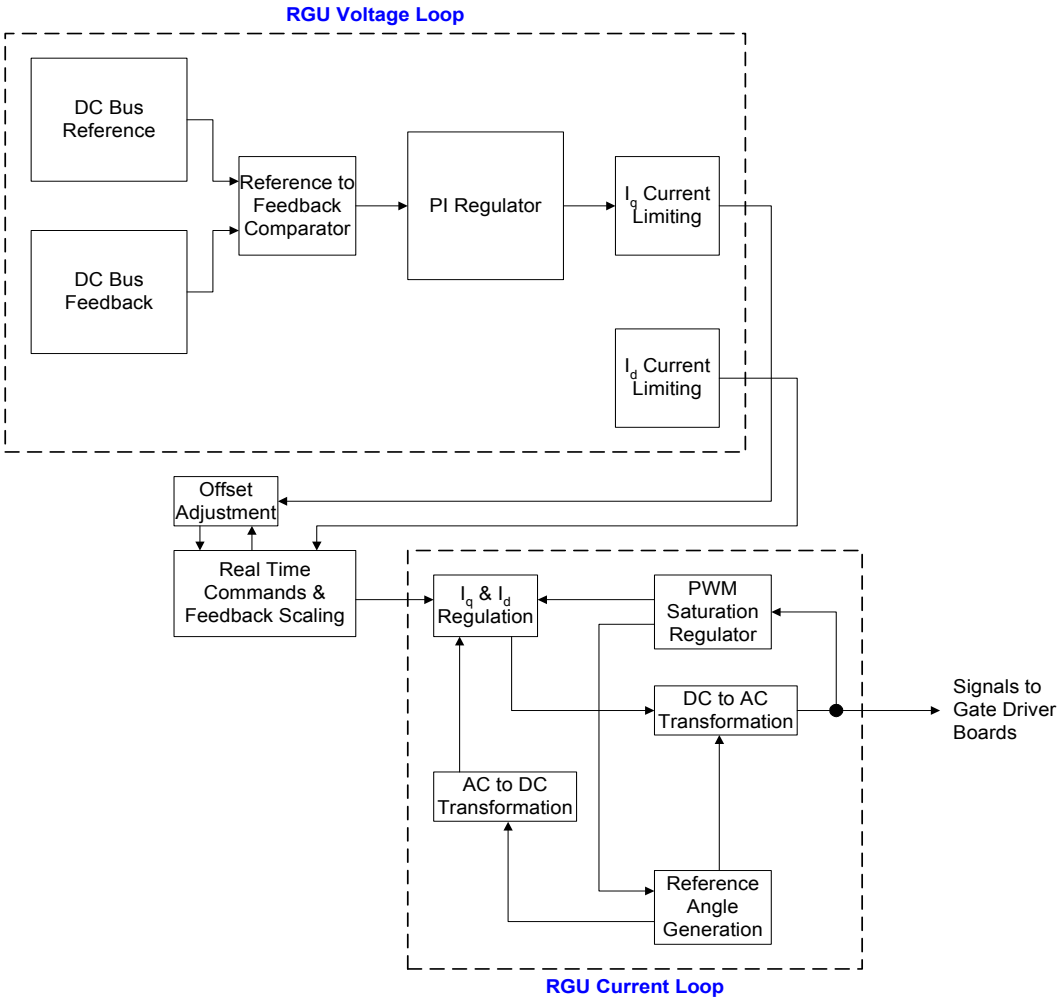
Voltage Loop Damping [P206]
The Voltage Loop Damping (P206) also determines the dynamic behavior of the voltage loop. This damping influences the amount of overshoot the voltage loop will exhibit during a transient. Typically, this value should be set to 100%.



Adjusting Voltage and Current Regulation Parameters

Regulation in the RGU consists of a voltage loop, a current loop, and the associated scaling commands. As you can see in Figure 9.1, regulation is a two-part process beginning in the voltage loop and ending in the current loop.

Figure 9.1
RGU Regulation Block Diagram



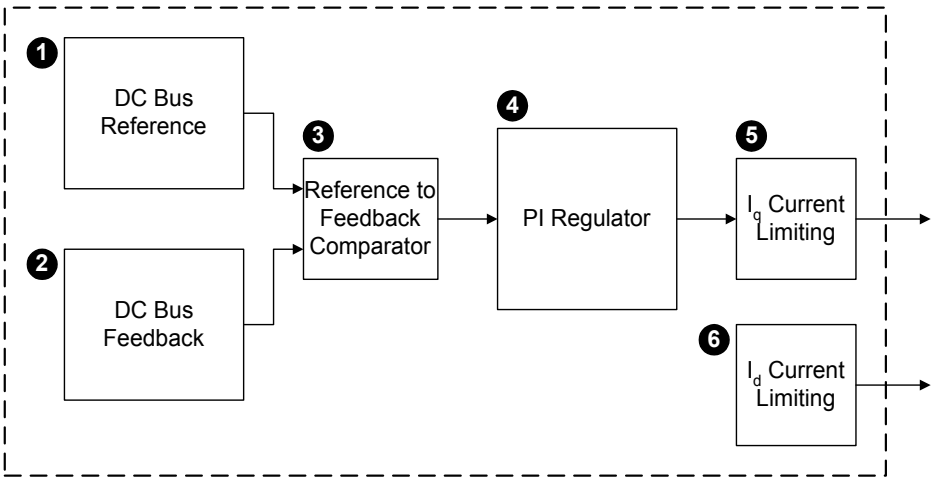
Voltage Loop Regulation

The voltage loop, which resides in the host processor on the main control board, performs the initial control calculations. Functionally, the voltage loop can be considered to be "roughly tuning" the RGU control. Voltage loop performance is adjusted via user-configured parameters.

Voltage loop tasks include (Step numbers below correspond to the functional boxes shown in Figure 9.2):

1. Identifying the DC bus reference
2. Monitoring the DC bus feedback
3. Comparing the DC bus reference with the DC bus feedback
4. Processing bus data and making necessary error corrections in the PI regulator
5. Generating a voltage loop I_q command
6. Generating a voltage loop I_d command

Figure 9.2
Voltage Loop Regulation Block Diagram

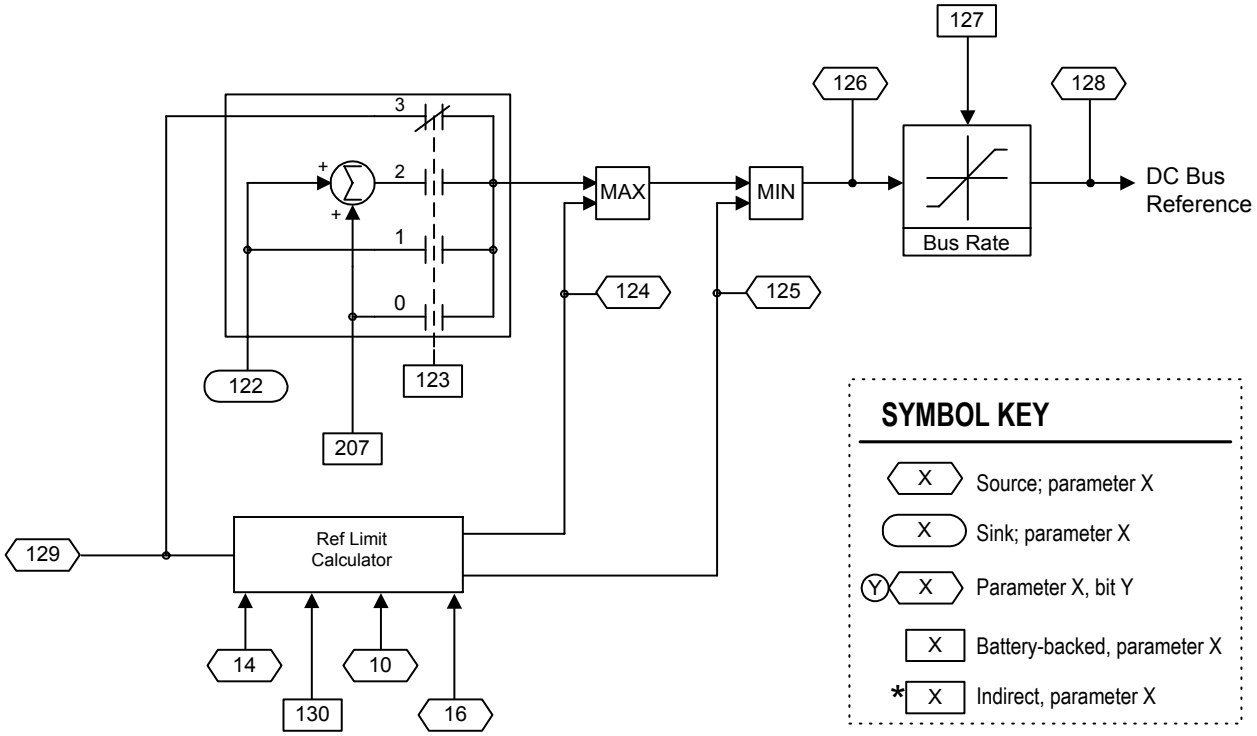


Identifying the DC Bus Reference

The DC bus reference is the DC bus voltage that you program the RGU to supply.

The user selects the source of the bus reference and the bus reference value when required. The RGU then performs a minimum-maximum comparison to ensure that the bus reference value is valid. Next, a user-configured rate limiter adjusts the bus reference as necessary to prevent the bus reference from changing too rapidly. Refer to Figure 9.3 for a firmware diagram of these operations.

Figure 9.3
Firmware Diagram for Identifying the DC Bus Reference



Parameter Number	Parameter Name
10	Nominal Line Voltage
14	Measured AC Line Voltage
16	Nominal DC Bus Voltage
122	Auxiliary Voltage Command
123	Voltage Mode Select
124	Minimum Bus Reference
125	Maximum Bus Reference
126	Bus Rate Reference
127	Bus Reference Change Rate
128	Bus Reference
129	Automatic Bus Reference
130	Automatic Bus Reference Tracking
207	Bus Voltage Command

1. Identify the source of the DC bus reference:

If you want the bus reference to be:	Then, set P123 to:
A constant voltage	0
A voltage set by an auxiliary source	1
The sum of a constant value and an auxiliary source	2
Adjusted automatically to follow the line voltage	3

2. Set the constant bus reference value, if required:

If you set P123 to:	Then:
0 or 2	Set P207 to the desired DC bus voltage.

3. Set the auxiliary bus reference, if required:

If you set P123 to:	Then:
1 or 2	Set P122 to the desired auxiliary bus voltage.

4. Set the parameters for automatic bus referencing, if required:

If you set P123 to:	Then:
3	(1) Set P35, bit 0 to "1" for regeneration only. (2) The RGU will regulate to a bus voltage equal to the peak of the AC line plus a percentage of the peak, as defined by P130. Enter a value between -5% and +10% in P130. (3) P129 will display the bus voltage that is being commanded by the automatic bus reference function.

If the RGU is run in parallel with an NRU, then P35 bit 0 must be set to 1, and P123 must be set to 3.

5. The RGU compares the DC bus voltage command with both the minimum (P124) and maximum (P125) bus reference voltages, as shown in Figure 9.3 to ensure that the DC bus voltage command value is valid. Refer to P126 for an adjusted DC bus voltage command that falls within the minimum and maximum limits.

6. Set P127 to the desired rate of bus change. You may select a rate from 0%/5 ms to 280%/5 ms. P128 contains the resulting DC bus reference.

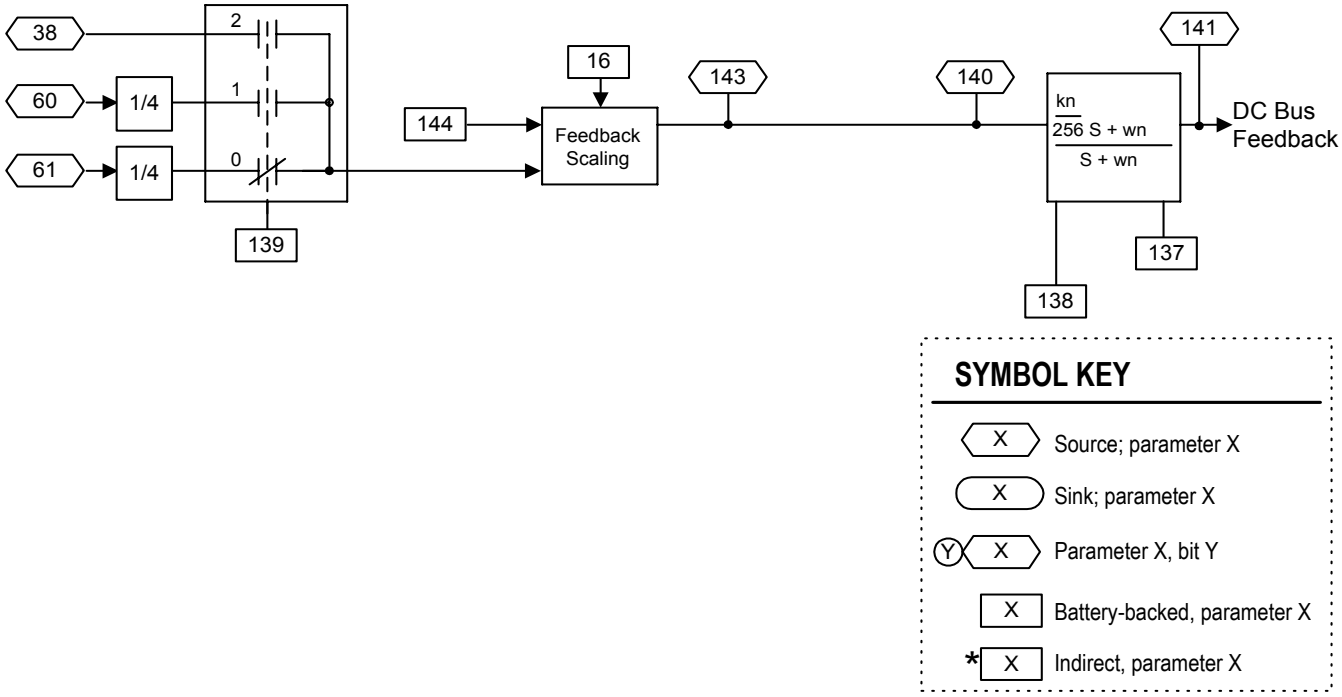
Monitoring the DC Bus Feedback

The DC bus feedback is a measurement of the DC bus voltage. Refer to Figure 9.4 For a firmware diagram that monitors the DC bus feedback.

Three different feedback references are available. Each reference provides the same voltage feedback at a different reference point in the processor. We recommend that you use the default setting (0) for P139.

The bus feedback is then scaled. When the feedback select (P219) is set to "0", the bus feedback is applied to the feedback filter. The feedback filter is configured using P137 and P138. Finally, P141 provides the DC bus feedback.

Figure 9.4
Firmware Diagram for Monitoring the DC Bus Feedback



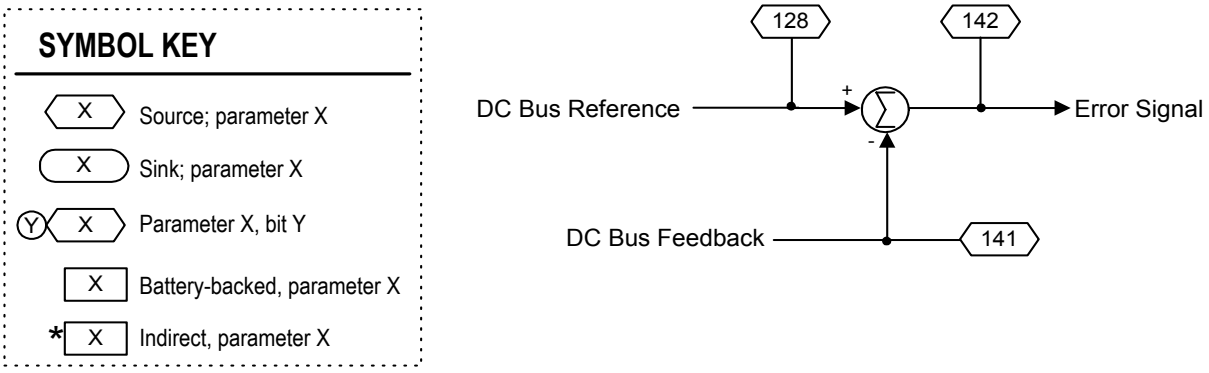
Parameter Number	Parameter Name
16	Nominal DC Voltage
38	Host A/D Converter Input 2
60	DSP DC Bus Voltage
61	DSP Averaged DC Bus Voltage
137	Wn, Bus Feedback Filter Bandwidth
138	Kn, Bus Feedback Filter Gain
139	Voltage Input Select
140	Prefiltered Feedback
141	DC Bus Feedback
143	Scaled Bus Feedback
144	Bus Feedback Calibration

1. Set P219 to "0" for normal operation (this value cannot be changed while the unit is running).
2. Select values for Wn (P137) between 0 and 32767 radians/second, and Kn (P138) between 0 and 1 of the feedback filter.
3. P141 contains the final DC bus feedback value.

Comparing the DC Bus Reference with the DC Bus Feedback

As shown in Figure 9.5, the error signal is the difference between the DC bus reference (P128) and the DC bus feedback (P141).

Figure 9.5
Firmware Diagram for Comparing the DC Bus Reference with the DC Bus Feedback



Parameter Number	Parameter Name
128	Bus Reference
141	Bus Feedback
142	Voltage Loop Error

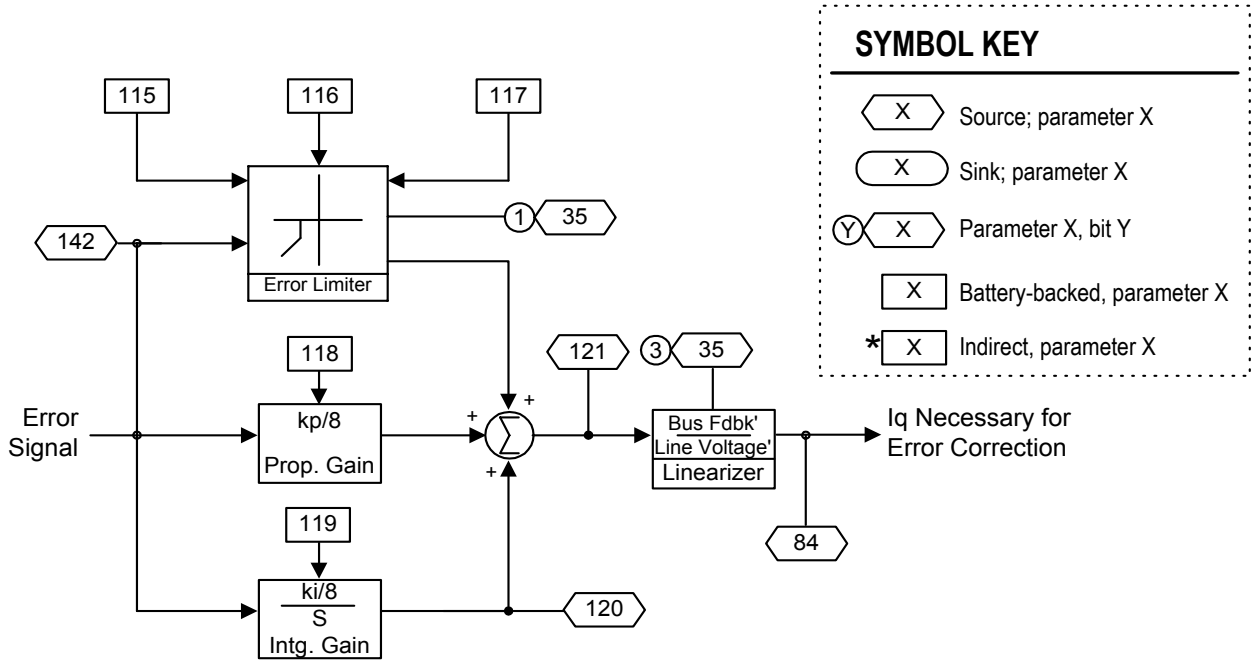
Processing Bus Data and Making Necessary Error Corrections in the PI Regulator

The PI (proportional-integral) regulator is responsible for making the necessary corrections to reduce the error signal (P142). Refer to Figure 9.6 for the PI regulator firmware diagram. In addition to having proportional and integral correction capabilities, the PI regulator also has the added feature of an error limiter.

The error limiter provides additional correction whenever the error signal exceeds the maximum error signal allowable (P115). The error limiter is only functional when the error limiter has been turned on and the RGU is regenerating.

Once the corrected I_q command has been calculated (P121), the linearizer can be used to keep the I_q command fairly constant when the installation is subject to fluctuations in the AC line and DC bus voltages.

Figure 9.6
Firmware Diagram for Processing Bus Data and Making Necessary Error Corrections in the PI Regulator



Parameter Number	Parameter Name
35 bit 1	Host Mode - Error Limiter
35 bit 3	Host Mode - Linearizer
84	Voltage Regulator Output
115	Voltage Loop PI Error Limit
116	Voltage Loop Error Limit Step
117	Voltage Loop Error Gain Limit
118	Voltage Loop Proportional Gain

Parameter Number	Parameter Name
119	Voltage Loop Integral Gain
120	Voltage Loop Inegrator Output
121	Voltage Loop PI Output
140	Bus Prefiltered Feedback

1. Verify the proportional gain setting (P118). The value calculated by the RGU is recommended.
2. Verify the integral gain setting (P119). The value calculated by the RGU is recommended.
3.

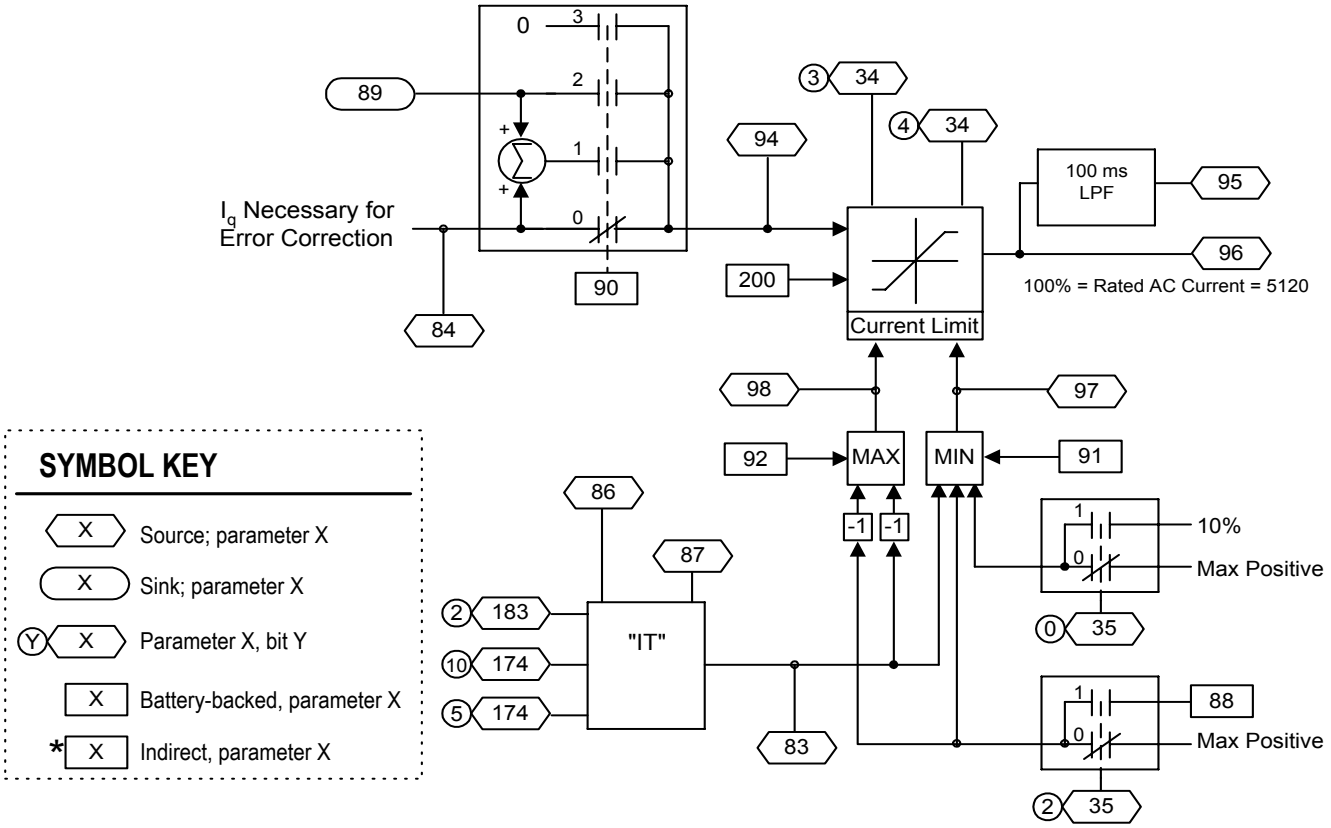
If:	Then:
You want to use the error limiter	(1) Set P35, bit 1 to "1" to enable the error limiter. (2) Set P115 to the maximum error between -100 and -4V DC that you will allow. (3) Set P116 to the maximum allowable voltage loop step of the error limiter. (4) Set P117 to the proportional gain of the error limiter.

Note: *The error limiter functions only when the unit is regenerating (and P35 bit 1 is set).*

Generating a Voltage Loop I_q Command

The voltage loop I_q command can originate in one of four ways as determined by user-configurable P90. That resulting I_q command is then processed through the current limiter to arrive at a voltage loop I_q command. The current limiter makes adjustments to maintain minimum and maximum I_q values and acceptable wire temperatures. Refer to Figure 9.7 for a firmware diagram.

Figure 9.7
Firmware Diagram for Generating a Voltage Loop I_q Command



Parameter Number	Parameter Name
34 bit 3	Host Status Word 2 - $I_{q\ Positive\ Limit}$
34 bit 4	Host Status Word 2 - Iq Negative Limit
35 bit 0	Host Mode - Regeneration Only
35 bit 2	Host Mode - Auxiliary Limit
83	It Foldback Current Limit
84	Voltage Regulator Output
86	Transistor Junction Temperature
87	Heatsink Temperature
88	Auxiliary Iq Current Limit
89	Auxiliary Iq Current Command
90	Iq Mode Select
91	Iq Positive Current Limit
92	$I_{q\ Negative\ Current\ Limit}$
94	Iq Current Command

Parameter Number	Parameter Name
95	Filtered Iq Current Reference
96	Iq Current Reference
97	Net Positive Current Limit
98	Net Negative Current Limit
174 bit 5	Host Fault Status Word 1 - Iq Foldback
174 bit 10	Host Fault Status Word 1 - Heatsink Overtemperature
183 bit 2	Host Fault Status Word 4 - I^{2t} Overload
200	Iq Reference Rate Limit

1.

If you want the I_q mode select to be:	Then set P90 to:
From the PI regulator (factory default)	0
The sum of the Iq from the PI regulator and an auxiliary Iq	1
An auxiliary Iq	2
Zero	3

2.

If:	Then:
You want to use a current limit that is applied to both positive and negative currents	(1) Set P35, bit 2 to "1" to enable the auxiliary limit. (2) Set P88 to the desired limit value between 0 and 150%.

3.

If:	Then:
You want to set a positive current limit	Set P91 to the desired positive current limit between 10 and 150%.

4.

If:	Then:
You want to set a negative current limit	Set P92 to the desired negative current limit between -150 and -40%.

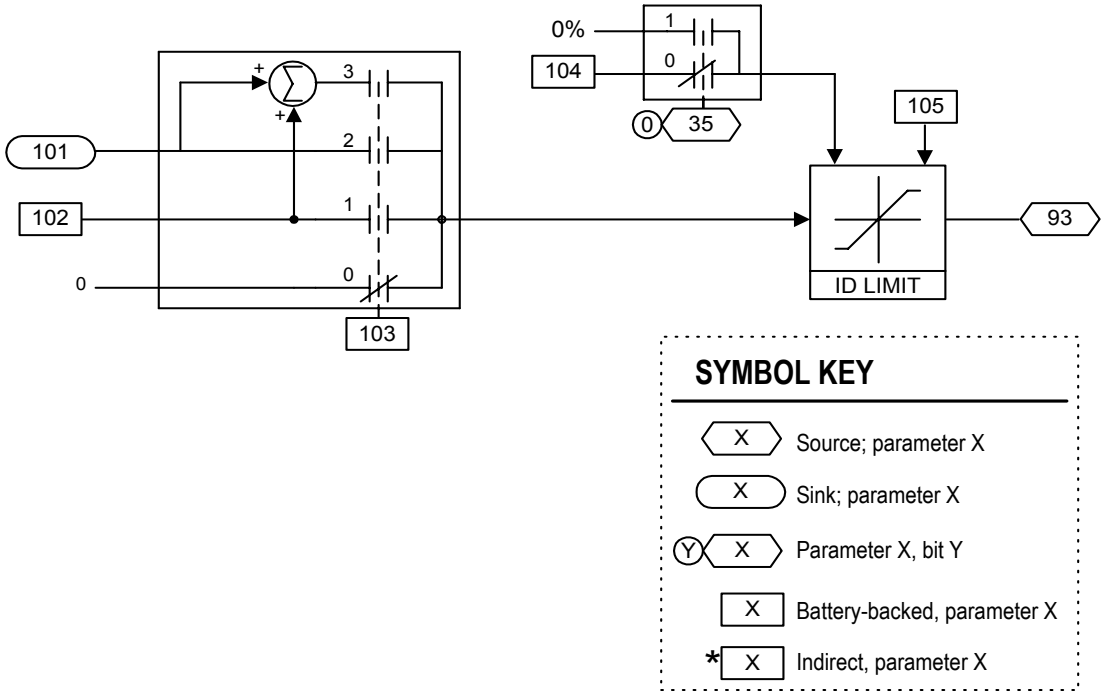
5. During operation, if the heatsink temperature (P87) or transistor-junction temperature (P86) becomes too high, the “IT” function will impose a current limit. See P83 for the IT-imposed current limit.

6. The RGU limits the desired Iq command (P94) using the smallest positive current limit (P97) and the largest negative current limit (P98). Refer to P96 for the final voltage loop I_q command.

Generating a Voltage Loop I_d Command

The voltage loop I_d command can originate in one of four ways as determined by user-configurable P103. That resulting I_d command is then processed through the I_d current limiter to arrive at a voltage loop I_d command. The current limiter makes adjustments to maintain the minimum and maximum I_d limit values. Refer to Figure 9.8 for a firmware diagram.

Figure 9.8
Firmware Diagram for Generating a Voltage Loop Id Command



Parameter Number	Parameter Name
35 bit 0	Host Mode - Regeneration Only
93	$I_{d\ Reference}$
101	Auxiliary Id Command
102	Id Current Command
103	Id Mode Select
104	Id Positive Current Limit
105	Id Negative Current Limit

1.

If you want the I_d mode select to be:	Then set P103 to:
Zero (factory default)	0
A constant value	1
From an auxiliary Id	2
The sum of a constant value and an auxiliary Id	3

2.

If P103 is set to:	Then:
1 or 3	Set P102 to the desired I_d current command between -40% and 60%. A value of zero is default and should be used for most applications.

3.

If P103 is set to:	Then:
2 or 3	Set P101 to the desired auxiliary I_d current command between -40 and 60%.

4.

If P103 is set to:	Then:
0	I_d parameter (P93) will be zero.

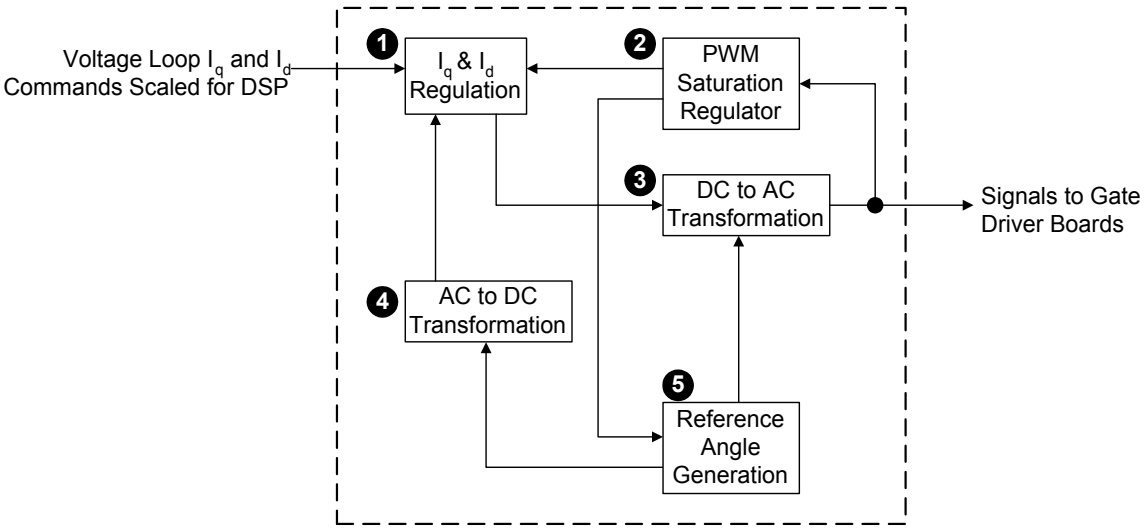
5. Set P105 to the desired negative I_d current limit between -40 and 0%.

6. Refer to P93 for the final voltage loop I_d command between -60 and 60%.

Current Loop Regulation

The current loop, which resides in the DSP processor, is responsible for processing the voltage I_q and I_d commands and generating the PWM signals for the IGBTs. The voltage loop is executed every 0.5 ms (2 kHz). The current loop is executed every 0.5 ms (2 kHz) for L, M, and N-code units, or is executed every 0.25 ms (4 kHz) for J and K-code units. Refer to Figure 9.9 for a current loop block diagram.

Figure 9.9
Current Loop Block Diagram



Current loop tasks include (Step numbers below correspond to the functional boxes shown in Figure 9.9):

1. I_q and I_d regulation
2. PWM saturation regulation
3. DC to AC transformation
4. AC to DC transformation
5. reference angle generation

I_q and I_d Regulation

I_q and I_d perform PI current regulation.

PWM Saturation Regulation

The PWM saturation regulator monitors current distortion and adjusts power factor compensation as required to maintain commanded bus voltage and current.

DC to AC Transformation

DC to AC transformation converts DC equivalents into 3-phase AC values for use in PWM.

AC to DC Transformation

AC to DC transformation converts 3-phase AC values into DC equivalents for use in calculation.

Reference Angle Generation

The reference angle generator executes a phase-lock loop algorithm to provide a reference angles that are in phase with those of the utility 3-phase AC line – line to neutral voltage.

Interpreting and Setting Status, Command, and Fault Words

Fault Status Indication

The RGU has 4 fault status words. Each fault status word has its own fault-report-mask word and fault/warning-mask word. The following table contains a fault status-to-parameter number cross reference:

Description	Fault Status Parameter Number	Fault-Report-Mask Parameter Number	Fault/Warning-Mask Parameter Number
Fault Status Word 1	174	175	176
Fault Status Word 2	177	178	179
Fault Status Word 3	180	181	182
Fault Status Word 4	183	184	185

Use the following table to interpret bit settings in fault status and mask word:

Parameter Type	A Bit Set to "0" Means:	A Bit Set to "1" Means:
Fault Status Word	Not faulted.	A fault/warning has occurred.
Fault-Report-Mask	- Fault/warning will not be recorded in fault queue or warning queue. - RGU operation will NOT respond to fault or warning.	- Fault/warning will be recorded in fault queue or warning queue. - If a fault occurs, the hard-fault bit 0 will be set to 1 in both host status words (Parameters #33 and #34). - If a warning occurs, the warning-fault bit 1 will be set to 1 in both host status words (Parameters #33 and #34).
Fault/Warning-Mask	Item set to cause a warning when corresponding fault-report bit is set to 1.	Item set to cause a fault when corresponding fault-report bit is set to 1.

The items that correspond to each bit in a fault status word/mask are identified in Table 10.1.

Table 10.1 Descriptions of Fault Status Bits

Fault Status Word 1 (P174-P176)

Bit	Description
0	ROM bad CRC
1	RAM error
2	Battery-backed RAM error
3	Error loading DSP software
4	Error loading FPGA software
5	I_q foldback has occurred
6	M1 failure
7	SCANport error
8	RGU-to-RGU hardware error
9	Control voltage inadequate
10	Heatsink temperature is high
11	DC bus voltage less than minimum bus limit
12	DC bus voltage greater than maximum bus limit
13	Invalid data in battery-backed RAM
14	Bus failed to precharge
15	Host processor cannot connect to DSP processor

Fault Status Word 2 (P177-P179)

Bit	Description
0	Board-level desaturization
1	Board-level ground fault detected
2	Hardware-detected bus overvoltage
3	Hardware-detected bus overcurrent
4	Zero sequence errror
5	Phase-lock loop
6	Phase-loss error
7	RESERVED
8	RESERVED
9	RESERVED
10	Line overcurrent
11	Current offset
12	DSP processor not connecting to host
13	RESERVED
14	RESERVED
15	Unknown DSP processor error

Fault Status Word 3 (P180-P182)

Bit	Description
0	Reset due to host clock loss
1	Reset due to host double bus fault
2	Watchdog reset
3	RGU power-up enabled
4	Battery low for battery-backed RAM
5	Primary control clock has been lost
6	RGU-to-RGU duplicate address
7	Slave RGU lost communications from Master RGU
8	Dual-port RAM error
9	DSP clock is no longer synchronized with host clock
10	Loss of fast task
11	Loss of background task
12	Address bus error
13	Data bus error
14	Line voltage is low
15	Line voltage is high

Fault Status Word 4 (P183-P185)

Bit	Description
0	I^{2t} approaching overload
1	I^{2t} overload
2	Heatsink temperature high
3	Reset required
4	Heatsink sensor open, not connected
5	Heatsink sensor shorted
6	Master RGU has faulted
7	RESERVED
8	RESERVED
9	RESERVED
10	RESERVED
11	RESERVED
12	RESERVED
13	RESERVED
14	RESERVED
15	RESERVED

Host Processor Information

RGU host processor information is made available via command, status, and mode words as follows:

Word Name	Parameter Number	Type of Information Provided
Host Processor Command Word	32	RGU command selection, see Table 10.B
Host Processor Status Word 1	33	Present conditions and status of operation.
Host Processor Status Word 2	34	Present conditions and status of operation.
Host Processor Mode Word	35	Specific information on operating modes, see Table 10.B

Use the following table to interpret bit settings:

Parameter Type	A Bit Set to "0" Means:	A Bit Set to "1" Means:
Command Word	Specific command is not executed.	Specific command is executed.
Status Word	Condition is false.	Condition is true.
Mode Word	Mode is disabled.	Mode is enabled.

The items that correspond to each bit are identified in Table 10.2.

Table 10.2 Descriptions of Bits

Host Processor Command Word (P32)

Bit	Description
0	Clear faults
1	Enable the RGU
2	Reset watt-hour meter
3	Save parameters
4	Recall parameters
5	Initialize parameters using defaults
6	Clear warnings
7	Reset RGU
8	Clear Fault Que
9	Clear Warning Que
10	Disable RGU
11	Reset the RGU
12	RESERVED
13	RESERVED
14	RESERVED
15	RESERVED

Host Processor Mode Word (P35)

Bit	Description
0	Operate in regenerative mode only
1	Error limitor is enabled
2	Auxiliary limit is used for current limit
3	Linearizer enabled
4	RESERVED
5	RESERVED
6	RESERVED
7	RESERVED
8	RESERVED
9	RESERVED
10	RESERVED
11	RESERVED
12	RESERVED
13	RESERVED
14	RESERVED
15	RESERVED

Host Processor Status Word 1 (P33)

Bit	Description
0	Hard fault has occurred
1	Warning fault has occurred
2	Clear fault(s) request pending
3	Clear warning(s) request pending
4	Bus control relay closed
5	Bus is at half of its rated voltage
6	Bus is at rated voltage
7	RGU enabled
8	DSP processor is ready
9	Bus control is ready
10	RESERVED
11	RESERVED
12	RESERVED
13	DC bus precharge complete
14	RGU control is ready
15	DC bus is under RGU control

Host Processor Status Word 2 (P34)

Bit	Description
0	Hard fault has occurred
1	Warning fault has occurred
2	Power factor is lagging
3	I_q is negative limited
4	Iq is negative limited
5	External clear fault required
6	Regenerating current
7	External enable activated
8	M1 feedback (1=closed)
9	DC bus at voltage
10	Wire overtemperature (I^2t) monitoring is active
11	Wire overtemperature (I^2t) warning
12	RESERVED
13	RESERVED
14	RESERVED
15	DC bus is under RGU control

DSP Processor Information

RGU DSP processor information is made available via one command and one status word as follows:

Word Name	Parameter Number	Type of Information Provided
DSP Processor Status Word	62	Present operational state of DSP.
DSP Processor Command Word	63	Host and system states for DSP usage.

Use the following table to interpret bit settings:

Parameter Type	A Bit Set to “0” Means:	A Bit Set to “1” Means:
Command Word	State is inactive.	State is active.
Status Word	Condition is false.	Condition is true.

The items that correspond to each bit are identified in Table 10.3.

Table 10.3 Descriptions of Bits

DSP Processor Status Word (P62)

Bit	Description
0	RESERVED
1	RESERVED
2	RESERVED
3	RESERVED
4	RESERVED
5	RESERVED
6	RESERVED
7	RESERVED
8	DSP is Ready
9	DSP is Running
10	DSP is Faulted
11	RESERVED
12	RESERVED
13	RESERVED
14	RESERVED
15	RESERVED

DSP Processor Command Word (P63)

Bit	Description
0	Host reset
1	Host enabled
2	Host run
3	Host faulted
4	Bench test PWM
5	Bench test sinusoid
6	External main contactor is closed (TRUE)
7	Current offset is enabled
8	RESERVED
9	RESERVED
10	RESERVED
11	RESERVED
12	RESERVED
13	RESERVED
14	RESERVED
15	RESERVED

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Configuring Analog Input and Output Parameters

Analog Inputs

The RGU has two 14-bit, analog-to-digital convertors (A/D) rated to receive user-configured analog inputs in the range of +/-10V DC. The two A/Ds are labeled ADC0 and ADC1.

The A/Ds are not programmed and will clip voltage inputs that exceed +10V or are less than -10V. When converted to digital values, the A/D will output values in the range of +/-8192. A +10V input equates to +8192, -10V to -8192.

The following A/D parameter contains the quantized equivalent of the voltage applied at the analog input:

Description	ADC0 Parameter Number	ADC1 Parameter Number
Value after A/D conversion	36	37

The analog input is accessible via terminal block 1 (TB1) on the main control board as follows:

ADC Name	Input	Terminal Designator
ADC0	(+)	TB1-2
	(-)	TB1-1
ADC1	(+)	TB1-5
	(-)	TB1-4

A/D Value Parameters

Use this parameter to view the quantized value of the voltage applied at the analog inputs.

Analog Outputs

The RGU has two 12-bit, digital-to-analog convertors (DAC) rated to provide analog outputs in the range of +/- 10V DC. The two DACs are labeled DAC1 and DAC2.

Each DAC is programmed using 4 parameters that identify the value to be sent to the analog output and specify how that value needs to be scaled prior to digital-to-analog (D/A) conversion. Refer to Figure 11.1 for a block diagram. These parameters are as follows:

Description	DAC1 Parameter Number	DAC2 Parameter Number
Source (Indirect)	49	53
Offset	50	54
Gain	51	55
Cutoff frequency for the internal low-pass filter	52	56

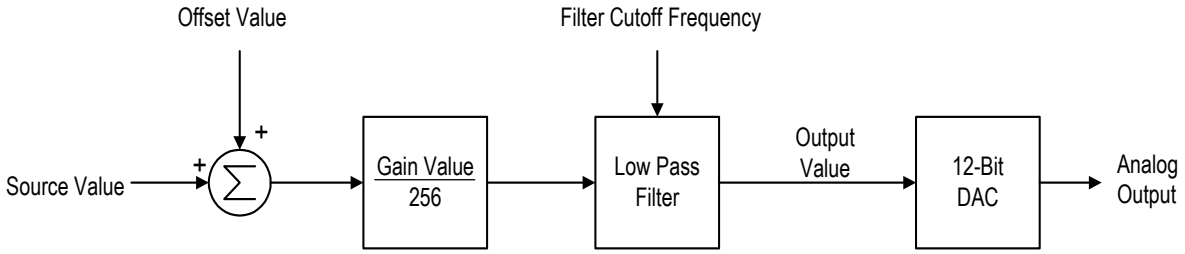
The following DAC parameter allows you to view the scaled value prior to D/A conversion:

Description	DAC1 Parameter Number	DAC2 Parameter Number
Scaled value prior to D/A conversion	47	48

The analog output is accessible via terminal block 1 (TB1) on the main control board as follows:

DAC Name	Output	Terminal Designator
DAC1	(+)	TB1-7
	(-)	TB1-8
DAC2	(+)	TB1-9
	(-)	TB1-10

Figure 11.1
Scaling Process for Analog Outputs



DAC Source Parameters

Use this parameter to specify the parameter number of the value that you want sent to the analog output.

For example:

If you want to output P143 (Scaled Bus Feedback), enter **143** in the Source Parameter (P49 or P53).

DAC Offset Parameters

Use this parameter to add or subtract an offset from the source value. An offset is arithmetically added to the source value.

To determine the relationship between the offset value and the source value, do the following:

1. Verify that P6 (Unit Selection) is set to display engineering units.
2. Identify the maximum and minimum values of the source value.
3. Looking at the maximum and minimum source values, determine the desired amount of offset and convert that amount to the nearest integer.
4. Enter that integer value as your offset.

Important: The offset value is not scaled in relation to the source value units; the offset value is directly added to the source value. The large range of acceptable offset values is intended to provide flexibility.

Note: *When specifying an offset value, verify that the offset value is of a desired magnitude when compared to DAC source parameter.*

DAC Gain Parameters

Use this parameter to specify the gain of the value that you want sent to the analog output. To determine a gain value, do the following:

1. Verify that P6 (Unit Selection) is set to display engineering units.
2. Identify the maximum and minimum values of the source value.
3. Add the offset value to both the maximum and minimum source values.
4. Select the largest absolute source value as the maximum DAC output.
5. Select a gain so that the maximum DAC output will not exceed +/- 2048.

Important: A gain value of 0 will result in an analog output value of 0V.

Important: If you select a gain value that permits the DAC output to exceed +/- 2048, the analog output value will cutoff to +10V DC for DAC outputs greater than +2048, and to -10V DC for DAC outputs less than -2048.

DAC Cutoff Frequency Parameters

Use this parameter to specify a cutoff frequency for the low pass filter.

Note: *A cutoff frequency of zero deactivates the filter.*

DAC Output Parameters

Use this parameter to view the scaled source value that is being converted and applied to the analog output.

Analog Output Example

Example:
In a unit with a 460V AC input, send the Scaled Bus Feedback (P143) out through Analog Out 1. The analog output will be between 0 and +10V.

---

143 Scaled Bus Feedback
[Scaled Bus Fbk]

This parameter shows the calibrated bus feedback. The value of this parameter is used to determine the Bus Feedback (P141) and is used to calculate the DC Bus Current (P107).

Parameter Type	Source (Read Only)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0
Minimum Value	0
Maximum Value	1.5 x P16
Related Parameters	P38, P60, P61, P144

Note: *The maximum value of P143 for this example would be 1050V (1.5 x 700 = 1050).*

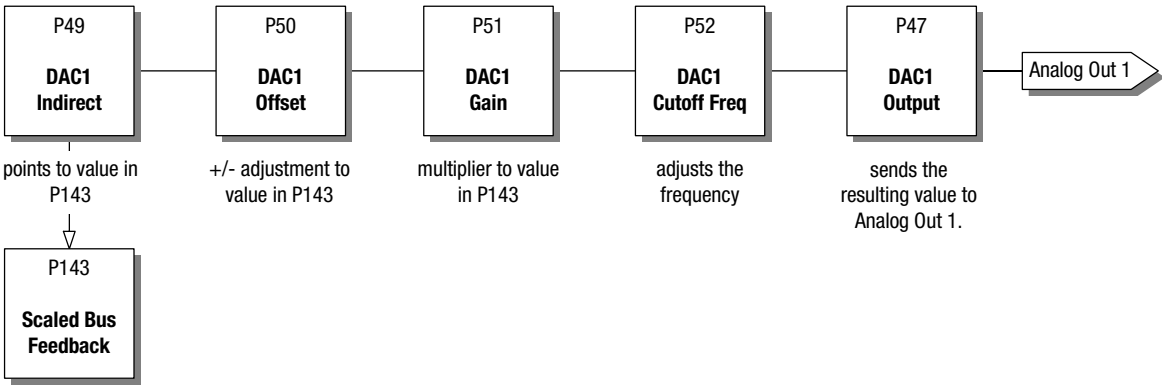
The DAC1 Indirect (P49) will be used to select which parameter should be processed through DAC1 (out TB1-7 and TB1-8).

The DAC 1 Offset (P50) will be used to determine how the parameter information will be adjusted (+/-) before being sent to Analog Out 1.

The DAC1 Gain (P51) will be used to adjust the magnitude of the signal being sent to Analog Out 1.

The DAC1 Cutoff Frequency (P52) will be used to adjust the frequency of the output to Analog Out 1.

The DAC1 Output (P47) will be used to view the output being sent to Analog Out 1. The value 2047 corresponds to a +10V AC output being sent to Analog Out 1, and the value -2048 corresponds to a -10V AC output being sent to Analog Out 1.



The following steps could be taken to send the Scaled Bus Feedback out through Analog Out 1 (TB1-7 and TB1-8) with an output of 0 to +10V.

1. Select P49 (DAC1 Indirect) and enter **143**.

P49 will allocate P143 as the source of output for Analog Out 1.

2. Select P50 (DAC1 Offset) and enter **0**, then select P51 (DAC1 Gain) and enter **0.33**.

The range of our source parameter (P143) needs to correspond with the desired range of the DAC1 Output (P47). To do this, we set the gain and offset.

Possible range of P143:	0-1050 (volts) / 0-6144 (internal units)
Desired range of DAC1 Output:	0-2047 (which corresponds to 0-10V)

It is the *internal units* of P143 are sent to the DAC1 Output. Here is how we can calculate the maximum internal units of P143.

$$\text{Max Internal Units} = \underbrace{\frac{\text{Max User Units} \times 4096}{\text{P16}}}_{\text{Formula for P143 Internal Units}} = \frac{1050 \times 4096}{\underbrace{700}_{\substack{\text{P16 = 700 in a unit} \\ \text{with a 460V AC input}}}} = 6144$$

The offset and gain needed to adjust P143 (0-6144) to the range of P47 (0-2047) can be calculated as shown below.

(P143 + Offset) x Gain = P47

(0 + Offset) x Gain = 0	(Min)
(6144 + Offset) x Gain = 2047	(Max)

The minimums are both zero, so for this example, we can set the offset to 0, and can just determine what multiplier (gain) would be needed.

6144 x Gain = 2047
Gain = 0.333

Setting P50 (DAC1 Offset) to 0 and setting P51 (DAC1 Gain) to 0.33 will result in a range of 0-2047 being sent to the P47 (DAC1 Output), which is what we want.

3. Select P52 (DAC1 Cutoff Frequency) and enter 0.5. Since this is monitoring a DC value, the filter can be set to a low value.

4. Select P47 (DAC1 Output) to view the values being sent to the D/A converter. The values in P47 (0 to 2047) should correspond to the magnitude of the output (0 to +10V).

Setting Up Trending

Trending is a diagnostic tool that you can use to capture and retain an input parameter data value until a trigger condition occurs. The RGU has the capacity to setup and monitor up to 4 parameters, Trend 1 through Trend 4. With trending, you program the:

- parameter to sample
- trigger condition
- sampling rate
- quantity of samples to be taken after the trigger occurs
- whether trending is to occur one time or continuously

Parameters used by trending are shown in the table below.

Table 12.1 Trending Parameters

Description	Trend 1 Parameter Number	Trend 2 Parameter Number	Trend 3 Parameter Number	Trend 4 Parameter Number
source	293	305	317	329
variable X source	294	306	318	330
variable X constant value	295	307	319	331
variable Y source	296	308	320	332
variable Y constant value	297	309	321	333
operator (comparison type)	298	310	322	334
sampling rate	299	311	323	335
quantity of post-trigger samples	300	312	324	336
mode (one-shot or continuous operation)	301	313	325	337
select	302	314	326	338
status	303	315	327	339
output	304	316	328	340

Selecting the Parameter to Sample

1. Identify the number of the parameter that you want to sample.

2.

If you are programming Trend:	Then enter the number of the parameter to be sampled in:
1	P293
2	P305
3	P317
4	P329

Setting the Trigger Condition

The trigger condition defines the event that must be true before the trend is triggered (activated). After the trend is activated and the required number of post samples have been recorded, the last 500 samples for that trend are made accessible via the output parameter.

The following statement determines the trigger point:

[Variable X] [Operator] [Variable Y]

Variable X is compared to Variable Y. If the condition specified by the Operator is true, then the trend is triggered. Typically, you link one variable to a parameter and the other variable to either a parameter or a constant value.

Important: You should make sure that you are comparing either both signed parameters or both unsigned parameters. Trying to compare a signed parameter to an unsigned parameter could cause unexpected results.

To set the trigger condition:

1.

If you want variable X to be a:	Then:
Parameter value	Identify the parameter number of that parameter.
Constant value	Select a desired constant value in the range of +32767 to -32768.

2.

If you have identified a parameter number for variable X and are programming Trend:	Then enter the number of the parameter to be sampled in:
1	P294
2	P306
3	P318
4	P330

3.

If you have selected a constant value for variable X and are programming Trend	Then:
1	1. Set P294 to"0". 2. Enter the desired constant value in P295.
2	1. Set P306 to"0". 2. Enter the desired constant value in P307.
3	1. Set P318 to"0". 2. Enter the desired constant value in P319.
4	1. Set P330 to"0". 2. Enter the desired constant value in P331.

4.

If you want variable Y to be a:	Then:
Parameter value	Identify the parameter number of that parameter.
Constant value	Select a desired constant value in the range of +32767 to -32768.

5.

If you have identified a parameter number for variable Y and are programming Trend:	Then enter the number of the parameter to be sampled in:
1	P296
2	P308
3	P320
4	P332

6.

If you have selected a constant value for variable Y and are programming Trend	Then:
1	1. Set P296 to"0".
	2. Enter the desired constant value in P297.
2	1. Set P308 to"0".
	2. Enter the desired constant value in P309.
3	1. Set P320 to"0".
	2. Enter the desired constant value in P321.
4	1. Set P332 to"0".
	2. Enter the desired constant value in P333.

7. Select the number that corresponds to the desired operator using the table below:

Number	This Operator:	Compares:
0	GT (Greater Than)	Data values for X and Y.
1	LT (Less Than)	Data values for X and Y.
2	EQ (EQual)	Data values for X and Y.
3	NE (Not Equal)	Data values for X and Y.
4	AND	16-bit word in X to a 16-bit mask in Y.
5	NAND (Negated AND)	16-bit word in X to a 16-bit mask in Y.
6	OR	16-bit word in X to a 16-bit mask in Y.
7	NOR (Negated OR)	16-bit word in X to a 16-bit mask in Y.

Important: Remember that the trigger condition is compared in the following manner [Variable X] [Operator] [Variable Y].

8.

If you are programming Trend:	Then enter the operator in:
1	P298
2	P310
3	P322
4	P334

Setting the Sampling Rate

You can specify how often you want the RGU to take data samples. Data samples may be taken 2 milliseconds apart to 30 seconds apart.

Note: *The trigger condition is evaluated:*

- at the rate of sampling whenever the sampling rate is less than 20 milliseconds
- at 20 milliseconds whenever the sampling rate exceeds 20 milliseconds.

1. Select a sampling rate between 0 and 30 seconds.

2.

If you are programming Trend:	Then enter the sample rate in:
1	P299
2	P311
3	P323
4	P335

Note: *The RGU will round the desired sample rate to the nearest 2-millisecond interval.*

Setting the Number of Post Samples

You also need to specify the number of data samples to be taken once a trigger condition occurs. You can specify that 0 to 499 post samples be taken. One sample is reserved for the instance when the trigger condition becomes true.

> ***Note:*** *"Pre-samples" are samples taken prior to the trigger condition becoming true.*

Important: Typically, when a trend buffer is set to trigger on a fault, you would set the post sample quantity to a lower value, such as 20. This allows you to evaluate the trended parameter's data from before the trigger.

When a trend buffer is set up as a level detector, the post sample value is generally set to a higher value. This allows you to evaluate what happened after the trigger occurred.

1. Determine the number of samples to be taken after the trigger point becomes true.

2.

If you are programming Trend:	Then enter the post trigger samples in:
1	P300
2	P312
3	P324
4	P336

Important: If the trigger condition occurs before the pre-samples can be taken, the pre-samples may be unreliable. The pre-samples are valid only if the trigger does not occur before the pre-sample time has elapsed. You can use the following equation to determine pre-sample time:

$T_1 = (500 - S_2 - 1) \times R_S$

T_1 pre-sample time

S_2 the number of post samples

R_S the sample rate

Setting the Trend Mode and Selection

1.

If you want the trend to be:	Select the following value for the Trend Mode:
Continuous	1
One shot	0

2.

If you are programming Trend:	Then enter the mode value in:
1	P301
2	P313
3	P325
4	P337

3.

If you want the trend to be:	Select the following value for the trend selection:
Disabled	0
Enabled	1
Forced to Trigger	2

4.

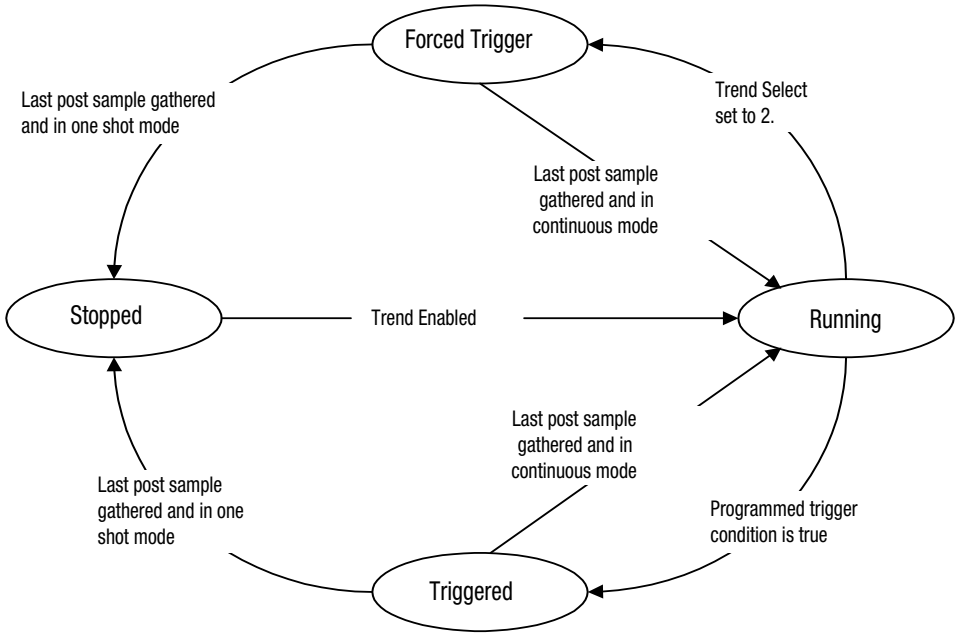
If you are programming Trend:	Then enter the mode value in:
1	P302
2	P314
3	P326
4	P338

Trending Status

The trending operation has five associated states (refer to Figure 12.1 for an illustration of the trending operation cycle.):

Number	This Operator:	Compares:
0	Unprogrammed	Trending is not operational.
1	Stopped	No data samples are being taken and output contains the data samples that have been taken for the previous trending.
2	Running	The trigger condition has not been reached and data samples are being taken at the specified rate. Output contains the data samples from the previous trend.
3	Triggered	The trigger condition has occured and the post samples are being taken.
4	Forced Triggered	The trigger condition was forced so that the post samples could be taken.

Figure 12.1
Trending Operation Cycle



1.

For the status of Trend:	See:
1	P303
2	P315
3	P327
4	P339

Looking at the Output

When the trend output is linked to the analog output and a chart recorder is then connected to the analog output, you can view the trend output. To locate the starting point of a trend, look for a negative spike followed by a positive spike. These spikes are added to indicate the oldest piece of sampled data.

If you want to look at the current data, you can read the real time trend sample data using:

- the DriveTrending portion of the DriveTools software
- a GPT

RGU Catalog Numbers

This appendix provides a description of RGU catalog numbers. For spare part kit information, see publication 2364-6.0.

Understanding Catalog Numbers

Catalog numbers consist of various components that make up a 2364 unit. Each character of the catalog number helps identify a specific RGU. The first four numbers represent the family of products (for example, 2364). The remaining characters define a specific version or option.

Determining Catalog Numbers

To help you to understand, we will provide an example of how to determine a catalog number for a 2364 RGU unit.

The beginning portion of the catalog number for all 2364 RGU units is 2364F (F is for the regenerative, DC bus supply unit). The remaining portion of the catalog number will represent the options for which you need to make a selection.

The options must appear in this order:

2364	**F**	*Wiring type*	-	*Current rating*	*Enclosure*	*AC input line voltage*	-	**XX**	*Trip device type*	-	*Options*

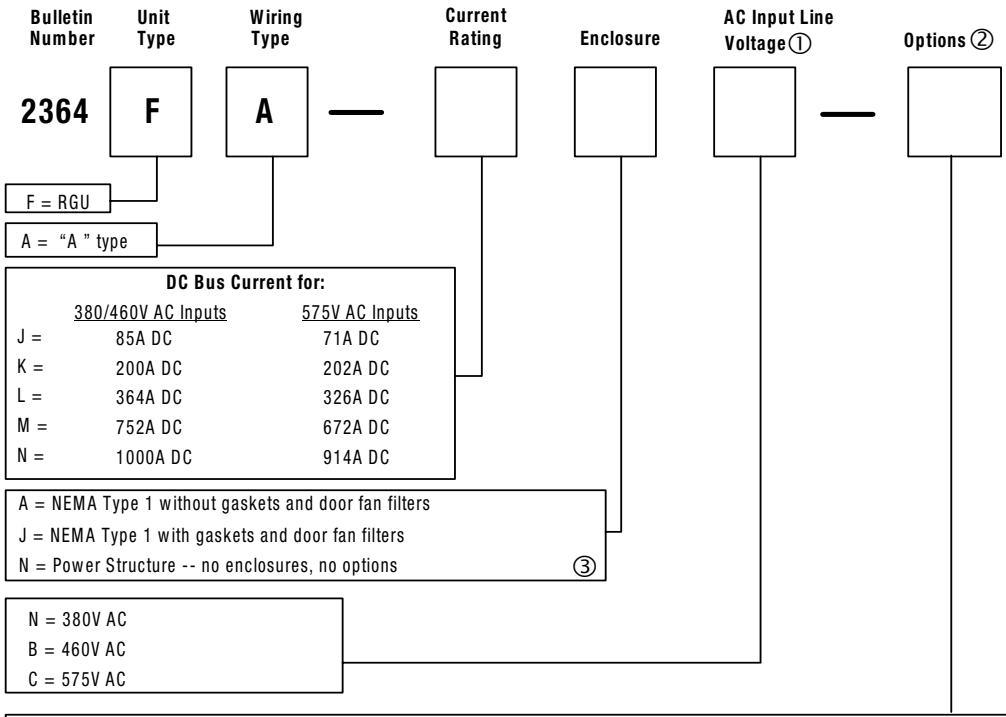
For example, if you were to use the table on the following page to select an RGU that:

- supplies 743A DC output
- inputs 460V AC
- has a NEMA Type 1 enclosure without gaskets and door fan filters
- includes the option:

  •Analog DC Bus Voltmeter

The catalog number would be: **2364FA-MAB-XXCM-715P**

RGU Catalog Numbers



Control Power Source ④	6P = Standard capacity control transformer for control bus
Door-Mounted Pilot Lights	4EA = Unit-Not-Faulted / Control Bus Power On Pilot Light
Door-Mounted Pushbutton	1R = Unit Reset
Metering	710P = Analog AC input ammeter (L1 Phase only) 715P = Analog DC bus voltage meter
Protection	14LSP = Line RC suppressor module ⑤ 88GF = Ground-fault detection ⑥
Communication Options ⑦	14G1 = Remote I/O communication interface board 14G2 = RS232/422/483 (using DF1 protocol) and DH485 communication interface board 14G5 = DeviceNet communication interface board
Unit Door Nameplates	M3EW = White background with black lettering; phenolic label N3EB = Black background with white lettering; phenolic label N3ER = Red background with white lettering; phenolic label
Human Interface Module ⑧	14HAPC = Door-mounted HIM (programmer only) 14HNBC = Door-mounted SCANport connector (HIM cradle & internal connection cable only)
Miscellaneous	14WLBL = Brady Datab ™ wire labels ⑨ J12 = 115V DC, 15A duplex receptacle ⑩ J11 = Audio phone jack

Footnotes:

① System utilization voltages.

② Multiple option numbers must be separated by a dash and added to the base catalog number.

③ IGBT module assembly is available for use as a spare part; do not include HP code, trip device, or options in the catalog string. IGBT module assembly includes IGBT modules, snubbers, free-wheeling diodes, module fan, precharge resistors, gate driver boards, main control board, and isolation board. Example: 2364FA-KNB

④ Each RGU includes a basic capacity control transformer that supplies the RGU with control power. The control power source option allows you to select a higher capacity control transformer for control bus applications. Control power source option includes a control bus fuse and control bus.

⑤ The line RC suppressor is recommended for installations where the primary of the distribution transformer is 2300V AC or greater.

⑥ Power transformer must have a resistive, grounded-wye secondary where the resistance is 150 ohms.

⑦ The RGU can accommodate up to 1 of the following options: 14G1, 14G2, or 14G5.

⑧ Human Interface Module options permit HIM or GPT connection through a closed unit door. Only one Human Interface Module option can be selected.

⑨ Units come standard with cloth wire labels. Datab labels offer the added protection of a clear plastic cover on top of the labels.

⑩ Customer supplies 115V AC control power and wiring to the duplex receptacle.

Bulletin 2364F RGU Spare Part Kits

Spare part kit information for all 2364 products can be found in publication 2364-6.0.

Specifications

Functional Specifications

Table B.1 Functional Specifications

Efficiency	97%
AC Input Frequency Tolerance	45 to 65 Hz
AC Input Voltage Tolerance	±10%
Motoring Output Current Overload	150% of rated current for 60 seconds
Regenerating Output Current Overload	150% of rated current for 60 seconds 150% of rated current for 30 seconds (380/460V AC N-code RGUs at 40°C, or 575V AC N-code RGUs at 30°C)
Output Voltage Variation	10% maximum for a ±100% DC output current step load change
Resolution of Output Voltage Selection	1.0V
Voltage Regulator Bandwidth	200 radians/sec maximum
Current Regulator Bandwidth	800 radians/sec (for 2 kHz units) 1200 radians/sec (for 4 kHz units)

Table B.2 Operating Sound Level

RGU Current Code	Average Operating Sound Level (dB) ①
J	75
K	77
L	84
M	82
N	85

① Sound level determined using "A"-type weighting.

ATTENTION: Appropriate hearing protection must be used in accordance with your company standards and local ordinances. (OSHA dictates effective hearing protection is to be administered when employees are exposed to noise equal to or greater than an 8-hour time-weighted average sound level of 85 decibels.)

Electrical Specifications

Table B.3 Electrical Specifications I

RGU Current Code	Nominal Input Voltage (V AC)	① Continuous AC Line Current (A AC)	Input Power (kVA)	Nominal DC Bus Voltage (V DC)	Maximum Continuous DC Bus Current (A DC)	②Rated DC Bus (kW)	Control Transformer Ratings	
							Basic Capacity (kVA)	Standard Capacity (kVA)
J	380	77	51	564	85	49	2.0	5.0
K	380	182	120	564	200	116	2.0	5.0
L	380	330	217	564	363	211	2.0	5.0
M	380	678	447	564	746	433	5.0	5.0
N	380	906	596	564	997	578	5.0	10.0
J	460	77	61	683	85	59	2.0	5.0
K	460	182	145	683	201	141	2.0	5.0
L	460	330	263	683	364	255	2.0	5.0
M	460	678	541	683	749	524	5.0	5.0
N	460	906	722	683	1000	700	5.0	10.0
J	575	77	62	848	88	74	2.0	5.0
K	575	182	181	848	201	170	2.0	5.0
L	575	286	285	848	326	276	2.0	5.0
M	575	602	600	848	686	582	5.0	5.0
N	575	802	799	848	914	775	5.0	10.0

① The continuous AC line current values apply to both motoring and regenerating operations.
② Rated DC bus kW is the power available on the DC thru bus at rated voltage and current.

Table B.4 Electrical Specifications II

RGU Current Code	Input Voltage (V AC)	Internal Capacitance (uF)	Line Inductance (uH)	Overcurrent Trip (Arms)	Overcurrent Trip Reference (TP20 Volts)	Overvoltage Trip (V DC)	Overvoltage Trip Reference (TP22 Volts)	Burden Resistor (Ohms)	Warning Temperature (ºC)	Trip Temperature (ºC)
J	380	6450	1193	173	4.55	820	3.75	8.87	80	100
K	380	12000	510	409	4.55	820	3.75	7.50	80	100
L	380	15000	317	743	4.55	820	3.75	6.19	80	100
M	380	24000	137	1526	4.55	820	3.75	4.02	80	110
N	380	24000	102	2039	4.55	820	3.75	3.01	80	110
J	460	6450	1193	173	4.55	820	3.75	8.87	80	100
K	460	12000	510	409	4.55	820	3.75	7.50	80	100
L	460	15000	317	743	4.55	820	3.75	6.19	80	100
M	460	24000	137	1526	4.55	820	3.75	4.02	80	110
N	460	24000	102	2039	4.55	820	3.75	3.01	80	110
J	575	2860	1853	140	4.55	1025	4.69	11.0	80	100
K	575	6000	832	409	4.55	1025	4.69	7.50	80	100
L	575	15000	404	644	4.55	1025	4.69	7.15	80	100
M	575	24000	191	1354	4.55	1025	4.69	4.53	80	110
N	575	24000	144	1805	4.55	1025	4.69	3.40	80	110

Table B.5 Typical Capacitor Bank Values in uf/10 (For 380/460V AC Lineups)

Frame Size ⇨	A							B					C	D			E		F		G		H
HP ⇨	0.5-1	1.5	2	3	5	7.5-10	15-20	1	3	7.5-10	15	20-30	40-60	60	75-100	125-150	150-200	250	250	300-450	250	300-600	700-800
1336 FORCE/	-	-	-	-	-	-	-	16	33	135	215	430	645	645	900	1200	1200	1500	-	2070	1500	2400	2400
1336 IMPACT	16	22	33	47	68	135	-	-	-	-	215	430	645	645	900	1200	1200	1500	-	2070	1500	2400	2400
1336 PLUS/1336	16	22	33	47	68	135	135	-	-	-	215	430	645	645	900	1200	1200	1500	2070	2070	1500	2400	-

Table B.6 Typical Capacitor Bank Values in uf/10 (For 575V AC Lineups)

Frame Size ⇨	A		B		C	D		E		F	G	H
HP ⇨	1-10	15-20	1-10	15-20	25-60	75-100	125	150	200-300	350-400	300-600	700-800
1336 FORCE/SA3100	-	-	90	140	290	400	600	900	1500	1800	2400	2400
1336 IMPACT	75	-	-	140	290	400	600	900	1500	1800	2400	2400
1336 PLUS/1336 PLUS II	75	75	-	-	290	400	600	900	1500	1800	2400	-

Table B.7 Typical Capacitor Bank Values for SA3000 Inverters (in uf/10)

Inverter	56A	70A	112A	140A	192A	240A	534A	972A	1457A
Capacitance	380	470	760	940	1330	1645	3200	6400	12800

Environmental Specifications

Table B.8 Operating Conditions

Altitude	3,300 feet (1,000 meters) ①
Ambient Temperature	0° to 40° C (32° to 104° F) ②
Relative Humidity	5% to 95%, non-condensing

① For altitudes higher than 1000 meters, derate RGU using Figure 2.
② For temperatures greater than 40° C, derate RGU using Figure 3.

Table B.9 Storage Conditions

Ambient Temperature	0° to 40° C (32° to 104° F)
Relative Humidity	5% to 95%, non-condensing

Figure B.1
Altitude Derate Curve

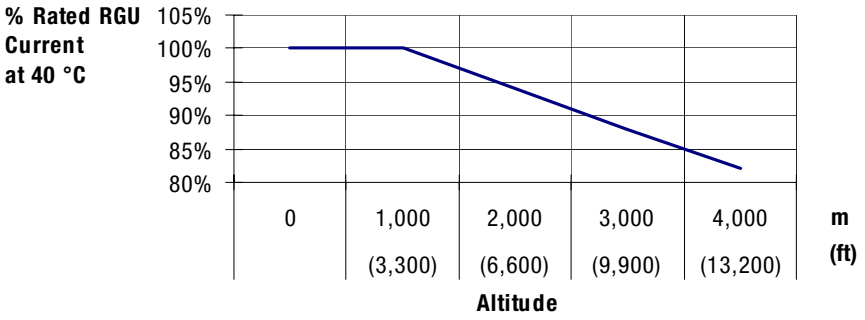
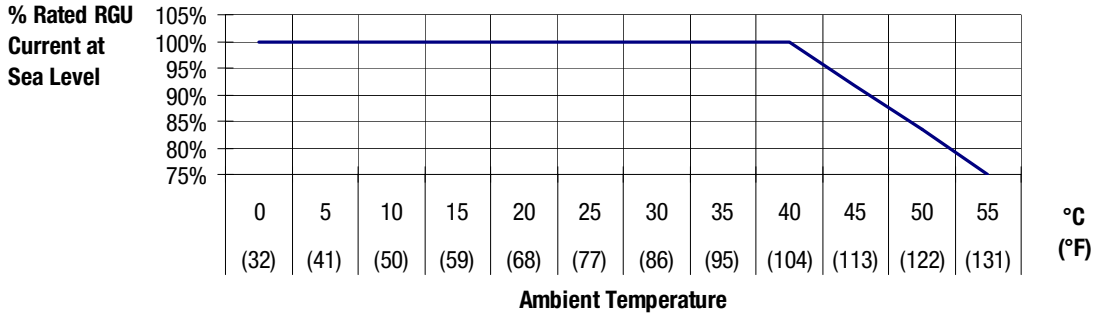


Figure B.2
Temperature Derate Curve



Power Dissipation

380V AC
460V AC
575V AC

Figure B.3
J-Code RGU Watts Dissipation versus % Load

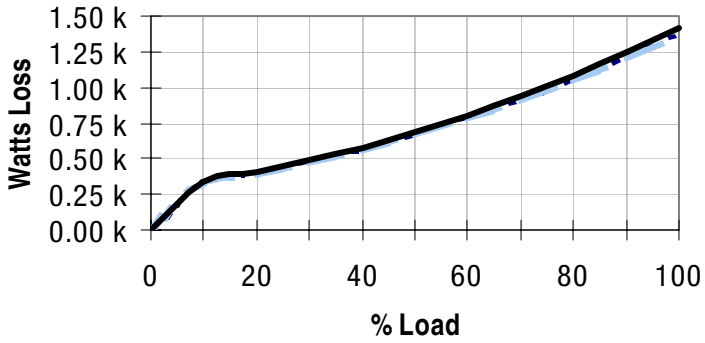


Figure B.4
K-Code RGU Watts Dissipation versus % Load

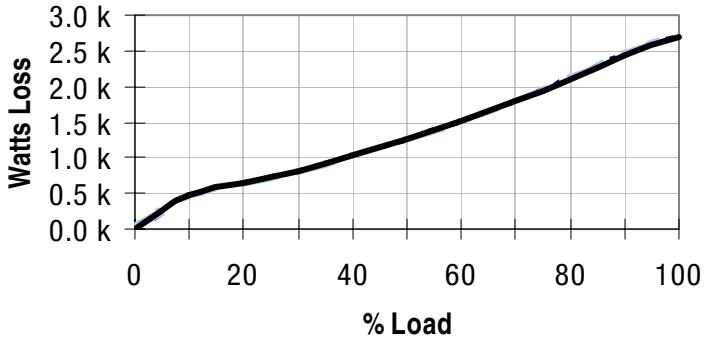


Figure B.5
L-Code RGU Watts Dissipation versus % Load

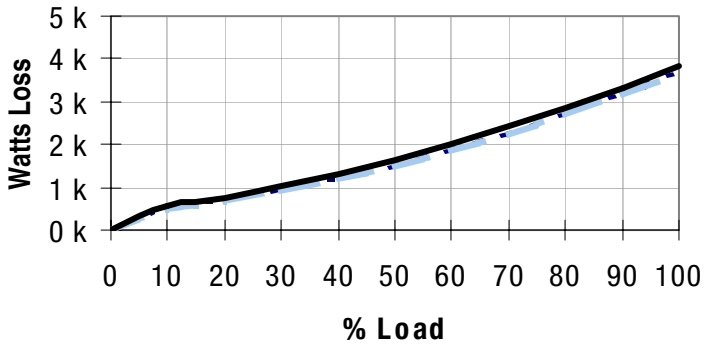


Figure B.6
M-Code RGU Watts Dissipation versus % Load

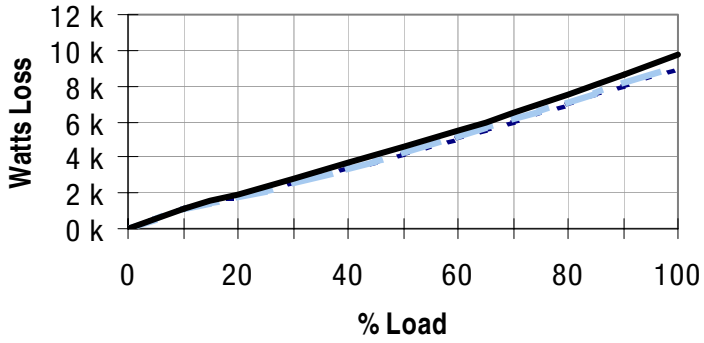
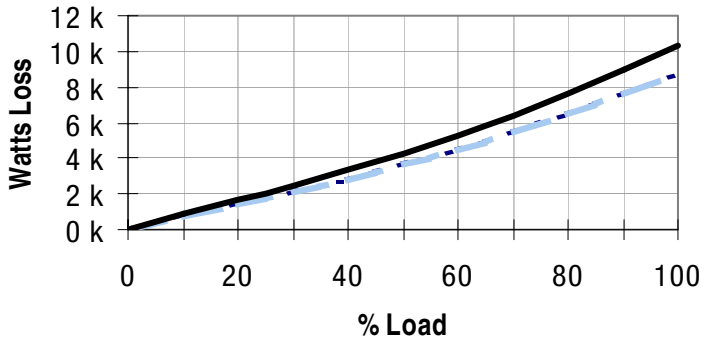


Figure B.7
N-Code RGU Watts Dissipation versus % Load



Physical Details

Physical Specifications

Table C.1 RGU Physical Specifications

Current Code	Height ①	Overall Width	Overall Depth ②	Number of MCC Sections
J	90" (2286 mm)	25" (635 mm)	15 or 20" (508 mm)	1
K	90" (2286 mm)	45" (1143 mm)	20" (508 mm)	2
L	91.5" (2324 mm)	55" (1397 mm)	20" (508 mm)	2
M	103.5" (2629 mm) ③	70" (1778 mm)	25" (635 mm)	2
N	91.5" (2324 mm)	90" (2286 mm)	25" (635 mm)	3

① The L, M, and N-code RGU heights include a 1.5 inch-high base channel (standard). This base channel is an option for the J and K-code RGUs.

② The M and N-code RGUs use both 20-inch deep MCC(s) and a 25-inch deep MCC, having an overall depth of 25 inches. Figure 1 shows top-view illustrations of the M and N-code RGUs.

③ The M-code height (103.5") includes the enclosure height (90"), the base channel (1.5"), and a top hat assembly (12"). The top hat assembly is shipped loose from the unit.

Approximate Shipping Weights

Table C.2 Approximate Shipping Weights

Unit Current Code	Weight of Regenerative Module ①	Weight of Complete RGU Unit
J	85 lb (39 kg)	970 lb (440 kg)
K	260 lb (119 kg)	1450 lb (658 kg)
L	440 lb (200 kg)	2020 lb (916 kg)
M	1000 lb (455 kg)	2900 lb (1316 kg)
N	1000 lb (455 kg)	3850 lb (1746 kg)

① The regenerative module for the J current code RGU is panel mounted. The regenerative modules for the K, L, M, and N current code RGUs are built as roll-out module assemblies.

MCC Structures and Bus Architecture

Figure C.1
MCC Structures Showing Bus Architecture (J, K, and L-Code RGUs)

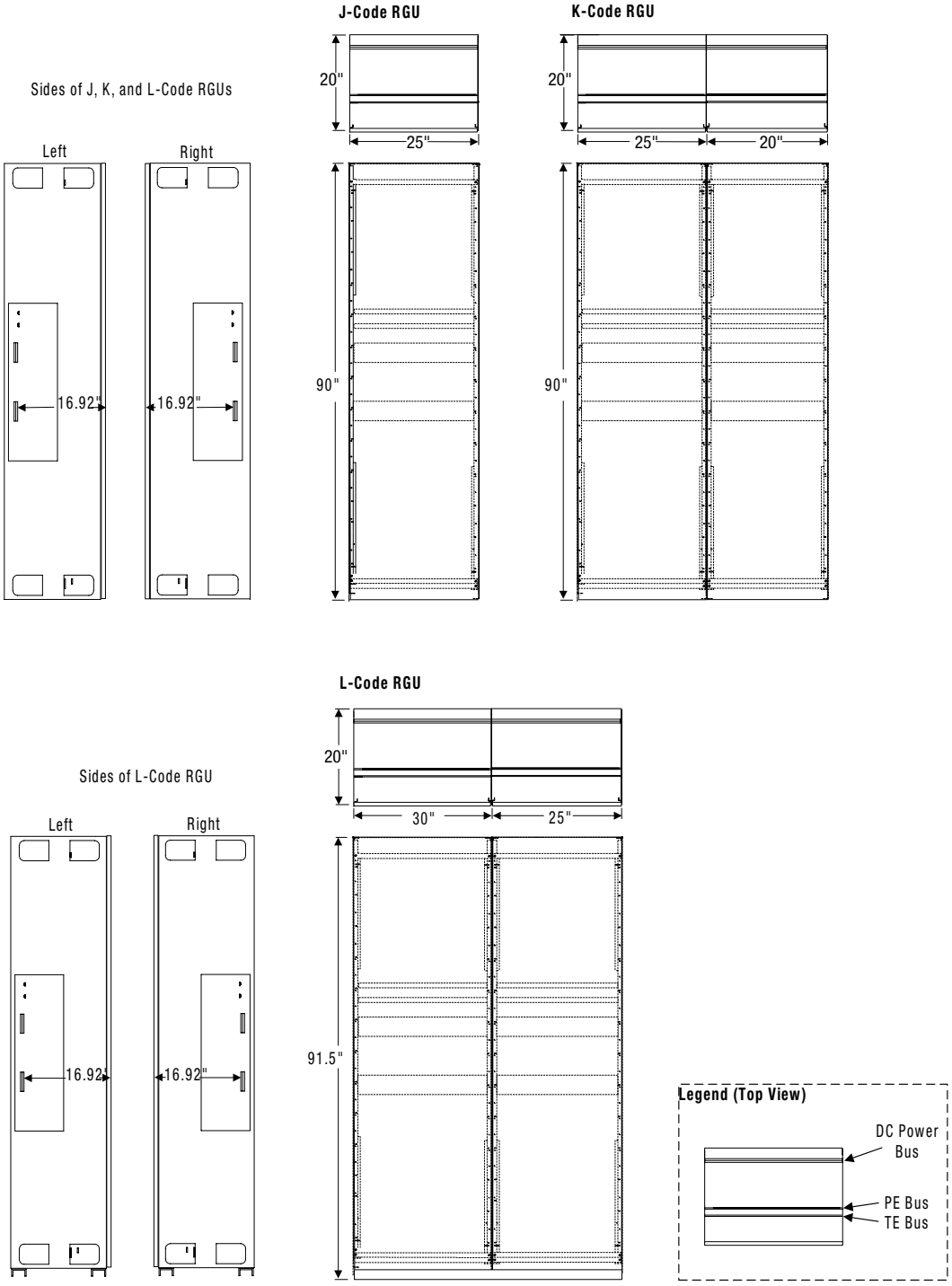
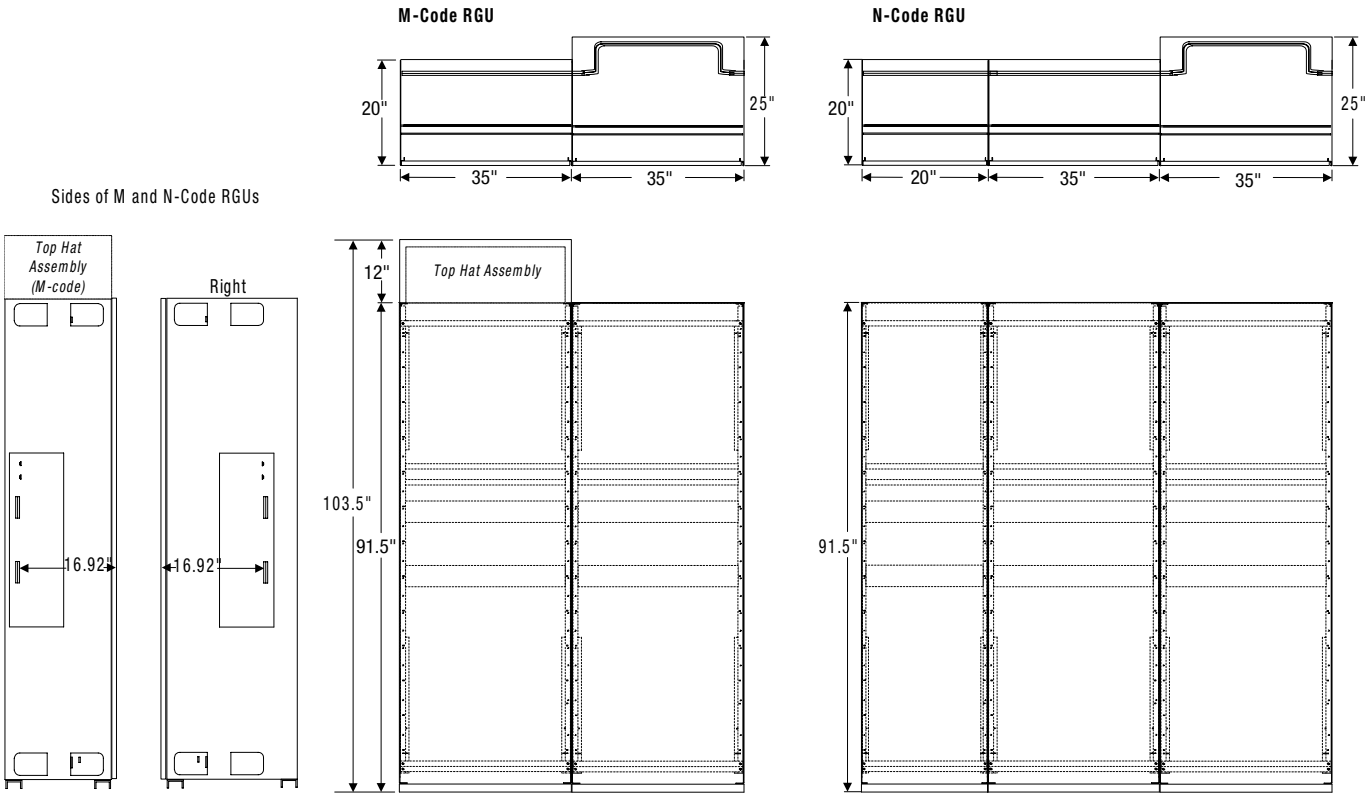


Figure C.2
MCC Structures Showing Bus Architecture (M and N-Code RGUs)



Note: *For the M and N-code RGUs, the DC bus and control bus (if selected) in the section containing the regenerative module is at a depth greater than 16.92 inches, with the bus ends at a depth of 16.92 inches (as shown in Figure C.2).*

Wireway Meter Cover Details

Figure C.3 shows the location and sizes of holes that can be made for the mounting of meters in the wireway meter cover.

Figure C.3
Details of Meter-Mounting Holes

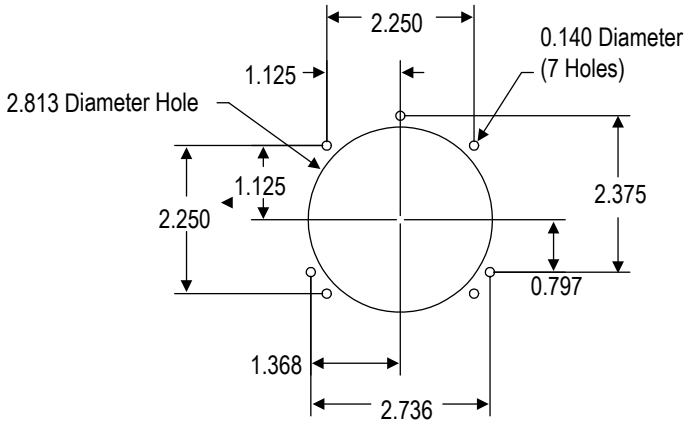
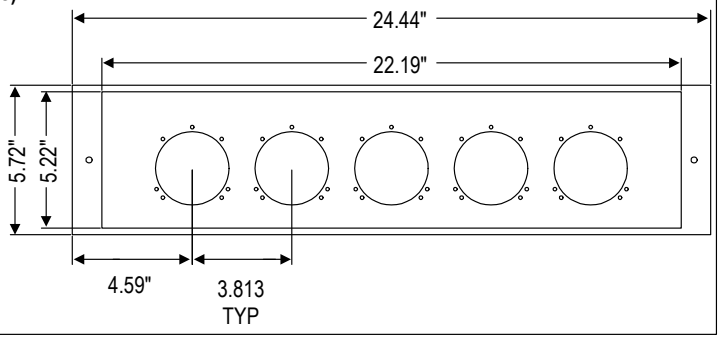
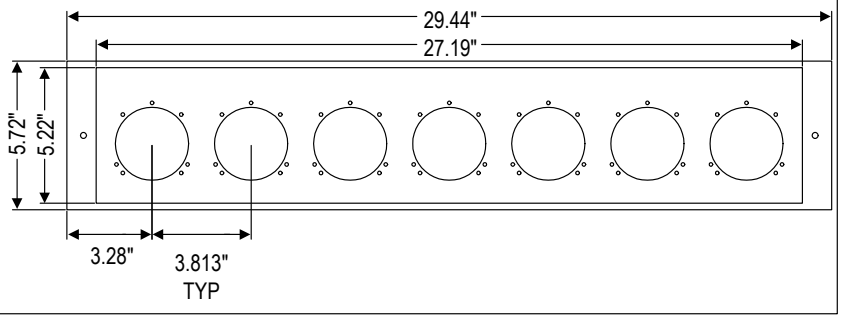


Figure C.4
Wireway Meter Cover Layouts

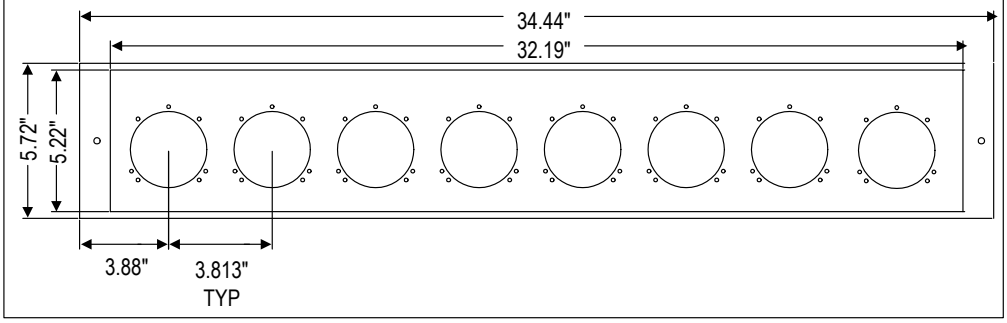
25"-Wide (J and K-Code RGUs)



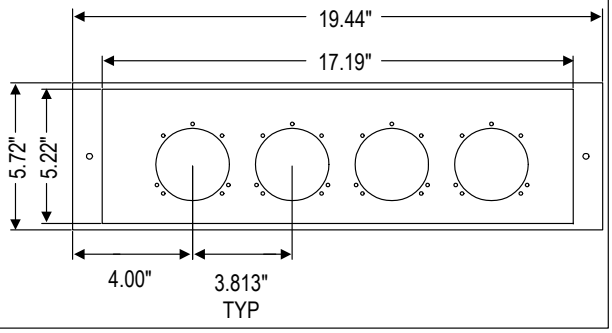
30"-Wide (L-Code RGUs)



35"-Wide (M-Code RGUs)



20"-Wide (N-Code RGUs)

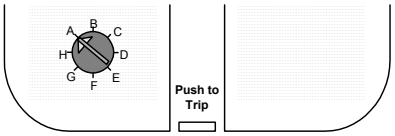


Recommended Disconnect Trip Settings

Table C.1 Recommended Disconnect Trip Settings

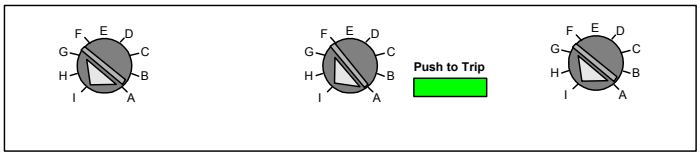
J-Code

Motor Circuit Protector (MCP1)
150A, HMCP-frame



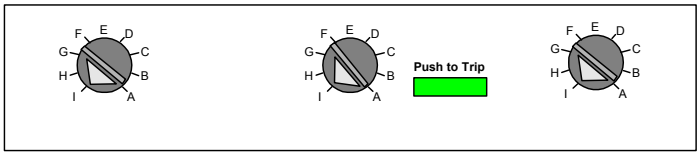
K-Code

Motor Circuit Protector (MCP1)
250A, HMCP-frame



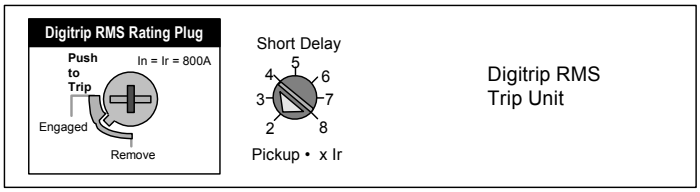
L-Code

Motor Circuit Protector (MCP1)



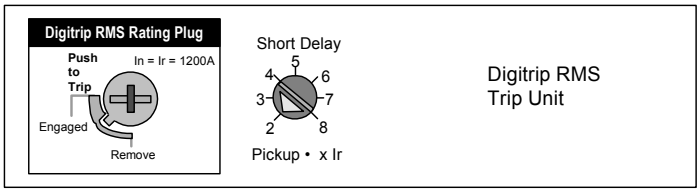
M-Code

Circuit Breaker (CB1)
800A, HND-frame

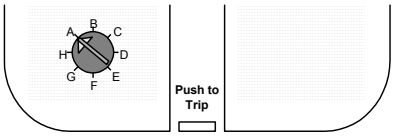


N-Code

Motor-Operated Circuit Breaker (CB1)
1200A, HND-frame



Motor Circuit Protector (MCP2)
30A, HMCP-frame



Programming Parameters

This appendix lists the programming parameters for the RGU.

A

32 Host Command Word B

[Host Command] C

D This parameter commands the processor to perform the function(s) indicated by each fault bit which is set to 1.

For example, to command the processor to clear faults, you would enter the command word, 0000 0000 0000 0001.

H

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	0000 1111 1111 1111
Related Parameters	P33, P34, P35

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

E

Bit	Description		G
0	Clr Faults	F Sends a command to clear faults in the RGU	
1	Enable Cmd	Sends a command to Enable RGU control	
2	Meter Reset	Sends a command to reset the watt-hour meter	
3	Save Command	Sends a command to save parameters	
4	Param Recall	Sends a command to reset parameters	
5	Default Init	Sends a command to initialize parameters to their defaults	
6	Clr Warnings	Sends a command to clear warnings in the RGU	
7	Reset Cmd	Sends a command to reset the RGU	
8	Clr Flt Que	Sends a command to clear the fault queue	
9	Clr Wrn Que	Sends a command to clear the warning queue	
10	Disable Cmd	Sends a command to Disable the RGU control	
11	Run Startup	Sends a command to reset the RGU and to initiate the startup sequence	
12-15	Not Used		

A Parameter Number

B Parameter Name

C Screen Text
This indicates the name shown on the display.

D Parameter Description
This describes the parameter's function and its relationship with other parameters. This may include diagrams and programming examples.

E Bit Number
For parameters displayed as words, the bits are displayed on the screen from 15 to 0. Each bit can be set separately (if read/write parameter).

F Bit Name
This indicates the bit name shown on the display screen.

G Bit Description
This describes the function of the bit end may show its relationship with other parameters or conditions.

H Parameter Specifications
These fields indicate parameter attributes.

Parameter Type	Indicates whether the parameter is a source or sink, and whether it is read/write or read only.
Display Units	Indicates the units shown on the display (i.e. %, Volts, uH).
Drive Units	Indicates the conversion formula for internal units. For example, if the drive units are equal to 'Display Units x 5120/100', a value of 15 on the display would be stored as 768 (15 x 5120/100) internally.
Factory Default	Indicates the default value for this parameter.
Minimum Value	Indicates the minimum value allowed.
Maximum Value	Indicates the maximum value allowed.
Related Parameters	Lists other parameters that are related in some way to this parameter.

1 RGU Software Version
[Software Version]

This parameter shows the version of software that is currently installed in the RGU.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 100
Factory Default	3.01
Minimum Value	0.00
Maximum Value	99.99

2 Password
[Password]

This parameter sets the user password. To select 'no password', set this to zero.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535

3 Language Select
[Language Sel]

This parameter is used to select the display language.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	0

Value	Description
0	English

4 Frame Catalog Number
[Frame Catalog #]

This parameter stores the frame catalog number of the RGU, describing the current code and input. This value is used to configure P10, P11, P12, and P16.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	11
Minimum Value	0
Maximum Value	15

Value	Description	
0	Not Used	
1	2364FA-JNN	(J-code, 380V AC)
2	2364FA-JNB	(J-code, 460V AC)
3	2364FA-JNC	(J-code, 575V AC)
4	2364FA-KNN	(K-code, 380V AC)
5	2364FA-KNB	(K-code, 460V AC)
6	2364FA-KNC	(K-code, 575V AC)
7	2364FA-LNN	(L-code, 380V AC)
8	2364FA-LNB	(L-code, 460V AC)
9	2364FA-LNC	(L-code, 575V AC)
10	2364FA-MNN	(M-code, 380V AC)
11	2364FA-MNB	(M-code, 460V AC)
12	2364FA-MNC	(M-code, 575V AC)
13	2364FA-NNN	(N-code, 380V AC)
14	2364FA-NNB	(N-code, 460V AC)
15	2364FA-NNC	(N-code, 575V AC)

5 RGU Control Mode
[RGU Control Mode]

This parameter is used to automatically configure other parameters for a master-slave or a standalone configuration.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	2
Minimum Value	0
Maximum Value	2
Related Parameters	None

Value	Description
0	Master Mode
1	Slave Mode
2	Standalone

6 Unit Selection
[Unit Selection]

This parameter selects the units (display or drive) to be shown on the display.

Selection 0 (Display Units) is recommended for setup and drive operation.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	1
Related Parameters	None

Value	Description
0	Display Units
1	Drive Units

7
P7 is for internal use only.

8 Remote/Local Selector
[Rem/Loc Selector]

This parameter determines if a HIM, GPT, or SCANport device can Enable or disable the RGU.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1
Minimum Value	0
Maximum Value	1
Related Parameters	None

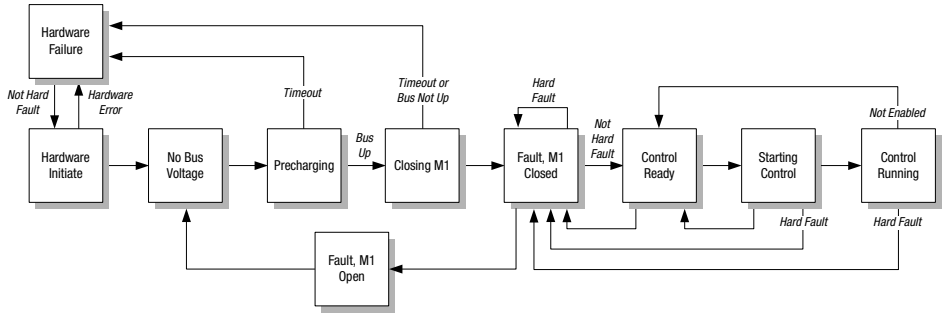
Value	Description	
0	Local Only	The RGU will modulate when the M1 contactor closes. A HIM, GPT, or SCANport device cannot start or Enable the RGU, but the Stop is always active.
1	Remote+Local	The HIM, GPT, or SCANport device can be used to Enable or Disable the RGU.

9 RGU State of Operation
[RGU State]

This parameter indicates the RGU's state of operation during the power-up sequence and during normal operation.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	9
Related Parameters	None

Value	Description	
0	HW Init	Indicates that the RGU hardware is initiating (startup or reset)
1	No Bus Voltage	Indicates that the DC bus is not yet powered
2	Precharging	Indicates that the RGU is precharging the capacitors
3	Closing M1	Indicates that precharging is complete and the main contactor M1 is closing
4	Flt, M1 Closed	Indicates that the RGU is faulted, M1 is closed
5	Flt, M1 Open	Indicates that the RGU is faulted, M1 is opened
6	HW Failure	Indicates that hardware failure has occured in the RGU
7	Crtl Ready	Indicates that the RGU control is ready for operation
8	Starting Ctrl	Indicates that the RGU control is starting operation
9	Ctrl Running	Indicates that the RGU control is processing



10 Nominal AC Line Voltage
[Nom Line Voltage]

This parameter stores the nominal input line voltage of the RGU.

Parameter Type	Source (Read/Write)
Display Units	Vrms
Drive Units	Display Units * 1
Factory Default	See below
Minimum Value	See below
Maximum Value	See below
Related Parameters	P4, P14, P26, P27

RGUs with a 380V AC Input		RGUs with a 460V AC Input		RGUs with a 575V AC Input	
Factory Default	380	**Factory Default**	460	**Factory Default**	575
Minimum Value	198	**Minimum Value**	207	**Minimum Value**	258
Maximum Value	418	**Maximum Value**	506	**Maximum Value**	633

11 Rated AC Line Current
[Rated AC Current]

This parameter stores the rated input line current of the RGU.

Parameter Type	Source (Read/Write)
Display Units	Amp
Drive Units	Display Units * 10
Factory Default	See below
Minimum Value	See below
Maximum Value	See below
Related Parameters	P4, P96, P100, P106

J-code RGUs		K-code RGUs		L-code RGUs		M-code RGUs		N-Code RGUs	
Factory Default	76.9	**Factory Default**	181.8	**Factory Default**	330.0 (286.0*)	**Factory Default**	678.0 (602.0*)	**Factory Default**	906.0 (802.0*)
Minimum Value	43.4	**Minimum Value**	93.6	**Minimum Value**	200.3	**Minimum Value**	421.4	**Minimum Value**	561.5
Maximum Value	84.6	**Maximum Value**	200.0	**Maximum Value**	363.4	**Maximum Value**	746.2	**Maximum Value**	996.6

* Value applies to units with 575V AC inputs

12 AC Line Reactor Inductance
[Line Inductance]

This parameter lists the total inductance of the AC line reactors (CH1-3) in standalone RGU configurations. Check the labels on the AC reactors to verify value.

Parameter Type	Sink (Read Only)
Display Units	uH
Drive Units	Display Units * 1
Factory Default	See below
Minimum Value	0
Maximum Value	3000
Related Parameters	P4

J-code RGUs		K-code RGUs		L-code RGUs		M-code RGUs		N-Code RGUs	
Factory Default	1193 (380/460V)	**Factory Default**	510 (380/460V)	**Factory Default**	317 (380/460V)	**Factory Default**	137 (380/460V)	**Factory Default**	102 (380/460V)
	1853 (575V)		832 (575V)		404 (575V)		191 (575V)		144 (575V)

13 Utility AC Line Frequency
[Utility AC Freq]

This parameter defines the input frequency of the RGU. Set to 50 or 60Hz.

Parameter Type	Sink (Read/Write)
Display Units	Hz
Drive Units	Display Units * 1
Factory Default	60
Minimum Value	45
Maximum Value	65
Related Parameters	None

14 Measured AC Line Voltage
[Line Voltage]

This parameter measures the incoming voltage on the AC line.

Parameter Type	Source (Read Only)
Display Units	Vrms
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	800
Related Parameters	P10, P15

15 AC Line Voltage Calibration
[Line Voltage Cal]

This parameter measures the voltage on the input line. The RGU must be Disabled (not modulating) when calibrating with this parameter.

To calibrate the measured AC line voltage (P14), adjust P15 until the value of P14 matches the reading of the AC input voltage on an external voltmeter.

Parameter Type	Sink (Read/Write)
Display Units	%
Drive Units	Display Units * 720/1000
Factory Default	0
Minimum Value	-3.1
Maximum Value	3.1
Related Parameters	P14

16 Nominal DC Bus Voltage
[Nom DC Bus Volts]

This parameter stores the nominal voltage on the DC bus. The nominal DC bus voltage is calculated as the nominal AC line voltage multiplied by the square root of two.

Parameter Type	Source (Read/Write)
Display Units	Volt
Drive Units	Display Units * 1
Factory Default	See below
Minimum Value	See below
Maximum Value	See below
Related Parameters	P4, P28, P29, P30, P141

RGUs with a 380V AC Input		RGUs with a 460V AC Input		RGUs with a 575V AC Input	
Factory Default	580	**Factory Default**	700	**Factory Default**	848
Minimum Value	200	**Minimum Value**	200	**Minimum Value**	200
Maximum Value	800	**Maximum Value**	800	**Maximum Value**	1000

17,18 *P17 and P18 are for internal use only.*

19 Seconds Counter
[Seconds Counter]

This parameter displays a running counter (in seconds). This can be used to verify that the system processor is running.

Parameter Type	Source (Read Only)
Display Units	sec
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535

20 Master Status
[Master Status]

This parameter displays the status of the master RGU in a master-slave configuration.

This status is sent to a slave unit through P272 (RGU-to-RGU Transmit Indirect). If this unit is not the master, the master status is received through P274 (RGU-to-RGU Receive 1, Indirect 1).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	0000 0000 0000 0011
Related Parameters	P5, P272, P274

Bit	Description
0	EnabledIndicates that the master unit is enabled.
1	FaultedIndicates that the master unit is faulted.
2-15	Not Used

21-25 *P21-P25 are for internal use only.*

26 AC Line Low Setting
[Line Low Setting]

This parameter defines the lowest acceptable AC line voltage. A fault or warning may be indicated in P180 (Host Fault Status Word 3)if the AC line voltage drops below the value of this parameter.

Parameter Type	Sink (Read/Write)
Display Units	Vrms
Drive Units	Display Units * 1
Factory Default	See below
Minimum Value	0
Maximum Value	800
Related Parameters	P14, P27, P180

RGUs with a 380V AC Input		RGUs with a 460V AC Input		RGUs with a 575V AC Input	
Factory Default	356	**Factory Default**	432	**Factory Default**	540

27 AC Line High Setting
[Line Hi Setting]

This parameter defines the highest acceptable AC line voltage. A fault or warning may be indicated in P180 (Host Fault Status Word 3) if the AC line voltage exceeds the value of this parameter.

Parameter Type	Sink (Read/Write)
Display Units	Vrms
Drive Units	Display Units * 1
Factory Default	528 (110% of 480V AC)
Minimum Value	0
Maximum Value	800
Related Parameters	P14, P26, P180

RGUs with a 380V AC Input	RGUs with a 460V AC Input	RGUs with a 575V AC Input
Factory Default 436	**Factory Default** 528	**Factory Default** 660

28 DC Bus Low Setting
[Bus Low Setting]

This parameter defines the lowest acceptable DC bus voltage. A fault or warning may be indicated in P174 (Host Fault Status Word 1) if the DC bus voltage falls below the value of this parameter.

Parameter Type	Sink (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	5/7 * P16
Minimum Value	0
Maximum Value	1.5 * P16
Related Parameters	P16, P29, P141, P174

29 DC Bus High Setting
[Bus Hi Setting]

This parameter defines the highest acceptable DC bus voltage. A fault or warning may be indicated in P174 (Host Fault Status Word 1) if the DC bus voltage exceeds the value of this parameter.

Parameter Type	Sink (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	8/7 * P16
Minimum Value	0
Maximum Value	1.5 * P16
Related Parameters	P16, P28, P141, P174

30 DC Bus Voltage Tolerance
[Bus V Tolerance]

This parameter defines the acceptable voltage tolerance on the DC bus. The DC bus is considered to be “at voltage” when the value of P141 (Bus Feedback) is within the range of P126 (Bus Rate Reference) +/- P30.

When the voltage is within the tolerance, the “Bus at Volt” bit of P34 (Host Status 2) is set to 1

Parameter Type	Sink (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/118
Factory Default	0.005 * P16 (0.5% of P16)
Minimum Value	0
Maximum Value	0.029 * P16 (2.9% of P16)
Related Parameters	P16, P34, P141, P126

31
P31 is for internal use only.

32 Host Command Word
[Host Command]

This parameter commands the processor to perform the function(s) indicated by each fault bit which is set to 1.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	0000 1111 1111 1111
Related Parameters	P33, P34, P35

For example, to command the processor to clear faults, you would enter the command word, 0000 0000 0000 0001.

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	Clr Faults	Sends a command to clear faults in the RGU
1	Enable Cmd	Sends a command to Enable RGU control
2	Meter Reset	Sends a command to reset the watt-hour meter
3	Save Command	Sends a command to save parameters
4	Param Recall	Sends a command to reset parameters
5	Default Init	Sends a command to initialize parameters to their defaults
6	Clr Warnings	Sends a command to clear warnings in the RGU
7	Reset Cmd	Sends a command to reset the RGU
8	Clr Flt Que	Sends a command to clear the fault queue
9	Clr Wrn Que	Sends a command to clear the warning queue
10	Disable Cmd	Sends a command to Disable the RGU control
11	Run Startup	Sends a command to reset the RGU and to initiate the startup sequence
12-15	Not Used	

33 Host Status Word 1
[Host Status 1]

This parameter indicates a number of conditions that the RGU is experiencing.

A condition is indicated by the bit being set to 1. For example, the word, 0000 0011 0100 0000, indicates that the DC bus is at voltage, the DSP processor is ready, and control is ready.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P32, P34, P35

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	Hard Fault	Indicates that a hard fault has occurred.
1	Warning Flt	Indicates that a warning fault has occurred.
2	Clr Faults	Indicates that clear fault command(s) are pending.
3	Clr Warnings	Indicates that clear warning command(s) are pending.
4	BCR Relay	Indicates that the bus control relay is closed.
5	Bus 1/2 Up	Indicates that the DC bus is at half of the rated voltage.
6	Bus Up	Indicates that the DC bus is at rated voltage.
7	Enable	Indicates that the RGU control is enabled.
8	DSP Ready	Indicates that the DSP processor is ready.
9	Ctrl Ready	Indicates that the RGU control is ready.
10-14	Not Used	
15	Ctrl Running	The RGU control is active.

34 Host Status Word 2
[Host Status 2]

This parameter indicates a number of conditions that the RGU is experiencing.

A condition is indicated by the bit being set to 1. For example, the word, 1000 0011 0100 0000, indicates that the RGU is regenerating current to the AC line, the M1 contactor is closed, the DC bus is at voltage, and the RGU control is active.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P32, P33, P35

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	Hard Fault	Indicates that a hard fault has occurred
1	Warning Flt	Indicates that a warning fault has occurred
2	pf Lagging	Indicates that the power factor is lagging (AC line voltage is lagging the current)
3	Iq Pos Limit	Indicates that the AC line active current (Iq) is at the positive limit
4	Iq Neg Limit	Indicates that the AC line active current (Iq) is at the negative limit
5	Ext ClrFault	Indicates that an external clear fault is required
6	Regen Cur	Indicates that the RGU is renerating current to the AC line
7	Ext Enable	Indicates that an external enable is activated
8	M1 Closed	Indicates that the main contactor M1 is closed
9	Bus at Volt	Indicates that the DC bus is at voltage
10	i2t Active	Indicates that the wire overtemperature monitor (i2t) is active
11	i2t Warning	Indicates that there is a wire overtemperature (i2t) warning
12-14	Not Used	
15	Ctrl Running	Indicates that the RGU control is active

35 Host Mode
[Host Mode]

This parameter initiates the commands listed below. To initiate commands, set each appropriate bit to 1.
For example, to initiate the Error Limiter, set P35 to 0000 0000 0000 0010.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 1000
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P32, P33, P34

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	Regen Only	Regenerative mode only (used with parallel NRU).
1	Err Limiter	Enables the Error Limiter.
2	Aux Limit	Activates the auxiliary limit as the current limit.
3	Linearizer	Activates the linearizer.
4-15	Not Used	

36 A/D Converter 0 Input

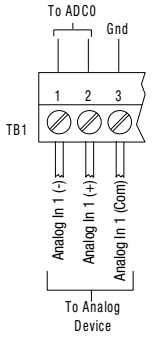
[ADC0 Input]

This parameter provides the diagnostics from the ADC0 input (TB1-1, TB1-2, TB1-3 [gnd]). An external analog device can be wired to the ADC0 input. The analog voltage (±10V) sent by the device is sampled by a 14-bit analog-to-digital converter (ADC) and the resulting value is stored in this parameter.

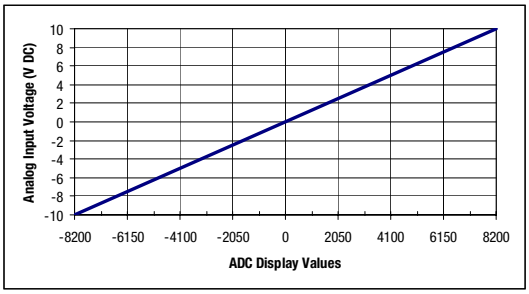
The value of this parameter provides a digital representation of the analog input which can then be used by other parameters (to read the device status, perform calculations, etc.).

The quick reference chart can be used to convert the display values into analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)
Related Parameters	P37
See Pages	7-6, 11-1



Quick Reference Chart



37 A/D Converter 1 Input

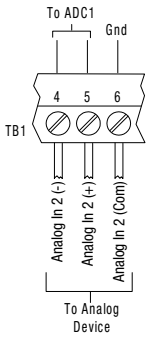
[ADC1 Input]

This parameter provides the diagnostics from the ADC1 input (TB1-4, TB1-5, TB1-6 [gnd]). An external analog device can be wired to the ADC1 input. The voltage (±10V) sent by the device is sampled by a 14-bit analog-to-digital converter (ADC) and the resulting value is stored in this parameter.

The value of this parameter provides a digital representation of the analog input which can then be used by other parameters (to read the device status, perform calculations, etc.).

The listing for P36 shows a quick reference chart for converting the display values into the analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)
Related Parameters	P36
See Pages	7-6, 11-1



38 A/D Converter 2 Input
[14 Bit A/D Chan 2]

This parameter receives an analog-to-digital sample from the DC bus to provide the value for the Scaled Bus Feedback (P143).

This parameter is sent to P143 when Host Channel is selected in the Bus Voltage Input Select (P139 = 2).

The listing for P36 shows a quick reference chart for converting the display value into the analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)
Related Parameters	P139, P143

39 A/D Converter 3 Input
[14 Bit A/D Chan 3]

This parameter receives an analog-to-digital sample from the negative DC bus and PE to provide the value for P146 (Negative DC Bus To Ground Voltage).

The listing for P36 shows a quick reference chart for converting the display value into the analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)
Related Parameters	P146

40 A/D Converter 4 Input
[14 Bit A/D Chan 4]

This parameter receives an analog-to-digital sample from the positive DC bus and PE to provide the value for P145 (Positive DC Bus To Ground Voltage).

The listing for P36 shows a quick reference chart for converting the display value into the analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)
Related Parameters	P145

41 A/D Converter 5 Input
[14 Bit A/D Chan 5]

This parameter receives an analog-to-digital sample from the AC line to provide the value for P14 (Measured AC Line Voltage).
The listing for P36 shows a quick reference chart for converting the display value into the analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)
Related Parameters	P14

42 A/D Converter 6 Input
[14 Bit A/D Chan 6]

This parameter receives an analog-to-digital sample from the AC line (composite line voltage) to provide the value for P14 (Measured AC Line Voltage).

The listing for P36 shows a quick reference chart for converting the display value into the analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)
Related Parameters	P14

43 A/D Converter 7 Input
[14 Bit A/D Chan 7]

This parameter receives an analog-to-digital sample from the heatsink thermoswitches to provide the value for P87 (Heatsink Temperature).

The listing for P36 shows a quick reference chart for converting the display value into the analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)
Related Parameters	P187

44 A/D Converter 8 Input
[14 Bit A/D Chan 8]

This parameter receives an analog-to-digital sample (+15V).

The listing for P36 shows a quick reference chart for converting the display value into the analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)

45 A/D Converter 9 Input
[14 Bit A/D Chan 9]

This parameter receives an analog-to-digital sample (-15V).

The listing for P36 shows a quick reference chart for converting the display value into the analog input voltage.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-8191 (-10V signal)
Maximum Value	8191 (+10V signal)

46
P46 is for internal use only.

47

D/A Converter 1 Output
[DAC1 Output]
This parameter contains the value that is to be sent to the digital-to-analog converter, then to Analog Out 1 (TB1-7, TB1-8 [com]).

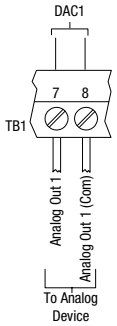
The display value (-2048 to 2047) represents the digital value, which is proportional to the voltage sent through Analog Out 1 (-10V to +10V).

An external analog device can be wired to Analog Out 1 (DAC1 Output), and can read the contents of a parameter, selected by P49 (D/A Converter 1 Source).

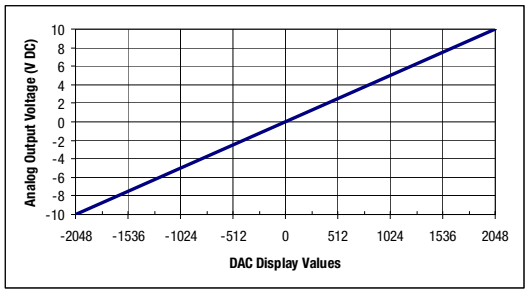
The quick reference chart can be used to convert the display value into the analog output voltage.

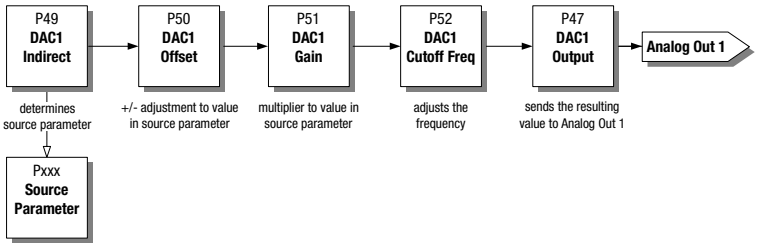
The diagram below shows how the source parameter value is processed using P49, P50, P51, P52, P47, then sent to the DAC for Analog Out.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-2048 (-10V signal)
Maximum Value	2047 (+10V signal)
Related Parameters	P49, P50, P51, P52
See Chapter	11



Quick Reference Chart





48 D/A Converter 2 Output

[DAC2 Output]

This parameter contains the value that is to be sent to the digital-to-analog converter, then to Analog Out 2 (TB1-9, TB1-10 [com]).

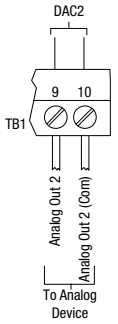
The display value (-2048 to 2047) represents the digital value, which is proportional to the voltage sent through Analog Out 2 (-10V to +10V).

An external analog device can be wired to Analog Out 2 (DAC2 Output), and can read the contents of a parameter, selected by P53 (D/A Converter 2 Source).

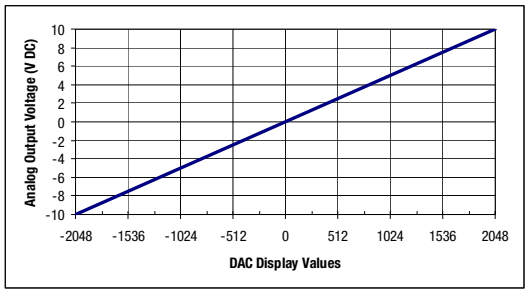
The quick reference chart can be used to convert the display value into the analog output voltage.

See the diagram for P46 (D/A Converter 1 Source) for an example of how a source parameter is processed for Analog Out.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-2048 (-10V signal)
Maximum Value	2047 (+10V signal)
Related Parameters	P53, P54, P55, P56
See Chapter	11



Quick Reference Chart



49 D/A Converter 1 Source

[DAC1 Indirect]

This parameter identifies the parameter value which will be sent to DAC1 and out to Analog Out 1. The P47 listing (D/A Converter 1 Output) shows a diagram of the DAC process.

The default selection is P141 (Bus Feedback).

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	141 (Bus Feedback Parameter)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P47, P50, P51, P52
See Chapter	11

50 D/A Converter 1 Offset

[DAC1 Offset]

This parameter determines the +/- adjustment to the value being sent to DAC1 (which is indicated by P49 [D/A Converter Source]). This offset is applied before the gain (P51).
The P47 listing (D/A Converter 1 Output) shows a diagram of the DAC process.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P47, P49, P51, P52
See Chapter	11

51 D/A Converter 1 Gain

[DAC1 Gain]

This parameter determines the gain adjustment to the value being sent to DAC1 (which is indicated by P49 [D/A Converter Source]). This gain is applied after the offset (P50).
The P47 listing (D/A Converter 1 Output) shows a diagram of the DAC process.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 256
Factory Default	0.25
Minimum Value	-128.00
Maximum Value	128.00
Related Parameters	P47, P49, P50, P52
See Chapter	11

52 D/A Converter 1 Frequency [DAC1 Cutoff Freq]

This parameter determines the cutoff frequency for the value being sent to DAC1 (which is indicated by P49 [D/A Converter Source]). This action is applied after the offset (P50) and gain (P51).
To turn the filter off, set this to 0.

The P47 listing (D/A Converter 1 Output) shows a diagram of the DAC process.

Parameter Type	Sink (Read/Write)
Display Units	R/S (rads/sec)
Drive Units	Display Units * 10
Factory Default	0 (Filter Off)
Minimum Value	0
Maximum Value	3276.7
Related Parameters	P47, P49, P50, P51
See Chapter	11

53 D/A Converter 2 Source [DAC2 Indirect]

This parameter identifies the parameter value which will be sent to DAC2 and out to Analog Out 2. The P48 listing (D/A Converter 2 Output) shows a diagram of the DAC process.
The default selection is P108 (Total Line Current).

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	108 (Total Line Current)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P48, P54, P55, P56
See Chapter	11

54 D/A Converter 2 Offset [DAC2 Offset]

This parameter determines the +/- adjustment made to the value being sent to DAC2 (which is indicated by P53 [D/A Converter Source]). This offset is applied before the gain (P55).
The P47 listing (D/A Converter 1 Output) shows a diagram of the DAC process.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32767
Maximum Value	32767
Related Parameters	P48, P53, P55, P56
See Chapter	11

55 D/A Converter 2 Gain [DAC2 Gain]

This parameter determines the gain adjustment made to the value being sent to DAC2 (which is indicated by P53 [D/A Converter Source]). This gain is applied after the offset (P54).
The P47 listing (D/A Converter 1 Output) shows a diagram of the DAC process.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 256
Factory Default	0.25
Minimum Value	-128.00
Maximum Value	128.00
Related Parameters	P48, P53, P54, P56
See Chapter	11

56 D/A Converter 2 Frequency [DAC2 Cutoff Freq]

This parameter determines the cutoff frequency for the value being sent to DAC2 (which is indicated by P53 [D/A Converter Source]). This action is applied after the offset (P54) and gain (P55).
To turn the filter off, set this to 0.

The P47 listing (D/A Converter 1 Output) shows a diagram of the DAC process.

Parameter Type	Sink (Read/Write)
Display Units	R/S (rads/sec)
Drive Units	Display Units * 10
Factory Default	0 (Filter Off)
Minimum Value	0
Maximum Value	3276.7
Related Parameters	P48, P53, P54, P55
See Chapter	11

57-59 *P57-P59 are for internal use only.*

60 DSP DC Bus Voltage
[DSP DC Bus]

This parameter measures the DC bus voltage for P143 (Scaled Bus Feedback) using the DSP.

This parameter is sent to P143 when DSP Channel is selected in the Bus Voltage Input Select (P139 = 1).

The displayed value of this parameter corresponds to the drive units of P143.

The value of 4096 indicates that the bus voltage feedback equals the Nominal DC Bus Voltage (P16).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 4
Factory Default	0
Minimum Value	-8196
Maximum Value	8188
Related Parameters	P38, P61, P139, P143

61 DSP Average Bus Voltage
[DSP Ave DC Bus]

This parameter sends the average DC bus voltage from the DSP to P143 (Scaled Bus Feedback).

This parameter is only sent to P143 when DSP

Averaged is selected in the Bus Voltage Input Select (P139 = 0).

The displayed value of this parameter corresponds to the drive units of P143.

The value of 4096 indicates that the bus voltage feedback equals the Nominal DC Bus Voltage (P16).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 4
Factory Default	0
Minimum Value	-8196
Maximum Value	8188
Related Parameters	P38, P60, P139, P143

62 DSP Status Word
[DSP Status]

This parameter indicates the status of the DSP, which is the processor used in the current loop.

A condition is indicated by the bit being set to 1. For example, the word 0000 0001 0000 0000 indicates that the DSP is ready.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P38, P60, P139, P143

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0-7	Not Used	
8	DSP Ready	Indicates that the DSP is ready
9	DSP Running	Indicates that the DSP is running
10	DSP Fault	Indicates that a DSP fault has occured
11-15	Not Used	

63
P63 is for internal use only.

64 Current Loop Cross Couple Gain
[CrossCouple Gain]

This parameter indicates the cross couple gain from the PI current regulator.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	752
Minimum Value	0
Maximum Value	65535

65 Iq Reference to DPS
[Iq Ref Scaled]

This parameter indicates the scaled active current reference (Iq) to be used by P96 (Iq Current Reference).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535

66 Id Reference to DPS
[Id Ref Scaled]

This parameter indicates the scaled reactive current reference (Id) to be used by P93 (Id Reference).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535
Related Parameters	P93

67 Ide Current Limit to DPS
[Ide Current Lim]

This parameter indicates the reactive current limit value to be by P104 (Id Positive Current Limit).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535
Related Parameters	P104

68 Current Loop Ki
[Current Loop Ki]

This parameter indicates the current loop integral gain (Ki). This provides an intermediate value which is to be used by other parameters.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	89
Minimum Value	0
Maximum Value	65535

69 Current Loop Kp
[Current Loop Kp]

This parameter indicates the current loop proportional gain (Kp). This provides an intermediate value to be used by other parameters.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	2392
Minimum Value	0
Maximum Value	65535

70 Id Feedback DSP
[Net Id Cmd, DSP]

This parameter indicates the DSP command for the Id feedback converter.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 5120/100
Factory Default	0
Minimum Value	0
Maximum Value	65535

71 Iq Feedback DSP
[Iqe Fbk DSP]

This parameter indicates the DSP command for the Iq feedback converter.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535

72-82 *P72-P82 are for internal use only.*

83 It Foldback Current Limit
[It Fldbk Cur Lim]

This parameter indicates what percentage of the rated DC bus current is being supplied by the RGU. The percentage decreases as the heatsink temperature increases.

A value of 300% is displayed when the RGU is not enabled.

Parameter Type	Source (Read Only)
Display Units	%
Drive Units	Display Units * 5120/100
Factory Default	300
Minimum Value	0
Maximum Value	300

84 Voltage Regulator Output
[Linear PI Out]

This parameter indicates the current reference from the PI regulator (P121) after it has passed the linearizer. Note that P35 bit 3 must be set to 1 to activate the linearizer.

The value is displayed as a percentage of the Rated AC Line Current (P11).

Parameter Type	Source (Read Only)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0
Minimum Value	-640
Maximum Value	640
Related Parameters	P35, P121

85

P85 is for internal use only.

86

Transistor Junction Temperature
[Abs Junct Temp]

This parameter indicates the calculated IGBT junction temperature. This value is used by the fault status parameters to indicate when high and excessive temperatures occur.

Parameter Type	Source (Read Only)
Display Units	degC
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-50
Maximum Value	150

87

Heatsink Temperature
[Heatsink Temp]

This parameter indicates the measured heatsink temperature. This value is used by the fault status parameters to indicate when high and excessive temperatures occur.

Parameter Type	Source (Read Only)
Display Units	degC
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-50
Maximum Value	127

88

Auxiliary Iq Current Limit
[Aux Iq Limit]

This parameter specifies the limit imposed on P89 (Auxiliary Iq Current Command).

The value of this parameter (current limit) is displayed as a percentage of the Rated AC Line Current (P11).

This parameter is only activated when Aux Limit is selected in Host Mode (P35 bit 2 = 1).

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	150.0
Minimum Value	0.0
Maximum Value	150.0
Related Parameters	P11, P89

89

Auxiliary Iq Current Command
[Aux Iq Command]

This parameter can be used to send an Iq command (current reference) to the current limiter. This command can passed as the total Iq command, or can be added to the PI regulator value (P121, Voltage Loop PI Output).

The value entered into this parameter is used only when 'PI +Aux Cmd' or 'Aux Iq Cmd' is selected in the Iq Mode Select (when P90 = 1 or P90 = 2).

This parameter can receive the Iq command from another RGU through P273 (RGU-to-RGU Receive 1, Indirect 1).

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-120.0
Maximum Value	120
Related Parameters	P88, P90, P273
See Chapters	1, 9

90

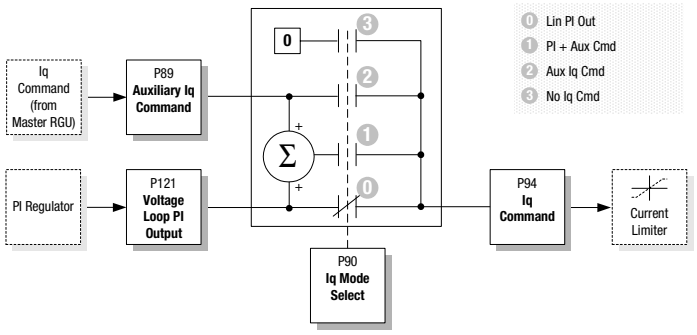
Iq Mode Select
[Iq Mode Select]

This parameter selects the current reference input to be passed to the current limiter.

Set this parameter to one of the values listed below.

Value	**Description**	
0	Lin PI Out	Selects the PI regulator output (P121). This is the normal selection for a standalone or master RGU.
1	PI + Aux Cmd	Selects the PI regulator output value plus the Auxiliary Iq Command value (P121+P89). This allows P89 to be used as a trim value.
2	Aux Iq Cmd	Selects the Auxiliary Iq Command (P89). This is normally used by a slave RGU which is receiving its Iq commands from a master RGU.
3	No Iq Cmd	Selects 0 as the Iq Command

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	3
Related Parameters	P89, P94, P121



91 Iq Positive Current Limit
[Iq Pos Limit]

This parameter defines the active current limit (positive).

This value is displayed as a percentage of the Rated AC Line Current (P11).

Parameter Type	Sink (Read/Write)
Display Units	% of 11
Drive Units	Display Units * 5120/100
Factory Default	150.0
Minimum Value	10.0
Maximum Value	150.0

92 Iq Negative Current Limit
[Iq Neg Limit]

This parameter defines the active current limit (negative).

This value is displayed as a percentage of the Rated AC Line Current (P11).

Parameter Type	Sink (Read/Write)
Display Units	% of 11
Drive Units	Display Units * 5120/100
Factory Default	-150.0
Minimum Value	-150.0
Maximum Value	-10.0

93 Id Reference
[Id Reference]

This parameter displays the output of the reactive current (Id) limiter.

This value is displayed as a percentage of the Rated AC Line Current (P11).

Parameter Type	Source (Read Only)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-60.0
Maximum Value	60.0

94 Iq Current Command
[Iq Command]

This parameter displays the Iq command being sent to the Current Limiter.

This value may be determined by the PI regulator and/or by an auxiliary Iq command from a master RGU.

The listing for P90 shows how the value for this parameter is determined.

Parameter Type	Source (Read Only)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-640.0
Maximum Value	640.0
Related Parameters	P89, P90, P121

95 Filtered Iq Current Reference
[Filtered Iq Ref]

This parameter displays the filtered value of the Iq Current Reference (P96).

This value is displayed as a percentage of the Rated AC Line Current (P11).

Parameter Type	Source (Read Only)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-150.0
Maximum Value	150.0
Related Parameters	P94, P96

96 Iq Current Reference
[Iq Reference]

This parameter specifies the active current reference (Iq) used by the current regulator loop.

This value is displayed as a percentage of the Rated AC Line Current (P11).

Parameter Type	Source (Read Only)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-150.0
Maximum Value	150.0
Related Parameters	P94, P95, P271

97 Net Positive Current Limit
[Net Iq Pos Limit]

This parameter displays the value of the positive active current limit (Iq).

This value is displayed as a percentage of the Rated AC Line Current (P11).

Parameter Type	Source (Read Only)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	150.0
Minimum Value	10.0
Maximum Value	150.0
Related Parameters	P91, P98

98 Net Negative Current Limit
[Net Iq Neg Limit]

This parameter displays the value of the negative active current limit (Iq).

This value is displayed as a percentage of the Rated AC Line Current (P11).

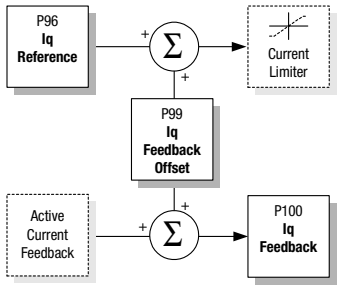
Parameter Type	Source (Read Only)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	-150.0
Minimum Value	-10.0
Maximum Value	-150.0
Related Parameters	P91, P98

99 Iq Feedback Offset
[Iq Fbk Offset]

This parameter is used to offset the Iq feedback value before it is stored in P100 (Iq Feedback), and is used to offset the output of P96 (Iq Reference) when it is passed to the current limiter.

Adjust this value to compensate for any offsets in the system.

Parameter Type	Sink (Read/Write)
Display Units	%
Drive Units	Display Units * 5120/100
Factory Default	0
Minimum Value	-2.4
Maximum Value	2.4
Related Parameters	P96, P100



100 Iq Feedback
[Iq Feedback]

This parameter specifies the measured Iq feedback (real or active current), displayed as a percentage of the Rated AC Line Current (P11). This value is used when calculating the Total Line Current (P108).

+ Motoring - Regenerating

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-640.0
Maximum Value	640.0
Related Parameters	P96, P99, P106, P108

101 Auxiliary Id Command
[Aux Id Command]

This parameter specifies a value which can be used to add to the value of the Id Current Command (P102), or can be used as the source sent directly to the Id limiter.

This parameter is used when 'Aux Id Cmd' or 'Id Cmd + Aux' is selected in the Id Mode Select (P103 = 2 or 3).

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-40.0
Maximum Value	60.0
Related Parameters	P93, P102, P103

102 Id Current Command
[Id Command]

This parameter specifies the Id current command which can be passed to the Id limiter.

This parameter is used when 'Id Command' or 'Id Cmd + Aux' is selected in the Id Mode Select (P103 = 1 or 3).

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-40.0
Maximum Value	60.0
Related Parameters	P93, P101, P103

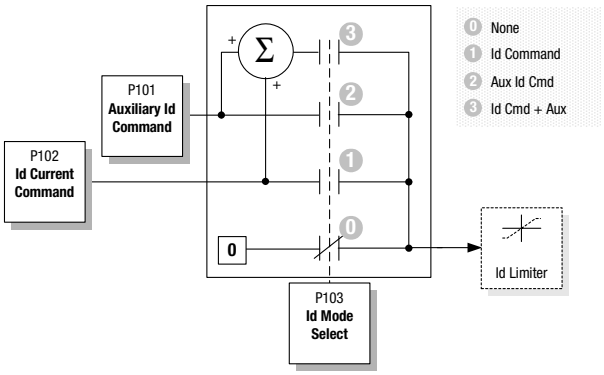
103 Id Mode Select
[Id Mode Select]

This parameter selects the Id current reference to be sent to the Id limiter.

Select the Id limiter input from the list below.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	3
Related Parameters	P93, P101, P102

Value	Description	
0	None	Selects 0% as the input to the Id limiter.
1	Id Command	Selects the value in P102 (Id Command) as the input to the Id limiter.
2	Aux Id Cmd	Selects the value in P101 (Auxiliary Id Command) as the input to the Id limiter.
3	Id Cmd + Aux	Selects the sum of P102 (Id Command) and P101 (Auxiliary Id Command) as the input to the Id limiter.



104 Id Positive Current Limit
[Id Pos Limit]

This parameter determines the maximum value for the Id Reference (P93). The value of this parameter is passed to the Id limiter.

This parameter is selected as the source to the Id limiter when P35 bit 0 = 0 (when the Host Mode, Regen Only bit is set to zero). This limit is selected by default.

When P35 bit 0 = 1, this parameter is not used, and a value of 0% is passed to the Id limiter.

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	60.0
Minimum Value	0.0
Maximum Value	60.0
Related Parameters	P35, P93, P105

105 Id Negative Current Limit
[Id Neg Limit]

This parameter determines the minimum value for the Id Reference (P93). The value of this parameter is passed to the Id limiter.

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	-40.0
Minimum Value	-40.0
Maximum Value	0
Related Parameters	P93, P104

106 Id Current Feedback
[Id Feedback]

This parameter displays the calculated Id feedback.

The value of this parameter is used with P100 (Iq Feedback) and P11 (Rated AC Line Current) to calculate the Total Line Current (P108).

The value is also used (with P100) to trigger the wire overload (I2t) indicators (P34 and P183).

Parameter Type	Source (Read Only)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-60.0
Maximum Value	60.0
Related Parameters	P93, P100, P108

107 DC Bus Current
[DC Bus Current]

This parameter displays the DC bus current, calculated by the Real Power (P151) and the Scaled Bus Feedback (P143).

Parameter Type	Source (Read Only)
Display Units	Amps
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	0.0
Maximum Value	3276.7
Related Parameters	P143, P151

108 Total Line Current
[Iac Total]

This parameter displays the total AC line current, calculated from the Iq Feedback (P100), the Rated AC Line Current (P11), and the Id Feedback (P106).

Parameter Type	Source (Read Only)
Display Units	Amps
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	-3276.7
Maximum Value	3276.7
Related Parameters	P11, P100, P106

109 Notch Filter Freq for Iq Cmd
[Iq Cmd FIR Freq]

Frequency for FIR notch filter applied to value of Iq current command (P94).

Parameter Type	Source (Read/Write)
Display Units	Hertz
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	0.0
Maximum Value	500
Related Parameters	P94

110-114 *P110-P114 are for internal use only.*

115 Voltage Loop PI Error Limit
[PI Error Limit]

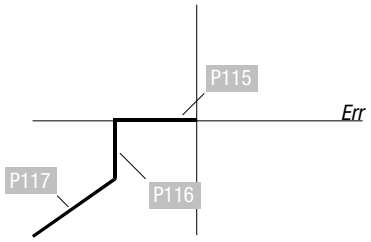
This parameter is used to determine when the error limiter will activate.

When the value of the Voltage Loop Error (P142) exceeds the value defined by this parameter,

and when P35 bit 1 = 1 (the Err Limiter bit is enabled in the Host Mode parameter), then the error limiter will be activated to provide the additional error correction needed.

Set this parameter to the desired error value for activating the error limiter.

Parameter Type	Sink (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	-34
Minimum Value	-100
Maximum Value	-4
Related Parameters	P35, P116, P117, P142



116 Voltage Loop Error Limit Step
[PI Err Lim Step]

This parameter determines the step used by the error limiter.

The P115 listing describes what the error limiter does, and how it is activated.

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 1000/40960
Factory Default	0.0
Minimum Value	-80.0
Maximum Value	0.0
Related Parameters	P115, P117

117 Voltage Loop Error Limit Gain
[PI Err Lim Gain]

This parameter specifies the gain to be applied in the PI error limiter.

The P115 listing describes what the error limiter does, and how it is activated.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 8
Factory Default	12.00
Minimum Value	0.00
Maximum Value	4096
Related Parameters	P115, P116

118 Voltage Loop Proportional Gain
[Iq Kp Gain]

This parameter specifies the proportional gain that is applied to the Voltage Loop Error (P142). The proportional (Kp) gain is adjusted to respond to a change in load.

The value of this parameter is adjusted by the RGU. See P121 for more details.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 8
Factory Default	15.00 (adjusted by RGU)
Minimum Value	0.00
Maximum Value	8100
Related Parameters	P119, P121, P142

119 Voltage Loop Integral Gain
[Iq Ki Gain]

This parameter specifies the integral gain that is applied to the Voltage Loop Error (P142). The integral gain is adjusted to remove any steady state instabilities. After the gain from this parameter is applied to P142, the result is stored in P120.

The value of this parameter is adjusted by the RGU.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 8
Factory Default	1500.00 (adjusted by RGU)
Minimum Value	0.00
Maximum Value	8100
Related Parameters	P118, P120, P121, P142

120 Voltage Loop Integrator Output
[Iq Integ Output]

This parameter displays the integral error command, which is calculated from the Voltage Loop Integral Gain (P119) and the Voltage Loop Error (P142).

The value of this parameter, which is displayed as a percentage of P11 (Rated AC Line Current), is used to determine the Voltage Loop PI Output (P121). The listing for P121 shows how this parameter is used in the PI regulator.

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-640.0
Maximum Value	640.0
Related Parameters	P119, P121

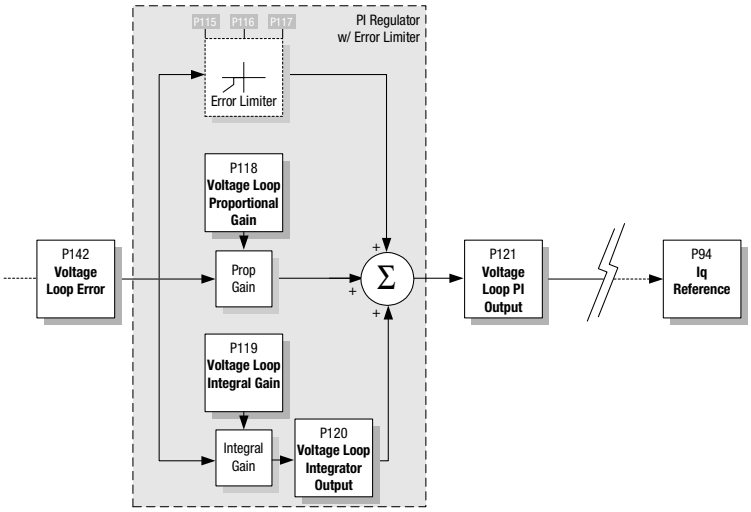
121 Voltage Loop PI Output
[PI Reg Out]

This parameter stores the output from the PI regulator. When the P90 (Iq Mode) equals 0 or 1, this value is passed through the current limiter to determine the Iq Reference (P96).

The diagram shows how the PI regulator is arranged, and shows how the value for P121 is determined.

See the P90 listing for more information about this parameter.

Parameter Type	Source (Read Only)
Display Units	% of P11
Drive Units	Display Units * 5120/100
Factory Default	0.0
Minimum Value	-640.0
Maximum Value	640.0
Related Parameters	P90, P96, P118, P119, P120



122 Auxiliary Voltage Command
[Aux Volt Cmd]

This parameter defines an auxiliary voltage that can be commanded for the DC bus. The value entered into this parameter can be used to command a specific bus voltage (when P123 = 1) or can be used to add to the Bus Voltage Command in P207 (when P123 = 2).

To use this parameter as an auxiliary bus voltage, enter the bus voltage that is needed during particular events then program P123 to equal 1 during those events.

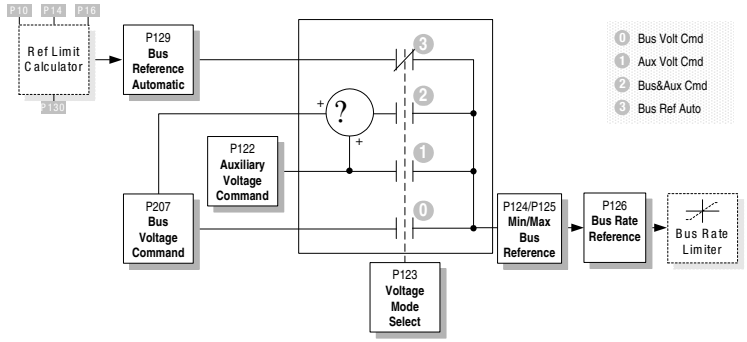
To use this parameter as a supplement to the Bus Voltage Command (P207) during particular events, enter the bus voltage to be added to P207 and program P123 to equal 2 during those events.

Parameter Type	Sink (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0
Minimum Value	-1.15 x P16
Maximum Value	1.15 x P16
Related Parameters	P123, P126, P207

123 Voltage Mode Select
[Volt Mode Sel]

This parameter selects the source voltage command used to produce the Bus Reference (P128), which determines the voltage that the RGU should supply to the bus.

Value	Description	
0	Bus Volt Cmd	Selects the P207 (Bus Voltage Command) as the input. By default, P207 is set to the Nominal DC Bus Voltage (P16).
1	Aux Volt Cmd	Selects the value entered into P122 (Auxiliary Voltage Command).
2	Bus&Aux Cmd	Selects the sum of P207 and P122.
3	Bus Ref Auto	Selects the bus reference calculated from P10, P14, P16, and P130.



The bus rate limiter shown is used to limit limit the bus reference from changing to rapidly. The output of this limiter is the Bus Reference (P128).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	3
Minimum Value	0
Maximum Value	3
Related Parameters	P122, P126, P128, P129, P207

124 Minimum Bus Reference
[Min Bus Ref]

This parameter defines the minimum voltage command value that can be sent as a Bus Reference (P128).

This value is calculated by the RGU and is 95% of the greater of either the Nominal AC Line Voltage (P10) multiplied by the square root of two, or the Actual AC Line Volage (P14) multiplied by the square root of two.

Parameter Type	Source (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0.85 x P16
Minimum Value	0.85 x P16
Maximum Value	1.15 x P16
Related Parameters	P125, P126, P128, P129

125 Maximum Bus Reference
[Max Bus Ref]

This parameter defines the maximum voltage command value that can be sent as a Bus Reference (P128).

This value is calculated by the RGU and is equal to 115% of the Nominal AC Line Voltage (P10) multiplied by the square root of two.

Parameter Type	Source (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	1.13 x P16
Minimum Value	0.85 x P16
Maximum Value	1.15 x P16
Related Parameters	P124, P126, P128, P129

126 Bus Rate Reference
[Bus Rate Ref]

This parameter specifies the bus voltage to be achieved. The value of this parameter is passed through the bus rate limiter to ensure that the DC bus voltage does not change too rapidly, resulting in the value for P128 (Bus Reference).

Parameter Type	Source (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0.0
Minimum Value	0.85 x P16
Maximum Value	1.15 x P16
Related Parameters	P122, P123, P124, P125, P129, P127, P128

127 Bus Reference Change Rate
[Ref Change Rate]

This parameter specifies the maximum increase or decrease allowed in the Bus Rate Reference (P126) per 5ms.

The bus rate limiter uses this value to produce the rate limited Bus Reference (P128).

Parameter Type	Sink (Read/Write)
Display Units	% of P16
Drive Units	Display Units * 4096/100
Factory Default	0.24
Minimum Value	0.00
Maximum Value	280.00
Related Parameters	P126, P128

128 Bus Reference
[Bus Reference]

This parameter indicates the voltage that needs to be supplied to the DC bus.

The RGU compares the voltage needed by the DC bus (P128) with the Bus Feedback (P141). The difference (P128-P141) signifies the Bus Error (P142). The PI regulator determines the gain required, and an Iq Reference (P96) directs the RGU to supply the required voltage.

Parameter Type	Sink (Read/Write)
Display Units	% of P16
Drive Units	Display Units * 4096/100
Factory Default	0.49
Minimum Value	0.00
Maximum Value	280.00
Related Parameters	P126, P128

129 Bus Reference Automatic
[Bus Ref Auto]

This parameter sends the calculated bus voltage that needs to be supplied to the DC bus.

This value is determined by a function of the measured AC voltage and the nominal AC and DC voltages (P10, P14, P16).

This parameter is the default input used for the Bus Reference (P128), which is selected by the Voltage Mode Selector (P123).

Parameter Type	Source (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0.85 x P16
Minimum Value	0.85 x P16
Maximum Value	1.15 x P16
Related Parameters	P123, P128, P130

130 Automatic Bus Reference Tracking
[AutoRef Tracking]

This parameter specifies the percentage over (or under) the calculated nominal DC bus voltage (P14 x sqrt(2)) to be commanded through the Bus Reference Automatic (P129).

For example, if an RGU is supplied with 460V AC, the calculated nominal DC bus voltage would be 650V (460V x sqrt(2)). The bus reference calculator would multiply this 650V x P130 (4.2% ,default) resulting in 27V DC, which would be added to the calculated Nominal DC Bus Voltage and be stored in P129 (Automatic Bus Reference), which would command that the DC bus be supplied with 683V DC.

Parameter Type	Sink (Read/Write)
Display Units	% of (P14 x sqrt(2))
Drive Units	Display Units * 5793/100
Factory Default	4.2
Minimum Value	-5.0
Maximum Value	10.0
Related Parameters	P14, P123, P129

131-136 *P131-P136 are for internal use only.*

137 Wn, Bus Feedback Filter Bandwidth
[Leadlag Freq, Wn]

This parameter specifies bandwidth for the bus feedback filter. This filters the feedback using the following formula:

$$\frac{\frac{P138}{256} \times P140 \times P137}{P140 + P137}$$

Parameter Type	Sink (Read/Write)
Display Units	R/S (rad/sec)
Drive Units	Display Units * 1
Factory Default	1000
Minimum Value	0
Maximum Value	32767
Related Parameters	P138, P140, P141

138 Kn, Bus Feedback Filter Gain
[Leadlag Gain, Kn]

This parameter specifies gain for the bus feedback filter. This filters the feedback using the formula listed in P137.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.63
Minimum Value	0.00
Maximum Value	5.00
Related Parameters	P137, P140, P141

139 Bus Voltage Input Select
[Volt Mode Sel]

This parameter selects the input used for the bus voltage feedback.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	2
Related Parameters	P38, P60, P61, P143

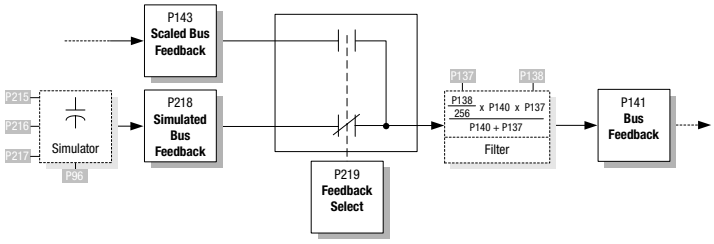
Value	Description	
0	DSP Averaged	Selects P61 (DSP Average Bus Voltage) as the input used for the Scaled Bus Feedback (P143).
1	DSP Channel	Selects P60 (DSP DC Bus Voltage) as the input used for the Scaled Bus Feedback (P143).
2	Host Channel	Selects P38 (A/D Converter 2 Input) as the input used for the Scaled Bus Feedback (P143). P38 provides a sample from the DC bus.

140 Bus Prefiltered Feedback
[Bus Prefil Fbk]

This parameter displays the bus feedback value before it is filtered (by the formula shown in the P138 listing) and passed to P141 (Bus Feedback).

Parameter Type	Sink (Read Only)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0
Minimum Value	0
Maximum Value	1.5 x P16
Related Parameters	P137, P138, P141, P143, P218, P219

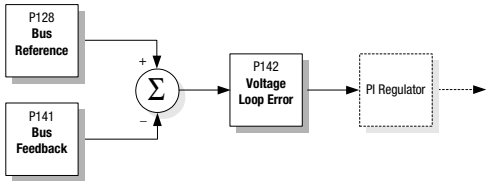
P219 (Feedback Select) can select feedback from the DC bus (P143), or can select a simulated feedback (P218) as the input for this parameter.



141 Bus Feedback
[Bus Feedback]

This parameter displays the value of the bus feedback. This bus feedback value is compared with the Bus Reference (P128) to determine the bus error (P142) which needs to be corrected by the PI regulator.

Parameter Type	Sink (Read Only)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0
Minimum Value	0
Maximum Value	1.5 x P16
Related Parameters	P128, P140, P142



142 Voltage Loop Error
[Bus Error]

This parameter shows the error in the DC bus that needs to be corrected through the PI regulator. This value is used to adjust the bus voltage (shown by the Bus Feedback (P141)) to the commanded voltage (shown by the Bus Reference (P128)).

Parameter Type	Sink (Read Only)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0
Minimum Value	0
Maximum Value	1.5 x P16
Related Parameters	P128, P140, P142

143 Scaled Bus Feedback
[Scaled Bus Fbk]

This parameter shows the calibrated bus feedback. The value of this parameter is used to determine the Bus Feedback (P141) and is used to calculate the DC Bus Current (P107).

Parameter Type	Source (Read Only)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0
Minimum Value	0
Maximum Value	1.5 x P16
Related Parameters	P38, P60, P61, P144

144 Bus Voltage Feedback Calibration
[Bus Volt Cal]

This parameter is used to adjust the voltage value shown in the bus feedback parameters (i.e. P140, P141, P143).

To calibrate the feedback, adjust this parameter until P143 (Scaled Bus Feedback) is equal to the voltage of the DC bus (use a voltmeter). This parameter can only be set when the RGU is Disabled.

Parameter Type	Sink (Read/Write)
Display Units	% of P143
Drive Units	Display Units * 1125/1000
Factory Default	0.0
Minimum Value	-3.1
Maximum Value	3.1
Related Parameters	P141, P143

145 Positive DC Bus to Ground Voltage
[+Bus Volt to Gnd]

This parameter indicates the voltage between the positive DC bus and the ground (PE).

P40 (A/D Converter 4 Input) supplies the raw data for this parameter.

Parameter Type	Source (Read Only)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0
Minimum Value	0
Maximum Value	1.15 x P16
Related Parameters	P40, P146

146 Negative DC Bus to Ground Voltage
[-Bus Volt to Gnd]

This parameter indicates the voltage between the negative DC bus and the ground (PE).

P39 (A/D Converter 3 Input) supplies the raw data for this parameter.

Parameter Type	Source (Read Only)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0
Minimum Value	0
Maximum Value	1.15 x P16
Related Parameters	P39, P145

147 Single Phase Detection Threshold
[1 Phase Threshold]

This parameter sets the threshold that a single phase trip will occur. The Single Phase Detector monitors the internal Phase Lock Loop (PLL) error signal.

A single phase trip occurs when the PLL error exceeds the threshold set by P147 for a time duration set by P148.

Parameter Type	Source (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	400
Minimum Value	100
Maximum Value	1000
Related Parameters	P148

148 Single Phase Detection Delay Before Fault
[1 Phase Err Delay]

Time delay between detection of single phase operation and the declaration of a fault.

Parameter Type	Source (Read/Write)
Display Units	SEL
Drive Units	Display Units * 200
Factory Default	3.0
Minimum Value	0.1
Maximum Value	60
Related Parameters	P147

149-150 *P149-P150 are for internal use only.*

151 Real Power
[Real Power]

This parameter indicates the real power being supplied through the DC bus.

This value is calculated using the AC line voltage (P14) and the active AC current (P100 x P11).

For example, if a K-code RGU has a 380V AC line voltage in P14, and if P100 indicates that the active current is 97% of the rated line voltage (182A AC), then P151 would equal 67kW (380 x 0.97 x 182 = 67kW).

Parameter Type	Source (Read Only)
Display Units	kW
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	-3276.8
Maximum Value	3276.7
Related Parameters	P11, P14, P100

152 Reactive Power
[Reactive Power]

This parameter indicates the reactive power being supplied through the DC bus.

This value is calculated using the AC line voltage (P14) and the reactive current (P106 x P11).

Parameter Type	Source (Read Only)
Display Units	kVAR
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	-3276.8
Maximum Value	3276.7
Related Parameters	P11, P14, P106

153 Apparent Power
[Apparent Power]

This parameter indicates the apparent power being supplied through the DC bus.

This value is calculated using the Real Power (P151) and the Reactive Power (P152).

Parameter Type	Source (Read Only)
Display Units	kVA
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	0.0
Maximum Value	6553.5
Related Parameters	P151, P152

154 Power Factor
[Power Factor]

This parameter indicates the power factor as a percent of unity.

Parameter Type	Source (Read Only)
Display Units	% of Unity
Drive Units	Display Units * 1
Factory Default	100.0
Minimum Value	-100.0
Maximum Value	100.0
Related Parameters	P14, P100, P106, P151, P152

155 kW Hours
[kW Hours]

This parameter indicates the kW hours of power consumed by the RGU.

P32 bit 2 can be selected to reset the meter (see P161 for details).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	-3276.8
Maximum Value	3276.7
Related Parameters	P32, P158, P161

156 kVA Hours
[kVA Hours]

This parameter indicates the kVA hours of power consumed by the RGU.

P32 bit 2 can be selected to reset the meter (see P161 for details).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	-3276.8
Maximum Value	3276.7
Related Parameters	P32, P159, P161

157 kVAR Hours
[kVAR Hours]

This parameter indicates the kVAR hours of power consumed by the RGU.

P32 bit 2 can be selected to reset the meter (see P161 for details).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	-3276.8
Maximum Value	3276.7
Related Parameters	P32, P160, P161

158 MW Hours
[MW Hours]

This parameter indicates the MW hours of power consumed by the RGU.

P32 bit 2 can be selected to reset the meter (see P161 for details).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P32, P155, P161

159 MVA Hours
[MVA Hours]

This parameter indicates the MVA hours of power consumed by the RGU.

P32 bit 2 can be selected to reset the meter (see P161 for details).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P32, P156, P161

160 MVAR Hours
[MVAR Hours]

This parameter indicates the MVAR hours of power consumed by the RGU.

P32 bit 2 can be selected to reset the meter (see P161 for details).

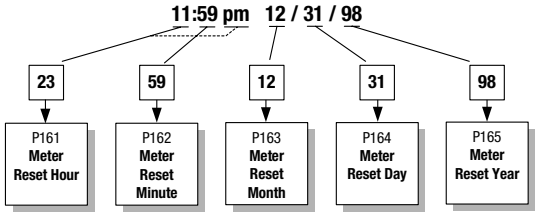
Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P32, P157, P161

161 Meter Reset Hour
[Meter Reset Hour]

This parameter defines the hour when the power consumption meter should reset (P32 bit 2 must be set (not default)).

For example, to have the meter automatically reset on December 31st, 1998 at 11:59pm, P32 bit 2 would need to be set to 1, and the meter reset parameters would need to be set as shown in the diagram.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	23
Related Parameters	P32, P162, P163, P164, P165



162 Meter Reset Minute
[Meter Reset Minute]

This parameter defines the minute when the power consumption meter should reset (P32 bit 2 must be set (not default)).

See P161 for details.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	59
Related Parameters	P32, P161, P163, P164, P165

163 Meter Reset Month
[Meter Reset Month]

This parameter defines the month when the power consumption meter should reset (P32 bit 2 must be set (not default)).

See P161 for details.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1
Minimum Value	1
Maximum Value	12
Related Parameters	P32, P161, P162, P164, P165

164 Meter Reset Day
[Meter Reset Day]

This parameter defines the day when the power consumption meter should reset (P32 bit 2 must be set (not default)).

See P161 for details.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1
Minimum Value	1
Maximum Value	31
Related Parameters	P32, P161, P162, P163, P165

165 Meter Reset Year
[Meter Reset Year]

This parameter defines the year when the power consumption meter should reset (P32 bit 2 must be set (not default)).

See P161 for details.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	99
Related Parameters	P32, P161, P162, P163, P164

166-173 *P166-P173 are for internal use only.*

174 Host Fault Status Word 1
[Fault Status 1]

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P175, P176

This parameter indicates a number of host fault conditions.

1 - Fault 0 - No Fault

P175 and P176 determine what conditions are reported and how the conditions are to be handled (warning/fault).

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	ROM Bad CRC	Indicates that a ROM fault has been detected.
1	RAM Error	Indicates a fault in the RAM.
2	BatRAM Err	Indicates a fault in the battery-backed RAM.
3	DSP Load	Indicates a DSP loading fault.
4	FPGA Load	Indicates an FPGA loading fault.
5	Iq Foldback	Indicates an Iq foldback fault.
6	M1 Open	Indicates that the M1 contactor has opened (P9).
7	SCANport Err	Indicates an error in the SCANport.
8	R2R HW Error	Indicates an error in the RGU-to-RGU hardware.
9	Control Volt	Indicates a control voltage fault.
10	H/S Overtemp	Indicates that the heatsink temperature (P87) has exceeded maximum.
11	Bus Low	Indicates that the DC bus voltage has fallen below the DC Bus Low Setting (P28).
12	Bus High	Indicates that the DC bus voltage has risen above the DC Bus High Setting (P29).
13	BRAM Chksum	Indicates a parity error in the battery-backed RAM.
14	Prchrg Fail	Indicates that the precharge operation has failed.
15	DSP Timeout	Indicates that the DSP has timed out.

175 Fault Status 1 Report Mask
[Flt Report Mask 1]

This parameter selects the faults that can be reported to P174.

1 - Report 0 - Suppress

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1111 1111 1111 1111
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P174, P176

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description		Bit	Description	
0*	ROM Bad CRC	Reports ROM errors.	8*	R2R HW Error	Reports errors in the RGU-to-RGU hardware.
1*	RAM Error	Reports RAM errors.	9	Control Volt	Reports control voltage faults.
2*	BatRAM Err	Reports errors in the battery-backed RAM.	10*	H/S Overtemp	Reports when the heatsink is at overtemperature.
3*	DSP Load	Reports DSP loading faults.	11	Bus Low	Reports when the DC bus falls below min voltage.
4*	FPGA Load	Reports FPGA loading faults.	12	Bus High	Reports when the DC bus rises above max voltage.
5	Iq Foldback	Reports Iq foldback faults.	13	BRAM Chksum	Reports parity errors in the battery-backed RAM.
6*	M1 Open	Reports when the M1 contactor opens.	14*	Prchrg Fail	Reports when the precharge operation fails.
7	SCANport Err	Reports SCANport errors.	15*	DSP Timeout	Reports when the DSP times out.

* These items cannot be changed to zero.

176 Fault/Warning Select Mask 1
[Fault/Warn Mask1]

This parameter determines whether conditions should be reported as a warning (0) or handled as a fault (1).

The factory default, for example, shows that a heatsink overtemperature causes a fault (bit 10 = 1) and a low bus voltage produces a warning (bit 11 = 0).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1100 0101 0101 1111
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P174, P176

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description		Bit	Description	
0*	ROM Bad CRC	Selects response to ROM error.	8*	R2R HW Error	Selects response to RGU-to-RGU hardware error.
1*	RAM Error	Selects response to RAM error.	9	Control Volt	Selects response to a control voltage condition.
2*	BatRAM Err	Selects response battery-backed RAM error.	10*	H/S Overtemp	Selects response to heatsink overtemperature.
3*	DSP Load	Selects response to DSP loading condition.	11	Bus Low	Selects response to low bus voltage (P28).
4*	FPGA Load	Selects response to an FPGA loading condition.	12	Bus High	Selects response to high bus voltage (P29).
5	Iq Foldback	Selects response to an Iq foldback error.	13	BRAM Chksum	Selects response to parity error in BRAM.
6*	M1 Open	Selects response to the M1 contactor opening.	14*	Prchrg Fail	Selects response to precharge failure.
7	SCANport Err	Selects response to SCANport errors.	15*	DSP Timeout	Selects response to a DSP timeout.

* These items cannot be changed to zero.

177 Host Fault Status Word 2
[Fault Status 2]

This parameter indicates a number of host fault conditions.

1 - Fault 0 - No Fault

P178 and P179 determine what conditions are reported and how the conditions are to be handled (warning/fault).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P178, P179

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	Desaturizatn	Indicates a desaturization fault.
1	Board Intlk	Indicates a board interlock condition.
2	HW Bus OverV	Indicates that the bus is operating at overvoltage (hardware).
3	HW Line I	Indicates a fault in the line current (hardware).
4	Zero Seq Err	Indicates an zero sequnce error.
5	Phase Lock L	Indicates an error in the phase lock loop.
6	Phase Loss	Indicates a phase has been lost from the AC line.
7	Not Used	
8	Not Used	
9	Not Used	
10	SW Line I	Indicates a fault in the line current (software).
11	I Offset Err	Indicates a current offset fault.
12	DualPort TO	Indicates an error in the dual port time out.
13	Not Used	
14	Not Used	
15	DSP Fault	Indicates a fault in the DSP.

178 Fault Status 2 Report Mask
[Flt Report Mask 2]

This parameter selects the faults that can be reported to P177.

1 - Report 0 - Suppress

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1111 1111 1111 1111
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P177, P179

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description		Bit	Description	
0*	Desaturizatn	Reports desaturization errors.	8	Not Used	
1*	Board Intlk	Reports board interlock errors.	9	Not Used	
2*	HW Bus OverV	Reports bus overvoltage conditions (hardware).	10*	SW Line I	Reports line current conditions (software)
3*	HW Line I	Reports line current conditions (hardware).	11*	I Offset Err	Reports current offset errors.
4*	Zero Seq Err	Reports zero sequence errors.	12*	DualPort TO	Reports errors in the dual port time out.
5*	Phase Lock L	Reports phase lock loop.	13	Not Used	
6*	Phase Loss	Reports phase losses in the AC line.	14	Not Used	
7	Not Used		15*	DSP Fault	Reports DSP faults.

* These items cannot be changed to zero.

179 Fault/Warning Select Mask 2
[Fault/Warn Mask2]

This parameter determines whether conditions should be reported as a warning (0) or handled as a fault (1).

The factory default, for example, shows that all the usable bits cause faults.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1001 1100 0111 1111
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P174, P176

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description		Bit	Description	
0*	Desaturizatn	Selects response to desaturization condition.	8	Not Used	
1*	Board Intlk	Selects response to a board interlock condition.	9	Not Used	
2*	HW Bus OverV	Selects response to bus overvoltage (hardware).	10*	SW Line I	Selects response to line current condition (software).
3*	HW Line I	Selects response to current condtn (hardware).	11*	I Offset Err	Selects response to current offset error.
4*	Zero Seq Err	Selects response to zero sequence error.	12*	DualPort TO	Selects response to dual port timeout.
5*	Phase Lock L	Selects response to phase lock loop condition.	13	Not Used	
6*	Phase Loss	Selects response to phase loss in AC line.	14	Not Used	
7	Not Used		15*	DSP Fault	Selects response to DSP fault.

* These items cannot be changed to zero.

180 Host Fault Status Word 3
[Fault Status 3]

This parameter indicates a number of host fault conditions.

1 - Fault 0 - No Fault

P181 and P182 determine what conditions are reported and how the conditions are to be handled (warning/fault).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P181, P182

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	Clock Loss	Indicates that a reset has occurred due to loss of oscillator.
1	Double Bus	Indicates a memory access error.
2	Watchdog	Indicates a expiration fault in the watchdog timer.
3	En at Pwr Up	Indicates that the RGU was Enabled at power up.
4	Battery Low	Indicates that the battery for the battery-backed memory is low.
5	TIO Loss	Indicates that the primary control loop clock has been lost.
6	R2R Dup Addr	Indicates that more than one RGU (in a parallel application) have the same R2R transmit address (P267).
7	Lost Master	Indicates that communication to the master has been lost.
8	DPRAM Error	Indicates a fault in the dual port between the host and DSP.
9	No Vloop Tic	Indicates that the voltage loop clock has been lost.
10	No Fast Task	Indicates that high speed control tasks have stopped.
11	No Bgnd Task	Indicates that background tasks are not executing.
12	Addr Bus Err	Indicates an error in the address bus.
13	Data Bus Err	Indicates an error in the data bus.
14	Line Low	Indicates that the AC line voltage has dropped below the AC Line Low Setting (P26).
15	Line High	Indicates that the AC line voltage has exceeded the AC Line High Setting (P27).

181 Fault Status 3 Report Mask
[Flt Report Mask 3]

This parameter selects the faults that can be reported to P180.

1 - Report 0 - Suppress

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1111 1111 1111 1111
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P180, P181

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description		Bit	Description	
0	Clock Loss	Reports when the oscillator clock is lost.	8*	DPRAM Error	Reports errors in the DPRAM.
1	Double Bus	Reports memory access errors.	9	No Vloop Tic	Reports when the voltage loop clock is lost.
2	Watchdog	Reports when the watchdog timer is expired.	10*	No Fast Task	Reports when high speed tasks are not executing.
3	En at Pwr Up	Reports when the RGU is Enabled at power up.	11*	No Bgnd Task	Reports when background tasks are not running.
4	Battery Low	Reports when the BRAM battery is low.	12*	Addr Bus Err	Reports address bus errors.
5*	TIO Loss	Reports when the primary clock is lost.	13*	Data Bus Err	Reports data bus errors.
6*	R2R Dup Addr	Reports when RGUs have an address conflict.	14	Line Low	Reports when the AC line voltage falls below P26.
7*	Lost Master	Reports when Master communication is lost.	15	Line High	Reports when the AC line voltage exceeds P27.

* These items cannot be changed to zero.

182 Fault/Warning Select Mask 3
[Fault/Warn Mask3]

This parameter determines whether conditions should be reported as a warning (0) and handled as a fault (1).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0011 1101 1110 1000
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P180, P181

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description		Bit	Description	
0	Clock Loss	Selects response to a lost clock.	8*	DPRAM Error	Selects response to DPRAM errors.
1	Double Bus	Selects response to memory access errors.	9	No Vloop Tic	Selects response to voltage loop timer errors.
2	Watchdog	Selects response to watchdog timer expiration.	10*	No Fast Task	Selects response to fast task lockup.
3	En at Pwr Up	Selects response when RGU Enables at pwr up.	11*	No Bgnd Task	Selects response to background task lockup.
4	Battery Low	Selects response to low BRAM battery voltage.	12*	Addr Bus Err	Selects response to address bus errors.
5*	TIO Loss	Selects response to primary clock being lost.	13*	Data Bus Err	Selects response to data bus errors.
6*	R2R Dup Addr	Selects response to duplicate address errors.	14	Line Low	Selects response to low voltage in the AC line.
7*	Lost Master	Selects response to losing the Master.	15	Line High	Selects response to high voltage in the AC line.

* These items cannot be changed to zero.

183 Host Fault Status Word 4
[Fault Status 4]

This parameter indicates a number of host fault conditions.

1 - Fault 0 - No Fault

P184 and P185 determine what conditions are reported and how the conditions are to be handled (warning/fault).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P184, P185

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	I2t Warnings	Indicates that a warning has been detected by the I2t wire overload protect circuit.
1	I2t Overload	Indicates that an overload condition has been detected by the I2t wire overload protect circuit.
2	H/S HighTemp	Indicates that the RGU heatsink temperature is high (P87).
3	Reset Req'd	Indicates that the RGU must be reset (P32).
4	NTC Open	Indicates an NTC open condition.
5	NTC Short	Indicates an NTC short condition.
6	MSTR Faulted	Indicates that the master RGU is faulted (see P20).
7	1 Phase Warn	Indicates single phase condition has been detected (see P147).
8	1 Phase Err	Indicates single phase condition has persisted beyond time limit (see P148).
9-15	Not Used	

184 Fault Status 4 Report Mask
[Flt Report Mask 4]

This parameter selects the faults that can be reported to P180.

1 - Report 0 - Suppress

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1111 1111 1111 1111
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P183, P185

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	I2t Warnings	Reports warnings from the I2t wire overload protector.
1*	I2t Overload	Reports overload conditions from the I2t wire overload protector.
2	H/S HighTemp	Reports high heatink temperatures (P87).
3*	Reset Req'd	Reports when a reset is required (P32).
4	NTC Open	Reports NTC open condition.
5	NTC Short	Reports NTC short condition.
6*	MSTR Faulted	Reports when the master RGU is faulted (P20).
7	1 Phase Warn	Reports single phase condition has been detected (see P147).
8	1 Phase Err	Reports single phase condition has persisted beyond time limit (see P148).
9-15	Not Used	

* These items cannot be changed to zero.

185 Fault/Warning Select Mask 4
[Fault/Warn Mask4]

This parameter determines whether conditions should be reported as a warning (0) or handled as a fault (1).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0001 0111 1010
Minimum Value	0000 0000 0000 0000
Maximum Value	1111 1111 1111 1111
Related Parameters	P183, P184

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Description	
0	I2t Warnings	Selects response to warnings detected by the I2t wire overload protect circuit.
1*	I2t Overload	Selects response to overload conditions detected by the I2t wire overload protect circuit.
2	H/S HighTemp	Selects response when the RGU heatsink temperature is high (P87).
3*	Reset Req'd	Selects response to reset required conditions (P32).
4	NTC Open	Selects response to NTC open condition.
5	NTC Short	Selects response to NTC short condition.
6*	MSTR Faulted	Selects response when the master RGU faults (see P20).
7	1 Phase Warn	Selects response when single phase condition has been detected (see P147).
8	1 Phase Err	Selects response when single phase condition has persisted beyond time limit (see P148).
9-15	Not Used	

* These items cannot be changed to zero.

186-188 *P186-P188 are for internal use only.*

189 Auxiliary Relay Source
[Aux Relay Ind]

This parameter specifies the source to be used in the logic operation shown in P191. This source parameter will be masked with the value in P190 to determine if the auxiliary relay will change state.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	33 (Host Status Word 1)
Minimum Value	0 (disabled)
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P190, P191, P192

190 Auxiliary Relay Mask
[Aux Relay Mask]

This parameter defines the mask to be applied to the value of the Auxiliary Relay Source parameter (P189).

Press F3 to change the parameter display to binary, hexadecimal, etc.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1
Minimum Value	0
Maximum Value	65535
Related Parameters	P189, P191, P192

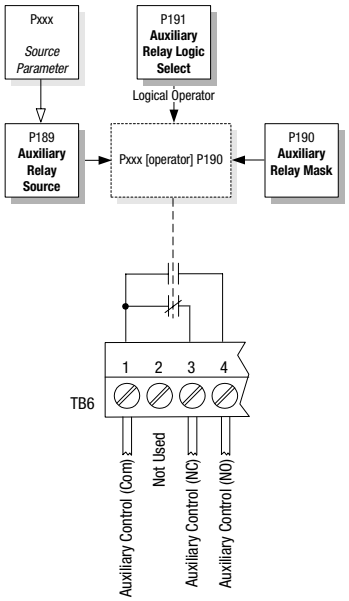
191 Auxiliary Relay Logic Select
[Aux Relay Select]

This parameter selects the logical operation to be performed between the parameter specified in P189 and the value of P190. If the result of the operation is true, then the relay energizes.

By default, P189 is set to read the contents of P33 (Host Status Word 1); P190 is set to 1; and P191 is set to 8 (NAND). This arrangement energizes the relay coil when the hard fault bit (P33 bit 0) is not set.

The NO contacts of this relay are connected to the 120V AC fault circuitry in the RGU.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	8
Minimum Value	0
Maximum Value	11
Related Parameters	P189, P190, P192



Value	Description *(Pxxx refers to the source parameter defined in P189)*
0	OPENRelay always open.
1	CLOSERelay always closed.
2	NERelay triggers when Pxxx is not equal to P190.
3	LTRelay triggers when Pxxx is less than P190.
4	GTRelay triggers when Pxxx is greater than P190.
5	EQRelay triggers when Pxxx is equal to P190.
6	XNORRelay triggers when Pxxx XNOR P190 is true.
7	NORRelay triggers when Pxxx NOR P190 is true.
8	NANDRelay triggers when Pxxx NAND P190 is true.
9	XORRelay triggers when Pxxx XOR P190 is true.
10	ORRelay triggers when Pxxx OR P190 is true.
11	ANDRelay triggers when Pxxx AND P190 is true.

192 Auxiliary Relay Hysteresis
[Aux Relay Hyst]

This parameter defines the variance allowed after an event is activated before the event is deactivated.

For the example in P191, the auxiliary relay will be closed when the RGU line voltage is 450V AC or less. If we want the relay to remain closed up to a 458V AC line voltage, we could enter 8 into P192, and the relay would remain closed until P14 indicates a value over 458V.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1
Minimum Value	0
Maximum Value	65535
Related Parameters	P189, P190, P191

193-197 *P193-P197 are for internal use only.*

198 Current Loop Bandwidth
[DSP Bandwidth]

This parameter defines the bandwidth used in the current loop.

Parameter Type	Sink (Read/Write)
Display Units	rad/s
Drive Units	Display Units * 1
Factory Default	800 (for 2kHz), 1200 (for 4kHz)
Minimum Value	300
Maximum Value	2000
Related Parameters	P199

199 Current Loop Damping
[DSP Damping]

This parameter defines the damping used in the current loop.

Parameter Type	Sink (Read/Write)
Display Units	%
Drive Units	Display Units * 1
Factory Default	100
Minimum Value	50
Maximum Value	200
Related Parameters	P198

200 Iq Reference Rate Limit
[Iq Change Rate]

This parameter defines the rate limit for the Iq reference. This value is used by the current limiter to prevent the Iq Reference (P96) from changing too rapidly.

For example, a 575V AC M-code RGU, bydefault, would not allow the Iq reference to change more than 200A (33.33% of 602A (P11)).

Parameter Type	Sink (Read/Write)
Display Units	% of P11
Drive Units	Display Units * 1
Factory Default	33.33
Minimum Value	2.44
Maximum Value	366.21
Related Parameters	P198

201 Per Unit Internal Capacitance Charge Rate
[Int Charge Rate]

This parameter indicates the charge rate of the RGU internal capacitance.

To determine the rate, divide P16 (Nominal DC Bus Voltage) by this value.

Parameter Type	Source (Read Only)
Display Units	msec
Drive Units	Display Units * 1
Factory Default	27
Minimum Value	0.00
Maximum Value	1000
Related Parameters	P202

202 Per Unit System Capacitance Charge Rate
[Sys Charge Rate]

This parameter indicates approximate charge rate for the system capacitance.

To determine the rate, divide P16 (Nominal DC Bus Voltage) by this value.

Parameter Type	Source (Read Only)
Display Units	msec
Drive Units	Display Units * 1
Factory Default	32
Minimum Value	0.00
Maximum Value	1000
Related Parameters	P201

203 External Capacitance
[Ext Capacitance]

This parameter specifies the estimated sum capacitace of the all the AC units connected to the DC bus. This value is used to calculate the proportional and integral gains in the PI regulator (P118 and P119).

See Appendix B for a listing of inverter capacitor bank values.

Parameter Type	Sink (Read/Write)
Display Units	uF/10
Drive Units	Display Units * 1
Factory Default	9600
Minimum Value	10
Maximum Value	65000
Related Parameters	P202, P204
See Chapter/(Appendix)	8, (B)

204 Internal Capacitance
[Int Capacitance]

This parameter specifies the internal capacitance of the RGU (determined by the Frame Catalog Number (P4)). P201 can be used to view the charge rate of the internal capacitance.

Parameter Type	Source (Read/Write)
Display Units	uF/10
Drive Units	Display Units * 1
Factory Default	See below
Minimum Value	10
Maximum Value	3000
Related Parameters	P201, P203

J-code RGUs		K-code RGUs		L-code RGUs		M-code RGUs		N-Code RGUs	
Factory Default	645 (286*)	Factory Default	1200 (600*)	Factory Default	1500	Factory Default	2400	Factory Default	2400

* Value applies to units with 575V AC inputs

205 Voltage Loop Bandwidth
[Bus Voltage BW]

This parameter specifies the bandwidth of the voltage loop. This value is used by the RGU to calculate the proportional gain and integral gain in the PI regulator (P118 and P119).

Parameter Type	Sink (Read/Write)
Display Units	rad/s
Drive Units	Display Units * 1
Factory Default	50.0
Minimum Value	5.00
Maximum Value	500.00
Related Parameters	P206

206 Voltage Loop Damping
[Bus Volt Damping]

This parameter specifies the damping for the voltage loop. This value is used by RGU to calculate the proportional gain and integral gain in the PI regulator (P118 and P119).

Parameter Type	Sink (Read/Write)
Display Units	%
Drive Units	Display Units * 1
Factory Default	100.00
Minimum Value	30.00
Maximum Value	500.00
Related Parameters	P205

207 Bus Voltage Command
[Bus Volt Cmd]

This parameter can be used to specify a command for the DC bus voltage.

This parameter is used to determine the Bus Reference (P128) when selected in the Voltage Mode Select (P123 = 1 or 2, not default).

Parameter Type	Sink (Read/Write)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	P16
Minimum Value	0.85 x P16
Maximum Value	1.15 x P16
Related Parameters	P122, P123, P128

208-215 *P208-P215 are for internal use only.*

215 Simulator Rate
[Simulator Rate]

This parameter defines the rate to be applied to the bus simulator.

Parameter Type	Sink (Read/Write)
Display Units	%
Drive Units	Display Units * 4096/100
Factory Default	4.88
Minimum Value	0.00
Maximum Value	799.98
Related Parameters	P216, P217, P218

216 Simulator Load
[Simulator Load]

This parameter defines the load to be applied to the bus simulator.

Parameter Type	Sink (Read/Write)
Display Units	%
Drive Units	Display Units * 5120/100
Factory Default	19.50
Minimum Value	-156.3
Maximum Value	156.3
Related Parameters	P215, P217, P218

217 Simulator Per Unit Capacitance
[Sim Charge Rate]

This parameter defines the capacitance charge rate to be applied to the bus simulator.

Parameter Type	Sink (Read/Write)
Display Units	msec
Drive Units	Display Units * 1
Factory Default	32
Minimum Value	20
Maximum Value	2000
Related Parameters	P215, P216, P218

218 Simulated Bus Feedback
[Sim Bus Fdbk]

This parameter indicates the simulated bus feedback determined by P96 (Iq Reference), P215, P216, and P217.

This value can be used as the source for P141 (Bus Feedback) when P219 = 1 (not default).

Parameter Type	Source (Read Only)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0.00
Minimum Value	0.00
Maximum Value	1.15 x P16
Related Parameters	P215, P216, P217, P219

219 Feedback Select
[Feedback Select]

This parameter selects the feedback source used for P141 (Bus Feedback). See P140.

Value	Description	
0	Bus Volt In	Selects the bus feedback
1	Bus Simulate	Selects a simulated feedback

Parameter Type	Source (Read Only)
Display Units	Volt
Drive Units	Display Units * 4096/P16
Factory Default	0
Minimum Value	0
Maximum Value	1
Related Parameters	P215, P216, P217, P219

220-223 *P220-P223 are for internal use only.*

224 SCANport Port Enable Mask
[Port Enable Mask]

This parameter activates SCANport ports.

SCANport 1 = J10 on main control board
SCANport 2 = J9 on main control board
SCANport 6 = J8 on main control board

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0111 1111
Minimum Value	0000 0000
Maximum Value	0111 1111
Related Parameters	P8, P225, P226, P227

Bit	Description
0	RGU I/OEnables the RGU I/O port
1	SCANport P:1Enables the port for SCANport 1
2	SCANport P:2Enables the port for SCANport 2
3	SCANport P:3Enables the port for SCANport 3
4	SCANport P:4Enables the port for SCANport 4
5	SCANport P:5Enables the port for SCANport 5
6	SCANport P:6Enables the port for SCANport 6
7	Not Used

225 SCANport Enable Mask
[Enable Mask]

This parameter allows a connected SCANport device to enable the RGU. The selected ports must be activated (P224).

Parameter Type	Sink (Read/Write)
Display Units	Bits
Drive Units	Display Units * 1
Factory Default	0111 1111
Minimum Value	0000 0000
Maximum Value	0111 1111
Related Parameters	P8, P224, P226, P227

Bit	Description
0	RGU I/OEnables the RGU I/O
1	SCANport P:1Enables SCANport 1
2	SCANport P:2Enables SCANport 2
3	SCANport P:3Enables SCANport 3
4	SCANport P:4Enables SCANport 4
5	SCANport P:5Enables SCANport 5
6	SCANport P:6Enables SCANport 6
7	Not Used

226 SCANport Clear Fault Mask
[Clear Fault Mask]

This parameter allows a connected SCANport device to clear faults in the RGU. The selected ports must be active (P224).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0111 1111
Minimum Value	0000 0000
Maximum Value	0111 1111
Related Parameters	P8, P224, P225, P227

Bit	Description
0	RGU I/OClears RGU I/O faults
1	SCANport P:1Clears SCANport 1 faults
2	SCANport P:2Clears SCANport 2 faults
3	SCANport P:3Clears SCANport 3 faults
4	SCANport P:4Clears SCANport 4 faults
5	SCANport P:5Clears SCANport 5 faults
6	SCANport P:6Clears SCANport 6 faults
7	Not Used

227 SCANport Reset Mask
[Reset Mask]

This parameter allows a connected SCANport device to reset the RGU. The selected ports must be active (P224).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0111 1111
Minimum Value	0000 0000
Maximum Value	0111 1111
Related Parameters	P8, P224, P225, P226

Bit	Description
0	RGU I/OResets RGU I/O
1	SCANport P:1Resets SCANport 1
2	SCANport P:2Resets SCANport 2
3	SCANport P:3Resets SCANport 3
4	SCANport P:4Resets SCANport 4
5	SCANport P:5Resets SCANport 5
6	SCANport P:6Resets SCANport 6
7	Not Used

228,229 *P228 and P229 are for internal use only.*

230 SCANport Disable Owner
[Disable Owner]

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	0000 0000 0111 1111
Related Parameters	P231, P232

Bit	Description
0	RGU I/OIndicates that the RGU I/O port is disabled
1	SCANport P:1Indicates that the port for SCANport 1 is disabled
2	SCANport P:2Indicates that the port for SCANport 2 is disabled
3	SCANport P:3Indicates that the port for SCANport 3 is disabled
4	SCANport P:4Indicates that the port for SCANport 4 is disabled
5	SCANport P:5Indicates that the port for SCANport 5 is disabled
6	SCANport P:6Indicates that the port for SCANport 6 is disabled
7-15	Not Used

231 SCANport Enable Owner
[Enable Owner]

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	0000 0000 0111 1111
Related Parameters	P230, P232

Bit	Description
0	RGU I/OIndicates that the RGU I/O port is enabled
1	SCANport P:1Indicates that the port for SCANport 1 is enabled
2	SCANport P:2Indicates that the port for SCANport 2 is enabled
3	SCANport P:3Indicates that the port for SCANport 3 is enabled
4	SCANport P:4Indicates that the port for SCANport 4 is enabled
5	SCANport P:5Indicates that the port for SCANport 5 is enabled
6	SCANport P:6Indicates that the port for SCANport 6 is enabled
7-15	Not Used

232 SCANport Clear Fault Owner
[Clr Fault Owner]

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	0000 0000 0111 1111
Related Parameters	P230, P231

Bit	Description
0	RGU I/OIndicates a clear fault is issued to RGU I/O
1	SCANport P:1Indicates a clear fault is issued to SCANport 1
2	SCANport P:2Indicates a clear fault is issued to SCANport 2
3	SCANport P:3Indicates a clear fault is issued to SCANport 3
4	SCANport P:4Indicates a clear fault is issued to SCANport 4
5	SCANport P:5Indicates a clear fault is issued to SCANport 5
6	SCANport P:6Indicates a clear fault is issued to SCANport 6
7-15	Not Used

233, 234 *P233 and P234 are for internal use only.*

235 Type 1 Status
[Type 1 Status]

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	0000 0000 1000 0001
Related Parameters	P236

Bit	Description
0	Enabled
1-6	Not Used
7	Faulted
8-15	Not Used

236 Type 2 Status
[Type 2 Status]

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0000 0000 0000 0000
Minimum Value	0000 0000 0000 0000
Maximum Value	0000 0000 0000 0111
Related Parameters	P236

Bit	Description
0	Enabled
1	Warning
2	Faulted
3-15	Not Used

237,238 *P237-P238 are for internal use only.*

239 SCANport Remote Data In: P1
[Rem Data In:P1]

This parameter shows the value that is being passed into SCANport 1 (J10).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

240 SCANport Remote Data In: P2
[Rem Data In:P2]

This parameter shows the value that is being passed into SCANport 2 (J9).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

241 SCANport Remote Data In: P3
[Rem Data In:P3]

This parameter shows the value that is being passed into SCANport 3 (expansion port).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

242 SCANport Remote Data In: P4
[Rem Data In:P4]

This parameter shows the value that is being passed into SCANport 4 (expansion port).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

243 SCANport Remote Data In: P5
[Rem Data In:P5]

This parameter shows the value that is being passed into SCANport 5 (expansion port).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

244 SCANport Remote Data In: P6
[Rem Data In:P6]

This parameter shows the value that is being passed into SCANport 6 (J7).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

245 SCANport Remote Data Out: P1
[Rem Data Out:P1]

This parameter shows the value that is being passed through SCANport 1 (J10).

To display a parameter value on the main HIM screen, link the desired parameter within P245. For example, linking P14 to P245 (Measured AC Line Voltage) would cause a HIM connected to J10 to display P14 on the main screen.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

246 SCANport Remote Data Out: P2
[Rem Data Out:P2]

This parameter shows the value that is being passed out SCANport 2 (J9).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

247 SCANport Remote Data Out: P3
[Rem Data Out:P3]

This parameter shows the value that is being passed out SCANport 3 (expansion port).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

248 SCANport Remote Data Out: P4
[Rem Data Out:P4]

This parameter shows the value that is being passed out SCANport 4 (expansion port).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

249 SCANport Remote Data Out: P5
[Rem Data Out:P5]

This parameter shows the value that is being passed out SCANport 5 (expansion port).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

250 SCANport Remote Data Out: P6
[Rem Data Out:P6]

This parameter shows the value that is being passed out SCANport 6 (J7).

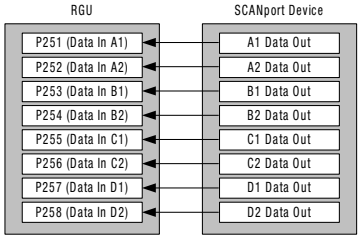
Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P224, P225

251 SCANport Remote Data In: A1
[Rem Data In:A1]

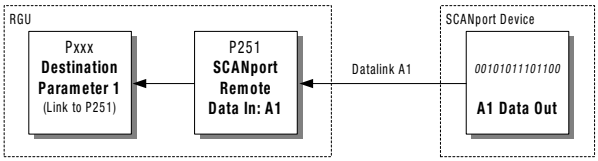
This parameter shows the value of datalink A1 which is being received from a SCANport device. This value may be used by linking other parameters to this parameter.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P259

Receiving a SCANport Image



Using SCANport Remote Data In



252 SCANport Remote Data In: A2
[Rem Data In:A2]

This parameter shows the value of datalink A2 which is being received from a SCANport device. This value may be used by linking other parameters to this parameter.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

253 SCANport Remote Data In: B1
[Rem Data In:B1]

This parameter shows the value of datalink B1 which is being received from a SCANport device. This value may be used by linking other parameters to this parameter.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

254 SCANport Remote Data In: B2
[Rem Data In:B2]

This parameter shows the value of datalink B2 which is being received from a SCANport device. This value may be used by linking other parameters to this parameter.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

255 SCANport Remote Data In: C1
[Rem Data In:C1]

This parameter shows the value of datalink C1 which is being received from a SCANport device. This value may be used by linking other parameters to this parameter.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

256 SCANport Remote Data In: C2
[Rem Data In:C2]

This parameter shows the value of datalink C2 which is being received from a SCANport device. This value may be used by linking other parameters to this parameter.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

257 SCANport Remote Data In: D1
[Rem Data In:D1]

This parameter shows the value of datalink D1 which is being received from a SCANport device. This value may be used by linking other parameters to this parameter.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

258 SCANport Remote Data In: D2
[Rem Data In:D2]

This parameter shows the value of datalink D2 which is being received from a SCANport device. This value may be used by linking other parameters to this parameter.

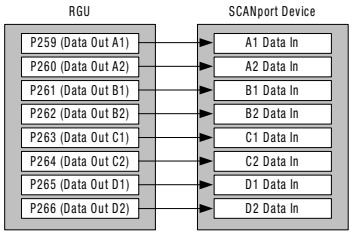
Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

259 SCANport Remote Data Out: A1
[Rem Data Out:A1]

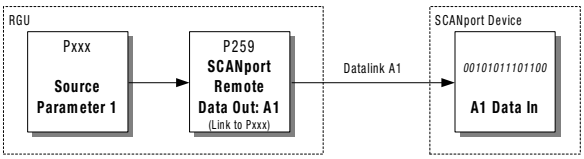
This parameter shows the value of datalink A1 which is being passed to a SCANport device. Link this parameter to the parameter that is to be passed through datalink A1.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251

Sending a SCANport Image



Using SCANport Remote Data Out



260 SCANport Remote Data Out: A2
[Rem Data Out:A2]

This parameter shows the value of datalink A2 which is being passed to a SCANport device. Link this parameter to the parameter that is to be passed through datalink A2.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

261 SCANport Remote Data Out: B1
[Rem Data Out:B1]

This parameter shows the value of datalink B1 which is being passed to a SCANport device. Link this parameter to the parameter that is to be passed through datalink B1.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

262 SCANport Remote Data Out: B2
[Rem Data Out:B2]

This parameter shows the value of datalink B2 which is being passed to a SCANport device. Link this parameter to the parameter that is to be passed through datalink B2.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

263 SCANport Remote Data Out: C1
[Rem Data Out:C1]

This parameter shows the value of datalink C1 which is being passed to a SCANport device. Link this parameter to the parameter that is to be passed through datalink C1.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

264 SCANport Remote Data Out: C2
[Rem Data Out:C2]

This parameter shows the value of datalink C2 which is being passed to a SCANport device. Link this parameter to the parameter that is to be passed through datalink C2.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

265 SCANport Remote Data Out: D1
[Rem Data Out:D1]

This parameter shows the value of datalink D1 which is being passed to a SCANport device. Link this parameter to the parameter that is to be passed through datalink D1.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

266 SCANport Remote Data Out: D2
[Rem Data Out:D2]

This parameter shows the value of datalink D2 which is being passed to a SCANport device. Link this parameter to the parameter that is to be passed through datalink D2.

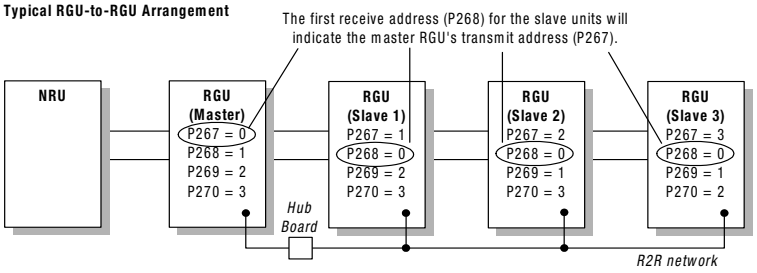
Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	65535
Related Parameters	P251, P259

267 RGU-to-RGU Transmit Address
[R2R Xmit Addr]

This parameter indicates the unit address, which identifies this unit when communicating on the R2R network.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	32.00
Related Parameters	P5, P271, P272

Typical RGU-to-RGU Arrangement



268 RGU-to-RGU Receive 1 Address
[R2R Rcv Addr 1]

This parameter indicates the address of a paralleled RGU on the R2R network.

For slave units, this parameter should indicate the transmit address from the master unit (P267).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	32.00
Related Parameters	P5, P273, P274

269 RGU-to-RGU Receive 2 Address
[R2R Rcv Addr 2]

This parameter indicates the address of a paralleled RGU on the R2R network.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	32.00
Related Parameters	P5

270 RGU-to-RGU Receive 3 Address
[R2R Rcv Addr 3]

This parameter indicate the address of a paralleled RGU on the R2R network.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0.00
Minimum Value	0.00
Maximum Value	32.00
Related Parameters	P5

271 RGU-to-RGU Transmit Indirect 1
[R2R Xmit Ind 1]

This parameter directs the value in P96 (Iq Current Reference) to the R2R network.

Parameter Type	Source (Read Only)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	96 (Iq Current Reference)
Minimum Value	1
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P5, P96, P267

272 RGU-to-RGU Transmit Indirect 2
[R2R Xmit Ind 2]

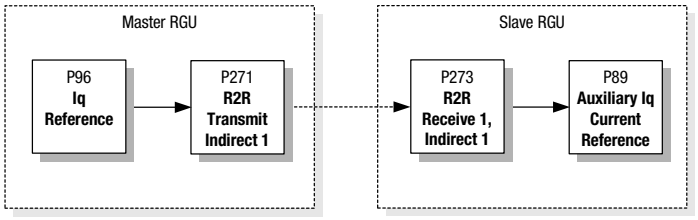
This parameter directs the master status indicated in P20 (Master Status) to the R2R network.

Parameter Type	Source (Read Only)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	20 (Master Status)
Minimum Value	1
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P5, P20, P267

273 RGU-to-RGU Receive 1, Indirect 1
[R2R Rcv1, Ind1]

This parameter directs the Iq Current Reference (P96) from the master to P89 (Auxiliary Iq Current Command).

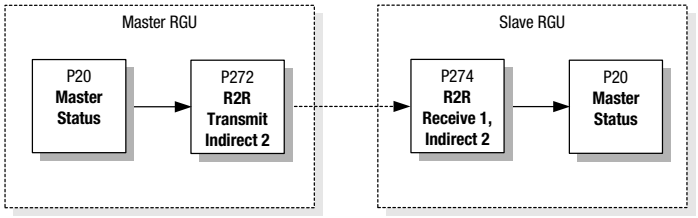
Parameter Type	Source (Read Only)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	89 (Auxiliary Iq Current Command)
Minimum Value	1
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P5, P89, P268



274 RGU-to-RGU Receive 1, Indirect 2
[R2R Rcv1, Ind2]

This parameter receives the status from the master RGU through the R2R network. This master status (Enabled/Faulted) is directed to P20 (Master Status).

Parameter Type	Source (Read Only)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	20 (Master Status)
Minimum Value	1
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P5, P20, P268



275-280 *P275-P280 are for internal use only.*

281 Scratch Pad 1
[Scratch Pad 1]

This parameter can be used to store miscellaneous positive values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535

282 Scratch Pad 2
[Scratch Pad 2]

This parameter can be used to store miscellaneous positive values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535

283 Scratch Pad 3 [Scratch Pad 3]

This parameter can be used to store miscellaneous positive values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535

284 Scratch Pad 4 [Scratch Pad 4]

This parameter can be used to store miscellaneous positive values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535

285 Scratch Pad 5 [Scratch Pad 5]

This parameter can be used to store miscellaneous positive values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	65535

286 Scratch Pad 6 [Scratch Pad 6]

This parameter can be used to store miscellaneous positive and negative values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767

287 Scratch Pad 7 [Scratch Pad 7]

This parameter can be used to store miscellaneous positive and negative values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767

288 Scratch Pad 8 [Scratch Pad 8]

This parameter can be used to store miscellaneous positive and negative values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767

289 Scratch Pad 9 [Scratch Pad 9]

This parameter can be used to store miscellaneous positive and negative values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767

290 Scratch Pad 10 [Scratch Pad 10]

This parameter can be used to store miscellaneous positive and negative values.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767

291,292 *P291 and P292 are for internal use only.*

293 Trend 1 Input Indirect [Trend In Ind]

This parameter designates the parameter to be output when Trend 1 is triggered.

The source parameter defined here is passed to the output (P304) when the trending operation is evaluated as true.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P294 to P304 (See P298)

294 Trend 1 Operand Indirect X [Trend X Ind]

This parameter designates a source parameter to be analyzed in the Trend 1 evaluation. The source value is masked with the trend Y value (P296 or P297). P295 (Trend 1 X Value) is used as the trend X operand when this parameter is zero (default).

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (disabled, P295 enabled)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P293 to P304 (See P298)

295 Trend 1 X Value [Trend X Value]

This parameter defines a constant to be masked with the trend Y value (P296 or P297).

To use this parameter, the trend X indirect (P294) must equal zero.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P293 to P304 (See P298)

296 Trend 1 Operand Indirect Y [Trend Y Ind]

This parameter designates a source parameter to be analyzed in the Trend 1 evaluation. The source value masks the trend X value (P294 or P295).

P297 (Trend 1 Y Value) is used instead when this parameter equals zero (default).

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (disabled, P297 enabled)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P293 to P304 (See P298)

297 Trend 1 Y Value [Trend Y Value]

This parameter defines a constant to mask the trend X value (P294 or P295).

To use this parameter, the trend Y indirect (P296) must equal zero.

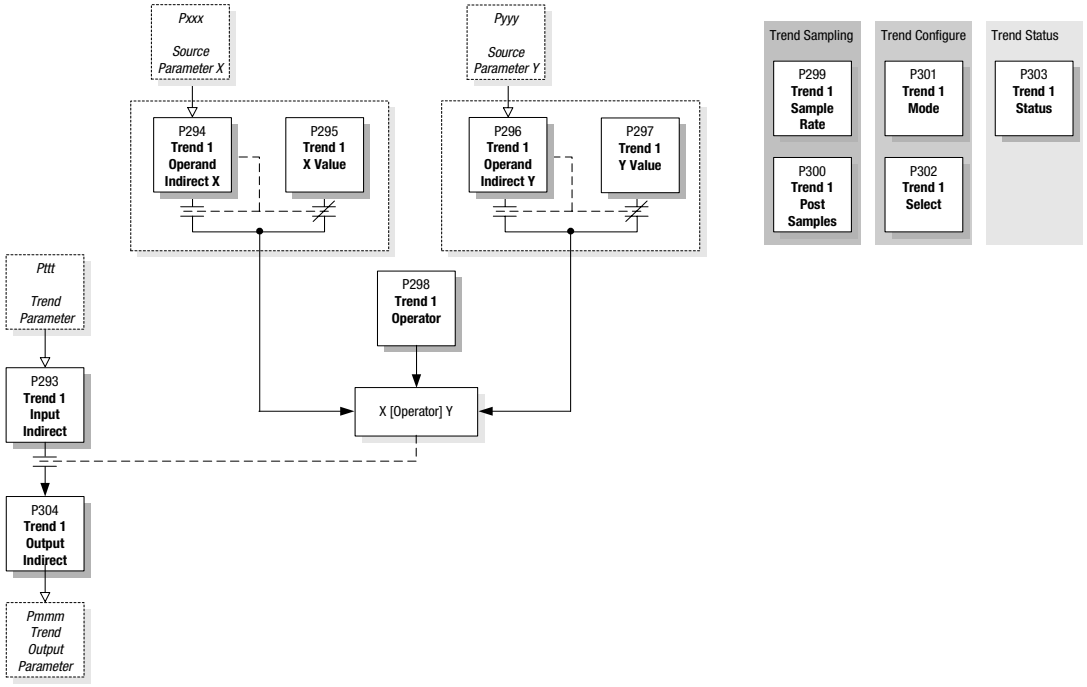
Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P293 to P304 (See P298)

298 Trend 1 Operator [Trend Operator]

This parameter selects the operation to be performed between trend X (P294 or P295) and trend Y (P296 or P297). If trending is enabled (P302), a true result of the operation will cause the Trend 1 Input parameter value (from P293) to be passed to the prescribed output (P293).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0 (GT)
Minimum Value	0
Maximum Value	7
Related Parameters	P293 to P304

Value	Description
0	GTSelects the operation [Trend X must be greater than Trend Y].
1	LTSelects the operation [Trend X must be less than Trend Y].
2	EQSelects the operation [Trend X must be equal to Trend Y].
3	NESelects the operation [Trend X must not be equal to Trend Y].
4	ANDSelects the operation [Trend X AND Trend Y].
5	NANDSelects the operation [Trend X NAND Trend Y].
6	ORSelects the operation [Trend X OR Trend Y].
7	NORSelects the operation [Trend X NOR Trend Y].



299 Trend 1 Sample Rate [Trend Samp Rate]

This parameter determines the rate of sampling for the Trend 1 Indirects (P294, P296).

The value of this parameter can be changed in increments of 0.002 sec.

Parameter Type	Sink (Read/Write)
Display Units	sec
Drive Units	Display Units * 2000
Factory Default	0.000
Minimum Value	0.000
Maximum Value	30.000
Related Parameters	P293 to P304 (See P298)

300 Trend 1 Post Samples [Trend Post Samp]

This parameter defines the number of samples (out of 500) to be allocated for post-trigger sampling.

Pre-samples + Post samples = 500 (0 to 499)

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	10
Minimum Value	0
Maximum Value	499
Related Parameters	P293 to P304 (See P298)

301 Trend 1 Mode [Trend Mode]

This parameter determines the duration of the trending process. The trending process can be configured to stop trending after a trigger event occurs (default), or can continue trending.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	1
Related Parameters	P293 to P304 (See P298)

Value	Description
0	One ShotCommands the trending process to stop after a single trigger event.
1	ContinuousCommands the trending process to run continuously.

302 Trend 1 Select [Trend Select]

This parameter commands the RGU to enable, disable, or force trigger Trend 1.

After the RGU processes the command, the value resets to 3 (No Command).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	3 (No Command)
Minimum Value	0
Maximum Value	3
Related Parameters	P293 to P304 (See P298)

Value	Description
0	DisableCommands the RGU to disable Trend 1.
1	EnableCommands the RGU to enable Trend 1.
2	Force TrigCommands the RGU to force trigger Trend 1. The trending value (prescribed by P293) will be sent to Trend 1 Output Indirect (P304).
3	No CommandIndicates that no command is issued at this time.

303 Trend 1 Status [Trend Status]

This parameter displays the status of Trend 1.

Parameter Type	Sink (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1 (Unprogrammed)
Minimum Value	0
Maximum Value	4
Related Parameters	P293 to P304 (See P298)

Value	Description
0	UnprogrammedTrend 1 is not programmed.
1	StoppedThe trending operation is stopped (trend X and trend Y values are not being evaluated).
2	RunningThe trending operation is running (trend X and trend Y values are being evaluated).
3	TriggeredThe trending operation between trend X and trend Y is true. The trending value (determined by P293) will be output through P304.
4	Forced TrigTrend 1 is triggered due to a 'Force Trig' command from the Trend 1 Select (P302 = 0). The trending value is output.

304 Trend 1 Output Indirect [Trend Out Ind]

This parameter prescribes the destination of the trend parameter value (listed in P293). The trending operation (X [operator] Y) must be evaluated as true for P304 to output the value from the trend source.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P293 to P303 (See P298)

305 Trend 2 Input Indirect [Trend In Ind]

This parameter designates the parameter to be output when Trend 2 is triggered (when the trend X/trend Y evaluation is true).

The source parameter defined here is passed to the output (P316) when the trending operation is evaluated as true.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P306 to P316 (See also P298)

306 Trend 2 Operand Indirect X [Trend X Ind]

This parameter designates a source parameter to be analyzed in the Trend 1 evaluation. The source value is masked with the trend Y value (P308 or P309).

P307 (Trend 2 X Value) is used instead when this parameter equals zero (default).

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (disabled, P307 enabled)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P305 to P316 (See also P298)

307 Trend 2 X Value [Trend X Value]

This parameter defines a constant to be masked with the trend Y value (P308 or P309).

To use this parameter, the trend X indirect (P306) must equal zero.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P305 to P316 (See also P298)

308 Trend 2 Operand Indirect Y [Trend Y Ind]

This parameter designates a source parameter to be analyzed in the Trend 2 evaluation. The source value masks the trend X value (P306 or P307). P309 (Trend 2 Y Value) is used as the trend Y operand when this parameter equals zero.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (disabled, P309 enabled)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P305 to P316 (See also P298)

309 Trend 2 Y Value [Trend Y Value]

This parameter defines a constant used to mask the trend X value (P306 or P307).

To use this parameter, the trend Y indirect (P308) must equal zero.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P305 to P316 (See also P298)

310 Trend 2 Operator [Trend Operator]

This parameter selects the operation to be performed between trend X (P306 or P307) and trend Y (P308 or P309). If trending is enabled (P314), a true result of the operation will cause the Trend 2 Input parameter value (from P305) to be passed to the prescribed output (P316).

P298 (Trend 1 Operator) shows a sample diagram of the trending configuration

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0 (GT)
Minimum Value	0
Maximum Value	7
Related Parameters	P305 to P316 (See also P298)

Value	Description
0	GTSelects the operation [Trend X must be greater than Trend Y].
1	LTSelects the operation [Trend X must be less than Trend Y].
2	EQSelects the operation [Trend X must be equal to Trend Y].
3	NESelects the operation [Trend X must not be equal to Trend Y].
4	ANDSelects the operation [Trend X AND Trend Y].
5	NANDSelects the operation [Trend X NAND Trend Y].
6	ORSelects the operation [Trend X OR Trend Y].
7	NORSelects the operation [Trend X NOR Trend Y].

311 Trend 2 Sample Rate [Trend Samp Rate]

This parameter determines the rate of sampling for the Trend 2 Indirects (P306, P308).

The value of this parameter can be changed in increments of 0.002 sec.

Parameter Type	Sink (Read/Write)
Display Units	sec
Drive Units	Display Units * 2000
Factory Default	0.000
Minimum Value	0.000
Maximum Value	30.000
Related Parameters	P305 to P316 (See also P298)

312 Trend 2 Post Samples [Trend Post Samp]

This parameter defines the number of samples (out of 500) to be allocated for post-trigger sampling.

Pre-samples + Post samples = 500 (0 to 499)

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	10
Minimum Value	0
Maximum Value	499
Related Parameters	P305 to P316 (See also P298)

313 Trend 2 Mode [Trend Mode]

This parameter determines the duration of the trending process. The trending process can be configured to stop trending after a trigger event occurs (default), or can continue trending.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	1
Related Parameters	P305 to P316 (See also P298)

Value	Description
0	One ShotCommands the trending process to stop after a single trigger event.
1	ContinuousCommands the trending process to run continuously.

314 Trend 2 Select [Trend Select]

This parameter commands the RGU to enable, disable, or force trigger Trend 2.

After the RGU processes the command, the value resets to 3 (No Command).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	3 (No Command)
Minimum Value	0
Maximum Value	3
Related Parameters	P305 to P316 (See also P298)

Value	Description
0	DisableCommands the RGU to disable Trend 2.
1	EnableCommands the RGU to enable Trend 2.
2	Force TrigCommands the RGU to force trigger Trend 2. The trending value (prescribed by P305) will be sent to Trend 2 Output Indirect (P316).
3	No CommandIndicates that no command is issued at this time.

315 Trend 2 Status [Trend Status]

This parameter displays the status of Trend 2.

Parameter Type	Sink (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1 (Unprogrammed)
Minimum Value	0
Maximum Value	4
Related Parameters	P305 to P316 (See also P298)

Value	Description
0	UnprogrammedTrend 2 is not programmed.
1	StoppedThe trending operation is stopped (trend X and trend Y values are not being evaluated).
2	RunningThe trending operation is running (trend X and trend Y values are being evaluated).
3	TriggeredThe trending operation between trend X and trend Y is true. The trending value (determined by P305) will be output through P316.
4	Forced TrigTrend 2 is triggered due to a 'Force Trig' command from the Trend 2 Select (P314 = 0). The trending value is output.

316 Trend 2 Output Indirect [Trend Out Ind]

This parameter prescribes the destination of the trend parameter value (listed in P305). The trending operation (X [operator] Y) must be evaluated as true for P316 to output the value from the trend source in P305.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P305 to P315 (See also P298)

317 Trend 3 Input Indirect [Trend In Ind]

This parameter designates the parameter to be output when Trend 3 is triggered.

The source parameter defined here is passed to the output (P328) when the trending operation is evaluated as true.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P318 to P328 (See also P298)

318 Trend 3 Operand Indirect X [Trend X Ind]

This parameter designates a source parameter to be analyzed in the Trend 3 evaluation. The source value is masked with the trend Y value (P320 or P321).

P319 (Trend 3 X Value) is used as the trend X operand when this parameter is zero (default).

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (disabled, P319 enabled)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P317 to P328 (See also P298)

319 Trend 3 X Value [Trend X Value]

This parameter defines a constant to be masked with the trend Y value (P320 or P321).

To use this parameter, the trend X indirect (P318) must equal zero.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P317 to P328 (See also P298)

320 Trend 3 Operand Indirect Y [Trend Y Ind]

This parameter designates a source parameter to be analyzed in the Trend 3 evaluation. The source value masks the trend X value (P318 or P319). P321 (Trend 3 Y Value) is used as the trend Y operand when this parameter equals zero.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (disabled, P321 enabled)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P317 to P328 (See also P298)

321 Trend 3 Y Value [Trend Y Value]

This parameter defines a constant used to mask the trend X operand (P318 or P319).

To use this parameter, the trend Y indirect (P320) must equal zero.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P317 to P328 (See also P298)

322 Trend 3 Operator [Trend Operator]

This parameter selects the operation to be performed between trend X (P318 or P319) and trend Y (P320 or P321). If trending is enabled (P314), a true result of the operation will cause the Trend 4 Input parameter value (from P317) to be passed to the prescribed output (P328).

P298 (Trend 1 Operator) shows a sample diagram of the trending configuration.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0 (GT)
Minimum Value	0
Maximum Value	7
Related Parameters	P317 to P328 (See also P298)

Value	Description	Value	Description
0	GTSelects the operation [Trend X must be greater than Trend Y].	4	ANDSelects the operation [Trend X AND Trend Y].
1	LTSelects the operation [Trend X must be less than Trend Y].	5	NANDSelects the operation [Trend X NAND Trend Y].
2	EQSelects the operation [Trend X must be equal to Trend Y].	6	ORSelects the operation [Trend X OR Trend Y].
3	NESelects the operation [Trend X must not be equal to Trend Y].	7	NORSelects the operation [Trend X NOR Trend Y].

323 Trend 3 Sample Rate [Trend Samp Rate]

This parameter determines the rate of sampling for the Trend 3 Indirects (P318, P320).

The value of this parameter can be changed in increments of 0.002 sec.

Parameter Type	Sink (Read/Write)
Display Units	sec
Drive Units	Display Units * 2000
Factory Default	0.000
Minimum Value	0.000
Maximum Value	30.000
Related Parameters	P317 to P328 (See also P298)

324 Trend 3 Post Samples [Trend Post Samp]

This parameter defines the number of samples (out of 500) to be allocated for post-trigger sampling.

Pre-samples + Post samples = 500 (0 to 499)

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	10
Minimum Value	0
Maximum Value	499
Related Parameters	P317 to P328 (See also P298)

325 Trend 3 Mode [Trend Mode]

This parameter determines the duration of the trending process. The trending process can be configured to stop trending after a trigger event occurs (default), or can continue trending.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	1
Related Parameters	P317 to P328 (See also P298)

Value	Description
0	One ShotCommands the trending process to stop after a single trigger event.
1	ContinuousCommands the trending process to run continuously.

326 Trend 3 Select [Trend Select]

This parameter commands the RGU to enable, disable, or force trigger Trend 3.

After the RGU processes the command, the value resets to 3 (No Command).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	3 (No Command)
Minimum Value	0
Maximum Value	3
Related Parameters	P317 to P328 (See also P298)

Value	Description
0	DisableCommands the RGU to disable Trend 3.
1	EnableCommands the RGU to enable Trend 3.
2	Force TrigCommands the RGU to force trigger Trend 3. The trending value (prescribed by P317) will be sent to Trend 3 Output Indirect (P328).
3	No CommandIndicates that no command is issued at this time.

327 Trend 3 Status [Trend Status]

This parameter displays the status of Trend 3.

Parameter Type	Sink (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1 (Unprogrammed)
Minimum Value	0
Maximum Value	4
Related Parameters	P317 to P328 (See also P298)

Value	Description
0	UnprogrammedTrend 3 is not programmed.
1	StoppedThe trending operation is stopped (trend X and trend Y values are not being evaluated).
2	RunningThe trending operation is running (trend X and trend Y values are being evaluated).
3	TriggeredThe trending operation between trend X and trend Y is true. The trending value (determined by P317) will be output through P328.
4	Forced TrigTrend 3 is triggered due to a 'Force Trig' command from the Trend 3 Select (P326 = 0). The trending value is output.

328 Trend 3 Output Indirect [Trend Out Ind]

This parameter prescribes the destination of the trend parameter value (listed in P317). The trending operation (X [operator] Y) must be evaluated as true for P328 to output the value from the trend source in P317.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P317 to P327 (See also P298)

329 Trend 4 Input Indirect [Trend In Ind]

This parameter designates the parameter to be output when Trend 4 is triggered.

The source parameter defined here is passed to the output (P328) when the trending operation is evaluated as true.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P330 to 340 (See also P298)

330 Trend 4 Operand Indirect X [Trend X Ind]

This parameter designates a source parameter to be analyzed in the Trend 4 evaluation. The source value is masked with the trend Y value (P332 or P333).

P331 (Trend 4 X Value) is used as the trend X operand when this parameter is zero (default).

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (disabled, P331 enabled)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P329 to 340 (See also P298)

331 Trend 4 X Value [Trend X Value]

This parameter defines a constant to be masked with the trend Y value (P332 or P333).

To use this parameter, the trend X indirect (P330) must equal zero.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P329 to 340 (See also P298)

332 Trend 4 Operand Indirect Y [Trend Y Ind]

This parameter designates a source parameter to be analyzed in the Trend 3 evaluation. The source value masks the trend X value (P330 or P331). P333 (Trend 4 Y Value) is used as the trend Y operand when this parameter equals zero.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (disabled, P333 enabled)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P329 to 340 (See also P298)

333 Trend 4 Y Value [Trend Y Value]

This parameter defines a constant used to mask the trend X operand (P330 or P331).

To use this parameter, the trend Y indirect (P332) must equal zero.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P329 to 340 (See also P298)

334 Trend 4 Operator [Trend Operator]

This parameter selects the operation to be performed between trend X (P330 or P331) and trend Y (P332 or P333). If trending is enabled (P338), a true result of the operation will cause the Trend 4 Input parameter value (from P329) to be passed to the prescribed output (P340).

P298 (Trend 1 Operator) shows a sample diagram of the trending configuration.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0 (GT)
Minimum Value	0
Maximum Value	7
Related Parameters	P329 to 340 (See also P298)

Value	Description	Value	Description
0	GTSelects the operation [Trend X must be greater than Trend Y].	4	ANDSelects the operation [Trend X AND Trend Y].
1	LTSelects the operation [Trend X must be less than Trend Y].	5	NANDSelects the operation [Trend X NAND Trend Y].
2	EQSelects the operation [Trend X must be equal to Trend Y].	6	ORSelects the operation [Trend X OR Trend Y].
3	NESelects the operation [Trend X must not be equal to Trend Y].	7	NORSelects the operation [Trend X NOR Trend Y].

335 Trend 4 Sample Rate [Trend Samp Rate]

This parameter determines the rate of sampling for Trend 4.

The value of this parameter can be changed in increments of 0.002 sec.

Parameter Type	Sink (Read/Write)
Display Units	sec
Drive Units	Display Units * 2000
Factory Default	0.000
Minimum Value	0.000
Maximum Value	30.000
Related Parameters	P329 to 340 (See also P298)

336 Trend 4 Post Samples [Trend Post Samp]

This parameter defines the number of samples (out of 500) to be allocated for post-trigger sampling.

Pre-samples + Post samples = 500 (0 to 499)

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	10
Minimum Value	0
Maximum Value	499
Related Parameters	P329 to 340 (See also P298)

337 Trend 4 Mode [Trend Mode]

This parameter determines the duration of the trending process. The trending process can be configured to stop trending after a trigger event occurs (default), or can continue trending.

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	1
Related Parameters	P329 to 340 (See also P298)

Value	Description
0	One ShotCommands the trending process to stop after a single trigger event.
1	ContinuousCommands the trending process to run continuously.

338 Trend 4 Select [Trend Select]

This parameter commands the RGU to enable, disable, or force trigger Trend 4.

After the RGU processes the command, the value resets to 3 (No Command).

Parameter Type	Sink (Read/Write)
Display Units	None
Drive Units	Display Units * 1
Factory Default	3 (No Command)
Minimum Value	0
Maximum Value	3
Related Parameters	P329 to 340 (See also P298)

Value	Description
0	DisableCommands the RGU to disable Trend 4.
1	EnableCommands the RGU to enable Trend 4.
2	Force TrigCommands the RGU to force trigger Trend 4. The trending value (prescribed by P329) will be sent to Trend 4 Output Indirect (P340).
3	No CommandIndicates that no command is issued at this time.

339 Trend 4 Status [Trend Status]

This parameter displays the status of Trend 4.

Parameter Type	Sink (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1 (Unprogrammed)
Minimum Value	0
Maximum Value	4
Related Parameters	P329 to 340 (See also P298)

Value	Description
0	UnprogrammedTrend 4 is not programmed.
1	StoppedThe trending operation is stopped (trend X and trend Y values are not being evaluated).
2	RunningThe trending operation is running (trend X and trend Y values are being evaluated).
3	TriggeredThe trending operation between trend X and trend Y is true. The trending value (determined by P329) will be output through P340.
4	Forced TrigTrend 4 is triggered due to a 'Force Trig' command from the Trend 4 Select (P338 = 0). The trending value is output.

340 Trend 4 Output Indirect [Trend Out Ind]

This parameter prescribes the destination of the trend parameter value (listed in P329). The trending operation (X [operator] Y) must be evaluated as true for P340 to output the value from the trend source in P329.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P329 to 339 (See also P298)

341 Number of Trend Samples [Trend Samples]

This parameter indicates the number of trend samples taken (up to 500).

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	500
Minimum Value	0
Maximum Value	500
Related Parameters	P298, P300

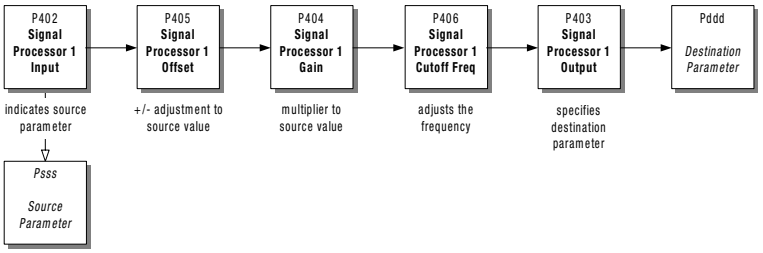
342-401 *P342-P401 are for internal use only.*

402 Signal Processor 1 Input [SigProc 1 Input]

This parameter indicates the parameter that is to be processed through Signal Processor 1.

To process a value, set P402 to the parameter to be processed, set P403 to the destination (where you want the results), set P405 to the offset value that should be applied to the source, set P404 to the gain that should be applied to the source value, and set P406 to the cutoff frequency.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P403 to P406



403 Signal Processor 1 Output [SigProc 1 Output]

This parameter specifies where the results of the processed value should be placed.

Parameter Type	Source (Read Only)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P402 to P406

404 Signal Processor 1 Gain [SigProc 1 Gain]

This parameter specifies the gain that should be applied to the source value (indicated in P402).

Note that the offset is applied before the gain.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1.00
Minimum Value	-4.00
Maximum Value	4.00
Related Parameters	P402 to P406

405 Signal Processor 1 Offset [SigProc 1 Offset]

This parameter specifies the offset to apply to the source value (indicated in P402).

Note that the offset is applied before the gain.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P402 to P406

406 Signal Processor 1 Cutoff Frequency [SigProc 1 Cutoff]

This parameter specifies the cutoff frequency to be used by the signal processor.

Parameter Type	Source (Read Only)
Display Units	R/S (rad/sec)
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P402 to P405

407 Signal Processor 2 Input [SigProc 2 Input]

This parameter indicates the parameter that is to be processed through Signal Processor 2.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P408 to P411 (See also P402)

408 Signal Processor 2 Output [SigProc 2 Output]

This parameter specifies where the results of the processed value should be placed.

Parameter Type	Source (Read Only)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P407 to P411

409 Signal Processor 2 Gain [SigProc 2 Gain]

This parameter specifies the gain that should be applied to the source value (indicated in P407).

Note that the offset is applied before the gain.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1.00
Minimum Value	-4.00
Maximum Value	4.00
Related Parameters	P407 to P411

410 Signal Processor 2 Offset [SigProc 2 Offset]

This parameter specifies the offset to apply to the source value (indicated in P407).

Note that the offset is applied before the gain.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P407 to P411

411 Signal Processor 2 Cutoff Frequency [SigProc 2 Cutoff]

This parameter specifies the cutoff frequency to be used by the signal processor.

Parameter Type	Source (Read Only)
Display Units	R/S (rad/sec)
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P407 to P410

412 Signal Processor 3 Input [SigProc 3 Input]

This parameter indicates the parameter that is to be processed through Signal Processor 3.

Parameter Type	Sink (Read/Write)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0 (no selection)
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P413 to P416 (See also P402)

413 Signal Processor 3 Output [SigProc 3 Output]

This parameter specifies where the results of the processed value should be placed.

Parameter Type	Source (Read Only)
Display Units	Parameter Number
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	0
Maximum Value	Maximum Defined Parameter Number
Related Parameters	P412 to P416

414 Signal Processor 3 Gain [SigProc 3 Gain]

This parameter specifies the gain that should be applied to the source value (indicated in P412).

Note that the offset is applied before the gain.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	1.00
Minimum Value	-4.00
Maximum Value	4.00
Related Parameters	P412 to P416

415 Signal Processor 3 Offset [SigProc 3 Offset]

This parameter specifies the offset to apply to the source value (indicated in P412).

Note that the offset is applied before the gain.

Parameter Type	Source (Read Only)
Display Units	None
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P412 to P416

416 Signal Processor 3 Cutoff Frequency [SigProc 3 Cutoff]

This parameter specifies the cutoff frequency to be used by the signal processor.

Parameter Type	Source (Read Only)
Display Units	R/S (rad/sec)
Drive Units	Display Units * 1
Factory Default	0
Minimum Value	-32768
Maximum Value	32767
Related Parameters	P412 to P415

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1336 FORCE Adjustable Frequency AC Drive

An adjustable frequency AC drive produced by Rockwell Automation. Most of the construction and components of the RGU power structure are equivalent to the 1336 FORCE drive.

Analog Input (A/D Conversion)

The RGU has two analog inputs. The RGU can convert analog DC voltage inputs into digital values that can be used in the RGU.

Analog Output (D/A Conversion)

The RGU has two analog outputs. The RGU can convert internal digital values into analog DC voltages that can be output to a connected analog device.

Control Power Filter

A filter used to reduce harmonics and noise in the 115V AC control power.

Current Loop

A portion of firmware which is responsible for sending a current command to the hardware. The *current bandwidth* determines the number of current commands to be made per second, and the *current damping* determines the precision of the current command process.

Current Transducer

A torroid that is typically used for AC feedback.

Digital Signal Processor (DSP)

The digital signal processor which is located on the main control board of the RGU. This component processes current commands for the RGU.

Disable

When a unit is disabled, the control logic is not directing current flow operations. A unit is typically disabled by a disable command or by a fault condition.

Disconnect

A circuit breaking device.

DriveTools

A software application which can be interfaced with the RGU. DriveTools includes tools which can be used to configure, monitor, and control the RGU and other drive system products.

DSP (Digital Signal Processor)

A processor on the main control board which is used to process the current loop.

Enable

When a unit is enabled, the control logic is directing the motoring or regenerative current by modulating its hardware (IGBTs).

Feedback

Signals from the hardware which indicate the hardware status to the control logic.

Gate Driver Board

The RGU gate driver board is responsible for modulating the power modules and supplying power to the control boards. The gate driver board is interfaced with the main control board.

Graphic Programming Terminal (GPT)

A programming terminal with a graphical LED display and a pushbutton keyboard which is used to program, control, and view the status of a unit. The GPT is also able to load and store parameters in its local memory.

Host Processor

The main processor on the main control board of the RGU. This component processes feedback and controls most of the activities in the RGU.

Human Interface Module (HIM)

A programming terminal used to program, control, and view the status of a unit.

Insulated Gate Bipolar Transistor (IGBT)

A transistor which can be used to allow current to flow in two opposite directions. Also known as *power module*.

Isolation Board

The RGU isolation board receives direct feedback from the AC line, DC bus, and current transducers. This board supplies scaled feedback to the main control board.

Main Control Board

The RGU main control board regulates the voltage and current, oversees activities in the unit, and processes I/O. This board is isolated from the power circuitry.

Metal-Oxide Varistor (MOV)

A component used to protect against voltage surges and excessively high line-to-line/line-to-ground voltages.

Motor Control Center (MCC)

An enclosure which is used for the RGU. The MCC for the RGU includes a horizontal DC bus.

Motoring Current

Current which is being supplied to the inverters (through the DC bus) for motoring.

Non-Regenerative DC Bus Supply Unit (NRU)

A six-pulse DC power supply produced by Rockwell Automation The NRU is typically used as a front end power supply on a drive system lineup.

Overload

A condition where the unit is supplying current above its rated current. For example, operating a unit at 150% overload would indicate that the unit is supplying 150% of its rated current. Most units can operate with an overload condition for a short period of time.

PE (Potential Earth Ground)

A safety ground which is used to ground hardware in the system.

Power Factor (pf)

A measurement of the time phase difference between the voltage and current in an AC circuit.

Power Module

A transistor used in the RGU and 1336 products to convert regulated power between AC and DC. See also insulated gate bipolar transistor (IGBT).

Power Structure

A 3-phase power bridge built in the RGU which converts AC to DC (motoring current) and DC to PWM AC (regenerative current). The power structure includes control boards, a precharge circuit, a power bridge, and a capacitor bank.

PWM (Pulse-Width Modulation)

A method which is used to control and maintain a nominal output voltage. Transistors (IGBTs) ‘chop’ the input into pulses, which allow an appropriate amount of current to flow to the output. With appropriate control, the current pulses will produce a steady output voltage.

Regenerative DC Bus Supply Unit (RGU)

A regenerative DC power supply unit produced by Rockwell Automation. The RGU is typically used as a front end power supply to provide motoring and regenerative current for a drive system lineup.

Regenerating Current

Current which is being driven back from the motors (from motoring induction) to the DC bus. RGUs are able to place regenerating current back onto the AC line.

Remote I/O

A serial communications architecture which can be used between the RGU, PLCs, drives, and other drive system components. The RGU requires a special communication interface board to use remote I/O.

RGU-to-RGU (R2R) Communications

A communication link used between master and slave RGUs. In R2R communications, the master RGU passes current commands, status information, and synchronization signals to the slave RGUs.

SCANport

Communications technology which is used by many Rockwell Automation products. HIMs, PLCs, and many drive systems products can communicate with one another through SCANport.

TE (Zero Potential)

TE provides a zero potential between communication endpoints.

Top Hat Assembly

An enclosure which is used for AC wire entry.

Trending

A monitoring process. The RGU can be programmed to sample a parameter value when a specific condition occurs in the unit.

Voltage Loop

A portion of firmware which is responsible for sending a voltage command to the current loop. The voltage *bandwidth* determines the number of voltage commands to be made per second, and the *voltage damping* determines the precision of the voltage command process.

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