Model M5600

Bi-Directional Buck Boost Voltage Regulator

Customer Reference Manual

Web: www.bonitron.com • Tel: 615-244-2825 • Email: info@bonitron.com

Bonitron, Inc.
Nashville, TN

An industry leader in providing solutions for AC drives.

ABOUT BONITRON

Bonitron designs and manufactures quality industrial electronics that improve the reliability of processes and variable frequency drives worldwide. With products in numerous industries, and an educated and experienced team of engineers, Bonitron has seen thousands of products engineered since 1962 and welcomes custom applications.

With engineering, production, and testing all in the same facility, Bonitron is able to ensure its products are of the utmost quality and ready to be applied to your application.

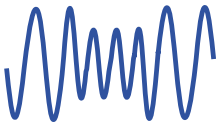
The Bonitron engineering team has the background and expertise necessary to design, develop, and manufacture the quality industrial electronic systems demanded in today's market. A strong academic background supported by continuing education is complemented by many years of hands-on field experience. A clear advantage Bonitron has over many competitors is combined on-site engineering labs and manufacturing facilities, which allows the engineering team to have immediate access to testing and manufacturing. This not only saves time during prototype development, but also is essential to providing only the highest quality products.

The sales and marketing teams work closely with engineering to provide up-to-date information and provide remarkable customer support to make sure you receive the best solution for your application. Thanks to this combination of quality products and superior customer support, Bonitron has products installed in critical applications worldwide.

AC Drive Options

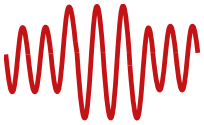
In 1975, Bonitron began working with AC inverter drive specialists at synthetic fiber plants to develop speed control systems that could be interfaced with their plant process computers. Ever since, Bonitron has developed AC drive options that solve application issues associated with modern AC variable frequency drives and aid in reducing drive faults. Below is a sampling of Bonitron's current product offering.

World Class Products



Undervoltage Solutions

Uninterruptible Power for Drives
(DC Bus Ride-Thru)
Voltage Regulators
Chargers and Dischargers
Energy Storage



Overvoltage Solutions

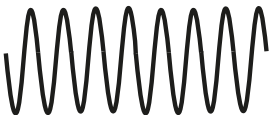
Braking Transistors
Braking Resistors
Transistor/Resistor Combo
Line Regeneration
Dynamic Braking for Servo Drives

Common Bus Solutions

Single Phase Power Supplies
3-Phase Power Supplies
Common Bus Diodes

Portable Maintenance Solutions

Capacitor Formers
Capacitor Testers



Power Quality Solutions

12 and 18 Pulse Kits

Green Solutions

Line Regeneration

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1. INTRODUCTION

1.1. WHO SHOULD USE

This manual is intended for use by anyone who is responsible for integrating, installing, maintaining, troubleshooting, or using this equipment.

Please keep this manual for future reference.

1.2. PURPOSE AND SCOPE

This manual is a user's guide for the Model M5600-PRQ67790. It will provide the user with the necessary information to successfully install, integrate, and use the M5600-PRQ67790.

In the event of any conflict between this document and any publication and/or documentation related to the AC drive system, the latter shall have precedence.

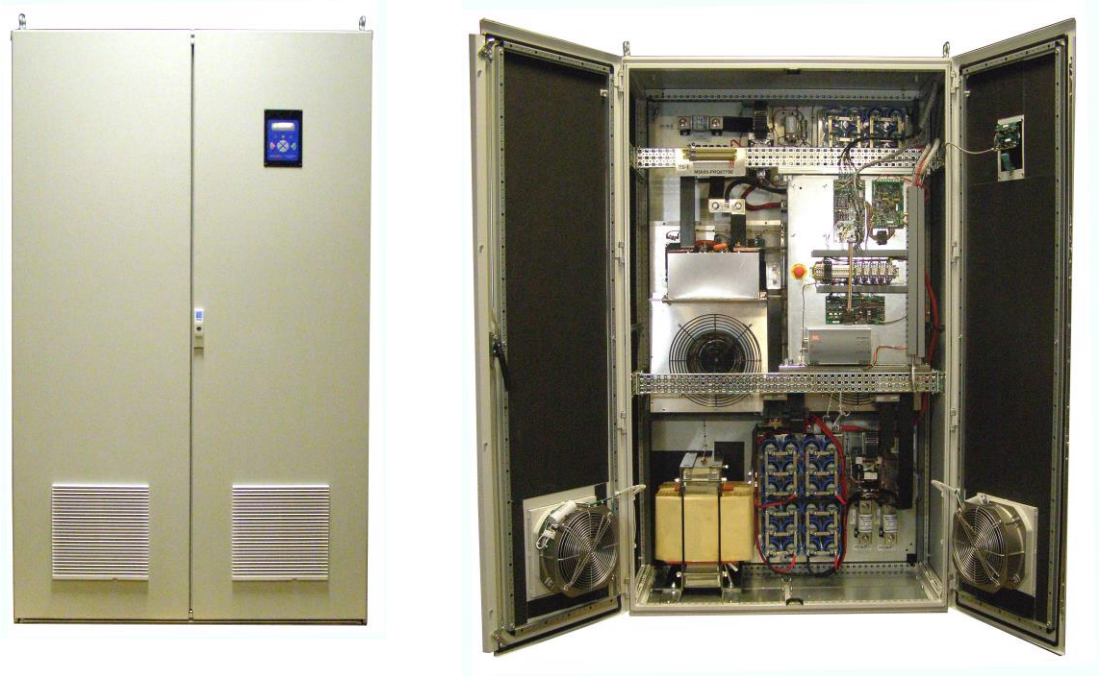
1.3. MANUAL VERSION AND CHANGE RECORD

Minor corrections were made in Rev 00a of this M5600-PRQ67790 manual.

About Bonitron section was updated in Rev 00b.

The manual template was updated in Rev 00c.

Figure 1-1: Picture of Unit



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2. PRODUCT DESCRIPTION / FEATURES

2.1. GENERAL SPECIFICATIONS

Table 2-1: General Specifications Table

PARAMETER	SPECIFICATION	
Input Voltage	575-800VDC	
Output Voltage	400-850VDC	
Output Current	500A Continuous, 1000A Surge, 120 seconds	
Output Ripple	1% of output voltage measured at output terminals	
Control Voltage	1Ø 15VAC ± 10% 20A	
I/O	Digital Inputs:	Output Enable/Precharge Current/Voltage Control
	Digital Outputs:	System Ready Precharge Complete Output Voltage Reached
	Analog Inputs:	Output Voltage Command Output Current Command
	Analog Outputs:	Output Voltage Output Current
Configuration:	H Bridge Buck/Boost	
Enclosure:	NEMA 1 enclosed	
Dimensions:	72x48x36 (estimated) (TBD)	
Weight:	2000 lbs (estimated)	
Cooling:	Forced Air	
Storage Temperature Range:	-20° to +65°C	
Operating Temperature Range:	0° to +40°C	
Humidity:	95% Non Condensing	
Altitude:	3000 ft	

2.2. General Precautions and Safety Warnings

DANGER!

HIGH VOLTAGES MAY BE PRESENT!

NEVER ATTEMPT TO OPERATE THIS PRODUCT WITH THE ENCLOSURE COVER REMOVED!

NEVER ATTEMPT TO SERVICE THIS PRODUCT WITHOUT FIRST DISCONNECTING POWER TO AND FROM THE UNIT.

ALWAYS ALLOW ADEQUATE TIME FOR RESIDUAL VOLTAGES TO DRAIN BEFORE REMOVING THE ENCLOSURE COVER. THIS MAY TAKE UP TO EIGHT MINUTES.

FAILURE TO HEED THESE WARNINGS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH!

CAUTION!

ALWAYS ALLOW AMPLE TIME FOR THE UNIT TO COOL BEFORE ATTEMPTING SERVICE ON THIS PRODUCT.

BEFORE ATTEMPTING INSTALLATION OR REMOVAL OF THIS PRODUCT, BE SURE TO REVIEW ALL DRIVE AND/OR RESISTIVE LOAD DOCUMENTATION FOR PERTINENT SAFETY PRECAUTIONS.

INSTALLATION AND/OR REMOVAL OF THIS PRODUCT SHOULD ONLY BE ACCOMPLISHED BY A QUALIFIED ELECTRICIAN IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE OR EQUIVALENT REGULATIONS.

ANY QUESTIONS AS TO APPLICATION, INSTALLATION, OR SERVICE SAFETY SHOULD BE DIRECTED TO THE EQUIPMENT SUPPLIER.

3. INSTALLATION INSTRUCTIONS

WARNING!

Installation and/or removal of this product should only be performed by a qualified electrician in accordance with National Electrical Code or local codes and regulations.

Proper installation of the M5600-PRQ67790 should be accomplished following the steps outlined below. Be sure to refer to the AC Drive instruction manual as these steps are performed.

3.1. ENVIRONMENT

The module should be installed in an area protected from moisture and falling debris. Buildup of dust or debris may cause poor performance and possibly a failure. Operating in a wet environment can pose a shock hazard. The recommended temperature range for operating or storing this module is 0° to +40°C.

3.2. UNPACKING

Upon receipt of this product, please verify that the product received matches the product that was ordered and that there is no obvious physical damage to the unit. If the wrong product was received or the product is damaged in any way, please contact the supplier from which the product was purchased.

3.3. WIRING AND CUSTOMER CONNECTIONS

3.3.1. POWER WIRING

TERMINAL	CONNECTION	TORQUE
DC In+, DC In-	1/2" stud	300 lb-in
DC Out+, DC Out-	1/2" stud	300 lb-in

3.3.1.1. DC BUS CONNECTIONS

Make sure that both the input and output DC bus connection polarities are correct. Improper polarity connections care a high risk of damaging equipment if energized.

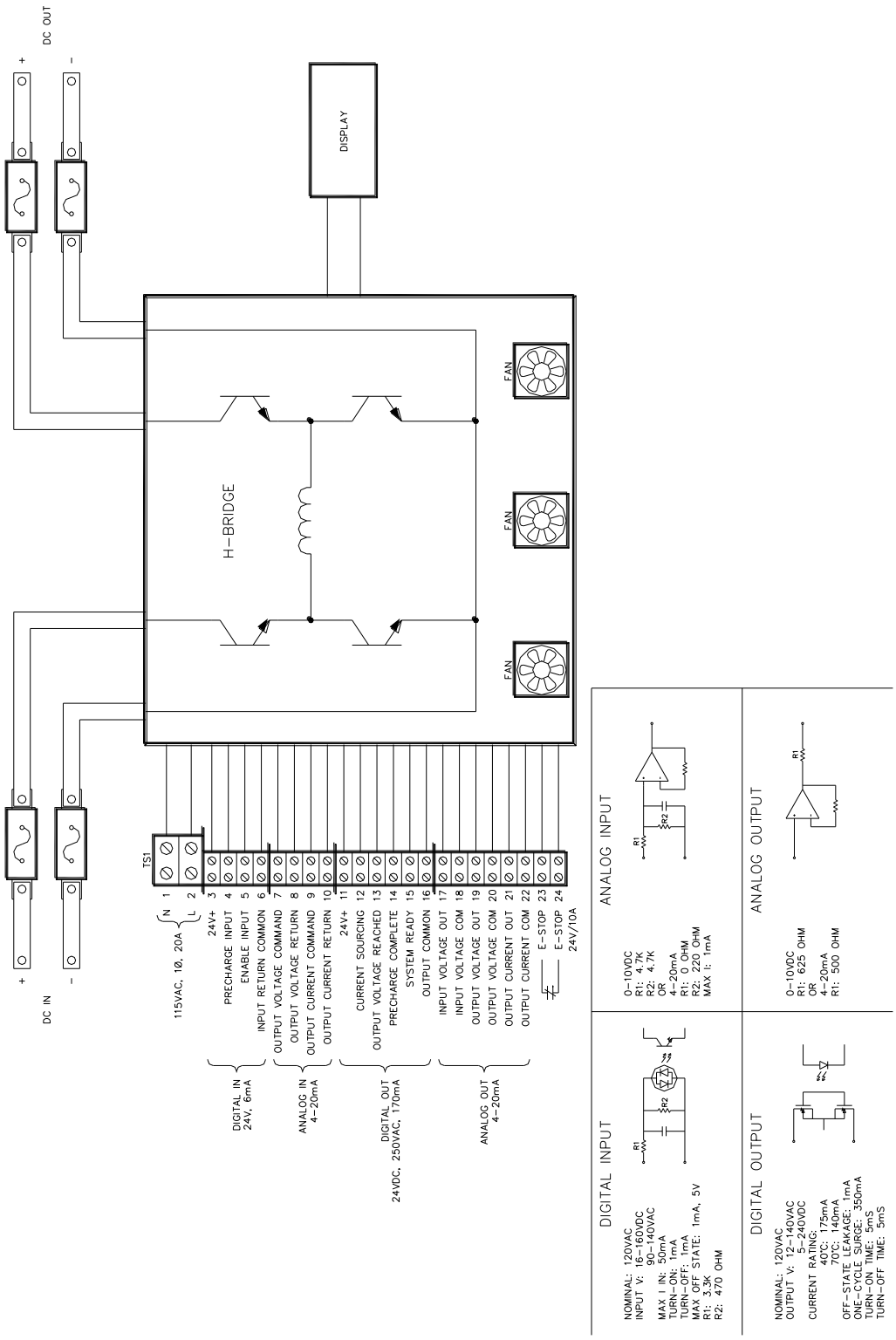
3.3.1.2. GROUNDING REQUIREMENTS

The M5600-PRQ67790 has a ground stud connected to the chassis just inside the unit, near the bottom of the right door. Ground the chassis in accordance with local codes.

3.3.2. CONTROL INTERFACE WIRING

TERMINAL	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE LB-IN
TS1-1	Control Voltage L1	120V – 20A	16	12	5.3 lb-in
TS1-2	Control Voltage L2	120V – 20A	16	12	5.3 lb-in
TS1-3	24V+	50mA	26	10	4.5 lb-in
TS1-4	Precharge Input	Dry Contact	26	10	4.5 lb-in
TS1-5	Enable Input	Dry Contact	26	10	4.5 lb-in
TS1-6	Input Return Com	4 - 20mA	26	10	4.5 lb-in
TS1-7	Output Voltage Command	4 - 20mA	26	10	4.5 lb-in
TS1-8	Output Voltage Return	4 - 20mA	26	10	4.5 lb-in
TS1-9	Output Current Command	4 - 20mA	26	10	4.5 lb-in
TS1-10	Output Current Return	4 - 20mA	26	10	4.5 lb-in
TS1-11	24V+	50mA	26	10	4.5 lb-in
TS1-12	Current Sourcing Output	140VAC / 200VDC @100mA max	26	10	4.5 lb-in
TS1-13	Current Voltage Reached Output	140VAC / 200VDC @100mA max	26	10	4.5 lb-in
TS1-14	Precharge Complete Output	140VAC / 200VDC @100mA max	26	10	4.5 lb-in
TS1-15	System Ready Output	140VAC / 200VDC @100mA max	26	10	4.5 lb-in
TS1-16	Output Common		26	10	4.5 lb-in
TS1-17	Input Voltage Out	4 - 20mA	26	10	4.5 lb-in
TS1-18	Input Voltage Com	4 - 20mA	26	10	4.5 lb-in
TS1-19	Output Voltage Out	4 - 20mA	26	10	4.5 lb-in
TS1-20	Output Voltage Com	4 - 20mA	26	10	4.5 lb-in
TS1-21	Output Current Out	4 - 20mA	26	10	4.5 lb-in
TS1-22	Output Current Com	4 - 20mA	26	10	4.5 lb-in
TS1-23	E-Stop	24V – 6A	26	10	4.5 lb-in
TS1-24	E-stop	24V – 6A	26	10	4.5 lb-in

Figure 3-1: Customer Connections



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4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The M5600 is a bi-directional voltage regulator, capable of sourcing and sinking current as necessary to maintain a specified output voltage. The unit accepts control signals specifying the desired output voltage and current limit. System status is both displayed on a digital display panel and reported via digital and analog output signals. I/O signals are isolated.

4.2. FEATURES

4.2.1. HARDWARE

The M5600 is composed of four primary circuit boards, a 24V power supply, and the main switching power stage.

4.2.1.1. 3660D3 DISPLAY BOARD

The 3660D3 display board provides a visual and tactile user interface to the M5600 unit.

4.2.1.1.1. DISPLAY

The display is a four-line, eighty-character LCD. This display shows information about the present status of the M5600, and displays menus allowing configuration of the unit.

4.2.1.1.2. LEDS

Red, yellow, and green LEDs indicate the status of the M5600.

4.2.1.1.3. BUTTONS

The function of each button depends on the active screen. For menu screens, *enter* selects a menu option, while *cancel* moves back to the previous screen. *Up* and *down* move the menu cursor. On screens where numbers are input by the user, the *left* and *right* buttons move the cursor, while the *up* and *down* buttons change the selected digit. *Enter* stores the present value, while *cancel* undoes any changes. On some screens, certain buttons may have no function at all.

4.2.1.2. 5600C1 CONTROL BOARD

The 5600C1 control board measures feedback and control signals for both voltage and current, determines the appropriate switching profile of the power stage, drives the transistors, and sends output signals to the 5600I1 interface and 3660D3 display boards.

4.2.1.3. 5600F2 FEEDBACK BOARD

The 5600F2 feedback board amplifies and isolates the high-voltage feedback signals. The F2 board compares the voltage inputs against hardware-configured setpoints, to ensure the system is not damaged due to overvoltage. This board also drives the input and output contactors, both main and precharge.

4.2.1.4. 5600I1 INTERFACE BOARD

The 5600I1 interface board isolates input from and output to the user. Analog input and output signals are 4-20 mA. Digital outputs are open-contact, and digital inputs are 24 VDC or 110 VAC. Courtesy voltage supplies are provided.

4.2.2. SCREENS & MENU NAVIGATION

Some screens are menus allowing access to other screens, or lists presenting a number of options. On these screens, the presently selected item is indicated by an '>' character. This selection indicator is moved using the *up* and *down* buttons. If a line on the menu represents another screen, that screen may be accessed with the *enter* key. The *cancel* button will typically return to the parent screen.

4.2.2.1. STATUS SCREEN

Upon system start, or after a set period of inactivity, the display system will transition to this screen. The status screen displays the present system input voltage, output voltage, and throughput current. If the system is not faulted, this screen also displays the present voltage and current setpoints as read from the 5600I1 interface board. If the system is faulted, the fault state is displayed instead of the setpoint values. Pressing the *enter*, *cancel*, *left*, or *right* buttons on this screen transitions to the Input Display Screen (4.2.2.2).

4.2.2.2. INPUT DISPLAY SCREEN

This screen displays the present status of the digital inputs (*enable* and *precharge*) and the display software version number. Pressing the *enter*, *cancel*, *left*, or *right* buttons on this screen transitions to the Status Screen (4.2.2.1).

4.2.2.3. CALIBRATION MENU

This is a hidden screen from which the system can be calibrated. To access this screen, press the *up* and *down* buttons simultaneously, then while holding those buttons, press *enter*.

WARNING!

This menu should not be accessed except by a Bonitron-trained service technician! Altering calibration data incorrectly will render your system inoperable without service, and may result in damage to attached equipment!

From this screen, the user may select which input channel they wish to calibrate: input voltage, output voltage, or throughput current. Pressing *enter* selects a channel and transitions to the Set/Adjust Screen (4.2.2.4). Pressing *cancel* will return to the Status Screen (4.2.2.1).

The calibration system operates by simple linear interpolation. Two points are defined for each input channel, termed “high” and “low”. Each point is comprised of an input value, derived from the control system's A/D converter, and a real-world voltage or current. Once these two points are defined, the system uses them to calculate the real-world value of all other inputs. If the two points are defined with identical input or output values, the system will instead display the uncalibrated A/D values.

4.2.2.3.1. SET/ADJUST SCREEN

From this screen the user may select whether they wish to set a calibration point, or adjust an existing one. Setting a calibration point overwrites any existing data in that point and creates a new point at the present A/D value. Adjusting an existing point allows the user to modify the real-world output voltage associated with the already-defined input value.
Pressing *enter* transitions to the Calibration Point Selection Screen (4.2.2.5). Pressing *cancel* returns to the Calibration Menu (4.2.2.3).

4.2.2.3.2. CALIBRATION POINT SELECTION SCREEN

From this screen the user may select which calibration point (high or low) they wish to set or adjust for the selected input channel. Pressing enter will transition to the Calibration Point Editing Screen (4.2.2.6). Pressing cancel returns to the Set/Adjust Screen (4.2.2.4).

4.2.2.3.3. CALIBRATION POINT EDITING SCREEN

From this screen the user may input a real-world, measured voltage or current to associate with the selected input channel and calibration point. The user edits this value one digit at a time. The cursor selecting each digit is moved using the *left* and *right* buttons. The value of each digit is changed using the *up* and *down* buttons. The data is not recorded until the user presses the *enter* button. Pressing *cancel* abandons all changes. Both *enter* and *cancel* return the user to the Calibration Point Selection Screen (4.2.2.5).

4.2.2.4. CURRENT LIMIT SCREEN

This is a hidden screen from which the user may set an absolute current limit, overriding all regulation setpoints. To access this screen, press the *up* and *down* buttons simultaneously, release them, then press the *left* and *right* buttons simultaneously.

WARNING!

Setting this value too low may render your system inoperable!

NOTE: This current limit value is approximate. Do not depend on it for precise regulation.

4.2.3. FAULTS

If any faults are present, the system will cease to run. Any active faults will be displayed on the Status Screen (4.2.2.1). Latched faults may be cleared by toggling the enable input signal (4.1.4.4.1.2) low and high again.

4.2.3.1. INPUT OVERVOLTAGE (INOV)

This fault indicates that the input voltage to the system has exceeded the safe limits of the system. This voltage setting can be altered by

jumper J3 on the 5600F2 feedback board (4.1.5.1.3). This fault will latch until reset by toggling the enable signal.

4.2.3.2. OUTPUT OVERVOLTAGE (OUTOV)

This fault indicates that the output voltage to the system has exceeded the safe limits of the system. This voltage setting can be altered by jumper J5 on the 5600F2 feedback board (4.1.5.1.5). This fault will latch until reset by toggling the enable signal.

4.2.3.3. OVERTEMPERATURE (OT)

This fault indicates that the system temperature has reached its trip point. This fault will clear automatically once the temperature falls to a safe level.

4.2.3.4. IGBT (IGBT)

This fault indicates that one or more of the IGBT drivers has indicated a fault. This fault will latch until reset by cycling the enable signal.

WARNING!

Repeated IGBT faults may be an indication of damage to your system. See Section 5.1.2 for troubleshooting information.

4.2.3.5. LOGIC UNDERVOLTAGE (LOGIC UV)

This fault indicates that the logic voltage on the 5600F2 feedback board has dropped too low to provide accurate feedback. This fault will latch until reset by cycling the enable signal.

WARNING!

Repeated Undervoltage faults may be an indication of damage to your system. See Section 5.1 for troubleshooting information.

4.2.3.6. PRECHARGE FAILURE (PRE FAIL)

This fault indicates that the system did not complete precharge with an acceptable period of time. See Section 5.1.4 for troubleshooting information.

4.2.3.7. INTERFACE BOARD CONNECTION LOST (I CONN)

This fault indicates that the control board has lost contact with the interface board. This is probably due to a bad connection on either the serial or power connections to the 5600I1 board (4.1.4). This fault will latch until reset by cycling the enable signal.

4.2.3.8. DISPLAY BOARD CONNECTION LOST (D CONN)

This fault indicates that the display board has lost contact with the control board. This is probably due to a bad connection on either of the serial connections between the boards (4.1.4). This fault will latch until reset by cycling the enable signal.

4.2.3.9. INPUT FUSE OPEN (IN FUSE)

This fault indicates that the input fuse reports open. This may be because the fuse has cleared, or because the connection wires have

come loose (4.1.4.4). This fault will latch until reset by cycling the enable signal.

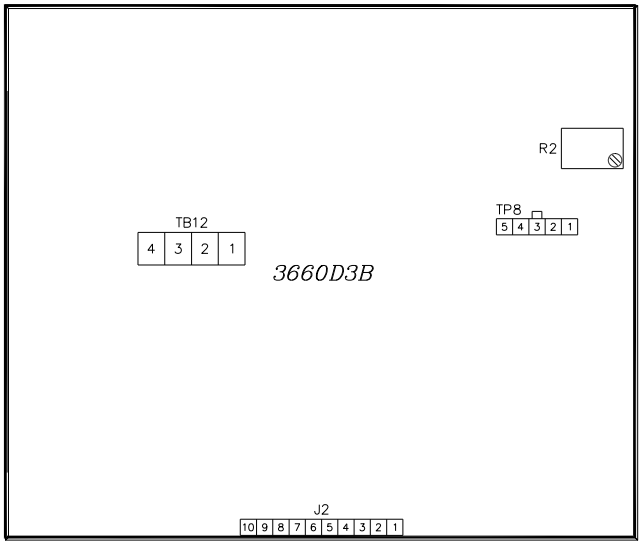
4.2.3.10. OUTPUT FUSE OPEN (OUT FUSE)

This fault indicates that the output fuse reports open. This may be because the fuse has cleared, or because the connection wires have come loose (4.1.4.4). This fault will latch until reset by cycling the enable signal.

4.2.4. CONNECTORS

4.2.4.1. 3660D3

Figure 4-1: 3660D3 Display Board Connectors and Pot



4.2.4.1.1. TB12-1&2 (24V INPUT)

These pins accept 24V power to the display board.

4.2.4.1.2. TB12-3&4 (CAN-BUS)

These pins carry serial communication signals between the display board and the rest of the M5600.

4.2.4.1.3. TP8 (PROGRAMMING)

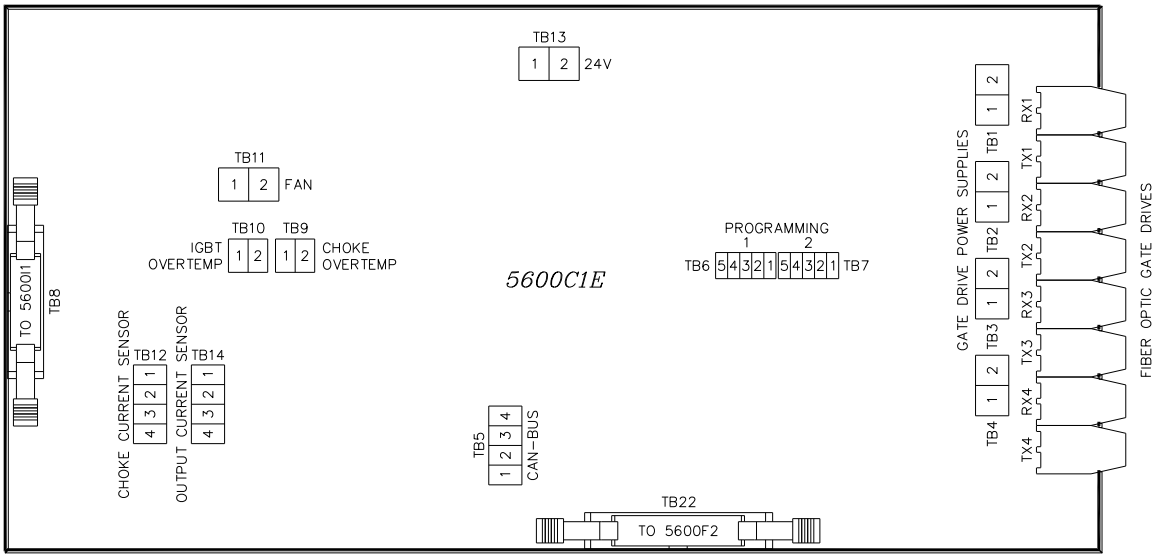
The programming jack is used to program the display board. This jack is for internal Bonitron use only and should not be accessed by unauthorized personnel.

4.2.4.1.4. J2 (BUTTONS)

The button header is where the membrane panel ribbon connector attaches to the 3660D3 board.

4.2.4.2. 5600C1

Figure 4-2: 5600C1 Control Board Connectors



4.2.4.2.1. TB1-TB4 (IGBT DRIVE POWER SUPPLY)

These terminals supply power to the gate drive boards. They should not be disconnected or altered, or the unit will not operate.

4.2.4.2.2. TX1-TX4 (IGBT DRIVE OPTICAL SIGNALS)

These connectors send gate drive signals over optical fiber to the IGBT drive boards. They should not be disconnected or altered, or the unit will not operate.

4.2.4.2.3. RX1-RX4 (IGBT FEEDBACK OPTICAL SIGNALS)

These connectors receive feedback signals over optical fiber from the IGBT drive boards. They should not be disconnected or altered, or the unit will not operate.

4.2.4.2.4. TB5-1-2 (24V OUTPUT)

These pins supply 24V from the 5600C1 board to the 3660D3 board, and to the isolation circuitry of the 5600I1 board.

4.2.4.2.5. TB5-3-4 (CAN-BUS)

These pins carry serial communication signals between the control board and the rest of the M5600.

4.2.4.2.6. TB6 & TB7 (PROGRAMMING)

These connectors are used to program the display board. They are for internal Bonitron use only and should not be accessed by unauthorized personnel.

4.2.4.2.7. TB8-1-10 (5600I1)

This connector sends analog voltage and current feedback signals to the 5600I1.

4.2.4.2.8. TB9-1-2 (CHOKE OVERTEMPERATURE)

This terminal connects to the overtemperature sensors for the primary system choke. Input to this terminal is closed at standard operating temperatures.

4.2.4.2.9. TB10-1-2 (IGBT OVERTEMPERATURE)

This terminal connects to the overtemperature sensors for the system IGBTs and heat sinks. Input to this terminal is closed at standard operating temperatures.

4.2.4.2.10. TB11-1-2 (UNUSED)

This connector is reserved for future use. It should remain unconnected.

4.2.4.2.11. TB12-1-4 (CHOKE CURRENT SENSOR)

The choke current sensor connections are wired for a standard four-pin current transducer, providing +-15VDC, common, and signal input. The choke current is compared against hardware- and software-set limits to prevent damage to the M5600.

4.2.4.2.12. TB13-1-2 (24V INPUT)

These pins accept 24V power to the control board.

4.2.4.2.13. TB14-1-4 (OUTPUT CURRENT SENSOR)

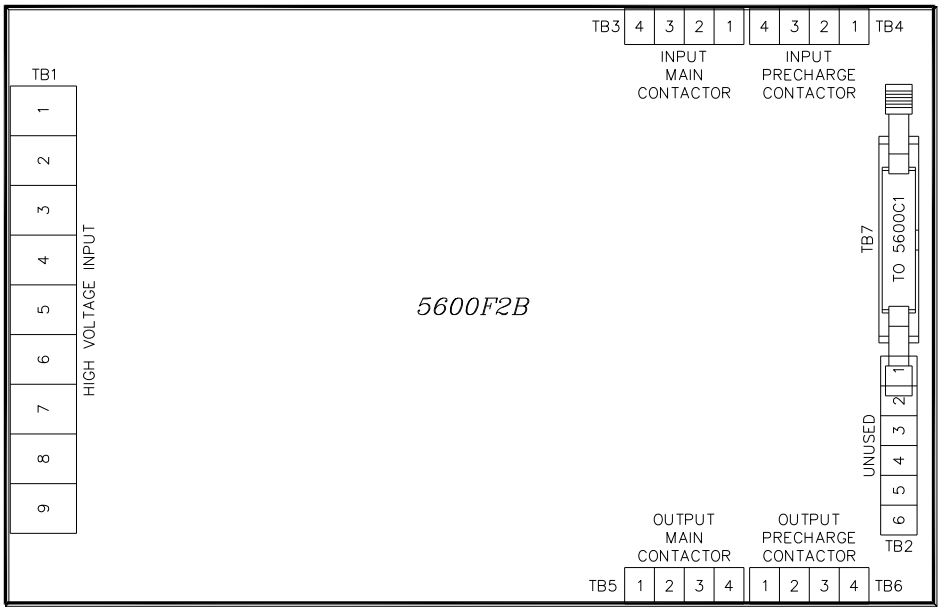
The output current sensor connections are wired for a standard four-pin current transducer, providing +-15VDC, common, and signal input. The output current reading is used by the control processor to control the system response to voltage and current commands.

4.2.4.2.14. TB22-1-16 (5600F2)

This connector supplies 24V power and precharge command signals to the 5600F2 feedback board, and carries analog voltage feedback, precharge complete, and fault signals from the 5600F2 board to the 5600C1 board.

4.2.4.3. 5600F2

Figure 4-3: 5600F2 Isolated Feedback Board Connectors



4.2.4.3.1. TB1 (HIGH VOLTAGE INPUT)

4.2.4.3.1.1. TB1-1 (POWER STAGE INPUT POST-CONTACTOR)

This pin is connected to the high-voltage input of the power stage, after the precharge contactors.

4.2.4.3.1.2. TB1-3 (POWER STAGE INPUT PRE-CONTACTOR)

This pin is connected to the high-voltage input of the power stage, before the precharge contactors.

4.2.4.3.1.3. TB1-5 (POWER STAGE COMMON)

This pin is connected to the shared common of the power stage.

4.2.4.3.1.4. TB1-7 (POWER STAGE OUTPUT POST-CONTACTOR)

This pin is connected to the high-voltage output of the power stage, after the precharge contactors.

4.2.4.3.1.5. TB1-9 (POWER STAGE OUTPUT PRE-CONTACTOR)

This pin is connected to the high-voltage output of the power stage, before the precharge contactors.

4.2.4.3.2. TB2-1-6 (UNUSED)

This connector serves no function. It should remain disconnected to ensure proper system operation.

4.2.4.3.3. TB3-1-4 (INPUT MAIN CONTACTOR)

This terminal drives the main input contactor, and receives feedback regarding its status.

4.2.4.3.4. TB4-1-4 (INPUT PRECHARGE CONTACTOR)

This terminal drives the main input contactor, and receives feedback regarding its status.

4.2.4.3.5. TB5-1-4 (OUTPUT MAIN CONTACTOR)

This terminal drives the main input contactor, and receives feedback regarding its status.

4.2.4.3.6. TB6-1-4 (OUTPUT PRECHARGE CONTACTOR)

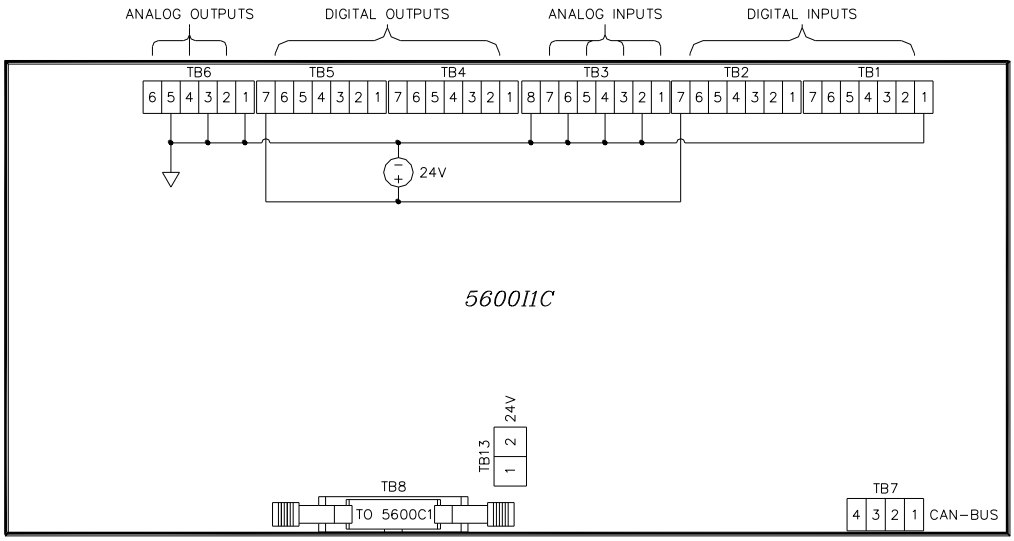
This terminal drives the main input contactor, and receives feedback regarding its status.

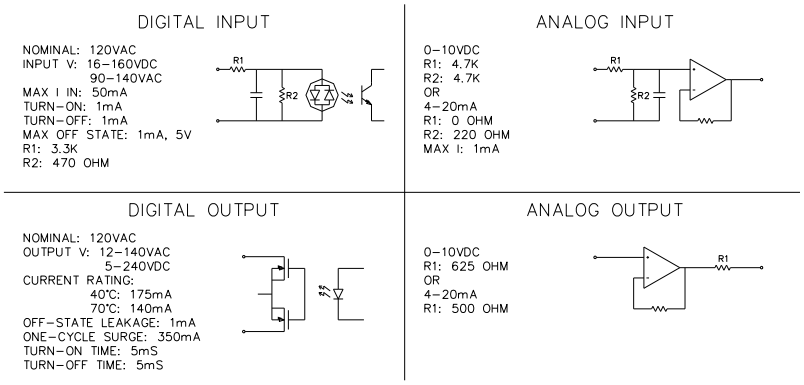
4.2.4.3.7. TB7-1-16 (5600C1)

This connector receives 24V power and precharge command signals from the 5600C1 board, and sends analog voltage feedback, precharge complete, and fault signals to the 5600C1 board.

4.2.4.4. 5600I1

Figure 4-4: 5600I1 Interface Board Connectors





4.2.4.4.1. DIGITAL INPUTS

4.2.4.4.1.1. TB1-1 (COURTESY COMMON)

4.2.4.4.1.2. TB1-2 (ENABLE)

Supplying voltage to this input will cause the unit to commence normal operation, if the system is precharged and no faults are detected. Removing voltage from this input will cease operation.

4.2.4.4.1.3. TB1-3 (PRECHARGE)

Supplying voltage to this input will cause the unit to begin precharging. Removing voltage from this input will open all contactors and cease operation.

4.2.4.4.1.4. TB1-3-7 (UNUSED)

4.2.4.4.1.5. TB2-1-4 (UNUSED)

4.2.4.4.1.6. TB2-1-5 (INPUT FUSE)

This pin is internally wired to the auxiliary contact on the input fuse. If this contact opens, the system will register an input fuse fault ().

4.2.4.4.1.7. TB2-1-6 (OUTPUT FUSE)

This pin is internally wired to the auxiliary contact on the output fuse. If this contact opens, the system will register an output fuse fault ().

4.2.4.4.1.8. TB2-7 (COURTESY 24V SUPPLY)

4.2.4.4.2. ANALOG INPUTS

4.2.4.4.2.1. TB3-1-4 (UNUSED)

4.2.4.4.2.2. TB3-5 (OUTPUT CURRENT COMMAND)

This terminal accepts a 4-20 mA signal corresponding to the desired system throughput current.

4.2.4.4.2.3. TB3-6 (OUTPUT CURRENT COMMAND RETURN)

4.2.4.4.2.4. TB3-7 (OUTPUT VOLTAGE COMMAND)

This terminal accepts a 4-20 mA signal corresponding to the desired system output voltage.

4.2.4.4.2.5. TB3-8 (OUTPUT VOLTAGE COMMAND RETURN)

4.2.4.4.3. DIGITAL OUTPUTS

4.2.4.4.3.1. TB4-1 (COURTESY COMMON)

4.2.4.4.3.2. TB4-2 (SYSTEM READY)

This normally-open output closes to common when the system is clear of faults and ready to run.

4.2.4.4.3.3. TB4-3 (PRECHARGE COMPLETE)

This normally-open output closes to common when the system has finished precharging.

4.2.4.4.3.4. TB4-4 (OUTPUT VOLTAGE REACHED)

This normally-open output closes to common when the system has reached the voltage setpoint.

4.2.4.4.3.5. TB4-5 (CURRENT SOURCING)

This normally-open output closes to common when the system is sourcing current. If the system is sinking current, this output is open.

4.2.4.4.3.6. TB4-6-7 (UNUSED)

4.2.4.4.3.7. TB5-1-6 (UNUSED)

4.2.4.4.3.8. TB5-7 (COURTESY 24V SUPPLY)

4.2.4.4.4. ANALOG OUTPUTS

4.2.4.4.4.1. TB6-1 (THROUGHPUT CURRENT COMMON)

4.2.4.4.4.2. TB6-2 (THROUGHPUT CURRENT)

This terminal outputs a 4-20 mA signal corresponding to the present system throughput current.

4.2.4.4.4.3. TB6-3 (OUTPUT VOLTAGE COMMON)

4.2.4.4.4.4. TB6-4 (OUTPUT VOLTAGE)

This terminal outputs a 4-20 mA signal corresponding to the present system output voltage.

4.2.4.4.4.5. TB6-5 (INPUT VOLTAGE COMMON)

4.2.4.4.4.6. TB6-6 (INPUT VOLTAGE)

This terminal outputs a 4-20 mA signal corresponding to the present system input voltage.

4.2.5. JUMPERS

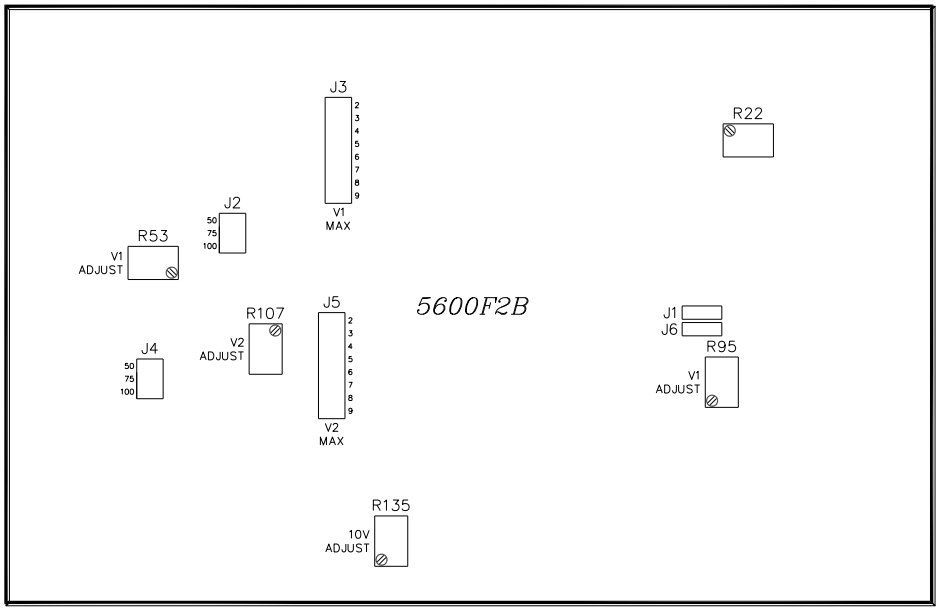
Jumpers on the circuit boards help configure the system for proper operation.

WARNING!

Jumpers are factory-set and should not be adjusted except by a Bonitron-trained service technician! Altering jumpers incorrectly may result in damage to the M5600 or attached equipment!

4.2.5.1. 5600F2

Figure 4-5: Isolated Feedback Board Jumpers and Pots



4.2.5.1.1. J1 (INPUT PRECHARGE VOLTAGE SWITCH)

If pins 1-2 are jumpered, the input precharge contactors will close regardless of whether input voltage is present. If pins 2-3 are jumpered, input voltage must be present before the input precharge contactors will close.

4.2.5.1.2. J2 (MAX INPUT DIFFERENTIAL)

This jumper sets the maximum voltage differential across the input precharge resistor before the main input contactor will close.

4.2.5.1.3. J3 (MAX INPUT VOLTAGE)

This jumper sets the maximum input voltage. If this voltage is exceeded, the system will throw an InOV fault (4.2.3.1).

4.2.5.1.4. J4 (MAX OUTPUT DIFFERENTIAL)

This jumper sets the maximum voltage differential across the output precharge resistor before the main output contactor will close.

4.2.5.1.5. J5 (MAX OUTPUT VOLTAGE)

This jumper sets the maximum output voltage. If this voltage is exceeded, the system will throw an OutOV fault (4.2.3.2).

4.2.5.1.6. J6 (OUTPUT PRECHARGE VOLTAGE SWITCH)

If pins 1-2 are jumpered, the output precharge contactors will close regardless of whether output voltage is present. If pins 2-3 are jumpered, output voltage must be present before the output precharge contactors will close.

4.2.6. POTENTIOMETERS

Potentiometers on the circuit boards help configure the system for proper operation.

WARNING!

Potentiometers are factory-set and should not be adjusted except by a Bonitron-trained service technician! Altering potentiometers incorrectly may result in damage to the M5600 or attached equipment!

4.2.7. TERMINAL STRIP IO

4.2.8. INDICATORS

4.2.8.1. 3660D3 DISPLAY BOARD

Red indicates a fault has occurred. The display will indicate the nature of this fault.

Yellow indicates that the M5600 is not Ready.

Green indicates that the display unit is receiving power from the M5600.

4.2.8.2. 5600C1

LD1-4 indicate that the IGBT drivers are operating properly. They should be lit during normal operation.

4.2.8.3. 5600F2

D20 (green) indicates that the feedback board is receiving power.

D19 (red) and D21 (yellow) indicate the precharge system status as shown in Table: 4-1.

Table 4-1: Precharge Status LEDs

	D19 (RED) LED ON	D19 (RED) LED OFF
D21 (YELLOW) LED ON	Precharge NOT Enabled	Precharging
D21 (YELLOW) LED OFF	Precharge Fault	Precharge Complete

4.3. STARTUP

4.3.1. PRE POWER CHECKS

Ensure that all connections are tight, DC bus polarity is correct, and that all field wiring is of the proper size for operational requirements. Check for exposed conductors that may lead to inadvertent contact. Verify that all I/O connections are correct, including polarity. Do not load the system.

4.3.2. STARTUP PROCEDURE AND CHECKS

Apply AC control power to the system. Verify the following:

- AC control voltage is within tolerance. See Table 2-6 for voltages and tolerances.
- Green LED on 3660D3 board (4.2.7.1) is on.
- All four red LEDs on 5600C1 board (4.2.7.2) are on.
- Input voltage is within system spec.
- Close the precharge input contact. Wait twenty seconds. Verify that the system has not registered a precharge fault.
- Verify that the voltage and current setpoints are as desired for system operation.

If any of the above conditions are not as indicated, turn off all power and allow ample time for all system energy sources to discharge. Verify that all voltages are zero and have discharged with a suitable meter! Check all wiring connections and jumper configurations. Refer to the Troubleshooting section of this manual (5.1) for more information. For further assistance, contact Bonitron Technical Support.

Once the pre-checks are complete, the output drive system can be enabled. Once the drive system is operational, close the 5600 unit's enable input contact. The system should begin to regulate the voltage to the drives as instructed.

4.4. OPERATIONAL ADJUSTMENTS

No adjustments are necessary for this unit. All regulation points are factory adjusted, and should not be changed in the field. If your unit is not functioning properly, refer to the Troubleshooting Section of this manual, or contact Bonitron for assistance.

4.5. CALIBRATION

See Section 4.2.2.3.

5. MAINTENANCE AND TROUBLESHOOTING

Repairs or modifications to this equipment are to be performed by Bonitron approved personnel only. Any repair or modification to this equipment by personnel not approved by Bonitron will void any warranty remaining on this unit.

If a problem occurs on start-up or during normal operation, refer to the problems described below. If a problem persists after following the steps below, contact the product supplier or your system integrator for assistance

5.1. TROUBLESHOOTING

5.1.1. OVERVOLTAGE FAULTS WILL NOT CLEAR

Measure the input and output voltages with a multimeter. Check J3 and J5 to ensure that the voltages are within the configured ranges.

5.1.2. IGBT FAULTS HAPPEN CONTINUOUSLY

Check 5600C1 TB1-4 (4.1.4.2.1), TX1-4 (4.1.4.2.2), and RX1-4 (4.1.4.2.3) to ensure all connectors are firmly connected to the board. Check that each set is also firmly connected to the same IGBT driver board.

5.1.3. CURRENT WILL NOT REACH SETPOINT

Check the current limit screen (4.1.2.4) to ensure that the current limit has not been set too low for desired system operation.

5.1.4. SYSTEM WILL NOT POWER ON

Check the 110VAC control voltage input to the system.

5.1.5. SYSTEM WILL NOT COMPLETE PRECHARGE

Ensure that the system is not loaded.

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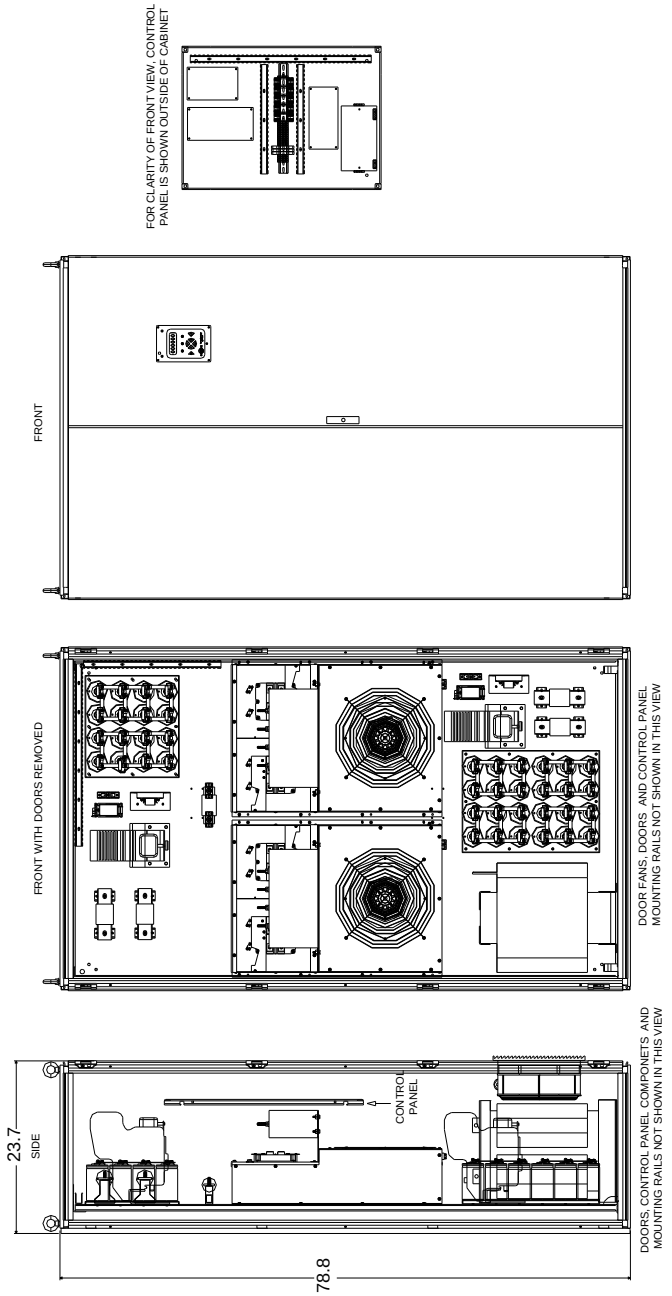
6. ENGINEERING DATA

6.1. FUSE/CIRCUIT BREAKER SIZING AND RATING

This unit includes a number of internal fuses. If a fuse happens to fail, do not replace the fuse and reapply power. Further damage could result. Consult Bonitron if any system fuse opens.

6.2. DIMENSIONS AND MECHANICAL DRAWINGS

Figure 6-1: 5600 H-Bridge Cabinet Overall View



6.3. BLOCK DIAGRAMS

Figure 6-2: M5600-H1000 Power Wiring

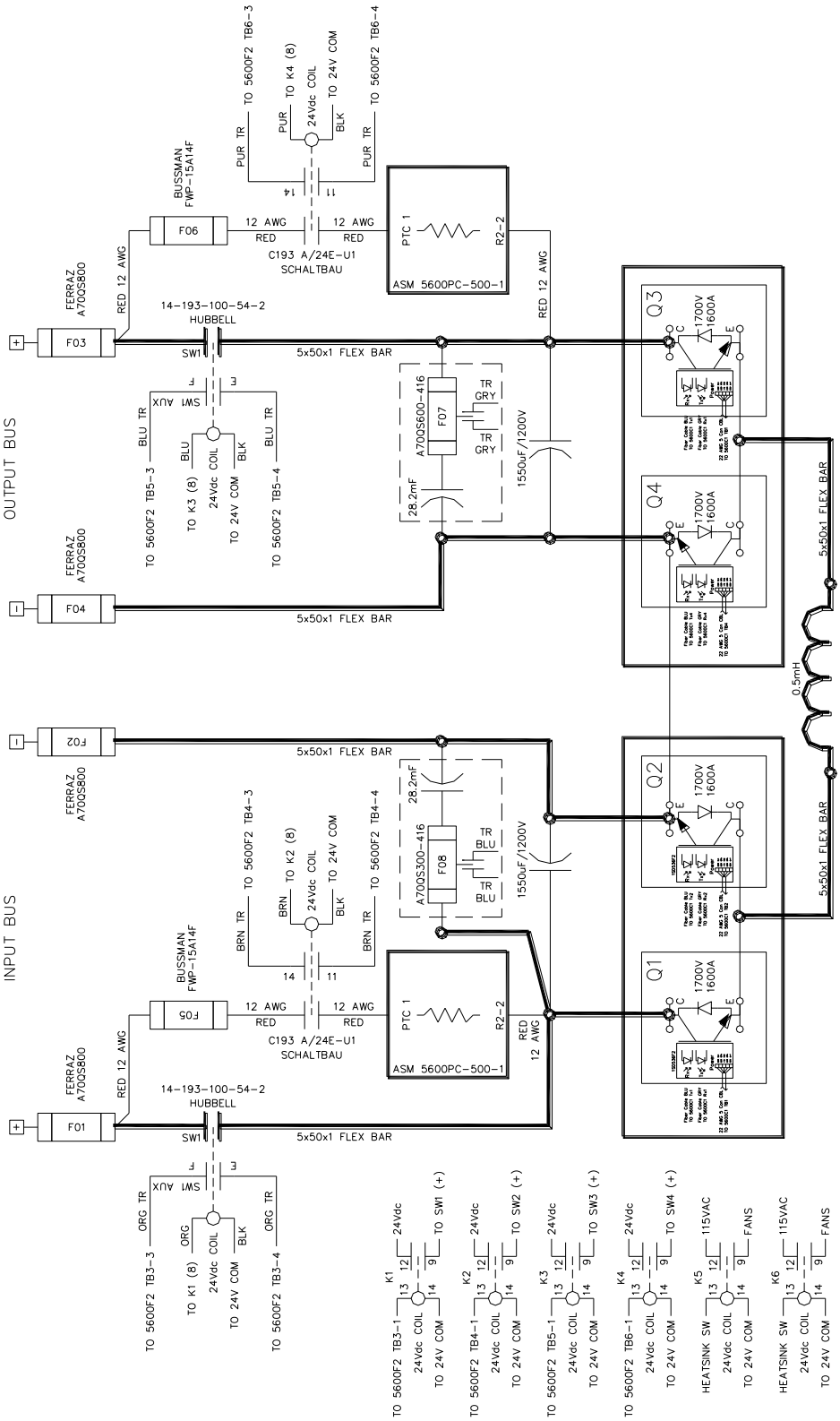
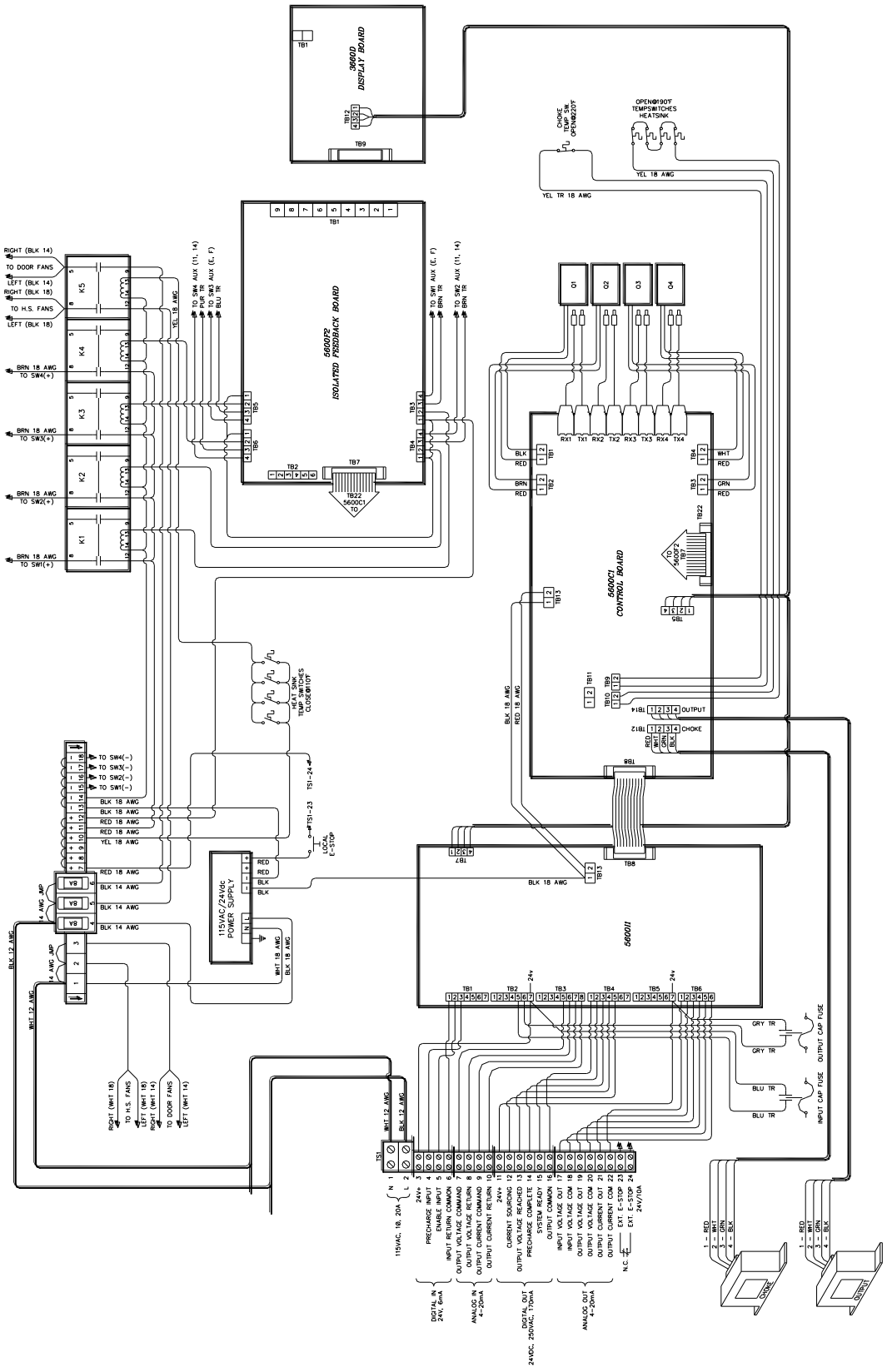


Figure 6-3: 5600 PRQ67790 Control Wiring



NOTES

521 Fairground Court ● Nashville, TN 37211 ● USA
Tel: (615) 244-2825 ● Fax: (615) 244-2833 ● Web: www.bonitron.com ● Email: info@bonitron.com