Model M5700-PRQ76505

Bi-Directional Isolated Charger/Ride-Thru

Customer Reference Manual

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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.

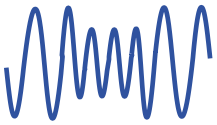
The Bonitron engineering team has the background and expertise necessary to design, develop, and manufacture the quality industrial electronic systems demanded in today's market. A strong academic background supported by continuing education is complemented by many years of hands-on field experience. 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

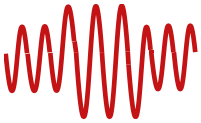
In 1975, Bonitron began working with AC inverter drive specialists at synthetic fiber plants to develop speed control systems that could be interfaced with their plant process computers. Ever since, Bonitron has developed AC drive options that solve application issues associated with modern AC variable 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

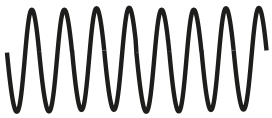
Braking Transistors
Braking Resistors
Transistor/Resistor Combo
Line Regeneration
Dynamic Braking for Servo Drives

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 M5700-PRQ76505. It will provide the user with the necessary information to successfully install, integrate, and use the M5700-PRQ76505.

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

Rev 00a is the original printing of the M5700-PRQ76505 manual

Memory Map and Ethernet Configuration were added in Rev 00b

Updates made to the Wiring and Customer Connections in Rev 00c.

The manual template was updated in Rev 00d.

Figure 1-1: Picture of M5700

1.4. SYMBOL CONVENTIONS USED IN THIS MANUAL AND ON EQUIPMENT

	Earth Ground or Protective Earth
	AC Voltage
	DC Voltage
 DANGER!	DANGER: Electrical hazard - Identifies a statement that indicates a shock or electrocution hazard that must be avoided.
 DANGER!	DANGER: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.
 CAUTION!	CAUTION: Identifies information about practices or circumstances that can lead to property damage, or economic loss. Attentions help you identify a potential hazard, avoid a hazard, and recognize the consequences.
 CAUTION!	CAUTION: Heat or burn hazard - Identifies a statement regarding heat production or a burn hazard that should be avoided.

2. PRODUCT DESCRIPTION / FEATURES

2.1. GENERAL SPECIFICATIONS

Table 2-1: General Specifications Table

PARAMETER	SPECIFICATION
Charging Input Voltage	450-1000VDC
Charging Output Voltage	16.5-28.8 VDC
Battery Output Current	0-140 A
Charging Output Current	0-250 A
Boosting Output Voltage	350-700 VDC
Boosting Output Current	0-18 A (limited by battery current)
Boosting Input Voltage	16.5-28.8 VDC
Boosting Input Current	0-250 A
Control Voltage	Internal
Analog I/O	None
Digital I/O	Inputs: 24VDC sinking • Reset Input • Trickle Charge Enable (thermal switch)
	Outputs: Dry Contacts – NO Held Closed • Unit Ready (not faulted)
Ethernet (I/P) Network I/O	Discrete Inputs: • Heartbeat • Reset • Charge Enable • Boost Enable • Save Parameters
	Word Inputs: • Charge Voltage Setpoint • Charge Current Setpoint • Boost Voltage Setpoint • Boost Current Setpoint • Trickle Voltage Setpoint • Trickle Current Setpoint • Trickle Timeout • Short Circuit Voltage • Short Circuit Timeout • Heartbeat Loss Timeout

General Specifications Table, Continued:

PARAMETER	SPECIFICATION
Ethernet (I/P) Network I/O	Discrete Outputs: • Heartbeat • Unit Ready • Charging • Boosting • Trickle Charge • Parameters Saved • Parameters Match • HV Logic Supply OK • Current Limit • LV Precharged • HV Precharged • Battery Sourcing • Heartbeat Loss
	Word Outputs: • Low Side Voltage • Low Side Battery Current • High Side Voltage • High Side Current • High side Transformer Midpoint Voltage • Temperature • Live Seconds • C1 Firmware Version • C2 Firmware Version • Fault State • Fault History (x10) • Fault Times (x10)
Configuration:	H-Bridge Isolator, High Side Buck/Boost
Enclosure:	Nema 4x
Dimensions:	20” x 15” x 32”
Weight:	TBD
Cooling:	Forced Air
Storage Temperature Range:	-20° to +55°C
Operating Temperature Range:	-20° to +50°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.

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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 M5700-PRQ76505 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 -20° to +50°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
HV DC In+, DC Out+, DC COM	6/32" screw terminal	4.5 lb-in
LV DC In+, DC Out+, DC COM	3/8" stud	230 lb-in

3.3.1.1. DC BUS CONNECTIONS

Make sure that all DC bus connection polarities are correct, on both the high- and low-voltage sides. Improper polarity connections carry a high risk of damaging equipment if energized.

3.3.1.2. GROUNDING

The M5700-PRQ76505 chassis has two provided ground studs. Both the high and low voltage commons are isolated from the chassis and from each other.

3.3.2. INPUT/OUTPUT CONNECTIONS

All the inputs for the M5700 unit are 24VDC. The inputs are all common to TB1-7. The inputs are bidirectional, and can be configured to be sinking or sourcing as the installation requires. It is recommended that inputs be configured as sinking, as this is more failsafe.
The status outputs are MOSFET optocouplers, and will show a low resistance (20Ω) when activated. When not activated, they will appear open.

WARNING!

Any terminal or pin not listed below should be assumed to be reserved for internal use. Any modification of internal wiring will prevent normal operation of the unit.

3.3.2.1. LOCAL I/O +24V SUPPLY - 5634C1 TB1-1 & TB1-8

This pin supplies 24V, a maximum of 100mA, which can be used to drive the user inputs. +24V is on TB1-1, 24V Common is on TB1-8.

3.3.2.2. TRICKLE CHARGE ENABLE INPUT – 5634C1 TB1-2

Supplying voltage to this input will enable trickle charge mode. This mode is overridden by either the charge or boost mode enable signals.

3.3.2.3. RESET INPUT – 5634C1 TB1-4

A rising edge on this input will clear any latched faults. This operates in parallel to the reset network bit, which performs the same function.

3.3.2.4. INPUT COM – 5634C1 TB1-7

All user inputs are common to this terminal.

3.3.2.5. READY OUTPUT – 5634C1 TB2-4

This output closes to TB2-8 when the M5700 is ready to operate. This contact will open if the system is not enabled, if the system is powered off, or on any fault condition.

3.3.2.6. OUTPUT COM – 5634C1 TB2-8

This terminal is the common to the outputs TB2-4 toTB2-7. It is not common to TB1 -8, and allows the use of a different power supply for outputs if the installation requires.

3.3.2.7. AUX IN – 5700L1 TB3-3 & TB3-4

TB3-3 (+) to TB3-4 (-) enables the unit's internal low-voltage logic supply. Without this or a high-voltage supply, the unit will not power on.

3.3.2.8. FAN OUT – 5700L1 TB4-1 & TB4-2, TB8-1 & TB8-2

These terminals (-1 positive, -2 negative) supply three amps of 24V power to operate the main cooling fans. TB4 and TB8 are tied together internally, and may be used interchangeably.

Table 3-1: Control Interface Wiring

TERMINAL	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE LB-IN
TB1-1	Courtesy 24V Output	24VDC to TB1-8	16	10	4.5 lb-in
TB1-2	Trickle Charge Enable Input	24VDC 5mA	16	10	4.5 lb-in
TB1-3	SEPIC OK (internal signal)	Do Not Alter	16	10	4.5 lb-in
TB1-4	Reset Input	24VDC 5mA	16	10	4.5 lb-in
TB1-5	Unused				
TB1-6	Unused				
TB1-7	Input Common	COM to TB1-2, -3, -4, -5, -6	16	10	4.5 lb-in
TB1-8	Courtesy Common	COM to TB1-1	16	10	4.5 lb-in
TB2-1	Fan Drive (internal signal)	Do Not Alter	16	10	4.5 lb-in
TB2-2	LV Precharge (internal signal)	Do Not Alter	16	10	4.5 lb-in
TB2-3	Internal Common (internal signal)	Do Not Alter	16	10	4.5 lb-in
TB2-4	Ready Output NO	250V, 150mA	16	10	4.5 lb-in
TB2-5	Unused				
TB2-6	Unused				
TB2-7	Unused				
TB2-8	Output Common	COM to TB2-4, -5, -6, -7			4.5 lb-in

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4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The M5700 is an isolated bi-directional power converter. It is designed to regulate voltage in either direction while limiting the current into or out of an attached low-voltage battery string.

The M5700 accepts Ethernet/IP network commands specifying the desired output voltage and current limit, as well as whether the system is charging or discharging the attached batteries.

System status is reported via Ethernet/IP. I/O signals are isolated from both DC busses.

4.1.1. OPERATING MODES

The system has three primary operating modes, which are selected via the network and discrete inputs to the system.

- **Trickle Mode:** the system will charge the low-voltage load, at the voltage and battery current specified by the network module. This mode is enabled by a discrete input terminal, and is overridden by either charge or boost mode.
- **Charge Mode:** the system will charge the low-voltage load to the voltage and battery current specified by the network module. This mode is enabled through the Ethernet/IP interface.
- **Boost Mode:** the system will hold the high-voltage load at the voltage specified by the appropriate network input, so long as the battery current does not exceed the setpoint set by the network input. This mode is enabled through the Ethernet/IP interface.

The overall throughput current of the M5700 will be limited to 250A on the low-voltage side for all three operating modes.

4.1.2. NON-OPERATING CONDITIONS

The M5700 will **NOT** operate if:

- No operating mode is enabled.
- The unit is faulted.
- The sourcing side precharge is not complete.
    - HV precharge closes at 510V and opens at 480V.
    - LV precharge closes at 9.4V and opens at 7.1V.

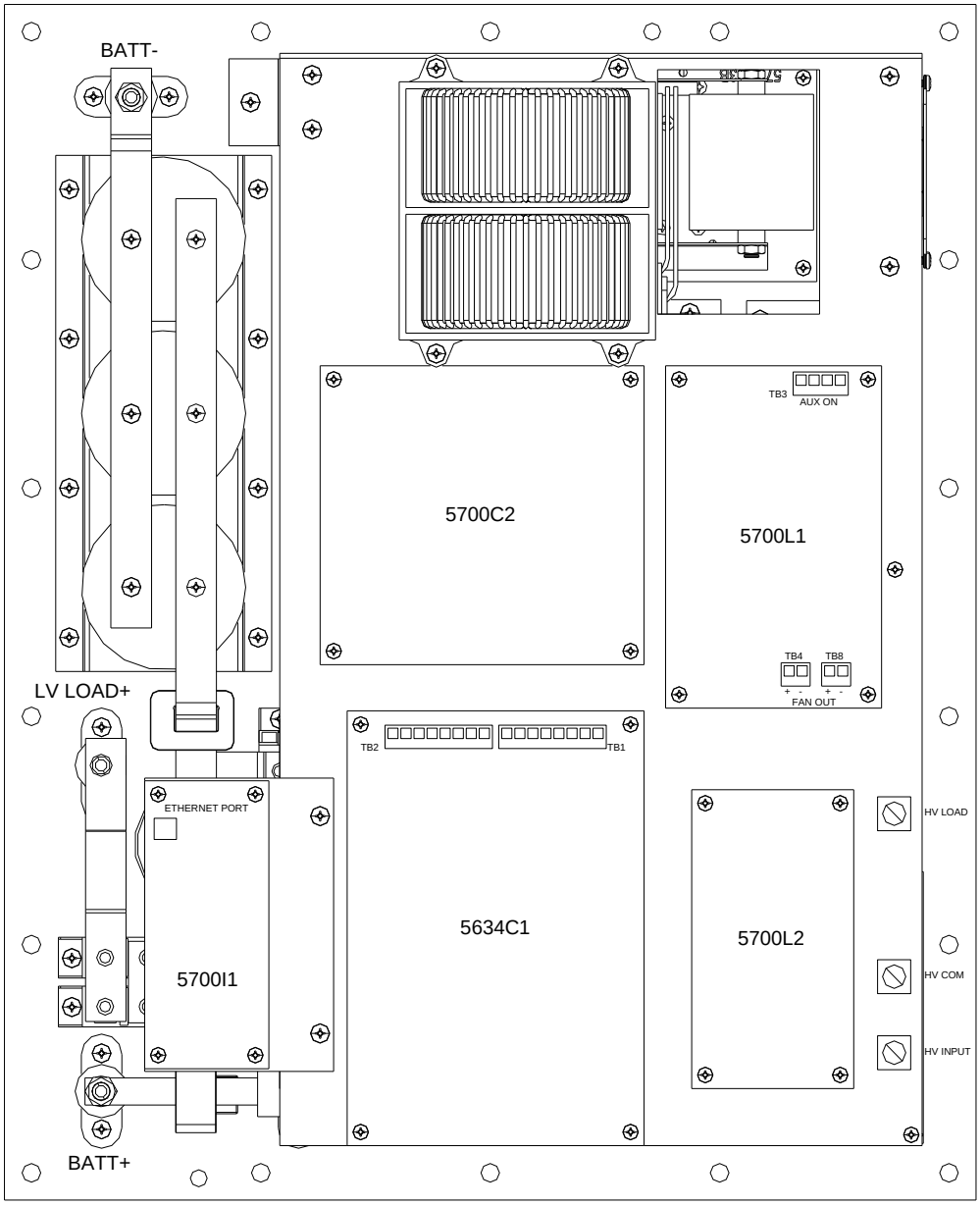
If the system is disabled or faults during operation, this may result in a delay of up to five seconds before operation can resume.

4.2. FEATURES

4.2.1. HARDWARE

The M5700 is composed of a single main power module. Other equipment may be included in the same overall enclosure with the M5700, but this equipment is separate from the M5700 and not covered by this manual.

Figure 4-1: ASB 5634C1



4.2.2. 5700 POWER MODULE

The 5700 power module has two primary modes: charging, in which power is drawn from the high-side to raise the low-side voltage; and boosting, in

which power is drawn from the low-side to support the high-side voltage. In both modes, the battery current is limited to the user-provided setpoint, and the current through the low-voltage side of the power module is limited to 250A. The modes and their respective setpoints are controlled by the unit's network interface and discrete enable input.

WARNING!

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

4.2.3. POTENTIOMETERS

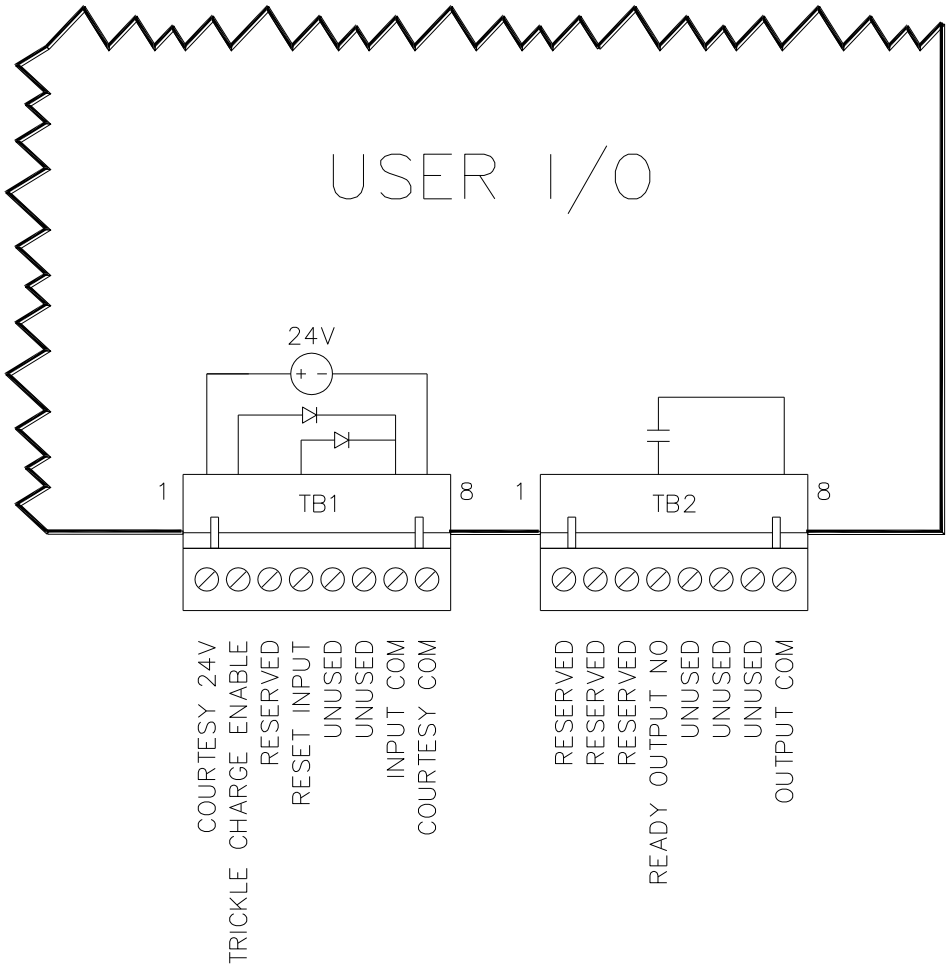
Potentiometers on the circuit boards help configure the system for proper operation.

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 M5700 or attached equipment!

4.2.4. CONNECTORS

Figure 4-2: 5634C1

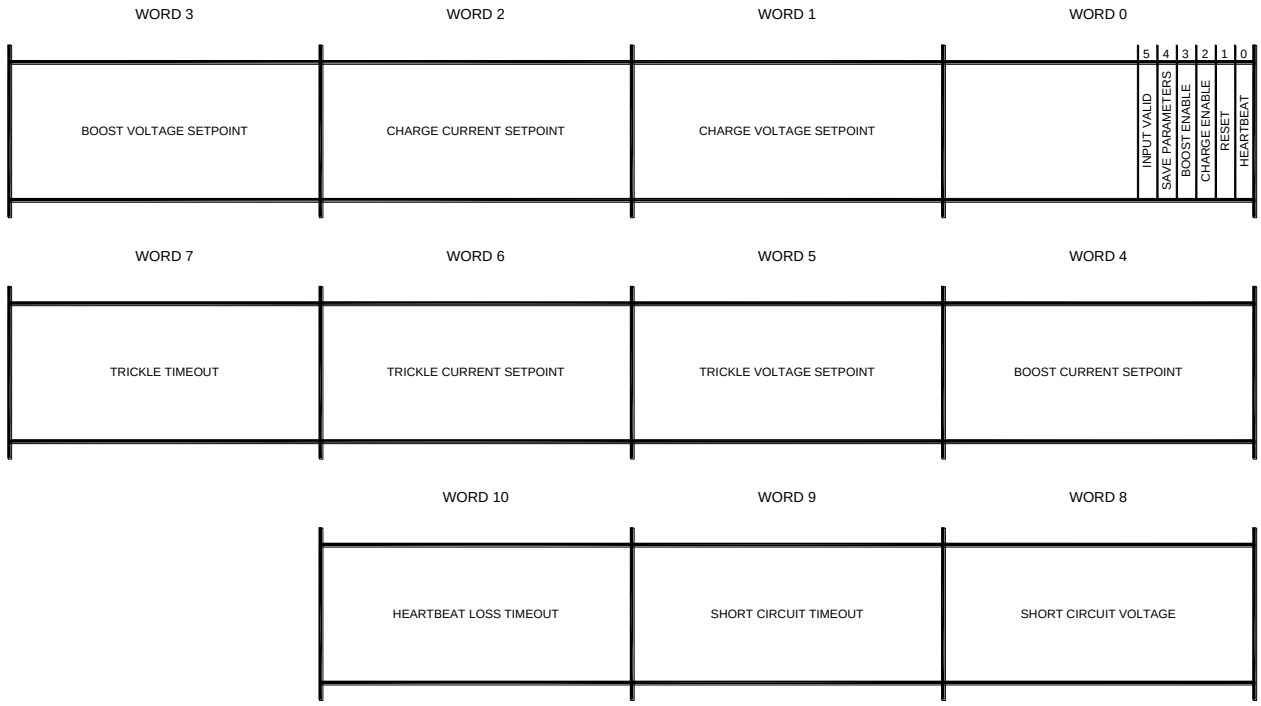


4.3. FIELDBUS I/O

4.3.1. MEMORY MAP

The memory map shows the position of the control and status words in relation to the base address on the network. Detailed descriptions of each bit and register are in the next sections.
The memory map is word based, each word using 16 bits.

Figure 4-4: Input Data Map



4.3.2. INPUT DATA MAP

4.3.2.1. HEARTBEAT

This bit indicates to the unit that communication is still taking place. If its state does not change for several seconds, the unit will stop responding to Charge and Boost commands. The PLC should set this bit to be equal to the unit's Heartbeat output bit.

4.3.2.2. RESET

A rising edge on this bit will reset latched faults.

4.3.2.3. CHARGE ENABLE

Setting this bit will allow the unit to enter Charge mode.

4.3.2.4. BOOST ENABLE

Setting this bit will allow the unit to enter Boost mode.

4.3.2.5. SAVE PARAMETERS

Setting this bit will cause the unit to save certain input words to persistent memory.

4.3.2.6. INPUT VALID

This bit must be set for the unit to respond to any other commands from the PLC.

4.3.2.7. CHARGE VOLTAGE SETPOINT

This word sets the unit's battery terminal regulation voltage during charge mode.

4.3.2.8. CHARGE CURRENT SETPOINT

This word sets the unit's battery terminal regulation current during charge mode.

4.3.2.9. BOOST VOLTAGE SETPOINT

This word sets the unit's high-side output terminal regulation voltage during boost mode.

4.3.2.10. BOOST CURRENT SETPOINT

This word sets the unit's battery terminal regulation current during boost mode.

4.3.2.11. TRICKLE VOLTAGE SETPOINT

This word sets the unit's battery terminal regulation voltage during trickle mode. The minimum recognized value is equivalent to 16.5V. This setpoint is persistent between power cycles.

4.3.2.12. TRICKLE CURRENT SETPOINT

This word sets the unit's battery terminal regulation current during trickle mode. The minimum recognized value is equivalent to 5A. This setpoint is persistent between power cycles.

4.3.2.13. TRICKLE TIMEOUT

This word sets how many seconds the unit will remain in trickle mode with the low-side voltage under 16.5V before faulting. This setpoint is persistent between power cycles.

4.3.2.14. SHORT CIRCUIT VOLTAGE

This word sets what voltage the unit must reach to prevent a short-circuit fault. The maximum recognized value is equivalent to 16V. This setpoint is persistent between power cycles.

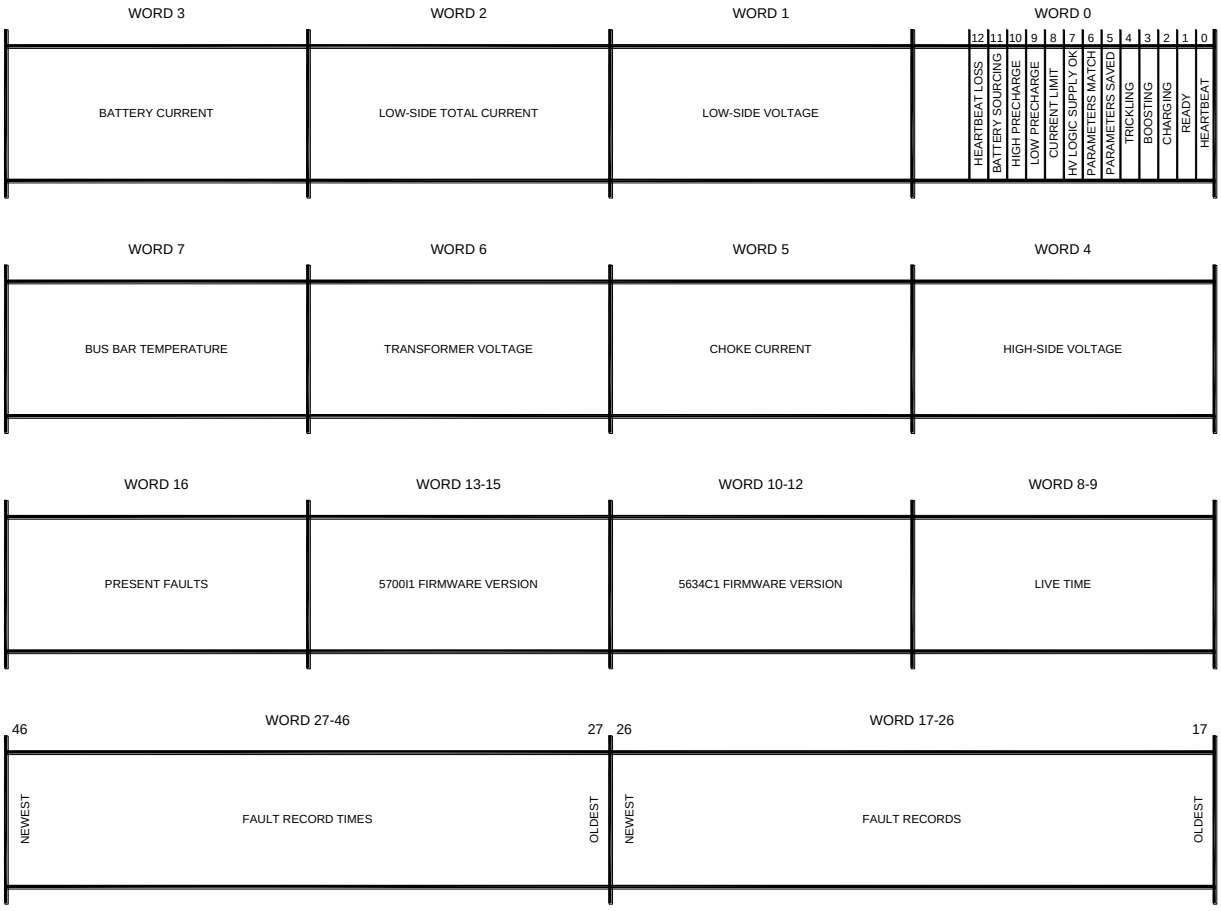
4.3.2.15. SHORT CIRCUIT TIMEOUT

This word sets how many tenths of seconds the unit will wait before declaring a short-circuit fault. The minimum recognized value is one tenth of one second. This setpoint is persistent between power cycles.

4.3.2.16. HEARTBEAT LOSS TIMEOUT

This word sets how many seconds the unit will wait between heartbeat bit changes before exiting charge and boost modes. The minimum recognized value is three seconds. This setpoint is persistent between power cycles.

Figure 4-5: Output Data Map



4.3.3. OUTPUT DATA MAP

4.3.3.1. HEARTBEAT

This bit indicates to the PLC that communication is still taking place. It is set to be equal to the inverse of the unit's Heartbeat input bit.

4.3.3.2. READY

This bit indicates that the unit is not faulted.

4.3.3.3. CHARGING

This bit indicates that the unit is in charge mode and actively charging the low-side load.

4.3.3.4. BOOSTING

This bit indicates that the unit is in boost mode and is actively pulling power from the attached battery bank to support the high-side load.

4.3.3.5. TRICKLING

This bit indicates that the unit is in trickle mode and is actively charging the low-side load.

4.3.3.6. PARAMETERS SAVED

This bit indicates that the persistent input words have been successfully saved.

4.3.3.7. PARAMETERS MATCH

This bit indicates that the values provided by the PLC match the values stored in persistent memory.

4.3.3.8. HV LOGIC SUPPLY OK

This bit indicates that the unit's internal logic supply derived from the high-voltage side is operating. If this bit is not set and the high-voltage source is present, the unit may be damaged.

4.3.3.9. CURRENT LIMIT

This bit indicates that the unit is presently in current limit, either because the battery current is at its setpoint or because the total current through the low-voltage side of the unit is exceeding 250A.

4.3.3.10. LOW PRECHARGE

This bit indicates that the low-side precharge is complete. This is necessary for the unit to successfully boost.

4.3.3.11. HIGH PRECHARGE

This bit indicates that the high-side precharge is complete. This is necessary for the unit to successfully charge.

4.3.3.12. BATTERY SOURCING

This bit indicates that the battery is presently sourcing current, either into the attached low-side load or into the unit itself.

4.3.3.13. HEARTBEAT LOSS

This bit indicates that the LVPS has not recognized a change on its Heartbeat input bit for longer than the heartbeat loss time. The unit will stop responding to charge and boost commands until this situation changes.

4.3.3.14. LOW-SIDE VOLTAGE

This word indicates the voltage on the low-voltage terminals of the unit.

4.3.3.15. LOW-SIDE TOTAL CURRENT

This word indicates the total current through the low-voltage side of the unit.

4.3.3.16. BATTERY CURRENT

This word indicates the total current through the battery terminal of the unit.

4.3.3.17. HIGH-SIDE VOLTAGE

This word indicates the voltage on the high-voltage terminals of the unit.

4.3.3.18. CHOKE CURRENT

This word indicates the current through the internal regulation inductor.

4.3.3.19. TRANSFORMER VOLTAGE

This word indicates the voltage on the internal isolation transformer.

4.3.3.20. BUS BAR TEMPERATURE

This word indicates the temperature of the low-voltage bus bar.

4.3.3.21. LIVE TIME

These words indicate the time, in seconds, that the unit has been powered on since first activation. The low-order word is word 8. The high order word is word 9.

4.3.3.22. 5634C1 FIRMWARE VERSION

These words indicate the version number of the firmware on the 5634C1 control board.

4.3.3.23. 5700I1 FIRMWARE VERSION

These words indicate the version number of the firmware on the 5700I1 interface board.

4.3.3.24. PRESENT FAULTS

This word indicates the present fault state. See section 4.6 for what each bit indicates.

4.3.3.25. FAULT RECORDS

These words indicate ten saved prior fault states. See section 4.6 for what each bit indicates.

4.3.3.26. FAULT TIMES

These words indicate the live time each saved fault state occurred.

4.4. ETHERNET / IP CONFIGURATION

The EtherNet I/P interface can be configured in several different ways. The module can be set using hardware switches, a PC utility or directly through a web browser. The default address is 0.0.0.0.

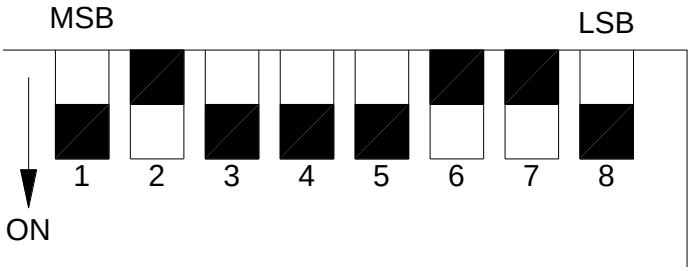
4.4.1. ETHERNET / IP ADDRESSING SWITCHES

The DIP switches on the EtherNet interface card can be used to set a static IP address. These switches are to the right of the EtherNet connector.

If the switches are set to a non-zero value, the module will use the following settings:

IP Address:	192.168.0.x (x = binary switch value)
Gateway	255.255.255.0
Subnet	255.255.255.0
DHCP	Off

The switches specify the binary value of the last byte of the IP address as illustrated by the following example, where the IP address is set to 192.168.0.185



Please note that the switches are numbered backwards from the bit numbers, the least significant bit is the rightmost switch.

If these switches are set to zero, the address used is the one set in the online configuration screen, described below.

4.4.2. ONLINE MODULE CONFIGURATION WITH ANYBUS IPCONFIG

At first power-on, the module has no pre-configured static IP address, and DHCP is off. To assign an IP address to the network module, perform the following steps.

1. Power on the unit.
2. Connect the network module to a network with a Windows PC.
3. From the Windows PC, run the Anybus IPconfig software, which may be found on the Anybus website. The program should list any M5700 units on the network. Unconfigured modules will have an IP address of 0.0.0.0. This utility will scan the network for Anybus modules and list them regardless of the current IP address setting.
4. Double-click the list entry which matches the MAC address labeled on the network module.
5. Configure the module with the desired IP address, subnet mask,

gateway, DNS servers, and DHCP configuration. A password may also be set if desired. Click “Set” to confirm changes. The IP address changes immediately, there is no need to cycle power.

6. Click “Scan” to confirm that the changes you made were accepted.

Multiple modules can be configured from the same PC at the same time.

4.4.3. ONLINE MODULE CONFIGURATION THROUGH A WEB BROWSER

The IP address can be changed using a standard web browser. Perform the following steps.

1. Power on the unit.
2. If you don’t know the IP address of the module, you can use the hardware switches to temporarily force it to a standard address and make the stored IP address change as below.
3. Use a standard web browser to connect to the unit. The web page configuration is compatible with Internet Explorer and Firefox. Others should work as well. To connect, put the IP address directly in the address bar of the browser.
4. This webpage can be used to crudely drive the inputs and observe the outputs of the unit. Use care, as bits set here will affect the actual operation of the unit.
5. Configure the module with the desired IP address, subnet mask, gateway, DNS servers, and DHCP configuration. There is no SMTP configuration available, this can be left blank.
6. Press “Store Configuration” to change the settings. This change is not immediate; power must be cycled before the change takes place. If you previously hard set the IP address with the configuration switches, make sure you turn all the switches off.

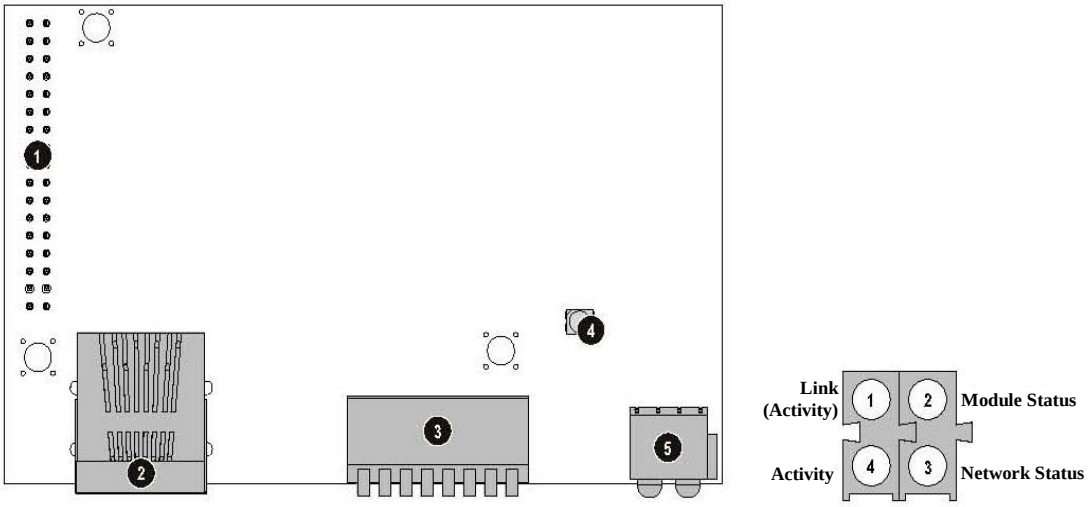
4.4.4. PLC CONFIGURATION

Contact your integrator for PLC configuration assistance.

4.4.5. ETHERNET / IP STATUS INDICATORS

These LEDs indicate run time status and errors to the user. During power up, a LED test sequence is performed according to the EtherNet / IP specification.

Figure 4-3: EtherNet / IP Module Features



Legend:
1 Application Connector
2 Ethernet Connector
3 Configuration Switch
4 Anybus Watchdog
5 Status indicators

Table 4-1: Ethernet Status Indicators

1 LINK (ACTIVITY)

STATE	DESCRIPTION
Off	Link not sensed
Green	Link sensed

2 MODULE STATUS

STATE	DESCRIPTION
Off	No power
Green	Controlled by a scanner in Run state
Green, flashing	Not configured, or scanner in idle state
Red, flashing	A minor recoverable fault has been detected
Red	A major unrecoverable fault has been detected
Alternating Green / Red	Self-test in progress

3 NETWORK STATUS

STATE	DESCRIPTION
Off	No power or no IP address
Green	On-line, one or more connections established (CIP Class 1 or 3)
Green, flashing	On-line, no connections established
Red	Duplicate IP address, fatal error
Red, flashing	One or more connections timed out (CIP Class 1 or 3)
Alternating Green / Red	Self-test in progress

4 ACTIVITY

LED blinks when packets are transmitted or received.

4.5. INDICATORS

4.5.1. 5634C1

- LD1 (red) indicates that the system is in a fault state.
- LD2 (yellow) indicates that the system is actively regulating.
- LD3 (green) indicates that the system is powered on.

All three LED's will blink for approximately one second when power is on.

4.6. FAULTS

If any faults are present, the system will cease to run. Latched faults may be cleared by toggling the Reset input signal (4.2.3.1.2) low and high again.

4.6.1. HIGH-SIDE OVERVOLTAGE

This fault indicates that the high-side voltage of the system has exceeded a safe level. This fault will automatically clear.

4.6.2. TRANSFORMER OVERVOLTAGE

This fault indicates that the voltage on the module's internal isolation transformer has exceeded the safe limits of the system. This fault will automatically clear.

4.6.3. LOW SIDE OVERVOLTAGE

This fault indicates that the low side voltage to the system has exceeded approximately 30V. This fault will clear automatically.

4.6.4. BOOST OVERLOAD

This fault indicates that the voltage on the high-voltage connections during boost mode is lower than the system's specified operating capabilities. This may indicate an excessive load, or a misconfigured setpoint. This fault will latch until reset by toggling the Reset signal.

4.6.5. CHARGE OVERLOAD

This fault indicates that the voltage on the low-voltage connection during charge mode is under the normal operating range for charge mode. This typically indicates that the load on the low-voltage output is too great for either the current setpoint or the absolute 250A current limit. This fault will latch until reset by toggling the Reset signal.

4.6.6. TRANSFORMER OVERCURRENT

This fault indicates that the current through the module's internal isolation transformer has exceeded the safe limits of the system. This fault will latch until reset by toggling the Reset signal.

4.6.7. CHOKE OVERCURRENT

This fault indicates that the current on the module's internal regulation inductor has exceeded the safe limits of the system. This fault will latch until reset by toggling the Reset signal.

4.6.8. LOW SIDE OVERCURRENT

This fault indicates that the current through the low-voltage side of the unit has exceeded a safe level. This fault will automatically clear.

4.6.9. CHARGE/BOOST MISMATCH

This fault indicates that the signals for both boost and charge mode have been enabled simultaneously. This fault will latch until reset by toggling the Reset signal.

4.6.10. TRANSFORMER PRECHARGE FAILURE

This fault indicates that the module's internal isolation transformer failed to start up correctly. This fault will latch until reset by toggling the Reset signal.

4.6.11. IGBT

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

4.6.12. OVERTEMPERATURE

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.

4.6.13. TRICKLE TIMEOUT

This fault indicates that the unit has operated in trickle mode for longer than the user-specified time, without rising above 16.5V. This may either indicate an excessive load on the unit, or a misconfigured timeout value. This fault will latch until reset by cycling the reset signal. .

4.6.14. COMM LOSS

This fault indicates that the unit has experienced an internal communication failure. This fault will automatically clear. .

4.6.15. CHARGE SHORT CIRCUIT

This fault indicates that the unit charged in current limit for more than the user-specified time, and did not exceed the user-specified voltage. This may either indicate an excessive load on the unit, or a misconfigured timeout value. This fault will latch until reset by cycling the reset signal.

4.7. STARTUP

4.7.1. 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.

4.7.2. STARTUP PROCEDURE AND CHECKS

Connect high voltage input to the system. Open the trickle charge enable input. Verify the following:

- Input voltage is within tolerance. See Table 2-1 for voltages and tolerances.
- Green LED on 5634C1 is on.

Remove the high-voltage input. Connect the battery bank. Apply 24V to 5700L1 TB3 3-4. Verify:

- Battery voltage is within tolerance.
- Green LED on 5634C1 is illuminated.
- Network interface indicates reasonable feedback values.

If any of the above conditions are not as indicated, turn off all power and allow one minute 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 these pre-checks are complete, close the M5700 unit lid. Connect all inputs. Close the Trickle Charge Enable Input. Set the unit's "Charge Enable" bit (4.2.3.1.3). The unit will start delivering current to the batteries at the rate specified by the network commands.

4.8. OPERATIONAL ADJUSTMENTS

Operational adjustments to the system are performed from the network module. No potentiometers or jumpers should be changed for any reason.

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. CURRENT WILL NOT REACH SETPOINT

Ensure that the voltage setpoint is not too low to reach the current setpoint.

5.1.2. VOLTAGE WILL NOT REACH SETPOINT

Ensure that the current setpoint is not too low to reach the voltage setpoint.
Ensure that the unit's total throughput current is less than 250A.

5.1.3. SYSTEM WILL NOT POWER ON

Check the voltage inputs to the system with a meter.

Ensure that 24V is present on 5700L1 TB3-3 and TB3-4.

5.1.4. SYSTEM WILL NOT COMPLETE PRECHARGE

Ensure that the system is not overloaded. Check the load impedance and the trickle and limit voltage and current as set by the network module.

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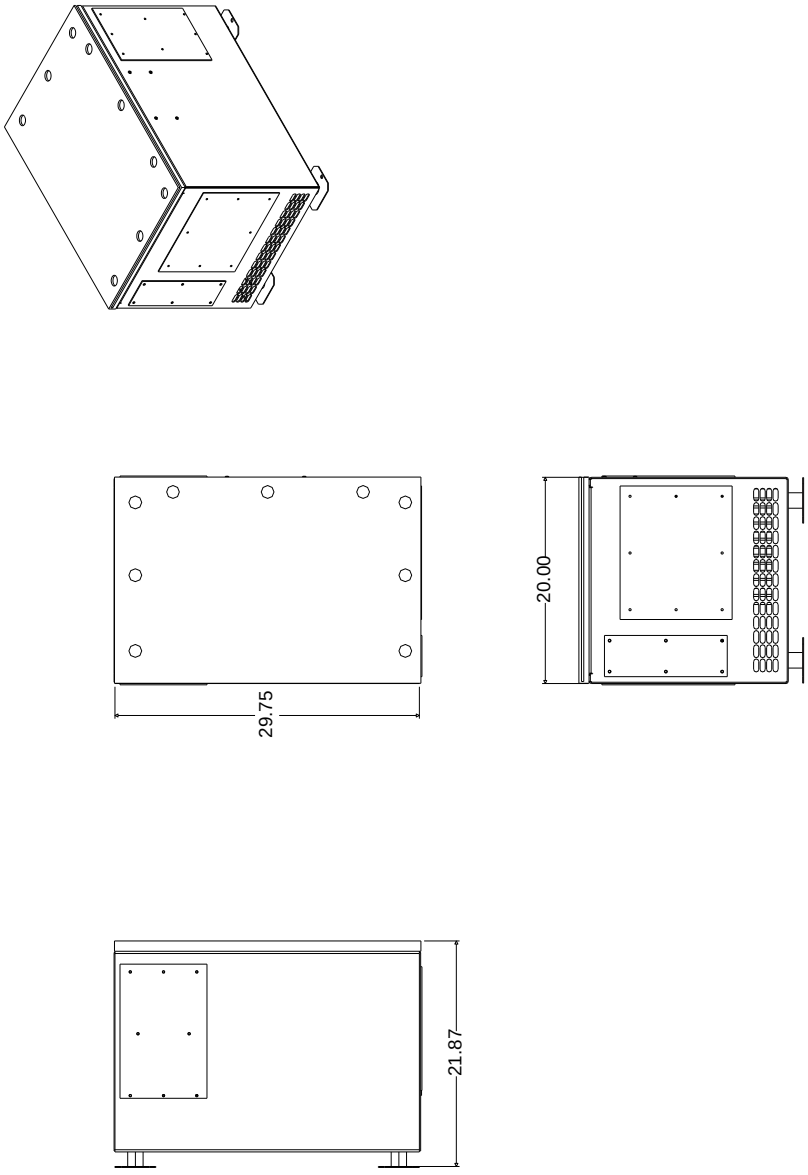
6. ENGINEERING DATA

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. A fuse failure typically indicates that the system has been damaged in some more serious way. Consult Bonitron if any system fuse opens.

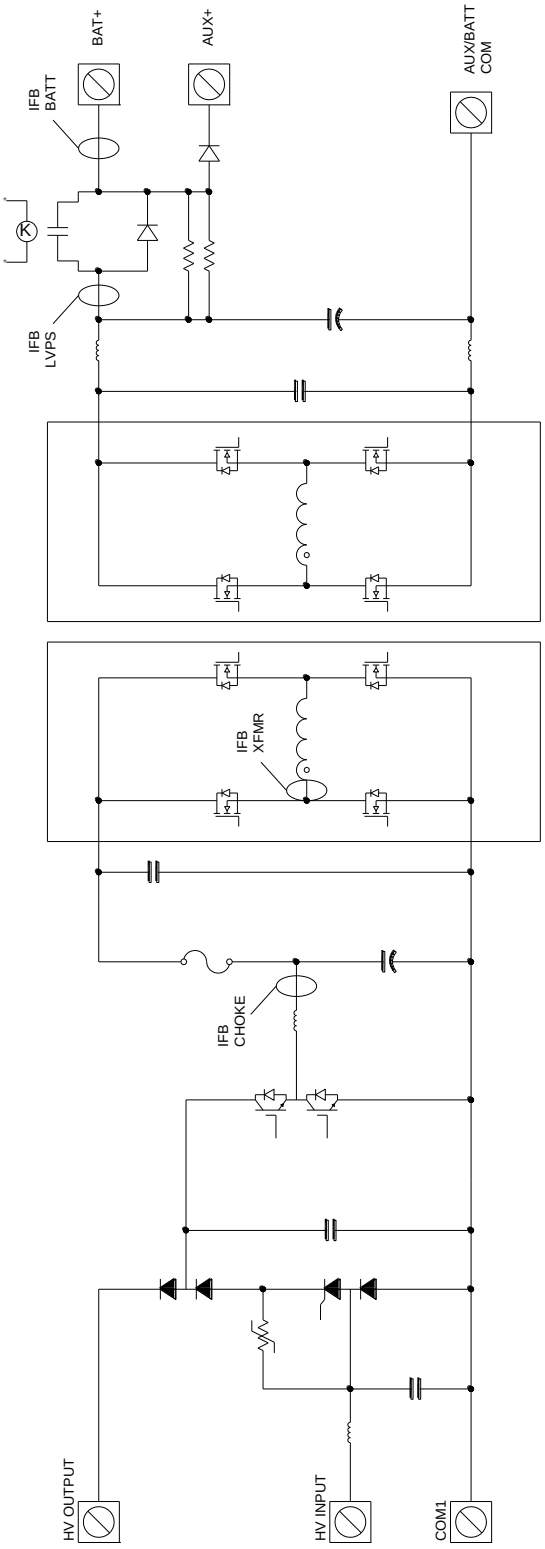
6.2. DIMENSIONS AND MECHANICAL DRAWINGS

Figure 6-1: Dimensional Outline



6.3. BLOCK DIAGRAMS

Figure 6-2: M5700 Power Topology



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