Model M5628

Isolated Charger Module

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.

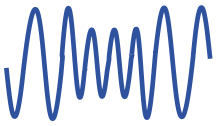
The Bonitron engineering team has the background and expertise necessary to design, develop, and manufacture the quality industrial electronic systems demanded in today's market. A strong academic background supported by continuing education is complemented by many years of hands-on field experience.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

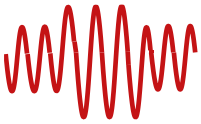
In 1975, Bonitron began working with AC inverter drive specialists at synthetic fiber plants to develop speed control systems that could be interfaced with their plant process computers. Ever since, Bonitron has developed AC drive options that solve application issues associated with modern AC variable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

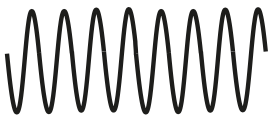
Braking Transistors
Braking Resistors
Transistor/Resistor Combo
Line Regeneration
Dynamic Braking for Servo Drives

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

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 M5628 charger module. It will provide the user with the necessary information to successfully install, integrate, and use the M5628 with battery or capacitive energy storage systems.

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 REVISION

Rev 00a is the original printing of the M5628 charger.

Updated Table 2-3 and Section 3.5 in Rev 00b.

Updated Figure 6-1 in Section 6.4 in Rev 00c.

Updated Table 6-4 in Rev 00e.

Added 20A rackmount, 5A panel mount and 5A rackmount models in Rev 01a.

Figure 1-1: M5628 Charger in A6 Chassis

Figure 1-2: M5628 Charger in A6R Chassis

1.4. SYMBOL CONVENTIONS USED IN THIS MANUAL AND ON EQUIPMENT

	Earth Ground or Protective Earth
	AC Voltage
	DC Voltage
 **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!**	Heat or burn hazard - Identifies a statement regarding heat production or a burn hazard that should be avoided.

2. PRODUCT DESCRIPTION

Bonitron's M5628 charger is a voltage and current limited power supply used to charge higher voltage lead acid batteries, ultracapacitor, or double layer capacitor energy storage strings.

Variable frequency drive systems can require energy storage to back up power for mission critical or continuous processes. Any system requiring energy during a complete loss of input power needs some type of energy storage device. These systems use batteries and ultracapacitors in strings with high voltage ranges at higher power ratings. Standard chargers typically do not have this voltage range and are intended for use with batteries only. The M5628 charger module can charge battery or ultracapacitor strings up to 600VDC.

2.1. RELATED PRODUCTS

M3460 SERIES RIDE-THRU MODULES

Voltage regulators used for sag or outage protection of higher power systems.

M3534 SERIES RIDE-THRU MODULES

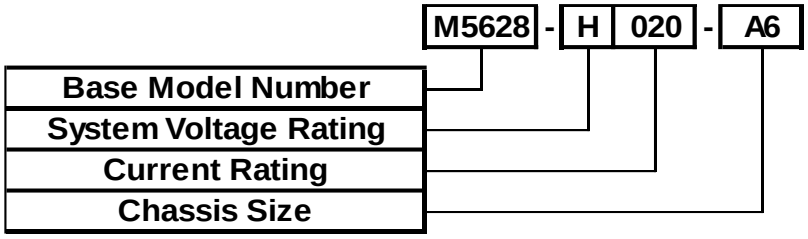
Voltage regulators used for sag or outage protection of lower power systems.

M3628 ULTRACAPACITOR SAFETY DISCHARGERS

Automatic discharge for large capacitor storage banks for safety and quick maintenance entry.

2.2. PART NUMBER BREAKDOWN

Figure 2-1: Example of M5628 Part Number Breakdown



BASE MODEL NUMBER

The base model number for all charger modules is **M5628**.

SYSTEM VOLTAGE RATING

The system voltage rating indicates the nominal system voltage levels as listed in Table 2-1.

Table 2-1: System Voltage Rating Codes

RATING CODE	NOMINAL AC LINEVOLTAGE
H	230-480VAC

CURRENT RATING

The current rating indicates the maximum charging current for the M5628 in DC Amps. This rating is directly represented by a 3-digit value. For instance, the rating for a 20ADC M5628 is indicated as **020**, and the 5ADC is indicated as **005**.

CHASSIS SIZE

The open type chassis size is indicated by the code as shown in Table 2-2. This chassis size is determined by the current rating of the unit.

Table 2-2: Chassis Size Codes

CHASSIS SIZE	DIMENSIONS H x W x D	CURRENT RATING
A6	18.6"x6.25"x11.25"	20A
A6R	4U Rackmount 6.94"x18.88"x18.10"Min – 31.98"Max*	20A
C5	17.00"x5.10"x10.06"	5A
2U	2U Rackmount 3.47"x9.00"x12.91"Min – 31.98"Max*	5A

*Depth is adjustable via rack ears.

2.3. GENERAL SPECIFICATIONS

Table 2-3: General Specifications Chart

PARAMETER	SPECIFICATION
AC Input Voltage	208-506VAC
DC Charging Voltage	Adjustabel up to 600VDC
Equalize Voltage	Adjustable up to 600VDC
Max DC Charging Current	5A, 20A
Isolation Rating	• Input/Output to Ground 2,500 VAC • Input to Output 2,500 VAC
Enclosure Rating	Open
Operating Temp	0 to +40^{O}C
Storage Temp	-20^{O} to +65^{O}C
Humidity	Below 90%, non-condensing
Atmosphere	Free of corrosive gas or conductive dust
Altitude	Up to 1000 Meters (3000 feet) above sea level*
Environmental	Pollution degree: 2- Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the equipment is out of operation.

*Units must be derated by 2% for every 300 meters (1000 feet) above 1000 meters (3000 feet) sea level.

2.4. 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 opening the enclosure.
- **FAILURE TO HEED THESE WARNINGS MAY RESULT IN SERIOUS INJURY OR DEATH!**

CAUTION!

- Certain components within this product may get hot during operation.
- Always allow ample time for the unit to cool before attempting service on this product.
- Installation and/or removal of this product should only be accomplished by a qualified electrician in accordance with National Electrical Code or equivalent regulations.
- Before attempting installation or removal of this product, be sure to review all system documentation for pertinent safety precautions.
- No user-serviceable parts are contained within this product. Inoperable units should be replaced or returned for repair.

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

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3. INSTALLATION INSTRUCTIONS

The M5628 has an open type chassis construction. It is intended to be part of a larger variable frequency drive system and will require different hardware for interconnection based on the installation. An appropriate enclosure may need to be provided to protect personnel from contact and the system from damage. The enclosure may also need to protect the equipment from the installation environment.

Please read this manual completely before designing the drive system or enclosure layout to ensure all required elements are included.

3.1. ENVIRONMENT

The maximum ambient operating temperature of the M5628 should not exceed 40°C at full load. Temperatures above this require derating.

Non-condensing filtered air may be required to cool the system if other components cause excessive heat buildup in the enclosure.

3.2. UNPACKING

Inspect the shipping crate and M5628 for damage.
Notify the shipping carrier if damage is found.

3.3. MOUNTING

Mounting dimensions can be found in Section 6.

Remove the M5628 from the shipping crate and mount it in the desired location using the mounting slots and holes and ¼" diameter studs or bolts. Mounting hardware is not supplied with the M5628.

3.4. WIRING AND USER CONNECTIONS

Review this entire Section before attempting to wire the M5628.

3.4.1. POWER WIRING

This section provides information pertaining to the field wiring connections of the M5628. Actual connection points and terminal numbers of the AC drive system will be found in the documentation provided with the drive system.

Be sure to review all pertinent AC drive system documentation as well as the connection details listed below before proceeding.

DANGER!

BATTERY SYSTEMS MUST BE HANDLED WITH EXTREME CARE. THE POWER CONNECTIONS TO BATTERY SYSTEMS MAY HAVE LETHAL VOLTAGES.

ENSURE THAT ALL STORAGE BANK MODULES ARE DISCONNECTED AND LOCKED OUT BEFORE ATTEMPTING SERVICE OR INSTALLATION.

USE PROPER TOOLS AND PROCEDURES TO MINIMIZE RISK OF INJURY OR DEATH.

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

Table 3-1: M5628 Power Wiring Connections

TERMINAL DESIGNATION	FUNCTION	WIRING SPECIFICATION	CONNECTION	TORQUE
AC LINE L1 L2 L3	AC Input	600VAC	#10 lug ring or spade	20 lb-in
STORAGE BUS +/-	DC Output	600VAC	#10 lug ring or spade	20 lb-in
⏚	Ground	600VAC	#10 lug ring or spade	15 lb-in

Main power connections should be made with copper wire rated 75°C or equivalent; and use compression fitting lugs. Wire sizing should be appropriate for the current being carried. System ratings are listed in Section 6.

3.4.1.1. AC LINE (L1 L2 L3) CONNECTIONS

The AC Line connections should be made to a 3-phase source.

3.4.1.2. STORAGE BUS (+/-) CONNECTIONS

The Storage Bus connections should be made to the capacitor or battery bank.

If connecting to a capacitor bank, it should be fully discharged when this connection is made.

Since a battery bank cannot be fully discharged without damaging the batteries, a disconnect or contactor should be placed between the Storage Bus terminals of the M5628 and the battery bank terminals.

Make sure the polarity is correct for the connection, failure to do so can cause severe damage to the system.

CAUTION!

ENSURE STORAGE BUS IS CONNECTED AND ALL DISCONNECTS ARE CLOSED BEFORE ENABLING THE 5628.

FAILURE TO HEED THIS WARNING COULD RESULT IN DAMAGE TO THE SYSTEM!

DANGER!

FOR SYSTEMS THAT HAVE DC STORAGE, ALWAYS MEASURE DC VOLTAGES, AND FOLLOW PROPER PRECAUTIONS TO ENSURE THEY ARE AT SAFE LEVELS BEFORE MAKING CONNECTIONS.

3.4.1.3. GROUNDING REQUIREMENTS

All units come equipped with a ground stud that is connected to the module chassis. Ground the chassis in accordance with local codes. Typically, the wire gauge will be the same as is used to ground the attached drive.

3.4.2. CONTROL INTERFACE AND I/O WIRING

Control wiring allows for remote enabling and monitoring of the M5628. Inputs can be a dry contact using an internally generated, isolated supply, or an external 24VDC signal.

Table 3-3: User I/O Connections

TERMINAL	FUNCTION	ELECTRICAL SPECIFICATIONS	WIRE AWG	TORQUE
TS2-1	24VDC+	24 VDC, 50 mA	16	2.1 lb-in
TS2-2	Enable Input			
TS2-3	24VDC+			
TS2-4	Equalize Input			
TS2-5	Input Common			
TS1-1	Output Common	350V, 120mA		
TS1-2	Charging Output			
TS1-3	Ready Output			

3.4.2.1. INPUT TERMINALS – TS2

The input terminals are located on TS2 on the customer I/O panel. They can use an internal supply with a dry contact or an external 24VDC.

3.4.2.1.1. 24V+ SUPPLY – TS2-1, TS2-3

The internal supply is capable of supplying 50mA at 24VDC. It is intended to be used for the inputs of the M5628 locally. It is not sufficient to serve as power for signaling the output terminals.

If more power is required, the inputs can be driven from a separate 24VDC power source. When a separate power source is used, the negative or common of that power supply should be connected to TS2-5.

3.4.2.1.2. ENABLE INPUT – TS2-2

The enable input allows the M5628 charger module to charge the storage bank. 24VDC may be placed between TS2-2 and TS2-5 or a contact closed between TS2-1 and TS2-2 to enable the charger module.

3.4.2.1.3. EQUALIZE INPUT – TS2-4

The equalize input allows the M5628 charger module to enter equalize mode and charge to the equalize voltage setting. 24VDC may be placed between TS2-4 and TS2-5 or a contact closed between TS2-3 and TS2-4 to put the charger into equalize mode.

Both the Enable Input and the Equalize Input must be activated for the charger to operate in Equalize mode.

3.4.2.1.4. INPUT COMMON – TS2-5

This terminal is the common for the inputs only. If the internal power supply from TS2-1 is used, there is no connection to this terminal.

This common is not connected to ground and should not be connected locally to avoid noise in the control circuits or ground loops.

It is also separate from the output common to allow the use of separate power supplies if desired.

3.4.2.2. OUTPUT TERMINALS – TS1

The status of the M5628 can be monitored from TS1 on the customer I/O panel.

3.4.2.2.1. OUTPUT COMMON - TS1-1

This pin is common to both the Charging and Ready outputs.

This common is not connected to ground and should not be connected locally to avoid noise in the control circuits or ground loops.

3.4.2.2.2. CHARGING OUTPUT - TS1-2

This output closes to the output common at TS1-1 when the M5628 is actively supplying current to the attached storage bank.

3.4.2.2.3. READY OUTPUT - TS1-3

This output closes to the output common at TS1-1 when the M5628 internal power supply is operating properly, and it is not in a faulted condition.

Figure 3-1: A6 Customer I/O Panel Layout

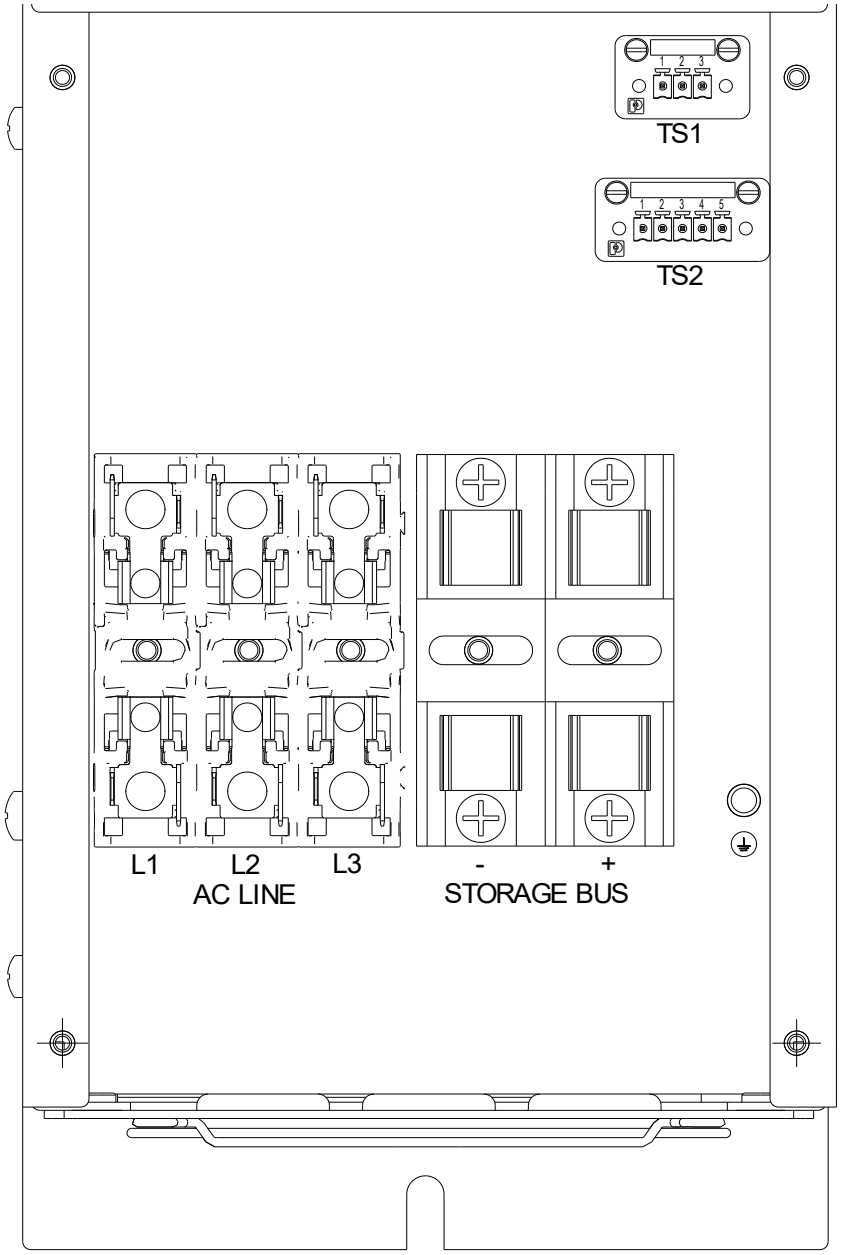


Figure 3-2: A6R Customer I/O Panel Layout

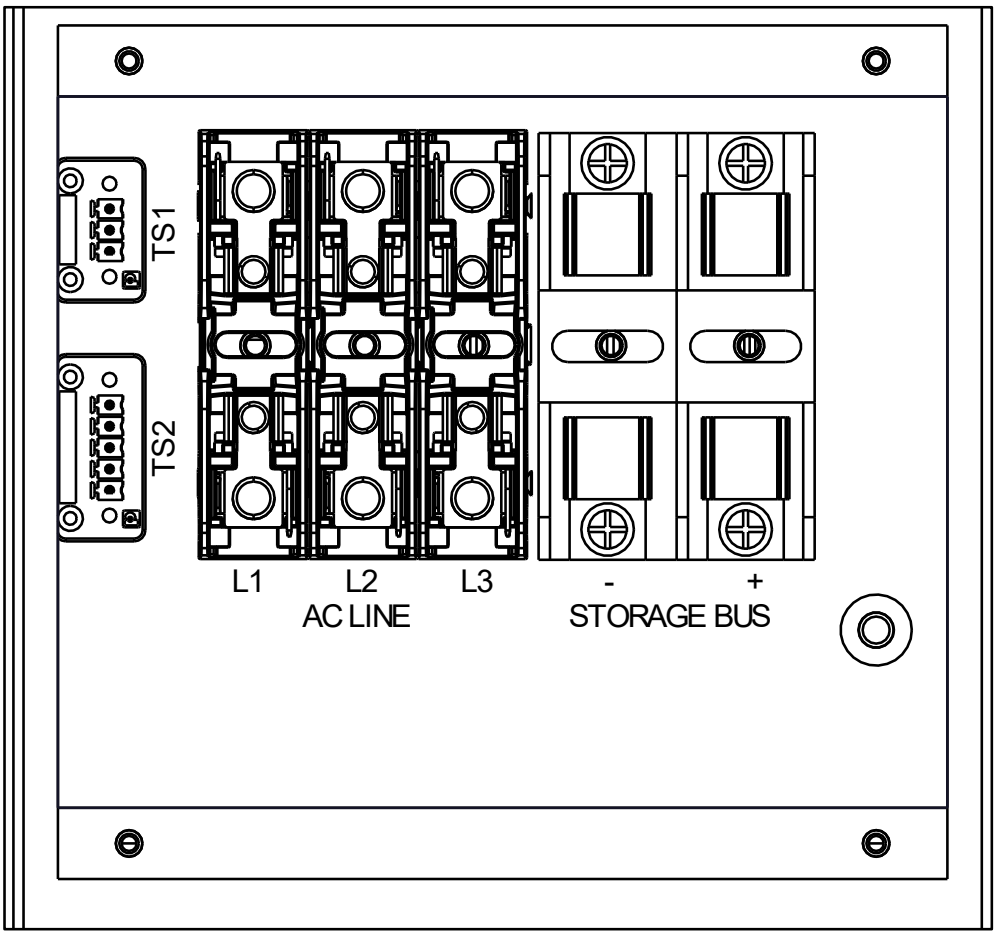


Figure 3-3: C5 Customer I/O Panel Layout

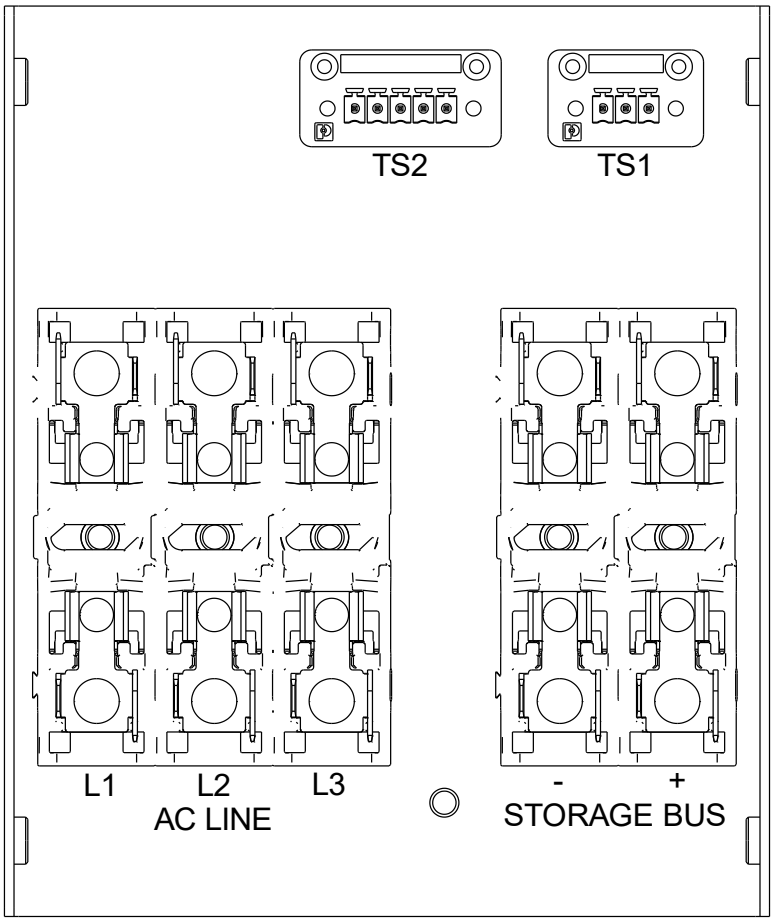
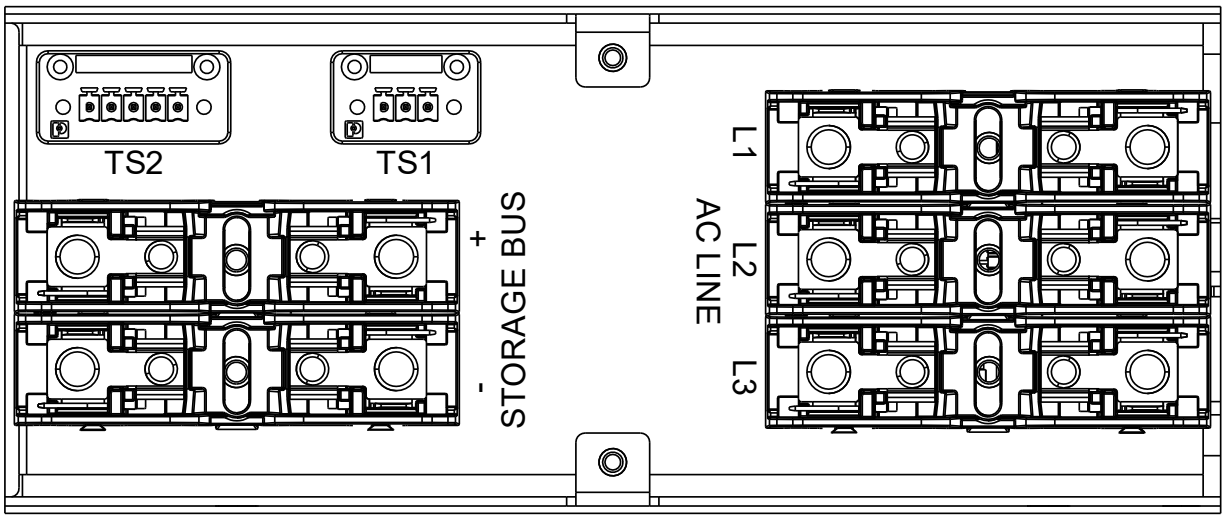


Figure 3-4: 2U Customer I/O Panel Layout



3.5. TYPICAL CONFIGURATIONS

Figure 3-5: M3460 Ultracapacitor System

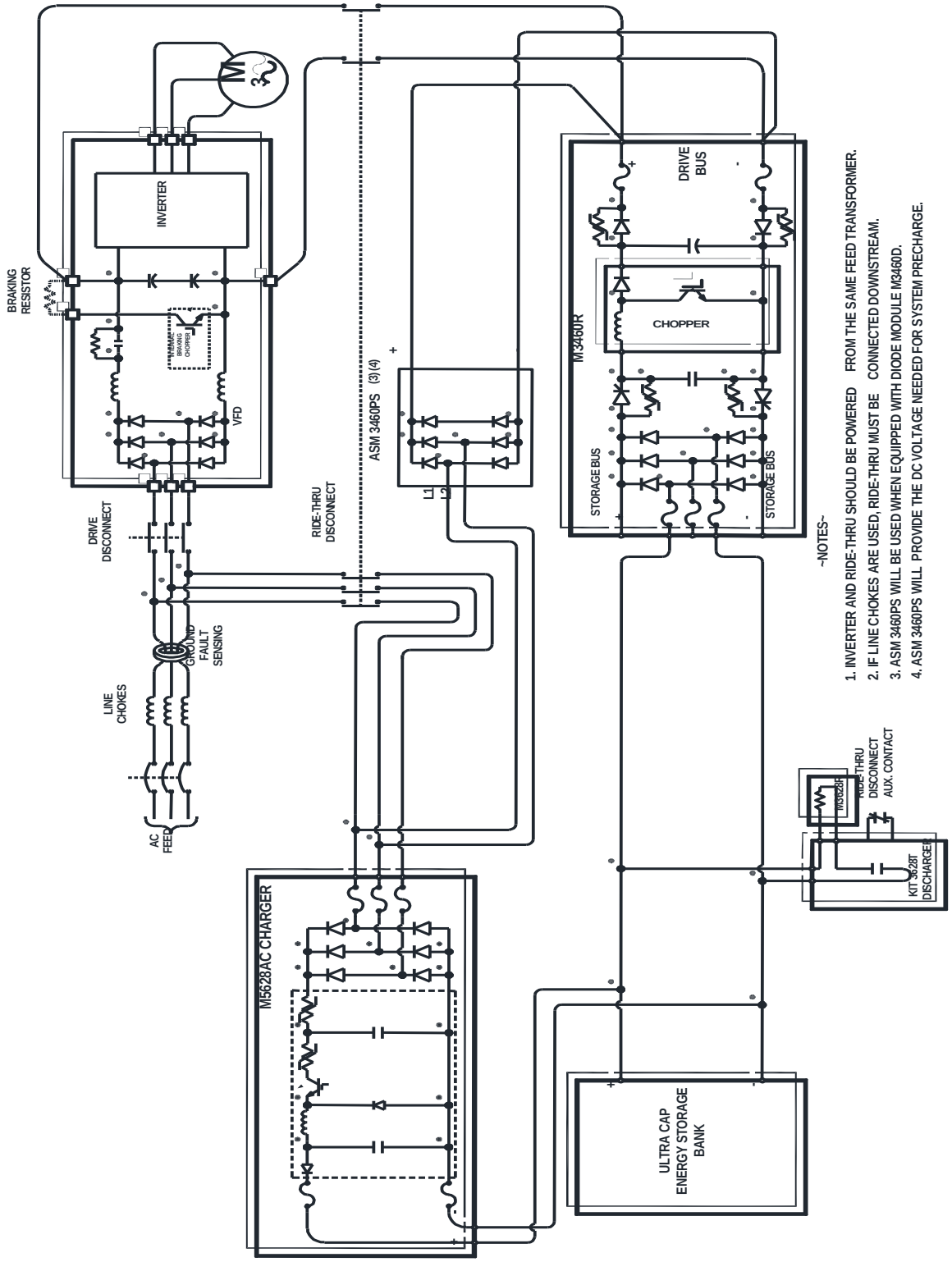


Figure 3-6: M3460 Battery System

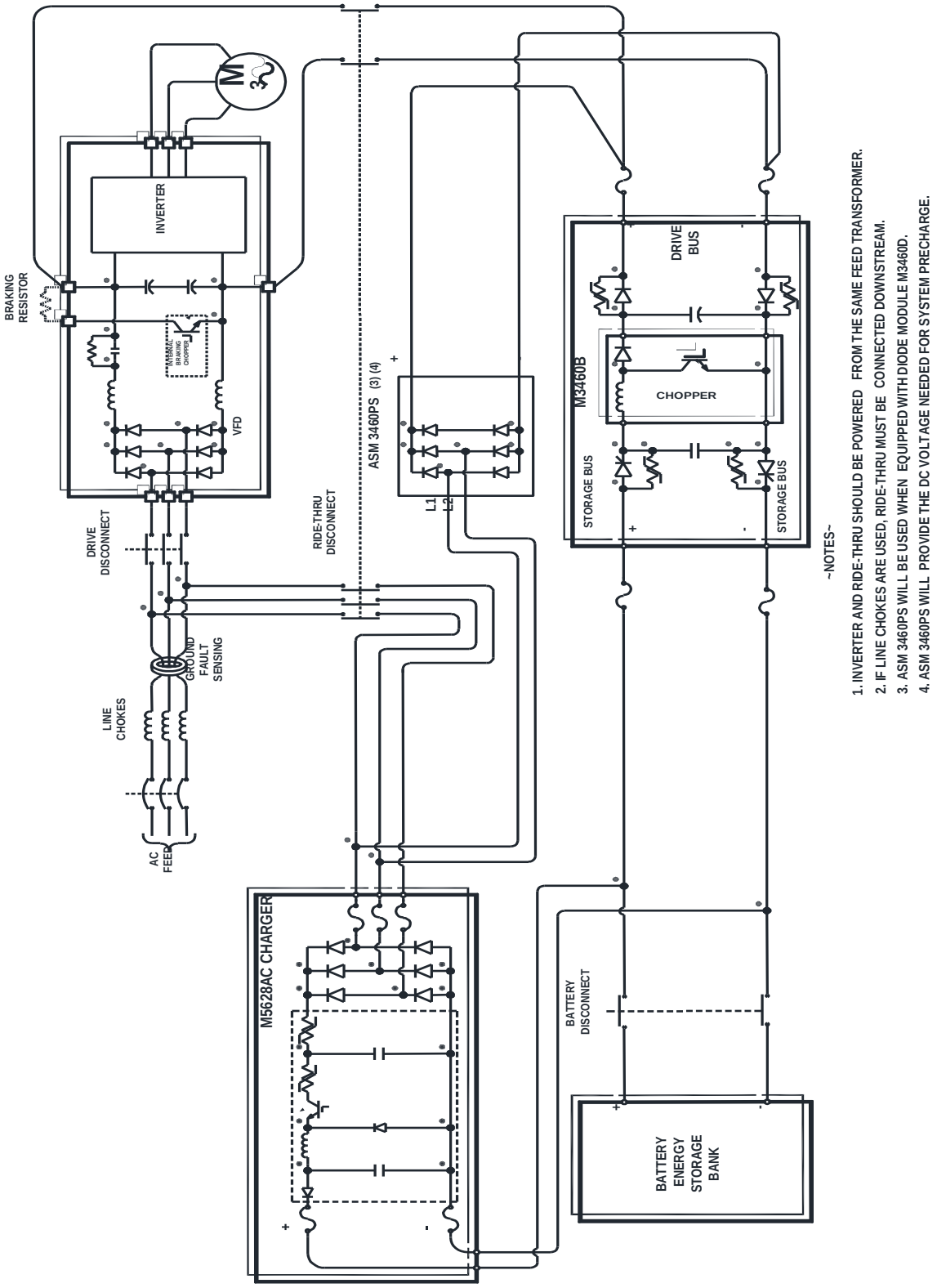


Figure 3-7: M3534 Ultracapacitor System

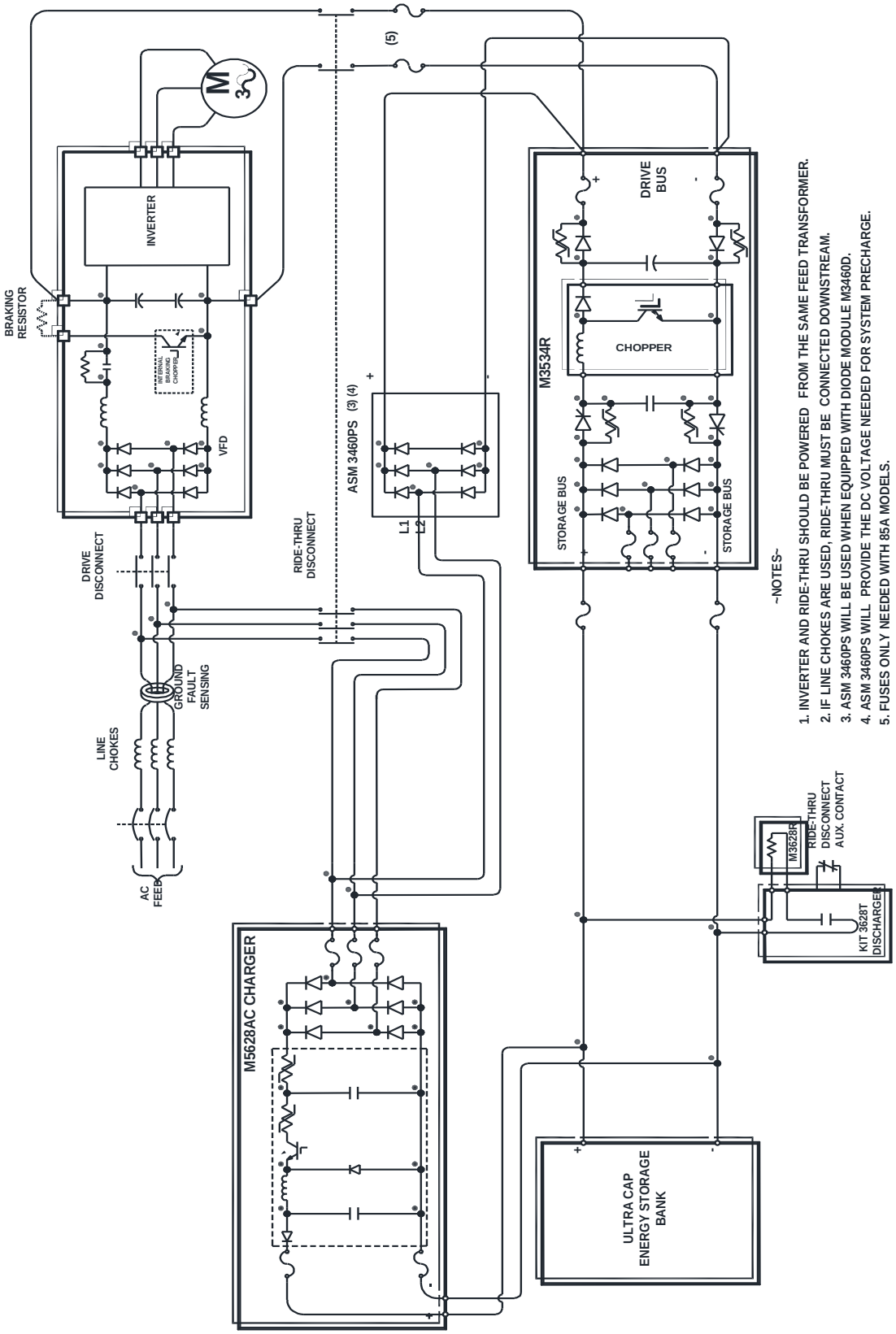
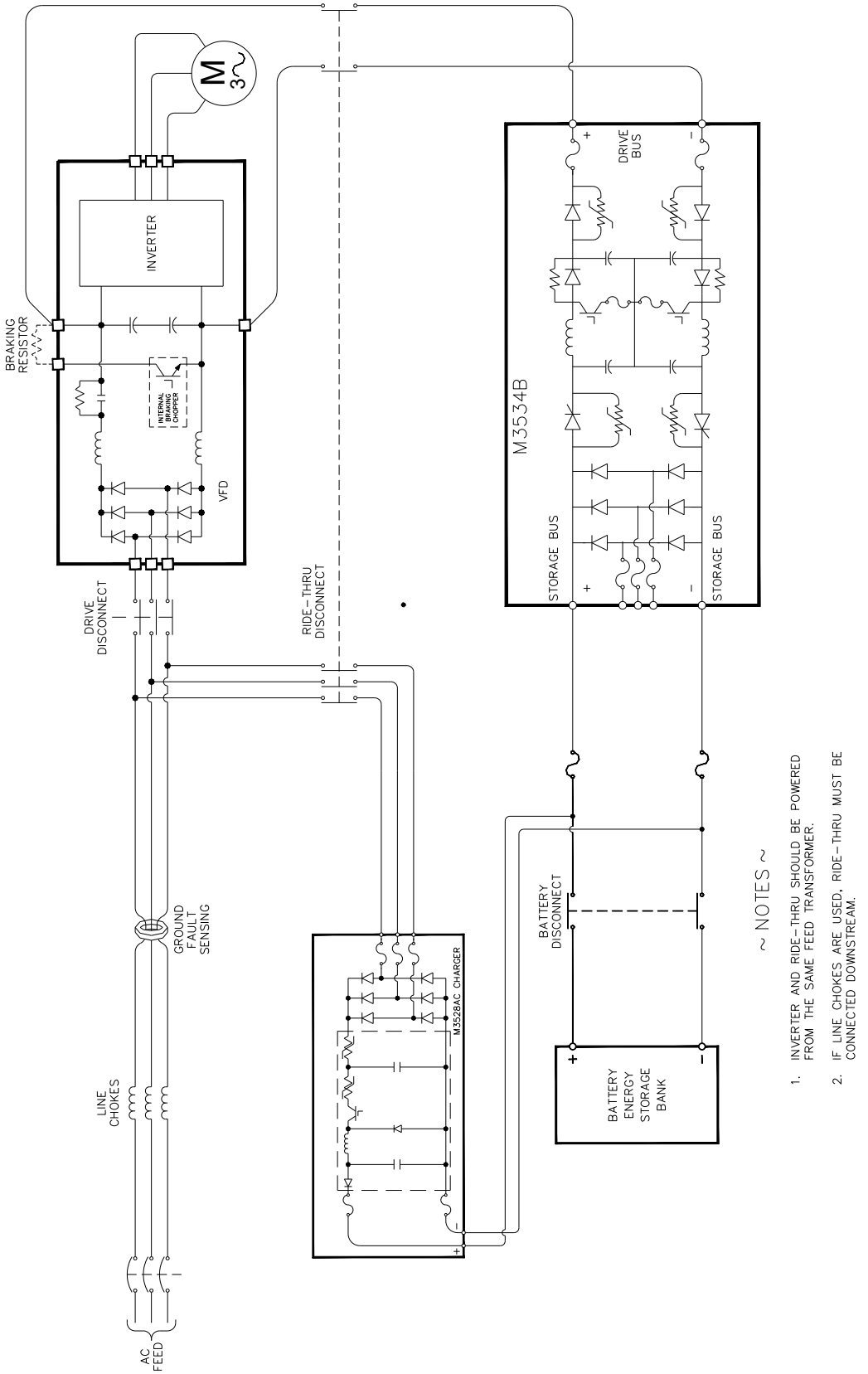


Figure 3-8: M3534 40A Battery System



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4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The M5628 charger module is a voltage and current limited power supply used to charge energy storage devices such as battery banks or high energy storage capacitor banks.

The M5628 charger does not test for battery impedance or voltage in order to start charging. Charging will begin when power is applied, the charge enable is active, and the output is sensed to be below the set point. Once charged, the M5628 maintains full voltage.

4.2. OPERATION MODES AND CONFIGURATION

4.2.1. NORMAL OPERATION

During normal operation, the M5628 will charge the attached storage bank to the voltage and current set by front display in the CHARGE SETPOINTS MENU.

This mode is activated by the Enable input on TS2-2, or through the ENABLE/DISABLE SCREEN on the front panel display. The method used to enable the unit is set through the front panel display in THE ENABLE CONTROL MENU.

4.2.2. EQUALIZE MODE

Equalize Mode is only available when the energy storage type is set to battery. While in Equalize mode, the M5628 will charge the attached storage bank to a voltage higher than the charge voltage setting. This can force long strings of batteries to have a more even charge across cells. The equalize voltage is set though the front panel display in the EQUALIZE OPTIONS MENU and can be set anywhere between the Charge voltage setpoint and the maximum voltage allowed according to the AC input. (this menu is hidden when the energy storage is set to capacitor)

The Equalize Mode functions in two different ways depending on the Enable Control setting. When control is set to Hardwire, the unit will be in Equalize mode anytime 24VDC is present on TS2-4. When control is set to Display, the Equalize mode is a timed cycle. The length of the equalize cycle is set in the EQUALIZE OPTIONS MENU. When the Equalize mode is started from the EQUALIZE OPTIONS MENU the unit goes into Equalize Mode for the set time, after that it returns to Normal Operation.

DANGER!

- ***DO NOT** USE THIS MODE FOR CAPACITOR STORAGE SYSTEMS. **E**XTREME DAMAGE AND CATASTROPHIC FAILURE CAN OCCUR IF CAPACITOR STORAGE BANKS ARE EXPOSED TO VOLTAGES ABOVE THEIR RATING!*
- ***O**VERCHARGING BATTERIES OR CHARGING AT LEVELS ABOVE THE RECOMMENDED FULL VOLTAGE CAN DAMAGE THE BATTERIES BY OVERHEATING, HYDROGEN GAS PRODUCTION, FIRE AND EXPLOSIONS.*
- ***P**ERFORM THIS PROCEDURE ONLY PER THE INSTRUCTIONS FROM THE BATTERY MANUFACTURER!*

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4.3. FRONT PANEL DISPLAY

4.3.1. DISPLAY

The display is a four-line, eighty-character LCD. This display shows information about the present status of the charger, records of unit faults, and menus allowing the user to select actions or access other screens.

4.3.2. LEDS

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

- Red indicates a fault has occurred. The display will indicate the nature of this fault.
- Flashing Yellow indicates that the unit is pre-charging.
- Solid Yellow indicates that the unit is enabled and charging.
- Green indicates that the charger is powered on.

4.3.3. BUTTONS

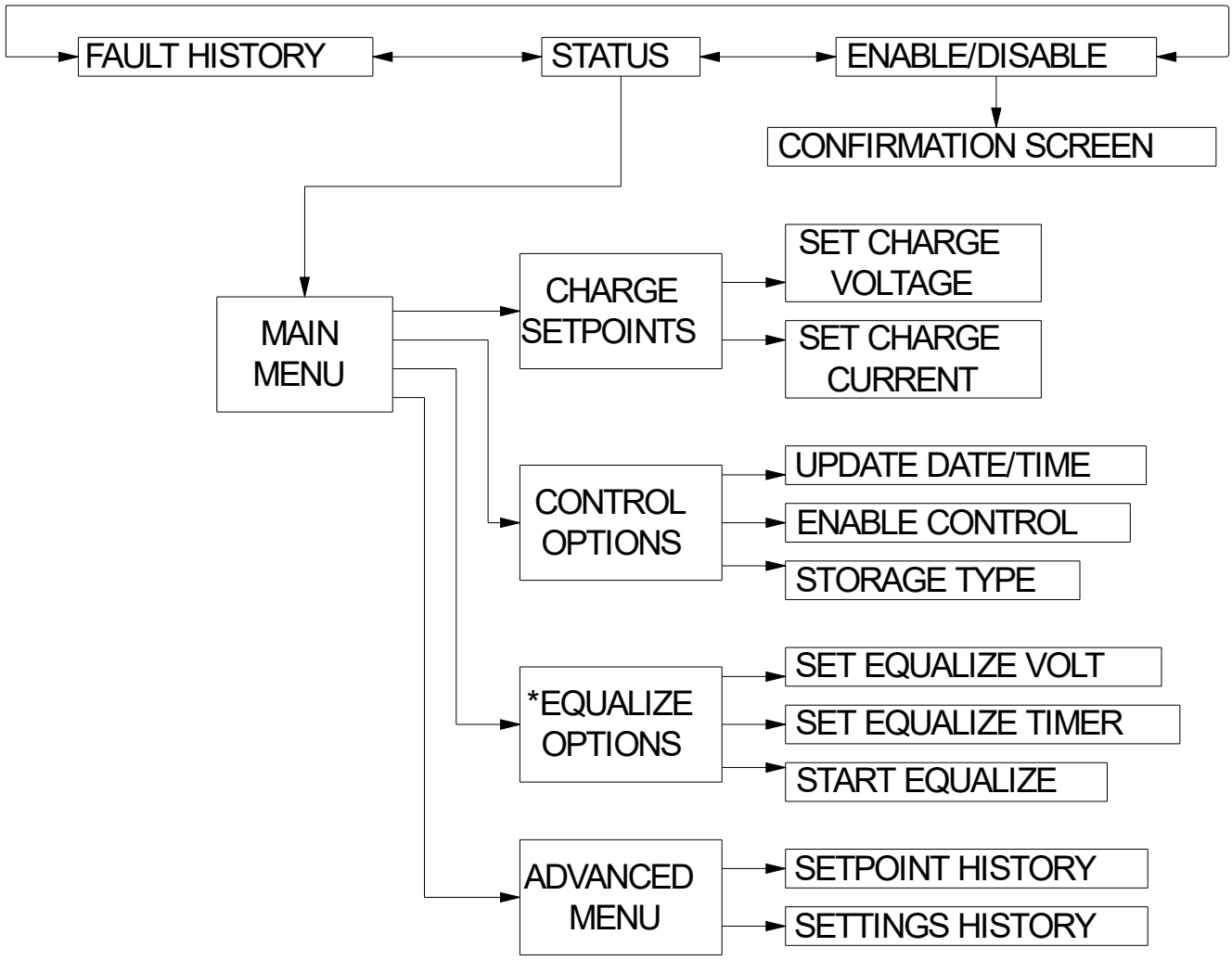
The function of each button depends on the active screen. For menu screens, *Enter* selects a menu option, while *Cancel* moves back to the previous screen. *Up* and *Down* move the menu curser. On screens where numbers are input by the user, the *Left* and *Right* buttons move the cursor, while the *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.

Figure 4-2 Front Panel Display

4.4. SCREENS & MENU NAVIGATION

Many screens are menus allowing access to other screens, or lists presenting several options. The presently selected item on the menu is indicated by a '>' character.

Figure 4-3: 5628 Display Menu Tree



*EQUALIZE OPTIONS IS ONLY VISIBLE WHEN STORAGE TYPE IS SET TO BATTERY

4.4.1. STATUS SCREEN

Upon unit startup, the unit will show the STATUS SCREEN. The top line of the STATUS SCREEN shows the units status. This will be either Standby, Precharge, Charging, Equalize, or Faulted. The next line down will show the charging voltage, and the line under that will show the charging current in amps. If the unit is in a faulted state, the red LED will turn on, and the STATUS SCREEN will display the current faults in place of the charging voltage and current.

Left: FAULT HISTORY SCREEN

Right: ENABLE/DISABLE SCREEN

Enter: MAIN MENU

4.4.2. FAULT HISTORY

Pressing the *Left* key while on the STATUS SCREEN will show the FAULT HISTORY SCREEN. Pressing the *Up* or *Down* keys will scroll through the fault history. The first line shows the fault record number, then under that is the date/time of the fault, and below that, it will list the faults that occurred at that time.

Up: Show next fault

Down: Show previous fault

Left: ENABLE/DISABLE SCREEN

Right: STATUS SCREEN

Cancel: STATUS SCREEN

Table 4-1 Fault Abbreviations

Abbreviation	Fault
OV	Overvoltage
OT	Over-temperature
OC	Over-current
In_UV	Input undervoltage
HB_OC	H-Bridge Over-current
Comm	Communications Error

4.4.3. ENABLE/DISABLE

Pressing the *Right* key while on the STATUS SCREEN will show the ENABLE/DISABLE SCREEN. When the unit has the enable control set to display, this screen will allow the user to enable the unit or disable the unit by pressing the *Enter* key. Once the *Enter* key is pressed, a confirmation screen will be displayed. Pressing *enter* again will confirm your selection and return you to the STATUS SCREEN, pressing *Cancel* will cancel your selection and return you to the STATUS SCREEN. If the unit is set for Hardwire control, a warning message will be displayed and both the *Enter* and *Cancel* buttons will return you to the STATUS SCREEN with no other action.

Left: FAULT HISTORY SCREEN

Right: ENABLE/DISABLE SCREEN

Enter: Enable/Disable unit

Cancel: STATUS SCREEN

4.4.3.1. MAIN MENU

From this screen, the user may select CHARGE SETPOINT, CONTROL OPTIONS, EQUALIZE OPTIONS (only when battery is set as the storage type), and ADVANCED MENU.
Up/Down: Move cursor
Enter: Make selection
Cancel: STATUS SCREEN

4.4.3.1.1. CHARGE SETPOINTS

From this screen, the user may set the charge voltage, and the charge current
Up/Down: Move cursor
Enter: Make selection
Cancel: MAIN MENU

4.4.3.1.1.1. SET CHARGE VOLTAGE

This screen allows the user to set the voltage that the batteries will be charged to. Maximum voltages are show in table 4-3.
Left/Right: Move cursor
Up/Down: Set value
Enter: Save value, return to CHARGE SETPOINTS MENU
Cancel: Cancel changes, return to CHARGE SETPOINTS MENU

DANGER!

- ***IMPROPER SETTING OF THE CHARGE VOLTAGE FOR BATTERIES CAN CAUSE OVERCHARGING, OVERHEATING AND/OR HYDROGEN GAS PRODUCTION AND RELEASE. THIS CAN LEAD TO BATTERY DAMAGE, EXPLOSIONS, PROPERTY DAMAGE AND DEATH. FOLLOW BATTERY BANK RECOMMENDATIONS FOR PER CELL FULL VOLTAGES AND PROCEDURES.***
- ***IMPROPER SETTING OF THE CHARGE VOLTAGE FOR CAPACITORS CAN CAUSE OVERCHARGING AND RESULT IN INTERNAL BREAKDOWN AND DAMAGE TO CAPACITOR BANKS. THIS CAN LEAD TO CAPACITOR DAMAGE, CATASTROPHIC FAILURE, PROPERTY DAMAGE AND DEATH. FOLLOW CAPACITOR BANK RECOMMENDATIONS FOR MAXIMUM ALLOWABLE CHARGING VOLTAGE.***

CAUTION!

- ***CHECK STORAGE BANK MANUFACTURER'S RECOMMENDATIONS BEFORE APPLYING POWER.***
- ***THE CHARGE VOLTAGE SETTING SHOULD BE VERIFIED BEFORE CONNECTING TO ANY ENERGY STORAGE BANK.***
- ***THE CHARGE VOLTAGE SETTING CANNOT BE SET ABOVE THE RECTIFIED INPUT OF THE M5628.***

Table 4-2 Maximum Charge Voltages

AC Line Voltage	Maximum Charge Voltage
230-240 VAC	300 VDC
380-415 VAC	500 VDC
460-480 VAC	600 VDC

4.4.3.1.1.2. SET CHARGE CURRENT

This screen allows the user to set the maximum current that the unit will supply when charging.
Left/Right: Move cursor
Up/Down: Set value
Enter: Set value, return to CHARGE SETPOINTS menu
Cancel: Cancel changes, return to CHARGE SETPOINTS menu

IMPROPER SETTING OF THE CHARGE CURRENT CAN CAUSE OVERHEATING IN BATTERIES, RESULTING IN DECREASED BATTERY LIFE. FOLLOW BATTERY BANK RECOMMENDATIONS FOR CHARGE CURRENT SPECIFICATIONS.

- ***CHECK STORAGE BANK MANUFACTURER'S RECOMMENDATIONS BEFORE APPLYING POWER.***
- ***THE CHARGE CURRENT SETTING SHOULD BE VERIFIED BEFORE CONNECTING TO ANY ENERGY STORAGE BANK.***

4.4.3.1.2. CONTROL OPTIONS

From this screen, the user may set the current date and time, choose the method that is used to enable the unit, and select what type of storage medium is used.
Up/Down: Move cursor
Enter: Make selection
Cancel: MAIN MENU

4.4.3.1.2.1. UPDATE DATE/TIME

This screen allows the user to set the current date and time. The time is set using a 24-hour format. (e.g. 1pm = 13, 2pm = 14, etc.)
Left/Right: Move cursor
Up/Down: Set value
Enter: Save value, return to CONTROL OPTIONS MENU
Cancel: Cancel changes, return to CONTROL OPTIONS MENU

4.4.3.1.2.2. ENABLE CONTROL

This screen allows the user to set how the unit is enabled. In Hardwire mode, the unit is enabled by supplying 24VDC to the inputs on TS2-2. In Display mode, the unit is enabled from the ENABLE/DISABLE SCREEN.

Left/Right: Move cursor
Enter: Save value, return to CONTROL OPTIONS MENU
Cancel: Cancel changes, return to CONTROL OPTIONS MENU

4.4.3.1.2.3. STORAGE TYPE

This screen allows the user to select the storage medium that is being used. The two types that can be selected are capacitor and battery. When capacitor is selected, the equalize functions of the unit are disabled and will be hidden.
Left/Right: Move cursor
Enter: Save value, return to CONTROL OPTIONS MENU
Cancel: Cancel changes, return to CONTROL OPTIONS MENU

4.4.3.1.3. EQUALIZE OPTIONS

From this screen the user can set the equalize voltage level and the equalize timer, as well as start an equalize cycle when the unit is set to display control under the ENABLE CONTROL SCREEN. This menu will be hidden when the storage type is set to Capacitor under the CONTROL OPTIONS MENU.
Up/Down: Move cursor
Enter: Make selection
Cancel: MAIN MENU

4.4.3.1.3.1. SET EQUALIZE VOLT

This screen allows the user to set the equalize voltage. The equalize voltage can be set to any voltage between the set charge voltage and the maximum charge voltage allowed by the incoming AC line.
Left/Right: Move cursor
Up/Down: Set value
Enter: Set value, return to EQUALIZE OPTIONS menu
Cancel: Cancel changes, return to EQUALIZE OPTIONS menu

DANGER!

IMPROPER SETTING OF THE EQUALIZE VOLTAGE SETTING CAN CAUSE OVERCHARGING, OVERHEATING AND/OR HYDROGEN GAS PRODUCTION AND RELEASE. THIS CAN LEAD TO BATTERY DAMAGE, EXPLOSIONS, PROPERTY DAMAGE AND DEATH. FOLLOW BATTERY BANK RECOMMENDATIONS FOR PER CELL FULL VOLTAGES AND PROCEDURES.

4.4.3.1.3.2. SET EQUALIZE TIMER

This screen allows the user to set the length of time that an equalize cycle will run when started from the display.
Left/Right: Move cursor
Up/Down: Set value
Enter: Save value, return to EQUALIZE OPTIONS MENU
Cancel: Cancel changes, return to EQUALIZE OPTIONS MENU

4.4.3.1.3.3. START EQUALIZE

From this screen the user can start an equalize cycle when the unit is set to Display mode and enabled. Once START EQUALIZE is selected, a confirmation screen is shown that shows the equalize voltage and time that the cycle will run for. If the user attempts to start an equalize cycle when the unit is disabled, or in Hardware mode for the enable, a warning message is displayed that says, “Unit must be DISPLAY ENABLED to do timed equalize”.
Enter: Start equalize cycle
Cancel: Return to EQUALIZE OPTIONS MENU

4.4.3.1.4. ADVANCED MENU

From this menu the user can access a history of setpoint and settings changes.
Up/Down: Move cursor
Enter: Make selection
Cancel: MAIN MENU

4.4.3.1.4.1. SETPOINT HISTORY

This menu shows the user a history of changes to the units setpoints. The settings include charger voltage, charge current, equalize voltage, and equalize time. The entries are sorted by date and time.
Up: Show next entree
Down: Show previous entree
Cancel: ADVANCED MENU

4.4.3.1.4.2. SETTINGS HISTORY

This menu shows the user a history of changes to the units control setting and storage setting. The entries are sorted by date and time.
Up: Show next entree
Down: Show previous entree
Cancel: ADVANCED MENU

5. START-UP PROCEDURES, MAINTENANCE, & TROUBLESHOOTING

5.1. START-UP PROCEDURE FOR USE WITH BATTERIES O CAPACITORS

1. Verify proper wiring and ensure the disconnect or contactor between the M5628 and battery bank is open.
2. Power on the M5628.
3. Ensure that the charge voltage and current are appropriate for the battery bank being used. See Section 4.4 and adjust if necessary.
4. Close the disconnect or contactor between the M5628 and battery bank.
5. Enable the M5628. It will begin to supply current to the battery bank. The amount of current depends on the charge level of the battery bank. The charge current will be shown on the front panel display. The Power and Charge lights will be on.
6. Record the voltage and current settings in Section 5.3.

CAUTION!

- ***ENSURE STORAGE BUS IS CONNECTED AND ALL DISCONNECTS ARE CLOSED BEFORE ENABLING THE 5628.***
- ***FAILURE TO HEED THIS WARNING COULD RESULT IN DAMAGE TO THE SYSTEM!***

CAUTION!

ENSURE STORAGE BUS IS CONNECTED AND ALL DISCONNECTS ARE CLOSED BEFORE ENABLING THE 5628.

FAILURE TO HEED THIS WARNING COULD RESULT IN DAMAGE TO THE SYSTEM!

5.2. MAINTENANCE

The M5628 is designed to require no maintenance. However, every M5628 charger module should be tested during initial start up to verify the Full Charge Voltage, Equalize Voltage, and Current Limit settings. These settings should be noted for future reference.

Full Charge Voltage: _____

Equalize Voltage: _____

Current Limit: _____

5.3. TROUBLESHOOTING

Table -1: Troubleshooting Guide

SYMPTOM	ACTION
No Panel Indicators Lit	• Check incoming voltage. • If no voltage, check input fuses within the charger. • If the incoming fuses are blown, contact Bonitron for assistance before replacing fuses. This can be an indication of further damage to the charger. • Check 24V power supply at TS2-1 and TS2-3. If there is no voltage, contact Bonitron for further assistance.
Fuses blow at power up	• Check for proper size & type fuses. • Make sure the voltage differential between the output of the charger and the battery bank is below 50V before connecting the charger to the storage bank.
Storage bank does not charge at all	• Verify Charger is powered ON • Verify Voltage and Current Setpoints are properly set • Verify Charger is properly Enabled and the preferred enable method is selected in Control Options
Storage Bank will not reach full voltage	• Verify Voltage and Current Setpoints are properly set • Measure input voltage and ensure it falls within the recommended range (Table 4-2)
Unit will not Equalize	• Ensure unit is Enabled and in Charge mode prior to attempting Equalize Operation • Verify Equalize Voltage Setpoint is set to a higher value than Charge Setpoint • Verify proper Equalize command is being used, as determined by the enable Control option
Equalize operation not maintaining for set duration	• The Timed Equalize operation is only available when unit is set to *Display* in the Control Options
Overtemp condition	• This indicates that the charger is above 150°F (65°C). • Make sure the fan is operating and airflow is unrestricted. • Make sure the ambient temperature is below 100°F (40°C).
Voltage fluctuates during open circuit test	Connect 150kΩ resistive load to DC output to stabilize.

CAUTION!

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.

5.4. TECHNICAL HELP – BEFORE YOU CALL

If possible, please have the following information when calling for technical help:

- Exact model number of affected units
- Serial number of unit
- Name and model number of attached drives
- Name of original equipment supplier
- Brief description of the application
- The AC line to line voltage on all 3 phases
- The DC bus voltage
- KVA rating of power source
- Source configuration Wye/Delta and grounding

This information will help us support you much more quickly. Please contact us at (615) 244-2825 or through www.bonitron.com

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6. ENGINEERING DATA

6.1. RATINGS

Table 6-1: M5628 Ratings

MODEL	AC INPUT VOLTAGE RANGE		OUTPUT VOLTAGE SETPOINT	CURRENT SETPOINT		SCCR RATING
	MIN VAC	MAX VAC	MAX VDC	RANGE AMPS	CONTINUOUS AMPS	
M5628-H020	208	506	600	1-20	20	10kA**
M5628-H005	208	506	600	0.0-5.0*	5	10kA**

*In 1/10th amp increments.

**Suitable for use on a circuit capable of delivering not more than 10,000 RMS symmetrical amperes, 480 volts maximum when protected by recommended fuses.

Table 6-2: Battery Bank Typical Values

Not to replace manufacturer's recommendations.

SYSTEM VOLTAGE	NUMBER OF BATTERIES IN STRING	MINIMUM BATTERY VOLTAGE (IUV LEVEL)	NOMINAL BATTERY VOLTAGE	FULL / FLOAT BATTERY VOLTAGE	EQUALIZE BATTERY VOLTAGE
230 - 240VAC	20	200VDC	240VDC	270VDC	277VDC
380 - 415VAC	36	360VDC	432VDC	486VDC	498VDC
460 - 480VAC	40	400VDC	480VDC	540VDC	554VDC
575 - 600VAC	50	500VDC	600VDC	675VDC	692VDC

6.2. EFFICIENCY / POWER CONSUMPTION

Table 6-3: M5628 Watt Loss Chart

MODEL	STANDBY OPERATION	CHARGING
20 Amp	20W	600W maximum
5 Amp	25W	150W maximum

6.3. BRANCH CIRCUIT PROTECTION AND WIRE SIZING

The following information is supplied for assistance in selecting the appropriate field wiring sizes and power source fuse ratings for the M5628:

- Wire size must be coordinated with circuit protection devices and IR drop of wire.
- For branch circuit protection, steady state Class J Time Delay or equivalent fusing should be used. The recommended minimum current rating for the power source fusing is listed in Table 6-4, based on the model type of the M5628.
- The field wiring sizes listed in Table 6-4 ensure a ≤10V drop for wire lengths of ≤100 feet and are compatible with the recommended steady state circuit branch protection fusing listed. The wire gauge selected for field wiring to the M5628 should be equal to or greater than that listed in Table 6-4.
- Use copper wiring rated 75°C or equivalent for field wiring terminals.

Table 6-4: M5628 Power Wiring Sizes and Fusing

MODEL TYPE	MINIMUM CIRCUIT BRANCH PROTECTION FUSING	RECOMMENDED FIELD WIRING SIZES
20A AC Input	A60Q25-2	10AWG
20A DC Output	FWP-25A14F	10AWG
5A AC Input	A60Q8-2	14AWG
5A DC Output	A60Q8-2	14AWG

6.4. DIMENSIONS AND MECHANICAL DRAWINGS

Figure 6-1: A6 Chassis Dimensional Outline

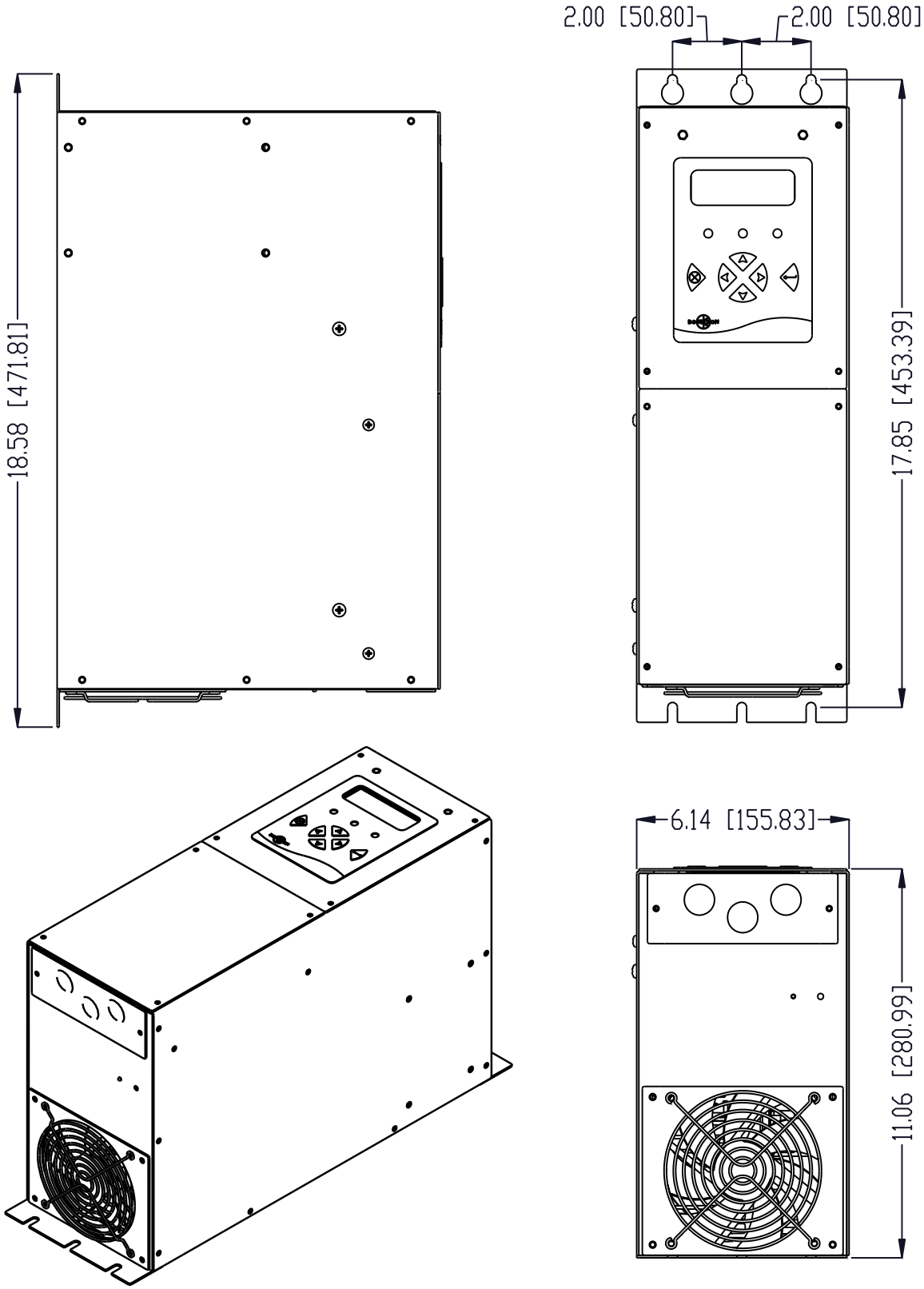


Figure 6-2: A6R Chassis Dimensional Outline

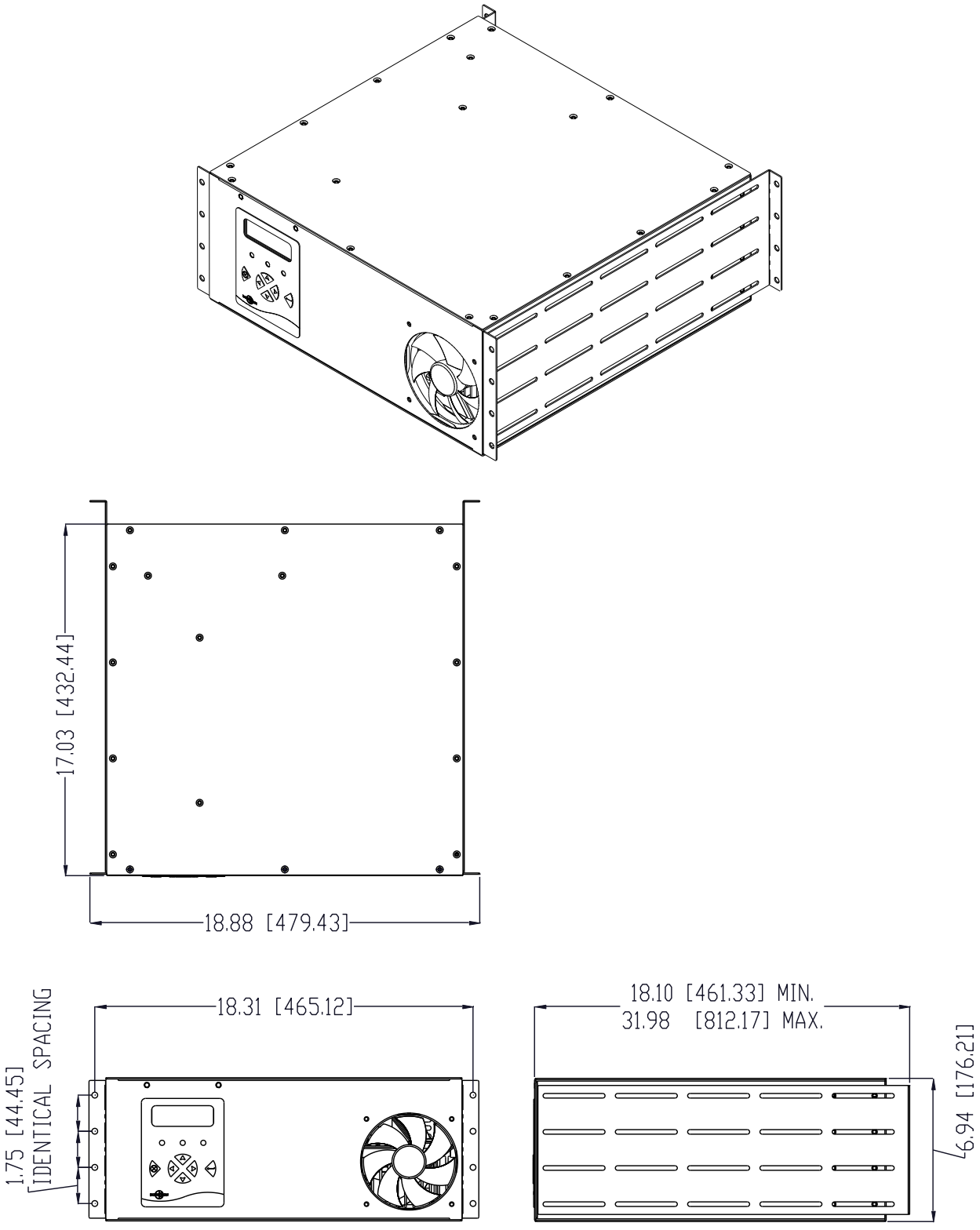


Figure 6-3: C5 Chassis Dimensional Outline

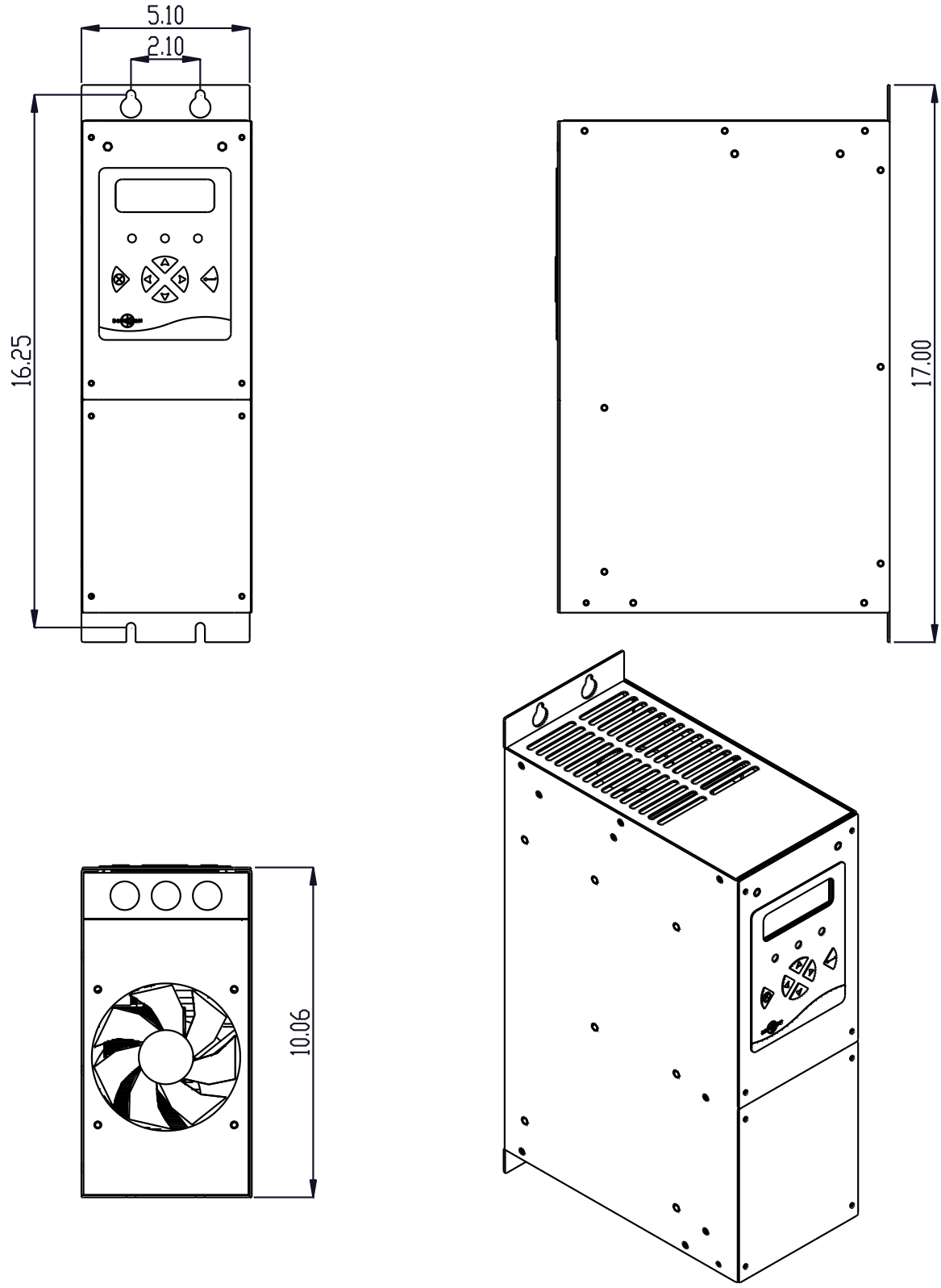
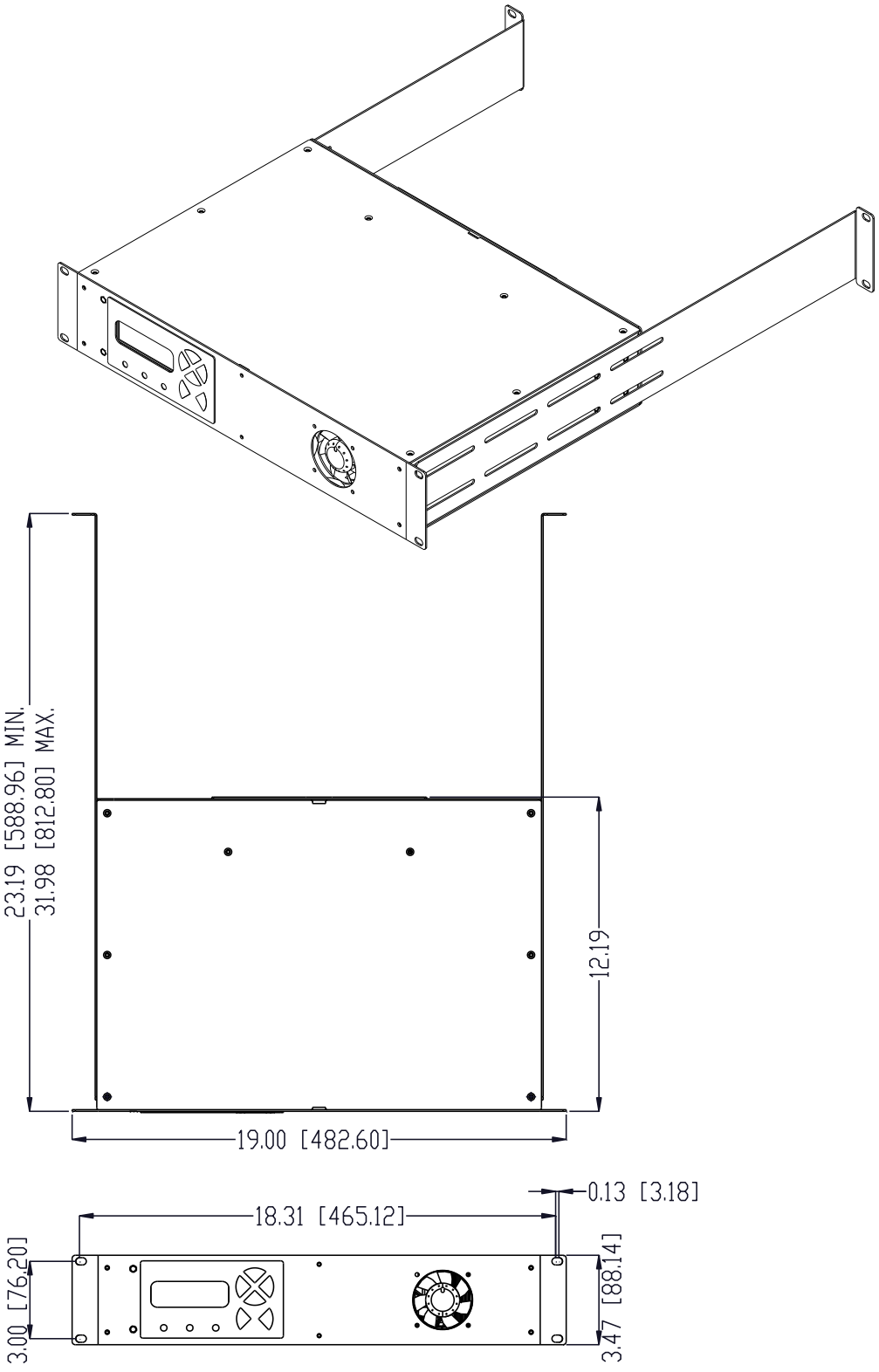


Figure 6-4: 2U Chassis Dimensional Outline



7. APPENDICES

7.1. APPLICATION NOTES

7.1.1. BULK OR FAST CHARGING BATTERY BANKS

Bulk charging a battery is a method used to get the full charge into the battery as fast as possible. In this mode, the Equalize voltage is used to set the target voltage higher than normal. This allows the battery bank to slightly overcharge, which allows the battery bank to come to full charge more quickly.

This can be a dangerous practice, however, as batteries can overheat and/or release explosive hydrogen gas, permanently damaging the battery bank.

If this method is used, it is critical that there be an external supervisory system or PLC that monitors the battery temperature and voltage to stop the battery charging if there is an issue to ensure that the battery bank is not damaged.

Please consult the battery manufacturer's instructions regarding this practice.

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NOTES

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