Model M3528M2

Voltage Monitor 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.

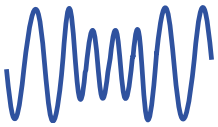
The Bonitron engineering team has the background and expertise necessary to design, develop, and manufacture the quality industrial electronic systems demanded in today's market. A strong academic background supported by continuing education is complemented by many years of hands-on field experience.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

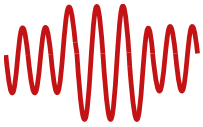
In 1975, Bonitron began working with AC inverter drive specialists at synthetic fiber plants to develop speed control systems that could be interfaced with their plant process computers. Ever since, Bonitron has developed AC drive options that solve application issues associated with modern AC variable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

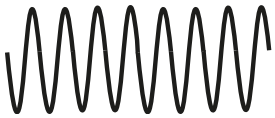
Braking Transistors
Braking Resistors
Transistor/Resistor Combo
Line Regeneration
Dynamic Braking for Servo Drives

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 is intended for use by anyone who is responsible for integrating, installing, maintaining, troubleshooting, or using this equipment with any DC energy storage system.

Please keep this manual for future reference.

1.2. PURPOSE AND SCOPE

This manual is a user's guide for the Model M3528M2 Voltage Monitor Module. It will provide the user with the necessary information to successfully install, integrate, and use the M3528M2.

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

1.3. MANUAL VERSION AND CHANGE RECORD

CE requirements for the M3528M2 are met in Rev 01.

Wiring Specs were corrected and terminology was clarified in Rev 01a.

The manual template was updated in Rev 01b.

Figure 1-1: Model M3528M2

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

The need for DC voltage monitoring arises in applications where a system voltage may otherwise rise or fall to an unsafe value. If a battery discharges too far, individual cells may change polarity, causing permanent damage to the battery and reducing its lifetime. Batteries, capacitors, and any other system can be damaged by the voltage across them rising too high. The M3528M2 voltage monitor is designed to monitor DC voltage levels and signal the user if the voltage departs a set range.

2.1. RELATED PRODUCTS

This product is designed for use with any DC energy storage system, including super capacitors and battery systems, such as the M3534 and M3460 Ride Thru Systems. Contact your distributor for more information.

2.2. PART NUMBER BREAKDOWN

BASE MODEL NUMBER

The Base Model Number, M3528, indicates that the unit is related to charger modules. 'M' specifies a monitor board, and '2' specifies this particular unit.

There are no special options at this time.

2.3. GENERAL SPECIFICATIONS

Table 2-1: General Specifications Chart

PARAMETER	SPECIFICATION
Power	24VDC ± 10%, 30 mA
Monitor Voltages	10-100VDC, 50-500VDC, 100-850VDC
Latch Reset Control Voltage	24VDC
Outputs	Overvoltage & undervoltage : Form C Solid State Relay, 250V, 100mA, 35 Ω
Storage Temp	-20ºC to +65ºC
Ambient Operating Temp Range	5°C to 40°C
Humidity	80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C
Atmosphere	For indoor use only and free of corrosive gas and dust
Pollution Degree	2
Installation/Overvoltage Category	II
Altitude	2000 m

2.4. General Precautions and Safety Warnings

DANGER!

- HIGH VOLTAGES MAY BE PRESENT!
- **FAILURE TO HEED THESE WARNINGS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH!**

CAUTION!

- NO USER-SERVICEABLE PARTS ARE CONTAINED WITHIN THIS PRODUCT.
- INOPERABLE UNITS SHOULD BE REPLACED OR RETURNED FOR EVALUATION AND/OR REPAIR BY QUALIFIED TECHNICIANS
- BEFORE ATTEMPTING INSTALLATION OR REMOVAL OF THIS PRODUCT, BE SURE TO REVIEW DOCUMENTATION OF ALL CONNECTED DEVISES 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 Model M3528M2 Voltage Monitor Module should be accomplished following the steps outlined below. Please direct all installation and start up inquiries regarding this product to your supplier or system integrator.

3.1. ENVIRONMENT

The installation site should be dry and clean without extreme temperatures.

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. MOUNTING

The unit is mounted with a standard DIN rail clip attached to the back of the enclosure. Refer to Figure 6-1 to determine the correct mounting dimensions for your unit.

3.4. WIRING AND CUSTOMER CONNECTIONS

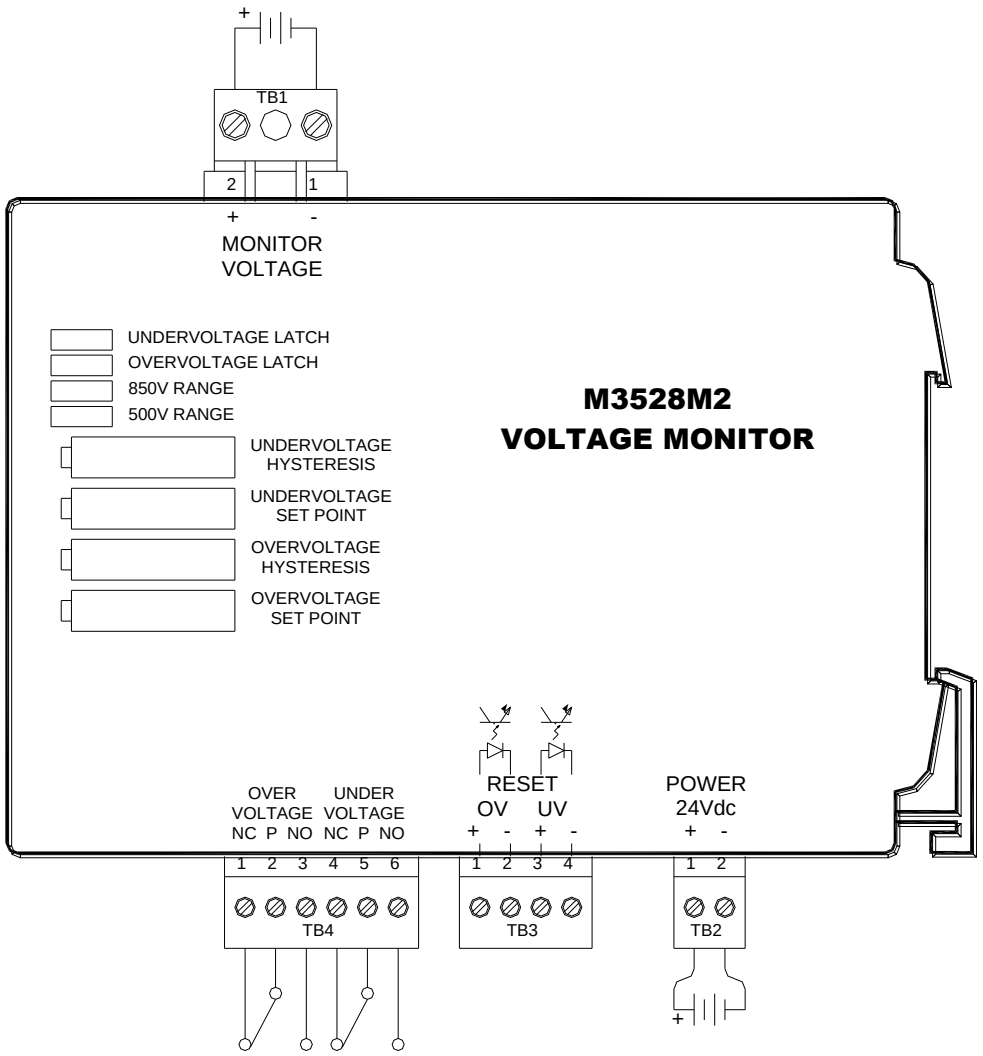
This section provides information about the field connection of the DC bus and signal inputs to the M3528M2 Voltage Monitor Module.

Be sure to review all pertinent system documentation as well as the power wiring information in Section 3.4.1 before proceeding.

For the maximum wire size accepted by the individual field connection terminals, refer to Table 3-1. Wire types and sizes should be chosen in accordance with national and local electrical codes to meet the voltage and current levels present for your application.

Figure 3-1 shows a typical interconnection of the M3528M2 with a DC voltage source and I/O signals.

Figure 3-1: Typical Interconnection Diagram



WARNING! *Only qualified electricians should perform and maintain the interconnection wiring of this product. All wiring should be done in accordance with National Electrical Code or equivalent regulations.*

3.4.1. POWER WIRING

The power connector supplies control power to the internal circuitry with power. The system must be supplied with at least 30 mA at 24VDC to guarantee correct functioning.

3.4.2. I/O WIRING

The I/O connectors connect the unit to an external voltage to be monitored, and to external signals used to indicate the state of the monitor voltage.

Table 3-1: Wiring Specifications

TERMINAL	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE
TB1-1	Monitor Input -	0-850VDC to TB1-2	18	10	4.4 lb-in
TB1-2	Monitor Input +	0-850VDC common to TB1-1	18	10	4.4 lb-in
TB2-1	Power Input +	+24VDC to TB2-2	18	16	2.2 lb-in
TB2-2	Power Input -	24VDC common to TB2-1	18	16	2.2 lb-in
TB3-1	Overvoltage Latch Reset Input +	+24VDC to TB3-2	18	16	2.2 lb-in
TB3-2	Overvoltage Latch Reset Input -	24VDC common to TB3-1	18	16	2.2 lb-in
TB3-3	Undervoltage Latch Reset Input +	+24VDC to TB3-4	18	16	2.2 lb-in
TB3-4	Undervoltage Latch Reset Input -	24VDC common to TB3-3	18	16	2.2 lb-in
TB4-1	Overvoltage Output NC	350VDC/ 120 mA max	18	16	2.2 lb-in
TB4-2	Overvoltage Output COM	350VDC/ 120 mA max	18	16	2.2 lb-in
TB4-3	Overvoltage Output NO	350VDC/ 120 mA max	18	16	2.2 lb-in
TB4-4	Undervoltage Output NC	350VDC/ 120 mA max	18	16	2.2 lb-in
TB4-5	Undervoltage Output COM	350VDC/ 120 mA max	18	16	2.2 lb-in
TB4-6	Undervoltage Output NO	350VDC/ 120 mA max	18	16	2.2 lb-in

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4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The M3528M2 Module monitors a DC voltage connected to the input terminals.

The module has two voltage setpoints, one each for the overvoltage and undervoltage, which are set by the user via potentiometers. While the monitored voltage remains within the setpoint range, both relays are energized. When the monitored voltage reaches either setpoint, that channel's output relay will de-energize, triggering whatever signaling device the user connects to it. By default, the output relay will return to its energized state when the monitor voltage returns to within the range between setpoints, accounting for hysteresis. However, the module's jumpers can be configured so that the output change will latch until a latch reset signal is received, the latch jumper is removed, or power is disconnected from the board.

4.2. FEATURES

4.2.1. CONNECTORS

4.2.1.1. TB1 – 1&2 (MONITOR)

The monitor connector accepts the input voltage which is to be monitored by the unit. The monitor connector is rated for 850VDC.

4.2.1.2. TB2 – 1&2 (POWER)

The power connector accepts 24VDC to supply power to the voltage monitor board.

4.2.1.3. TB3 – 1&2 (OVERVOLTAGE LATCH RESET)

The isolated latch reset connector accepts a 24VDC overvoltage latch reset signal. When a latch reset signal is received, any latch on the overvoltage channel is cleared.

4.2.1.4. TB3 – 3&4 (UNDERVOLTAGE LATCH RESET)

The isolated latch reset connector accepts a 24VDC undervoltage latch reset signal. When a latch reset signal is received, any latch on the undervoltage channel is cleared.

4.2.1.5. TB4 – 1-3 (OVERVOLTAGE SIGNAL OUTPUT)

The overvoltage signal output connector is connected to a form C relay. This connector can be used to establish or break an electrical connection when the monitored voltage crosses its overvoltage set point.

When the monitor voltage exceeds the overvoltage set point, the overvoltage relay de-energizes. If the overvoltage channel is not set to latch by the latch jumper, the overvoltage relay returns to its energized state when the monitor voltage drops to below the overvoltage set point minus the overvoltage hysteresis value. If the channel is set to latch, the overvoltage relay only re-energized when a latch reset signal is received, the latch jumper is removed, or power is cut to the board.

4.2.1.6. TB4 – 4-6 (UNDERVOLTAGE SIGNAL OUTPUT)

The undervoltage signal output connector is connected to a form C relay. This connector can be used to establish or break an electrical connection when the monitored voltage crosses its undervoltage set point.

When the monitor voltage falls below the undervoltage set point, the undervoltage relay de-energizes. If the undervoltage channel is not set to latch by the latch jumper, the undervoltage relay returns to its energized state when the monitor voltage rises above the undervoltage set point plus the undervoltage hysteresis value. Else, the undervoltage relay only re-energizes when a latch reset signal is received, the latch jumper is removed, or power is cut to the board.

4.2.2. JUMPERS

4.2.2.1. RANGE (850V, 500V)

Jumpers 850V and 500V control the ranges in which the setpoints for the overvoltage and undervoltage outputs can be configured. The voltage ranges for different combinations of these jumpers may be seen in Table 4-1: Setpoint Range Jumper Configurations. Please ensure that the voltages connected to the system remain within the range determined by the range jumper settings, or correct system operation is not guaranteed, and damage to the monitor board may result.

Table 4-1: Setpoint Range Jumper Configurations

MONITOR RANGE	850V	500V
100-850V	ON	-
50-500V	OFF	ON
10-100V	OFF	OFF

4.2.2.2. OUTPUT LATCHING (LATCH 1 & 2)

When the monitor voltage reaches one of the two setpoints and that channel's output switches, the new output can be set to either latch, or to return to its energized state when the monitor voltage returns to within its hysteresis range. If a channel is set to latch by having the appropriate jumper in place, once the relay switches the output will hold its new state regardless of changes in the monitor voltage. The latch can be cleared by sending a latch reset signal to the appropriate channel, removing the latch jumper, or cutting power to the board. If a channel's latch jumper is open, that output will not latch, and will instead return to its energized state when the monitor voltage returns to the set range.

4.2.3. POTENTIOMETERS

4.2.3.1. SETPOINT (SET 1 & 2)

The setpoint for each output channel is controlled by adjusting a potentiometer. The adjustment range for the setpoints is determined by the jumper settings, shown in Table 4-1.

Turn the setpoint potentiometers clockwise to increase the setpoint voltages, and counter-clockwise to decrease them. The approximate adjustment in volts-per-turn is shown in Table 4-2.

Table 4-2: Setpoint Adjustment Sensitivity

MONITOR RANGE	VOLTS PER TURN
10 – 100V	5V
50 – 500V	25V
100 – 850V	50V

4.2.3.2. HYSTERESIS (HYST 1 & 2)

If the outputs are not set for latching operation as described in sections 4.2.1.3 and 4.2.1.4, the reset voltage is set with these pots. This means that once an output changes, it resets at a different input level. This hysteresis prevents rapid switching between output states in cases that the input voltage is very close to a set point.

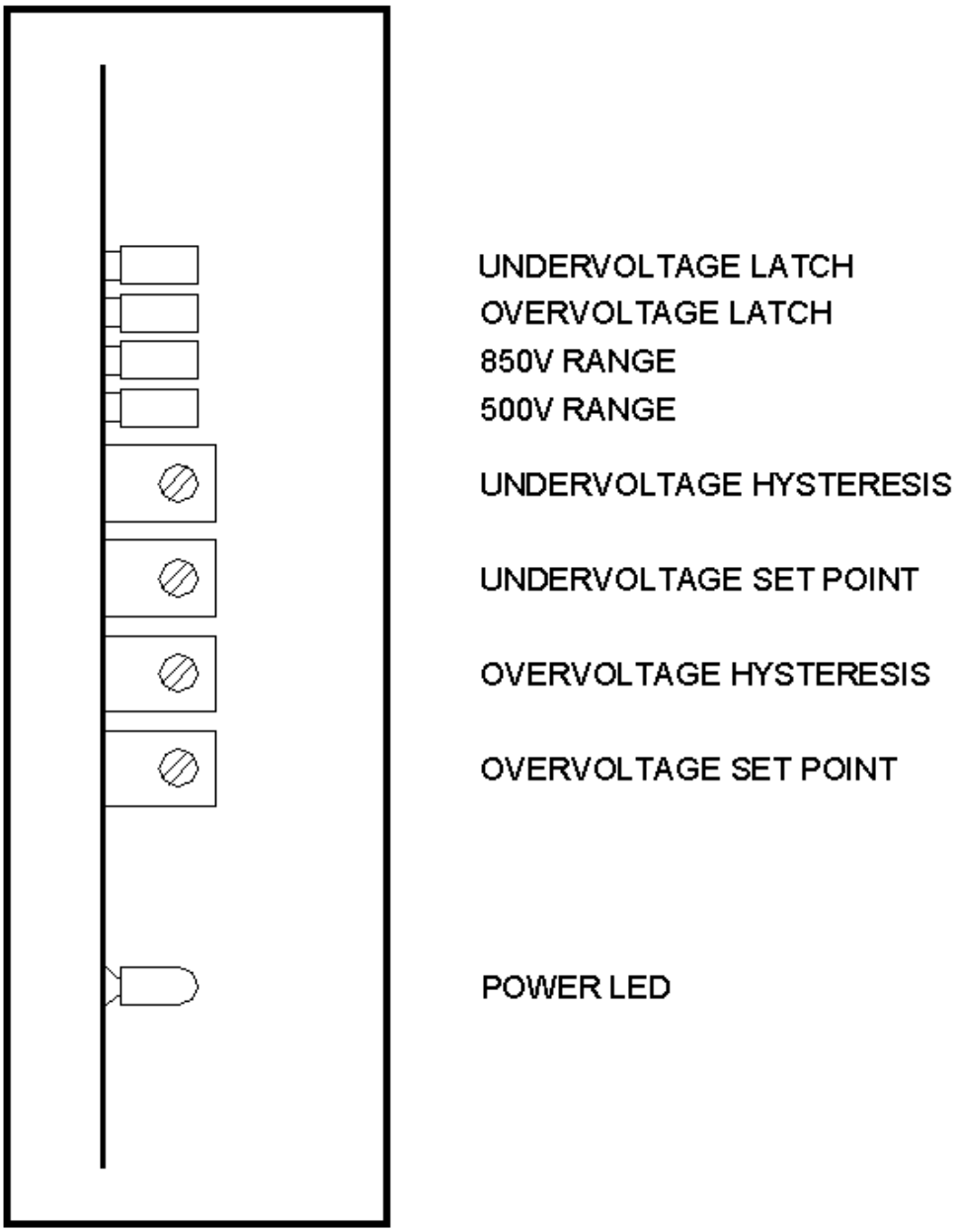
The hysteresis range for each channel is controlled by adjusting a potentiometer. The hysteresis range can be set to between 3% and 100% of the maximum setpoint range as determined by the jumper settings in Table 4-1.

Turn the hysteresis potentiometers clockwise to increase the hysteresis range, and counterclockwise to decrease it.

For overvoltage, increasing the hysteresis causes the reset point to go down. For example, if the setpoint is 100V, turning the hysteresis pot clockwise will make the reset voltage decrease from 100V to 0V.

For undervoltage, increasing the hysteresis causes the reset point to go up. For example, if the setpoint is 100V, turning the hysteresis pot clockwise will make the reset voltage increase from 100V to the maximum voltage as selected by the jumpers.

Figure 4-1: Front View



5. MAINTENANCE AND TROUBLESHOOTING

5.1. TROUBLESHOOTING

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.

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.

OUTPUT SWITCHES UPON VOLTAGE REACHING SETPOINT, BUT DOES NOT SWITCH BACK WHEN VOLTAGE RETURNS TO SET RANGE

Ensure that the output latch jumpers are open. Reduce the hysteresis value by turning the hysteresis potentiometers counter-clockwise.

OUTPUT NEVER SWITCHES

Ensure that the ranging jumpers are correctly set for the voltage being tested. Turn the appropriate setpoint potentiometer counterclockwise a full twenty turns, and then clockwise a full twenty turns, until the signal switches.

OUTPUT SWITCHES RAPIDLY

Check the monitor signal for noise. Increase the hysteresis of the switching output.

OUTPUT WILL NOT LATCH

Ensure that the latch jumpers are connected appropriately.

OUTPUT WILL NOT RESET

Ensure that the monitor voltage is below the set point. Check the wiring of the latch reset connector. Check that the voltage of the latch reset signal is 24VDC. Remove and replace the latch jumper.

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6. ENGINEERING DATA

6.1. RATINGS CHARTS

Table 6-1: M3528M2 Ratings Chart

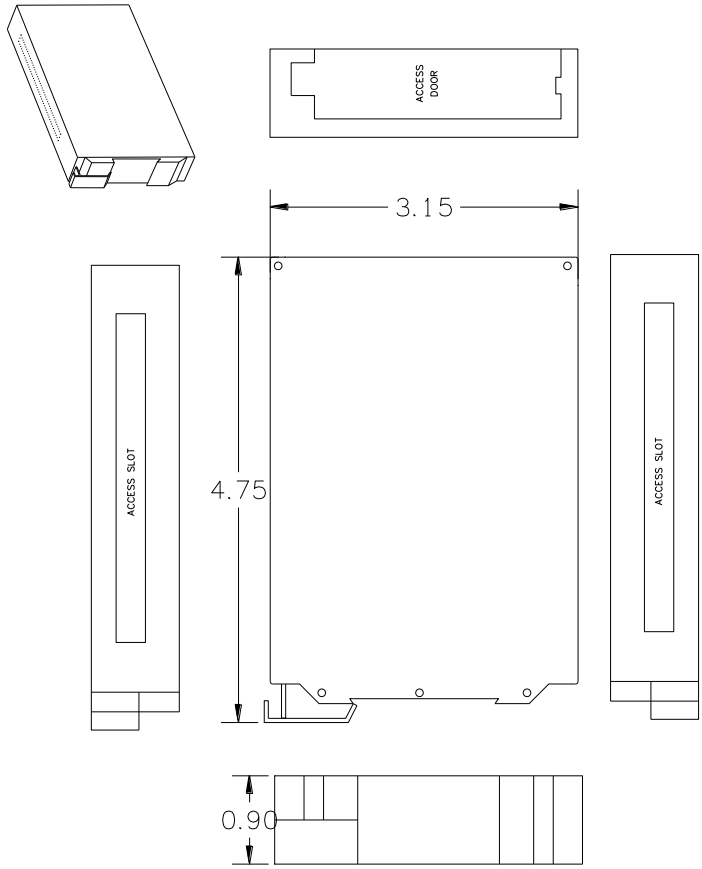
Power Supply Tolerance	24VDC +- 10%
Set Point Accuracy	+- 2VDC

Table 6-2: Recommended Settings

SYSTEM AC LINE VOLTAGE	208	230	380	400	415	460
Battery bank nominal voltage	216	240	408	420	432	480
Battery bank full charge voltage	243	270	459	473	486	540
M3528M2 Set Points						
Over-Voltage trip level (+5% over full charge)	255	284	470	484	498	553
Over-Voltage reset level (full charge)	243	270	459	473	486	540
Under-Voltage trip level (≈ 84% of nominal)	180	200	340	350	360	400
Under-Voltage reset level (nominal voltage)	216	240	408	420	432	480

6.2. DIMENSIONS AND MECHANICAL DRAWINGS

Figure 6-1: M3528M2 Chassis Dimensional Outline



NOTES

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