Model M3460RD

Impedance Module
For Sag Ride-Thru Applications without Energy Storage

Customer Reference Manual

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.

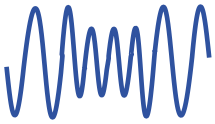
The Bonitron engineering team has the background and expertise necessary to design, develop, and manufacture the quality industrial electronic systems demanded in today's market. A strong academic background supported by continuing education is complemented by many years of hands-on field experience.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

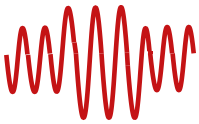
In 1975, Bonitron began working with AC inverter drive specialists at synthetic fiber plants to develop speed control systems that could be interfaced with their plant process computers. Ever since, Bonitron has developed AC drive options that solve application issues associated with modern AC variable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

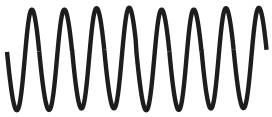
Braking Transistors
Braking Resistors
Transistor/Resistor Combo
Line Regeneration
Dynamic Braking for Servo Drives

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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Table of Contents

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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 M3460RD Impedance Module. It will provide the user with the necessary information to successfully install, integrate, and use the M3460RD module in a variable frequency AC drive system.

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 RECORD

The initial release of this manual is Rev 00a.

Figures 6-2 and 6-3 were added in Rev 00b.

Section 2 was updated in Rev 00c.

Figure 1-1: M3460RD-225

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

Bonitron's M3460RD Impedance Modules are designed to offer system integrators a low cost solution for using an M3460R Ride-Thru Module (RTM) in systems where there is an AC input directly to the M3460R module. In some installations, additional impedance in the negative DC link may be required for proper operation. The M3460RD prevents circulating currents between the variable frequency drive and the M3460R Ride Thru Module.

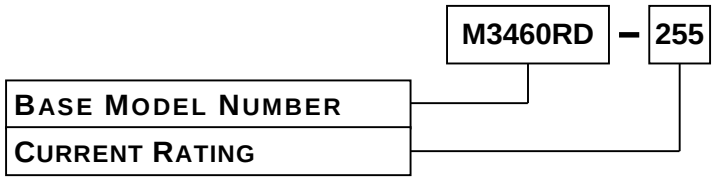
Please see the Application Notes in Section 7 for additional information.

2.1. RELATED PRODUCTS

The M3460RD modules are intended to be used with Bonitron M3460R Ride-Thru Modules.

2.2. PART NUMBER BREAKDOWN

Figure 2-1: Example of M3460RD Part Number Breakdown



BASE MODEL NUMBER

The Base Model Number for the Impedance Modules for use with M3460R Ride Thru Modules is **M3460RD**.

CURRENT RATING

The maximum current rating of the M3460R Ride Thru module is designated by this value in amperes. M3460R Ride-Thru modules rated 85A-255A should use **255**. M3460R Ride-Thru modules rated 340A-425A should use **425**.

2.3. GENERAL SPECIFICATIONS

Table 2-1: General Specifications Chart

PARAMETER	SPECIFICATION
Nominal System Voltage	208 – 480VAC
Current Ratings	255A – 425A
Maximum Run Time	4 minutes
Storage Temperature	-20ºC to +65ºC
Operating Temperature	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!**
- **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!**
- **FAILURE TO HEED THESE WARNINGS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH!**

CAUTION!

- **Certain components within this product may generate high ambient temperatures during operation.**
- **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 AC drive documentation for pertinent safety precautions.**
- **Installation and/or removal of this product should only be accomplished by a qualified electrician in accordance with National Electrical Code or equivalent regulations.**

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

3. INSTALLATION INSTRUCTIONS

3.1. PRODUCT INSPECTION

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.

3.2. SITE SELECTION

- All units require adequate protection from the elements. Open frame modules must be mounted within enclosures of suitable rating for the environment.
- Adequate clearance should be allowed for easy access to terminals. This will facilitate inspection and maintenance.
- Sufficient circulation of clean, dry air should be provided. Ambient temperatures should not exceed +40°C (+104°F) nor be less than 0°C (+32°F) and non-condensing. Ambient air should not be contaminated with harmful chemical vapors or excessive dust, dirt, or moisture.
- The unit requires a minimum clearance of three (3) inches in all directions. Avoid mounting the unit near heat sources.

3.3. MOUNTING

Once the installation site has been selected as outlined above, the unit should be mounted in place.

Mounting holes should be drilled and mounting studs or anchors installed before positioning the M3460RD Module. Once the studs or bolts are in place the module can be mounted. Be sure all mounting hardware is tightened securely.

Refer to Section 6 of this manual to determine the correct mounting dimensions and provisions for the unit.

3.4. WIRING AND CUSTOMER CONNECTIONS

Table 3-1: Field Wiring Connections

TERMINAL DESIGNATION	FUNCTION	WIRING SPECIFICATION	CONNECTION	MAX. TORQUE
Drive Bus –	DC Connection to Drive	600VAC	3/8" stud	230 lb-in
3460R Output Bus –	DC Connection to M3460R Module			

3.4.1. POWER WIRING

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.

Wire size should be selected in accordance with local codes, according to the current rating of the M3460R module.

3.4.1.1. DRIVE BUS – CONNECTION

The Drive Bus should be connected to the negative side of the DC Bus on the Drive. Connecting to the positive side of the Drive carries a high risk of damaging drive equipment if energized. Some drives have a

connection to an internal braking transistor. Do **NOT** use this connection. Connect **only** to the DC bus terminals. See the operation manual for your drive.

3.4.1.2. M3460R OUTPUT BUS – CONNECTION

The M3460R Output Bus should be connected to the negative side of the ouput bus on the M3460R module. Connecting to the positive side of the M3460R Output Bus carries a high risk of damaging drive equipment if energized.

3.5. TYPICAL CONFIGURATIONS

Figure 3-1: M3460R Typical Configuration without Energy Storage

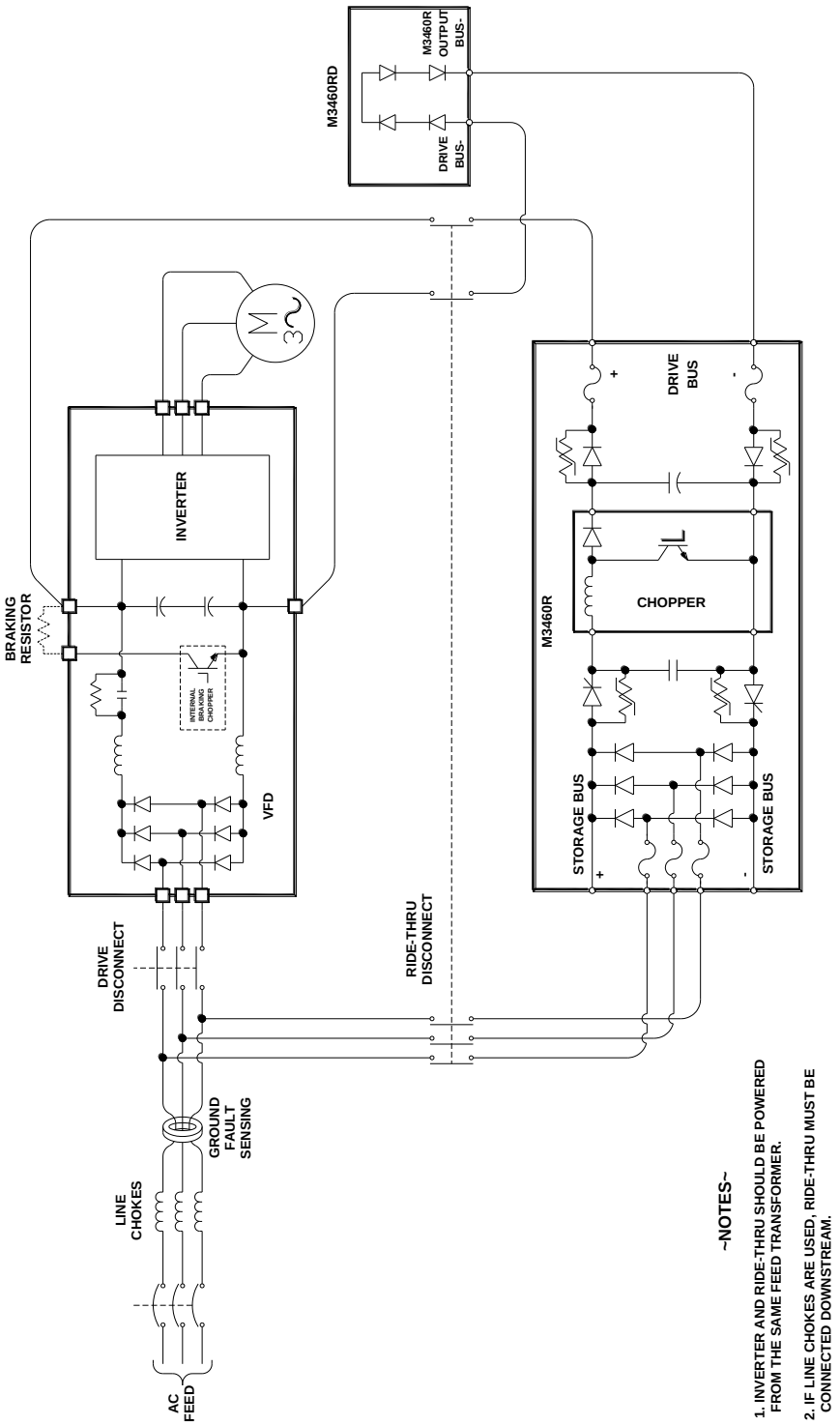
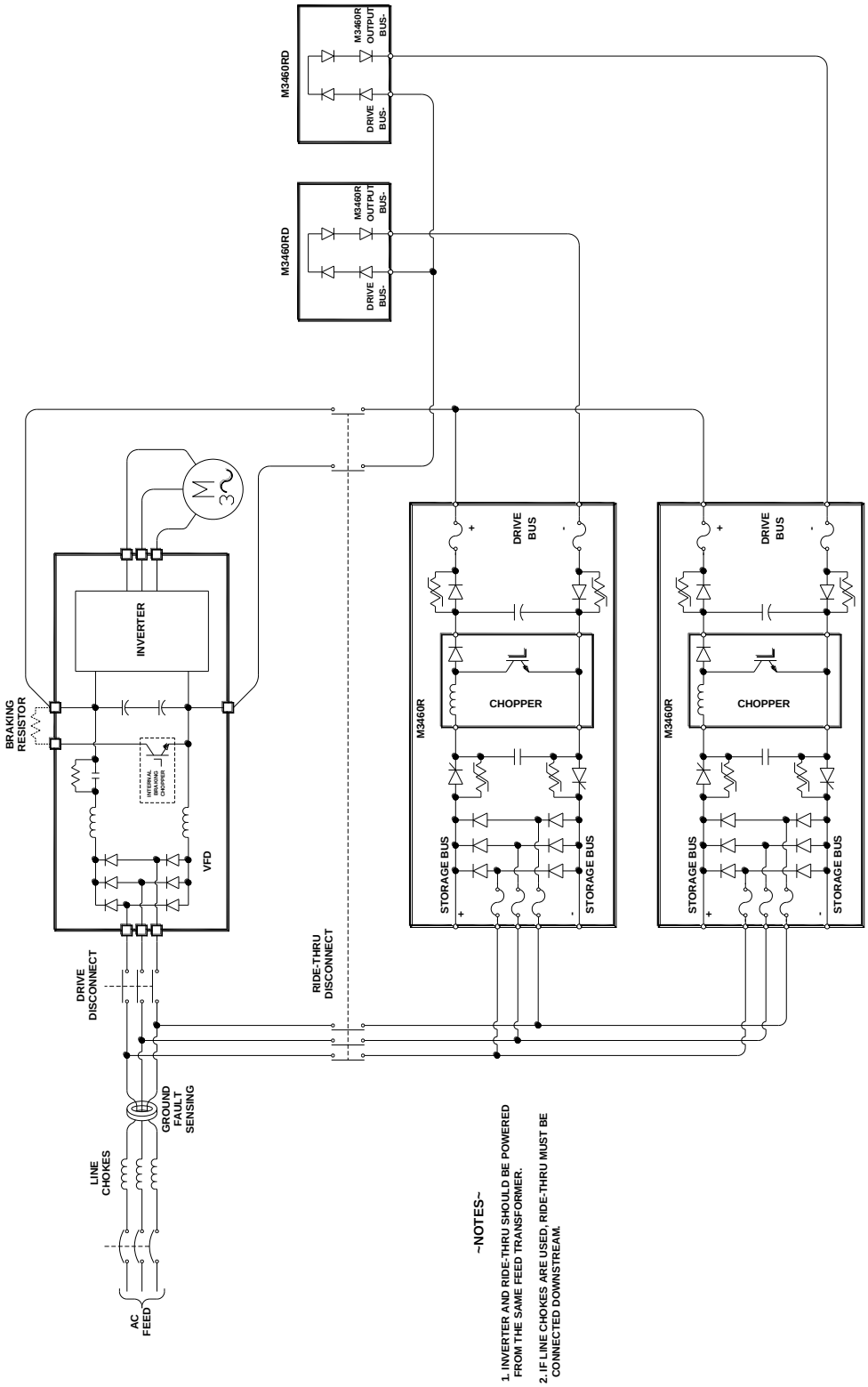


Figure 3-2: M3460RS Typical Configuration without Energy Storage



4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The Ride-Thru Impedance Module provides the necessary impedance to prevent the propagation of circulating currents between the variable frequency drive and the Ride-Thru Module. Stray circulating currents cause heating in the components of the Ride-Thru and the variable frequency drive. The addition of the Impedance Module adds a fixed voltage drop in the negative link in the connection between the boost regulator and the drive. Please see Section 7 for further details.

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5. STARTUP, MAINTENANCE AND TROUBLESHOOTING

5.1. STARTUP

5.1.1. PRE-POWER CHECKS

Ensure that all connections are tight, DC bus polarity is correct, and that the drive is connected to the proper terminals. Check for exposed conductors that may lead to inadvertent contact or shorting. Ensure that the current rating of the module is suitable for the application.

5.1.2. STARTUP PROCEDURE

Refer to the M3460 Ride Thru User Manual for the startup procedure of the Ride Thru system. This can be found online at www.bonitron.com or by contacting Bonitron.

5.2. MAINTENANCE

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.

5.3. TROUBLESHOOTING

5.3.1. RIDETHROUGH SYSTEM DOES NOT HOLD UP THE DRIVE DURING A SAG EVENT

Make sure the M3460RD is connected in the negative power return between the VFD and the M3460R.
Check the polarity of the installation of the M3460RD with respect to the M3460R and VFD. The anode side of the M3460RD shold be connected to the VFD and the cathode side should be connected to the M3460RD.

5.3.2. CIRCULATING CURRENTS BETWEEN DRIVES OR HEATSINK IN THE M3460R GETS HOT

Make sure the connections are correct between the drives and the Ride-Thru Module. The M3460RD is intended to be used only in the negative power connection between the M3460R and the VFD.

5.4. TECHNICAL HELP – BEFORE YOU CALL

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

- Serial number of unit
- Name of original equipment supplier
- Brief description of the application
- Drive and motor hp or kW
- The line to line voltage on all 3 phases
- The DC bus voltage
- KVA rating of power source
- Source configuration Wye/Delta and grounding

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6. ENGINEERING DATA

6.1. RATINGS CHARTS

Table 6-1: M3460RD Impedance Module Ratings

PART NUMBER	CURRENT RATING	WATT LOSS
M3460RD-255	255A	370
M3460RD-425	425A	450

6.2. WATT LOSS

Watt losses listed are figured at full load. Losses occur and heat is generated only when the Ride-Thru is active. Ensure that enclosure cooling is adequate based on the duty cycle of the Ride-Thru Module attached. Maximum duty cycle for the M3460RD is 1%. See Table 6-1.

6.3. DIMENSIONS AND MECHANICAL DRAWINGS

Figure 6-1: M3460RD Backplate Dimensional Outline

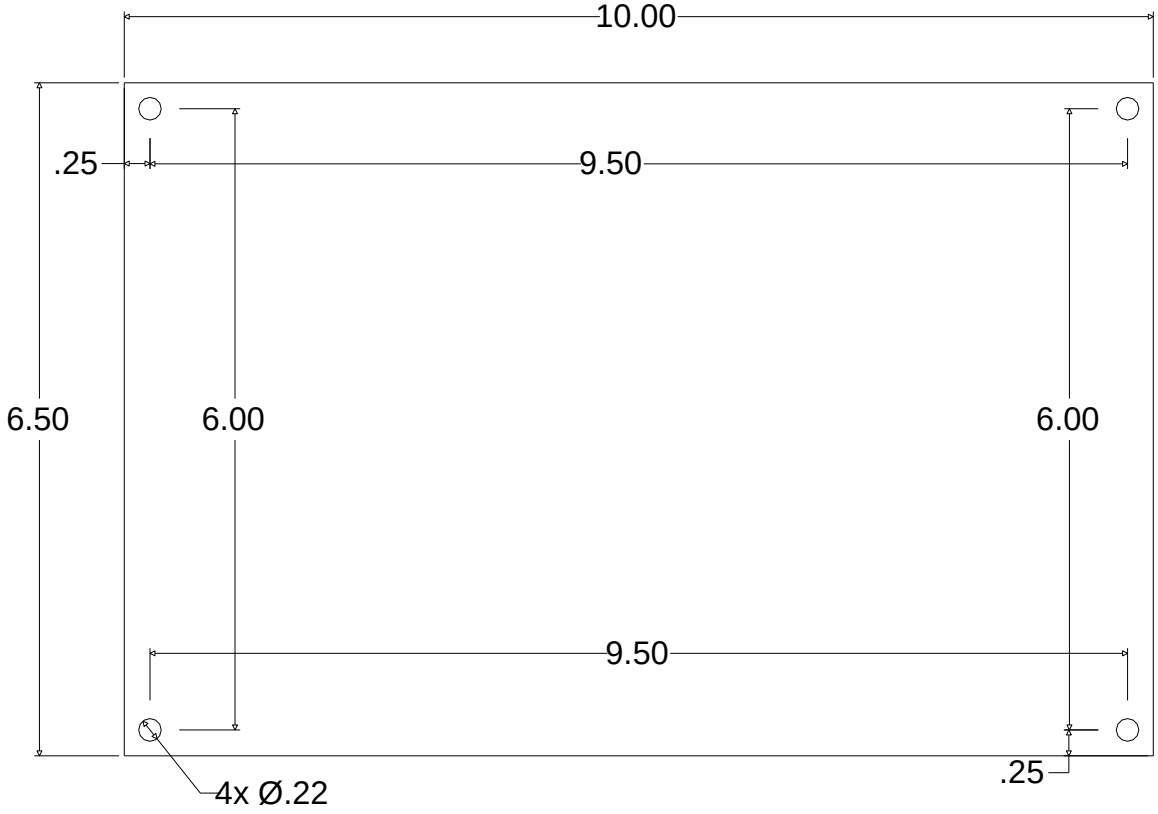


Figure 6-2: M3460RD-255 Chassis Outline

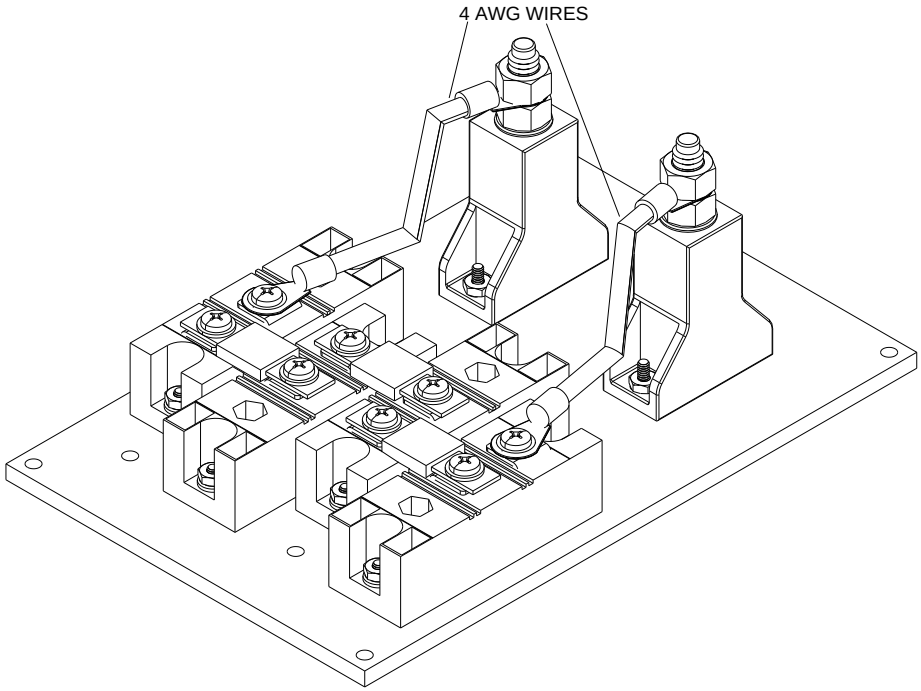
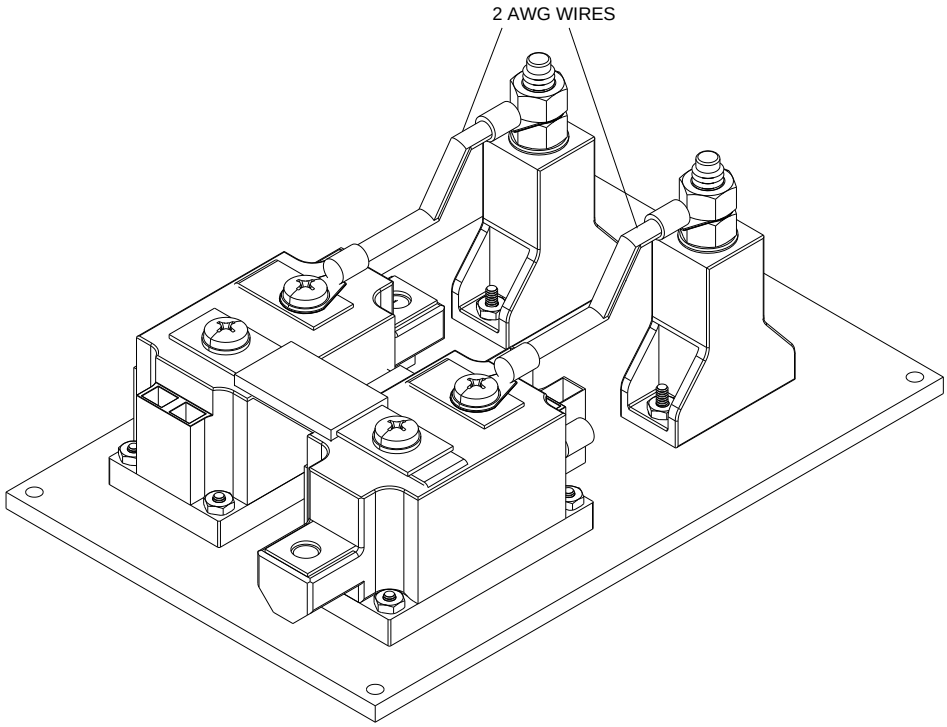


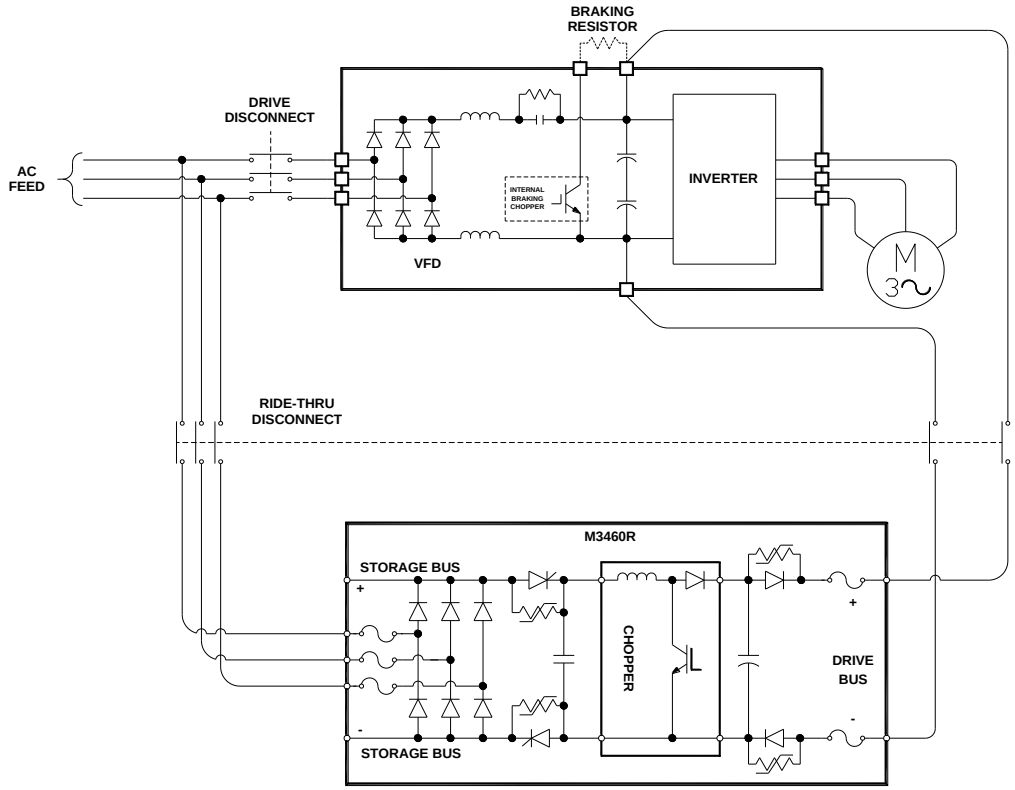
Figure 6-3: M3460RD-425 Chassis Outline



7. SAG ONLY INSTALLATIONS & CIRCULATING CURRENTS

The topology of the M3460R Voltage Boost Module incorporates a six diode full wave three phase rectifier bridge. When the M3460R is connected to the DC bus of the variable frequency drive, the input rectifier bridge of the variable frequency drive is in parallel with the M3460R input rectifier bridge. There are two diodes in parallel from the DC bus to the AC line for each connection.

Figure 7-2: M3460R Typical Configuration without Energy Storage



Since current flows through the connection with the lowest resistance, "circulation currents" may enter the DC bus of the M3460R through one bridge and return to the AC source through the VFD input bridge. This can occur through any parallel bridge arrangements if the impedances between the two do not prevent it.

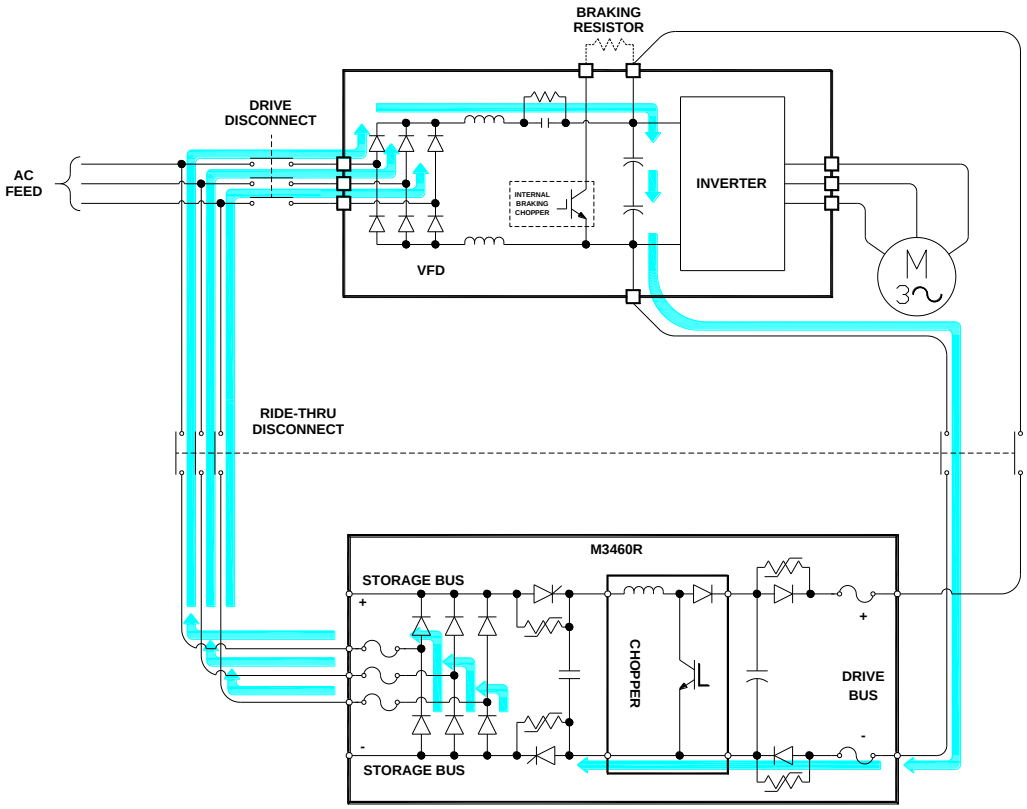
When the system is operating normally, the AC is at the nominal level and the boost converter is turned off. In this case, the VFD is powered only through the AC bridge in the VFD, as the SCR's within the M3460 are turned off.

During a sag event, the incoming AC line is lower than normal, and the M3460 begins to boost the rectified AC line power to a voltage level that keeps the drive running. When the M3460 is boosting, all of the power is provided to the drive through the M3460 bridge and boost converter, because the DC bus is held at a level higher than the peak of the sagging AC input line. Therefore, the VFD input bridge is reverse biased and turns off.

At the end of a sag event, the power flow returns normally through the VFD input bridge and the boost regulator turns off. In general, the impedance in the DC power

path through the M3460 is high enough to allow the internal SCR's to reverse bias and turn off. This is particularly true in the positive power path through the M3460R, as there are several elements that increase the impedance, such as the choke and boost diode. There are not as many elements in the negative power path, and this can allow the current to continue to flow through the negative rail of the M3460, causing the negative SCR to latch on.

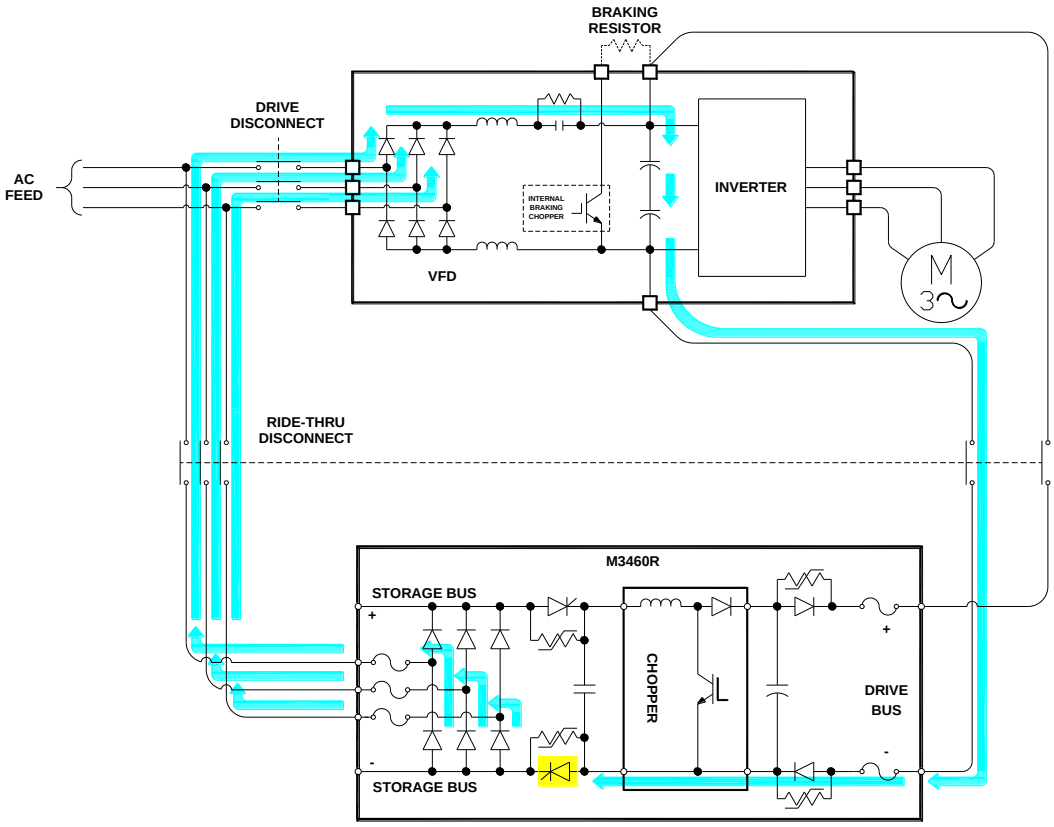
Figure 7-3: M3460R Typical Configuration with Circulating Current Flow



If the circulation current shown above in Figure 7-2 is established and remains during standby operation, the highlighted SCR/Thyristor in Figure 7-3 can remain on and overheat due to the continuous current flow. This can occur if there is low enough impedance between the AC input of the VFD and the AC input of the M3460.

If the circulating current situation is not corrected the SCR may be permanently damaged and fail.

Figure 7-3: M3460R Typical Configuration with Current Flow with affected SCR Highlighted



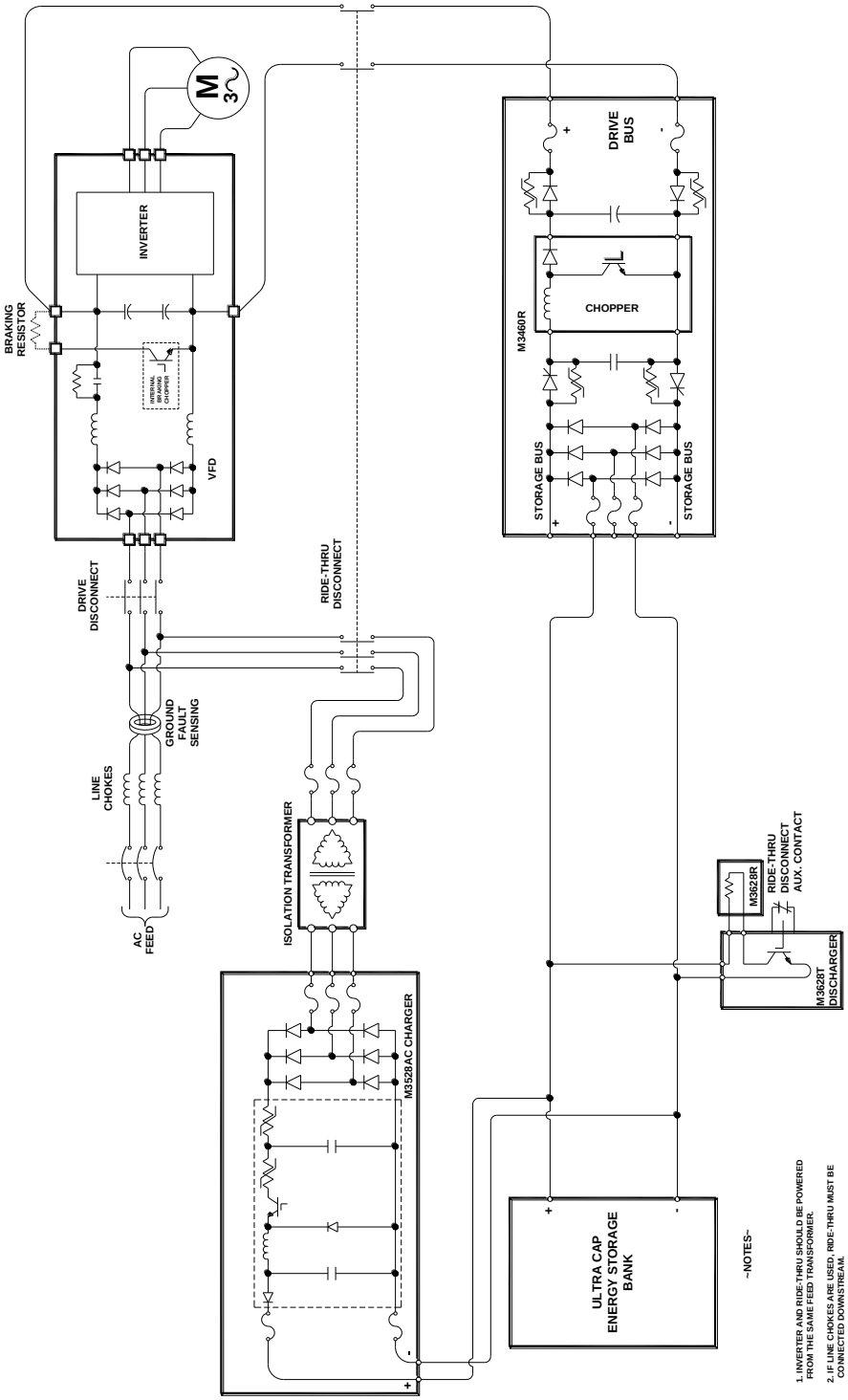
In order to prevent this situation, extra impedance should be added to the negative power connection of the ride-thru to the drive. This prevents the circulation current from being sustained after a sag event. The M3460RD unit adds roughly 5 Volts of drop between the VFD and the M3460 by adding series diodes. Since this voltage drop is not dependant on current flow, once the AC power returns to normal, the negative power flow through the M3460 drops to zero, and the SCR's turn off.

The M3460RD is not required in all installations, however determining the requirement is difficult due to the variables involved with the physical installation. Using the M3460RD does not reduce the Ride-Thru capacity for the system, and is recommended for all installations.

Please note that this situation can only occur when there is an AC connection to the input bridge of the M3460R unit. If the installation contains energy storage, such as capacitors, the two input bridges are galvanically isolated from each other by the

isolation transformer of the charging system. In this case, the M3460RD is not required. See Figure 7-4 for an example of a galvanically isolated system.

Figure 7-4: M3460R Typical Configuration with Ultracapacitor Storage Bank



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