Model
MRA B1398PS
3-Phase Power Supply

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.

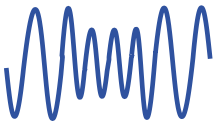
The Bonitron engineering team has the background and expertise necessary to design, develop, and manufacture the quality industrial electronic systems demanded in today's market. A strong academic background supported by continuing education is complemented by many years of hands-on field experience.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

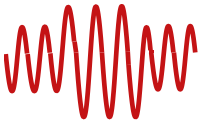
In 1975, Bonitron began working with AC inverter drive specialists at synthetic fiber plants to develop speed control systems that could be interfaced with their plant process computers. Ever since, Bonitron has developed AC drive options that solve application issues associated with modern AC variable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

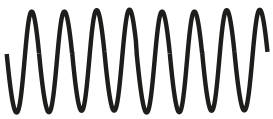
Braking Transistors
Braking Resistors
Transistor/Resistor Combo
Line Regeneration
Dynamic Braking for Servo Drives

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 AC Drive System.

Please keep this manual for future reference.

1.2. PURPOSE AND SCOPE

This manual is a user's guide for the Model MRA B1398PS 3-Phase Power Supply. It will provide you with the necessary information to successfully install and use the MRA B1398PS modules in your application.

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

1.3. MANUAL VERSION AND CHANGE RECORD

The initial release of the MRA B1398PS 3-Phase Power Supply is Rev 00a

Updates to the User I/O Connections and fuse were included in Rev 00b.

Updates to the basic formatting were made in Rev 00c.

Figure 1-1: MRA B1398PS 3-Phase Power Supply

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.
 WARNING!	WARNING: Identifies information about actions or circumstances that will probably lead to property damage, personal injury or economic loss.
 CAUTION!	CAUTION: Identifies information about practices or circumstances that can lead to property damage, or economic loss.
 CAUTION!	CAUTION: Heat or burn hazard - Identifies a statement regarding heat production or a burn hazard that should be avoided.
 ATTENTION!	ATTENTION: Helps you identify a potential hazard, avoid a hazard, and recognize the consequences.

2. PRODUCT DESCRIPTION

The MRA B1398PS is a non-regenerative 3-phase power supply intended for use among multiple servo drives and compatible motors,

2.1. GENERAL SPECIFICATIONS

Table 2-1: General Specifications Chart

PARAMETER	SPECIFICATION
Input Voltage	100-240V AC three phase
Intermittent Duty Limit	150% Full Load Rating for 60 seconds
Precharge Ramp	2 seconds
Peak Current Limit	450 ADC
Operating Temp	0°C to +55°C
Storage Temp	-20°C to +65 °C
Humidity	Below 90% Non-condensing
Atmosphere	Free of corrosive gas and conductive dust
Control I/O	Inputs: 24V+ Sinking • RUN ENABLE Outputs: 250VAC,120mA Max • STATUS "POWER ON" • NOT FAULTED
Indicators	PHASE LOSS OVERTEMP DISABLED READY

2.2. General Precautions and Safety Warnings

DANGER!

- High voltages may be present!
- Never attempt to operate or service this equipment with access doors or covers opened!
- **Failure to heed these warnings may result in serious bodily injury or death!**

CAUTION!

- High temperatures may be generated by this equipment during normal operation!
- This equipment should be installed on a non-flammable surface in a well ventilated area with a minimum of 2 inches of clearance all around.
- Lethal voltages can exist in unit after power has been removed. Allow 5 minutes for capacitor banks to discharge, and insure there are less than 40VDC on the DC bus before attempting service.
- 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.

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 Power Supply Modules should be accomplished following the steps outlined below. Be sure to refer to the AC Drive instruction manual as these steps are performed. Please direct all installation inquiries that may arise during the installation and start-up of this product to the equipment supplier or system integrator.

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 failure. Operating in a wet environment can pose a shock hazard. The recommended temperature range for operating or storing this module is 0°C 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.

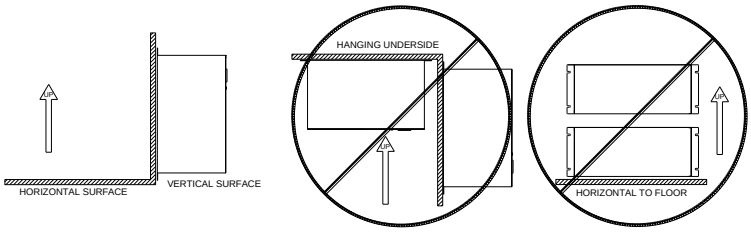
3.3. MOUNTING

3.3.1. MOUNTING THE MRA B1398PS

The installation site for the module should be chosen with several considerations in mind:

- The unit requires a minimum clearance of two (2) inches in all directions when mounted near a non-heat source.
- Unit should not be exposed to falling debris or condensation.
- The MRA B1398PS must be properly oriented for proper heat flow through the units. The MRA B1398PS must be mounted with the rear surface of the unit to the mounting surface. **Unit should be mounted vertically** as shown in Example A of Figure 3-1.
  - **Do Not** mount the unit upside-down or on the underside of a mounting surface as shown in Example B of Figure 3-1.
  - **Do Not** mount unit in a horizontal position with its side parallel to the mounting surface or floor as shown in Example C of Figure 3-1.

Figure 3-1: MRA B1398PS Mounting Orientation



Example A Example B Example C

3.4. WIRING AND CUSTOMER CONNECTIONS

Be sure to review all AC Drive and system documentation for attached equipment as well as the information listed below before proceeding. Connection points and terminal numbers of the AC Drive will be found in the documentation provided with those units.

3.4.1. POWER WIRING

Table 3-1 shows the connectors and wire specifications for the MRA B1398 PS.

WARNING!

Only qualified electricians should perform and maintain the interconnection wiring of this product. All wiring should be done in accordance with local codes.

WARNING!

This unit contains substantial capacitance and can maintain lethal voltages for a long time after power is removed! Insure that the DC bus level has dropped below 40VDC before attempting to work on or with this unit!

Table 3-1: Power Connection Specifications

TERMINALS	FUNCTION	ELECTRICAL RATINGS	WIRE SIZE MINIMUM	WIRE SIZE MAXIMUM	TORQUE
DC+, DC-	DC Bus Output	± 300 VDC	6 AWG	2 AWG	50 lb-in
L1, L2, L3	AC Line Input	300 VAC	8 AWG	2 AWG	40 lb-in
RESISTOR	Shunt Resistor	600 VAC	12 AWG	6 AWG	15 lb-in
GND	Ground	-	#10 STUD	-	40 lb-in

Figure 3-2: Power Connections

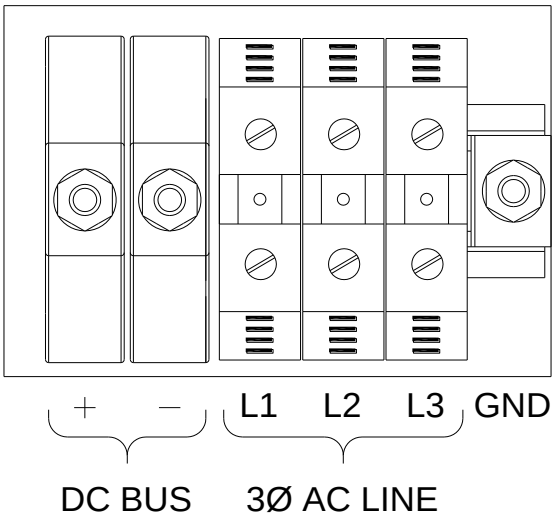
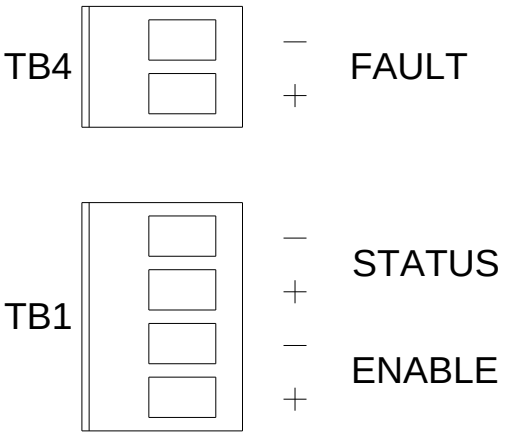


Table 3-2: I/O Terminal Specifications

TERMINAL	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE
TB4-1	NOT FAULTED	250VAC,120mA	18 AWG	12 AWG	4.5 lb-in
TB4-2	NOT FAULTED		18 AWG	12 AWG	4.5 lb-in
TB1-1	STATUS "POWER OUT"	250VAC,120mA	18 AWG	12 AWG	4.5 lb-in
TB1-2	STATUS "POWER OUT"		18 AWG	12 AWG	4.5 lb-in
TB1-3	ENABLE (-)	5 – 24VDC	18 AWG	12 AWG	4.5 lb-in
TB1-4	ENABLE (+)		18 AWG	12 AWG	4.5 lb-in

Figure 3-3: User I/O Diagram



3.4.1.1. MAIN AC INPUT

⚠ **ATTENTION!**

Do not connect to a generator without consulting Bonitron!

The AC input should be connected to a 3-phase source following the typical guidelines used when sizing for an inverter. Refer to the chart in Section 6.1 for guidance in conducting and overcurrent protection sizing.

The input is not sensitive to phase rotation. The unit will operate properly if the phasing is ABC or ACB.

Many installations will need to use an input reactor to reduce the AC input currents as well as the DC bus ripple. Bonitron recommends at least 3% source impedance. If your source transformer is very large compared to the input rating of the power supply, you may need to provide an input reactor.

3.4.1.2. OUTPUT TO VFD

DC+ and DC– should be connected to the DC bus terminals of the VFD. Ensure the polarity of the connection is correct, as this can cause severe damage to the drive. Refer to your drive manual for the exact location of this connection.

This link should be fused in accordance with the drive manufacturer's recommendations. If the Power Supply is installed in the same cabinet as the VFD, DC link fusing may not be necessary. Semiconductor fuses such as the A70Q or FWP are recommended for this purpose.

It is usually not necessary to attach AC power to the attached drive. Refer to your drive manual for more information.

Do not connect the output of the Power Supply to the braking terminals of the drive. This can also cause severe damage to the drive.

3.4.1.3. GROUNDING CONSIDERATIONS

Using the ground stud provided, ground the chassis in accordance with local codes. Typically, the wire gauge will be the same as is used to ground the attached drive.

Refer to your local codes and standards for installation guidelines.

4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The MRA B1398PS 3-Phase Power Supply uses an SCR bridge with phase control to provide DC voltage. These supplies may be used as common bus supplies for multiple drives and inverters.

The MRA B1398PS includes a built-in shunt transistor for dissipating energy from overhauling loads as well as fast shutdown.

A complete system will require the MRA B1398PS power supply, inverters or drives, and any filtering systems required for the application.

4.1.1. PRECHARGE

The MRA B1398PS Power Supply has a precharge function that slowly ramps the capacitor bank to full voltage before going into full operation to minimize the inrush currents during bus charging.

4.1.2. OPERATION

During operation, the unit will sense the output for several parameters, including undervoltage, over temperature and other operational faults. If a fault is sensed, the unit will shut down the DC output, and the fault will be displayed on the front panel of the unit.

4.1.3. SHUNT RESISTOR CONNECTION

The shunt resistor connection is for an external load to dissipate regenerated energy from the inverters. Minimum resistance to be connected is 4Ω.

The voltage at which the internal transistor turns on is 375 VDC and turns back off at approximately 355 VDC. This is over and above expected high line conditions. It is recommended to use a temperature switch from the resistor and use it in conjunction with the ENABLE input to shut down the power supply upon over temperature.

4.2. FEATURES

4.2.1. I/O – INPUTS AND OUTPUTS

4.2.1.1. TB4-1&2 NOT FAULT

The NOT FAULT contact is a normally open held closed solid state relay rated for 250 VAC at 120 mADC. If AC power is present with no faults, this contact will be closed providing low impedance. The typical on-state resistance is 35Ω. Phase Loss will be indicated but will not shut the power supply down. If phase loss is indicated check input power for proper voltages and or open fuses.

4.2.1.2. TB1-1&2 STATUS "POWER OUT"

The STATUS contacts will close when the unit is providing voltage on the DC Output terminals. This includes from the beginning when the voltage is being ramped up and when in full conduction. The STATUS contacts will open upon being disabled, or any faults other than Phase Loss.

The attached drive system should not be started until 0.5 seconds after the STATUS contacts are closed.

4.2.1.3. TB1-3&4 ENABLE INPUT

The ENABLE INPUT is for manual/remote control of the power supply output. In order to use this input, jumper **J1** must be in the A position. This is defined in the following description. See Section 4.2.2.1.

Applying a 5-24VDC signal to this input will enable the unit for operation. This input is isolated to allow the use of external power supplies. Once DC voltage is applied to the input the unit will begin its precharge ramp followed by going into full conduction. This will take approximately 2 seconds.

If the Enable Input is left open, the unit will remain in standby. The Enable input is also used to clear latching faults. The only latching fault is Overtemp so that it may be identified. Disabling and re-enabling the unit will clear the fault and resume normal operation.

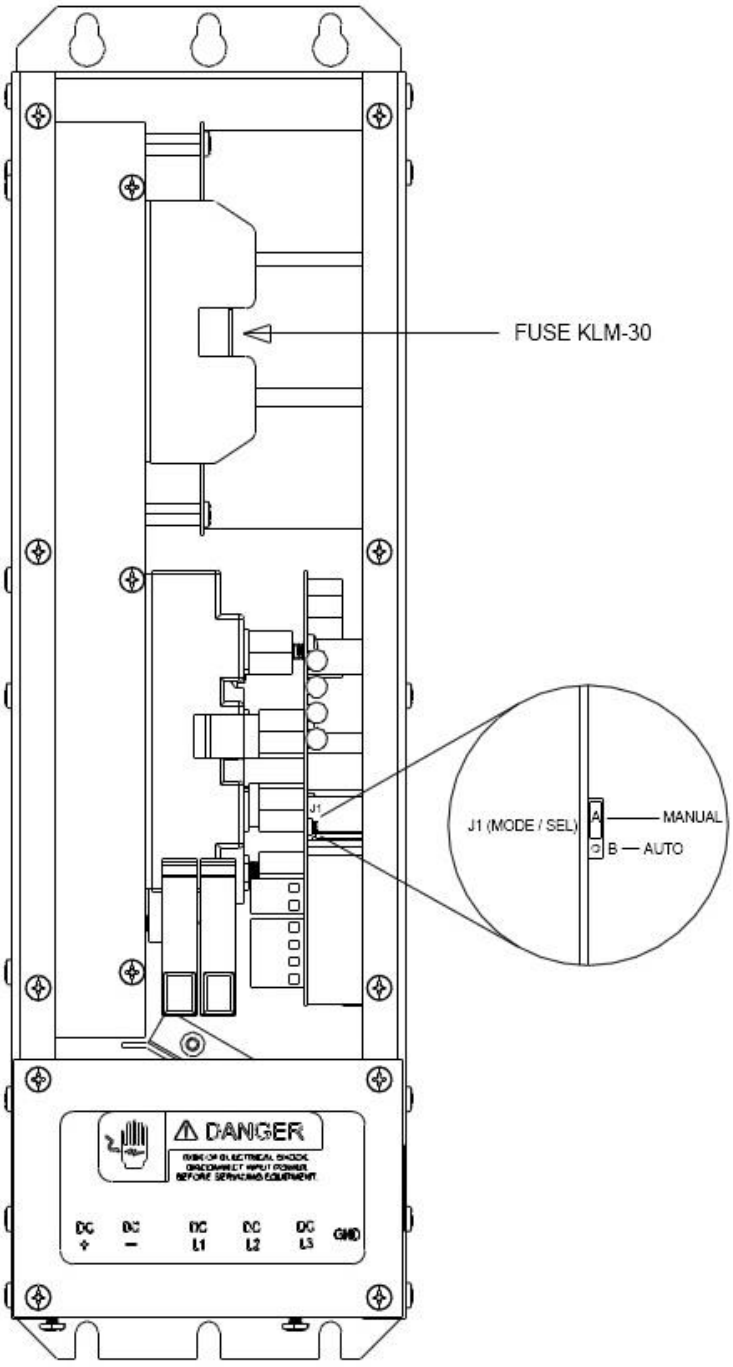
Once this input goes off, all faults but Phase loss are cleared, and the unit can be enabled again to continue operation.

4.2.2. JUMPERS

4.2.2.1. J1 – AUTO ENABLE

J1 is used to select the Enable Input function described in the previous section. When the Jumper is in the "B" position the unit will automatically go into operation when power is applied providing there are no faults. In the event of an Overtemp fault, the power will need to be cycled in order to clear the latching fault.

Figure 4-1: Enable Jumper Placement



4.2.3. EXTERNAL INDICATORS

The unit has indicators in the front panel that will show basic status information for the supply and can be used for troubleshooting or general information.

4.2.3.1. PHASE LOSS (RED) INDICATOR

The PHASE LOSS Indicator on the front of the unit will be illuminated when loss of one of the three phases has occurred for more than 0.5 seconds. The indicator will turn off soon as all three phases have been restored.

4.2.3.2. OVERTEMP (RED) INDICATOR

The OVERTEMP Indicator illuminates when the unit has exceeded its safe operating temperature, reached a heatsink temperature of 175ºF or 80ºC. The OVERTEMP indicator will turn off when the thermostat closes again but the unit will remain disabled until the Enable Input has been toggled or power has been cycled.

4.2.3.3. DISABLED (RED) INDICATOR

The DISABLED Indicator illuminates when there is no Input Enable signal and J1 is in the “B” position for manual / remote control.

4.2.3.4. READY (GREEN) INDICATOR

The READY Indicator illuminates when power is being applied to the input terminals of the module. The indicator will also blink during the precharge process before going into full conduction.

4.2.4. FAULT S

The MRA B1398PS monitors a number of different fault conditions that can prevent the power supply from operating. The Overtemp Fault is the only latching fault which may be cleared by powering the unit down and restarting, or by toggling the Enable Input. See Section 4.2.2.1.

4.2.4.1. PHASE LOSS

This fault is indicated by the loss of any of the three phases connected to the power supply. The power supply will continue to operate but the fault contacts will open indicating that the condition exists.

The fault will clear as soon as power is restored to all three phases. Running at full capacity with a phase absent, will cause excessive currents and heating within the power supply.

4.2.4.2. OVERTEMP

The Overtemp Fault is a latching fault which can be distinguished from the self-resetting faults. The thermostat opens when the unit has reached a heatsink temperature of 175ºF or 80ºC. The OVERTEMP Indicator will be illuminated and the unit will immediately discharge the DC Bus.

The unit will remain disabled until the Enable Input is toggled or power has been cycled. See Section 4.2.2.1.

4.2.4.3. UNDERVOLTAGE

In the event that the input voltage drops below the minimum requirements, the unit will shut down and discharge the DC Bus output until sufficient voltage returns for operation.

4.3. STARTUP

This section covers basic checks and procedures that may be used when performing a startup with a MRA B1398PS.

4.3.1. PRE-POWER CHECKS

- Ensure that all connections are tight and that all wiring is of the proper size and rating for operation.
- Verify continuity of all input fuses.
- Ensure that the polarity of the DC link to the attached drive is correct.
- Check for exposed conductors that may lead to inadvertent contact.
- Check for any debris, shavings, trimmings, etc that may cause shorts or obstruct ventilation on unit.
- Perform the pre-power checks required for the attached drive.

4.3.2. STARTUP PROCEDURE AND CHECKS

4.3.2.1. AUTOMATIC MODULE OPERATION

- For automatic mode operation, J1 should be installed in the "B" position. See Section 4.2.2.1 for more information.
- After completing pre-checks and the recommended checks for the connected equipment, apply power to the system.
- The READY indicator will flash rapidly during precharge.
- Once PRECHARGE is complete, the Ready indicator will stay on solid, and the STATUS and FAULT contacts will close.
- The attached drive should then be started up according to its instructions.

4.3.2.2. MANUAL / REMOTE OPERATION

- For Manual / Remote operation J1 should be in the "A" position. The Enable Input requires 5 - 24 VDC to be applied.
- After completing pre-checks and the recommended checks for the connected equipment, apply power to the system.
- Apply signal to Enable Input and the READY indicator will flash rapidly during precharge.
- Once PRECHARGE is complete, the Ready indicator will stay on solid, and the STATUS and FAULT contacts will close.
- The attached drive should then be started up according to its instructions.

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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.

5.1. PERIODIC TESTING

There are no requirements for periodic testing of these units. When performing routine maintenance it may be beneficial to repeat start-up procedures and checks.

5.2. MAINTENANCE ITEMS

Check periodically for debris, clear as necessary. Buildup can cause short circuits and dangerous conditions.

Reduced airflow can cause nuisance tripping and overheating.

Power should not be applied when blowing dust and debris out of unit.

5.3. TROUBLESHOOTING

WARNING!

This unit contains substantial capacitance and can maintain lethal voltages for a long time after power is removed! Insure that the DC bus level has dropped below 40VDC before attempting to work on or with this unit!

ATTENTION!

Only qualified personnel familiar with adjustable frequency AC drives and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury, death and/or equipment damage!

5.3.1. READY INDICATOR IS NOT ON

- Check AC input voltage at the terminals. This voltage should be the same as your system voltage within the range specified in Table 2-1.
- If there is voltage at these terminals, and the POWER indicator is not on, the unit may be damaged, and need repair. Contact your supplier or Bonitron for assistance.

5.3.2. ATTACHED DRIVE DOES NOT COME ON

- If the POWER Indicator is on, make sure the ENABLE inputs are activated. See Section 4.2.2.1
- The STATUS indicator should begin to flash rapidly, or come on solid.
- If the STATUS indicator does not flash or come on solid, then check the connection to the Enable Input.
- If the READY indicator comes on solid, check the connections between the MRA B1398PS and the attached drive. If there are fuses in the link, make sure they are not blown.
- If the READY indicator does not come on solid, continue troubleshooting below.

5.3.3. ATTACHED DRIVE TRIPS ON OVER-VOLTAGE

- If attached drive encounters Over-voltage faults check the connected shunt resistor. If the connections are good and the resistor measures ok, check the internal shunt fuse. This fuse is located behind the front panel of the power supply module.

5.3.4. STATUS INDICATORS

5.3.4.1. PHASE LOSS

The unit has phase loss detection that will indicate a fault in case one or more of the input phases is not present. This is to protect the unit from an unbalanced input. The unit will continue to run but the capacity will be limited by the additional heat. It is strongly recommended to bring the system to a stop and identify the cause of the phase loss. Verify that the source voltage is not being reduced too much when the system is loaded, as the input impedance to the power supply may be too high.

Check the main input devices to each incoming leg, such as fuses or circuit breakers.

5.3.4.2. OVERTEMP

This indicates that the unit's heatsink has exceeded 80°C (175°F). The unit will shut down until the heatsink cools.

Once the unit cools, the fault can be reset on power down, or when the ENABLE input is removed.

If the unit frequently overheats, it may be overloaded. The power supply is designed for 150% of rated output current for 60 seconds at a maximum of 40°C (104°F). If the ambient temperature around the module is higher than this, the unit must be de-rated.

The fans should be running at all times when power is applied.

5.3.4.3. DISABLED

This indicates the unit is not receiving an Enable signal. If the unit is running in automatic mode with J1 in the "B" position verify that the jumper is in the right position. If the unit is in the manual / remote mode verify the Input signal to be between 5 and 24Vdc. Make sure the polarity is correct at the terminal. If the jumper and input signal are correct and the Disable light is still illuminated, you will need to return the module to Bonitron.

5.4. TECHNICAL HELP – BEFORE YOU CALL

If technical help is required, please have the following information when calling:

- Serial number of unit
- Name of original equipment supplier (if available)
- Record the line voltage
- Record the DC Bus voltage immediately after the AC voltage
- Brief description of the application
- Drive and motor hp or kW
- kVA rating of power source
- Source configuration and grounding

6. ENGINEERING DATA

6.1. RATINGS CHARTS

Table 6-1: Ratings Chart

MODEL NUMBER	SYSTEM VOLTAGE	NOMINAL DRIVE HP	APPROX. 3Ø INPUT CURRENT (AC RMS) (1)	INPUT FUSE SIZE (A70QS SERIES) (2)	OUTPUT CURRENT (DC AVERAGE)	DC LINK FUSES (A70QS SERIES) (2)
MRA B1398PS	110-240 VAC	40 HP	90	150	100	150

1) AC Input current is dependent on source impedance and is listed here only as a guideline.
(2) Suitable for use on a circuit capable of delivering not more than 10,000 RMS symmetrical amperes when protected by the recommended fuses.

6.2. WATT LOSS

Table 6-2 lists the maximum Watt Loss generated by the listed units. When installing MRA B1398PS units in an enclosure, consideration should be given to internal temperature rise. The Watt Loss rating in following table is based upon the maximum capability of each unit.

Table 6-2: Full Load Watt Loss

OUTPUT CURRENT	FULL LOAD OF POWER SUPPLY
100 ADC	350 W

Applications that do not utilize the full capacity may be calculated as follows:

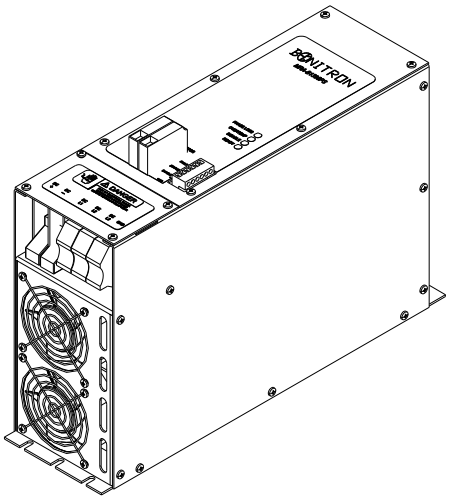
$$\text{Watt Loss} = \text{Full Load Watt Loss} * \left(\text{Average hp} \Big/ \text{Rated Horsepower} \right)$$

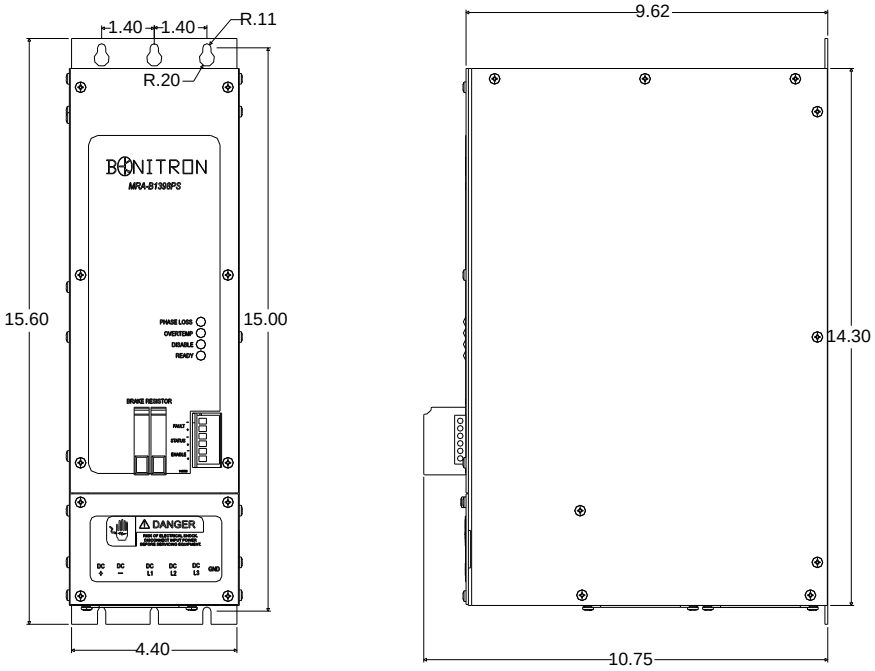
6.3. DIMENSIONS AND OUTLINES

Table 6-3: Chassis Dimensions for MRA B1398PS Module

MODEL NUMBER	OVERALL (IN INCHES)			MOUNTING (IN INCHES)		WEIGHT (LBS.)
	HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH	
MRA B1398PS	15.6"	4.5"	10.75"	15.0"	2.8"	21 lbs

Figure 6-1: MRA B1398PS Dimensional Outline





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