



Solutions for AC Drives

Model M3713DM
3-Phase Bridge
Without Precharge
For Variable Frequency Drives

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.

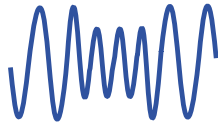
The Bonitron engineering team has the background and expertise necessary to design, develop, and manufacture the quality industrial electronic systems demanded in today's market. A strong academic background supported by continuing education is complemented by many years of hands-on field experience.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

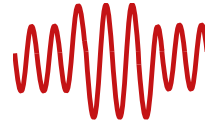
In 1975, Bonitron began working with AC inverter drive specialists at synthetic fiber plants to develop speed control systems that could be interfaced with their plant process computers. Ever since, Bonitron has developed AC drive options that solve application issues associated with modern AC variable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



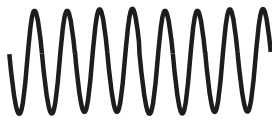
Common Bus Solutions

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

1. INTRODUCTION	7
1.1. Who Should Use	7
1.2. Purpose and Scope	7
1.3. Manual Version and Change Record	7
Figure 1-1: Typical M3713DM 3-Phase Bridges	7
1.4. Symbol Conventions Used in this Manual and on Equipment	8
2. PRODUCT DESCRIPTION	9
2.1. Related Products	9
2.2. Part Number Breakdown	10
Figure 2-1: Example of Part Number Breakdown	10
Table 2-1: Voltage Rating Codes	10
Table 2-2: Current Ratings	10
Table 2-3: Chassis Style	11
2.3. General Specifications	11
Table 2-4: General Specifications Chart	11
2.4. General Precautions and Safety Warnings	12
3. INSTALLATION INSTRUCTIONS	13
3.1. Environment	13
3.2. Unpacking	13
3.3. Mounting	13
Figure 3-1: M3713DM Mounting Orientation	13
3.4. Wiring and Customer Connections	14
3.4.1. Power Wiring	14
Table 3-1: Power Connection Specifications	14
3.4.2. I/O Wiring	15
Table 3-2: I/O Wiring Specifications	15
3.5. Typical Configurations	16
Figure 3-2: M3713DM 3-Phase Bridge Field Wiring Diagram	16
Figure 3-3: M3713DM 3-Phase Power Supply Field with M3645 Regen Wiring Diagram	17
3.6. Typical 12 Pulse Configurations	18
Figure 3-4: M3713DM 12-Pulse System	18
Figure 3-5: M3713DM 12-Pulse System with VFD	19
3.7. Typical 18 Pulse Configurations	20
Figure 3-6: M3713DM 18-Pulse System	20
Figure 3-7: M3713DM 18-Pulse System with VFD	21
4. OPERATION	23
4.1. Functional Description	23
4.1.1. I/O – Inputs and Outputs	23
4.2. Features	23
4.2.1. External Indicators	23
4.3. Startup	24
4.3.1. Pre-Power Checks	24
4.3.2. Startup Procedure And Checks	24
5. MAINTENANCE AND TROUBLESHOOTING	25
5.1. Periodic Testing	25
5.2. Maintenance Items	25
5.3. Troubleshooting	25
5.3.1. Power LED doesn't turn on	25
5.3.2. Attached drive does not come on	26

5.3.3.	Temp Sensor contacts open	26
5.3.4.	Fan doesn't run	26
5.3.5.	Overheating	26
5.3.6.	Cleared Input Fuses or Circuit Breakers	27
5.3.7.	No current seen in one leg of the AC input	27
5.4.	Technical Help – Before you call	27
6.	ENGINEERING DATA	29
6.1.	Ratings Charts	29
	Table 6-1: Ratings Chart	29
6.2.	Watt Loss	30
	Table 6-2: Full Load Watt Loss	30
	Table 6-3: Reactor Specifications Chart	30
6.3.	Certifications	31
6.4.	Dimensions and Outlines	31
	Table 6-4 Chassis Dimensions for M3713DM Module	31
	Figure 6-1: M3713DM B5 Chassis Dimensional Outline	32
	Figure 6-2: M3713DM K7 Chassis Dimensional Outline	33
	Figure 6-3: M3713DM K10 Chassis Dimensional Outline	34
6.5.	Block Diagram	35
	Figure 6-4: M3713DM Functional Block Diagram	35
	Figure 6-5: 18 Pulse Functional Block Diagram	36
7.	APPENDICES	37
7.1.	50Hz operation	37
7.2.	Application Considerations	37
	7.2.1. Drives	37
	7.2.2. M3713DM Parallel Power Supplies	38
7.3.	System Voltage and Source Impedance	38
	7.3.1. Transformers	38
	7.3.2. Input Reactors	39
7.4.	Input Voltage Imbalance	39
	NOTES	40

This page intentionally left blank.

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 M3713DM 3-Phase Bridge. It will provide you with the necessary information to successfully install and use the M3713DM module 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

Additional models were added in Rev 01.

Specification terminology was corrected in Rev 01a.

Certification information was updated in Rev 01b.

Drives unable that are unable to be powered was updated in Rev 01c.

Updated reactor usage for parallel units in Rev 01d.

Voltage ranges were updated in Rev 01e.

Updated ratings in Table 6-1 in Rev 01f.

The manual template was updated in Rev 01g.

Figure 1-1 and Section 3.4.1.1 were updated in Rev 01h.

Information regarding 12 and 18 pulse solutions was added in Rev 01i.

Typos were fixed in Rev 01j.








Update to Table 2-4 made in Rev 01k.

Update to Table 2-4 in Rev 01l.

Figure 1-1: Typical M3713DM 3-Phase Bridges



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: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.
	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

The M3713DM is a six pulse diode bridge intended for use as the main power supply for a common DC bus drive system. The drives can be either servo or variable frequency drives (VFDs) intended for use with DC powered systems. Drives must have internal precharge for DC input to use with "DM" modules. Drives without precharge must use the M3713SC modules or some external precharge circuit.

The M3713DM power supplies can be used in parallel for high power applications, as well as redundancy. The M3713DM can also be used as a building block for 12 and 18 pulse systems for VFDs.

2.1. RELATED PRODUCTS

COMMON BUS POWER SUPPLY WITH PRECHARGE

- M3713SC is a 3 phase power supply with precharge.

FUSE PLATE

- M3713F fuse plate provides ready low cost fusing.

DC BUS CAPACITOR

- M3612EC offers capacitors with integral bleeder resistors.

DC BUS SNUBBER

- M3612RC adds extra snubbing to the DC bus for higher frequency bus filtering.

LINE REGEN

- M3645 three phase line regen (30A – 300A)
- M3545 single or three phase line regen (<15A)

BRAKING TRANSISTORS

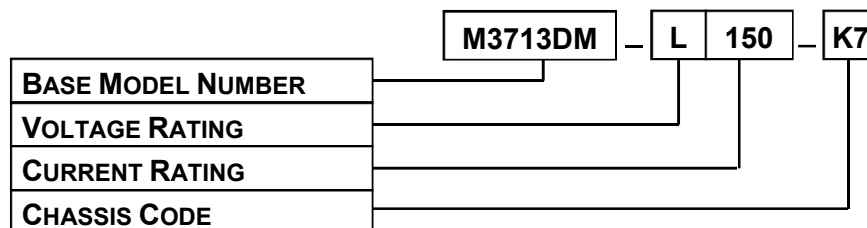
- M3452 Heavy Duty Braking Transistor (<1600A)
- M3575T Standard Duty Braking Transistor (<600A)
- M3675T Low HP Braking Transistor (<10A)

BRAKING RESISTORS

- M3575R Standard Duty Braking Resistors (<30A)
- M3775R Various Duty Load Banks (<1600A)

2.2. PART NUMBER BREAKDOWN

Figure 2-1: Example of Part Number Breakdown



BASE MODEL NUMBER

The Base Model Number for 3-Phase Bridges without precharge is **M3713DM**.

CONTROL VOLTAGE RATING

A 1-character code represents the single phase AC line input voltage to the M3713DM module. The voltage rating must be selected for the system voltage that will be applied.

Table 2-1: Voltage Rating Codes

RATING CODE	VOLTAGE
L	208 - 240VAC
E	380 - 415VAC
H	440 - 480VAC
C	540 - 575VAC

CURRENT RATING

A 3-digit code represents the nominal output current that the M3713DM is intended to support. (i.e. **075** designates 75 amps.) Exceeding this limit may cause poor performance and possible failure.

Table 2-2: Current Ratings

RATING CODE	NOMINAL DRIVE CURRENT
030	30A
075	75A
150	150A
225	225A
375	375A

CHASSIS CODE

An alphanumeric code represents the chassis style as defined below.

Table 2-3: Chassis Style

CHASSIS CODE	CURRENT	DIMENSIONS (H x W x D)
B5	30-75	17.75 x 5.50 x 7.80
K7	150-225	20.00 x 7.12 x 10.35
K10	375	20.00 x 10.00 x 10.50

2.3. GENERAL SPECIFICATIONS

Table 2-4: General Specifications Chart

PARAMETER	SPECIFICATION
Input Voltage	240VAC, 400VAC, 480VAC, 575VAC, 3Ø, 50 Hz, 60 Hz
Out Voltage DC	Approximately 1.4x Input VAC
Intermittent Duty Limit	150% Full Load Rating for 60 seconds
Overcurrent Limit	Fuse protection recommended. See Table 6-1
Short Circuit Current Rating (SCCR)	Suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 575 volts maximum when protected by the recommended fuses
Operating Temp	0°C to +50°C
Storage Temp	-20°C to +65°C
Humidity	Below 90% non-condensing
Atmosphere	Free of corrosive gas or conductive dust
Control I/O	Outputs: 250VAC at 120mA 110VAC at 500mA OVERTEMP (NC)
Indicators	Power

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 ENSURE 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



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 3-phase bridges 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 a failure. Operating in a wet environment can pose a shock hazard. The recommended temperature range for operating or storing this module is 0 to +50°C.

3.2. UNPACKING

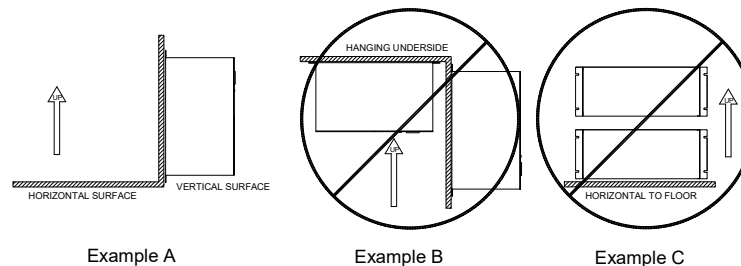
Upon receipt of this product, please verify that the product received matches the product that was ordered and that there is no obvious physical damage to the unit. If the wrong product was received or the product is damaged in any way, please contact the supplier from which the product was purchased.

3.3. MOUNTING

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 around it when mounted near a non-heat source.
- Unit should not be exposed to falling debris or condensation.
- Once the installation site has been selected as outlined above, the unit should be mounted in place. The M3713DM must be properly oriented for proper heat flow through the units. The M3713DM 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: M3713DM Mounting Orientation



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. See Table 3-1 and Figure 3-2 for connection details.

Use copper conductors rated 75°C.

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 local codes.



WARNING!

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

Table 3-1: Power Connection Specifications

MODEL	CONNECTOR WIRE SIZE RANGE ⁽¹⁾	TORQUE
L030 E030 H030 C030	6 - 20 AWG	13-16 lb-in
L075 E075 H075 C075	2 - 14 AWG	35-50 lb-in
L150 E150 H150 C150	2/0 - 14 AWG	120 lb-in
L225 E225 H225 C225	350 kcmil - 6 AWG	275 lb-in
L375 E375 H375 C375	500 kcmil - 6 AWG	500 lb-in

⁽¹⁾ Maximum and minimum are the sizes that the terminal block will accept. These are not recommendations.

⁽²⁾ Use copper conductors rated for 75°C.

3.4.1.1. MAIN AC INPUT



ATTENTION!

When operating this unit with generator, verify the generator is properly sized for required load. The generator may slow down when the drive is precharged and running at full load.

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 for guidance in conducting and overcurrent protection sizing. Reactors may be installed in the AC line if required for noise immunity or harmonic mitigation.

Reactors **“MUST”** be installed when using parallel power supplies. Do not parallel power supplies with different current ratings.

Refer to the Application Notes in Section 7 for more information on input impedance.

3.4.1.2. OUTPUT TO VFD

“DC—” and “DC+” should be connected to the DC bus terminals of the VFD respectively. 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 M3713DM 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.

Do not connect the output of the M3713DM to the braking terminals of the drive. This can 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 and grounding requirements.

3.4.2. I/O WIRING

Table 3-2: I/O Wiring Specifications

TERMINAL	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE LB-IN
TS1-1&2	Temp Sensor	110VAC / 500mA 250VAC / 1200mA	18 AWG	12 AWG	3.6 -5.3 lb-in
TS1-3&4	No Connection	N/C			

3.5. TYPICAL CONFIGURATIONS

Figure 3-2: M3713DM 3-Phase Bridge Field Wiring Diagram

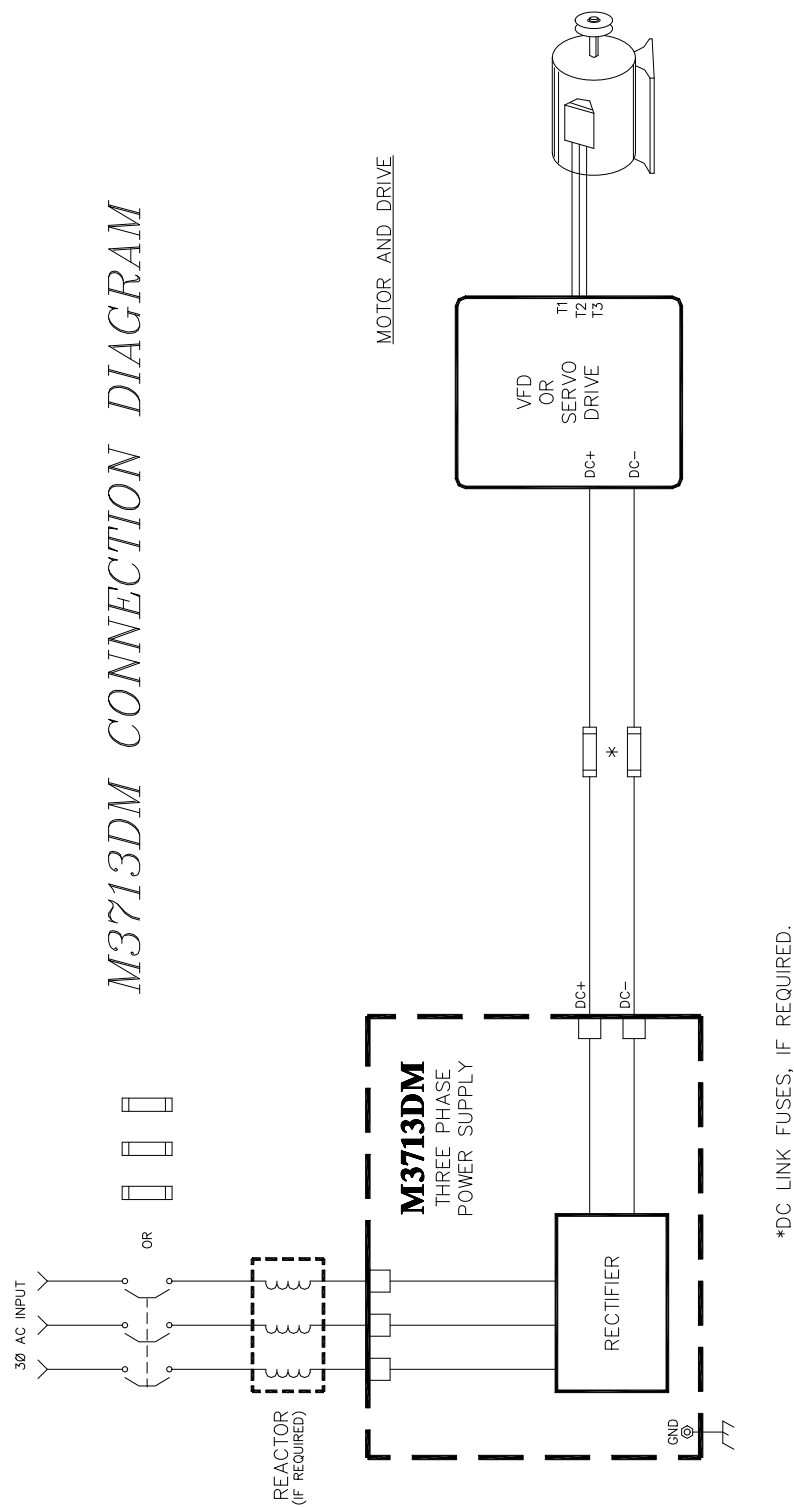
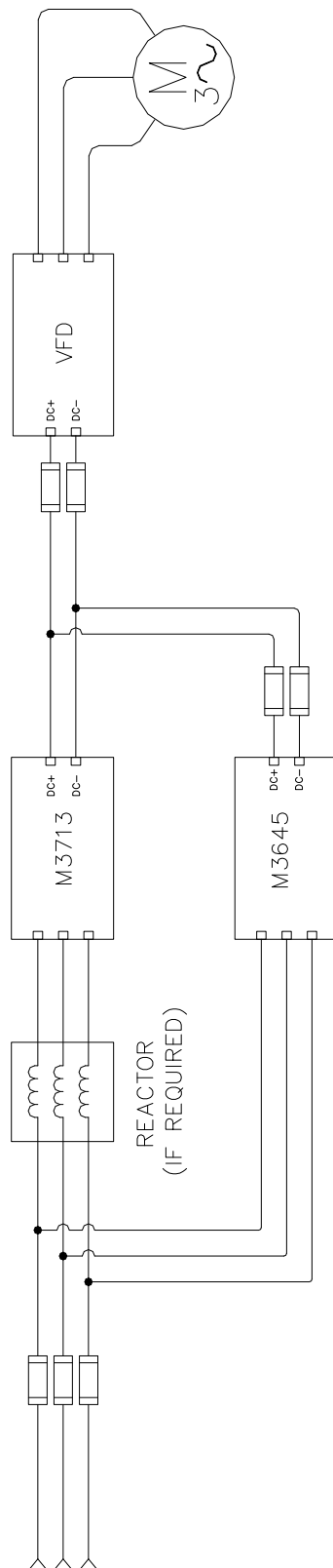


Figure 3-3: M3713DM 3-Phase Power Supply Field with M3645 Regen Wiring Diagram



3.6. TYPICAL 12 PULSE CONFIGURATIONS

Figure 3-4: M3713DM 12-Pulse System

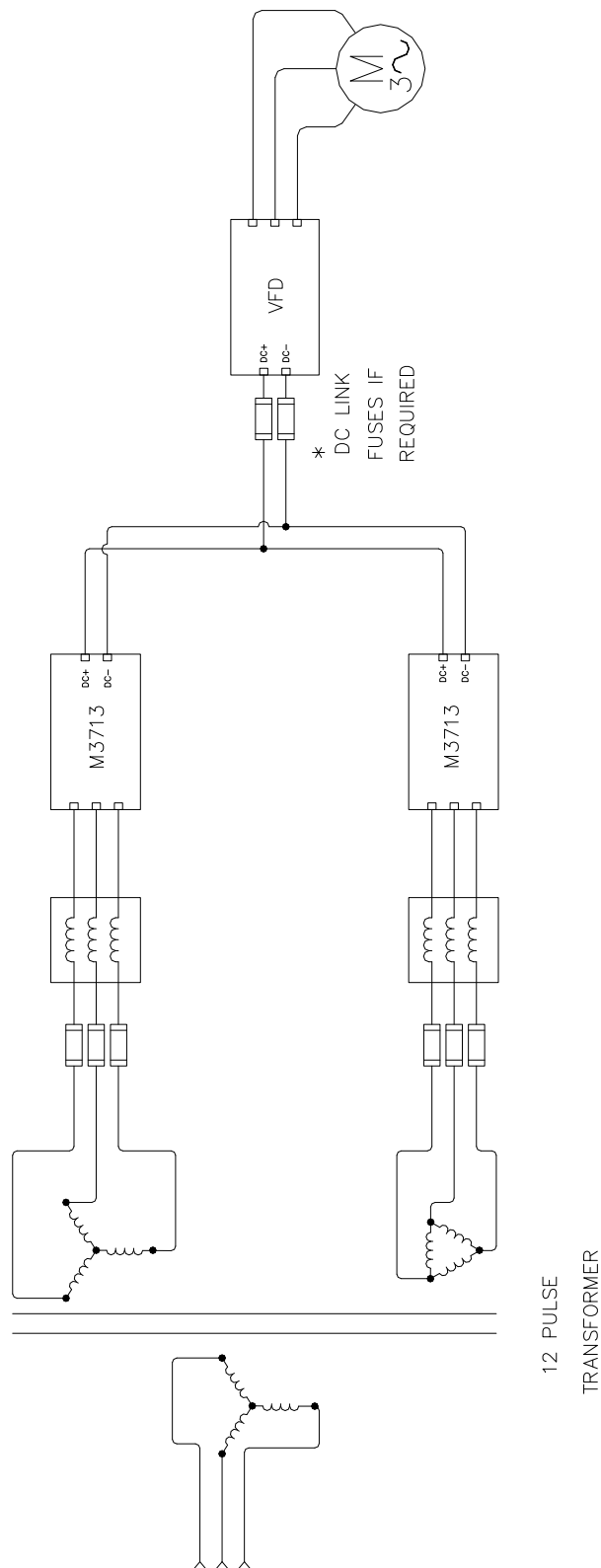
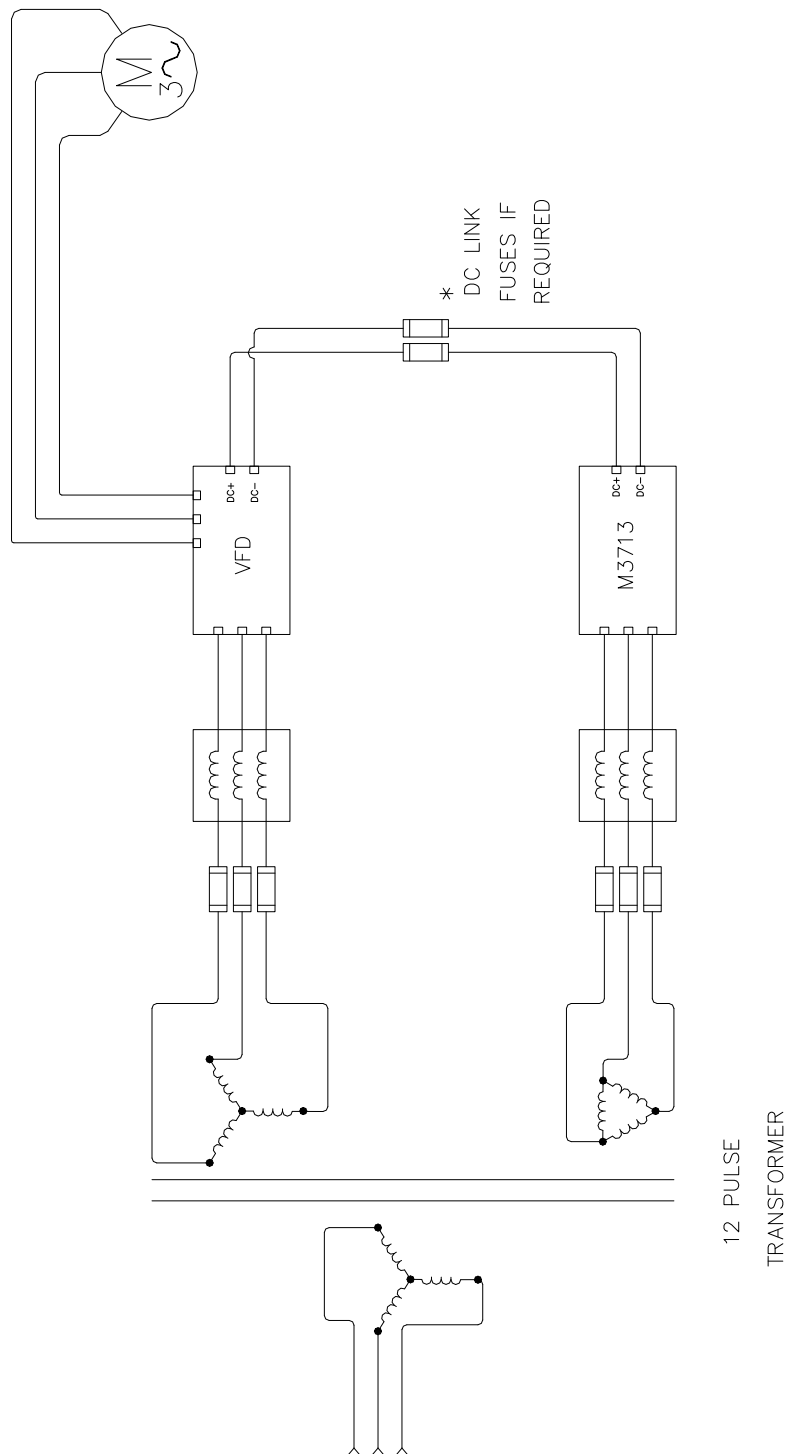


Figure 3-5: M3713DM 12-Pulse System with VFD



3.7. TYPICAL 18 PULSE CONFIGURATIONS

Figure 3-6: M3713DM 18-Pulse System

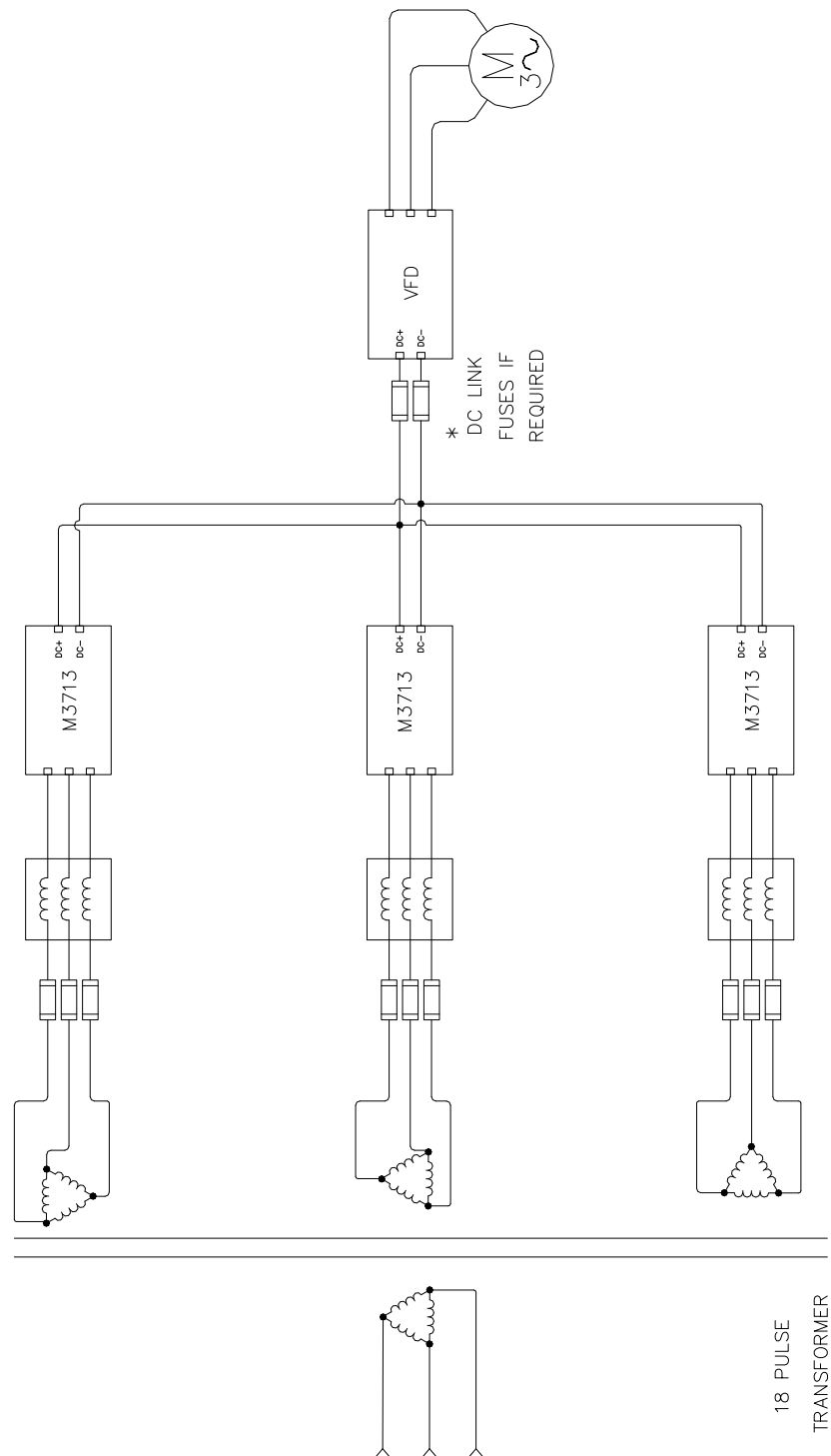
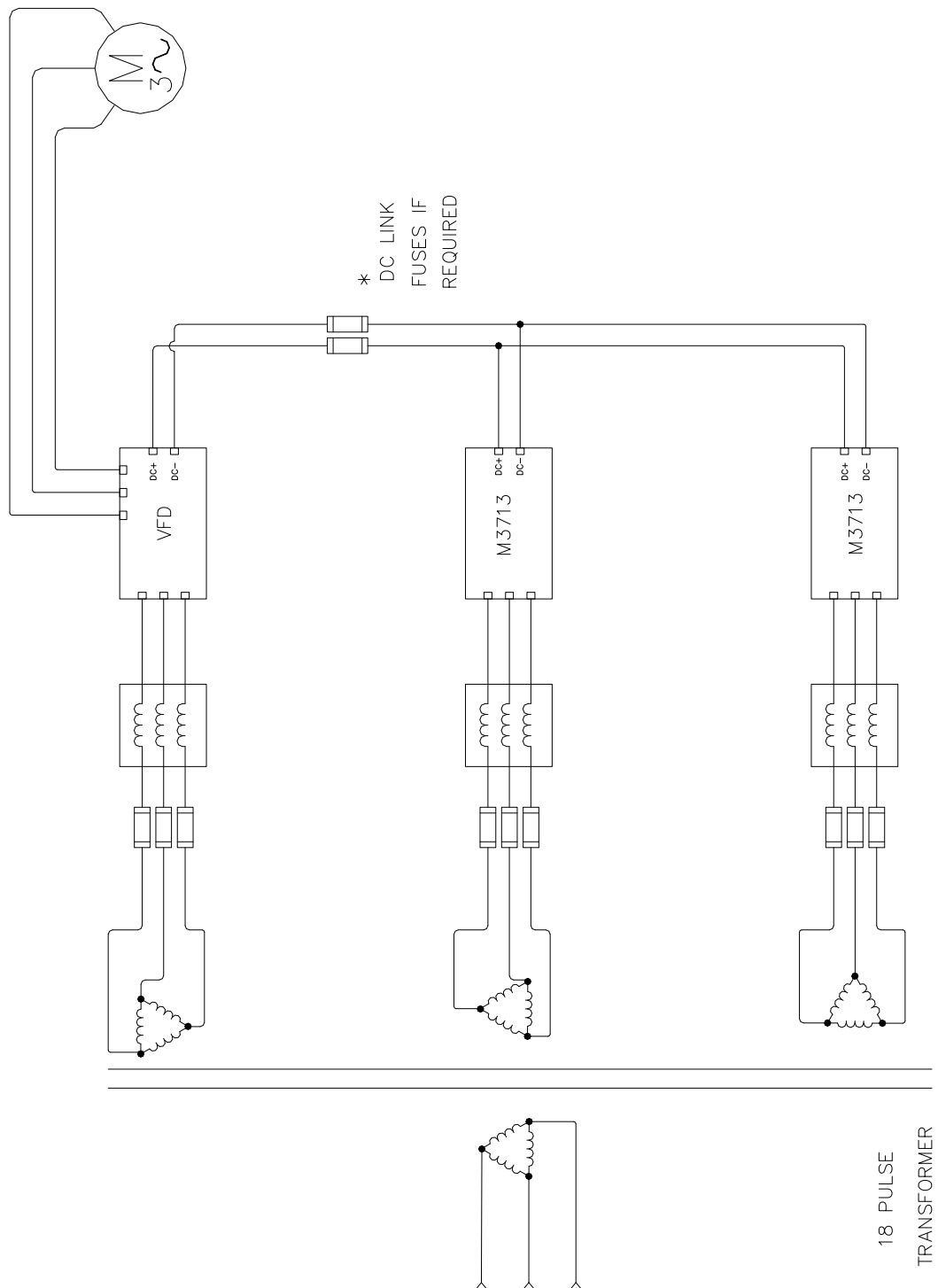


Figure 3-7: M3713DM 18-Pulse System with VFD



This page intentionally left blank.

4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The M3713DM 3-Phase Bridge provides DC voltage for 3-phase VFDs. These supplies may be used as common bus supplies for multiple drives and inverters. The M3713DM power supplies may also be placed in parallel to build 12 and 18 pulse systems for VFDs.

4.1.1. I/O – INPUTS AND OUTPUTS

4.1.1.1. TS1-1&2 TEMP SENSOR

These contacts will be closed if the unit is at operating temperature. The contacts open if the unit is above the safe operating temperature (175°F). These contacts should be monitored and the drive system shut down to avoid damage to the power supply. This output should be used to interlock the attached drive system to shut down to keep the M3713DM from operating under load until the unit cools to a safe level.



- **THE M3713DM WILL CONTINUE TO RECTIFY INCOMING VOLTAGE AND OPERATE WITH THE TEMPERATURE SWITCH OPEN.**
- **CONTINUED OPERATION WITH THE TEMPERATURE SWITCH OPEN CAN CAUSE DANGEROUS OVERHEATING OF THE M3713DM, AND CAN CAUSE PERMANENT DAMAGE, AND CATASTROPHIC FAILURE.**

4.2. FEATURES

4.2.1. EXTERNAL INDICATORS

4.2.1.1. POWER

The POWER indicator on the front of the unit will be illuminated when L1 and L3 are connected to the bridge. It will not indicate a phase loss or other diagnostic information.



- **THE POWER INDICATOR WILL NOT COME ON IF THE INTERNAL FAN FUSES ARE CLEARED OR IF THERE IS A PHASE LOSS AT L1 OR L3.**
- **DO NOT USE THE POWER INDICATOR AS AN INDICATION THAT THE UNIT DOES NOT HAVE POWER APPLIED.**
- **ALWAYS ENSURE THE INCOMING POWER IS REMOVED BEFORE ATTEMPTING SERVICE.**

4.3. STARTUP

This section covers basic checks and procedures that may be used when performing a startup with a M3713DM.

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

- After completing pre-checks and recommended checks for connected equipment and drives, you may apply power to the system.
- The fan is controlled by a thermostat, and will only come on when the temperature of the heatsink exceeds 110°F.
- The attached drive should then be started up according to its instructions.

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



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



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!

Feel free to call Bonitron at any time if the equipment appears to be having problems.

5.3.1. POWER LED DOESN'T TURN ON



- THE POWER INDICATOR WILL NOT COME ON IF THE INTERNAL FAN FUSES ARE CLEARED OR IF THERE IS A PHASE LOSS AT L1 OR L3.
- DO NOT USE THE POWER INDICATOR AS AN INDICATION THAT THE UNIT DOES NOT HAVE POWER APPLIED.
- ALWAYS ENSURE THE INCOMING POWER IS REMOVED BEFORE ATTEMPTING SERVICE.

- 1) Ensure that power is applied to the input of the M3713DM. Check all fuses, circuit breakers, disconnects, etc. that may interrupt power to the unit. Check for voltage at the incoming terminals L1, L2 and L3 for power.
- 2) Make sure that the fan fuses are not cleared. The fuse locations are just above the AC power terminations.

5.3.2. ATTACHED DRIVE DOES NOT COME ON

- 1) Ensure that power is applied to the input of the M3713DM with a voltmeter and that the power indicator is lit.
- 2) Check for output voltage at the DC+ and DC- terminals of the unit.
- 3) Check all fuses, circuit breakers, disconnects, etc. in between the M3713DM and the attached drive.
- 4) Check for voltage at the DC input of the attached drive with a voltmeter.
- 5) If there is voltage at the input of the attached drive, refer to the drive manual for further troubleshooting assistance.

5.3.3. TEMP SENSOR CONTACTS OPEN



- **THE M3713DM WILL CONTINUE TO RECTIFY INCOMING VOLTAGE AND OPERATE WITH THE TEMPERATURE SWITCH OPEN.**
- **CONTINUED OPERATION WITH THE TEMPERATURE SWITCH OPEN CAN CAUSE DANGEROUS OVERHEATING OF THE M3713DM, AND CAN CAUSE PERMANENT DAMAGE, AND CATASTROPHIC FAILURE.**

This indicates that the unit's heatsink has exceeded 175°F. The unit has overheated and needs to cool before operation should continue.

If these contacts open, the attached drives should be disabled until the unit cools off.

Once the unit cools, the contacts will close again, and the system can be enabled.

If the unit is cool and the contacts do not close, the temperature switch may be damaged and the unit needs to be serviced.

5.3.4. FAN DOESN'T RUN

The fan is controlled by a thermostat, and will only come on when the temperature of the heatsink exceeds 110°F. If the fan is not running, it may be blocked by debris, or the fuses may be cleared. Make sure there is sufficient input voltage and that the fan fuses are not clear. The Fuse location is just above the power terminations.

5.3.5. OVERHEATING

Check to ensure that all three phases are supplying the unit. A loss of one phase will cause uneven heating in the bridge, and can damage the M3713DM.

If the unit continually overheats during operation, you may need a larger unit. Check the output current to ensure it is within tolerance of the unit.

If the unit is sized properly to the application and the output currents are within tolerance, you may need to install an input reactor. An input reactor will reduce the incoming RMS currents to the bridge and allow it to operate cooler under full load. See Section 7 for guidelines.

5.3.6. CLEARED INPUT FUSES OR CIRCUIT BREAKERS.

Fuses can be cleared on power due to inrush current or wrong DC bus polarity. If fuses clear, check DC polarity and ensure ALL drives have internal precharge (inrush limiting).



Cleared overcurrent devices can indicate damage to the unit. Do not replace the input fuses and repower the unit as severe damage can occur.

Contact Bonitron Technical Support before attempting to restart the system.

5.3.7. NO CURRENT SEEN IN ONE LEG OF THE AC INPUT

Check to make sure that the incoming line fuse to the suspect leg has not cleared.

If you suspect that the unit is damaged, remove the M3713 from the system and use a diode drop check to make sure the six diodes are not shorted or opened.

5.4. TECHNICAL HELP – BEFORE YOU CALL

If technical help is still 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

This page intentionally left blank.

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 (J-TYPE OR BETTER) ⁽²⁾	OUTPUT CURRENT (DC AVERAGE)
M3713DM-L030-B5	208 - 240VAC	7.50	27	35	30
M3713DM-L075-B5		20	65	80	75
M3713DM-L150-K7		50	134	200	150
M3713DM-L225-K7		75	210	250	225
M3713DM-L375-K10		125	375	400	375
M3713DM-E030-B5	380 - 415VAC	12	27	35	30
M3713DM-E075-B5		32	65	80	75
M3713DM-E150-K7		80	134	200	150
M3713DM-E225-K7		120	210	250	225
M3713DM-E375-K10		200	375	400	375
M3713DM-H030-B5	440 - 480VAC	15	30	35	30
M3713DM-H075-B5		40	75	80	75
M3713DM-H150-K7		100	150	200	150
M3713DM-H225-K7		150	225	250	225
M3713DM-H375-K10		250	375	400	375
M3713DM-C030-B5	540 - 575VAC	20	30	35	30
M3713DM-C075-B5		50	75	80	75
M3713DM-C150-K7		125	150	200	150
M3713DM-C225-K7		175	225	250	225
M3713DM-C375-K10		300	375	400	375

⁽¹⁾ AC Input currents are dependent on source impedance and are listed here only as a guideline.

⁽²⁾ Suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 575 volts maximum when protected by the recommended fuses.



Drive hp rating does not always calculate directly to system kW due to motor and drive efficiencies at low hp ranges. When using drives on a common DC bus system, be sure to consult the drive manual for input power requirements when sizing the system.

6.2. WATT LOSS

Table 6-2 lists the maximum watt loss generated by the listed units. When installing M3713DM units in an enclosure, consideration should be given to internal temperature rise. The 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
30	150W
75	260W
150	500W
225	800W
375	1150W

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

$$\text{Watt Loss} = \text{Full Load Watt Loss} \left(\frac{\text{Average HP}}{\text{Rated HP}} \right)$$

Table 6-3: Reactor Specifications Chart

M3713DM MODEL NUMBER	SYSTEM VOLTAGE	NOMINAL DRIVE HP	BONITRON REACTOR NUMBER	REACTOR INDUCTANCE μH
M3713DM-L030-B5	208 – 240VAC	7.5	IN RL-03502	800
M3713DM-L075-B5		20	IN RL-08002	400
M3713DM-L150-K7		50	IN RL-13001	100
M3713DM-L225-K7		75	IN RL-20002B14	110
M3713DM-L375-K10		125	IN RL-32002B14	75
M3713DM-E030-B5	380 - 415VAC	12	IN RL-02503	1000
M3713DM-E075-B5		32	IN RL-05503	850
M3713DM-E150-K7		80	IN RL-16003	230
M3713DM-E225-K7		120	IN RL-20003B14	185
M3713DM-E375-K10		200	IN RL-32003B14	125
M3713DM-H030-B5	440 - 480VAC	15	IN RL-02503	1000
M3713DM-H075-B5		40	IN RL-05503	850
M3713DM-H150-K7		100	IN RL-13003	300
M3713DM-H225-K7		150	IN RL-20003B14	185
M3713DM-H375-K10		250	IN RL 32003B14	125
M3713DM-C030-B5	540 - 575VAC	20	IN RL-02503	1000
M3713DM-C075-B5		50	IN RL-05503	850
M3713DM-C150-K7		125	IN RL-13003	300
M3713DM-C225-K7		175	IN RL-20003B14	185
M3713DM-C375-K10		300	IN RL-32003B14	125

6.3. CERTIFICATIONS

All M3713 models are UL and cUL listed by Underwriter's Laboratories under file number E204386 for UL508C Power Conversion Equipment

6.4. DIMENSIONS AND OUTLINES

Table 6-4 Chassis Dimensions for M3713DM Module

MODEL NUMBER	CHX	OVERALL (IN INCHES)			MOUNTING (IN INCHES)		WEIGHT (LBS.)
		HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH	
M3713DM-L030	B5	17.75	5.50	7.80	16.75	3.0	16.5
M3713DM-E030							
M3713DM-H030							
M3713DM-C030							
M3713DM-L075	B5	17.75	5.50	7.80	16.75	3.0	16.5
M3713DM-E075							
M3713DM-H075							
M3713DM-C075							
M3713DM-L150	K7	20.00	7.12	10.30	19.25	5.0	26.5
M3713DM-E150							
M3713DM-H150							
M3713DM-C150							
M3713DM-L225	K7	20.00	7.12	10.30	19.25	5.0	28.5
M3713DM-E225							
M3713DM-H225							
M3713DM-C225							
M3713DM-L375	K10	20.00	10.00	10.50	19.00	7.0	41.5
M3713DM-E375							
M3713DM-H375							
M3713DM-C375							

Figure 6-1: M3713DM B5 Chassis Dimensional Outline

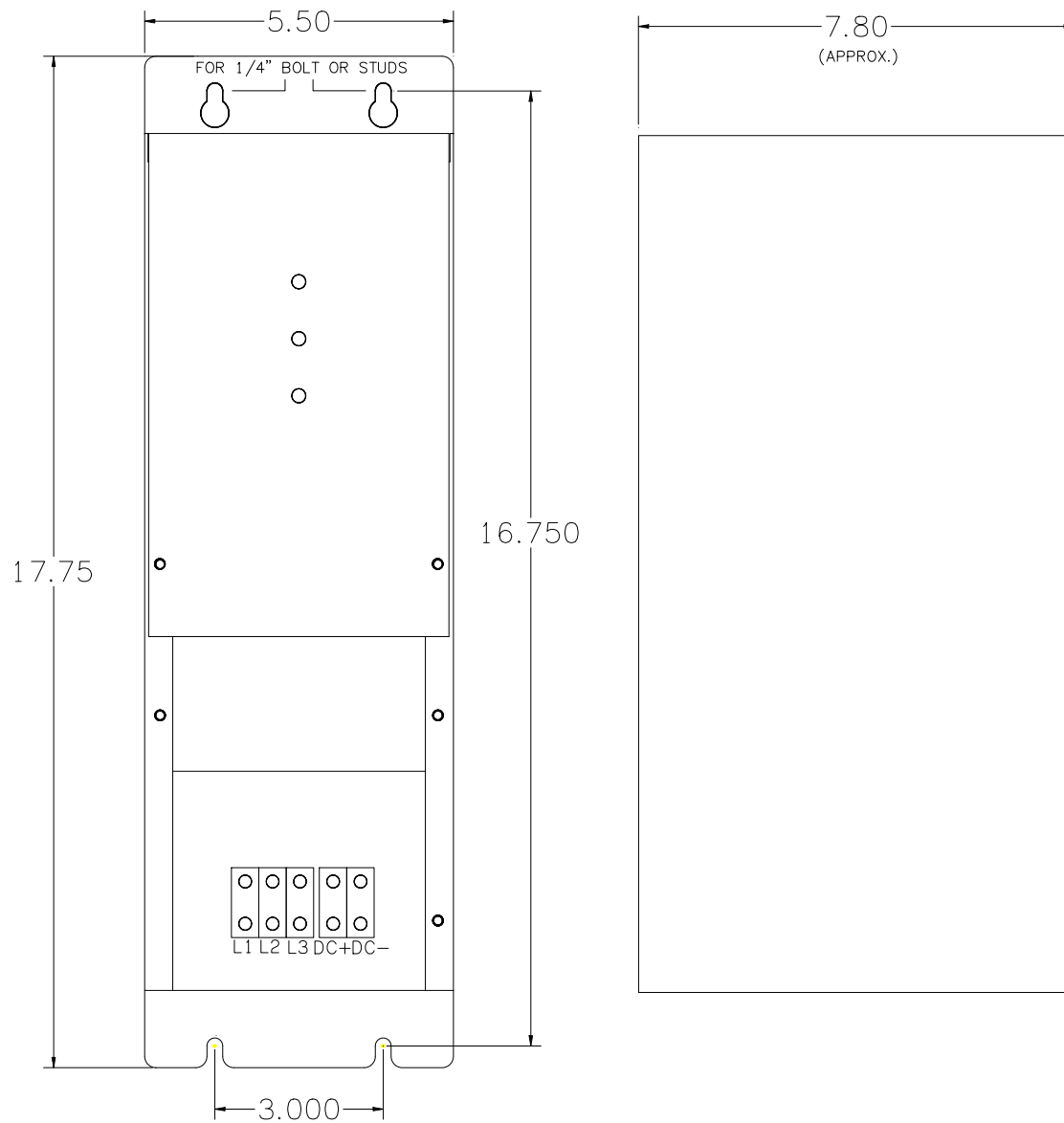


Figure 6-2: M3713DM K7 Chassis Dimensional Outline

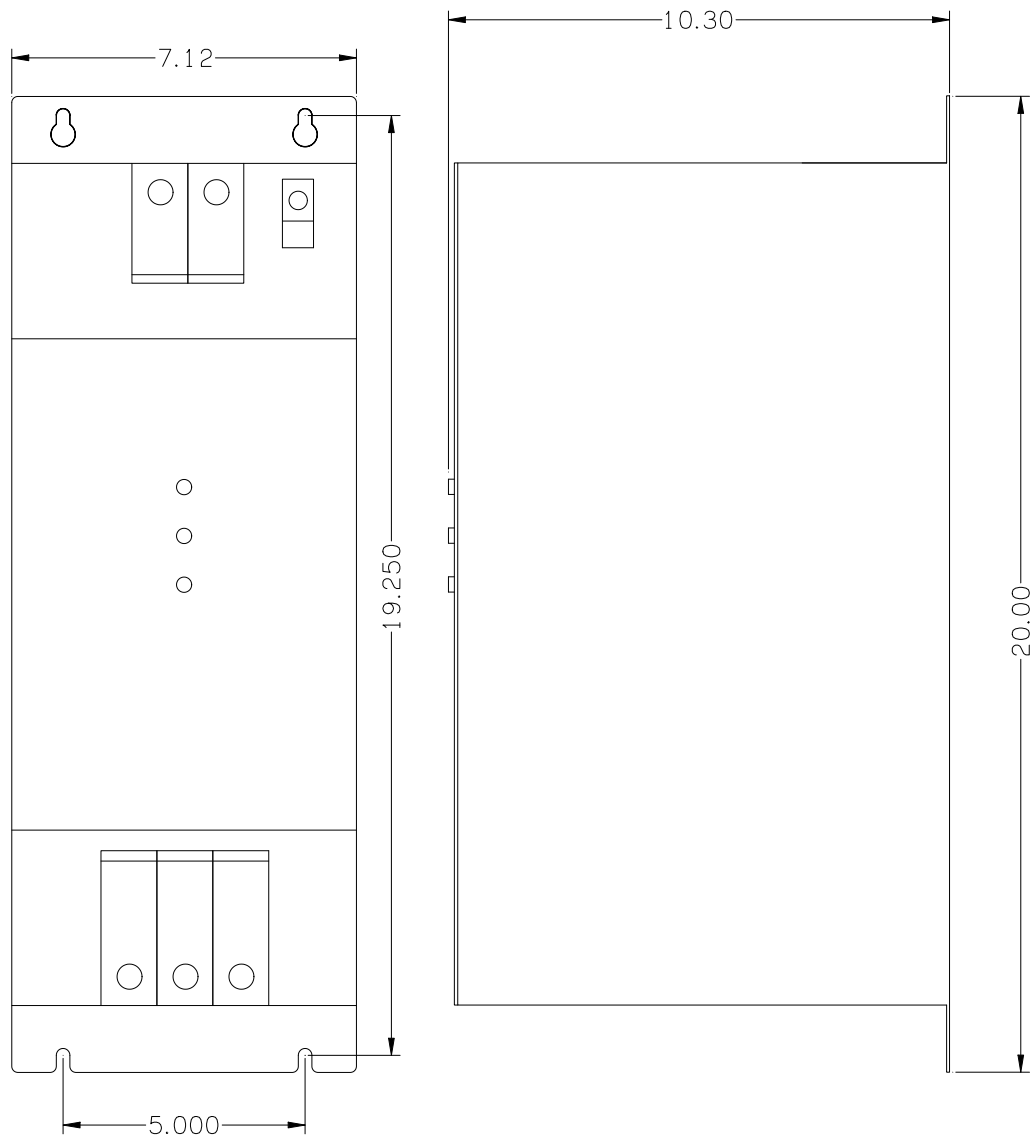
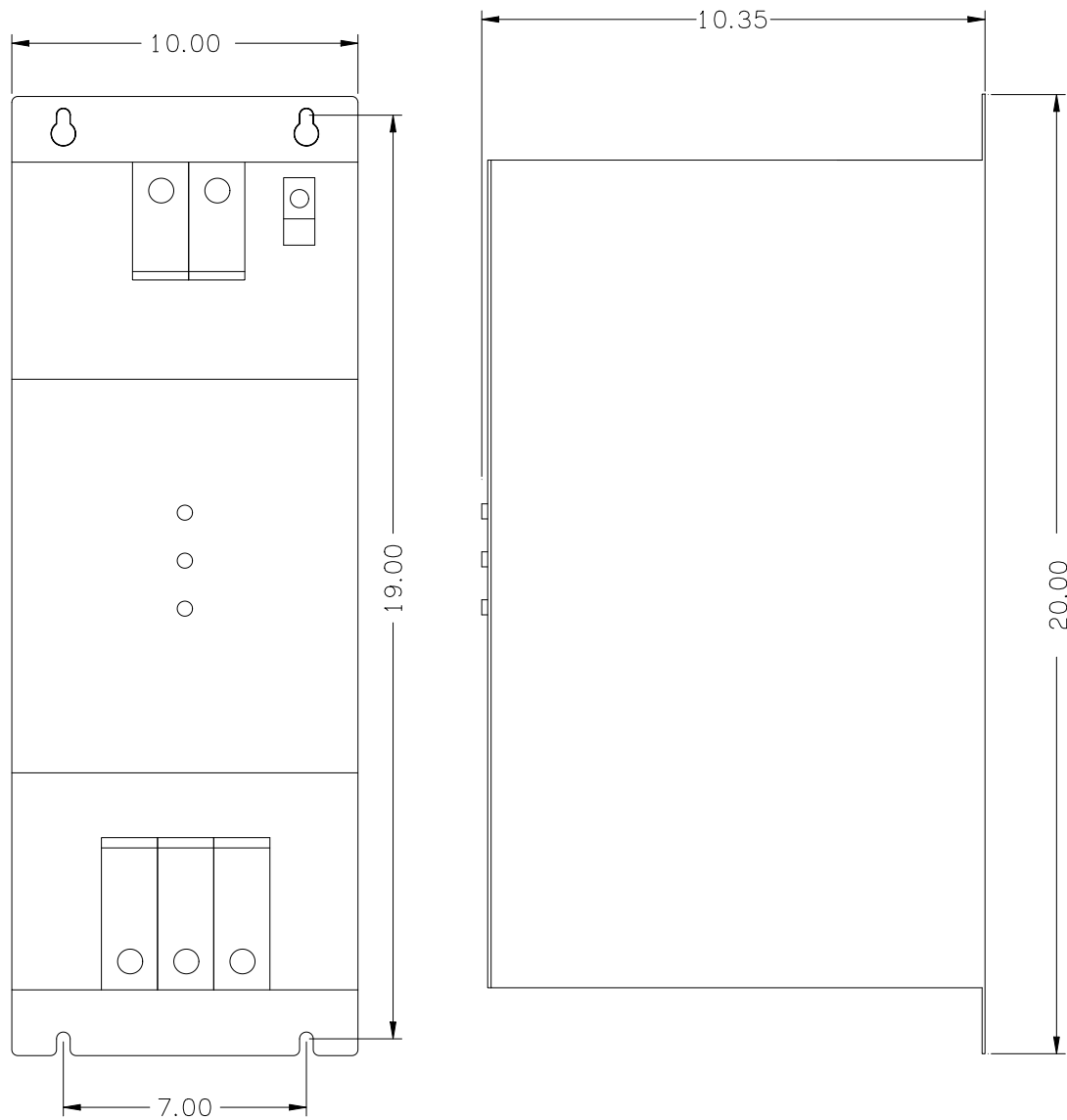


Figure 6-3: M3713DM K10 Chassis Dimensional Outline



6.5. BLOCK DIAGRAM

Figure 6-4: M3713DM Functional Block Diagram

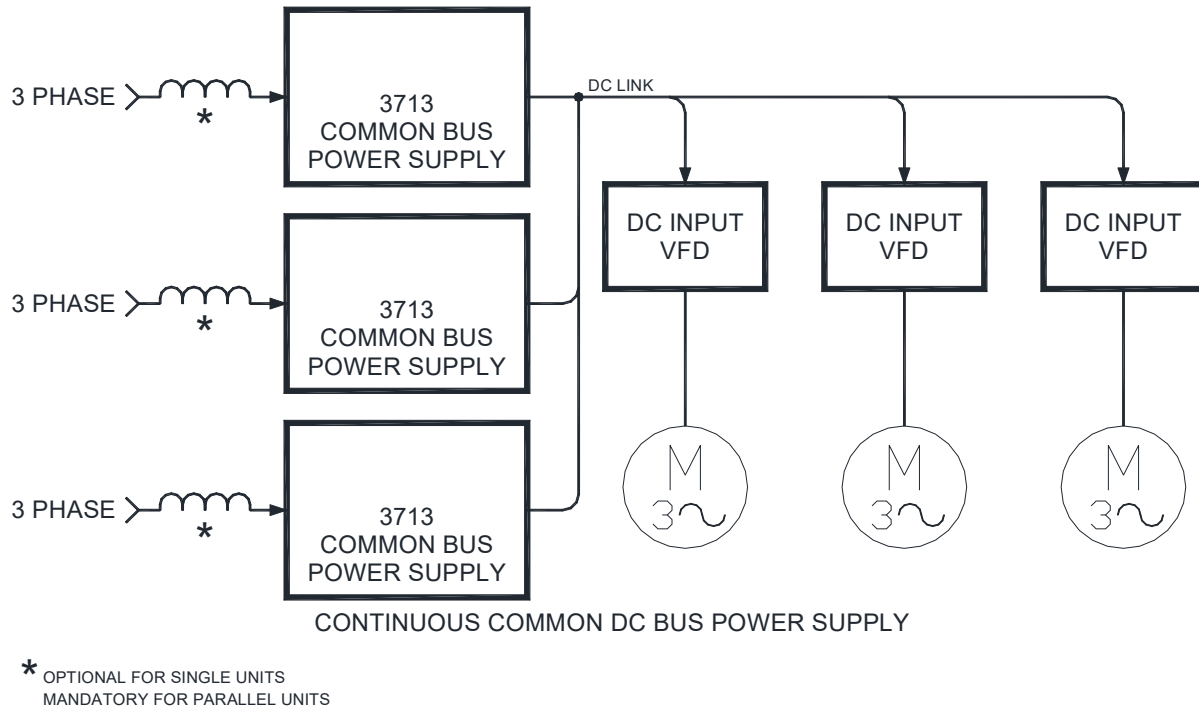
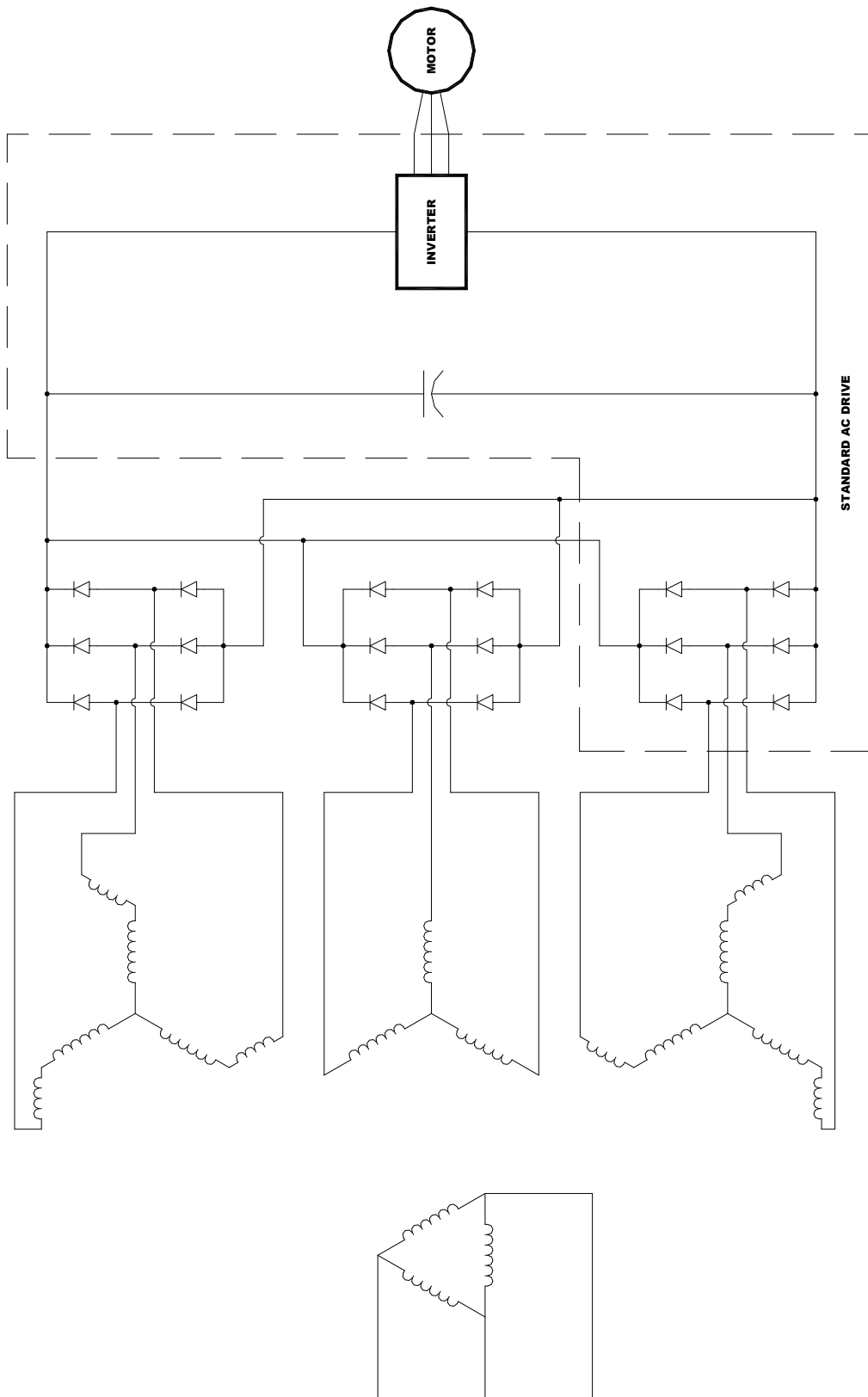


Figure 6-5: 18 Pulse Functional Block Diagram

7. APPENDICES

7.1. 50Hz OPERATION

The M3713DM can operate on a 50Hz supply. In this instance, the cooling fan will run slower, and the unit should be derated by 10% to allow for the reduced cooling. As with any application, the temperature switch should be monitored to protect the unit from damage from overheating.

7.2. APPLICATION CONSIDERATIONS

The M3713DM is a 3-phase six pulse DC power supply. There are some issues that should be considered when designing the complete system.

7.2.1. DRIVES

Most variable frequency AC drives are suitable for use with the M3713DM. Some things to consider are listed below.

Check the manual for the drive you are using, or call the technical support line for the drive manufacturer if you have questions on this hookup.

7.2.1.1. DC CONNECTION

The majority of variable frequency AC drives have a direct connection to the capacitor bank of the drive. The M3713DM does not have a precharge control circuit. Make sure you provide a precharge to the capacitor bank. In general, the hookup can be described as a common bus input.

Check the manual of the drive you are using, or call the technical support line for the drive manufacturer if you have questions on this hookup.

7.2.1.2. DRIVES UNABLE TO BE POWERED FROM DC BUS

Due to connection points and certain topologies some drives may not be compatible with external DC supplies. The following drives do not support external DC supplies. Please consult drive manufacturer for details and support.

- Allen Bradley Powerflex 4 series.
- Allen Bradley Powerflex 400-E frame.

7.2.1.3. DRIVE AC INPUT LOSS DETECTION

Some variable frequency AC drives incorporate AC input line sensing that causes a fault in the drive when the AC input lines are not used.

If the drive has phase loss detection, you can usually bypass this fault to allow the system to run without the AC input being connected.

NOTE: The M3713DM does not provide phase loss detection. Phase loss detection should be used externally to protect the drive.

7.2.1.4. 3-PHASE LOADS

A few large frame AC drives have 3-phase blower motors integral to the drive. If this is the case, the blower will not operate when the drive is powered from the M3713DM. This can cause overheating and drive faults or failure.

Some packaged drives may also have other 3-phase loads in the cabinets such as fans or power supplies.

If you have a drive that has an integral 3-phase motor, consult your drive manufacturer for a possible solution. One may be to install a small inverter or drive to power the 3-phase loads from the output of the M3713DM.

7.2.2. M3713DM PARALLEL POWER SUPPLIES

When placing the M3713DM in parallel with other power supplies, only use power supplies with the same model number.

Line reactors are required for each M3713DM when the units are placed in parallel.

7.2.2.1. M3713DM TWELVE PULSE SYSTEMS

A twelve pulse system using a normal drive can be achieved by using a twelve pulse transformer with either a M3713DM power supply in parallel to the rectifier section for the drive or using two M3713DM power supplies in parallel to power the drive from the DC bus. The M3713DM should be sized for at least one half the peak power of the application.

7.2.2.2. M3713DM EIGHTEEN PULSE SYSTEM

An eighteen pulse system using a normal drive can be achieved by using an eighteen pulse transformer with either two M3713DM power supplies in parallel to the rectifier section of the drive or using three M3713DM power supplies in parallel to power the drive from the DC bus. The M3713DM should be sized for at least one third of the peak power of the application.

7.3. SYSTEM VOLTAGE AND SOURCE IMPEDANCE

The M3713DM is intended to be used with an input reactor for the reduction of peak input currents and bus ripple. The reactor adds inductive impedance to the circuit to reduce these factors, and adds to the total input impedance of the system. Other sources of inductive impedance in your installation are the main incoming transformer and the conductors to that transformer. If the total input impedance is too high, it can cause low voltage at the input of the M3713DM, and therefore the DC bus of the drive. This is referred to as a “soft” source, and will have a transformer closely matched to the load and high impedance.

7.3.1. TRANSFORMERS

Transformers are rated in kVA and percent impedance. In order to see what kVA your system needs, you can roughly multiply the horsepower by 1000. Your transformer should be rated higher than this. In other words, a 50 horsepower system would require at least a 50kVA transformer, if not larger. If the transformer has 5% impedance, the voltage drop to the output of the transformer at full load will be 5%. For instance, a transformer with 5% impedance and an open terminal voltage of 480VAC can have only 456VAC at the terminals at full load. If the transformer is much larger than the required kVA, or has a low percent impedance, the source is considered to be “stiff” and can cause high charging currents, high input harmonics, and system overheating.

If the input impedance is too high to the system, the input to the M3713DM can drop to the point where the DC bus of the drive will be out of specifications. When the DC bus falls too low, the motor can lose power or run hotter than usual. If the DC bus falls low enough, the drive will trip and

not operate the motor. This typically is shown as an Undervoltage fault on the drive.

7.3.2. INPUT REACTORS

Input reactors are used for many reasons, all of which are related. Input reactors reduce the peak input currents to the power supply and provide some protection from incoming spikes and surges.

When using parallel power supplies, input reactors must be used to ensure current sharing between the inputs. A minimum of 3% impedance should be used along with a derating of 10% for the combined power supply capacity.

The impedance of the reactor reduces the RMS input currents, which can reduce nuisance tripping of incoming overload protection devices. The bus voltage ripple is also reduced, which causes less capacitor heating and therefore increases capacitor lifespan.

Input reactors are generally rated for RMS current and percentage, much as transformers are rated. If the reactor has 5% impedance, the voltage drop to the output of the reactor at full load will be 5%. For instance, a 480V reactor with 5% impedance can only have 456VAC at the terminals at full load.

If the total input impedance is too high to the system, the input to the M3713DM can drop to the point where the DC bus of the drive will be out of specifications. When the DC bus falls too low, the motor can lose power or run hotter than usual. If the DC bus falls low enough, the drive will trip and not operate the motor. This typically is shown as an Undervoltage fault on the drive.

7.4. INPUT VOLTAGE IMBALANCE

The balance between phases on the input of a 3-phase system can be critical. Depending on input impedances, a voltage imbalance of as little as 3% can cause the 3-phase bridge to effectively operate as a single phase bridge. This causes high input currents and capacitor overheating.

Isolation transformers can be used to mitigate voltage imbalances seen from the incoming supplies.

NOTES

[illegible]

This page intentionally left blank.

This page intentionally left blank.

