



# GPD 503

## Field Repair Manual

### for Drives in Lower HP Range



## INTRODUCTION

This manual provides test and repair procedures for the power circuit of drive, beyond the scope of the troubleshooting procedures included in the drive Technical Manual.

This manual provides power circuit test procedures for the following MagneTek Adjustable Frequency drives:

<u>230V GPD 503:</u>	<u>460V GPD 503:</u>
<u>CT HP</u>	<u>CT HP</u>
1 Model No. DS305	1 Model No. DS313
2 Model No. DS302	2 Model No. DS304
3 Model No. DS306	3 Model No. DS314
5 Model No. DS307	5 Model No. DS315
7.5 Model No. DS308	7.5 Model No. DS316
10 Model No. DS309	10 Model No. DS317
15 Model No. DS310	15 Model No. DS318
20 Model No. DS311	20 Model No. DS326
25/30 Model No. DS322	25/30 Model No. DS325
30 Model No. DS323	30 Model No. DS330
	40/50 Model No. DS340
	50/60 Model No. DS350
	75 Model No. DS360

## CONTENTS

This manual is divided into sections as follows:

<b>Section 1</b>	<b>CHECKS WITHOUT POWER</b> .....	Page 1
	Explains the steps used to check out the drive, WITH NO POWER APPLIED, using only an ohmmeter.	
<b>Section 2</b>	<b>POWER CHECKS</b> .....	Page 21
	Explains a systematic method of applying power to the drive and checking various points on the drive to verify proper operation.	

## Section 1. CHECKS WITHOUT POWER

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### WARNING

#### LETHAL VOLTAGES

**Before attempting any checks in this manual, make sure that the three-phase power is disconnected, and locked out if possible. With the power removed from the unit, the DC bus capacitors will stay charged for up to 20 minutes. The "CHARGE" lamp in the unit will glow red until the DC bus is lower than 50 Vdc. To ensure that the DC bus is completely discharged, measure between the positive and negative bus with a DC voltmeter set on the highest scale.**

#### DRIVE TEST EQUIPMENT

The basic tools used for troubleshooting a MagneTek Adjustable Frequency drive unit are:

1. An analog multimeter, such as a Simpson Model 260.
2. An ungrounded oscilloscope, with a 10X and 100X probe.
3. A rectifier-type voltmeter.
4. A 30 watt, 1 k-ohm resistor.

#### CHECKING THE UNIT FOR POWER (DC BUS VOLTAGE CHECK)

- Test equipment : DC voltmeter set to highest scale.

#### IMPORTANT

This test is a safety necessity! Before touching any components inside the drive unit, perform the following test to make sure that the unit is powered down and the DC bus capacitors have fully discharged.

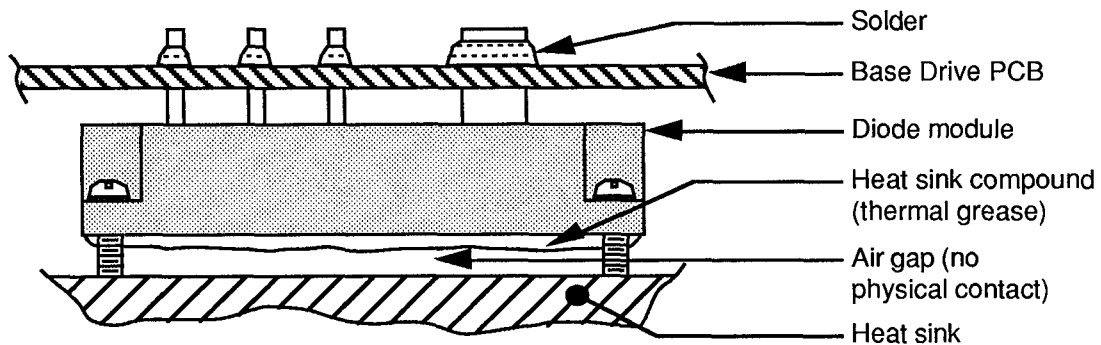
With the unit powered down and the incoming three-phase power disconnected and locked out, look at the "CHARGE" lamp inside the drive unit. If high voltage is present on the DC bus, the "CHARGE" lamp will glow red. As the DC bus capacitors discharge, the "CHARGE" lamp will fade out. There is a possibility of there being at least 50 Vdc present on the DC bus even when the "CHARGE" lamp is off. To determine if the DC bus is completely discharged, measure between the positive and negative portions of the DC bus with a DC voltmeter. Set the meter to its highest scale and place the positive lead onto the positive portion of the DC bus and place the negative lead onto the negative portion on the DC bus. If the measured voltage is below 10 Vdc, you can safely work inside the unit.

#### CAUTION

**The motor must be disconnected from the drive before performing any troubleshooting tests on the unit.**

## CORRECT METHOD FOR REPLACING HEAT SINK MOUNT COMPONENTS

The GPD 503 will not operate properly, or may fail again shortly after repair, if power circuit components which require heat sink contact and connection to the Base Drive PCB have not been correctly installed. The major point to remember is that these components must have firm contact with the heat sink for heat transfer.



***Example of Incorrect Power Component Mounting***

The correct procedure for replacing components of this nature is as follows:

1. De-solder connections of all heat sink mount components from the Base Drive PCB, then remove the board.
2. Remove each defective component, and install its replacement component to the heat sink, including thermal compound.
3. Re-install the Base Drive PCB over the heat sink mounted components.
3. Solder terminals or tabs of components to the board.

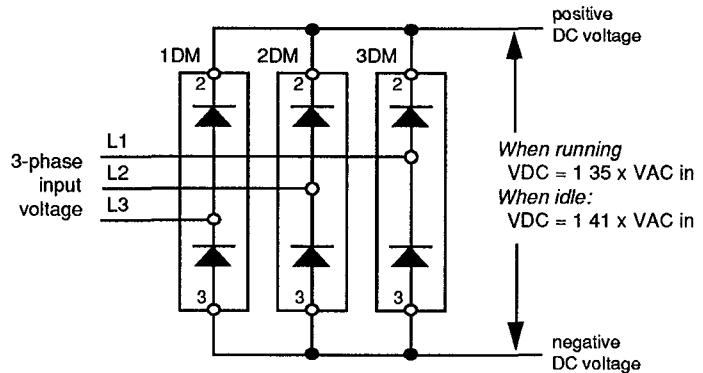
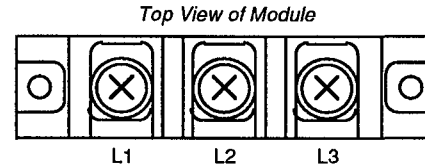
Power OFF  
Motor Disconnected

### INPUT RECTIFIER CHECK

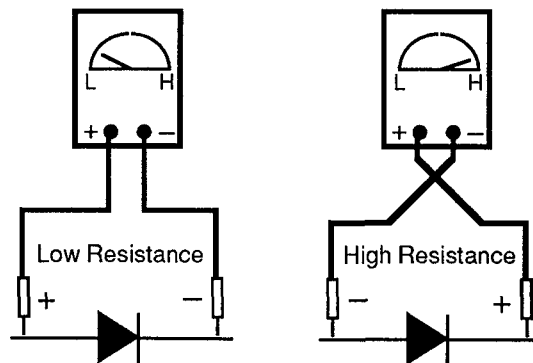
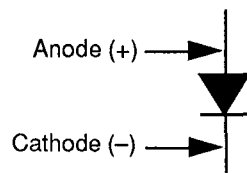
- Test equipment : Analog ohmmeter set to Rx1 scale

The input rectifiers (sometimes called input diodes) are labeled 1-3DM or 1DM on the elementary diagram. The input rectifiers rectify or transform the three-phase AC input voltage into DC bus voltage. The DC bus voltage is directly proportional to the three-phase AC voltage level. The DC bus voltage level should normally be about

The input diodes that form the three-phase input rectifier bridge can be easily checked by measuring the forward and reverse resistance of the diodes. Simply use an analog ohmmeter set to the Rx1 scale to measure resistance across each diode, by looking at the appropriate main power circuit terminals. Refer to the elementary diagram in the back of this manual (or in the diagram at left) to determine the relationship between the main input terminals (L1, L2, L3) and the DC bus terminals. By checking the resistances from each input terminal to the positive bus and the negative bus, then swapping your meter leads (see below), you can check each of the diodes. Remember, you should see a resistance reading typical of a diode, with low resistance in one direction and fairly high resistance in the other direction.



**Typical Diode Module and Rectifier Bridge**



**Diode Resistance Readings**

**Power OFF**  
**Motor Disconnected**

Remember, some units have cooling fans and/or control transformers that may give you unexpected resistance readings. These units should be apparent from their respective elementary diagrams.

If you find that you need to replace a particular module, the elementary idagram can again be used as a valuable tool. Inside each GPD 503 there is a component layout diagram that references the designators shown in the elementary diagram.

It is crucial that you remember to apply a thermal compound to the mounting surface of the diode module, tjo ensure proper heat transfer from the module to the drive's heat sink. Failure to do so may result in another component failure.

It is possible for the input rectifiers to be damaged by very high power line surges (e.g. a lightning strike). The input rectifiers can be easily checked by following the steps listed below.

**Measurement Procedure:**

Step No.	Ohmmeter Positive Lead	Ohmeter Negative Lead	Expected Reading
1	<ul style="list-style-type: none"> <li>• Connect to L1 terminal</li> <li>• Connect to L2 terminal</li> <li>• Connect to L3 terminal</li> </ul>	Negative DC bus terminal labeled "-" or "B0/-"	Infinite ohms
2	<ul style="list-style-type: none"> <li>• Connect to L1 terminal</li> <li>• Connect to L2 terminal</li> <li>• Connect to L3 terminal</li> </ul>	Positive DC bus terminal labeled "B1/+"	Approx 10 ohms
3	Negative DC bus terminal labeled "-" or "B0/-"	<ul style="list-style-type: none"> <li>• Connect to L1 terminal</li> <li>• Connect to L2 terminal</li> <li>• Connect to L3 terminal</li> </ul>	Approx 10 ohms
4	Positive DC bus terminal labeled "B1/+"	<ul style="list-style-type: none"> <li>• Connect to L1 terminal</li> <li>• Connect to L2 terminal</li> <li>• Connect to L3 terminal</li> </ul>	Infinite ohms

**Power OFF**  
**Motor Disconnected**

**Part Numbers:**

Drive Rating (CT)	Diode Designation	Manufacturer Part Number	MagneTek Part Number	Specifications
230V, 1HP	DM1	10L6P44	50207820	800V, 10A, 6 in 1
230V, 2HP	DM1	20L6P44	50207821	800V, 20A, 6 in 1
230V, 3HP	DM1	6R130E-180	50207822	800V, 30A, 6 in 1
230V, 5HP				
230V, 7.5HP	DM1	6R150E-080M5	50207823	800V, 50A, 6 in 1
230V, 10HP	DM1	6R175E-080	50207824	800V, 75A, 6 in 1
230V, 15HP	DM1	100L6P41	50173962	800V, 100A, 6 in 1
230V, 20HP	DM1-3	11L2G43	50184816	800V, 160A, 2 in 1
230V, 25/30HP				
230V, 30HP				
460V, 1HP	DM1	RM10TA-24	50207825	1200V, 20A, 6 in 1
460V, 2HP				
460V, 3HP				
460V, 5HP	DM1	30Q6P42	50207826	1200V, 30A, 6 in 1
460V, 7 5HP				
460V, 10HP				
460V, 15HP	DM1	50Q6P43	50184817	1200V, 50A, 6 in 1
460V, 20HP	DM1	75Q6P43	50207827	1200V, 75A, 6 in 1
460V, 25/30HP	DM1	100Q6P43	50184818	1200V, 100A, 6 in 1
460V, 30HP				
460V, 40/50HP	DM1-3	110Q2G43	50207828	1200V, 110A, 2 in 1
460V, 50/60HP				
460V, 75HP				

Power OFF  
Motor Disconnected

## DC BUS FUSE CHECK

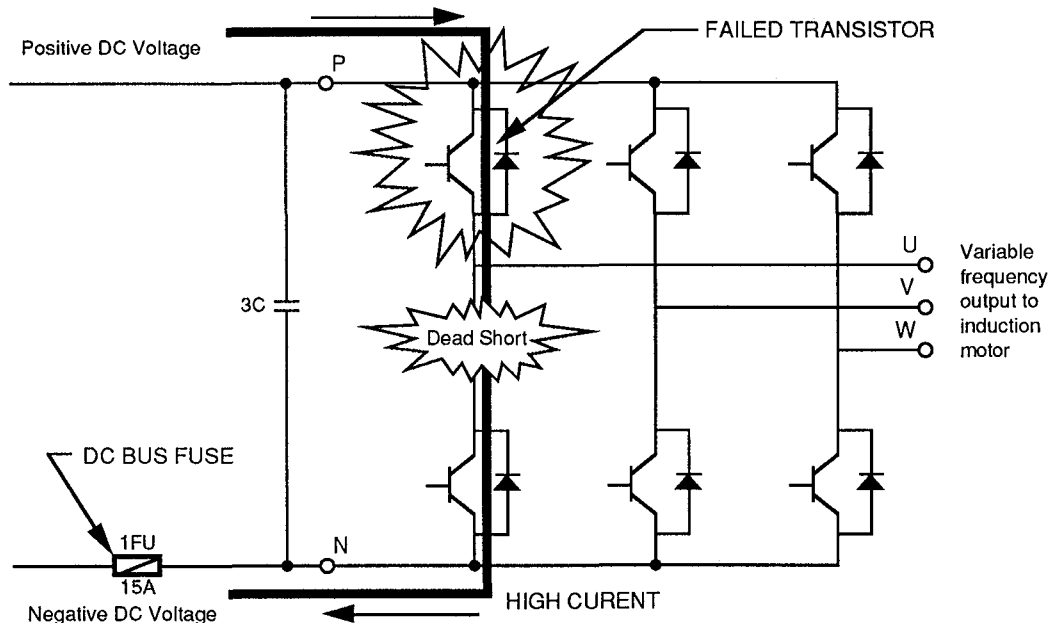
- Test equipment : Analog ohmmeter set to Rx1 scale

The DC bus fuse is located in the negative section of the DC bus. It is used to protect the main circuit components if the output transistors short. If the DC bus fuse is open, at least one output transistor has failed. When a transistor fails, there is a short between the positive and negative sections of the DC bus. Again, the DC bus fuse does not protect the transistors, but protects the rest of the main circuit from the high currents present during a short between the positive and negative sections of the DC bus (as shown in the illustration below).

### CAUTION

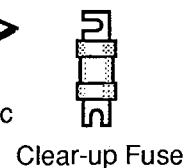
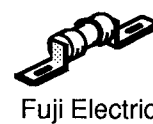
**Never replace the DC bus fuse without first replacing the shorted output transistors.**

If the DC bus fuse is replaced without replacing the shorted out transistor, non-warranty damage will occur.



**Function of DC Bus Fuse**

DC bus fuses vary in size, rating and manufacturer, depending on the rating of the drive. Shown here are some examples of fuse types by different manufacturers.



**Power OFF**  
**Motor Disconnected**

To check the fuse, use an analog ohmmeter set to the Rx1 scale. Place one meter lead on one side of the fuse and place the other meter lead on the opposite side of the fuse. If the fuse is good, the meter will read 0 ohms. If the fuse is bad, the meter will read infinite ohms (the needle will swing to the high end of the meter dial).

**Part Numbers:**

Drive Rating (CT)	Manufacturer Part Number	MagneTek Part Number	Specifications
230V, 1HP	CR2LS-10/UL	50207849	250V, 10A
230V, 2HP			
230V, 3HP	CR2LS-20/UL	50184828	250V, 20A
230V, 5HP	CR2LS-30/UL	50184829	250V, 30A
230V, 7.5HP	CR2LS-50/UL	50184830	250V, 50A
230V, 10HP			
230V, 15HP	CR2LS-75/UL	50184831	250V, 75A
230V, 20HP	A50P-100	50818324	250V, 100A
230V, 25/30HP	A50P-150	50814859	250V, 150A
230V, 30HP			
460V, 1HP	A70P15-4	50207850	700V, 15A
460V, 2HP			
460V, 3HP			
460V, 5HP	A70P30-4	50207851	700V, 30A
460V, 7.5HP			
460V, 10HP			
460V, 15HP	A70P-50	50184835	700V, 50A
460V, 20HP			
460V, 25/30HP	A70P100-4	50207852	700V, 100A
460V, 30HP			
460V, 40/50HP	A70L125	50184862	700V, 125A
460V, 50/60HP	A70P-150	50184863	700V, 150A
460V, 75HP			

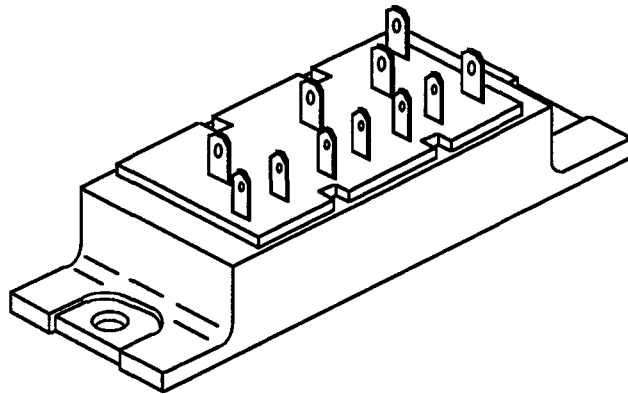
<p>Power OFF Motor Disconnected</p>
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## OUTPUT TRANSISTOR MODULES

- Test equipment : Analog ohmmeter set to Rx1 scale
- Disconnect motor from drive.

The output transistors are used to produce an output voltage that will supply power to the motor. Think of them as switches that turn on and off very quickly to supply power to the motor. They are rectangular in shape, black in color, and are mounted to the heat sink of the drive.

Large capacity drives use single pair style transistors, while the smaller capacity drives use the 6-in-1 style transistor module (illustrated at right). In the single pair transistor, one transistor switches positive DC voltage to the motor, while the other transistor switches negative DC voltage to the motor. The positive transistor is turned on by the red and white twisted wires connected to mini-terminals G1 and E1. The negative transistor is turned on by the red and white wires connected to mini-terminals G2 and E2. The 6-in-1 module works the same way, with the positive and negative leads connected to the screw terminals labeled (+) and (-). The terminals labeled U, V, and W are the leads that go out to the motor.

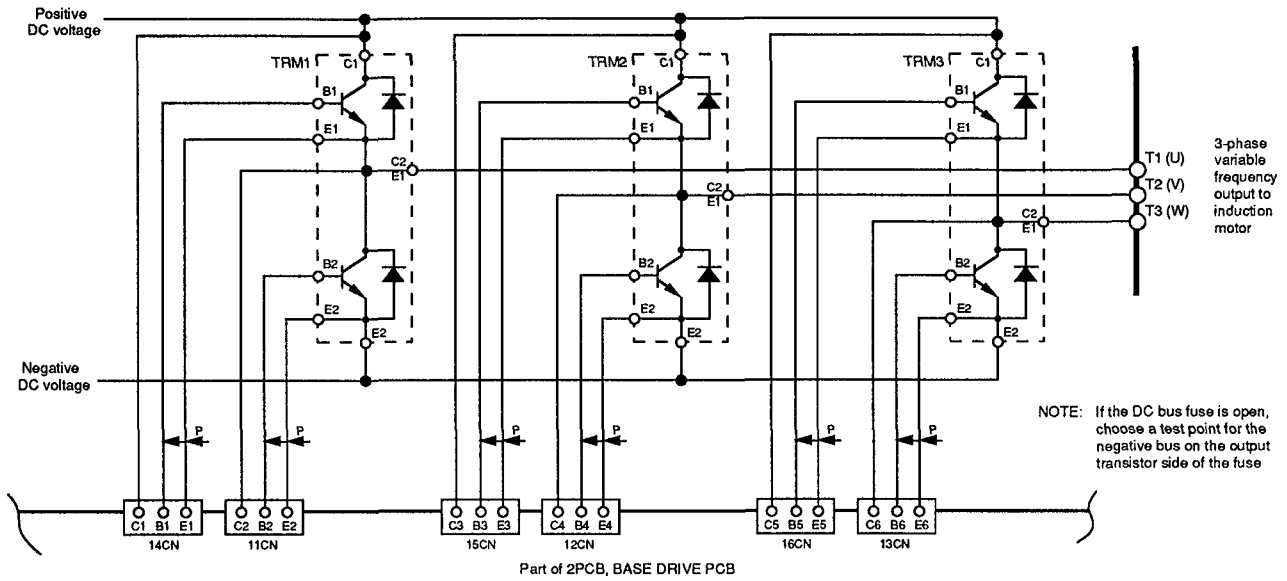


**6-in-1 Insulated Gate Bipolar Transistor (IGBT) Module**

Output transistors can be checked by simply measuring the resistance from the collector to the emitter. The power transistors used in the GPD 503 all have a free-wheeling diode connected in anti-parallel with the collector-emitter junction. This diode is contained within the transistor module. When measuring the resistance across the output transistors, you should use an ohmmeter set to the Rx1 scale, and expect to see resistance readings characteristic of the free-wheeling diode. Resistance should be fairly low in the forward direction and very high in the reverse direction.

When a transistor fails, all the transistors in the failed phase must be replaced. They must be replaced with the identical transistor manufacturer and part number. It is very important to remember to apply a thermal compound to the mounting surface of the transistor module to ensure proper heat transfer from the module to the heat sink. Failure to follow any of these procedures will lead to non-warranty drive damage.

Power OFF  
Motor Disconnected



### Output Transistor Schematic Diagram

#### Measurement Procedure: Checking across the gate and emitter

Step No.	Ohmmeter Positive Lead	Ohmmeter Negative Lead	Expected Reading
1	<ul style="list-style-type: none"> <li>• Connect to T1 terminal</li> <li>• Connect to T2 terminal</li> <li>• Connect to T3 terminal</li> </ul>	Negative DC bus terminal labeled "-" or "B0/-"	Infinite ohms
2	<ul style="list-style-type: none"> <li>• Connect to T1 terminal</li> <li>• Connect to T2 terminal</li> <li>• Connect to T3 terminal</li> </ul>	Positive DC bus terminal labeled "B1" or "B1/+"	Approx 10 ohms
3	Negative DC bus terminal labeled "-" or "B0/-"	<ul style="list-style-type: none"> <li>• Connect to T1 terminal</li> <li>• Connect to T2 terminal</li> <li>• Connect to T3 terminal</li> </ul>	Approx 10 ohms
4	Positive DC bus terminal labeled "B1" or "B1/+"	<ul style="list-style-type: none"> <li>• Connect to T1 terminal</li> <li>• Connect to T2 terminal</li> <li>• Connect to T3 terminal</li> </ul>	Infinite ohms

**Power OFF**  
**Motor Disconnected**

**Part Numbers:**

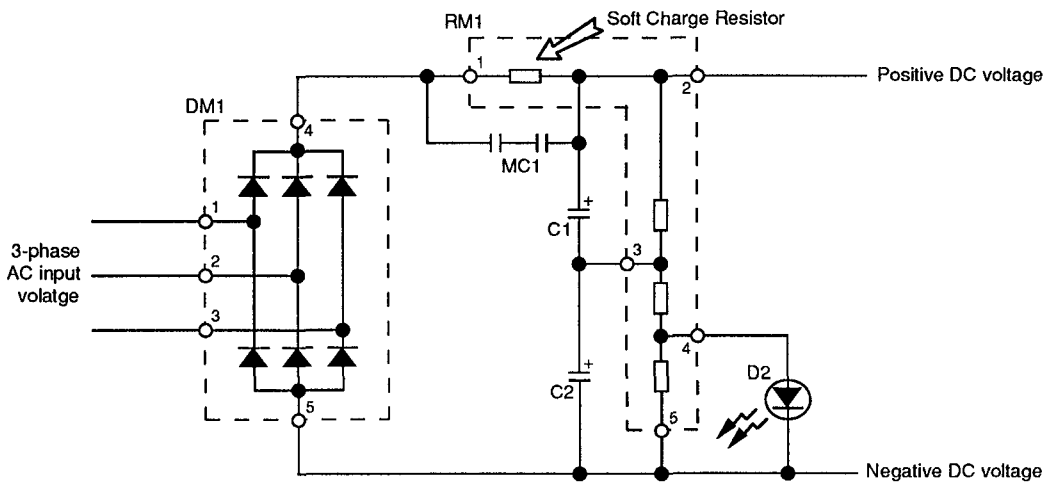
Drive Rating (CT)	Transistor Designation	Qty	Manufacturer Part Number	MagneTek Part Number	Specifications
230V, 1HP	TRM 1	1	6MBI15-060	50207802	600V, 15A, 6 in 1
230V, 2HP	TRM 1	1	6MBI20-060	50207803	600V, 20A, 6 in 1
230V, 3HP	TRM 1	1	6MBI30-060	50207804	600V, 30A, 6 in 1
230V, 5HP	TRM 1	1	6MBI50-060	50207805	600V, 50A, 6 in 1
230V, 7.5HP	TRM 1-3	3	MG75J2YS1	50207806	600V, 75A, 2 in 1
230V, 10HP	TRM 1-3	3	MG100J2YS1	50207807	600V, 100A, 2 in 1
230V, 15HP	TRM 1-3	3	MG150J2YS1	50207808	600V, 150A, 2 in 1
230V, 20HP	TRM 1-3	3	MG200J2YS1	50207809	600V, 200A, 2 in 1
230V, 25/30HP	TRM 1-6	6	CM300HA-12	50207810	600V, 300A
230V, 30HP					
460V, 1HP	TRM 1	1	6MBI8-120	50207811	1200V, 8A, 6 in 1
460V, 2HP	TRM 1	1	6MBI15-120	50207812	1200V, 15A, 6 in 1
460V, 3HP					
460V, 5HP	TRM 1-3	3	2MBI25-120	50207813	1200V, 25A, 2 in 1
460V, 7.5HP	TRM 1-3	3	2MBI150-120	50207814	1200V, 50A, 2 in 1
460V, 10HP					
460V, 15HP	TRM 1-3	3	MG75Q2YS1	50207815	1200V, 75A, 2 in 1
460V, 20HP	TRM 1-3	3	MG100Q2YS1	50207816	1200V, 100A, 2 in 1
460V, 25/30HP	TRM 1-3	3	MG150Q2YS1	50207817	1200V, 150A, 2 in 1
460V, 30HP					
460V, 40/50HP	TRM 1-6	6	CM300HA-24	50207818	1200V, 300A
460V, 50/60HP					
460V, 75HP	TRM 1-6	6	CM400HA-24	50207819	1200V, 400A

Power OFF  
Motor Disconnected

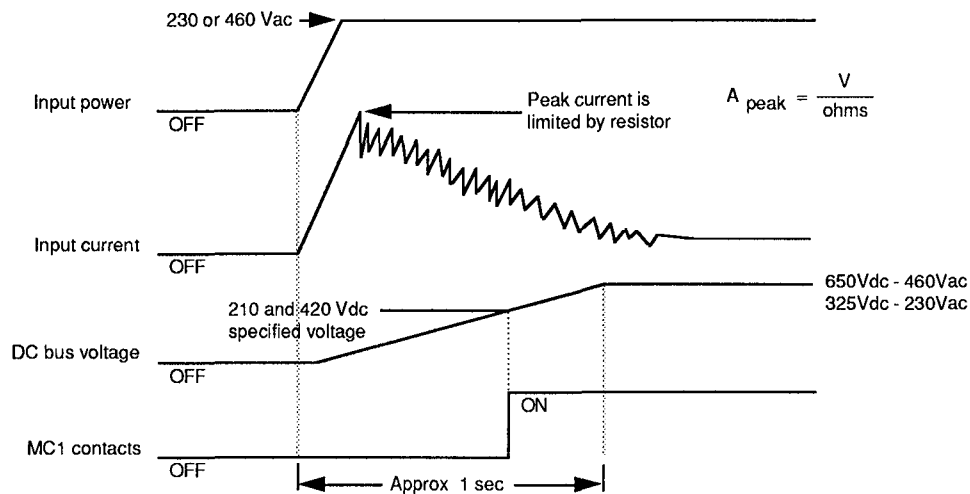
**SOFT CHARGE RESISTOR CHECK**

- Test equipment : Analog ohmmeter set to Rx1 scale

The soft charge resistor, or current limiting resistor, works in conjunction with the MC1 contactor to slowly charge the DC bus capacitors and minimize the inrush current, when power is applied to the drive. With no power applied to the drive, the DC bus is discharged and the contacts labeled MC1 are open. When the input power is applied to the drive, the DC bus voltage starts to increase. The contact labeled MC1 is open, so the current that is charging the DC bus is passing through the soft charge resistor, labeled RM1. The soft charge resistor acts like a flow control valve, and causes the DC bus to charge slowly. When the DC bus voltage reaches a specified level, the MC1 contact closes and bypasses the soft charge resistor. If a soft charge resistor was not used, the large inrush current would damage the input diodes.



**Soft Charge Resistor Circuit Schematic Diagram (Small Capacity Drive Shown)**

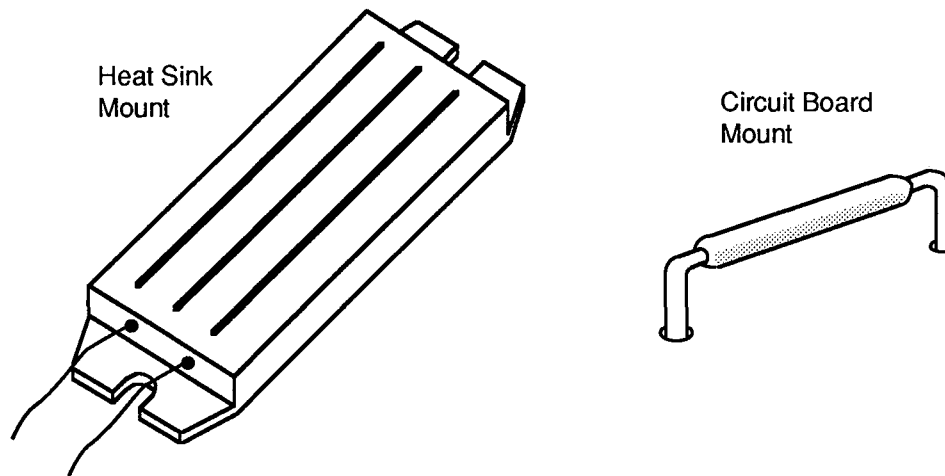


**Soft Charge Resistor Circuit Sequence Diagram**

<p>Power OFF Motor Disconnected</p>
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It is common during a drive malfunction for the soft charge resistor to be damaged. The soft charge resistor will change with the capacity of the drive. The small capacity drives use a heat sink mounted resistor module, which is labeled RM1 on the elementary diagram, and also houses the bus resistor. It is white in color and made from a ceramic material. The larger capacity drives use a single circuit board mount resistor for a soft charge resistor, usually labeled R1 on the elementary diagram. It is contained in a metal casing and is about 5 inches long.

The first step to check the resistor is to look at it. Many times a damaged soft charge resistor has physical damage, such as burn marks, discoloration, or rupture of the casing. If there is no physical evidence of damage, a check with an ohmmeter must be performed. Locate the MC1 contactor inside the drive unit. With the ohmmeter set to the Rx1 scale, measure across the contacts of the MC1 contactor. Check the ohmic value on the side of the resistor to make sure the measured value is correct. If the resistor is damaged, the measured value will be infinite ohms (burned open).



***Examples of Soft Charge Resistors***

**Power OFF**  
**Motor Disconnected**

**Part Numbers:**

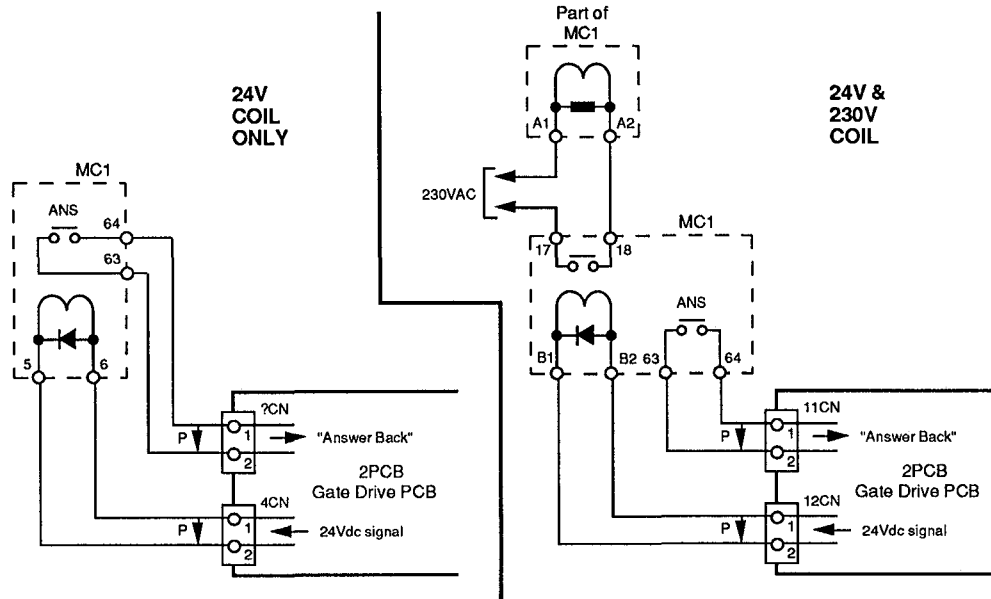
Drive Rating (CT)	Reistor Designation	Code Number	Specifications
230V, 1HP	R41	R007464	10W, 22 ohm, ±10%
230V, 2HP			
230V, 3HP	R1, R2	R007461	7W, 3.3 ohm, ±10%
230V, 5HP			
230V, 7.5HP	R1	R007477	40W, 3 ohm, ±5%
230V, 10HP			
230V, 15HP	R1	R007491	80W, 1.5 ohm, ±10%
230V, 20HP			
230V, 25/30HP	R1	R007492	80W, 1 ohm, ±10%
230V, 30HP			
460V, 1HP	R1, R2	R007465	7W, 25 ohm, ±10%
460V, 2HP	R1, R2	R007466	10W, 19 ohm, ±10%
460V, 3HP			
460V, 5HP	R1	R007472	40W, 10 ohm, ±10%
460V, 7.5HP			
460V, 10HP			
460V, 15HP	R1	R007493	80W, 8.2 ohm, ±10%
460V, 20HP			
460V, 25/30HP	R1	R007494	80W, 4.3 ohm, ±10%
460V, 30HP			
460V, 40/50HP			
460V, 50/60HP	R1	R007495	80W, 3 ohm, ±10%
460V, 75HP			

**Power OFF**  
**Motor Disconnected**

### MC1 CONTACTOR

- Test equipement : Analog ohmmeter set to Rx1 scale

The purpose of the MC1 contactor is to bypass around the soft charge resistor after the DC bus voltage has risen above the undervoltage detection point (210 Vdc for 230V units; 420 Vdc for 460V units).



#### Sequence of Operation:

##### For 24V Coil Only

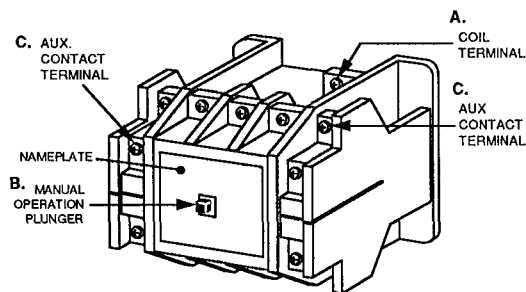
1. DC bus voltage rises above UV point.
2. 24 volt signal turns on at 4CN pins 1 & 2 to energize contactor coil.
3. "Answer back" contact closes (terminals 63 & 64) to signal that contactor is energized.

##### For 24V & 230V Coil

1. DC bus voltage rises above UV point.
2. 24 volt signal turns on at 12CN pins 1 & 2, on Gate Driver board, to turn on MC1's 24 Vdc pilot relay (terminals B1 & B2).
3. N.O. contact (terminals 17 & 18) closes, and energizes the 220 Vac main coil (terminals A1 & A2).
4. "Answer back" contact closes (terminals 63 & 64) to signal that contactor is energized.

#### Check Points:

- A. Measure coil(s) (terminals 5 & 6, or A1 & A2 and B1 & B2) with analog meter, checking for open or short.
- B. Measure across main contacts (terminals 1 & 2, 3 & 4, 5 & 6), and press in the plunger to observe main contacts closing.
- C. Apply 24 Vdc to 24V main coil (terminals 5 & 6) or pilot relay coil (terminals B1 & B2); watch contacts at terminals 17 & 18 and 63 & 64 open and close.



NOTE: This illustration not true to scale

Power OFF  
Motor Disconnected

**MC1 CONTACTOR (continued)**

**Part Numbers:**

Drive Rating (CT)	24V Coil Only	24V & 230V Coil	Manufacturer Part Number	Specifications
230V, 1HP	√		JR1A-DS24V	DC24V, 250A, 16A
230V, 2HP				
230V, 3HP	√		JH1A-DC24V	DC24V, 80MA, 30A
230V, 5HP				
230V, 7 5HP		√	JH2AS-DC24V	DC24V, 250V, 20A
230V, 10HP				
230V, 15HP		√	HI-15E2TCU	220V, 30A
230V, 20HP				
230V, 25/30HP		√	HI-25ETCU-U	200V, 58A
230V, 30HP				
460V, 1HP	√		JC2A-DC24V	DC24V, 250V, 10A
460V, 2HP				
460V, 3HP				
460V, 5HP	√		JH2AS-DC24V	DC24V, 250V, 20A
460V, 7 5HP				
460V, 10HP				
460V, 15HP	√		HP-20GU	DC24V, 20A, 3A
460V, 20HP				
460V, 25/30HP		√	HI-15E2TCU	220V, 30A
460V, 30HP				
460V, 40/50HP		√	HI-25ETCU-U	200V, 58A
460V, 50/60HP				
460V, 75HP				

Power OFF  
Motor Disconnected

### CONTROL POWER/COOLING FAN FUSE

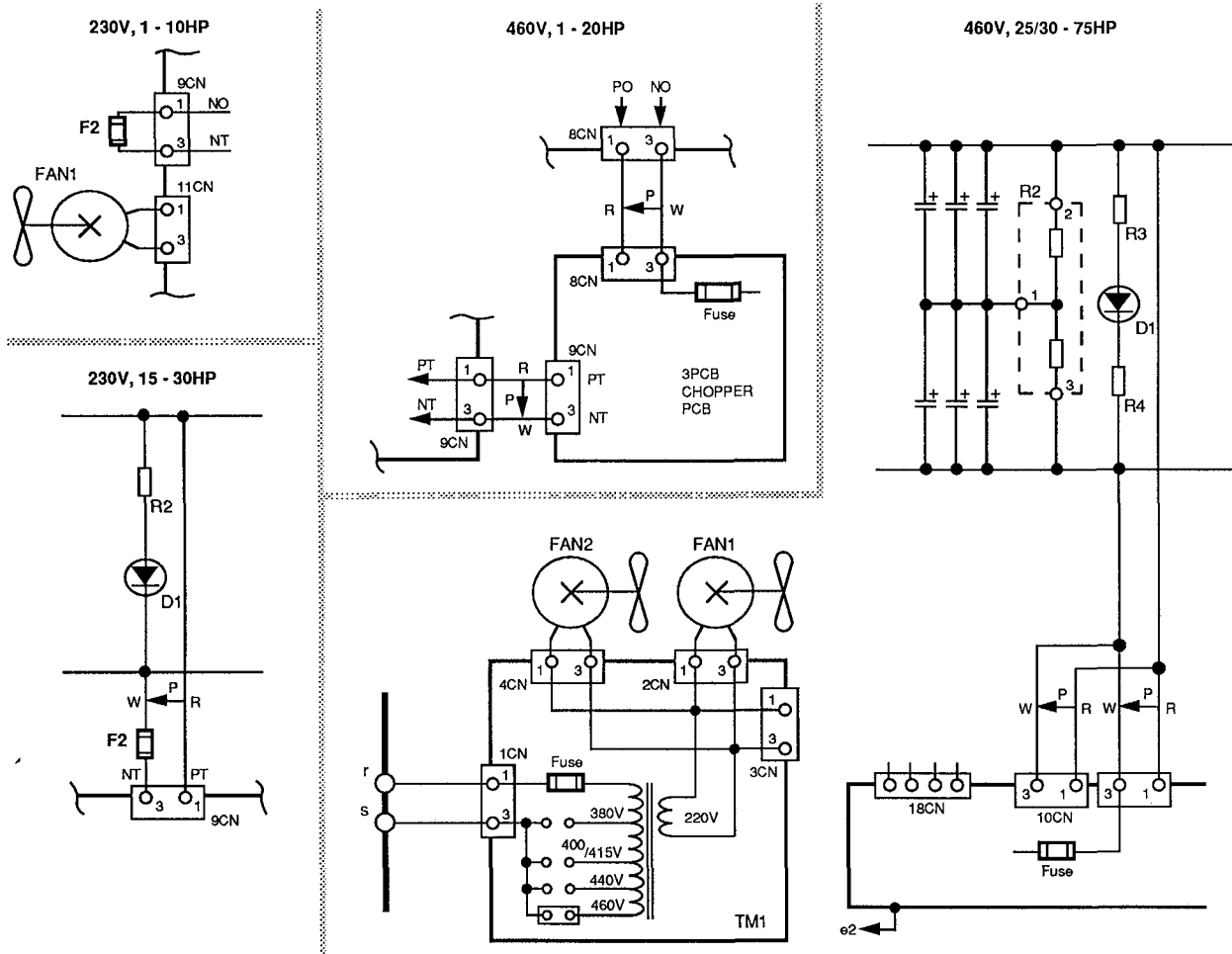
- Test equipment : Analog ohmmeter set to Rx1 scale

A small control circuit fuse is located inside the drive. In some units the fuse protects the control power circuit; in some it protects the cooling fan; and in others, it protects both.

If the control fuse is open, check the following items for a problem:

- Control power rectifier is shorted on control power transformer printed circuit board.
- Control power smoothing capacitor is bad on control power transformer printed circuit board.
- The cooling fan motor is bad (refer to "Cooling Fan Check").
- MC1 contactor coil is shorted.
- Control Board power supply is defective.

The fuse can be easily checked using an analog ohmmeter set to the Rx1 scale. Place one lead of the ohmmeter on one side of the fuse, and place the other lead of the ohmmeter on the other side of the fuse. If the fuse is good, the measured value will be 0 ohms. If the power fuse is bad, this indicates that there is a problem somewhere in the unit.



**Schematic Diagrams of Control Power Fuses**

Power OFF  
Motor Disconnected

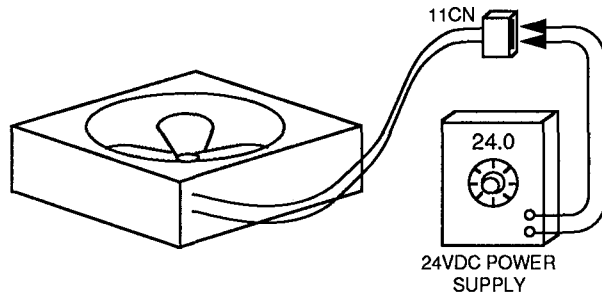
### COOLING FAN CHECK

- Test equipment : Analog ohmmeter set to Rx1 scale  
24Vdc power supply

Except for the lowest rated 230V GPD 503s, every drive has a cooling fan that blows cooling air across the heat sink. If the cooling fan is not working properly, the drive will trip on an overheat fault. Visually check each cooling fan to make sure it turns freely. If there is no physical evidence that the fan motor is bad, it may be checked with a 24Vdc power supply or an ohmmeter.

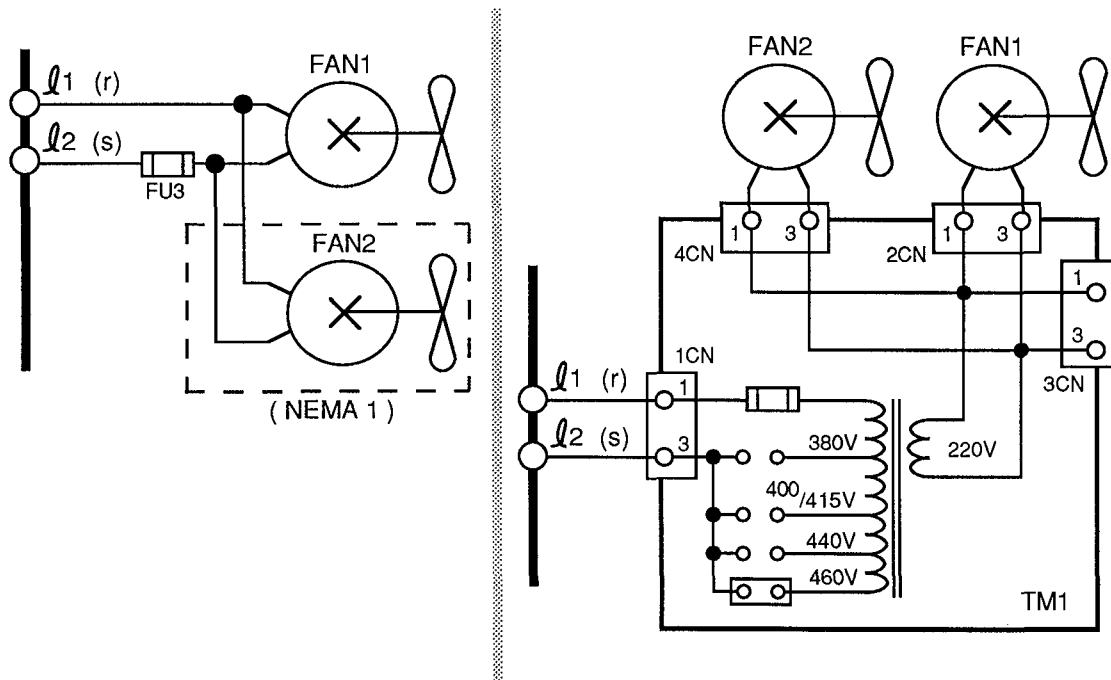
#### Procedure for 24VDC fan:

1. Locate the fan.
2. Disconnect fan motor leads connector (11CN) from Control PCB.
3. Apply 24Vdc to the pins in 11CN, and verify that the fan motor turns.



#### Procedure for 200-220V fans:

1. Locate Fans 1, 2 and 3.
2. Disconnect the two yellow leads that are connected to the fan motor terminals.
3. Using an analog ohmmeter set to the Rx1 scale, measure across the fan terminals. If the fan motor is good, the measured value should be close to 500 ohms. If the measured value is 0 ohms, you can conclude that the motor is shorted; a reading of infinite ohms indicates that the motor that the motor is burned open.



Power OFF  
Motor Disconnected

**COOLING FAN CHECK (continued)**

**Part Numbers:**

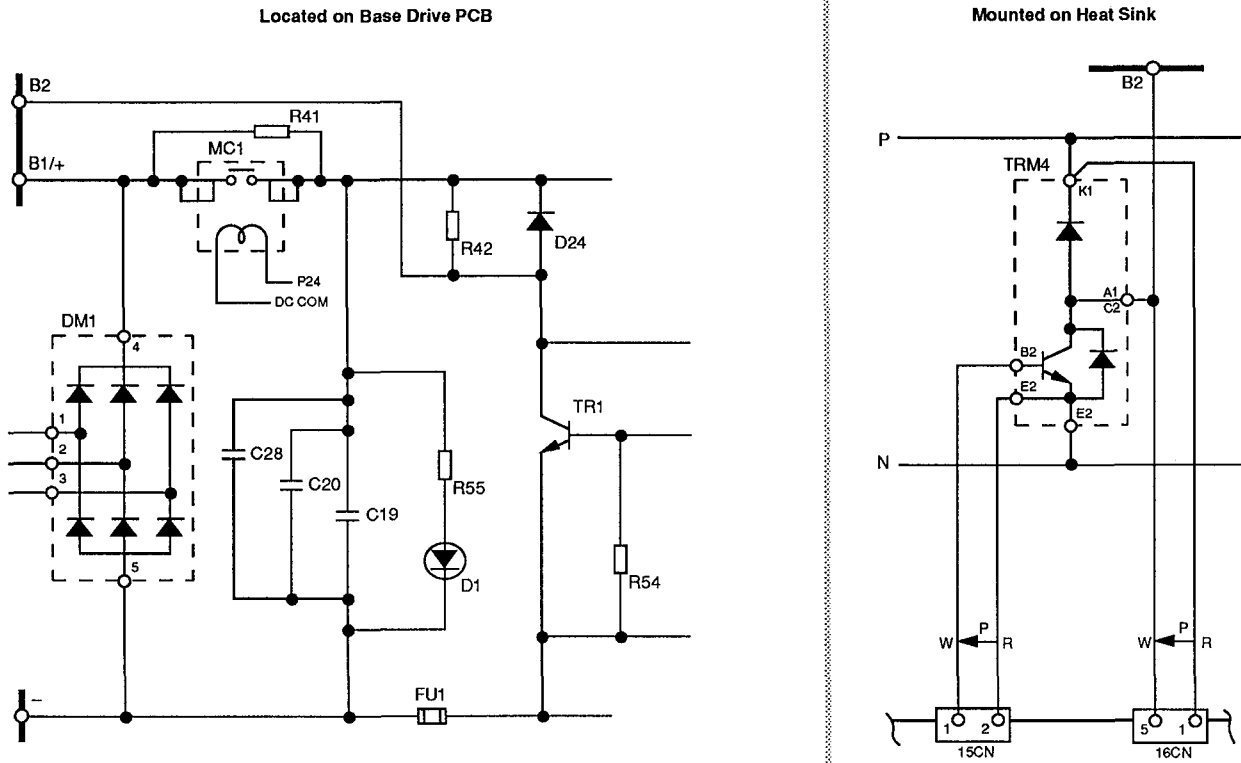
Drive Rating (CT)	Fan Designation	Qty	Manufacturer Part Number	MagneTek Part Number	Specifications
230V, 1, 2HP	none	—	—	—	—
230V, 3HP	FAN 1	1	4710NL-05W-B40	50207846	DC24V, 0.17A, RIB type
230V, 5HP					
230V, 7.5HP					
230V, 10HP					
230V, 15, 20HP					
230V, 15, 20HP	FAN 1	1	5915PC-22T-B30-B00	50173902	200-220V, 50/60Hz, 36/40W
	FAN 2	1	4710PS-22T-B20-B00	50207847	200-220V, 50/60Hz, 9/8W
230V, 25/30, 30HP	FAN 1	1	5915PC-22T-B30-B00	50173902	200-220V, 50/60Hz, 36/40W
	FAN 2	1	4710PS-22T-B30-B00	50173901	200-220V, 50/60Hz, 14/13W
460V, 1HP	FAN 1	1	4710NL-05W-B40	50207846	DC24V, 0.17A, RIB type
460V, 2HP					
460V, 3HP					
460V, 5HP					
460V, 7.5HP					
460V, 10HP					
460V, 15HP	FAN 1	1	UHS4556M	50207848	220V, 50/60Hz, 20/18W
460V, 20HP					
460V, 25/30, 30HP	FAN 1	1	5915PC-22T-B30-B00	50173902	200-220V, 50/60Hz, 36/40W
	FAN 2	1	4715PS-22T-B30-B00	50173901	200-220V, 50/60Hz, 14/13W
460V, 40/50HP	FAN 1	1	5915PC-22T-B30-B00	50173902	200-220V, 50/60Hz, 36/40W
460V, 50/60HP					
460V, 75HP	FAN 1-2	2	5915PC-22T-B30-B00		200-220V, 50/60Hz, 36/40W
	FAN 3	1	4715PS-22T-B30-B00		200-220V, 50/60Hz, 14/13W

Power OFF  
Motor Disconnected

### BRAKING IGBT CHECK

- Test equipment : Analog ohmmeter set to Rx1 scale

Measure across the emitter and collector of the braking IGBT.



**Schematic Location of Braking IGBT**

Power OFF  
Motor Disconnected

**Part Numbers:**

Drive Rating (CT)	Brake IGBT Designation	Qty	Manufacturer Part Number	Code Number	Specifications
230V, 1HP	TR1	1	GT 15J101	STR00358	600V, 15A
230V, 2HP	TR1	1	GT 50J101	STR00383	600V, 50A
230V, 3HP					
230V, 5HP					
230V, 7.5HP	TR1	2			
230V, 10HP					
230V, 15HP	none *	-	-	-	-
230V, 20HP					
230V, 25/30HP					
230V, 30HP					
460V, 1HP	TR 1	1	GT 15Q101	STR00377	1200V, 15A
460V, 2HP	TR 1	1			
460V, 3HP					
460V, 5HP	TR 1	2	GT 25Q101	STR00338	1200V, 25A
460V, 7.5HP					
460V, 10HP					
460V, 15HP	TRM4	1	GT 50E3Y-24	STR00373	1200V, 50A
460V, 20HP					
460V, 25/30HP	none *	-	-	-	-
460V, 30HP					
460V, 40/50HP					
460V, 50/60HP					
460V, 75HP					

\* To use dynamic braking, external Braking Module (Transistor Unit) must be used

## Section 2. POWER CHECKS

### CAUTION

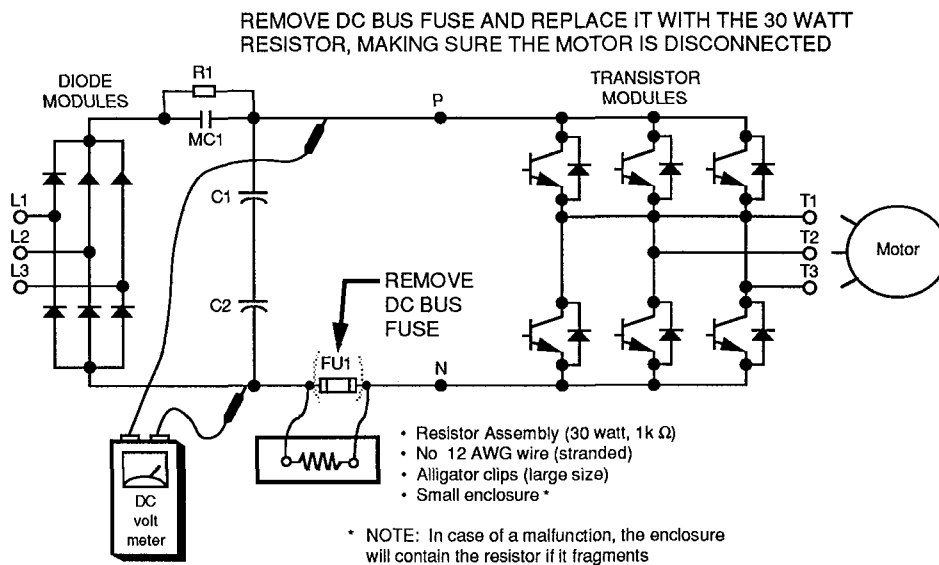
When performing checks with power, the DC bus voltage on a 230V drive will be 325 Vdc; on a 460V drive, it will be 650 Vdc. Extreme caution must be used when working on the drive. Make sure the "CHARGE" lamp is not glowing and the DC bus measures below 10 Vdc before touching any components. The motor must be disconnected to perform these tests!

Power OFF  
Motor Disconnected

### REMOVE DC BUS FUSE

- Test equipment : 30 watt, 1 k-ohm, DC resistor; DC voltmeter with 1,000 volt scale

Remove the DC bus fuse and install a 30 watt, 1 k-ohm resistor. Connect your DC voltmeter between P and N, on the DC bus.



Power ON  
Motor Disconnected

Apply power to the drive and watch for three signs of trouble:

- Voltage measured between P and N is low.  
325 Vdc for 230V drive is normal  
650 Vdc for 460V drive is normal
- Digital Operator displays an undervoltage ( **Uu** ) fault.
- The 30 watt, 1 K-ohm resistor gets very hot.

If any of these conditions occur, there is still a short between the P and N bus. Turn off the power immediately!

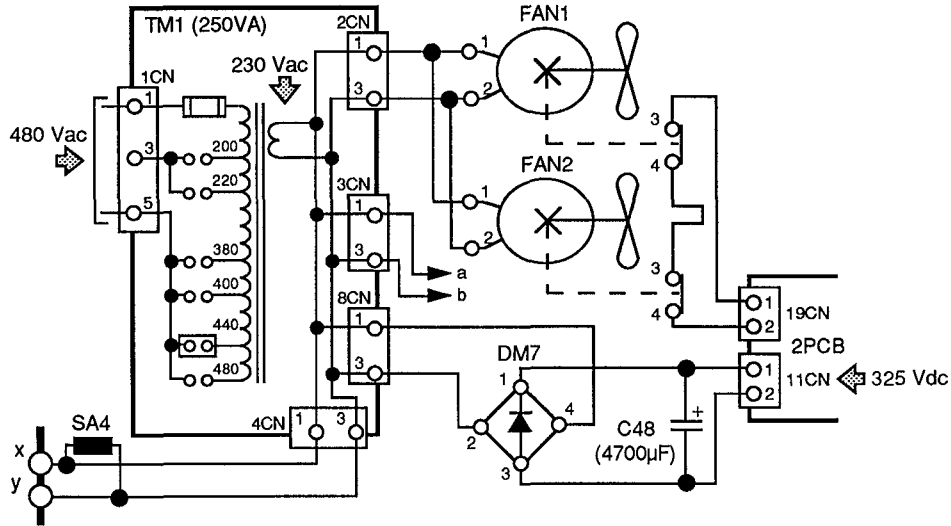
**Power ON**  
**Motor Disconnected**

**CONTROL POWER VOLTAGE CHECK**

- Test equipment : DC voltmeter with 600V scale

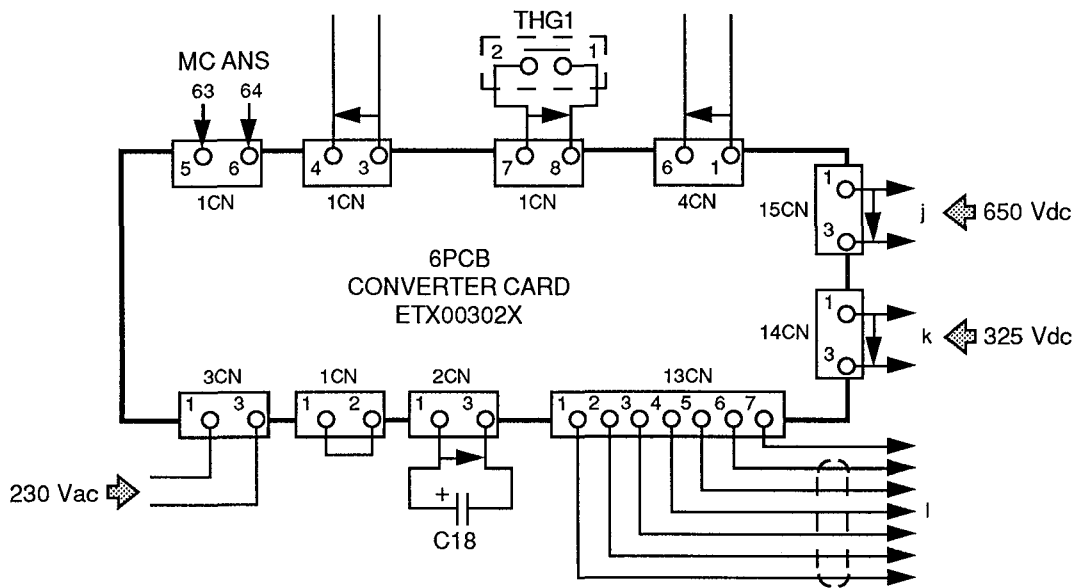
The control power circuit consists of a small bridge rectifier, a resistor and a smoothing capacitor. The control power can be measured at 11CN on the Gate Drive board. Normal voltage level is 310-325 Vdc.

- Typical for all except 460V 250-400HP (230V units do not require transformer TM1):



When measuring the control power on 460V 250-400HP, locate 6PCB converter card.

- Typical for 460V 250-400HP:



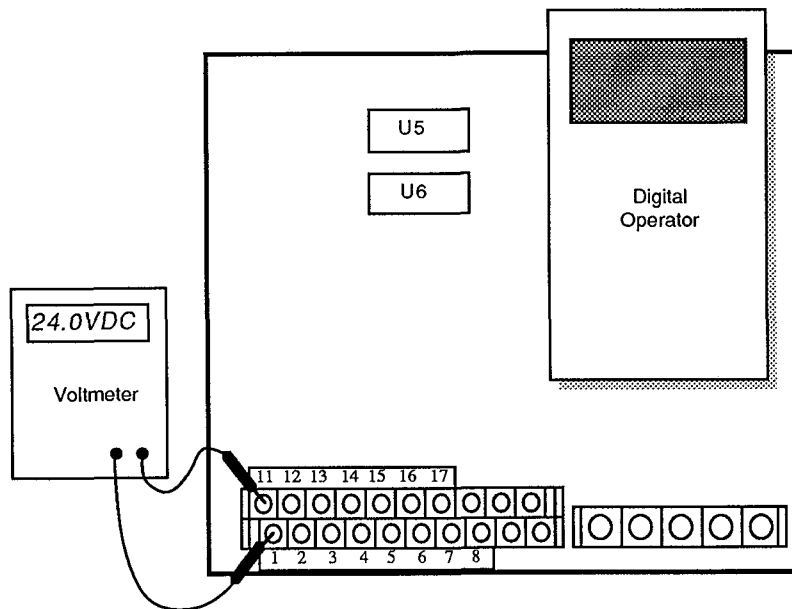
Power ON Motor Disconnected
--------------------------------

## CONTROL BOARD POWER SUPPLY TEST

– Test equipment : DC voltmeter set at 50V scale

To check the power supplies on the control board external terminals, follow the steps listed below:

1. Apply power to the circuit.
2. Measure between terminal 11 (-) and terminals 1 (+) through 8 (+); +24 Vdc should be present.
3. Measure between terminals 15 (+) and 17 (-); +15 Vdc should be present.
4. Measure 8CN points 1 (+) and 2 (-); +24 Vdc should be present.
5. Measure between 8CN pins 3 (+) and 4 (-); +10 Vdc should be present.
6. Measure between 8CN pins 5 (+) and 6 (-); +18 Vdc should be present.



Power ON  
Motor Disconnected

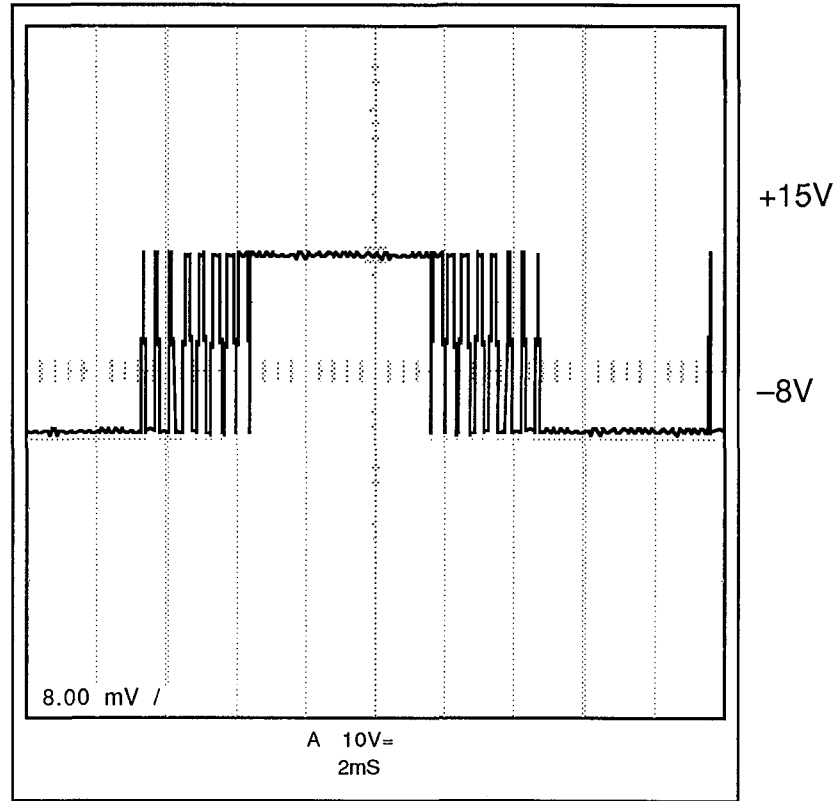
**GATE CIRCUIT CHECK ON THE GATE DRIVE BOARD**

- Test equipment : Ungrounded oscilloscope with X10 probe

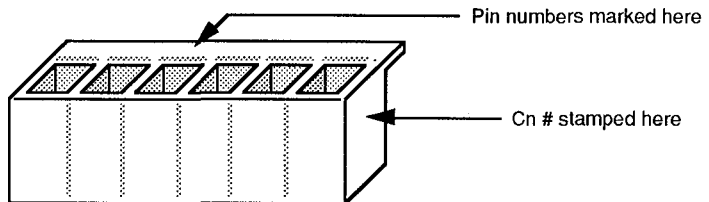
Set the scope to 2V/div, and 2mSec.; then measure across gate and emitter pins which lead to the output IGBT. Run the drive at 60Hz, and compare the waveform you see to Waveform 1 below.

**Do not remove white connectors CN11, CN12, CN13 or CN14 from the board!  
Removing the connectors from the board while power is applied to the drive will cause transistors to be damaged.**

**Waveform 2 – Gate-Emitter Waveform at 60Hz**



**White Connector  
Physical Diagram**



Power ON Motor Disconnected
--------------------------------

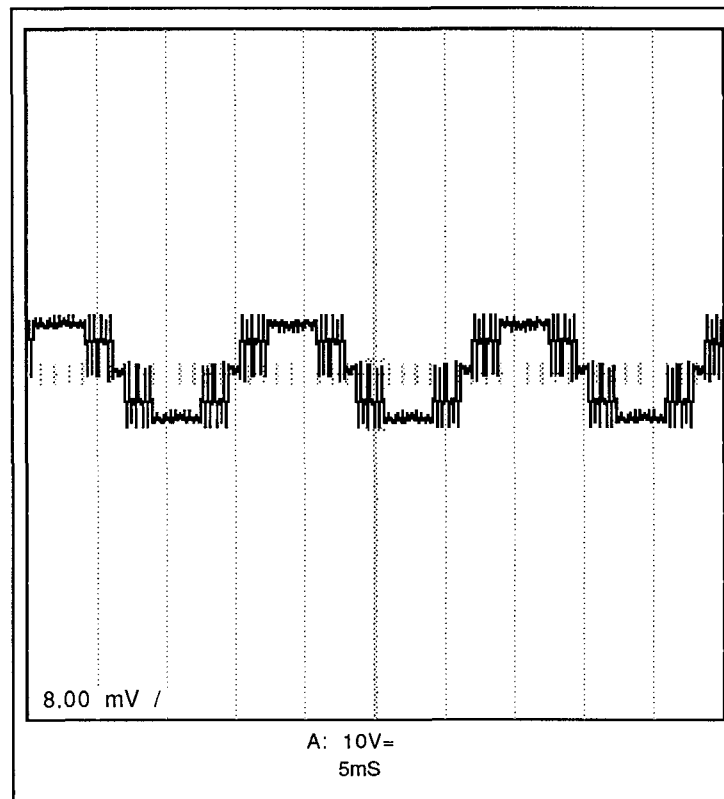
## OUTPUT VOLTAGE WAVEFORM

- Test equipment : Ungrounded oscilloscope with X100 probe

Set the scope to 200V/div, and 5mSec., in order to observe the output voltage waveform.

1. Using the oscilloscope, measure between T1 and T2.
2. Run the drive up to 60Hz, watching the waveform as it accelerates.
3. Compare the waveform at 60Hz with Waveform 2 below.
4. Stop the drive.
5. Repeat steps 1 through 4, measuring T1 to T3, and T2 to T3.

**Waveform 2 - Output Voltage Waveform at 60Hz**



Power OFF Motor Disconnected
---------------------------------

Remove AC power from the drive and allow the DC bus capacitors to discharge. When the DC bus measures less than 10 Vdc, remove the 30 watt, 1 k-ohm resistor and reinstall the DC bus fuse.

<p>Power ON Motor Connected</p>
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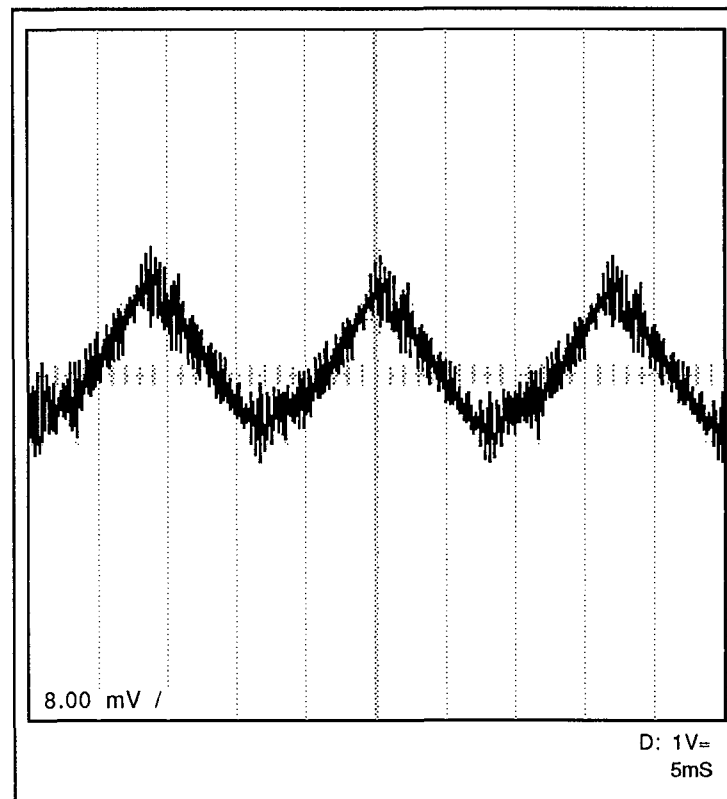
## OUTPUT CURRENT WAVEFORM

– Test equipment : Ungrounded oscilloscope with X100 probe

Set the scope to 0.2V/div, and 5mSec., in order to observe the output current waveform. Connect the motor to the output of the drive at T1, T2 and T3, and check the output current waveform using the following procedure:

1. Using the oscilloscope, measure between CN19, pins 3 and 4 on 230V units, pins 3 and 5 on 460V units.
2. Run the drive up to 60Hz, watching the waveform as it accelerates.
3. Compare the waveform at 60Hz with Waveform 3 below.
4. Stop the drive.
5. Repeat steps 1 through 4 for connectors CN20 and CN21.

**Waveform 2 – Output Current Waveform at 60Hz**



0 } Amplitude will increase as output current increases

# GPD 503

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