

# POWEROHM INSTRUCTION MANUAL FOR “PW-NC” SERIES HIGH CURRENT BRAKING MODULES



**IMPORTANT:** These instructions should be read thoroughly before installation. All warnings and precautions should be observed for both personal safety and for proper equipment performance and longevity. Failure to follow these instructions could result in equipment failure and/or serious injury to personnel. Braking modules contain lethal voltages when connected to the inverter. It is very important to remove power to the inverter before installing or servicing this unit. Always allow adequate time (approximately 5 minutes) after removing power before touching any components. The LED's must be completely out before servicing the unit.

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AC variable frequency drives are commonly used with general purpose AC induction motors to form reliable variable speed drive systems. Problems with these drive systems can occur when an application requires a deceleration rate faster than what can be managed by the drive alone, or when motor speeds exceed the synchronous speed set by the output frequency of the drive (which is called an overhauling load condition). Both of these conditions create regenerated power which flows from the motor back into the drive, causing its DC Bus to rise. To manage the regenerated power and avoid shutting the drive down due to an over-voltage trip, this power must be dissipated by an external braking resistor.

PowerOhm Type BM Braking Modules can be used in conjunction with any AC drive to monitor the DC bus of the drive and activate external braking resistor as needed not only to avoid over-voltage trips, but to greatly improve the performance of the drive system. The use of Braking Modules and resistors increase the braking torque capability of a variable frequency drive, allowing faster and more controlled deceleration times.

To accommodate system horsepower requirements beyond the capability of a single Module, the Modules are all Master/Slave programmable. This allows an arrangement of multiple Modules to effectively function as a single higher rated module.

## INSPECTION UPON RECEIPT

Upon receipt of your PowerOhm Braking Module, be sure to carefully unpack the module and inspect the unit carefully for any shipping damage. The module contains electronics that can be damaged by static electricity, so handle in accordance with industry standards. Check for loose, broken or otherwise damaged parts due to shipping. Report any shipping damage immediately to the freight carrier. Be sure to verify that the part number and ratings listed on the nameplate match the order specification and the capabilities of the drive system. ***The ratings listed on the nameplate are critical – installing and energizing the incorrect part number could damage the braking module and/or the drive!***

## ENVIRONMENTAL CONDITIONS

The PowerOhm Type PW-NC Braking Module should be installed in an environment protected from moisture and excessive dust. Dust buildup can reduce the electrical insulation characteristics of the unit and moisture can cause arcing or shorting. Air must be free of combustible gases and corrosive vapors.

**Ambient Temperature Range: -10°C to 40°C**

**Maximum Altitude: 3300 feet (1000m)**

The PowerOhm Type PW-NC Braking Module is available in line voltages ranging from 208 to 720 volts. Peak currents up to the maximum are allowed at intermittent duty cycles (reference the below tables for details).

**TABLE 1a: General Specifications for 450 amp “PW-NC” Braking Module**

PowerOhm Part No.	Nominal AC Line Voltage	Minimum Ohms @ listed Turn ON	Turn ON Voltage (vdc)	RMS Cont Current	Max Peak Current	Max Watt Loss
PWA-450NC	240	0.63	375	450	600	1155
PWB-450NC	480	1.25	750			
PWC-450NC	600	1.57	940			
PWD-450NC	690	1.77	1090			
PWE-450NC	720	1.81	1120			

**TABLE 1b: General Specifications for 600 amp “PW-NC” Braking Module**

PowerOhm Part No.	Nominal AC Line Voltage	Minimum Ohms @ listed Turn ON	Turn ON Voltage (vdc)	RMS Cont Current	Max Peak Current	Max Watt Loss
PWA-600NC	240	0.42	375	600	900	1522
PWB-600NC	480	0.83	750			
PWC-600NC	600	1.04	940			
PWD-600NC	690	1.18	1090			
PWE-600NC	720	1.21	1120			

**TABLE 1c: General Specifications for 900 amp “PW-NC” Braking Module**

PowerOhm Part No.	Nominal AC Line Voltage	Minimum Ohms @ listed Turn ON	Turn ON Voltage (vdc)	RMS Cont Current	Max Peak Current	Max Watt Loss
PWA-900NC	240	0.28	375	900	1350	2257
PWB-900NC	480	0.56	750			
PWC-900NC	600	0.70	940			
PWD-900NC	690	0.79	1090			
PWE-900NC	720	0.80	1120			

**TABLE 1d: General Specifications for 1200 amp “PW-NC” Braking Module**

PowerOhm Part No.	Nominal AC Line Voltage	Minimum Ohms @ listed Turn ON	Turn ON Voltage (vdc)	RMS Cont Current	Max Peak Current	Max Watt Loss
PWA-1200NC	240	0.21	375	1200	1800	2992
PWB-1200NC	480	0.42	750			
PWC-1200NC	600	0.52	940			
PWD-1200NC	690	0.59	1060			
PWE-1200NC	720	0.60	1085			

The PowerOhm Type PW-NC Braking Module should be installed on a low vibration surface that is non-flammable.

**Maximum Vibration: 10 to 20Hz, 32ft/sec/sec; 20 to 50Hz, 6.5 ft/sec/sec**

**Attention: Installation and removal of this equipment should be done by qualified personnel only. Equipment must be installed in accordance with all applicable national and local electrical codes and regulations.**

## MOUNTING REQUIREMENTS

To allow proper cooling, it is very important to install the fan cooled PowerOhm braking modules in a location with an ambient temperature not exceeding 40 degrees Celsius or below 0 degrees Celsius. Modules should be installed in an environment with sufficient circulation of clean, dry air. The module should be installed in an area allowing a minimum of 6 inches of free space above and below the frame, and 2" on both sides to allow proper airflow and cooling.

## POWER EARTH GROUNDING

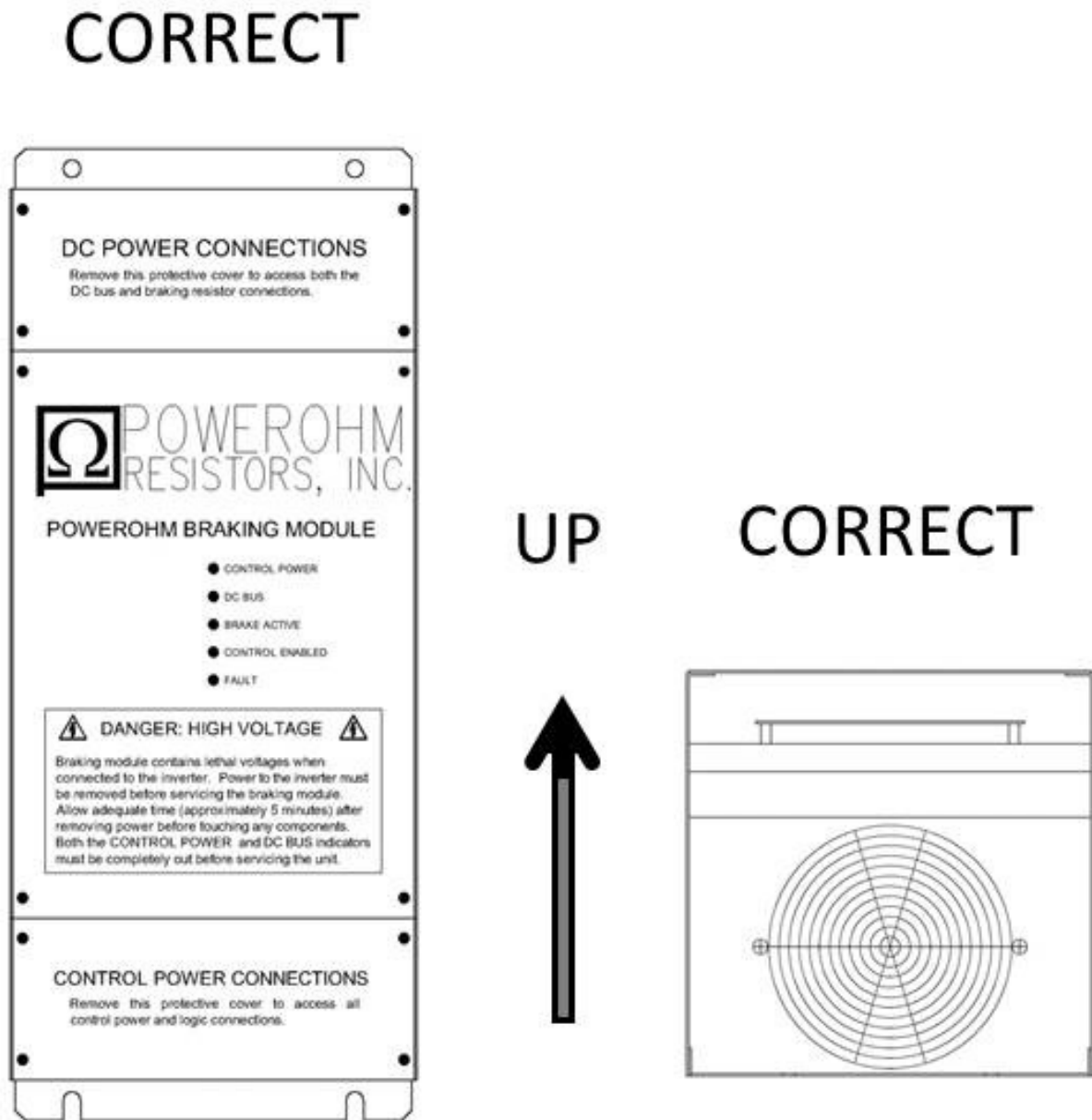
A good earth ground is essential in today's PWM drive installations. The PowerOhm brake module should have a dedicated Power Earth ground wire that runs directly to the drive PE ground to mitigate drive system noise. Each drive and cabinet should be properly earth grounded, with all safety grounds connected directly to PE ground. Excessive common mode noise may need to be shunted to PE ground.

## CONTROL EARTH GROUNDING

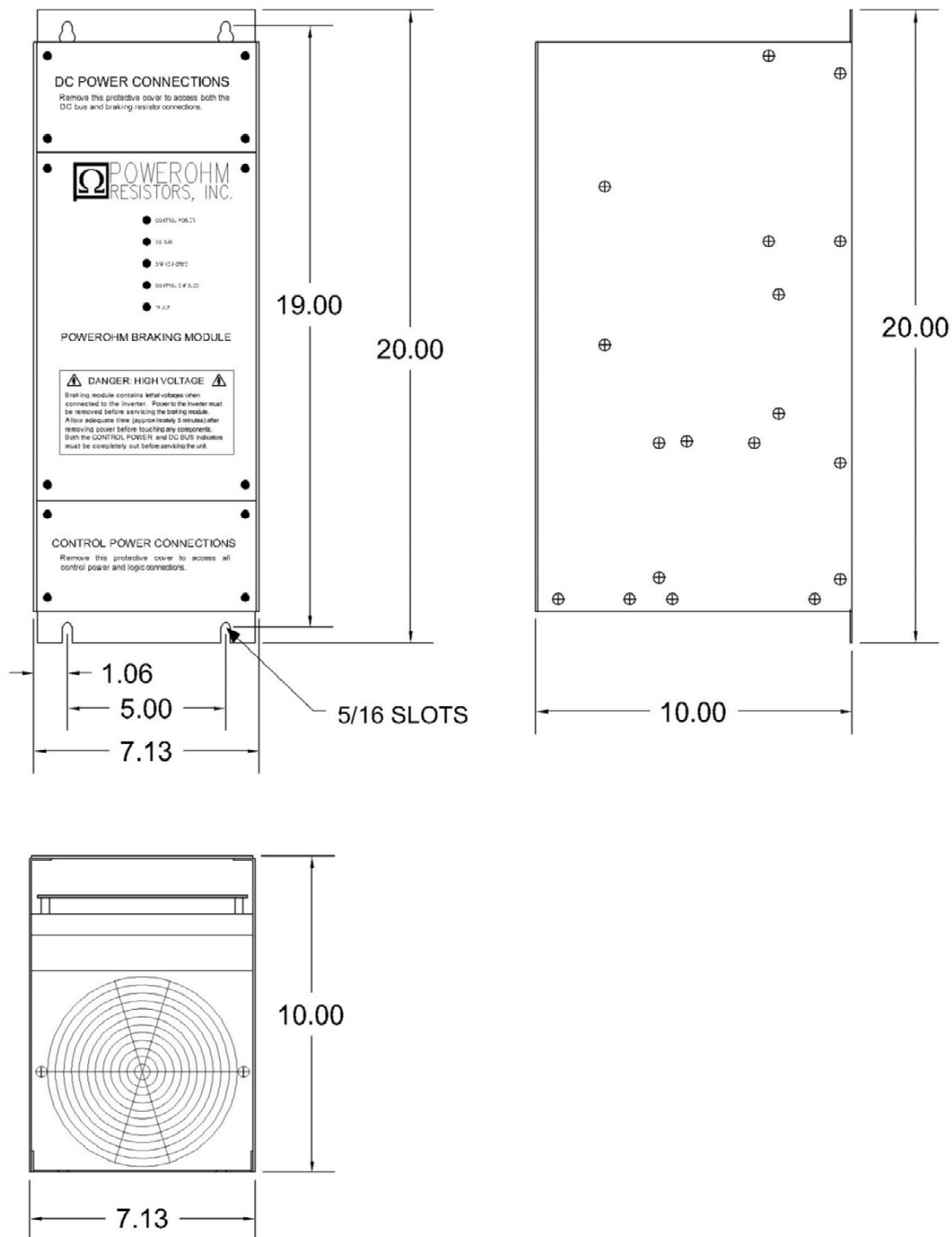
In order to minimize the effects of drive system noise it is recommended that the control power supply and I/O INPUTS not be tied to earth ground. If they must be tied to earth for other system components, use a clean earth ground.

The PowerOhm PW-NC Series Braking Module can be installed in both a vertical or horizontal position (see Figure 1).

**FIGURE 1: Mounting Orientation for PW-NC Braking Modules**

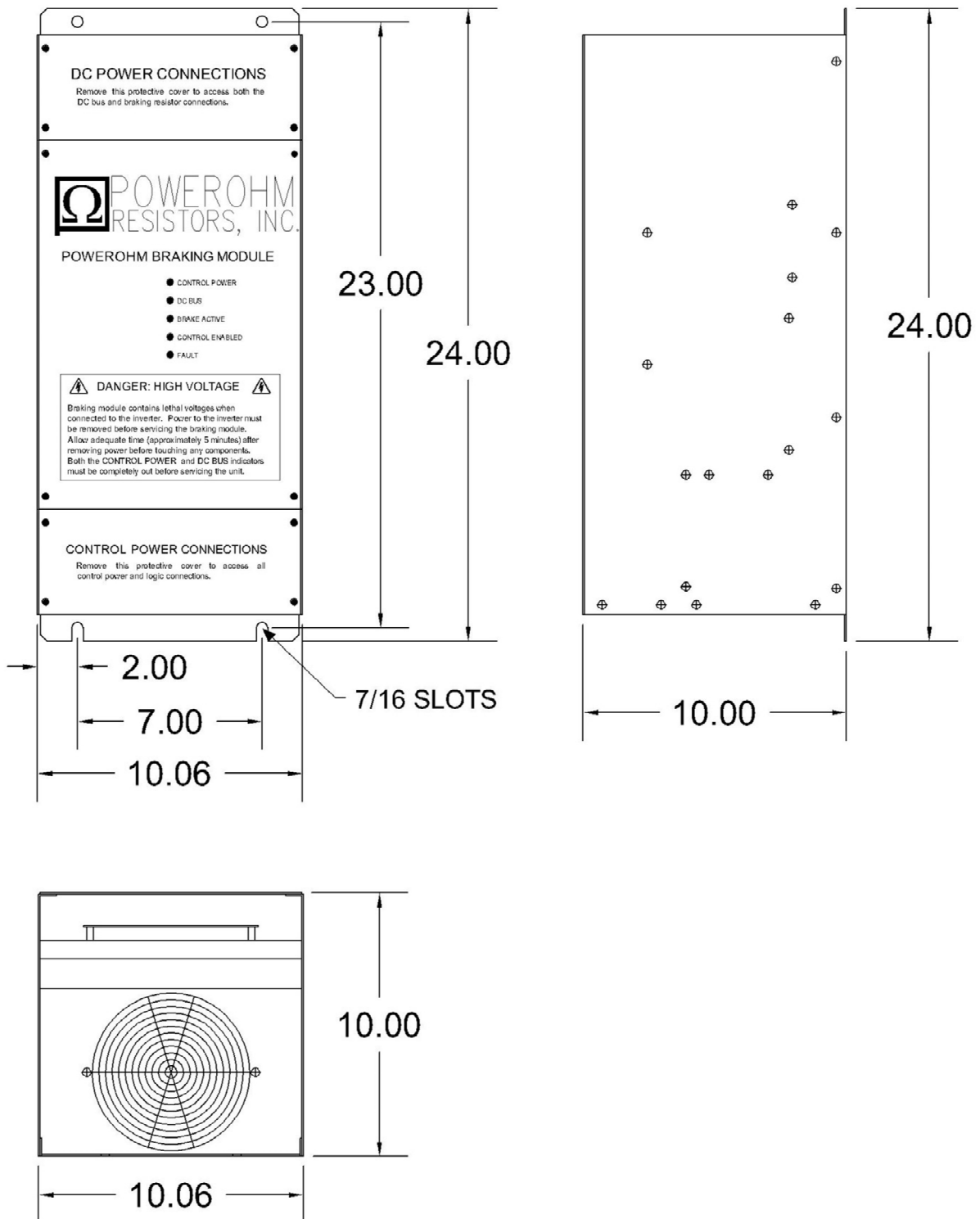


## FIGURE 2a: Braking Module Dimensions for 450 & 600 amp Models



**Weight:** The weight of the 450 amp unit is 30lbs and the 600 amp is 34 lbs.

# FIGURE 2b: Braking Module Dimensions for 900 & 1200 amp Models



**Weight:** The weight of the 900 amp unit is 55lbs and the 1200amp is 60lbs.

# WIRING RECOMENDATIONS

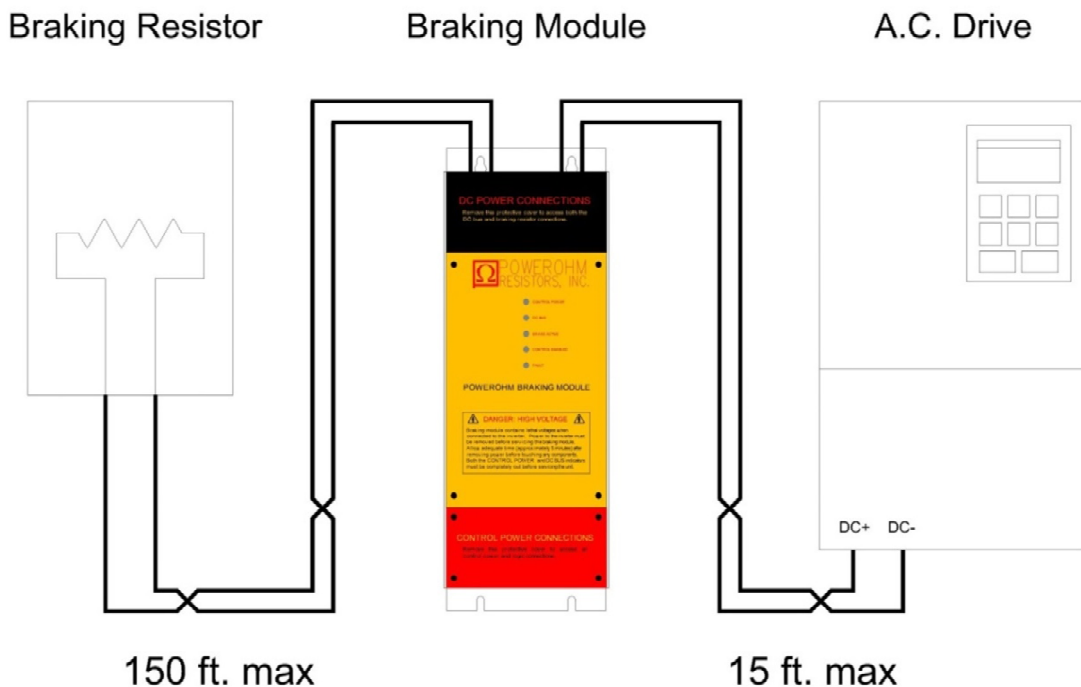
It is recommended that the AC drive manual, braking resistor instructions and any other pertinent documentation be thoroughly reviewed before proceeding.

NEVER bundle power wires and control wires together. Control and power wiring should be separated to avoid electrical noise and interference problems. The responsibility for proper wiring lies with the machine builder.

The wiring between the drive and braking module should not exceed 15 feet and between the braking resistor and braking module should not exceed 150 feet.

**IMPORTANT: Always properly ground each module to earth. Ground Braking Module directly to AC Drive Module Power ground (PE)**

**Figure 3: Power Wiring Lengths Between Drive System Components**



**WARNING: Never install a braking resistor directly across the DC bus of the drive. Drive damage or failure may occur upon applied power. Additionally, without the braking module to activate and deactivate the braking resistor, the resistor will dissipate power continuously and be subject to overheating and failure.**

# WIRE SIZING

Reference Table 2 for suggested minimum wire sizes only. Keep in mind the duty cycle rating greatly affects the minimum wire size needed, and wire size/length affect the load ohm value.

**TABLE 2: Wire Sizing for Power Interconnections**

Motor HP at 10% Duty Cycle			MIN WIRE SIZE
240VAC	480VAC	600VAC	
50HP-100HP	100HP to 200HP	100HP to 200HP	4awg
100HP to 200HP	300HP to 500HP	300HP to 500HP	1/0
N/A	500HP-1000HP	500HP-1000HP	4/0
Motor HP at 30% Duty Cycle			MIN WIRE SIZE
240VAC	480VAC	600VAC	
50HP-100HP	100HP to 200HP	100HP to 200HP	2awg
100HP to 200HP	300HP to 500HP	300HP to 500HP	2/0
N/A	500HP-1000HP	500HP-1000HP	350kcm

**Note: 18 AWG wire is sufficient for all control and signal wiring**

**ATTENTION: The National Electric Code (NEC) and local regulations govern the installation and wiring of electrical equipment such as braking resistors and modules. DC power wiring, AC power wiring, control wiring and conduit must be installed in accordance with all applicable codes and regulations.**

## POWER CONNECTIONS

The PowerOhm Type PW-NC Braking Module features a total of five power connections.

- \* Run both resistor leads direct to the RES+ and RES – terminals.
- \* Run both DC bus leads from drive direct to the DC+ and DC – terminals.
- \* Keep away from all control wiring and cross at 90deg angles at least an inch away.

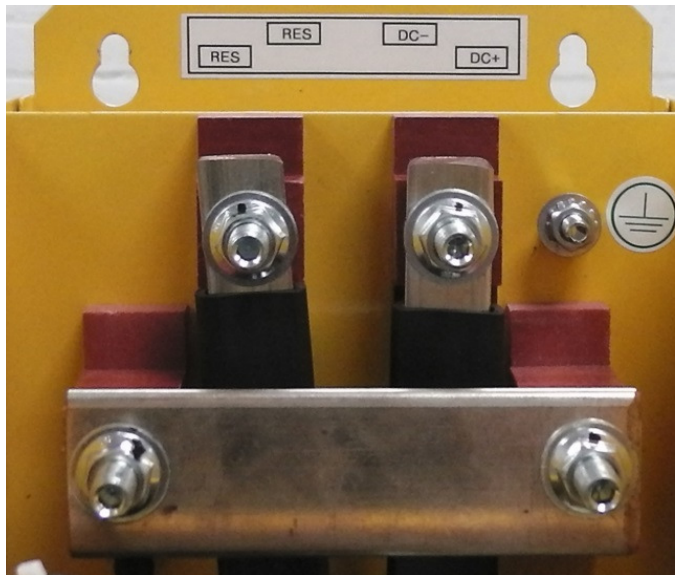
**TABLE 3a: Descriptions of Power Connections for 450 & 600 amp**

Terminal Label	Terminal Description	Connection Type	Socket Size	Max.Torque (lb-ft) for 900A/1200A
DC -	DC Bus Connection (Negative)	3/8" studs	9/16"	50
DC+	DC Bus Connection (Positive)	3/8" studs	9/16"	50
⊕	Ground Connection	3/8" hole	-	-
RES -	Braking Resistor IGBT Connection	3/8" studs	9/16"	50
RES+	Braking Resistor DC+ Connection	3/8" studs	9/16"	50

**450amp**

**600 amp**

Power  
Earth  
Ground



**TABLE 3b: Descriptions of Power Connections for 900 & 1200 amp**

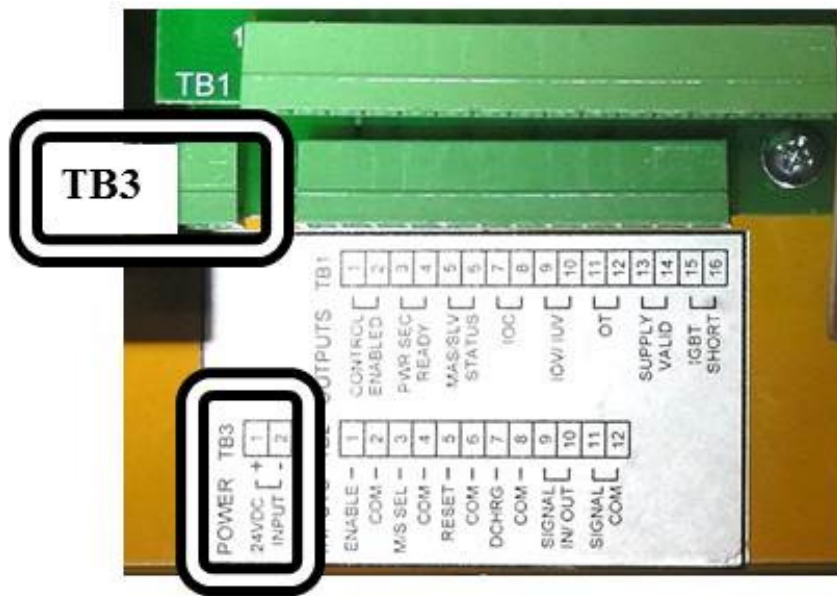
Terminal Label	Terminal Description	Connection Type	Socket Size	Max.Torque (lb-ft) for 900A/1200A
DC -	DC Bus Connection (Negative)	Two ½" studs	¾"	50
DC+	DC Bus Connection (Positive)	Two ½" studs	¾"	50
⓪	Ground Connection	3/8" hole	-	-
RES -	Braking Resistor IGBT Connection	Two ½" studs	¾"	50
RES+	Braking Resistor DC+ Connection	Two ½" studs	¾"	50

**900 & 1200 amp**



**TABLE 4: 115vac Control Power Description**

TB3 Terminal Number	Terminal Description (TB3)	Electrical Ratings	Max Wire Size	Maximum Torque (lb-in)
1	115vac Input Power	115vac / 1a	14awg	2.2
2	115vac Input Power			



While it is safe to earth ground the external control supply, the placement of this ground could inadvertently add to system noise in the control loop. Floating this source may be best for noise immunity.

## CONTROL POWER DESCRIPTION (TB3)

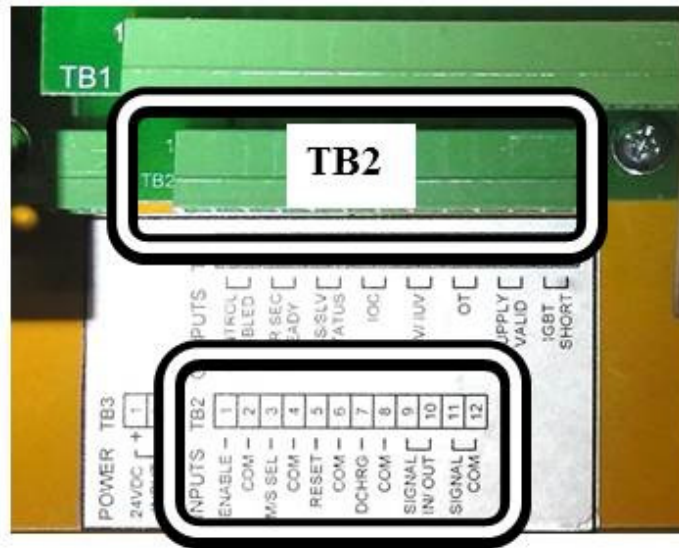
### 1. CONTROL POWER

- 115vac +/- 10% is used for control and fan power.
- Supply valid fault occurs when the internal 24v feeding the control board drops below 19vdc.
- Current draw is approximately .5 amps, with a surge up to 1 amp at power up

**TABLE 5: TB2 Input Control Command Descriptions**

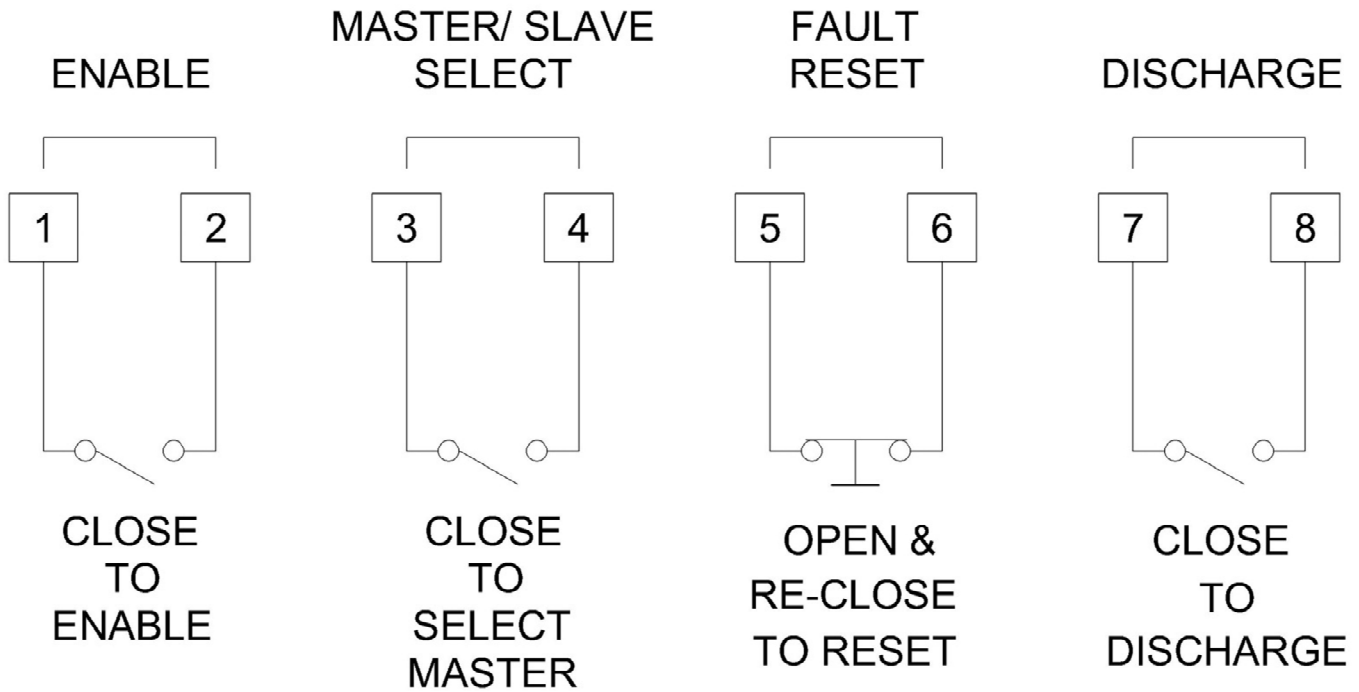
TB2 Terminal Number	Terminal Description (TB2)	Electrical Ratings	Max Wire Size	Maximum Torque (lb-in)
1 (+)	Enable	10ma 24vdc	14awg*	2.2
2 (-)	Common			
3 (+)	Master or Slave Select			
4 (-)	Common			
5 (+)	IOC/ IOV, IUUV Reset			
6 (-)	Common			
7 (+)	DC Bus Discharge			
8 (-)	Common			
9 (+)	M/S Signal +IN/ OUT			
10 (+)	M/S Signal +IN/ OUT			
11 (-)	M/S Signal Common			
12 (-)	M/S Signal Common			

\*18AWG is sufficient for control wiring



While it is safe to earth ground the control input commons, the placement of this ground could inadvertently add to noise in the system control loop. Floating these commons may be best for noise immunity.

**FIG 4: TB2 Input Command Details**



## **I/O INPUT COMMAND DESCRIPTIONS (TB2)**

### **1. ENABLE**

- Short TB2, 1 & 2 to enable brake module
- Allows the brake module to output pulses to IGBT switch
- Front panel "Control Enabled" LED ON indicates the presence of an enable contact closure

### **2. M/S SEL**

- Short TB2, 3 & 4 to run single module or to set as Master
- Steers pulses to external slaves.

### 3. RESET

- a. Short TB2, 4 & 5 to reset
- b. For best noise immunity keep closed, and then momentarily cycle to reset
- c. Clears any temporary faults
- d. Will not clear IGBT short or over-temp faults if they still exist

### 4. DCHARG

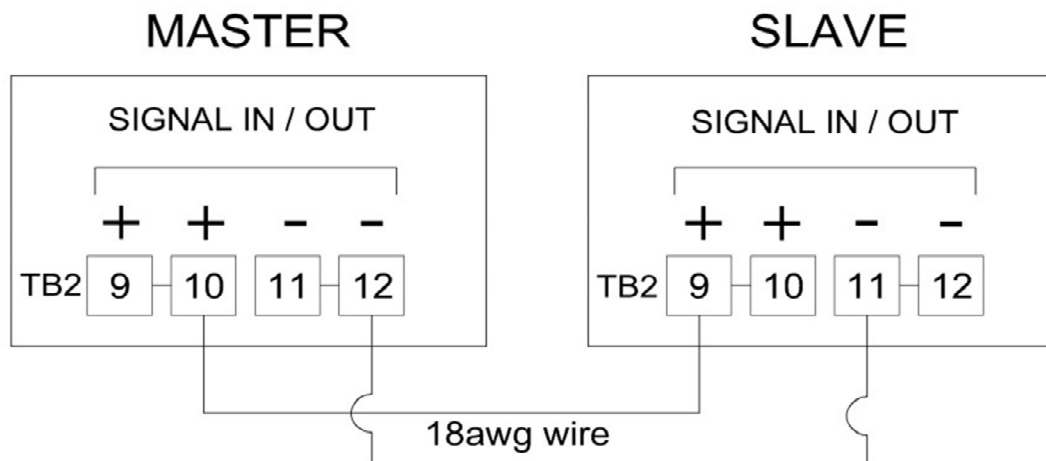
- a. Short TB2, 7 & 8 to turn on brake and discharge drive or system DC bus
- b. Functions only in master mode
- c. Dumps DC bus caps into braking load resistor
- d. Use during maintenance to save time waiting for safe discharge levels

### 5. MASTER SIGNAL (OUTPUT)

- a. Connect Slave module signal wires to TB2, 10(+) & 12(-) of the master module
- a. Outputs signal when master is selected by shorting TB2. 3 & 4
- b. Fiber optic connection for multiple slave systems

### 6. SLAVE SIGNAL (INPUT)

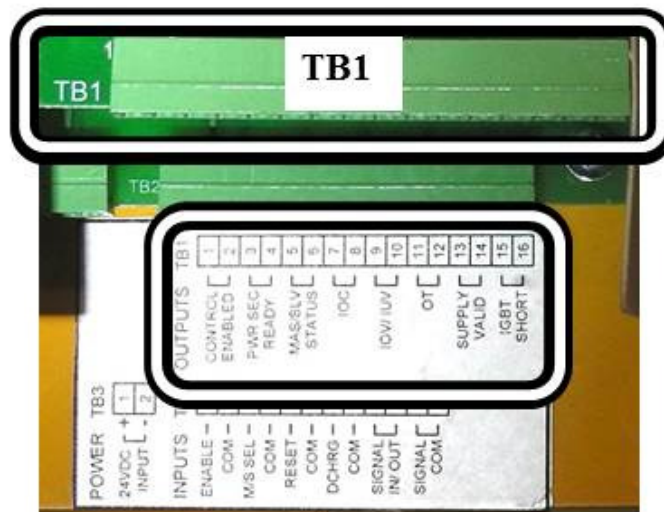
- c. Connect Master module output signal to TB2, 9(+) & 11(-) of the slave module
- d. Accepts external signal when M/S select at TB2. 3 & 4 is NOT shorted
- e. Fiber optic option available when using more than one slave



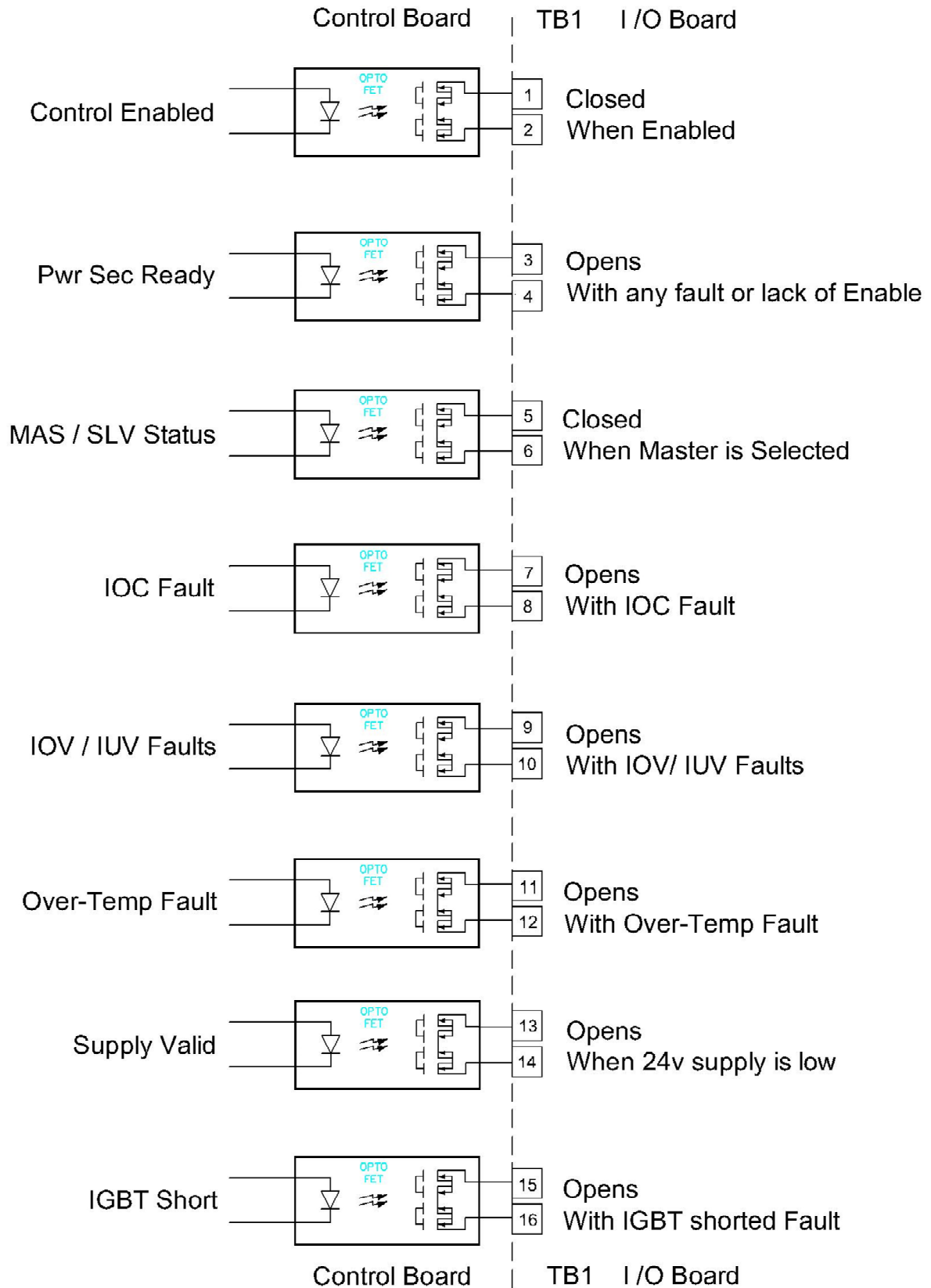
**TABLE 6: TB1 Isolated Output Status Terminal Descriptions**

TB1 Terminal Number	DC Pol	Terminal Description (TB1)	Electrical Ratings	Max Wire Size	Maximum Torque (lb-in)
1	+	Control Enabled	150ma 250v AC or DC	14awg*	2.2
2	-				
3	+	Power Section Ready			
4	-				
5	+	Master Slave Status			
6	-				
7	+	Instant Over Current (IOC)			
8	-				
9	+	IOV/ IUV			
10	-				
11	+	OT			
12	-				
13	+	SUPPLY VALID			
14	-				
15	+	IGBT SHORTED			
16	-				

\*18AWG is sufficient for status wiring



# FIG 5: TB1 Output Status Signal Details



## **I/O OUTPUT SIGNAL DESCRIPTIONS (TB1)**

### **1. CONTROL ENABLED**

- a. Indicates the Enable signal is present
- b. TB1-1&2 are closed when Enabled
- c. Front panel "Control Enabled" LD8 ON indicates the presence of an enable contact closure

### **2. PWR SEC READY**

- a. Indicates the enable is present and no faults are seen
- b. TB1-3&4 are closed when ready to run
- c. Front panel "Fault" LD7 OFF indicates the brake module is ready to run
  - i. Control board "PSR" LD4 will be ON

### **3. MAS/SLV STATUS**

- a. Indicates status of Master Slave selection
- b. TB1-5&6 are closed when Master is selected
- c. Master must be selected for single brake module
- d. Closed when master is selected

### **4. IOC**

- a. Indicates an incorrect load resistor or a resistor short or arc to earth
- b. TB1-7&8 are normally closed, and latch open on fault
- c. TB1-3&4 are normally closed, and latch open with this fault
- d. If an IOC occurs the front panel "Fault" LD7 will turn ON
  - i. Control board "IOC" LD2 will turn ON

### **5. IOV/IUV**

- a. Indicates an incorrect connection to the drive, possibly on the rectifier before a precharge resistor or filter choke.
- b. TB1-9&10 are normally closed, and latch open on fault
- c. TB1-3&4 are normally closed, and latch open with this fault
- d. If an IUV or IOV occurs, the front panel "Fault" LD7 will turn ON
  - i. IUV/IOV is normally closed, and latches open on fault

- e. IUV = Input under-voltage senses an unfiltered 3Ø DC bus
  - i. Control board “IUV” LD6 turns on
- f. IOV = Input over-voltage, senses too much inductance between brake module and DC bus caps
  - i. Control board “IOV” LD5 turns on

## 6. OT

- a. If an OT occurs the front panel “Fault” LD7 will turn ON
  - i. \*there is no control board LED for OT.
- b. TB1-11&12 are normally closed, and open on OT. Non-latching.
- c. TB1-3&4 are normally closed, and open with this fault
- d. Indicates module is running too much RMS current or has an inoperable fan

## 7. SUPPLY VALID

- a. Indicates proper control voltage level
- b. TB1-13&14 are normally closed, and open with low voltage
- c. Low logic voltage occurs below 19vdc

## 8. IGBT SHORT

- a. Indicates the internal IGBT switch is shorted resulting in a dangerous condition where the brake module permanently connects the resistor to the DC bus. This draws constant power from the DC bus, can cause damage to the resistor, and overheat the surrounding area.
- b. TB1-15&16 are normally closed, and open with a shorted IGBT
- c. TB1-3&4 are closed, and open with this fault
- d. It is strongly recommended that the brake module fault contacts be monitored. In the case of an IGBT short the brake module may pass more energy to the resistor than it can handle causing permanent damage.

- **For best safety use the braking resistor over-temp contact to remove power from the system in case of extreme resistor overload.**

**TABLE 7: Fiber Optic Specifications**

Component	Specification	Maximum Length
CABLE	1mm core diameter	60 ft
CONNECTOR	SMA Type Connector	-

While it is usually not necessary to use fiber optic cables in single slave systems (one Master, one Slave), it is recommended for best noise immunity and to prevent ground loops in the control power.

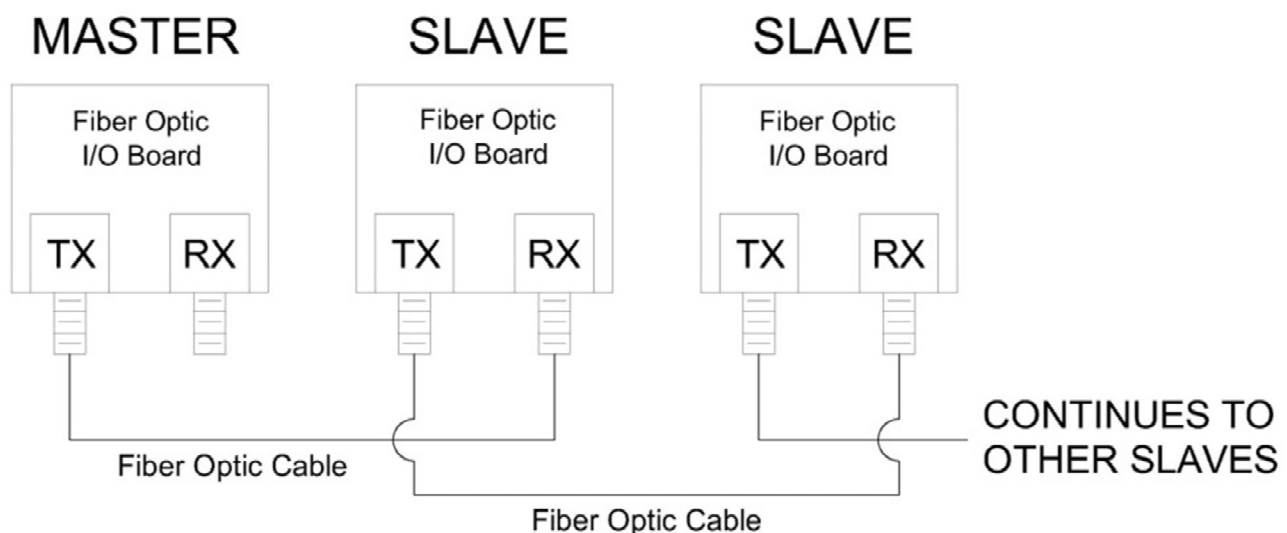
Using fiber optic cable is strongly recommended in order to maximize noise immunity for systems with more than 1 slave module (Master and 2 or more Slaves).

The fiber optic signal board can easily be added in the field. Contact PowerOhm for details.

Note: Slaves will produce a TX pulse when fed from the Master or previous Slave

**Master - Slave Settings:** In all master slave systems one module is selected to be the Master, and the remaining modules are set as Slaves. The Master is selected by shorting M/S SEL connections at TB2, 3 & 4.

- Damage will occur if more than one module is set for master with signal wires connected



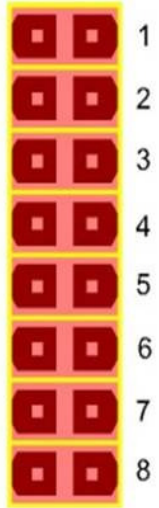
## JUMPER SETTINGS

The PowerOhm Type PW-NC Braking Module has eight jumper settings located in the top right corner of the main control board, accessible by removing the center front cover that contains the LED indicators. The jumper allows for a wide range of drive input voltages as listed in Table 12. Note that the measurement of line voltage should be done by qualified personnel only. Do not make jumper changes while the power is applied!

Factory setting will be the jumper corresponding to the voltage indicator position in the model number on the label. PWB450-NC will be calibrated for 750vdc turn on level with jumper JP5 on.

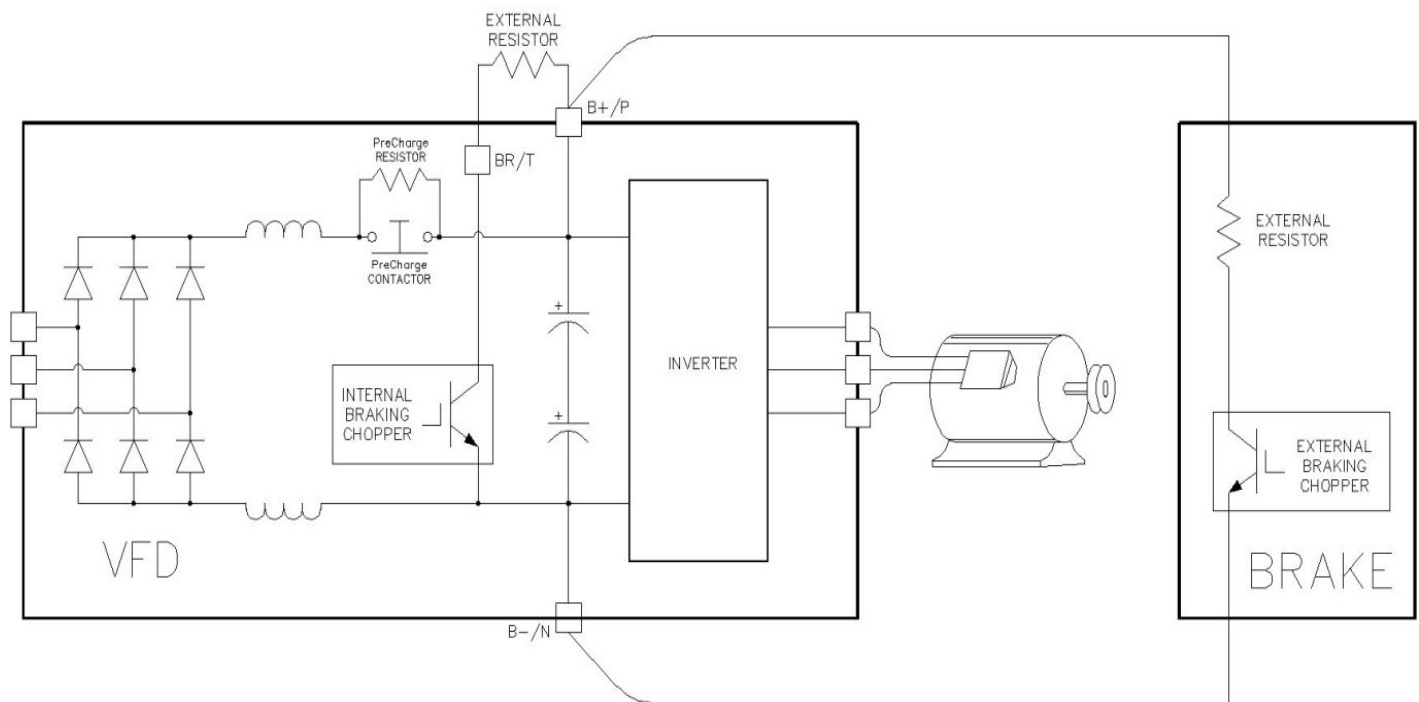
**Note: Generally speaking, it is best to operate the module with the highest allowable jumper setting to allow for upward drift of the AC line during lightly loaded conditions. This will minimize the possibility of the upward drift causing unnecessary action from the braking module.**

**TABLE 8: Description of Voltage Select Jumper Settings**

Model #	Jumper Position	Line Voltage	DC Bus Voltage	Voltage Jumper Positions
	1	208VAC	325VDC	
PWA	2	240VAC	375VDC	
	3	380VAC	593VDC	
	4	415VAC	650VDC	
PWB	5	480VAC	750VDC	
PWC	6	600VAC	940VDC	
PWD	7	690VAC	1060VDC	
PWE	8	710VAC	1085VDC	

**Warning:** Do not make jumper changes while power is applied! Change as required only when power is removed and the green power indicator and amber dc bus indicators are off! Use insulated tool to change jumper position.

**Figure 6: Drive DC BUS Power Connections**



Always connect DIRECTLY to the capacitor bank of the drive. Connecting to the Rectifier or upstream of any pre-charge or inductance can cause IOV faults and possible damage to the brake module.

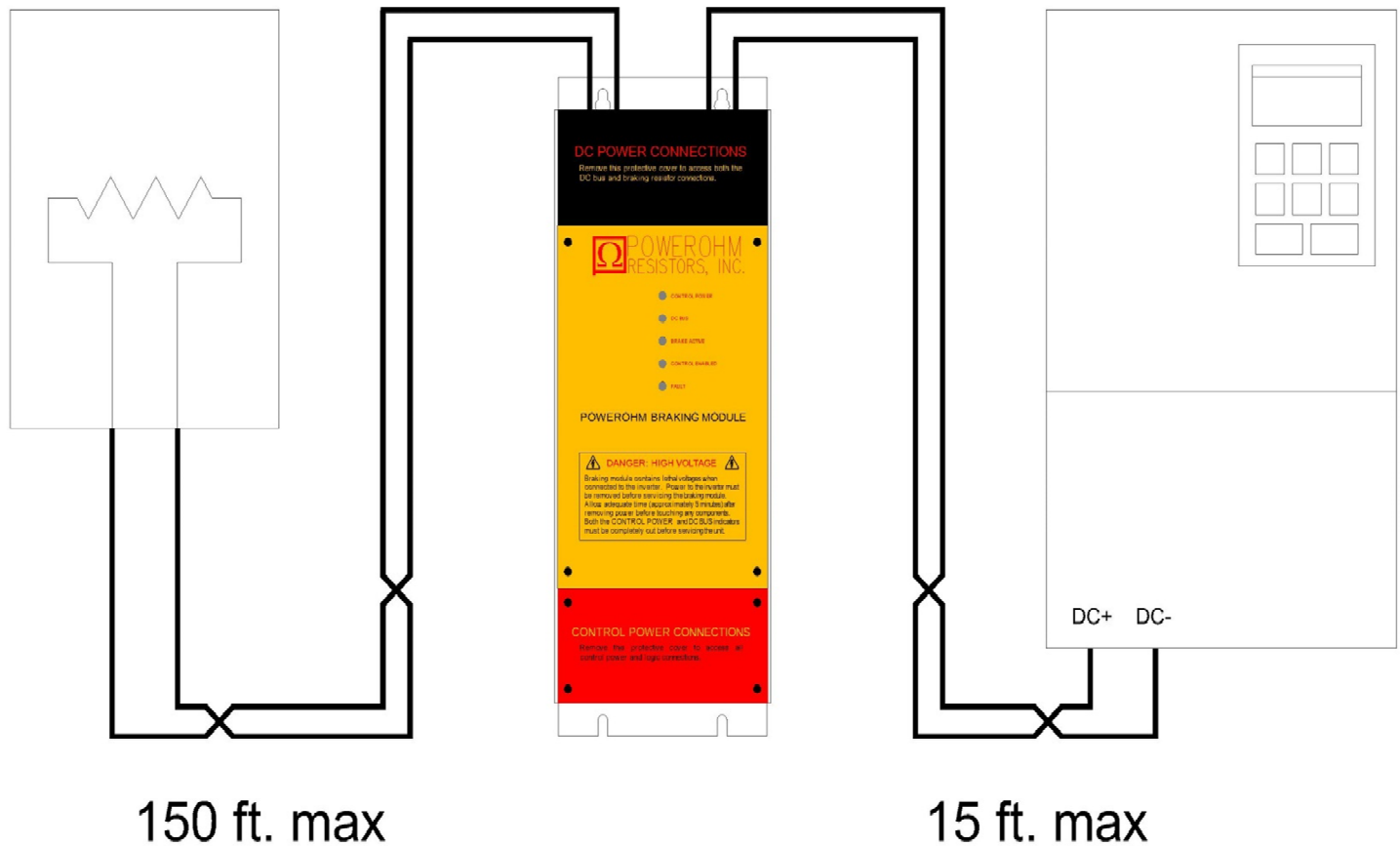
Check drive topology drawings from drive manual itself to confirm that available DC connections are directly from the capacitor bank.

## Figure 7: Typical Power Connections for a Single Braking Module

Braking Resistor

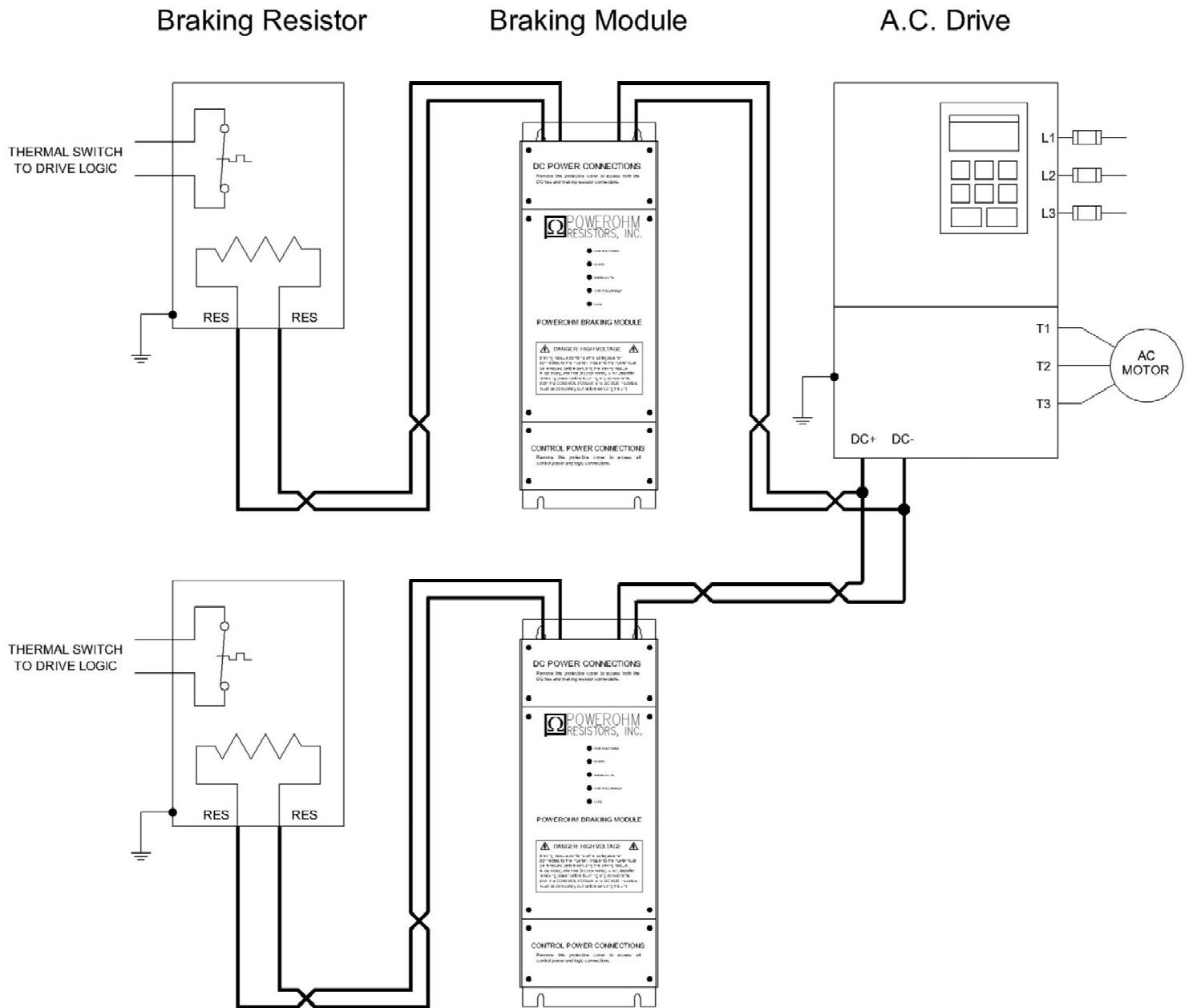
Braking Module

A.C. Drive



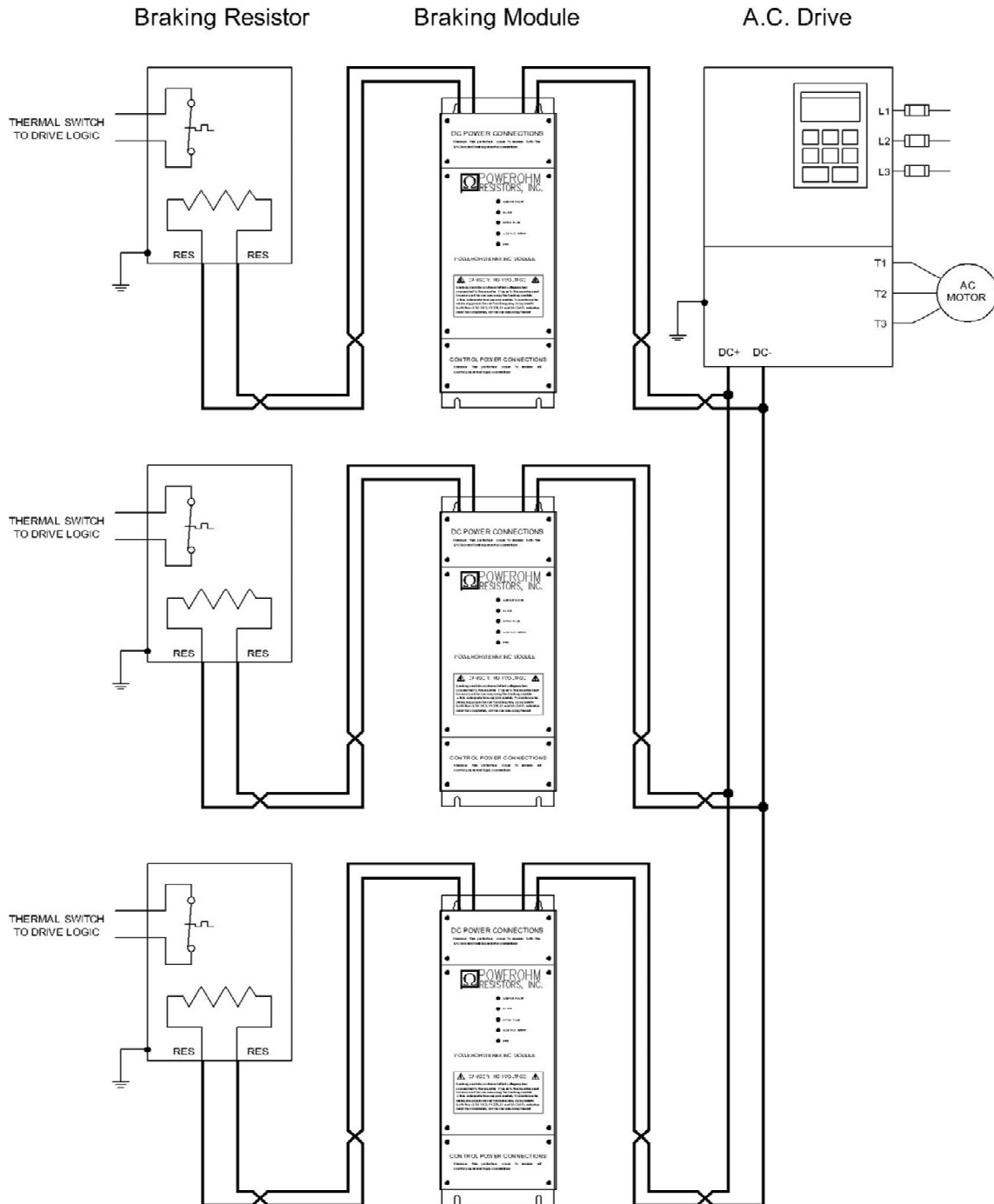
**Wiring Notes:** In order to minimize interference between power and signal cabling, all DC power wiring between the drive, braking module and braking resistor, should be run separate from all control wiring. If control and power wires must cross paths, cross at 90 deg angles and keep at least 2 inches away from each other.

# Figure 8: Typical Power Connections for Two Braking Modules



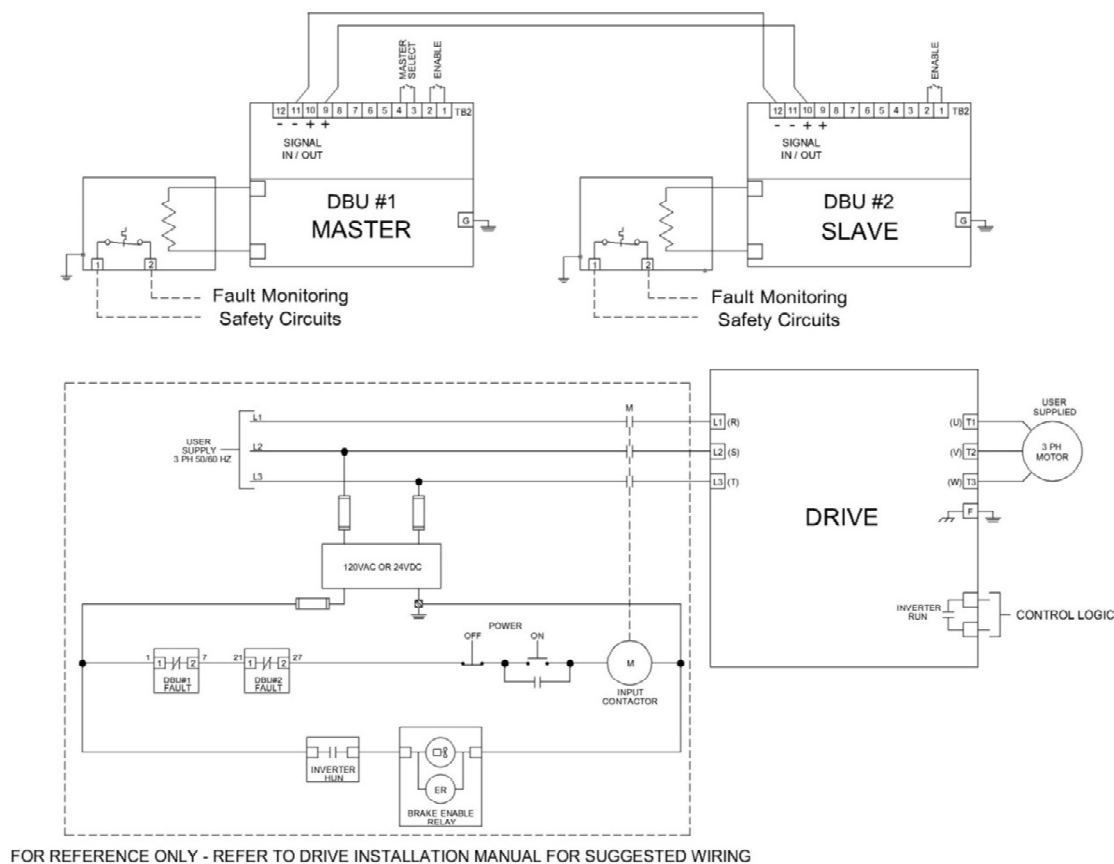
**Wiring Notes:** In order to minimize interference between power and signal cabling, all DC power wiring between the drive, braking module and braking resistor, should be run separate from all control wiring. If control and power wires must cross paths, cross at 90 deg angles and keep at least 2 inches away from each other.

# Figure 9: Typical Power Connections for Multiple Slave Modules (2 or more)



**Wiring Notes:** In order to minimize interference between power and signal cabling, all DC power wiring between the drive, braking module and braking resistor, should be run separate from all control wiring. If control and power wires must cross paths, cross at 90 deg angles and keep at least 2 inches away from each other.

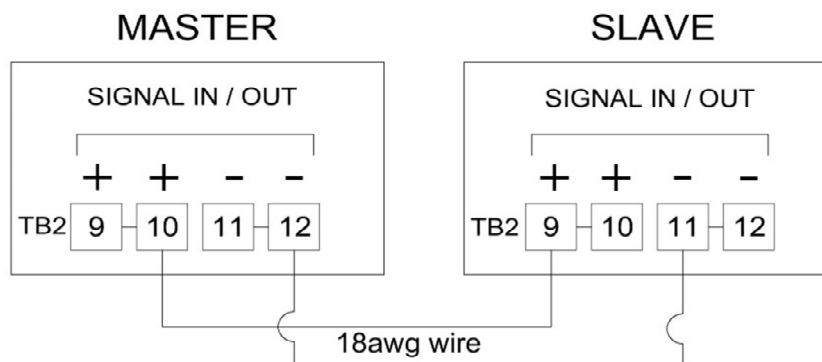
### Figure 10: Typical Control Connections for Two Braking Modules



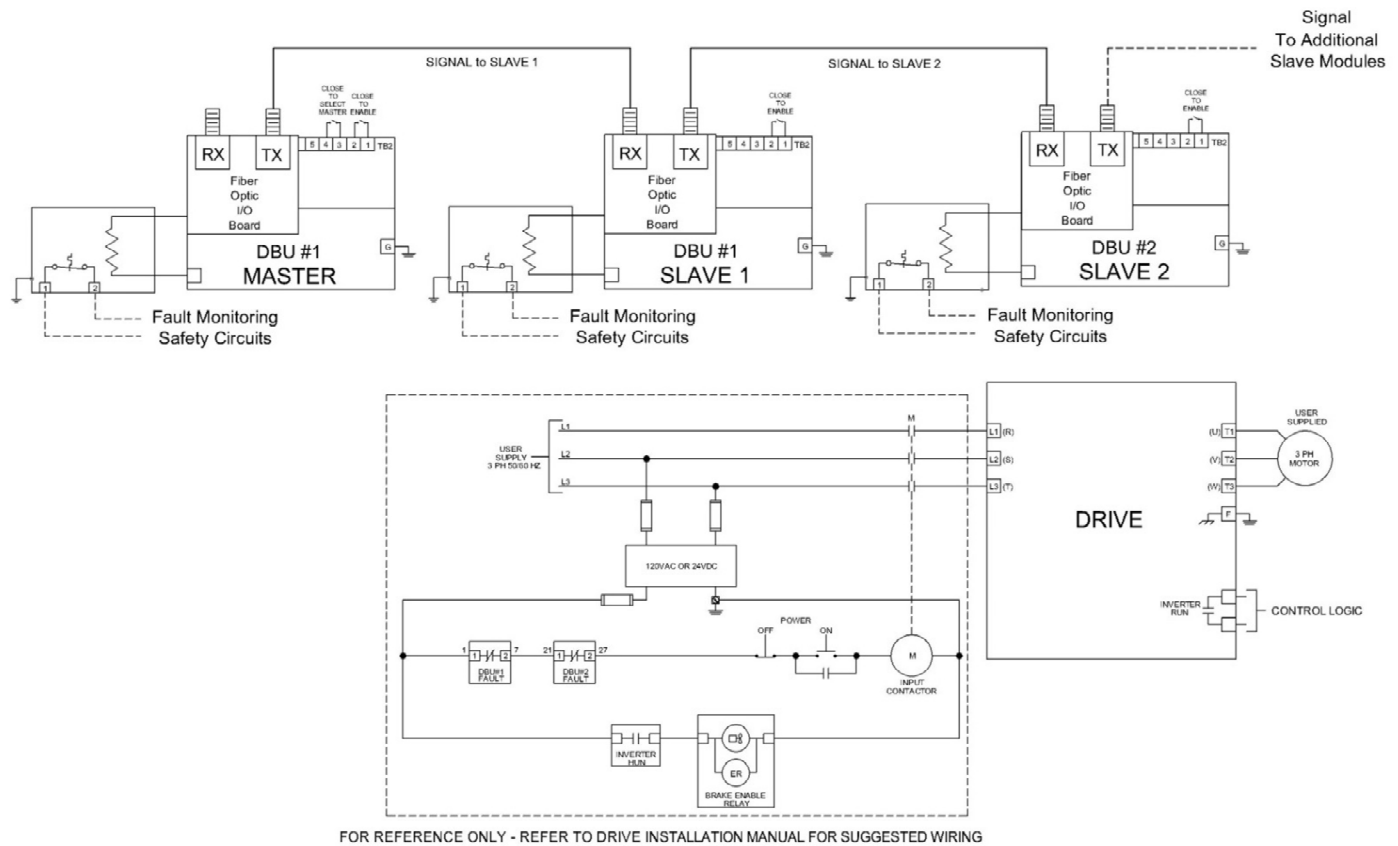
**Master - Slave Settings:** In all master slave systems ONLY one module is set to be the Master, and the remaining modules are set as Slaves.

**Wiring Notes:** In order to minimize interference between power and signal cabling all control wiring must be twisted or shielded and run separate from all power wiring.

### Figure 11: Master Slave Signal TB2 Wiring Connections for Single Slave



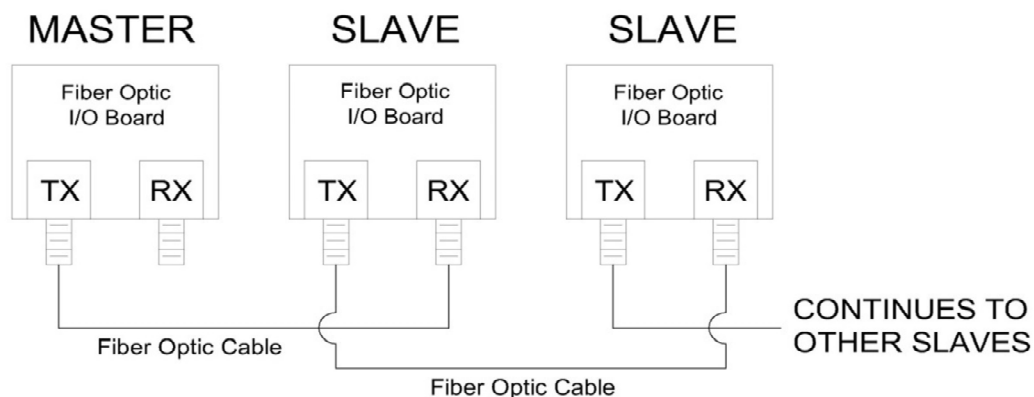
## Figure 12: Typical Control Connections for Three or more Braking Modules



**Master - Slave Settings:** In all master slave systems **ONLY** one module is set to be the Master, and the remaining modules are set as Slaves.

**Wiring Notes:** In order to minimize interference between power and signal cabling all control wiring must be twisted or shielded and run separate from all power wiring. For Master Slave systems with 3 or more modules it is recommended to use fiber optics for the control signal.

## Figure 13: Typical Master Slave Fiber Optic Connections for Multiple Slaves



## PRELIMINARY:

- Ensure the DC bus connections are proper polarity.
- Ensure DC bus connections are directly on drive capacitor bank, with no pre-charge or filtering circuits between. If not already known, check drive manual for topology drawing showing DC bus structure.
- Verify Serial # tag's model number to make sure that braking module voltage rating is equivalent to the drive
- Ensure the enable contact at TB2 is closed or will be once the system is ready to brake.
- Ensure the Mas/Slv SEL contact at TB2 is closed for Single & Master modules, open for all slaves.
- Ensure drives internal braking circuits are disabled
- Ensure Power Section Ready signal to PLC is working. (if monitored)
- It is good practice to monitor the DC bus under stopped and braking conditions, making sure the braking setpoint is not too close to the nominal unloaded DC bus voltage.
- In order to best capture the peak voltage use an oscilloscope or a meter with a peak hold function.

**APPLY CONTROL POWER:** Turn on 24vdc control power first. Do not allow the DC bus to be present when the control power is off or damage may occur. The green "CONTROL POWER" ON LED illuminates indicating that control voltage is properly applied to the power connections at TB3. At this time all other LEDs should be OFF.

**APPLY DC BUS POWER:** The Yellow DC BUS LED will turn on with an intensity somewhat proportional to the DC bus level. Note unloaded DC bus level.

**ENABLE BRAKE:** The green "Control Enabled" LED indicates the brake is enabled.

**BRAKING CYCLE:** Start the drive and run the motor unloaded. Stop the drive quickly and monitor the green BRAKE LED. The LED will flash on, the heavier the braking, the more it flashes. Load motor, then start and stop drive and again monitor braking LED. Note DC bus level during the peak of the braking cycle. If the unloaded nominal DC bus is within 10% of the peak DC Bus during braking, consider increasing the braking voltage threshold or using a drive contact to disable the brake while drive is idle.

**DECELERATION:** While under full load slowly decrease drive decel time while monitoring DC bus level. Decrease decel time as process allows until DC bus rises above the braking module trip level. Now increase decel time back to a level allowing a comfortable amount of headroom to prevent nuisance overvoltage trips. (If the drive trips on overvoltage easily or you can't stop the drive fast enough, the brake module may be undersized)

**DUTY CYCLE:** While under full load increase the duty cycle while monitoring the DC bus level and module resistors. If the resistors are glowing at the end of each braking cycle the duty cycle should be decreased. (Although the resistors can take extreme temperature they will last longer if they are not stressed on every cycle)

**FAULT:** With the brake module sized correctly and the proper decel time and duty cycle settings the fault LED should never turn ON. If the fault LED turns on and the brake module is hot simply allow time too cool, and either increase the decel time or decrease the duty cycle. Ensure the cooling fan is operating properly.

**CAUTION: NEVER** perform any maintenance while power is present. **ALWAYS** be sure to double check for safe voltage levels by measuring the DC bus input as well as any external power, control or status signals before working on equipment.

**Monthly:** Check that the Green power LED is ON, The Amber DC Bus LED is ON, The Control Enabled LED is on, and the Red Fault LED is OFF. If the brake module has an internal fan, check that it is blowing air.

**Yearly:** Check the module circuit boards for buildup of dust, debris, or moisture. Check the cooling fan and heatsink for any buildup. High voltages exist within the module and the buildup of dust, debris, and moisture can contribute to arcing and equipment damage. Take corrective action as necessary to keep the module clean.

If cleaning is needed remove power from system and allow time for all voltages too drain to safe levels. It is usually best to vacuum debris rather than blow it away. If a vacuum is not available then blow the debris out with clean dry air only, taking care not to blow into the circuitry.

## BRAKE MODULE FRONT PANEL LED INDICATORS

**CONTROL POWER:** An illuminated green LED indicates that control power is present.

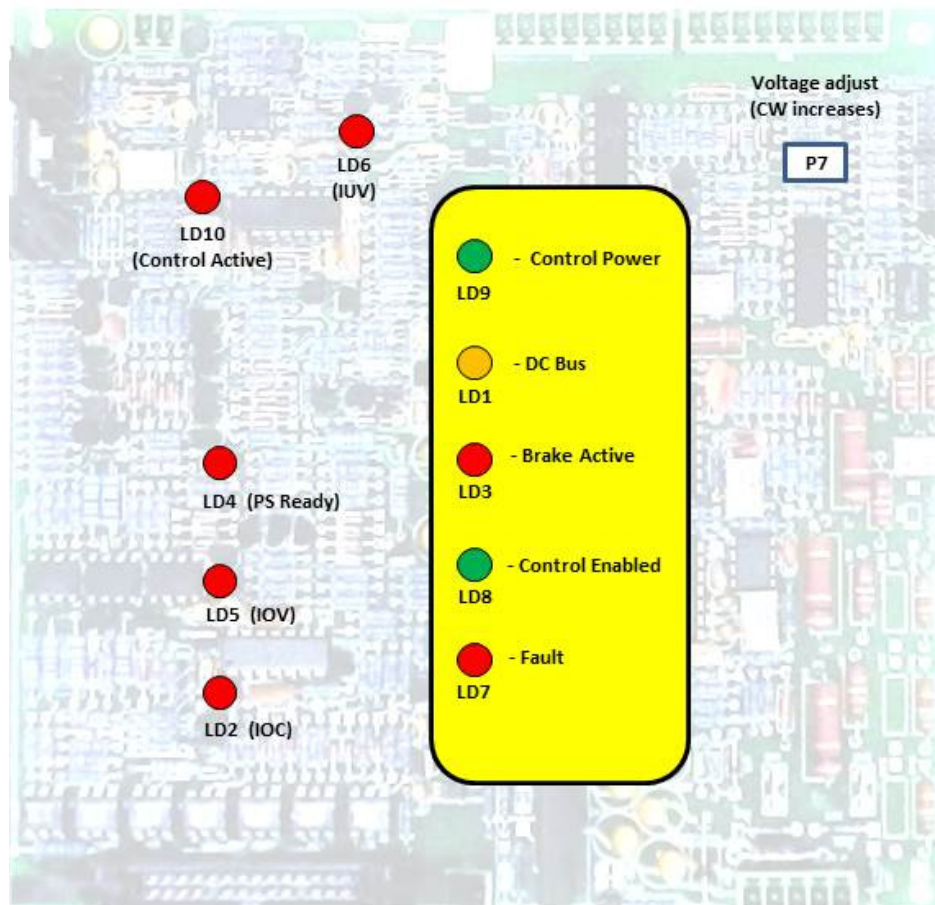
**DC BUS:** An illuminated amber LED indicates that DC bus voltage is present

**BRAKE ACTIVE:** An illuminated red LED indicates that the module is braking.

**CONTROL ENABLE:** An illuminated green LED indicates that the control has been enabled.

**FAULT:** An illuminated red LED can indicate any number of possible system faults. Refer to Table 6 and check the status of all outputs to help identify the problem. Likewise, if using a communications module, refer to Table 11 and the Acromag instruction manual to check the status of the outputs.

**FIGURE 16: Control Board LED Locations**



Before removing equipment covers or making any changes in jumper positions or adjustments, power down equipment and wait for DC bus to drop to safe levels. Always use an insulated screwdriver or insulated pliers when making jumper changes or adjustments

Follow these steps and make note of indications before calling for help. Have unit model and serial number ready to aid PowerOhm in troubleshooting

## **GREEN CONTROL POWER LED IS NOT ON**

- Check for control power at TB3 of I/O board. Make sure connector is seated properly
- If new installation check for loose wires or for 24vdc on 2 pin plug at top left of control board
- Check for proper polarity of 24v input control power
- If control power is present and all connections seem to be normal, replace module

## **AMBER DC BUS LED IS NOT ON**

- Ensure DC bus is present at DC Power input terminals.
- Ensure Red DC bus feedback wire is properly connected to CN1

## **RED BRAKING LED IS ALWAYS ON**

- Ensure system voltage jumper is set for actual line voltage
  - a. See Jumper Settings in Module Set Up section of this manual

## **RED BRAKING LED NEVER TURNS ON**

- Check for Enable signal at I/O board
  - a. Jumper TB2 1-2 if external enable is not used
- Check for Master Slave Select signal at I/O board
  - a. Jumper TB2 3-4 for stand-alone and Master modules
- Check for proper positioning of voltage adjust jumpers at top right of control board
  - a. System AC line voltage may be different than module factory set up
  - b. Verify proper voltage rating of Module by checking label and jumper (table 8)
- Ensure DC bus is actually reaching braking turn on level
  - a. An unloaded motor may not have enough energy to regenerate

## **BRAKING LED NEVER TURNS OFF AND/OR RESISTOR IS OVERHEATING**

- Turn off power immediately except for taking measurements
- Check for proper voltage rating of control board and jumper positions
- Ensure the brake module is connected DIRECTLY to the drive DC bus cap bank.  
Connecting up stream of the precharge circuits may result in high peak voltages that can turn on the brake module
- Check actual system AC line voltage for high harmonic content (high peak to RMS ratio) or for excessive noise spikes as this may cause an unusually high DC bus level on an unloaded drive
- Using an insulated screwdriver turn adjustment pot P7 CW. If the control board is working properly, and the DC bus voltage is normal, at some point the braking LED should turn off. This indicates the unit has been tampered with and should be re-calibrated by qualified personnel at the PowerOhm facility
- Remove the enable signal. This should force the brake module to turn off.
- If none of the above steps solves the problem, replace module

## **BRAKING LED FLICKERS**

- During light duty braking or at the end of a braking cycle it is normal for the LED to flicker some
- If the LED flickers when the Drive is idle there may be excessive noise on the DC bus from other equipment, a higher than expected AC line level, or high harmonics on the incoming voltage
- If the LED flickers when the drive is running normal load (not braking) there may be excessive common mode noise on the DC bus and additional DC bus filtering may be needed

## **BRAKING MODULE GETS HOT**

- It is normal for brake modules to generate heat during heavy duty operation
  - a. Check watt loss in Tables 1-4.
- Check load and duty cycle to make sure module is sized correctly
- If the module overheats the fault LED will turn on and the output fault contact will change states
- If IGBT is shorted the switch module will not get hot, but the resistor will

## **FAULT LED IS ON**

- Find which signal caused the fault condition
  - a. If all I/O is monitored check plc for fault indication and go to that step in this troubleshooting guide
  - b. If no I/O is monitored, you must be able to see the control board with the middle front cover removed. See figure showing LED designations
- Check unit for heatsink overheating and allow time to cool
- Check for proper sizing of brake module as overheating indicates the module is running beyond its capacity
  - a. Reduce the duty cycle or increase the decel time
- Use a higher rated braking module. Confirm the 2 position thermostat plug at top of control board is seated properly
- If the above are OK, replace module

## **MASTER SLAVE SYSTEM DOES NOT SEEM TO WORK PROPERLY**

- Check position of master slave jumpers on each module
  - a. Only one module should be selected as master by shorting TB2 3&4 on I/O board
- Make sure wiring between master and slaves are correct at TB1 of the control board
  - a. Fiber optic option should be used for systems with more than 1 slave module
- Ensure the system is sized properly
- Monitor Braking LED on all modules. If master braking LED turns on but any slave does not, and wiring is correct, replace slave module(s).
- Master braking LED never turns on follow steps for “Red braking LED never turns on”

## **IOC FAULTS OCCUR**

- Measure resistor ohmic value with milliohm meter
  - a. Resistance below min ohm rating table will cause IOC faults
- Check insulation breakdown of resistor and resistor wiring.
  - a. A breakdown to earth can cause IOC faulting.
- Make sure module earth ground has a dedicated wire to PE ground of the associated drive
  - a. Add ground wire as needed
- Make sure control power and I/O are not grounded to noisy ground.
- Monitor common mode noise between earth ground and both DC + & - rails
  - a. Add additional filtering between DC bus rails and earth.

## **IUV OR IOV FAULTS OCCUR**

- Ensure wire lengths between brake module and drive do not exceed what is prescribed in this manual
- Ensure wire lengths between brake module and resistor do not exceed what is prescribed in this manual
- Ensure Brake Module DC input is connected DIRECTLY to the drive DC bus caps. The brake module is designed to fault if the drive connection is incorrect.
  - a. Inductance between the brake module and cap bank will cause IUV and/or IOV faults.
    - i. Some drives have chokes in the DC link between the rectifier and cap bank.
  - b. Some drives have connections for an external resistor or the rectifier.
  - c. The brake module may be damaged or not work properly if connected to the RES (resistor) output of the drive or the rectifier

**BM “PW-NC” Series Manual REV 2014-03-18**

