8.1 GENERAL START-UP PROCEDURES

The following paragraphs describe the start-up procedure for the control and the reading and setting of the operating parameters that is required for the application.

Read this section thoroughly to develop an understanding of the operation and logic incorporated into the control.

To insure maximum efficiency with a minimum amount of delay in production, factory start-up assistance by a factory engineer is also available. Contact Field Service as described in the inside back cover of this manual to make arrangements.

WARNING

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD START AND ADJUST THIS EQUIPMENT. READ AND UNDERSTAND THIS ENTIRE SECTION BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN EQUIPMENT DAMAGE AND POSSIBLE PERSONAL INJURY.

When proceeding with the start-up, keep in mind the following:

1. The factory setting is for 480 VAC input. See paragraph 8.3.1 for jumper selection of other voltages.

2. Check all jumper programming described in paragraph 8.3.2.

3. The internal HP scaling resistor in models 9500-8X02 through -8X06 is selected to limit the current output to 10 amps. See paragraph 8.7 for installation of external HP scaling resistors to program the control for proper horsepower.

4. Check all the wiring procedures described in Section 7.

Quantum III drives shipped from Control Techniques' factory are pre-set for 480VAC operation providing 500VDC on the armature and about 300VDC on the field. The units are set up for armature voltage feedback (AVF). Drives 9500-8X02 through -8X06 are set to produce current as described in paragraph 8.7. All other drives are set to produce 100% of their nameplate DC current rating of the lowest HP rating for each drive model. Current Limit is set at 150% and the Current Overload is set at 105%

of this nameplate rating. For motors with an armature current less than the full load rating, these parameters must be reduced proportionally to protect the motor from excessive currents. See Paragraph 8.7 for details.

8.2 HARDWARE PRE-START CHECKS

8.2.1 General Checks

A. Read and thoroughly understand all of the safety information given in Section 3 of this manual.

B. Use a volt-ohmmeter having a sensitivity of 1000 or more ohms per volt on the DC scale (such as a Triplett Model 630 or a Simpson 260) as test equipment.

CAUTION

Do not use a megger to perform continuity checks in the drive equipment. Failure to observe this precaution could result in equipment damage.

8.2.2 Installation Checks

WARNING

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN AC POWER IS CONNECTED TO THE DRIVE. DISCONNECT INCOMING POWER TO THE DRIVE BEFORE PROCEEDING. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT TERMINALS L1, L2 AND L3 THAT NO VOLTAGE EXISTS BEFORE TOUCHING ANY INTERNAL PARTS OF THE DRIVE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN PERSONAL INJURY.

A. Make sure the input disconnect is in the OFF position (power OFF). Install any safety locks if disconnect is remote.

B. Make sure the drive shutdown interlocks, such as safety switches installed around the driven machinery, are operational. When activated, these devices should shut down the drive.

C. Check that all the jumpers have been set correctly.

D. Verify the programming for the feedback used (AVF, tachometer, or encoder) is correct.

8.2.3 Motor Checks

A. Verify that motor nameplate data corresponds to the drive output ratings as shown in Section 4. Verify that motor full load armature current and motor field current do not exceed the drive ratings.

B. Check that the motor is installed according to the motor instruction manual.

C. If possible, uncouple the motor from the driven machinery.

D. Rotate the motor shaft by hand to check that the motor is free from any binding or mechanical load problem.

E. Check that no loose items, such as shaft keys, couplings, etc., are present.

F. Check that all connections are tight and properly insulated.

G. Check that any motor thermal switch or overload device is wired as needed.

WARNING

THE CUSTOMER IS RESPONSIBLE FOR ENSURING THAT DRIVEN MACHINERY, ALL DRIVE-TRAIN MECHANISMS, AND PROCESS LINE MATERIAL ARE CAPABLE OF SAFE OPERATION AT THE MAXIMUM OPERATING SPEED OF THE DRIVE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN PERSONAL INJURY OR MACHINE DAMAGE.

8.2.4 Drive and Enclosure Checks

A. Open the drive front panel cover.

B. Look for physical damage, remaining installation debris, wire, strands, etc.

C. Remove all debris from the drive.

D. Check that there is adequate clearance around the drive for air flow.

E. Complete all the wiring procedures described in this manual.

F. Check that all control and power terminal connections are tight.

G. Check that all fuses are in place and properly seated in the fuse holders.

H. Check the continuity of all fuses. If any fuse reads open, replace the defective fuse.

I. Insure that the control has been properly programmed for the incoming line voltage. Using a voltmeter, check that the correct voltage is available on the incoming line side of the input disconnect.

8.2.5 Grounding Checks

WARNING

THE CUSTOMER IS RESPONSIBLE TO MEET ALL CODE REQUIREMENTS WITH RESPECT TO GROUNDING ALL EQUIPMENT. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN PERSONAL INJURY.

CAUTION

Do not check any points on the drive with an ohmmeter, megger or any similar device. Failure to observe this precaution could result in equipment damage.

A. Verify that the ground wire installed between the chassis ground terminal, the enclosure, and a suitable earth ground has been properly sized to meet NEC and local codes. Make sure that the connections are tight.

B. With the volt-ohmmeter, check for and eliminate any grounds between the drive input power leads and the drive chassis ground. Check for and eliminate any grounds between the drive output power leads and the drive chassis ground.

C. Verify that a properly sized ground wire is installed between the motor frame and a suitable earth ground and that the connections are tight.

D. With the volt-ohmmeter, check for and eliminate any grounds from the motor frame and the motor power leads.

E. Verify that a properly sized ground wire is installed between the transformer (if used) and a suitable earth ground and that the connections are tight.

F. Verify that a properly sized ground wire is installed between all operator's control stations (if used) and a suitable earth ground and that the connections are tight.

G. Verify that the above ground wires are run unbroken.

8.3 SETUP

8.3.1 Motor Nameplate

Shown below is a typical DC Shunt wound DC motor nameplate.

Rated Horsepower

Rated Speed

Full Load Armature Amps

Rated Armature Voltage

Shunt Field Voltage with fields wired in series

Shunt Field amps with fields wired in series

Shunt Field Voltage with fields wired in parallel

Shunt Field amps with fields wired parallel

Typically for a 500v motor (armature) the shunt field windings should be wired for a series connection for 300 VDC supply

Note: This motor is not designed for extended speed range as it does not indicate 2 RPM values.

8.3.2 Setting the Power Transformer

The Quantum III's main control circuitry utilizes "switchmode" power supply technology that can accept line voltage anywhere between 208 VAC (-5%) to 480 VAC (+10%), 50/60Hz without jumpers or parameters to set.

LINE VOLTAGE	TOLERANCE	TAP SETTING	COMMENTS
480 VAC	+/-10%	**480 VAC**	← **Factory Setting**
415 VAC	+/-10%	415 VAC	
380 VAC	+/-10%	380 VAC	
240 VAC	+/-10%	240 VAC	
208 VAC	+10% -5%	208 VAC	

However, to provide 115 VAC for Interface Circuitry and correct voltage for the built-in Armature Contactor and fans (when required), a Control Transformer-T1 is used. The factory setting for this transformer tap is set on 480 VAC and must be changed to match other line voltages. Loosen the 480v screw and move the SINGLE RED wire to line voltage you will be applying to the drive.
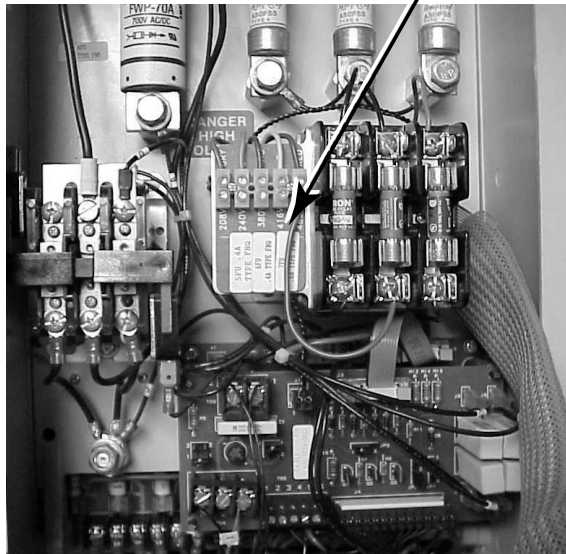
8.3.3 Parameter Security and Storage

Refer to Section 10 for complete instruction.

To access all the parameters required for the changes listed, go to any menu column at the 00 parameter and enter 200. This permits access to all required parameters. To store parameters, depress reset and store the information within the drive by entering a 1 into parameter 00 under any menu, then press reset. If this sequence is not enacted, the changes will be lost when power is removed from the drive. Frequent use of this procedure will help to prevent losing parameter settings.

8.3.4 Jumper and Switch Programming

NOTE

The jumper and switch block are located on PCB MDA2, (Figure 8-3), accessible when the lower, snap-on front cover is removed (Figure 8-2).

JUMPER SWITCH	LOCATION	RANGE	PURPOSE
SW1A OFF	1 Negative Logic only with Quantum Drives	0V to +24V	Logic input polarity. MDA2 is marked POS and NEG to show the positions of SW1A. Pos. = 24V, Neg. = 0V. POWER-OFF BEFORE CHANGING.
SW1F SW1G SW1H	6 7 8	10V to 50V 50V to 200V 60V to 300V	Selects tachometer feedback range. Only <u>one</u> to be selected. Refer to paragraph 8.5 for details.
LK1		ADJ or FB	Selects adjustment mode or feedback mode. Refer to paragraph 8.5 for procedure.
SW1B SW1C SW1D	2 3 4	+5V +12V +15V	Selects encoder power supply voltage. Only <u>one</u> to be selected. Refer to paragraph 8.6 for details.

8.3.5 Horsepower Setup for Size 1 Models

Your motors Armature Voltage & HP
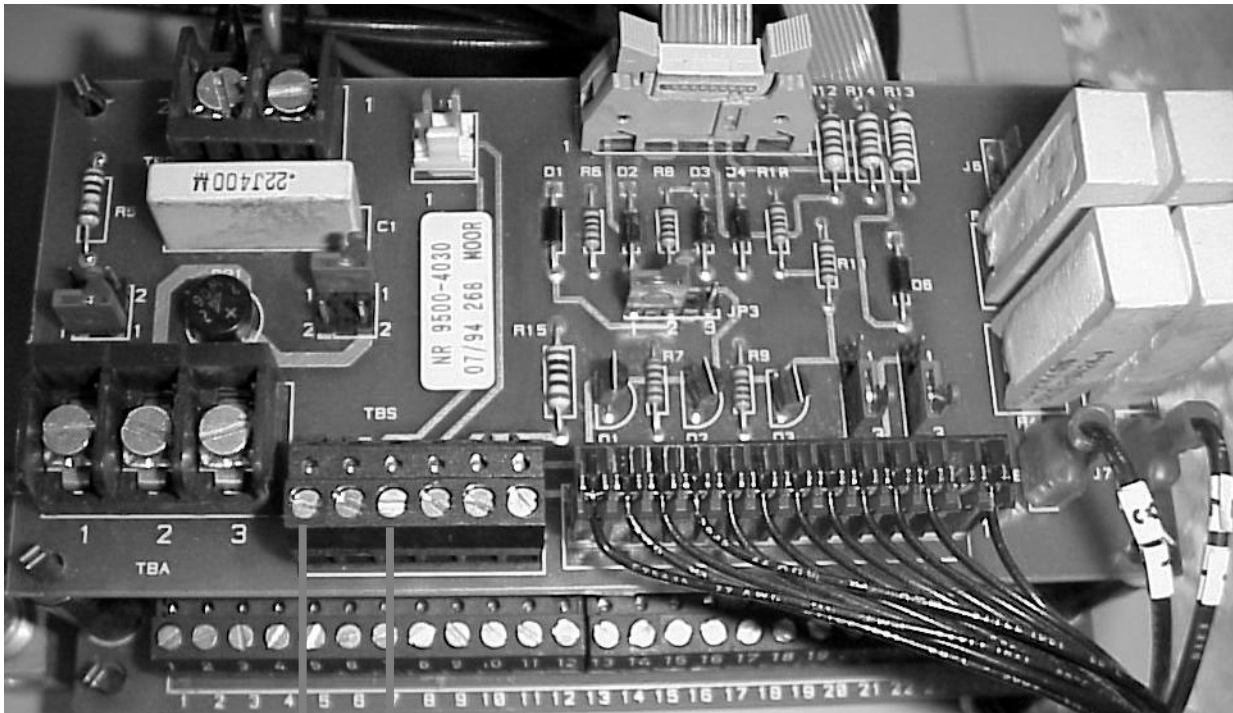
Horsepower scaling RESISTOR from attached bag
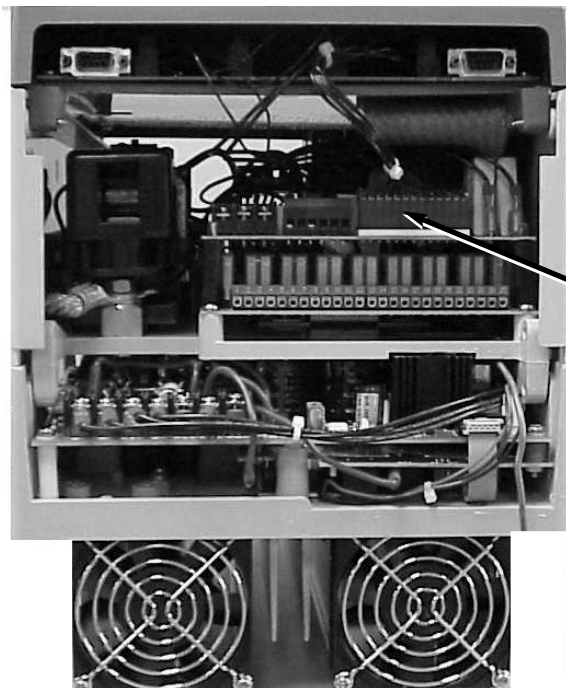
9500-4030 Current Scaling Interface Board

8.3.5 Horsepower Setup for Size 1 Models (Continued)

A	B	C	D	E			F
QUANTUM MODEL	DRIVE RATED OUTPUTS	MOTOR HORSEPOWER		SCALING RESISTOR			DRIVE AMMETER SCALER
Model Number	Amps	@240 VDC	@500 VDC	Value-	Part No.	Marking	Parameter #5.05
	DC			OHMS			
9500-8X02	10.2	2.5	5	n/a	n/a	n/a	15
	12.3	3	7.5	127	3857-127-3W	127	18
	20.4	5	10	26.1	3857-26R1-3W	26R1	31
	29.3	7.5	15	14	3857-14R0-3W	14R0	44
	38.2	10	20	9.53	3857-9R53-3W	9R53	57
9500-8X03	43.3	n/a	25	8.06	3857-8R06-3W	8R06	65
	55.4	15	30	5.9	3857-5R9-3W	5R9	83
9500-8x05	72	20	40	4.32	3857-4R32-3W	4R32	108
	88.6	25	50	3.4	3857-3R40-3W	3R40	133
	105	30	60	2.8	3857-2R80-3W	2R80	158
9500-8x06	125	n/a	75	2.32	3857-2R32-3W	2R32	188
	144	40	n/a	2	3857-2R00-3W	2R00	215
	172	50	100	1.65	3857-1R65-3W	1R65	288
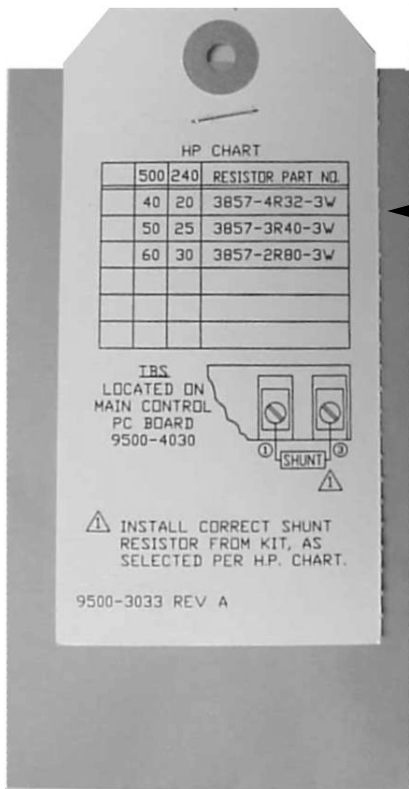
Example:

If you are using a Quantum Model Number 9500-8x05, this is the chart from the scaling resistor bag that would be attached to the drive.

If your motor nameplate indicates 500v 40HP you would select, the topmost resistor 4R32 to be placed into TBS pins 1-3 (see Ref 1).

In addition, you could calibrate the built-in Armature Ammeter by placing 108 in parameter #5.05. In doing so, parameter #5.02 will read out DC Armature Amps.

8.4 ARMATURE VOLTAGE FEEDBACK

Controls are shipped with Parameter 3.13 set to 1 to select AVF. Parameter 3.15 is defaulted to 500V to limit armature volts. This parameter should be set to motor nameplate rated armature voltage for other ratings.

8.5 TACHOMETER FEEDBACK

Parameter 3.13 must be set to 0 for speed feedback. Quantum III units will accept AC or DC tachometer feedback.

Parameter 3.15 should be set to 0.875 times nameplate rated armature voltage.

WARNING

AC TACHOMETER FEEDBACK IS NOT FOR USE ON REGENERATIVE UNITS.

The controls are shipped set up for AC tach. Jumpers JP4 and JP5 on the 9500-4030 logic interface board must be re-programmed to the 1 position for DC tachometer feedback. See Figure 8-1 for location. The speed loop gain default settings may require re-setting. Reduce 3.09 to 15 and 3.10 to 5 as a starting point. This may need additional adjustments for better dynamic performance under actual load conditions.


WARNING

EQUIPMENT DAMAGE AND/OR PERSONAL INJURY MAY RESULT IF ANY JUMPER PROGRAMMING IS ATTEMPTED WHILE THE CONTROL IS OPERATIONAL. ALWAYS LOCK OUT POWER AT THE REMOTE DISCONNECT BEFORE CHANGING ANY JUMPER POSITIONS.

8.5.1 AC or DC Tach Feedback

If the motor is equipped with a Speed Feedback device such as:

• AC Tach (not for use with regenerative models 9500-86xx

• DC Tach
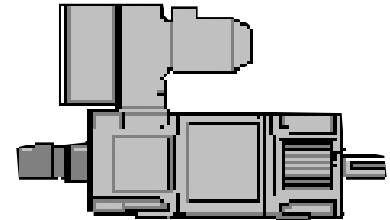
Nameplate data/specifications for this device (if it is intended for use) must be obtained.

AC or DC Tach Voltage Constant -K_{tach}

The tachometer voltage constant or $K_{tach\_}$, is the value typically stamped on the tachometer nameplate and is usually expressed as volts/rpm.Some typical examples are listed below:

Ex. 1) 50.3 volts/1000RPM or
  $K_{tach\_}$ = 0.0503vdc/rpm

Ex. 2) 26VAC/1K rpm (or 26vac/1000rpm)
  $K_{tach\_}$ = 0.026vac/rpm

You will need to calculate the maximum generated tachometer voltage at your intended motor RPM which we can refer to as **Max Tach Voltage**.

Example 1:

Our motor uses a DC Tach whose nameplate indicates that it produces 50.6v/1000rpm. Our machine has a 4:1 gearbox between the motor and the machine. Our motor is a 1750RPM DC motor and the output shaft of the gearbox is to turn at 410RPM at full speed. What is the **Max Tach Voltage**?

Solution 1:

Since the machine requires 410RPM, the motor will need to rotate 4x this speed per the gear ratio or 1640RPM.

$$K_{tach\_} = \frac{\text{Tach Voltage at}}{\text{What RPM}} = \frac{50.6}{1000} = \mathbf{0.0506}$$
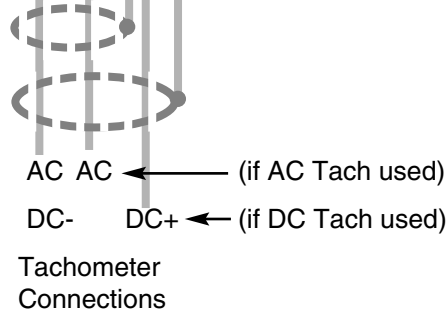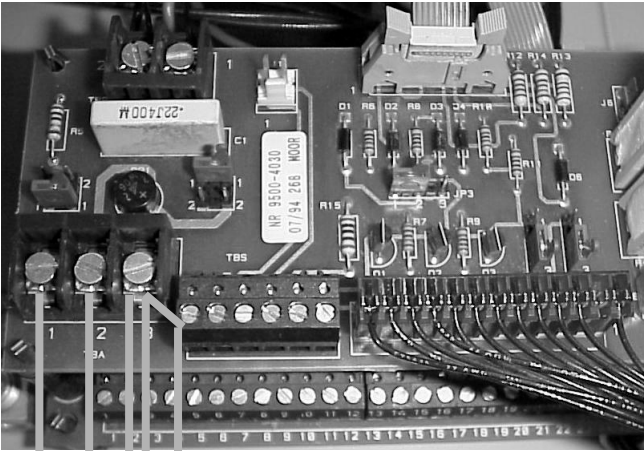
**Max Tach Voltage =
K_{tach} x Max Intended Motor RPM**

= 0.0506 x 1640

Max Tach Voltage = 82.984 or 83vdc

The **Max Tach Voltage** is that voltage which could be measured at the Tach terminals - TBA pins (on 9500-4030 Interface Board) at maximum machine speed. The previous formula/example would hold true for AC or DC tachometers.

AC AC ← (if AC Tach used)

DC-   DC+ ← (if DC Tach used)

Tachometer
Connections

If using an AC tach multiply this entire result by 1.4

8.5.2 Setting the Max Tach Range

When using either AC or DC Tach Feedback, the Quantum III needs to be aware of the maximum Feedback Voltage that it will be reading. This is the value calculated previously. There are 3 switches that set the range of this Feedback Voltage namely switches 6, 7, and 8. See photo.
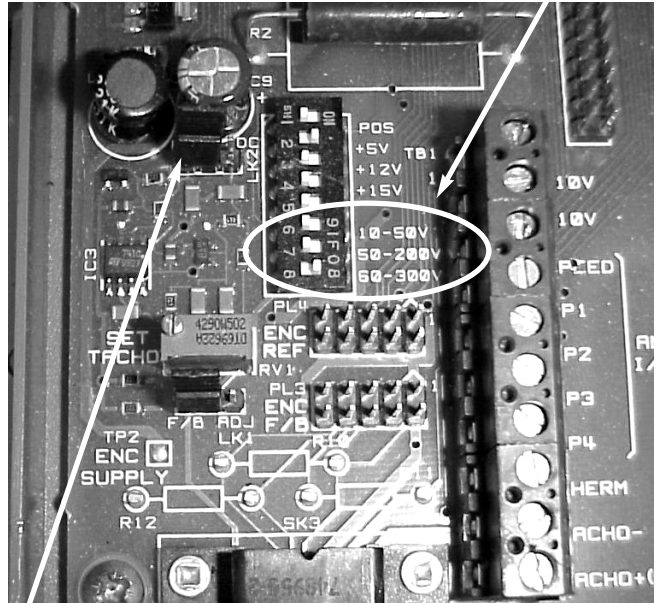
To allow enough headroom for any speed overshoots an additional 10% is added to the Feedback Voltage value before the Tach Range Switch Setting is determined.

Tach Voltage Range =

Feedback Voltage x 1.1

Tach Voltage Range	Switch ON
10-49 volts	6
50 to 200v	7
150 to 300v	8

Example

From the previous example, since the Tach was a DC Tach, the **Feedback Voltage** was equal to the Max Tach Voltage or 89vdc. Therefore:
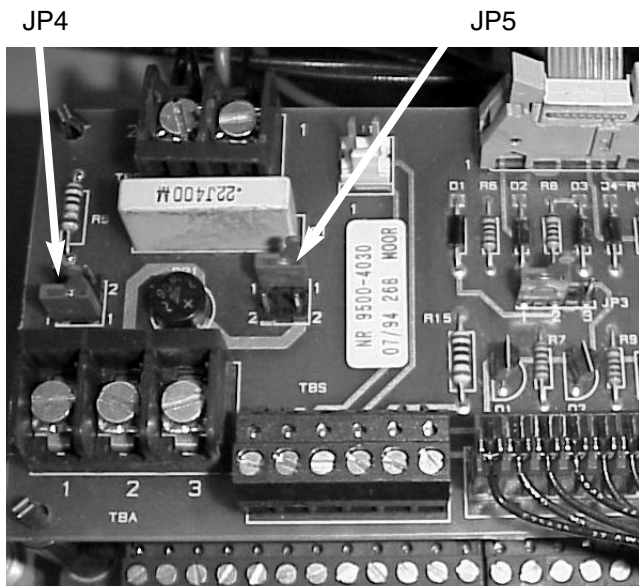
Tach Voltage Range =

Feedback Voltage x 1.1   89v x 1.1 = **98v**

This would indicate that Tach Range Switch 7 should be placed in the ON position based on the table above.

8.5.3 AC or DC Tach Feedback Setup

Shown below is the Interface Board and the jumpers that may need set for AC or DC Tach feedback. JP4 and JP5 are to be set in pairs. If tachometer feedback is not used these do not need to be considered.

TACHOMETER TYPE	JP4 POSITION	JP5 POSITION	FACTORY SETTING
AC	2	2	← for Non-Regen's
DC	1	1	← for Regen's

JP4   JP5

8.5.4 Tachometer Jumper and Calibration Items
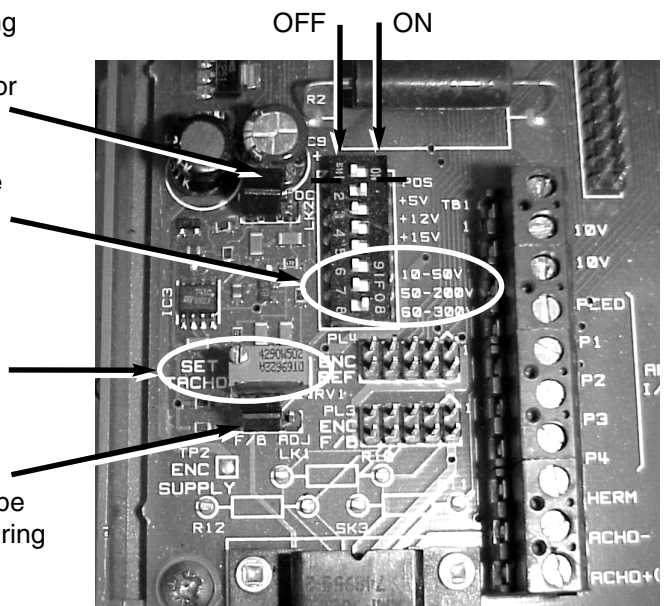**MDA2B Control Board (lower left corner)**

Under top cover

Optional Additional Filtering
Put in LF (low-pass filter)
position if using AC Tach or
on noisy DC tachs

Tachometer Max Voltage
Range Setting 6, 7 or 8
Set only one to ON

Tachometer Max
Speed Adjustment

Optional Static Tach
Calibration Jumper - must be
in F/B (feedback position) during
normal operation

OFF   ON

8.6 ENCODER/DIGITAL PULSE TACH REQUIREMENTS & CONNECTIONS

If a Pulse Tach is to be used as a Speed Feedback device, it must provide 2 complementary channels of information in quadrature. Encoder outputs must be a differential line driver type 88C30/8830 or similar. The encoder must provide:

ChA	Differential Channel 1
/ChA	
ChB	Differential Channel 2
/ChB	
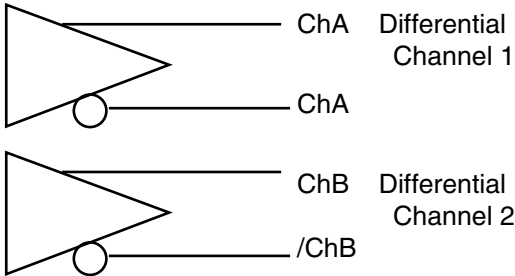
Pin #Sk3	Function
1	0v Supply
2	+Supply
3	ChA
4	/ChA
5	ChB
6	/ChB
7	No conn
8	ChC
9	/ChC

optional

If optional marker channel is used, the encoder must be 1024 ppr.

Encoders with Open collector channel outputs (or single ended outputs) are not directly usable.

ChA

ChB
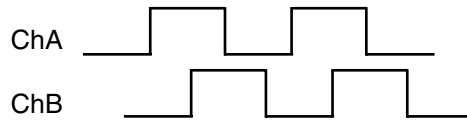
Illustration of 90° quadrature for direction sensing CHA leads CHB for CW rotation facing shaft end

A differential marker channel (ChC and /ChC) can be accommodated but is optional depending on the intended application.

Encoder Connector 9 Pin D
Female Socket SK3

8.6.1 Encoder or Digital Pulse Tach Setup

The MDA2B Control Board can supply 5 VDC, 12 VDC or 15 VDC (300mA max) for such encoders. Transmission line terminating resistors should be installed on the standoffs provided (see photo below). These terminating resistors help prevent line reflections and reduce noise pickup as it is important to have accurate speed feedback information. The ohmic value depends on the voltage swing of the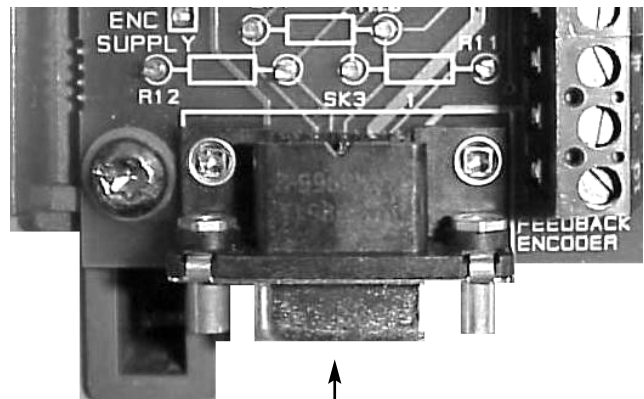 differential drivers on the pulse tach. The following table summarizes settings and suggested terminating resistors for those supply ranges.

Switch Number*	Pulse Tach Supply	Terminating Resistor**
2	5vdc	330ohm
3	12vdc	750ohm
4	15vdc	1000ohm

Resistor values shown call for approximately 15-16mA drive capability from the encoder line driver. Different values can be calculated and used based on the manufacturer's recommended loading/termination resistor.

* Only one switch must be in the ON position and should only be switched with power off
** Resistors can be 1/4 or 1/2 watt

OFF — ON

Encoder Supply Voltage Range Setting 2, 3 or 4 Set only one to ON

Encoder Supply Voltage Test Point

Encoder Transmission Line Driver Termination Resistors
Encoder Frequency can be measured across R10 or R11
(R12 is for optional marker channel)

Encoder Connector 9 Pin D Female Socket SK3
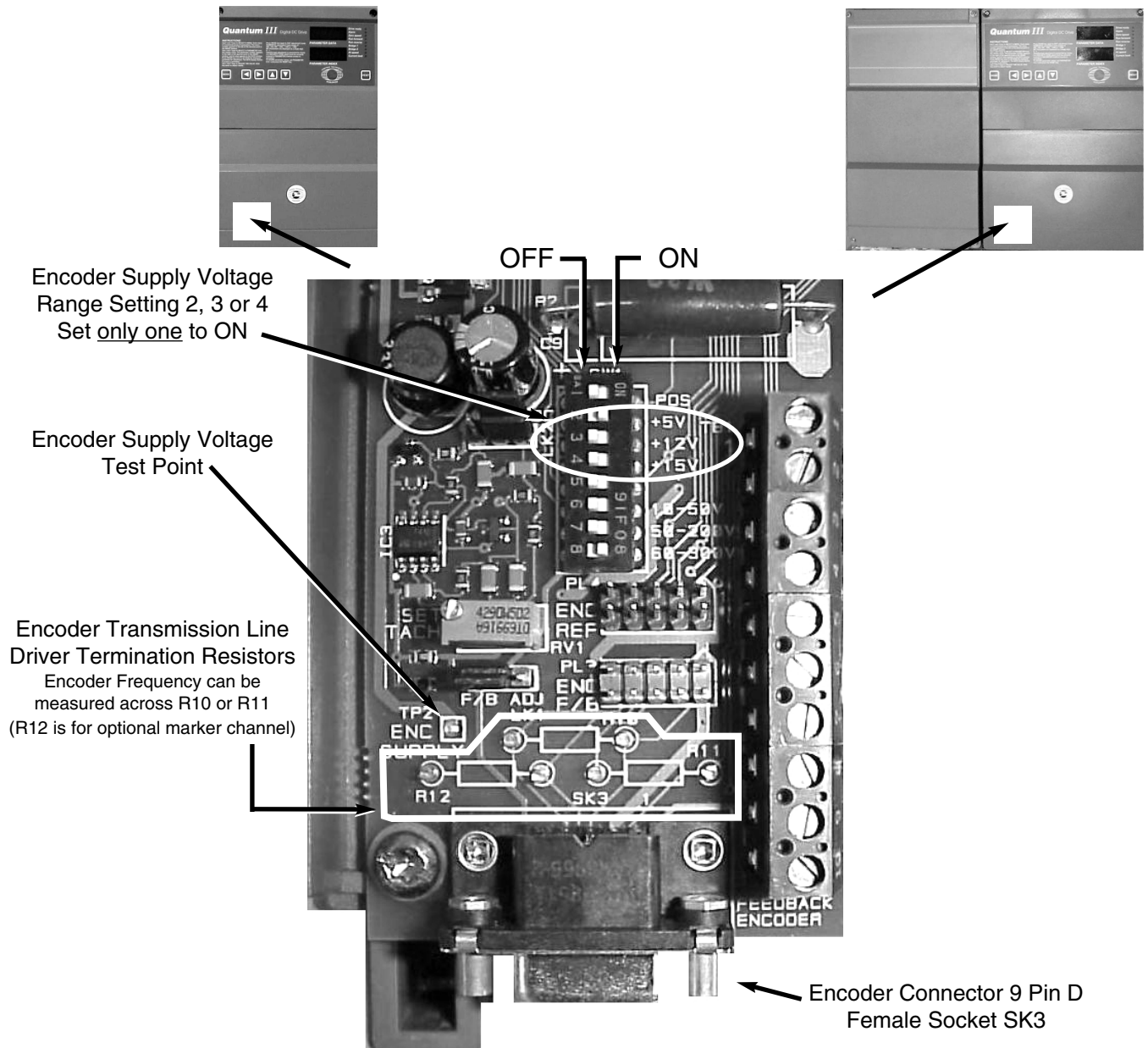
8 Drive Start-up

8.6.2 Encoder or Digital Pulse Tach Feedback

Example 1:

Our motor uses a Digital Pulse Tach whose nameplate indicates that it produces 1024PPR (or 1000 pulses/rev). Our machine has a 4:1 gearbox between the motor and the machine. Our motor is a 1750RPM DC motor and the output shaft of the gearbox is to turn at 410RPM at full speed. **What is the Max Tach Frequency and how do I set up the Quantum III for this situation ?**

Solution 1:

Since the machine requires 410RPM, the motor will need to rotate 4x this speed per the gear ratio or 1640RPM.

Max Tach Frequency =

PPR _ * Max Intended Motor RPM

= $\frac{1024 \text{ pulses}}{1\text{rev}}$ x $\frac{1640\text{revs}}{1 \text{ MIN}}$ x $\frac{1 \text{ MIN}}{60\text{sec}}$

Max Tach Frequency =

27989.33 $\frac{\text{pulses}}{\text{sec}}$ or 27.989KHz

> The Max Tach Frequency is that frequency which could be measured at the encoder terminals at maximum machine speed with frequency meter to verify correct motor speed.

The Max Tach Frequency must not exceed 100KHz.

8.6.3 Scaling the Quantum for Encoder

Setting the Quantum for this Encoder and this intended max motor RPM involves calculating a scaling value for parameter #3.14.

#3.14 = $\frac{1,000,000}{\text{PPR}}$ x $\frac{750}{\text{Intended Max RPM}}$

#3.14 = $\frac{1,000,000}{1024}$ x $\frac{750}{1640}$

#3.14 = 976.5625 x 750 then divide by 1640

#3.14 = 446.59 or rounded to **447**

In addition, control bit parameter #3.12 must be to a 1 to set the Quantum to use the encoder as Speed Feedback.

8.7 CURRENT LIMIT SETUP

Current limit and motor overload are drive features protecting motors from excessive currents and long term overloads.

The Quantum III derives a current signal through isolated AC current transformers, rectified by a full wave bridge, and scaled by HP scaling resistors. Models 9500-8X02 through -8X06 have an internal HP scaling resistor that limits the current to 10 amps. External resistors are provided to program each model to all the standard horsepowers in its range. These resistors are wired to TBS-1 and TBS-3 on the 9500-4030 logic interface board. Refer to Figure 8-1 and interconnect drawing, Figure A-1.

The values are shown in the following table:

PART	HORSEPOWER		RESISTOR	
NUMBER	240V	500V	VALUE	PART NO.
9500-8X02	2.5	5	-	-
	3	7.5	127	3857-127-3W
	5	10	26.1	3857-26R1-3W
	7.5	15	14	3857-14R0-3W
	10	20	9.53	3857-9R53-3W
9500-8X03	-	25	8.06	3857-8R06-3W
	15	30	5.9	3857-5R9-3W
9500-8X05	20	40	4.32	3857-4R32-3W
	25	50	3.4	3857-3R40-3W
	30	60	2.8	3857-2R80-3W
9500-8X06	-	75	2.32	3857-2R32-3W
	40	-	2.0	3857-2R00-3W
	50	100	1.65	3857-1R65-3W

When the drive is set up for the desired HP via

QUANTUM III CURRENT TABLE							
QUANTUM III	HP		ADDED	PARALLEL	150%	100%	REGISTER
MODEL	240V	500V	RESISTOR	COMBO	AMPS	AMPS	#5.05
9500-8X02	2.5	5	NONE	26.1	15.3	10.2	15
	3	7.5	127	21.65	18.5	12.3	18
	5	10	26.1	13.05	30.7	20.4	31
	7.5	15	14	9.11	43.9	29.3	44
	10	20	9.53	6.98	57.3	38.2	57
9500-8X03	—	25	8.06	6.16	65	43.3	65
	15	30	5.9	4.81	83	55.4	83
9500-8X05	20	40	4.32	3.71	108	72	108
	25	50	3.4	3.01	133	88.6	133
	30	60	2.8	2.53	158	105	158
9500-8X06	—	75	2.32	2.13	188	125	188
	40	—	2	1.86	215	144	215
	50	100	1.65	1.55	258	172	258

NOTES: 26.1 Ohms is always installed internally, therefore, drives are set for 5HP without an added external HP scaling resistor.
Parameter #5.05 must be set for 150% of FLA rating for the amp readout on the drive (#5.02) to be correctly scaled.
Readout register #5.02 will indicate actual amps with no decimals.

additional HP scaling resistors, #5.05 must be set appropriately for the armature current readout to be scaled correctly. The accompanying table indicates the value to be set into #5.05 for the various horsepowers along with some other potentially useful information. By measuring across the shunt/HP scaling resistor terminals on the Quantum III, one could refer to this table to determine the HP rating and other pertinent currents for a given unit.

Models 9500-8X07 through -8X20 use three (3) internal HP scaling resistors, R234, R235, and R245, in parallel, scaled for the maximum rating of each model. These resistors are mounted on PCB MDA6.

NOTE

These HP scaling resistors can be re-scaled for any current value less than the drive rating by the following formula:

$$R_{Total} = \frac{1600}{I_{max}}$$

$$I_{max} = 1.5 \times I_{motor}$$

NOTE: This will create a non-standard, non-stocked drive.

Quantum III drives are factory set with 150% current limit, governed by parameter #4.05 (and #4.06 with regenerative drives for reverse bridge current). This means that drive output current is limited to 1.5 times the DC continuous current rating of that specific size of drive. Parameter #4.05 (and #4.06 with regenerative drives) is factory set at 1000 which corresponds to 150%. A 666 setting equals 100%.

The Motor Overload threshold, parameter #5.06, is factory set at 700 or 105% of the DC continuous current rating. This determines the point at which the software I x t integrator starts accumulating. The greater the overload means the faster the accumulation. The Overload Time, heating parameter #5.07, is factory set for 30 seconds and the overload time cooling is set to 50 seconds. All three parameters can be reset for specific applications.

Suppose one applied a Quantum III non-regenerative model number 9500-8307 to run a 150HP 500VDC motor. If this motor was a standard 150HP motor, the full load nameplate current would be 260A which is the drive rating. In this case, the Quantum current limit is already set for 150% (390A) which is considered normal for high starting torque and intermittent duty. However, the motor overload feature

protects the motor from this high current should this be sustained for a period of 30 seconds or 1 minute, typically. Therefore, in this case, nothing has to be done to the current limit or overload parameters.

If this same drive was applied to a 125HP motor, however, one must protect the motor. Limit the current to the customary 150% of its full load nameplate rating and adjust the motor overload threshold accordingly. This can be accomplished by the following procedure. Reset the parameter settings to correspond to the actual motor. To determine the lower current limit settings, calculate the following:

$$\frac{\text{Motor F.L. Amps}}{\text{Drive Rating}} = \frac{205}{260A} = 0.788$$

(or 78.8% of Drive Capability)

Therefore, set the factory current limit setting of 1000 or 1000 x .788 =788 into parameter #4.05 (and #4.06 if this was a regenerative drive and symmetrical current limits were desired).

Also, the electronic motor overload integrator threshold must be reset. As mentioned previously, the factory setting of parameter #5.06 is 700, which represents 105% (since 666=100%). To adjust the overload for this smaller motor, re-enter 78.8% of 700 or 551 into parameter #5.06.
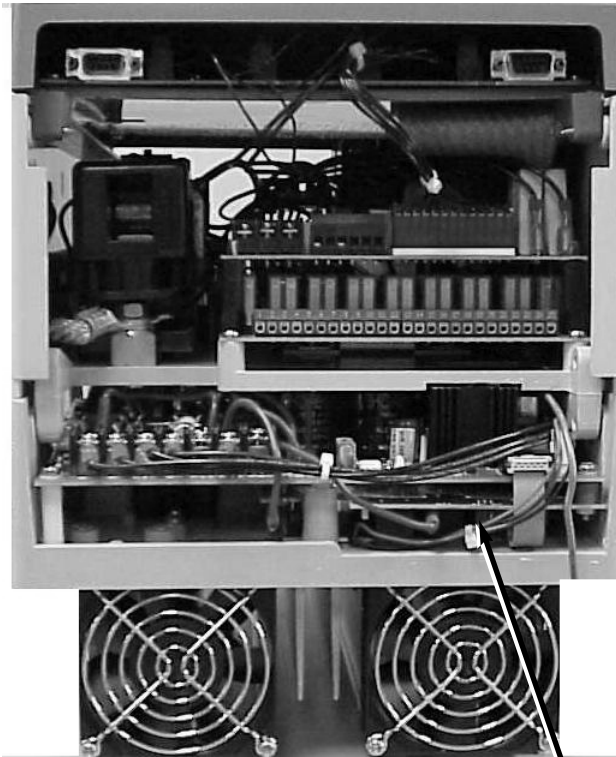
8.8 FIELD CURRENT REGULATOR

Quantum III models 9500-8X02 through -8X06 are supplied standard with 8 amp field current regulators (MDA-3). Models 9500-8X07 through -8X20 can be supplied with an optional FXM5 20 amp field regulator. Both of these regulators are software controlled from menu 6 of the Quantum III. Jumper JP-1 on the MDA-3 (see Figure 8-5) and parameter 6.11 set the maximum current to be scaled for the desired field current. See Section 10 menu 6 for the range table of parameter 6.11.

Quantum III controls are shipped with the field disabled to prevent damage to the motor field. Parameter 06.13 must be set to 1 to enable field control.

CAUTION

Be sure the field current is set to the motor nameplate rating. Motor damage may occur if current is incorrectly set.

8.8.1 Quantum III MDA3 Field Regulator Range Jumper

Bottom End View   MDA3 Field Regulator
                        & 2A-8A Range
                        Jumper Location
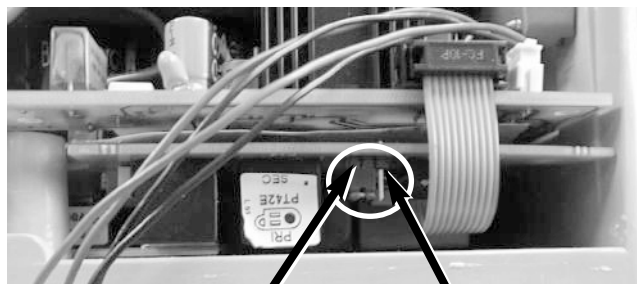
2A   8A
2 amp   8amp

**Maximum Field Range Output Select
On MDA3 Field Regulator Board
for Size 1 Quantums
Models 9500-8X02 thru 9500-8X06**

8.8.2 Field Current Setup

Example :   For Size 1 Quantum III

Suppose you were setting up to run a motor that had a Field that required 3.3A with a Size 1 Quantum III.

What changes would be needed to properly set up the drive for this motor?

Solution :

1) Set the MDA3 Field Range Jumper (2A/8A). Since the field current requires more than 2A, we must move the Field Range jumper to the 8A position.

2) Since the required field of 3.3A is greater than 3A we would need to set parameter #6.11 to deliver 3.5A. This calls for #6.11 to be set at 207 per the adjacent table.

3) But we don't want all 3.5A. We only want 3.3A. So we must reduce our request.

To calculate the required **reduction** of Field Current, one needs to only **multiply the factory setting** by the **Reduction Factor**.

The Reduction Factor is simply the ratio of:

$$\text{Reduction Factor} \quad = \frac{\text{Desired Field amps}}{\text{Max MDA3 amps}}$$

For our example:

$$\text{Reduction Factor} \quad = \frac{3.3}{3.5} = \underline{0.943}$$

(We only need 94.3% of that range setting)

4) Parameter #6.08 sets the amount of the Max amps that #6.11 determines. The factory setting for #6.08 is 1000 (or 100%). So we would multiply the Reduction factor by the Factory Setting.

> **New Value** for Full Field amps **#6.08** =
> Factory Setting x Reduction Factor =
> 1000 x 0.943 = 943

MDA3 Setup Table

MDA3 Max Amps	Field Range Jumper 2A/8A	Parameter #6.11 Setting
A	B	C
0.5	2	201
1	2	202
1.5	2	203
2	2	204
2.5	8	205
3	8	206
3.5	8	207
4	8	208
4.5	8	209
5	8	210
5.5	8	211
6	8	212
6.5	8	213
7	8	214
7.5	8	215
8	8	216

Parameter 6.21 limits the maximum firing angle to the field. To prevent the field from overheating if parameters are mis-set, it is defaulted to 815. If desired current cannot be achieved, increase its value accordingly.

8.9 FIELD ECONOMY

Field economy reduces the current to the shunt field when the drive is not running. This will increase motor field life and reduce the possibility of field roast-outs due to loss of ventilation. Set parameter 6.15 to 1 to enable the field economy function.

The value of parameter 6.09 will determine the field economy current value. This is typically set to 50% of the running current. Therefore, the setting of parameter 6.09 = 6.08 x 0.5. Parameter 6.12 sets the time before the drive goes to the economy current in seconds. It is defaulted to 30 seconds which is recommended for most applications.

8.10 FIELD WEAKENING

When field weakening is required, the maximum (base speed) current as defined by parameters 6.11, 6.08, and 6.21 is set as defined under paragraph 8.8, Field Current Regulator.

Parameter 6.07 is defaulted to 1000 to prevent field weakening. To enable field weakening, parameter 6.07, Back EMF Crossover Point, should be set 20 volts below the rated armature voltage of the motor. The field weakening will then occur over this span (from 480 to 500 VDC). For a 500 VDC motor, parameter 6.07 is set to 480. The field will weaken down to the minimum field current as set by parameter 6.10. This parameter is a percentage of the maximum set by range parameter 6.11 and is set as follows:

$$6.10 \quad = \quad \frac{\text{Minimum current desired x 1000}}{\text{MDA-3 max amps as set by 6.11}}$$

NOTE

Field weakening requires speed feedback for correct operation. AC tach, DC tach, or encoder feedback must be used.

8.11 CURRENT LOOP SELF-TUNING

NOTE

The following procedure is optional and not required for most general applications. However, where optimum response is required, the inner most control loop (the current loop) must be properly set up to enable the outer control loop (such as the speed loop) to function correctly. The current loop dynamics is mainly a function of a particular motor's electrical characteristics.

For general purpose applications, the default values for current loop stability parameters are satisfactory. However, for optimal current loop tuning, the Quantum III has a self-tuning procedure built-in to the unit to facilitate tuning of this inner loop.

To perform this procedure, the motor rotor must be locked or the field must be disconnected. This allows the drive to inject armature current and determine the motor armature electrical characteristics. The motor must not rotate during this procedure. Normally, when the field is removed, the shunt field motor will not rotate.

Quantum III units from 9500-8X02 through -8X06 contain an internal field regulator. Units with this regulator do not require the field wires to be removed for this purpose.

1. Apply power to the drive.

2. Set parameter 5.09 = 1. This enables the auto tune circuits and disables the field when a field regulator is used.

3. Enable drive run (the drive must first be disabled, then enabled). When the auto tune process is complete, it will reset 5.09 = 0 and disable the drive.

4. Store parameters to memory. Parameters affected are 5.12 through 5.15.

5. Fill out info sheet on page 197.
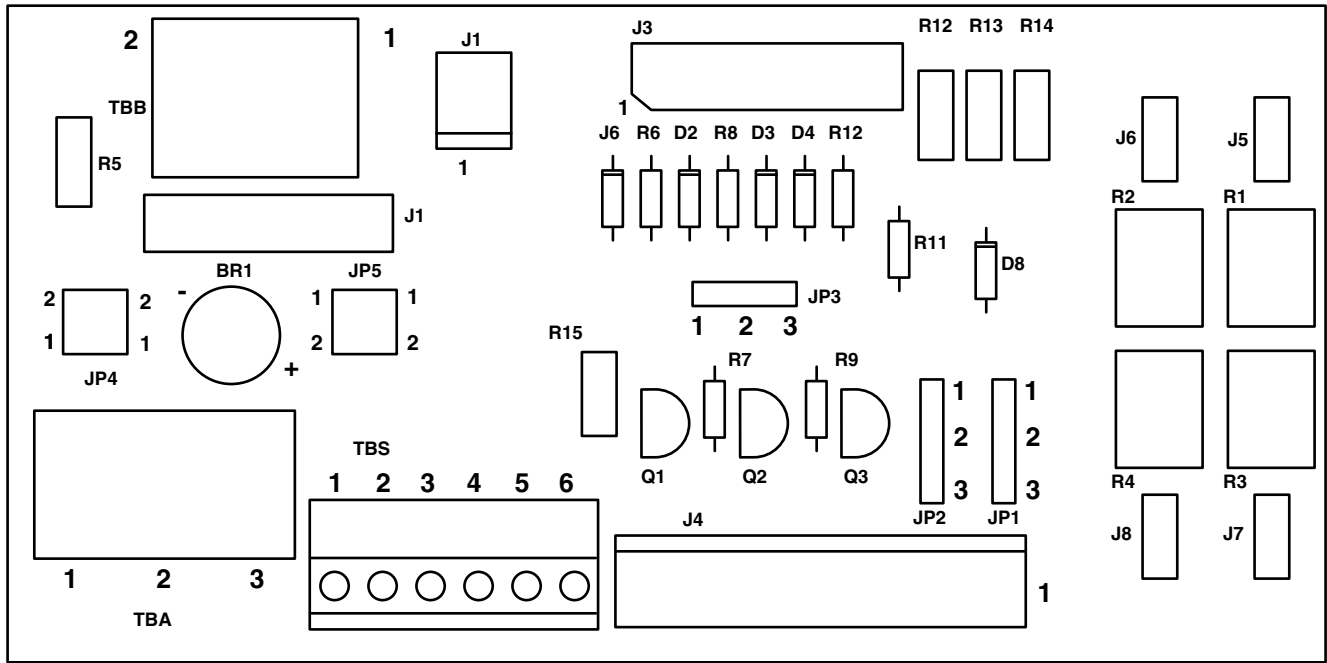
Top Board—Logic Interface
9500-4030

See Figure A-8
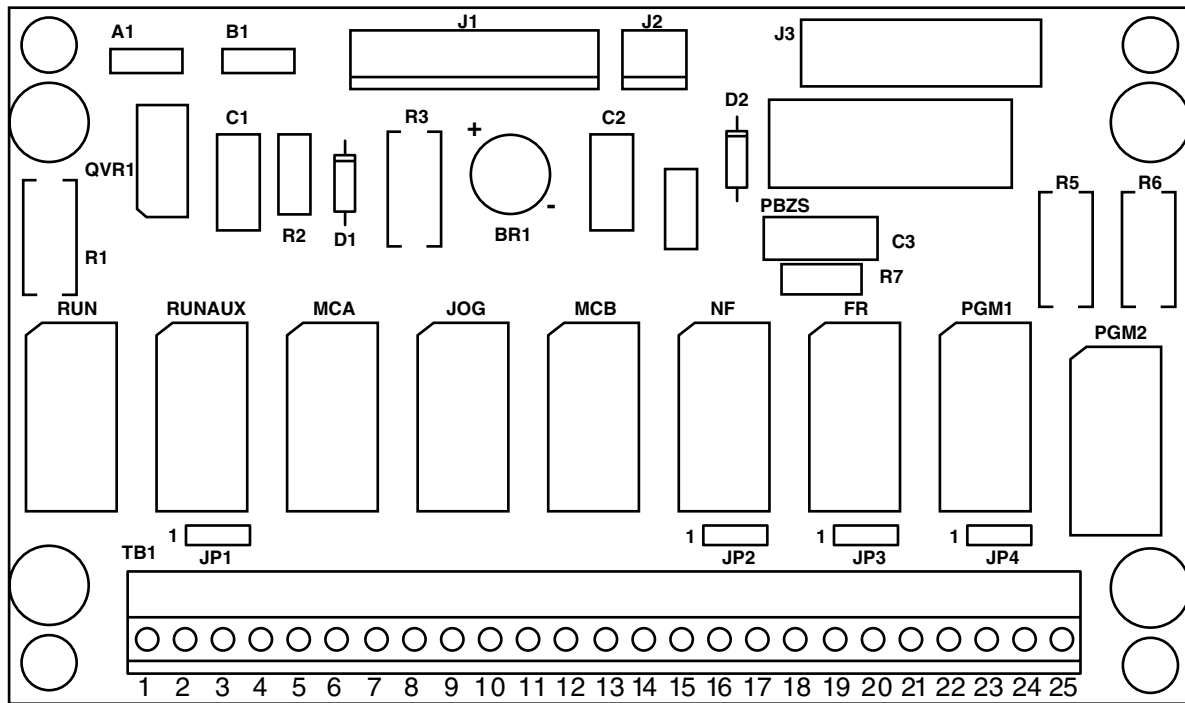
Lower Board—AC Interface
9500-4025
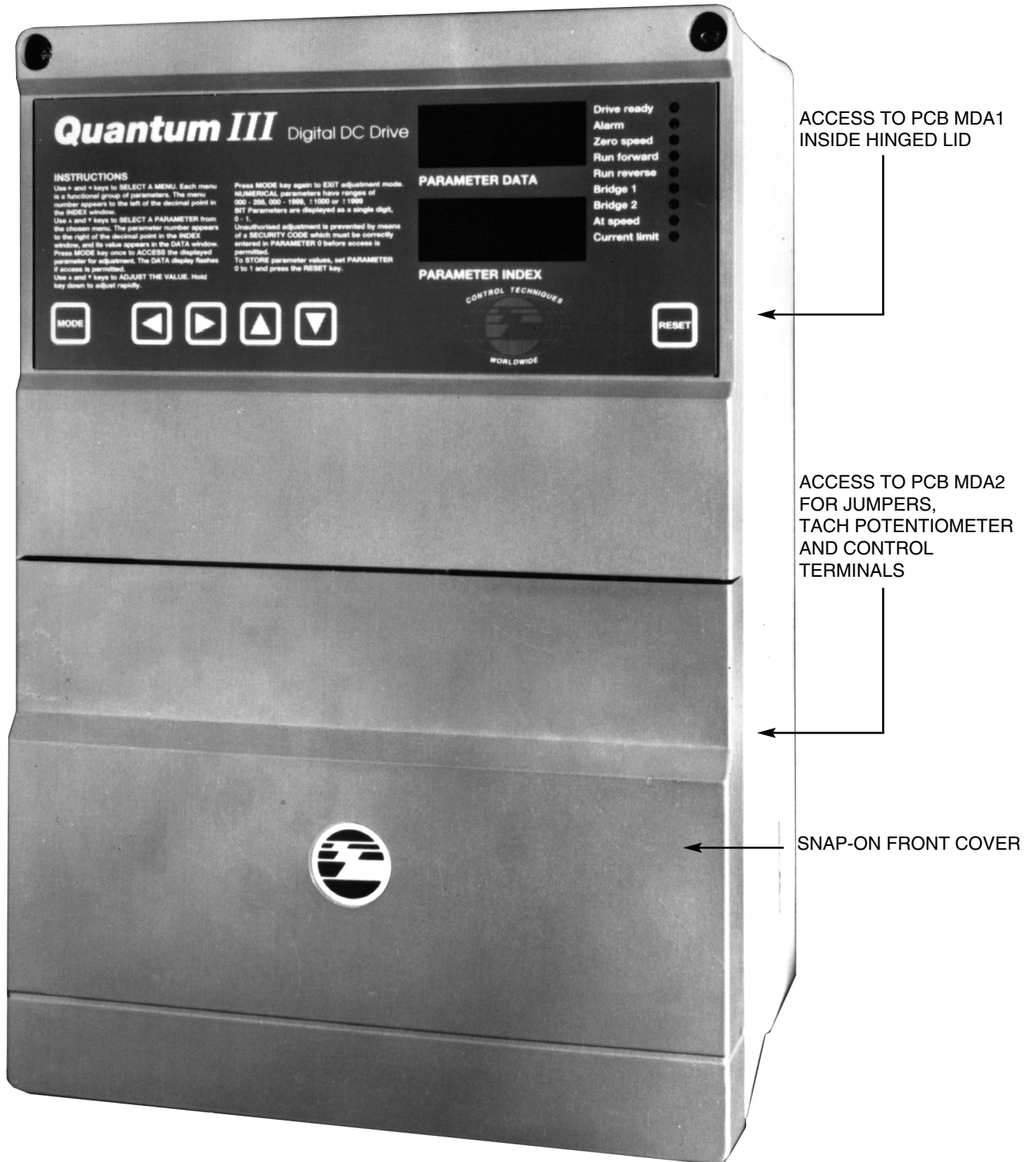
See Figure A-8

Figure 8-1.
Logic Interface and AC Interface Boards

Figure 8-2.
Location of Main Components

1	SW1A	=	**Pos or Neg Logic (Negative Logic only with Quantum Drives)**
2	SW1B	=	+5V ⌉
3	SW1C	=	+12V Encoder Supply
4	SW1D	=	+15V ⌋
5	SW1E	=	Not used
6	SW1F	=	10-50V ⌉
7	SW1G	=	50-200V Max Tach Voltage
8	SW1H	=	60-300V ⌋

MDA2B

PL6

PL5

MD29
(Compressor Option)
or Factory Communications Option

MAX SPEED
ADJUST
W/ TACH F/B

TACHOMETER
POTENTIOMETER

RV1

SW1A
SW1B
SW1C
SW1D

SW1F
SW1G
SW1H

LK1

MOUNTING
TERMINALS FOR
TERMINATING
RESISTORS

PL4

PL3

R10

R12   R11

1	+10v	CURR	11		21	F1 (STOP)	ENABLE	31
2	-10v	DAC1	12		22	F2 (1R)	RESET	32
3	SPEED	DAC2	13		23	F3 (1F)	+24v	33
4	GP1	DAC3	14		24	F4 (RR)	POLE	34
5	GP2	ST1	15		25	F5 (RF)	NC	35
6	GP3	ST2	16		26	F6	NO	36
7	GP4	ST3	17		27	F7	POLE	37
8	THERMAL	ST4	18		28	F8	NC	38
9	TACH	ST5	19		29	F9	NO	39
10	TACH 0v	0v	20		30	F10	0v	40

R6

PL2

SK3

Feedback
encoder

Communications
termination
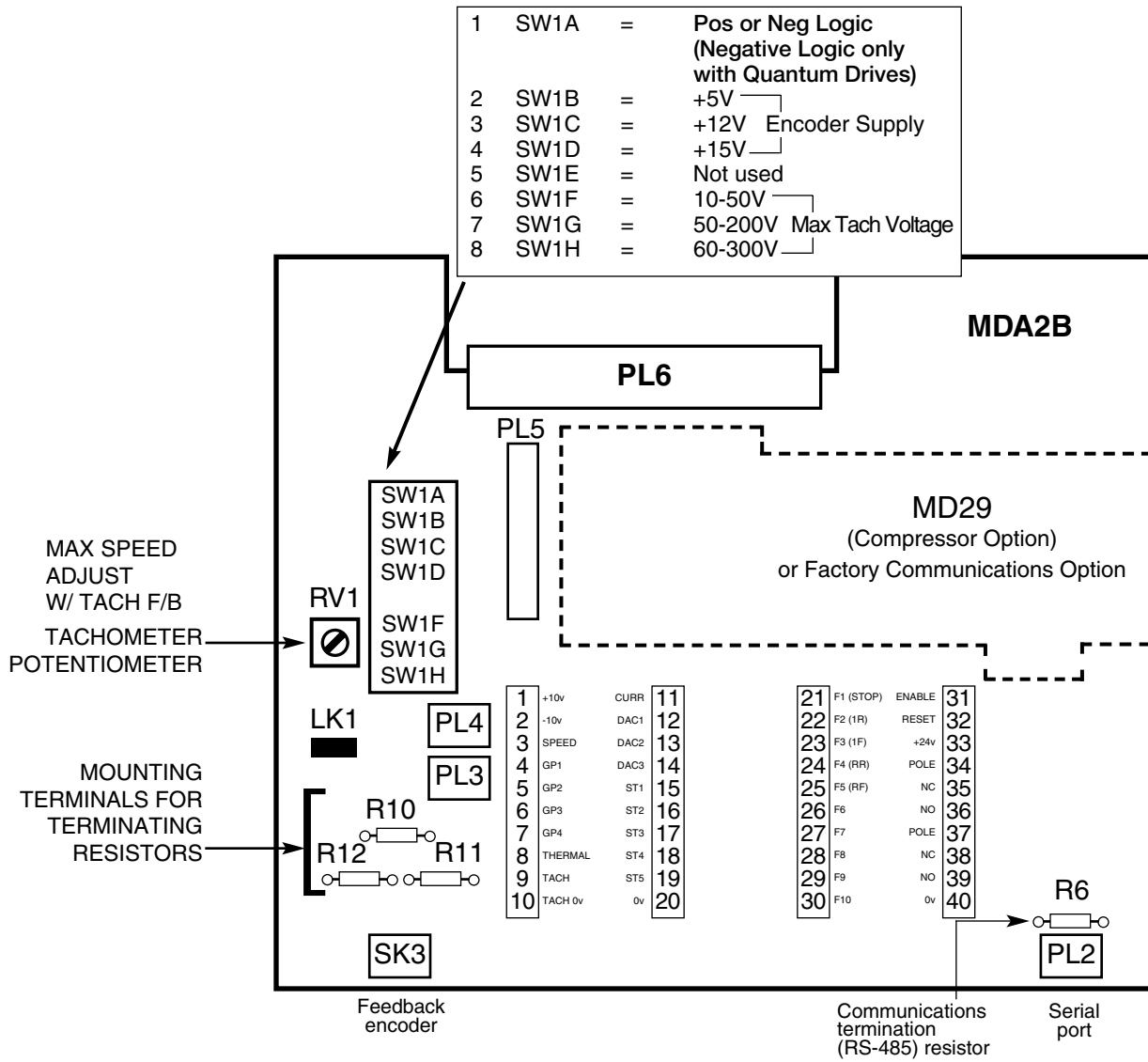(RS-485) resistor

Serial
port

**Figure 8-3.
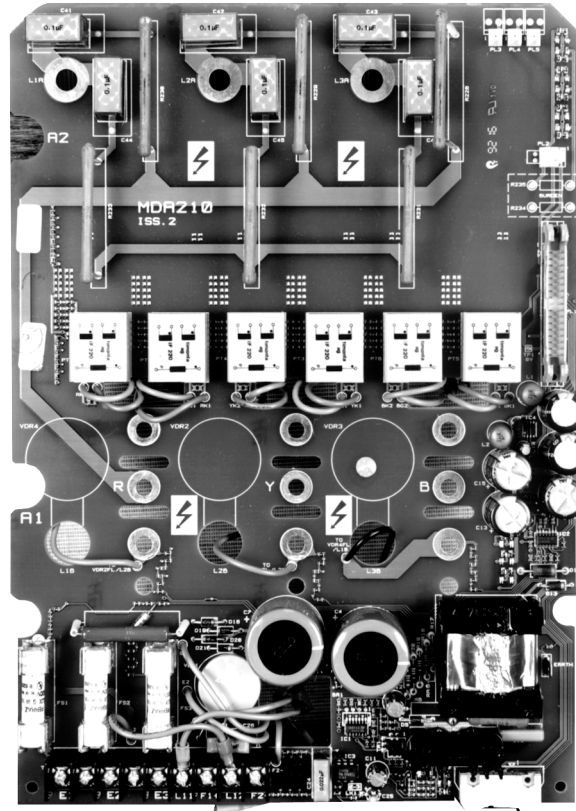Location of Principal Components on PCB MDA2, Rev. 2**

**Figure 8-4.
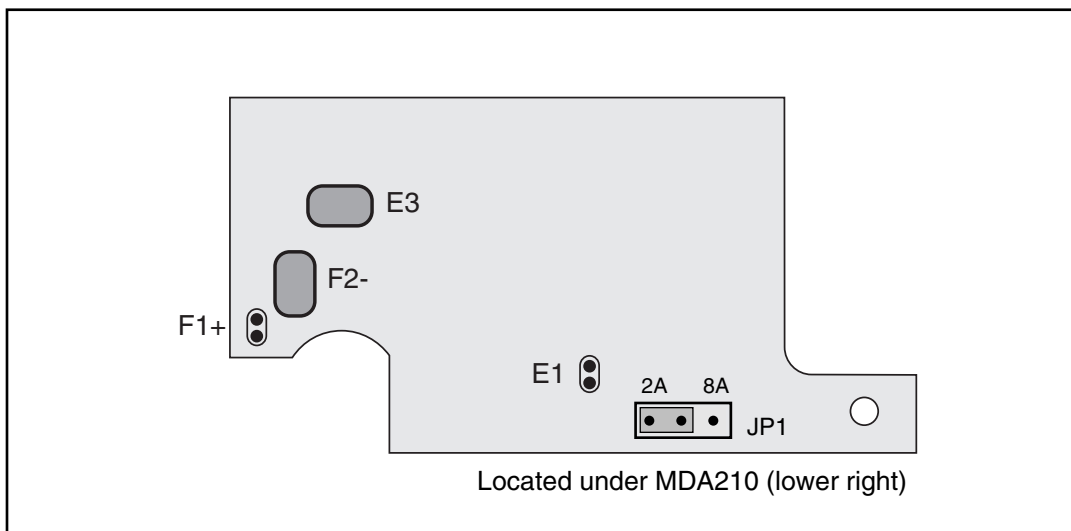MDA210 Power Board**

Field Regulator
Located
Under this Area

**Figure 8-5.
MDA3 Field Regulator PCB**

8 Drive Start-up

8.11.1 Other Jumper Selections on 9500-4030 Interface Board

JP1 Selection to determine the meaning of 115 VAC Programmable Input #2 (TB1 Pin 12)

Position	1-2	Select Digital Reference #3 (Parameter #1.19) as the Speed Reference i.e. for Thread or Drool Speed
Position	**2-3**	**Remote Drive Reset**

JP2 Selection to determine the meaning of the FR (Fault Relay) Output (TB1 Pins 17 & 18)

Position	1-2	External Trip Inactive. FR Relay output contacts usable
Position	**2-3**	**Loss of 115 VAC from TB1 Pin 4 will cause External Trip**

JP3 Selection to determine how the Drive is to stop

Position	**1-2**	**COAST STOP (Armature Contactor Opens upon STOP input)**
Position	2-3	RAMP STOP (Reference is ramped to zero then Armature Contactor Opens)

Items in **bold** are factory settings.