7.1 POWER WIRING

7.1.1 Incoming Power Requirements

Refer to Figures 14-1 through 14-3 for location of power connections.

A remote fused AC line disconnect or circuit breaker is required by the National Electric Code. This AC line disconnect or circuit breaker must be installed in the incoming AC power line ahead of the control.

Overload protection must be provided per NEC (National Electric Code) guidelines.

The control will operate from typical industrial 3-Phase AC power lines. The line should be monitored with an oscilloscope to insure that transients do not exceed limitations as listed below:

1. Repetitive line spikes of less than 10 microseconds must not exceed the following magnitude:

   240 Volt Programming: 400V Peak
   480 Volt Programming: 800V Peak

2. Non-repetitive transients must not exceed 25 watt seconds of energy. Transients of excessive magnitude or time duration can damage dv/dt suppression networks.

3. Line notches must not exceed 300 microseconds in duration. An abnormal line condition can reflect itself as an intermittent power unit fault. High amplitude spikes or excessive notch conditions in the applied power could result in a power unit failure.

The control is designed to accept three phase AC line voltage. See Section 4 Rating Table for drive input and output ratings and acceptable wire sizes. When using three phase power, connect the incoming lines to terminals L1, L2 and L3. These terminals are located as shown in Figures 14-1 through 14-3. Any incoming line can be connected to any of the L1, L2 and L3 terminals. The control is not sensitive to phase rotation.

WARNING

CONNECTING THE INPUT AC POWER LEADS TO ANY TERMINALS OTHER THAN L1, L2 OR L3 WILL CAUSE AN IMMEDIATE FAILURE OF THE CONTROL.

CAUTION

The voltage and frequency of the incoming line to the control must be as shown in Paragraph 2.1, depending on the jumper programming. If the incoming line voltage and/or frequency is out of this tolerance, the control may fail to operate properly.

7.1.2 Power Distribution Requirements

When applying DC Drives to power systems it is important to insure that the power distribution ampacity is sufficient but not too excessive. In general, if a power distribution KVA capacity exceeds 7 times that of the smallest drive KW rating, an isolation transformer or line reactor should be employed to achieve a suitable impedance between the drive and the power lines to insure reliable operation. Drives tend to work most reliably when the line impedance applied to them is between 1-6%.

Power Factor Corrected Lines

Drive installation should be avoided on lines that are corrected for power factor. When the power distribution system contains power factor correction capacitors, drives should be installed as far way as possible from these correction capacitors so that the length of wire offers some protective impedance. If this is not possible, line reactors or an isolation transformer are recommended to insure reliable operation.

7.2 OUTPUT POWER CONNECTIONS

Refer to Figures 14-1 through 14-3 for location of power connections.

Before connecting the DC motor to the control, observe all of the following precautions:

A. Verify the motor is the appropriate size to use with the drive.

CAUTION

All of the precautions listed in the following steps must always be observed to avoid equipment malfunctioning and damage.

1. Never connect the control to a motor with a current rating higher than the continuous rating of the drive. The motor current rating should not be less than 40% of the drive continuous rating, unless the drive is re-shunted..
2. Never connect the control to a motor with a field current rating greater than the drive field supply rating. When a field regulator is used the field current should not be forced below 0.25ADC, or 5% of the drive field current rating, whichever is greater.
3. When the control is in the regenerating mode (power flow is back into the line), the line voltage must commutate the SCRs. If the DC motor voltage is too high, or the line voltage is too low, commutation failures can occur. This may damage components and blow fuses. Armature voltage (as set by parameter #3.15) should never be set higher than 1.09 times the RMS incoming line voltage (500VDC for 460VAC supplies, or 240VDC for 230VAC supplies). If the armature voltage is reduced from the values listed above, the margin for proper commutation, if a line “dip” occurs, improves substantially.

B. Install the DC motor according to its instruction manual, being sure to maintain correct polarity between A1 and A2, S1 and S2, and F1, F2, F3, and F4.

NOTE

S1 and S2 should not be used with regenerative drives. S1 and S2 connections should be left unconnected and taped off.

C. Make sure the motor is properly aligned with the driven machinery to minimize unnecessary motor loading from shaft misalignment.

D. Install protective guards around all exposed rotating parts.

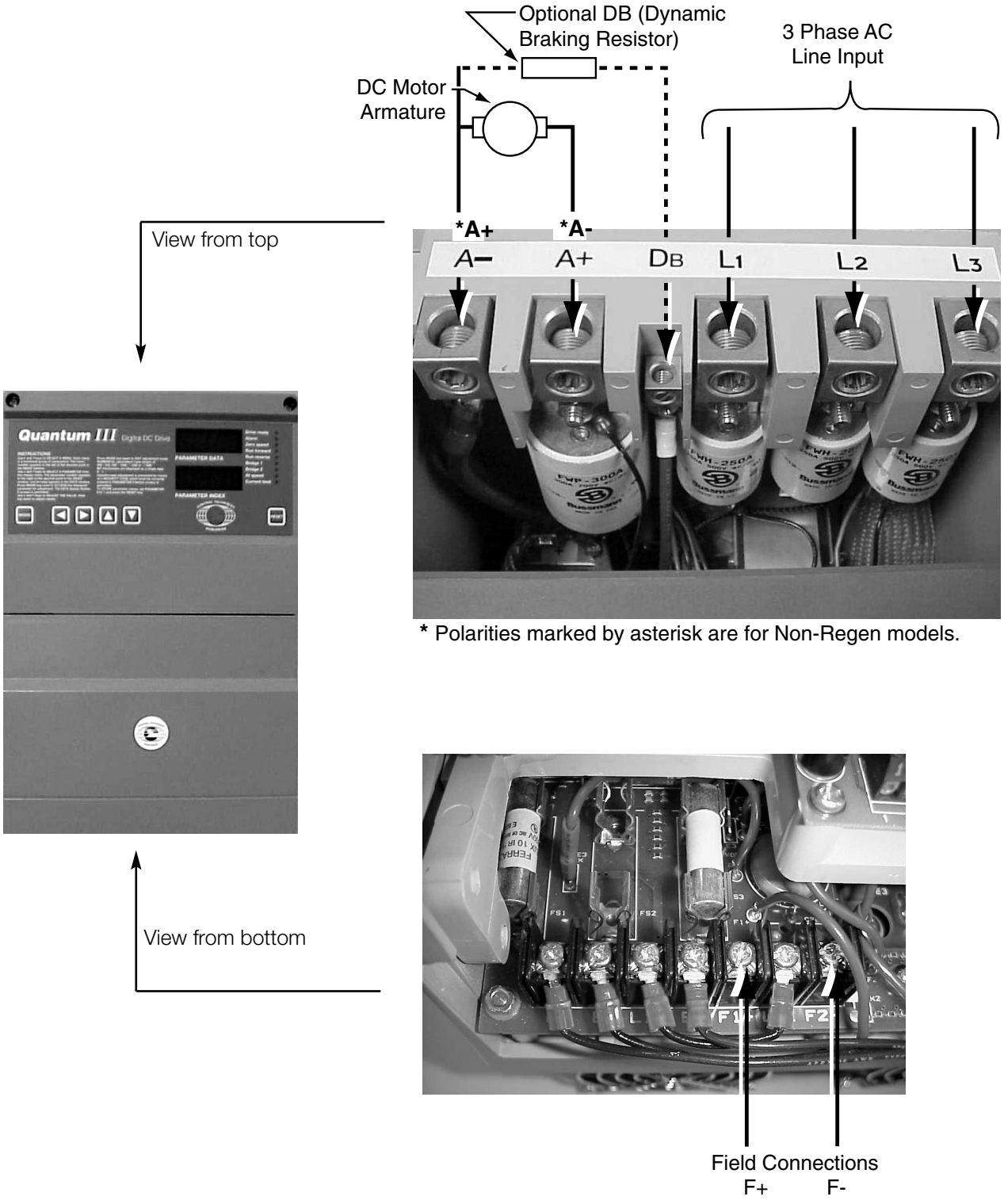
If the motor has a built-in thermal overload protection device, connect the thermal overload lead to the drive. Connect the motor thermal (P1, P2) as described in paragraph 7.2.

If, with the motor connected, the wrong rotational direction is observed, the rotational problem can be corrected in any of three (3) possible ways:

1. Exchanging the A+ and A- output leads to the motor.
2. Exchanging the shunt field F+ and F- leads on shunt wound motors only.
3. On regenerative drives only, changing the position of the Forward/Reverse switch (if used).

Note that exchanging the incoming power leads to terminals L1, L2, and L3 will not affect the direction of motor rotation.

7.2.1 Size 1 Power Connections

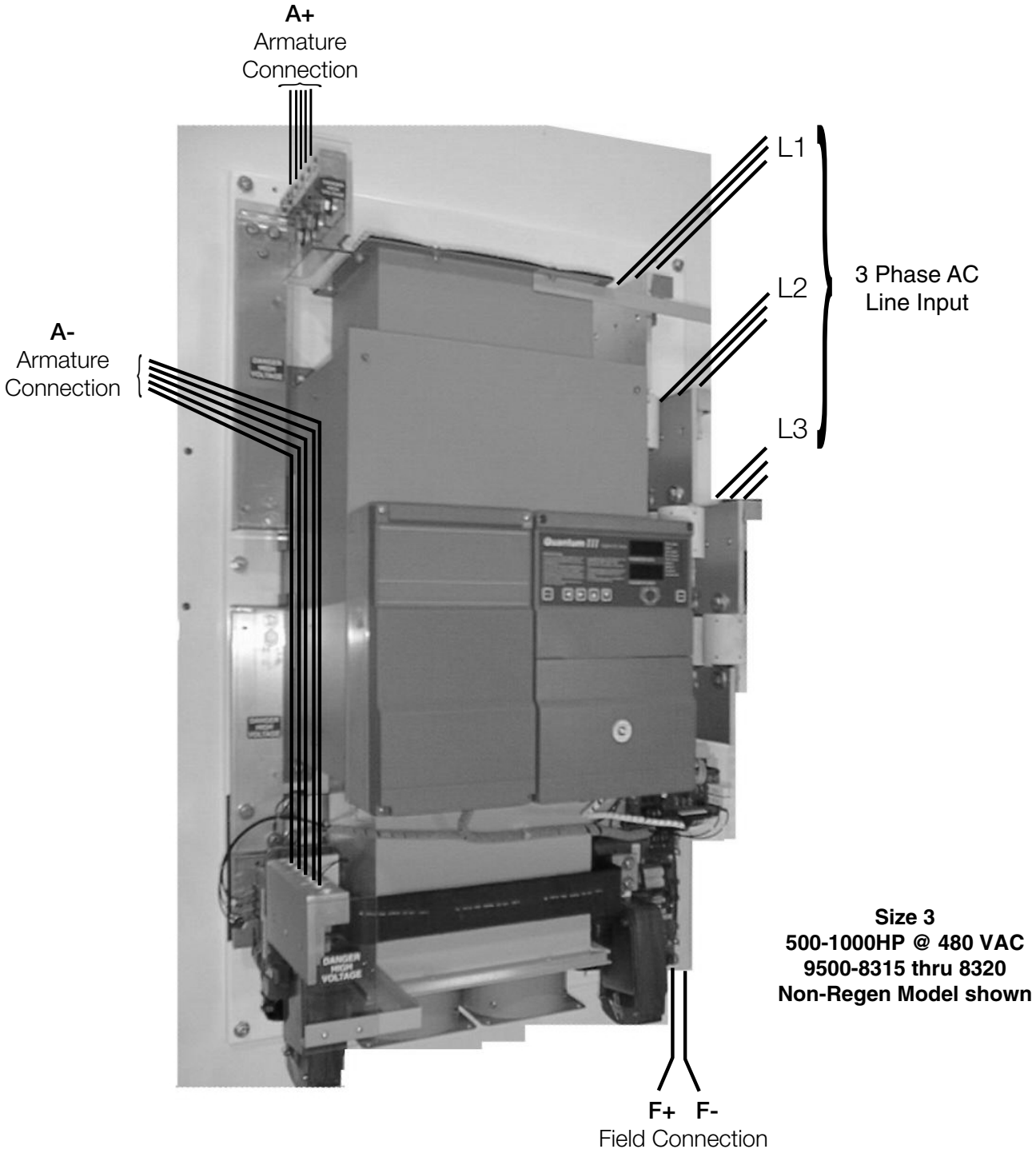


* Polarities marked by asterisk are for Non-Regen models.

7.2.2 Size 2 Power Connections

Size 2
150-400HP @ 480 VAC
75-200HP @ 230 VAC
9500-8X07 thru 8X11

7.2.3 Size 3 Power Connections

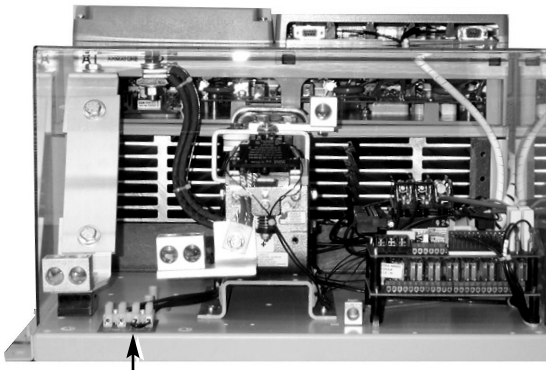


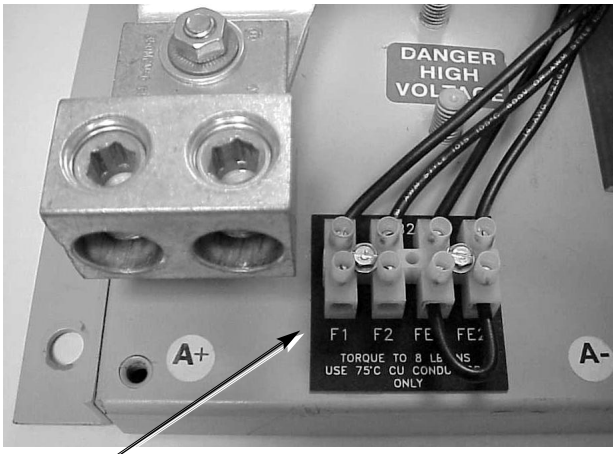
7.2.4 Field Connections for Quantum III Size 2 & Size 3

The Field Supply on Quantum III's Size 2 and 3 is a rectified DC voltage derived from the three phase AC power connected to L1, L2, L3. The approximate DC voltage supplied on F1 and F2 of the Quantum III is shown in the adjacent table.

One should ensure that parameter #10.29 is set to 0 to Enable Field Loss Detection and subsequent Drive Trips.

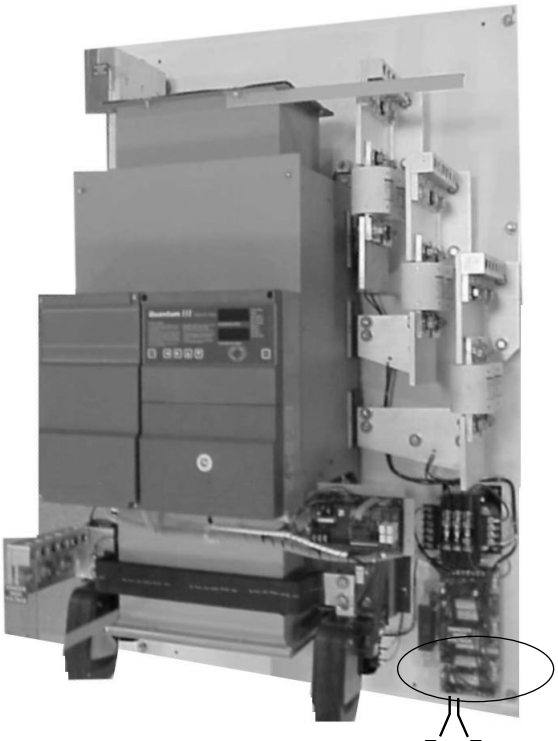
AC Power Line	Motor Field Voltage
230	150
380	240
415	300
460	305
480	315



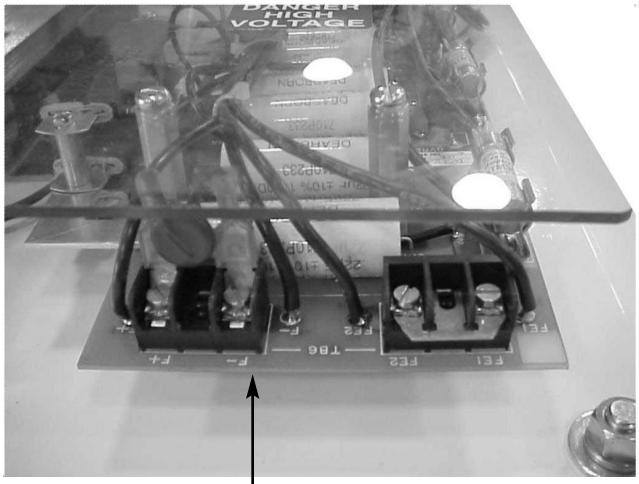


Field Connections
10A Max on Size 2 Quantum

Field Connections for Quantum III Size 3



F+ F-
Field Connection



Field Connections
20A Max on Size 3 Quantum

7.3 CONTROL LOGIC WIRING

Note the following in the interconnect diagrams, Figures A-1 through A-4 (9500-1300-I). See Figures 8-1, 8-3, and 14-1 through 14-3 for locations. Also refer to Section 9 for a complete description of logic interface circuits.

a. A 3-wire Start/Stop circuit is shown. A stop command in this configuration will cause the motor to coast to a stop. If the dynamic braking option is used, a stop command will cause the motor to stop by dynamic braking.

   For applications requiring ramp stop, the only change required for a 3-wire configuration (as shown in Figure A-4) is to change the position of jumper JP3 on the 9500-4030 board from position 1-2 (coast stop) to position 2-3 (ramp stop). In this case, the E-stop/dynamic braking pushbutton (normally closed) should be connected between terminals #1 and #2 of TB1 on the 9500-4025 board.

b. A 2-wire Start/Stop is also shown. A jumper is connected between 5 and 6 and an N/O contact that closes to start the drive is wired to terminals 6 and 7. JP1 must be moved to the 1-2 position on the 9500-4025 board. For ramp stop, JP3 on the 9500-4030 board must be set in position 2-3 and the E-stop/dynamic braking pushbutton should be connected as described in step (a) above.

c. The Forward/Reverse wiring shown on the 9500-4025 board is for regenerative drives, only.

d. The motor thermal is connected between 3 and 4 of TB1 on the 9500-4025 board. The motor thermal can also be connected to TBS-4 and 5 on the 9500-4030 board. This will then show as a drive fault rather than a system fault and its status can be observed in parameter 10.21. Parameter 10.32 must be set to a 1 to enable this function. Terminals 2 and 3 are used for system interlocks. If these functions are not required, a closed connection must be provided.

e. The N/O Jog pushbutton is connected to terminals 8 and 9.

f. 120VAC at 6 VA is available on terminals 24 and 25 to power a drive run light.

g. An external drive reset function is available by connecting an N/O pushbutton to terminals 10 and 12.

h. A Form C NO/NC programmable relay rated 5 amps is available at TB3-34,35, and 36 on the MDA-2. It is defaulted to zero speed.

When proceeding with the signal wiring, the following safety precautions for the signal conduit and wire types must be followed.

A. SIGNAL CONDUIT REQUIREMENTS

- Use either a rigid steel or flexible armored steel cable.
- The signal conduit must cross non-signal conduit at an angle between 45° and 90°.
- Do not route the conduit through junction or terminal boxes that have non-signal wiring.

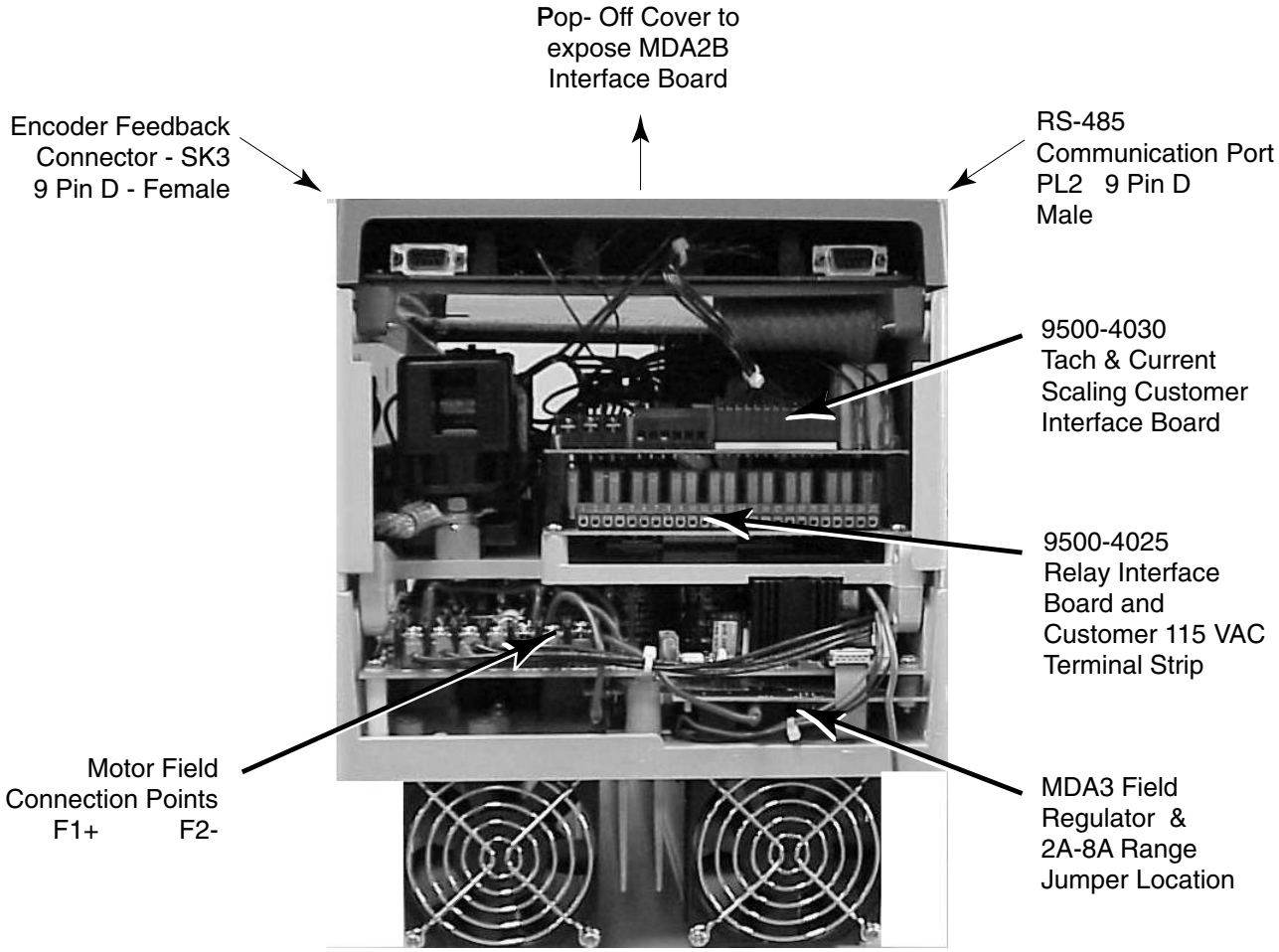
B. SIGNAL WIRE REQUIREMENTS

- Size and install all wiring in conformance with the NEC and all other applicable local codes.
- Use shielded wire for reference and other signal wire connections. Belden #83394 (2 conductor) and Belden #83395 (3 conductor) shielded wire (or equivalent) is recommended. The shields should be taped off at the remote end. At the drive control, the shields should be connected to circuit common.
- Route all wiring away from high current lines such as AC lines and armature wiring.
- Always run the signal wire in steel conduit. Never run the signal wire with non-signal wire.
- Route external wiring, rated at 600 volts or more, in separate steel conduit to eliminate electrical noise pickup.
- For distances less than 150 feet, use a minimum of #22AWG wire. For distances more than 150 feet and less than 1000 feet, use a minimum of #16AWG wire.

CAUTION

It is important to use wire rated at 600 volts or more because this wiring may make contact with uninsulated components. Failure to observe this precaution can result in equipment damage.

Quantum III Size 1 - Bottom End View



Note: Fans on 9500-8X05 and 9500-8X06 only

Figure 7-1
Quantum III, Size 1 Bottom End View

Quantum III Size 2 - Bottom End View

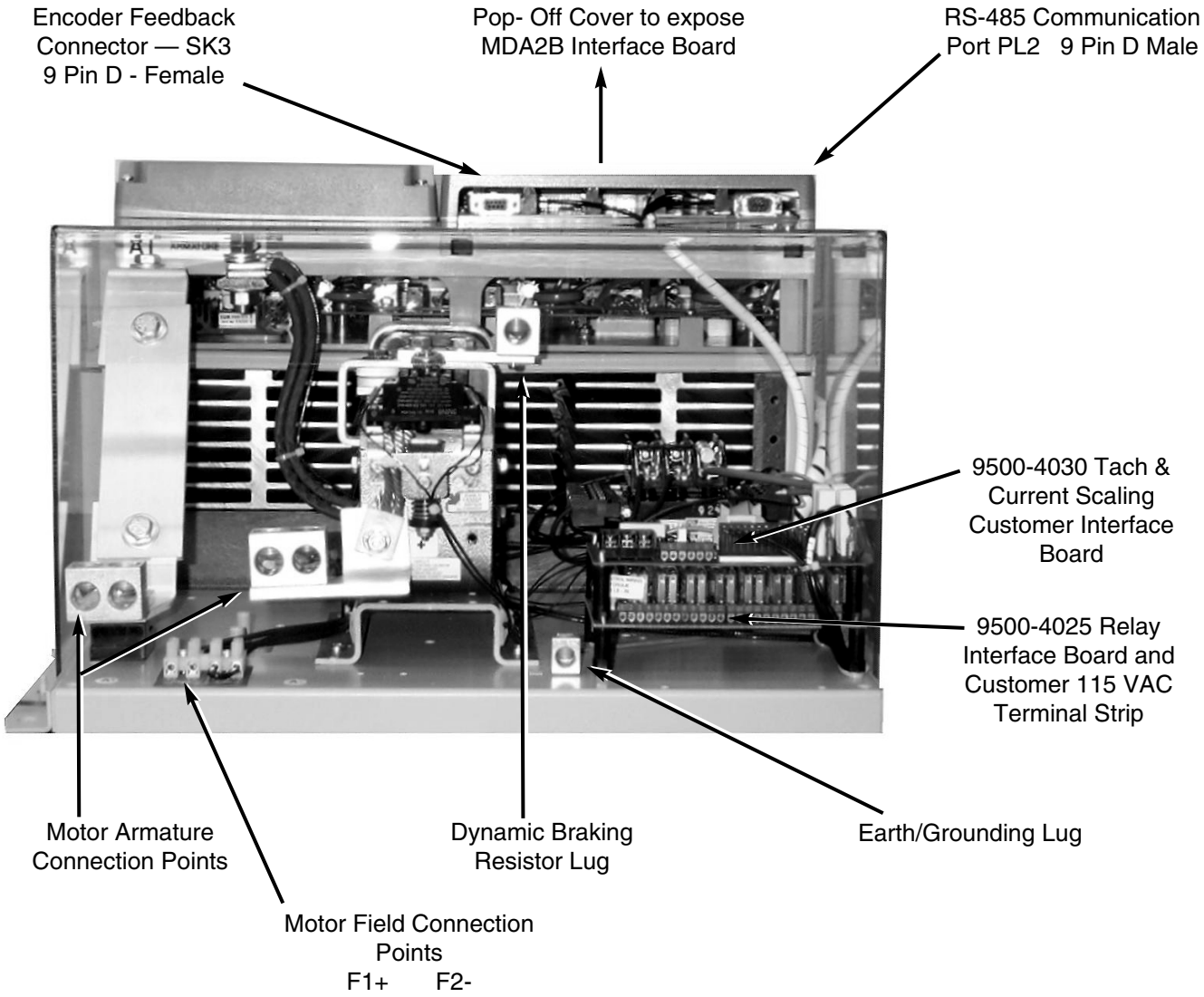


Figure 7-2
Quantum III, Size 2 Bottom End View

Quantum III Size 3 - Bottom End View

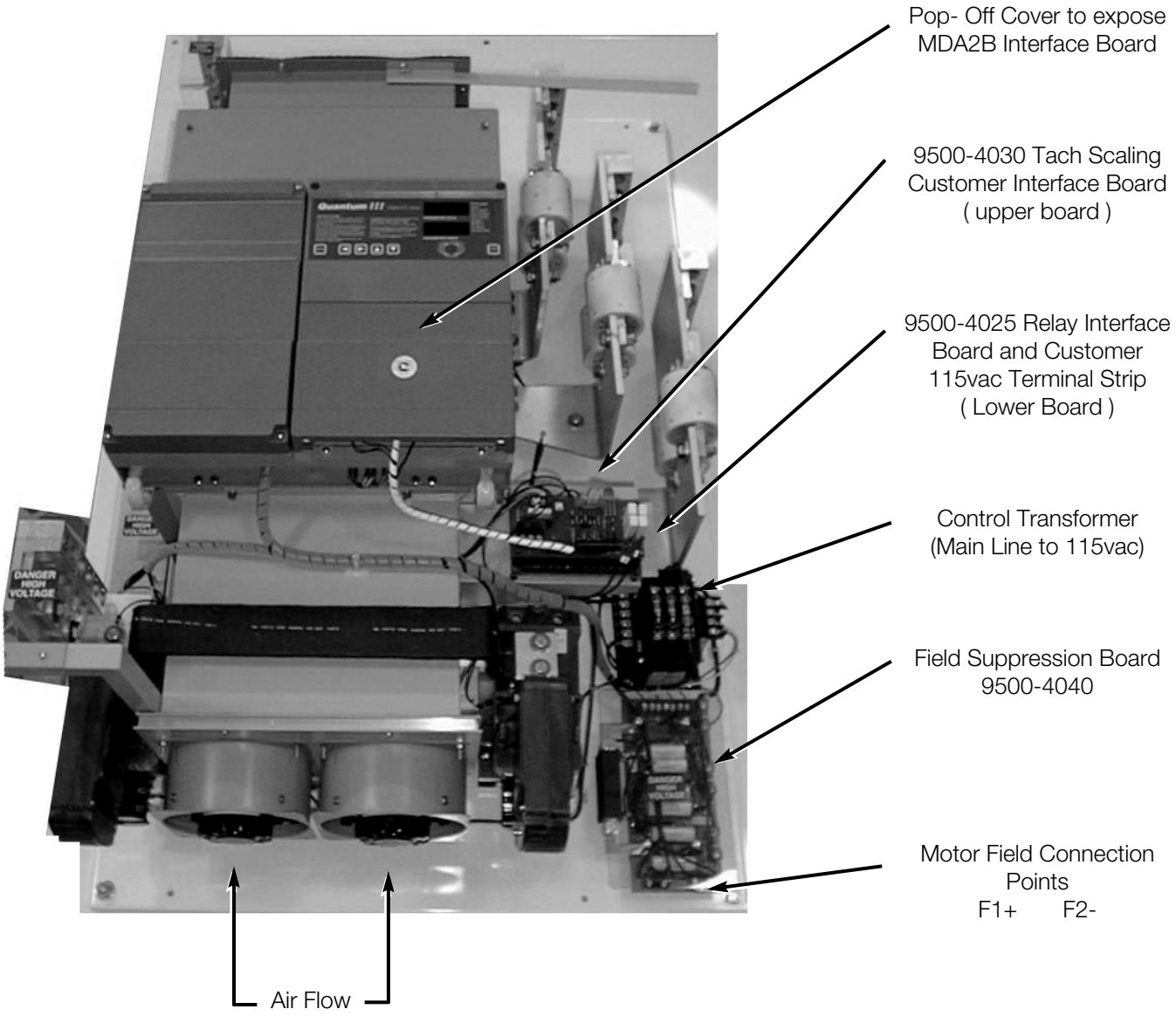


Figure 7-3
Quantum III, Size 3 Bottom End View

7.4 SIGNAL WIRING

Note the following in Interconnect Diagrams Figures A-1 through A-4 (9500-1300-I).

Signal Connections—Logic Interface 9500-4030

TBA-1	DC Tachometer negative or AC tach
TBA-2	AC tach
TBA-3	DC Tachometer positive/shield
TBS-5	Signal Common
TBS-6	+24VDC (100 mA max)

Signal Connections—MDA 2 Board

TB numbers not shown are used for control sequencing and interface logic. They are not available for customer use.

TB1-1	+10V Reference supply (5 mA)
TB1-2	-10V Reference supply (5 mA)
TB1-3	Speed reference input
TB1-4,5,6,7	General purpose analog inputs
TB2-11	Armature current analog output
TB2-12,13,14	Programmable analog outputs (5 mA)
TB2-15,16, 17,18	Open collector outputs
TB2-20	Common 0 VDC
TB3-27,28, 29, 30	Programmable logic inputs

PL5 is a 34-pin male connector that duplicates many, but not all, of the control functions on TB1 through TB4. Pin numbers not shown are used for control sequencing and interface logic. They are not available for customer use.

PL5-1	+10VDC Reference supply—10 mA max
-2	-10VDC Reference supply—10 mA max
-3	Speed reference input—12 bit resolution
-4-7	General purpose analog inputs—10 bit resolution
-11	Armature current analog output
-12-14	Programmable analog outputs (5 mA)
-15-18	Open collector outputs
-20	Common 0 VDC
-27-30	Programmable logic inputs
-33	+24 VDC—(100mA max)
-34	Common 0 VDC

Encoder Connectors

Reference Encoder--PL4 is a 10-pin header. Cable connections can be made by using the 3M insulation displacement connector, part number 3473, and the 3M 10-conductor ribbon cable, part number 3365/10.

Location	Description
PL4-1	0
PL4-2	N/C
PL4-3	$\overline{A}$
PL4-4	A
PL4-5	$\overline{B}$
PL4-6	B
PL4-7	NC
PL4-8	$\overline{C}$
PL4-9	C
PL4-10	0V

Feedback Encoder PL3/SK3-1

PL3 is a 10-pin header connected in parallel with SK3. PL3 can be connected, as the reference encoder, to PL4 of a follower drive. SK3 is a 9-pin D-type female connector for the feedback encoder.

PL3/SK3	-1	0
	-2	Supply (300 mA max)
	-3	$\overline{A}$
	-4	A
	-5	$\overline{B}$
	-6	B
	-7	NC
	-8	$\overline{C}$
	-9	C
	-10	0V (not SK3)

Communications Connections

PL2 is a 9-pin D-type male connector.

Location	Description	
PL2-1	$\overline{0V}$ isolated	
PL2-2	$\overline{TX}$	
PL2-3	RX	
PL2-4	NC	
PL2-5	NC	7 Data,
PL2-6	TX	1 Stop,
PL2-7	RX	Even Parity
PL2-8	NC	
PL2-9	NC	

7.5 POST WIRING CHECKS

After connecting the motor to the control and grounding, the following readings across terminals A- and A+, F+ and F-, and GND should be verified. The reading connections for terminals A- and A+ must be made where the actual DC motor connection is made. Terminals F+ and F- are located on the fuse panel assembly. Perform these checks before connecting the AC power input.

In making the readings listed in the following table, use a volt-ohm-milliammeter such as a Simpson 260, Triplett 630, or equivalent.

WARNING

DO NOT USE A VACUUM TUBE VOLTMETER OR OTHER SIMILAR TYPE OF METER THAT REQUIRES AC POWER FOR OPERATION.

Using red as the positive lead, make the following checks:

CHECKS		RANGE OF ACCEPTABLE READINGS
RED +	BLACK -	
A+	A-	.02-4 ohms typical
F+	F-	20-300 ohms typical *
F+, F-, A+, A-	GND	Infinite

*Provided motor has a field winding.

If any of the above checks are not within the indicated range, verify all connections and recheck before proceeding.

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.